Transforming Agri-food Systems to Achieve Healthy Diets for All

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CGIAR Consortium

CGIAR is a global research partnership for a food secure future

Outline:

- **Challenges:**
  - *Why Agri-Food Systems Need to Be Transformed*
- **Opportunities:**
  - *What Science Can Offer to Address these Challenges*
- **The CGIAR partnership:**
  - *Our Contribution to achieving the UN's Sustainable Development Targets*

What are the challenges going forward?

- ***Poor diets*** are now the #1 cause of ill health globally, overtaking smoking, with 800 million hungry people, 2 billion malnourished people, 159 million stunted children and 2 billion people overweight or obese, causing rapid increases in diabetes in India and heart disease in China. Three quarters of all overweight children live in Africa and Asia.
- ***Planetary ill health***. The food system is the primary driver, and responsible for soil degradation on 25% of cropped land, deforestation and loss of biodiversity, water scarcity, pollution of lakes and seas, and circa 25% of all greenhouse gas emissions
- ***Massive un(der)employment*** for young people in rural areas, with employment in the agri-food system, on farms or in the food value chain, as the only realistic option for 60% of African next generation youth, requiring over 200 million jobs

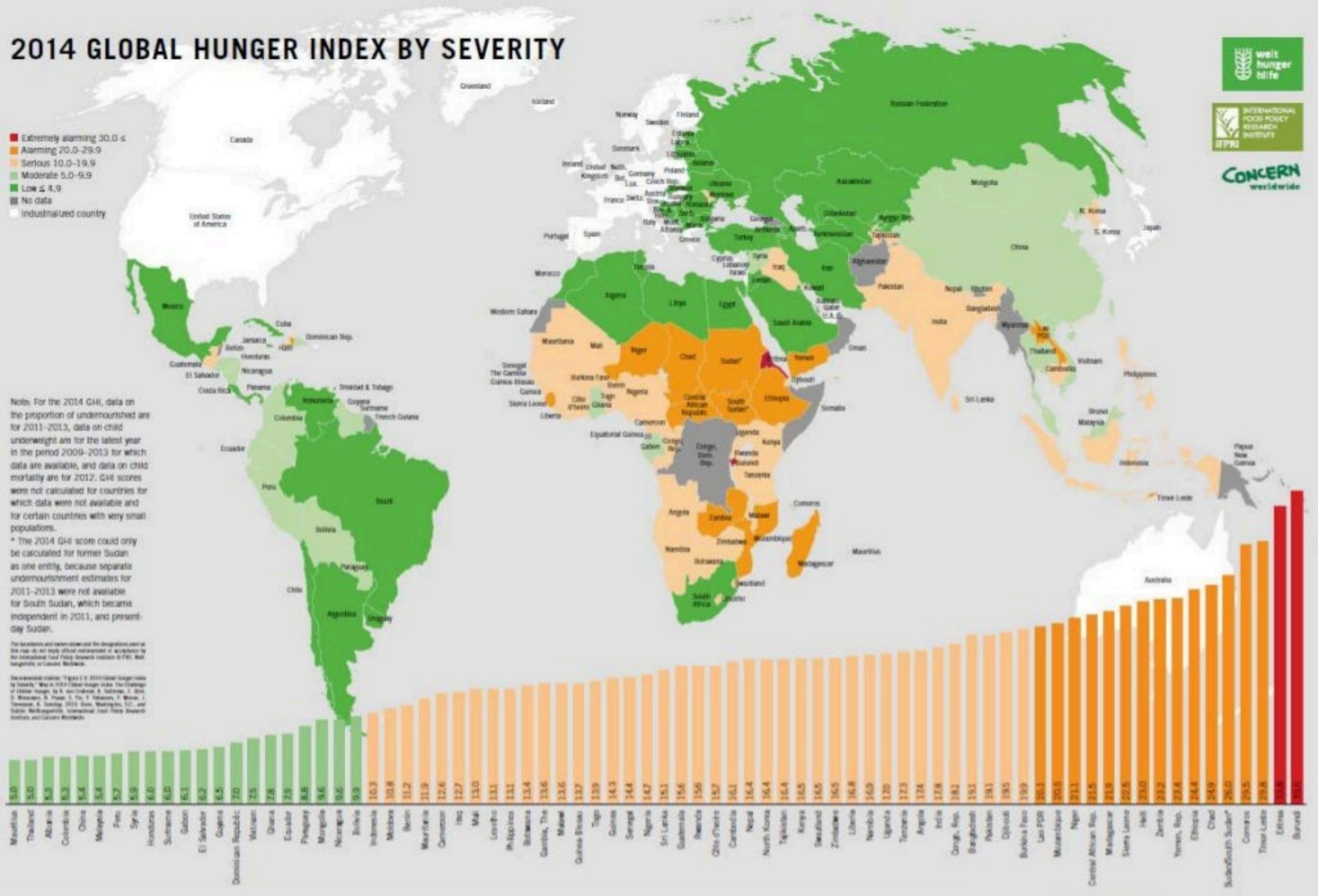
Simply put:

- The food we produce and eat is not healthy enough, and the global food system is vulnerable
- The planet is not healthy as a result of the food we produce
- Agri-Food Systems need a ***radical overhaul*** to provide healthy diets from sustainable food systems ***urgently***

Traditional focus: Increased production calories from staple foods to reduce hunger.

FAO: Produce 60% more food by 2050 to feed growing and richer population

2014 GLOBAL HUNGER INDEX BY SEVERITY



CGIAR is a global research partnership for a food secure future

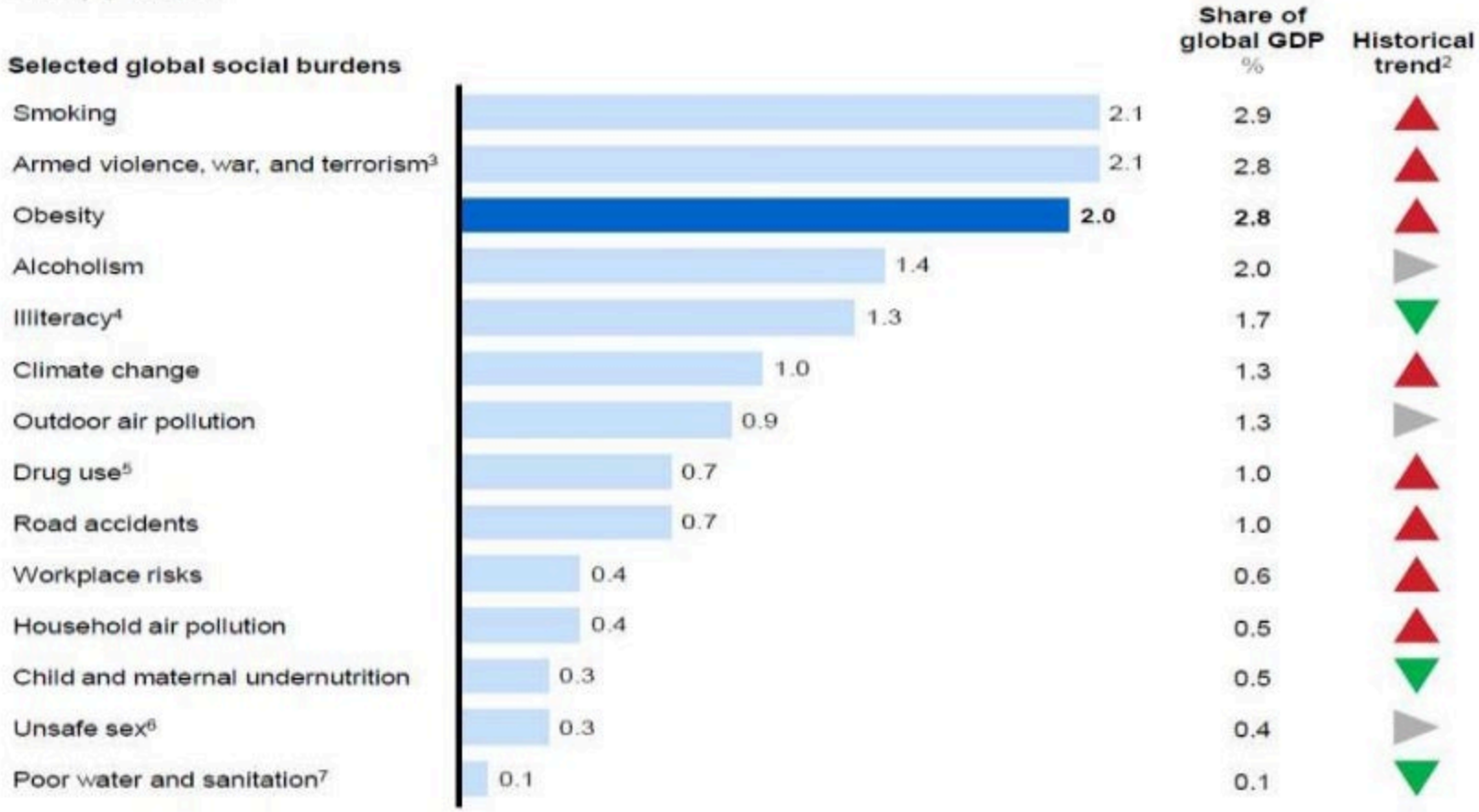
There are 2 Billion people malnourished and 2 Billion people overweight and obese

Exhibit E1

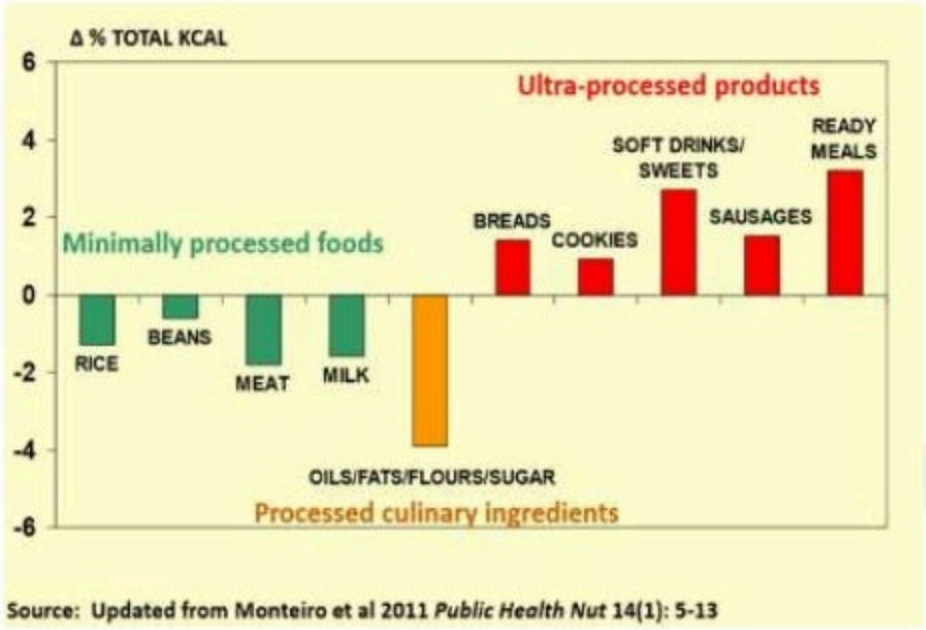
Obesity is one of the top three global social burdens generated by human beings

Estimated annual global direct economic impact and investment to mitigate selected global burdens, 2012[1]

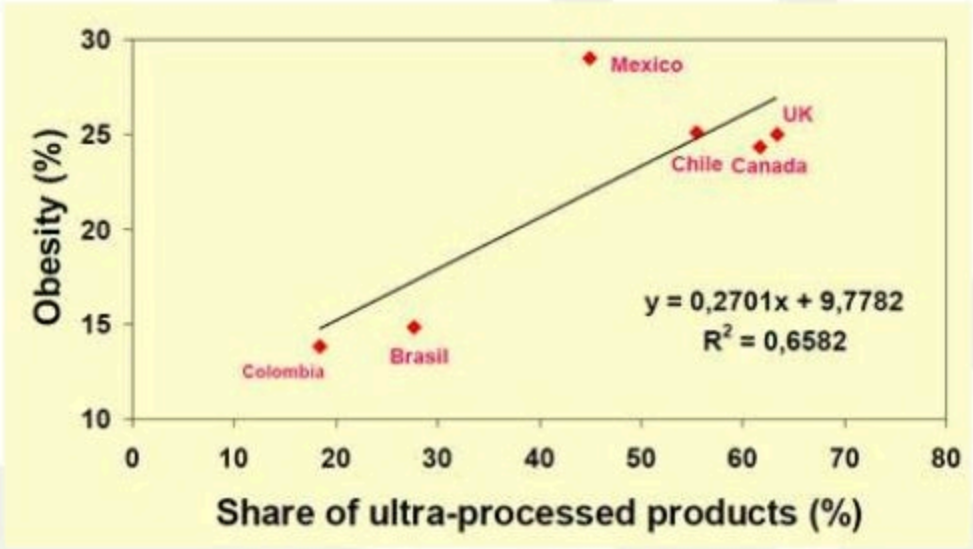
GDP, $ trillion



There has been a shift towards obesity and non communicable diseases



Source: Updated from Monteiro et al 2011 *Public Health Nut* 14(1): 5-13



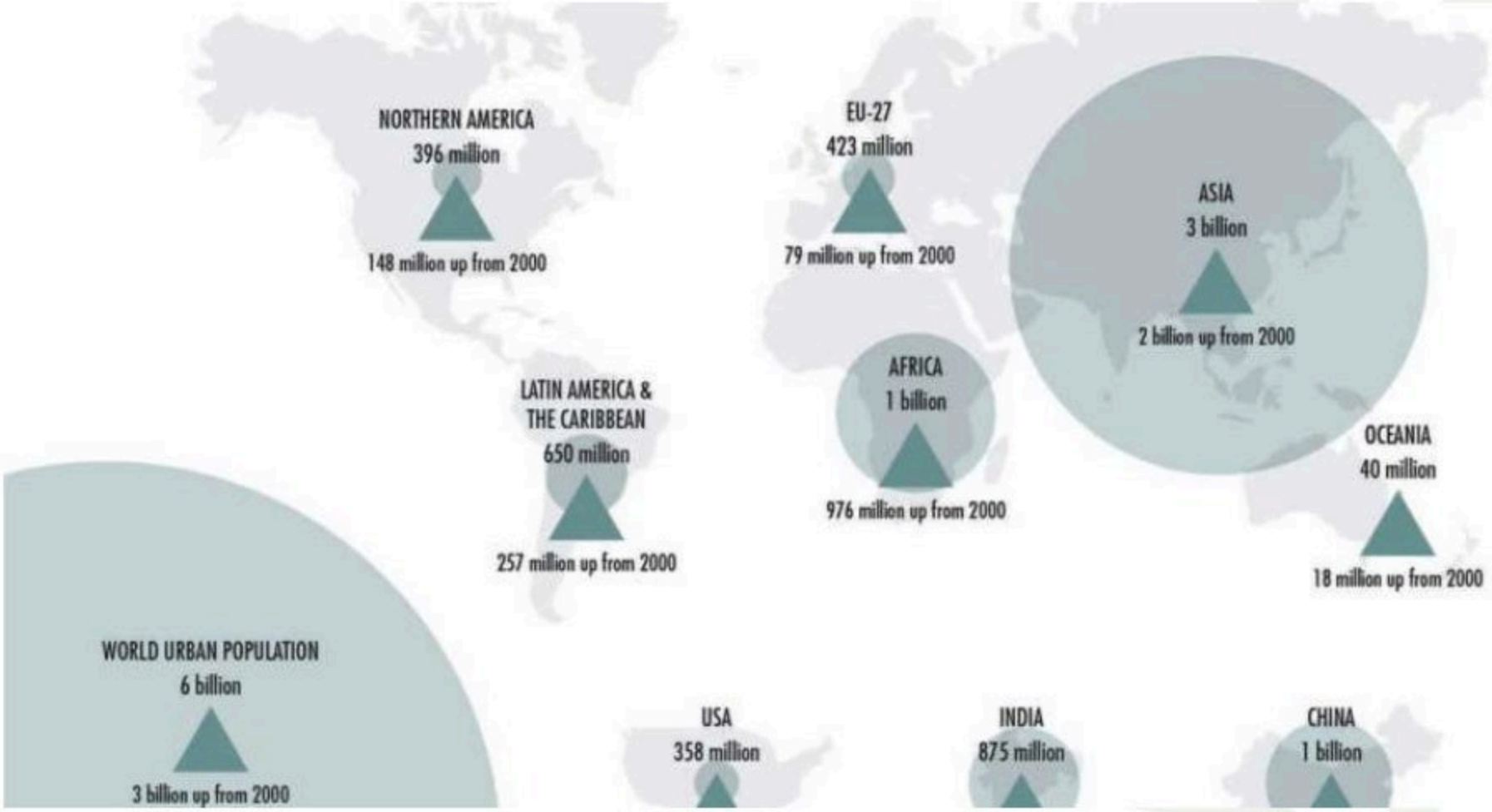
Prevalence of obesity among adult increased from 12% to 17%.

Brazil, from 2006 to 2012:
Ultra processed products in household diets: from 20% to 28% (32% in urban areas)
Cooking ingredients: from 37% to 32%.

