



# Climate-smart, sustainable and nutritious food for all

How can public agricultural research engage with agri-business to tackle sustainability challenges?

**Alain Vidal**  
CGIAR System Organization





# Global food system in crisis

## Nutrition

2 billion people suffer from micronutrient deficiency, while 2 billion people are overweight or obese

## Climate

Crop yields are reducing from impacts of climate change, floods and droughts now affect over 150 million people per year

## Hunger

1 billion people live on less than US \$1.25 per day, 800 million of whom are chronically undernourished.

## Equality

Women remain particularly disadvantaged, lacking access to resources, providing much of the labor without fully sharing in its financial returns.

## Resources

Overexploitation left an estimated 3.5 billion ha of degraded land unproductive, unsustainable water use threatens 40% of the world's grain production.

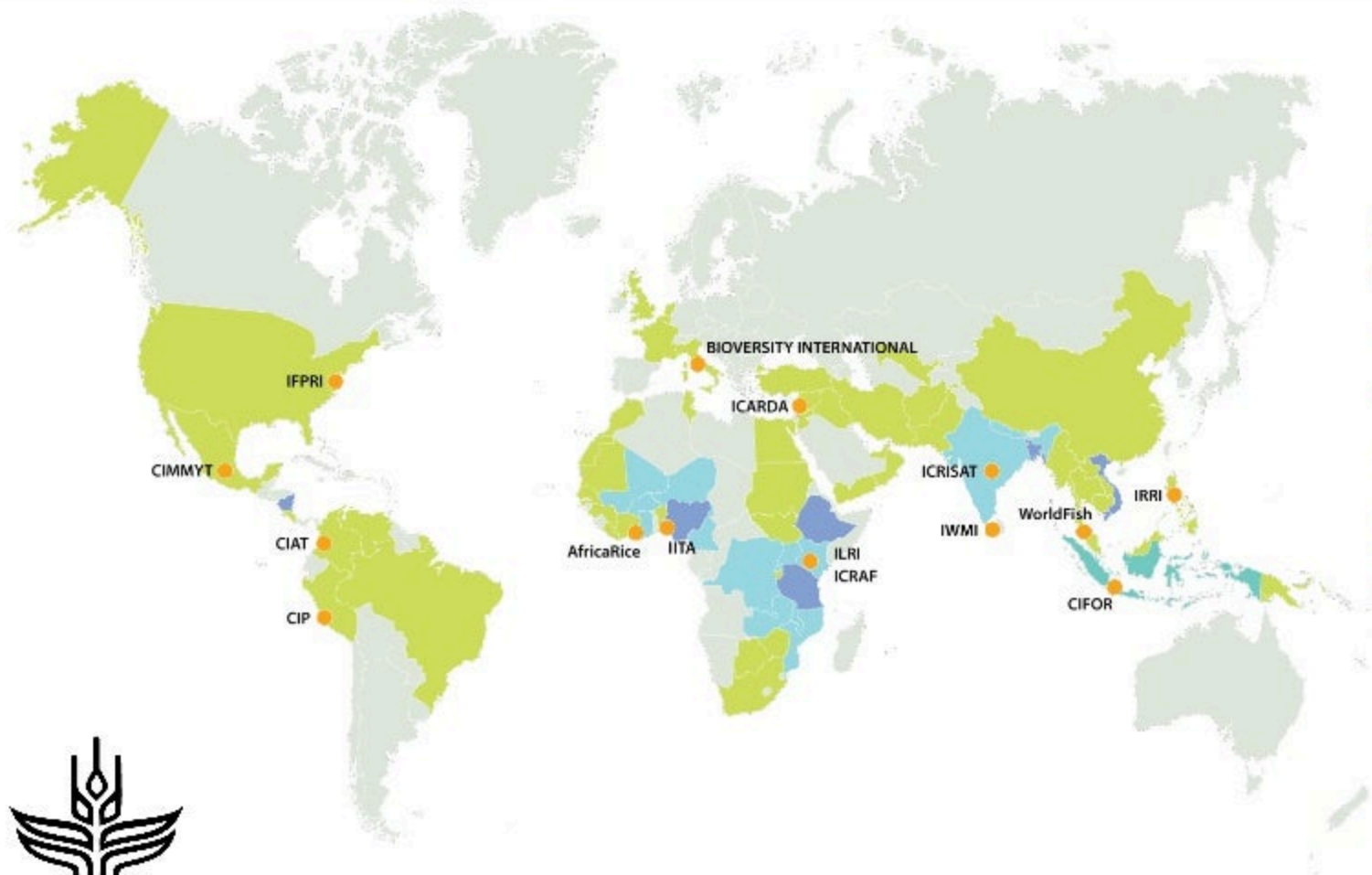






**CGIAR** is committed to advance agri-food science and innovation to enable poor people, especially women, to better nourish their families, and improve productivity and resilience





