

Developing a regional and landscape ecology-based  
science PROGRAM to support management of aquatic  
resources:  
thoughts from the Michigan Rivers Inventory mafia...

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## ELOHA

1. Reference flows
2. River types
3. Degree altered
4. Ecological responses
5. Ecological targets
6. E-flow targets
7. Implement program

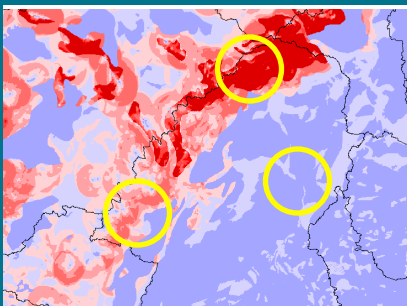
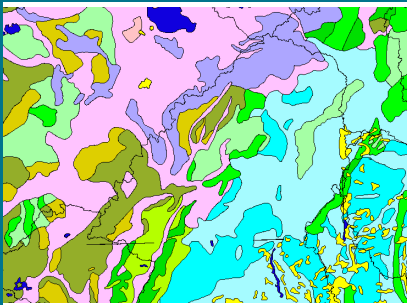
## MRI

1. Landscape ecology approach
2. Regional databases
3. Relationships & predictive models
4. Choosing & delineating spatial units; experts
5. Component & system classifications; experts
6. Management applications
7. Key ingredient: collaboration

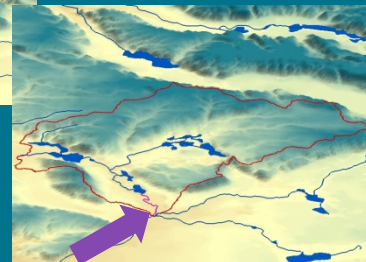
# 1. Landscape ecology approach

Object of study = regional “set” = all streams or lakes  
Think systems, processes, hierarchy, landscape context

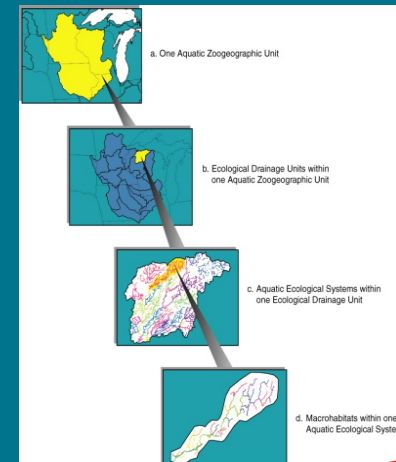
Historic View of “Habitat”



