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Climate Change

Action on Non-CO_2 Greenhouse Gases: Nitrous Oxide Emissions

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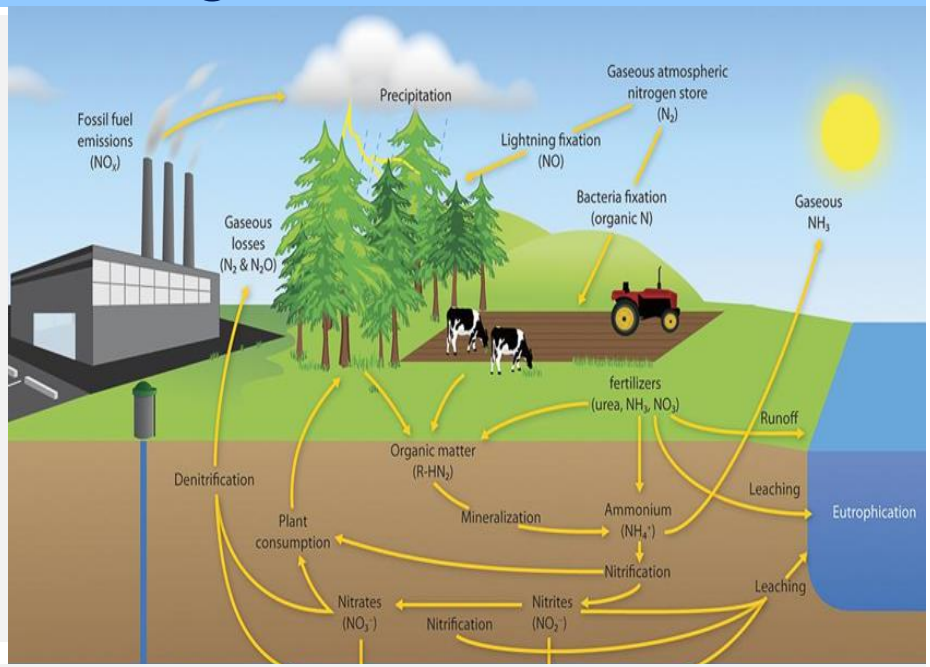
N_2O Emissions from Agriculture

Issues

- About half of the nitrogen applied to agricultural land is lost
- N_2O emissions have implications for crop productivity, climate and environment
- Adverse environmental impacts: nitrate run-off in water; ammonia volatilization & nitrogen oxide impact air quality; & nitrous oxide induced warming causes stratospheric ozone depletion



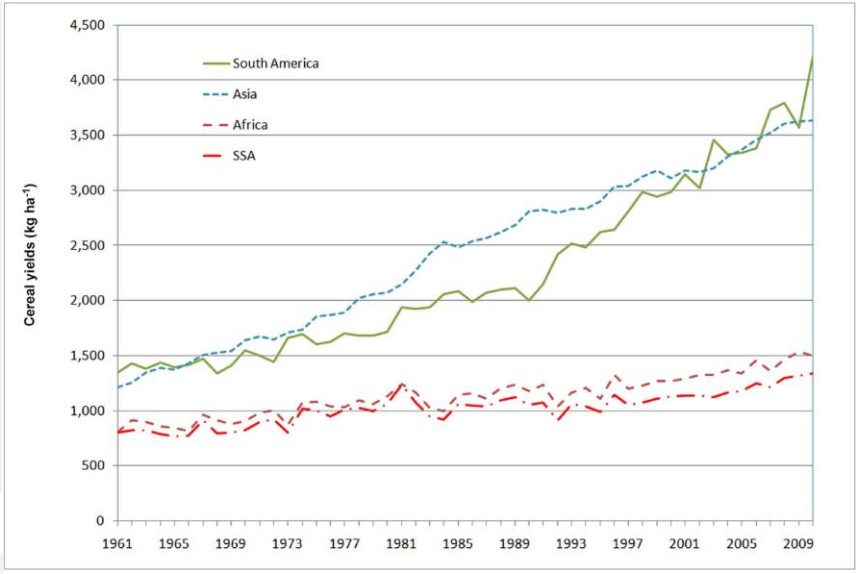
Opportunities

- Improving soil productivity and nutrient use efficiency have major role in addressing N_2O emissions from agriculture in the near term and in long term
- **Near term**: Role in closing 10% of emissions gap by 2020 to achieve 2°C target
- **Long term**: N_2O mitigation in agriculture is major part of the cumulative emission reduction of up to 60 Gt CO_2e and 3500 ODP kt by 2050.
- 20% improvement in nitrogen use efficiency costs about US$12 billion annually, and saves about US$23 billion in annual fertilizer costs alone
- Additional environmental and health benefits are worth US$160 billion per year

Soil and Nutrient Management for Enhancing Agricultural Productivity and Minimizing N_2O Emissions

