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Annapolis, MD, 27-28 October 2004

Latest Developments Regarding Fertilizers and the Nitrogen Cycle: Implications for the Fertilizer Industry

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International Fertilizer Industry Association

ifa

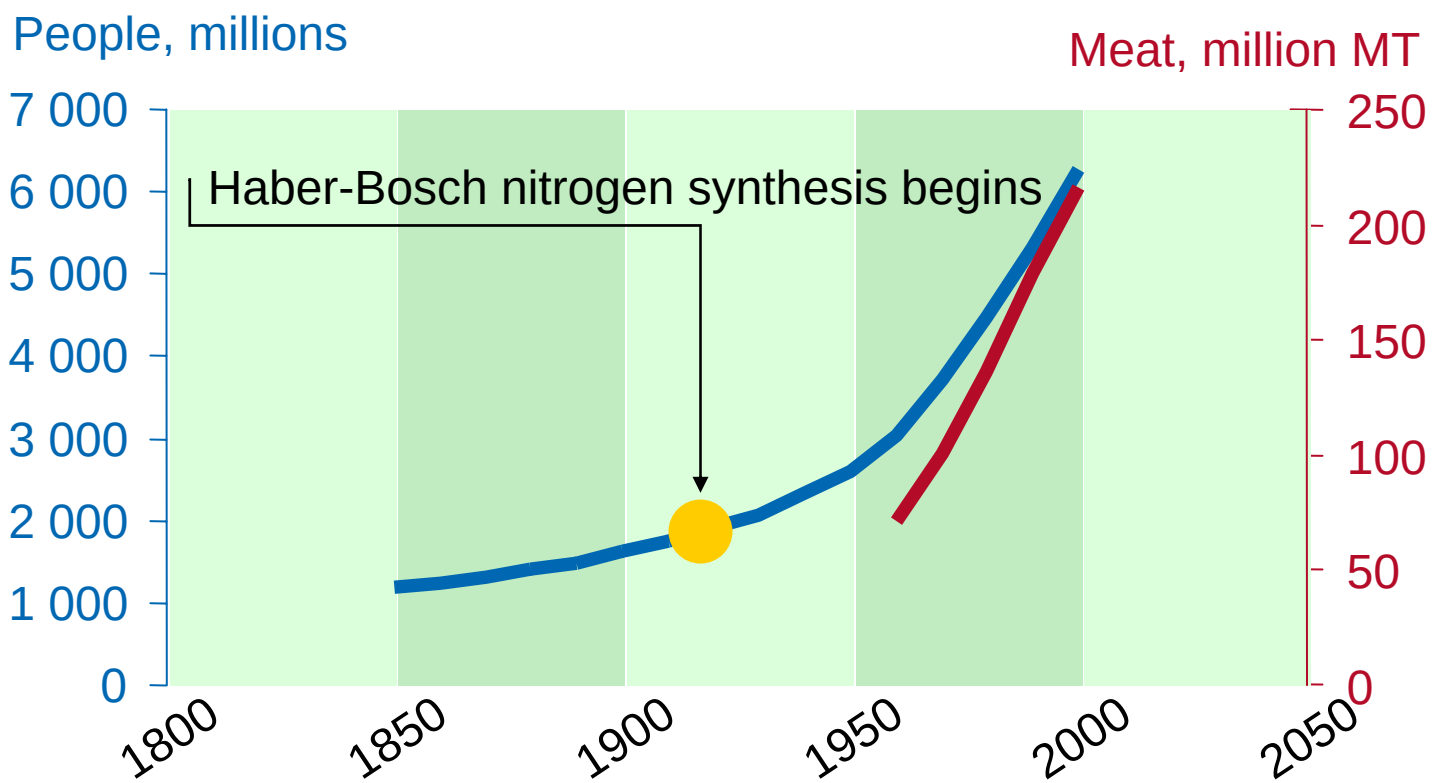
international Fertilizer Industry Association

