

Global and local food security and the Sustainable Development Goals

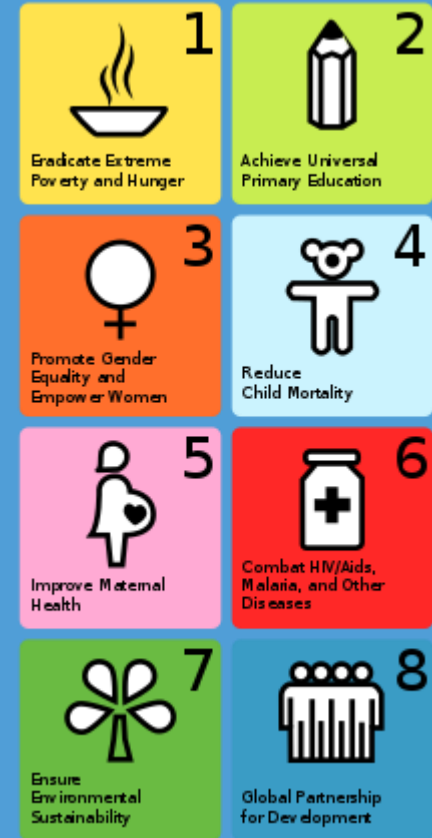
Martin van Ittersum

*Professor Plant Production Systems
Wageningen University & Research*

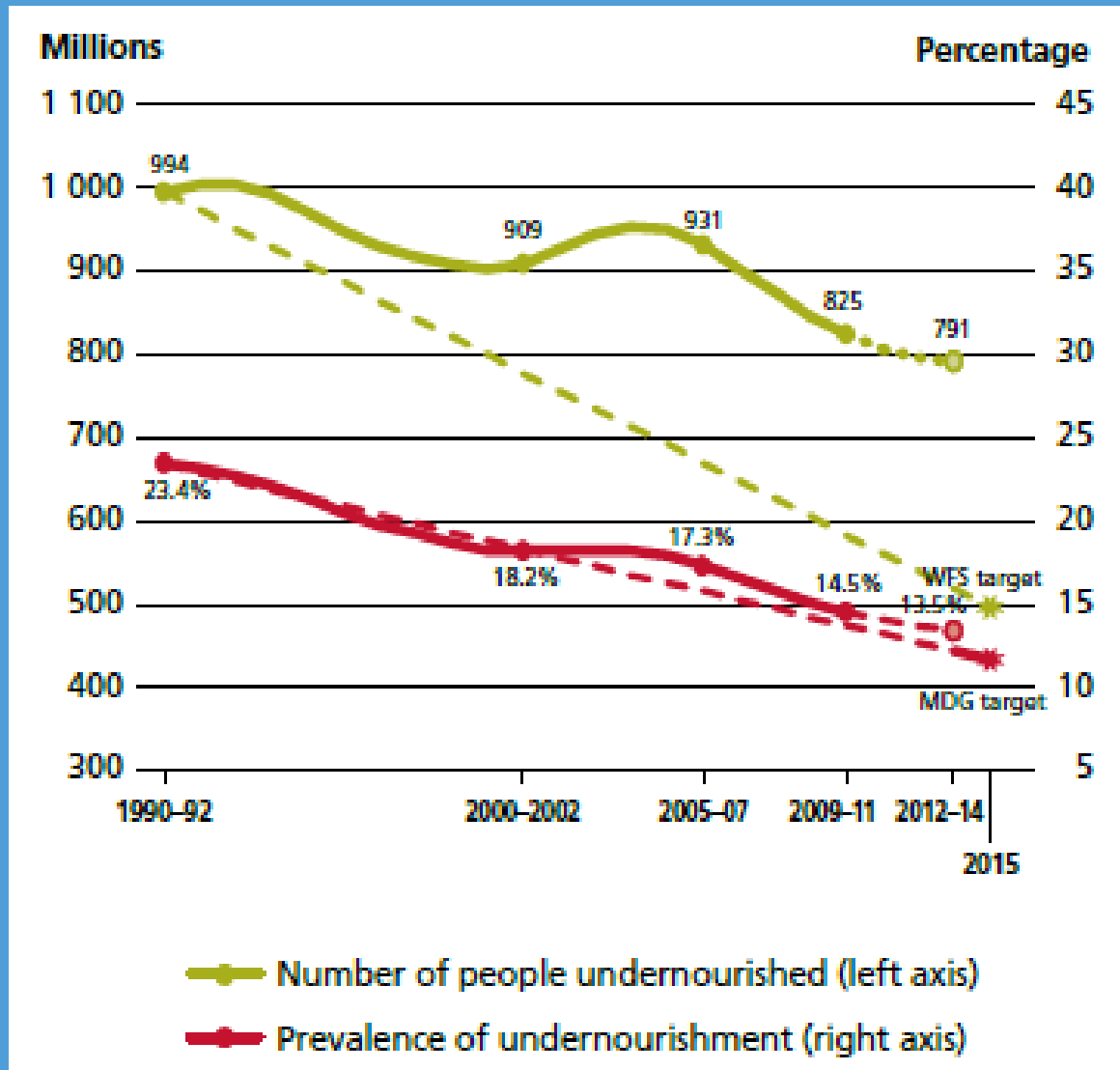


Millennium Development Goals (2000-2015)

- The Millennium Development Goals (MDGs) were eight goals with measurable targets and clear deadlines for improving the lives of the world's poorest people.
- To meet these goals and eradicate poverty, leaders of 189 countries signed the historic millennium declaration at the United Nations Millennium Summit in 2000.

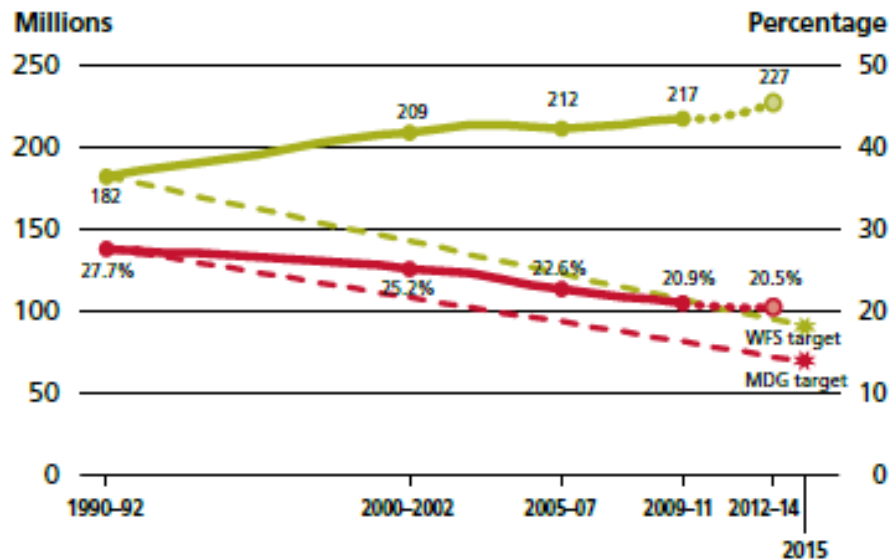


Number of hungry people

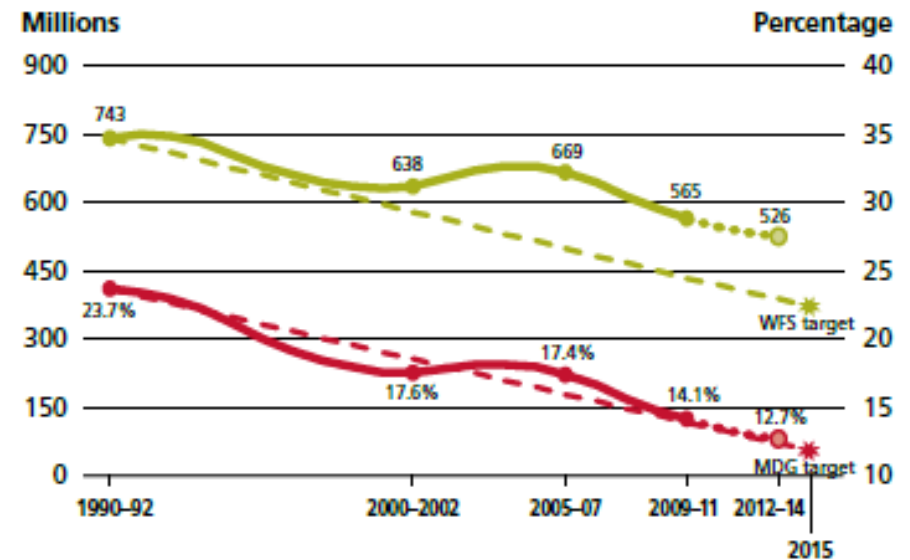


Where?

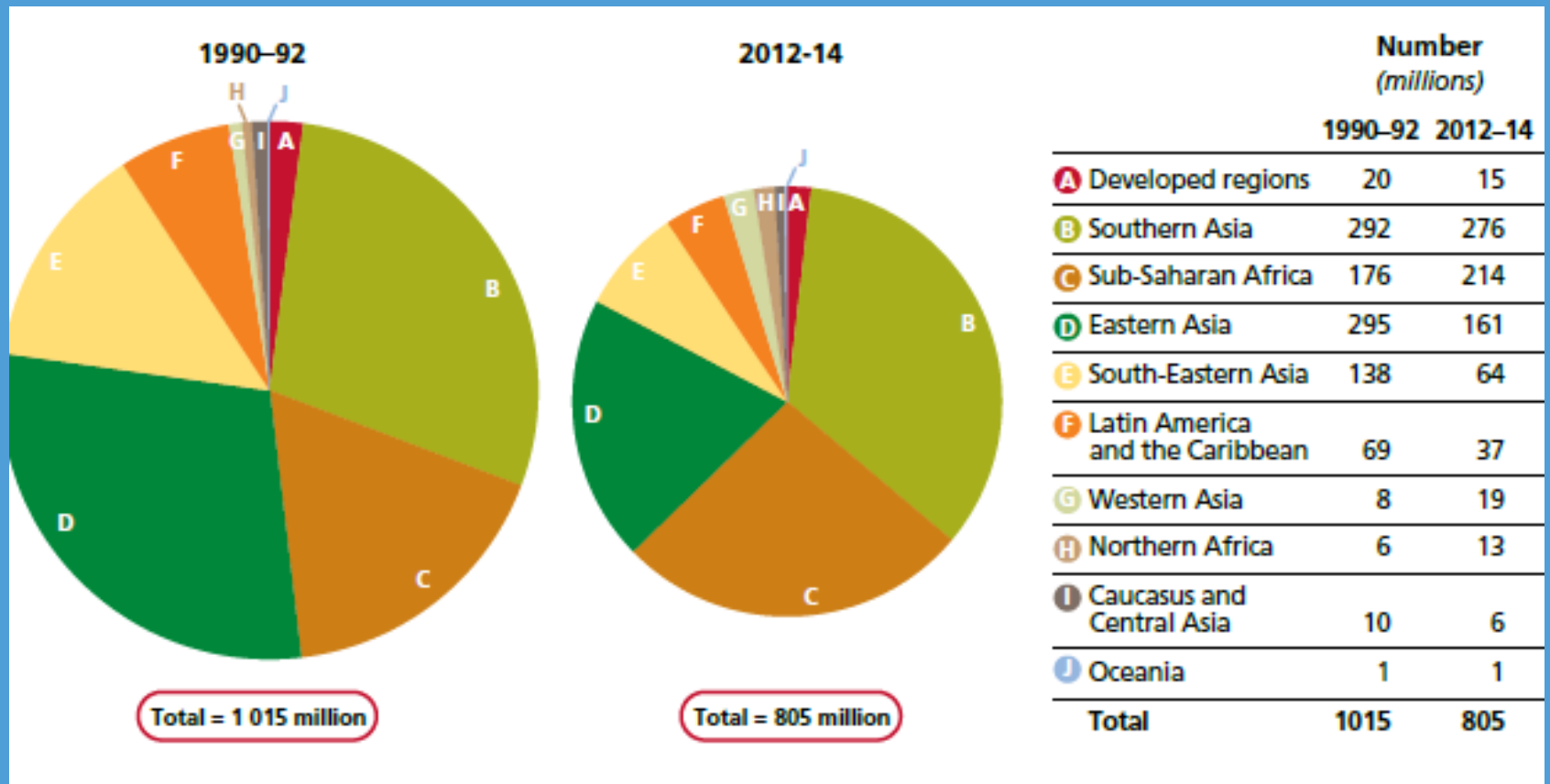
Africa



Asia



Where ?



