



Integrated Nitrogen Management: Informing Decisions for Sustainability

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NHEERL, NERL, NCEA, NRMRL, OAQPS, OW
NRC, ORISE, WSU-Vancouver

Clients: OAR, OAQPS, OW, Regions, Local Stakeholders

Challenge

- Increases in reactive N have led to benefits but high costs for ecosystems and human health.
- Need approaches to reduce N inputs in the most economically efficient, socially acceptable, and environmentally sound way.
- How do we help get there, in response to local, regional and national issues?



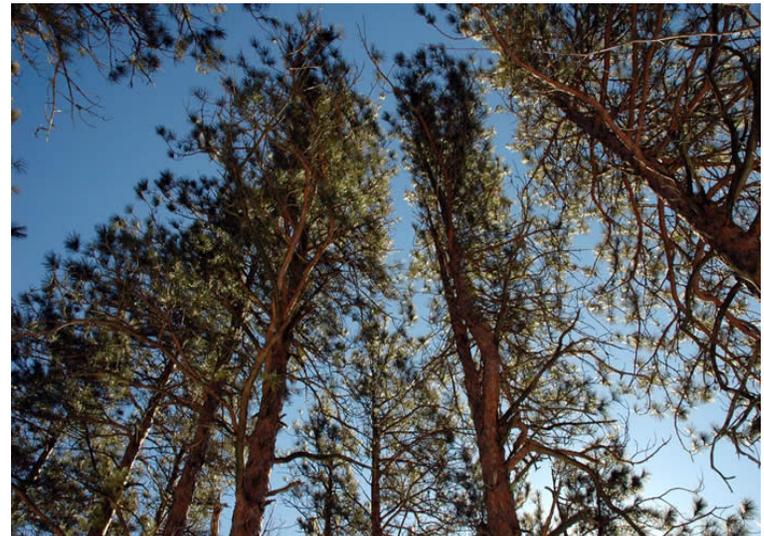
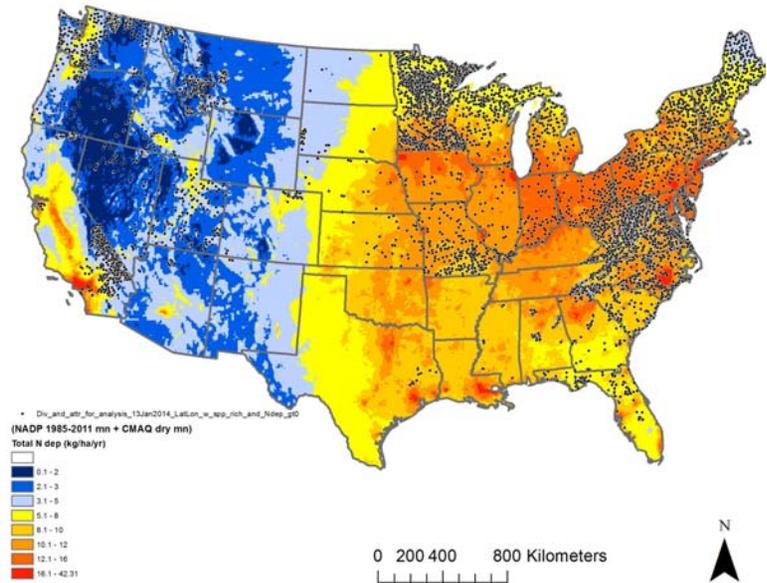


Research

- **Air standards and programs**
 - N input and CC impacts on biodiversity and ES
- **Water quality – OW and states - Regional**
 - Link nutrient load/source to economic impacts
- **Cross-media - Communities**
 - Application of nutrient loading, management tools, scenarios and dynamic modeling
 - Tools to help determine how and where to reduce N inputs

