



Consortium

CGIAR is a global research partnership for a food secure future

Wayne Powell

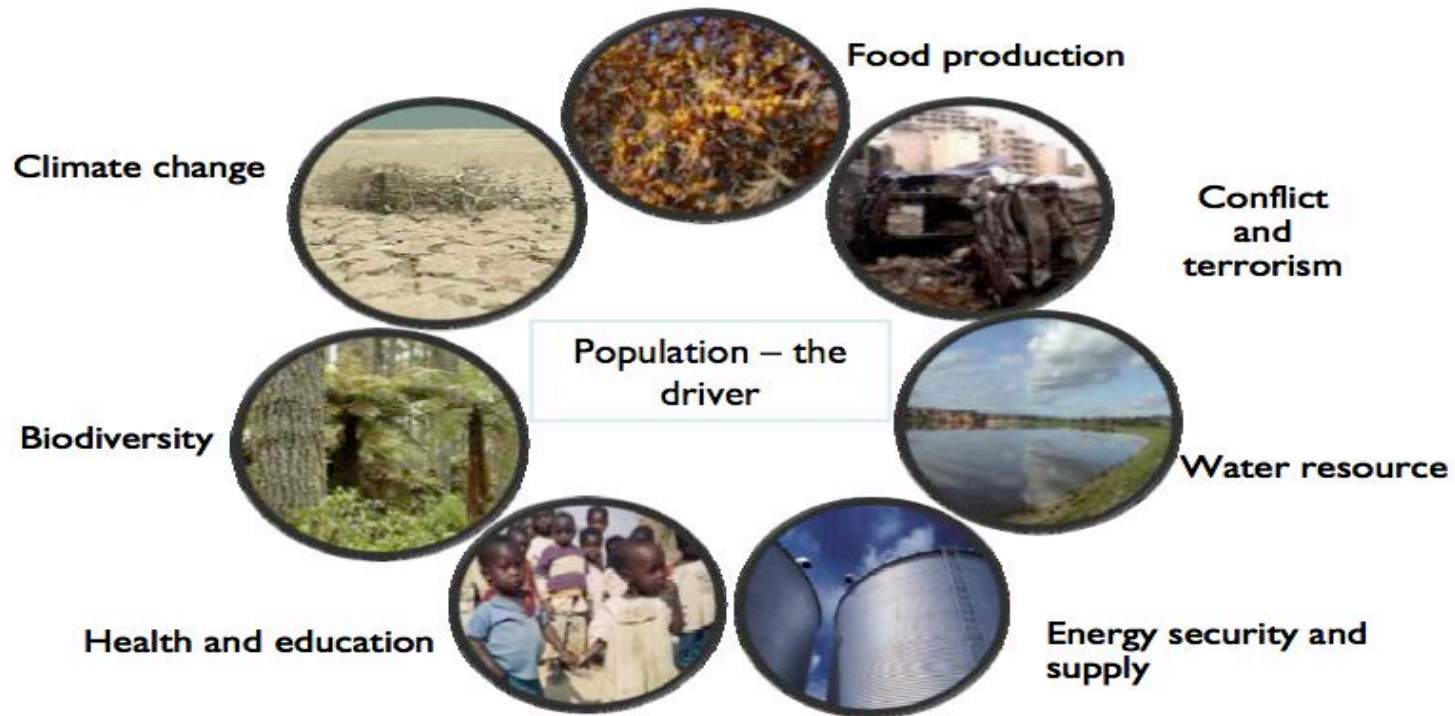
September 29th , 2014

The need for Reform of Agricultural Systems in both Europe and the South

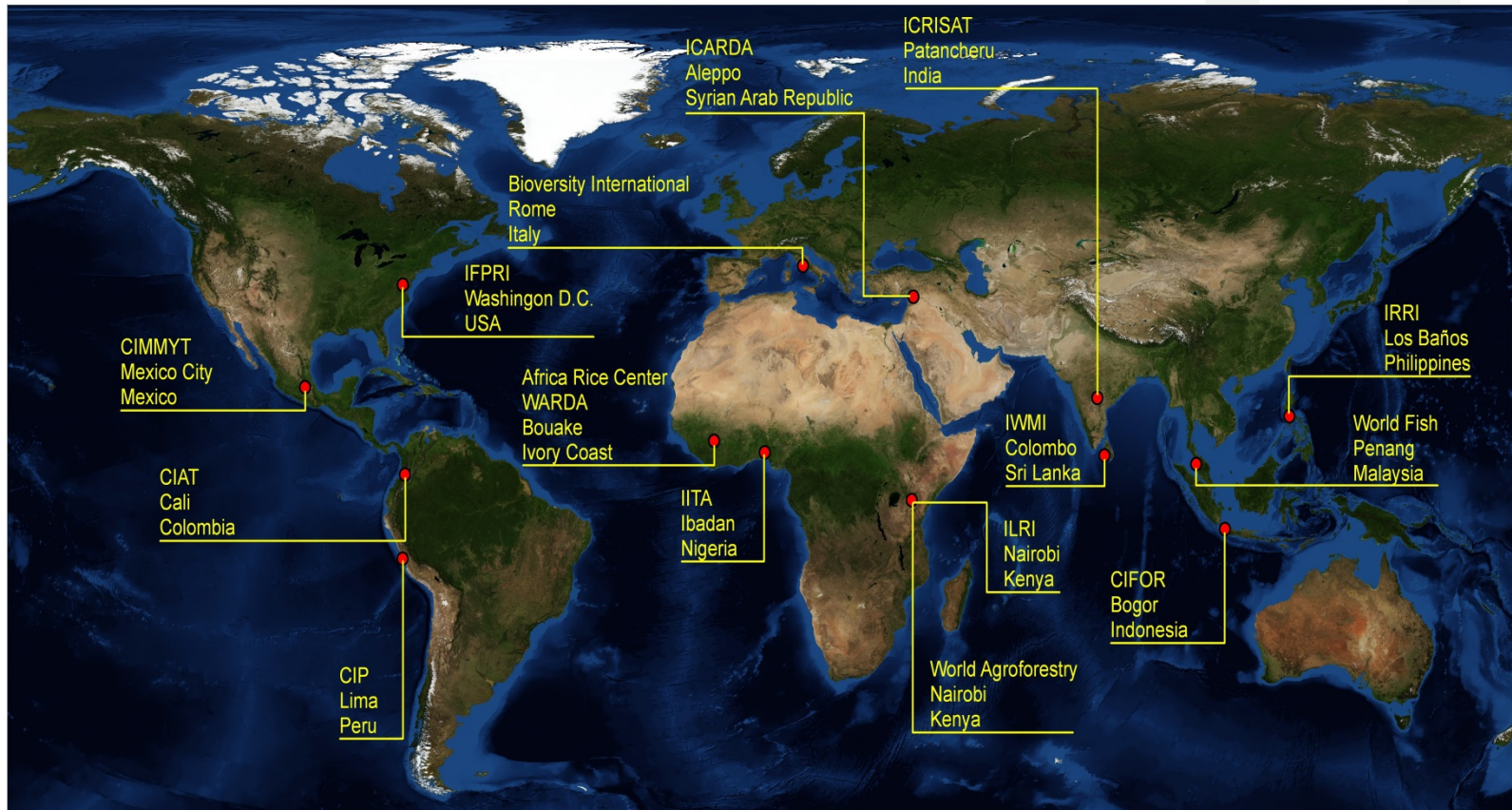
Agriculture is at the Centre of Many of Society's Most Important Debates



