

Creating Regional Monitoring Networks in Streams to Detect Climate Change Effects



Jen Stamp, Tetra Tech, Inc.

Britta Bierwagen, EPA/ORD

Jonathan Witt, ORISE Fellow, EPA/ORD

Anna Hamilton, Tetra Tech, Inc.

Margaret Passmore, EPA/R3

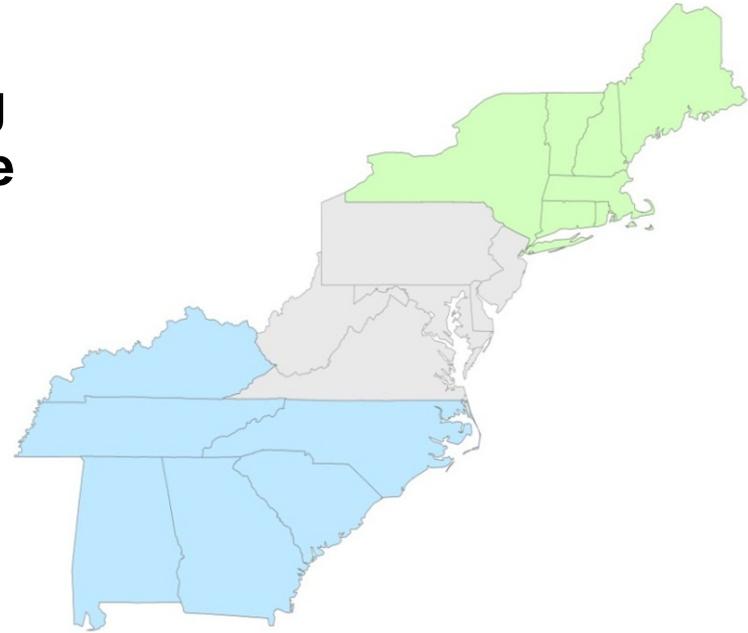
Debbie Arnwine, Tennessee DEC



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Background

- Working with **states, tribes, river basin commissions, EPA Regional offices** and others in the **Northeast, Mid-Atlantic & Southeast** to develop **Regional Monitoring Networks (RMNs)** for **freshwater wadeable streams**
- Collecting **biological, thermal** and **hydrologic** data
- Detect **climate-related changes**; **monitor reference conditions**
- **Integrating** into **existing programs** and **efforts**
 - Existing sentinel networks
 - National Reference Network (NWQMC)
 - National Climate Assessment



Why Create RMNs



- Detecting **temporal trends**
 - Trends related to changing **thermal** and **hydrologic** conditions
 - Shifts in **reference condition**
- Providing information that will allow for a **better understanding of relationships between biological, thermal, and hydrologic data**
- Providing information about **response and recovery of organisms to extreme weather events**
- Testing hypotheses and predictive models related to **climate change vulnerability**
- Quantifying **natural variability**

Data Collection Targets

Biological: macroinvertebrates (collected annually).

Optional: fish and periphyton, with fish being higher priority than periphyton.

Temperature: year-round water and air temperature.

Hydrologic (as resources permit): year-round water level data, ideally converted to discharge.

Habitat: qualitative (rapid visual habitat methods like USEPA RBP or equivalent)

Optional: quantitative habitat (e.g., US EPA NRSA protocols)

Water quality: *in situ*, instantaneous water quality parameters (specific conductivity, dissolved oxygen, pH and temperature)

Optional: additional or more complete water chemistry

Photodocumentation

Geospatial data (e.g., GIS-based land use land cover).

