Fighting food, fertilizer, and the climate crisis in Africa through targeted N management

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International Maize and Wheat Improvement Center (CIMMYT)

CPCN Bi-Weekly Webinar Series
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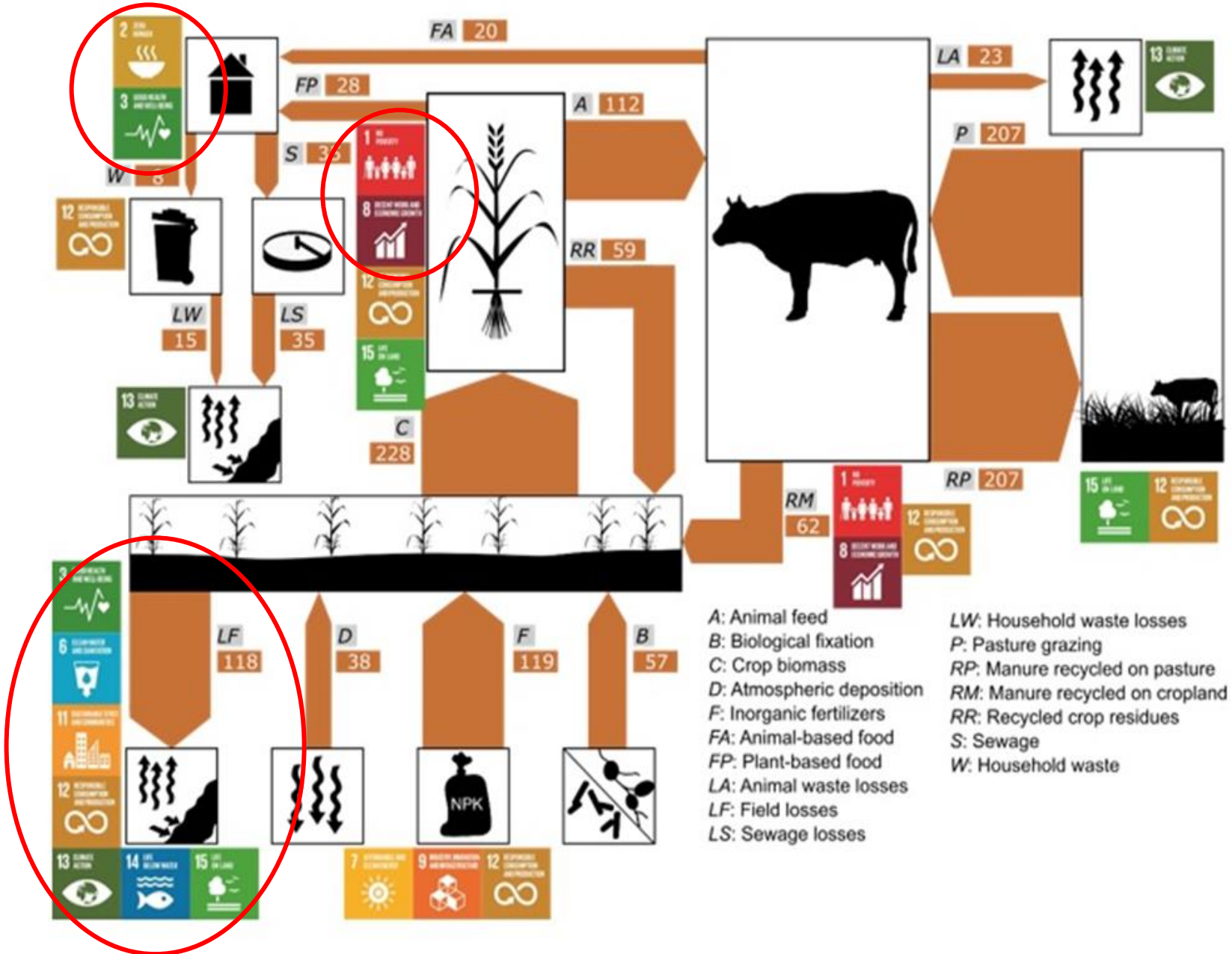
CIMMYT

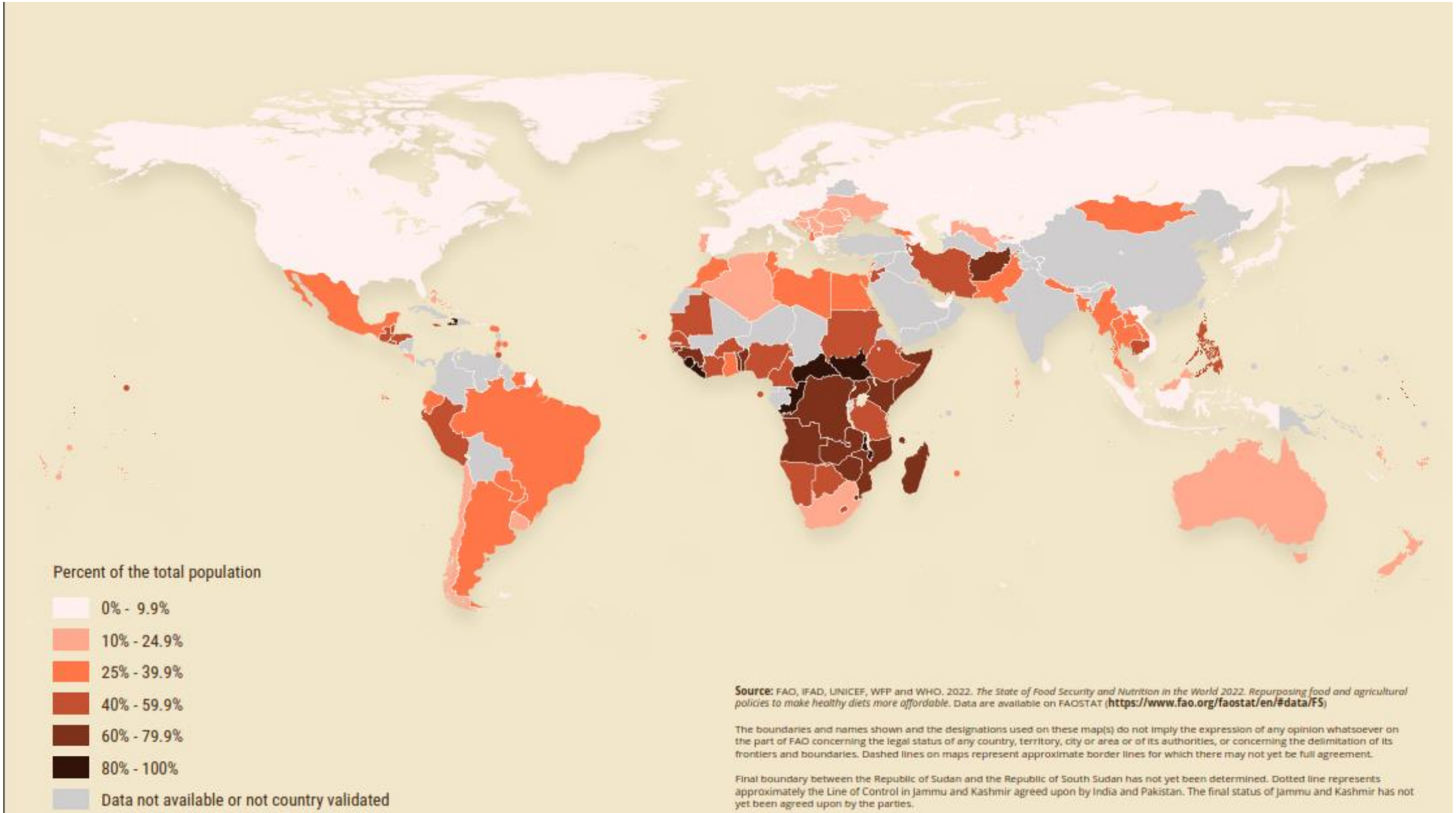
Outline

- Role of N in Food Security and other SDGs
- Food security situation and trend of N application for crop production in Africa
- Current status of N input/N output and NUE
- Examples of some targeted N management approaches
- Scaling climate-robust N management strategies for smallholder farmers including in Africa (AIM4C)