Objective of INI

Balance the two faces of nitrogen

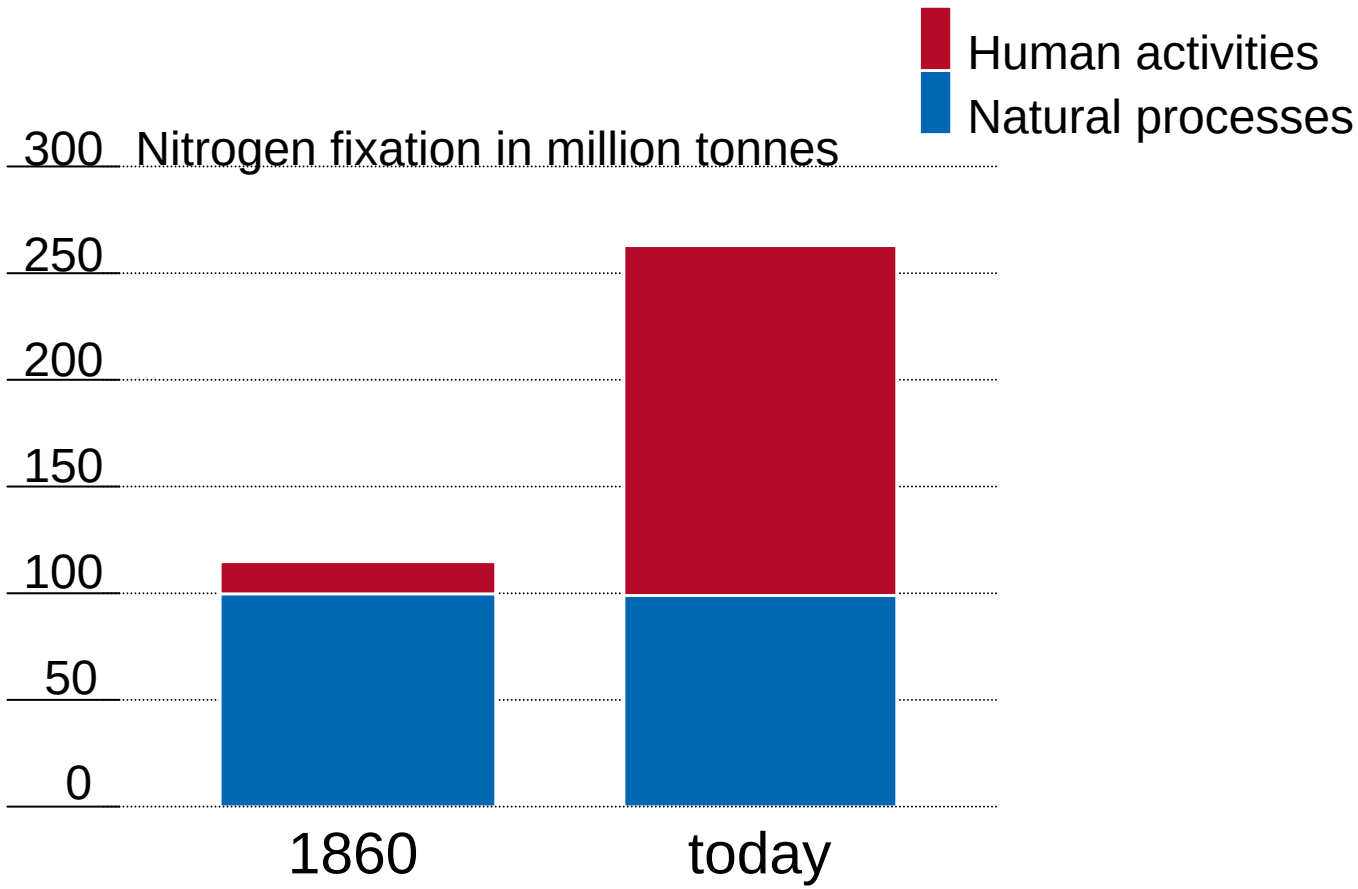
+	−
Food production	**Environment**
Energy	**Human health impacts**

