Forest loading sensitivity to atmospheric deposition

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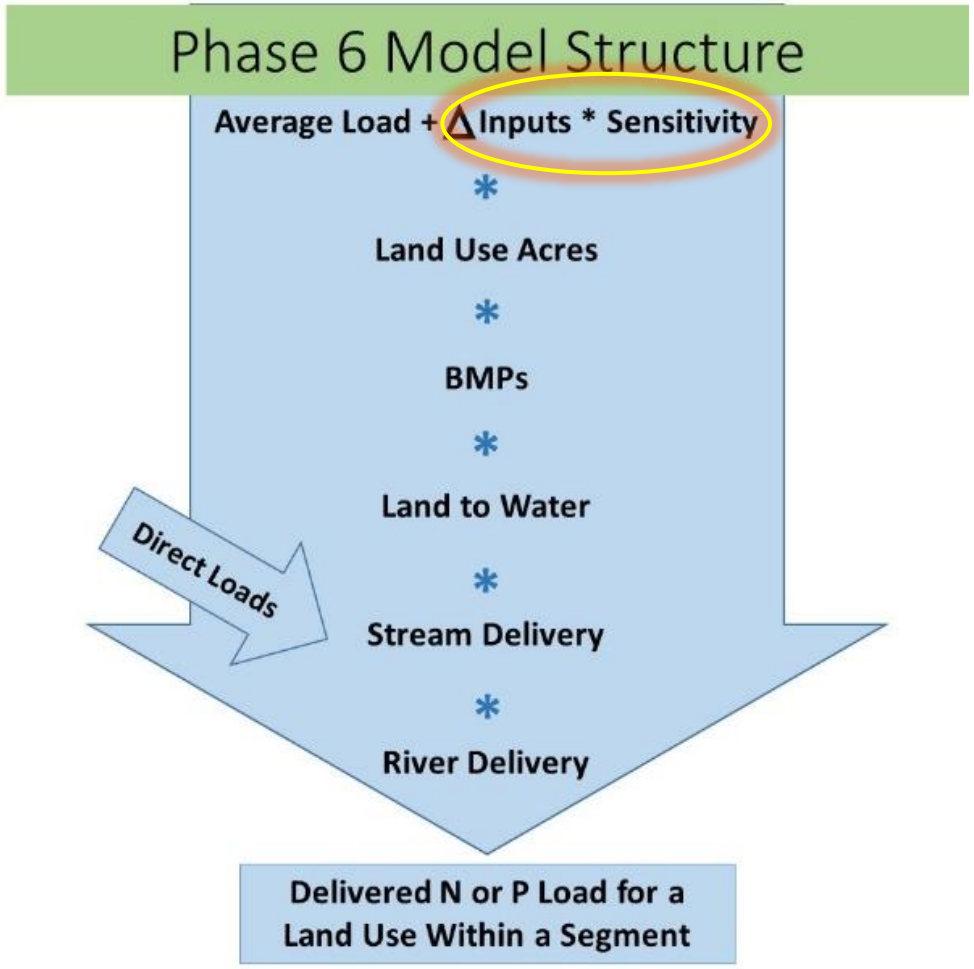
CAST Load Sensitivity to Inputs

Sensitivity (S) is defined as the change in export load per change in input load. If inputs change by Δ, the export will change by S*Δ (S=Δ Export/Δ Input). Δ is defined relative to the mean input.

In other words:

- When added to the land use average load we identify the load, by source (land use and input), which is available for export (edge of field or stream load).
- Sensitivities account for the spatial and temporal variation in the load available for export.
- A lower sensitivity value will result in a more muted loading response to changes in inputs.
    - If there is no sensitivity (0), then the load available for export is constant in space and time for that land use defined by the loading rate.