Source: Monteiro et al. 2011; Martins et al. 2013

The urban population is rising

2050 projections:



Nourishing the world's cities

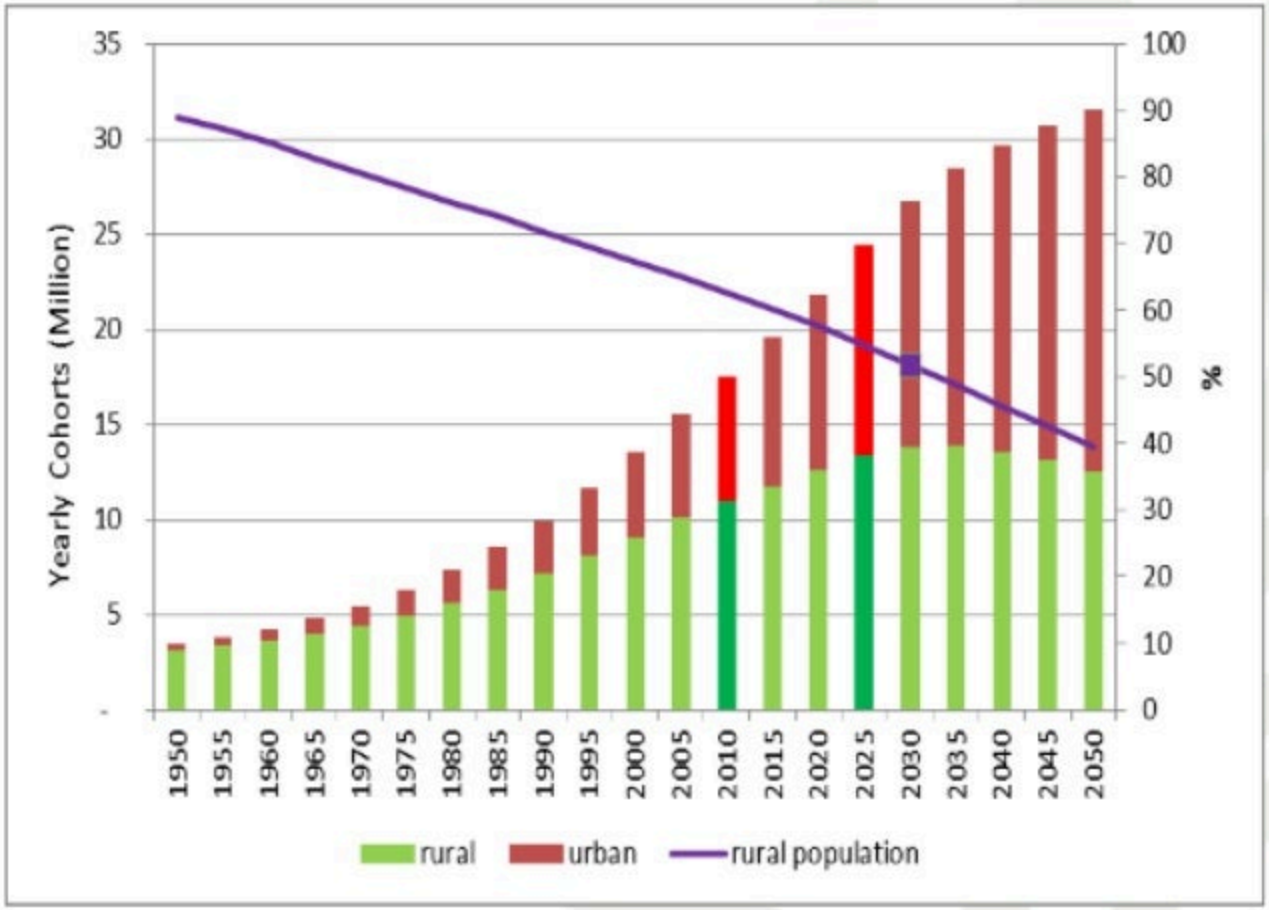
Global food security will become primarily an urban challenge in the future. However, the current international food security agenda is mostly rural-oriented and still focuses more on food availability than on food access and nutrition.

- Food deserts
- Urban food security indicators
- Informal economy
- Rural-urban linkages

Meeting the needs of women farmers & generating employment for youth

Youth and agriculture:
key challenges and concrete solutions

Youth employment in agriculture is especially relevant in Africa, south of the Sahara



Trends and Patterns in Food consumption

PNAS

Increasing homogeneity in global food supplies and the implications for food security

Colin K. Khoury[a,b,1], Anne D. Bjorkman[c,d], Hannes Dempewolf[d,e,f], Julian Ramirez-Villegas[a,g,h], Luigi Guarino[f], Andy Jarvis[a,g], Loren H. Rieseberg[d,e,i], and Paul C. Struik[b]

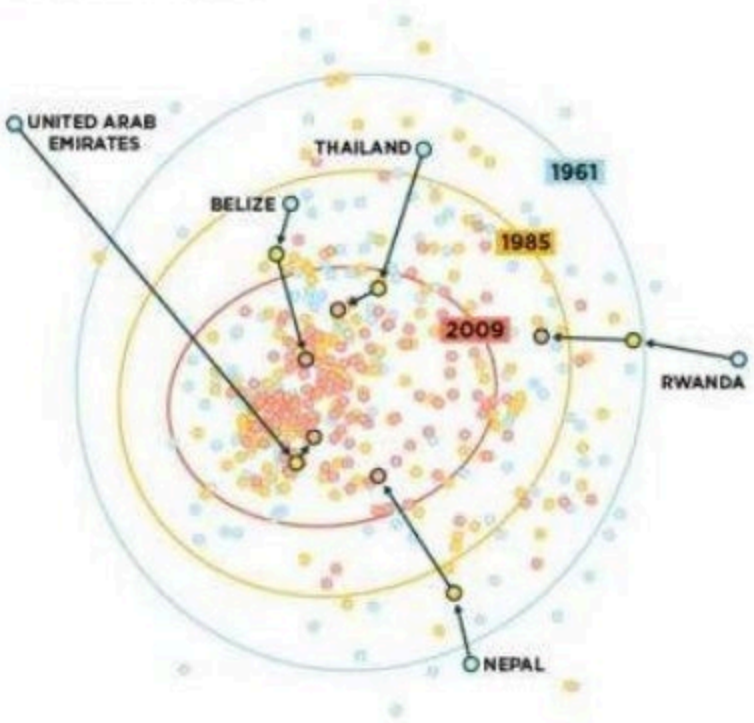
[a]International Center for Tropical Agriculture, Apartado Aéreo 6713, Cali, Colombia; [b]Centre for Crop Systems Analysis, Wageningen University, 6708 PB, Wageningen, The Netherlands; Departments of [c]Geography and [e]Botany, [d]The Biodiversity Research Centre, University of British Columbia, Vancouver, BC, Canada V6T 1Z4; [f]Global Crop Diversity Trust, 53115 Bonn, Germany; [g]CGIAR Research Program on Climate Change, Agriculture, and Food Security, Cali, Colombia; [h]Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds LS2 9JT, United Kingdom; and [i]Department of Biology, Indiana University, Bloomington, IN 47405

Convergence of global diets & a need for diet diversity

A study of the world's countries finds that over the last 50 years, diets have become ever more similar.

Each country's food supply composition in contribution to calories in:

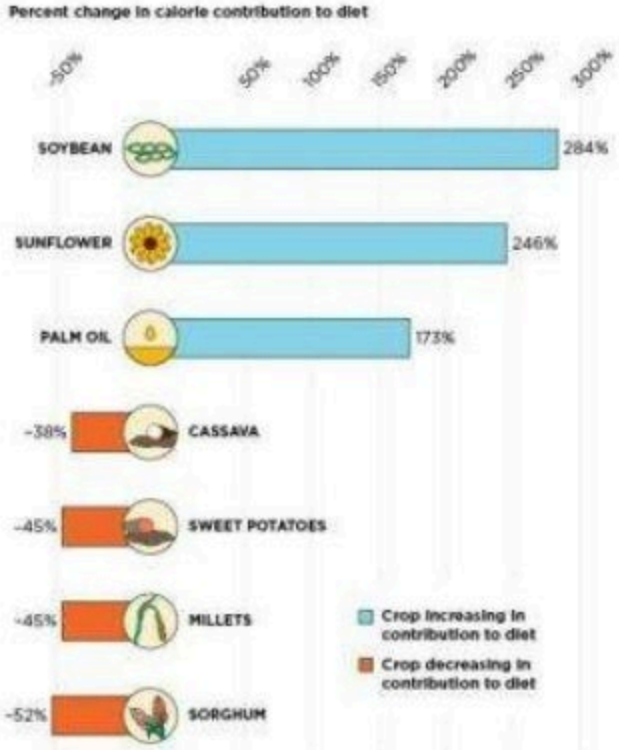
1961 1985 2009



Source: Khoury et al. 2014. Proc. Natl. Acad. Sci. USA.

Over the last 50 years, the global diet has shifted dramatically, including greater amounts of major oil crops and lesser quantities of regionally important staples.

Average change in the calories from crops in national diets worldwide, 1961-2009



Source: Khoury et al. 2014. Proc. Natl. Acad. Sci. USA.

Shifts and homogenisation of global diets

Diets in developing countries increasingly comprise major globalized crops.

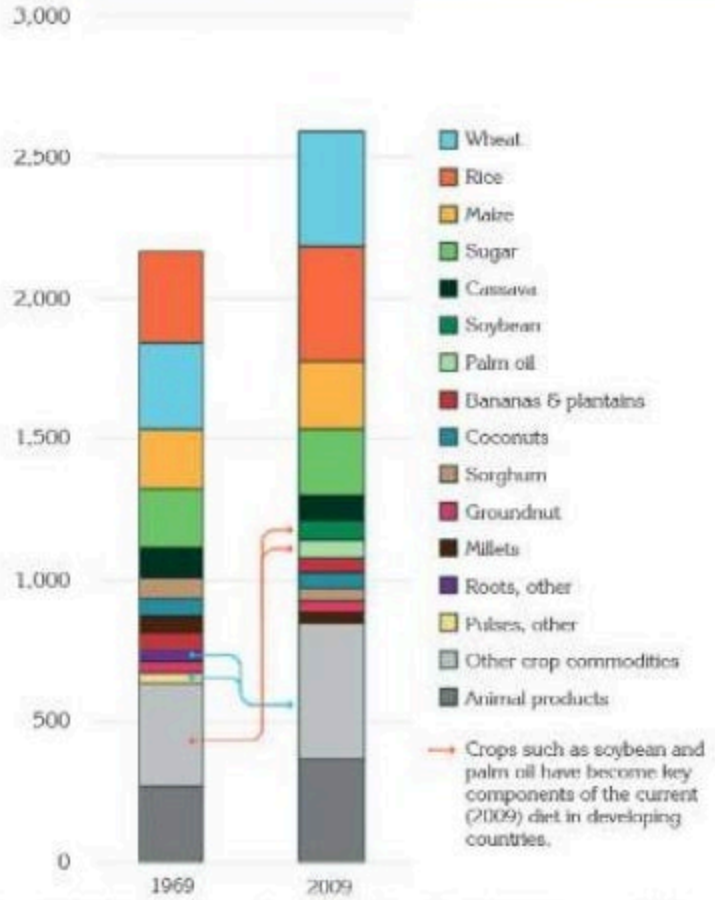


Figure 1. Contribution of crops to mean food supplies in developing countries for calories (kcal/capita/day), 1969 and 2009.

Source: Adapted from Khoury et al. 2014.

Since the inception of CGIAR, diets in developing countries have shifted dramatically, including greater amounts of major oil crops and lesser quantities of regionally important staples.

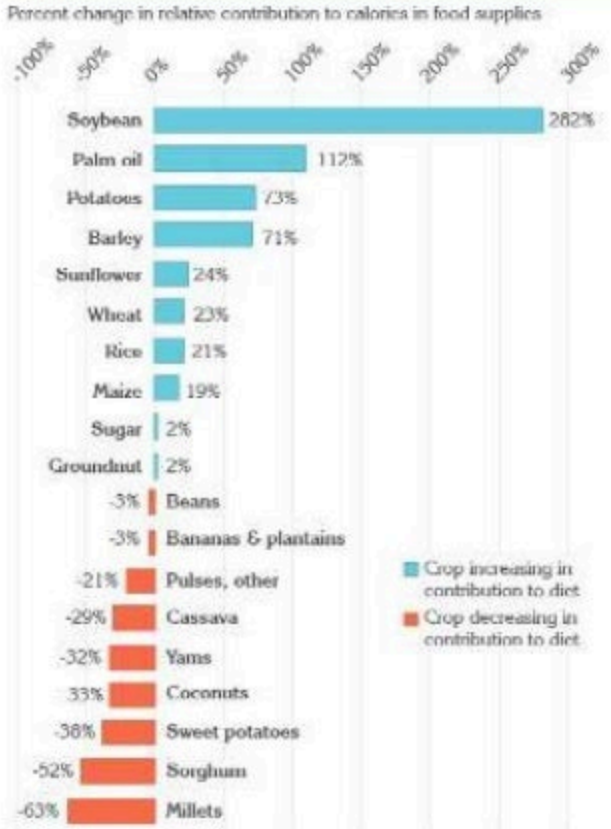
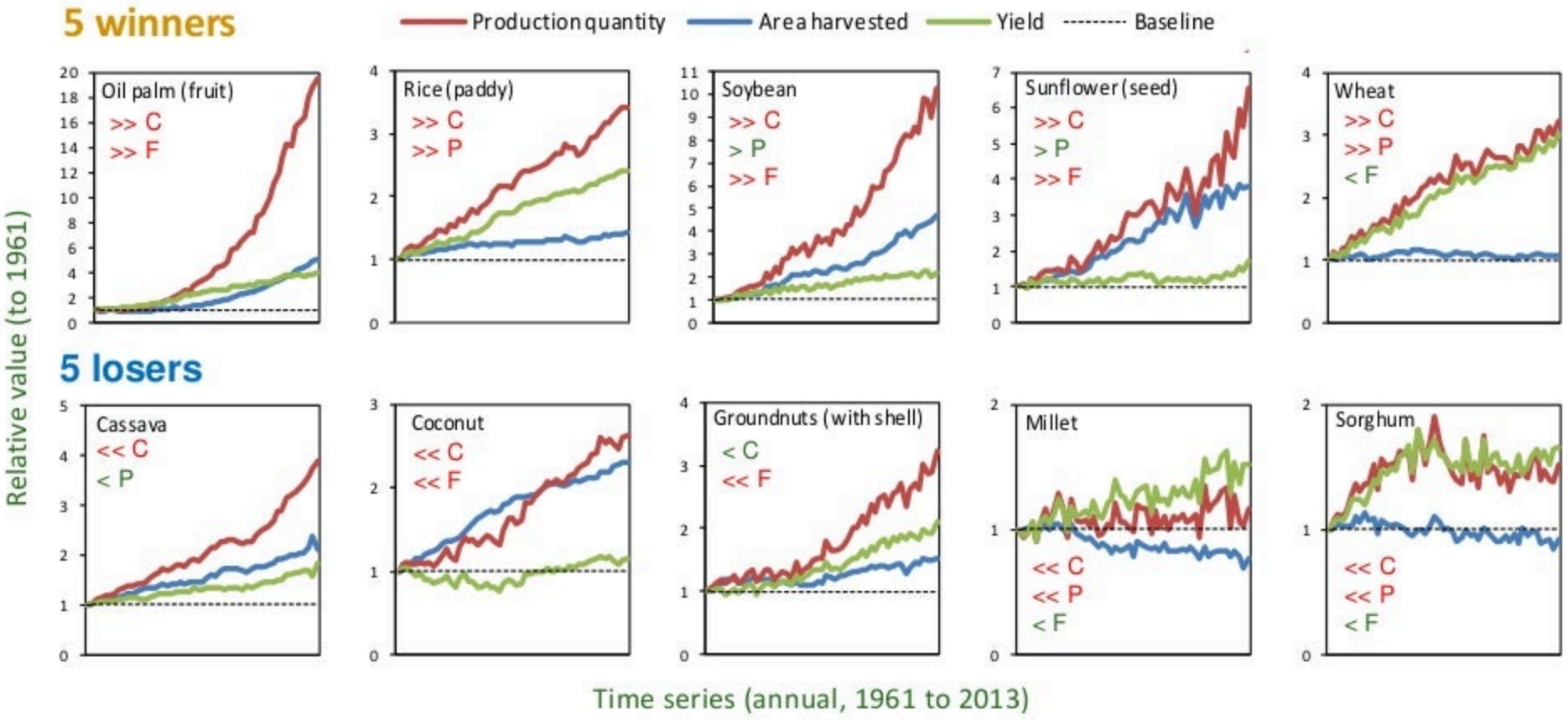


Figure 2. Median change in the relative contribution to calories from crops of interest to CGIAR in national diets in developing countries, 1969–2009.

Source: Adapted from Khoury et al. 2014.