Nitrogen management contributes to Food Security & number of other SDGs



More than 50% population in Africa are Food Insecure

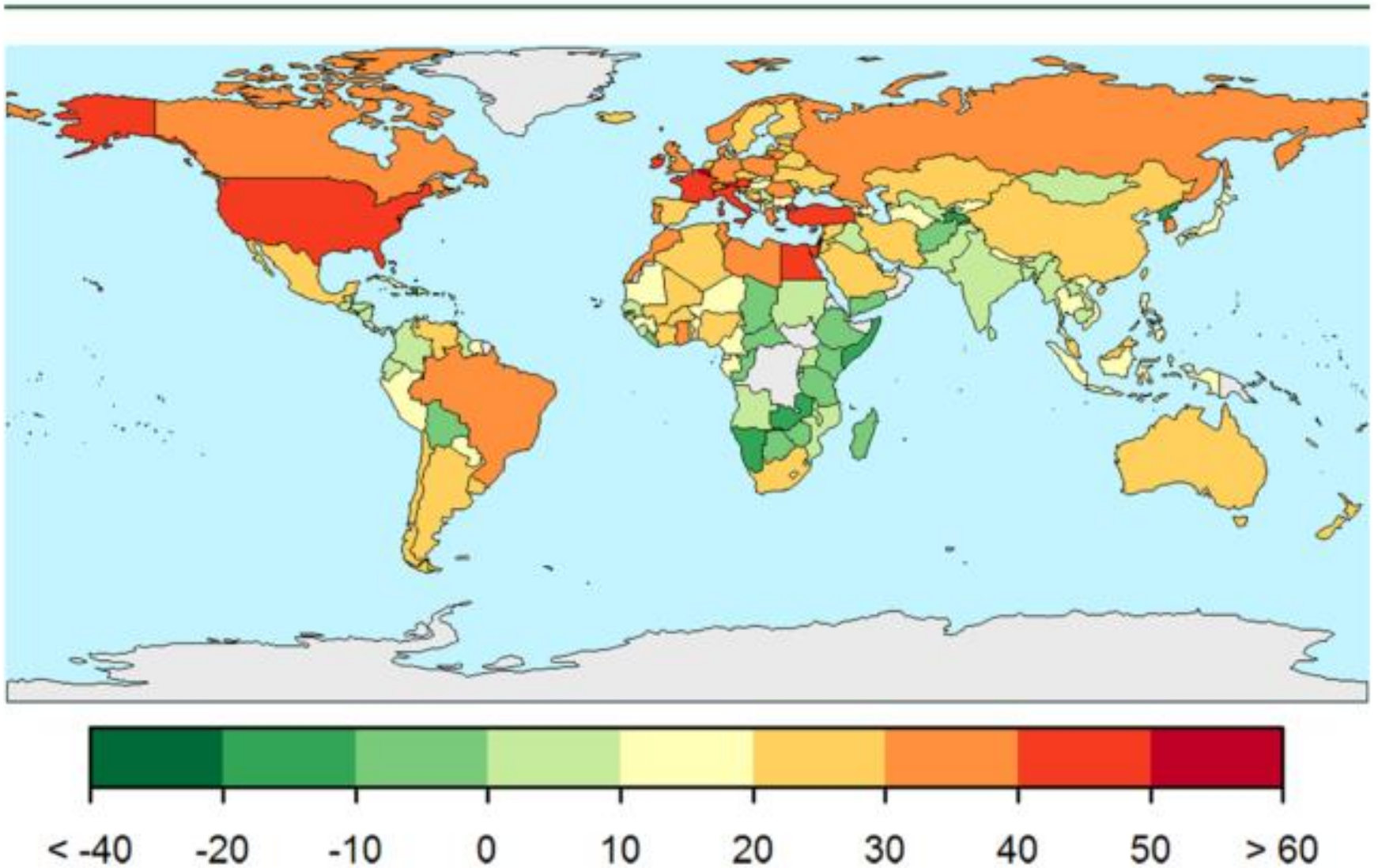


Source: FAO, IFAD, UNICEF, WFP and WHO. 2022. *The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable.* Data are available on FAOSTAT (**https://www.fao.org/faostat/en/#data/FS**)

The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

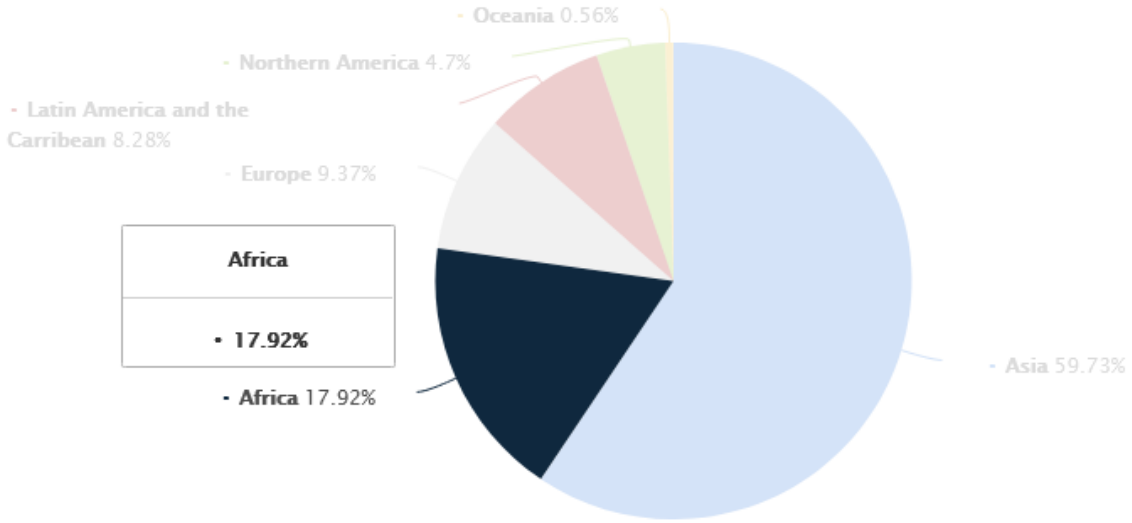
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

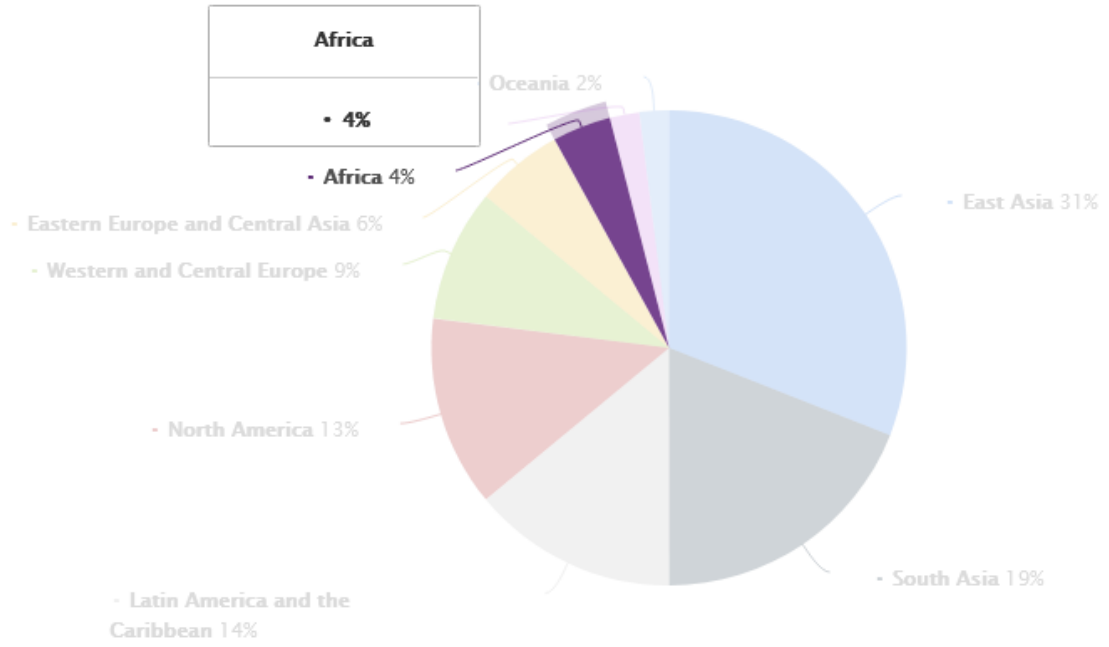
Food surplus/deficit from domestic production



