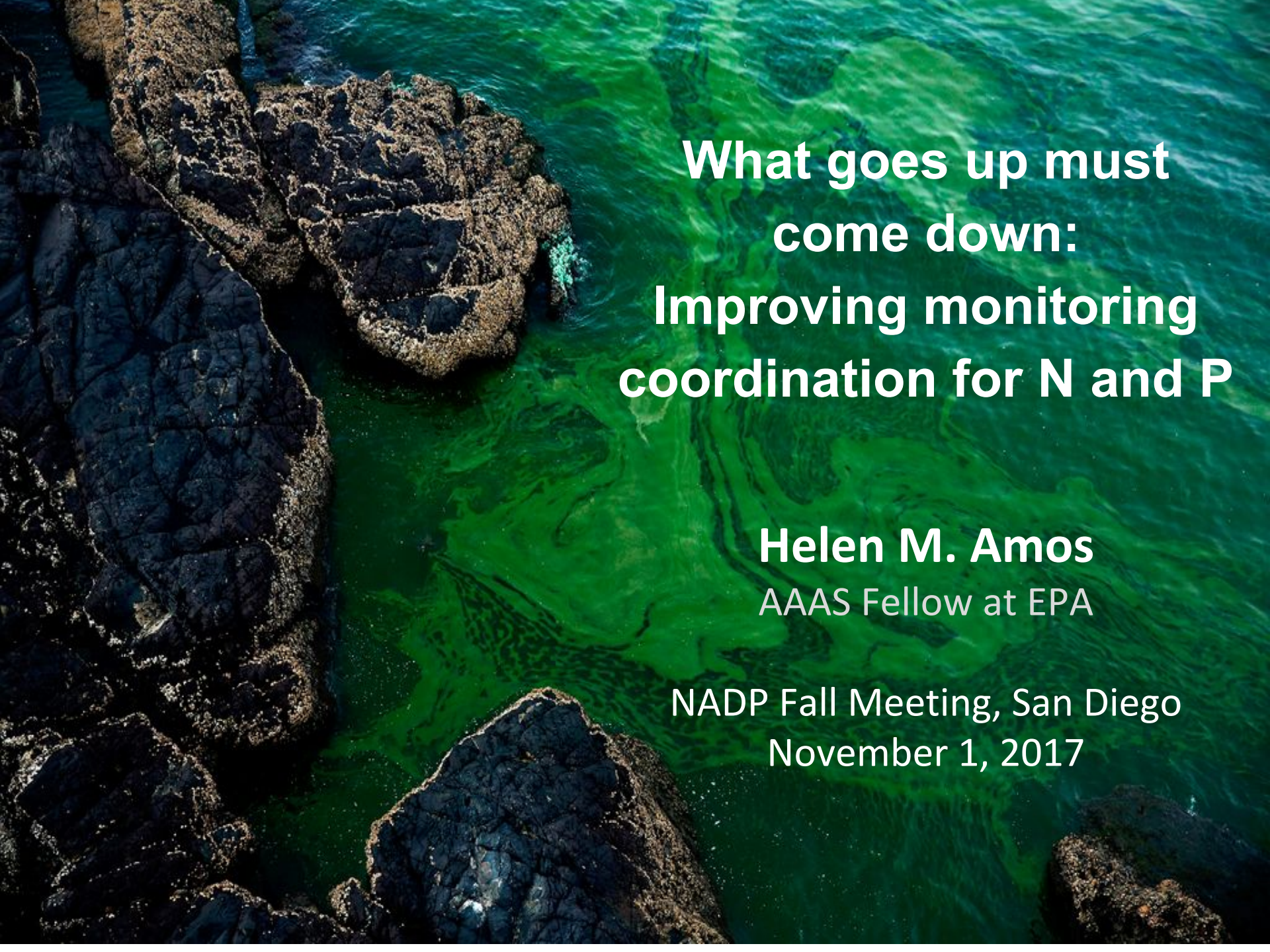

What goes up must come down: Improving monitoring coordination for N and P

Helen M. Amos
AAAS Fellow at EPA

NADP Fall Meeting, San Diego
November 1, 2017

DISCLAIMER

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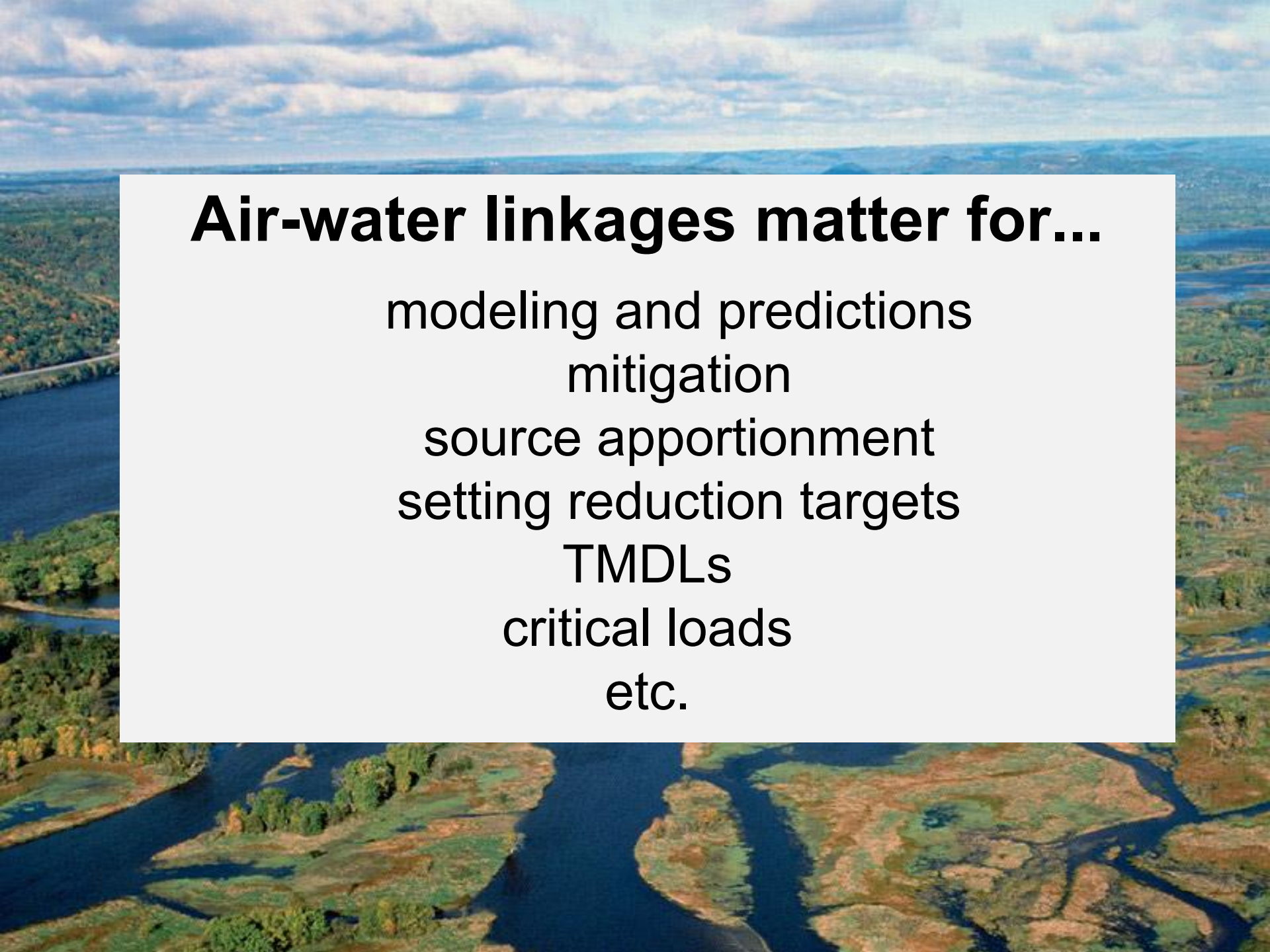
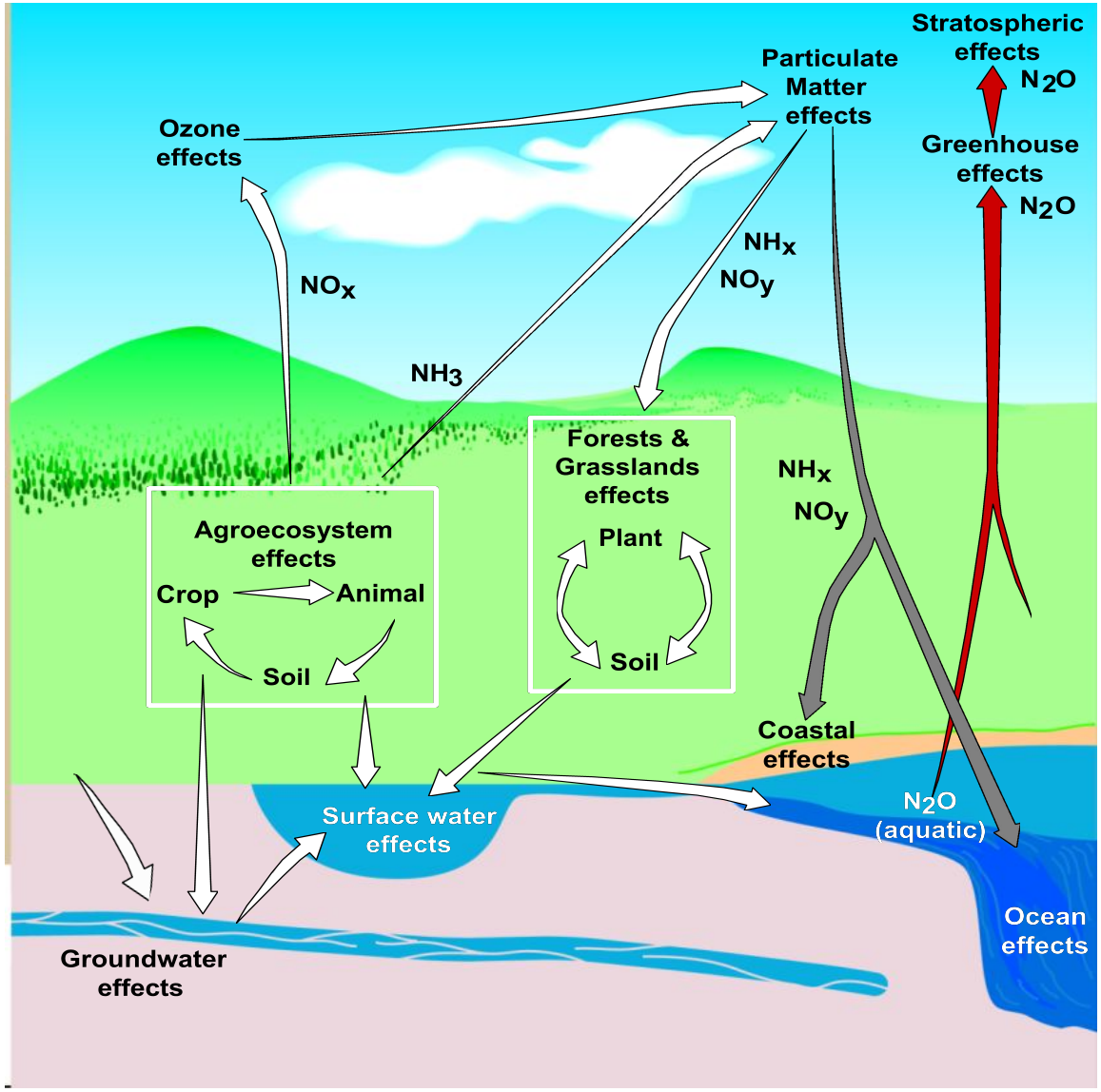


Air-water linkages matter for...

modeling and predictions
mitigation
source apportionment
setting reduction targets
TMDLs
critical loads
etc.

Nitrogen Cascade



Modified from Galloway et al. (2003) and Compton et al. (2011)

N loading from atmospheric deposition can be significant

Image credit: savebuzzardbay.org

25-49%
Chesapeake Bay[1,2]