People and animals



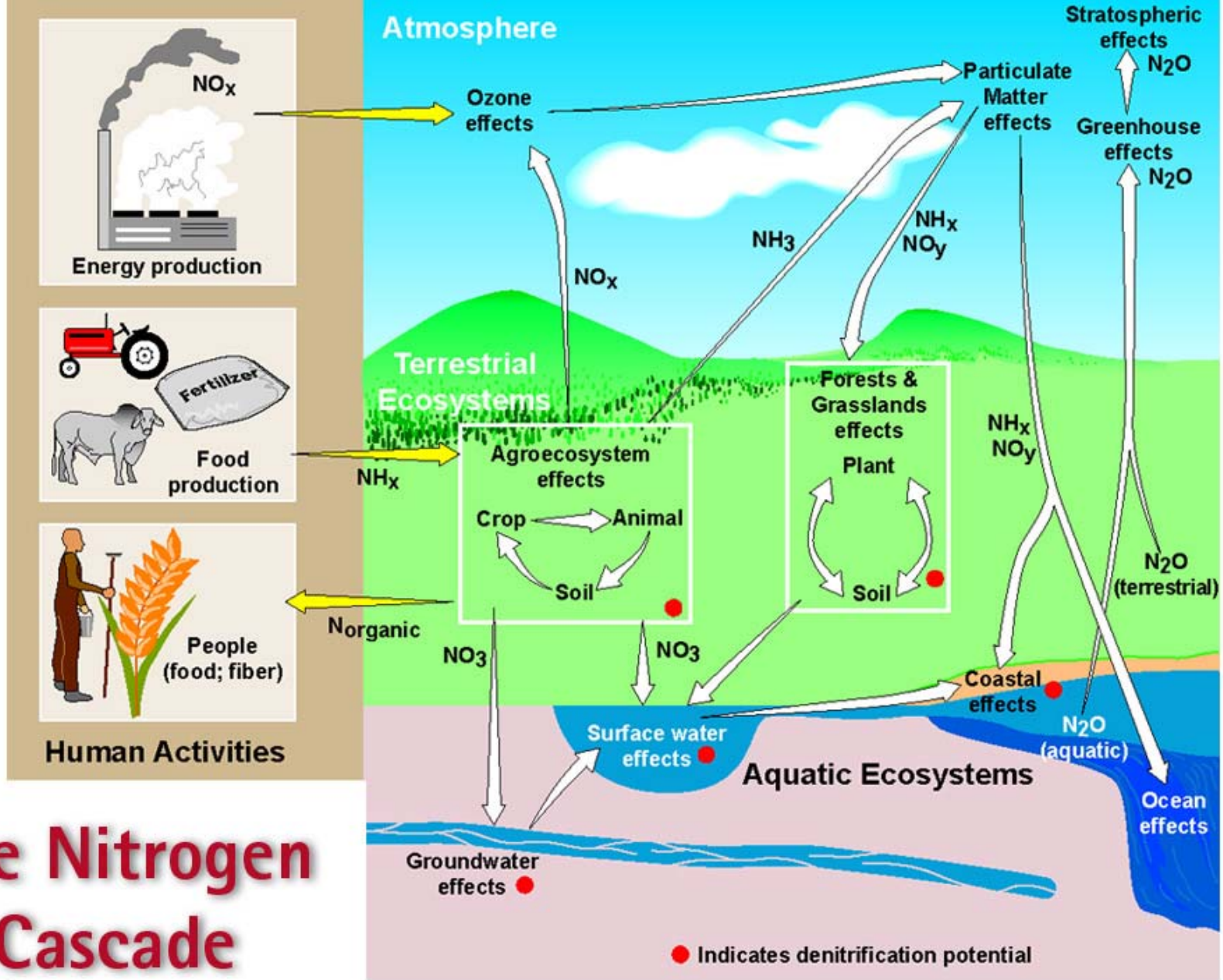
Source: Davidson

Human fixation outstrips natural processes