Hic et al., 2017

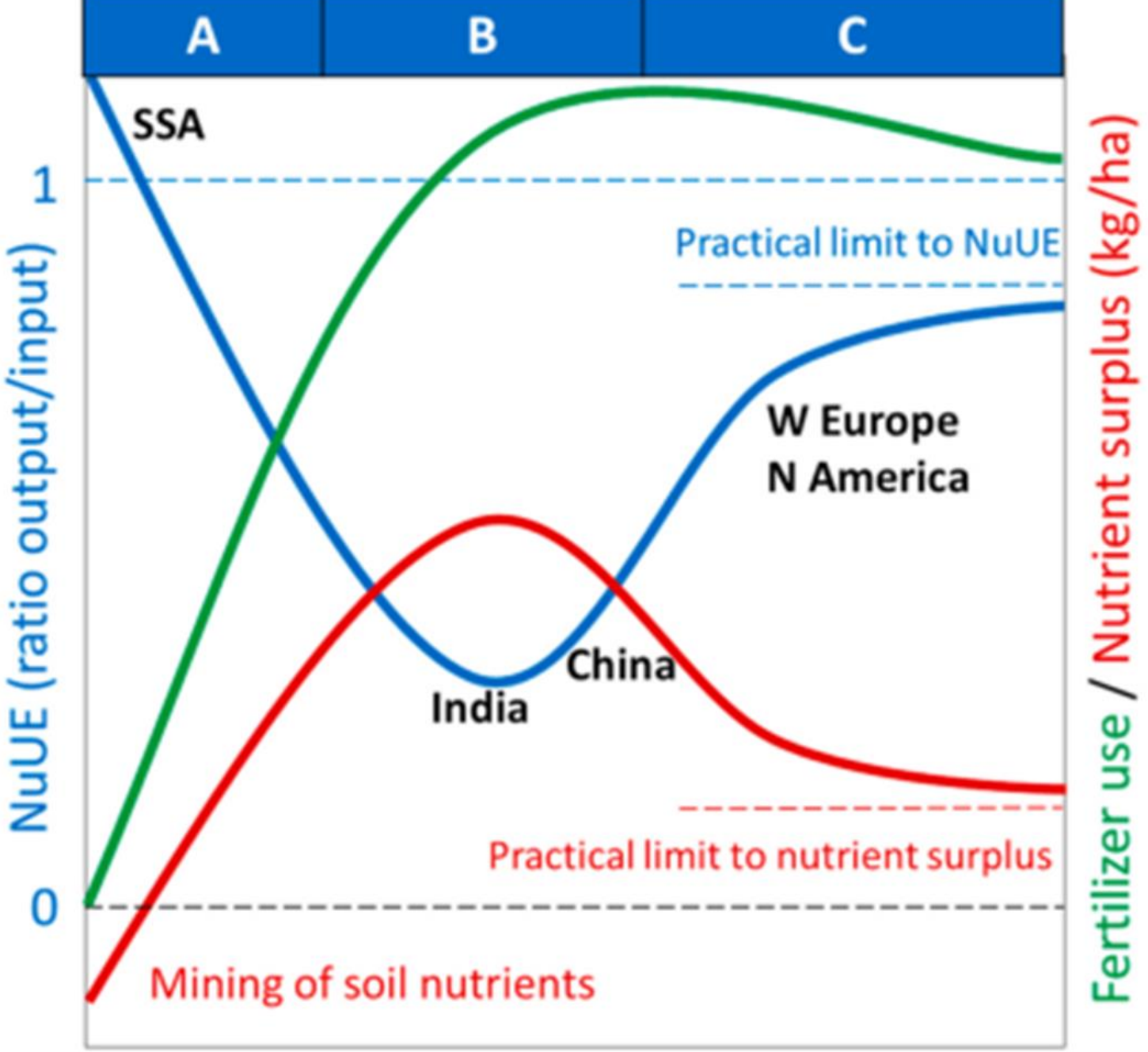
18% of the global population only 4% of fertilizers





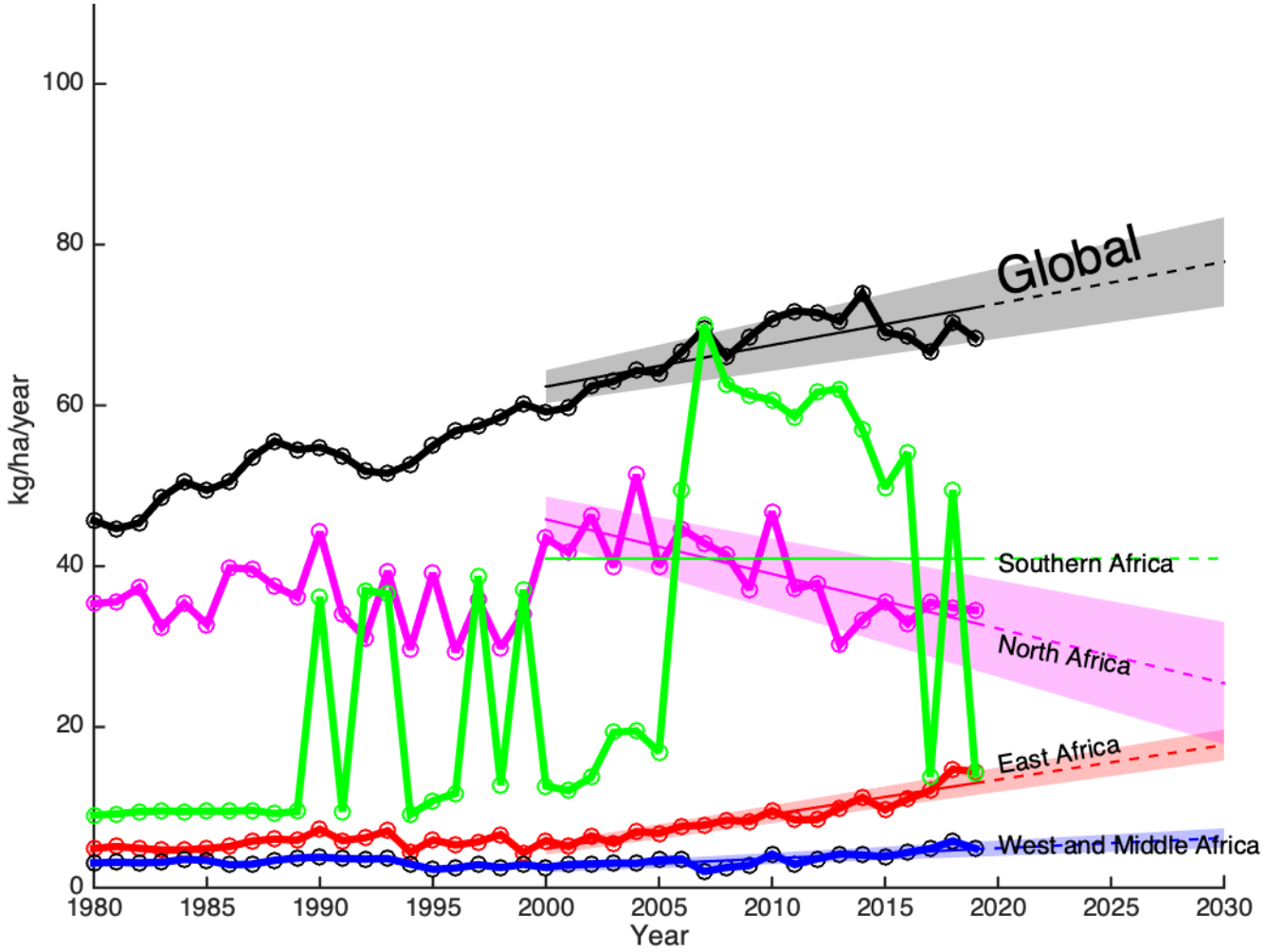
www.statista.com

Nutrient Input and Crop yield progression over time (Hypothetical)



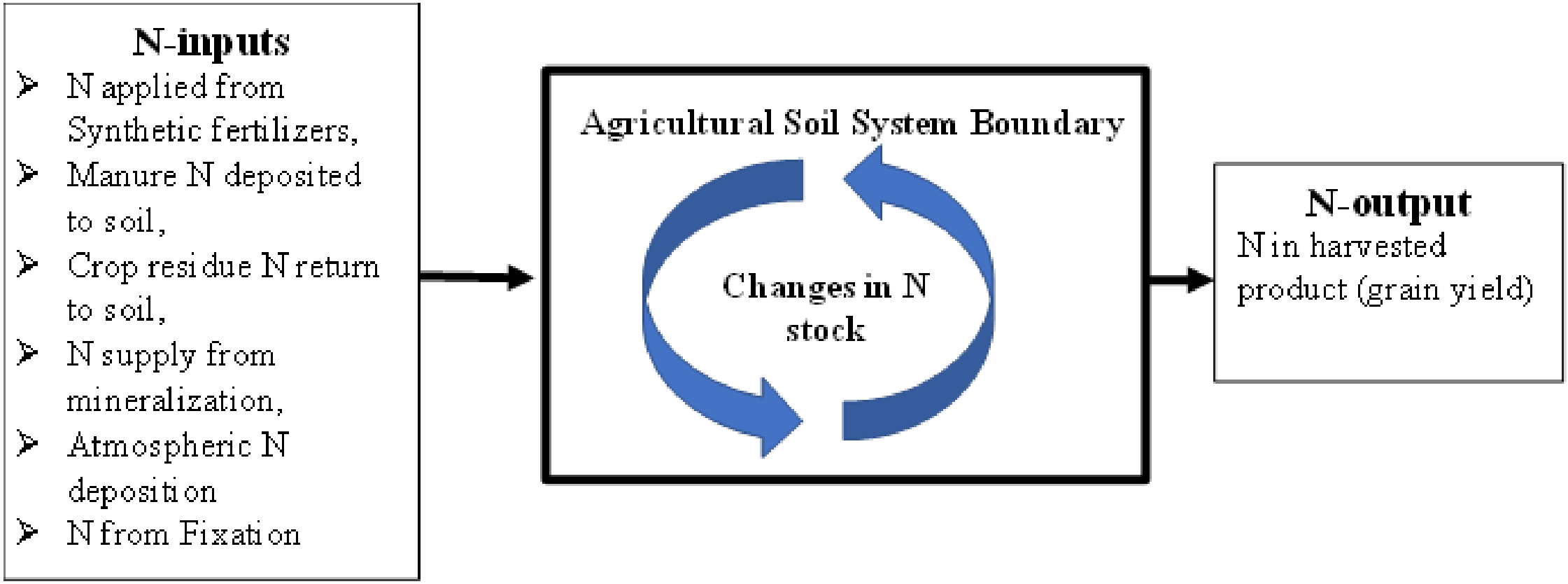
Dobermann et al, 2022

Average N application rates over time



Ray, Sapkota & others (in prep)

