ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

# Policy Work Group

# Refresher

* Agriculture – Warren Goetsch, IDOA
* Point Source – Rick Manner, C-U Sanitary District
* Environmental - Cindy Skrukrud, Sierra Club
* Urban Stormwater – Hal Sprague, Center for Neighborhood Technology
* Drinking Water – Ted Meckes, CWLP
* Government Agencies – Ivan Dozier, USDA-NRCS

# Major Themes

* Overwhelming amount of stakeholder involvement
* Process that has a role for everyone
* Allowed for time and flexibility to make meaningful investments in permits, programs, people and partnerships
* Big challenge still ahead, and lots of work to do
* Freedom to innovate will lead to the most environmental benefit

# Agriculture

* Where have we been?
  * EVERYWHERE!
  * Ag community – organizations and individual farmers and retailers – are owning this issue
* Where do we need to go?
  * Continue work on implementation
  * Don’t burn out – or burn out our “early adopters”
  * Local leaders to assist in local adoption

# Point Source

* Where have we been?
  * Real financial investments in new technology and plant upgrades
  * Numerous permits modified
  * Huge reductions in P already, more in process
* Where do we need to go?
  * Continue to understand that every plant is UNIQUE, and installation of good technology takes time
  * Innovation will get us to useful projects faster
  * Watershed based studies should take precedence
  * Trading

# Environmental

* Where have we been?
  * Happy to see progress with ag and point sources
* Where do we need to go?
  * Need a concrete path forward toward interim goal
  * Continue biennial NASS survey of farmers
  * Continue charting progress of WWTPs
  * Work toward more action in stormwater program

# Urban Stormwater

* Where have we been?
  * Disappointed in themselves
  * But do have successes due to 319 program, Lawn to Lake, MS4-driven education, MWRD investments, Calumet Stormwater Collaborative
* Where do we need to go?
  * Focus on bringing together more stakeholders in this work group
  * Investigate funding sources like improved SRF, GIG, bigger rain barrels, community stormwater management, stormwater fee programs, education, street sweeping

# Drinking Water

* Where have we been?
  * Happy to be at the table
  * Excited to see more awareness within ag, but need to do more faster
* Where do we need to go?
  * Want to see more cover crops, reduced tillage and setbacks, grassed waterways and filter strips, NMPs
  * Want to see continued collaboration between farmers, water supplies and agencies
  * Identify funding sources
  * Continue education

# Government Agencies

* Where have we been?
  * We "got to know each other", and figured out what we can all offer toward solutions
* Where do we need to go?
  * Continue to become more aware of the strengths and weaknesses of the practices
  * NRCS will do more data sharing (within existing boundaries)

# Session B Overview: Tracking BMP Adoption

Trevor Sample

Illinois EPA

ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Improving our water resources with collaboration and innovation

Purpose:

# Answer Questions About Implementation Tracking

- 1. What data do we need in the future
- 2. What are the action steps for getting it?



# Tracking Measures

**Resources**
- Staff
- Funding & Grants

**Outreach**
- Partner organization's events & media
- Farmer knowledge

**Land & Facilities**
- Land use changes
- Facility & permit updates

**Water**
- Calculated load reduction
- Measured loads at existing montioring stations

Agricultural

# Agriculture Voluntary BMP Adoption

## Types of Ag BMPs recommended in NLRS

### Nitrate

- **In Field Practices**
  - Nitrogen Management
    - MRTN, Inhibitors, Split appl.
  - Cover Crops
- **Edge of Field Practices**
  - Bioreactors
  - Buffers (non-tile drained)
  - Wetlands
- **Land Use Change**
  - Perennial/Energy Crops

### Phosphorus

- **In Field Practices**
  - Reduced Tillage Systems
  - Soil Tests/Nutrient Management
  - Cover Crops
- **Edge of Field Practices**
  - Buffers
  - Wetlands
- **Land Use Change**
  - Perennial/Energy Crops

# What Data Do We Need in the Future?

Agricultural

## Continue Collecting Data Used in the Biennial Report

- Nutrient Management (4Rs)
- Cover Crops
- Wetlands
- Filter Strips/Buffers
- Perennial/Engery
- Bioreactors

*Additional Practices?

(Process for adding new practices to Strategy)


Table 4.3. Agriculture Land and Facilities Measures BMP tracking template

| BMPs | Data Source | | | | |
|---|---|---|---|---|---|
| | FSA | Illinois DNR | USDA-NRCS | Illinois EPA | NASS |
| Reduced N rate from background to MRTN on 10 percent of acres | | | | | ✔ |
| Nitrification inhibitor with all fall-applied fertilizer on tile-drained corn acres | | | | | ✔ |
| Split application of 50 percent fall and 50 percent spring on tile-drained corn acres | | | | | ✔ |
| Spring-only application on tiled-drained corn acres | | | | | ✔ |
| Split application of 40 percent fall, 10 percent pre-plant, and 50 percent side dress | | | | | ✔ |
| Cover crops on all corn/soybean tile-drained acres | ✔ | | | ✔ | ✔ |
| Cover crops on all corn/soybean non-tiled acres | ✔ | | | ✔ | ✔ |
| Bioreactors on 50 percent of the tile-drained land | | | ✔ | ✔ | |
| Wetlands on 25 percent of tile-drained land | ✔ | ✔ | | ✔ | |
| Buffers on all applicable crop land | ✔ | ✔ | | ✔ | ✔ |
| Perennial/energy crops equal to pasture/hay acreage from 1987 | ✔ | | | | ✔ |
| Perennial/energy crops on 10 percent of tile-drained land | ✔ | | | | |

# What Data Do We Need in the Future?

| Metric | Action Steps |
| --- | --- |
| • Tillage/Residue Mgt. | IDOA Soil Transect Survey |
| • Accurate Cover Crop acres | FSA crop reporting, Remote Sensing, NASS Survey |
| • Accurate 4R Nutrient Stewardship | Ag Retailers, IFCA |
| • Est. Baseline for Structural BMPs | Remote Sensing, Mapping Software, other? |
| • Track NGO and citizen data | Develop Reporting Database (HTF) |


# Urban Stormwater BMPS

Reid Christianson, U of I

## Permitted and Unpermitted Sources

- **MS4 Program—NPDES Permit**
  New Development—Post Construction Runoff Control
  Existing Development —Retrofit