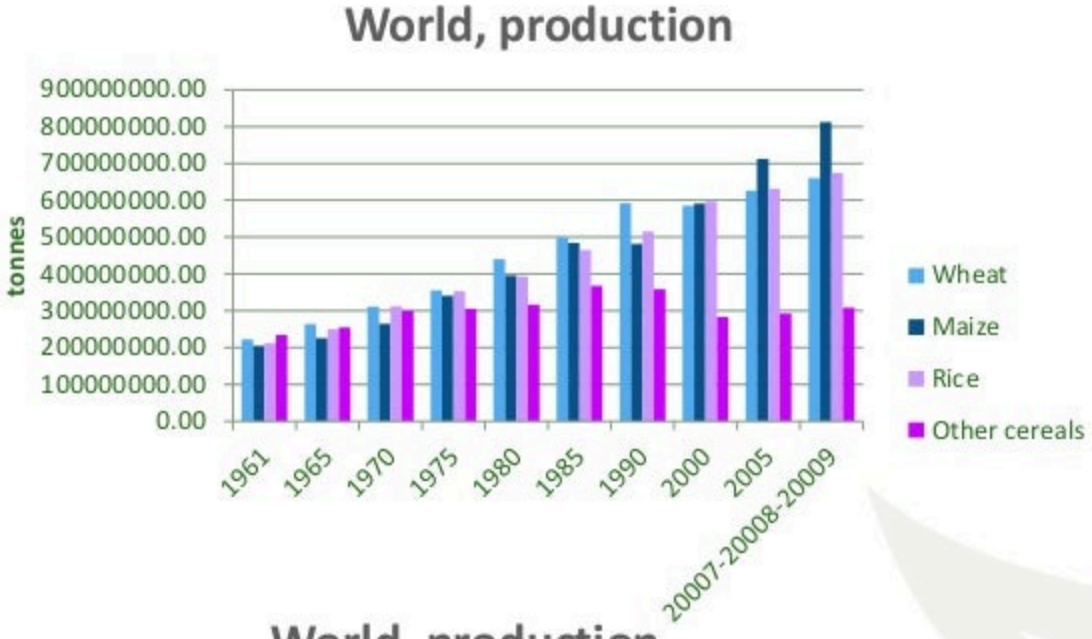
Production trends for 'winner' and 'loser' crops

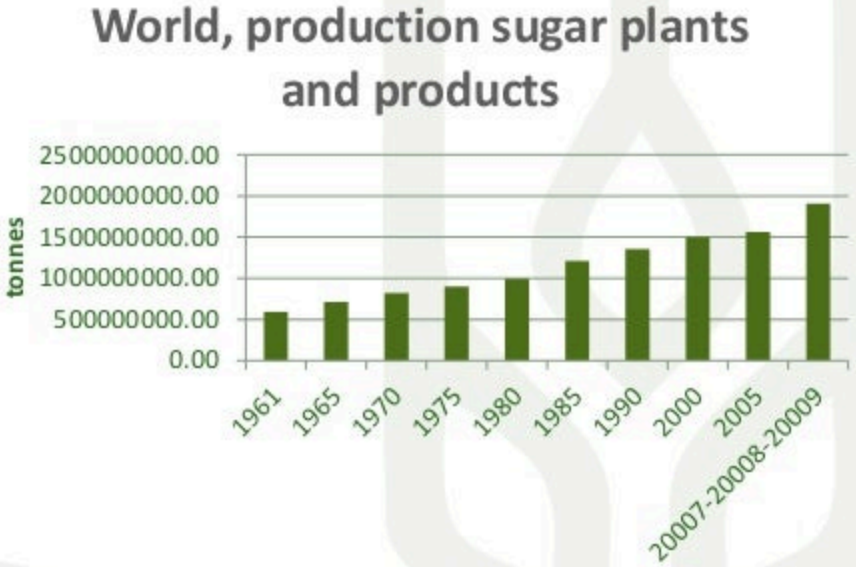
Khoury et al. 2014

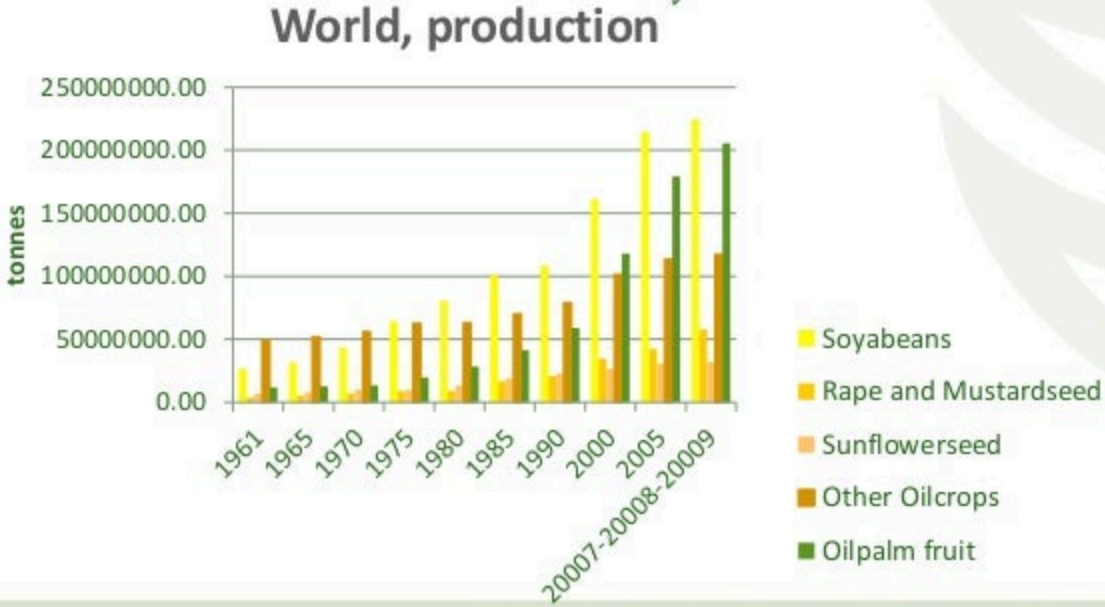


Source of production data 1961 to 2013: FAOSTAT

Evolution of agricultural production





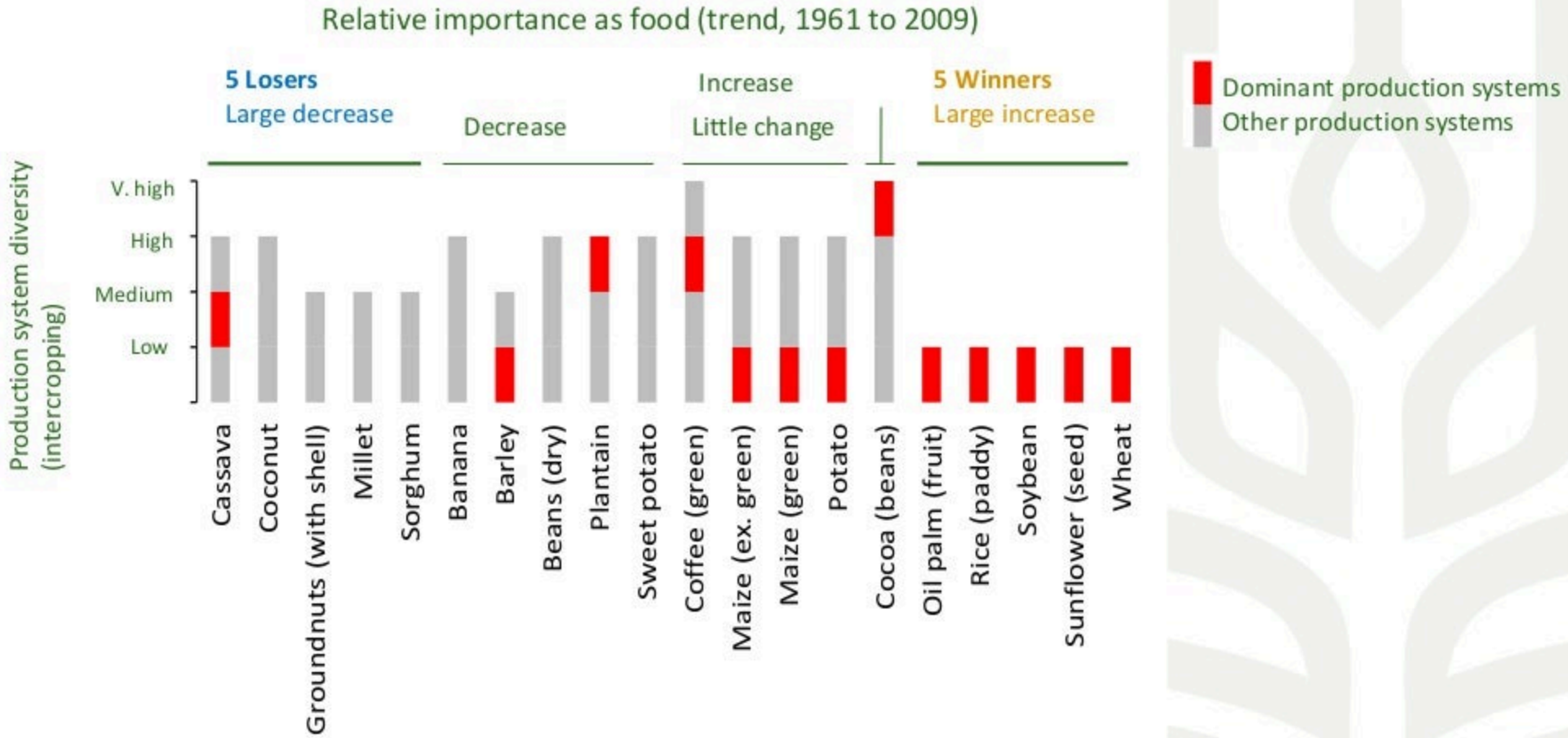


Maize: nearly X4
Sugar: more than X3
Soyabean: more than X8
Oilpalm fruit: more than X17

Source: Agrimonde-Terra

Production systems for 'winner' and 'loser' crops

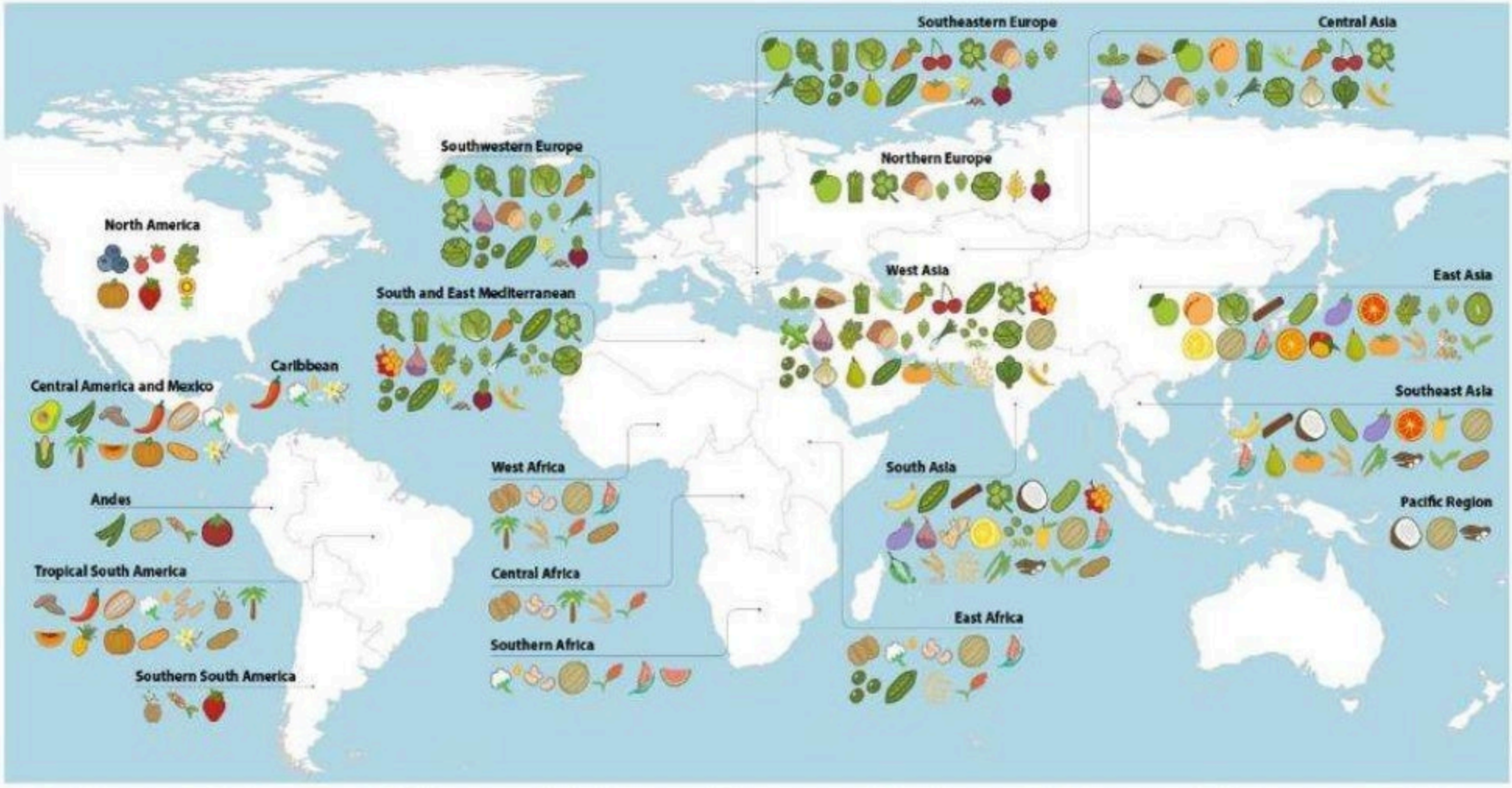
Khoury et al. 2014



- Winner crops are often grown in monoculture or close to monoculture systems
- The implications of their increased success as foods are serious for biodiversity when based on area expansion and when grown in biodiversity rich areas (e.g., soybean, oil palm)

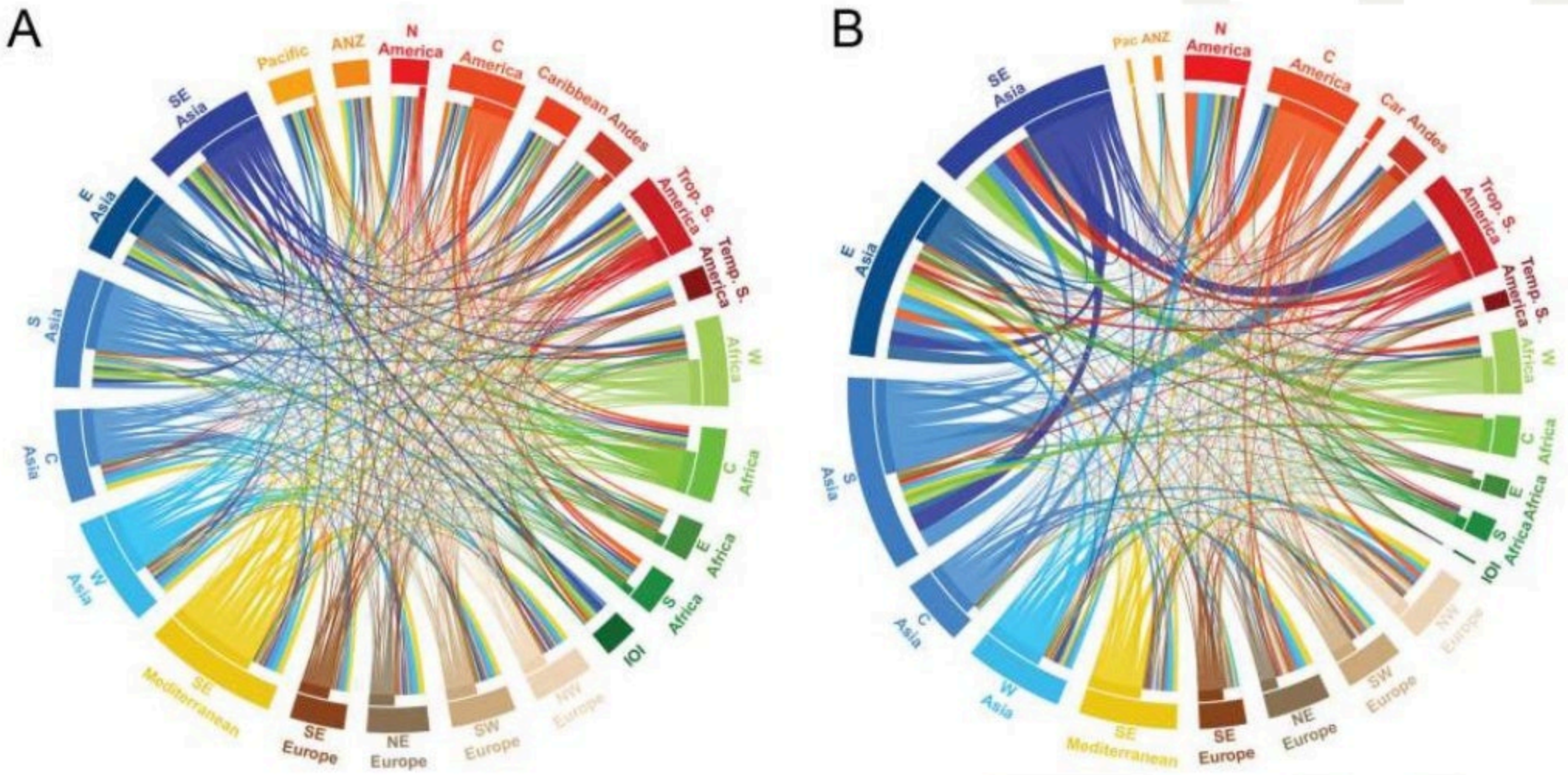
WHERE OUR FOOD CROPS COME FROM *Global interdependence on plant genetic resources*

CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change



- Alfalfa
- Almonds
- Apples
- Apricots
- Artichokes
- Asparagus
- Avocados
- Bananas & plantains
- Barley
- Beans
- Blueberries
- Cabbages
- Carrots
- Cassava
- Cherries
- Chickpeas
- Chillies & peppers
- Cinnamon
- Clover
- Cocoa beans
- Coconuts
- Coffee
- Cottonseed oil
- Cowpeas
- Cranberries
- Cucumbers
- Dates
- Eggplants
- Faba beans
- Figs
- Garlic
- Ginger
- Grapefruit
- Grapes
- Groundnut
- Hazelnuts
- Hops
- Kiwi
- Leeks
- Lemons & limes
- Lentils
- Lettuce
- Maize
- Mangoes
- Mate
- Melons
- Millets
- Oats
- Olives
- Onions
- Oranges
- Palm oil
- Papayas
- Peaches & nectarines
- Pears
- Peas
- Pigeonpeas
- Pineapples
- Plums
- Potatoes
- Pumpkins
- Quinoa
- Rape & mustard seed
- Rice
- Rye
- Sesame
- Sorghum
- Soybean
- Spinach
- Strawberries
- Sugar beet
- Sugarcane
- Sunflower
- Sweet potatoes
- Taro
- Tea
- Tomatoes
- Vanilla
- Watermelons
- Wheat
- Yams

Countries are highly interdependent in regard to the primary regions of diversity of crops that are important in their food systems.