## CGIAR on-the-ground collaboration

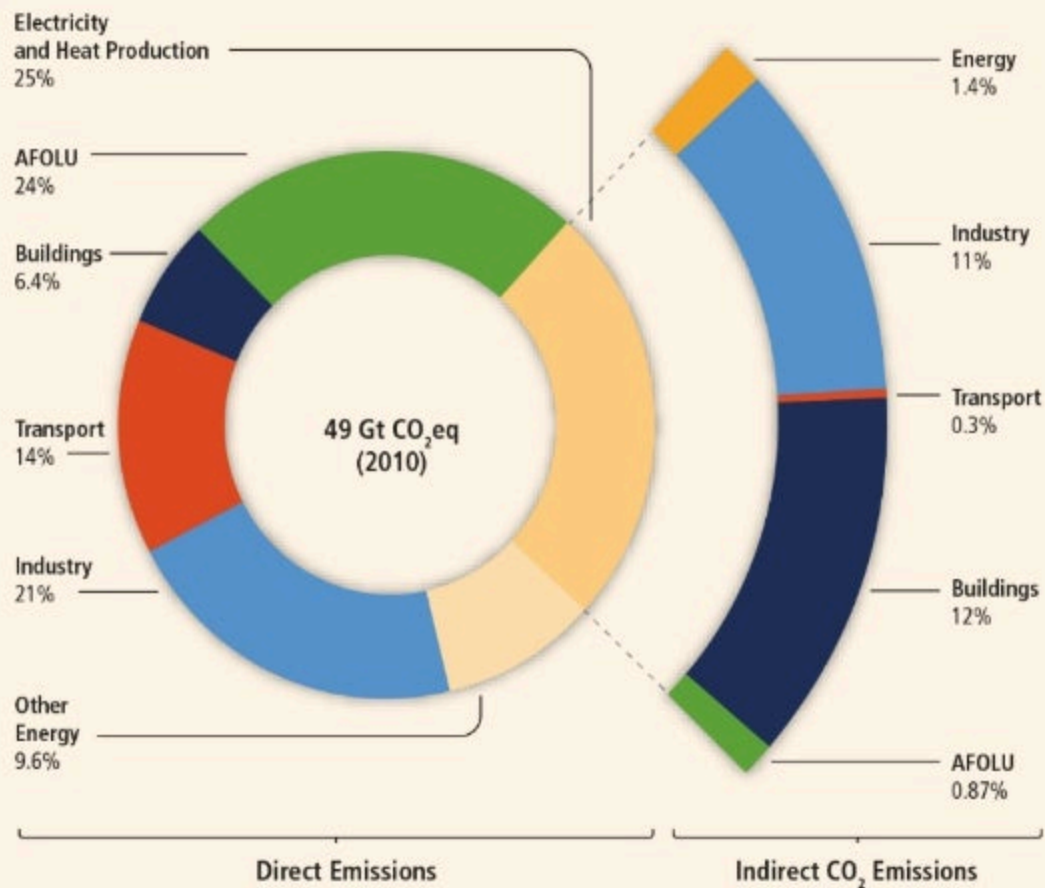
- CGIAR Member Center Headquarters
- Countries with CGIAR Offices and Stations
- Site Integration ++
- Site Integration +





# CGIAR and its partners aim to





Source: IPCC WGIII

## Our food system: the largest driver of climate change

- 24% of global greenhouse gas emissions today
- 50% tomorrow under BAU



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# The first economic sector impacted by climate change

Crop yields drop by 2050 under BAU:

- Maize 16%
- Rice 21%
- Wheat 42%
- Coffee 50%

## Effects of Climate Change on Global Food Production



Projected Maize Yield Change in %  
1970-2000 Baseline to 2050, SRES A1F Scenario



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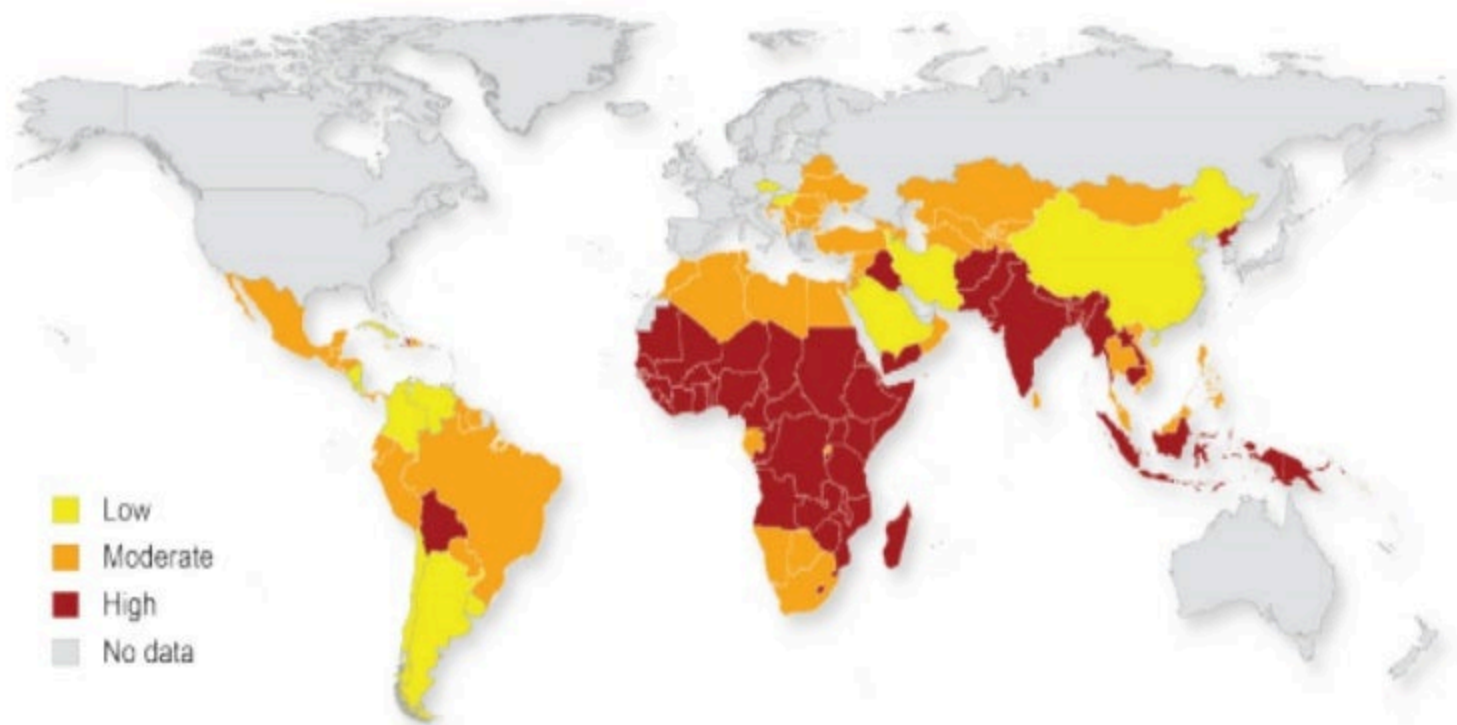
Publication Date: March 2006

This map is for illustrative purposes and does not imply the expression of any opinion on the part of the co-authors, CGD/CDF, or their sponsors concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.



