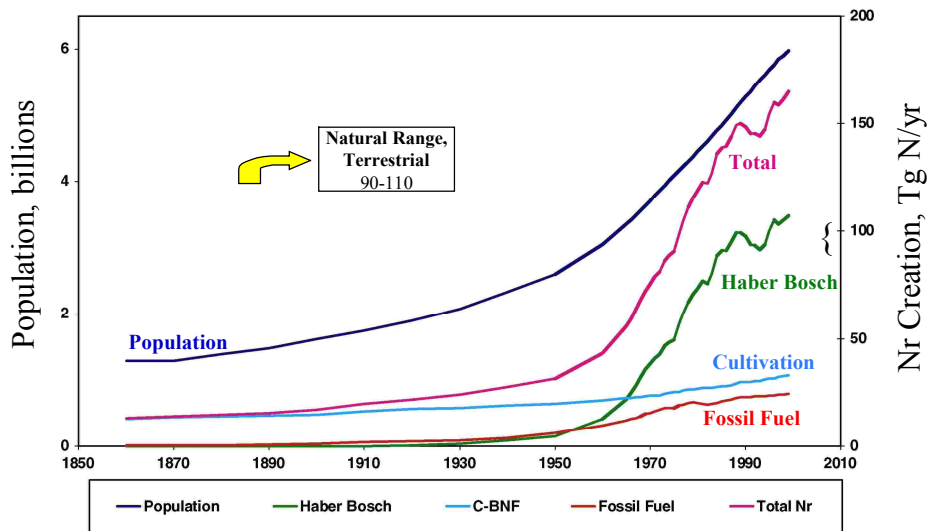


Setting the Scene-- The International Nitrogen Initiative

Arvin Mosier and James Galloway

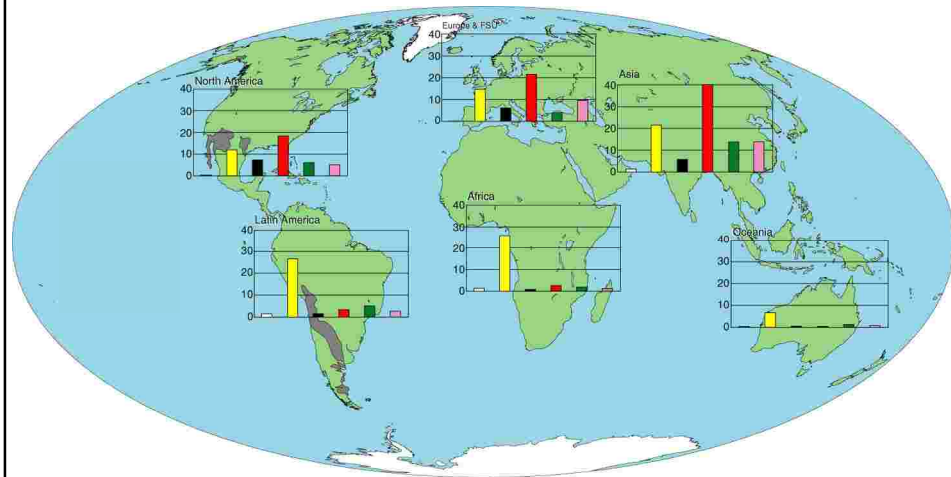


Global Nr Creation & Population 1860 to 2000



Nr Creation by Region

Tg N yr⁻¹