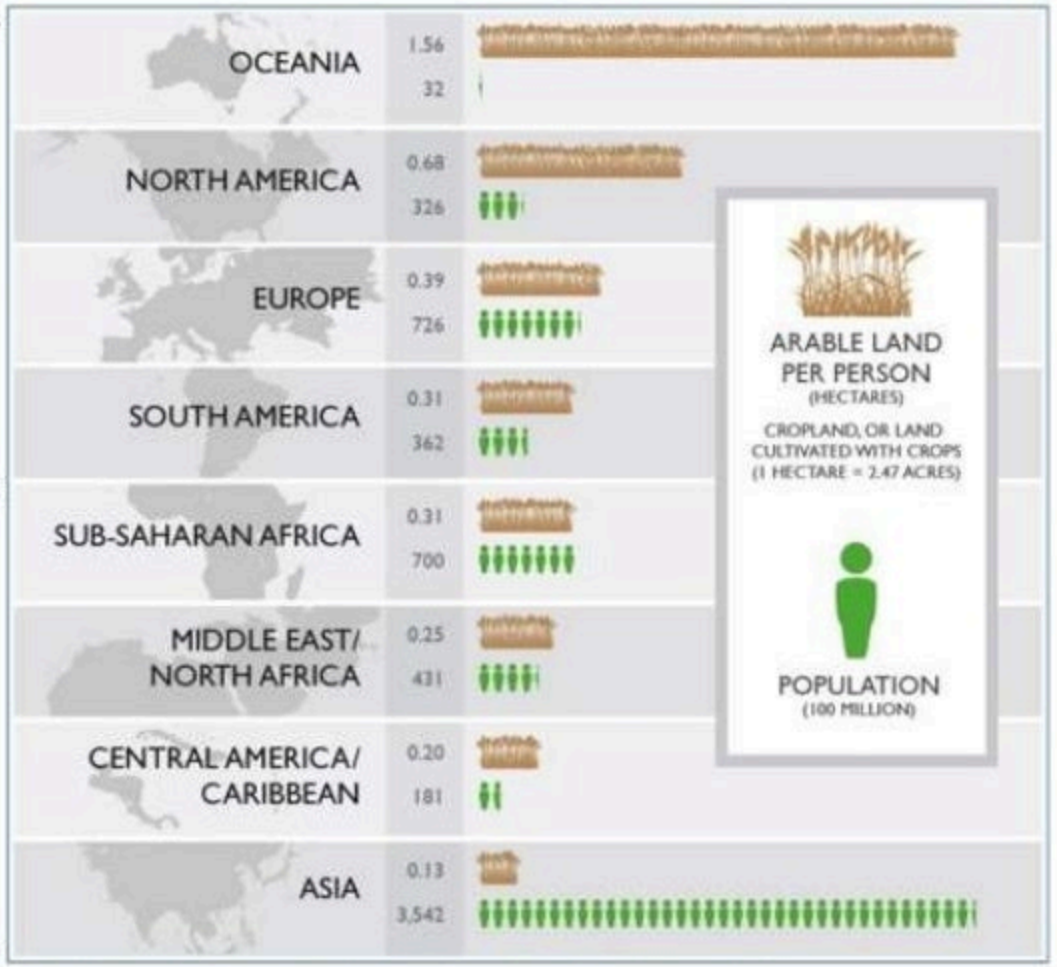


(A) calories in national food supplies

B) production quantity in national production systems.

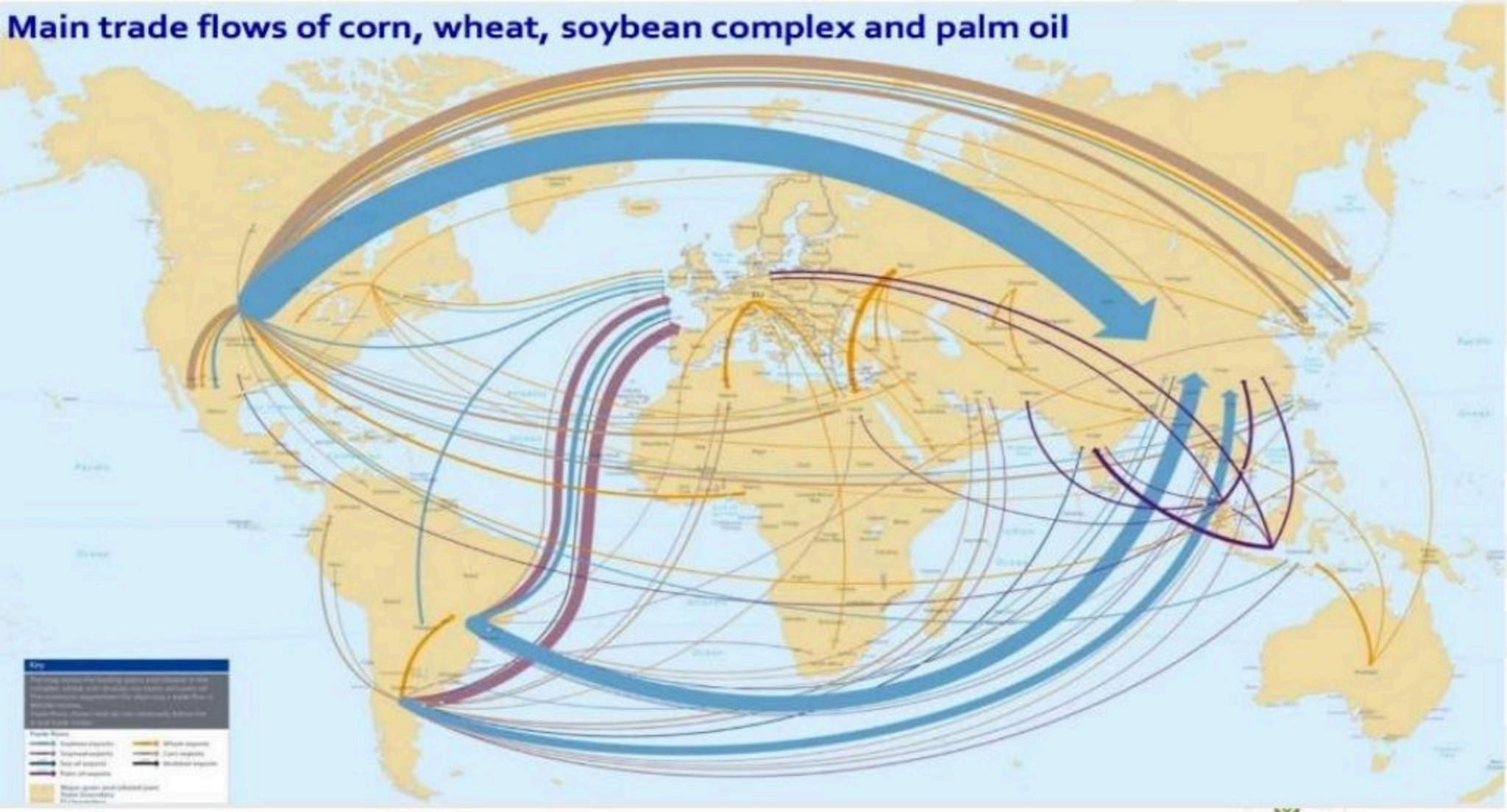
Global Arable Land and Population

In the future, a larger fraction of agricultural production **will need to move through trade** because the world's population distribution by region is not the same as the distribution of arable land.



Source: UN data from Global Harvest Initiative GAP Report (2011).

Global homogenization of food and interdependence-need for resilience

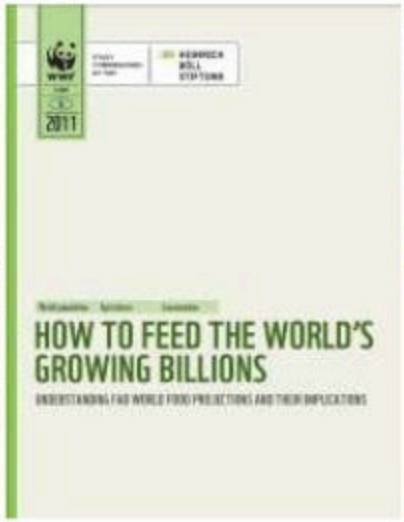


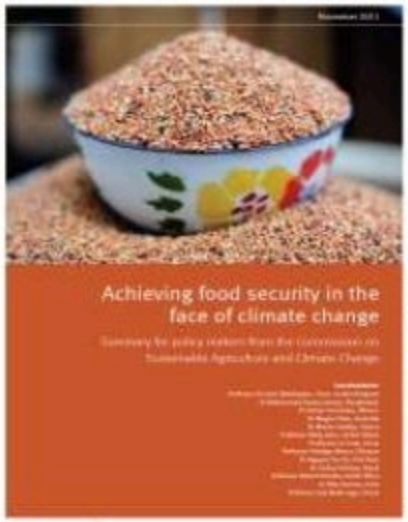
What if trade of agricultural products collapses

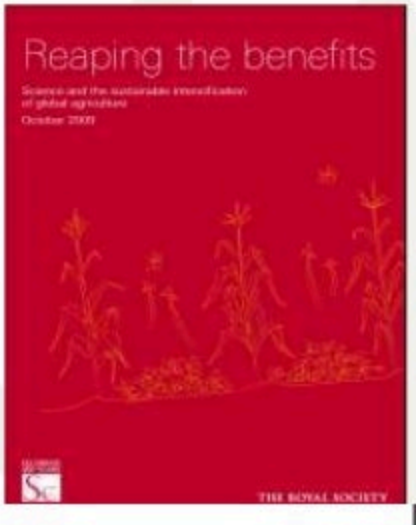
The last thirty years have been marked by increased liberalisation and globalisation, yet a number of uncertainties could profoundly stop or reverse this trend

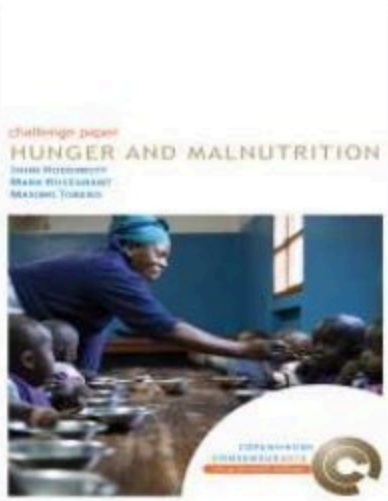
- governance local/global
- international negotiations
- food quality and safety standards
- regulations
- climate change
- trade, value chains, food access

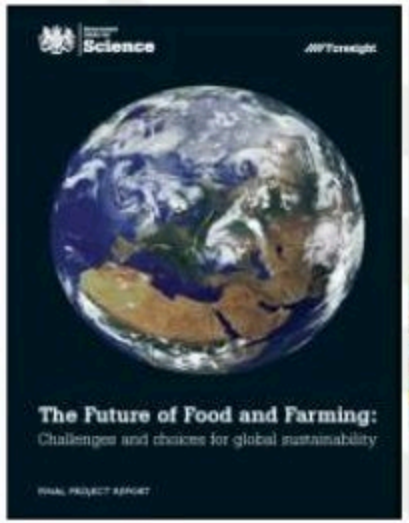
Extensive reviews of food system challenges

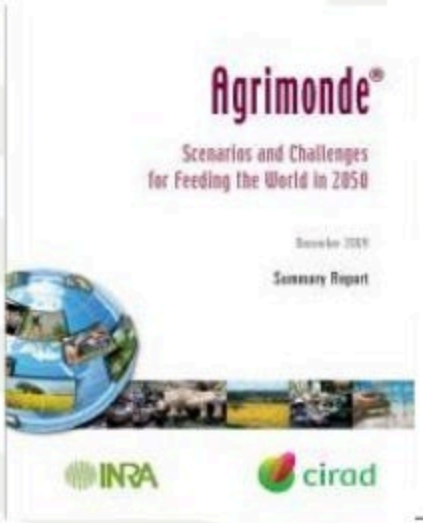












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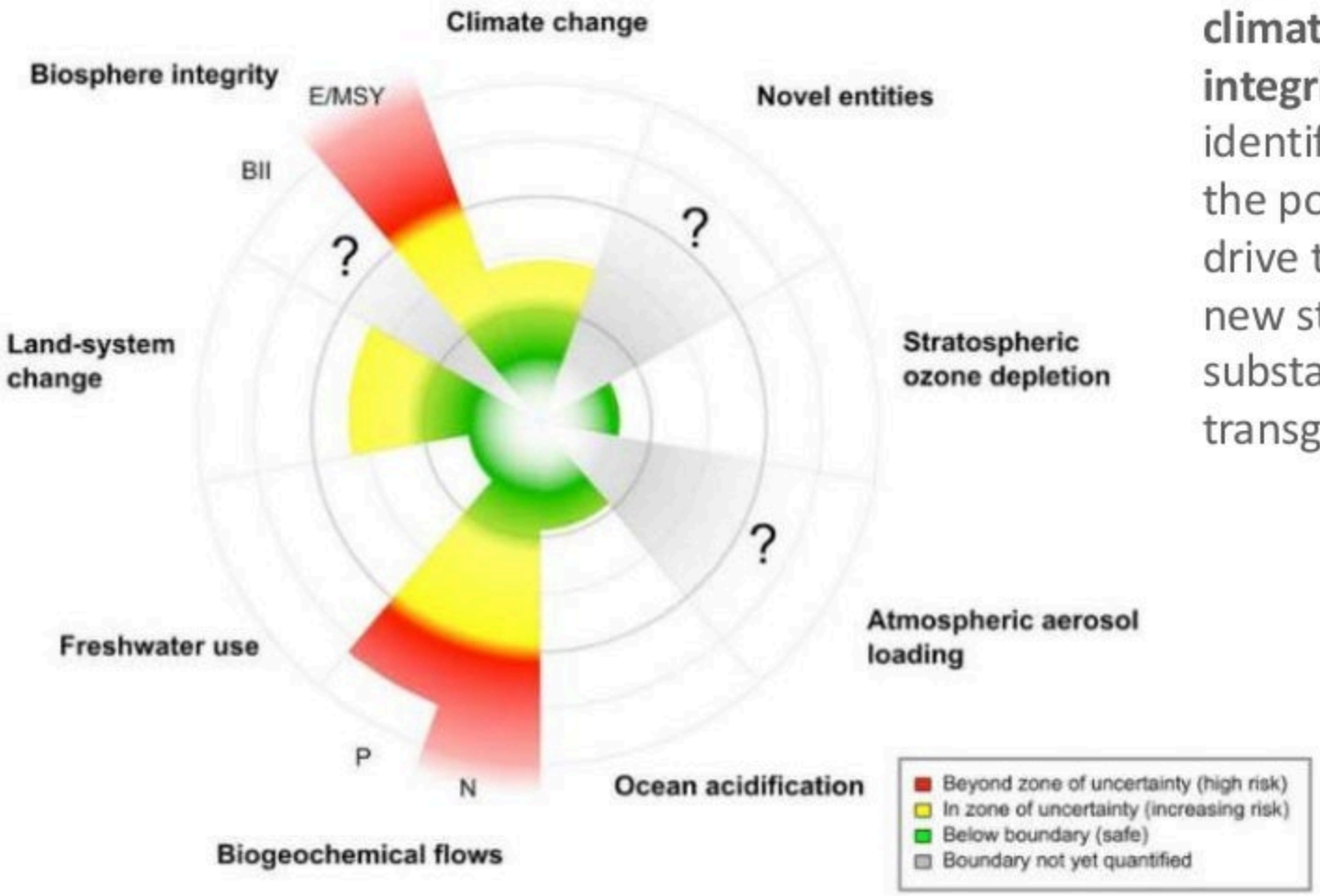
CGIAR is a global research partnership for a food-secure future

Food System Foresight challenges:

- Highlight the complexity of food systems
- Still strong focus on production and the main challenges for the agricultural system
- Focus on defining key actions for sustainable intensification
- *Everything* is important – difficult to prioritize
- ***Shows need to increase focus on: (1) nutrition and health; (2) food value chains; & (3) food loss and waste***

The world risks exceeding planetary safe boundaries

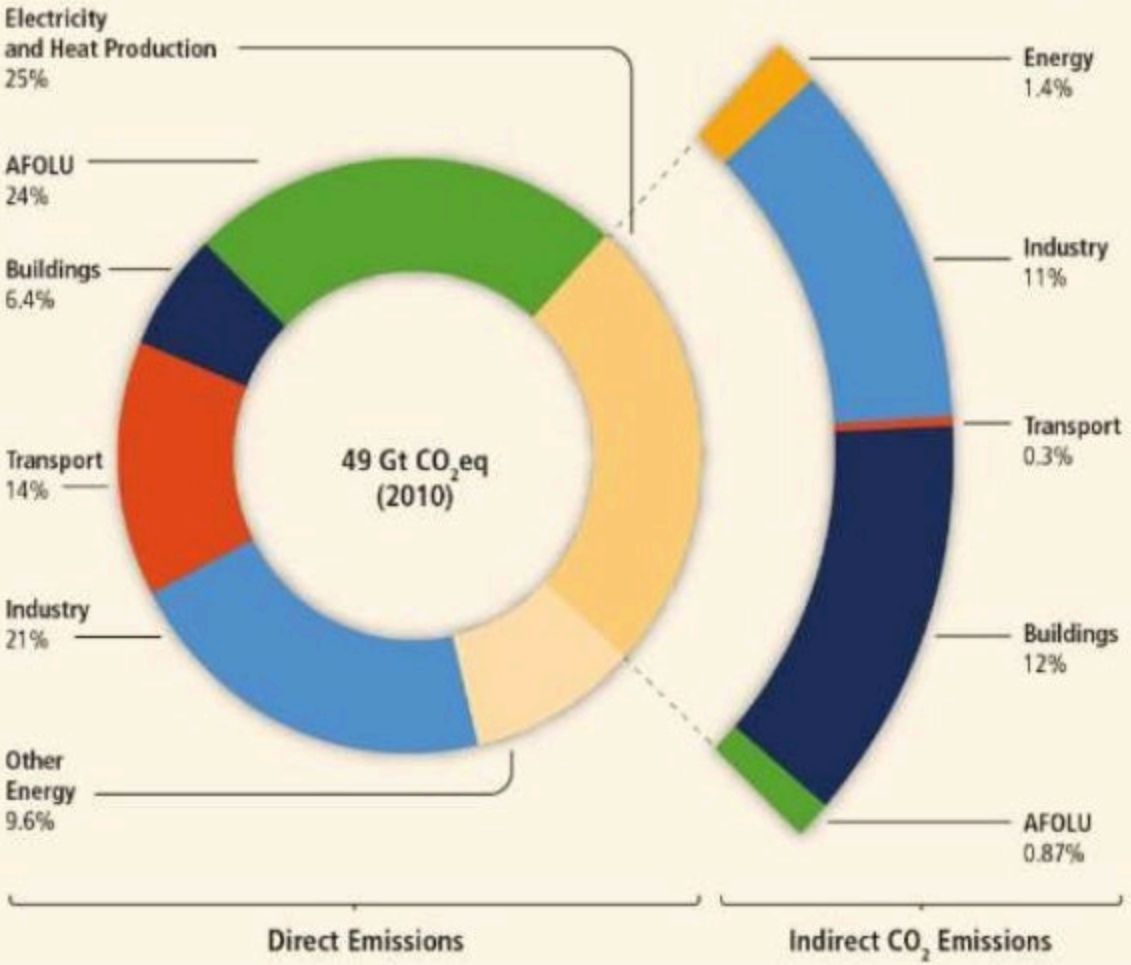


"Two core boundaries — **climate change** & **biosphere integrity**— have been identified, each of which has the potential on its own to drive the Earth System into a new state should they be substantially and persistently transgressed."