- **Stormwater Runoff from unpermitted areas**

## Rain Gardens

https://prairierivers.org/raingardens/

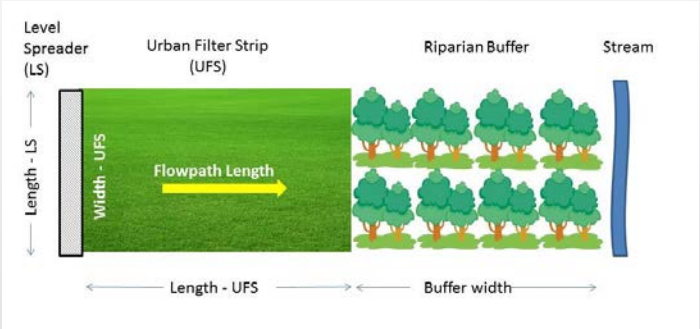
## Stormwater Wetlands

http://chesapeakestormwater.net/download/3280/

## Grade Control

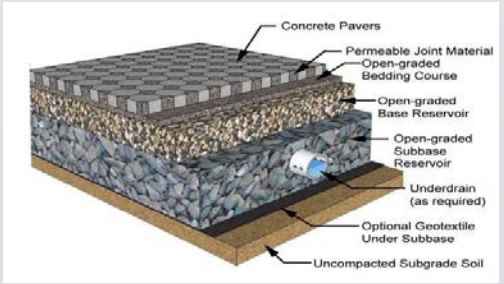

http://www.intuitionandlogic.com/Project%20Writeups/609%20-%20Brentwood%20Reach%20Lenexa/Write%20Up/609%20-%20Brentwood%20Reach%20Lenexa.html

## Urban Filter Strip




http://chesapeakestormwater.net/download/4323/

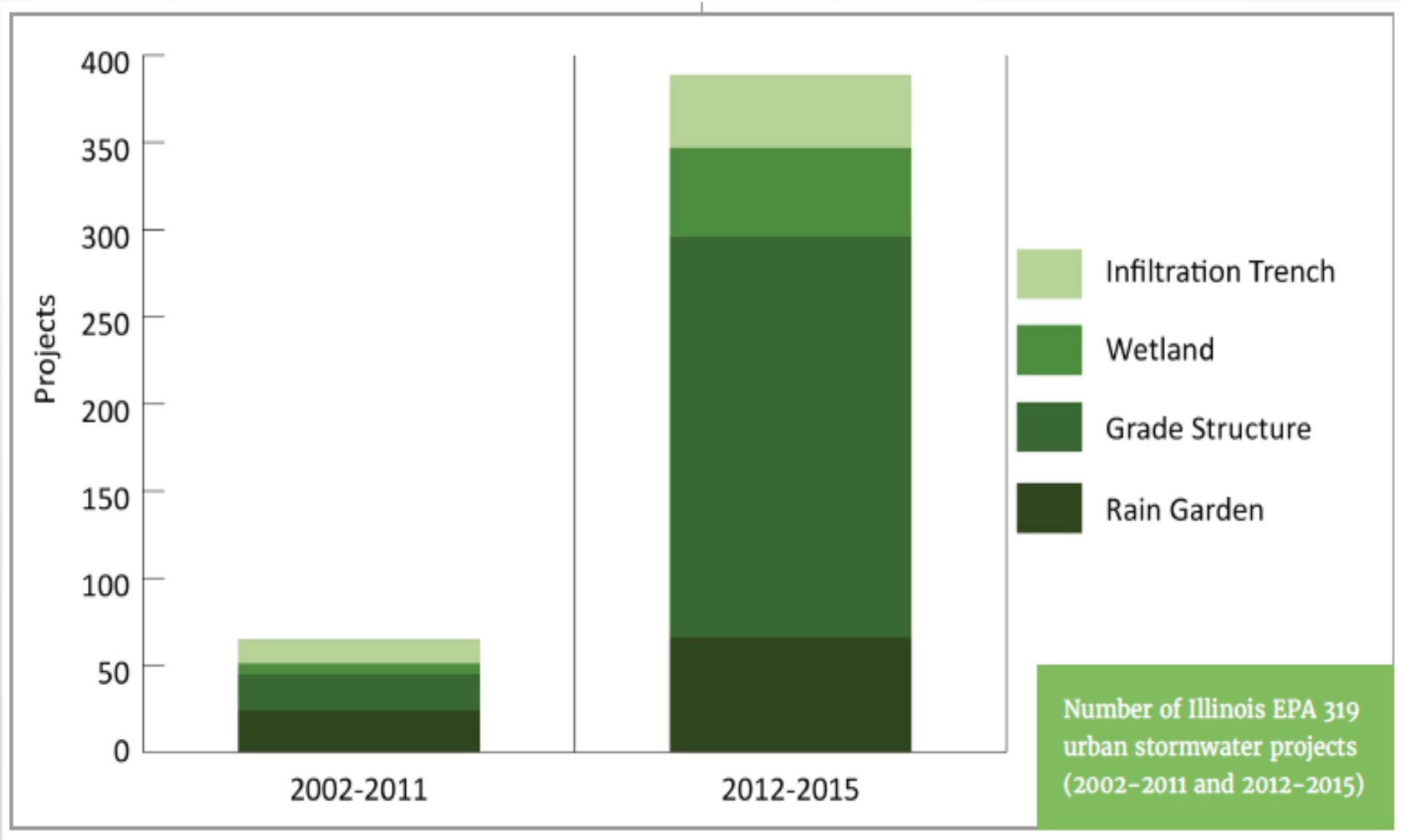
## Permeable Pavement




http://vwrrc.vt.edu/swc/NonPBMPSpecsMarch11/VASWMBMPSpec7PERMEABLEPAVEMENT.html

Urban

# Urban Stormwater BMP Data used for Biennial Report




## Strategic Actions

- **Urban Stormwater Workgroup**
  - Nutrient info for MS4s
  - Let us tell the *whole* story
- **Stormwater Management Planning**
- **Storm Sewer System Mapping**
- **Encourage Stormwater Management Training**

## Future Data Sources

- **County/town/city/village**
- **Watershed plans**
- **Private Groups**
  - Non Profits
  - Foundations
  - Citizens

Urban

# Suggested Minimum Measures

- Location
- Practice Type
- Land Area Treated by BMP
  - Acres Treated
- When the Practice was Installed
- Expected Life of Practice
- Funding Source, if applicable


# Point Source Facility Improvements

Amy Dragovich, Illinois EPA

- Nutrient Discharges
  - Current Activities
  - Enhancement to Current Activities
  - Future Tools


## Current Activities

- WQ standard for lakes and reservoirs
- Effluent standard for new/expanded facilities
- Waste load allocations in TMDL reports
- Antidegradation assessments
- DO effluent limits included in permits

## Enhancement to Current Activities

- Developing nutrient TMDLs
- Additional monitoring to develop TMDLs
- Reopener clause to incorporate permit limits
- Watershed study groups
- Interim phosphorus permit limits for algae or DO impaired waters
- Identification of operational modifications


# Future Tools

- Future regulations to address nutrients
  - Nutrient Science Advisory Committee
  - Future rules filed with Illinois Pollution Control Board


# MWRDGC PERMIT- Appeal and Settlement

- Calumet, Stickney and O'Brien Permits re-issued July 6, 2017
- Included interim 1 mg/L P limit with compliance schedules
- P improvements include:
  - Converting aeration zones to anaerobic zones
  - Optimizing P removal
  - Sidestream P recovery process
  - Supplemental carbon process
  - Centrate treatment
  - Investigating use of algae to recover P
- Included settlement special conditions – 0.5 mg/L P by 2030