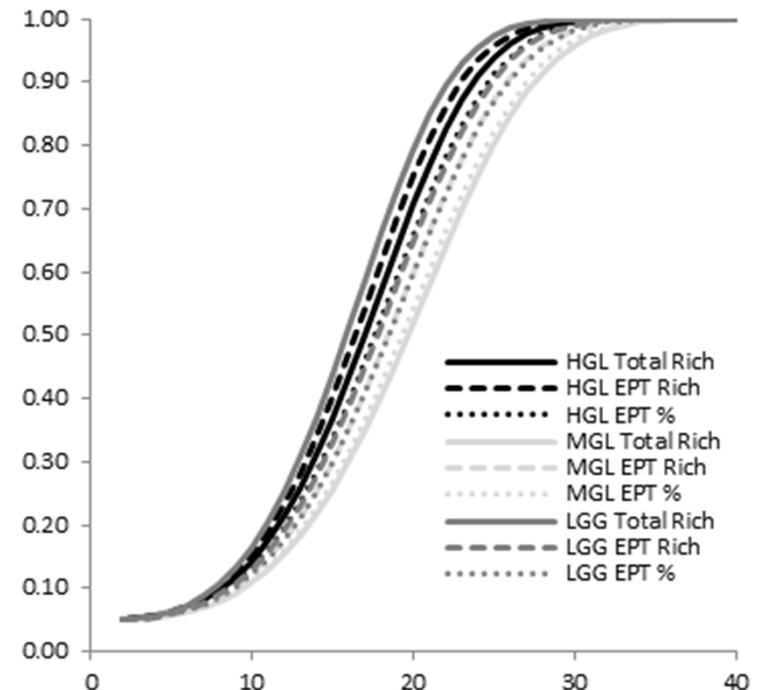


Site Selection

Sampling efforts at the RMNs will be concentrated at a core group of **'primary'** sites

- 2 to 15 primary sites per state (depending on the size of the state and availability of resources)

Well-designed networks of **30 sites** monitored consistently can detect underlying **changes of 1–2% per year** in a variety of **biological metrics** within **10–20 years**, if such trends are present (Bierwagen et al. 2014 - in review)



Primary Site Selection

Main considerations when selecting primary sites

Consideration	Desired characteristics at primary sites
Disturbance	Low level of anthropogenic disturbance.
Potential for future disturbance	Located in protected watersheds.
Sampling record	Historical sampling record for biological, thermal or hydrological data.
Equipment	Co-located with existing equipment (e.g., USGS gage, weather station).
Classification	Within the desired stream class. For this phase of work, the focus is primarily on the colder, faster stream class (Witt et al., 2014 – in progress).
Sustainability	Accessible , part of an existing network (e.g., MDDNR Sentinel Stream Network), opportunities for partnerships .
Climate change vulnerability	Rated as moderately or most vulnerable to at least one of the exposure scenarios: increasing temperatures, increased frequency and severity of extreme precipitation events, and increased summer low flow events (US EPA 2014a – in progress).

