The National Nutrient Inventory and its use in water quality modeling

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Nutrient Inventory Co-Authors: Robert Sabo[2], Michael Pennino[2], Jana Compton[2], Ryan Hill[2], Marc Weber[2], Christopher Clark[2], Jiajia Lin[3], Gerardo Ruiz-Mercado[2], Lauren Knose[1], Sarah Stackpoole[4], James Carleton[2], and Anne Rea[2]

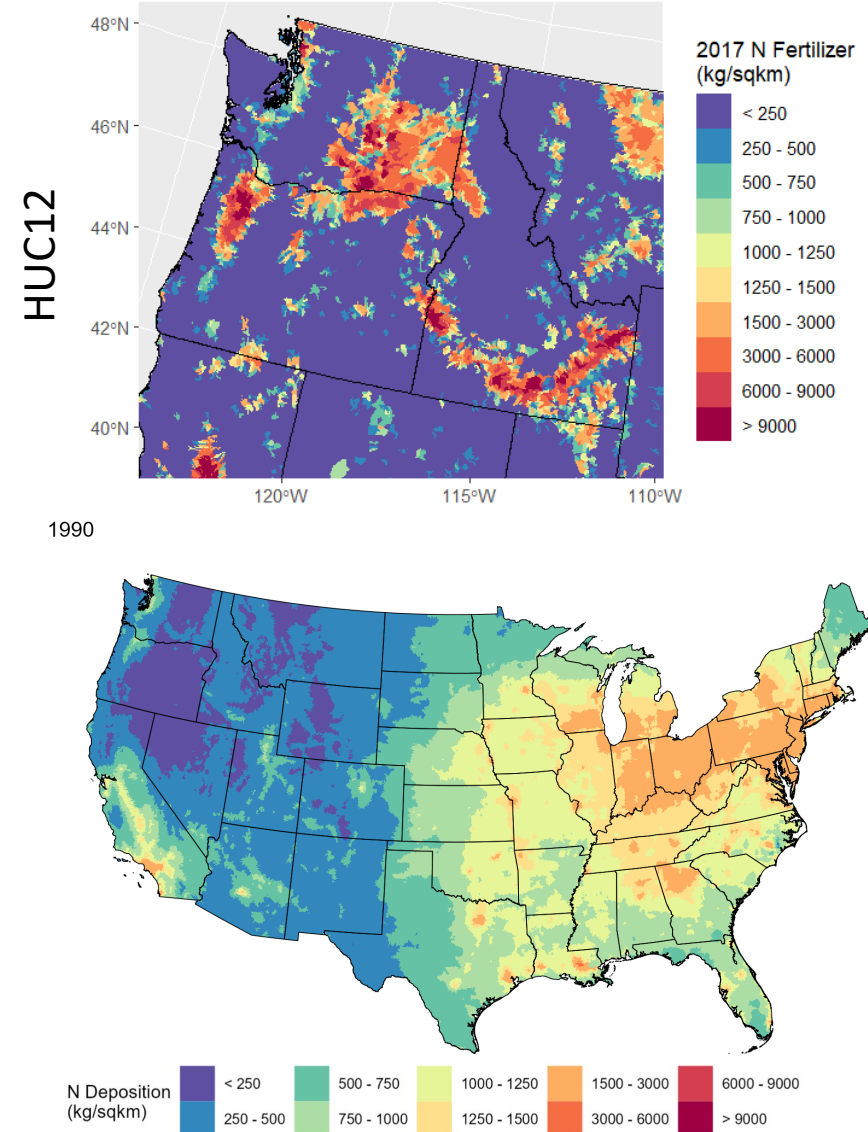*Nutrients and Chlorophyll RF Co-Authors:* Michael Pennino[2], Amalia Handler[2], Jana Compton[2], Sylvia Lee[2], and Robert Sabo[2]

