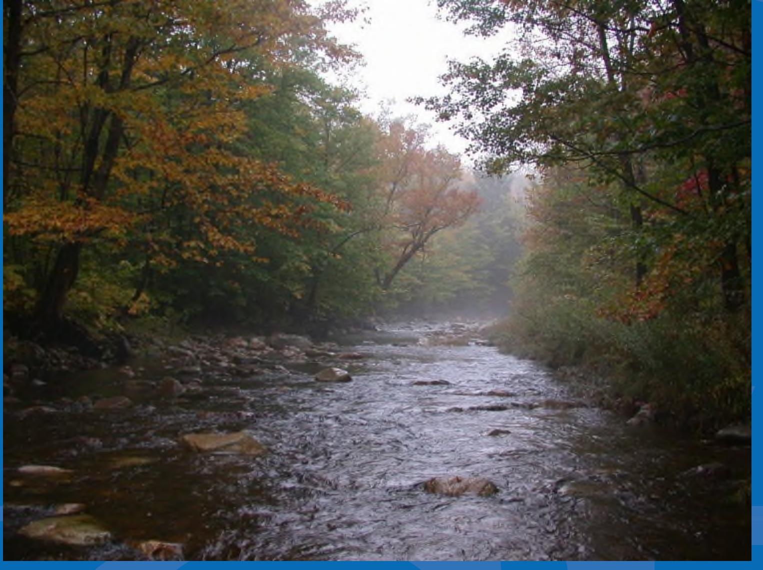
United States Environmental Protection Agency

Applications of Regional Monitoring Network (RMN) data



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Office of Research and Development
Air, Climate and Energy Program, National Center for Environmental Assessment

May 5, 2016

Background on Regional Monitoring Networks (RMNs)

Stemmed from pilot studies -

- How will climate change affect aquatic ecosystems?
- What do bioassessment programs need to know to respond?
- How will they maintain their ability to assess condition and detect impairment?

Looked for climate-related trends in routine macroinvertebrate data from ME, OH, NC & UT.

- Difficult to assess due to data gaps (not many minimally disturbed sites have long-term biological data; of these, few have contemporaneous thermal and hydrologic data)

Background on Regional Monitoring Networks (RMNs)

2012 - Northeast expressed strong interest in starting a regional monitoring network in freshwater wadeable streams to detect climate change effects

- Felt it was important to start doing this now (didn't want to look back 10 years from now wishing they had started collecting data earlier)
- Several states had already set up their own sentinel networks, which the RMN was able to tie into

- EPA and partners performed power analyses on an aggregated Northeast dataset (comprised of data from 10 entities) to help inform the RMN design

Background on Regional Monitoring Networks (RMNs)

Then other regions joined in…

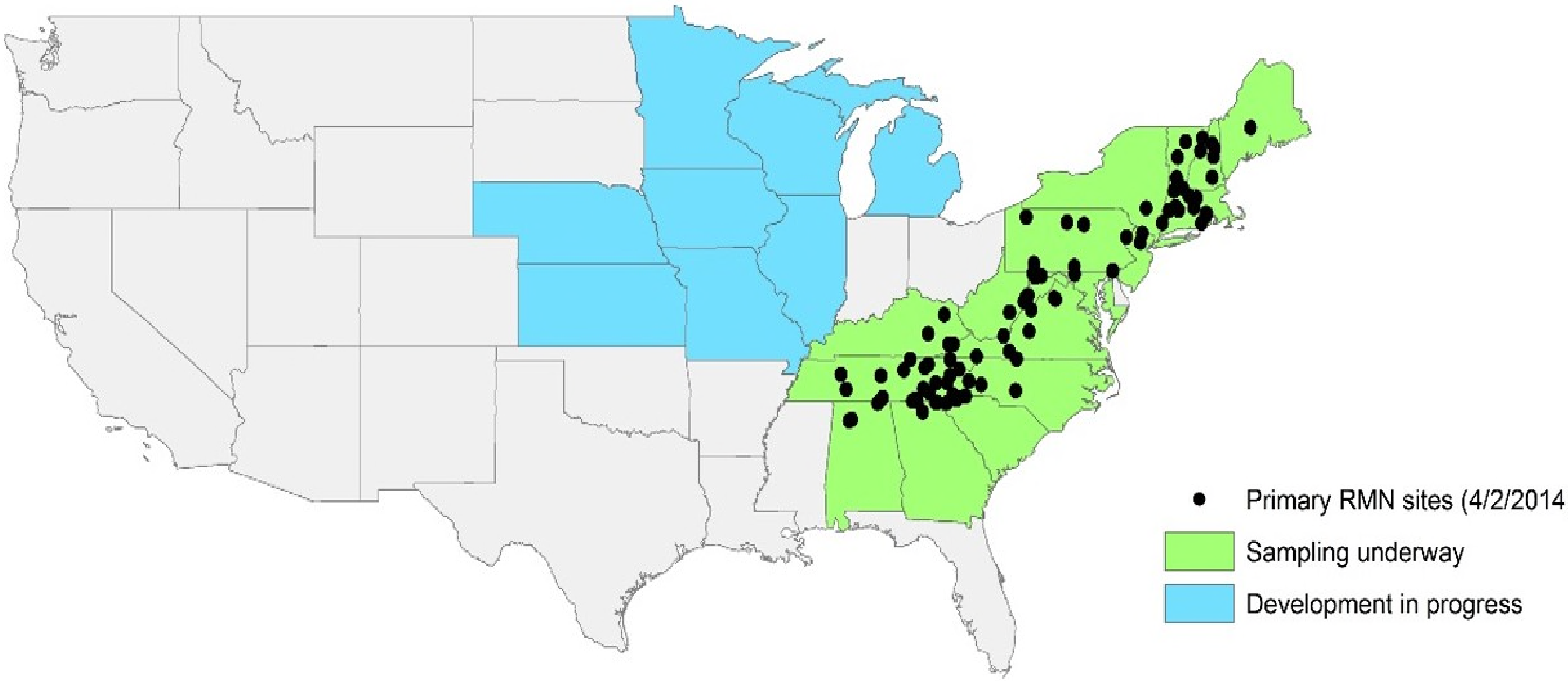
2013 – Debbie Arnwine (TN DEC) started a RMN in the Southeast.

2014 – Maggie Passmore (formerly EPA R3) spearheaded the Mid-Atlantic RMN.

2015 – Pete Jackson (EPA R5) & Gary Welker (EPA R7) have been working with Midwestern states and tribes; expect to start sampling this year.

Other regions have expressed interest as well.