Source: INI

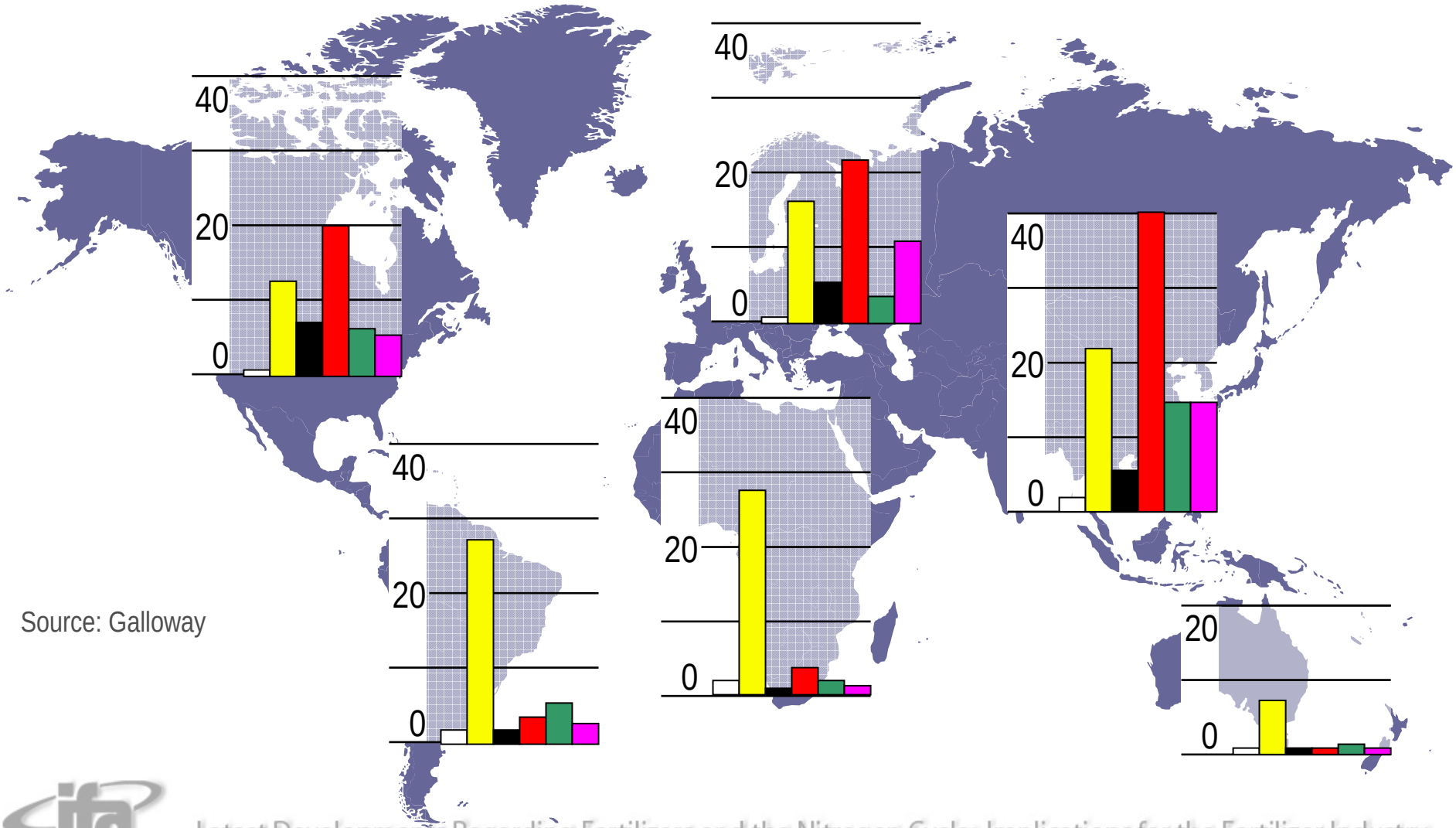
The Nitrogen Cascade



Source: Galloway et al.