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Office of Research and Development
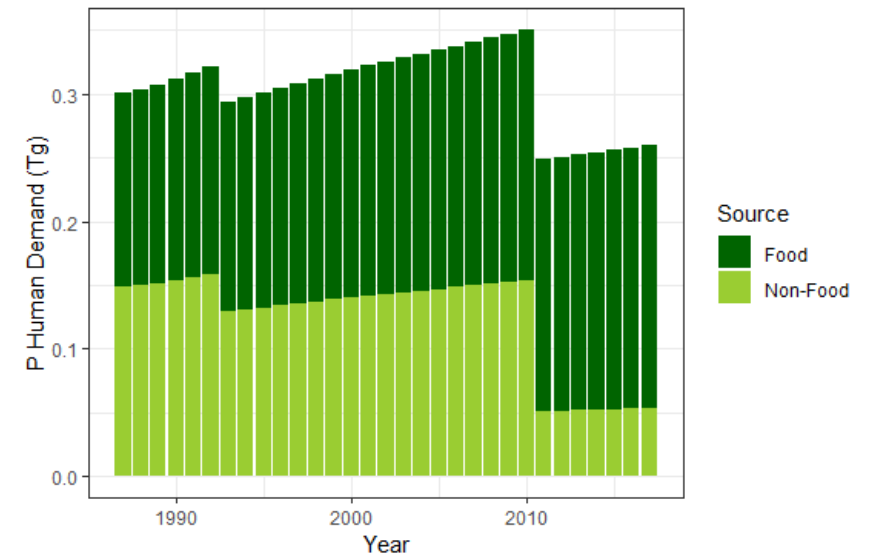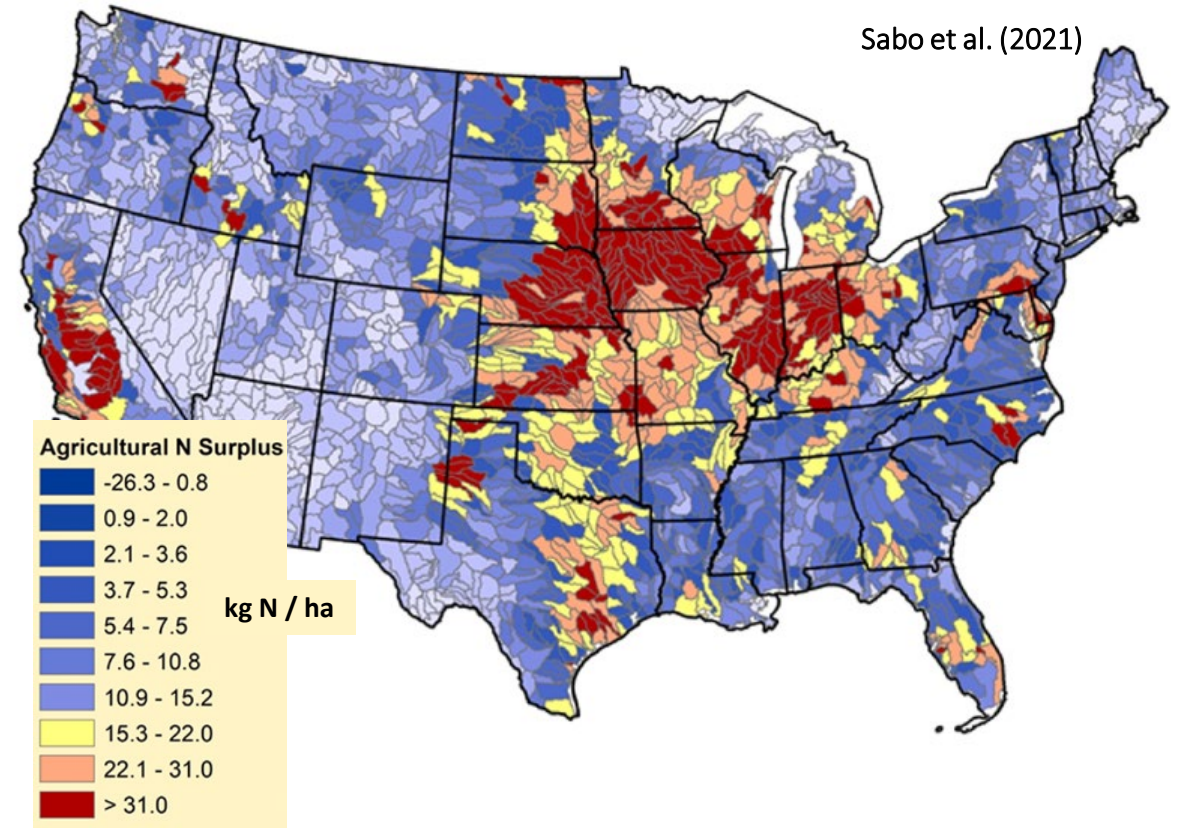CPHEA | HEEAD | IEAB