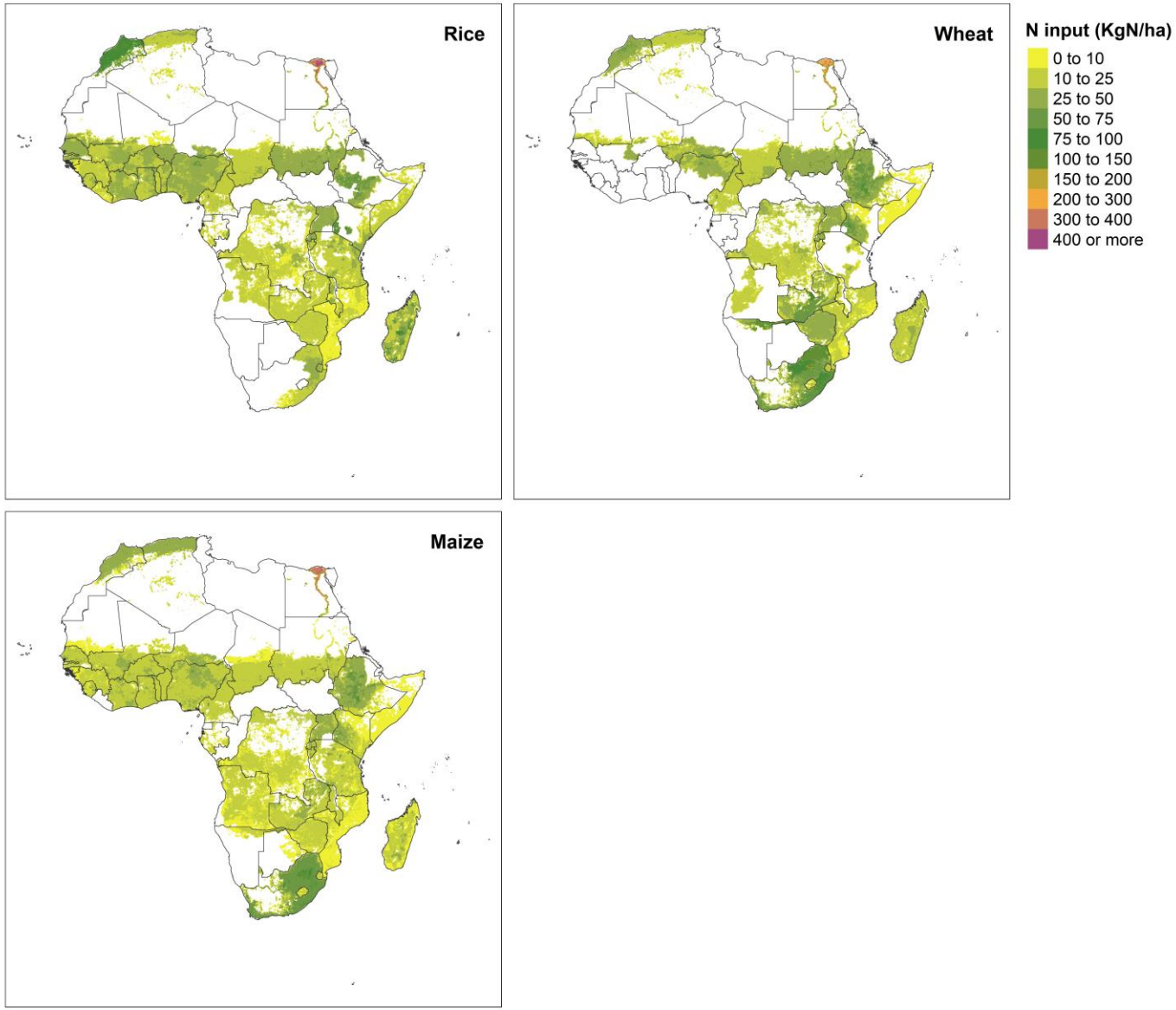
Global NUE Atlas



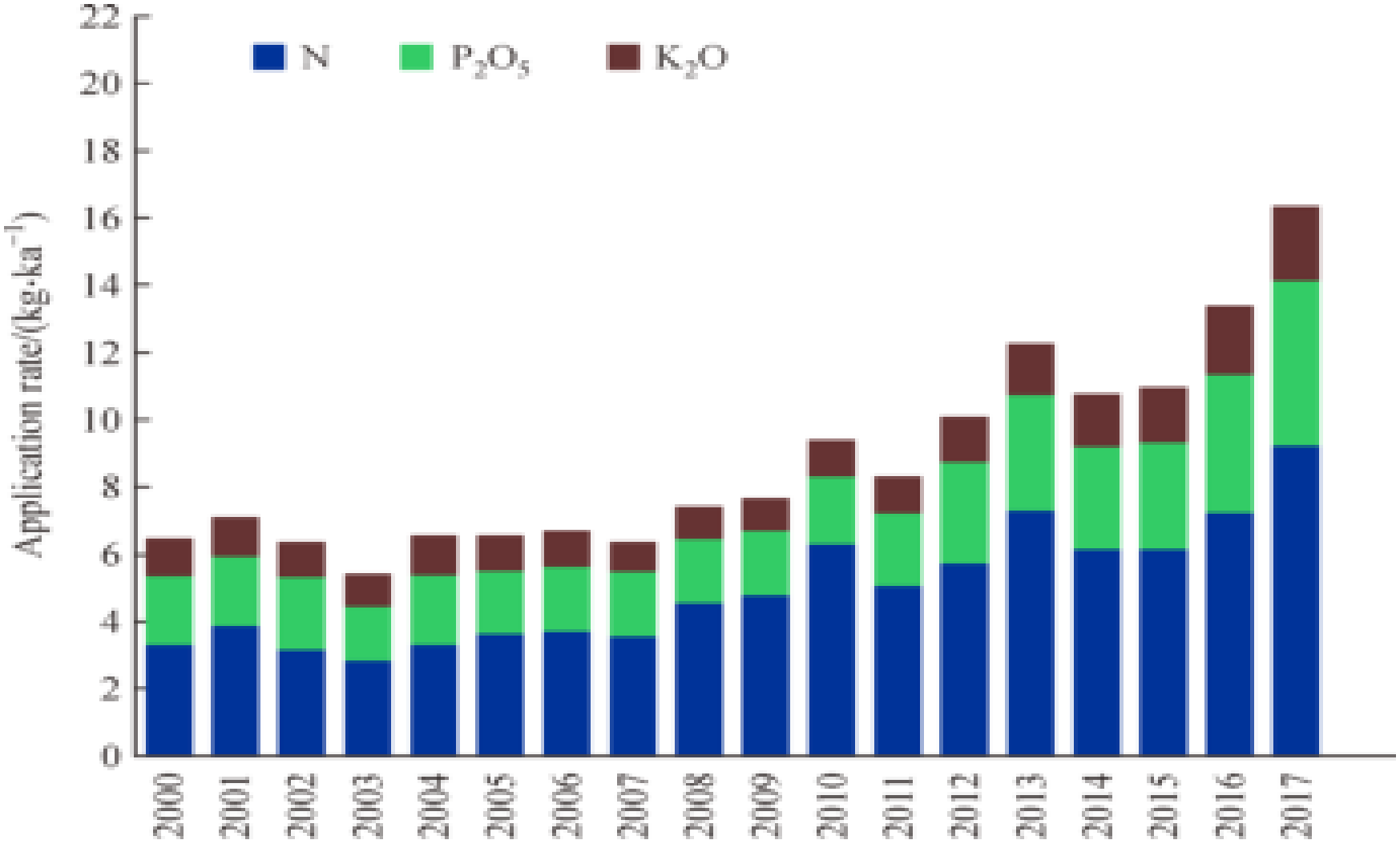
5 arc-minute
1962-2016

N input in Rice, Wheat and Maize area across African continent

- NUE atlas



