Livestock manure and related statistics

30 November 2015, Kigali, Rwanda

International Workshop on

Statistics on nitrogen input from livestock manure: Estimating availability and use

Food and Agriculture Organization of the United Nations

Outline

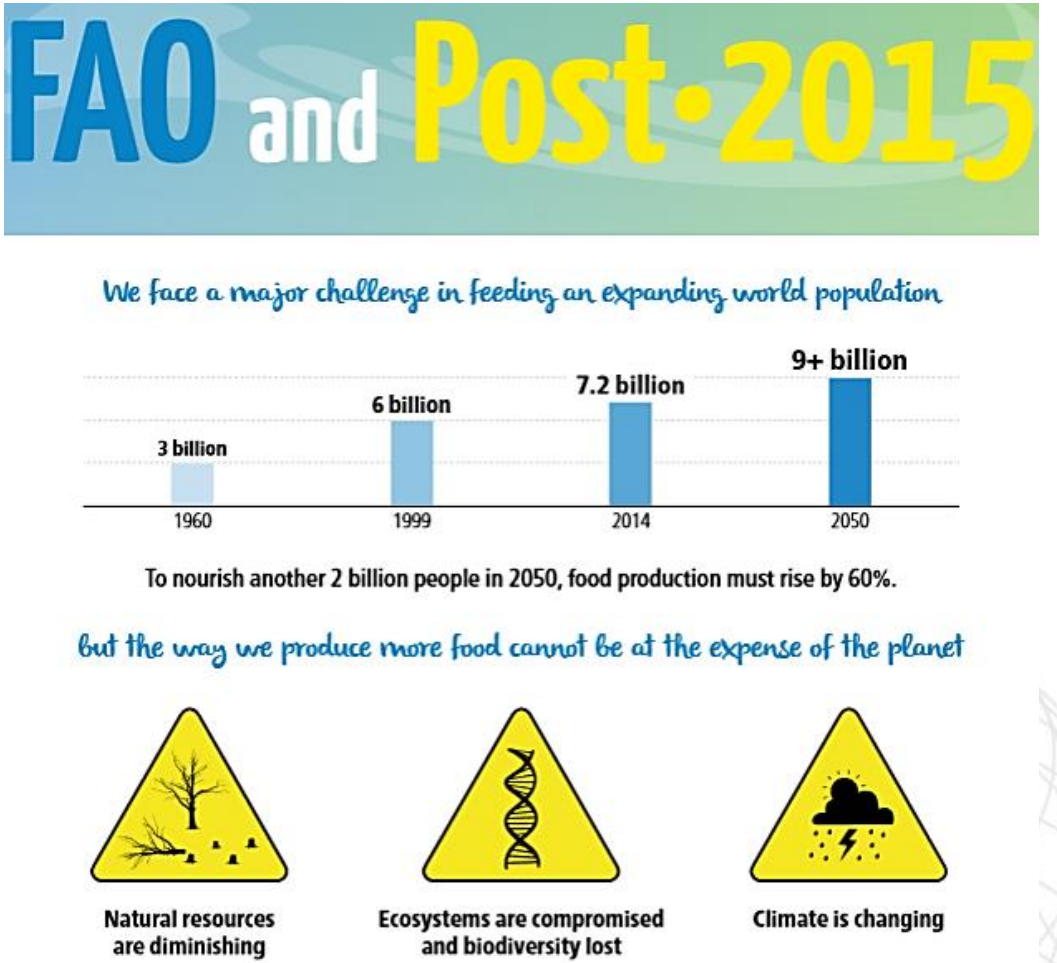
- ✓ The challenge of making agriculture more productive and sustainable
- ✓ Soil degradation
- ✓ Causes of soil degradation in Africa
- ✓ Manure and soil degradation
- ✓ Statistics on livestock manure: uses and trends at global, regional and sub regional scale
- ✓ Conclusions

Making agriculture more productive and sustainable

- ✓ ~800 M people undernourished
- ✓ World population continues to grow
- ✓ Ecosystems and biodiversity are increasingly stressed
- ✓ Climate change

Challenge

Increase food production in a sustainable way in the areas where it is most needed