Goals, Approach, and Scope

- Inventory of nitrogen (N) and phosphorus (P) inputs and outputs at scales relevant to hydrology and political boundaries

- Data available for the conterminous US
  - Ability to zoom in for more detailed analysis

- Next Generation National Nutrient Inventory (NNI) (currently in development) has data at the county and NHD+v2 HUC12 and catchment scales

- NNI informs policy and research decisions regarding nutrient pollution
  - Source
  - Extent/Magnitude
  - Trajectory

- NNI data spatially linked to water quality data, allows for easy modeling through HUC12

Results

Sabo et al. (2021)

- NNI data output
  - Agricultural: Crops, fertilizer, livestock
  - Urban: Human demand and waste
  - Air: Deposition and emissions
  - Natural: N fixation

- Derive management relevant metrics
  - Agricultural surplus
  - Nutrient use efficiency
  - Legacy nutrient pollution

- Applications
  - Track effectiveness of nutrient reduction policies
  - Predict drinking water nitrate violations
  - Determine drivers of nutrient delivery to sensitive aquatic ecosystems
 - Other water quality endpoints

Agricultural N Surplus
	kg N / ha
-26.3 - 0.8	
0.9 - 2.0	
2.1 - 3.6	
3.7 - 5.3	
5.4 - 7.5	
7.6 - 10.8	
10.9 - 15.2	
15.3 - 22.0	
22.1 - 31.0	
> 31.0	

Example Application –

Predict Lake Nutrient and Chlorophyll-*a* Concentrations

- Trained three Random Forest models (for TN, TP, and Chlorophyll-*a*)
- Made predictions of nutrient and chlorophyll-*a* concentrations in ~112,000 lakes across seasons

Watershed scale prediction maps - 2007

Trophic state from chlorophyll-a benchmarks

Oligotrophic (0 - 2 ug/L)   Eutrophic (7 - 30 ug/L)
Mesotrophic (2 - 7 ug/L)   Hypereutrophic (>30 ug/L)
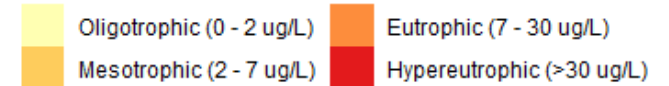
May	July	October