Stephen et al. (2015) Planetary boundaries: Guiding human development on a changing planet. **sciencemag**.org/content/early/recent / 15 January 2015 / Page 1 / 10.1126/science.125985

Agriculture as driver of climate change

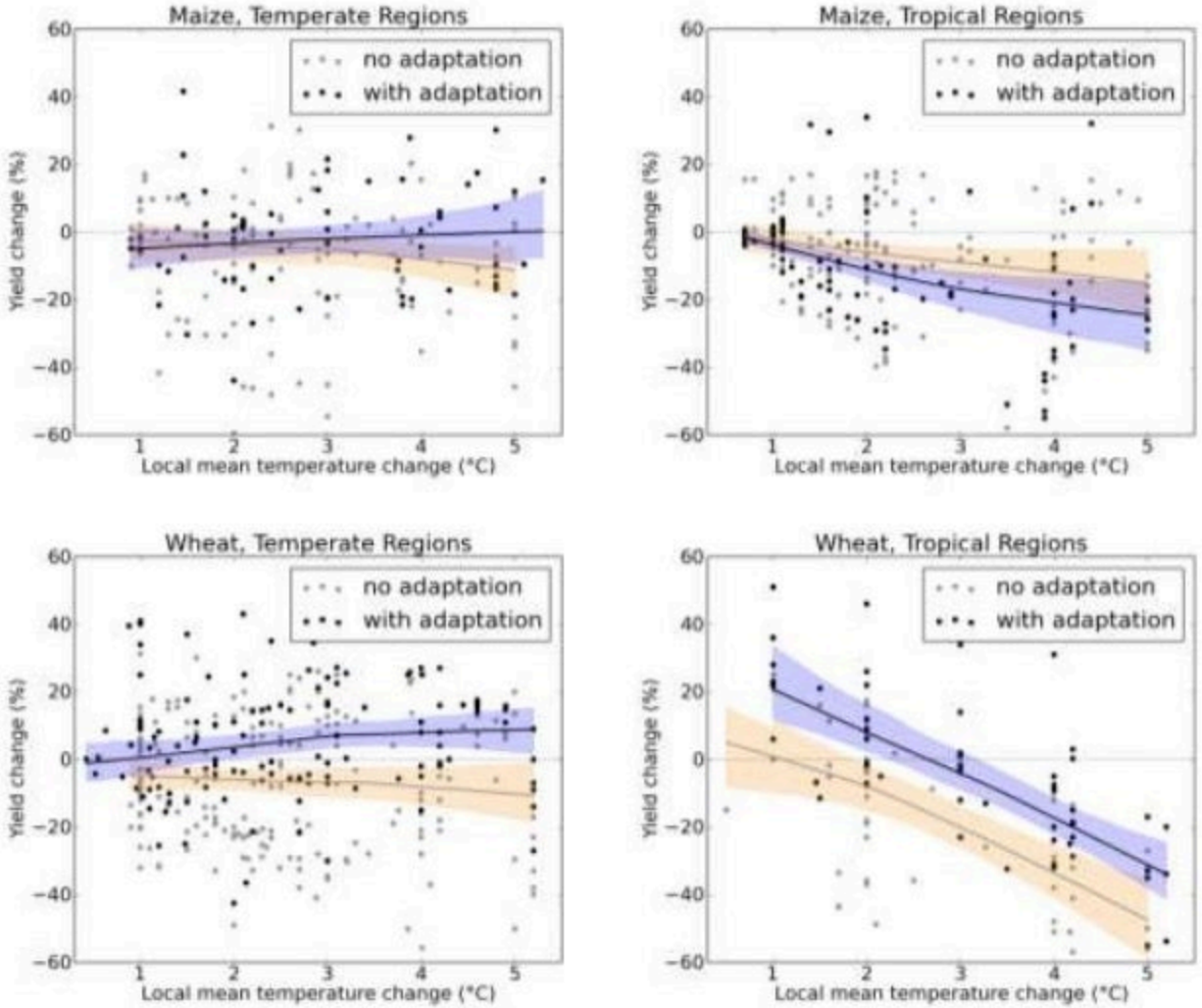
Agriculture-related activities are 19-29% of global greenhouse gas emissions (2010)



Source: IPCC WGIII

Agriculture is sensitive to climate change

Global wheat and maize yields: response to warming



CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

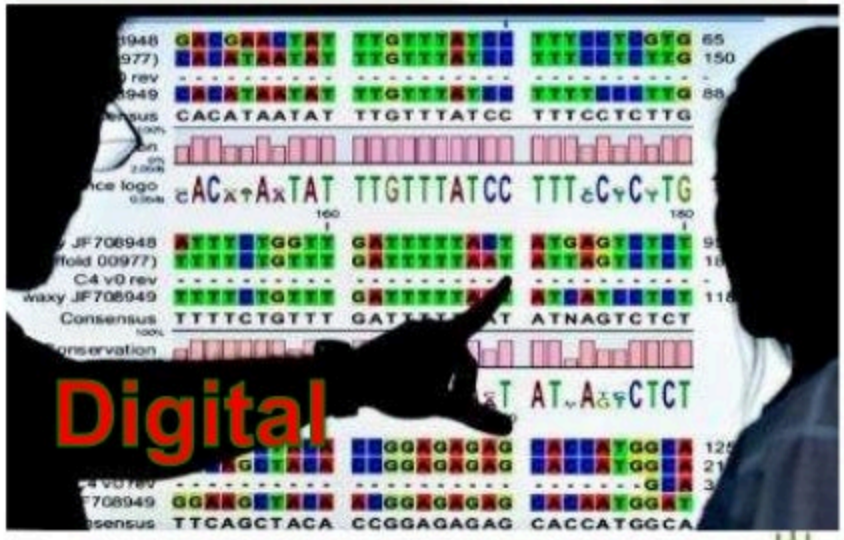
In summary: Agri-Food System Challenges

1. Diets are not healthy – particularly for the urban poor
2. Total production is currently sufficient – but access / availability is not – and up to a third of total food produced is lost / wasted
3. Global diets increasingly homogenized – and increasingly processed
4. Agri-food systems are globally interdependent and vulnerable to shocks – food safety, climate change (floods / droughts), food price volatility
5. Agri-food systems are primary driver of planetary ill health: climate, water, soils, bio-geo-chemical cycles

Daunting challenges - impressive opportunities:

- The ***life science revolution*** is changing our understanding of the fundamental biology of plants, animals and people. It has already transformed medicine and is just now reaching agriculture.
- ***Big data*** approaches are critically transforming the retail end of food value chains
- ***Open access*** to agriculture and nutrition related publications and data will increase access and accelerate agri-food system innovation, and the potential for impact
- Renewed policy focus on the central role of the ***Bio-economy*** in the broader sense

Building on Biodiversity:
genetic resources for the future of humanity



Consortium

CGIAR

What's So Special About New Seed Varieties? They are like vaccines

- Innovation captured in a small seed/propagule package:
  - Yield
  - Land use efficiency
  - Water use efficiency
  - Nutrient use efficiency
  - Resistance to pest and diseases
- Widest reach and impact of technologies: Global Public Good at scale
- Represents long-term mission driven research
- Infrastructure & capability
- Delivers multiple benefits
- Products & knowledge

Cheap high-throughput sequencing is revolutionizing biology – and only just hitting agri-food sciences

Rate of genome sequence production

Knowledge

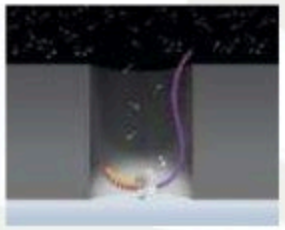
Genome per decade	Genome per year	Genome per day	>100 genomes per day

ABI 3730

2001-2007

- *Roche 454*
- *Illumina*
- *SOLiD (Life Technologies)*
- *Helicos*
- *Pacific Biosciences*

2007-2014



- *Roche 454*
- *Illumina*
- *SOLiD (Life Technologies)*
- *Helicos*
- *Pacific Biosciences*
- *Oxford Nanopore (Illumina)*
- *Ion Torrent*

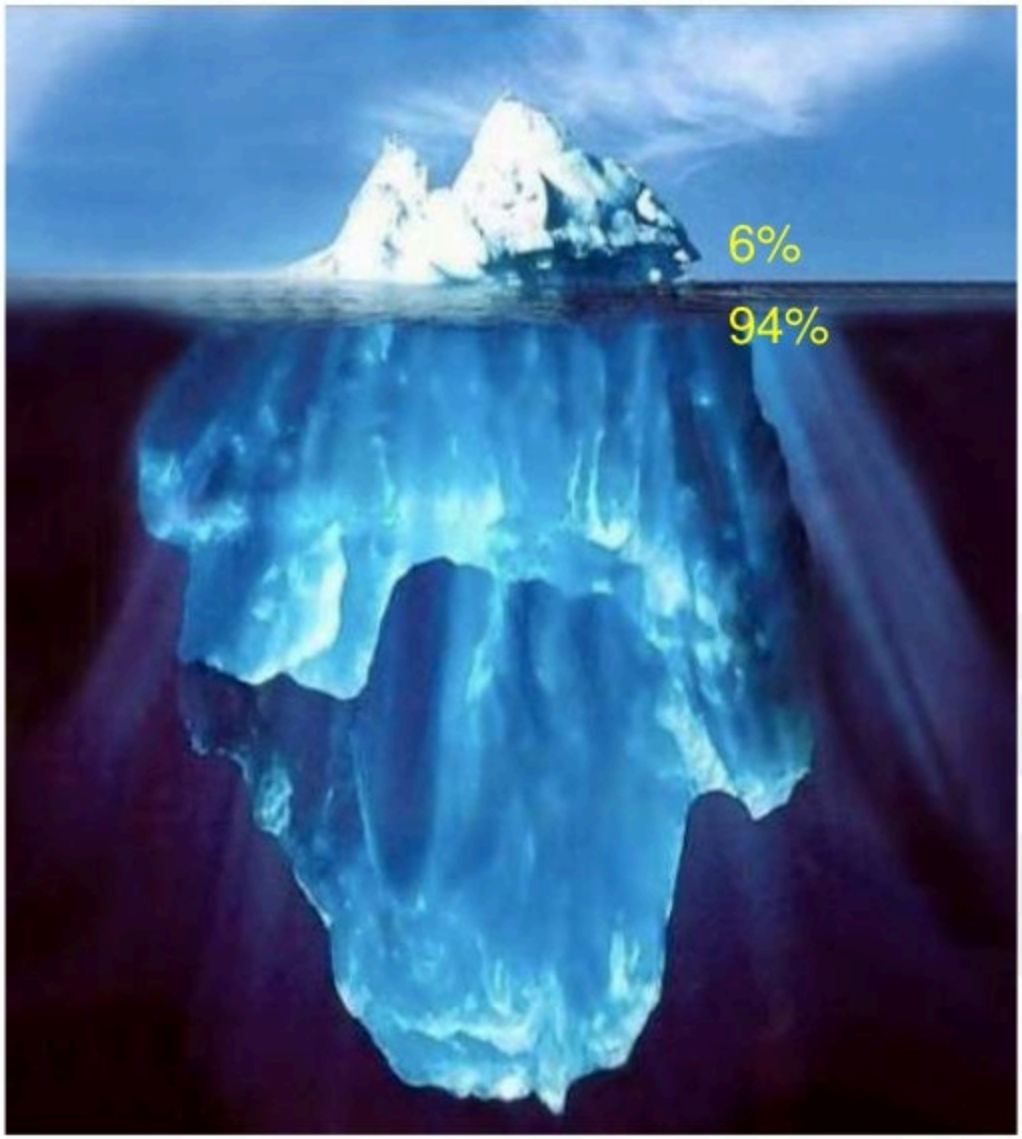
2014-2020

Thousands of genes per year	Hundreds of thousands of genes per year	Millions of genes per year	Tens of millions of genes per year

Rate of novel gene & allele discovery

New Opportunities

Crop diversity in CGIAR collections



738,000 accessions

702,934 seed

31,681 tissue culture

27,763 whole plants

RESPONDING TO USERS

EVERY YEAR:

~ 2000 requests

~ 130,000 samples distributed

> 100 countries worldwide

Genome editing-game changer

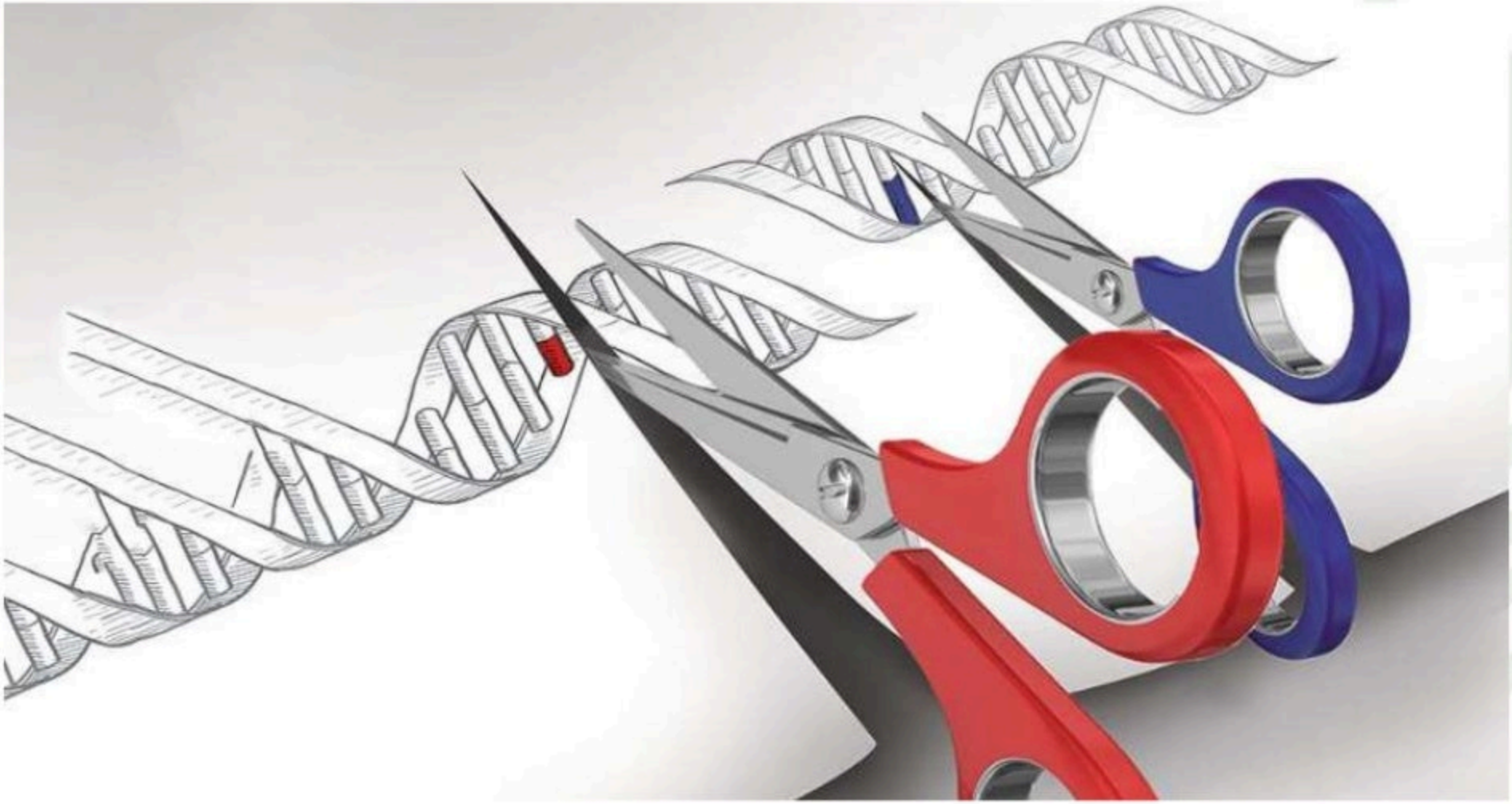
GE is the process of precise editing genome