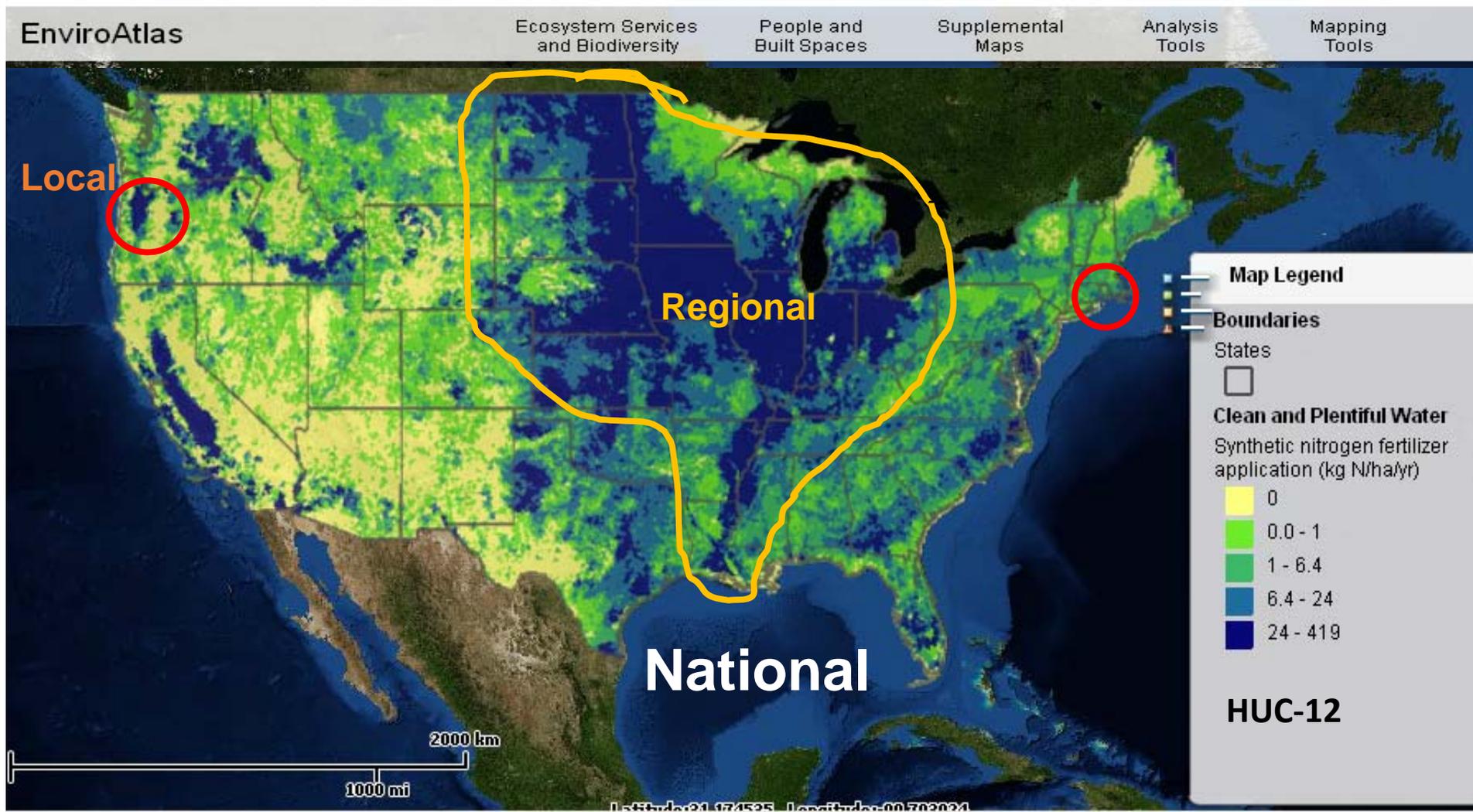
Results: Interactive effects of climate change and N on ecosystems and services

1. National analysis of N deposition impacts on plant communities.
2. Regional N deposition and climate change effects on forest composition and ecosystem services.
3. Online tool for stakeholders to explore ecosystem vulnerability to nitrogen deposition.