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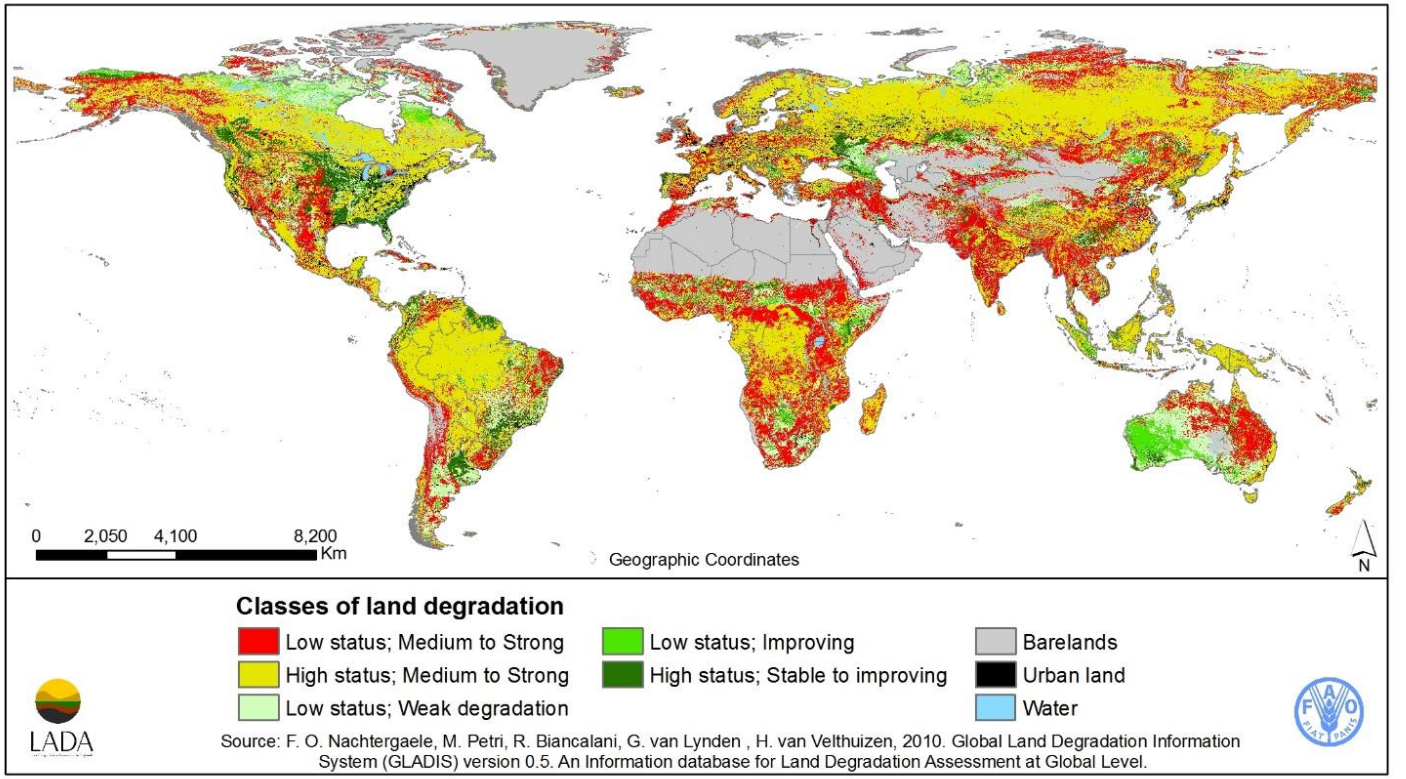
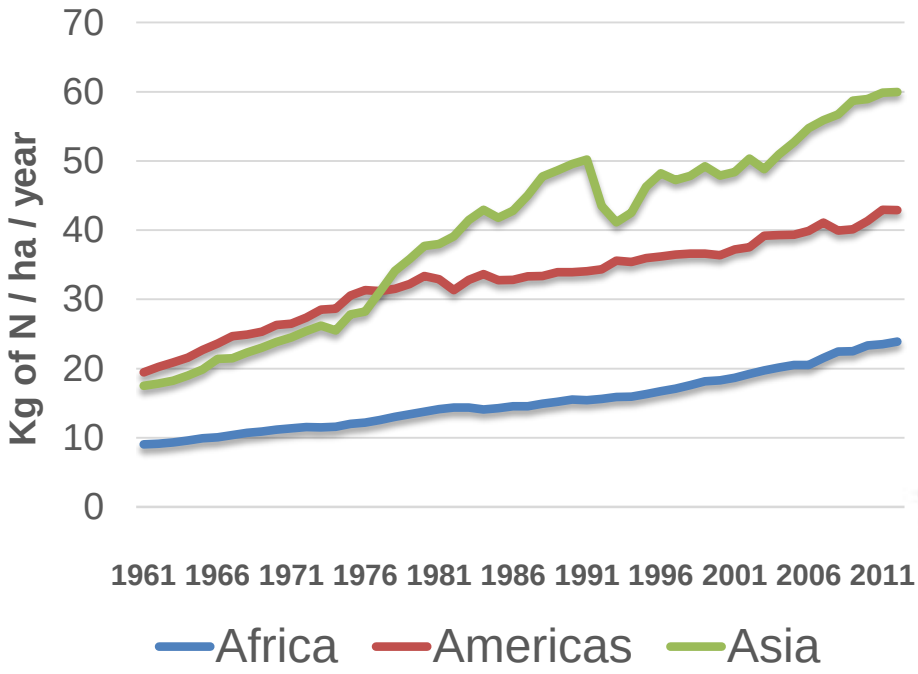
Example: Need to reverse soil degradation

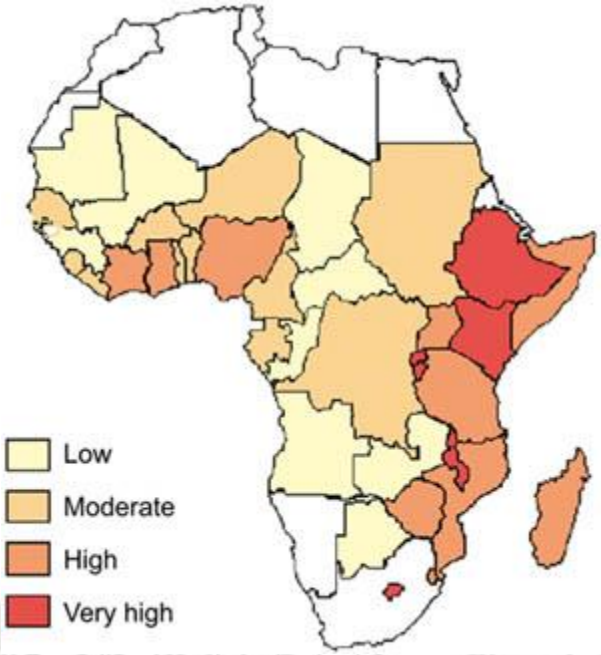


- ✓ About 30% of the world soils are moderately to high degraded
- ✓ About 40% of these soils are located in Africa

Causes of soil degradation in Africa (i)



Nutrient depletion rate in SSA

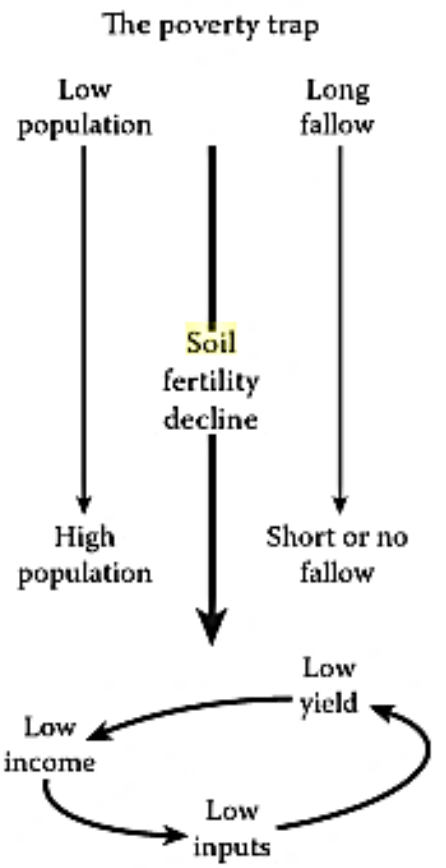


- ✓ Very old and weathered soils
- ✓ The limited fertilizer inputs application have not been able to replace the nutrients export in yields (Soil nutrient mining)

Causes of soil degradation in Africa (ii)

- ✓ Increased demographic pressure limits the possibility to leave the land fallow which used to restore soil fertility

- As a response soil fertility declines
- Poverty trap: low yield, low income, low inputs
- Relationship between soil degradation and poverty