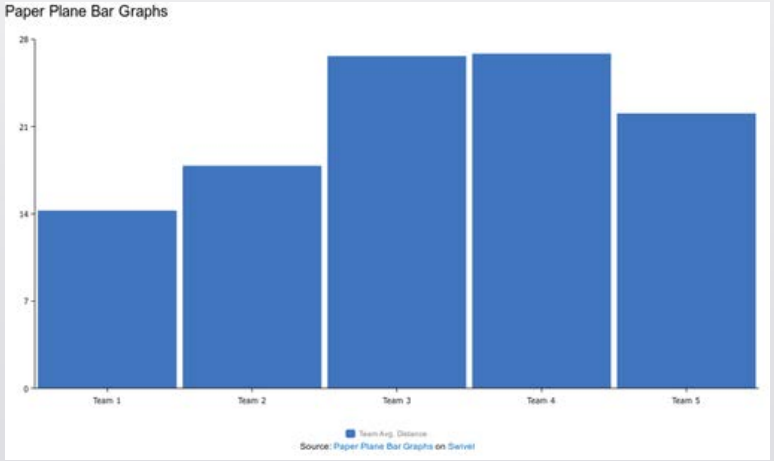

# Watershed Permitting—Watershed Workgroups

- Fox River Study Group
- DuPage River/Salt Creek Workgroup
- Des Plaines River Watershed Workgroup
- Lower DuPage River Watershed Coalition
- Hickory Creek Watershed Planning Group
- Lower Des Plaines Watershed Group

Point Source

# Tracking Point Source Loads

- Need Ability to track Point Source Load contributions (lbs/year)
  - Majors
  - Minors?
  - Statewide
  - HUC 8 Priority Watersheds
  - All HUC 8 Watersheds?






# Discharge Monitoring Report (DMR) Pollutant Loading Tool



**The Loading Tool is being transitioned into ECHO to increase user access to data and streamline site maintenance. The beta version is now available for testing. EPA plans to retire this site in late November 2017. Current site functionality will be available in ECHO.**

**Note:** The tool uses discharge monitoring report (DMR) data from ICIS-NPDES to calculate pollutant discharge amounts. EPA has verified the accuracy of the tool's calculations. EPA has also performed a limited review of the underlying data that has focused on facilities with the largest amounts of pollutant discharges. Due to the large amount of DMR data, some errors exist in ICIS-NPDES DMR data. Please see the User Guides page for instructions on how to use the tool and how to correct errors in ICIS-NPDES. The tool also uses wastewater pollutant discharge data from the Toxics Release Inventory (TRI). Contact Us with any comments or questions about the tool, and sign up for our e-mail news bulletin to be notified when new data, enhancements, or training materials become available.

## Watershed Statistics and Loadings

***Instructions.*** Select a reporting year and watershed criteria. Select "Download Watershed File" to generate a comma-separated values (CSV) file of facility counts and loadings for the selected watershed(s). Select "Download Facility File" to generate a CSV file with facility attribute information (e.g., facility name, unique identifiers, address) for the selected watershed(s).

Facilities are aggregated to the Facility Registry Service (FRS) ID. FRS identifies a facility by assigning an identification number (FRS ID), and uses this ID to link together EPA regulatory program database records. Note that FRS IDs may link to one or more NPDES IDs or TRIFIDs. As a result, the counts displayed in the Watershed downloads may not match counts in the results of an EZ Search (DMR) or TRI Search , as these features identify facilities by NPDES ID and TRIFID, respectively.

**Select Reporting Year:** 2017

### Watershed

◉ **Nationwide**

○ **Search by Watershed**

**HUC Region** Select a HUC Region

**Watershed ID (2-Digit to 12-Digit HUC):**

*Separate multiple HUC12 codes with a comma or carriage return. LIMIT: 400.*

Major U.S. Watersheds:

Select a watershed group

Download Watershed File | Download Facility File

# Audience Discussion

- Track Manure application and BMPs
- Use watershed modeling to determine load reductions from BMPs
- Address climate variability
- Perform Soil Transect Survey annually
- Using tracking to facilitate water quality trading

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

# Thank You!

Trevor Sample
Illinois EPA, Bureau of Water
Watershed Management Section
217/782-3362
Trevor.Sample@Illinois.gov

# Session C Wrap Up For NLRS Policy Working Group: Monitoring Nutrient Loads and Water Resource Outcomes – Progress, Opportunities, and Challenges

*Gregg Good, IEPA (11/30/17)*

# Session C: Summary

- *Introduction to the Nutrient Monitoring Council (NMC)*
  - Who are we and when were we formed?
  - What's our charge?
  - When and where do we meet?
  - What's our typical meeting structure?
- *Session Overview*
  - What we've been up to over the past 2+ years.

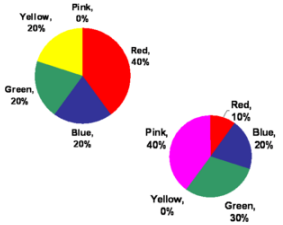
# NMC Charges (Revised 10/26/15)

1. Coordinate the development and implementation of monitoring activities (e.g., collection, analysis, assessment) that provide the information necessary to:

   a. Generate estimations of 5-year running average loads of Nitrate-Nitrogen and Total Phosphorus *leaving the state of Illinois* compared to 1980-1996 baseline conditions; and
   b. Generate estimations of Nitrate-Nitrogen and Total Phosphorus loads *leaving selected NLRS identified priority watersheds* compared to 1997-2011 baseline conditions; and
   c. Identify Statewide and NLRS priority watershed *trends in loading over time* using NMC developed evaluation criteria.

2. Document *local water quality outcomes* in selected NLRS identified priority watersheds, or smaller watersheds nested within, where future nutrient reduction efforts are being implemented (e.g., increase in fish or aquatic invertebrate population counts or diversity, fewer documented water quality standards violations, fewer algal blooms or offensive conditions, decline in nutrient concentrations in groundwater).

3. Develop a *prioritized list of nutrient monitoring activities and associated funding* needed to accomplish the charges/goals in (1) and (2) above.




# When and where do we meet?

- 3-4 times per year
- Alternate between Springfield and Urbana
- 9 meetings so far
- Today is “meeting 9.5 lite” – many members are here
- 10th – March 28, 2018
- 11th – August 29, 2018

# Illinois' Super Gage Network – Operation and Maintenance Happenings

Kelly Warner, USGS


# NUTRIENT AND SEDIMENT EXPORT FROM ILLINOIS–QUANTIFICATION THROUGH A CONTINUOUS LOADINGS NETWORK (PROVISIONAL RESULTS)

Results After Approximately One Year of Monitoring

Paul Terrio
U.S. Geological Survey

USGS

Table 2. Provisional annual load for nitrate, total phosphorus, and suspended sediment for each site that the data and (or) regression equations were provisionally adequate.

