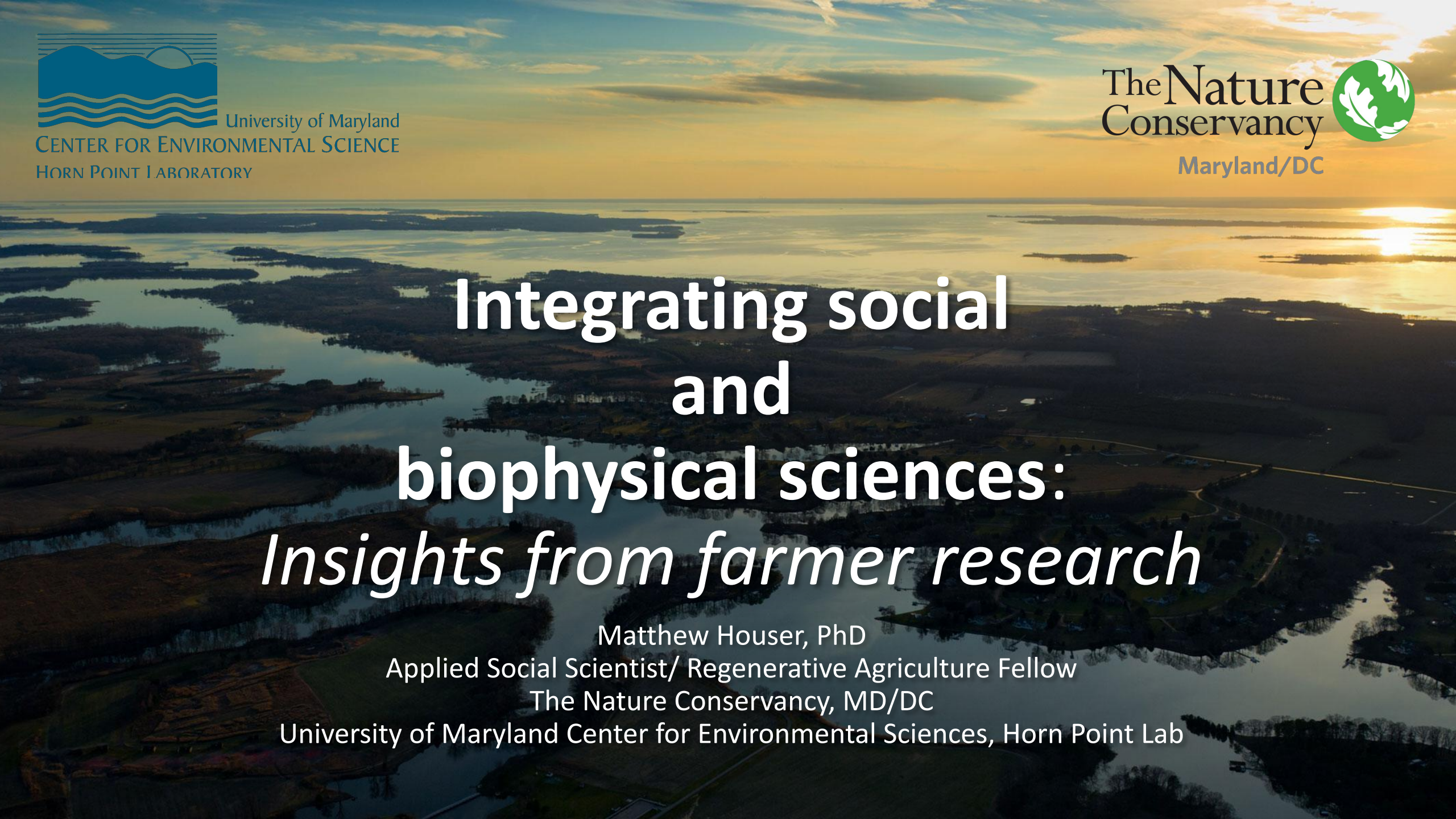

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The Nature Conservancy
Maryland/DC

Integrating social and biophysical sciences: *Insights from farmer research*

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OVERVIEW: MY WORK

- ***Environmental social scientist***
  - Cross-scale forces that shape farmers' recognition of and responses to environmental change
    - Mostly focused on N management
  - Interdisciplinary, collaborative, applied

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Today's talk: What's my point?

- Inter- or transdisciplinary research increasing seen as key to address major environmental challenges (Houser et al. 2021).

- But more needs to be done
  - Social science still often seen only as a means for stakeholder engagement
  - Social scientists often resistant to collaborative and applied work

Today's talk: What's my point?