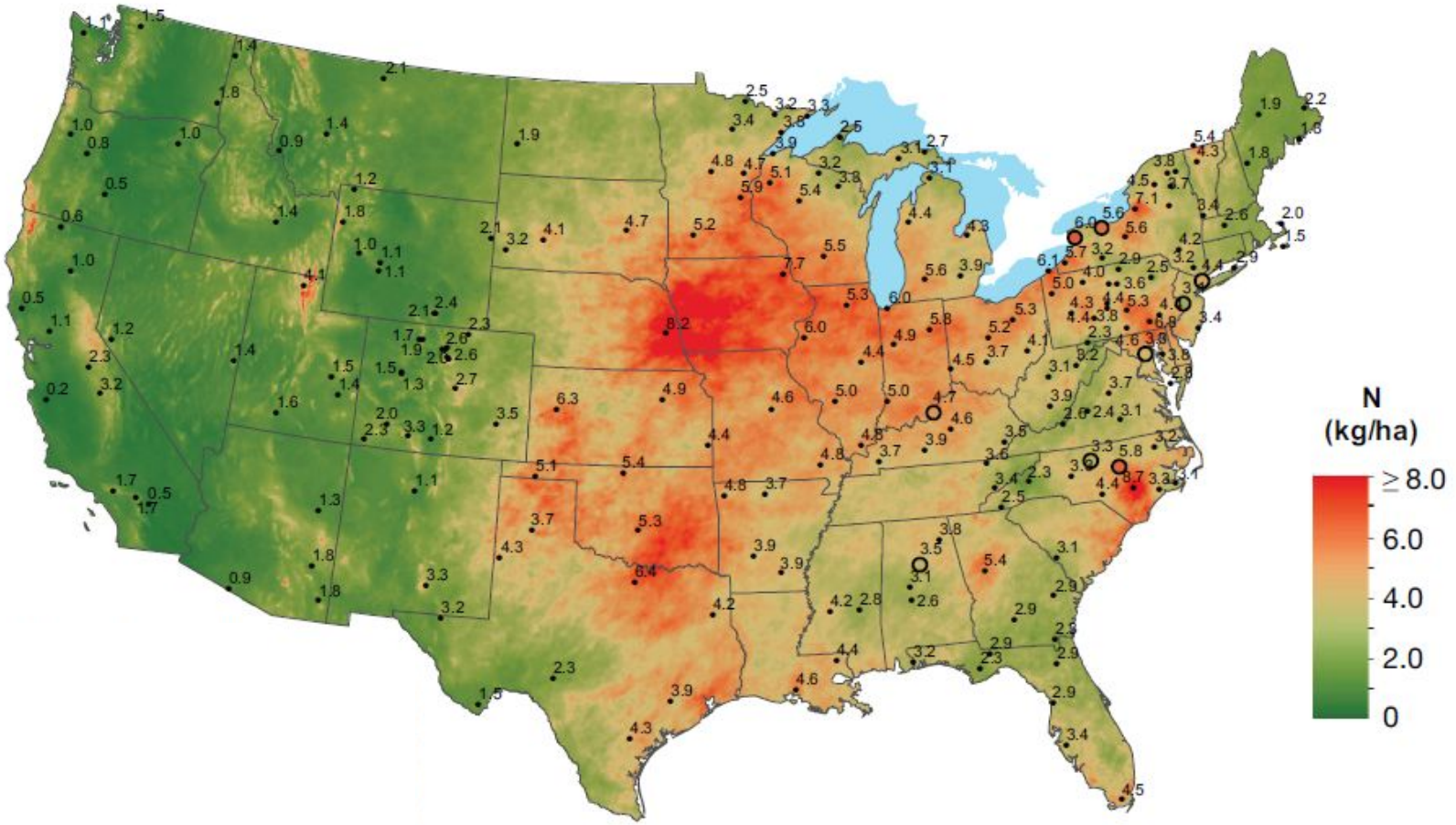
40%
Great Bay, NJ[3]

70%
Tampa Bay[4]

[1] Chesapeake Bay Program; [2] Howarth (2006); [3] Castro et al. (2003); [4] Poor et al. (2012)

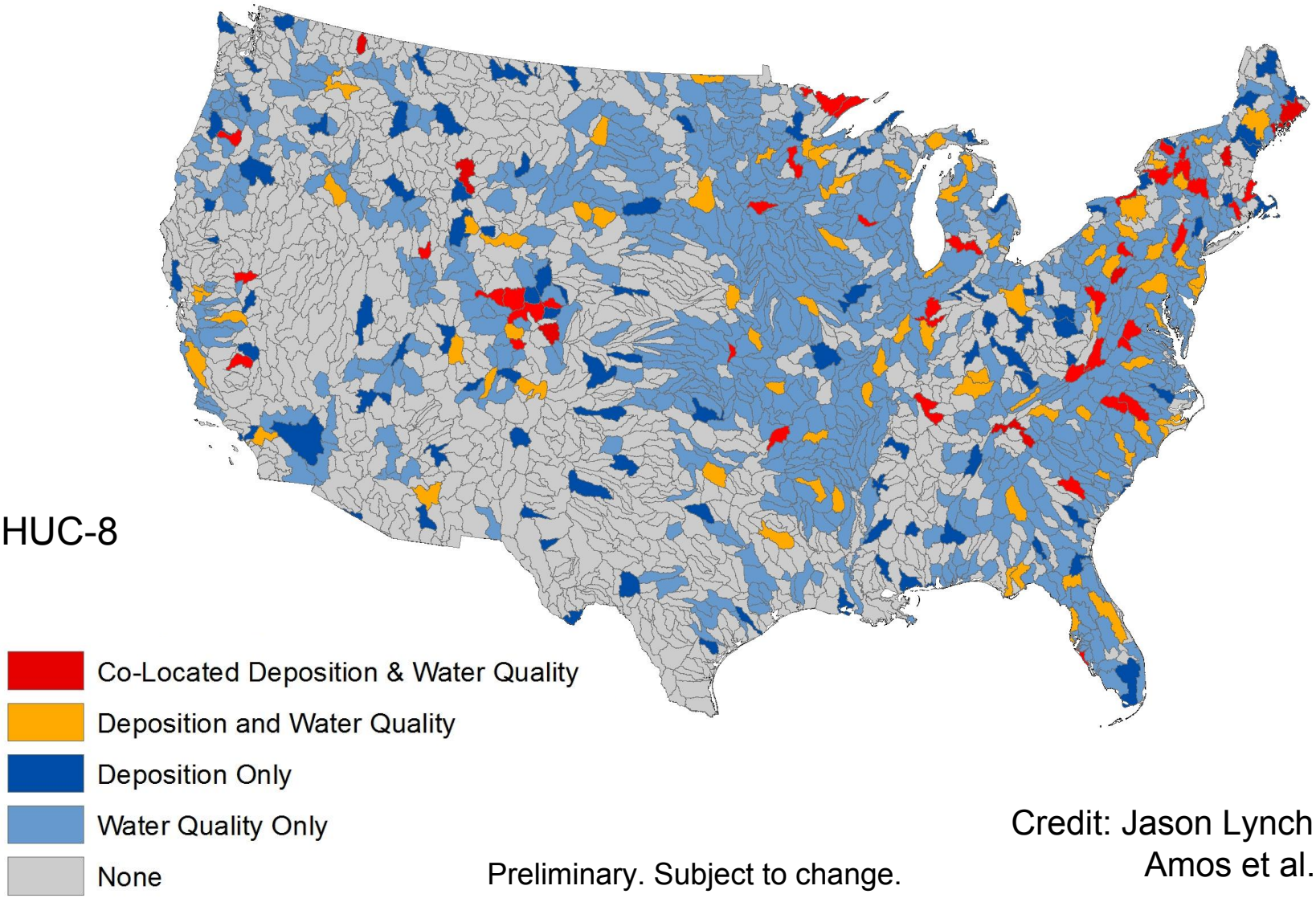
Atmospheric deposition of total nitrogen

Annual average, 2015



Source: NADP 2015 Annual Report

Current status: Deposition and water quality collocated at a small number of sites