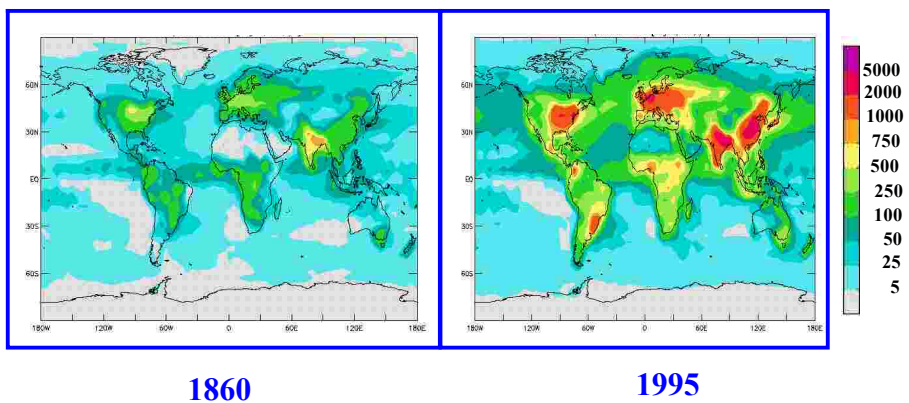


Galloway et al., 2004

□ Lighting ■ BNF ■ Fossil Fuel ■ Fertilizer Prod. ■ C-BNF ■ Imports

Atmospheric Deposition: Past and Present

mg N m⁻² yr⁻¹

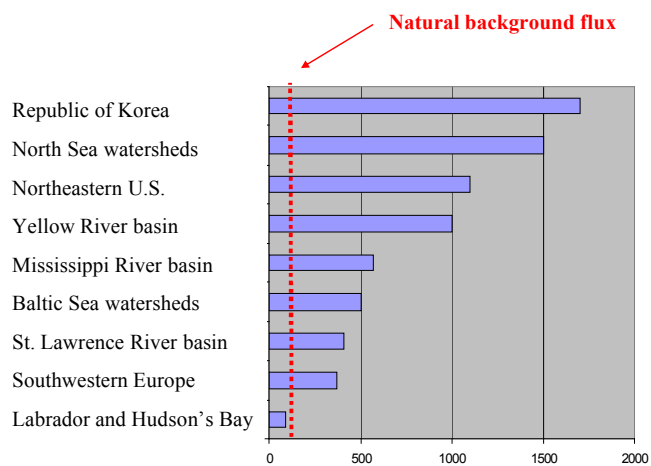
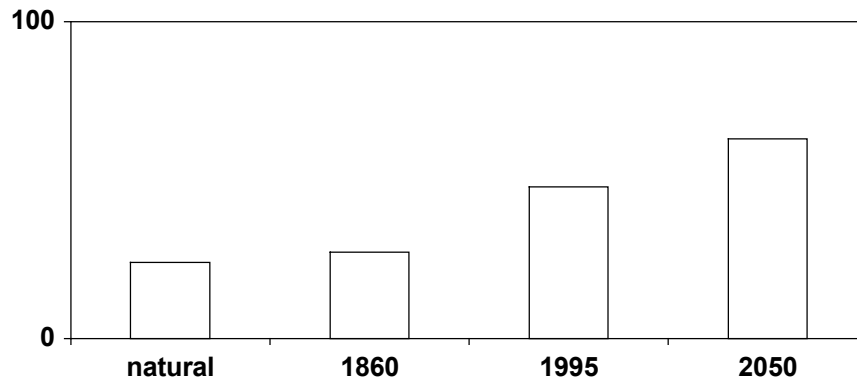