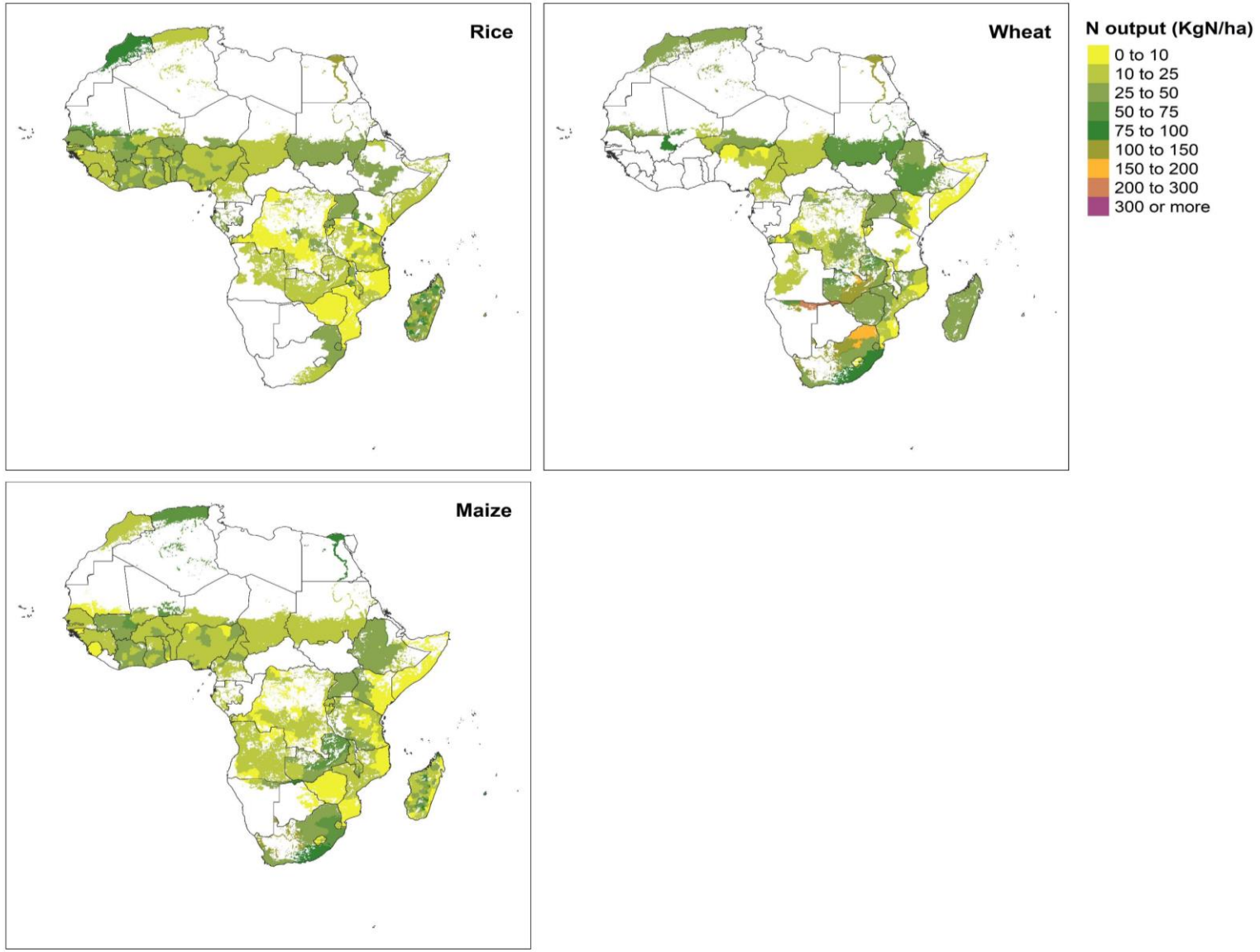
Average rates of fertilizer-nutrient application in SSA



Vanlauwe and Dobermann, 2020

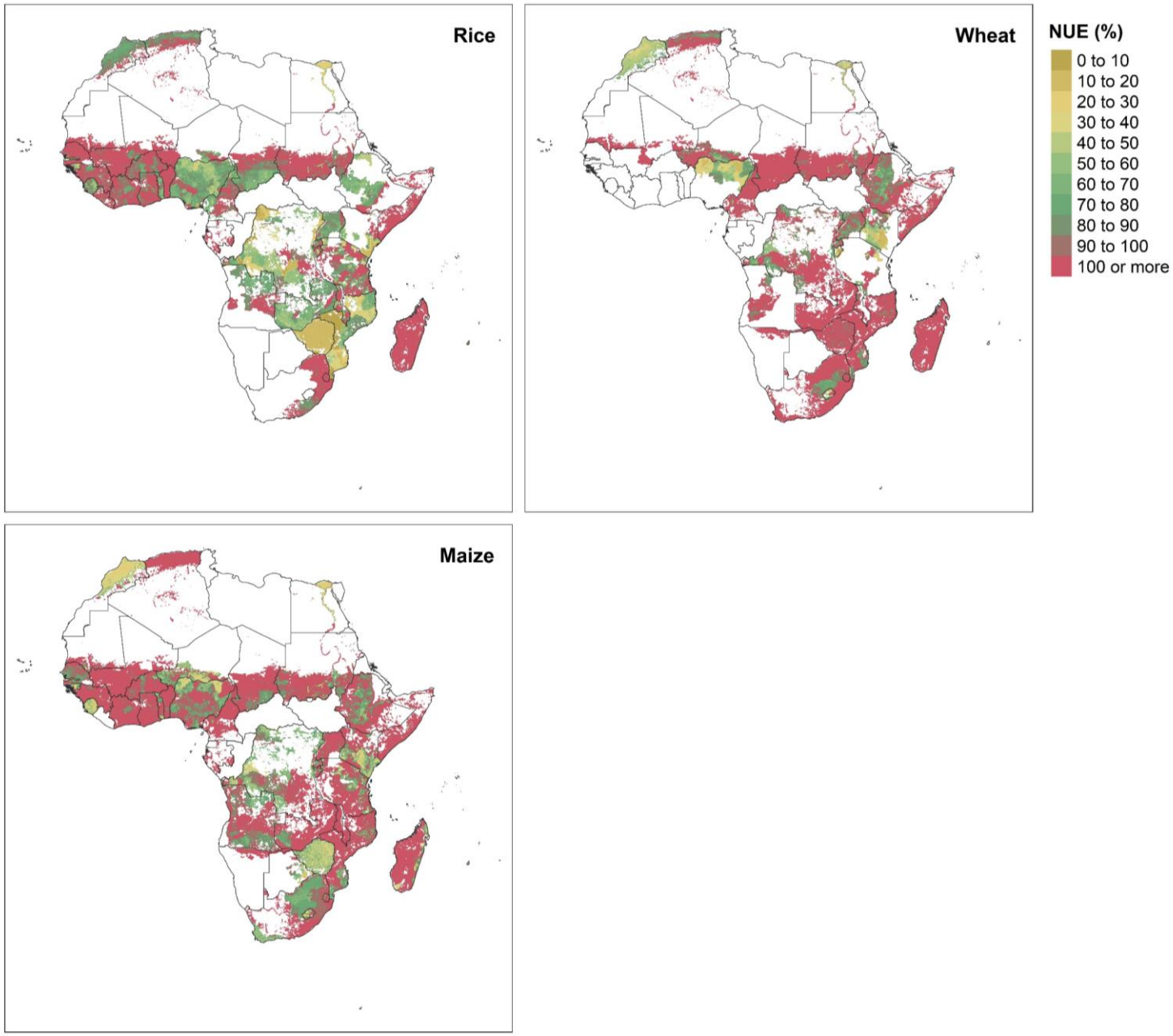
N output from Rice, Wheat and Maize harvest across African continent