The Sustainable Development Goals

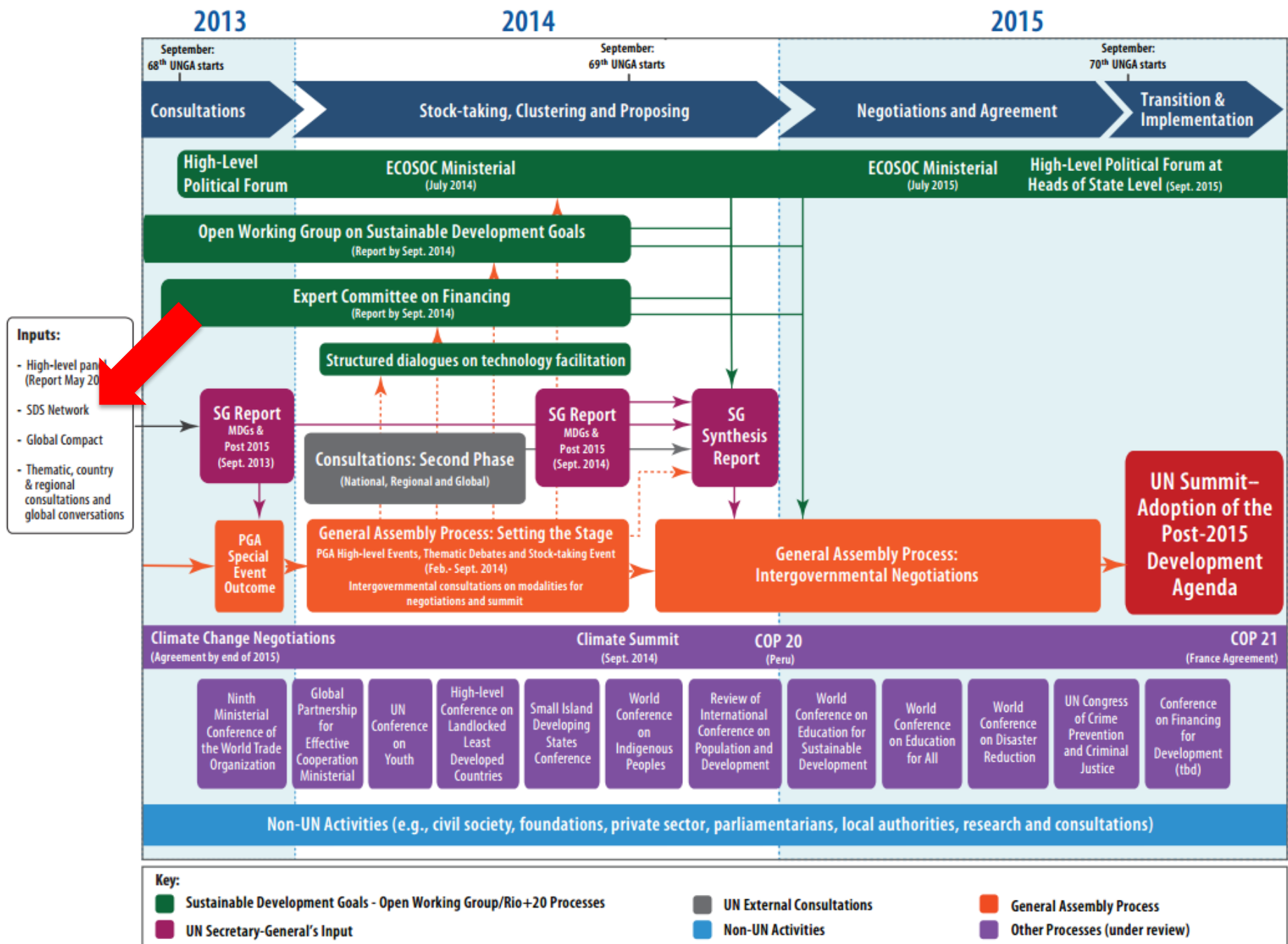
2015– 2030 - 17 Goals, 169 Targets, 230 Indicators



Key Differences with the MDGs

- Broader agenda in terms of topics (climate, terrestrial and marine ecosystems) than the MDG topics
- Apply to all countries (“universality”)
- Universal goals
- More participatory/inclusive approach to their development

Processes feeding into the Post-2015 Development Agenda



SDG Index and Dashboard Report 2017

NETHERLANDS

OECD Countries

OVERALL PERFORMANCE

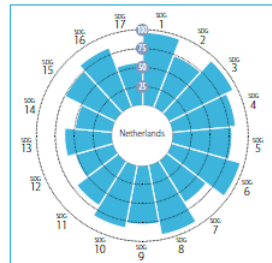
Index score



Regional average score



SDG Global rank
13 (OF 157)



AVERAGE PERFORMANCE BY SDG

COMPARISON WITH OTHER DEVELOPMENT METRICS

	GLOBAL RANK	SCORE OR VALUE	REGIONAL AVERAGE
GDP per capita, PPP (2015)	11/153	US\$ 46,354	US\$ 38,362
Subjective Wellbeing (2016)	4/133	75.0	66
Environmental Performance Index (2016)	36/155	82.0	84.5
Human Development Index (2016)	7/157	92.4	88.7
Global Competitiveness Index (2016/17)	4/134	79.5	71.4
Global Peace Index (2016)	21/149	69.2	67.1

SDG DASHBOARD



NIGERIA

Sub-Saharan Africa

OVERALL PERFORMANCE

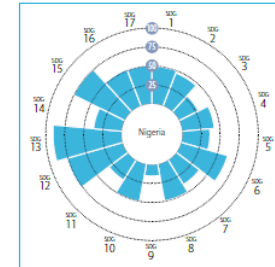
Index score



Regional average score



SDG Global rank
145 (OF 157)



AVERAGE PERFORMANCE BY SDG

COMPARISON WITH OTHER DEVELOPMENT METRICS

	GLOBAL RANK	SCORE OR VALUE	REGIONAL AVERAGE
GDP per capita, PPP (2015)	108/153	US\$ 5,639	US\$ 4,103
Subjective Wellbeing (2016)	77/133	52	41
Environmental Performance Index (2016)	120/157	58.3	52.8
Human Development Index (2016)	127/157	52.7	50.6
Global Competitiveness Index (2016/17)	123/134	48.5	51.4
Global Peace Index (2016)	139/149	42.5	56.5