Background on Regional Monitoring Networks (RMNs)



Background on Regional Monitoring Networks (RMNs)

Objective: detect potentially small, **climate-related trends** at a **regional scale**, in a **decision-relevant timeframe**, in the context of routine biomonitoring

Sampling goals:

- At least **30 sites with similar environmental and biological characteristics in each region**
  - Average 5 sites per state (range:1-15)
  - Design informed by power analyses on Northeast dataset (2012)
- Sample on an **annual basis** for **10 or more years**, using as **consistent** and **comparable** methods as possible (QAPP)

Background on Regional Monitoring Networks (RMNs)

- **Being integrated into existing programs**
  - Where feasible, RMN sites are part of established long-term monitoring networks and are co-located with USGS gages

- **Coordinate/collaborate where possible**

- **Regional coordination =**

  pooled resources + increased efficiencies

- Decision on level of involvement is **voluntary** and must fit within the **resource constraints** of the participating agencies

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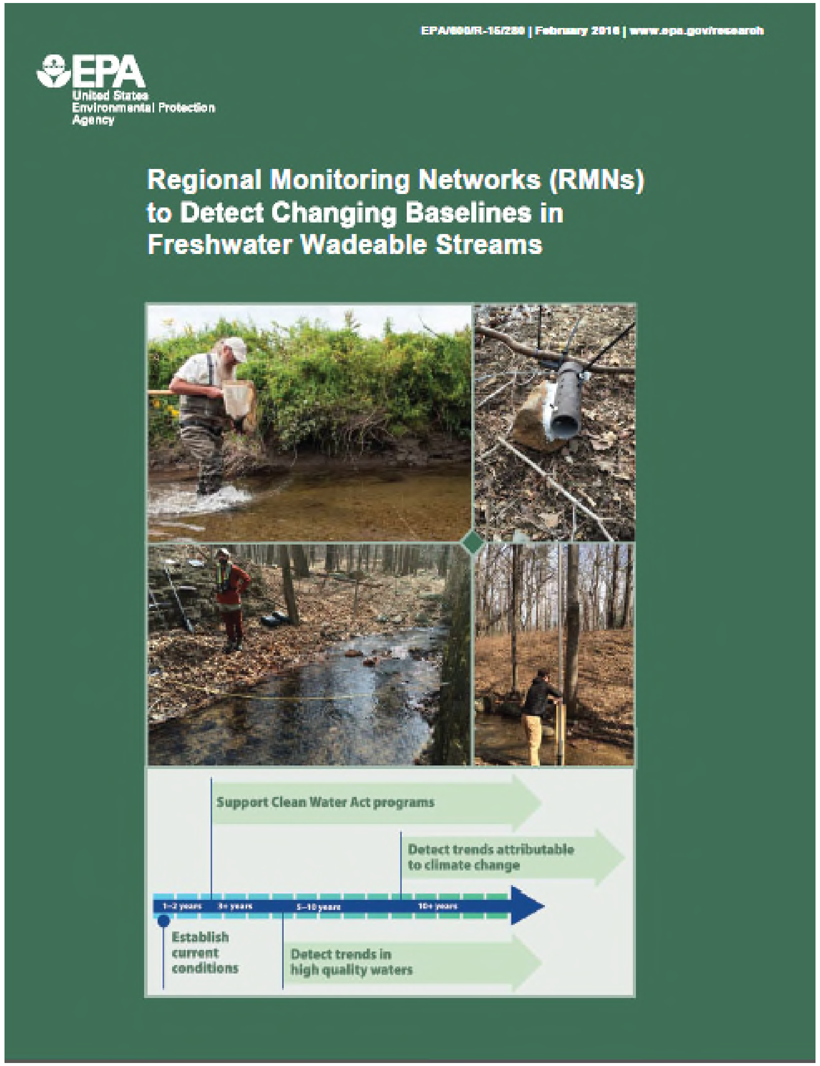
Data Collection Targets

- **Biological**: macroinvertebrates.
  - Optional: fish and periphyton
- **Temperature**: year-round water and air temperature
- **Hydrologic**: year-round water level data (from USGS gages or pressure transducers), ideally converted to discharge.
- **Habitat**
- **Water chemistry**

RMN report



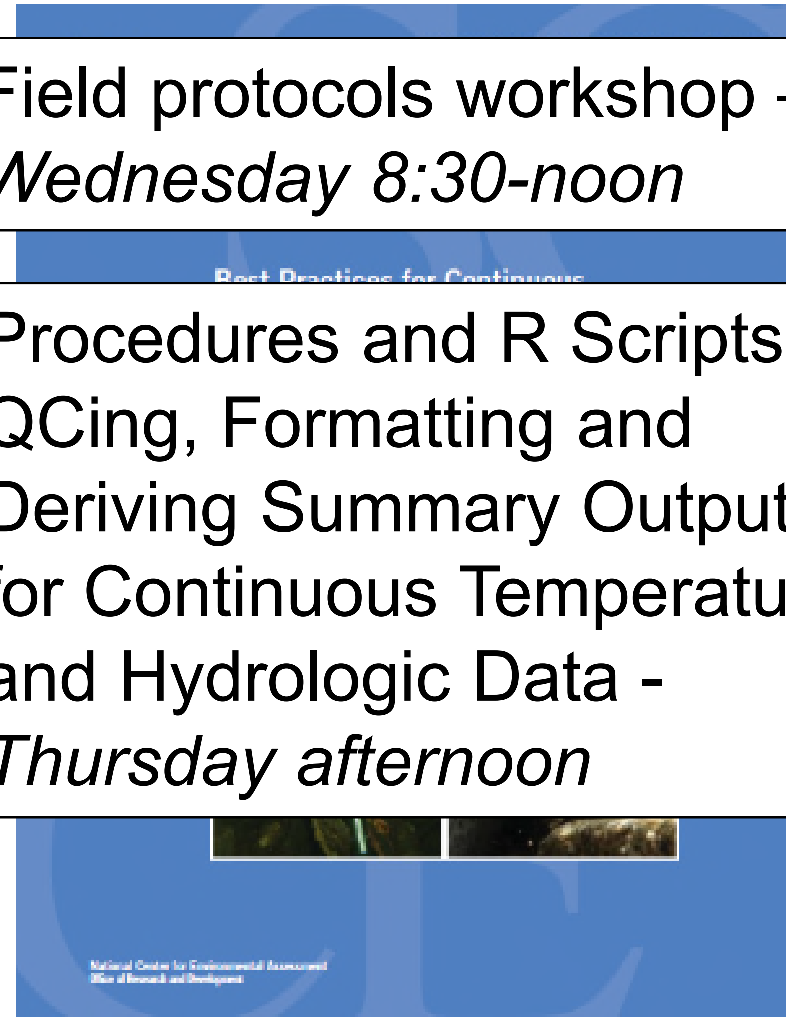
- Describes **development** of **Regional Monitoring Networks** in Northeast, Mid-Atlantic, and Southeast
- **Site selection**
- **Data collection** and **QA/QC procedures**
- **How to summarize** and **share** the data
- Examples of how the data can be **analyzed** and **used**

Available online:
https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=307973&CFID=60022322&CFTOKEN=41072377

Protocols for collection of thermal and hydrologic data

Many different aspects to collection of high quality continuous data:

- Proper equipment
- Accuracy checks
- Sensor configuration
- Sensor placement
- Installation techniques
- Documentation
- Maintenance
- Data retrieval
- Data processing
- Data storage



Field protocols workshop – *Wednesday 8:30-noon*

Procedures and R Scripts for QCing, Formatting and Deriving Summary Outputs for Continuous Temperature and Hydrologic Data - *Thursday afternoon*

https://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=280013

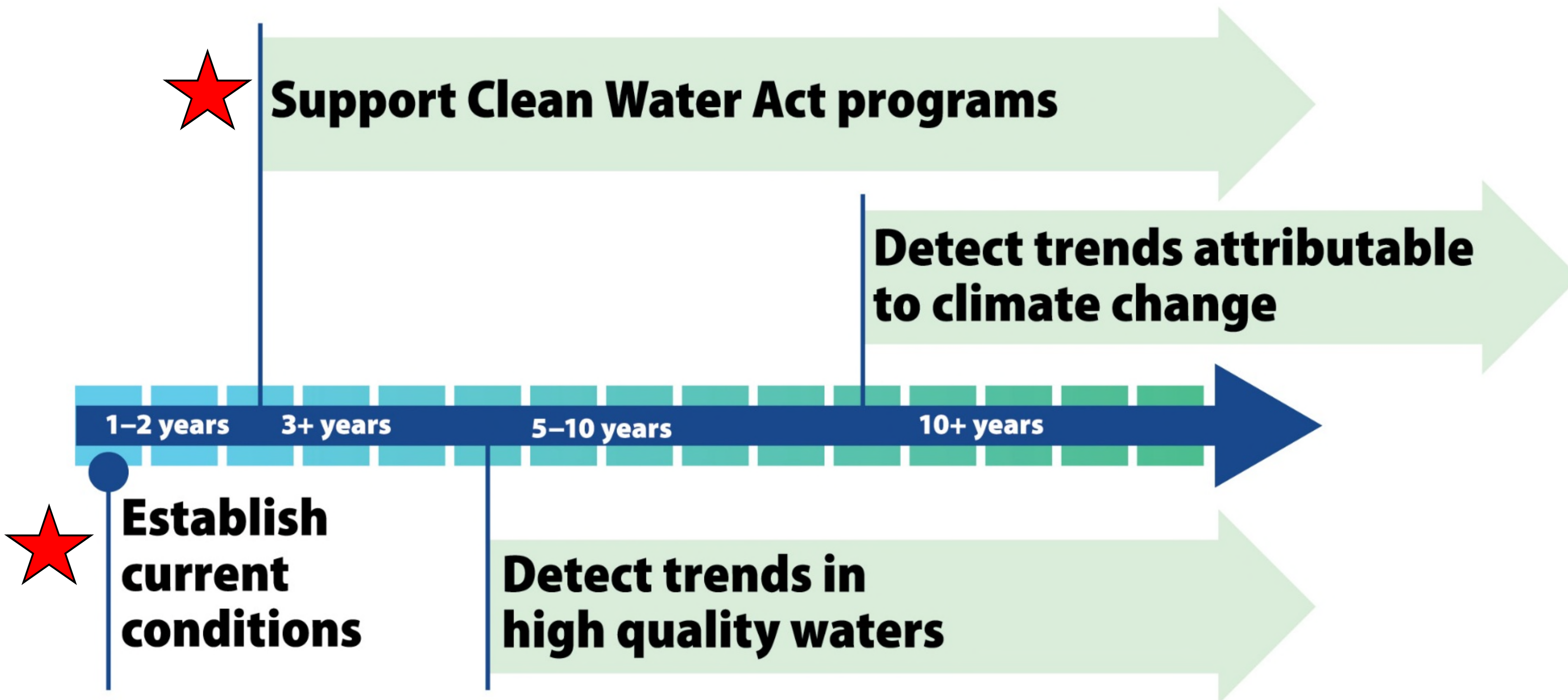
Hard copies available upon request (contact Britta - Bierwagen.Britta@epa.gov)

Data Usage

Networks are **multipurpose!**

RMN data can be used in many ways, spanning **short** to **long-term** **timeframes**…

Data usage timelines



★ 1-5 year timeframe

Data usage: 1-5 year timeframe

Monitor high quality waters

Standard against which other bioassessment sites are compared

Critical to
- Document current conditions at these sites
- Monitor how conditions change over time

- Fill data gaps - not many minimally disturbed sites have long-term biological data; of these, few have year-round thermal and hydrologic data

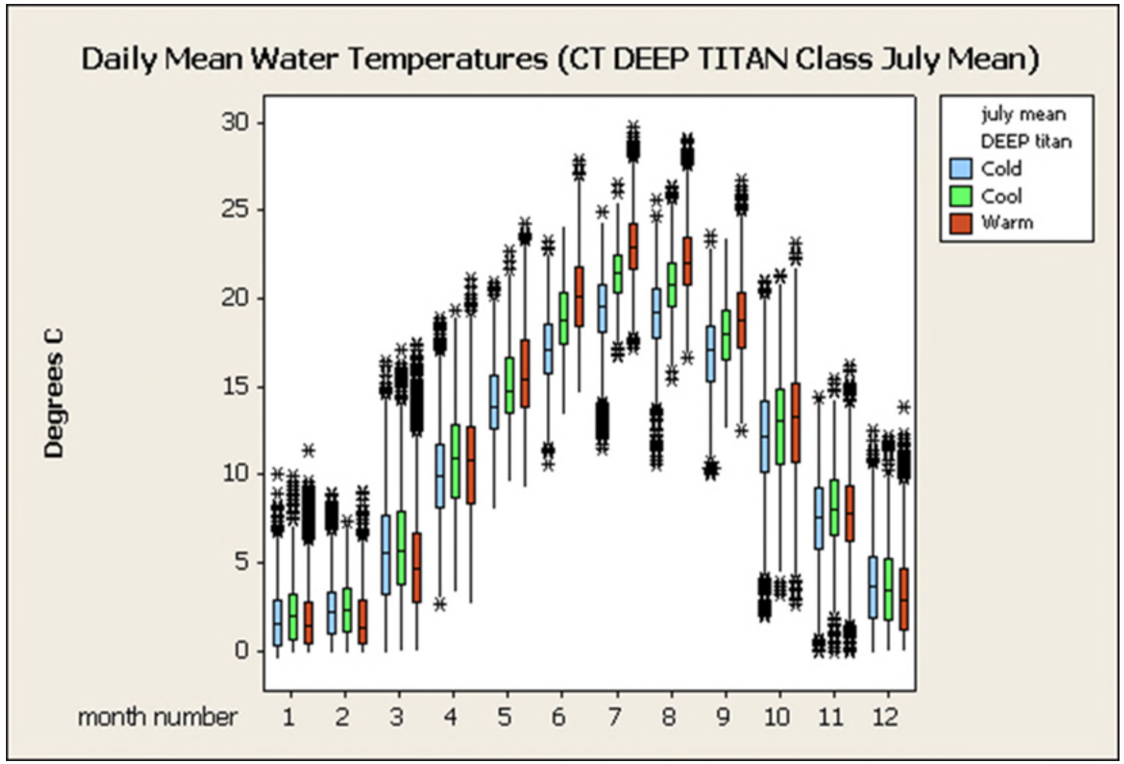
Data usage: 1-5 year timeframe

Inform criteria refinement or development

- Help identify ecologically meaningful thresholds

Connecticut DEEP used continuous temperature data and fish data to develop quantitative thresholds for 3 major thermal classes:

- Cold <18.29 C
- Cool 18.29–21.70 C
- Warm >21.70 C



Reference: Beauchene et al. 2014

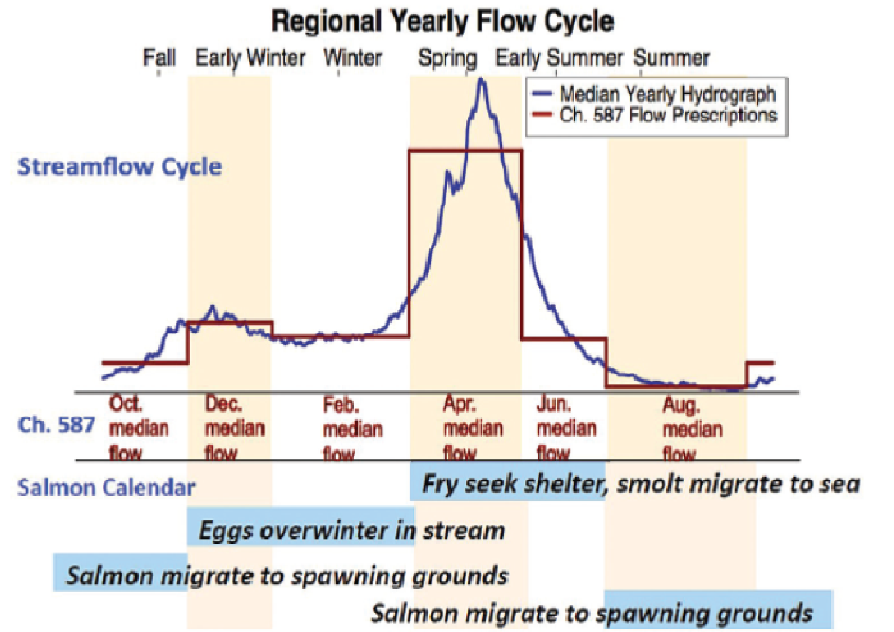
Data usage: 1-5 year timeframe

Inform criteria refinement or development

Maine used biological and hydrologic data to develop statewide environmental flow and lake level standards.

- Protect aquatic life and maintain important hydrologic processes

Salmon Lifecycle Calendar



References: Maine DEP 2007, Ricupero 2009

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Data usage: 1-5 year timeframe

Protection planning

Maryland DNR used continuous temperature and biological data to generate a thermal indicator organism list based on the benthic macroinvertebrate community

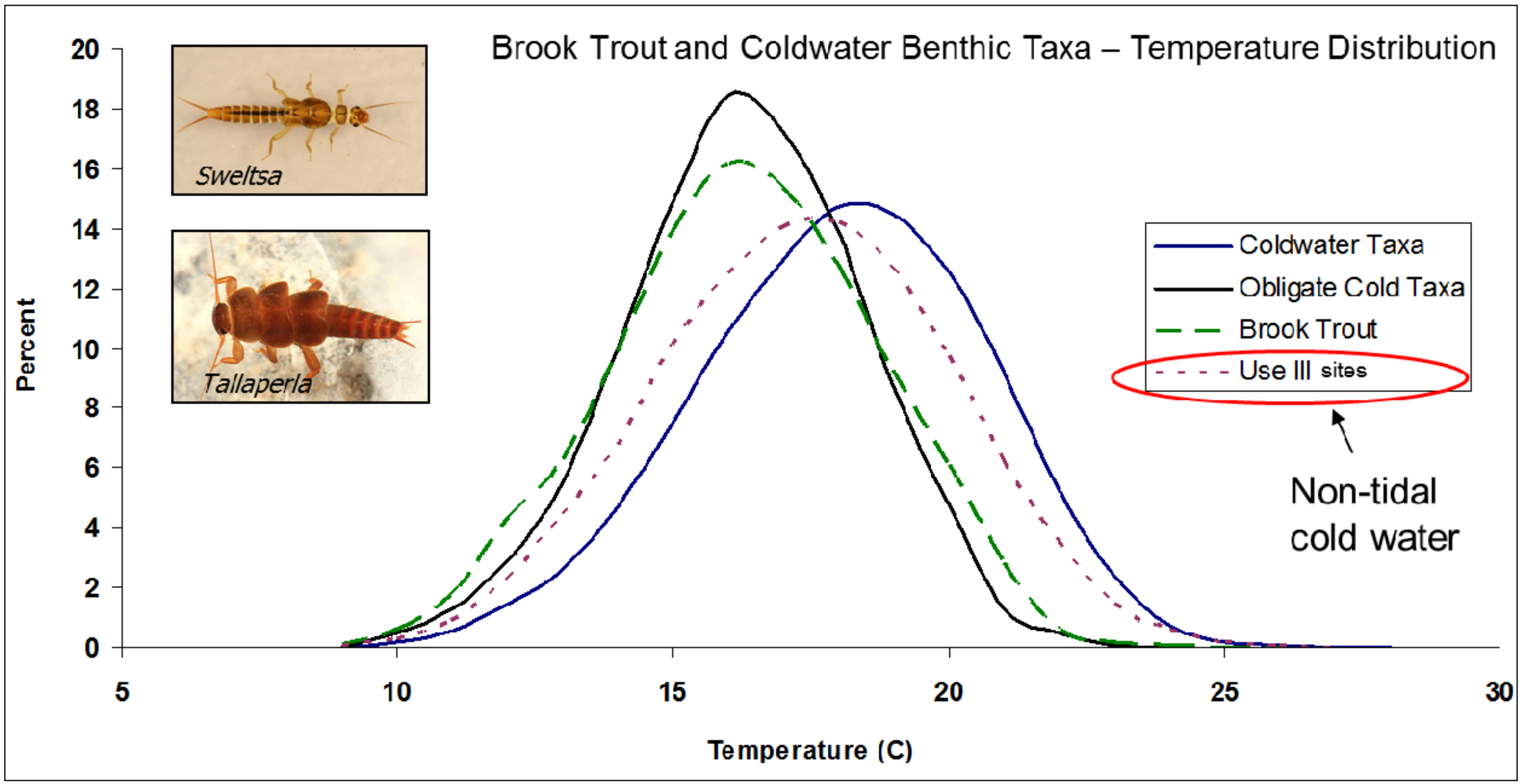
- Calculated probability that 99% of genera's occurrence was found below certain temperature threshold