Nr Creation by Region

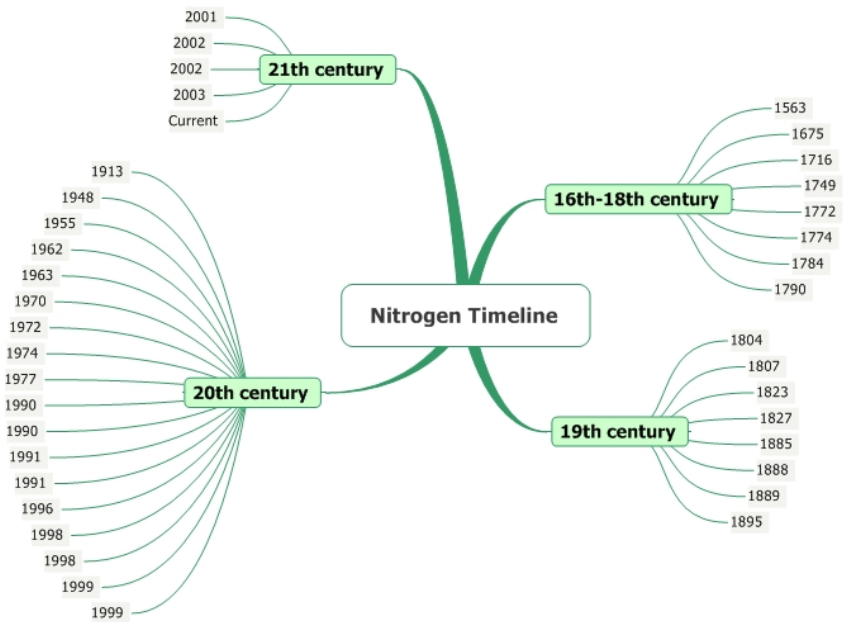
Tg N yr^{-1}



Source: Galloway

The Nitrogen Timeline

www.iniforum.com/fileadmin/timeline



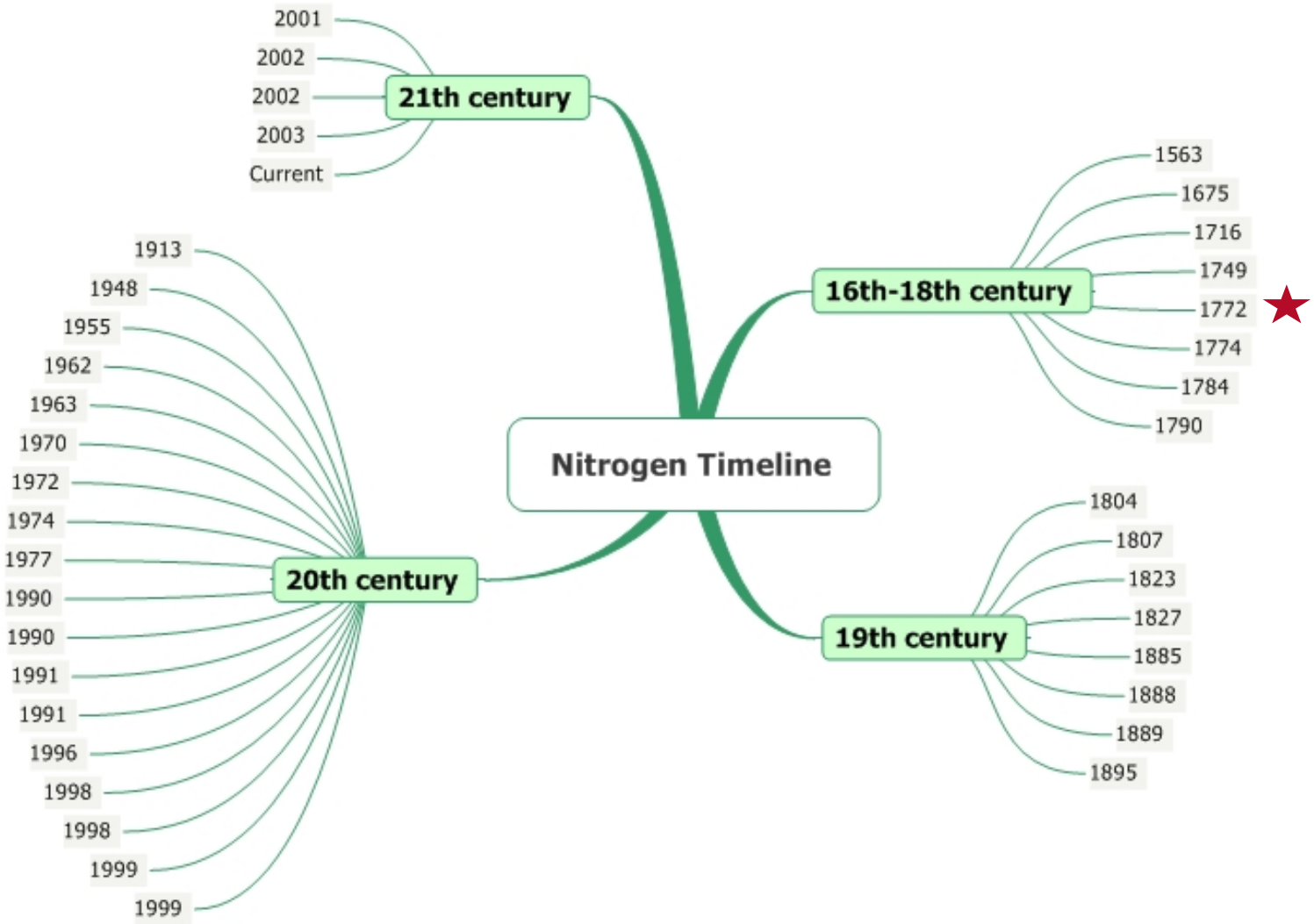
The Nitrogen Timeline provides a brief overview of the history of nitrogen and the policies that have resulted due to the impacts of nitrogen pollution.