SDG DASHBOARD

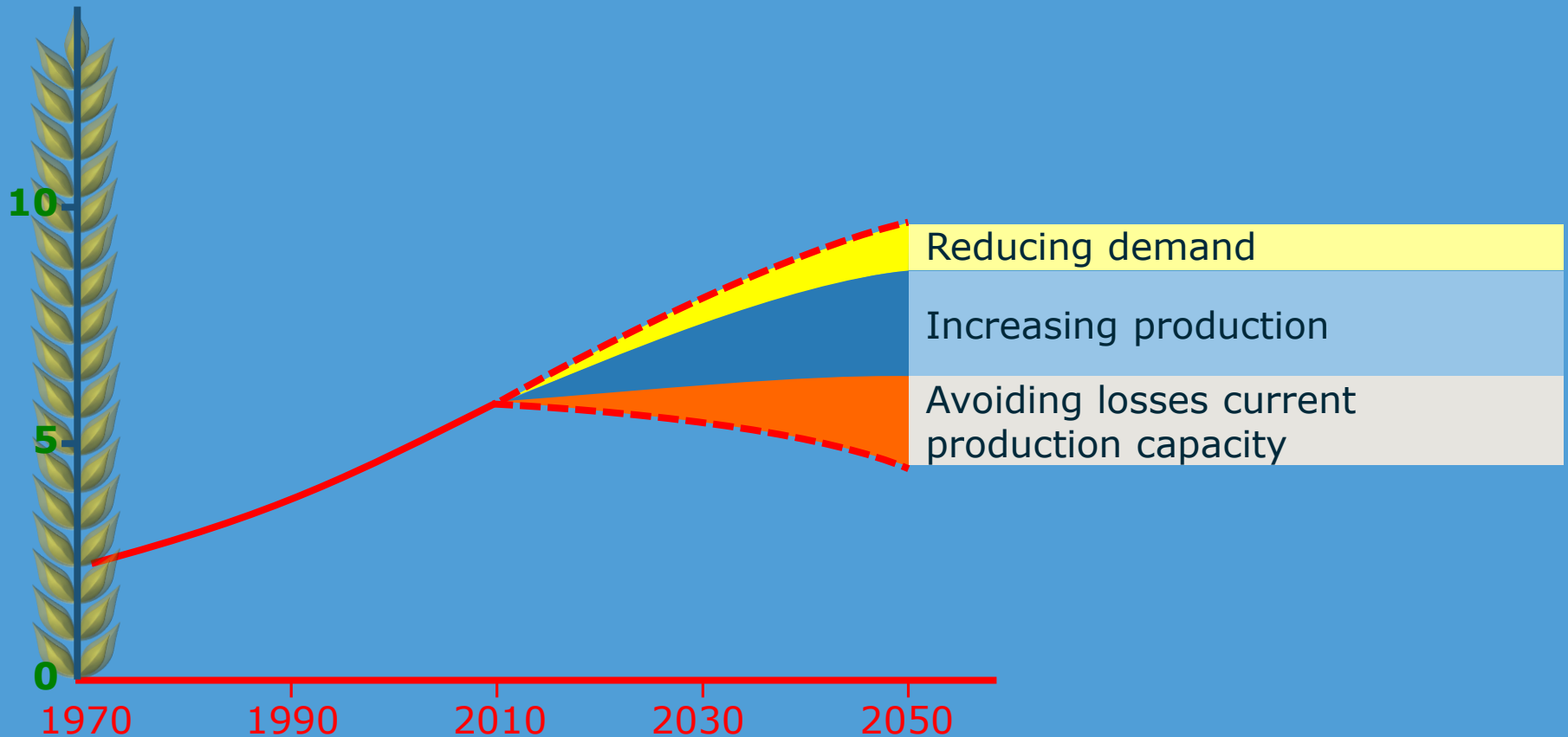


Context

- Global food production

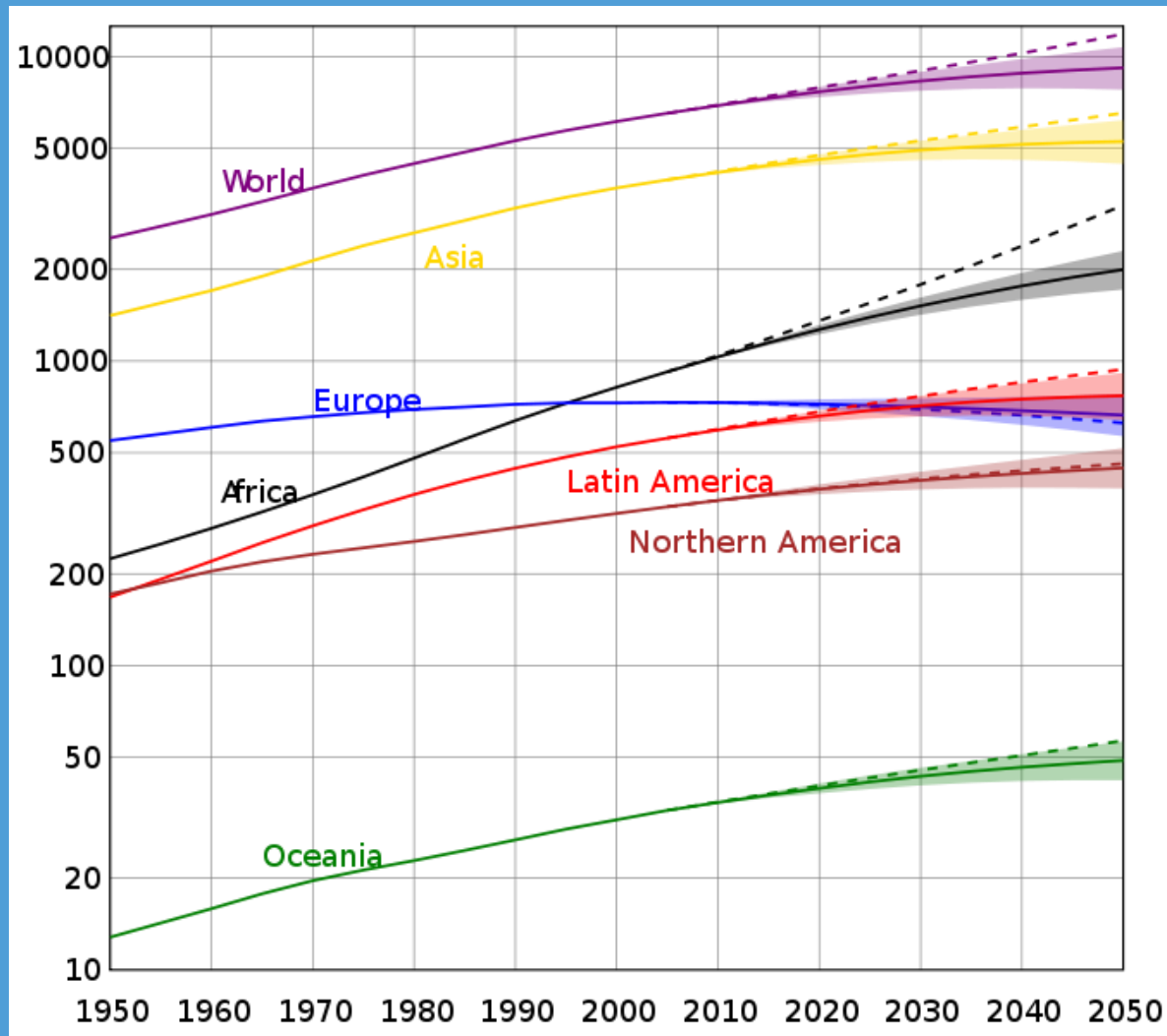
Looking ahead: Pathways to +60-70% availability

Grain equivalents per year
(billion tonnes)

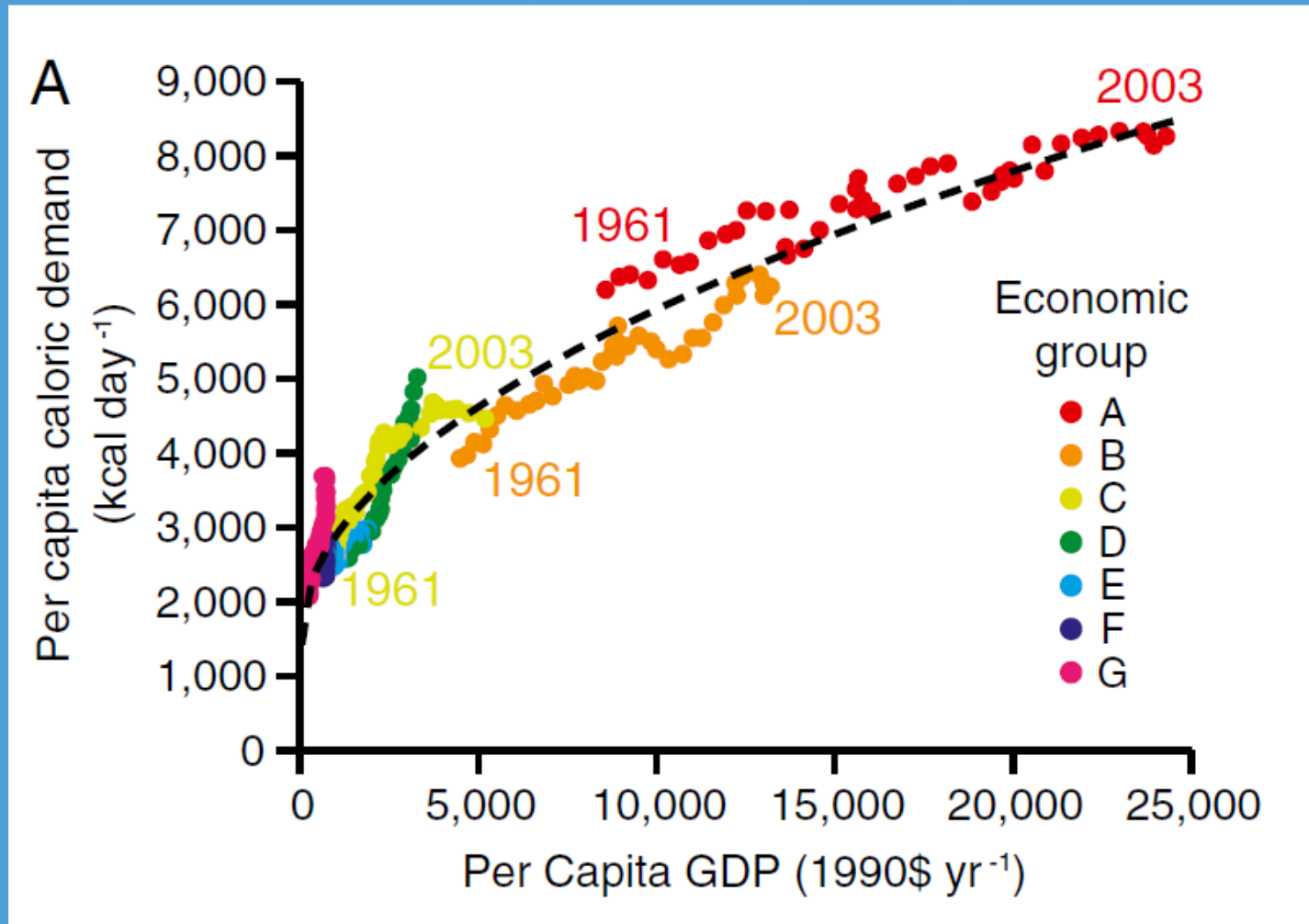




Population growth

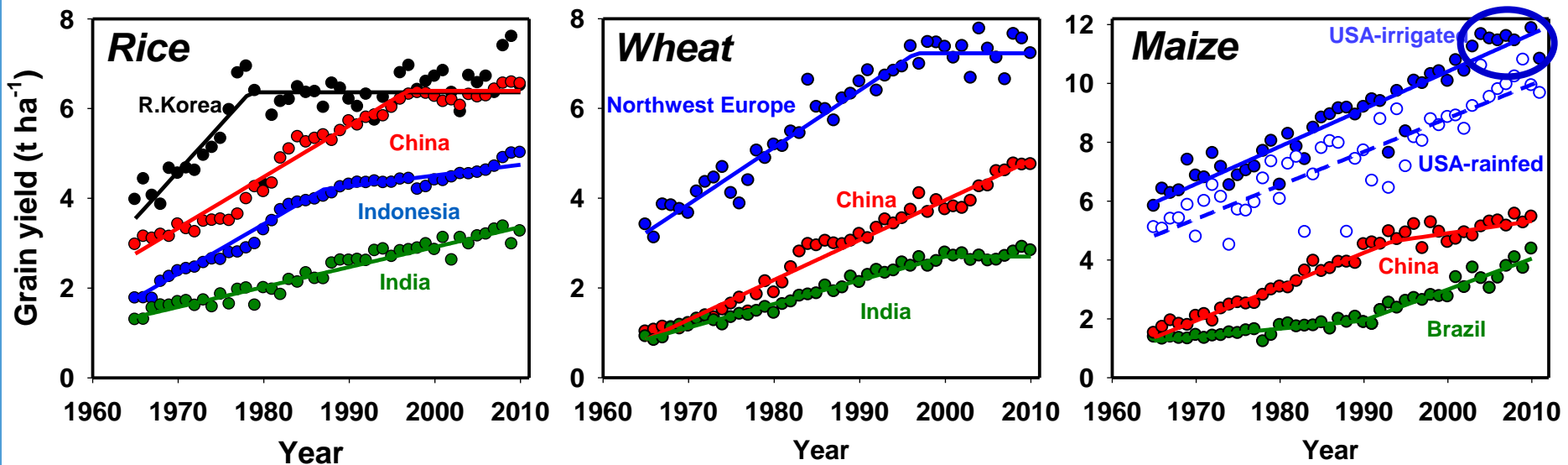


Demand versus income (per capita)

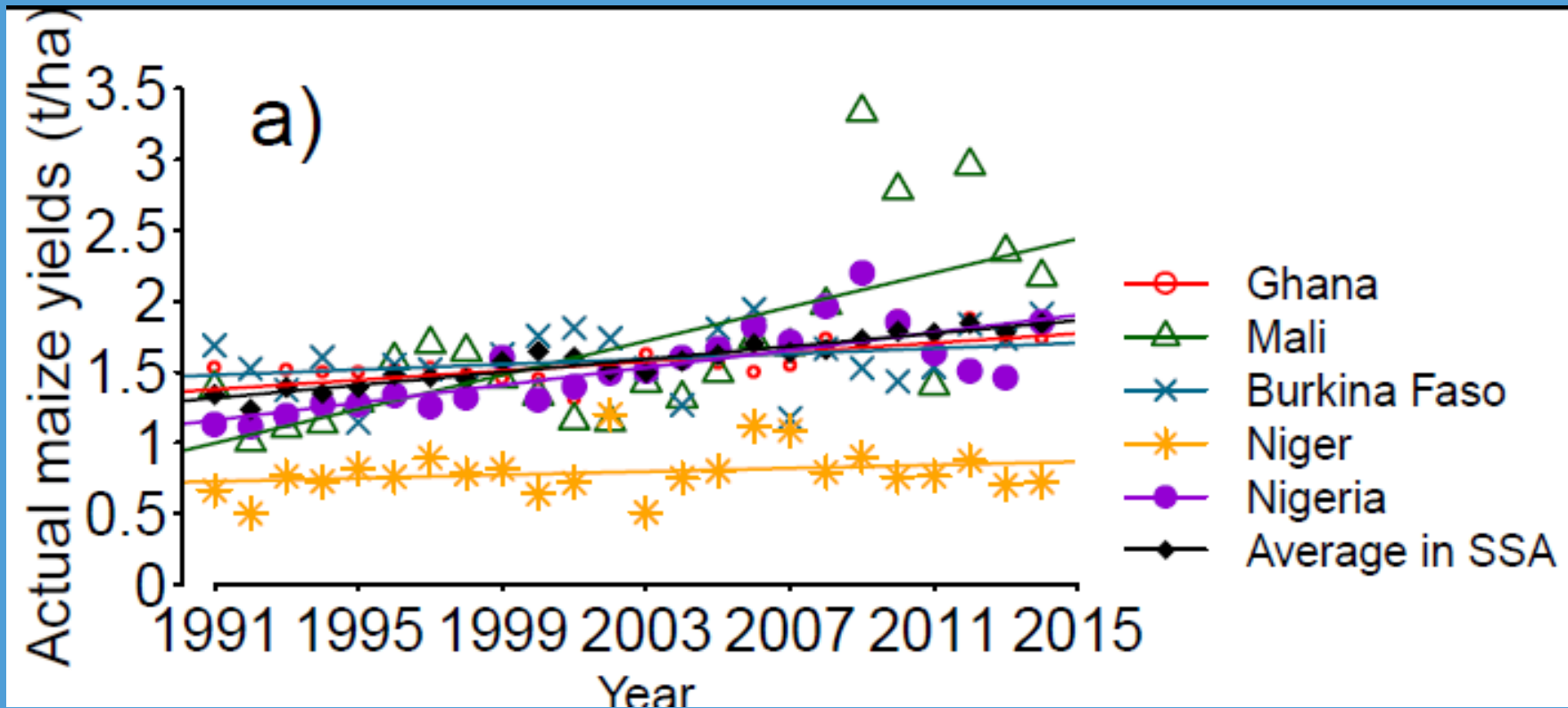


Tilman et al., 2011 (PNAS)

Slack in cereal yield increases?