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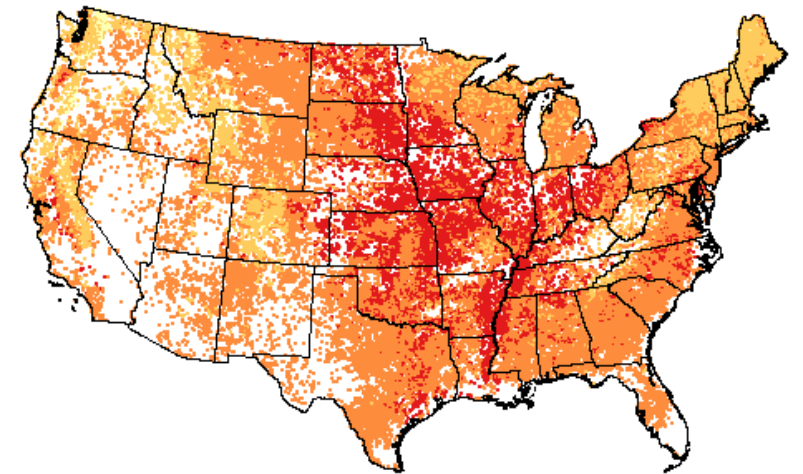
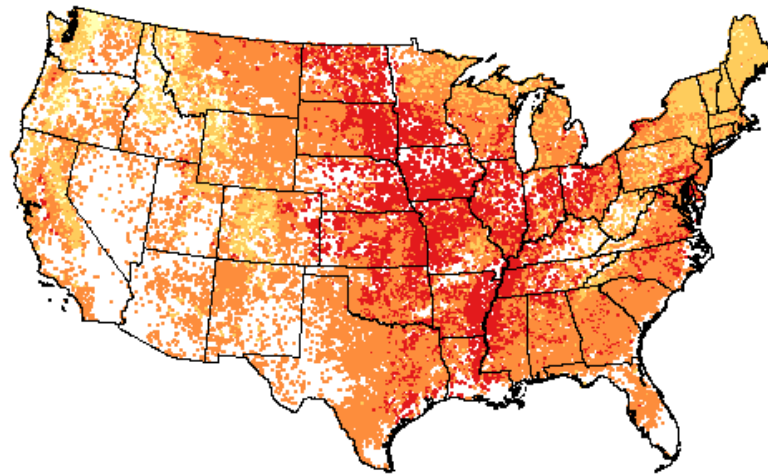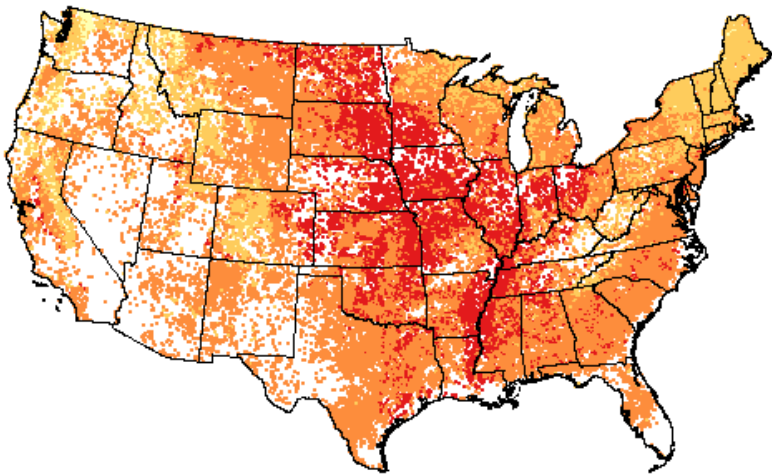Watershed scale prediction maps - 2007

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Change in Chlorophyll-*a* from May to July 2007
Relative to 30 ug/L Threshold