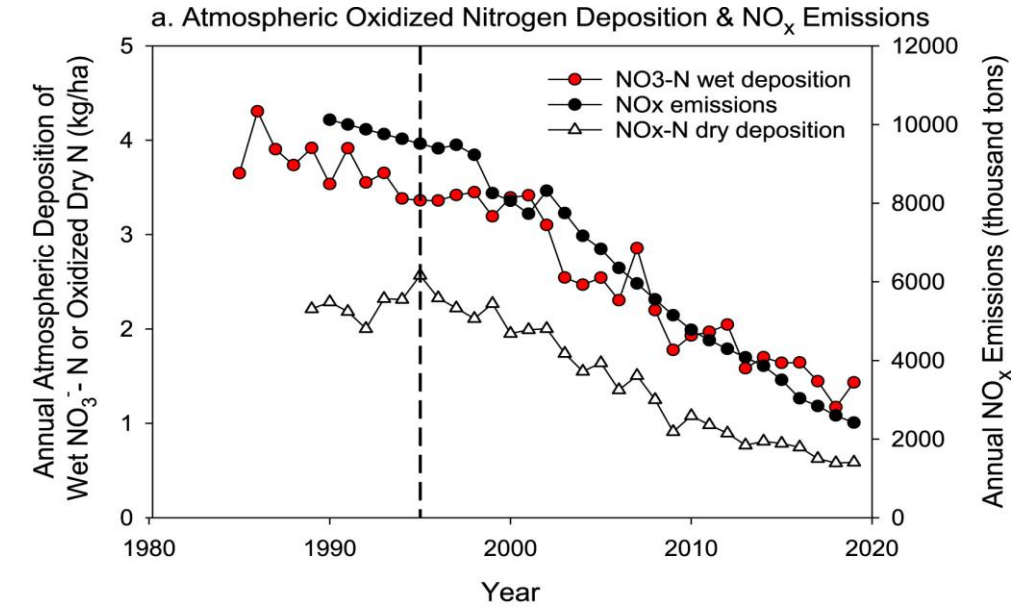
P6 N Atm. Dep. sensitivity values

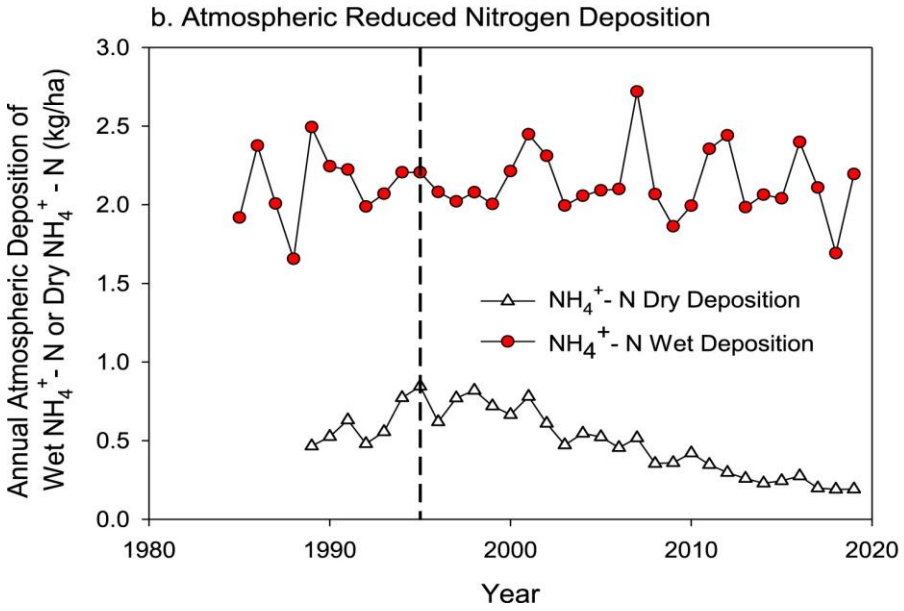
- True Forest: 0.023
- Harvested Forest: 0.161
- Construction: 0.2
- Ag. Open: 0.22
- Road: 0.6247