- Cold water macroinvertebrates = 99th percentile ≤ 24 C
- Cold water obligate taxa = 99th percentile ≤ 22 C

Data usage: 1-5 year timeframe

Protection planning

Two stoneflies, *Sweltsa* and *Tallaperla* meet obligate cold taxa requirements

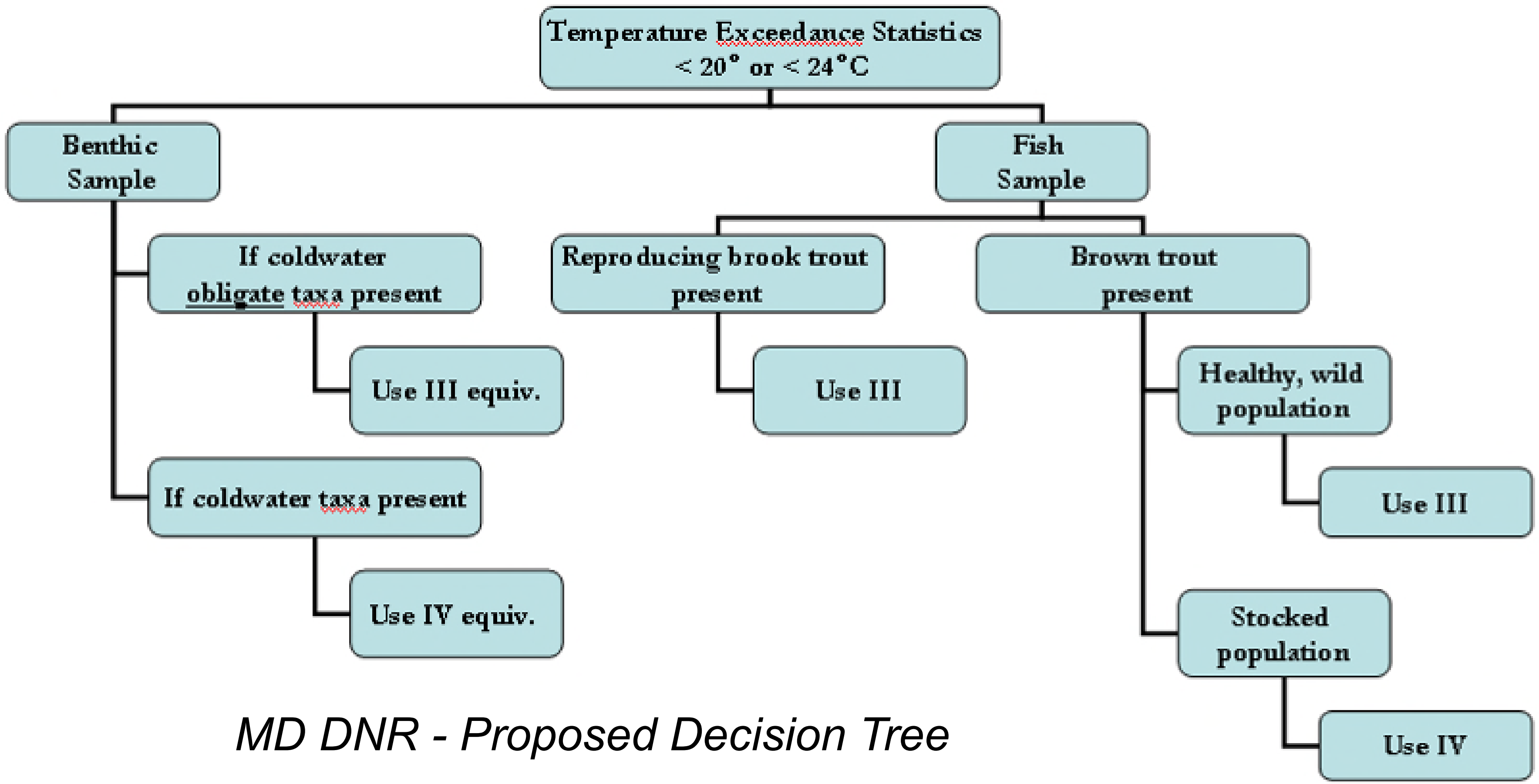


Provided by the Maryland Department of Natural Resources

Data usage: 1-5 year timeframe

Protection planning

Afford protection to cold/cool streams that can't support trout but that harbor unique aquatic communities/taxa