These loads will change as more data becomes available and the regression equations are refined.

| | Nitrate | | Total Phosphorus | | Suspended Sediment | |
|---|---|---|---|---|---|---|
| Stream name | Annual load (lb) | Annual yield (lb/acre) | Annual load (lb) | Annual yield (lb/acre) | Annual load (ton) | Annual yield (ton/acre) |
| Illinois River at Florence/Valley City | 215,220,950 | 12.5 | 21,020,287 | 1.2 | 4,340,965 | 0.3 |
| Embarras River at Lawrenceville | 17,427,920 | 11.7 | 1,961,336 | 1.3 | 809,448 | 0.5 |
| Big Muddy River at Murphysboro | 2,339,032 | 1.7 | 1,310,602 | 0.9 | 279,837 | 0.2 |
| Green River near Geneseo | 11,614,829 | 18.1 | 338,962 | 0.5 | 162,462 | 0.3 |
| Rock River near Joslin | 83,426,545 | 13.7 | TBD | TBD | TBD | TBD |
| Little Wabash River at Carmi | TBD | TBD | 2,571,015 | 1.3 | 730,403 | 0.4 |
| Kaskaskia River at New Athens | 12,957,382 | 3.9 | TBD | TBD | 758,746 | 0.2 |
| Vermilion River near Danville | TBD | TBD | TBD | TBD | TBD | TBD |

Indicates highest yield

Indicates lowest yield

USGS

# Assessing Long-term Changes in Riverine Nutrient Loads and Comparison of Different Nitrate-N Load Estimation Methods for the Illinois River at Valley City and Florence

Gregory McIsaac
Associate Professor Emeritus
University of Illinois at Urbana Champaign
&
Agricultural Watershed Institute
Decatur, IL

# What does it all mean?

- Continuous probe measured Nitrate-N concentrations at Florence averaged about 9.4% greater than point sampled concentrations at Florence. Is there a need for better calibration?
- Annual Load estimates from probe concentrations averaged 12.6% greater than estimates from linear interpolation between traditional sampling events.
- Differences in load estimates may be due to 1) probe calibration; and 2) the probe detecting high concentration episodes missed by less frequent traditional sampling;
- Accurate assessment of changes over time requires either consistent methods or methods that produce equivalent results.
- There is considerable variability in 5 year average loads, partly due to rainfall and flow variations; 17 year average loads have been more stable.

# Great Lakes To Gulf Virtual Observatory – A Place to Deposit, Organize, and Integrate NLRS Data and Information?

Jong Sung Lee (jonglee1@illinois.edu)
Senior Research Scientist, NCSA

National Center for Supercomputing Applications
University of Illinois at Urbana-Champaign

# Monitoring Challenges for Estimating Nutrient Loads and Developing Water Quality Standards

*Gregg Good, IEPA and Paul Terrio, USGS*

# 20-Minute Panel Discussion

# Discussion of Future Needs

- USGS Super Gage Network
  - 8 base sites (IEPA) and 1 added site at Joliet (MWRD)
  - Site on the Kankakee in Indiana
  - Need for a site on the Rock River in Wisconsin?
  - Need to keep the Super Gage Network going for an additional 5 years after 2020 - $2,000,000+?
  - Is there an interest in outfitting all Super Gages with chlorophyll probes? If so, who has the funds?

- Who will do what Dr. Mark David and Dr. Greg McIsaac have been doing for us for free? (Charge: generating 5-year running average loads of N and P leaving the state compared to 1980-1996 baseline conditions, and estimations of N and P leaving priority watersheds compared to 1997-2011 baseline conditions)

# Discussion of Future Needs

- Great Lakes to Gulf – Illinois NLRS Site Suggestions
  - What data sets to load into the observatory?
  - Recommendations on how to depict data?
  - Nutrient Monitoring Council members will be asked for their input.

- Documenting Water Quality Outcomes – a lot of the data are being collected at priority watersheds (e.g., chemical, physical, biological, loads), but pulling the data together and documenting results (good or bad) is a big endeavor.

# Discussion of Future Needs

- WQ Standards Development Needs (e.g., benthic chlorophyll monitoring, user perception surveys, additional continuous D.O. monitoring, revised mIBI that isolates the effects of nutrients, sediment respiration/sediment oxygen demand, physical habitat improvement measurements)

- We gotta keep the ball rolling!

# NSAC Progress

Dr. Candice Bauer, U.S. Environmental Protection Agency

Presented by Paul Terrio, USGS

**NSAC members:**

Dr. Todd Royer, Indiana University, Chair

Dr. Candice Bauer, U.S. Environmental Protection Agency, Region 5

Dr. Doug McLaughlin, National Council for Air and Stream Improvement

Dr. Christopher Peterson, Loyola University

Paul Terrio, U.S. Geological Survey

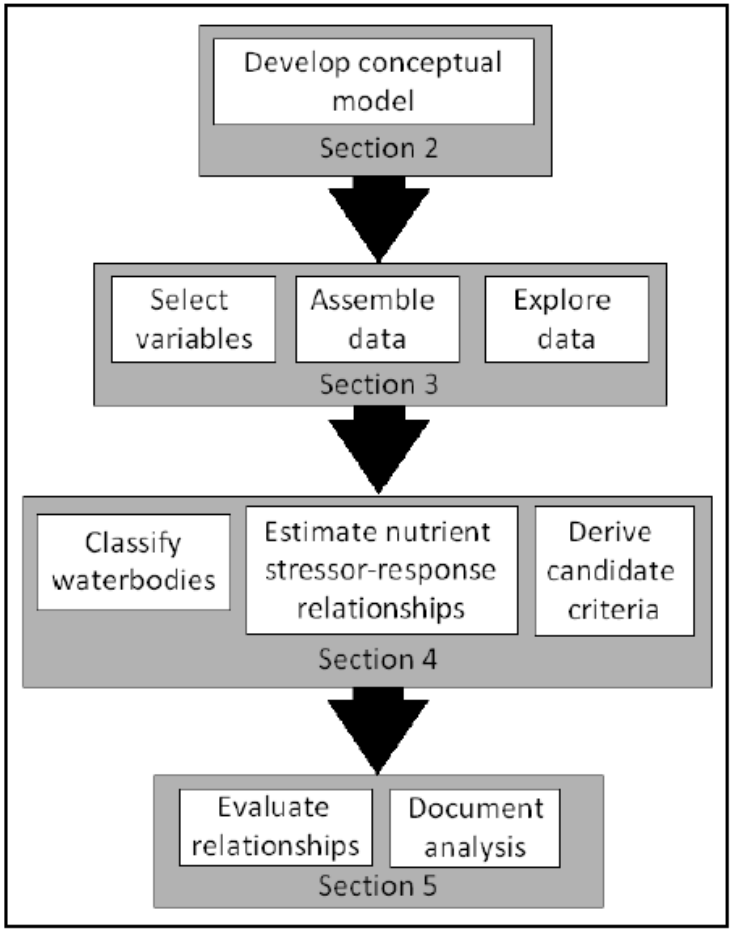
Dr. Matt Whiles, Southern Illinois University