Catchment summaries



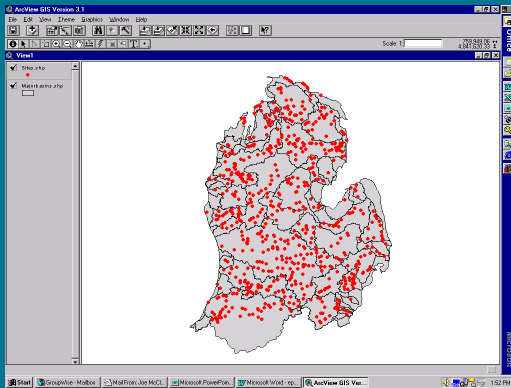
Riparian buffer summaries



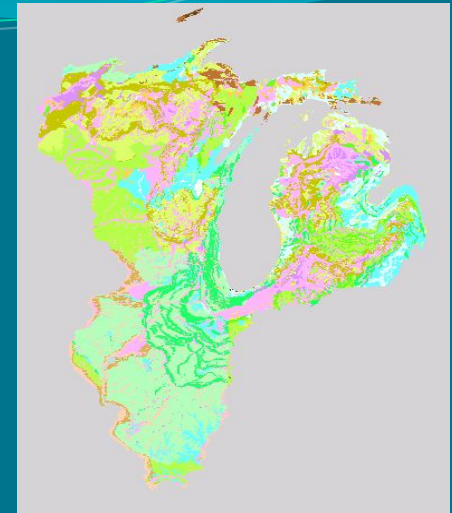
NHD+ Reach

## 2. Regional databases

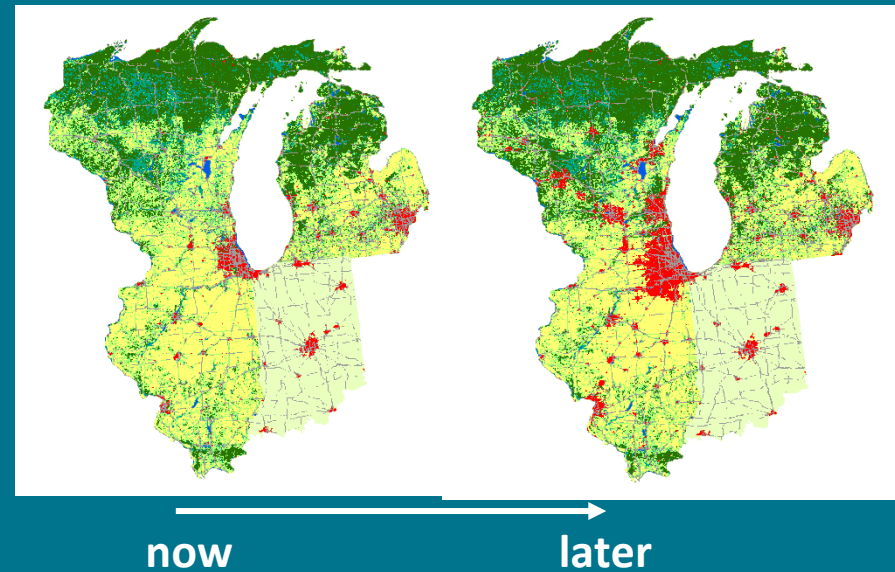
Sampled sites; predicted units



Regional consistency,  
x-walking, & coverage

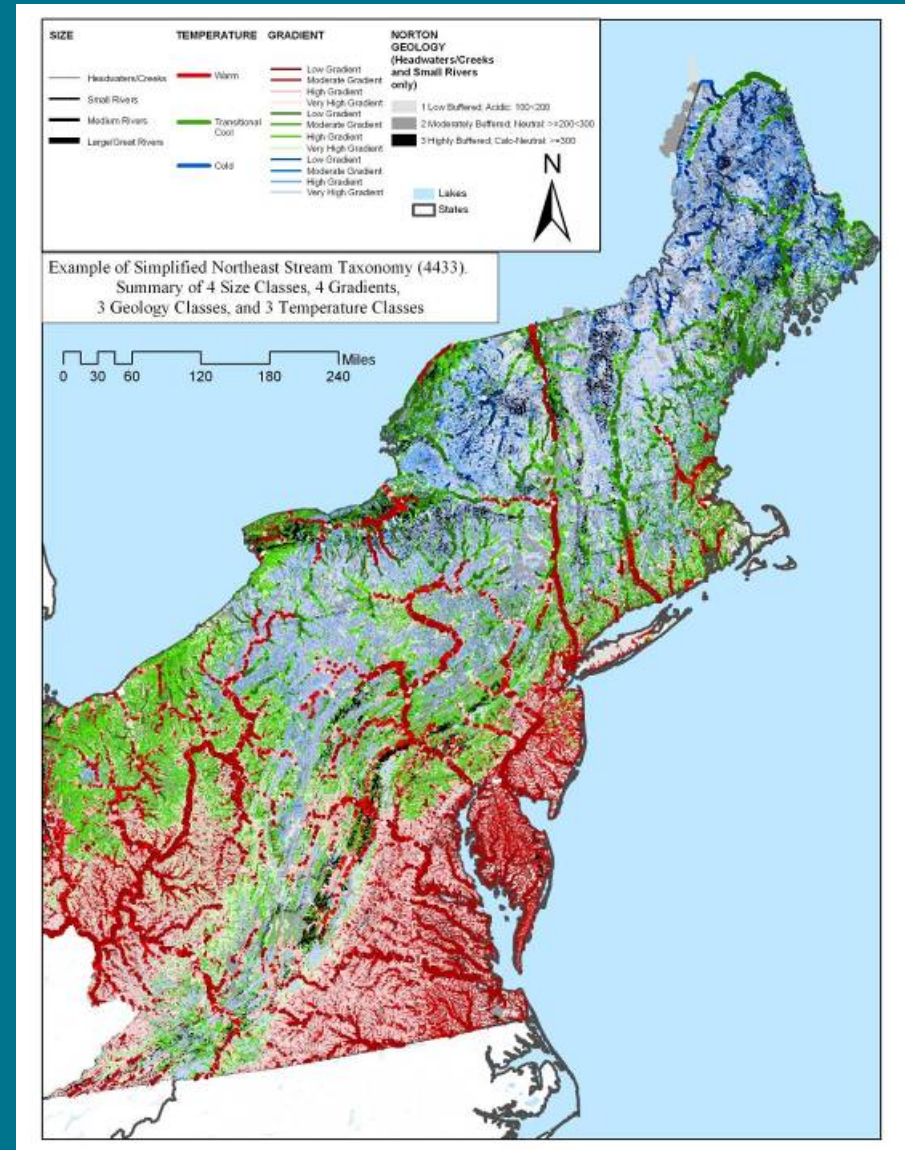


Flow yields  
Temperature  
Fishes  
IBIs  
Nutrients  
Stressors  
Current land cover  
Alternate scenarios



## 2. Regional databases

Olivero reach  
database for NEast



### 3. Relationships and predictive models

Per reach unit. Apply to all reach units. Already second/third generations.