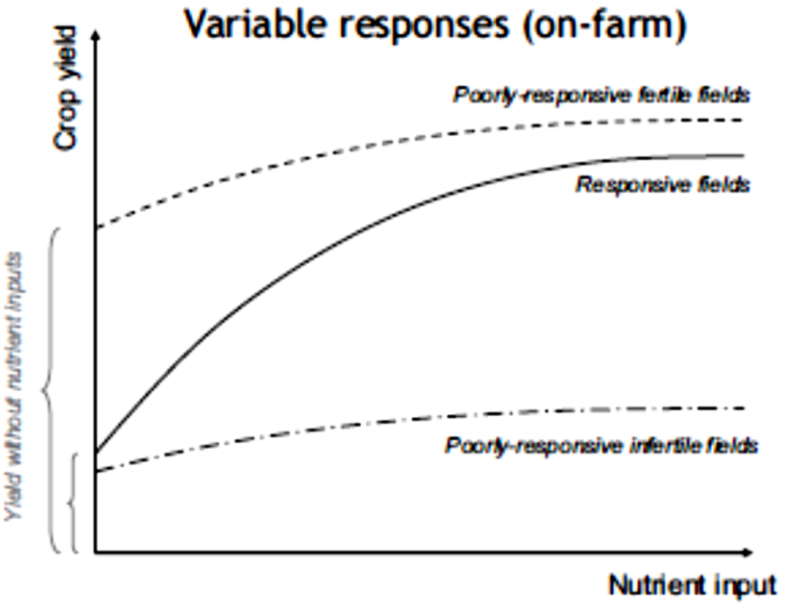



PUBLISHED: 7 JULY 2015 | ARTICLE NUMBER: 15101 | DOI: 10.1038/NPLANTS.2015.101
correspondence

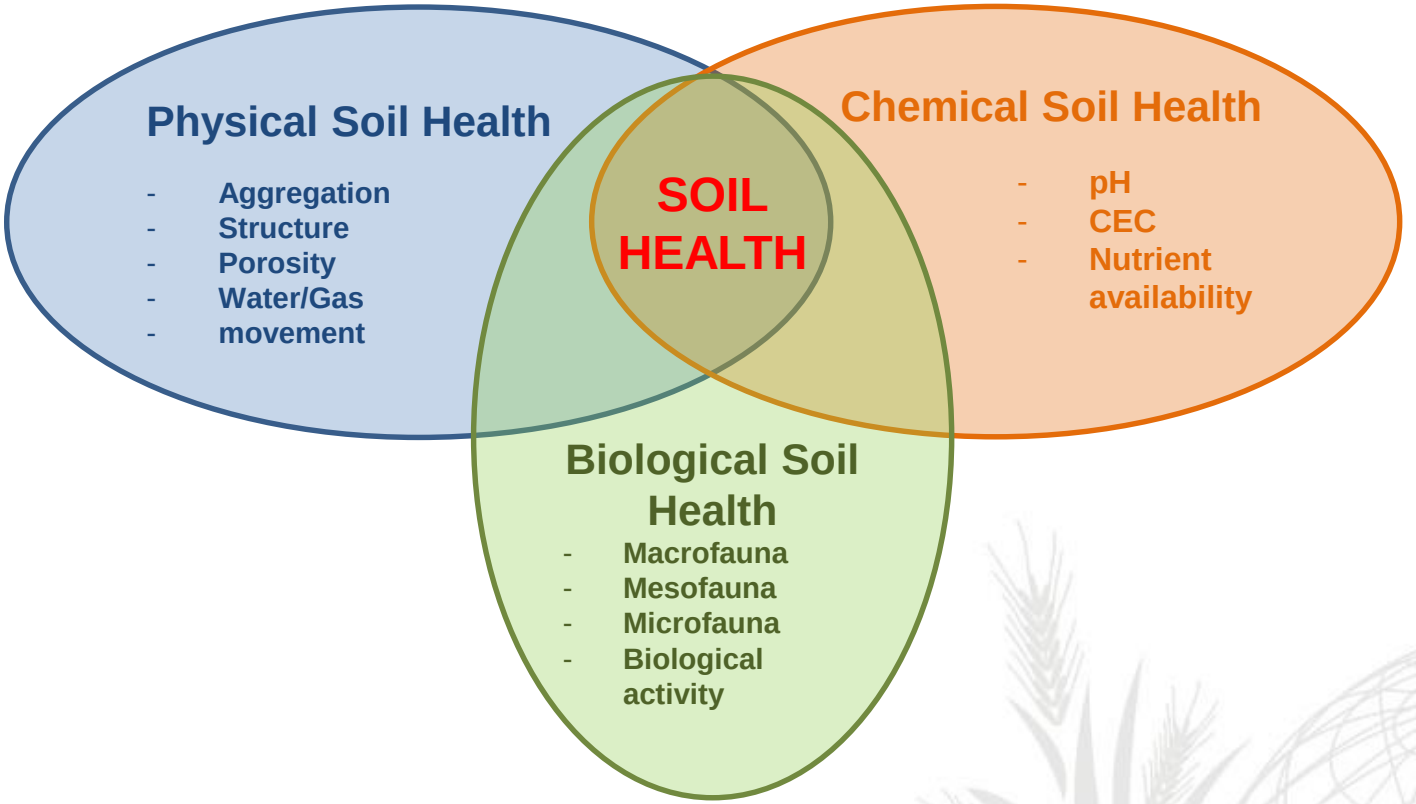
Soil fertility decline at the base of rural poverty in sub-Saharan Africa

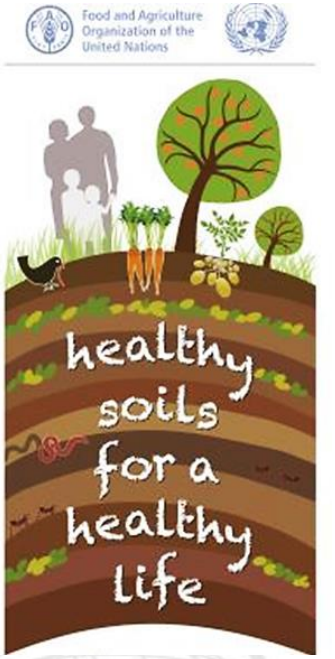
Manure can have a primary role in supporting crop production in Africa, reversing soil degradation

- ✓ Soils in a severe degradation state are not responsive to nutrient inputs as plants are no longer able to capture the nutrients
- ✓ In these soils large applications of manure can restore **soil health** and the responsiveness of the soils
- ✓ Similarly, in more responsive soil the addition of manure can maintain **soil health** (integrated nutrient management)



The three dimensions of soil health





Soil heath consists of **chemical, physical and biological** soil health with the three dimensions being **equally important**