1860

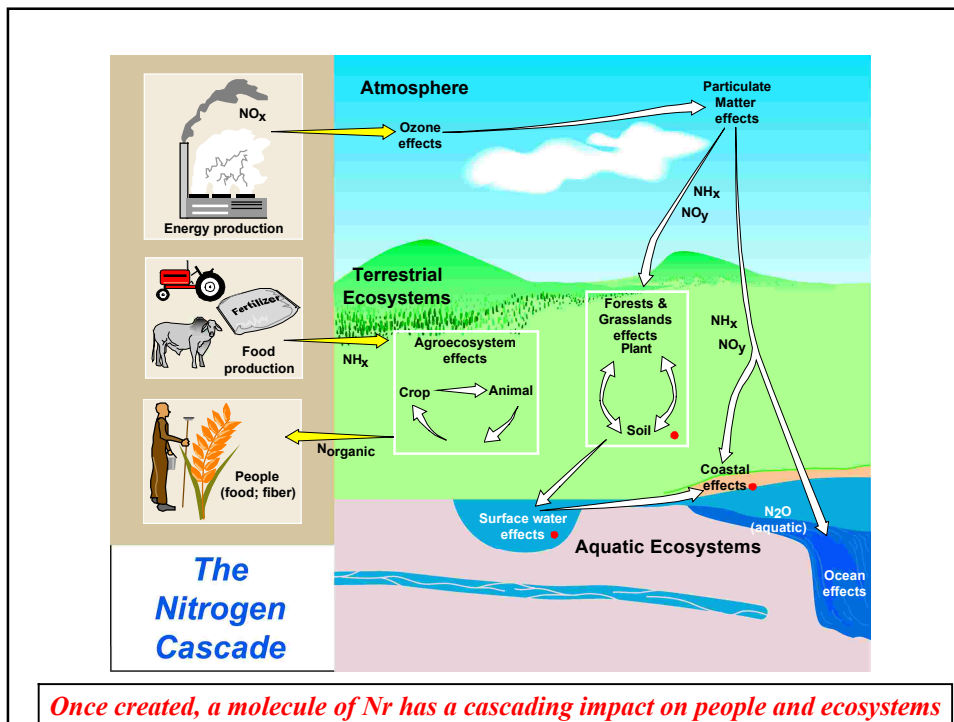
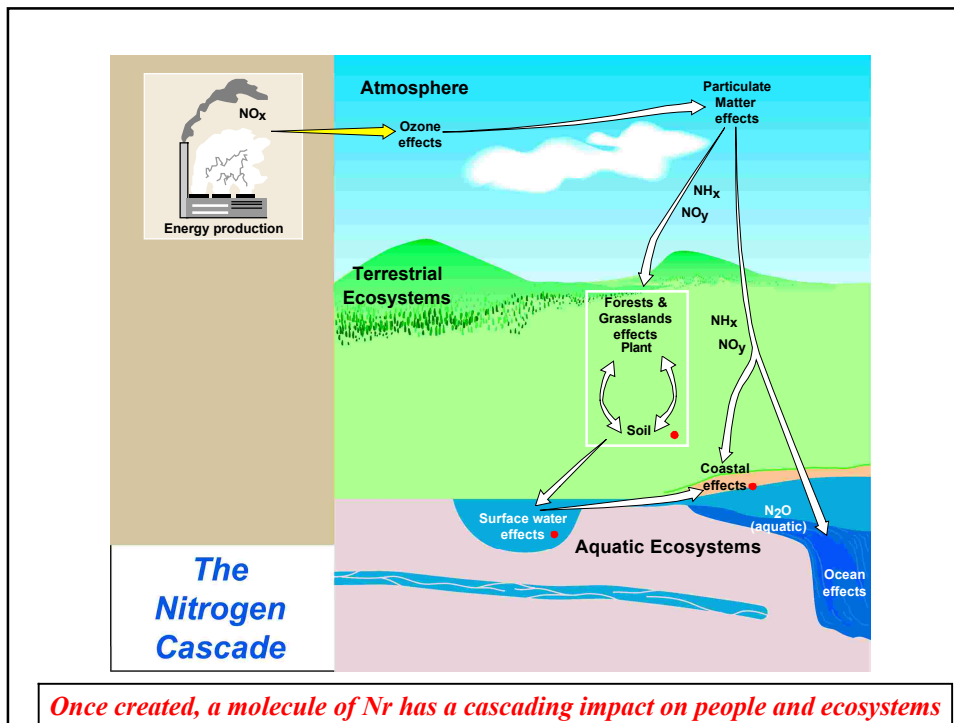
1995