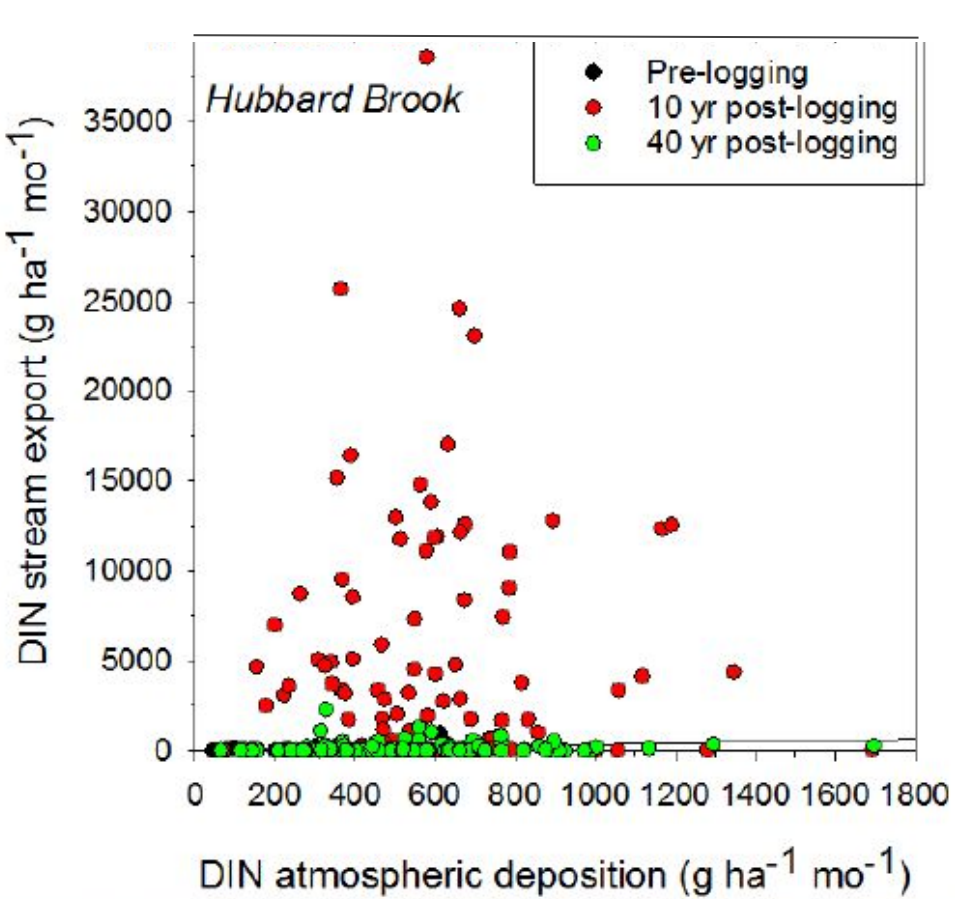


Preliminary. Subject to change.

Credit: Jason Lynch, USEPA
Amos et al., in prep.

The power of colocated cross-media monitoring

Land cover changes can decouple atmospheric inputs and watershed outputs.