- Data: NUE atlas



NUE in Rice, Wheat and Maize across African continent

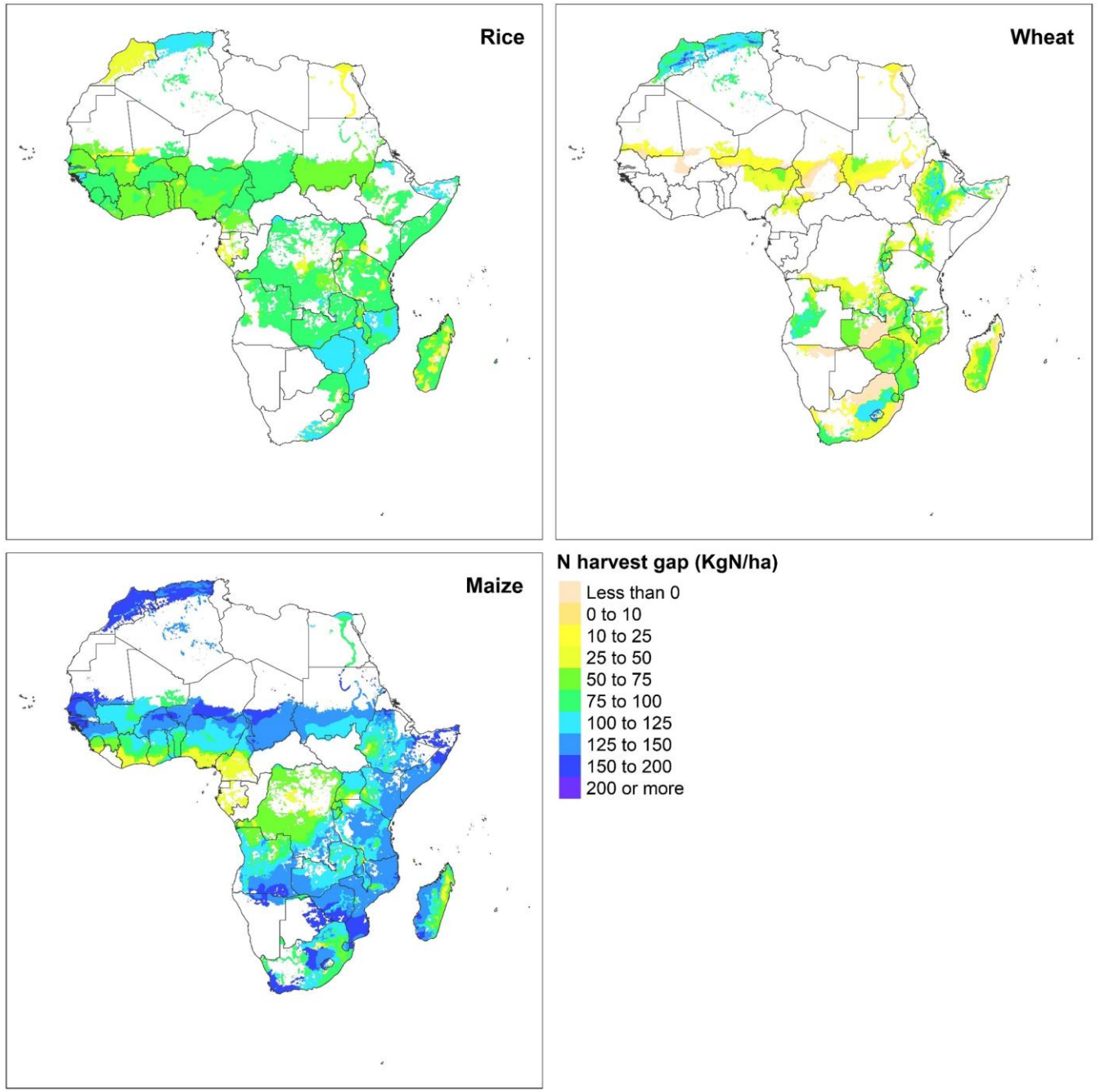
- Data: NUE atlas



N harvest gaps across Rice, Wheat and Maize fields in African contient

Data: NUE atlas

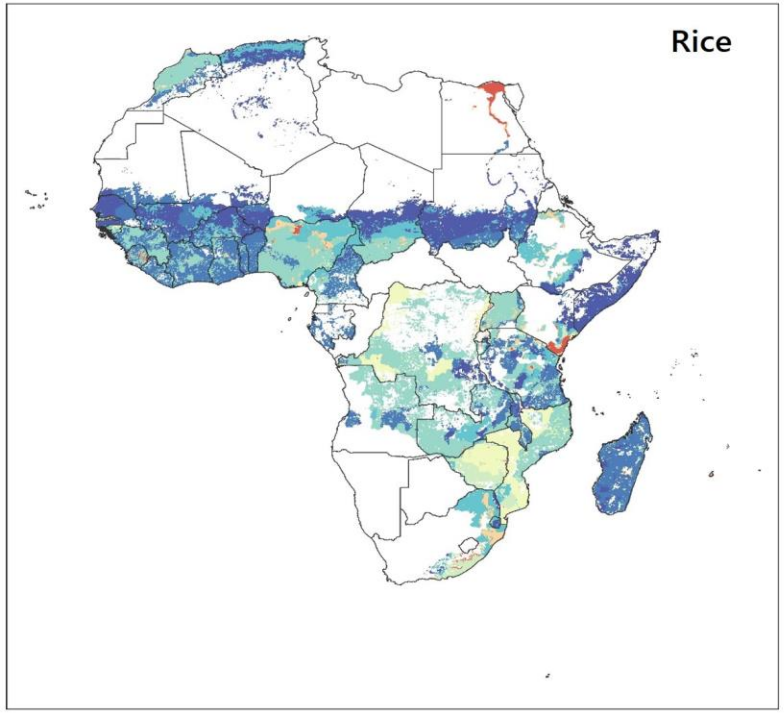
FAO GAEZ yield potential

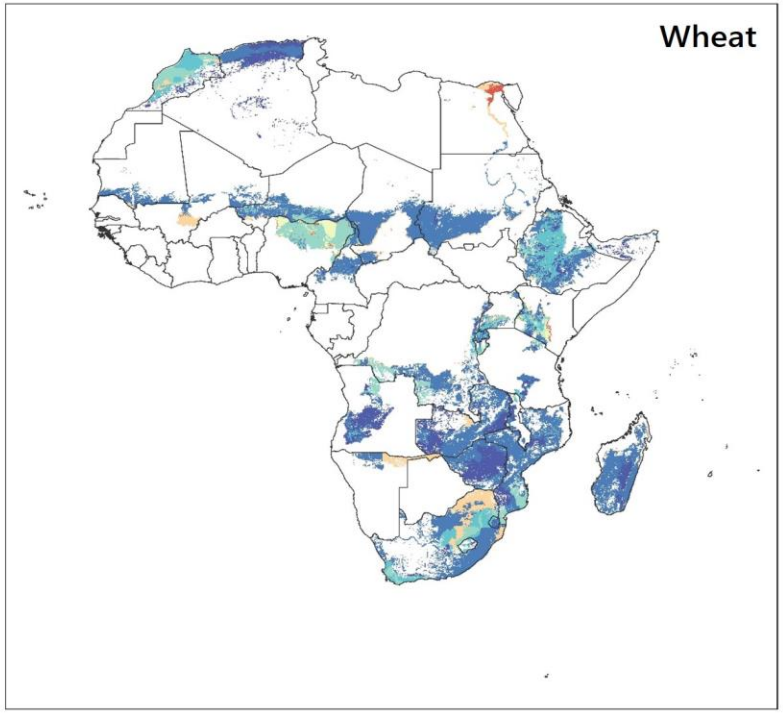


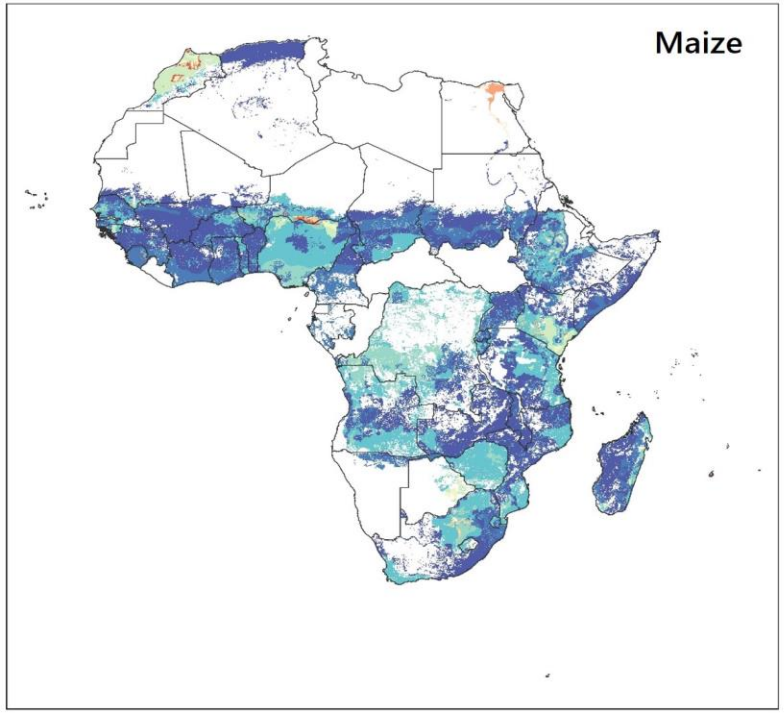
Classification of Rice, Wheat and Maize area based in N surplus/deficit, nitrogen use efficiency, and N removal gap

Calculation

N Surplus/deficit: N input-N output
NUE: N output/N input (NUE≤ 30 , 30 < NUE < 90, NUE ≥ 90)
N harvest gap: Potential N harvest-Actual N harvest







N classification

- Surplus N, Low NUE, Low harvest gap
- Surplus N, Low NUE, High harvest gap
- Surplus N, Med NUE, Low harvest gap
- Surplus N, Med NUE, High harvest gap
- Deficit N, Low NUE, Low harvest gap
- Deficit N, Low NUE, High harvest gap
- Deficit N, Med NUE,Low harvest gap
- Deficit N, Med NUE, High harvest gap
- Deficit N, N mining, Low harvest gap
- Deficit N, N mining, High harvest gap