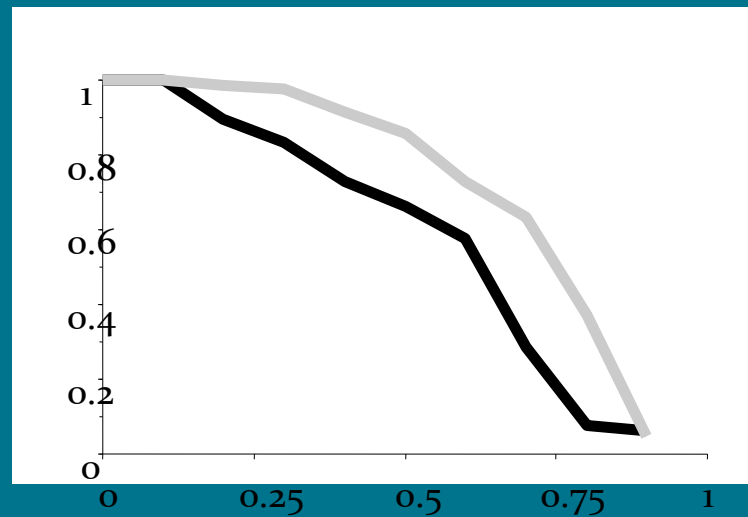
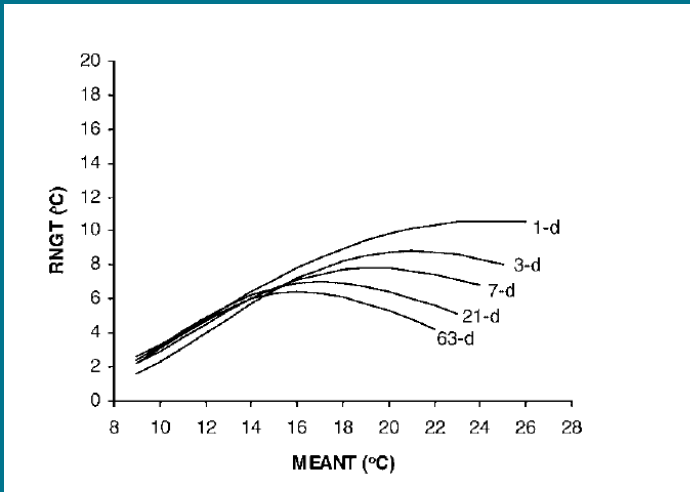
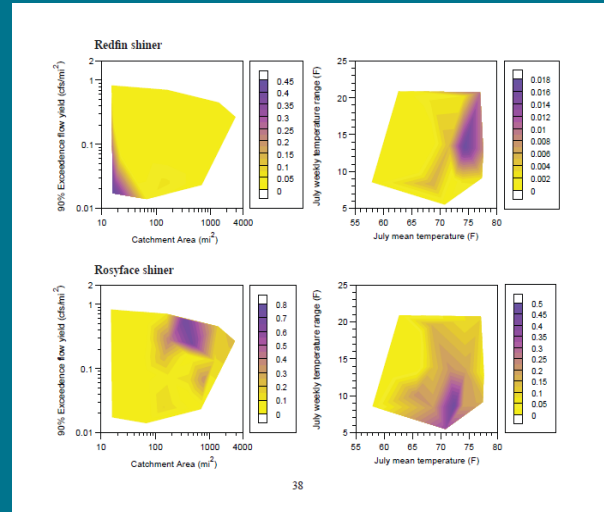
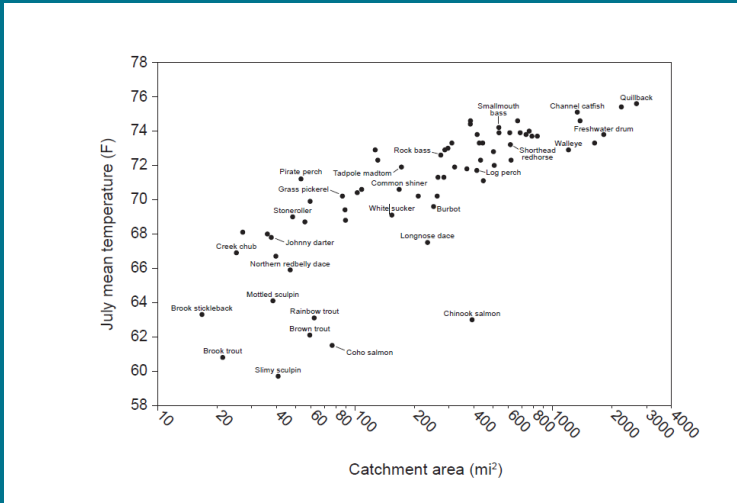
Estimate expectations or reference. Creates comprehensive NEW landscape mosaic. Philosophy of “multi models”.