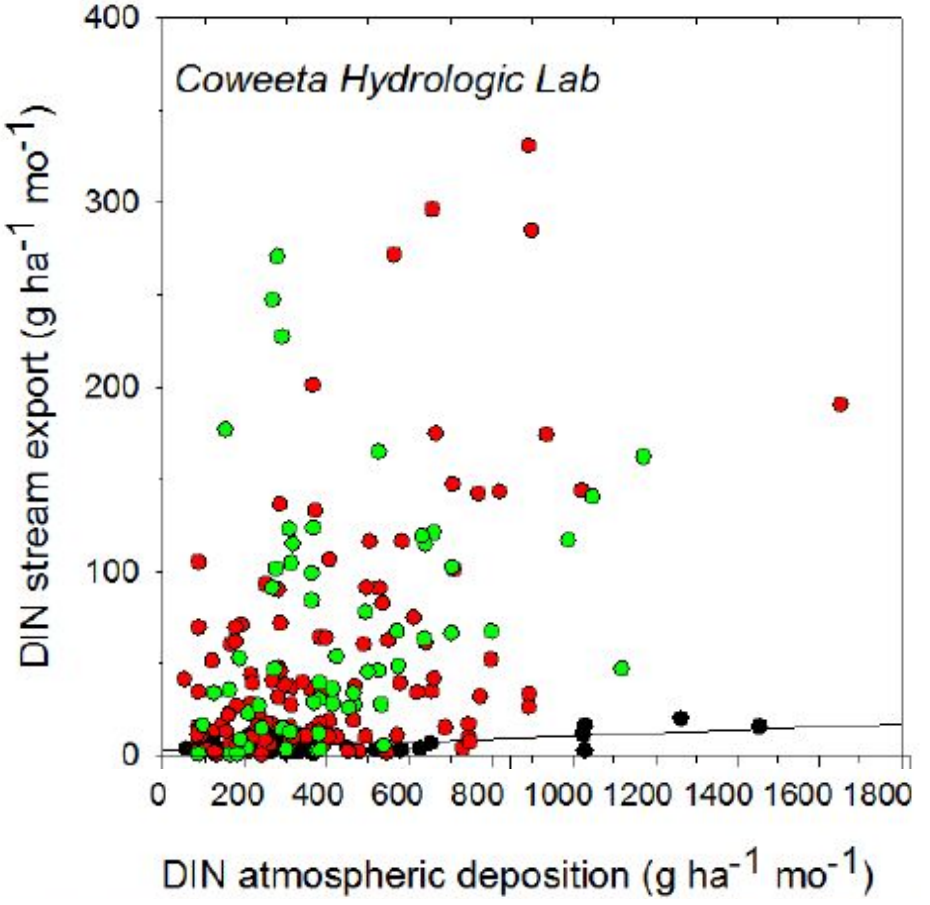


Figure credit: Chelcy Miniat

Amos et al., in prep

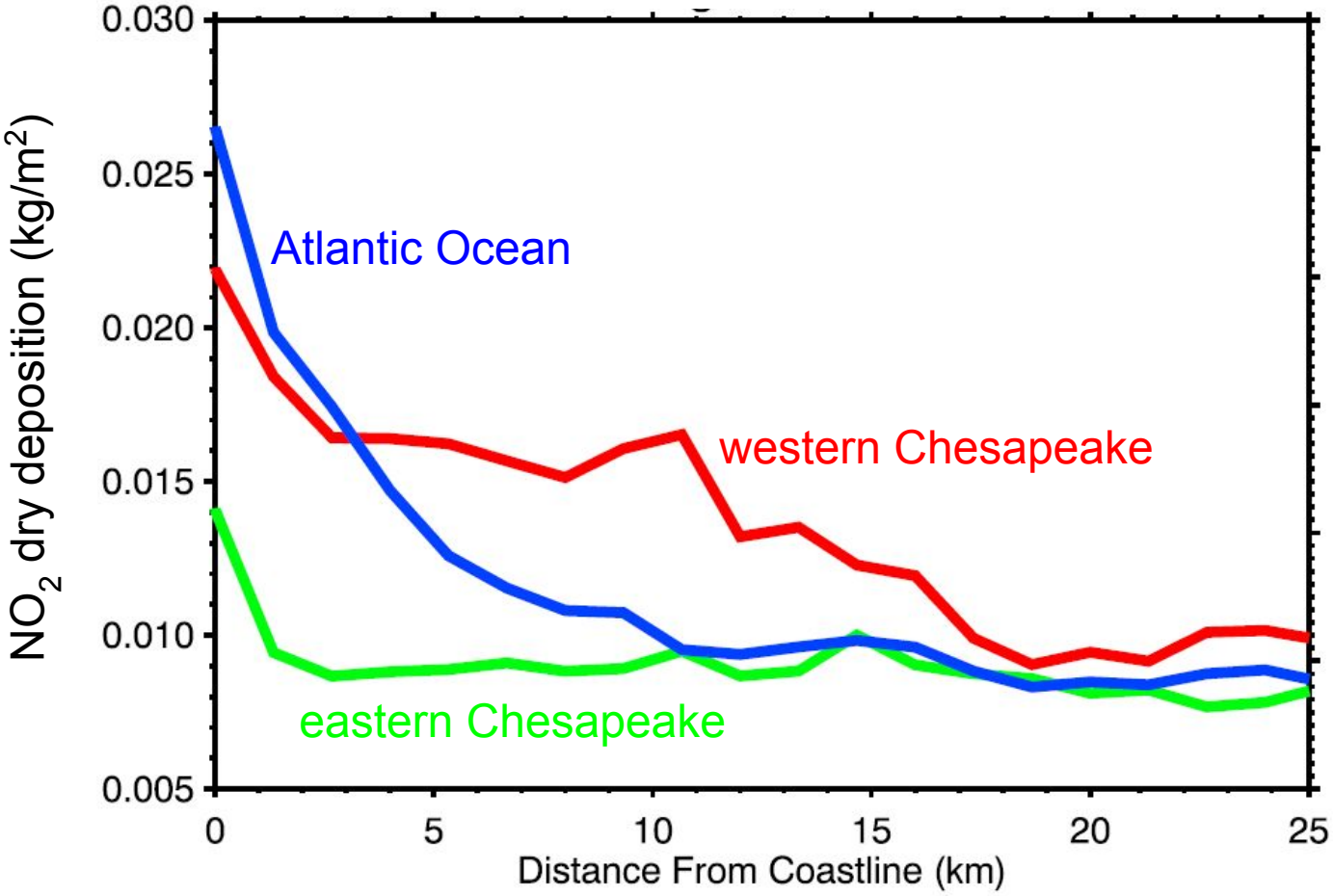
Identified knowledge gaps

Coastal	What is the atmospheric contribution to nutrient enrichment in coastal waters?
Urban	What is the atmospheric contribution to nutrients in urban stormwater runoff?
Agricultural Areas	How is a shifting speciation of nitrogen deposition impacting water quality?
Undeveloped Watersheds	Is atmospheric deposition driving phosphorus trends in lakes and streams?

Coastal

What is the atmospheric contribution to nutrient enrichment in coastal waters?

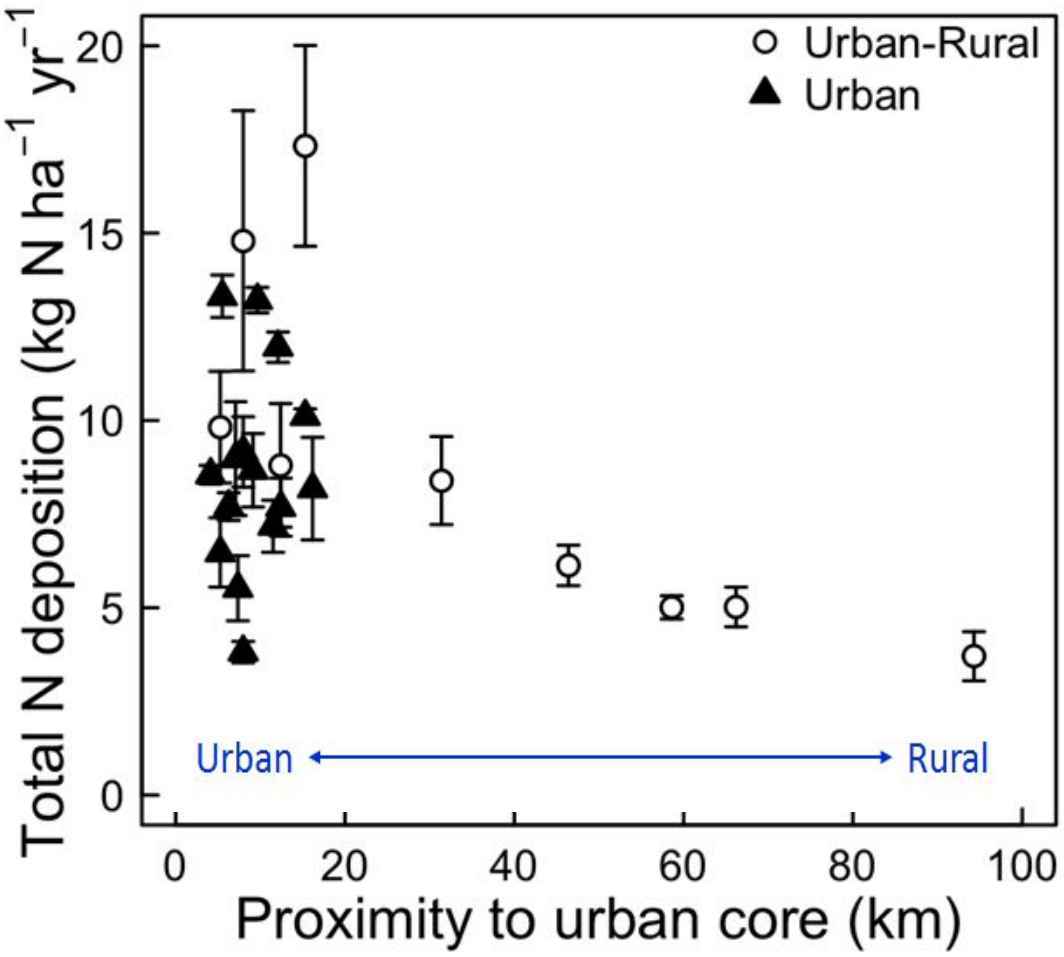
Inland and coastal monitoring will not give same answer.



Loughner et al. (2016)

What is the atmospheric contribution to nutrients in urban stormwater runoff?

Urban and rural monitoring will not give same answer.