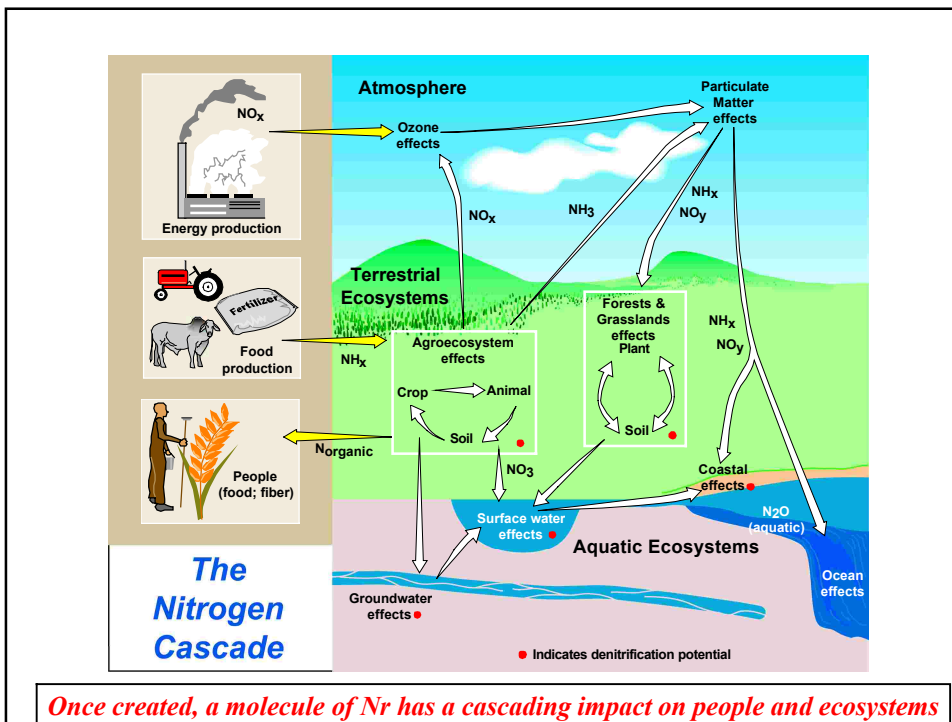
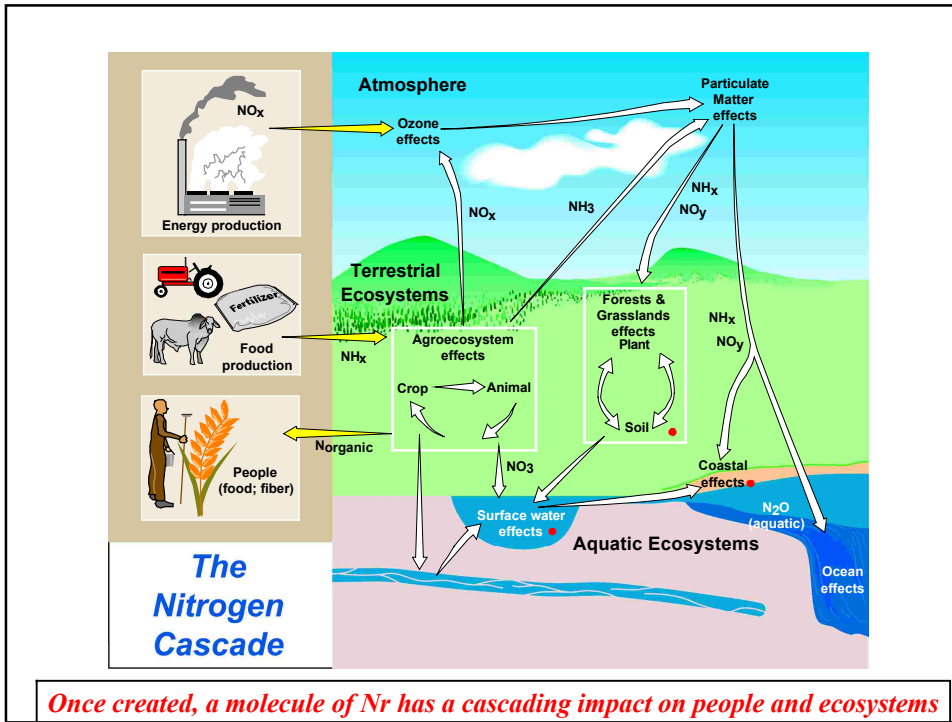
Galloway et al., 2004