# Nutrient Science Advisory Committee

- Charge:
  - Make recommendations to Illinois EPA regarding numeric river and stream eutrophication water quality standards
  - Consider whether standards should vary spatially or by other classification factors
  - Consider need to obtain EPA approval in recommendations
- 2016 Framework (http://www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy/index)

United States Environmental Protection Agency
Office of Water
Mail code 4304T
EPA-820-S-10-001
November 2010

# Using Stressor-response Relationships to Derive Numeric Nutrient Criteria



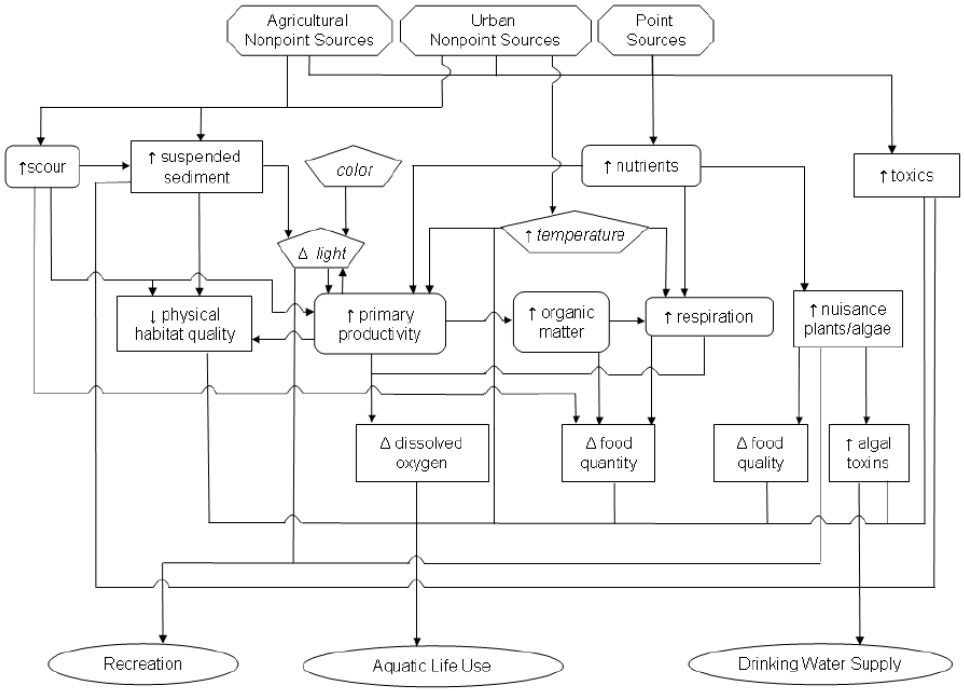




**Figure 2-2. Conceptual model diagram for streams.** See text for explanation of shapes and symbols.

United States
Environmental Protection Agency

Office of Water
Mail Code 4305T

EPA-820-F-13-039
September 2013

# *Guiding Principles on an Optional Approach for Developing and Implementing a Numeric Nutrient Criterion that Integrates Causal and Response Parameters*

… OR what NSAC calls “combined criteria”

These guiding principles apply when states wish to rely on response parameters to indicate that a designated use is protected, even though a nitrogen and/or phosphorus level is/are above an adopted threshold. If a state prefers to apply causal and response parameters independently, the principles in II.C will not apply.

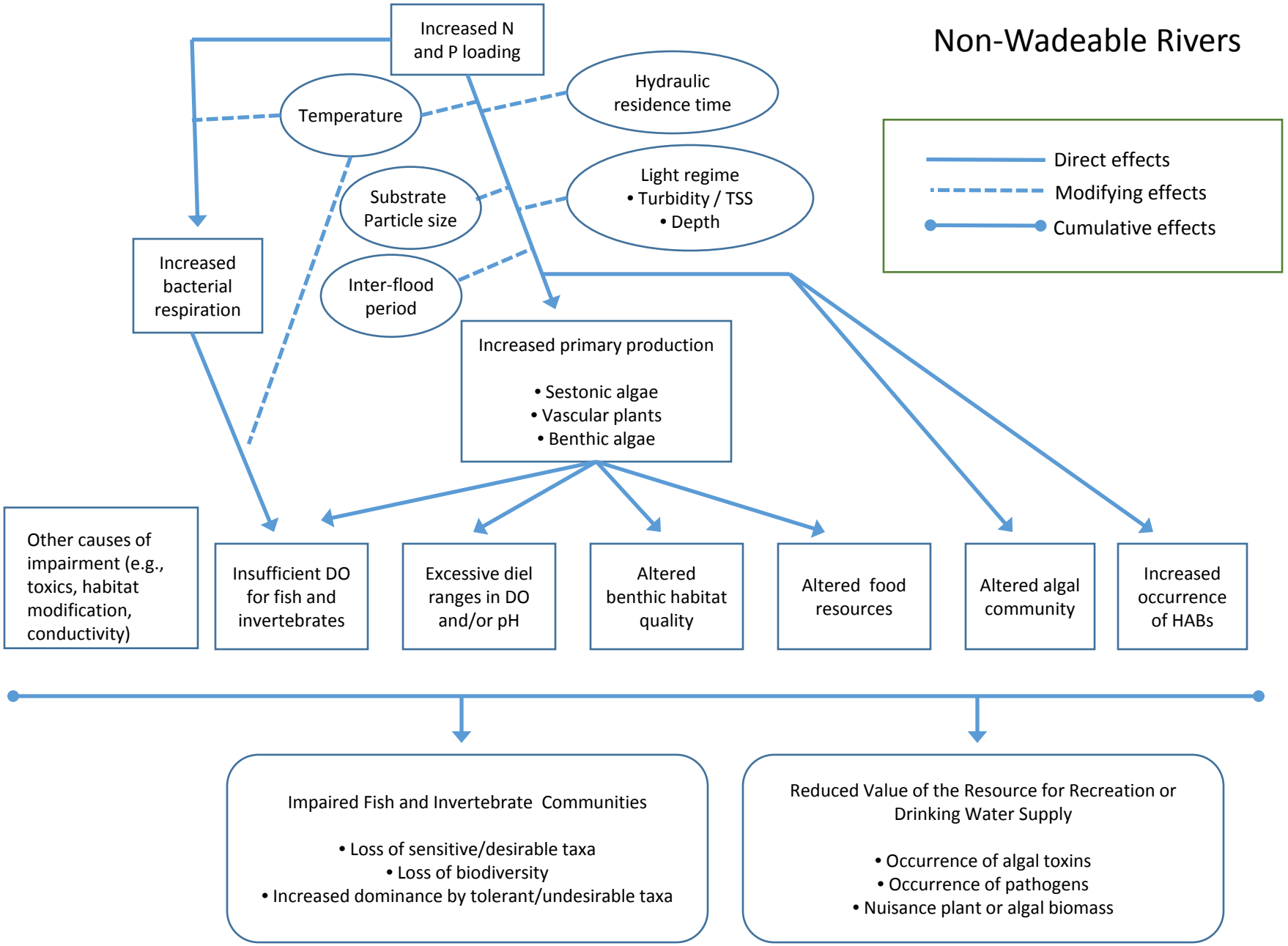
States interested in this approach should have a biological assessment program that confidently measures biological responses and other nutrient-related response parameters through a robust monitoring program to account for spatial and temporal variability to document the effects of nutrient pollution.