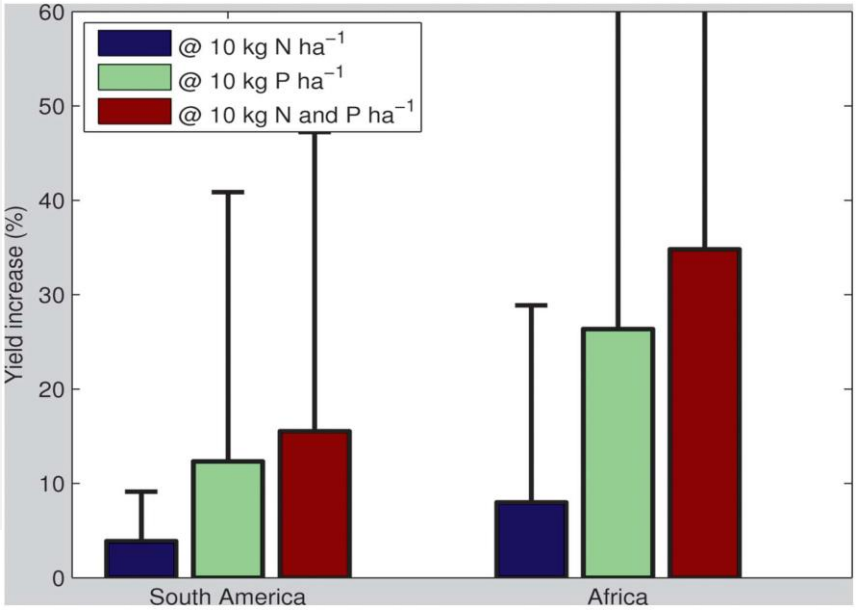
Issues

- Urgency to increase agricultural productivity by enhancing annual growth rate in cereal yield
- Significant gaps in agricultural productivity among developing countries and regions.
- Raising agricultural productivity is key to lower the risks of deforestation, land degradation; loss of habitat & biodiversity.



Opportunities:

- Soil and nutrient management priorities help to focus attention on nutrient use efficiency.
- Harnessing biological nitrogen with intercropping and crop rotation involving legumes.
- Macro and micro nutrient balance key to improving productivity and adaptation to climate change (e.g. yield increases with improved nitrogen & phosphorus balance).



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World Bank Investment and Policy Interventions for N_2O Mitigation in Agriculture

Investment

- Investment in agriculture is important to the World Bank's twin goals on poverty & shared prosperity.
- World Bank investments in agriculture & allied sectors more than doubled during the past decade from an annual average of $4.1 billion in FY2006–08 to about $10 in FY2013–15.
- About half of the investments in agriculture have been targeted to improvements in agricultural productivity, with soil productivity and nutrient management receiving attention.
- N_2O mitigation has been advanced through support to policy design; and implementation of improved agricultural technologies and practices on the ground.

Policy

- Integrated nutrient management priorities for sustaining soil productivity
- Measures for improving nitrogen use efficiency
- Targeting fertilizer subsidies to avoid overuse of nitrogen fertilizers
- Local production, formulation and repackaging of fertilizers
- Investments in soil conservation, erosion control & soil productivity
- Improved cook stoves to prevent burning of biomass & animal manure
- Improvements in livestock production and waste management
- Organization of extension systems to promote fertilizer use efficiency

Practices with N_2O Mitigation Role in World Bank Agricultural Investment Projects

Agronomy
- Varietal improvement
- Inter cropping
- Crop rotation


Tillage and residue
- Conservation tillage
- Residue management

Nutrient Management
- Organic manure
- Green manure
- Fertilization (frequency, dose, time)


Soil Conservation
- Conservation measures
- Erosion control
- Drainage


Multi-enterprise
- Agroforestry
- Crop and livestock


Quantification of N_2O Emission Reductions in the World Bank Projects

- Promotion of landscape approach covering multiple land uses; and climate smart agriculture practices have increased recognition of N_2O mitigation activities.
- Screening of active and pipeline agricultural projects initiated to identify N_2O mitigation actions.
- Implementation of GHG accounting in agriculture investment projects from 2015
  - Example project: Climate Smart Staple Crop Production Project in China
    - Activities promoted
      - Reduced and conservation tillage, crop rotation, soil amendments
      - Crop residue management and prevention of the burning of biomass residues
      - Use of appropriate dose, formulation, time and placement of fertilizers to demonstrate fertilizer use efficiency,
      - Training of farmers on improved technologies and practices
    - Monitoring and quantification of N_2O emission reductions
- Methodological framework for Reducing Deforestation & Forest Degradation (REDD) programs requires quantification of N_2O emissions of biomass burning in forest fires.
- Quantification of N_2O mitigation benefits have also been conducted in several other project types such as manure management and waste water treatment.

Summing Up

- World Bank investments in agriculture have more than doubled during the past decade with about half of them targeted to improvements in agricultural productivity.
- Landscape and climate smart focus to agricultural investments have increased attention to N_2O mitigation in WB agricultural investments.
- As part of the Global Alliance on Climate Smart Agriculture, World Bank is committed to achieving GHG mitigation target of the alliance, with N_2O mitigation as significant part of the effort.
- Implementation of GHG accounting in World Bank agricultural investments helps to influence project design with information on N_2O mitigation potential.
- Mitigation activities involving REDD+, manure management, and waste water treatment projects also recognize N_2O mitigation benefits
- Apart from climate benefits, N_2O mitigation priorities of WB investments lower the threat of stratospheric ozone depletion, and provide multiple environmental and heath benefits.