Pre-assessment of the African Nitrogen Cycle: A Summary

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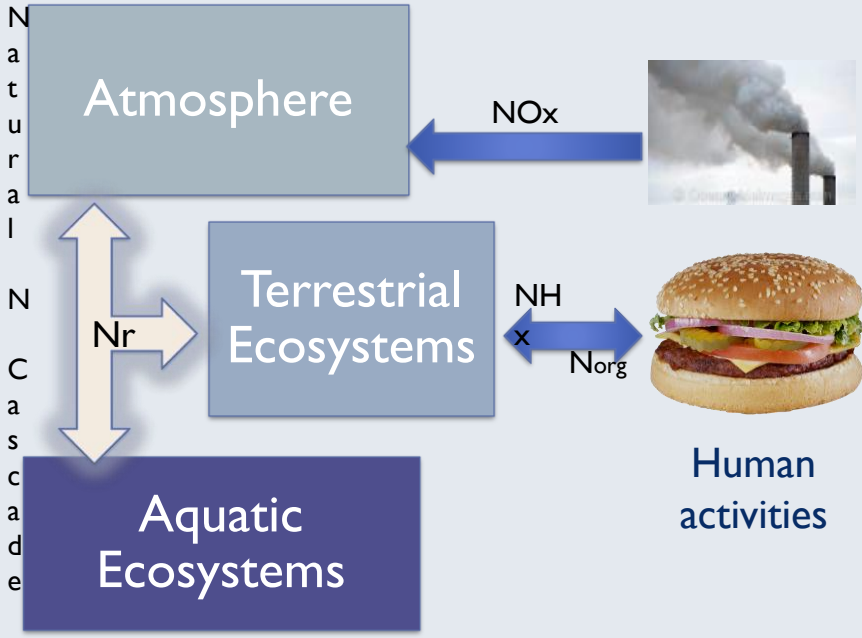
Presentation outline

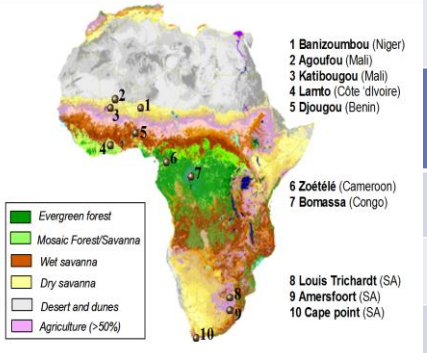
- Reason for the pre-assessment
- N in Africa's atmosphere
- N in Africa's aquatic systems
- Anthropogenic influence on N in terrestrial systems
- Present and future coping mechanisms
- An announcement

Note: Summary of a RAP workshop report in the process of publication



INI Phase 1: Assessment of knowledge

IDAF Study Stations



Atmospheric N balance (kg/ha/yr)

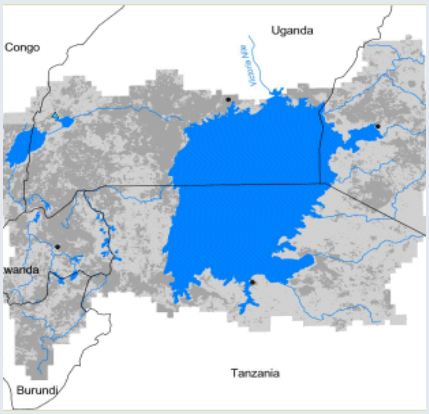
Ecological zone	Deposition	Emmission	Balance
Dry Savanna	7.8	9.2	-1.4
Wet Savanna	8.4	9.6	-1.2
Forest	11.4	8.5	+2.9

Atmospheric N deposition & emission in Africa.

Source of data: surface measurements, satellite, modeling

Processes: dry & wet deposition, biogenic emissions, biomass burning, volatilization, domestic fires

N flows and storage in inland water systems (L. Victoria)

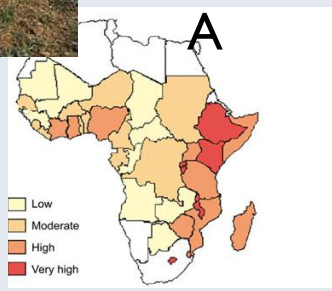


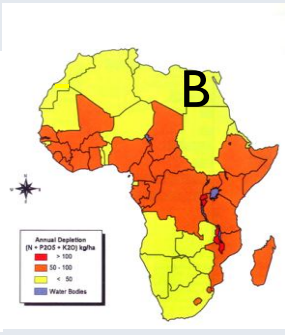
Basin area: 283,168 sq. km
Cropped land: 40 % (2006)