Flows. State regressions. MA estimator. AFINCH for GL Basin.

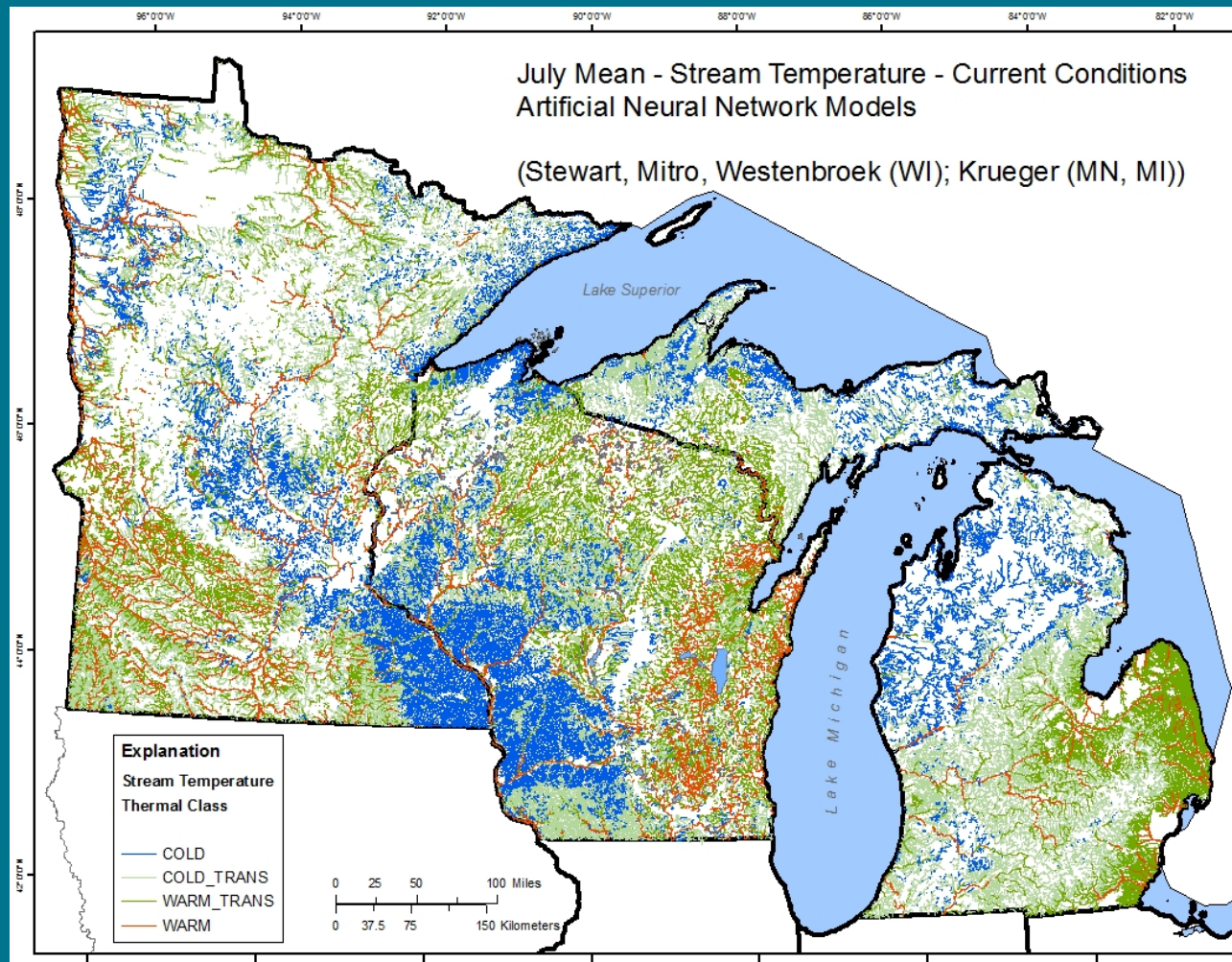
Fish. State regressions. GL GAP regression trees and neural nets. NE = target fishes?