- **What I'll try to get across today:**
  - "Good" environmental research and "effective" environmental policy/projects *depend* on committing to integrating the social and biophysical sciences across our efforts

- **To get my point across—two examples:**
  - 1. What climate modeling for the Bay is missing
  - 2. How our understanding of technical BMPs may be flawed

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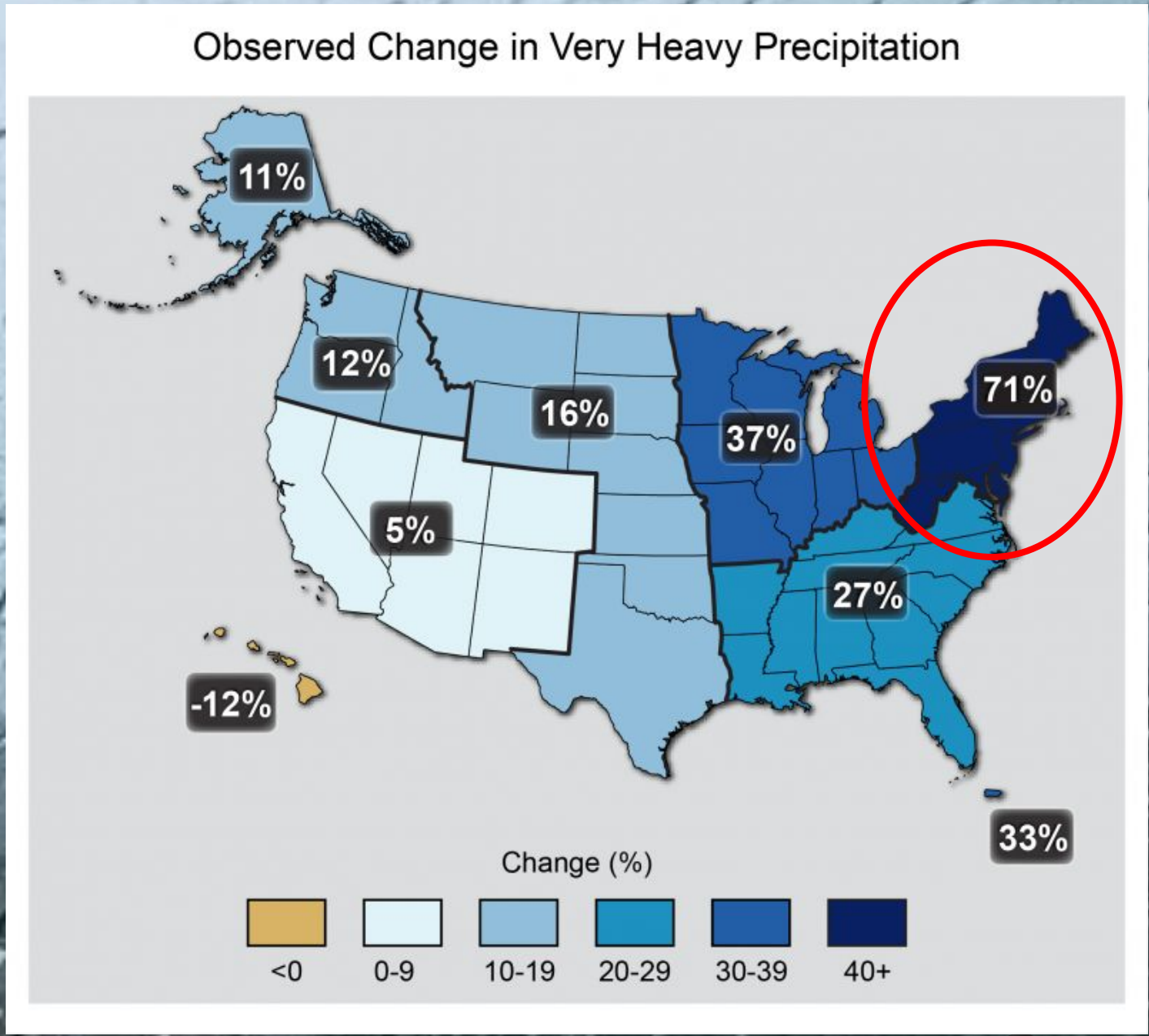
1958 to 2012