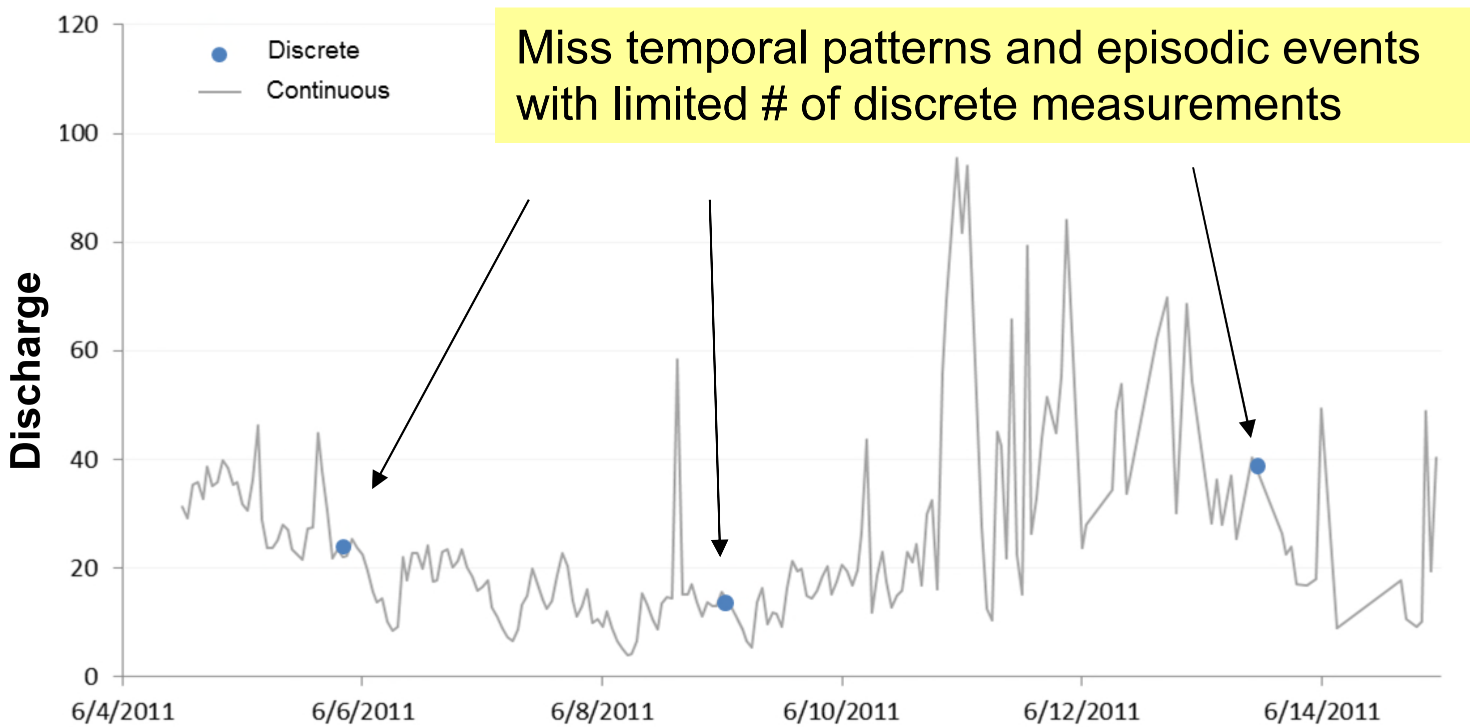


MD DNR - Proposed Decision Tree

Data usage: 1-5 year timeframe

Build capacity

Learning curve - continuous thermal and hydrologic data

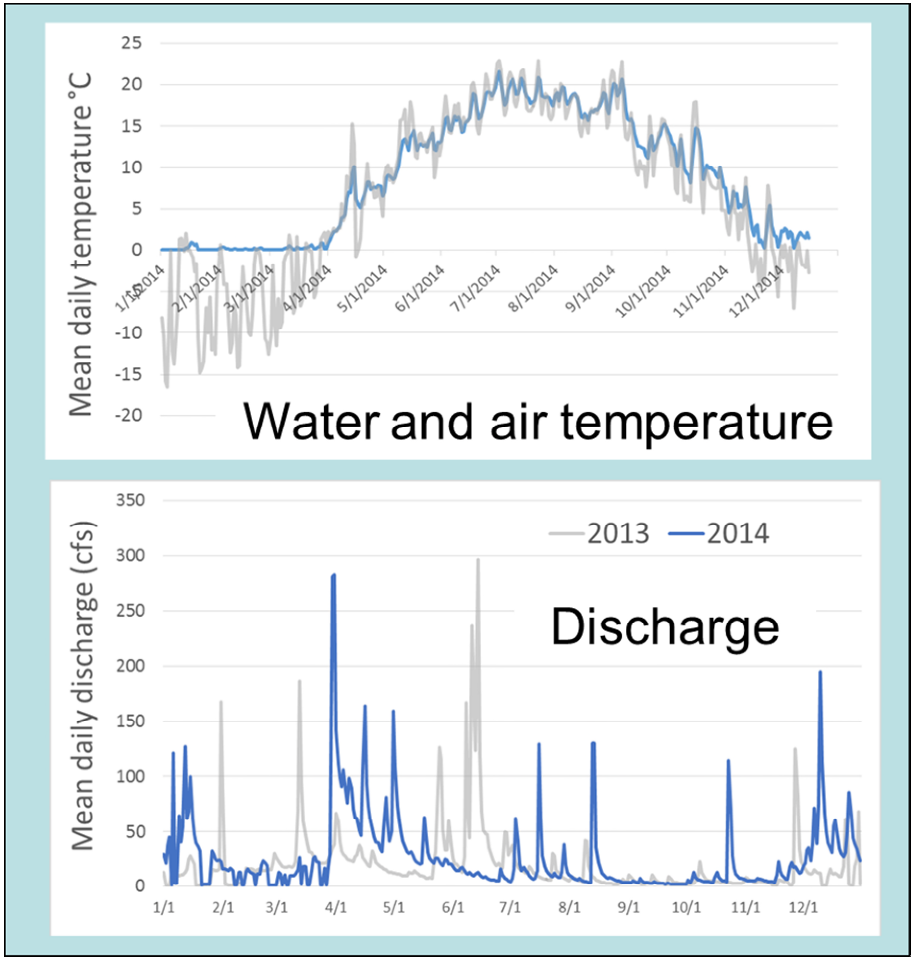


Lessons learned can **improve quality of data** collected in future monitoring efforts

Data usage: 1-5 year timeframe

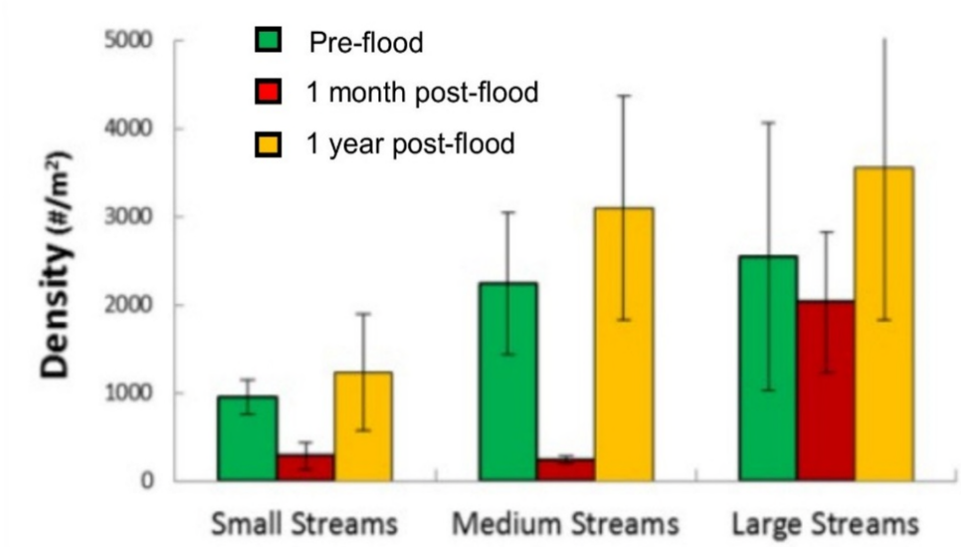
Natural variability

- Help quantify temporal variability in biological metrics, and how this relates to changing thermal and hydrologic conditions.
- Better understand **year-round thermal and hydrologic regimes**
  - Compare to altered regimes