21ST CENTURY CHALLENGES



Consortium of International Agricultural Research Centers



CGIAR is a global research partnership for a food secure future



Consortium

CIMMYT^{MR}

CIMMYT developed high yielding varieties for staple cereals that were the engine of the Green Revolution



Evolution of the CGIAR



CGIAR is a global research partnership for a food secure future



Consortium

2011

USD 673 million

Integration and transformation

**CGIAR Consortium
CGIAR Fund**

2010

USD 673 million

Reform

**15 CGIAR Centers
64 Members, including
25 from the developing world**

2000

USD 331 million

Rethink

**16 CGIAR Centers
58 Members, including
22 from the developing world**

1990

USD 235 million

Expansion

**16 CGIAR Centers
40 Members, including
6 from the developing world**

1980

USD 123 million

Multidisciplinary

**13 CGIAR Centers
35 Members, including
4 from the developing world**

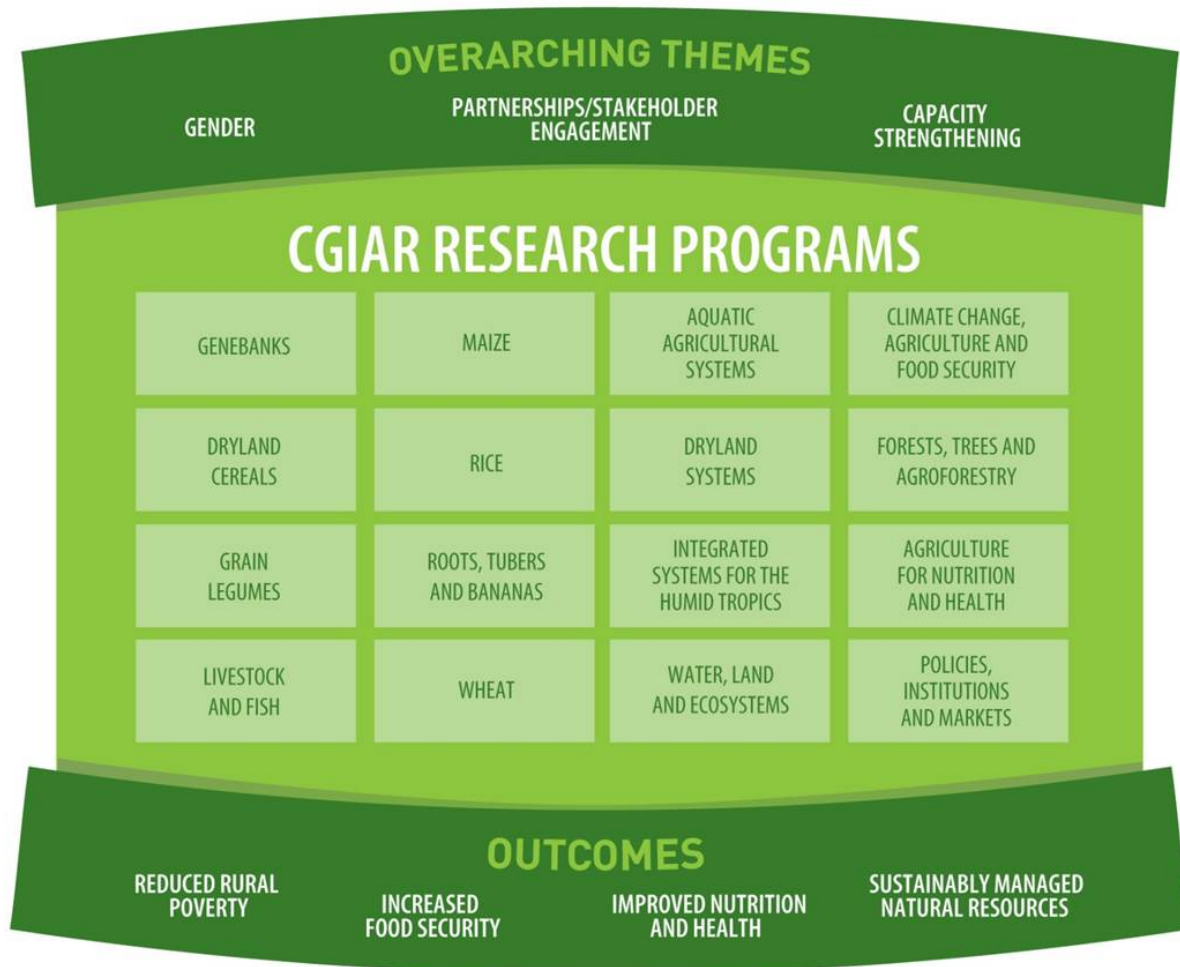
1971

USD 20 million

Disciplinary

**4 CGIAR Centers
18 Members**

CGIAR's research is carried out by 16 Research Programs (CRPs), working in close collaboration with hundreds of partners worldwide.