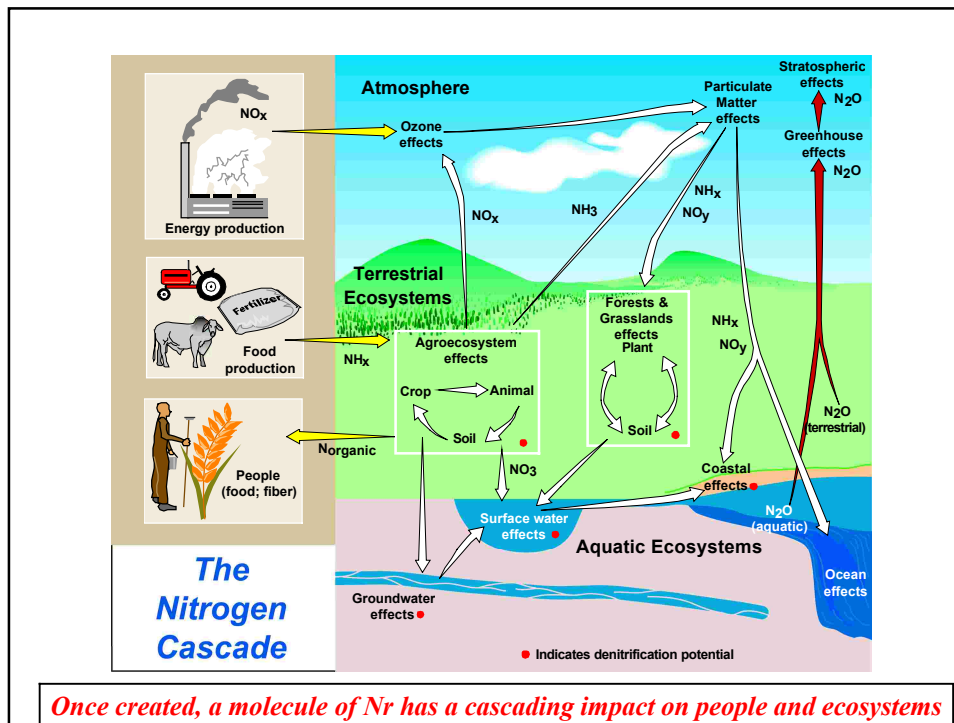
Loss of Reactive N via Rivers to World's Coastal Systems (Tg N/yr)



Flux of nitrogen from the landscape to coastal oceans in rivers for contrasting regions of the world in the temperate zone (kg per km² of watershed area per year; from Howarth et al. 1996, 2002; Bashkin et al. 2002).







Mid-Course Summary

Summary

- Energy production converts N_2 to NO_x and releases it to the atmosphere
- Food production converts N_2 to NH_x and releases it to the terrestrial ecosystem
- Humans dominate Nr creation on land.
- Nr is accumulating in the environment

Next Questions

- INI

Why Nitrogen?

- ◆ It is essential for life *but*
 - ◆ in some regions there is not enough;
 - ◆ in other regions there is too much.
- ◆ Excess N contributes to most environmental issues.
- ◆ The challenge is to optimize its availability while minimizing its negative effects.



To meet the challenge we need a more complete scientific assessment and a closer interaction with all stakeholders.

The International Nitrogen Initiative



Optimize nitrogen's beneficial role in sustainable food production and minimize nitrogen's negative effects on human health and the environment resulting from food and energy production

Sponsored by: -Scientific Committee on Problems of the Environment
-International Geosphere-Biosphere Programme
-Ministry of the Environment, The Netherlands

<http://www.initrogen.org/>

International Nitrogen Initiative Approach

- ◆ **Using** a three-phased approach to work towards the overall goal of the INI
 - ◆ Phase I: Assessment of knowledge on N flows and problems
 - ◆ Phase II: Development of region-specific solutions.
 - ◆ Phase III: Implementation of scientific, engineering and policy tools to solve problems.
- ◆ **Established** regional centers for North America, Latin America, Asia, Oceania, Europe and Africa
- ◆ **Identified** cross cutting themes to be addressed by all regions.