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# Severity of Micronutrient Deficiencies: Vitamin A, Iron, and Zinc





- The most important human food, eaten by more than half of the world's population everyday
- In Asia, where 90% of rice is consumed, rice security, is equivalent to food security
- IRRI & HarvestPlus develop healthier rice varieties to help those in need get more nutrients into their diet to reduce malnutrition





- “Rice-producing Asia” - 91% of world rice production and a net exporter of rice to the rest of the world

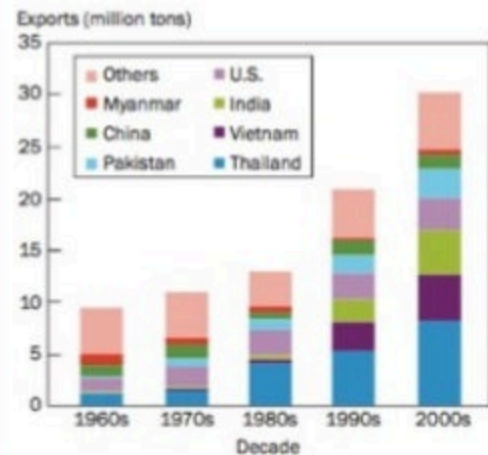


Fig. 3.7. Rice exports (million tons) by country, 1960 to 2009. Source: USDA data.

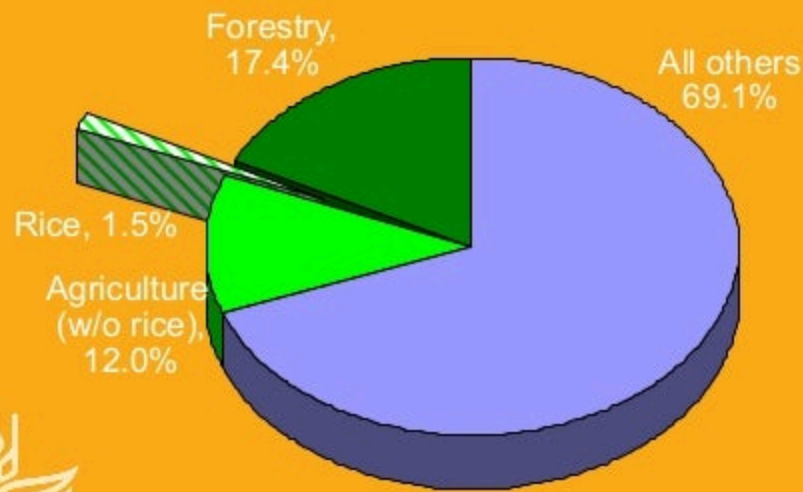
- Rice research has provided 75% of the rice varieties now grown and increased potential yields from 4 to 10+ t/ha/crop