Primary Site Selection

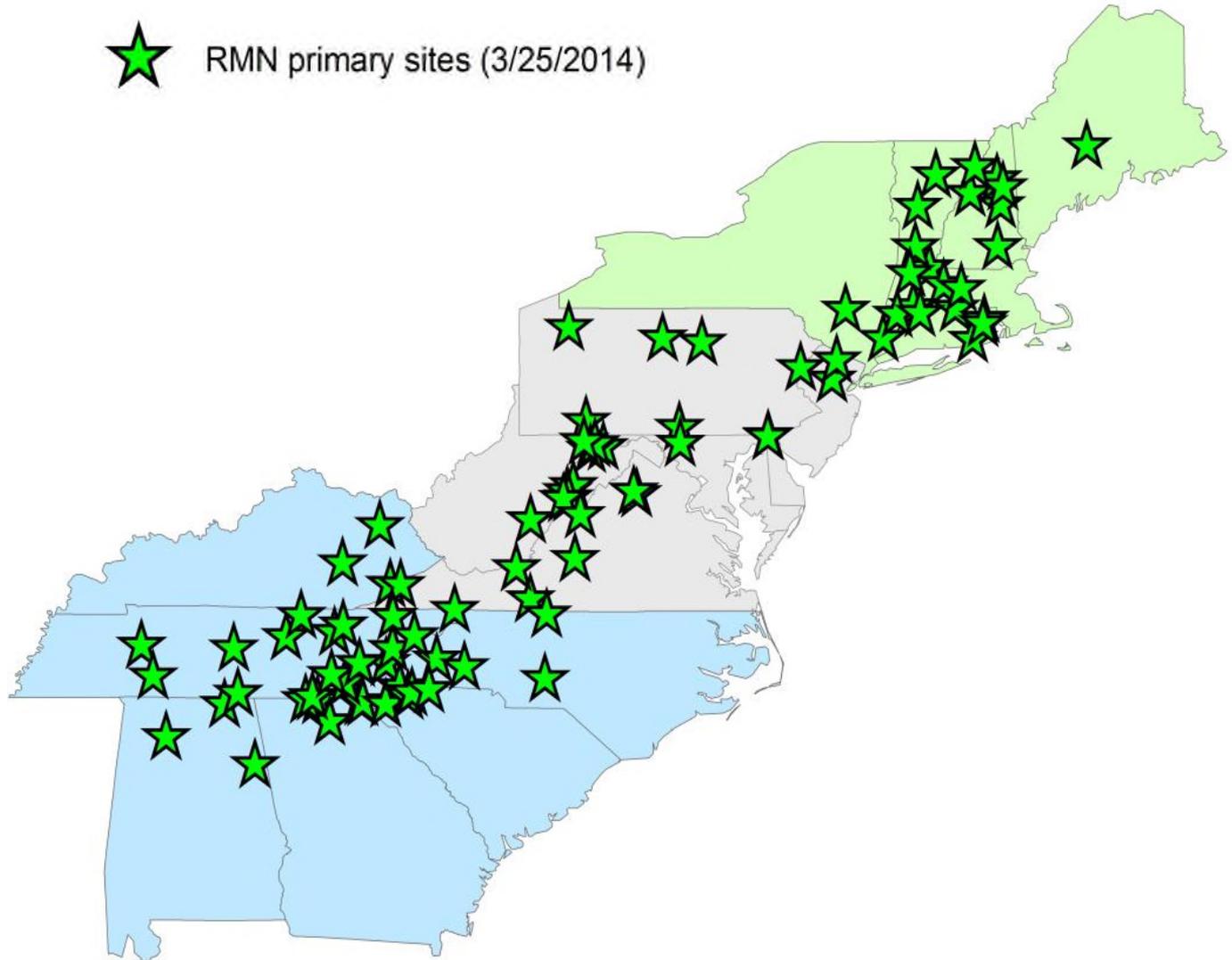
Reference sites are being targeted because:

- They are the **standard against which other bioassessment sites are compared**, thus it is critical to track changes at these sites over time
- **Higher likelihood** of being able to **characterize climate-related impacts** in the absence of other non-climatic stressors
- A **lack of long-term paired biological, thermal and hydrologic data** exists at these types of sites



Primary Site Selection

 RMN primary sites (3/25/2014)



Data Collection at Primary Sites

To the extent possible, **uninterrupted, paired long-term biological, thermal and hydrologic data** should be collected, using **methods agreed upon by regional working group**



Macroinvertebrate sampling

- Annual collection
- Abundant riffle habitat
- 300-organism target
- Taxonomic resolution – lowest practical level

Secondary Sites

Data from additional ‘**secondary**’ sites are now being considered for the RMNs.

These are sites at which **data are already being collected** on an annual or biannual basis, but for various reasons, they are not selected to be primary sites. Examples –

- **Sentinel sites in VT, CT, MD, WV, TN**
- USGS GAGES Network
- Susquehanna River Basin Commission (SRBC)
continuous monitoring stations

Efforts will be made to collect the full suite of data at primary sites; **data from secondary sites may be more limited.**