Chris Clark, ORD-NCEA

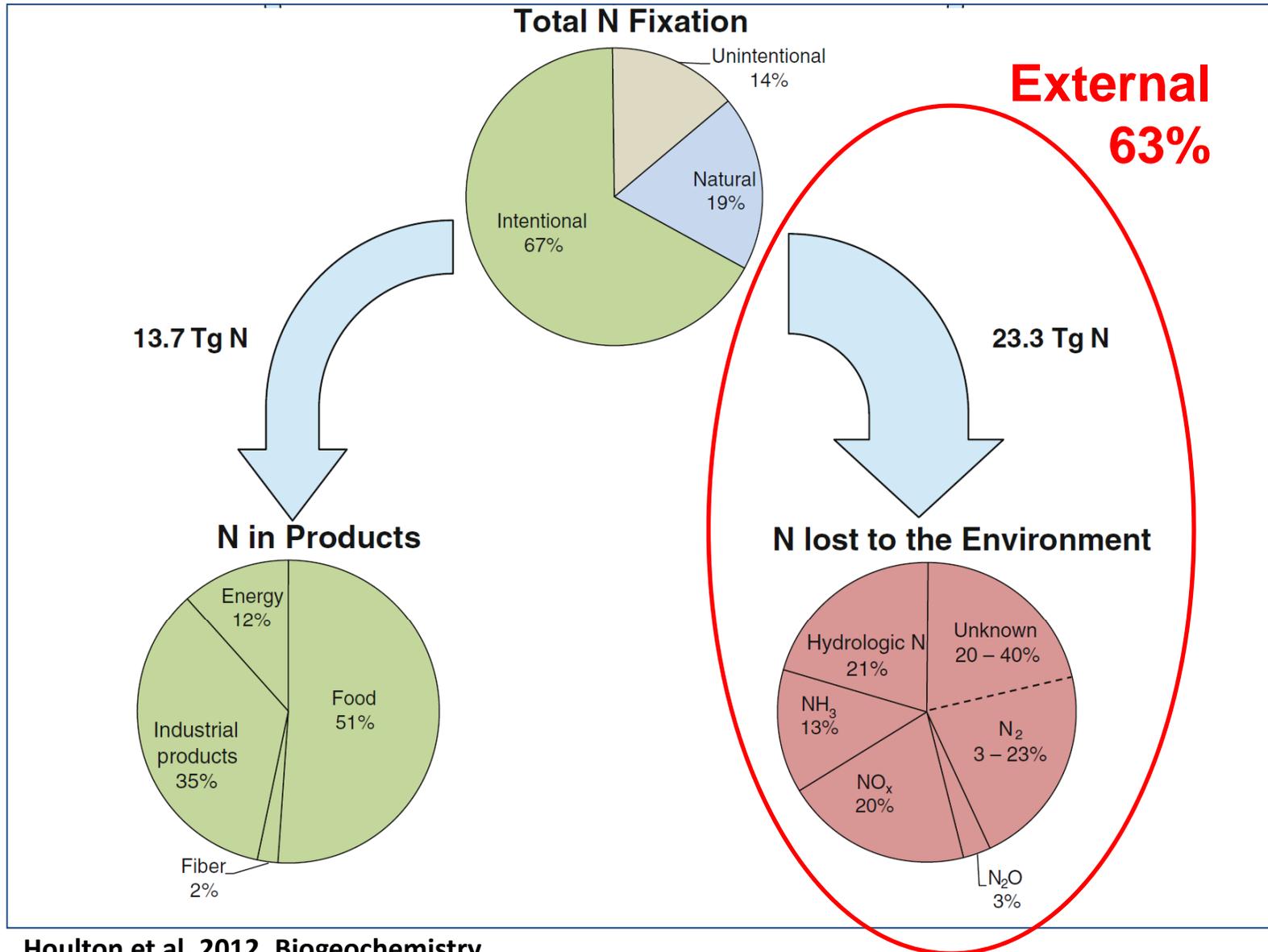
Results - Improved Spatial Data & Maps for reactive N