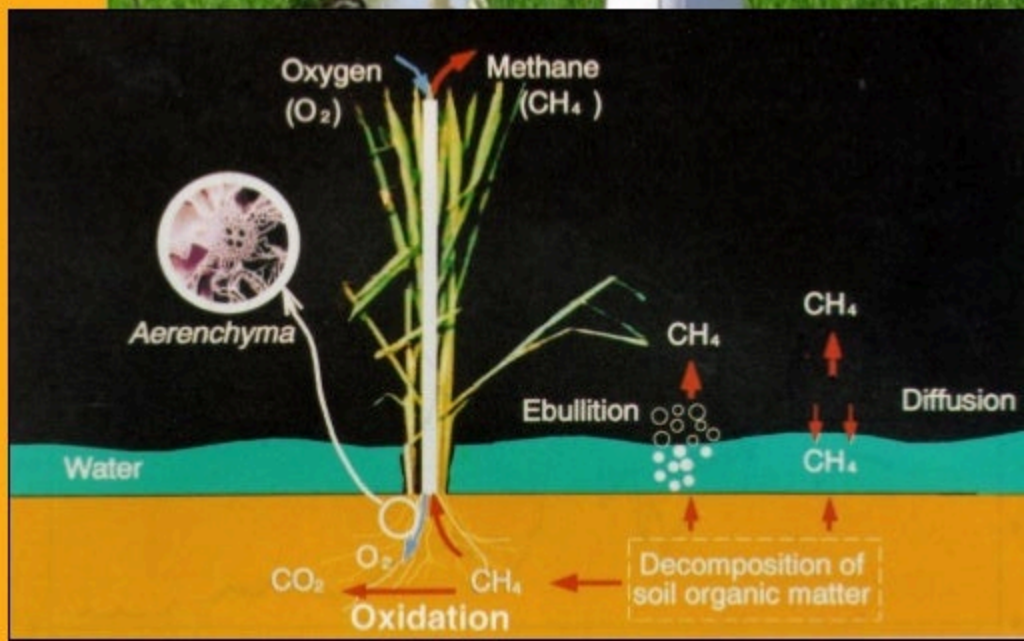


# GHG emissions from rice fields

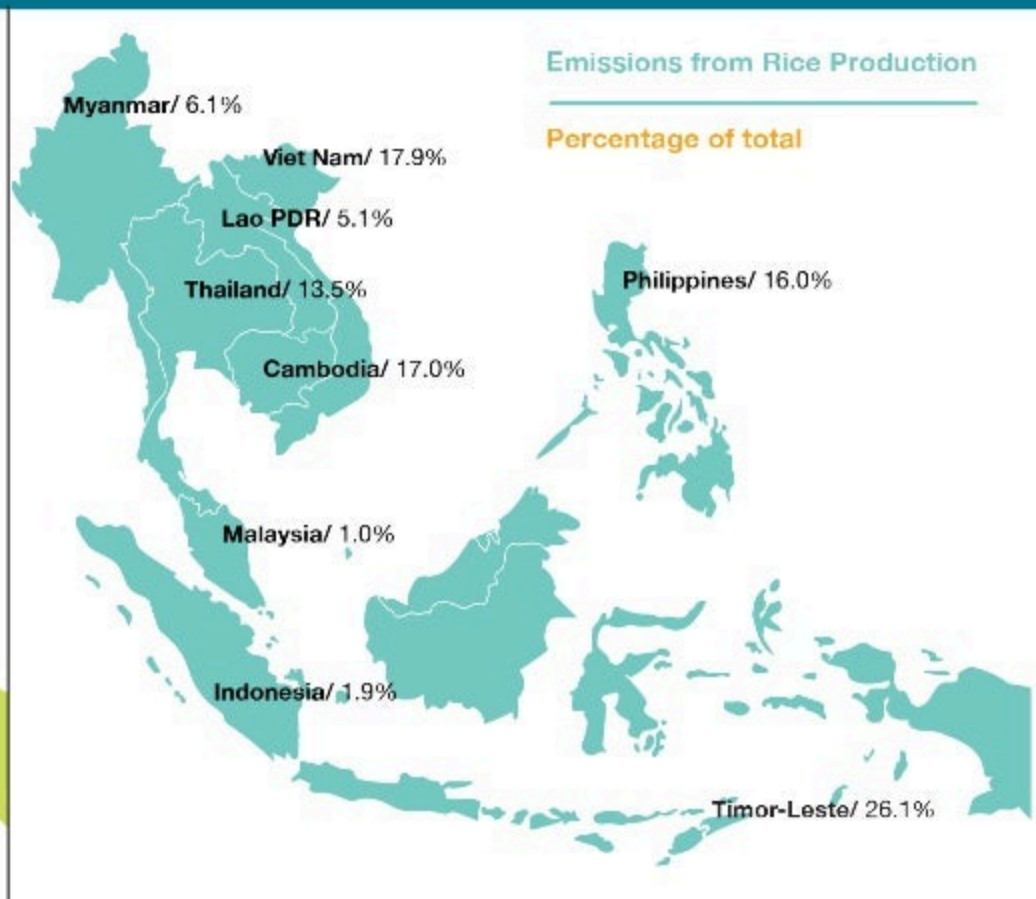
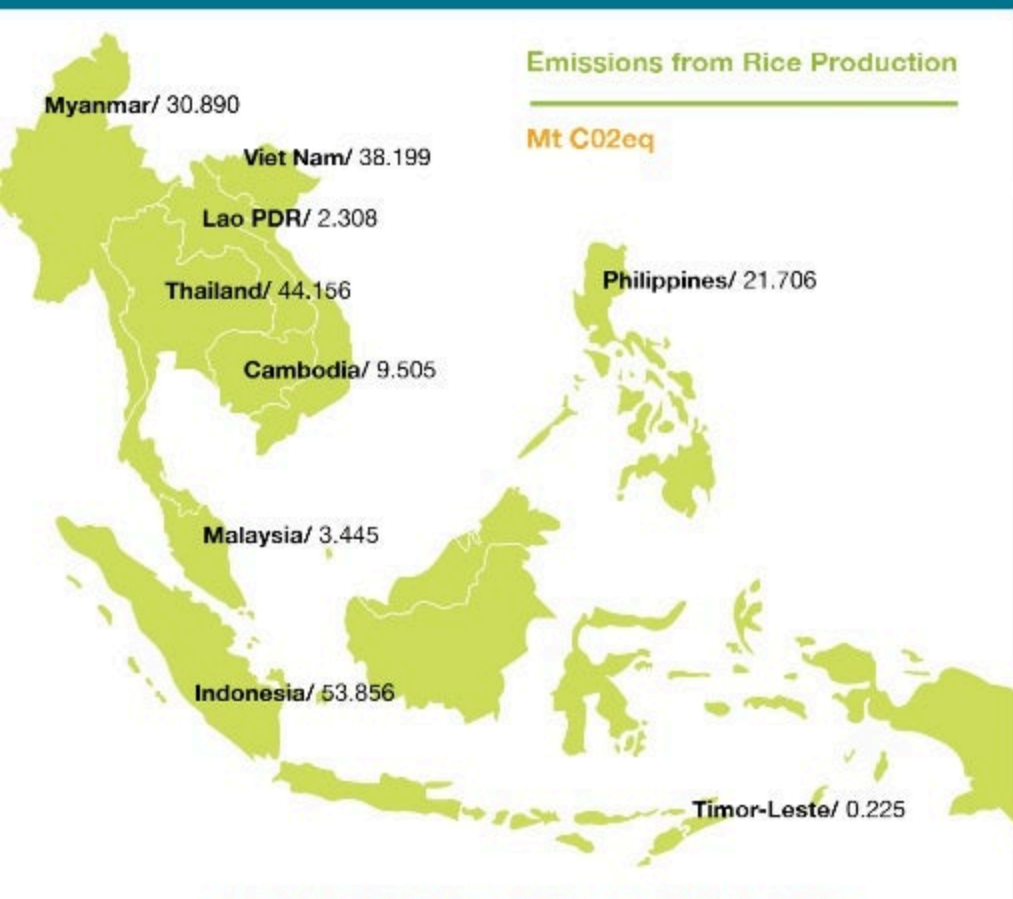
Mostly methane - 21 CO<sub>2</sub>eq



(IPCC 4th AR, 2007)