Temperature. State regressions, regression trees, GL GAP neural nets. Jana..

# 3. Relationships and predictive models



### 3. Relationships and predictive models





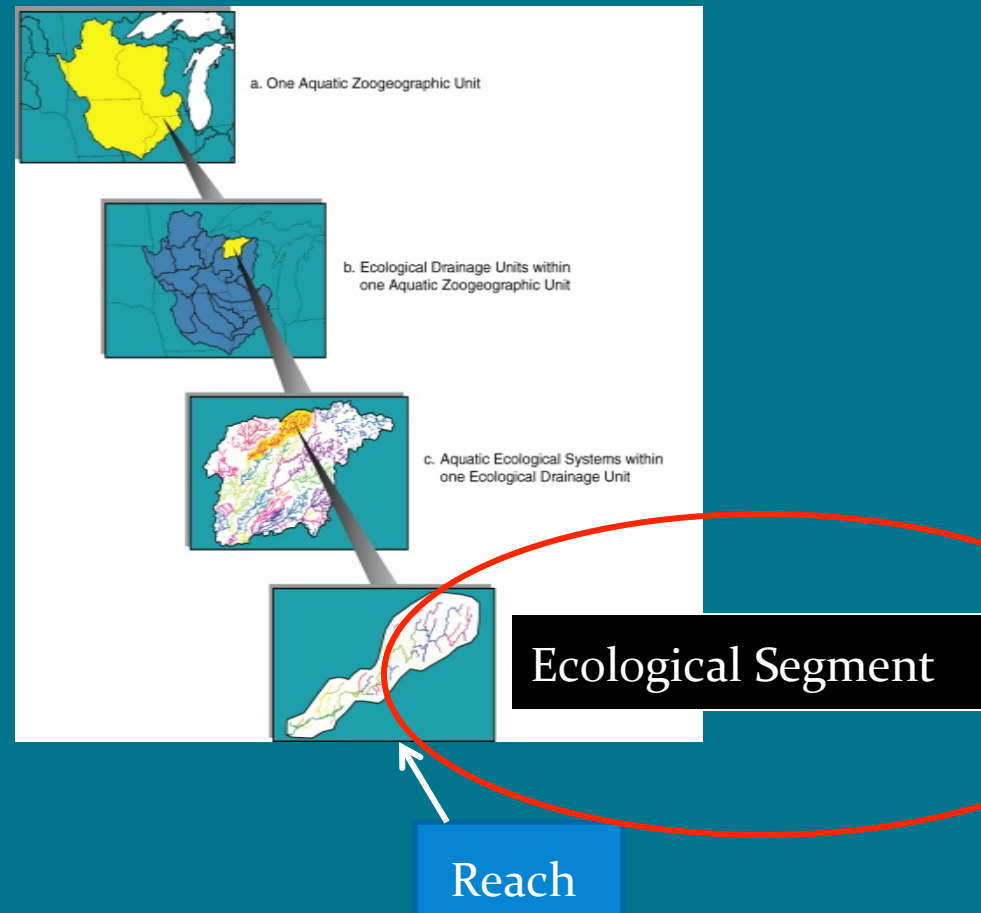
## 4. Choosing and delineating spatial units; experts

Ecological segments are the key spatial unit. Rolled up from like neighbor reach attributes. 6,000 units from original 30,000.

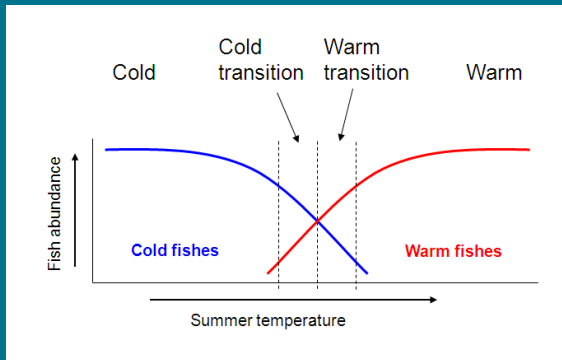
Relatively homogenous hydro-geomorph-thermal-fish units.

Seelbach et al. 2006.