International Nitrogen Initiative

Scientific Advisory Committee and Consultants*

Mateete Bekunda, Uganda	Bill Moomaw, USA	Ellis Cowling, USA
Gilles Billen, France	Kiliparti Ramakrishna, USA	Eric Davidson, USA
Zucong Cai, China	Henning Rodhe, Sweden	Paul Fixen, USA
Jan Willem Erisman, Netherlands	Mary Scholes, South Africa	Luc Maene, France
Jim Galloway, USA	Sybil Seitzinger, USA	Rabindra Roy, Italy
Bob Howarth, USA	Janet Sprent, UK	
Luiz Martinelli, Brazil	Keith Syers, Thailand	
Katsu Minami, Japan		

Steering Committee**

<u>Chair</u>	<u>Asian Nitrogen Center</u>
James N. Galloway	Cai Zucong, Director
<u>IGBP Representative</u>	<u>European Nitrogen Center</u>
Sybil Seitzinger	Jan Willem Erisman, Coordinator
<u>SCOPE Representative</u>	<u>Latin American Nitrogen Center</u>
John Freney	Luiz Martinelli, Coordinator
<u>Assessments Coordinator</u>	<u>North American Nitrogen Center</u>
Mary Scholes	Robert Howarth, Director
<u>African Nitrogen Center</u>	
Mateete Bekunda, Coordinator	

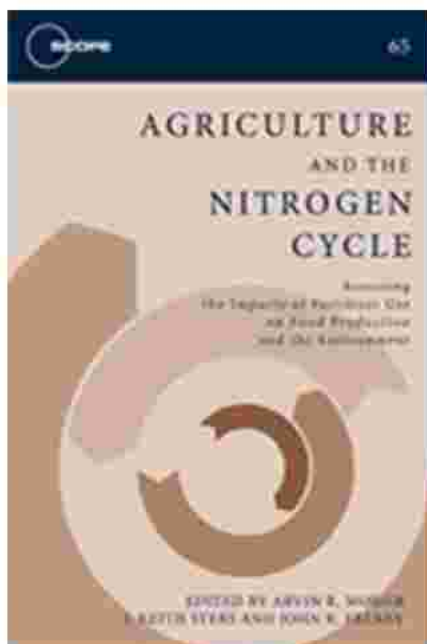
*The INI Science Advisory Committee, with associated Consultants was appointed in early 2003

**Appointed by SCOPE and IGBP in late 2003



INI Activities--To Date

- ◆ *Nitrogen Fertilizer Rapid Assessment Project (NFRAP) Workshop*
 - Kampala, Uganda; January 16-20
 - Mosier et al. 2004. *Agriculture and the Nitrogen Cycle: Assessing the Impacts of Fertilizer Use on Food Production and the Environment*. Island Press.
- ◆ *Denitrification Workshop*
 - Woods Hole, MA, USA; May 3-5
 - Papers submitted to Ecological Applications
- ◆ *Inter-American Nitrogen Network workshop*
 - University of Puerto Rico, Puerto Rico
 - Papers submitted to Biogeochemistry
- ◆ *3rd International N Conference*
 - Nanjing, China; October 12-16
 - Zhaoliang Zhu (China) and Katsu Minami (Japan), co-chairs
 - *Preliminary Assessment*
 - mmmmmmm
 - Nanjing Declaration
 - mmmmmmm
- ◆ *Industrial Animal Production Systems Workshops*
 - Stanford University, November, 2004, March 2005
 - Hal Mooney, chair



NFRAP Product

SCOPE Volume 65

September, 2004

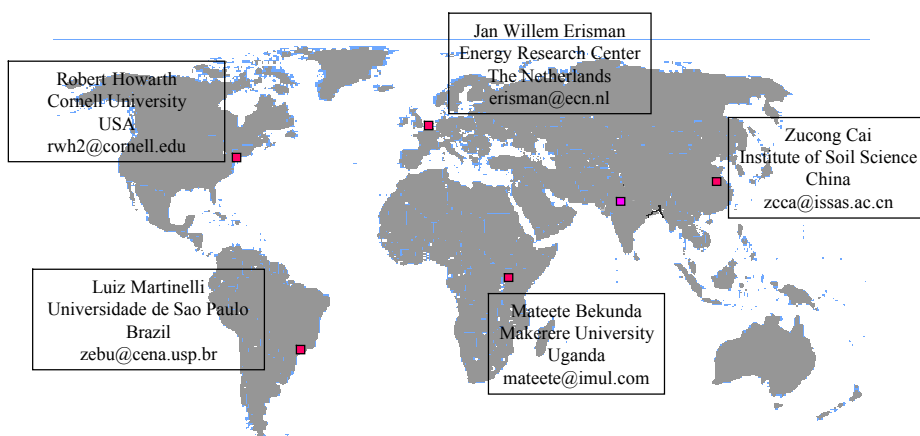
**Agriculture and the
Nitrogen Cycle
Assessing the Impacts
Of Fertilizer Use on
Food Production and
The Environment**