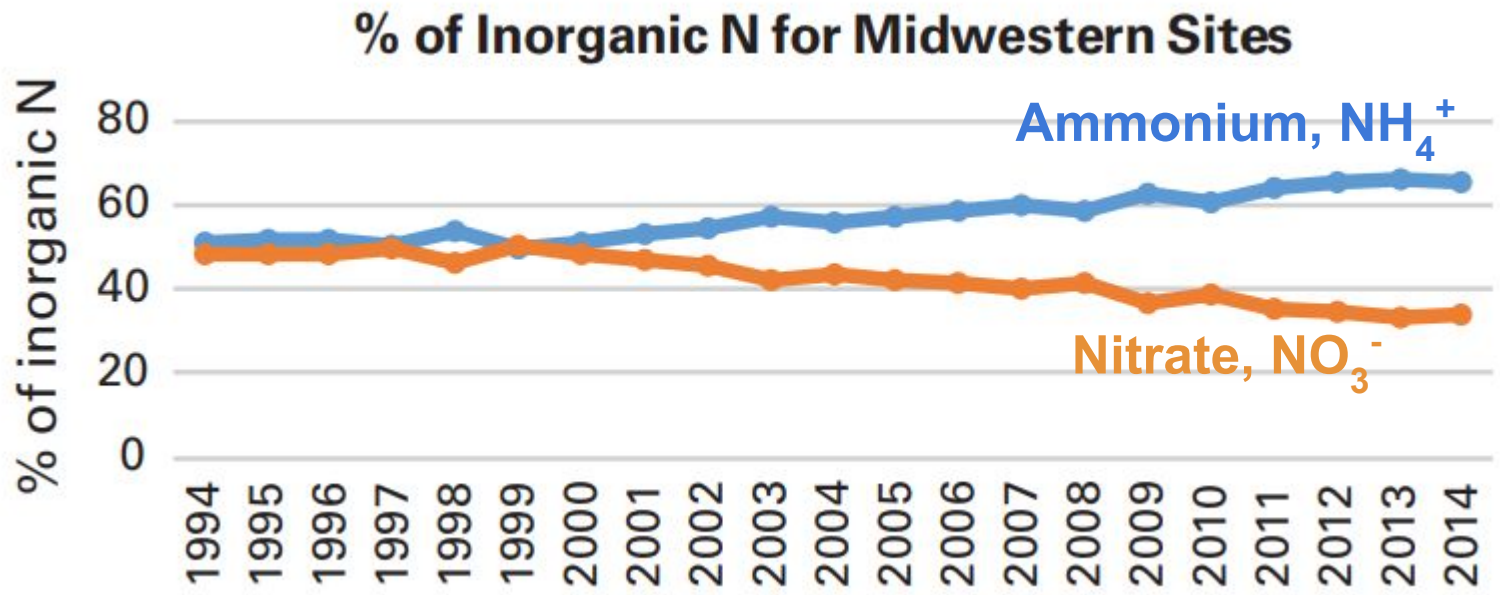


Rao et al., 2014;
Decina et al., 2017

Agricultural Areas

How is a shifting speciation of N deposition impacting water quality?

Shifts in N deposition are projected to continue.

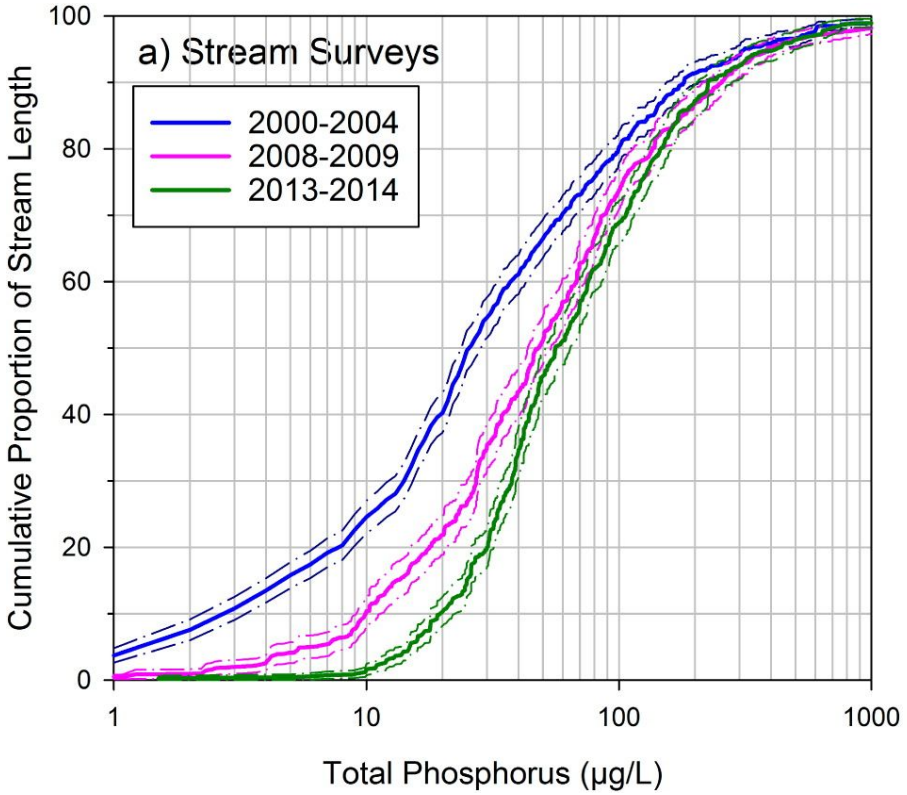


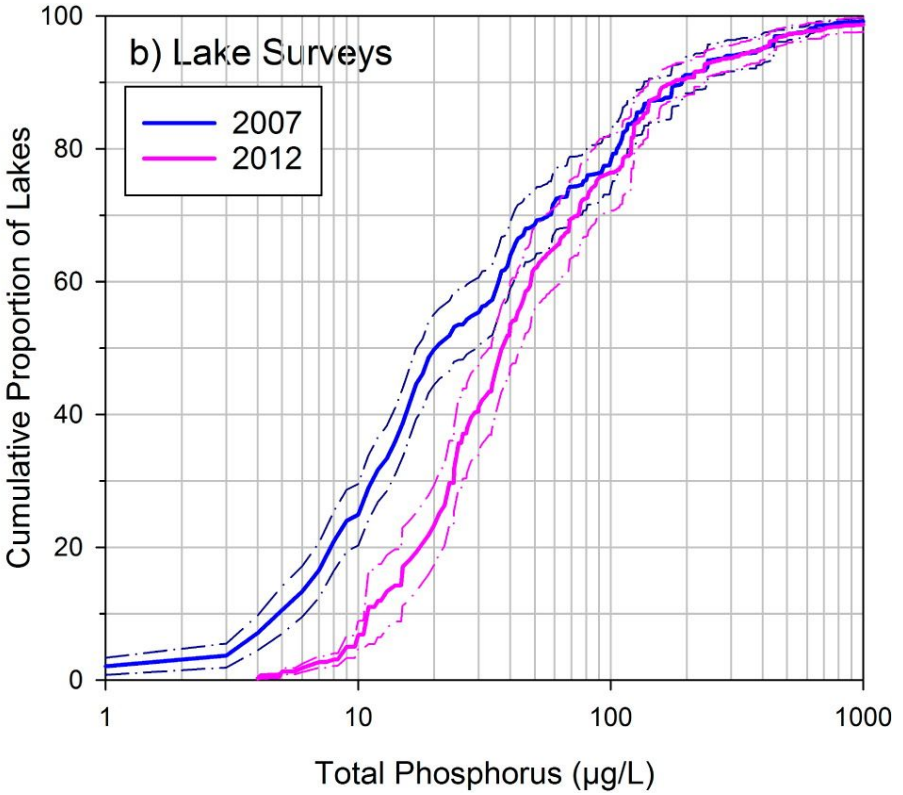
Source NADP
http://nadp.sws.uiuc.edu/lib/brochures/nitrogenAtmos.pdf