Nucleotides can be

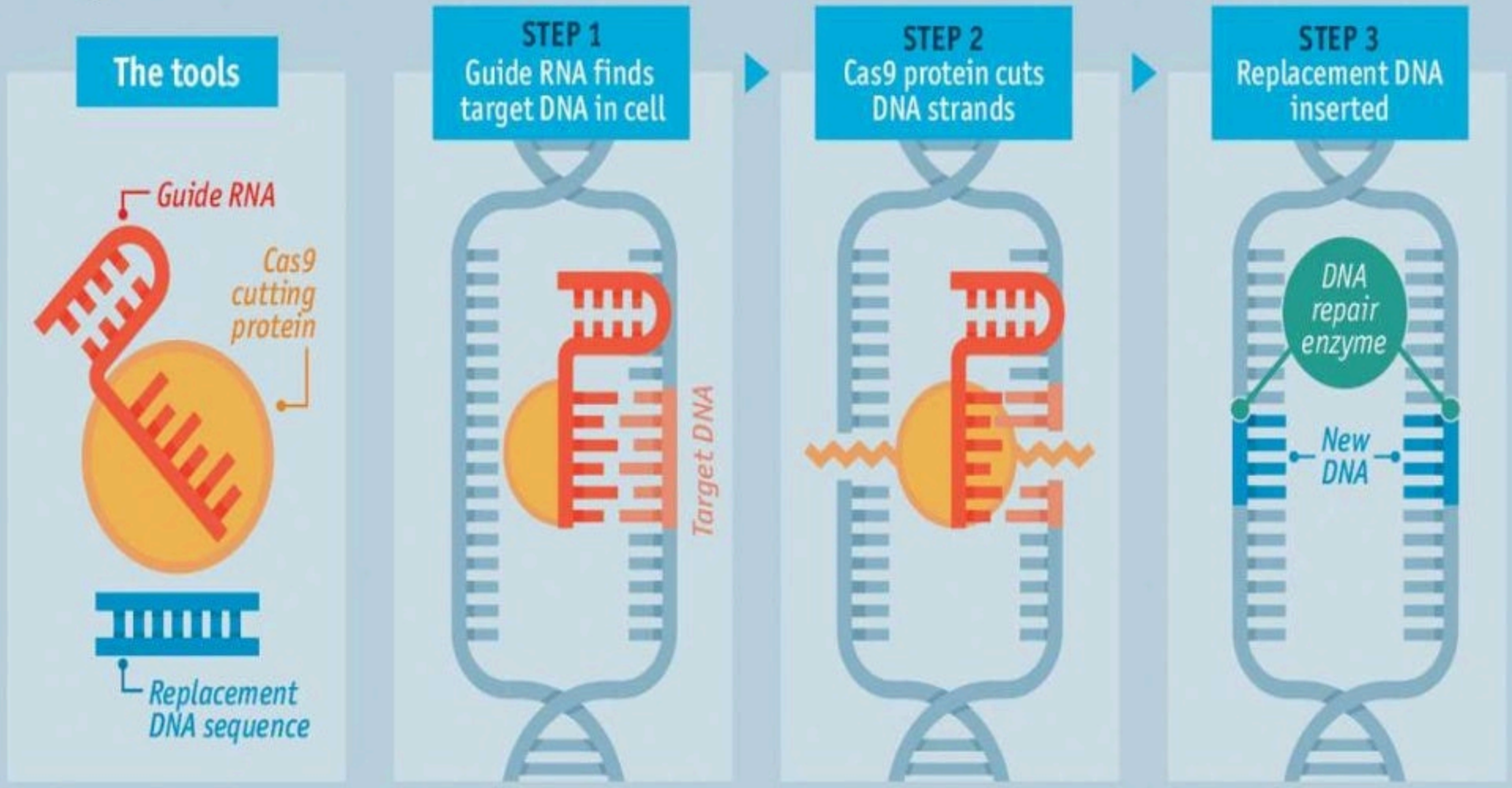
- added
- deleted
- replaced

Software for the Genome

It is now easy to edit the genomes of crops, animals and humans



Using CRISPR



Source: *The Economist*

New tools allow us to look in new places for sources of variation – including wildlife