Synthetic fertilizer inputs

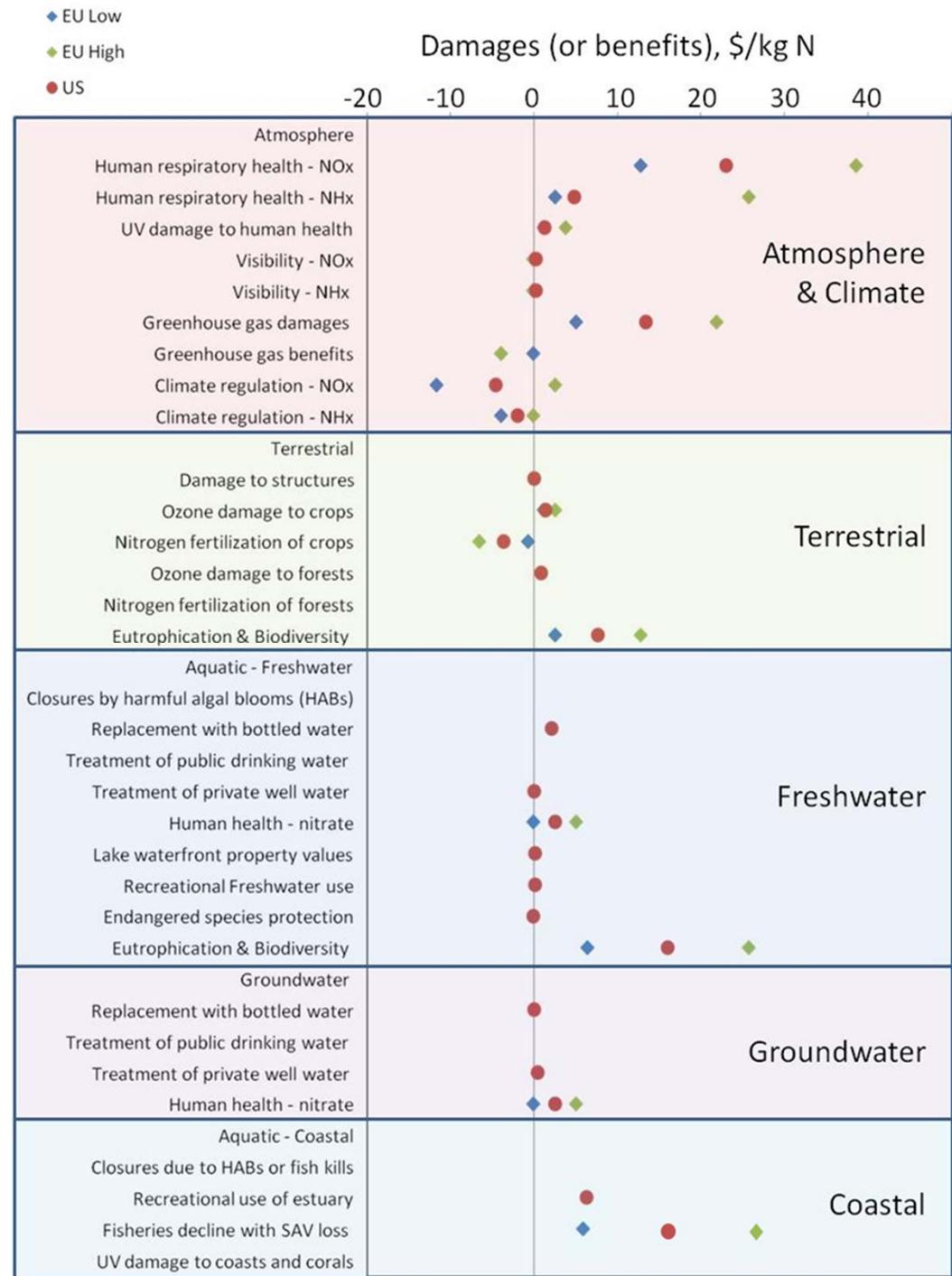
<http://enviroatlas.epa.gov/enviroatlas/atlas.html>

What happens to the N inputs?

