

Selected Recommendations
in Support of
Integrated Nitrogen Management
Revisited

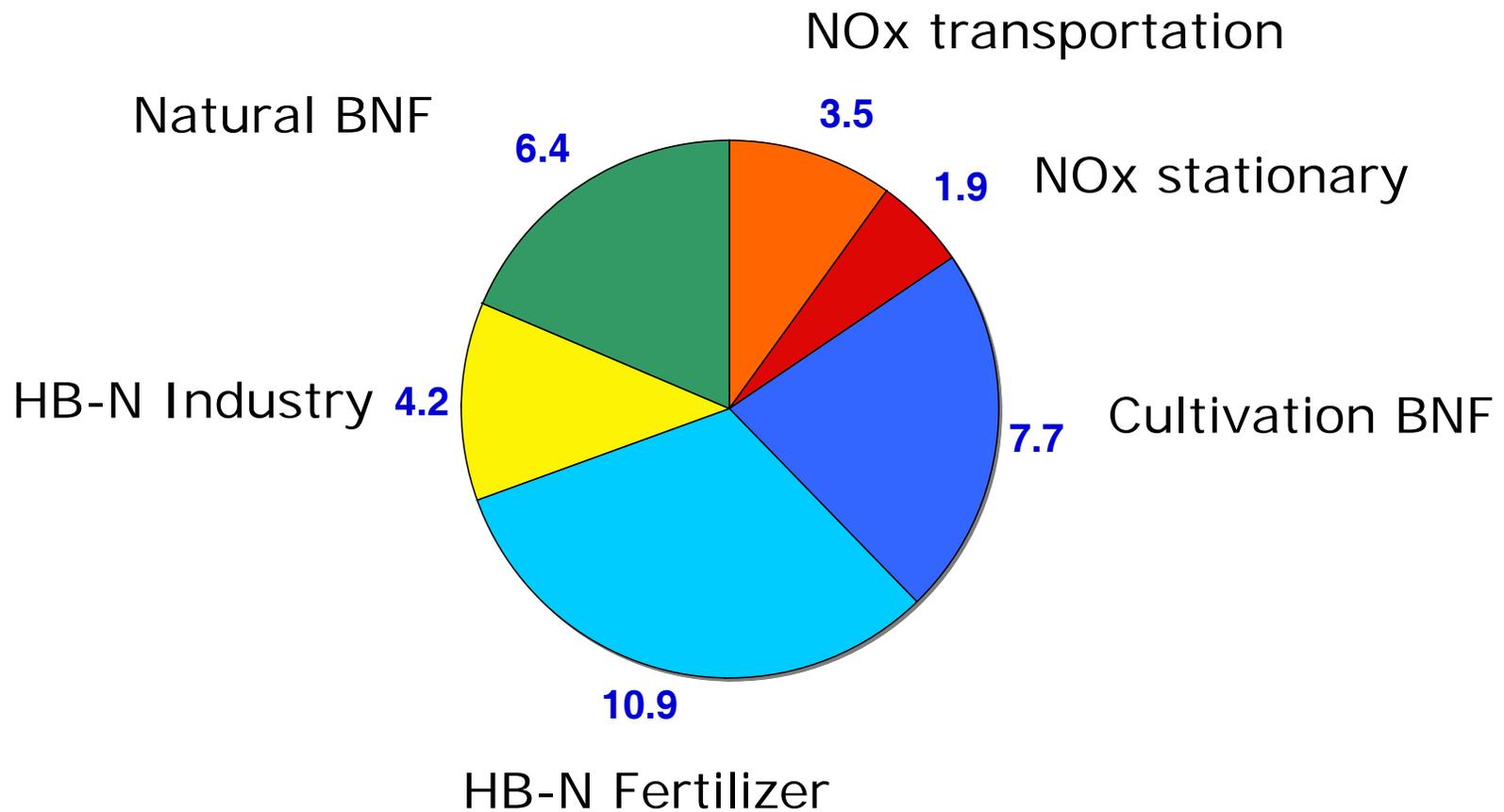
USEPA SAB INC
Workshop and Meeting
October 20 - 22, 2008

Overview of Talk

- **Reactive Nitrogen (Nr) entry into the US.**
- Nr Fate in the US.
- Consequences, Impacts and Metrics.
- Major Findings and Recommendations