Manure and soil health

Chemical Soil Health

- Macronutrients and Micronutrients
- C input to soils
- SOM input to soils which improves cation exchange capacity, pH buffering
- Favors nutrient cycling with the farm

Physical soil health

- The increased SOM favors soil aggregation
- Reduced bulk density
- Stimulate biological activity thereby improving soil structure

Biological soil health

- Increased biological activity and functional diversity
- Feed for the soil biota
- The increased SOM creates a suitable environment for the soil biological communities

- Unlike chemical fertilizers, manure has positive effects on the three aspects of soil health

Environmental impact of manure

- ✓ Nutrient and C losses occurs during manure storage and applications
- ✓ Net nutrient losses varies across different manure management systems, soil types, environmental conditions

Ammonia volatilization, CH_4, N_2O, CO_2

Run off

Leaching

Livestock Science

Volume 112, Issue 3, December 2007, Pages 261–272

Recycling of Livestock Manure in a Whole-Farm Perspective

Nutrient losses from manure management in the European Union

Oene Oenema, Diti Oudendag, Gerard L. Velthof

Plant Soil (2010) 328:253–269
DOI 10.1007/s11104-009-0107-x

REGULAR ARTICLE

Carbon and nutrient losses during manure storage under traditional and improved practices in smallholder crop-livestock systems—evidence from Kenya

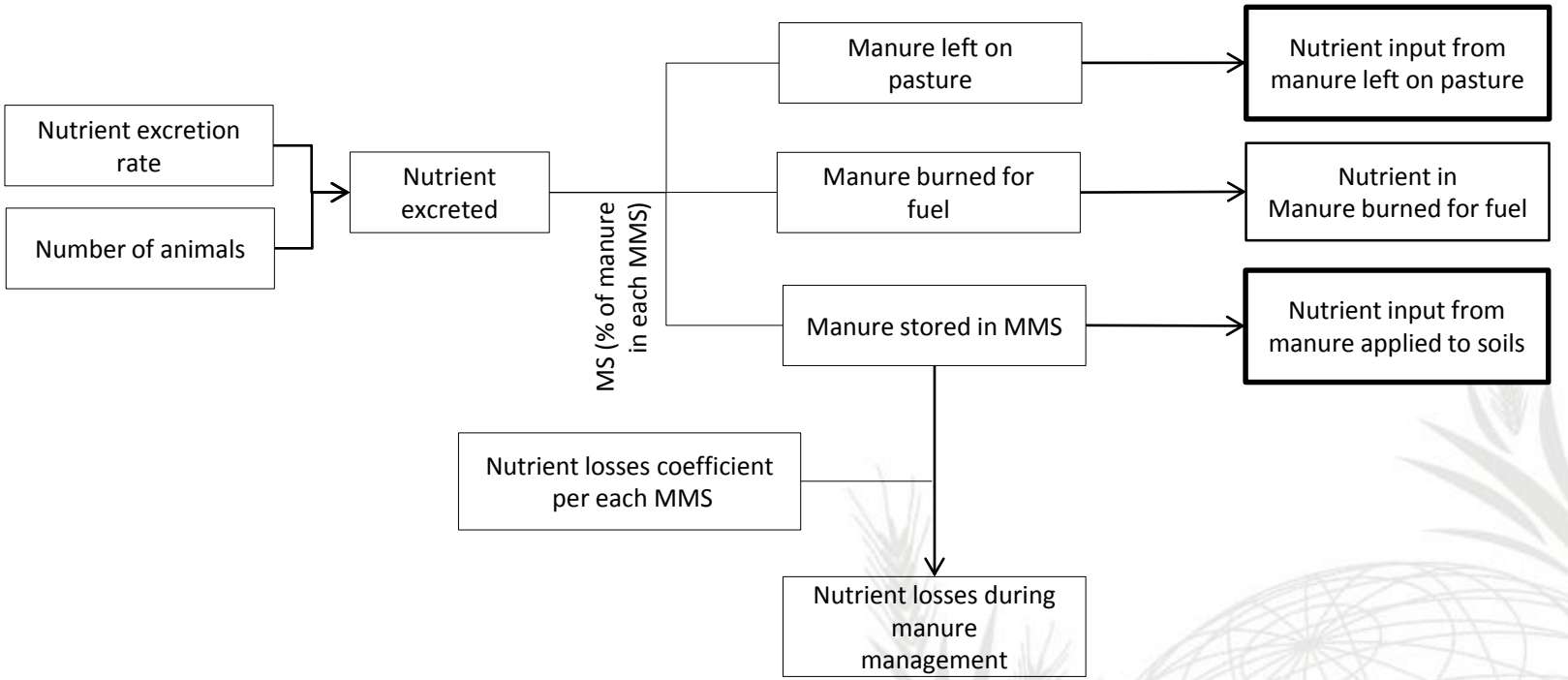
Pablo Tittonell · Mariana C. Rufino · Bert H. Janssen · Ken E. Giller

The importance of improving the statistics on manure

- ✓ Manure can have:
  - A primary role in supporting crop production, especially in Africa
  - Negative impacts on the environment

- ✓ Improved statistics on livestock manure are needed in order to:
  - Compile comprehensive accountings of the total nutrients input applied to soils and pastures
  - Assess current and potential environmental impact (e.g. GHG)

Improving analysis on livestock manure through better statistics



- **Input data**
  - Livestock numbers
  - Feed baskets

- **Coefficients/parameters**
  - Nutrient excretion rates
  - Use of manure
  - Losses from manure management systems