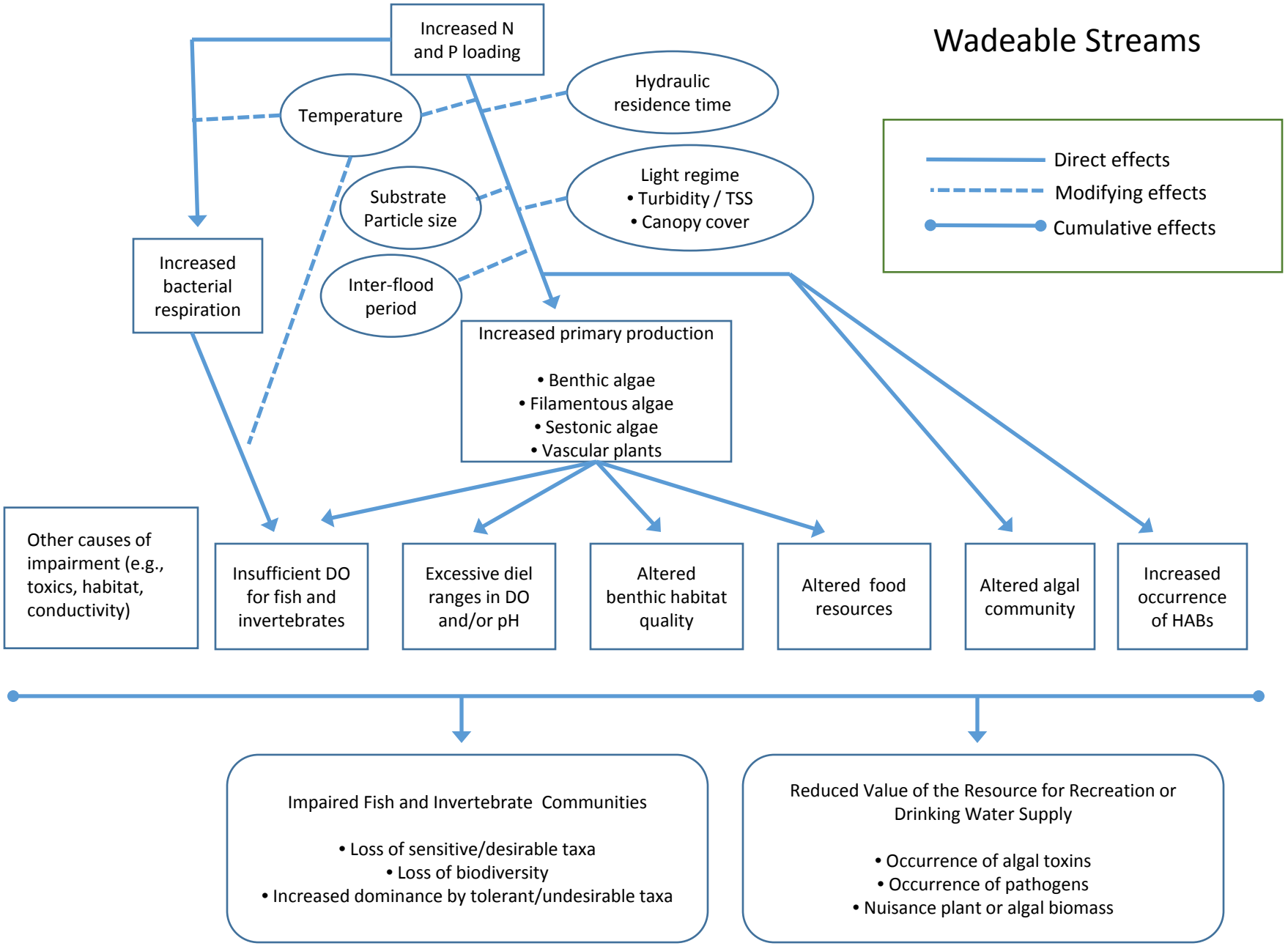
# *Example: Minnesota River Eutrophication Standards*

*A. Eutrophication standards are compared to data averaged over the summer season or as specified in subpart. 4.*
*Exceedance of the total phosphorus and either sestonic chlorophyll-a, biochemical oxygen demand (BOD5), diel dissolved oxygen flux or pH standard is required to indicate a polluted condition for assessment and implementation purposes.*

Criteria consist of TP and four response indicators (chl *a*, DO flux, $BOD_5$ and pH):

| Ecoregion | TP (µg/L) | Chlorophyll a (µg/L) | Daily DO flux (mg/L) | $BOD_5$ (mg/L) | pH |
|---|---|---|---|---|---|
| North | 50 | 7 | 3 | 1.5 | CW: 6.5-8.5<br>WW: 6.5-9.0<br>(From MN WQS) |
| Central | 100 | 18 | 3.5 | 2 | |
| South | 150 | 35 | 4.5 | 3 | |


Non-Wadeable Rivers
Increased N and P loading
Temperature
Hydraulic residence time
Substrate Particle size
Light regime
• Turbidity / TSS
• Depth
Inter-flood period
Increased bacterial respiration
Increased primary production
• Sestonic algae
• Vascular plants
• Benthic algae
Direct effects
Modifying effects
Cumulative effects
Other causes of impairment (e.g., toxics, habitat modification, conductivity)
Insufficient DO for fish and invertebrates
Excessive diel ranges in DO and/or pH
Altered benthic habitat quality
Altered food resources
Altered algal community
Increased occurrence of HABs
Impaired Fish and Invertebrate Communities
• Loss of sensitive/desirable taxa
• Loss of biodiversity
• Increased dominance by tolerant/undesirable taxa
Reduced Value of the Resource for Recreation or Drinking Water Supply
• Occurrence of algal toxins
• Occurrence of pathogens
• Nuisance plant or algal biomass


Wadeable Streams
Increased N and P loading
Temperature
Hydraulic residence time
Substrate Particle size
Light regime
• Turbidity / TSS
• Canopy cover
Inter-flood period
Increased bacterial respiration
Increased primary production
• Benthic algae
• Filamentous algae
• Sestonic algae
• Vascular plants
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Reduced Value of the Resource for Recreation or Drinking Water Supply
• Occurrence of algal toxins
• Occurrence of pathogens
• Nuisance plant or algal biomass