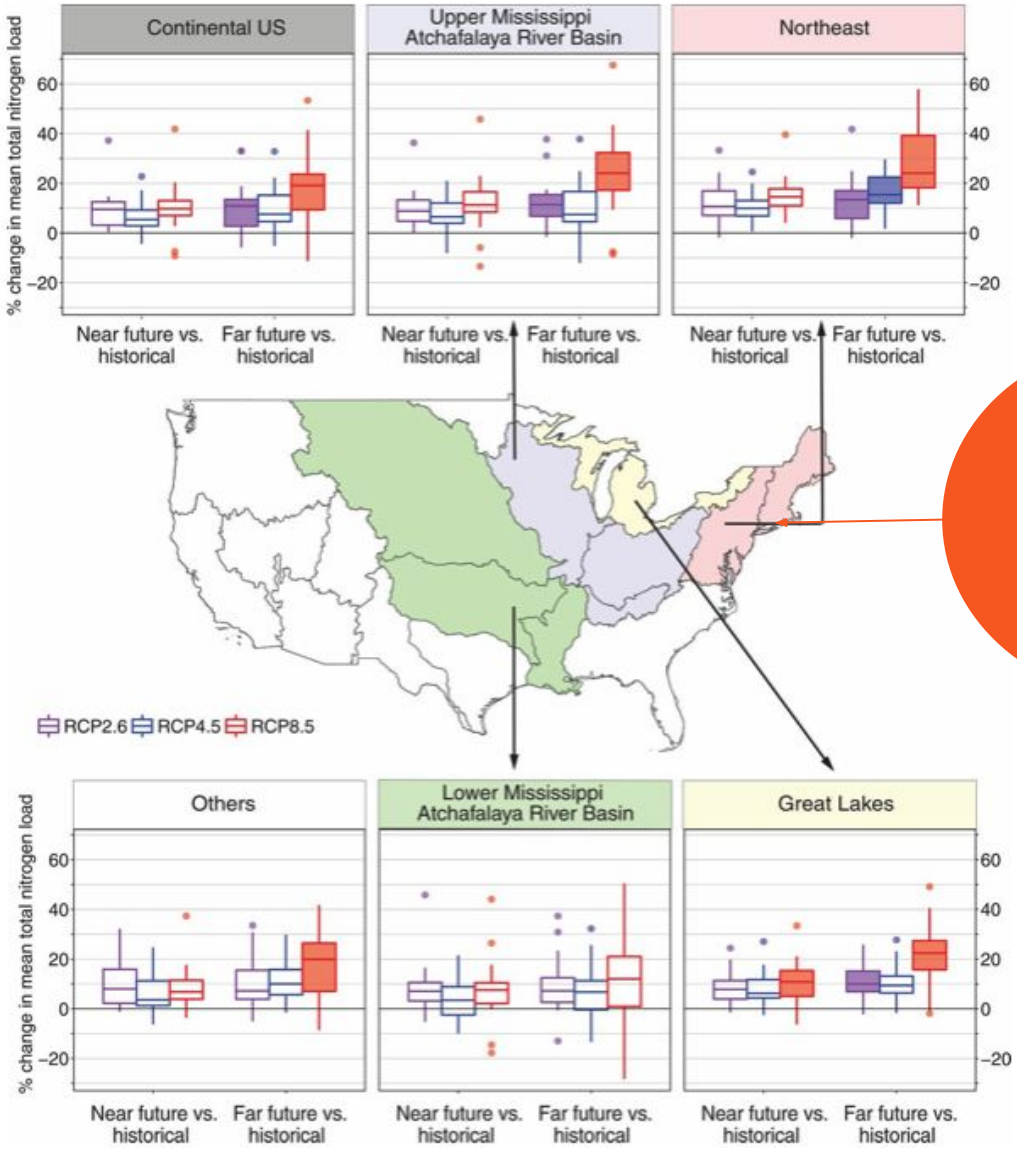
Pryor et al. 2014



INCREASED LOSS OF N

(Robertson et al. 2013)

Chesapeake Climate Impacts



28% ⇧ in nitrogen loads

Offsetting this increase would require **a 33±24%** reduction in nitrogen inputs, presenting a massive management challenge.

Sinha et al. 2017 □ Heavy rain events will make N losses much worse in Bay watershed

Skeptical but Adapting

- Many farmers reporting experiencing more impacts from heavy rain
  - -> challenging their operations
- Adaptation/resilience widely supported

Doll et al. 2017; Houser et al. 2017; Houser 2018

Not all adaptation is created equal…

- **But HOW are farmers adapting?**

- *My research suggests…*
  - Farmers find many recommended "adaptation" practices ineffective…
    - e.g., cover crops, nitrogen 4-R

  - **Instead, most are <u>increasing N application rates</u>**
    - In anticipation of *or* in response to heavy rain events
    - Extra N is left over to support crop growth