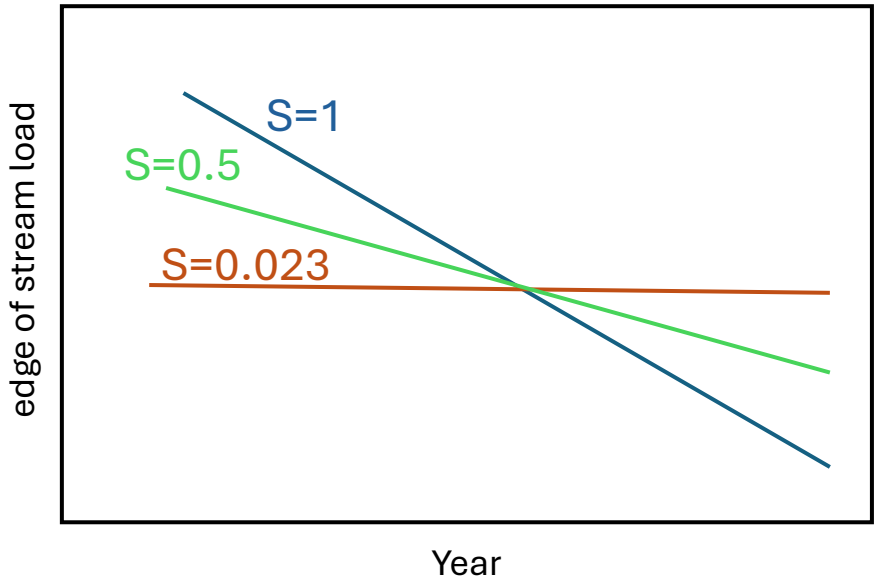
- Sensitivity values are set relative to their loading ratios in the absence of additional information.

Harvested For. Sens. / LR = True For. Sens.

0.16 / 7 = 0.023







Burns, D. A., Bhatt, G., Linker, L. C., Bash, J. O., Capel, P. D., & Shenk, G. W. (2021). Atmospheric nitrogen deposition in the Chesapeake Bay watershed: A history of change. *Atmospheric Environment*, *251*, 118277.

Literature review to revise P7 sensitivity values

- Rosh Nair-Gonzalez and Conor Keitzer - UMCES
- Focused on “true forest” catchments or watershed scale models where harvested forest is assumed to be a small percent.
- 43 papers were reviewed
- Data was compiled from 6 field studies and 5 watershed models
- Corrections were applied for various factors, and outlier removed, to align values with forest and atm. dep. representation in CAST

Results summarized

CI: 0.05 – 0.16

Average: 0.12

Mean loading rate: 3.32 lbs/ac/yr

For reference only, not proposing to use this to adjust loading rate!

- There are different ways to select sensitivity values given a range in literature values

The full list of papers as well as the subset used to inform sensitivities will be posted.

Reconcile literature with CAST

Proposal: Set the sensitivity relative to the loading rate in CAST vs literature

$$\frac{\text{P7 loading rate}}{\text{Lit. loading rate}} = \frac{\text{P7 sens.}}{\text{Lit. sens.}}$$

$$\frac{1.68 \text{ lbs/ac/yr}}{3.32 \text{ lbs/ac/yr}} = \frac{\text{P7 sens.} = 0.06}{0.12}$$

Preliminary: Subject to selection of value from the range and the final P7 loading rate

Given the range in potential loading rates for P7: 0.04 – 0.14

Questions

- Is this method reasonable?
- Is the range of sensitivity values reasonable given your experience and expertise?
- Should the sensitivity value of harvested forest (and/or true forest) be modified to maintain the 7x difference set in P6?
  - Or modified to increase harvested forest sensitivity relative to true forest by another factor
- Additional literature is welcome.

True forest P7 ~ 0.04- 0,15 (0.06 with P6 loading rate)

True forest P6 ~ 0.023

Harvested forest = 0.161

- no plans to conduct a harvest forest specific literature review

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END