Data: NUE atlas &
FAO GAEZ yield potential

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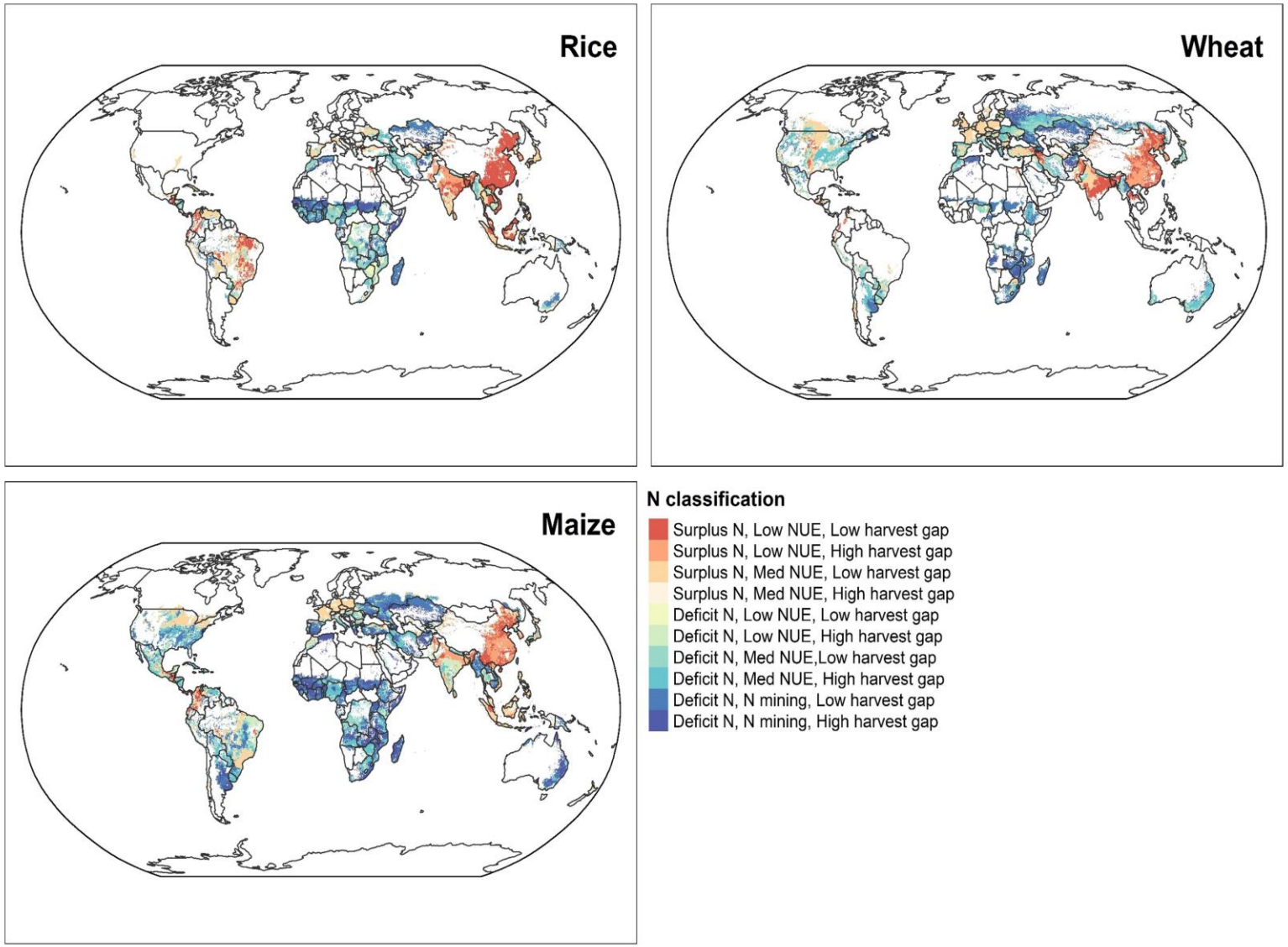
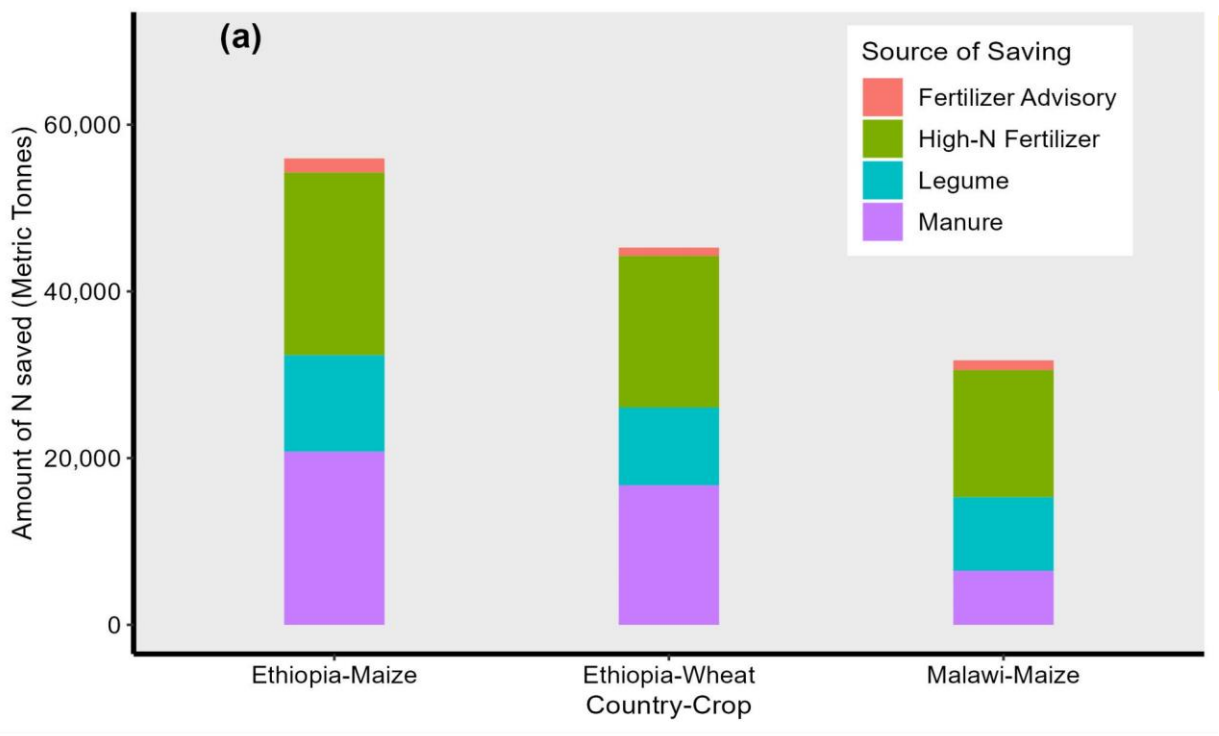
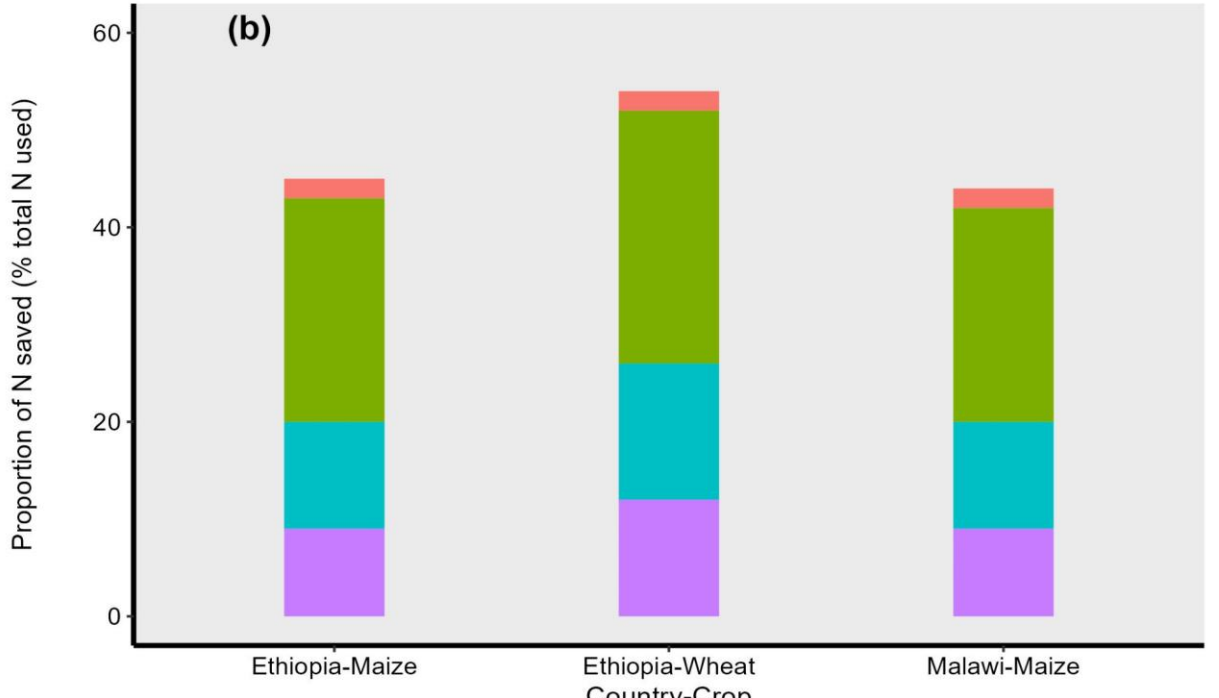