Ug99: preventing disasters for millions



Source: CIFOR flickr collection.

CGIAR is a global research partnership for a food secure future



We have to ensure that children receive plenty of nutritious foods



Source: Gates Foundation flickr collection.

CGIAR is a global research partnership for a food secure future



Nutrient dense food, bio-fortification: long-term multidisciplinary



2007

Sweet Potato
Provitamin A
Uganda
Mozambique



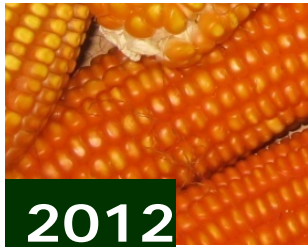
2011

Cassava
Provitamin A
DR Congo, Nigeria



2012

Beans
Iron (Zinc)
DR Congo, Rwanda



2012

Maize
Provitamin A
Zambia



2012

Pearl Millet
Iron (Zinc)
India



2013

Rice
Zinc
Bangladesh,
India



2013

Wheat
Zinc
India,
Pakistan

2003

2008

2013

2018

Discovery

Development

Delivery



**GOAL: delivery-at-scale to 50 million people from 8 target countries*

Doubling maize yields in Malawi by planting fertilizer tree species



Source: CIFOR flickr collection.

➤ **12 million farmers & 40 different crops insured**

✓ **Allows farmers to access fertilizer and better seed**

✓ **Reduces pressure to bring more land under cultivation**

✓ **Reduces risks**

C4 plants: increasing yield, water and nitrogen use efficiency by 30-50%



[Germplasm+Genomic+Phenotyping] data



The International Center for Tropical Agriculture in Colombia holds 65,000 crop samples from 141 countries.

Feeding the future

We must mine the biodiversity in seed banks to help to overcome food shortages, urge **Susan McCouch** and colleagues.

Humanity depends on fewer than a dozen of the approximately 300,000 species of flowering plants for 80% of its caloric intake. And we capitalize on only a fraction of the genetic diversity that resides within each of these species. This is not enough to support our food system in the future. Food availability must double in the next 25 years to keep pace with population and income growth around the world. Already, food-production systems are precarious in the face of intensifying demand, climate change, soil degradation and water and land shortages.

Farmers have saved the seeds of hundreds of crop species and hundreds of thousands of 'primitive' varieties (local domesticated called

landraces), as well as the wild relatives of crop species and modern varieties no longer in use. These are stored in more than 1,700 gene banks worldwide. Maintaining the 11 international gene-bank collections alone costs about US\$18 million a year.

The biodiversity stored in gene banks fuels advances in plant breeding, generates billions of dollars in profits, and saves many lives. For example, crossbreeding a single wild species of rice, *Oryza nivara*, which was found after screening more than 6,000 seed-bank accessions, has provided protection against grassy stunt virus disease in almost all tropical rice varieties in Asia for the past 36 years¹. During the green revolution, high-yielding rice and wheat varieties turned India into a net

food exporter. By 1997, the world economy had accrued annual benefits of approximately \$115 billion from the use of crop wild relatives² as sources of environmental resilience and resistance to pests and diseases.

The time is ripe for an effort to harness the full power of biodiversity to feed the world. Plant scientists must efficiently and systematically domesticate new crops and increase the productivity and sustainability of current crop-production systems.

Why does plant breeding need a boost? Because new, high-yielding seeds that are adapted for future conditions are a cornerstone of sustainable, intensified food production³. Since the mid-1990s, progress in conventional plant breeding has ▶

Most importantly, results from genomics and agronomic research must be connected to the communities that are creating new varieties of crops. An international network of scientists in both the public and the private sectors must work together to provide seeds and plants to farmers and commercial plant breeders for further crossing and testing in different environments. The research community must pay specific attention to the development of locally adapted varieties that meet the needs of the world's poorest farmers.

From "SeedSeq" (Jan 2014)

to

"DivSee"



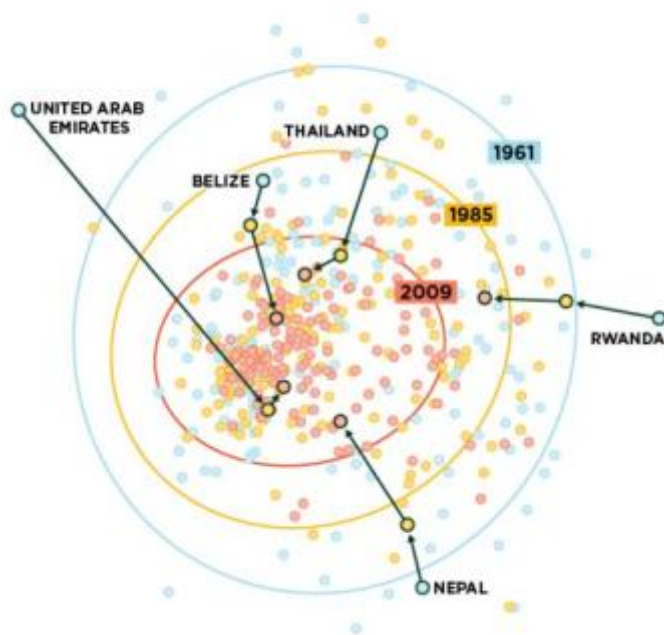
Consortium

Convergence of global diets

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

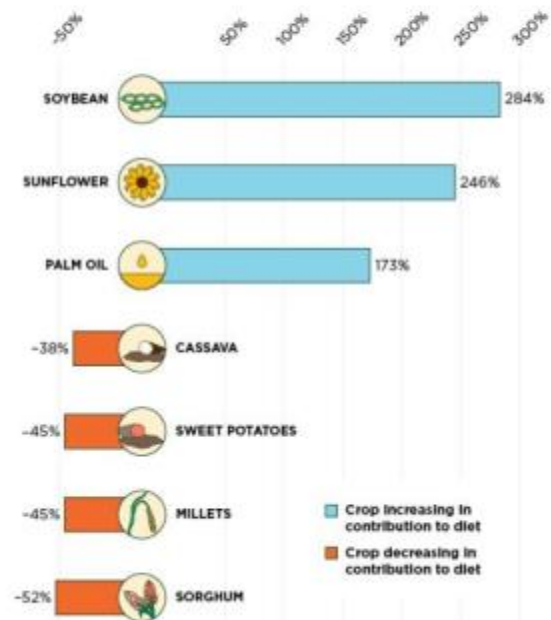


Source: Khoury et al. 2014, Proc. Natl. Acad. Sci. USA.