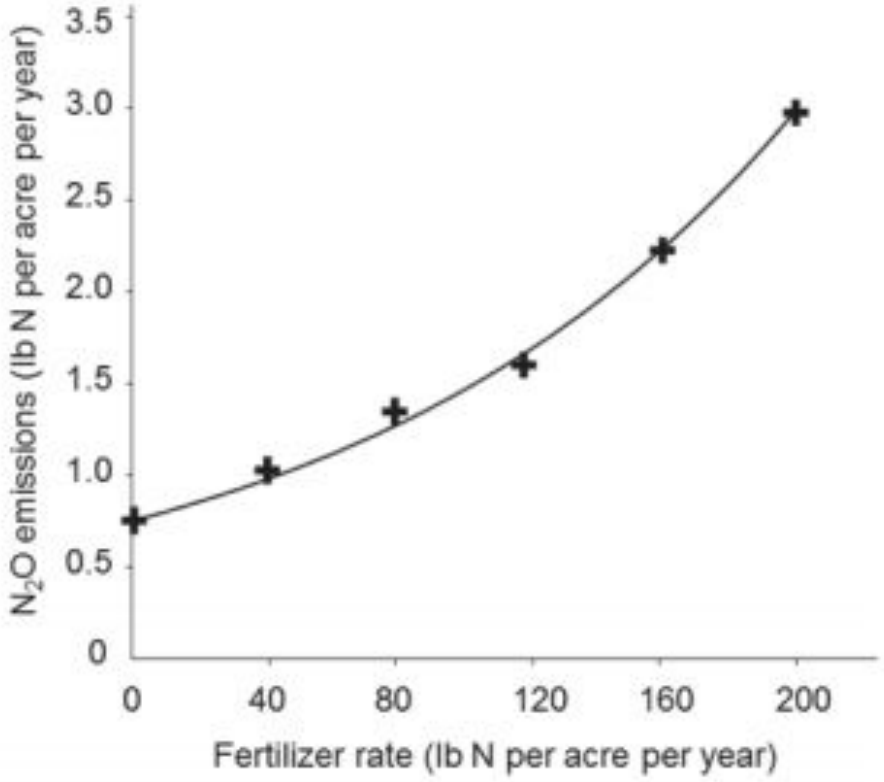
Houser & Stuart 2020

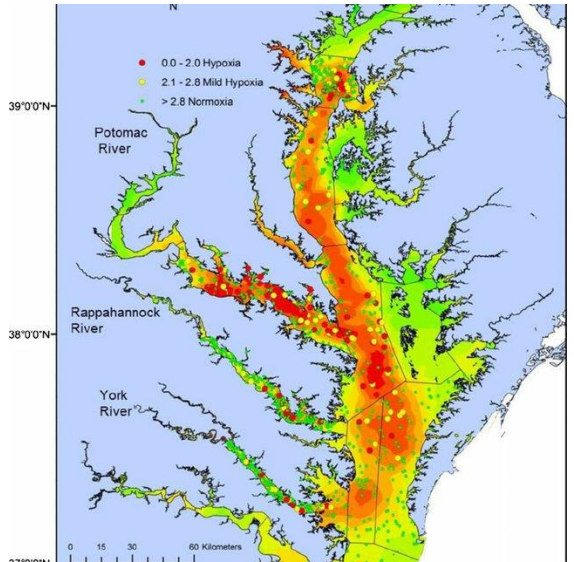
Results: Higher N rates

- "The amount of rain we've had [recently] has made us add **an additional 50 pounds of [nitrogen at] sidedress**, just because the rain flushes it down the system"