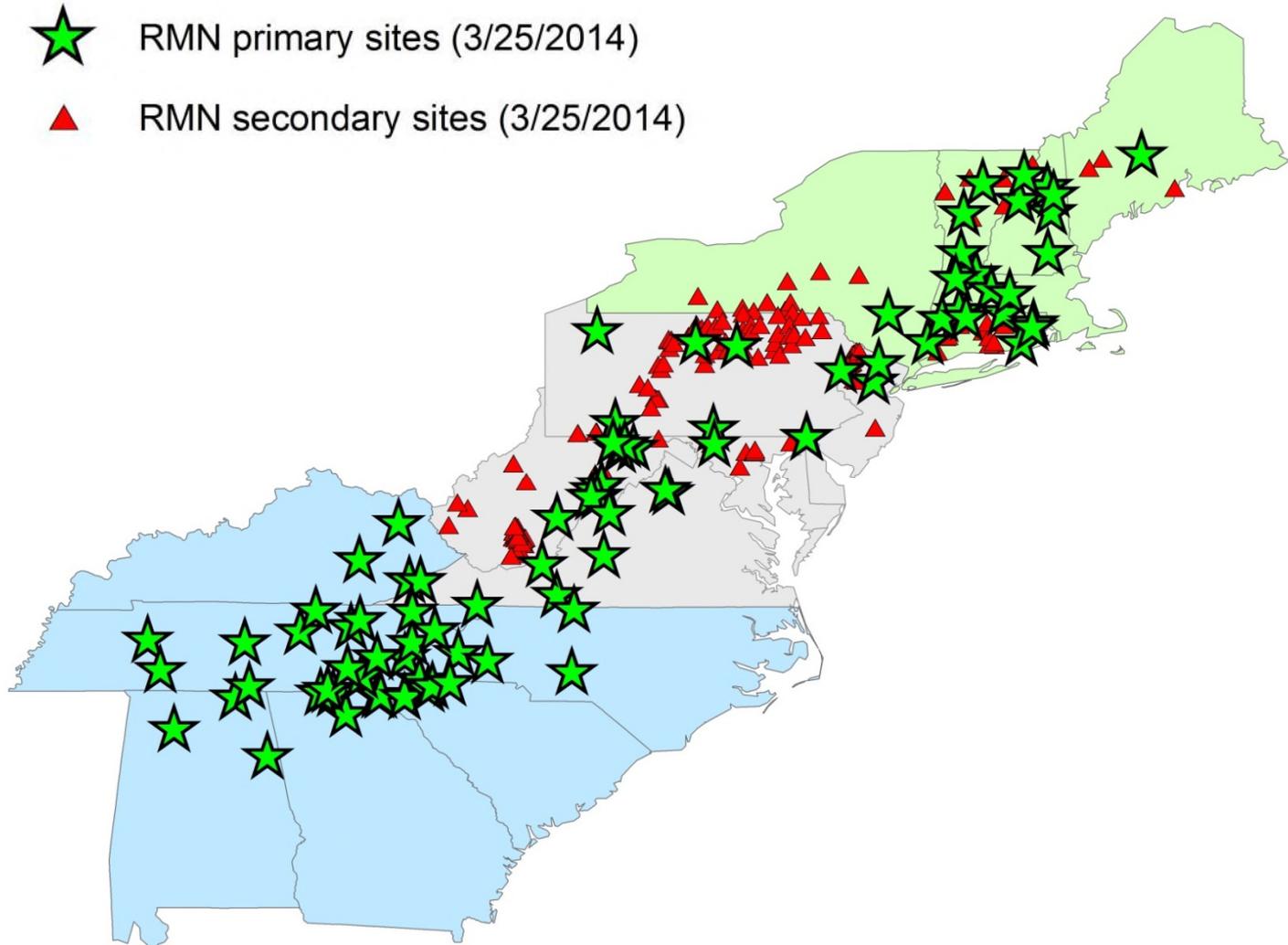
Secondary Sites

Secondary sites may contribute data on:

- **Non-reference sites**
- **Interacting effects of changing thermal and hydrologic conditions with non-climatic stressors** (attention will be paid not just to the level of stress, but also to the types of stress)
- Sites with differing levels of **vulnerability to climate change**
- **Unique and/or underrepresented geographic areas** (e.g., Pine Barrens)

RMN Sites – Eastern USA

primary + secondary



- Describes **development of Regional Monitoring Networks** in Northeast, Mid-Atlantic, and Southeast
- **Site selection**
- **Data collection and QA/QC procedures**
- **How to summarize and share the data**
- Examples of how the data can be **analyzed and used**

EPA/600/R-14/xx

Internal Review Draft

March 2014

Regional Monitoring Networks



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National Center for Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC 20460

Framework could be extended to **other regions** and **waterbody types**

RMN Framework

- **Adaptable**
 - Allows the **amount and types of data** collected at each RMN site to **vary from year to year**
 - Accommodates **differences in sampling methodologies** within or across regions while still providing data that are **sufficiently similar** that they can be used to generate **comparable indicators**
- **Balances the needs** of the states, tribes, RBCs, and others with those of the regional working groups