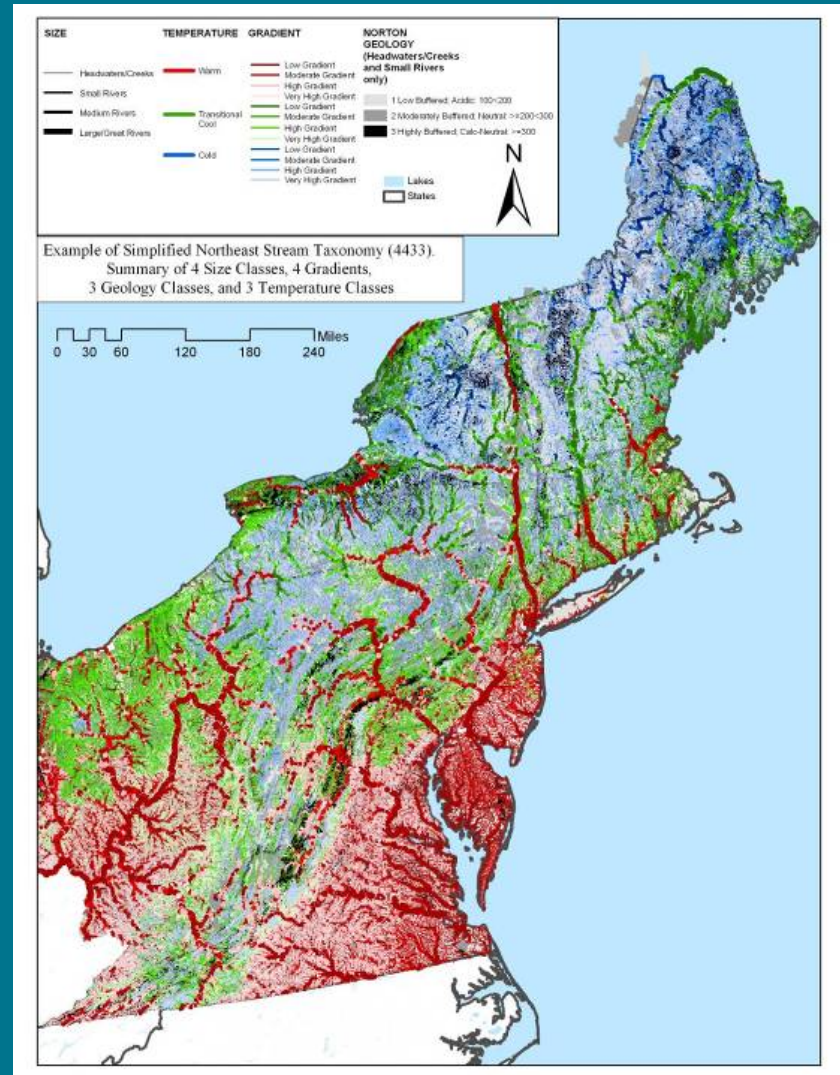
Brenden et al. 2010. Gets you 70% home; still need expert revision.



# 5. Component and system classifications; experts



Cold	—	—	
Cold Trans	—	—	—
Warm Trans	—	—	—
Warm	—	—	—
	Streams	Sm Rivers	Lg Rivers



MI experts altered 30% of segment class predictions

## 6. Management applications

Aquatic Ecosystem Toolkit services all aquatic management disciplines:

**Water quantity**

Water quality

Fisheries

Biodiversity Conservation

Vulnerability Assessment

MI Water Withdrawal  
Assessment Process and  
Screening Tool

The screenshot shows a web browser window titled "Screening Results - Windows Internet Explorer". The address bar shows a URL from the Michigan Water Withdrawal Assessment Tool. The main content area is titled "Water Withdrawal Screening Results".

**WARNING:** For evaluation purpose only.

**Adverse Resource Impact (ARI) Graph**

The graph shows a vertical line representing the "ARI Line" on a scale from 0 to 100. The scale is divided into four zones: A (green), B (yellow), C (orange), and D (red). The ARI Line is positioned in Zone A. To the right of the graph is a green pentagon with the word "PROCEED" written inside.

The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI). The proposed withdrawal has passed in Zone A.

**Screening Results - PASSED**

**STREAM CLASSIFICATION:** Warm stream

**TEST VERSION RESULTS:**  
The proposed withdrawal would pass the screening process. The projected impact of the withdrawal lies within 'Zone A' and would not likely cause an adverse resource impact under the zones that become effective on February 1, 2009.

**REGISTRATION:**  
A Large quantity withdrawal (LQW) with a capacity of 70 gpm or greater must be registered with the Michigan Department of Environmental Quality or with the Michigan Department of Agriculture if the LQW is for an agricultural purpose, before the withdrawal can begin. A registration is valid for 18 months. The withdrawal capacity must be installed within this time period or the registration becomes void. Registration may be done at this time through the button at the right.