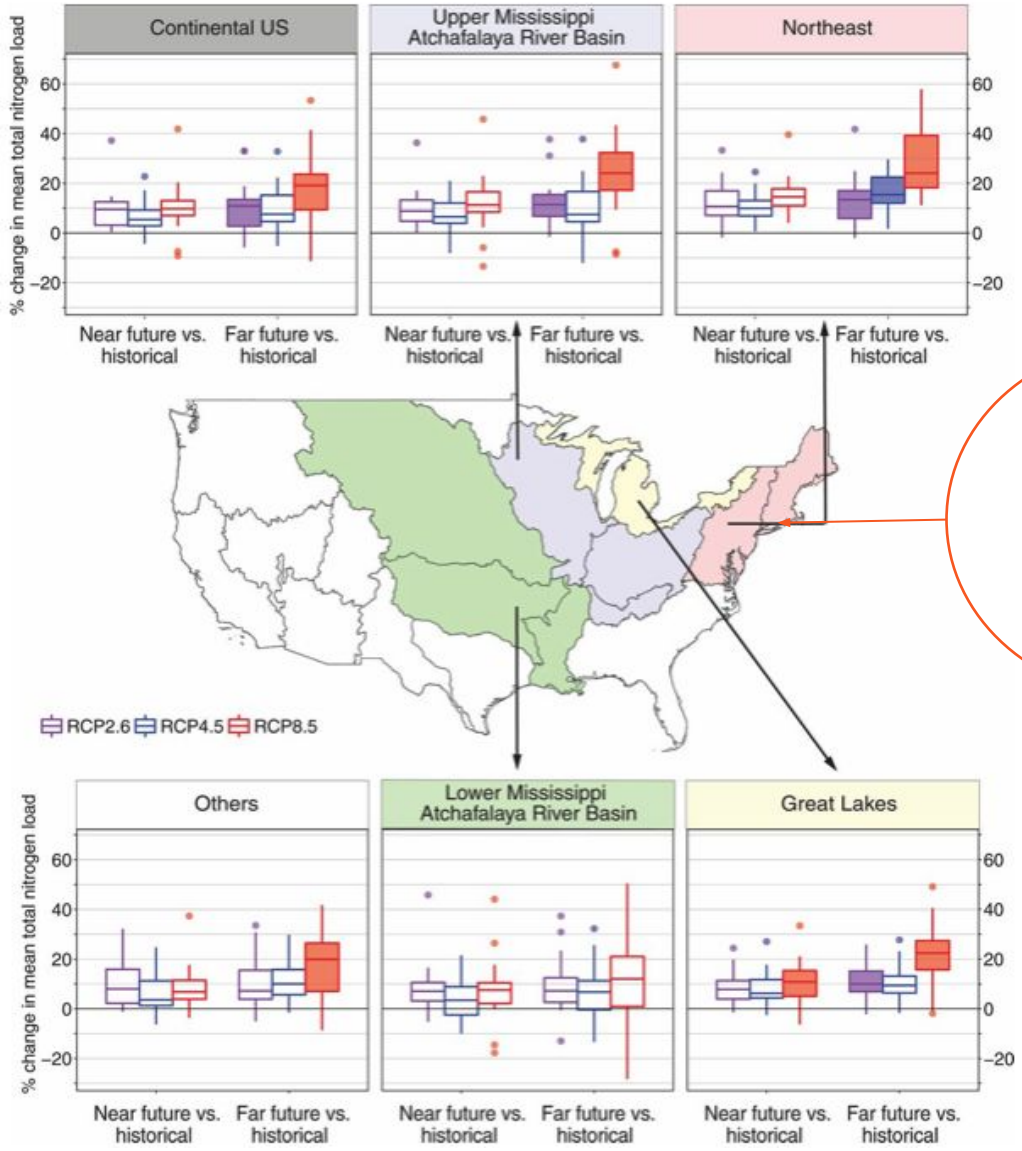
N rate is key factor shaping N pollution

Hoben et al. 2010;
Robertson and Vitousek 2013





Chesapeake Climate Impacts



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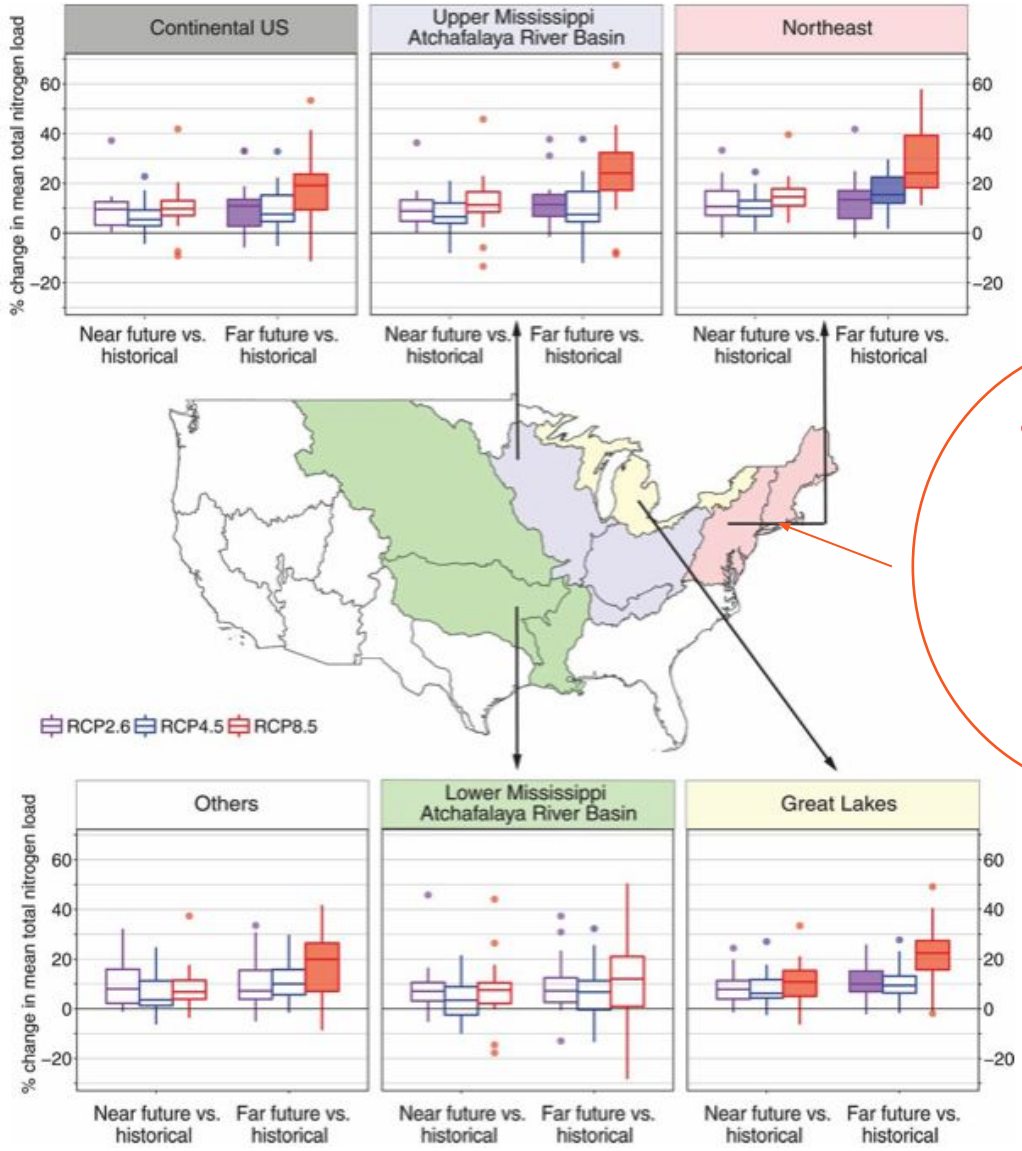