Nr Introduction into the US

Tg N/yr

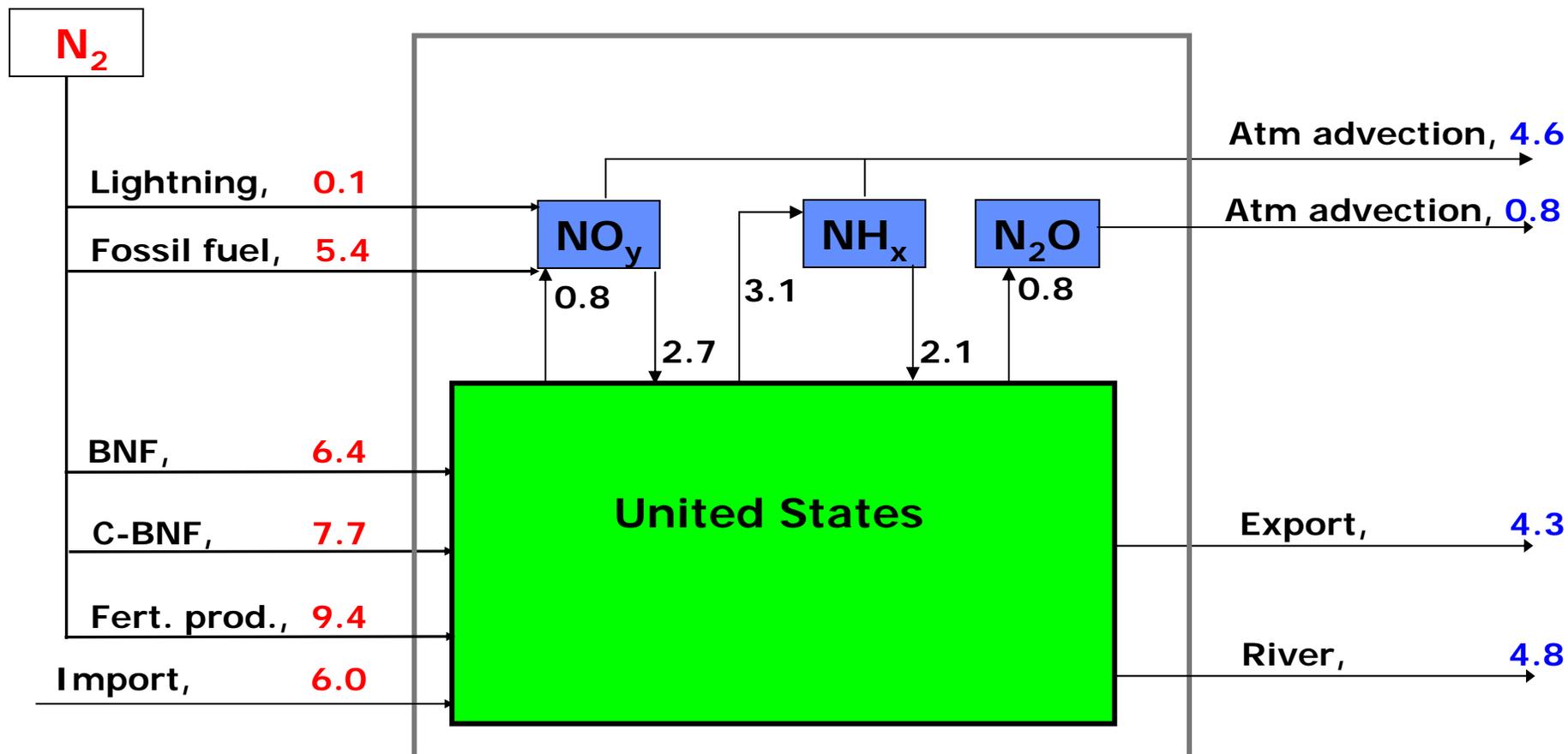


Natural, 6.5 Tg N/yr

Anthropogenic, 29 Tg Nr/yr

US Nitrogen Budget

Tg N yr⁻¹



Nr Inputs: **35 Tg N**

Nr Outputs: **14 Tg N**

Nr Missing: **21 Tg N**

Nr Storage: **5 Tg N**

~ 2 Tg soils&vegetation

~ 3 Tg groundwater

Nr Denitrified to N₂:

21 Tg N - 5 Tg N = **16 Tg N**

Fundamental Findings

- N_r is a critical element of the nation's health, welfare and a driver of climate change that needs to be addressed.
- EPA specifically, and the government in general, is poorly organized to address this problem. There needs to be coordination.
- Integration is needed across media and nitrogen species.
- Geospatial and temporal data, and models are needed.