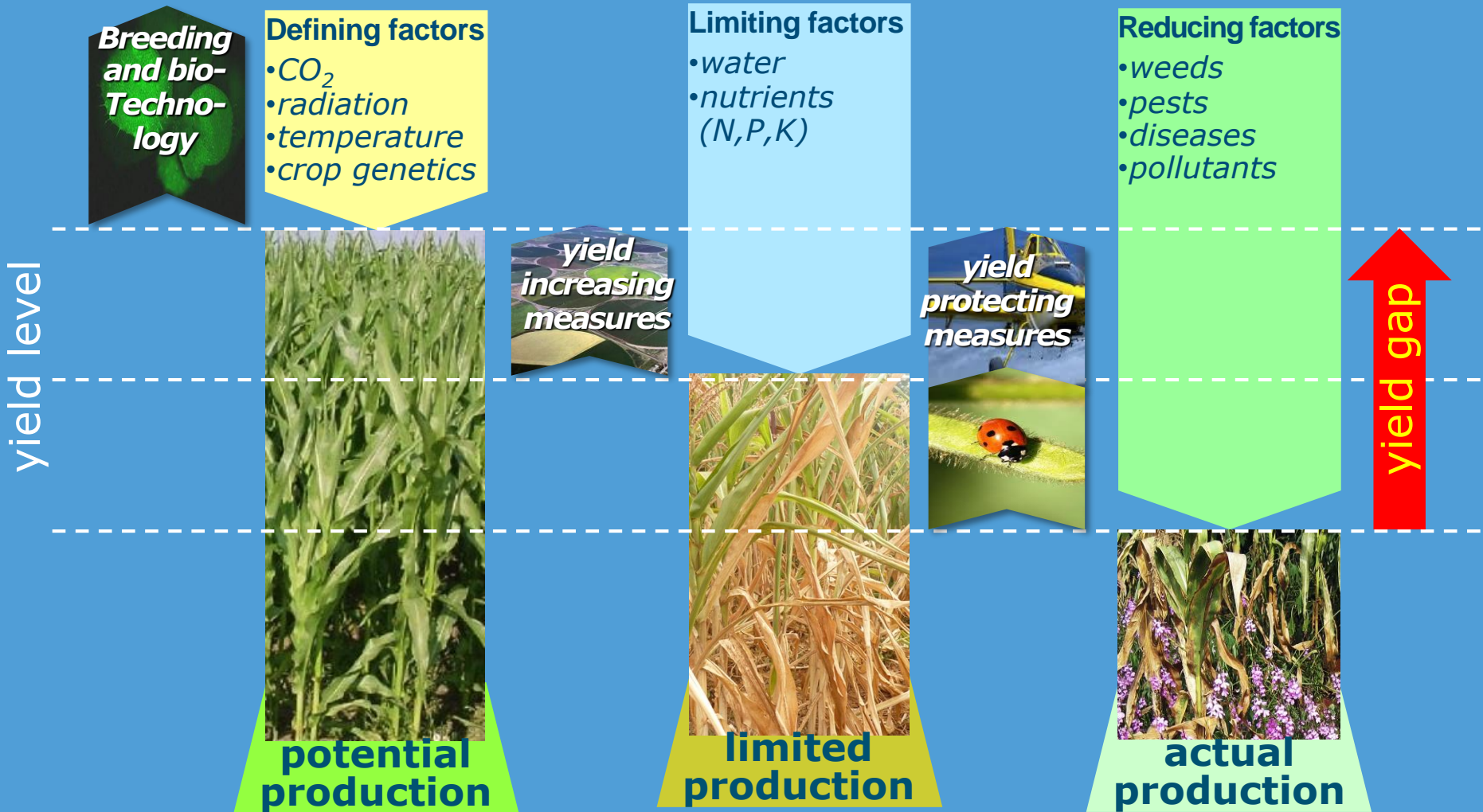
Slack in cereal yield increases?



The need and possibilities for extra food is very region-specific

So, it is crucial to know where production can be increased and how

Production-ecological principles & practice



PRODUCTION SITUATION

Yield gap analysis

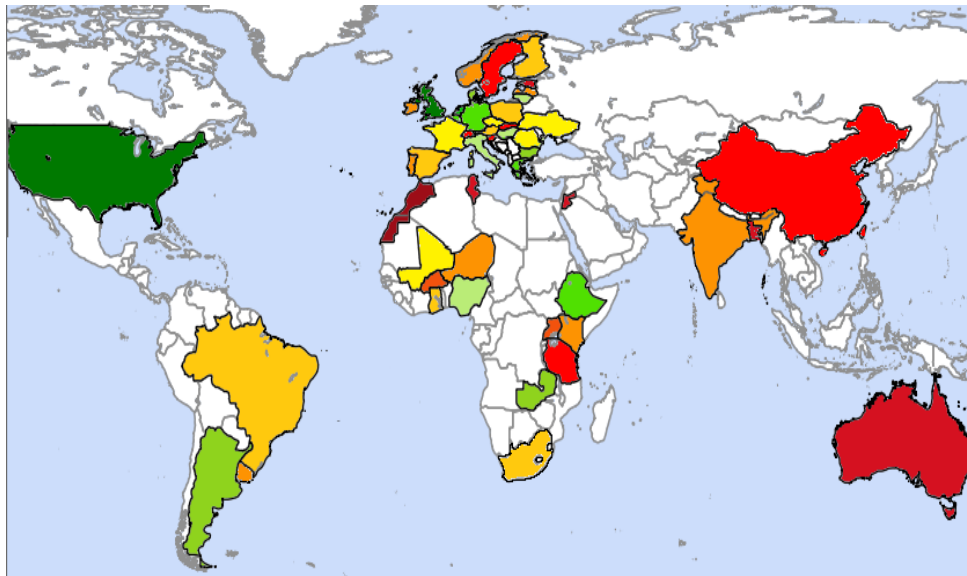


Photo: Ken Giller



Global Yield
Gap Atlas

Global Yield Gap Atlas



www.yieldgap.org

With University of Nebraska, ICRISAT, AfricaRice, CIMMYT and many regional and national partners

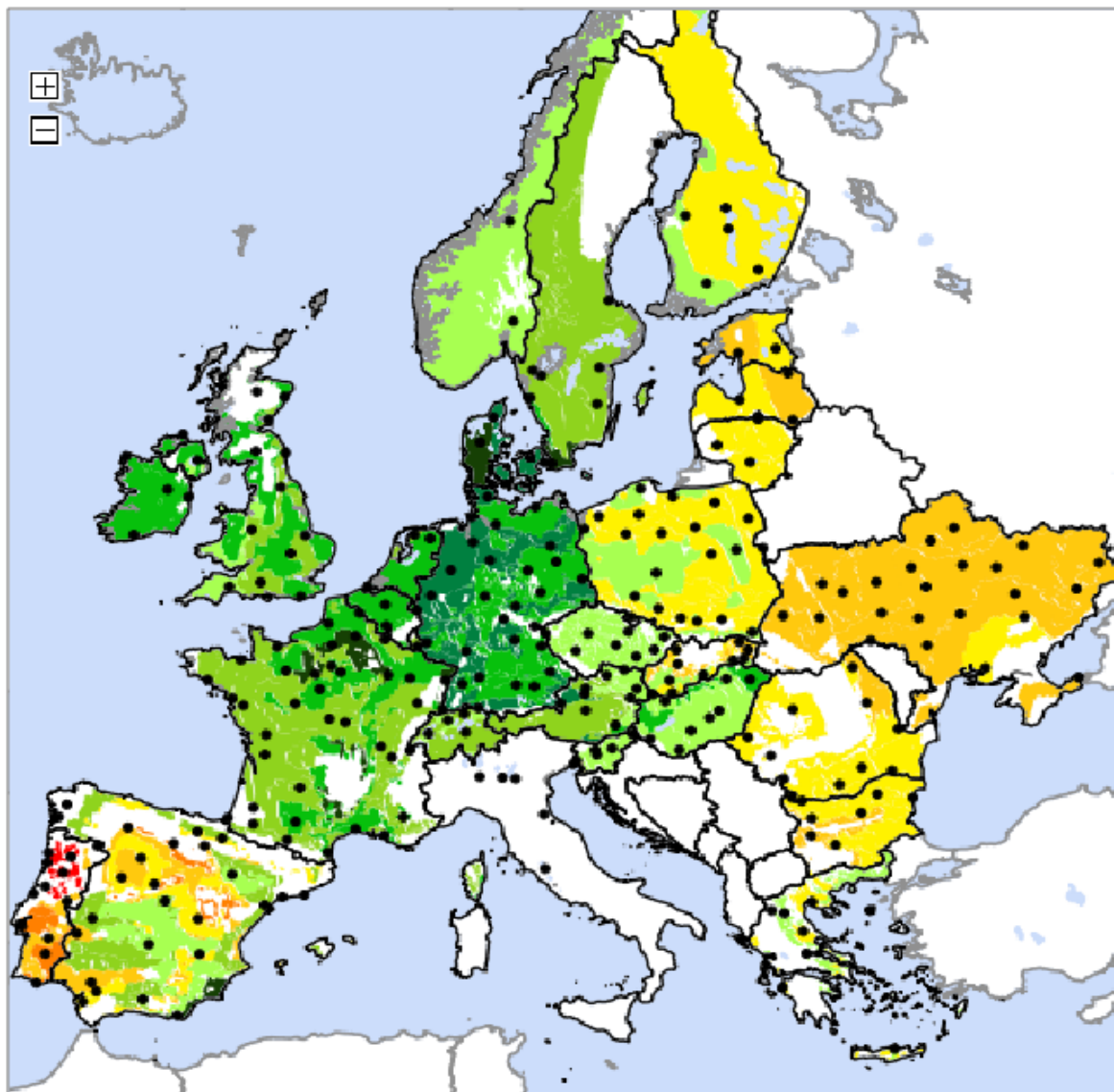
- Major food crops in the world
 - Global protocol with local application
 - Local data and evaluation
 - Strong agronomic foundation
-
- Co-financed by Bill and Melinda Gates Foundation



Rainfed wheat

Yields

Map layers



Select crop :

Rainfed wheat

Select aggregation level:

Climate zones

Select yield indicator:

- Relative yield: $Y_a / Y_w \times 100\%$

Select variable:

Mean value

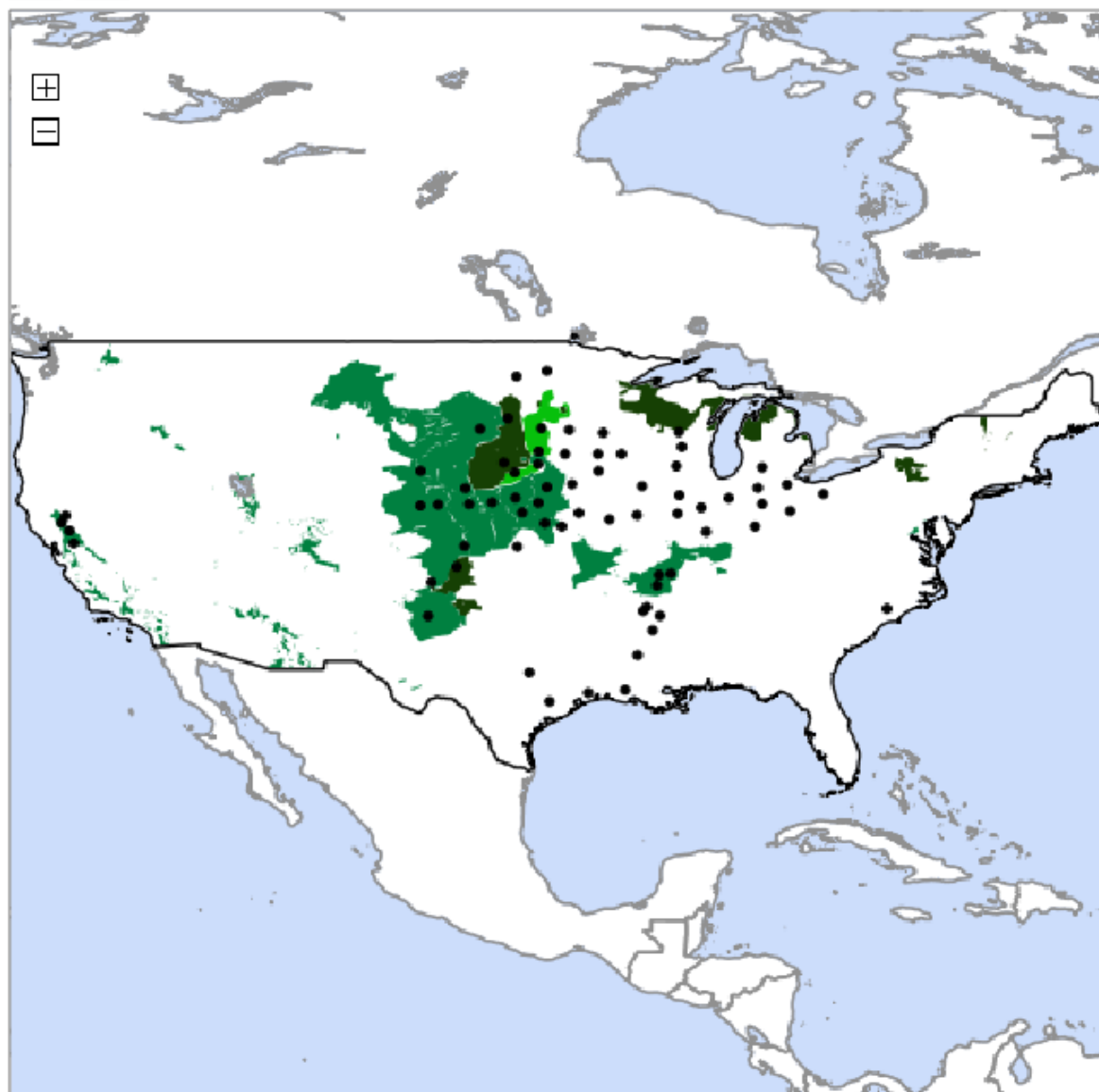
Apply SPAM2005 crop mask: ☒ No ☐ YesLegend: ☒ all classes ☐ current classes