Undeveloped Watersheds

Is atmospheric deposition driving P trends in lakes and streams?

P trends strongest in more pristine lakes.





Source: Stoddard et al., 2016, ES&T

Strategy for Improving Coordination

3. Fill identified gaps with new sites or new data collection

2. Enhance coordination among existing sites.

1. Facilitate consistent reporting.
(Metadata, methods, QA/QC, online access)
Examples: CLAD & Sprague et al. (2017)

Amos et al., in prep

Closing thoughts

Interconnected systems require interconnected monitoring.

Future vision: Integrated monitoring and modeling that connects atmospheric inputs to water quality changes in N and P to inform state, regional, and national decisions.

- Coastal, urban, agricultural areas, and undeveloped watersheds.

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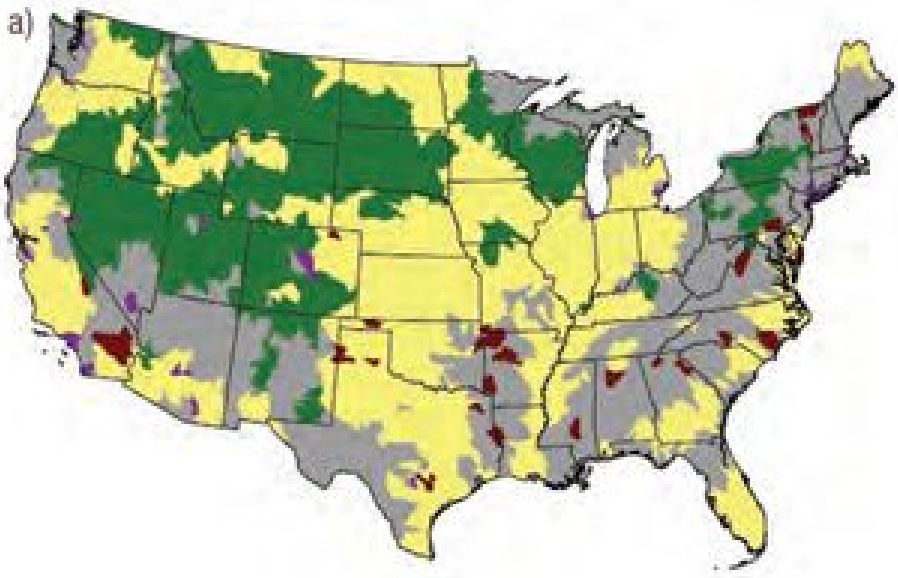
Extra slides

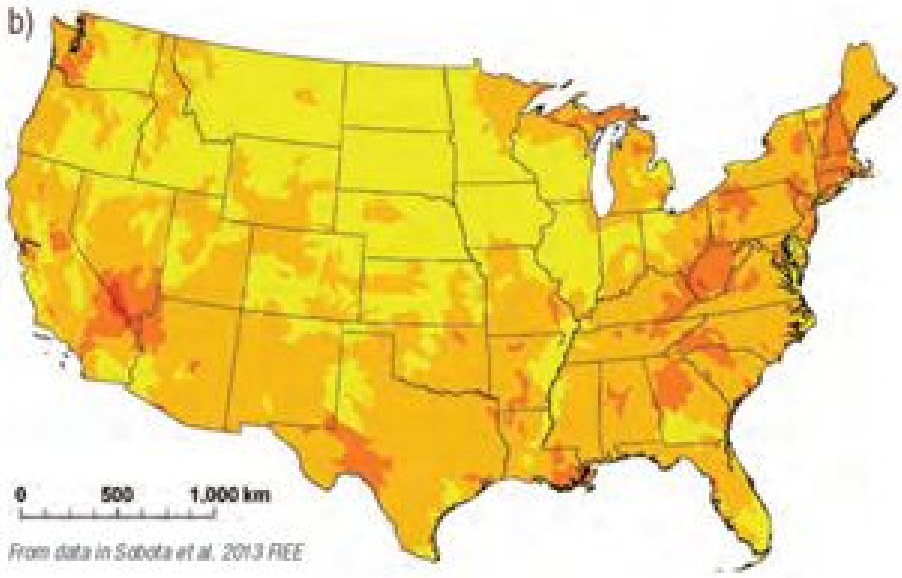
Atmospheric deposition is 20% of annual N load in many US watersheds



Dominant human-mediated N source

- Synthetic fertilizer
- Atmospheric N deposition
- Agricultural BNF
- Confined feedlot manure
- Centralized Sewage

Most: Synthetic fertilizer (886 HUC-8s)
Least: Centralized sewage (32 HUC-8s)