Specific Recommendations

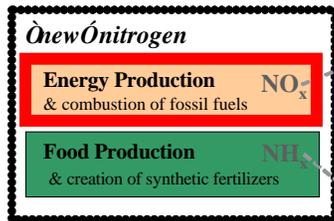
- Nr can be managed at specific control points:
 - Where it is formed
 - e.g., fossil fuel combustion
 - Where it is introduced into food production systems
 - e.g., nitrogen use efficiency
 - Where it is lost to the environment
 - e.g., sewage

Specific Recommendations

- Nr can be managed at specific control points:
 - Where it is formed
 - e.g., fossil fuel combustion
 - Where it is introduced into food production systems
 - e.g., nitrogen use efficiency
 - Where it is lost to the environment
 - e.g., sewage
- We have 5 specific recommendations
 - Totally 25% of the amount of Nr formed each year.
 - There are other ways to decrease Nr losses to environment.
 - They are needed

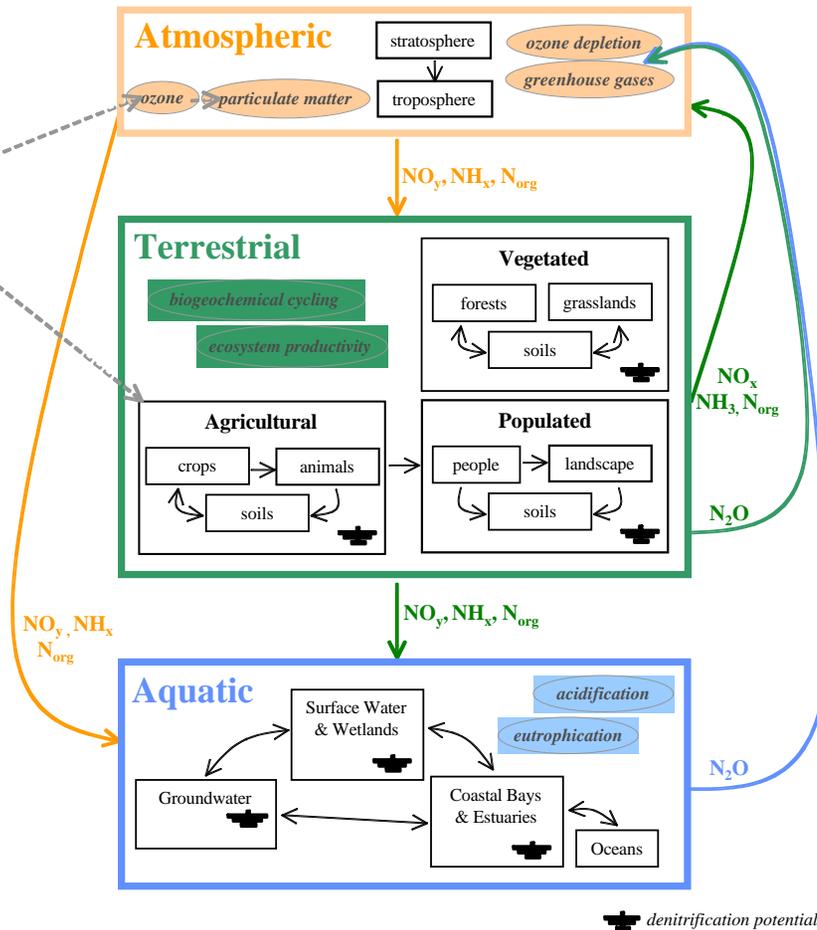
Control Point: Combustion

The Nitrogen Cascade



Current: 5.4 Tg N

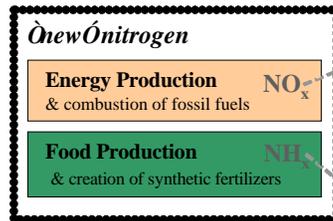
Proposed: 3.4 Tg N



- We recommend that the EPA expand its NO_x control efforts to include 90% decreases of emissions from heavy-duty on-road, all off-road mobile sources and currently uncontrolled electricity generation and industrial processes.
- Instituting this recommendation would decrease annual emissions by about **2 Tg N per year**.