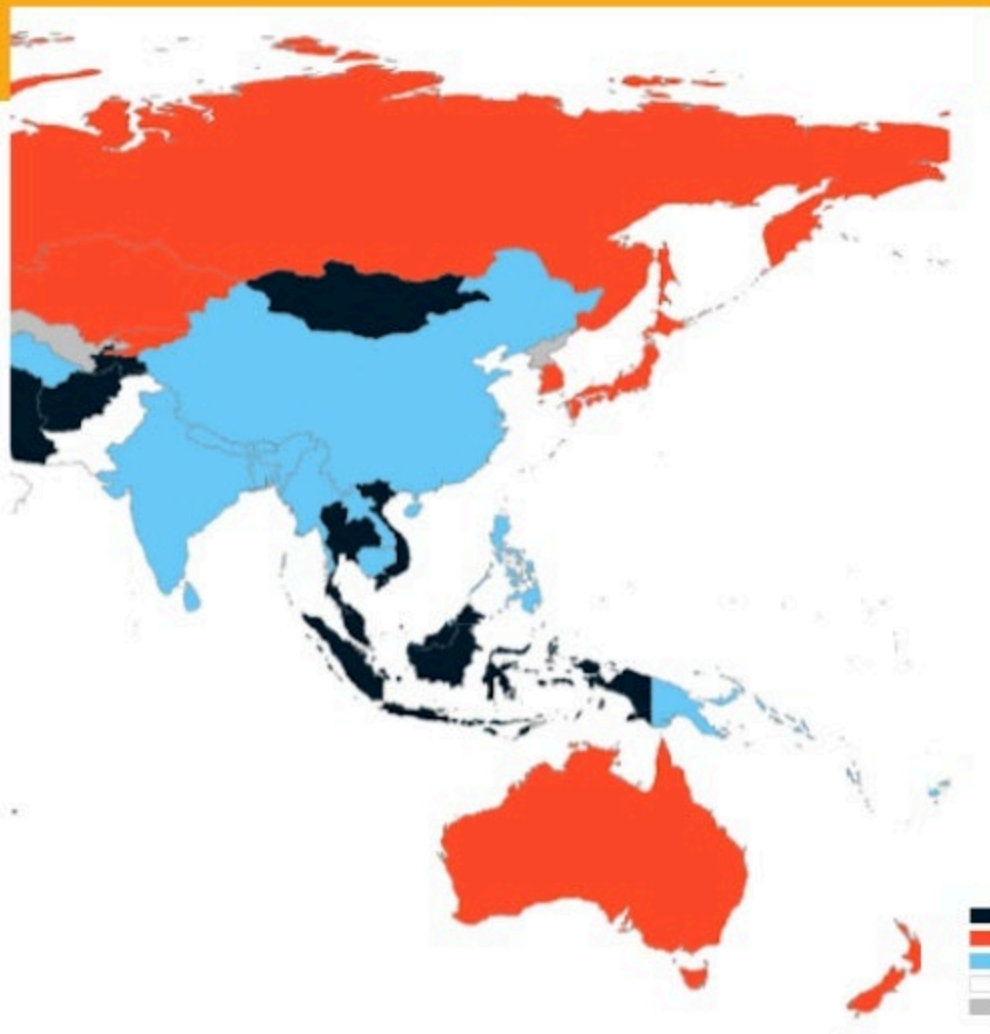


# GHG emissions from rice in South East Asia





# Mitigation from and adaptation of agriculture reflected in INDCs



Discussing INDCs improvement with country representatives at SBSTA44 in Bonn

## Agriculture in the INDCs

- Mitigation target and adaptation priorities include agriculture
- Mitigation target includes agriculture
- Adaptation priorities include agriculture
- No agriculture in INDC
- No INDC



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# Mitigating methane emissions from rice production



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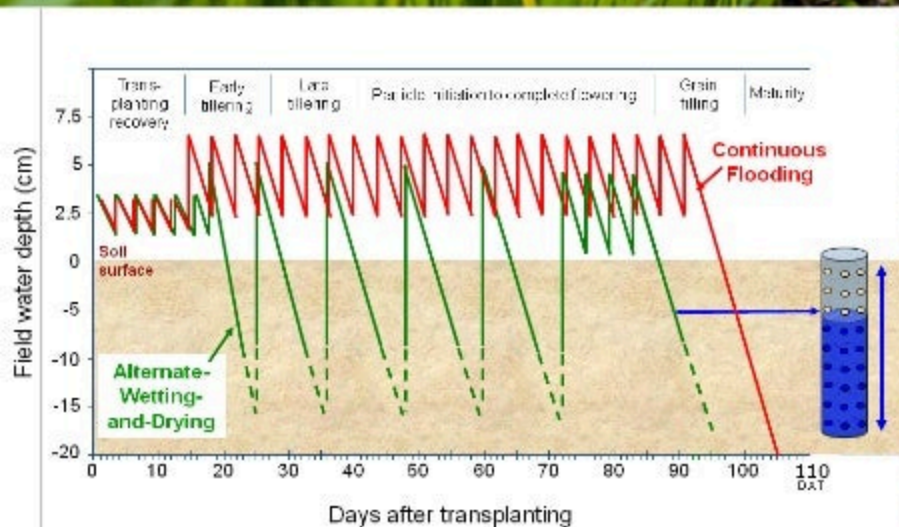
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CLEAN AIR  
COALITION  
TO REDUCE SHORT-LIVED  
CLIMATE POLLUTANTS





- Irrigation techniques that reduces water use by 15-30%
- Reduces methane emissions by 50%
- Irrigate when water depth ~ - 15cm
- Keep flooded until 15 days after transplanting and during flowering

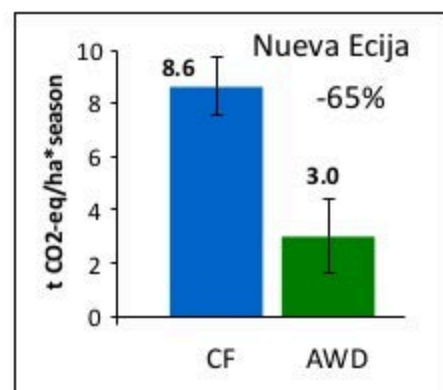
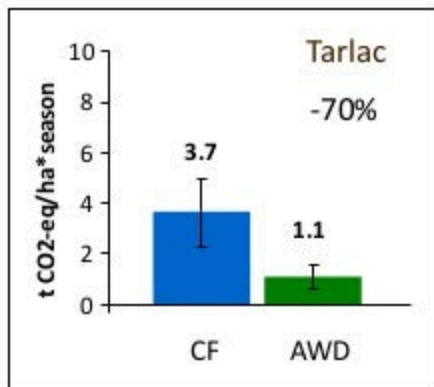
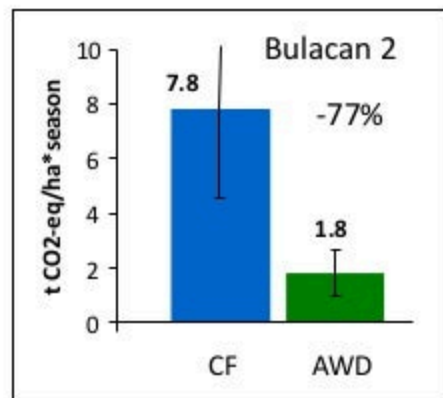
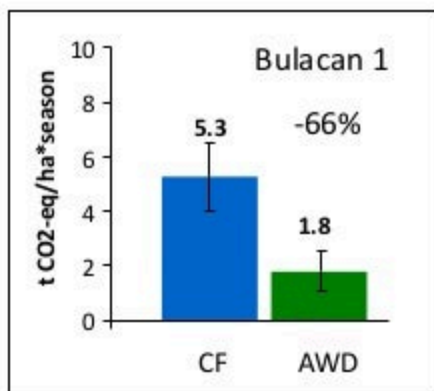
## Alternate wetting and drying (AWD)



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# Mitigation potential of AWD: Results from farmers' fields



Sander et al., manuscript in preparation



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COALITION  
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CLIMATIC POLLUTANTS