Data: NUE atlas &
FAO GAEZ yield potential

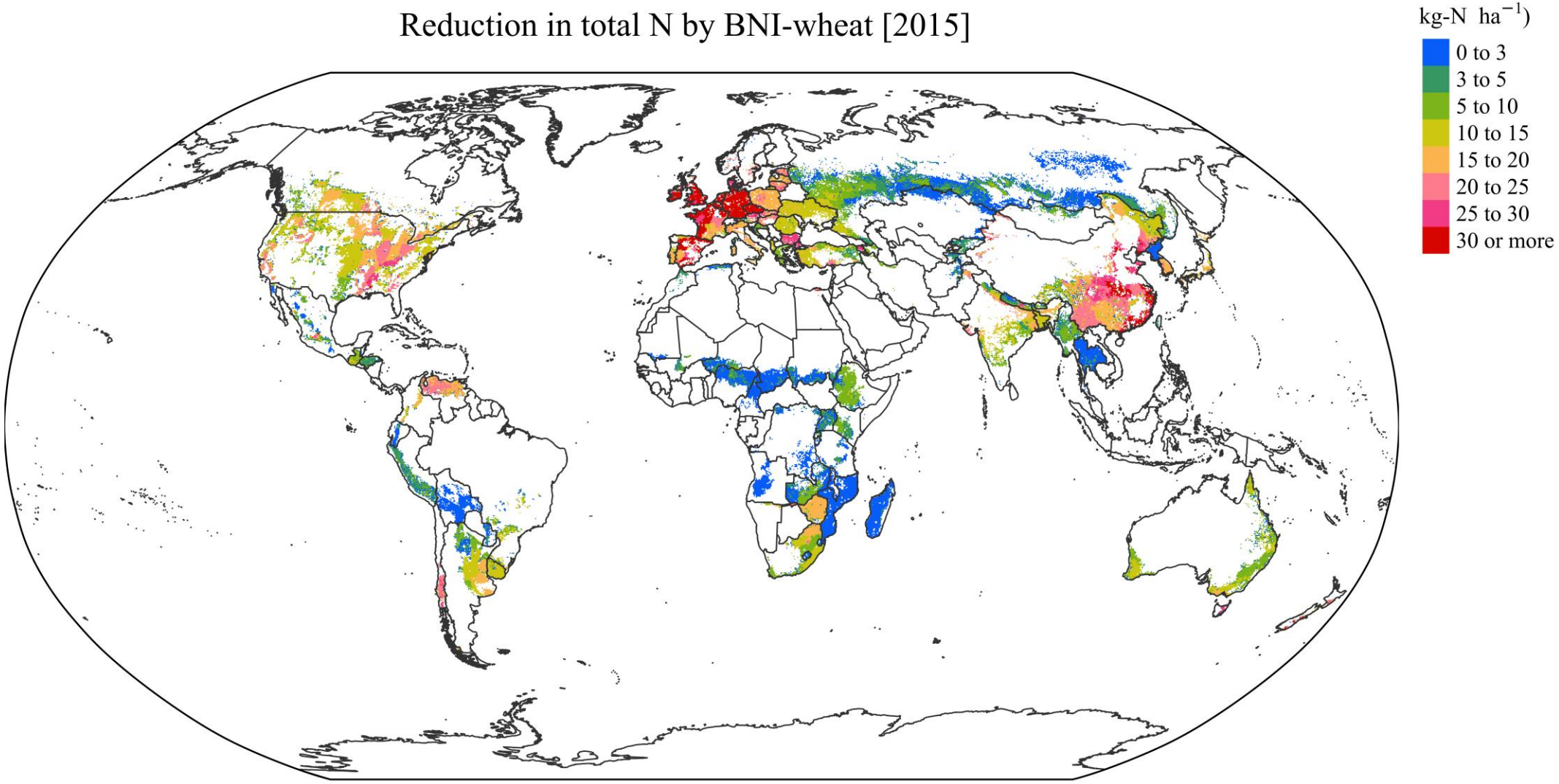
Few Recommended Strategies

- Using high N-containing fertilizer
- Decision support systems (SSNM)
- In-season N management
- Biological sources of N (legume integration)
- Organic inorganic integration
- Reallocating public subsidies to more cost-effective, high-N fertilizers
- Fertilizer advisories prescribing improved fertilizer management strategies





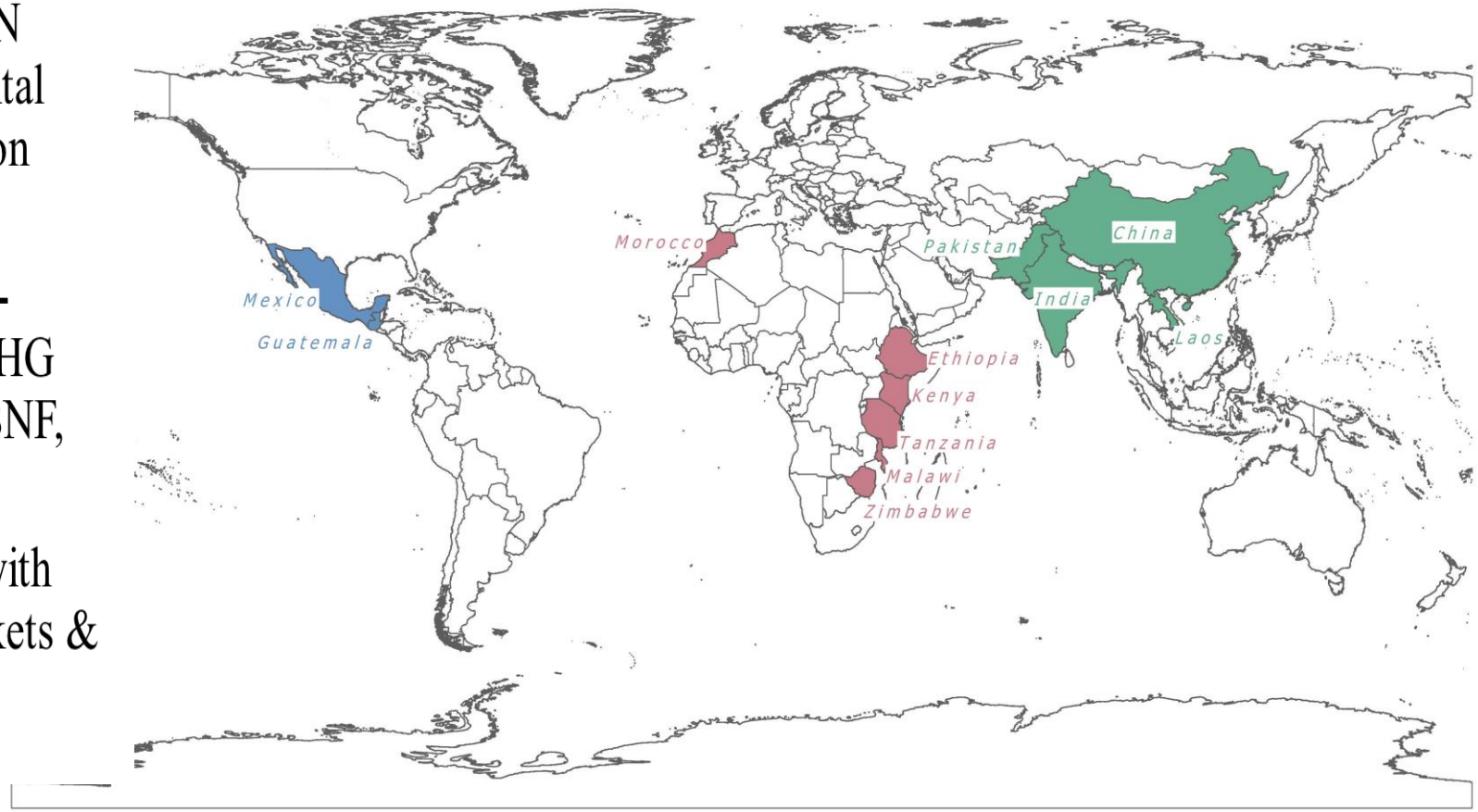
Reduction in total N fertilization by BNI-wheat



Strategies going forward

AIM4C: Implement and scale-up range of climate robust nutrient management strategies in 12 countries to reach millions of smallholder farmers

- **Increasing the uptake** of tried and tested N management practices (e.g. living lab, digital extensions, citizen science, ICT and decision support systems)
- **Continuous R4D on cutting-edge nature-based solutions** for Managing N, C and GHG simultaneously for net zero farming (e.g. BNF, BNI, ISFM)
- **Market and Policy**: Connecting farmers with Carbon credit and ecosystem services markets & repurposing subsidies



Thank you for your interest!