- **Outputs**
  - Nutrient loads on pastures and cropland

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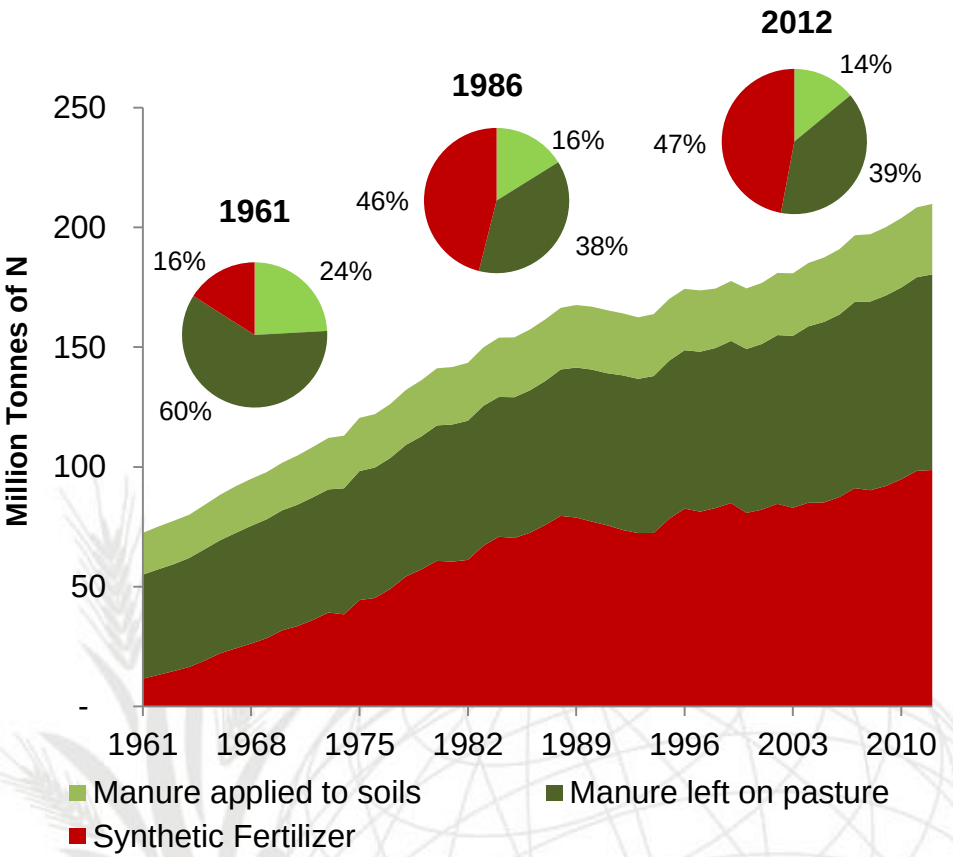
Better Data in support of Analysis: Manure production and uses in the world

- ✓ Manure production has increased from 1961-2012
- ✓ N input from synthetic fertilizers increased exponentially and became the first source of N worldwide in 1986
- ✓ Wide variations among regions



Source: FAOSTAT 2015

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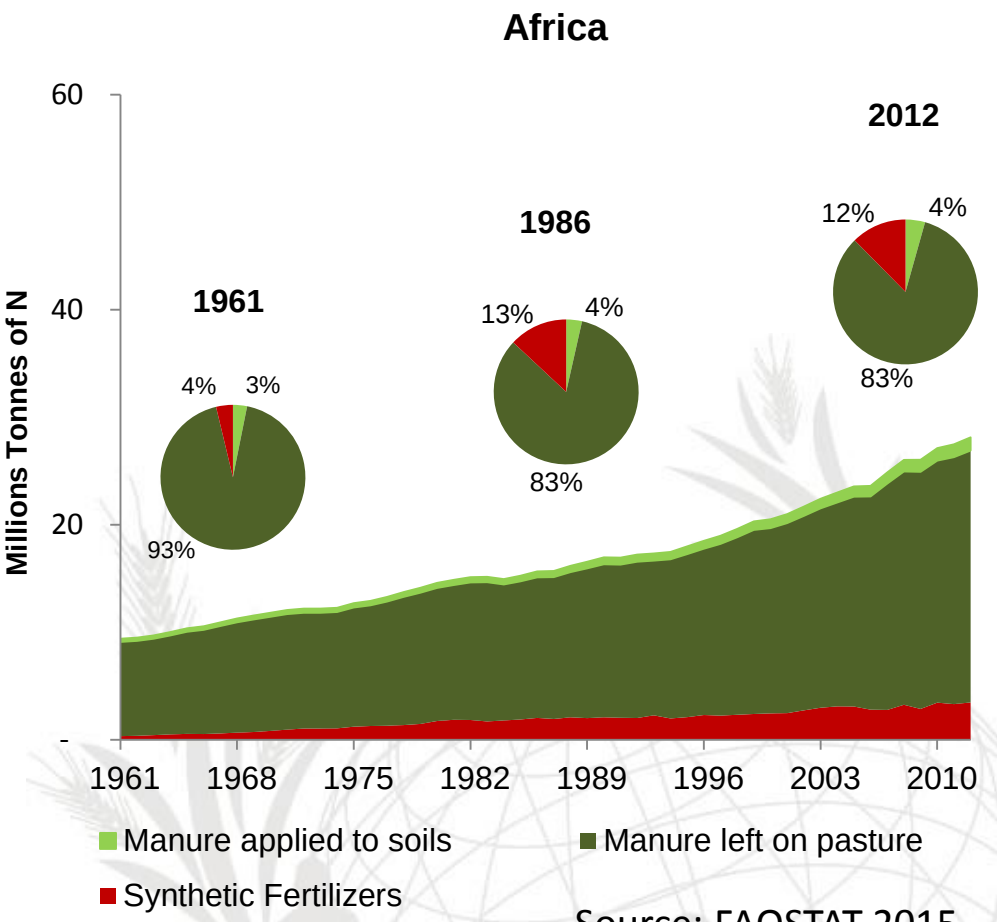
Manure production and uses in Africa

- ✓ Manure production has increased steadily from 1961-2012
- ✓ More than 80% of the N input from manure is left on pasture
- ✓ While the contribution of the manure applied to soils is very limited (3-4%)
- ✓ Chemical N input has gained importance but still represents only about 12% of the total N input applied
- ✓ High variability among sub regions