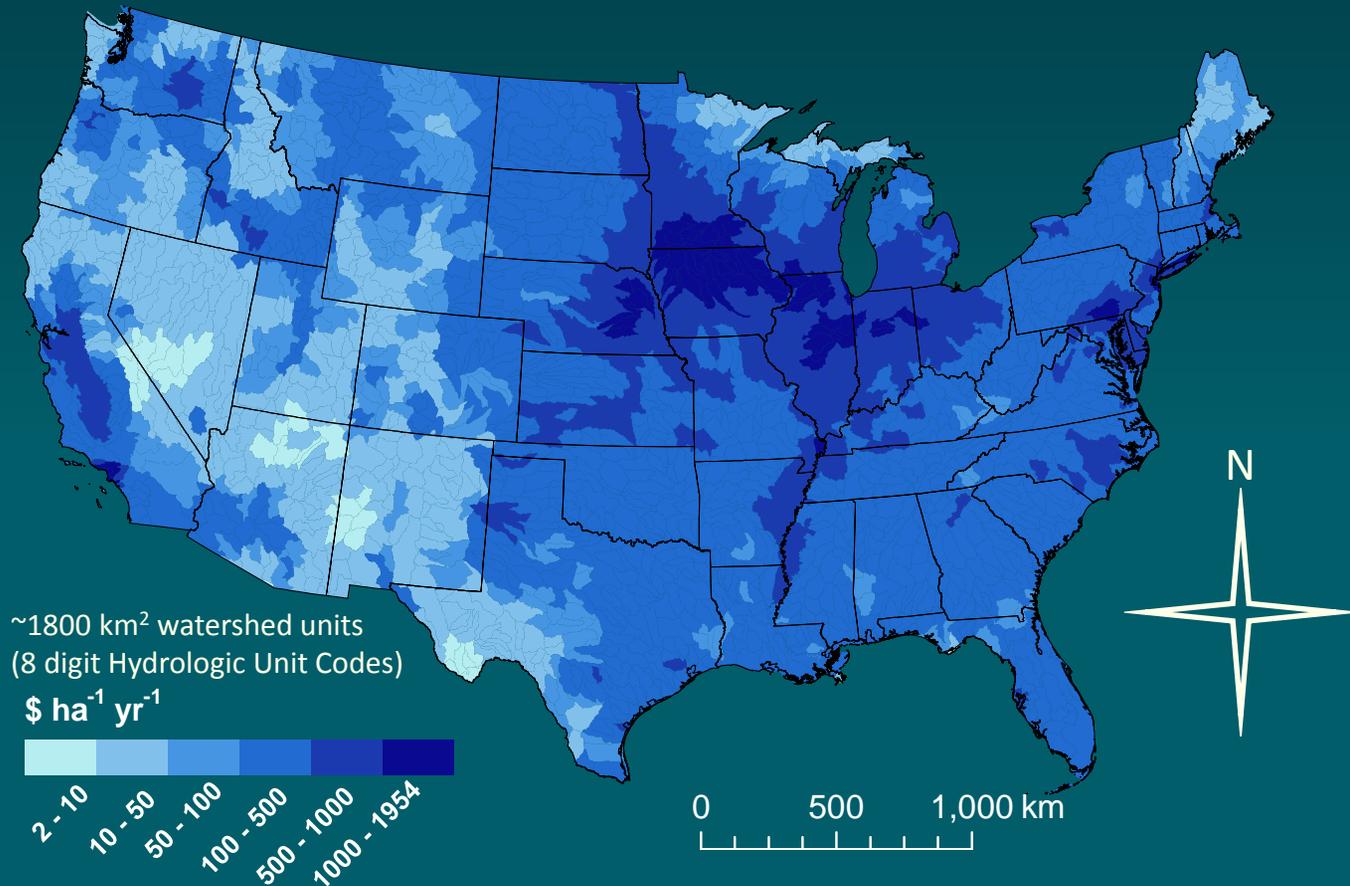


Costs of nitrogen pollution

- US values
 - Compton *et al.* (2011 EL)
- EU low and high values are from EU N Assessment
- Many gaps exist
 - e.g. HABs, N and forests