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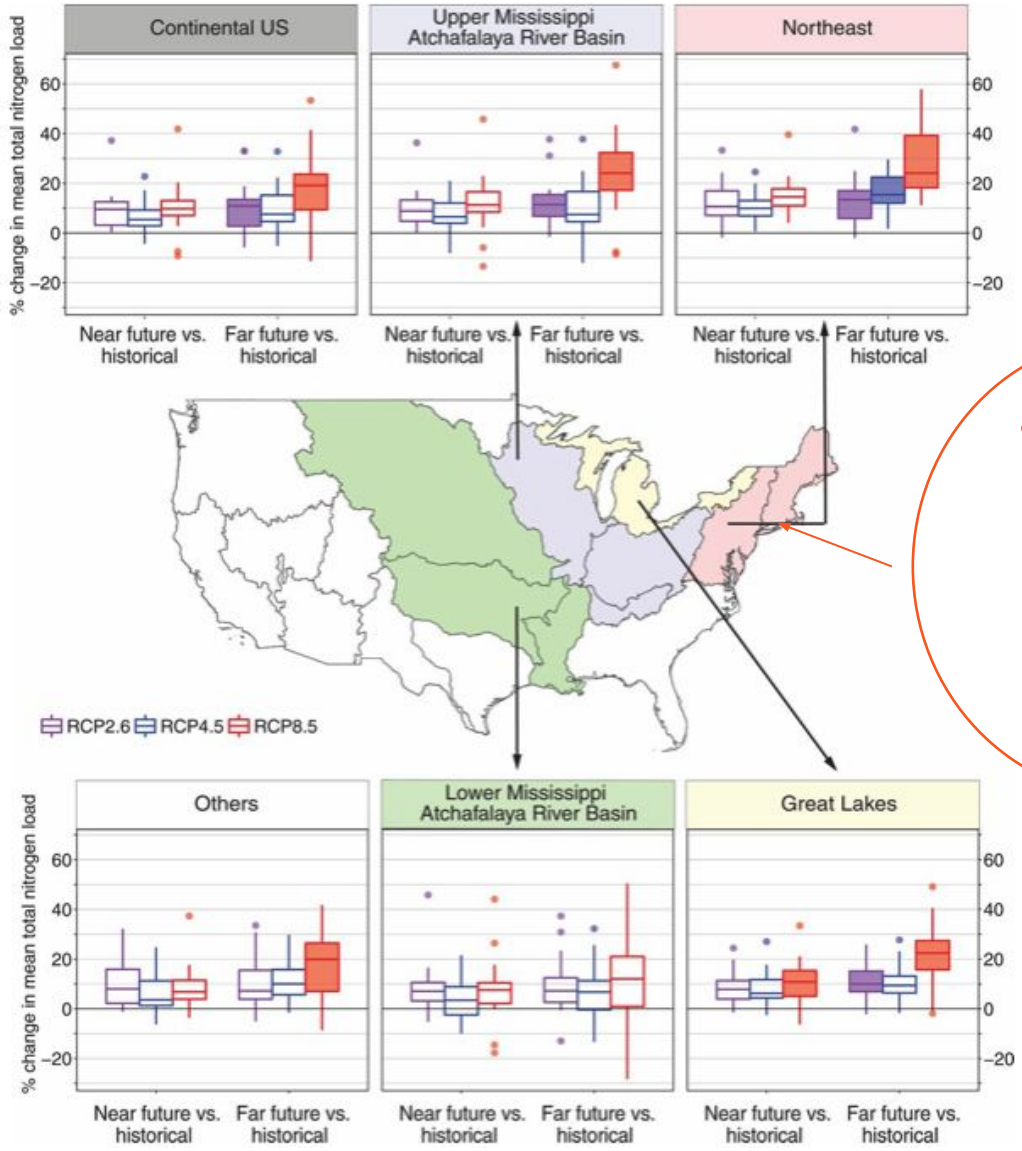

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My point

- Obviously good environmental social science depends good biophysical science
- If we don’t incorporate social sciences into existing environmental modeling…
  - **we cannot accurately understand the nature of the challenges we face**
  - **nor the scope of the solutions that are needed**

Today's talk: What's my point?