You may come back to this site at a later time to register, or you may obtain a form to register the withdrawal by contacting Andrew LeBaron at 517-241-1435, or on-line at: [www.michigan.gov/dewwateruse](http://www.michigan.gov/dewwateruse)

**Actions:**

- Help
- Rerun
- Register Now
- Feedback
- Print Report
- Exit

**DISCLAIMER:**  
The Water Withdrawal Assessment Tool is designed to estimate the likely impact of a proposed water withdrawal on nearby streams. It is not an indication of how much groundwater may be available for your use. The quantity and quality of groundwater varies greatly with depth and location. You should consult with a water resources professional or a local well driller about

## 6. Management applications

Toolkit services all aquatic management disciplines:

Water quantity

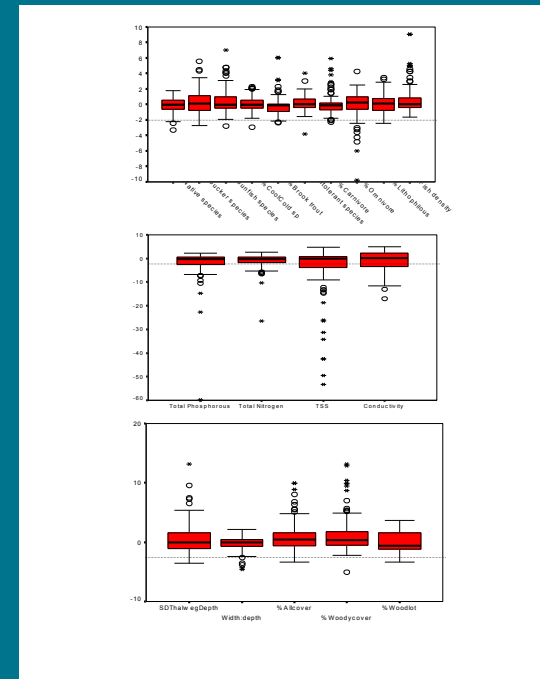
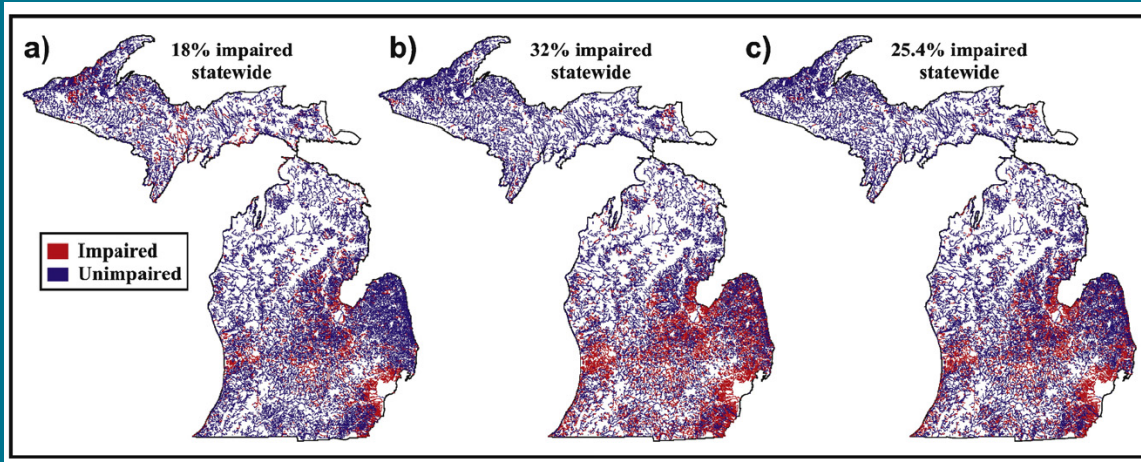
Water quality

Fisheries

Biodiversity Conservation

Vulnerability Assessment

Northern Lakes and Forests



## 6. Management applications

Aquatic Ecosystem Toolkit services all aquatic management disciplines:

Water quantity

Water quality

**Fisheries**

Biodiversity Conservation

Vulnerability Assessment

Stratification for DNR fish S&T Surveys for streams and lakes  
(also coordinated with DEQ biological surveys)

Potential for stocking, regulations, etc.

## 6. Management applications

Aquatic Ecosystem Toolkit services all aquatic management disciplines:

Water quantity

Water quality

Fisheries

**Biodiversity Conservation**

Vulnerability Assessment

Basis for MI Wildlife Action Plan; second generation.