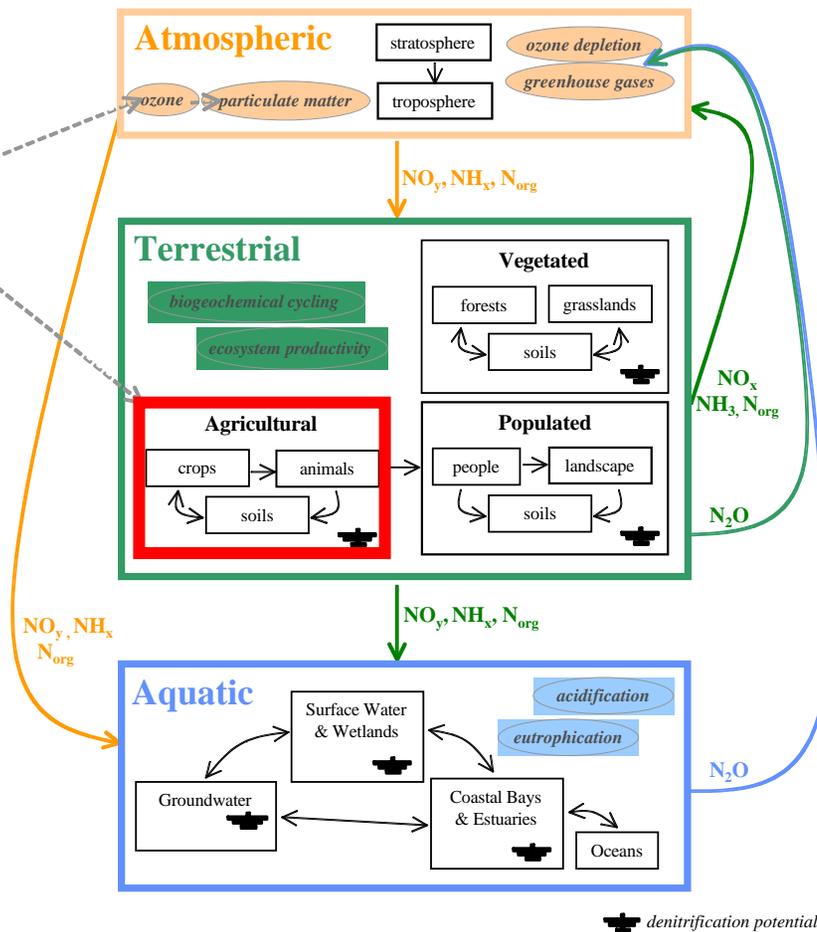
Control Point: NH₃ from Manure and Fertilizer

The Nitrogen Cascade



Current: 2.7 Tg N

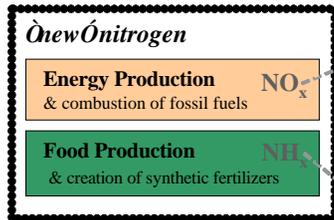
Proposed: 2.0 Tg N



- We recommend decreasing livestock-derived ammonia emissions to approximately 80% of 1990 emissions, a decrease of **0.5 Tg N per year**.
- We recommend decreasing ammonia emissions derived from fertilizer applications by 20%, a decrease by **~0.2 Tg N per year**.