Source: FAOSTAT 2015

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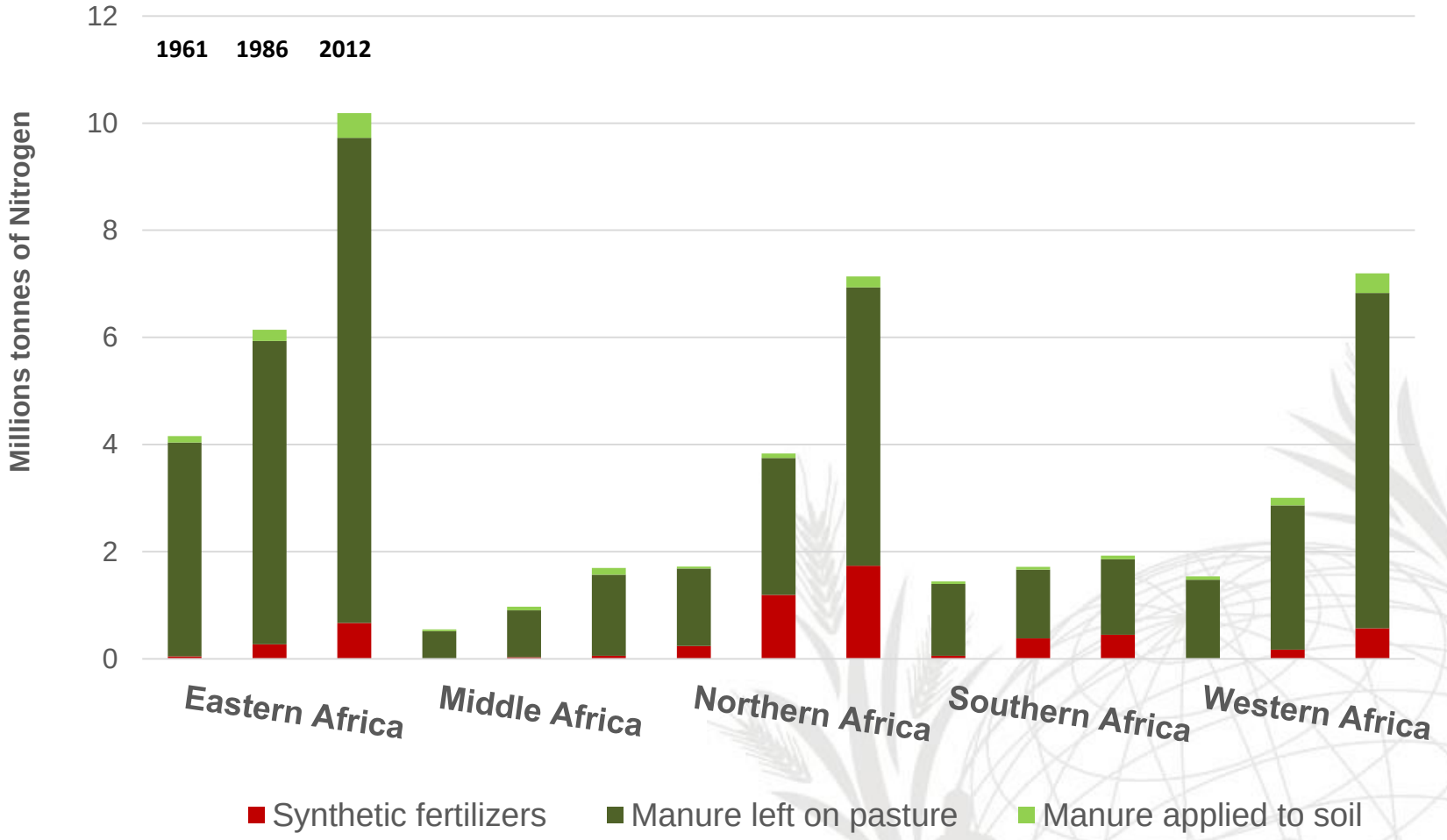
Manure production and uses in the African Sub regions



Source: FAOSTAT 2015

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Conclusions

- ✓ The challenge of eliminating hunger in the context of climate change, limited natural resources, ecosystem degradation and demographic pressure
- ✓ Many soils are degraded and manure can help in reversing soil degradation and maintaining soil health
- ✓ Manure management and applications can also results in negative environmental externalities
- ✓ Therefore improved statistics of manure are relevant both from an agronomic and environmental point of view
- ✓ Lasting trends indicated that:
  - Globally synthetic fertilizers are the main source of N
  - The African N input strongly relies on manure; with the manure left on pasture being the main source of Nitrogen in all the sub regions

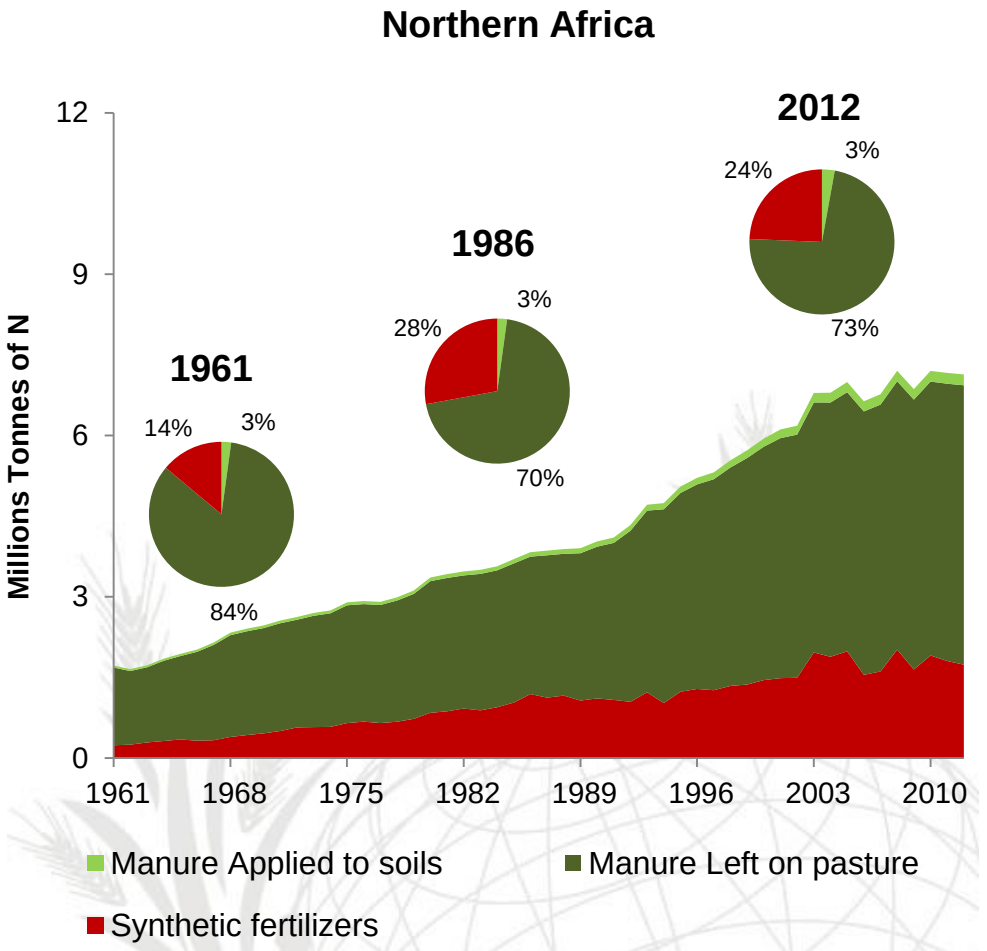
Thank you for your attention

Environment-Statistics@fao.org

Manure production and uses in Northern Africa

Source: FAOSTAT 2015

- ✓ NA is the sub region with the second highest N input
- ✓ Greater contribution of synthetic fertilizers compared with other African sub regions
- ✓ Manure left on pasture accounted for about 73% of the total N input in 2012
- ✓ Limited amount of manure is applied to soils