# Other Midwest Nutrient Criteria

- Minnesota Eutrophication Standards
  - Weighed multiple lines of evidence including stressor response based and reference-based approaches
  - Includes values for western Corn Belt ecoregion
- Wisconsin TP criteria
  - Stressor response based
  - Lacks CornBelt ecoregion
- No EPA-approved numeric standards
  - IN, IA, MO, OH

# Lines of Evidence Weighed by NSAC for Illinois Rivers and Streams

- IEPA Data
  - Stressor-response analyses
  - Statistical distribution
  - Modeled reference condition
- Stressor – Response data from Literature
  - Conclusions from Council on Food and Agricultural Research (C-FAR) funded work in Illinois streams
  - Other sources
- Reference/Background Nutrient estimates from Literature

# Analyses of Illinois EPA Data

- Conducted updated analyses of Illinois EPA dataset with EPA-funding (assistance from Tetra-Tech)
- NSAC used a portion of available Illinois EPA dataset:
  - 2006-2015
  - Included sites from ambient network and intensive basin surveys
  - Parameters included:
    - TP/TN
    - Sestonic chl a (measure of water column algae)
    - Continuous dissolved oxygen (DO)
    - Macroinvertebrate and fish indexes of biological integrity
    - QHEI (measure of habitat quality)
    - Other Water quality measures (turbidity, temperature, etc.)

# Analyses of Illinois EPA Data

- Conducted updated analyses of Illinois EPA dataset with EPA funding (assistance from Tetra-Tech)
  - Summer 2016-Fall 2017
  - Iterative process of analyses/work planning
  - Reviewed interim work products
  - Analyses have been completed
  - Tetra-Tech Report in progress

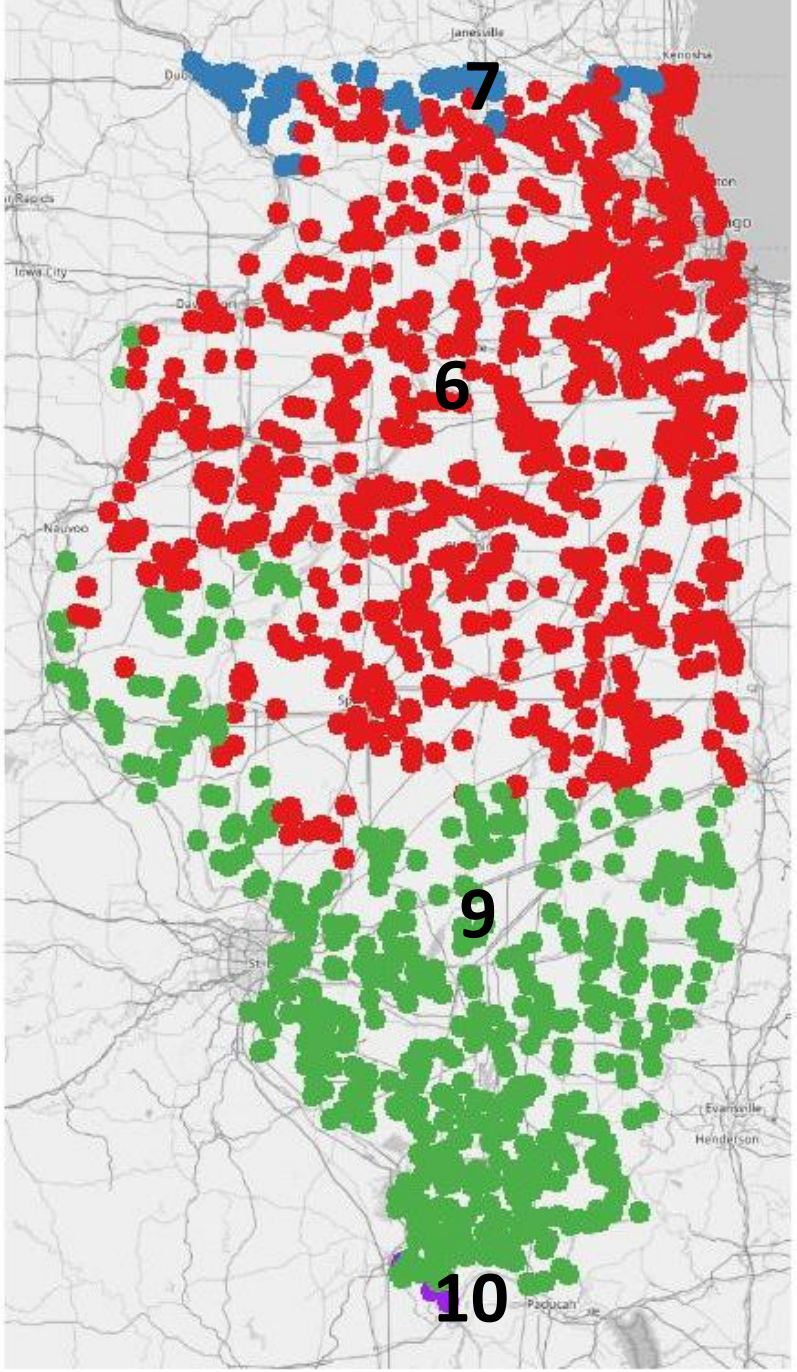
# Analyses of Illinois EPA Dataset

- Focused on stressor response relationships:
  - Nutrients vs. Chl a/DO min/DO avg/DO flux
  - Nutrients vs. mIBI/macroinvert metrics/fIBI
  - Chl a/DO vs. mIBI/macroinvert metrics/fIBI
- Analyzed relationships in different ways:
  - Statewide vs. Aggregate Nutrient Ecoregions vs. Level 3 ecoregions vs. major river basin
  - Watershed area
  - All stream orders vs. 3 stream order groupings
  - All sites vs. high QHEI vs. high IBI sites
- Some support for conceptual model, but in virtually all cases the stressor-response models had low predictive power with $R^2$ values less than 0.35

# Lines of Evidence

- IEPA Data
- **Reference/Background Nutrient estimates from Literature**
- Conclusions from Council on Food and Agricultural Research (C-FAR) funded work in Illinois streams
- Stressor – Response data from Literature

# Nutrient Ecoregions in Illinois



## Background Nutrient Concentrations from USEPA (2001) and IEPA dataset (2017)

| Statistical Distribution Sources | Ecoregion 6* TP (ug/L) | Ecoregion 9* TP (ug/L) | Ecoregion 6 TN (ug/L) | Ecoregion 9 TN (ug/L) |
|---|---|---|---|---|
| 25th USEPA (annual) | 76 | 37 | 2180 | 690 |
| 25th IEPA data (seasonal) | 90 | 130 | 2100 | 900 |
| 25th IEPA data (annual) | 80 | 120 | 2400 | 900 |
| 75th IEPA Minimally Disturbed Sites (seasonal; n=104) | 160 | 110 | 5600 | 1100 |
| 75th IEPA Minimally Disturbed Sites (annual; n=92) | 160 | 110 | 6400 | 1100 |
| 75th IEPA Attaining mIBI Sites (seasonal) | 190 | 200 | 6000 | 1500 |
| 75th IEPA Attaining mIBI Sites (annual) | 190 | 200 | 6100 | 1600 |