# Assessment of co-benefits of AWD-CCAFS Project

Better root development

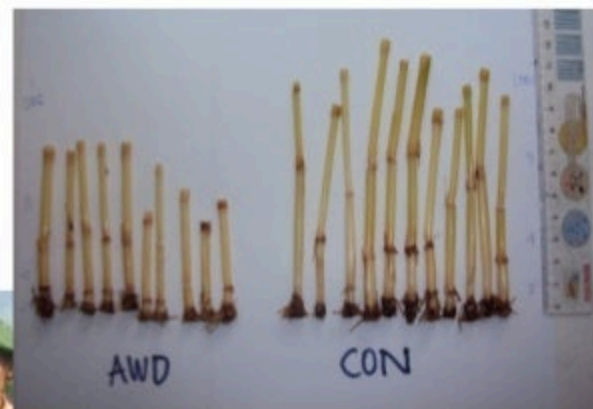
= Higher nutrient uptake

Shorter internodes

= Higher lodging resistance

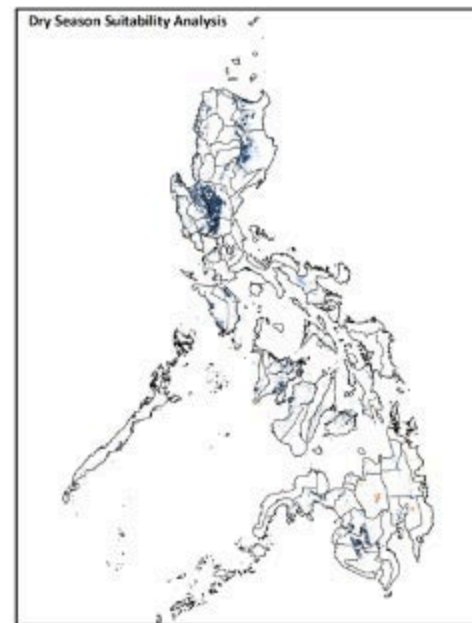
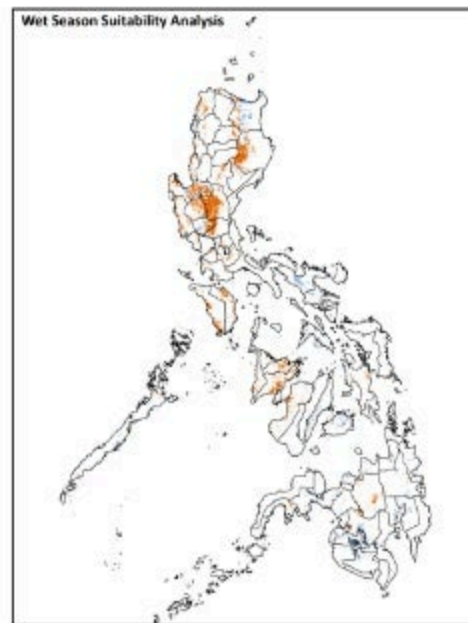
Reduced pests (eg BPH)

= Less pesticide use



# Climatic AWD suitability mapping

- Based on cropping calendar, rice extent and water balance
- Considering biophysical factors only
- Further improvement/ongoing research on salinity, flooding, irrigation, pests (rats, leptospirosis)
- Expansion of suitability maps to Vietnam & Bangladesh (under revision by countries)



Assessment Philippines: Sander et al., 2017



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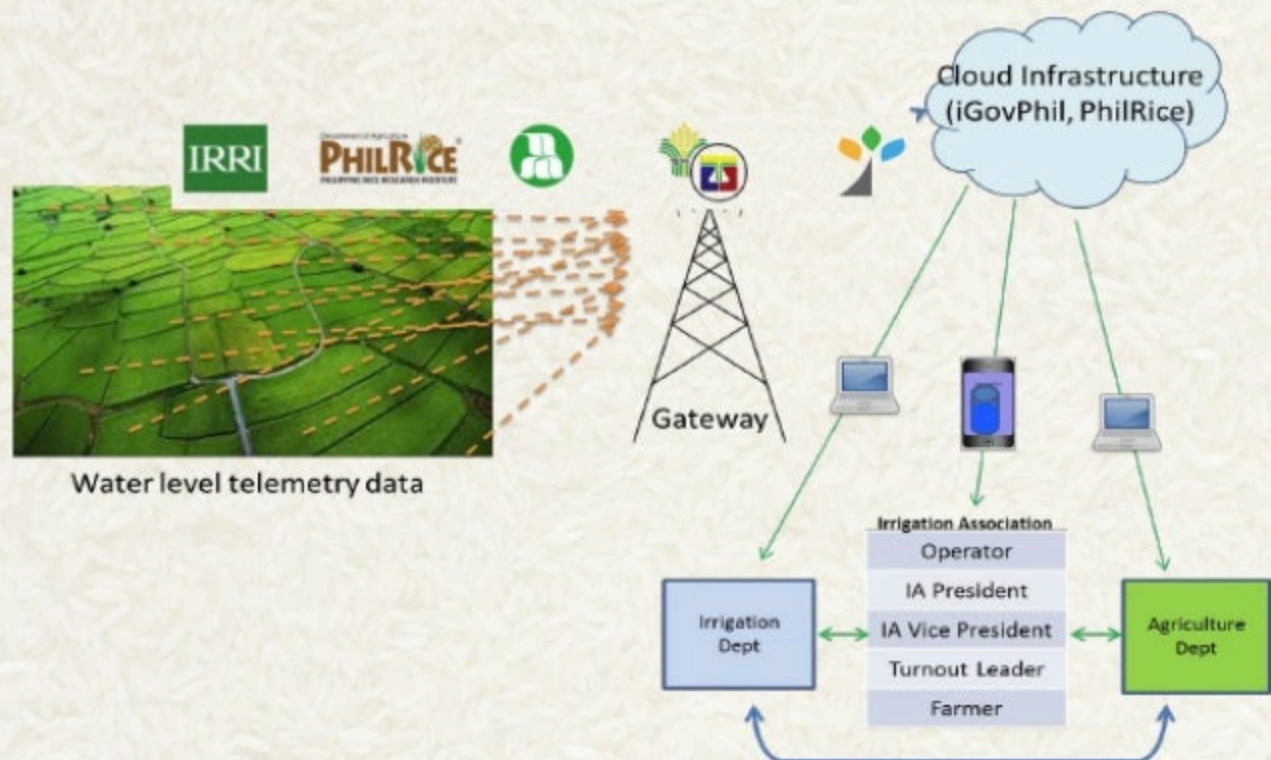
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CLIMATE POLLUTANTS