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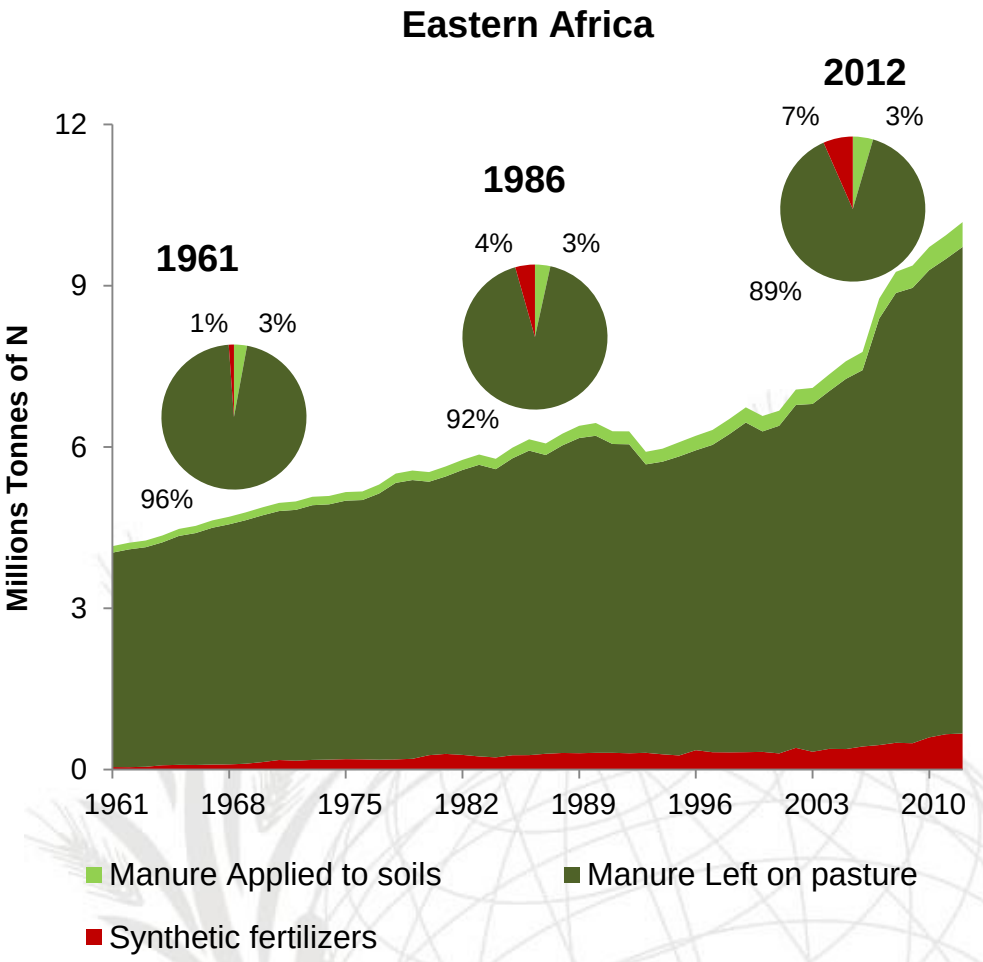
Manure production and uses in Eastern Africa

Source: FAOSTAT 2015

- ✓ EA is the region with the highest N input
- ✓ Manure left on pasture is the main N source of N
- ✓ Limited amount of manure is applied to soils
- ✓ N input from synthetic fertilizers 14 times higher in 2012 than in 1961
- ✓ However synthetic fertilizers only accounted by 7% of the total N input



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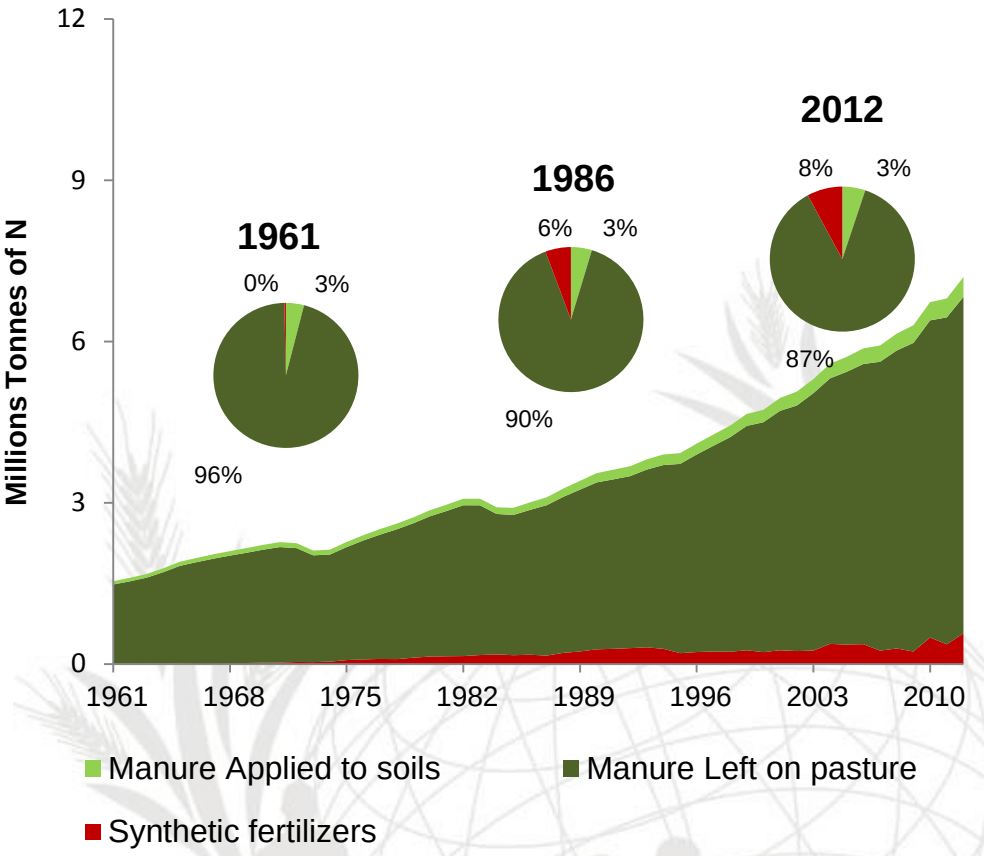
Manure production and application in Western Africa

Source: FAOSTAT 2015

- ✓ Fertilizers increased exponentially in the last 50 years (more than 100 times)
- ✓ Still, they only accounted for 8% of the total N input in 2012
- ✓ Manure left on pasture was the main source of N and accounted for about 87% in 2012
- ✓ Limited amount of manure is applied to soils