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

Percent change in calorie contribution to diet



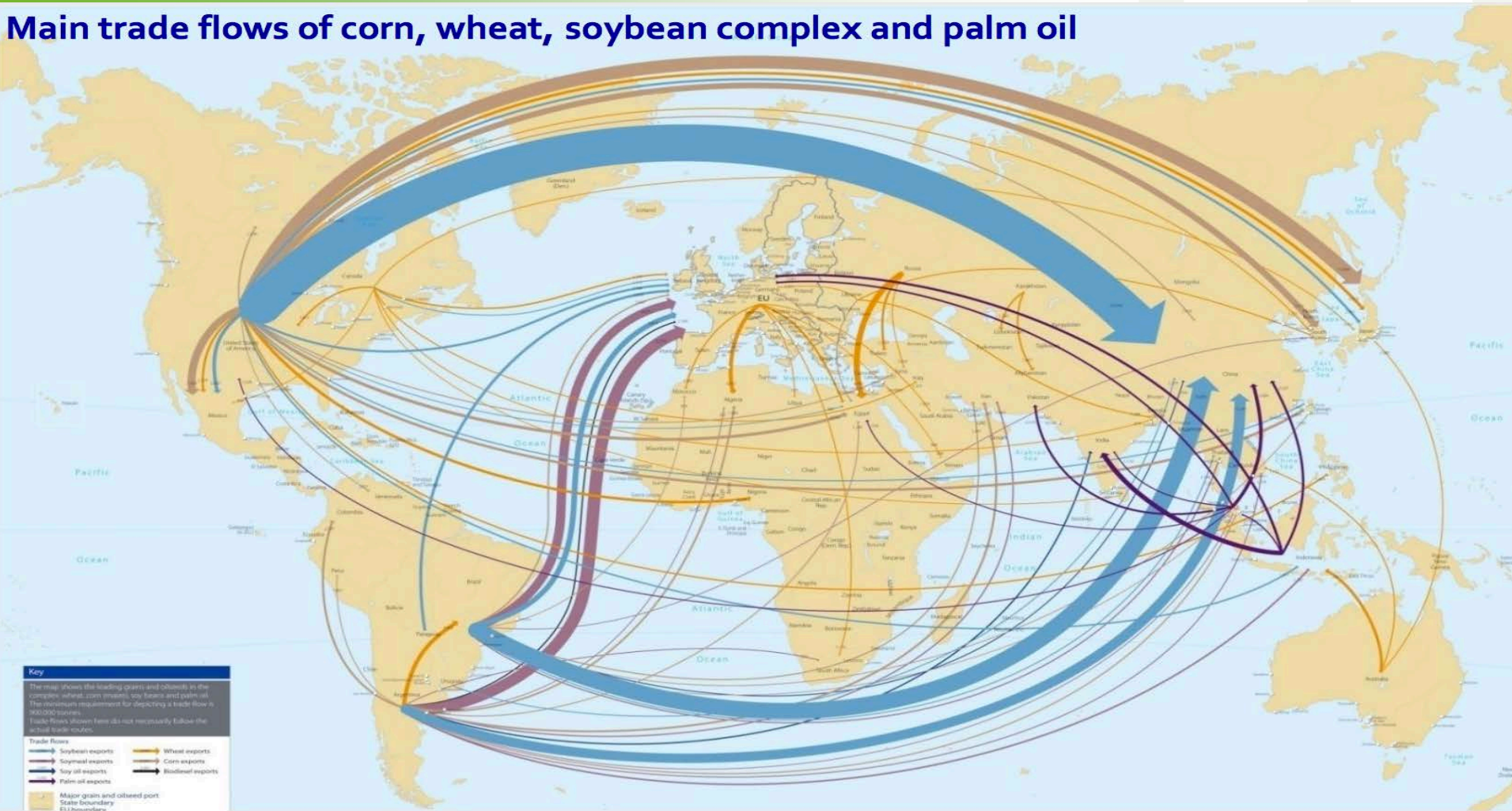
Source: Khoury et al. 2014, Proc. Natl. Acad. Sci. USA.