# AWD requires smarter water management

## How **AutoMon<sup>PH</sup>** work?



# More nutritious rice



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Nutrition  
and Health

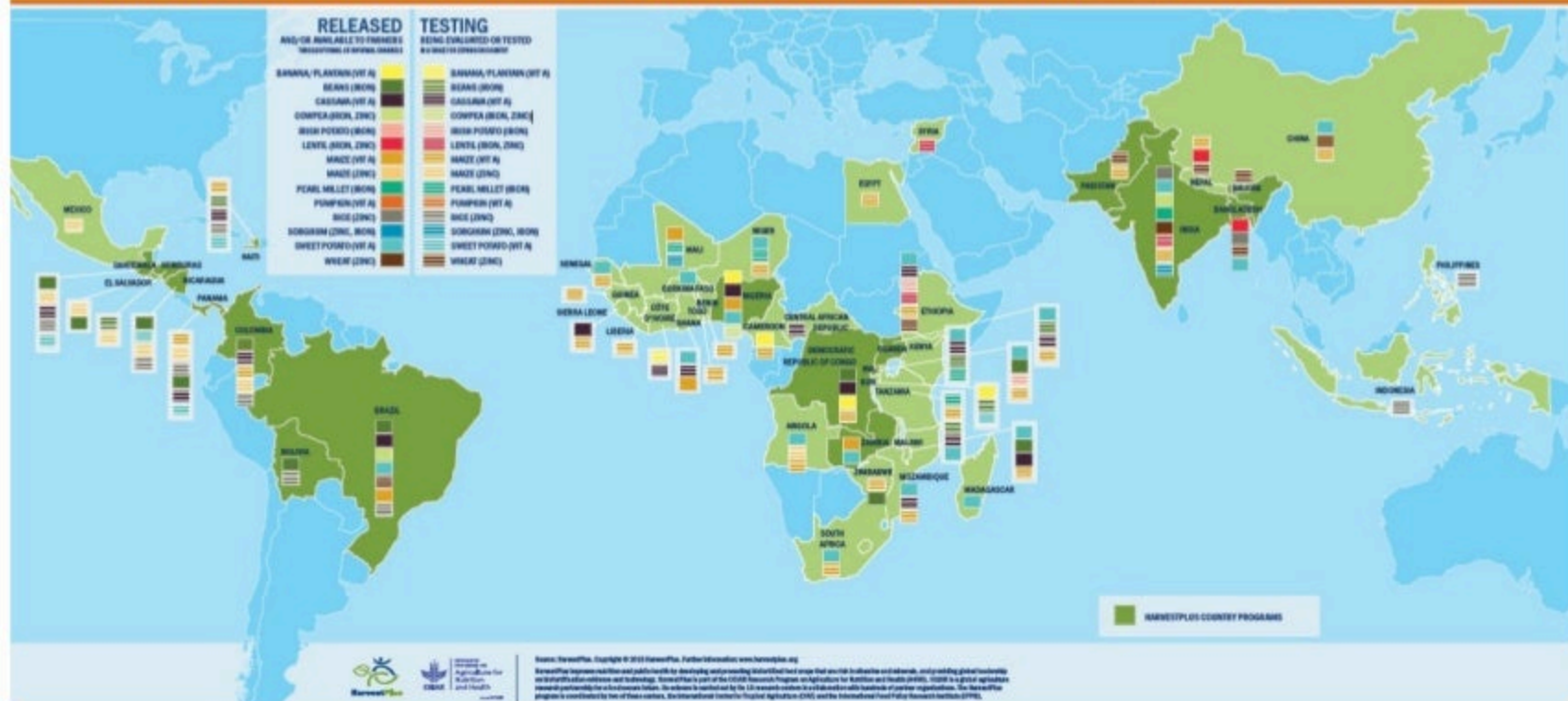




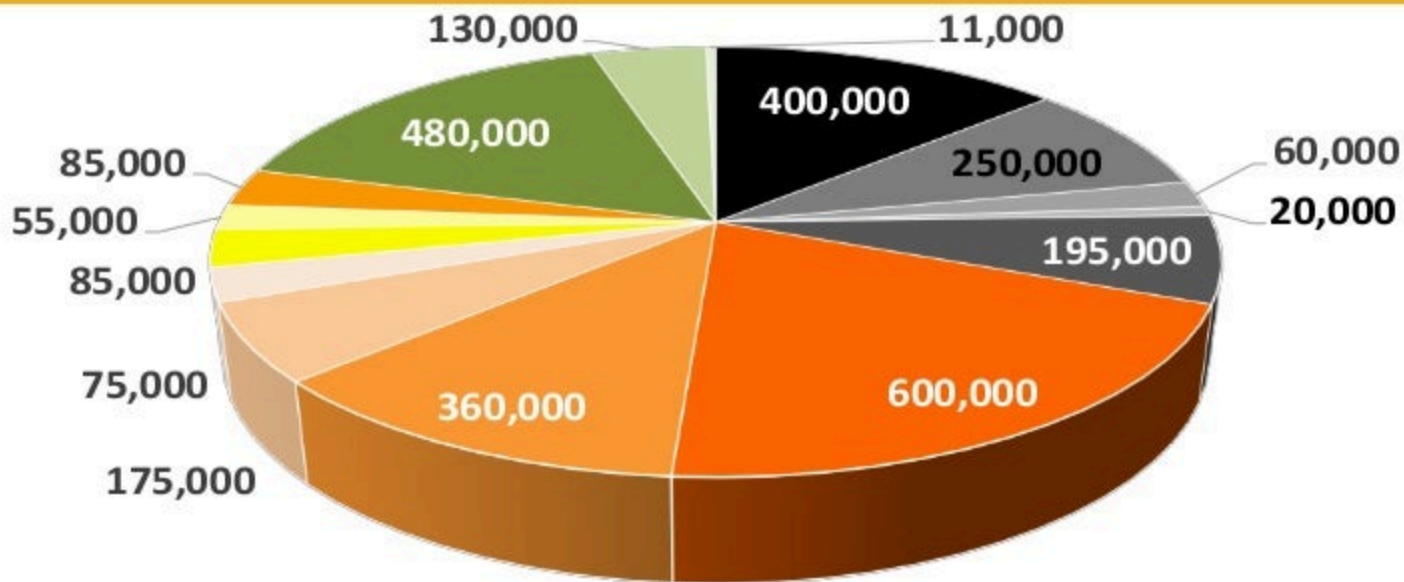
# Present reach of biofortification

## NUTRITIOUS STAPLE FOOD CROPS: WHO IS GROWING WHAT?

These crops have been conventionally bred to be rich in essential vitamins and minerals that are needed for good health.