"Traditional" linkage mapping requires crosses – so initial discovery is limited to variants within a species

```
Cow NDama     KFITRRPSLKTLQEKGLIKDQIFGSPLHTLCEREKSTVPRFVKQCIEAVEK
Cow Boran     KFITRRPSLKTLQEKGLIKDQIFGSHLHTLCEREKSTVPRFVKQCIEAVEK
Human         KFISRRPSLKTLQEKGLIKDQIFGSHLHTVCEREHSTVPWFVKQCIEAVEK
Pig           KFITRRPSLKTLQEKGLIKDQIFGSHLHTVCERENSTVPRFVKQCIEAVEK
Chicken       KFISRRPSLKTLQEKGLIKDQIFGSHLHLVCEHENSTVPQFVRQCIKAVER
Salmon        KFISRRPSMKTLQEKGIIKDRVFGCHLLALCEREGTTVPKFVRQCVEAVEK
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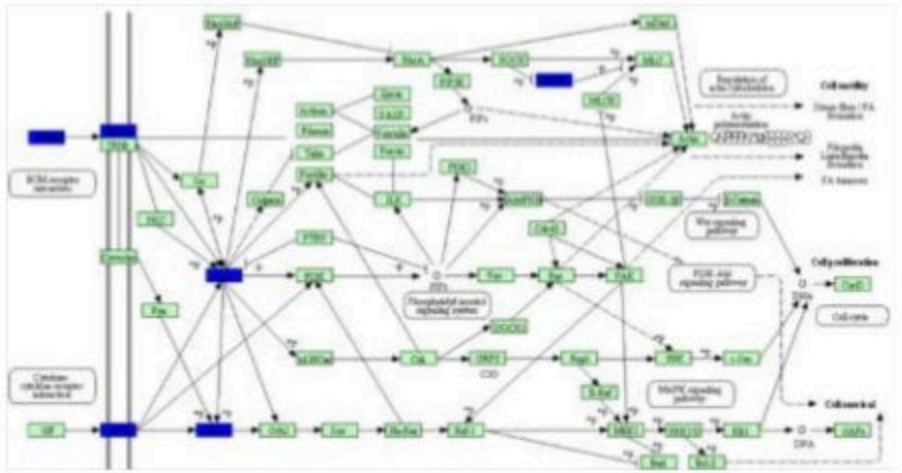
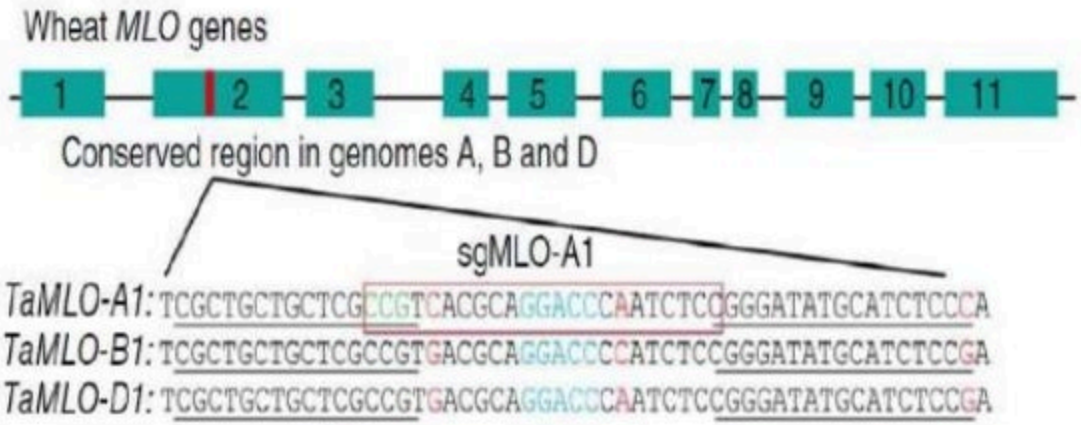
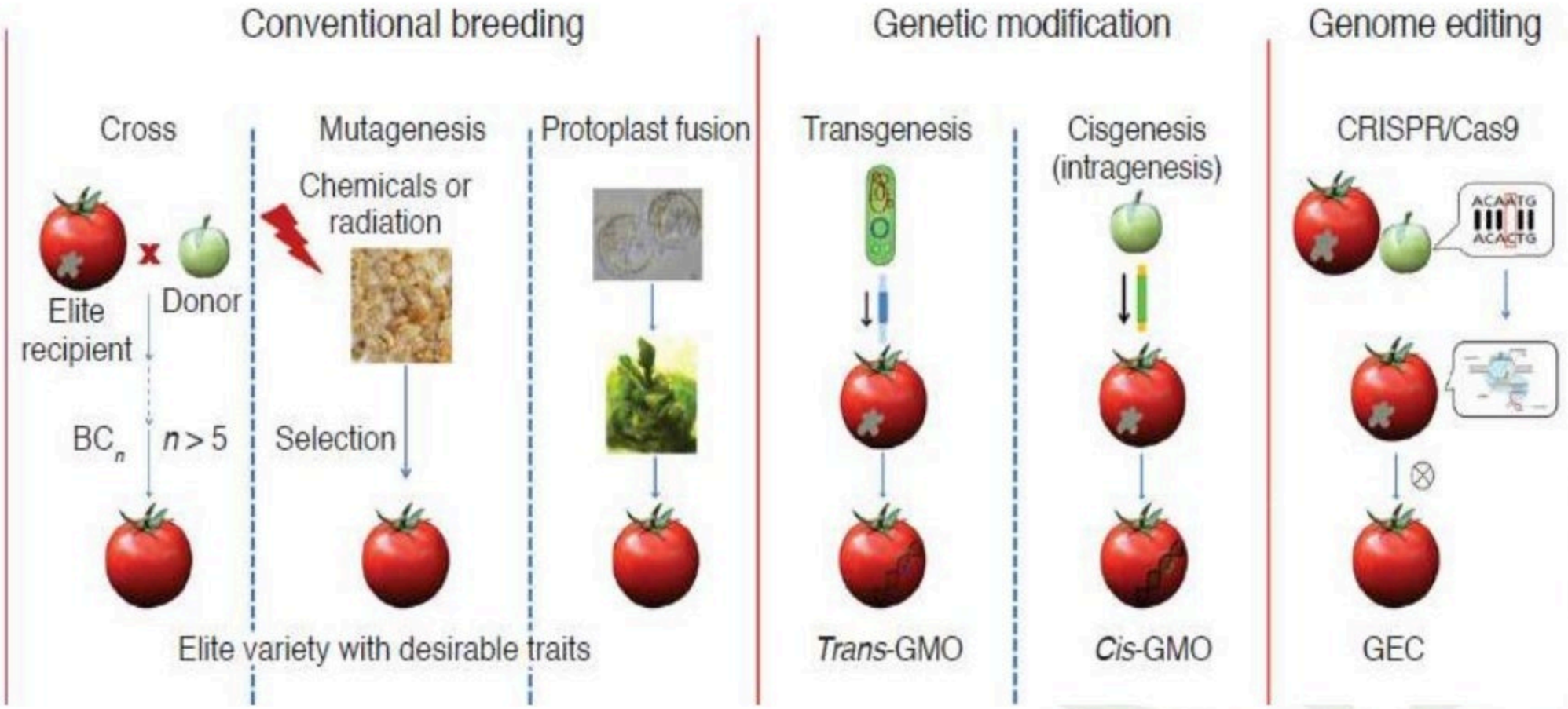


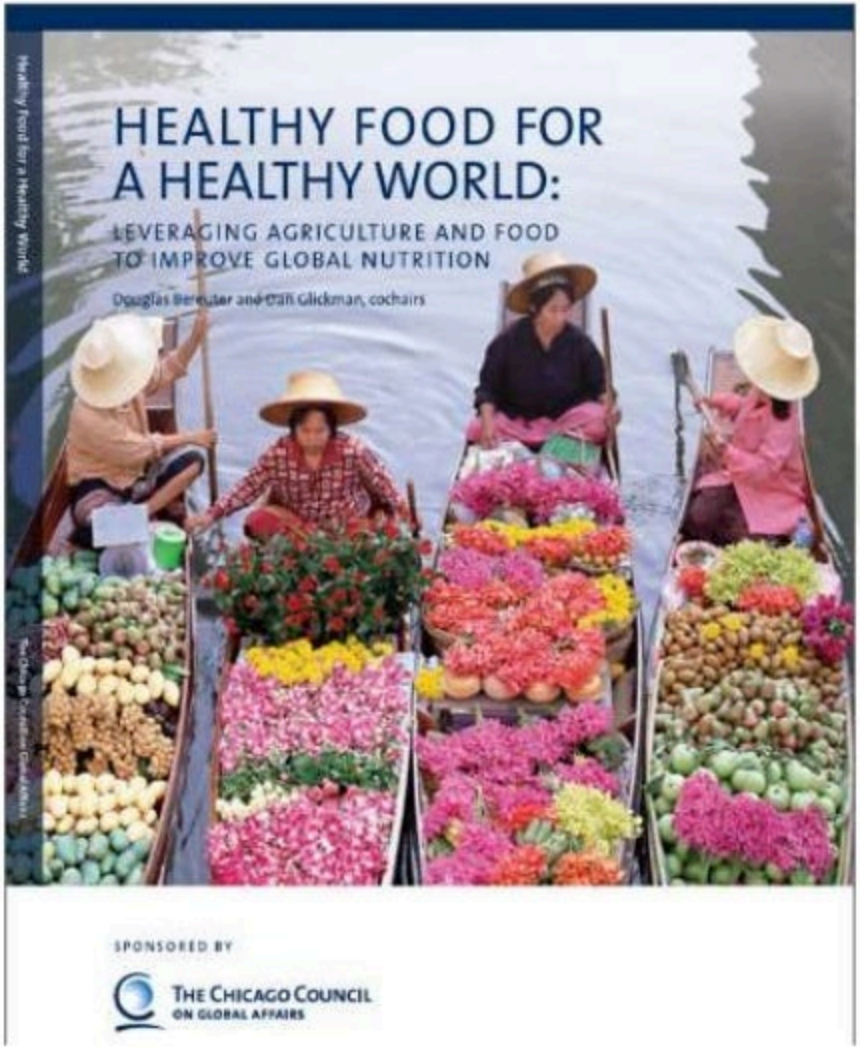
Comparative gene network and sequence analysis allows to ask new kinds of questions about genomes:
eg "what is different about this (group of) species compared to all other mammals"

Simultaneous editing of three homoeoalleles in hexaploid bread wheat confers heritable resistance to powdery mildew




Conventional breeding
Genetic modification
Genome editing
Cross
Mutagenesis
Protoplast fusion
Transgenesis
Cisgenesis (intragenesis)
CRISPR/Cas9
Chemicals or radiation
Elite recipient
Donor
BC$_n$ n > 5
Selection
Elite variety with desirable traits
Trans-GMO
Cis-GMO
GEC

Research agenda for nutrition sensitive food systems



Production diversity and dietary diversity in smallholder farm households

Kibrom T. Sibhatu, Vijesh V. Krishna, and Matin Qaim

Hunger and malnutrition are complex global problems. Despite improvements in food and nutrition security over the last few decades, the prevalence of undernutrition remains high, especially in Africa and Asia (1–3). Close to 800 million people are still classified as chronically hungry, meaning that they do not have sufficient access to calories (4). An estimated 2 billion people suffer from micronutrient malnutrition, mostly due to low intakes of vitamins and minerals such as iron and zinc (5). Nutritional deficiencies are responsible for a large health burden in terms of lost productivity, impaired physical and mental human development, susceptibility to various diseases, and premature deaths (5). Nutritional deficiencies are not only the result of low food quantities consumed, but also of poor dietary quality and diversity. In fact, the level of dietary diversity was shown to be a good indicator of people's broader nutritional status in many situations (6–12). More diverse diets tend to be associated also with lower rates of overweight and obesity—other nutritional problems of rising magnitude in many parts of the world (13). Increasing dietary diversity is therefore an important strategy to improve nutrition and health. This implies that agricultural production also needs to be diversified, so that a wide range of different types of foods are available and accessible also to poor population segments (14). Over the last 50 y, agricultural modernization has contributed to narrowing global production patterns with a focus on a limited number of major crop plants (15).

In Africa and Asia, the majority of the undernourished people live in rural areas. Many of them are smallholder farmers (16). Against this background, further diversifying production on these smallholder farms is often perceived as a useful approach to improve dietary diversity and nutrition (17–20). Several recent development initiatives have promoted smallholder diversification through introducing additional crop and livestock species with the intention to improve household nutrition (21, 22). Because farm diversity can help to increase agrobiodiversity too, this approach is also welcome from environmental perspective (23, 24). But is there really such a close link between production diversity on the farm and consumption diversity in the farm household? What are other factors that influence this relationship and dietary diversity in smallholder farm households more generally? These are underresearched questions of relevance for improving agriculture and nutrition in the smallholder sector (25, 26). Here, we address these questions empirically with data from several developing countries.

A positive relationship between farm production diversity and dietary diversity is plausible, because much of what smallholder farmers produce is consumed at home (27). However, assuming that all smallholders are pure subsistence farmers and do not sell and buy any food is too simplistic. Taking into account market transactions, the relationship between production diversity and dietary diversity becomes more complex. Instead of producing everything at home, households can buy food diversity in the market when they generate sufficient income (17). Farm diversification may contribute to income growth and stability up to a certain point, but beyond that point further diversification may reduce household income due to foregone benefits from specialization (28). Because lower household income tend to be associated with lower dietary quality, the relationship between production and consumption diversity may even turn negative in some situations. Beyond farming, the majority of smallholder households in developing countries also have off-farm income sources (29), further adding to the complexity. When relying on markets, nutrition effects in farm households will also depend on how well the markets function and

Significance

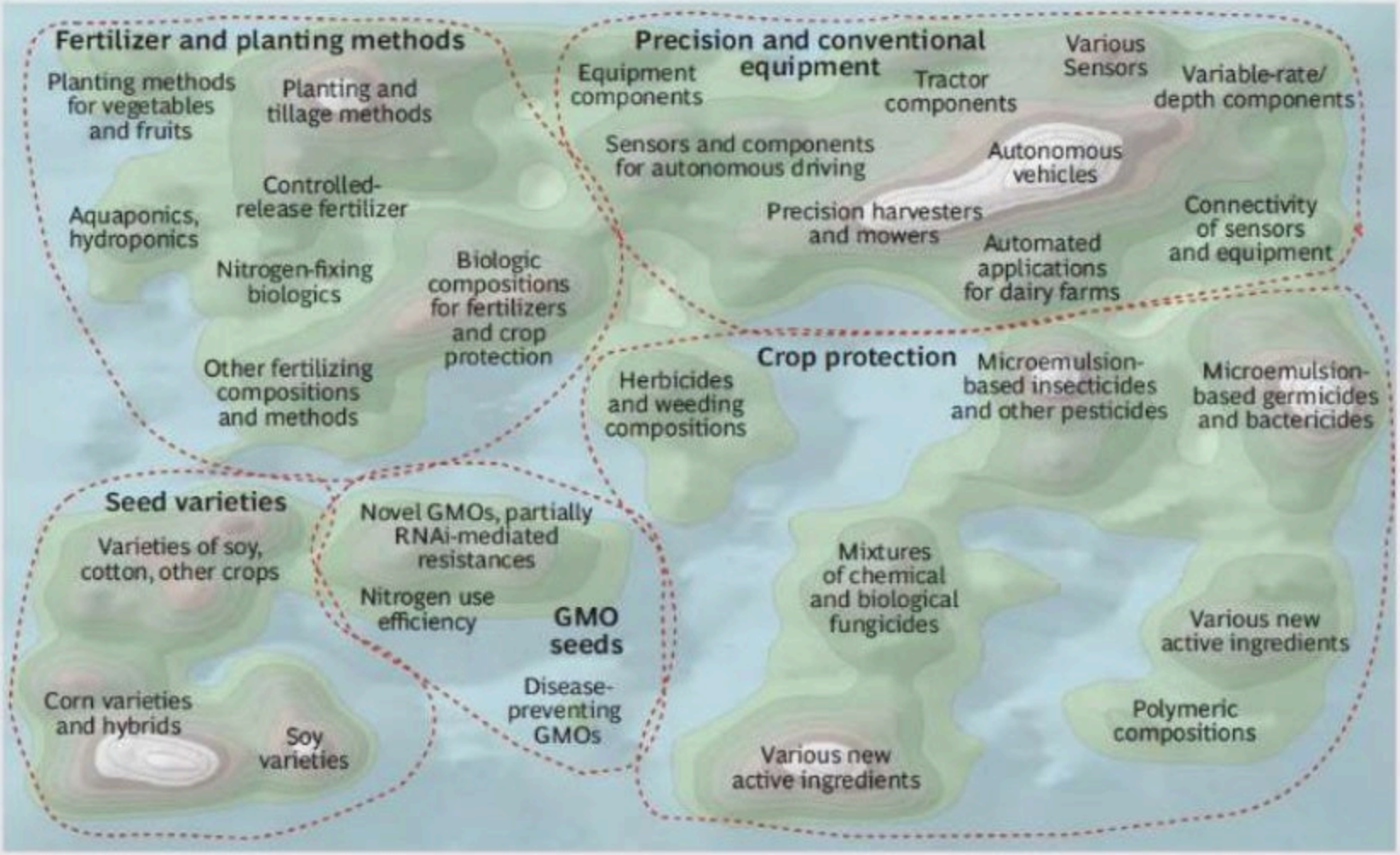
Given that hunger and malnutrition are still widespread problems in many developing countries, the question of how to make agriculture and food systems more nutrition-sensitive is of high relevance for research and policy. Many of the undernourished people in Africa and Asia are smallholder subsistence farmers. Diversifying production on these farms is often perceived as a promising strategy to improve dietary quality and diversity. This hypothesis is tested with data from smallholder farm households in Indonesia, Kenya, Ethiopia, and Malawi. Higher farm production diversity significantly contributes to dietary diversity in some situations, but not in all. Improving smallholders' access to markets seems to be a more effective strategy to improve nutrition than promoting production diversity on subsistence farms.

Consortium

CGIAR

Private sector innovation focus

EXHIBIT 4 | Agriculture Patents Registered Worldwide from 2010 Through 2014



Sources: Thomson Innovation; BCG analysis.
Note: Analysis based on approximately 16,000 Derwent World Patents Index patent families registered from 2010 through 2014.

Consortium

In summary: Agri-Food Science Opportunities

1. Life science revolution is changing the way ag research does business – speeding up innovation cycle
2. The exciting new science is bringing a new generation of young scientists to agri-food science
3. Science is increasingly transdisciplinary, systems / value chain focused – linking ag – food – health - environment
4. Big Data and ICT revolution is changing precision agriculture and ability to study systems – natural resources as well as food systems
5. Renewed "political" interest in bio-economy – with merging agendas on agri-food, development, environment

What is CGIAR?

CGIAR is the only worldwide research partnership addressing agricultural research for development, whose work contributes to the global efforts to tackle poverty, food and nutrition insecurity, and environmental degradation.

Our Vision

A world free of poverty, hunger and environmental degradation.

Our Mission

To advance agri-food science and innovation to enable poor people, especially poor women, to increase agricultural productivity and resilience, share in economic growth, feed themselves and their families better, and conserve natural resources in the face of climate change and other threats.

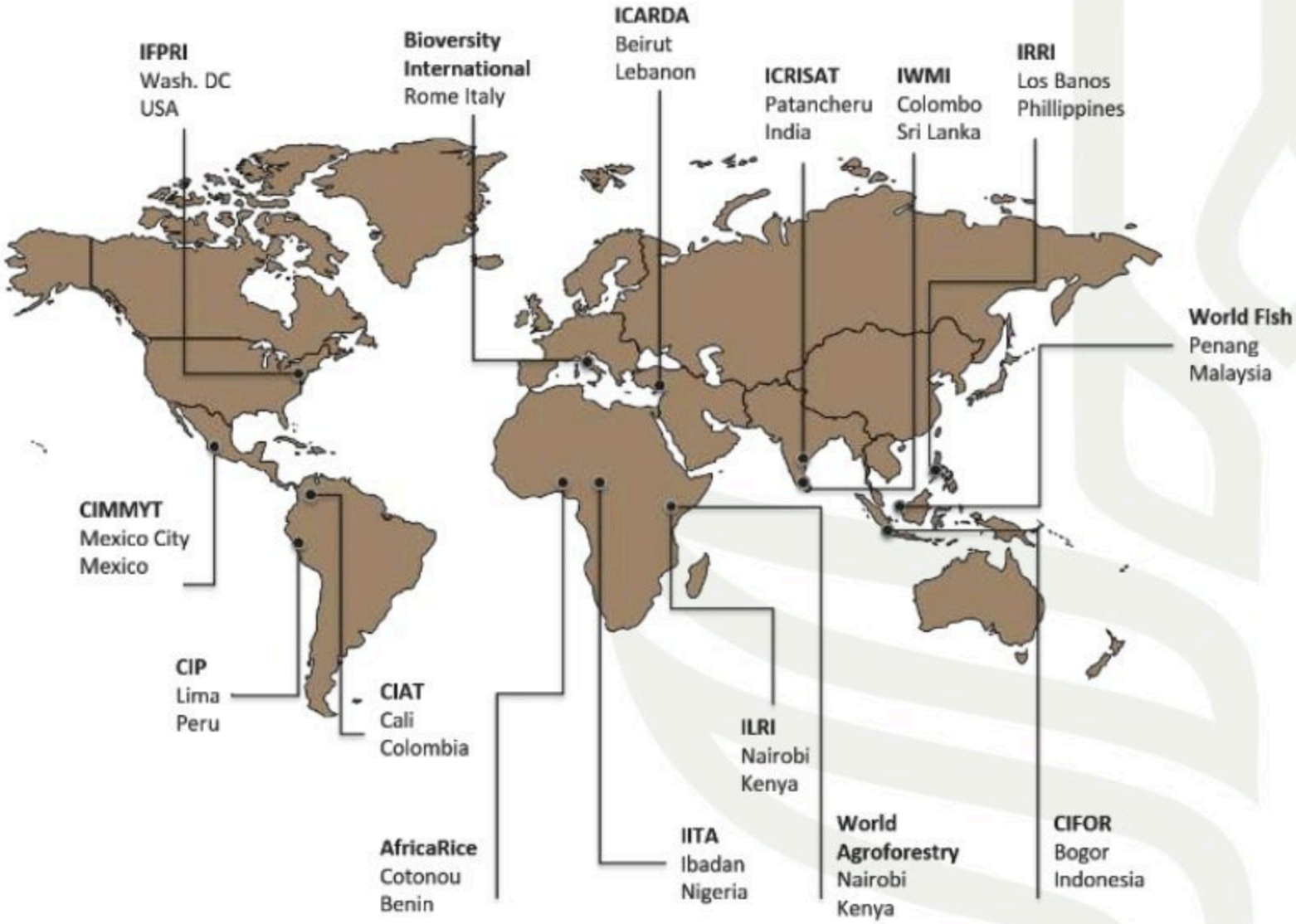
CGIAR key facts:

- Annual turnover of US$1 billion in public funding provided by broad range of key development donors
- 15 non-profit research Centers with some 10 thousand world class scientists and support staff on the ground in over 70 countries
- Unique in public sector to work from discovery to translational research and have a product development capacity; reaching millions of farmers through work with development partners
- CGIAR genebanks safeguard the world's largest germplasm collections for staple food crops, that provide over 90% of all recorded transfers under the International Treaty on Plant Genetic Resources