Consortium

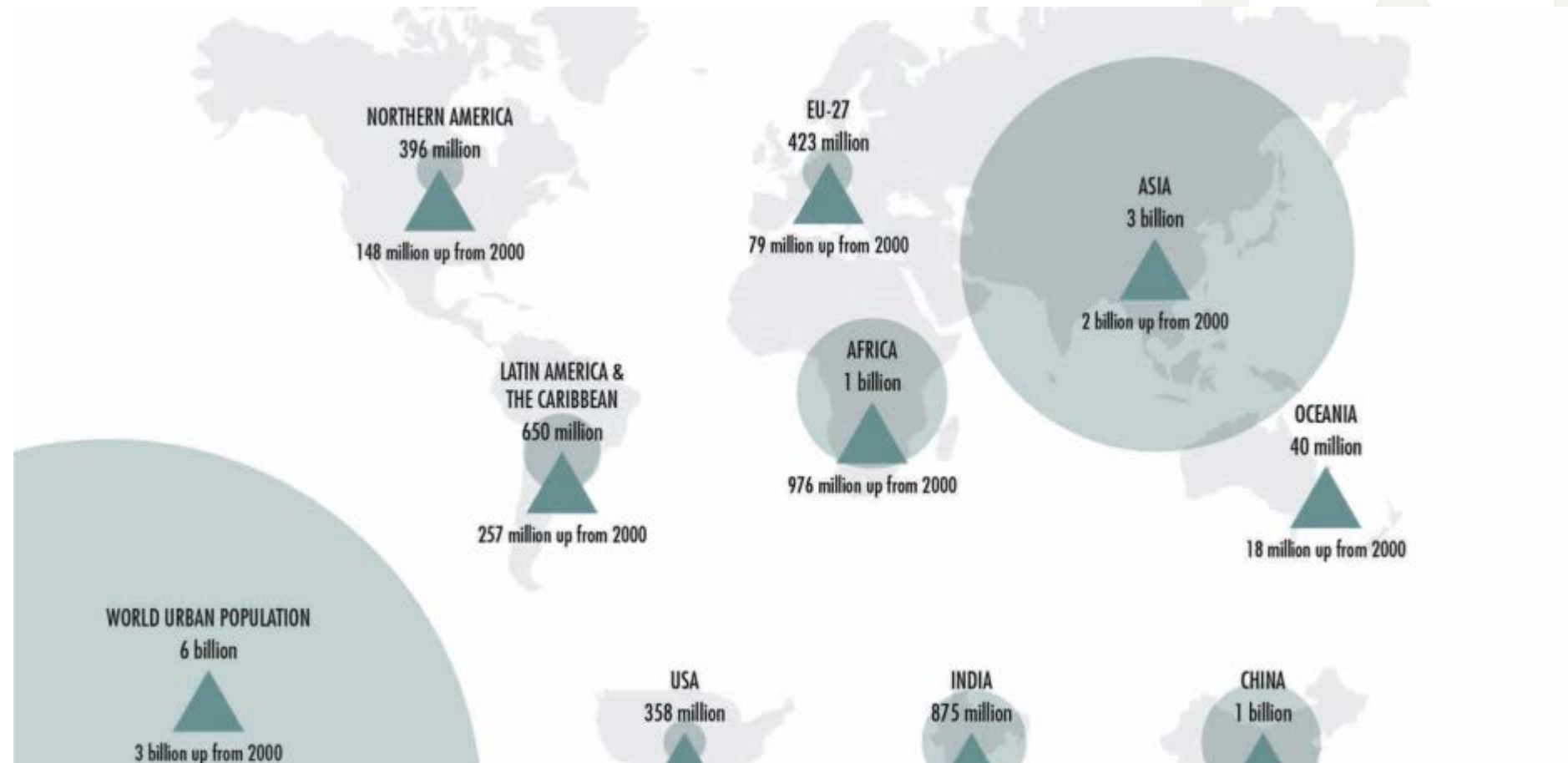


Modern food systems are dynamic, complex and fundamentally important to security and survival

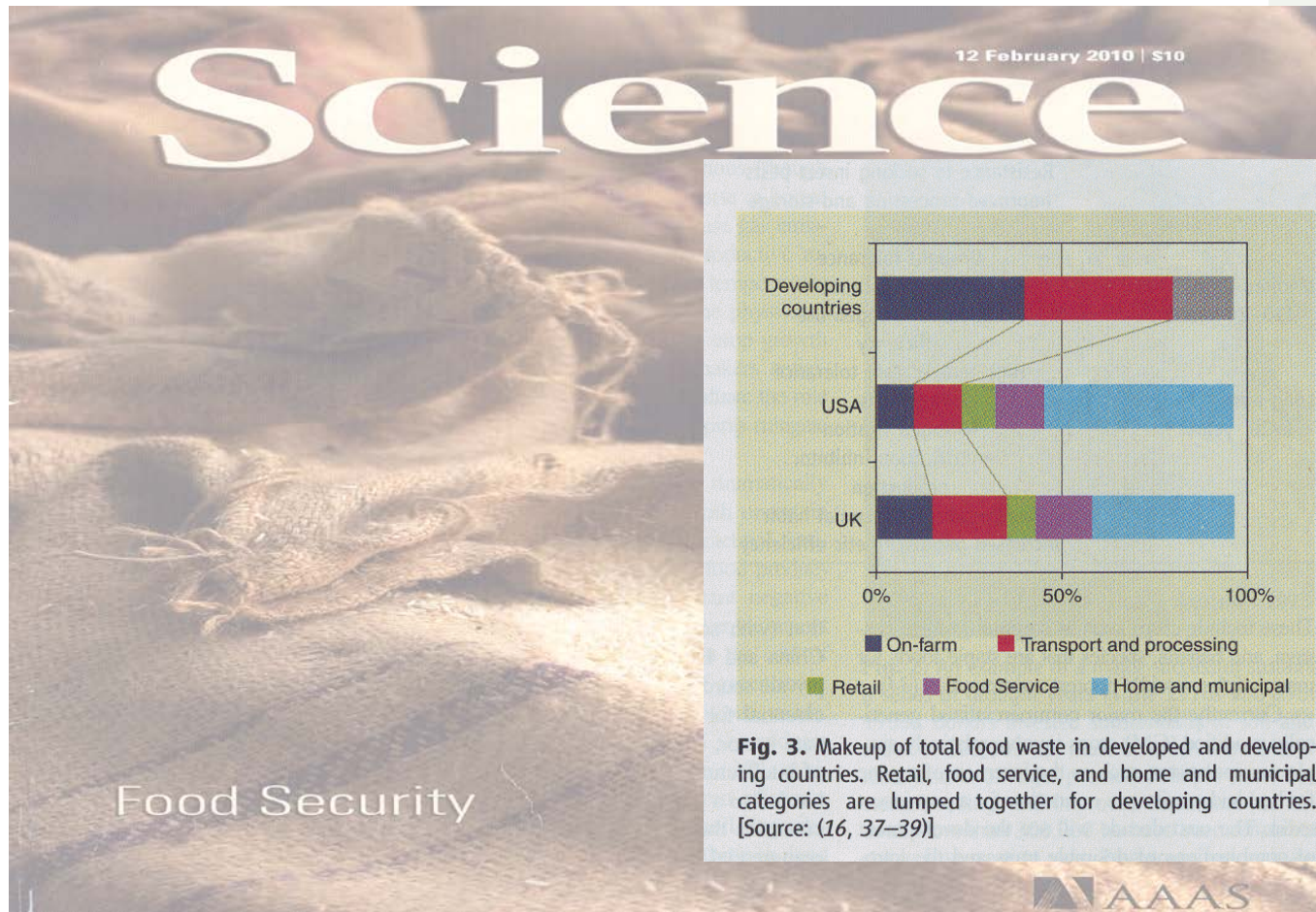
Main trade flows of corn, wheat, soybean complex and palm oil