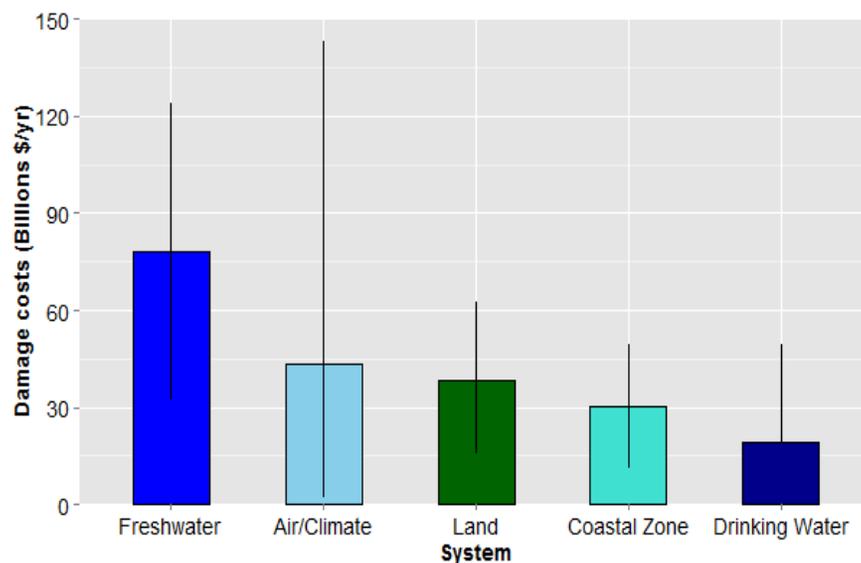
Freshwater damage costs, early 2000s



Damages from source

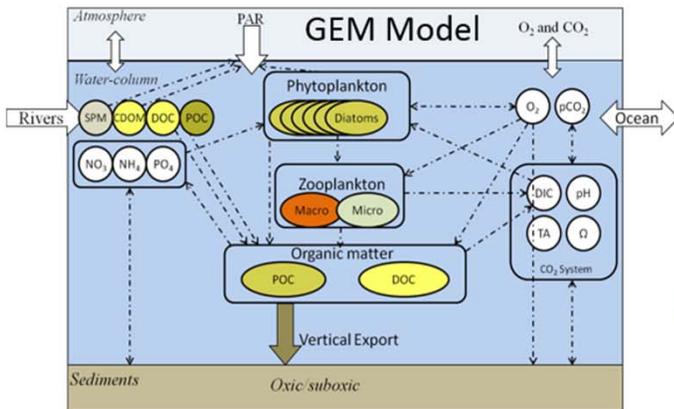
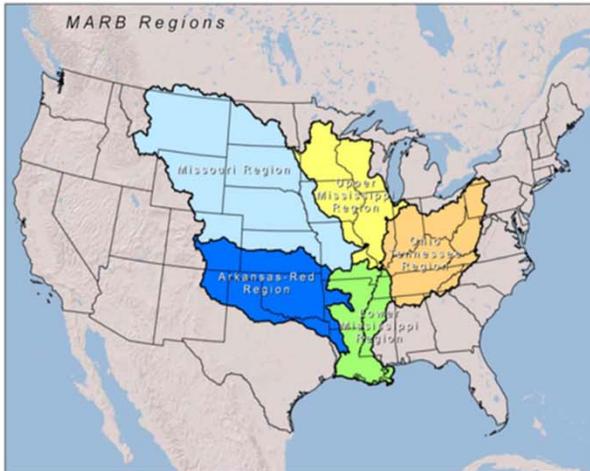
Source	Agriculture	Fossil Fuel	Sewage	Total	Range
Damage cost (billion USD)	\$157.1	\$50.2	\$2.3	\$209.6	\$81-441