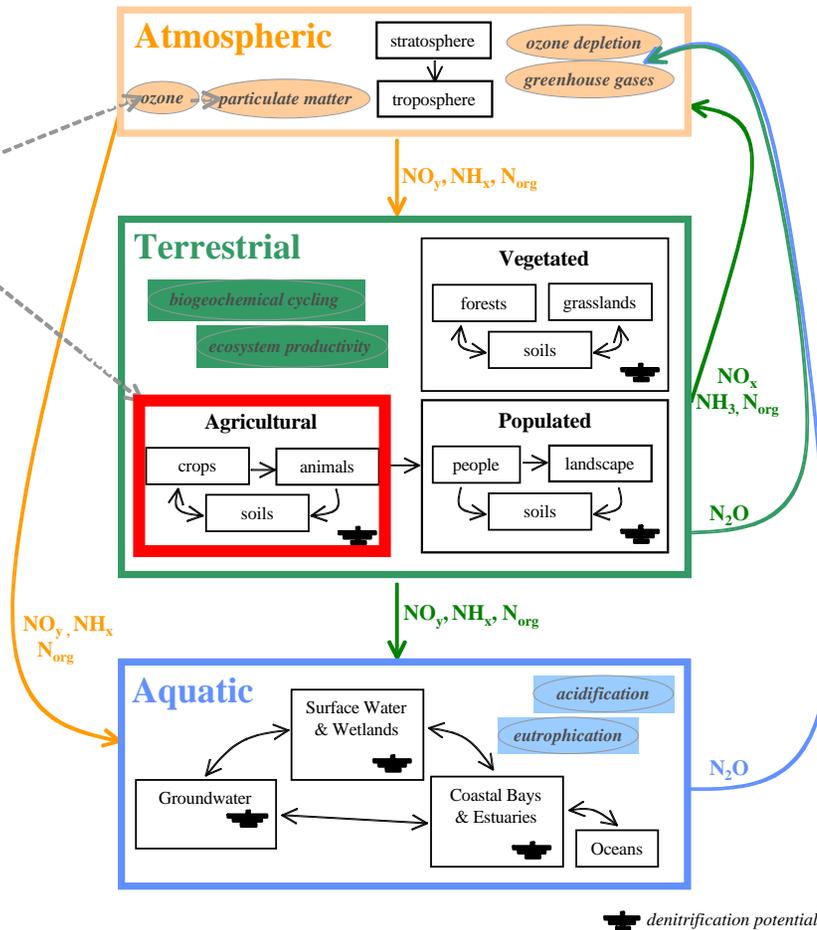
Control Point: Nr losses from Croplands

The Nitrogen Cascade



Current: 4.8 Tg N

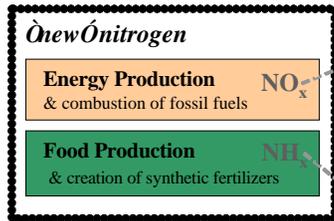
Proposed: 3.8 Tg N



- We recommend decreasing flows of Nr into streams, rivers, and coastal systems by approximately 20% (~1 Tg N per year) through improved landscape management, including wetland management improved tile-drainage systems and riparian buffers on crop land, etc.