## Modelled Reference Nutrient Concentrations from Literature and IEPA dataset (2017)

| Modelled Reference Sources | Ecoregion 6* TP (ug/L) | Ecoregion 9* TP (ug/L) | Ecoregion 6 TN (ug/L) | Ecoregion 9 TN (ug/L) |
|---|---|---|---|---|
| IEPA data (annual) | 190 | 50 | 1600 | 500 |
| Dodds and Oakes | 23 | 31 | 215 | 370 |
| Smith et al. | 54 | 48 | 355 | 150 |
| Robertson EPZ 1 and 2 and ENZ 3* | 100 | 40 | 1480 | 1480 |

# Lines of Evidence

- IEPA Data
- Reference/Background Nutrient estimates from Literature
- **Conclusions from Council on Food and Agricultural Research (C-FAR) funded work in Illinois streams**
- Stressor – Response data from Literature

# Conclusions from C-FAR work

- Benthic algae saturation threshold for dissolved phosphorus in laboratory experiments occurred at ~25ug/L SRP – consistent with other literature (Hill and Fanta 2007)
- Statewide survey of 53 streams for nutrients, habitat, and macroinvertebrate measures observed that both habitat and nutrients (nitrogen and phosphorus) affected measures of macroinvertebrate health (Heatherly et al. 2007)
- Statewide 2004 low-flow survey observed possible increase in sestonic algae in open-canopied sites with TP > ~70 ug/L (Royer et al. 2008)

# Assessment of Chlorophyll-*a* as a Criterion for Establishing Nutrient Standards in the Streams and Rivers of Illinois

**Todd V. Royer*** Indiana University
**Mark B. David, Lowell E. Gentry, Corey A. Mitchell, and Karen M. Starks** University of Illinois at Urbana-Champaign
**Thomas Heatherly II and Matt R. Whiles** Southern Illinois University

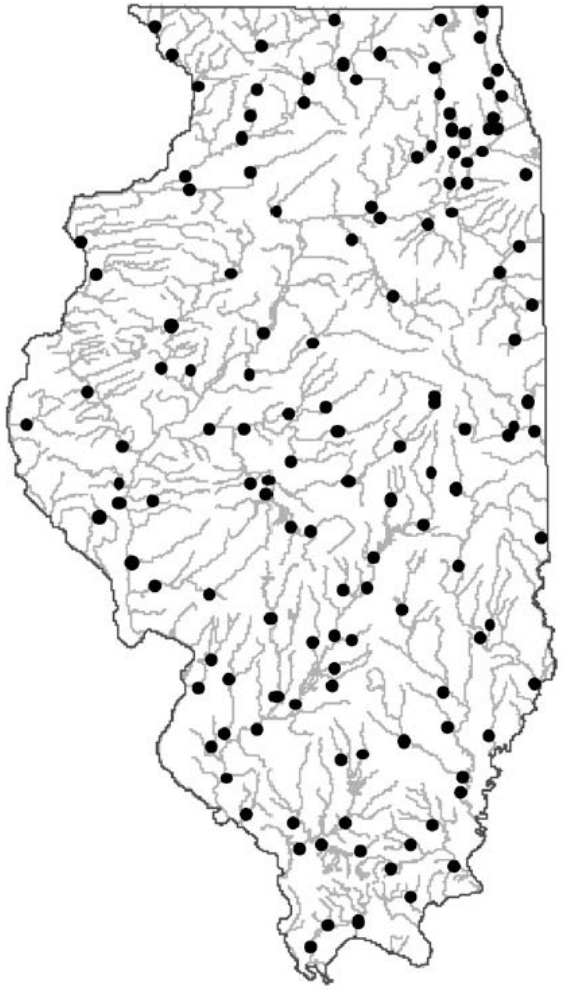


Fig. 1. Map of Illinois showing the major river networks and the distribution of the 138 sites used for the study.

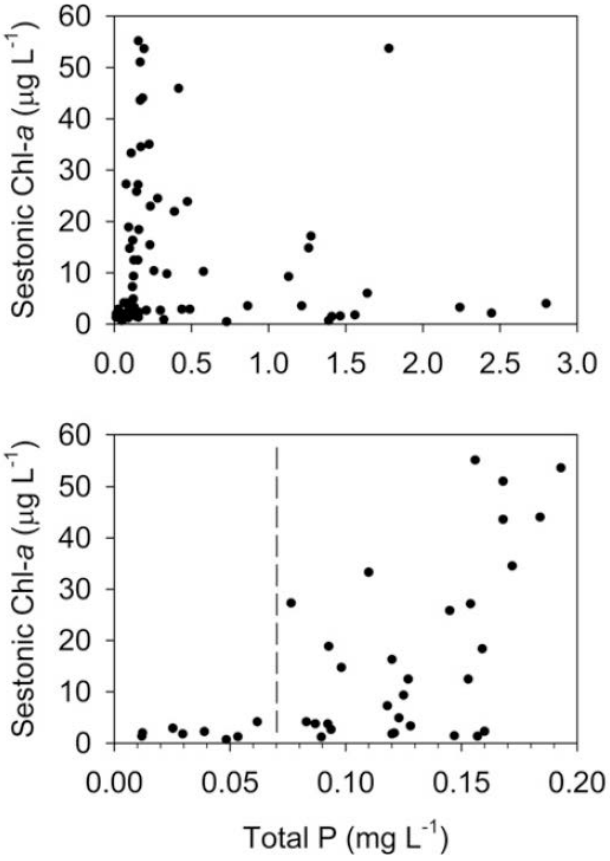



Fig. 4. Relationship between total P and sestonic chlorophyll-*a* (chl-*a*) concentrations during the 2004 low-discharge survey using all sites (upper panel), and only sites with an open canopy (<25%) and total P concentrations of <0.2 mg $L^{-1}$ (lower panel; $n$ = 38). The dashed vertical line indicates an apparent threshold value of 0.07 mg $L^{-1}$ total P.

# Limitations

- IEPA monitoring program was not specifically developed to support nutrient criteria development
- Data collection is not developed in a probabilistic design
- Lack data on periphyton in Illinois streams
- Some analyses excluded sites that did not include continual DO, resulting in decreased sample size

# Lines of Evidence

- IEPA Data
- Reference/Background Nutrient estimates from Literature
- Conclusions from Council on Food and Agricultural Research (C-FAR) funded work in Illinois streams
- **Stressor – Response data from Literature**
  - **Compilation in progress**

# Moving Forward

- Face-to-Face Meeting in December planned
- Request finalization of TetraTech Report for Illinois analyses
- Derivation of numeric criteria recommendation and supporting rationale, pending data availability