%		%	
up to 10 %	▲	50 % - 60 %	▲
10 % - 20 %		60 % - 70 %	
20 % - 30 %		70 % - 80 %	
30 % - 40 %		80 % - 90 %	
40 % - 50 %	▼	more than 90 %	▼

To view data details: Click on the map.



Irrigated maize



Yields

Map layers

Select crop :

Irrigated maize

Select aggregation level:

Climate zones

Select yield indicator:

- Relative yield: $Y_a / Y_p \times 100\%$

Select variable:

Mean value

Apply crop mask: ☒ No ☐ Yes**Legend:** ☒ all classes ☐ current classes

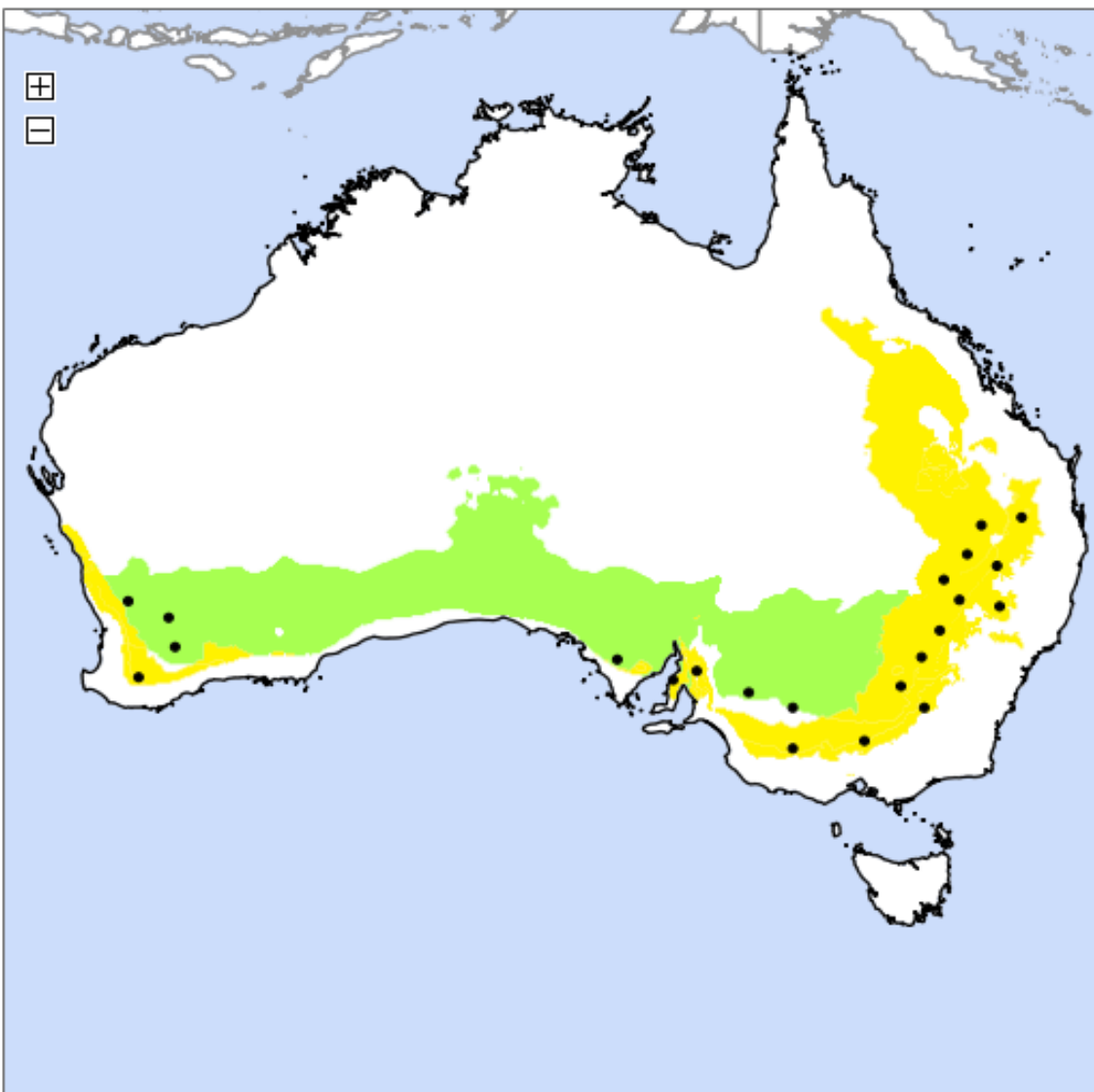
	%		%
	up to 10 %		50 % - 60 %
	10 % - 20 %		60 % - 70 %
	20 % - 30 %		70 % - 80 %
	30 % - 40 %		80 % - 90 %
	40 % - 50 %		more than 90 %



Rainfed wheat

Yields

Map layers



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Climate zones

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Apply crop mask: ☒ No ☐ YesLegend: ☒ all classes ☐ current classes

	%		%
	up to 10 %		50 % - 60 %
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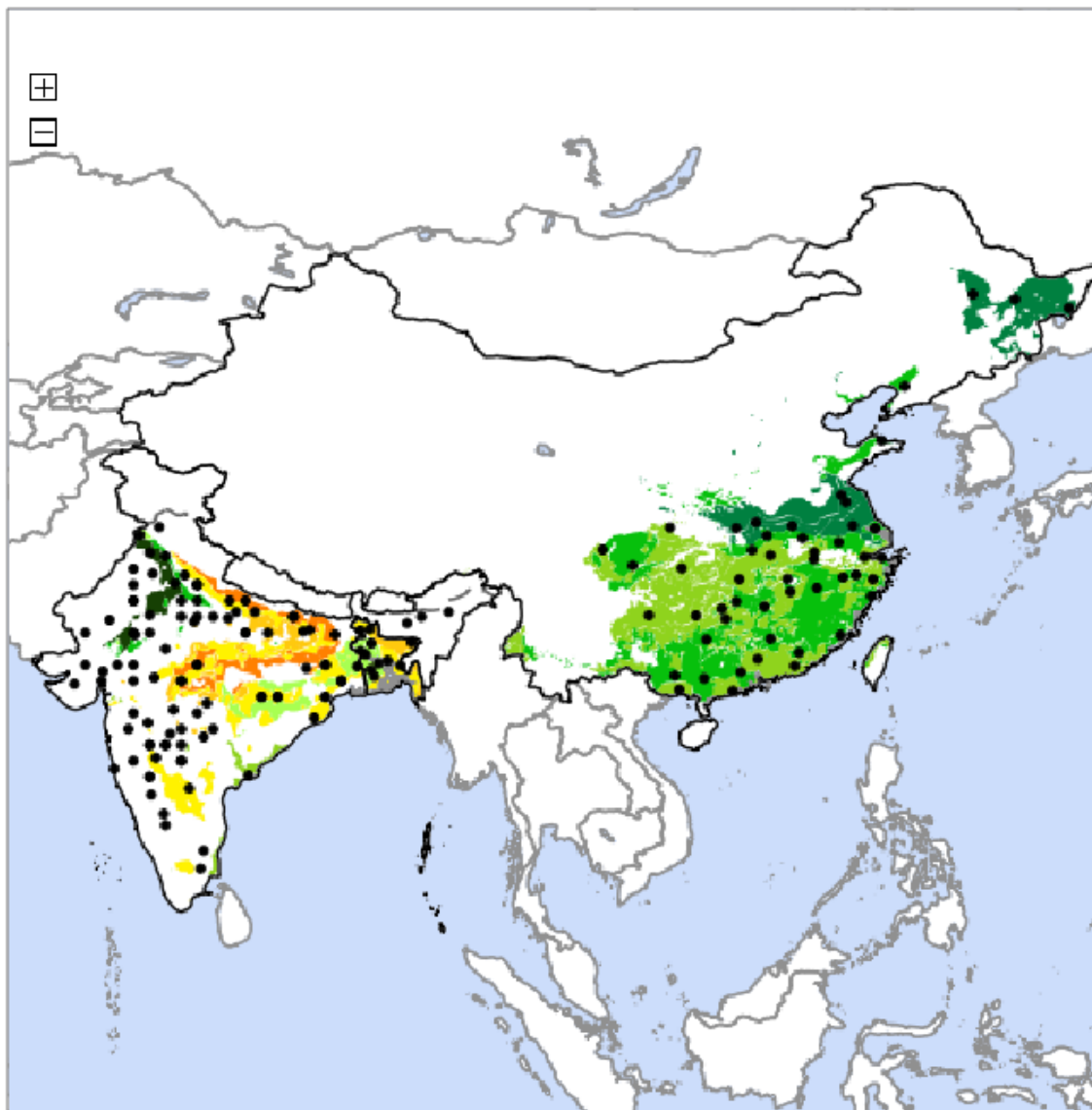




Irrigated rice

Yields

Map layers



Select crop :

Irrigated rice

Select aggregation level:

Climate zones

Select yield indicator:

- Relative yield: $Y_a / Y_p \times 100\%$

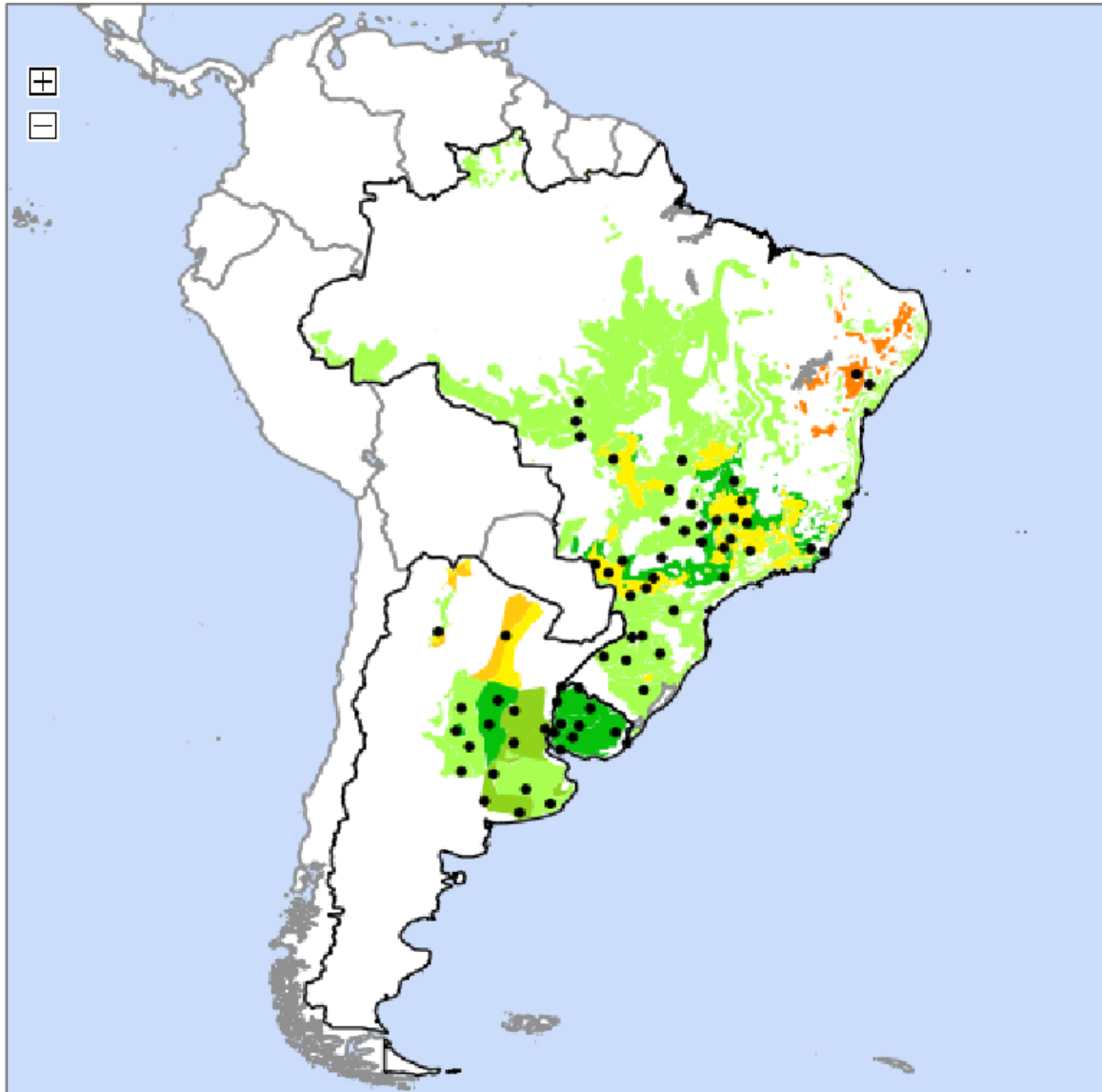
Select variable:

Mean value

Apply crop mask: ☒ No ☐ YesLegend: ☒ all classes ☐ current classes

%		%	
	up to 10 %		50 % - 60 %
	10 % - 20 %		60 % - 70 %
	20 % - 30 %		70 % - 80 %
	30 % - 40 %		80 % - 90 %
	40 % - 50 %		more than 90 %

Rainfed maize



Yields

Map layers

Select crop :

Rainfed m aize

Select aggregation level:

Climate zones











Select yield indicator:

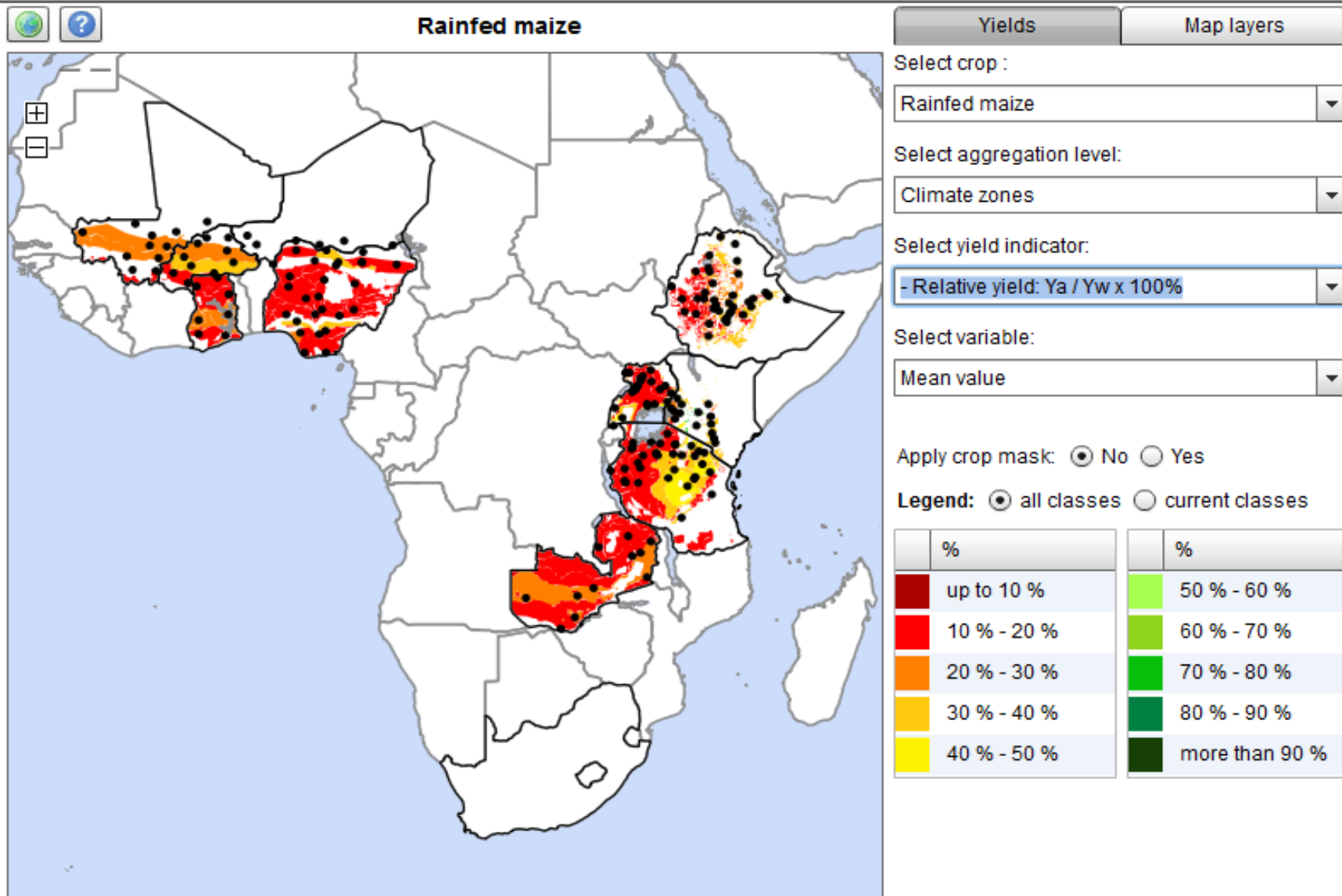
- Relative yield: $Y_a / Y_w \times 100\%$

Select variable:

Mean value

Apply crop mask: ☒ No ☐ YesLegend: ☒ all classes ☐ current classes

	%		%
	up to 10 %		50 % - 60 %
	10 % - 20 %		60 % - 70 %
	20 % - 30 %		70 % - 80 %
	30 % - 40 %		80 % - 90 %
	40 % - 50 %		more than 90 %





Can sub-Saharan Africa feed itself?

Martin van Ittersum, Lenny van Bussel – Plant Production Systems group
Patricio Grassini, Ken Cassman – University of Nebraska-Lincoln
GYGA team, including ten country agronomists from SSA

PNAS14964–14969 | PNAS | December 27, 2016 | vol. 113 | no. 52

Growth in population and cereal demand - 2050

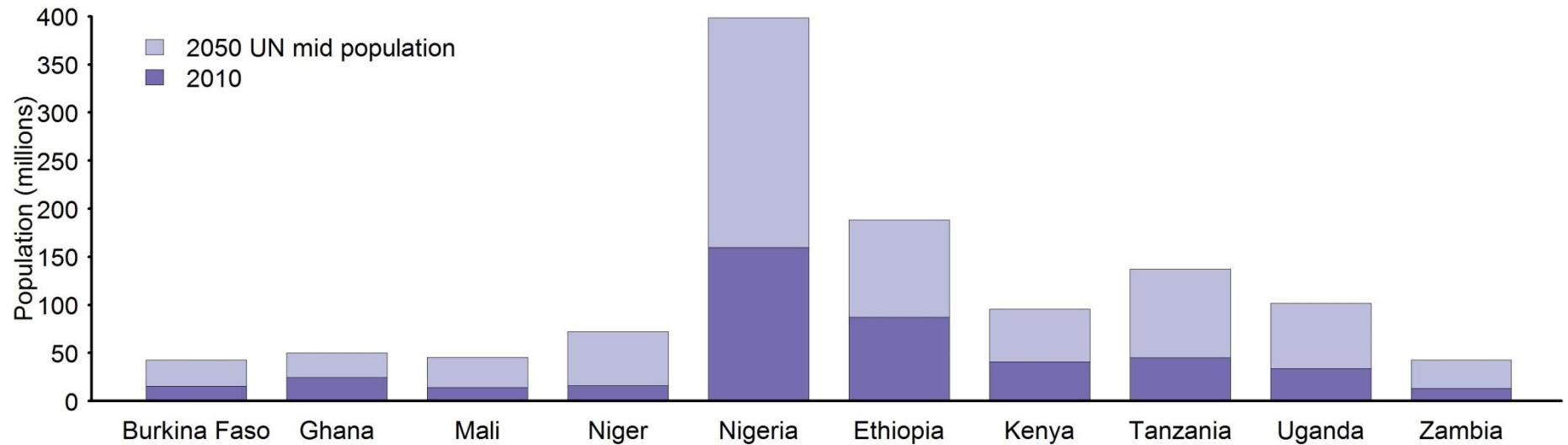
Country	Population 2010 (million)	Population 2050 (million)	% Population increase
Burkina Faso	16	41	256
Ghana	24	46	192
Mali	14	45	321
Niger	16	69	431
Nigeria	159	440	277
Ethiopia	87	188	216
Kenya	41	97	237
Tanzania	45	129	287
Uganda	33	104	315
Zambia	13	44	338

UN, 2012 and IMPACT,
2012 (and 2015)