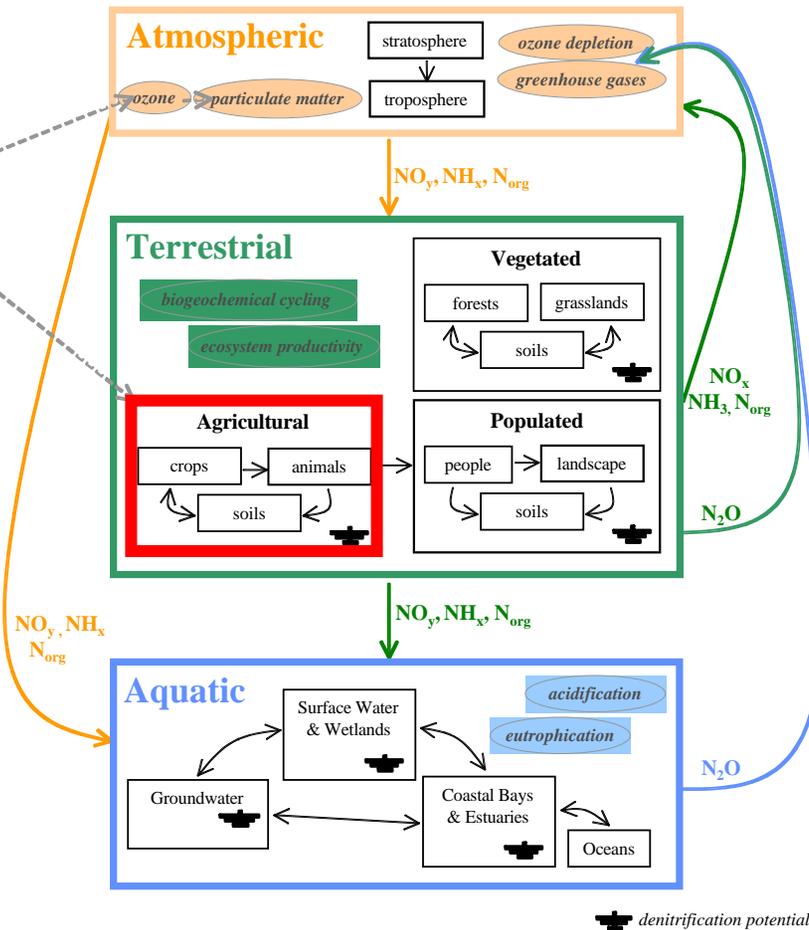
Control Point: Nitrogen Use Efficiency

The Nitrogen Cascade



Current: 18.6 Tg N

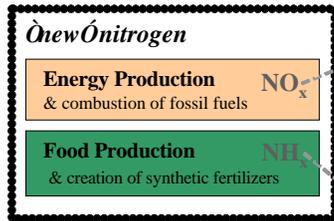
Proposed: 16.2 Tg N



- We recommend an increase in crop N-uptake efficiencies of 25% over current levels through a combination of knowledge-based practices and advances in fertilizer technology (such as controlled release).
- This would decrease the amount of Nr applications to crop lands by **2.4 Tg N/yr.**