Damages to endpoints



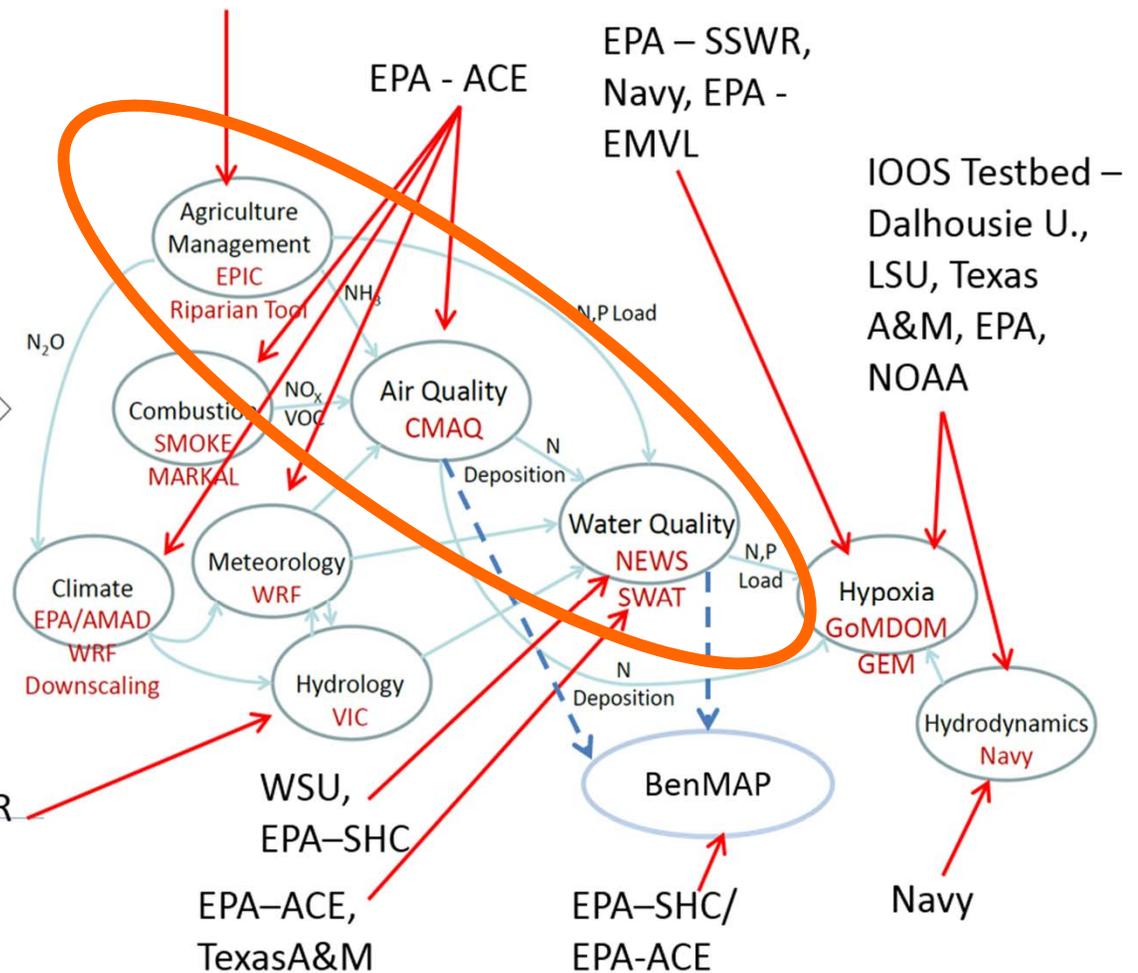
(Sobota et al. In press)