General information about nitrogen and the discovery of the major nitrogen processes along with anthropogenic alterations and impacts to the nitrogen cycle are included.

Please send your suggestions for improvements and your additions, preferably with references and/or pictures to Jan Willem Erisman:

ntimeline@iniforum.org

The Nitrogen Timeline



The Nitrogen Timeline

1772

Daniel Rutherford discovers nitrogen and publishes his findings in *Azote: Air Without Life*.

The Three INI Phases

Phase I
Assessment of Knowledge

What are the controls on N fluxes in the environment?

How have N fluxes changed due to human action?

What are the consequences?

What are the gaps in knowledge?

How do the answers to these questions vary by region?

Phase II
Identification of Solutions

What research is needed to fill identified gaps?

Which solutions can be used to solve identified problems?

Which tools are required?

Which areas of expertise are required?

How do the answers to these questions vary by region?

Phase III
Implementation of Solutions

Which solution is best for a specific problem?

What are the barriers to solution implementation?

Are there economic issues?

How long will the solutions be effective?

How do the answers to these questions vary by region?

Source: Galloway

International Nitrogen Initiative
Cross-Cutting Themes

- Biological N fixation
- Fertilizer*
- Energy production/use
- Nr distribution
- Animal production*
- Human waste
- Denitrification*
- Nr management
- Nitrogen policies*
- Oceans
- Human wellbeing

* Indicates that a workshop has occurred or is planned

INI Planned Activities

➔ **Industrial Animal Production Systems Workshops**
Stanford University, November and March
Hal Mooney, chair

➔ **Decision-makers Workshop**
September 2005
Kilaparti Ramakrishna, chair

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 to be submitted to Ecological Applications

- **Inter-American Nitrogen Network Workshop**

  University of Puerto Rico, Puerto Rico

  Papers to be submitted to Biogeochemistry

- **3rd International N Conference**

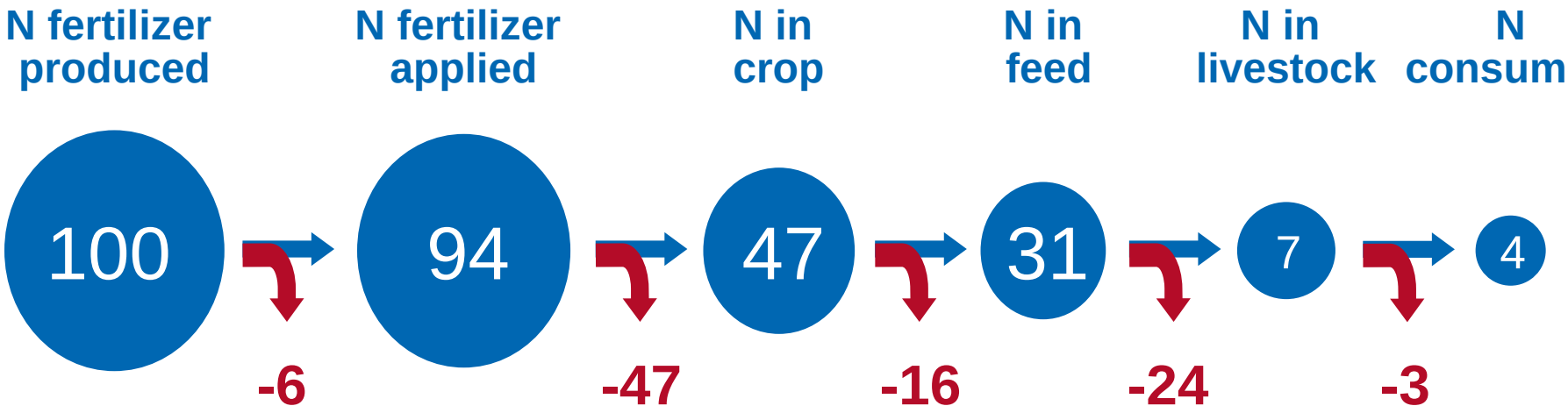
  Nanjing, China; October 12-16

  Zhaoliang Zhu (China) and Katsuyake Minami (Japan), co-chairs

- **Preliminary Assessment**

  Draft presented at 3rd International Nitrogen Conference

The fate of Haber-Bosch Nitrogen



4% of the N

produced in the Haber-Bosch process and used for animal production enters the human mouth