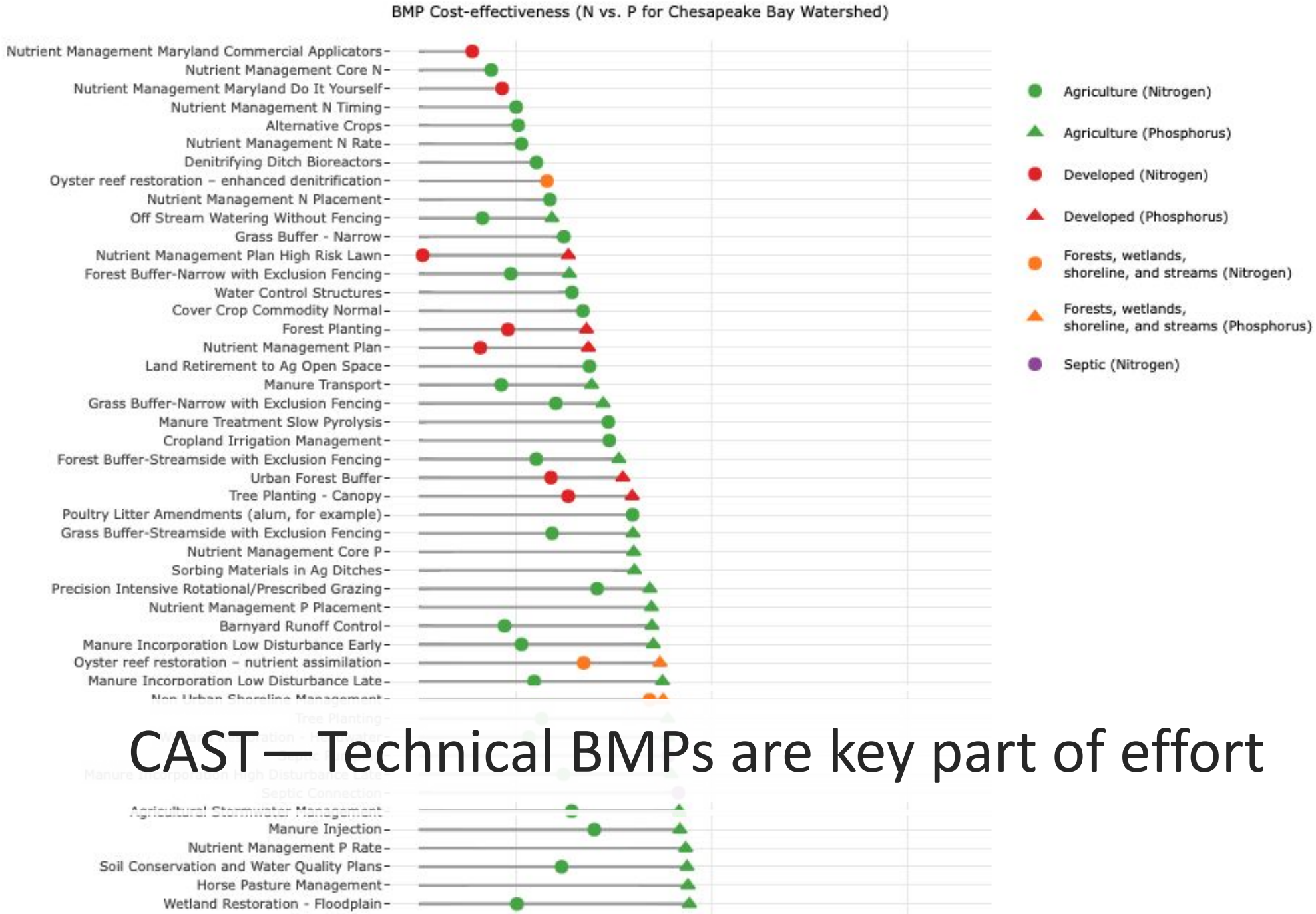
- 1. What climate modeling for the Bay is missing
- **2. How our understanding of technical BMPs may be flawed**