Draft RMN report

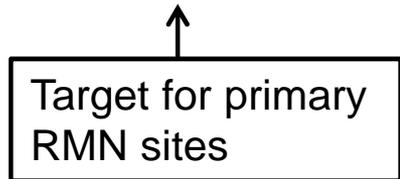
Four levels of rigor

Level of rigor	Usability for RMNs
1 (lowest)	Data are usable under certain or limited circumstances. Data are not collected and processed in accordance with methods agreed upon by the regional working group, which severely limits their usefulness.
2	Data are usable under some, but not all circumstances. Only certain aspects of sample collection and processing are done using the protocols that are agreed upon by the regional working group, which limits their usefulness.
3 (target) 	Data meet the desired level of rigor. They are collected in accordance with the methods that are agreed upon by the regional working group. Where methodological differences exist, steps have been taken to minimize biases, and data are sufficiently similar to generate comparable indicators and meet RMN objectives.
4 (optional) 	Data exceed expectations. Data include optional high quality data and meet or exceed the desired level of rigor agreed upon by the regional working group.

Draft RMN report

Example –macroinvertebrate data collection

Component	1 (lowest)	2	3	4 (highest)
Habitat	No riffle habitat	Multi-habitat composite from a sampling reach with scarce riffle habitat	Abundant riffle habitat	Multi-habitat sample with taxa from each habitat kept separate
Index period	Index period varies from year to year, and adjustments are NOT made for temporal variability	Index period varies from year to year, but adjustments are made for temporal variability	Adherence to an index period	Samples are collected during more than one index period (e.g., spring and late summer/early fall)
Fixed count subsample	Presence/absence or field estimated categorical abundance (e.g., rare, common, abundant, dominant)	Fixed count with a target of 100 or 200 organisms	Fixed count with a target of 300 organisms	Fixed count with a target of more than 300 organisms
Processing	Organisms are sorted, identified and counted in the field	Samples are processed in the laboratory by trained individuals, in accordance with methods that are systematically documented as standard operating procedures (SOPs). These methods differ from those that are agreed upon by the regional working group.	Samples are processed in the laboratory by trained individuals, in accordance with the methods that are agreed upon by the regional working group. These methods may or may not match with the normal SOPs used by the participating entity.	Samples are processed in the laboratory by trained individuals, in accordance with the methods that are agreed upon by the regional working group. If these methods differ from those that are normally used by the entity, the entity also processes the sample using its own method and compares results.
Qualifications	Identifications are done by a novice or apprentice biologist with no certification	Identifications are done by a taxonomist without certification	Identifications are done by a trained taxonomist who has the appropriate level of certification (or equivalent).	Identifications are done by a trained taxonomist who has the appropriate level of certification (or equivalent).



Summarizing and sharing the RMN data

- Which biological, thermal and hydrologic metrics to calculate
- Recommendations on QA/QC procedures to perform before calculating the metrics