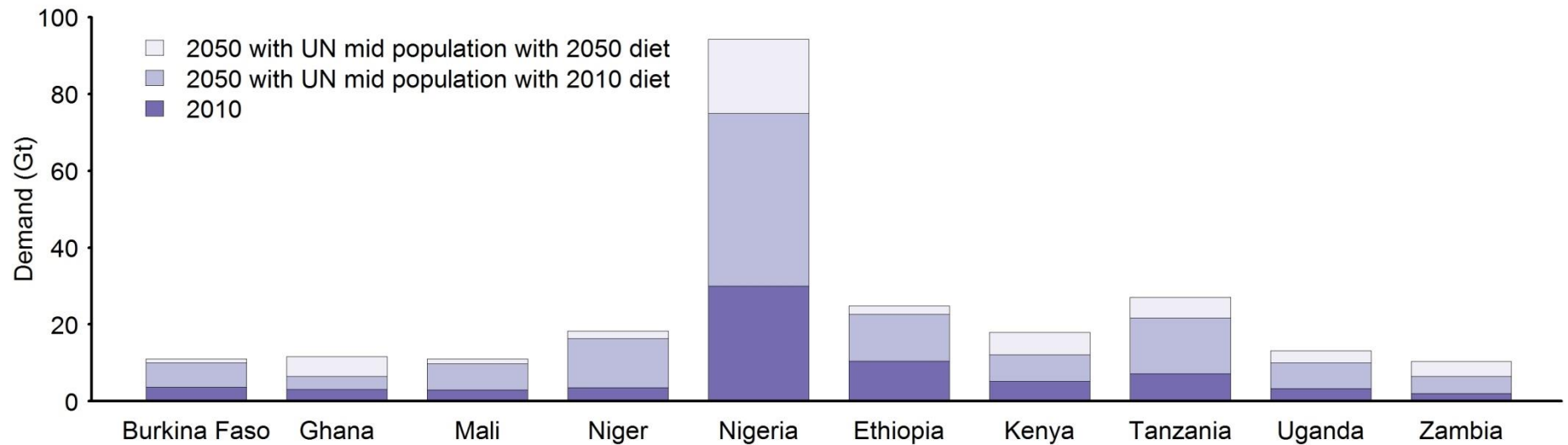
Global Yield
Gap Atlas

Growth in population 2050



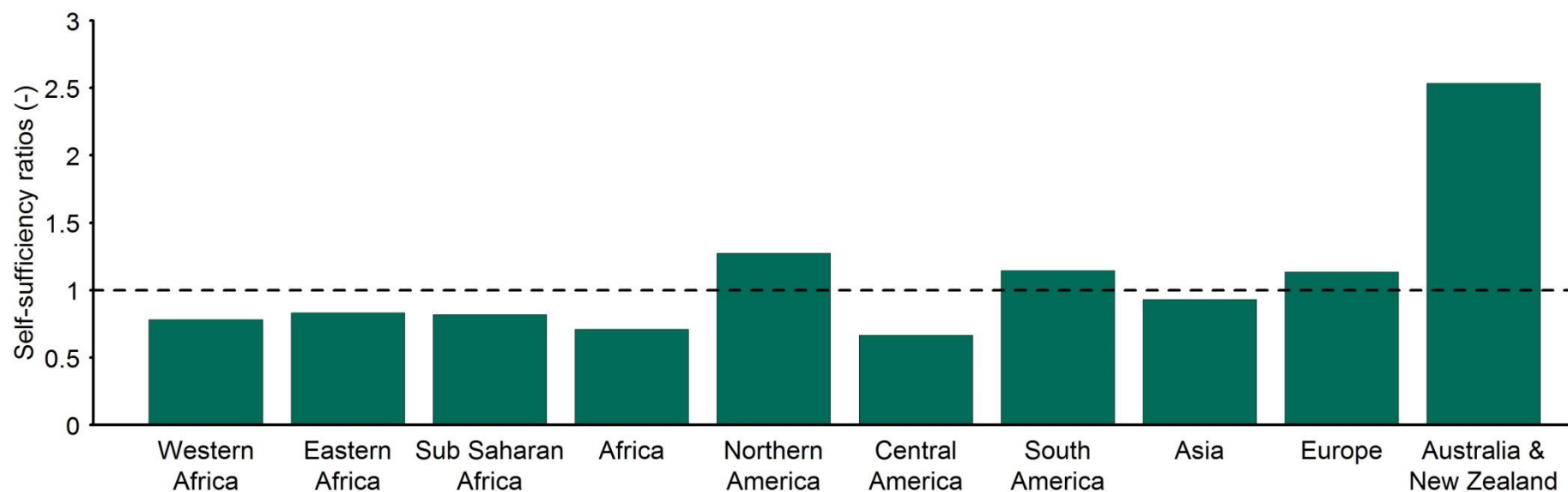
From 0.45 to 1.2 billion (2.6 times)

Growth in population and cereal demand - 2050



A factor 3.4 increase!

Current self-sufficiency ratios cereals - 2010

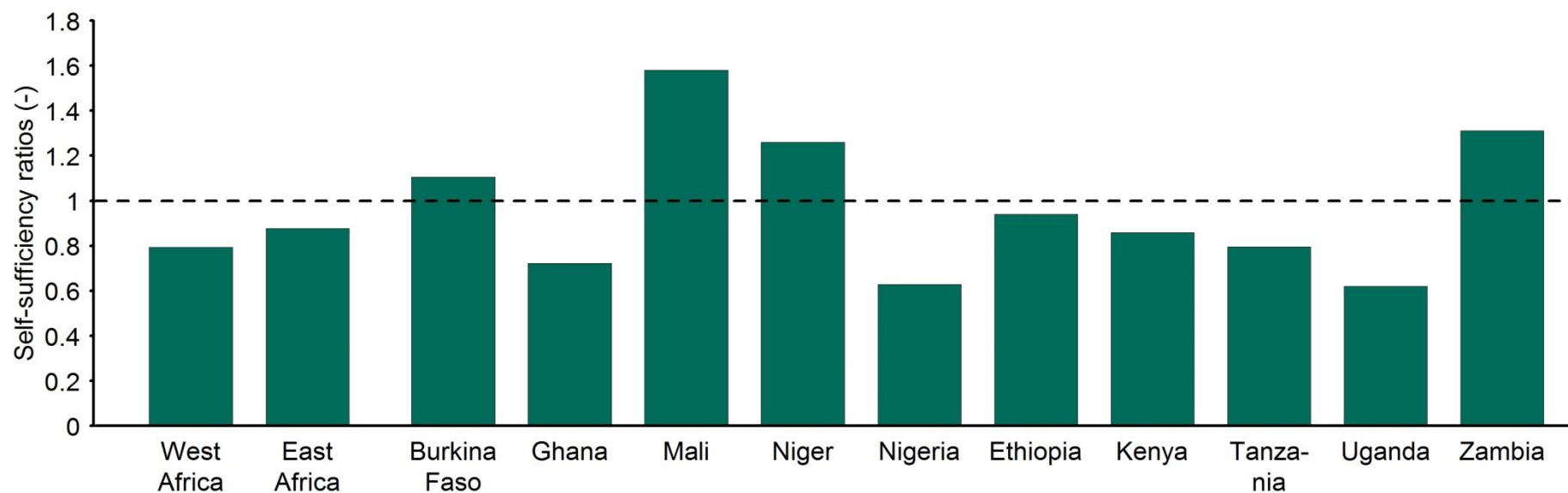


Source: FAOstat



Global Yield
Gap Atlas

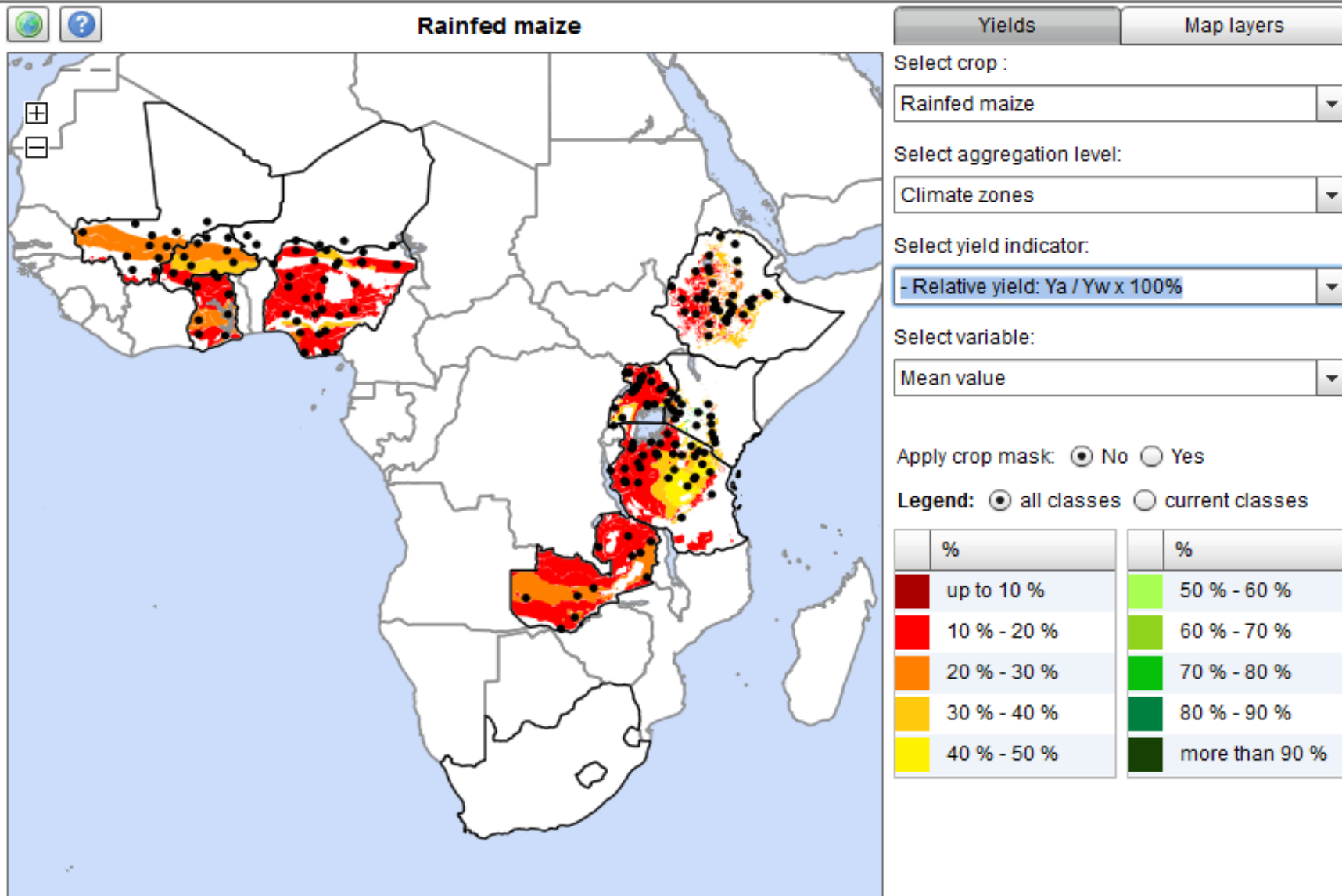
Current self-sufficiency cereals SSA - 2010