INI Activities--In Progress

- ◆ *Industrial Animal Production Systems Workshops*
 - Stanford University, August 2005
 - Hal Mooney, chair
- ◆ *Decision-makers Workshop*
 - late 2005
 - Kilaparti Ramakrishna, chair
- ◆ *N and Human Well Being workshop*
 - In development
- ◆ *N and Oceans workshop*
 - In development



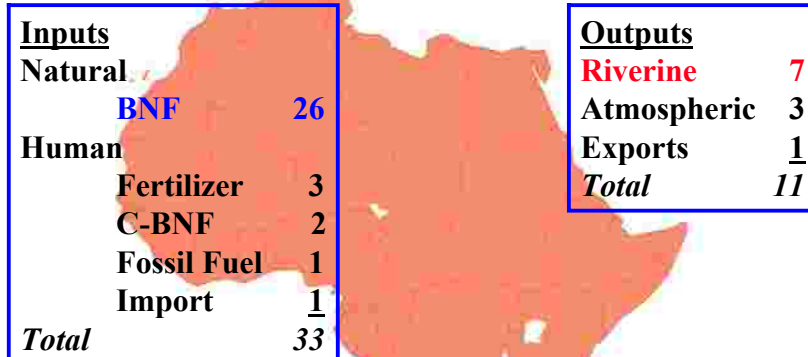
International Nitrogen Initiative Regional Centers and Directors/Coordinators



■ Developing a South Asian regional center in New Delhi



Africa: Inputs, Outputs and Issues



<u>Inputs</u>		<u>Outputs</u>	
Natural		Riverine	7
	BNF 26	Atmospheric	3
Human		Exports	<u>1</u>
	Fertilizer 3	Total	11
	C-BNF 2		
	Fossil Fuel 1		
	Import <u>1</u>		
Total	33		

Points and Issues

Largest source is natural BNF
 Largest sink is riverine
 Not enough N to feed people

Galloway et al., 2004

N. America: Inputs, Outputs and Issues



<u>Inputs</u>		<u>Outputs</u>	
Natural		Riverine	7
	BNF 12	Atmospheric	4
Human		Exports	8
	Fertilizer 18	Total	19
	C-BNF 6		
	Fossil Fuel 7		
	Import <u>5</u>		
Total	49		

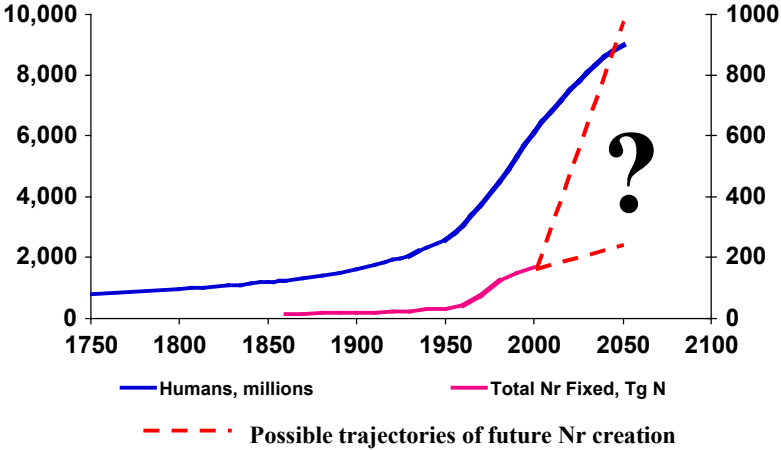
Points and Issues

Largest source is fertilizer production
 Largest sink is Nr export
 N policies driven by impacts on atmosphere, surface waters
 And coastal ecosystems

Galloway et al., 2004

The Future of Nitrogen

--N_r Creation, Total--



after Galloway and Cowling, 2002