Analyzing and using the RMN data

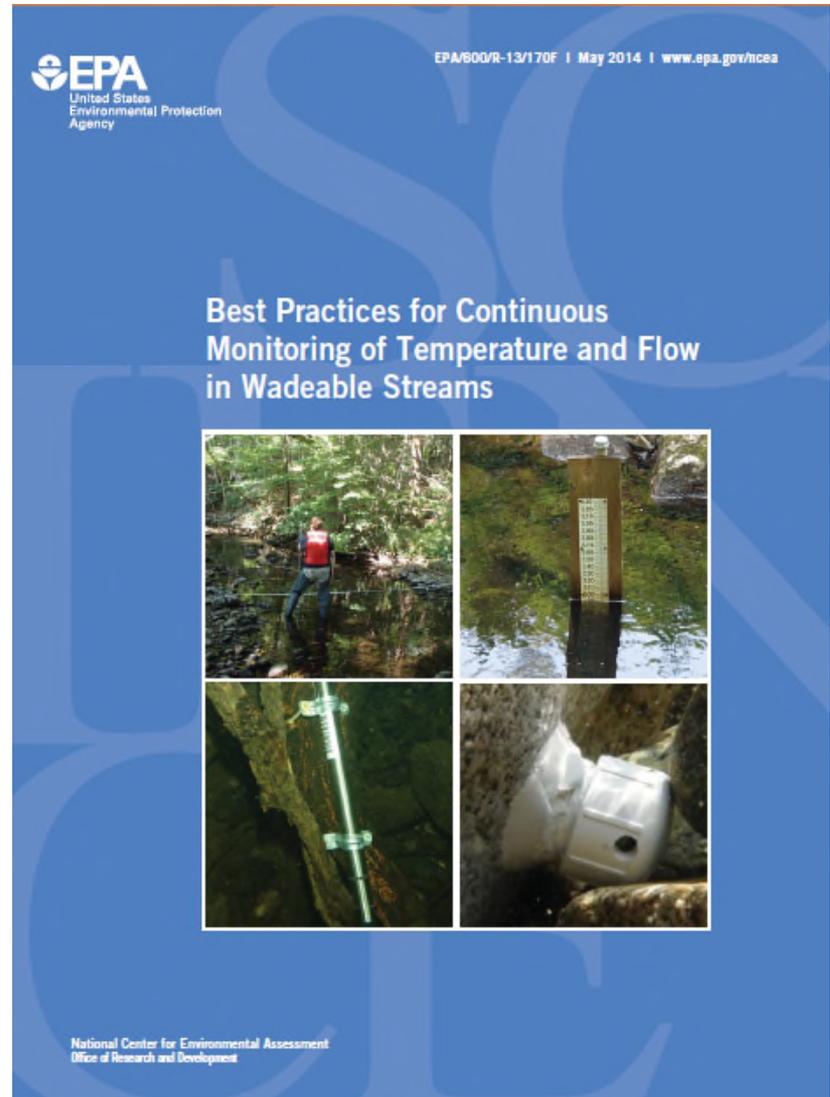
These recommendations are intended to serve as **starting points**, and **should be re-evaluated** after the first several years of data collection at RMN sites.

EPA Report:

Best practices for collecting year-round temperature and hydrologic data at ungaged sites

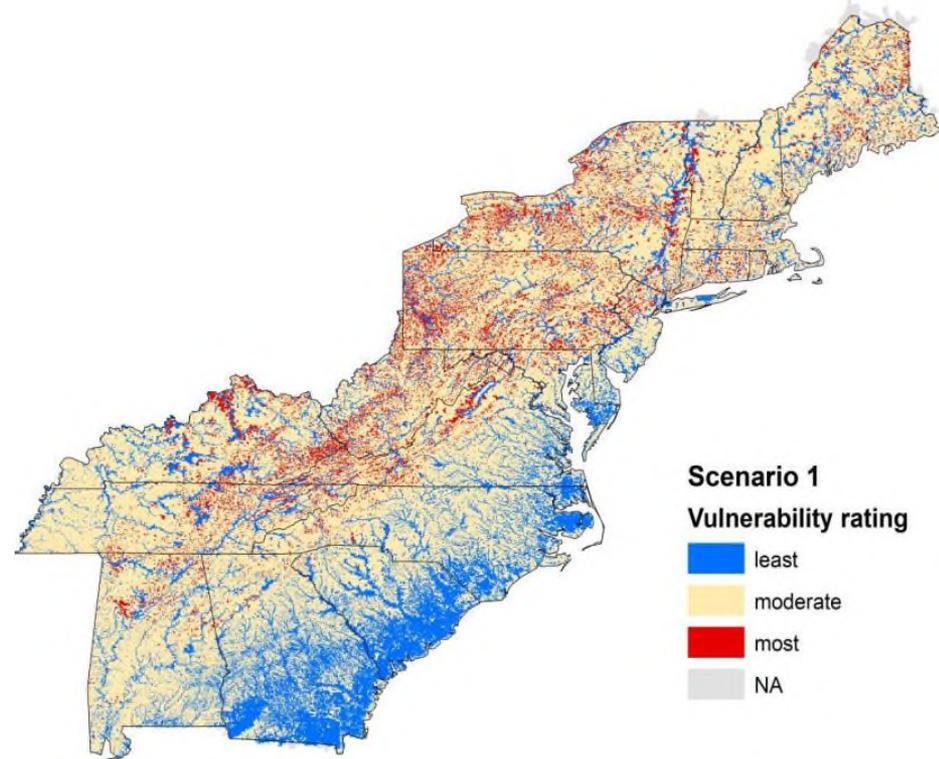
Collaborative effort

Addressing external review comments



Other Activities & Updates

- Regional **climate change vulnerability assessments** (EPA report in progress)
- **Classification** analysis for eastern states (based on macroinvertebrates in freshwater wadeable streams)
- **Species distribution modeling** on Northeast dataset