Source: Galloway and Cowling

N fertilizer RAP priorities

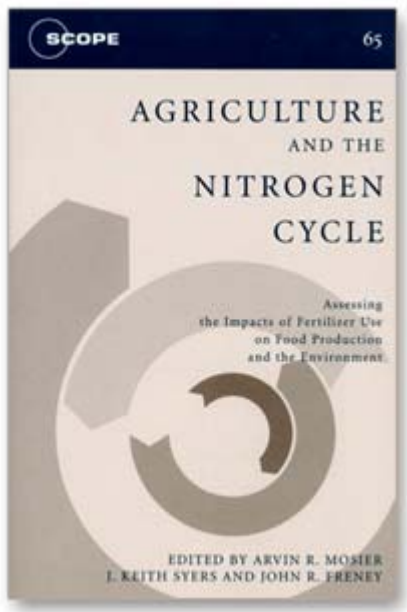
1. The fate of N fertilizer added to different farming systems in diverse environments

2. Reactive N in agricultural systems in context with other sources of N to water and the atmosphere

3. Technological and management strategies for enhanced N fertilizer use efficiency

NFRAP outcomes

- Pathways, related impacts and appropriate responses
- Regionally adapted societal responses
- Enhanced efficiency fertilizers and better management
  → NFUE



NFRAP recommends

➔ Support fertilizer use where soil degradation exists

- Industry to advocate framework
- Mini-packs

➔ Increase NFUE where loss is excessive

- Education on enhanced efficiency products, IPNM, balanced fertilization and SSNM
- BAPs and supporting tools
- Reduce price differential for enhanced efficiency fertilizers

3rd International N Conference

Nanjing Declaration

▪▪▪

Preliminary Assessment circulated

▪▪▪

Better knowledge of interaction between environmental and economic considerations

▪▪▪

Nanjing Declaration

- Further assessment of the N cycle
- More effective and efficient agriculture
- Increased information and technology exchanges
- Ensure adequate nitrogen supplies locally
- Develop best management practices
- Use emissions-reducing technologies

Preliminary Assessment

- "Changes in the Global Nitrogen Cycle as a Result of Anthropogenic Influences"
- Preliminary Assessment circulated
- IFA can provide copies
- Comments to ini@iniforum.org

Economic cascade

Simplified Cost Cascades for the Cheasapeake Bay *(Terrestrial flux estimates include all terrestrial additions)*				
		$/ton atmospheric emissions	**$/ton terrestrial emissions**	**$/ton freshwater emissions**
Atmosphere				
	Climate change	+		
	Ozone depletion	+		
	PM: Visibility	$290		
Terrestrial				
	Acid: Agriculture	$0		
	O_3: Agriculture	$1,100		
	Ecosystem services (agriculture)	+		
	Acid: Materials damage	+		
	PM: Household soiling	$40		
	PM: Human health	$7,800		
	O_3: Human health	$4,300		
	Ecosystem services (urban/mixed)	+		
	Acid: Commercial forests	$0		
	O_3: Commercial forests	$660		
	Ecosystem services (forests)	+		
	Fertilization: Agriculture	**–**	**–**	
Freshwater				
	Acid: Recreation	+	+	+
	NO_3^-: Recreation	+	+	+
	Ecosystem services	+	+	+
Bay				
	NO_3^-: Commercial fisheries	+	+	+
	NO_3^-: Recreation	$500	$1,200	$7,300
	Ecosystem services	+	+	+

Source: Moomaw, 2004

Summing up

- Fertilizer-N supplies basic needs
- Regional variation exists and must be respected
- We have experience and technologies to manage N better
- The political, economic, and environmental interactions are complex
- Industry must be proactive and engaged, or risk the consequences