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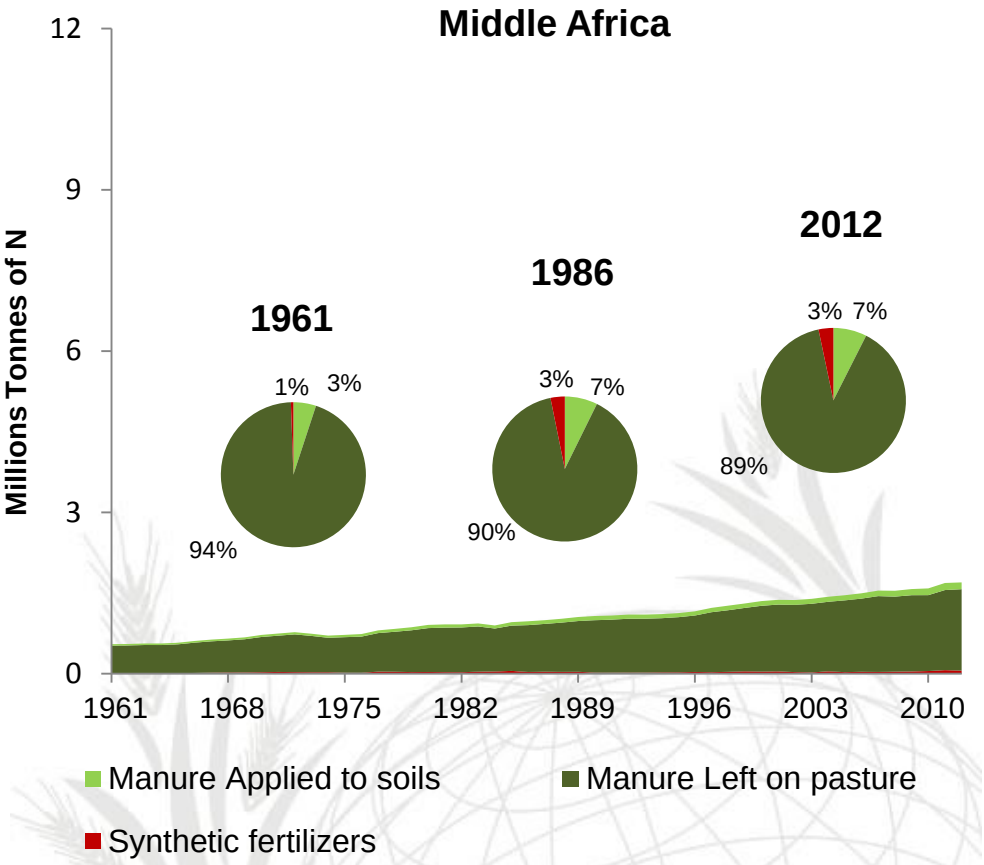
Manure production and application in Middle Africa

Source: FAOSTAT 2015

- ✓ MA is the region with the lowest total N input
- ✓ Steady increase of N input from 1961-2012
- ✓ Manure applied to soils and synthetic fertilizers increased across the period considered
- ✓ Still, the manure left on pasture represents about 89% of the total N input in 2012



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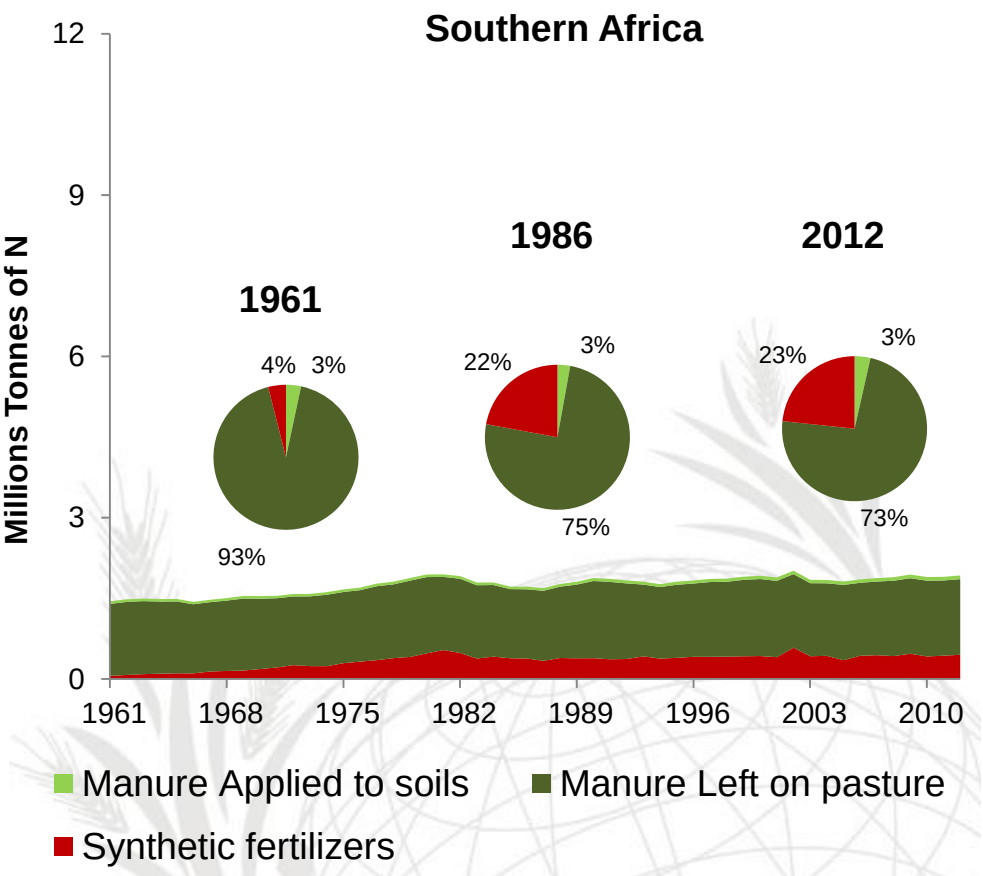
Manure production and application in Southern Africa

Source: FAOSTAT 2015

- ✓ The total N input did not record remarkable variation in terms of total tonnage
- ✓ Significant variation in terms of N source
- ✓ Manure left on pasture decreased from 93% to 73 in 1961 and 2012, respectively
- ✓ N input form the manure applied to soils represented only 3% of the total N input
- ✓ Synthetic fertilizers increased considerably reaching 23% of the total N input in 2012



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