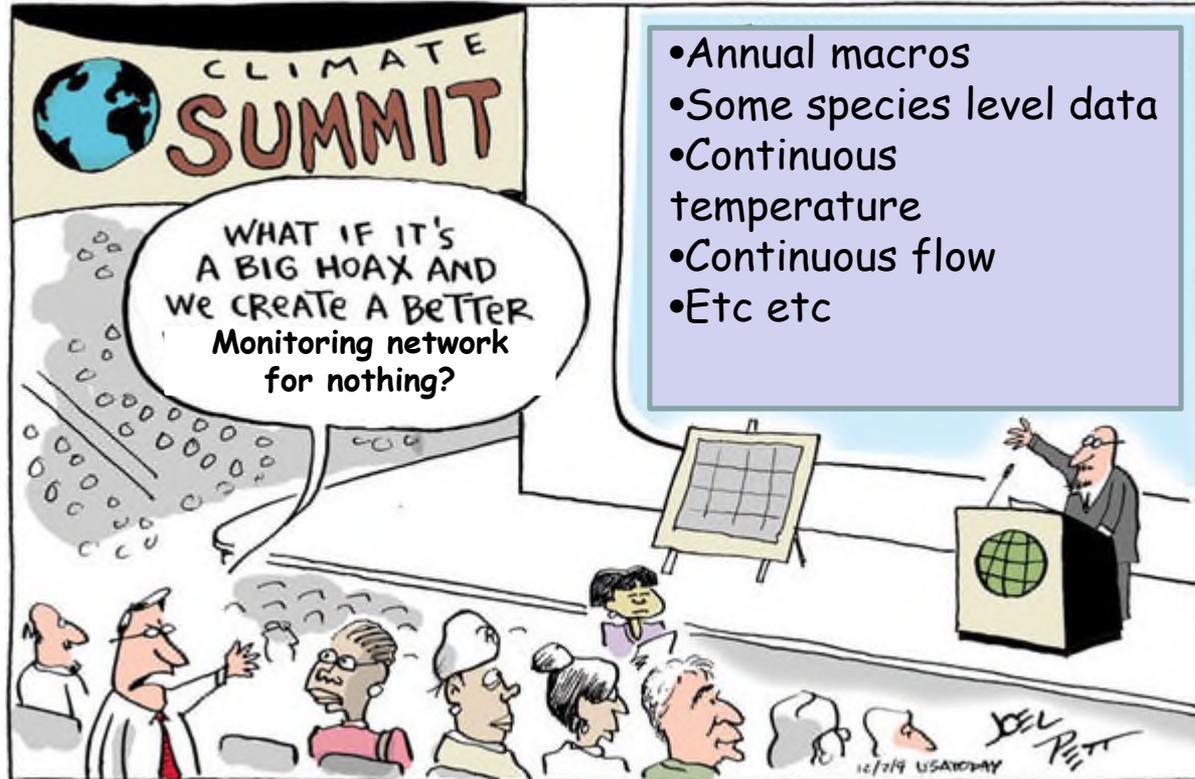
Challenges for RMNs

Challenges inherent with setting up long-term sampling, especially on ad hoc and volunteer basis

- Equipment needs
- Installation assistance
- Macroinvertebrate sample identification
- Data storage and analysis

Seeking opportunities for collaboration!

- National Reference Network (NWQMC)
- USGCRP monitoring and observing network survey
- NCA indicators system
- DOI LCCs and CSCs



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Acknowledgments

Northeast work group

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VT – Steve Fiske and Aaron Moore

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USGS - Anne Choquette

DOI Southeast Climate Science Center - Cari Furiness

NPS - Matt Kulp

Southeast Aquatics – Mary Davis

South Atlantic LCC - Rua Mordecia

QUESTIONS? COMMENTS?



Jen Stamp (Jen.Stamp@tetratech.com)

Britta Bierwagen (bierwagen.britta@epa.gov)

Jonathan Witt (Witt.Jonathan@epa.gov)

Anna Hamilton (Anna.Hamilton@tetratech.com)