Opportunistic data usage

Track response and recovery to extreme weather events



Aaron Moore and Steve Fiske, Vermont DEC

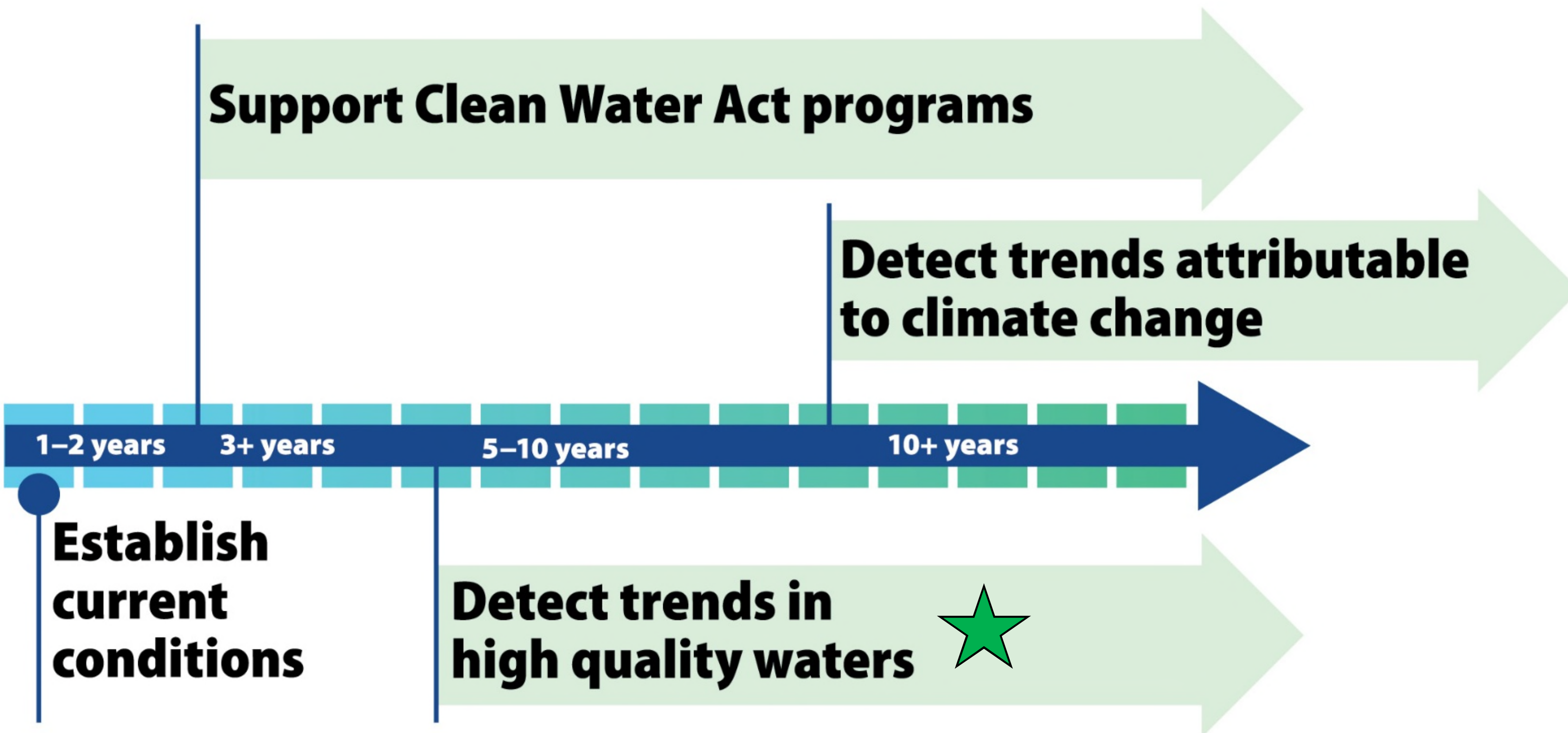
Vermont - **density** metric decreased by 69% (on average) following flooding from Tropical Storm Irene, but organisms recovered rapidly the following year.

Droughts and **floods** are projected to occur with **greater frequency** in the future.

Comparative analyses on **pre- and post-event** data.

Continuous thermal and hydrologic data capture the magnitude, timing and duration of the events.

Data usage timelines



★ 5-10 year timeframe

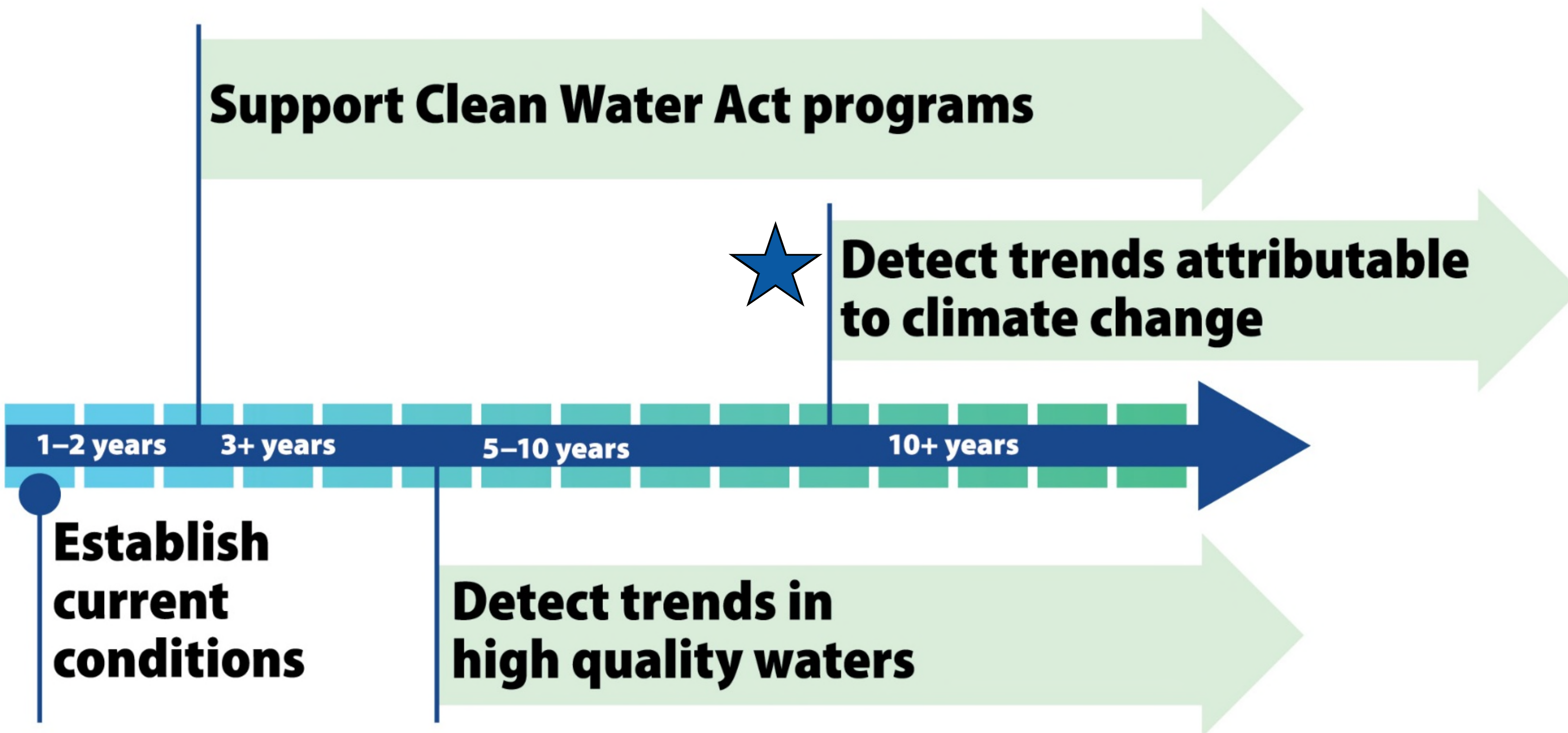
Data usage: 5-10 year timeframe

Analyze **trends and patterns** in biological, thermal, hydrologic, habitat and water chemistry data