CGIAR is a global research partnership for a food secure future

CGIAR Consortium

CGIAR Centers



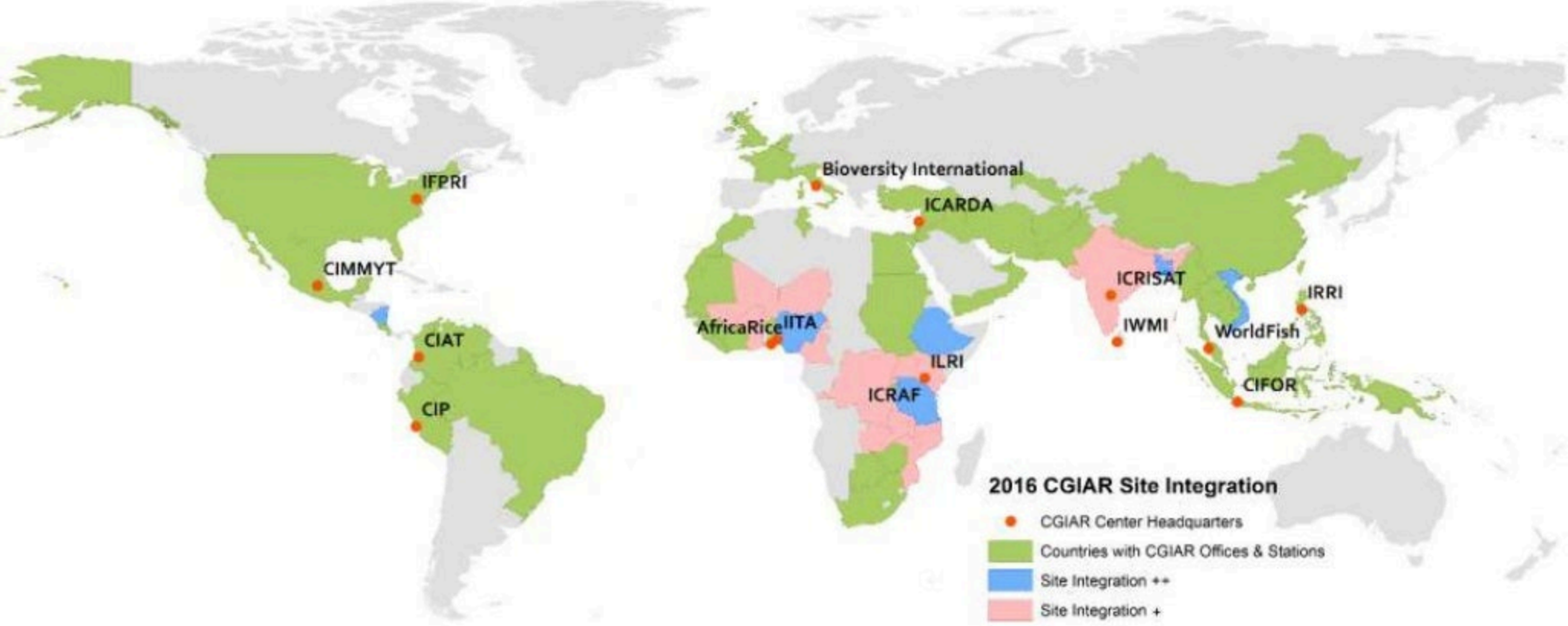
CGIAR

CGIAR is a global research partnership for a food-secure future

CGIAR Consortium

Where do we work?

CGIAR has a dedicated staff of 10,000 people in 71 countries with a major presence in 20-odd countries beyond the HQ countries of centers



(Map courtesy of IFPRI)

CGIAR Consortium

CGIAR is a global research partnership for a food secure future

The "second generation" CGIAR Strategy 2016–2030:

- Guides the development and implementation of an ambitious portfolio of "second-generation" CGIAR Research Programs (CRPs)
- Focuses on selected grand challenges, and is articulated in 3 strategic goals, or System Level Outcomes (SLOs), which by 2030 will contribute significantly to the achievement of key Sustainable Development Goals (SDGs)
- Highlights a return on investment evaluated at US$17 for every US$1 put into CGIAR over its lifetime

System Level Outcome (SLO) 1:

Reduced Poverty

2030 Targets

- 350 million more farm households have adopted improved varieties, breeds or trees, and/or improved management practices
- 100 million people, of which 50% are women, assisted to exit poverty

This outcome contributes directly to the achievement of the following United Nations Sustainable Development Goals

System Level Outcome (SLO) 2

Improved Food & Nutrition Security for Health

2030 Targets

- Increase the yield increase rate of major food staples from current <2.0 to 2.5%/yr.
- 150 million more people, of which 50% are women, meeting minimum dietary energy requirements
- 500 million more people, of which 50% are women, without deficiencies of one or more of the following essential micronutrients
- 33% reduction in women of reproductive age who are consuming less than the adequate number of food groups

This outcome contributes directly to the achievement of the following United Nations Sustainable Development Goals

System Level Outcome (SLO) 3

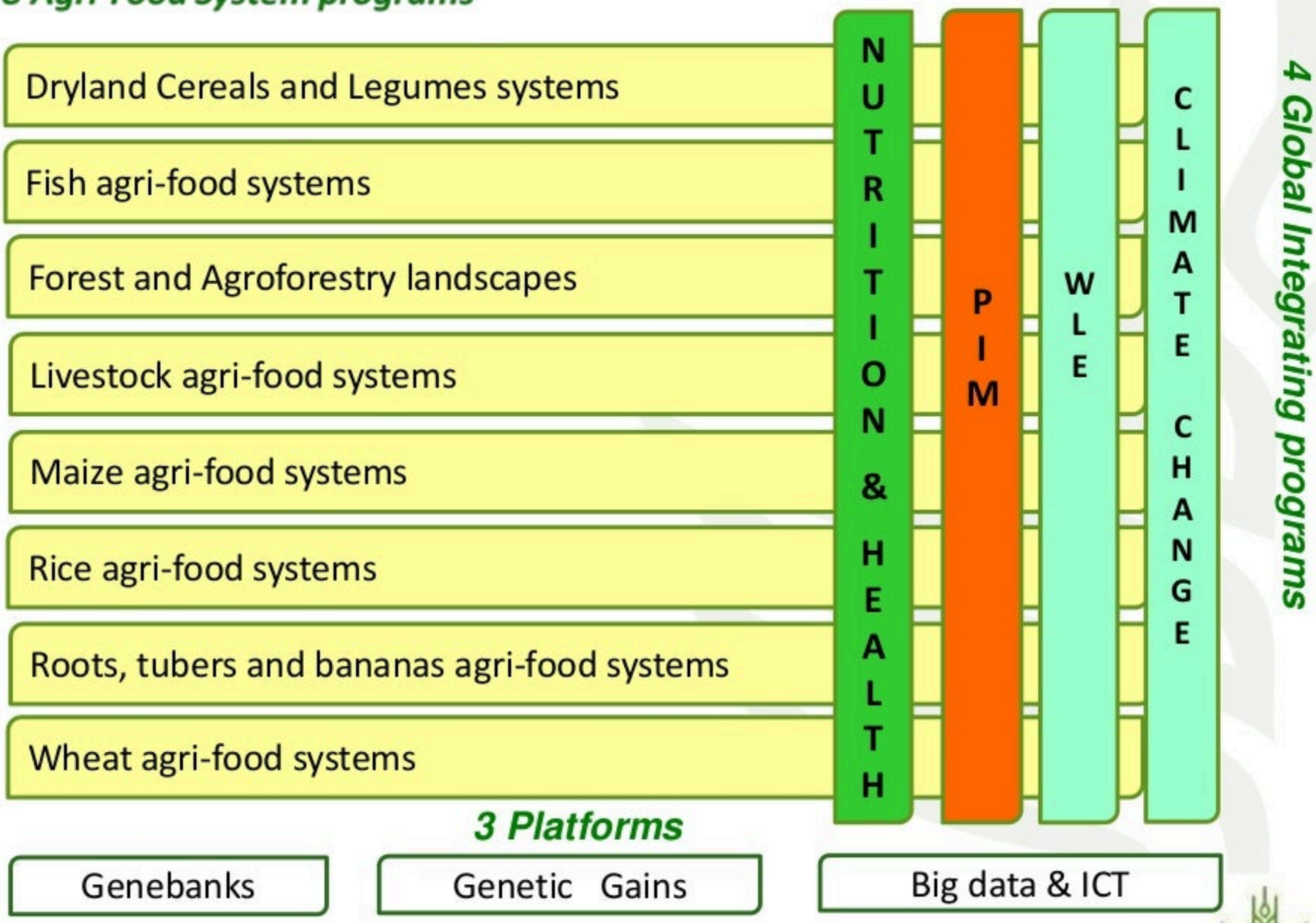
Improved Natural Resource Systems & Ecosystem Services

2030 Targets

- 20% increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse
- Reduce agriculturally-related greenhouse gas emissions by 0.8 Gt CO2-e yr–1 (15%) compared with a business as usual scenario in 2030
- 190 million hectares (ha) degraded land restored
- 7.5 million ha of forest saved from deforestation

This outcome contributes directly to the achievement of the following United Nations Sustainable Development Goals

Portfolio of 2nd generation CGIAR research programs



New CGIAR technologies already in the field:

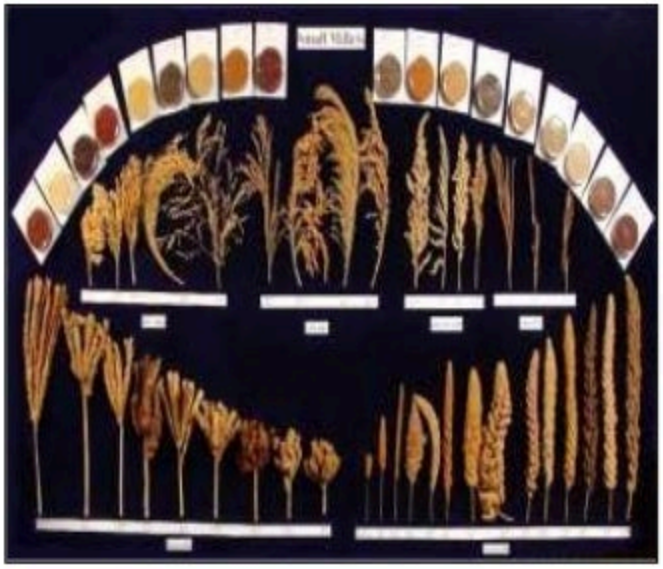
- ***Scuba rice***, which can survive under water for two weeks, is protecting the harvests, incomes, and food security more than 5 million farmers in Asia.
- New high-yielding, and more nutritious – ***biofortified - varieties*** of foods such as maize, cassava, beans, pearl millet, rice, beans and orange sweet potato are targeted to reach 50 million consumers by 2018.
- ***AFLASAFE*** reduces aflatoxin contamination in African farmers fields by up to 90% - a product that has 4 atoxigenic strains of the fungus developed by CGIAR with USDA.
- Index-based crop and livestock ***drought insurance*** and seasonal weather forecasts now benefit millions of poor rural households in Africa and Asia.
- ***Wheat stem rust -Ug99- resistant varieties*** have been made available, preventing disaster at a scale affecting many millions of people. ***Maize lethal necrosis resistant varieties*** have been developed through rapid cycling (4 years).
- ***Agroforestry:*** unfertilized maize yields under Faidherbia trees average **4.1** tonnes per hectare, compared to **1.3** tonnes; in Niger, more than 1.2 million households have regenerated 200 million fertilizer trees on their sorghum and millet fields across 5 million hectares.
- **Brachhiaria forages** with Biological Nitrification Inhibition capacity have reduced greenhouse gas emissions and improved nitrogen efficiency on 500 thousand hectares.

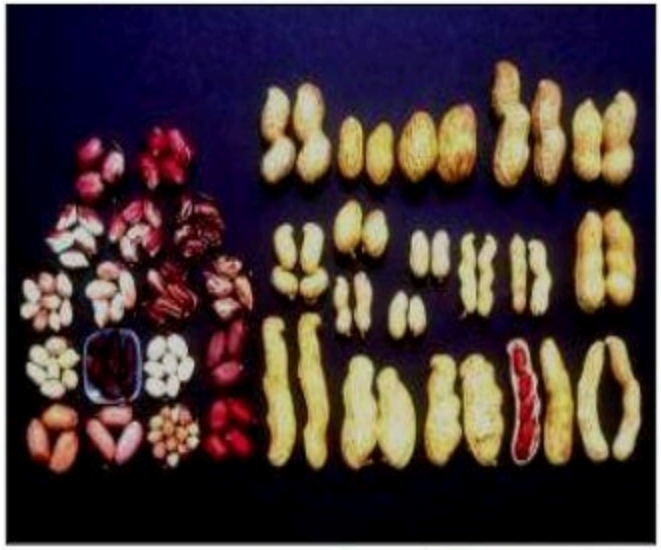
CGIAR discovery research now in the lab:

- ***C4 Rice***: targets introduction of more efficient photosynthesis in rice that would yield up to 50% more grain than current varieties, and double water-use efficiency, and increase nitrogen-use efficiency by 30%
- Massive ***high-throughput sequencing of all 167 thousand accessions*** in CGIAR's maize and wheat genebanks targets breakthroughs in understanding genetic diversity at molecular level for the whole collection, with over 60 thousand accessions already sequenced and in genotyping analysis
- Discovery of **naturally transgenic sweet potatoes** that contain genes of Agrobacterium

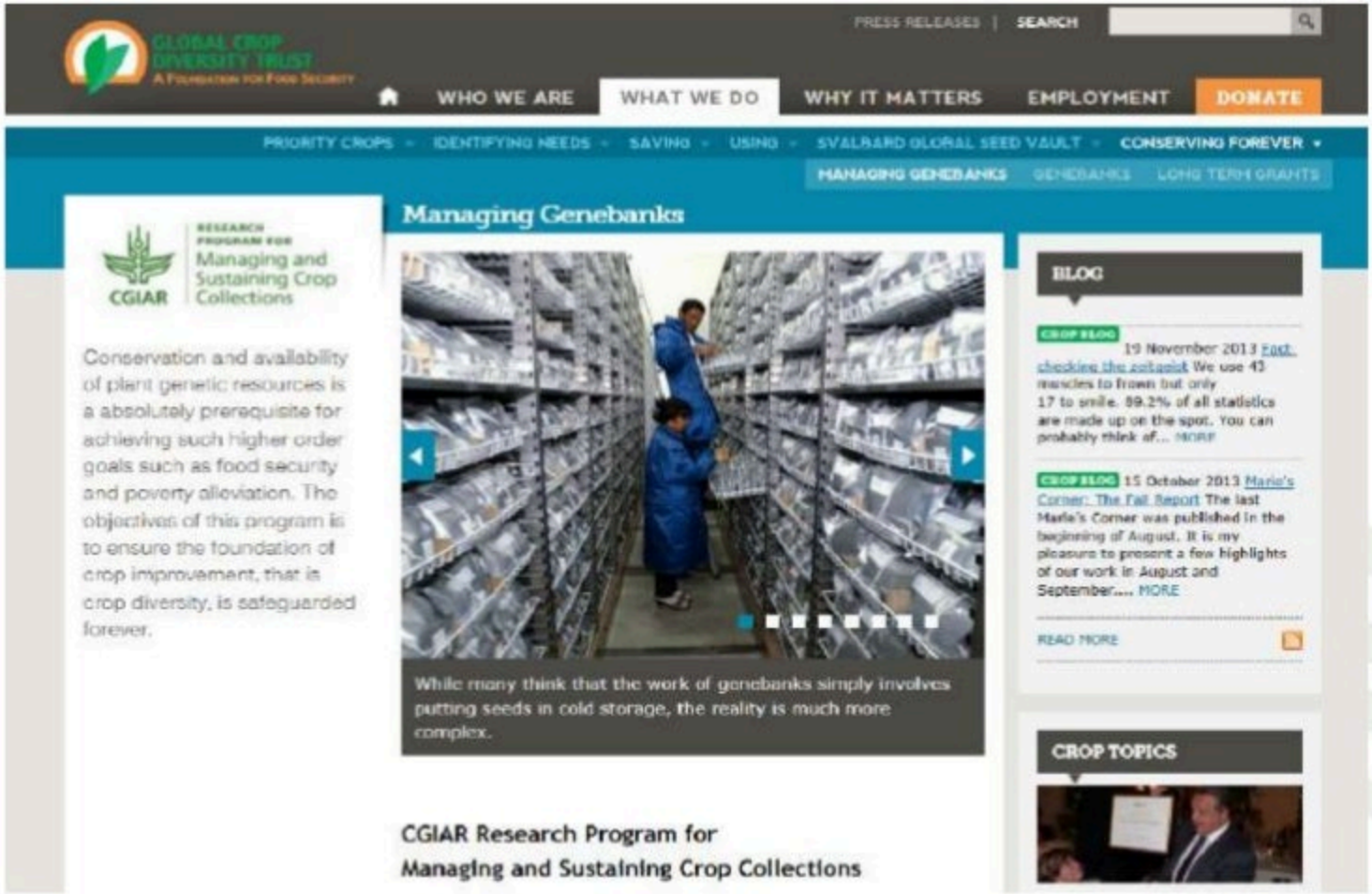
Managing & Sustaining Crop Collections (eg ICRISAT, India)





Platform for Managing & Sustaining Crop Collections



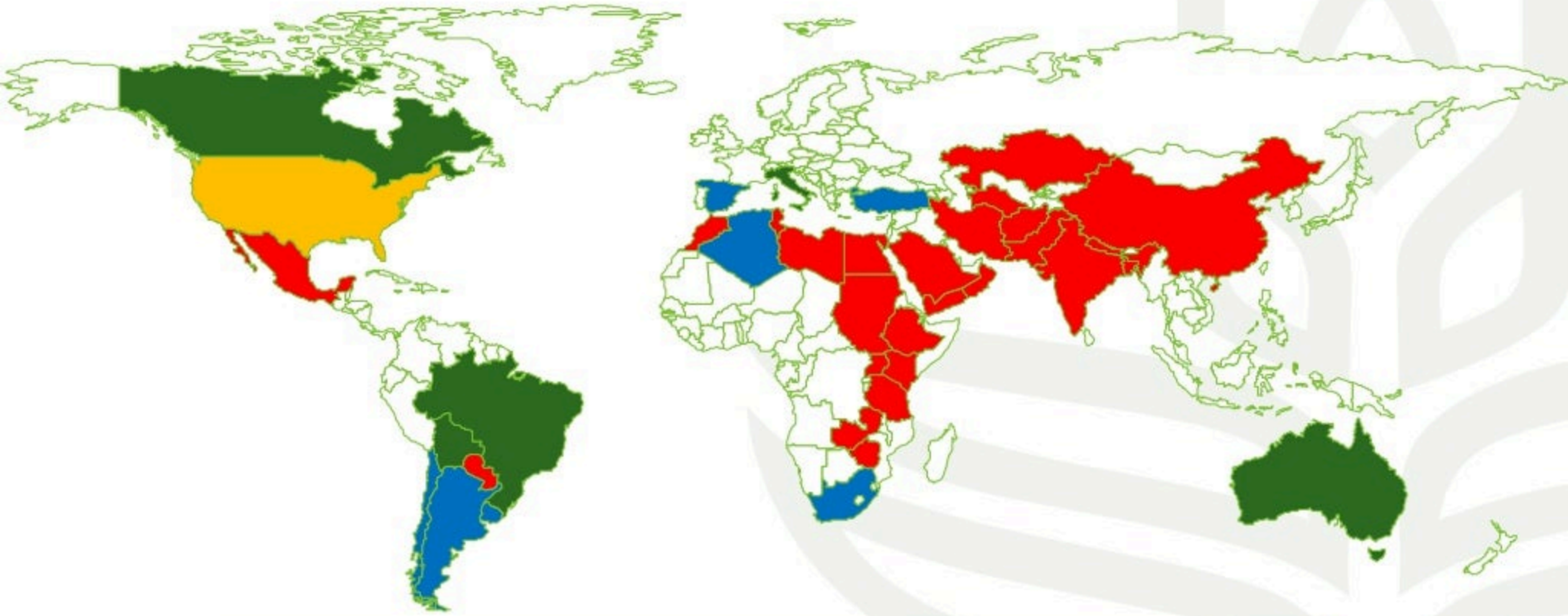
Source: http://www.croptrust.org/content/managing-genebanks/

Global Stewardship of Plant Genetic Resources

International Treaty on Plant Genetic Resources for Food and Agriculture

CGIAR have committed to PGRFA being made available in the multilateral system of access and benefit sharing and managed according to FAO Genebank Standards

Percentage wheat germplasm originating from CGIAR genebanks



>75%	51 – 75%	26 – 50%	10-25%

Nutrient dense food through "bio-fortification" – increasing Micro-nutrient content of staple foods

Goal: delivery-at-scale to 50 million people by 2018

Sweet Potato
Provitamin A
Uganda
Mozambique

Cassava
Provitamin A
DR Congo, Nigeria

Beans
Iron (Zinc)
DR Congo, Rwanda

Maize
Provitamin A
Zambia

Pearl Millet
Iron (Zinc)
India

Rice
Zinc
Bangladesh,
India

Wheat
Zinc
India,
Pakistan

2003 **2008** **2013**

Discovery ***Development*** ***Delivery***

Beans that Can Beat the Heat

Thirty elite lines show tolerance to temperatures
4 degrees centigrade above the crop's normal "comfort zone"

"A couple of years ago, when climate change experts warned that rising temperatures could devastate bean production, we were asked how this would affect the spread of high-iron beans."

"Now, I'm confident we can deliver more iron-rich beans that are also heat tolerant, offering even greater benefits than expected, because these beans can be grown more widely."

S. Beebe

Brachiaria-tropical grass species bred to reduce nitrogen emissions from soil.

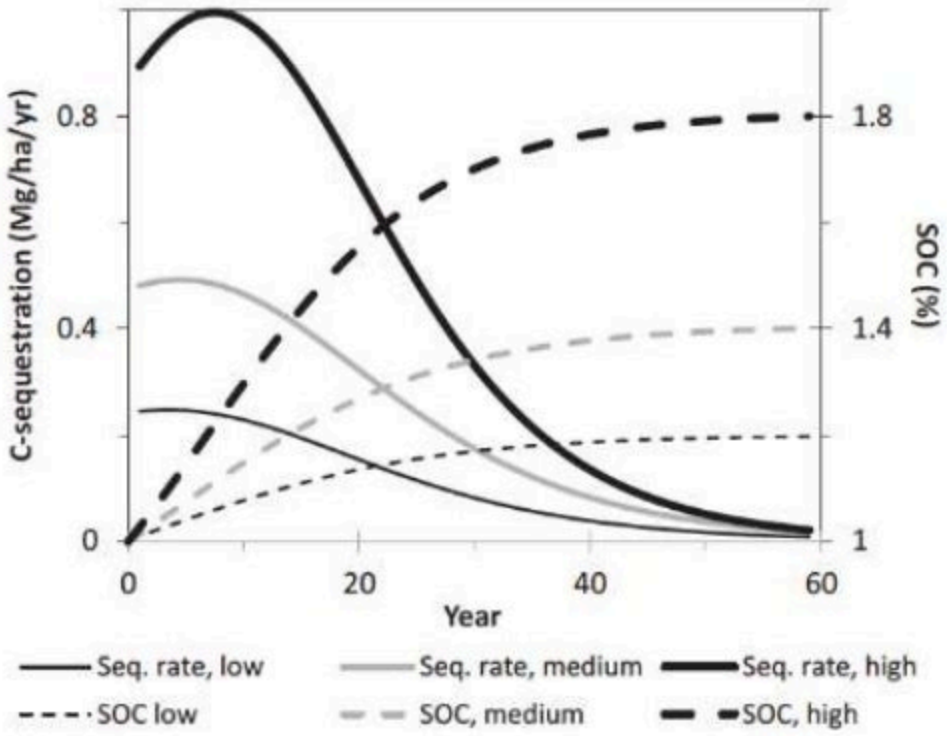
Climate Smart Agriculture, 4p1000:

A global research initiative led by France

Stéphane Le Foll,
Spokeperson of the French Government,
French Minister of Agriculture, Agrifood and forestry

*In March 2015, Stéphane Le Foll announced the establishment of an international research programme, the "**Quatre pour Mille**", which aims to develop agricultural research to improve organic matter stocks in soil by four parts per 1000 (0.4%) per year*

Soil carbon sequestration: scientific questions



- A steady yearly sequestration rate only realistic in the first years (probably below 0.4%)
- Mitigation effect limited in time
- More lasting impact is on resilience and food security
- But gives a positive role for agriculture in GHG reduction while increasing adaptation and food security

Sommer & Bossio, 2014

A sister development initiative on Climate-Smart Agriculture led by CGIAR

- Design, test and implement CSA solutions at scale
- Leading to enhanced soil carbon sequestration
- 5-6 emerging and least developed countries eligible to GCF funding
- 200m$ in 5 years

Can Agri-Food Systems be Transformed to Provide Healthy Diets for all?

1. Agri-food system perspective to address complex issues:
   - Value chain approach from farm inputs to food safety
   - Increased focus on food waste and loss
   - Focus on role of women as well as employment for next generation
2. Break through silos of Agriculture, Health and Environment
3. Speeding up Genetic Gain: seize opportunities in Genomics revolution, linked to genetic resources, modernized breeding programs, big data
4. Increase private sector collaboration and focus on comparative strength
5. Eco-system services approach to sustainability at landscape scale
6. Urgent food system transformation requires scaling up the pace of innovation – which will need increased investments in research, the driver of innovation

Thank you