Modeling of Mississippi River Basin- Gulf of Mexico



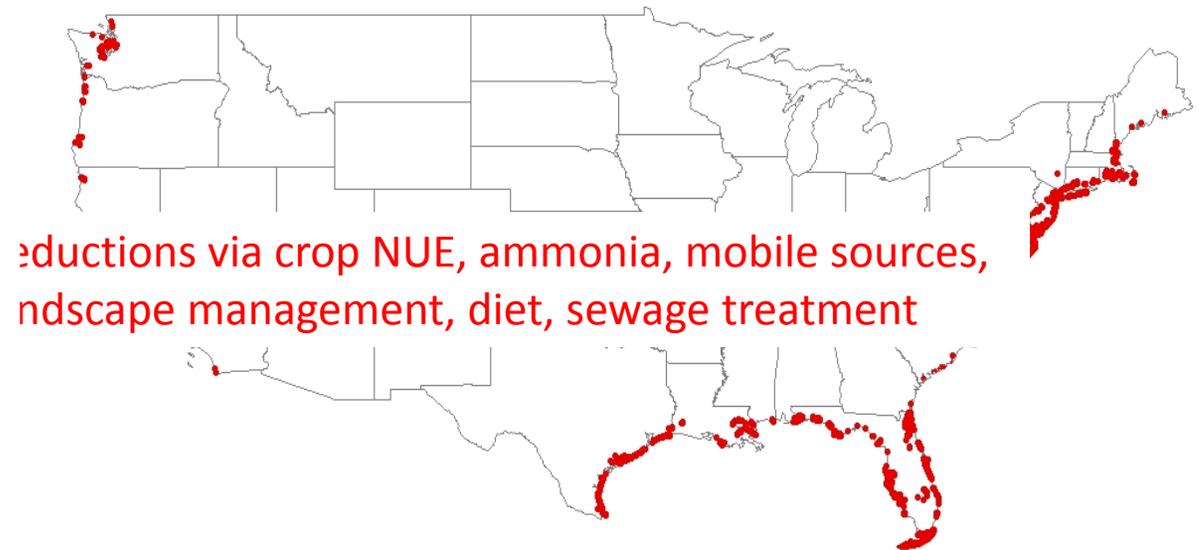
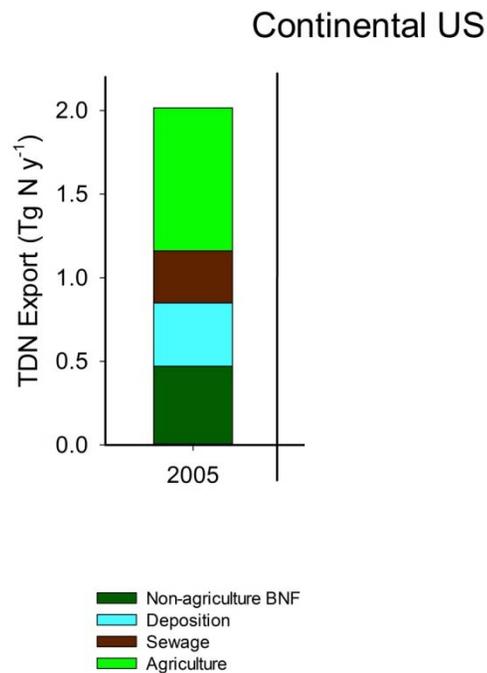
**Cross RAP, cross EPA Lab,
Multi-agency, Multi-university**

EPA-ACE/
EPA -SSWR,
USDA, UofMD



EPA - ACE/EPA - SSWR
UW, PNNL

Results - Nutrient reductions to coast possible with improved management



Impaired water body under Clean Water Act Section 303(d) 

Michelle McCrackin, John Harrison & Jana Compton
JEQ 2014

Nutrient Tracking for Surface and Groundwater Protection

Innovative Research for a Sustainable Future

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Linn Soil & Water
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Project support:

EPA RARE
DEQ
ODA
SWCD
NRCS

SWCS
GWMA
Land owners
Willamette Partnership
Lane Council of Governments

Science directions in SHC-N

- Response functions – for terrestrial, aquatic and drinking water impacts on ecosystem services
- Connect N reductions in N loads to benefits
- Research at several scales, cooperation from many agencies to address wicked problem