# Three million households targeted in 2016

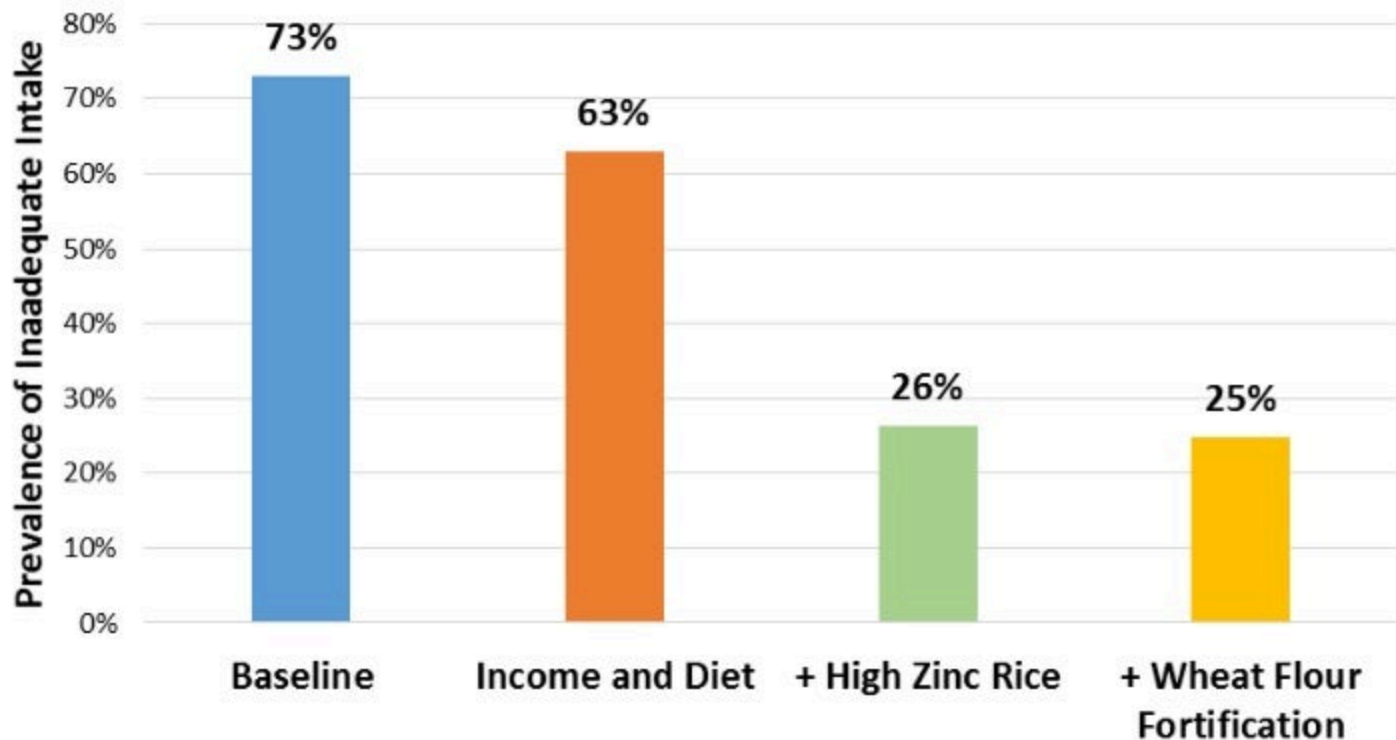


- Iron Bean Rwanda
- Iron Bean DRC
- Iron Bean Uganda
- Iron Bean Zimbabwe
- Iron Pearl Millet India
- Vita-A Cassava Nigeria
- Vita-A Maize Zambia
- Vita-A Maize Nigeria
- Vita-A Maize Zimbabwe
- Vita-A Maize DRC
- Vita-A OSP Uganda
- Zinc Rice Bangladesh
- Zinc Wheat India
- Zinc Wheat Pakistan



# Incremental changes in the prevalence of inadequate Zinc intake

Change in the Prevalence of Inadequate Zinc Intake Over 30 Years, Bangladesh



# Science-based solutions for agribusiness sustainability







## Wicked problems can't be washed away

Climate change, sustainability and food security impose *wicked* problems, that hit industries in all their supply chains

“Good communication” (e.g. imposing a tax on palm oil) diverts from the real issues

Time wasted whereas the Earth will reach +1.5°C in 7 years from now!



# Public-Private Science Dialogue

Lessons from TFT (The Forest Trust)

dialogue on palm oil vs. deforestation

- 50% of palm oil produced by smallholders at only 20% of potential
- Engaging with smallholders and policy makers has more impact than certification
- Reconsidering supply chains and supplying landscapes (maps) helps reconnect with national and local governments, and re-establish dialogue





# Potential “Mega Varieties” Emerging



Mega-Varieties have potential to assume a major market share, high demand, pull strategy and use as platforms to derive next wave varieties by improving traits based on feedback from farmers



# Towards a Low Carbon Rice Fund (Vietnam)



## Opportunities:

- Water management for reduced emissions a priority in Vietnam's INDC
- Areas of biophysical suitability identified
- Sustainable rice as way for business to enter new markets

## Challenges:

- Lack of control over water at farm level
- Lack of incentive to save water due to flat fee or free pricing
- Rice companies not currently recouping cost

## Solution being explored:

- **Low Carbon Rice Fund:** payments for certified emission reductions from rice
- Would require public-private partnership and solid MRV

Demand side

Low Emission  
Development  
opportunities in the  
rice sector

Viable investment plan

Favorable policy conditions

Monitoring, reporting & verification

Supply side

Sources and  
types of  
international  
finance