Atmospheric N deposition,
as % of all anthropogenic N inputs
circa 2000

0 – 20
20 – 40
40 – 60
60 – 80
80 – 100

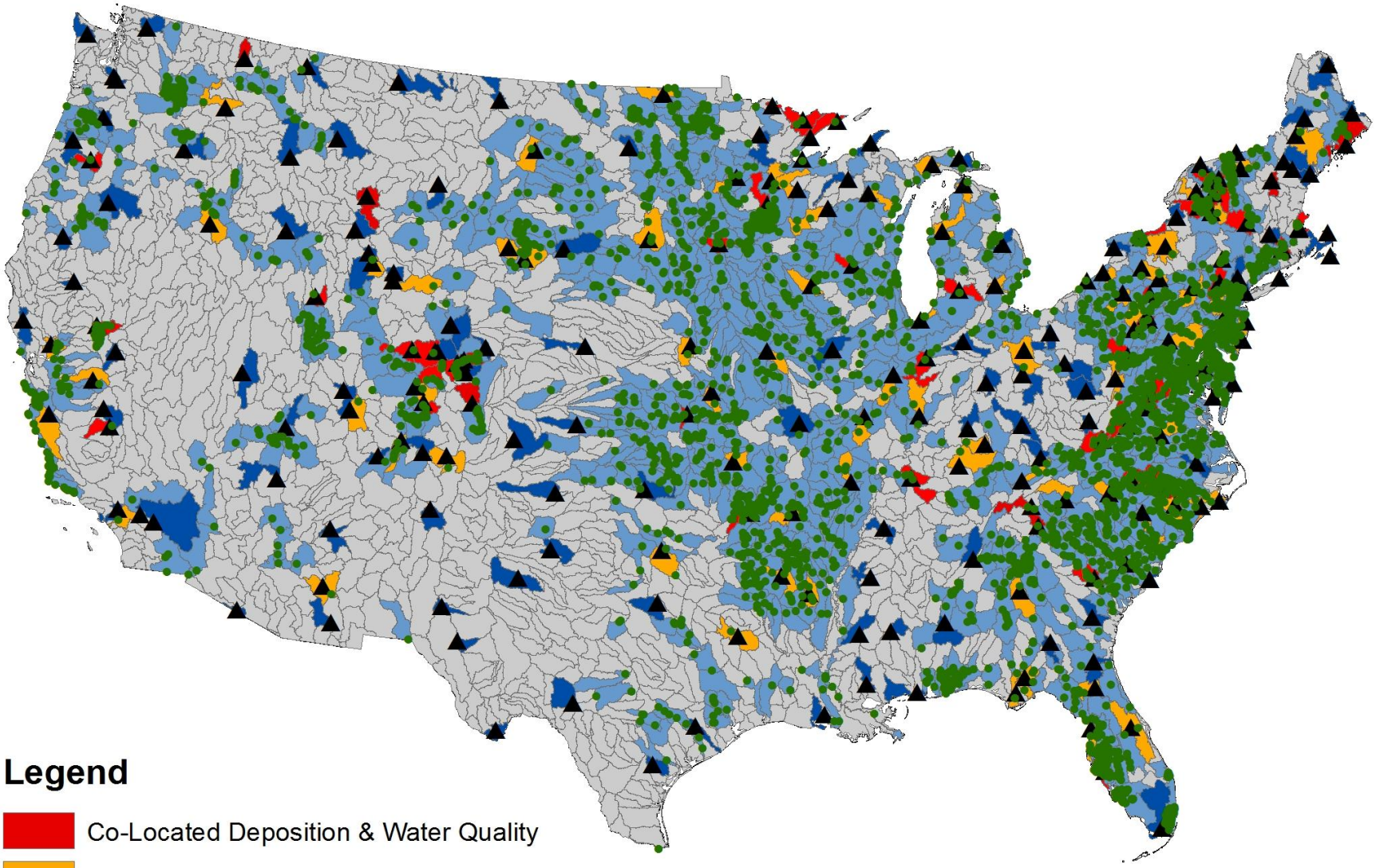


Figure Credit:
Jason Lynch, USEPA

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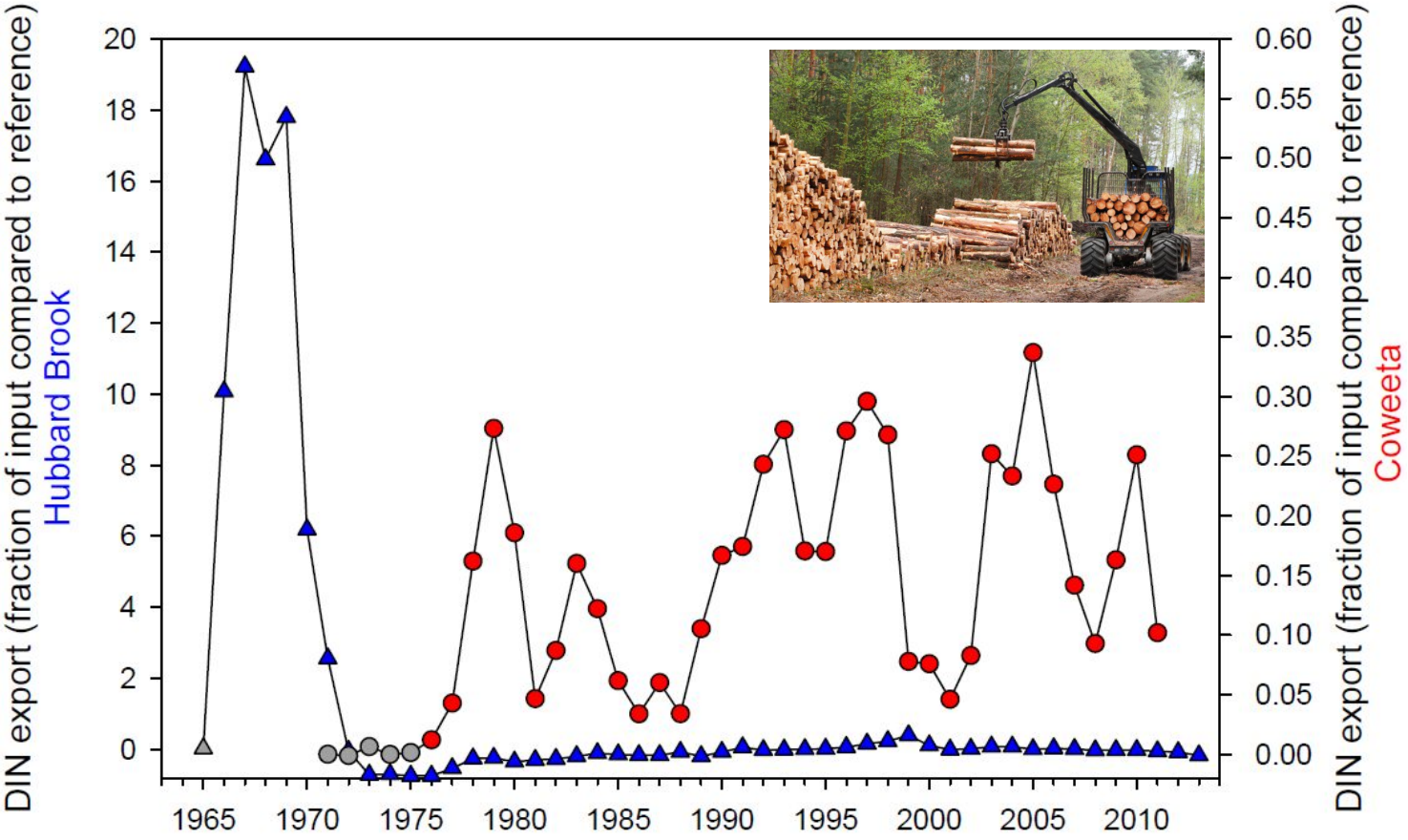

Figure credit: Chelcy Miniat

Amos et al., in prep