Rising urban population, 2050 projections



Reducing Food Waste



Who for the risk his new of

Risks and opportunities in food systems are being understood in new ways with new implications

CGIAR is a global research partnership for a food secure future



Consortium

CGIAR

Food insecurity a significant risk to “global society”

Food safety/security issues create “direct and indirect risks & opportunities for businesses”

Insurance can play a large role in risk mitigation/management as well as innovation/investment

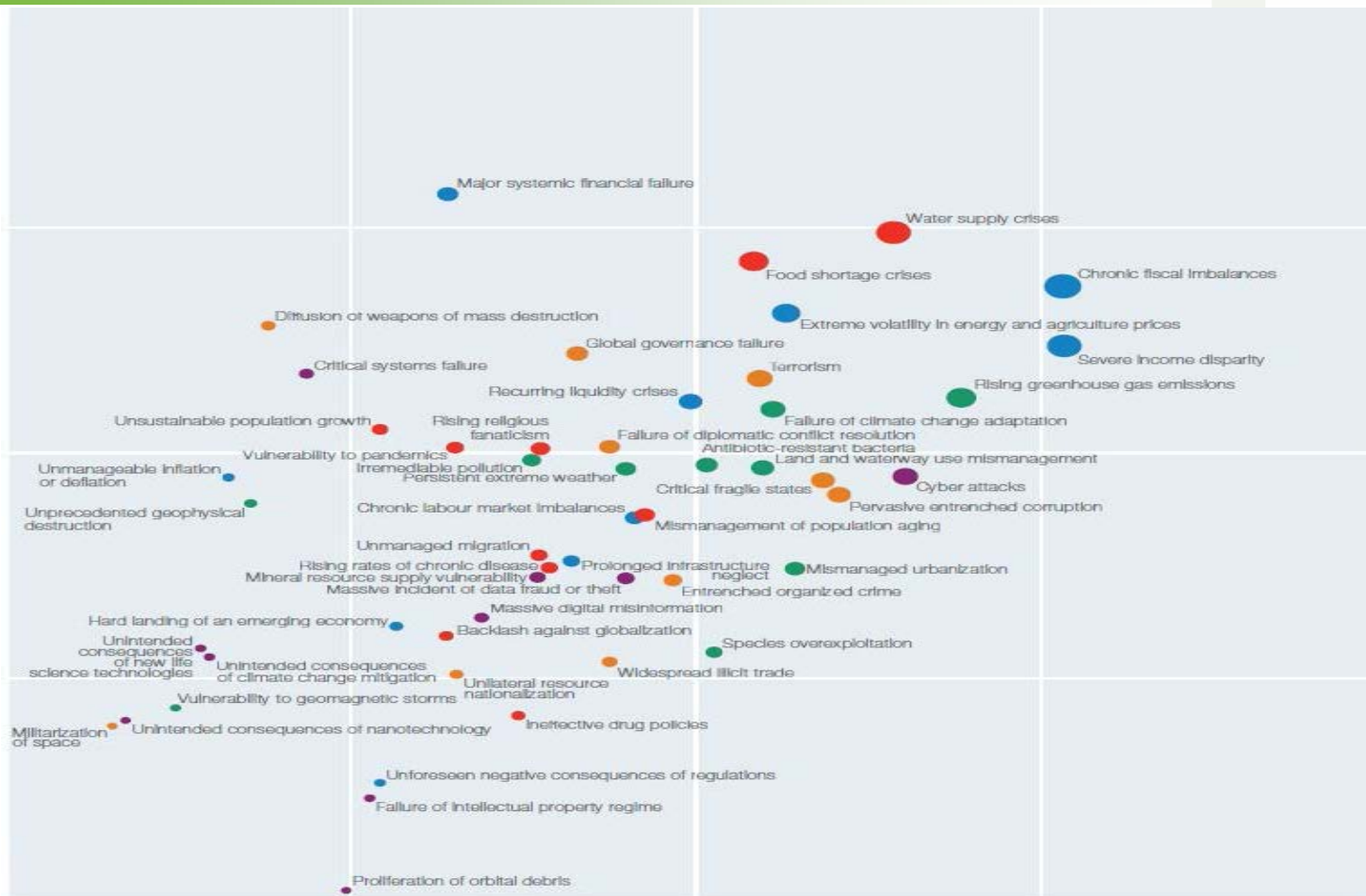
March, 2014



FEAST OR FAMINE

**BUSINESS AND INSURANCE IMPLICATIONS OF FOOD
SAFETY AND SECURITY**

Global Risks by Likelihood & IMPACT



Consortium

CGIAR is a global research partnership for a food secure future

Role of knowledge & innovation systems ~9 Billion People / 1 Planet

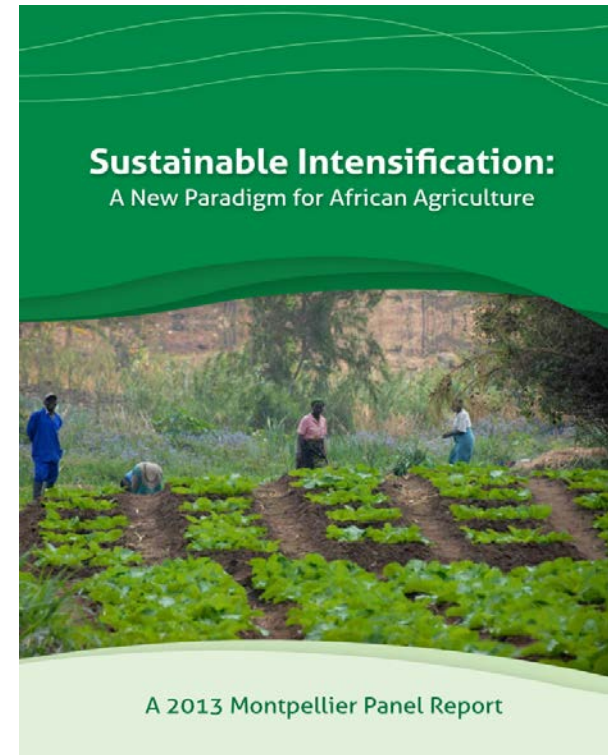


CGIAR is a global research partnership for a food secure future



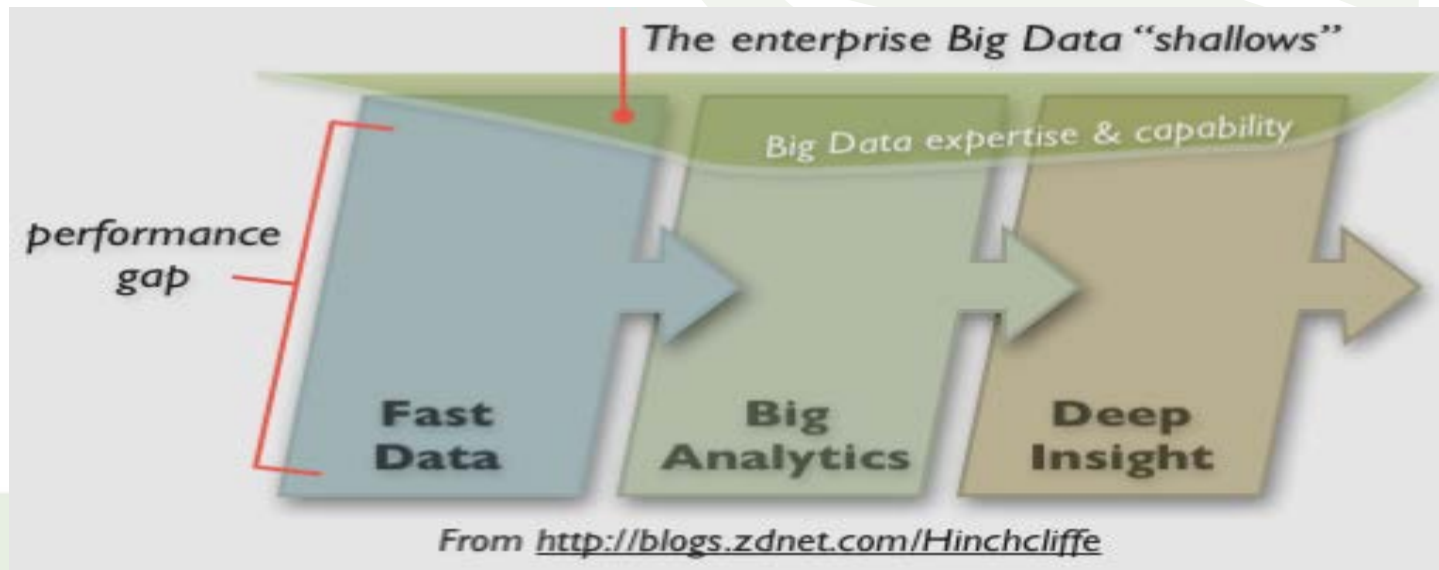
Consortium

The expectations of Science & Research has changed dramatically





Systems approach for BIG DATA & Global Connectivity



Data Science in Agriculture



Consortium

CGIAR is a global research partnership for a food secure future



Sustainability metrics for food systems

Goal: Sustainable Food and Nutrition Security

Insufficient cals
Insufficient nutrs
~ 1 billion

Sufficient cals
Insufficient nutrs
~ 2 billion

Sufficient cals
Sufficient nutrs
~ 3 billion

Excess cals (incl. some with
insufficient nutrs)
~ 2 billion

CONSUMERS

Constraints on dietary choice and diversity

affordability, preference, allocation, cooking skill, convenience, cultural norms, ...

=> Consumption by Sub-populations and Sustainability Metrics

Access Models: disposable income, allocation, health

Behavioural Models: education, customs, preferences

FOOD CHAIN ACTORS

'Post-farm gate' Food System Activities

processing, packaging, trading, shipping, storing, advertising, retailing, ...

=> Final Nutrient Quantity, Price and Sustainability Metrics

Food Chain, Logistics and Economic Models

Food Science & Technologies Information

PRODUCERS

Local, Regional & Global Production Activities

farming, livestock raising, aquaculture, fishing, ...