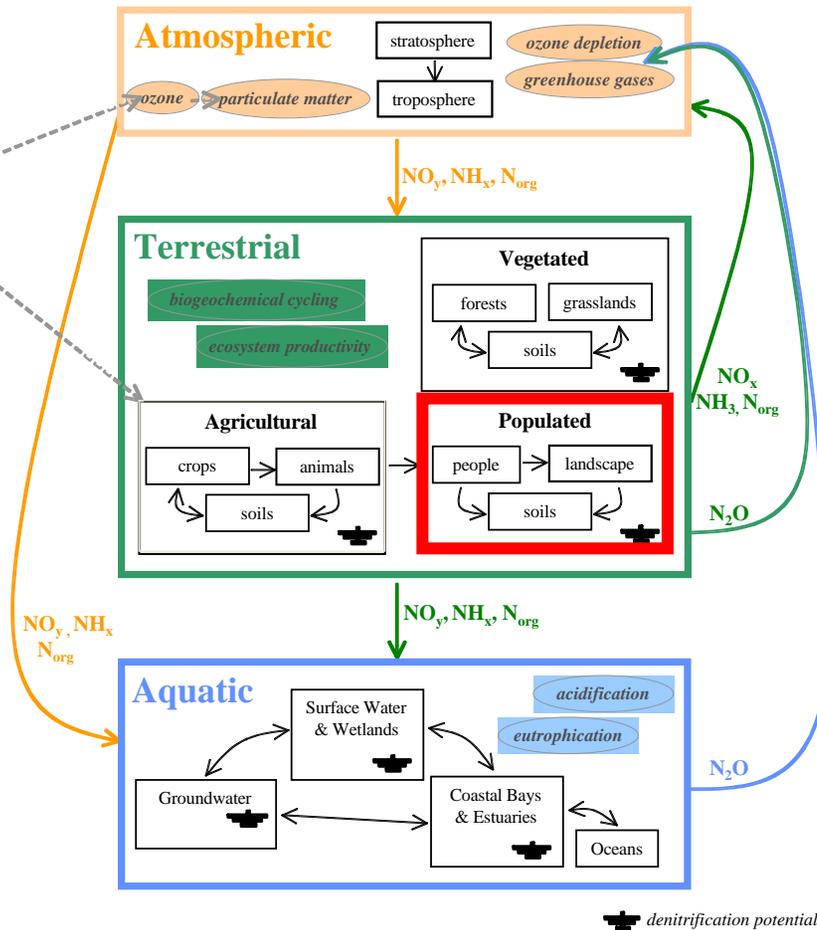
Control Point: Sewage Treatment

The Nitrogen Cascade



Current: 1.9 Tg N

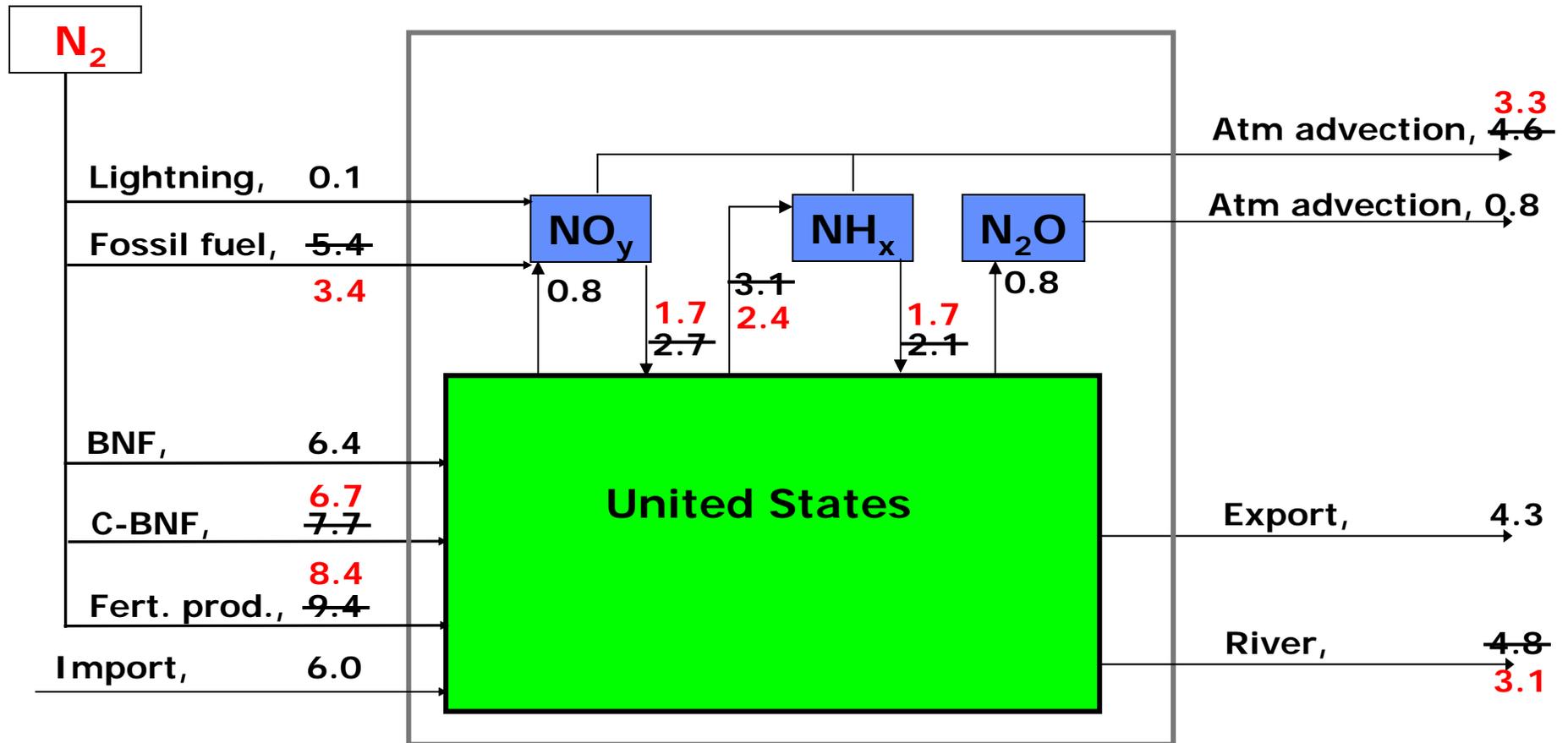
Proposed: 1.2 Tg N



- We recommends that a high priority be assigned to nutrient management through a targeted construction grants program under the CWA
- Improved sewage treatment practices would decrease Nr losses by **0.5 to 0.8 Tg N/yr.**

US Nitrogen Budget: Revised

Tg N yr⁻¹



Nr Inputs: ~~35~~ **29** Tg N
 Nr Outputs: ~~14~~ **11** Tg N

The numbers on this slide have been modified, assuming the actions at control points were effective.

Integrated Nitrogen Committee

History & Future

- April 2003: SAB's Environmental Engineering Committee proposed the study
- June 2004: SAB approved the proposal
- January 2007: First INC meeting
- September 2008: White Paper posted
- October 2008: Workshop
- November 2008: Draft#1 posted for comment
- February 2009: Draft#2 posted for comment
- March 2009: Draft#3 posted for comment
- September 2009: Final Report