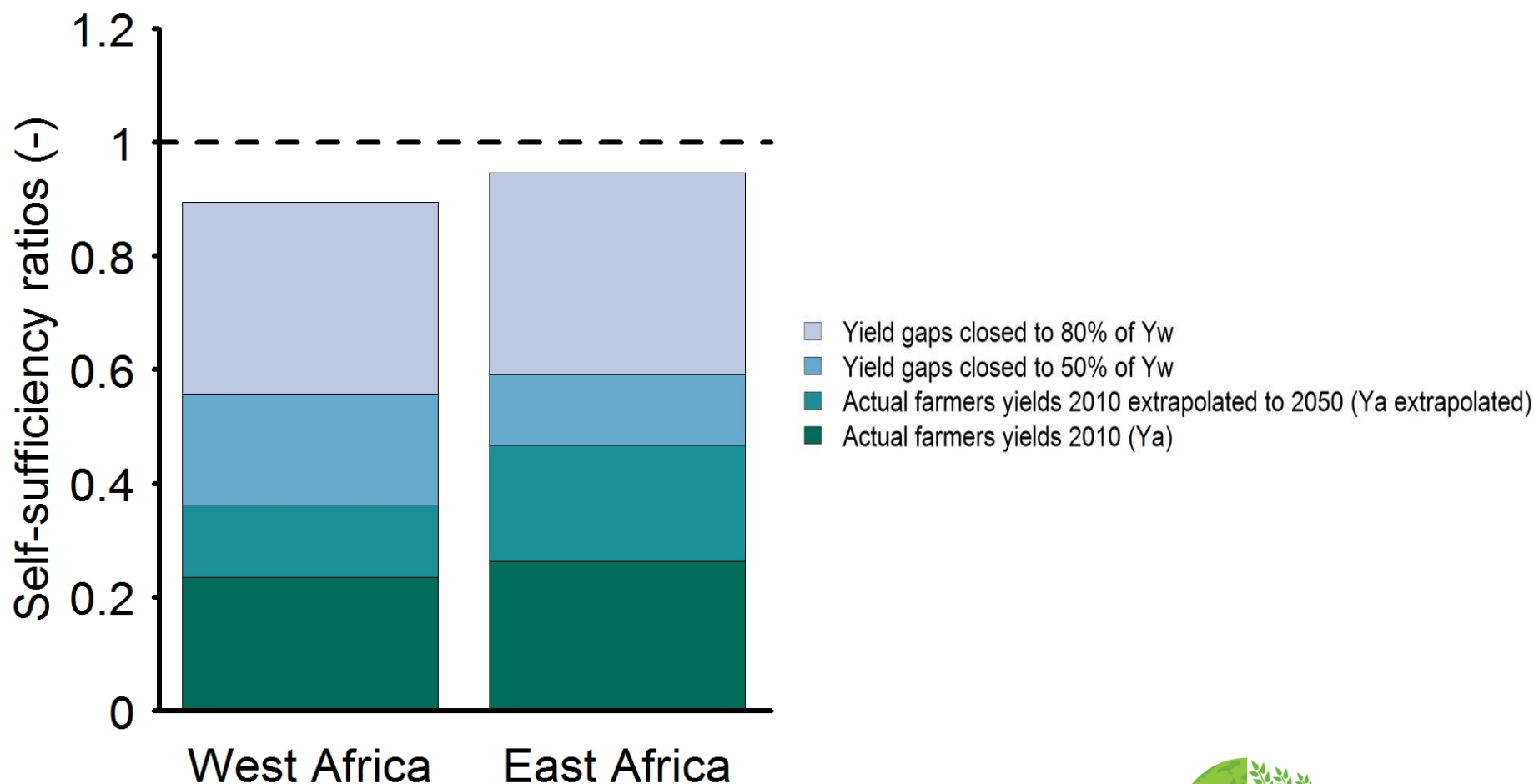
Source: IMPACT model



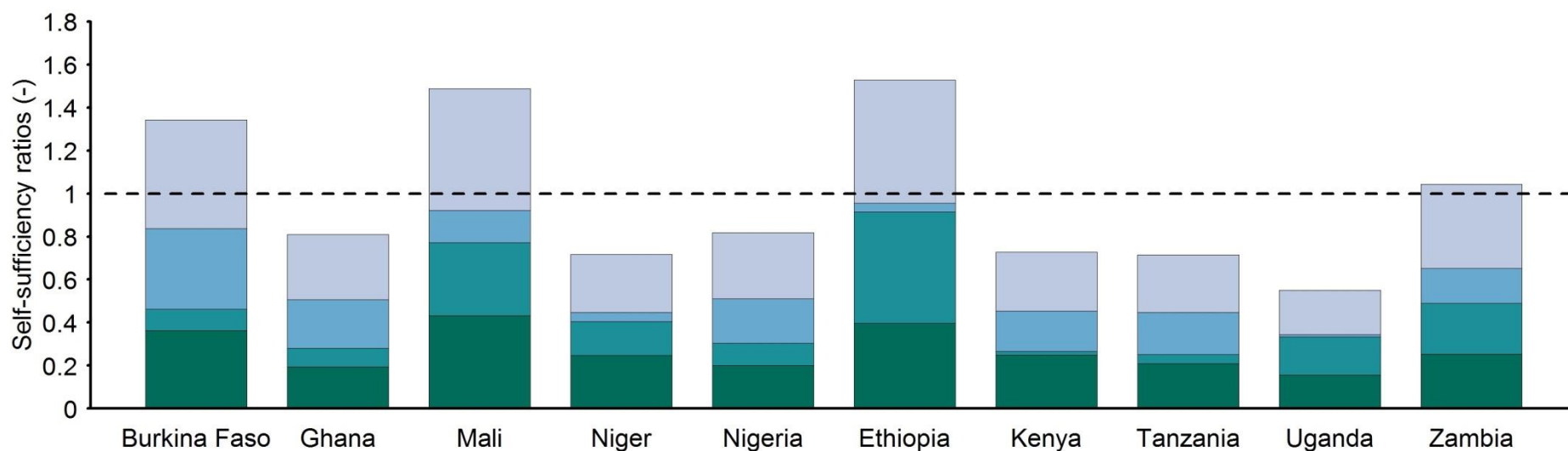
Global Yield
Gap Atlas



West and East Africa aggregated



Self-sufficiency 2050: 10 countries

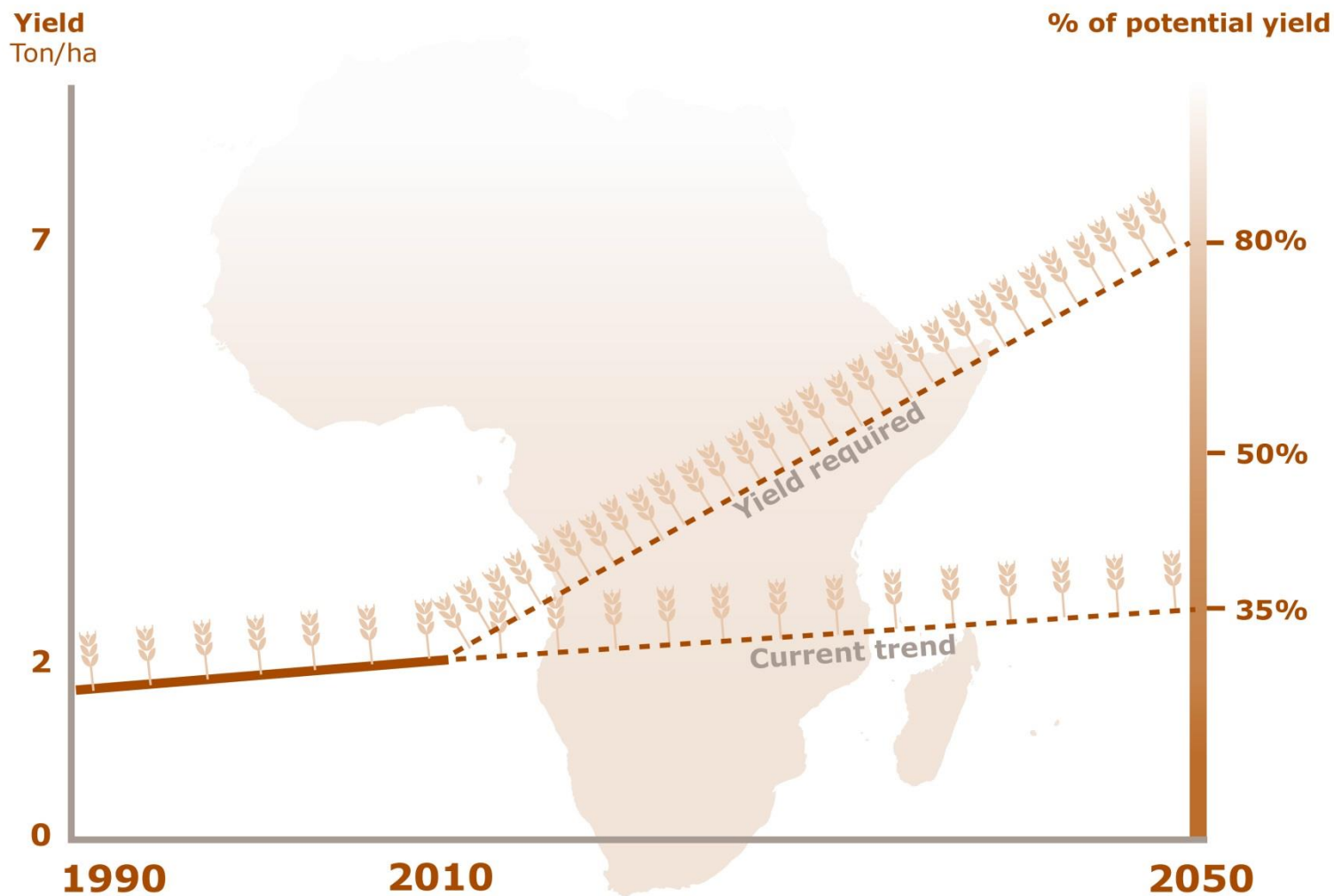


- Yield gaps closed to 80% of Yw
- Yield gaps closed to 50% of Yw
- Actual farmers yields 2010 extrapolated to 2050 (Ya extrapolated)
- Actual farmers yields 2010 (Ya)



Global Yield
Gap Atlas

Food production in Africa in 2050



© Wageningen University & Research



Global Yield
Gap Atlas

Historical maize yield increases (kg/ha/year)

Country	1961-1990	1991-2013
Argentina	68	131
Brazil	25	122
China	107	56
Ethiopia	n.a.	79
France	130	61
Ghana	0.7	17
India	15	48
Indonesia	43	130
Kenya	26	6
Nigeria	21	39
Spain	168	196
USA	112	111

FAOSTAT



Global Yield
Gap Atlas

If a successful intensification is not achieved

The consequences in terms of:

- cereal self-sufficiency and/or
- area expansion (GHG, biodiversity!)

will be huge!



The Sustainable Development Goals - challenges



SDG 2 (example)

- SDG-2 is particularly focused on global food security and agricultural sustainability.
- Like other SDGs, SDG-2 requires urgent and concerted action from both developing and developed countries.
- However, two obstacles may hinder their implementation:
 - the lack of clear and universally applicable targets and indicators;
 - the novel and complex nature of the SDGs, especially in the face of existing interlinkages across SDG objectives and scales.

Some weaknesses of the UN SDG-2


- Inconsistencies with respect to...
 - Targeted stakeholders (not always the same between targets and indicators);
 - Importance of indicators (some targets are only partially covered).
- Unclear definitions posing obstacles to target quantification/monitoring
 - Ex.: 2.4.1: *Percentage of agricultural area under sustainable practices*
- Not always universally relevant
 - Ex.: 2.3: *Double agricultural productivity by 2030*
- Other uncertainties with regards to...
 - Scale of enforcement and monitoring
 - Boundaries of *food systems*


Target 2.3: Productivity & income


SDG 2 target	Original indicators (UN-IAEG-SDGs)	Conceptually clear?	Quantif.?	Universally relevant?	Edited list of indicators
[2.3] By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.	[2.3.1] Volume of production per labor unit by classes of farming / pastoral / forestry enterprise size.	Does <i>labor unit</i> refer to total labor (specialized + non-specialized)?	Yes (changes in volume of production or income)	<u>Target:</u> No <u>Indicators:</u> Yes, but not equally important across countries	[2.3.1] Yield gap. [2.3.2] Rural poverty headcount ratio at national poverty lines. [2.3.3] Prevalence of farmers earning less than the national minimum wage.
	[2.3.2] Average income of small-scale food producers, by sex and indigenous status.	<i>Small-scale</i> may refer to land, econ. output, etc. Does <i>income</i> refer to agricultural vs. total, on-farm and/or off-farm? <i>Secure and equal access</i> ?			

Target 2.3: Productivity & income

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 Not universally applicable. In some countries, the pursuit of agricultural intensification is not coherent with agricultural sustainability.

 Measuring productivity on a labor basis may not be adequate in some contexts. Teasing out variations in ag. output from changes in labor productivity vs. other inputs (e.g. machinery) is hard.

 The relationship between the target and its original indicators may not be proportional, posing further obstacles to the calculation of country-specific thresholds.

- Replace UN 2.3.1 by “Yield Gap”
- Replace UN 2.3.1 by two indicators on farmers’ income level independent of scale-based classifications. Country-specific reference values account for PPP and are thus comparable.

Target 2.4: Environmental soundness of farming practices

SDG 2 target	Original indicators (UN-IAEG-SDGs)	Concept. clear?	Quantifiable?	Universally relevant?	Edited list of indicators
[2.4] By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.	[2.4.1] Percentage of agricultural area under sustainable agricultural practices.	What are <i>sustainable practices</i> ?	Yes (%)	Yes	[2.4.1] Water withdrawn by agriculture as a % of total withdrawal.
	[2.4.2] Percentage of agricultural households using irrigation systems compared to all agricultural households.	Yes	Yes (%)	No - Irrigation needs, possibilities and efficiency vary across countries.	[2.4.2] Average water productivity in agriculture. [2.4.3] Nitrogen use efficiency. [2.4.4] Average nitrogen surplus. [2.4.5] GHG emission intensity of food production.
	[2.4.3] Percentage of agricultural households using eco-friendly fertilizers compared to all agricultural households using fertilizers.	What are <i>eco-friendly fertilizers</i> ?	Yes (%) but unclear conceptual definitions pose obstacles.	Yes	[2.4.6] Average carbon content in the topsoil. [2.4.7] Climate change vulnerability index for food. [2.4.8] Use of pesticides per area.

Target 2.4: Environmental soundness of farming practices

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- ⚠ 2.4.2 and 2.4.3 seem embedded into 2.4.1. Unclear why emphasis has been placed on *irrigation* and *fertilizer use* but not on e.g. water, GHGs.
- ⚠ Unclear concepts. 2.4.1 ignores location and 2.4.3 ignores total fertilizer use.
- ⚠ The use of irrigation may be (un)sustainable depending on e.g. water availability, WUE, etc.

- Replacement of UN indicators by 7 new indicators directly related to key elements of ag. sustain.
- Additional indicator on vulnerability of food systems and resilience to climate change.

Hans Rosling (1948-2017)



“Data allow your political judgements to be based on fact, to the extent that numbers describe realities”

Future harvest

Thank you for your attention!

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