GL Aquatic GAP (McKenna)

## 6. Management applications

Toolkit services all aquatic management disciplines:

Water quantity

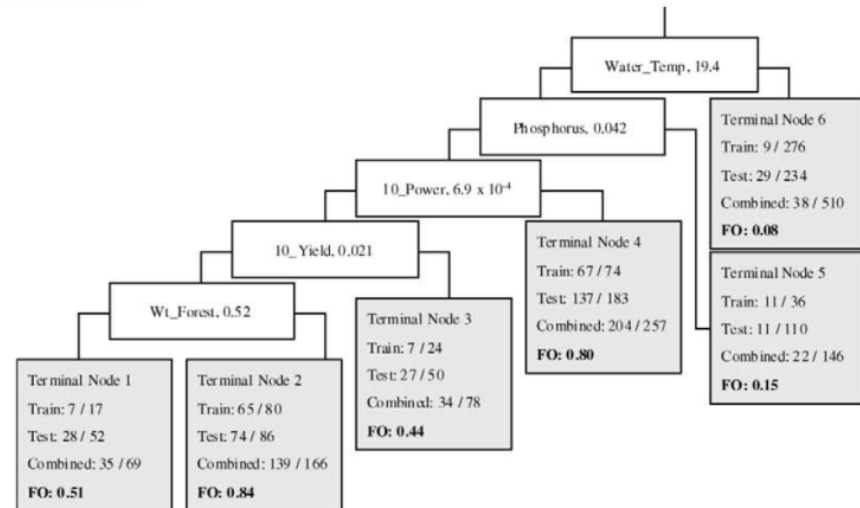
Water quality

Fisheries

Biodiversity Conservation

# Vulnerability Assessment

a. Brook trout

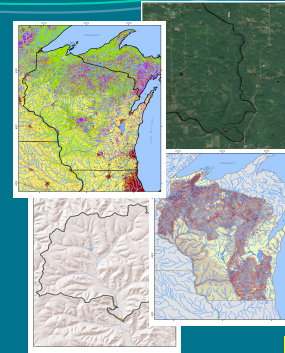


# CLIMATE SCENARIOS – A1B Scenario (10 models)

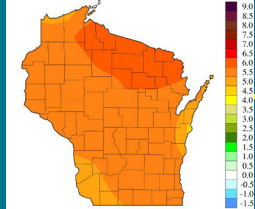
**Run SWB**



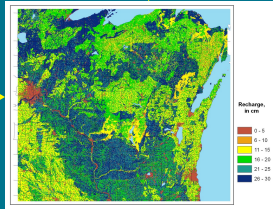
SWB Clusters  
(extract/aggregate values)



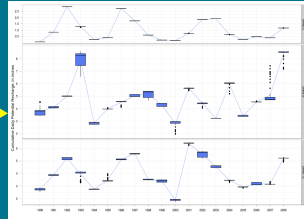
Static Landscape Characteristics



Downscaled GCM output

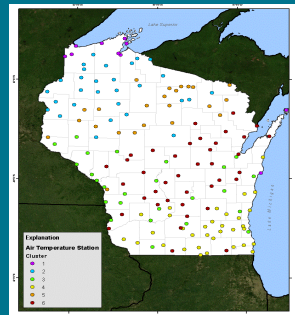


Accumulated Recharge

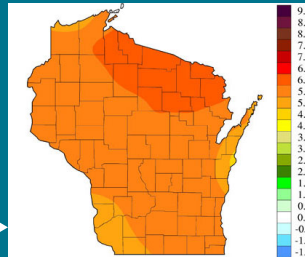


SWB Time Series

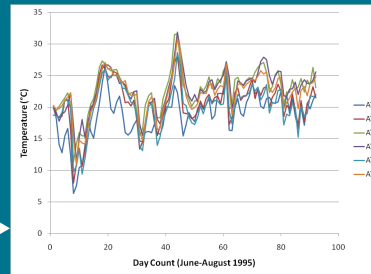
**Run ANN**



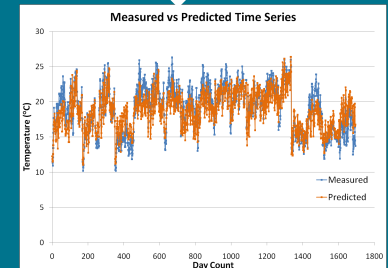
Air Temperature Clusters



Downscaled GCM Output



Down-scaled Air Temperature Time Series



**Stream temperature climate scenario time series**



## 7. Key ingredient is collaboration

Unit of study is “regional set”  
“Collaboratory” = new model



“Collective Impact” (Stanford Social Innovation Review) – required conditions