Technical
N BMPs
e.g. 4-R

N-Serve™

Optinyte™ technology

NITROGEN STABILIZER

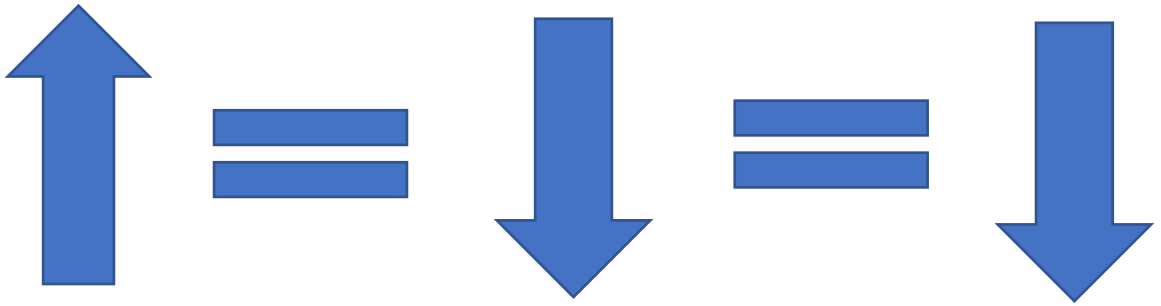


CAST—Technical BMPs are key part of effort

BMPs in practice—*in theory*

In-season or “split N” application

For instance: Sidedress application lower rate by ≅ 40% w/o harming yields and thereby reduce environmental harms (Gehl et al. 2005; Zhang et al. 2015).



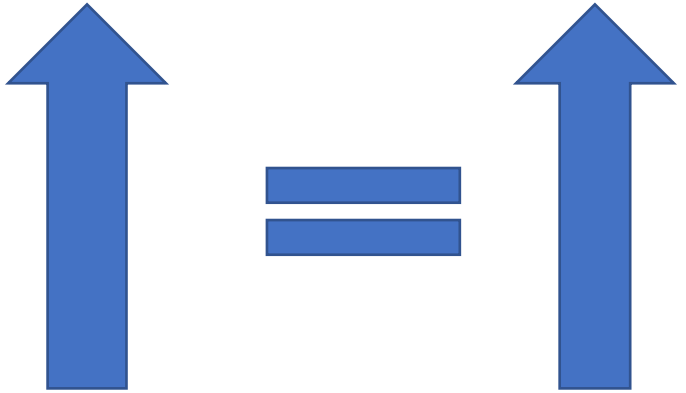
N application rate Reduce environmental harm

But achieving this outcome depends on how BMPs are used by farmers

BMPs in practice—*in practice*

In-season or “split N” application

Statistical modeling of nearly 2,600 farmers’ reported practices suggests…



N application rate

What does this mean: Practice is not being used in a way that maximizes its potential to reduce environmental harm

*controls for key agronomic factors, including yield

Houser 2021, Agriculture and Human Values

BMPs in practice—*in practice*

- Preliminary…
  - Only 10% of BMP adoption studies have assessed if practices are being used in ways that achieve potential biophysical outcomes (Yoder et al. 2019)
  - More work needed!

- But evidence is mounting that adopted practices are not being used as we would expect…
  - **Expectation**: Farmers use nitrogen tests to ensure they're not **over-apply** N
  - **Reality**: Farmers use nitrogen tests to ensure they're not **underapplying** N
    - Reimer, Houser, & Marquart-Pyatt 2020, Journal of Soil and Water Conservation

  - **Expectation**: Nutrient management plans will increase nutrient use efficiency
  - **Reality**: Farmers abandon plans if they feel circumstances demand alternative N management
    - Osmond et al. 2015, Journal of Environmental Quality

My point:

- Technical BMPs are often seen as key part of the solution
  - Embedded within our progress modeling-e.g. CAST
- **But**: BMPs, like many green technologies, are used within broader social, economic, and political contexts and subject to individual preferences
  - Social and biophysical processes shapes if and how BMPs are being used
- **By not integrating**: We may be mis-understanding our progress and the barriers to progress in Bay watershed

Closing thoughts…

- **Integrating biophysical and social sciences is a critical if we are to accurately understand…**
  - The scope of environmental challenges we face
  - Our progress towards addressing them
  - *What interventions work and don't work to promote meaningful behavior change*

- **Don't have all the answers, but…**
  - Much effort dedicated to changing farmers' behavior at the individual-level
  - **TNC/UMCES research and implementation efforts:**
    - What motivates farmer *AND* how is individual behavior shaped by biophysical, social, and economic contexts that surround it?
    - From this we're trying to scale-up our efforts to not just incentivize, but to also *enable meaningful* behavior change and better document it given these contexts.
      - Doing this through collaborative, interdisciplinary efforts
      - Not always easy, but ultimately, we feel its necessary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Prepared for Environmental Change
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Thank you!