Change to Above Threshold
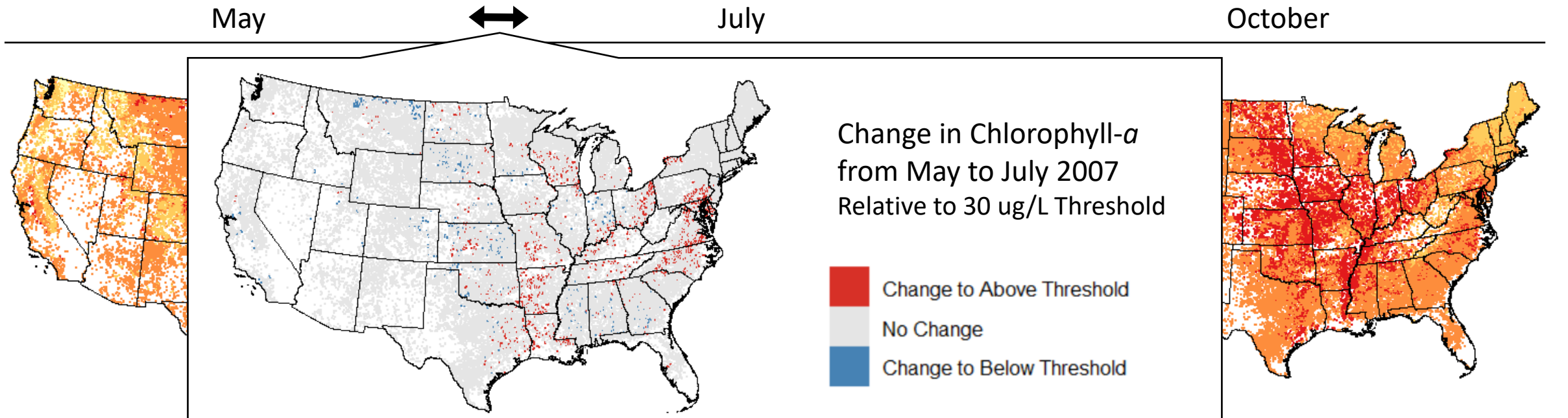No Change
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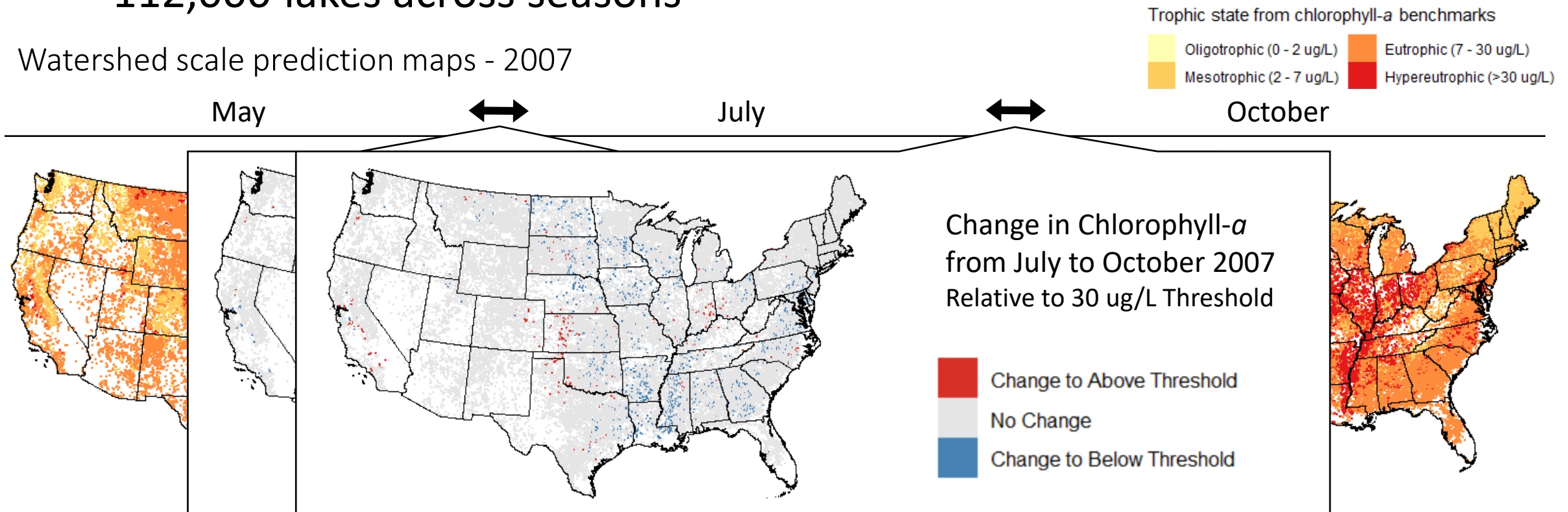Watershed scale prediction maps - 2007

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Questions?

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