Continue to –

- Characterize current conditions and temporal variability
- Support CWA programs
- Evaluate and refine the recommended metrics and indicators

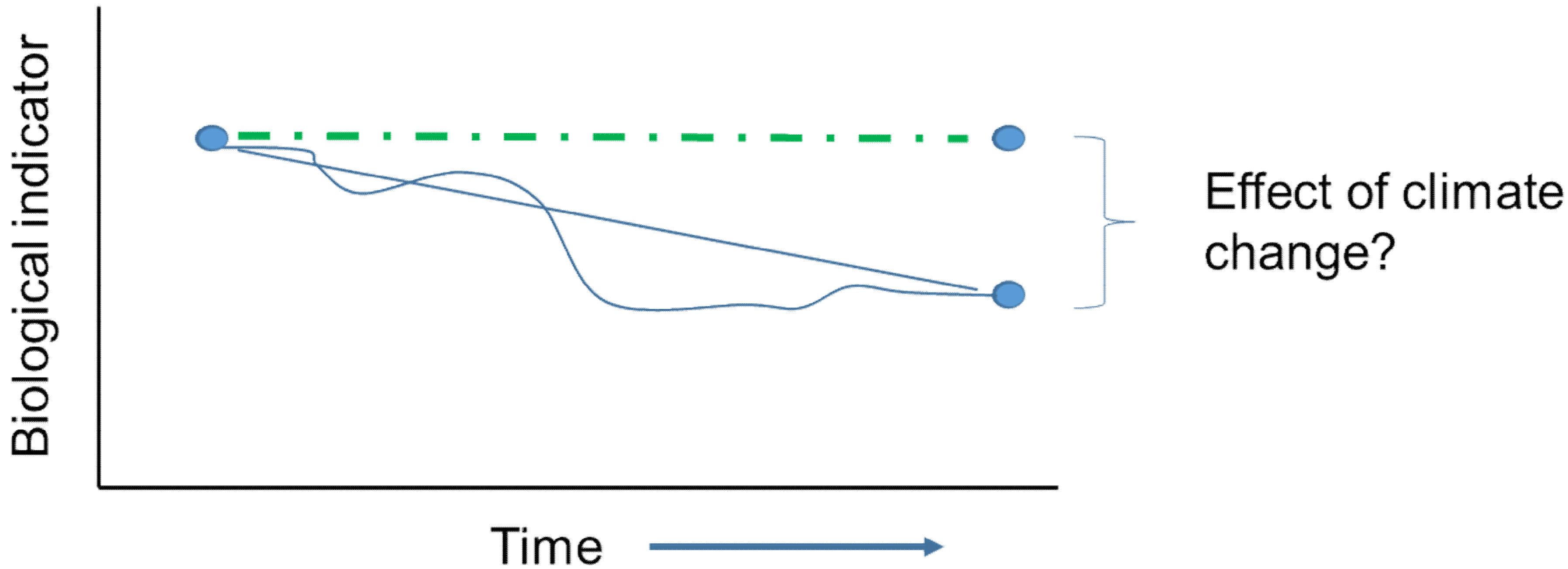
Data usage timelines



★ 10+ year timeframe

Data usage: 10+ year timeframe

Detect trends attributable to climate change



Higher likelihood of being able to **characterize climate-related impacts** in the absence of other non-climatic stressors

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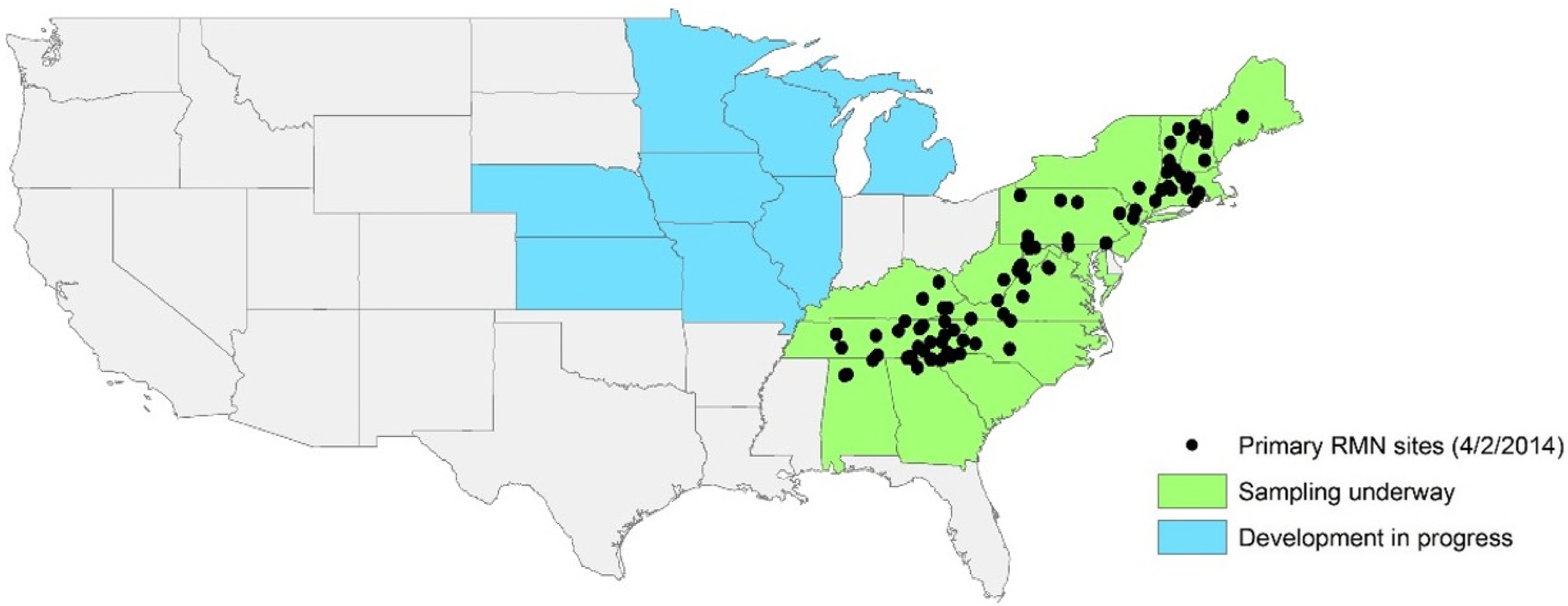
Acknowledgments

Many thanks to our RMN partners and collaborators in each region!



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QUESTIONS? COMMENTS?

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