Inland lake N flows & balance (kg/ha/yr)

N source	In flow	Out flow	Load
Domestic waste	0.5		
Industrial Source	0.1		
Rivers/swamps	7.2		
Cropped land	3.3		
Uncultivated land	4.3		
Wet Deposition	9.1		
Dry Deposition	5.7		
N - BNF	?		
River Nile		5.8	
Fishery		0.6	
Denitrification		0.4	
Balance			23.4

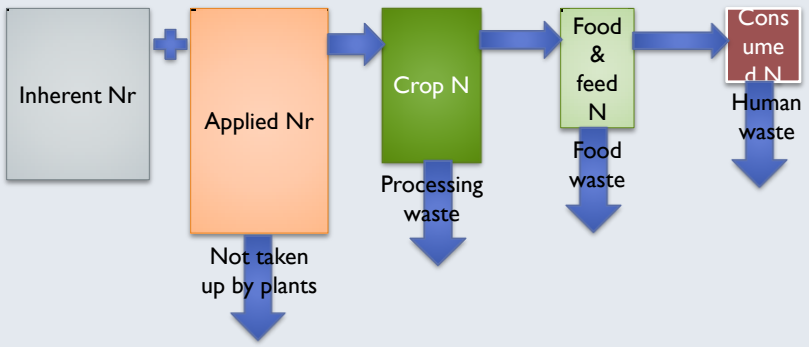
Studies of nutrient flows in African terrestrial ecosystems show massive and continuing depletion





State of nutrient depletion (Stoorvogel and Smaling, 1990 - A), and Annual Soil nutrient depletion (Henao and Banante, 1999 - B)

Anthropogenic influence (model)



Pre-assessment to Identify challenges, solutions…

Attaching numerical values (IN)

- Data not readily available!
- Inherent reserves: very variable; contributes about 40% available to crops.
- 16.2 kg N ha^{-1} applied to agricultural lands in 2007 from external sources of which:
  - 2.2 kg N ha^{-1} was from mineral fertilizers
  - 0.3 kg N ha^{-1} from livestock manures
  - Remainder mainly from BNF

Attaching numerical values (OUT)

- N removed through crop harvests in 2007 was 18.0 kg N ha^{-1}
- Annual Estimates of N depletion from combined processes vary:
  - 22 kg ha^{-1} (Sanchez et al, 1997)
  - 34 kg ha^{-1} (Sheldrick and Lingard, 2004)
  - 17.4 kg ha^{-1} (Tan et al, 2005)

Coping mechanisms: Synthetic fertilizers preferred

Ranking of nutrient sources according to gender and reasons for preference (Mapfumo et al, 2001)

Nutrient resource	Ranking by		Factors (restrictions)
	women	men	
Synthetic	1	2	Immediate & reliable results (Cost prohibitive)
Animal manure	2	1	Long lasting in soil (Ownership of substantial livestock)
Compost	3	4	Processed from local materials (Labor intensive)
Termite mounds	4	3	Readily available in fields (Labor intensive)

Coping mechanisms:
Improve Fertilizer N management technologies

Technology type	Process and comments
Pre-plant application	Adjust fertilizer type, rate, technique to local conditions
Topdressing	Identify suited fertilizer, need, rate, timing
PKS blends	Reinforce N limiting conditions
ISFM	Maximise input interactions, investment, productivity, sustainability

Coping mechanisms:
Empowering farmers

N awareness attribute	Empower farmers to:	Effective empowerment indicators
N deficiencies	Identify N deficiency symptoms	Adjust N management to early deficiency symptoms
N cycling	Acquire N inputs; reduce N losses	Diagnostic test strips and adjust N management
N fertilizer use	Apply N fertilizer	Application methods, based on return to investment & nature conservation
HH protein management	Complement carbohydrates with legumes & greens	Consumption of nutritionally complete diets

Summary

- ❑ External N use in African agriculture is extremely low
- ❑ Practitioners consider synthetic N sources a priority; developed coping mechanisms for low N
- ❑ Green revolution for Africa focuses on increasing fertilizer inputs to help restore soil fertility
- ❑ Studies are necessary to predict and manage unintended impacts of the greening of Africa
- ❑ To know and contribute more on these issues, follow the Announcement…

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