=> Basic Nutrient Quantity, Price and Sustainability Metrics

Economic Models

Socioeconomic databases

Productivity

Quality

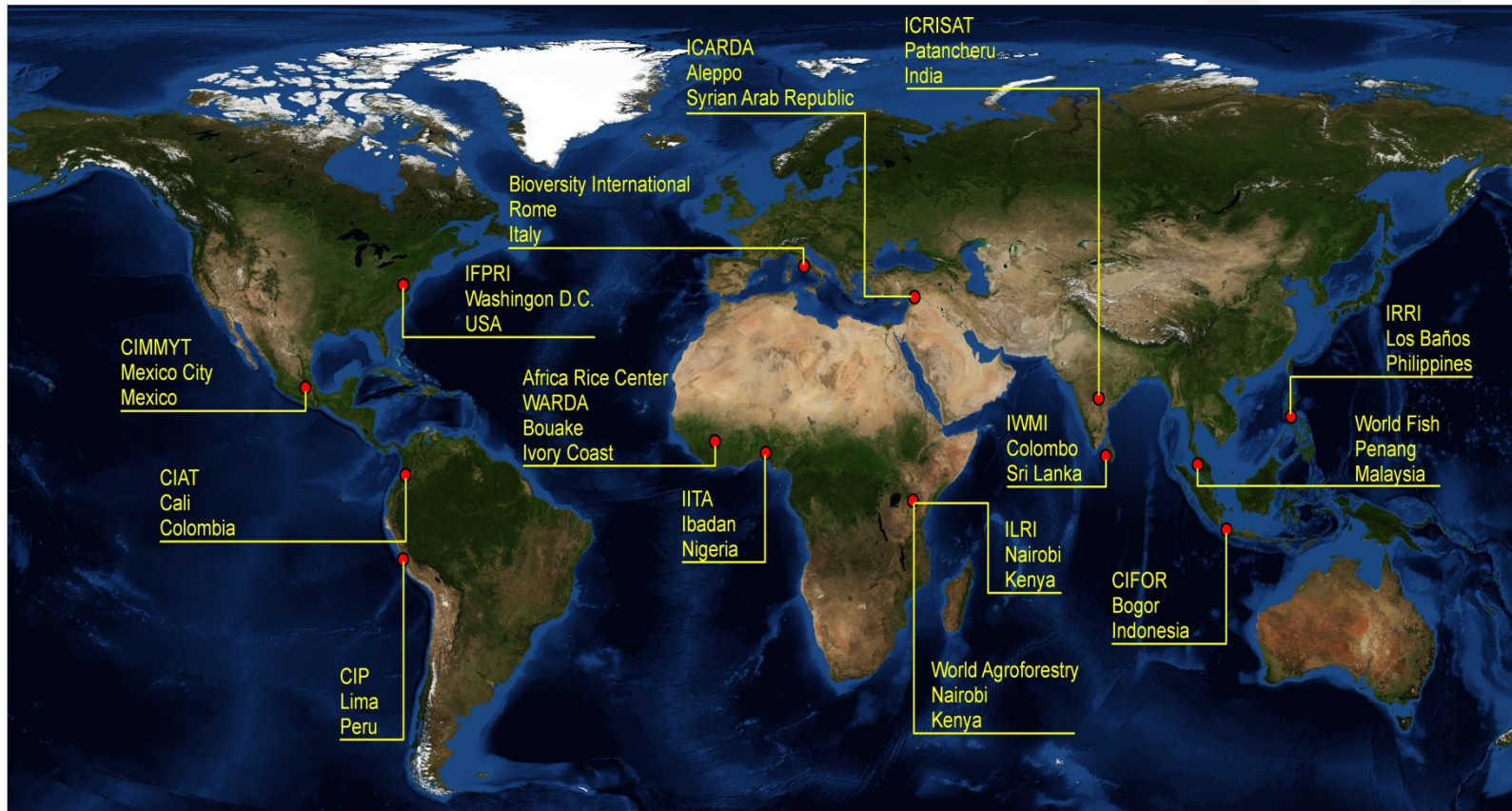
Crop, Livestock, Fisheries and Landuse Models

Nutrient
Composition Databases



Consortium

Consortium of International Agricultural Research Centers



CGIAR

CGIAR is a global research partnership for a food secure future



Consortium

CGIMMYT^{MR}



International Institute for Applied Systems Analysis



CSIRO



OAK RIDGE National Laboratory



CIMMYT

THE EARTH INSTITUTE COLUMBIA UNIVERSITY



Willis

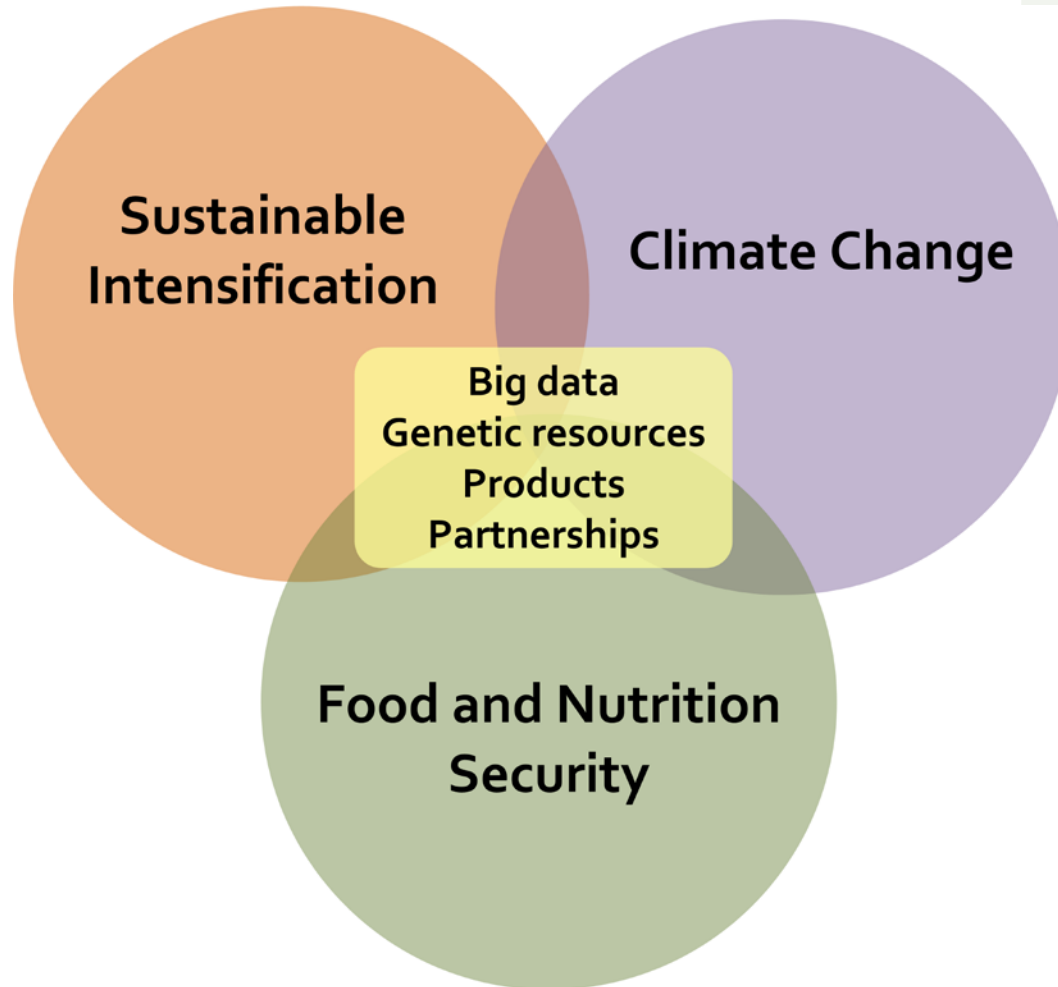
Knowledge systems as public goods market makers?

An alliance of global science and business blueprinting public goods knowledge systems in pre-competitive space at the land/water/energy

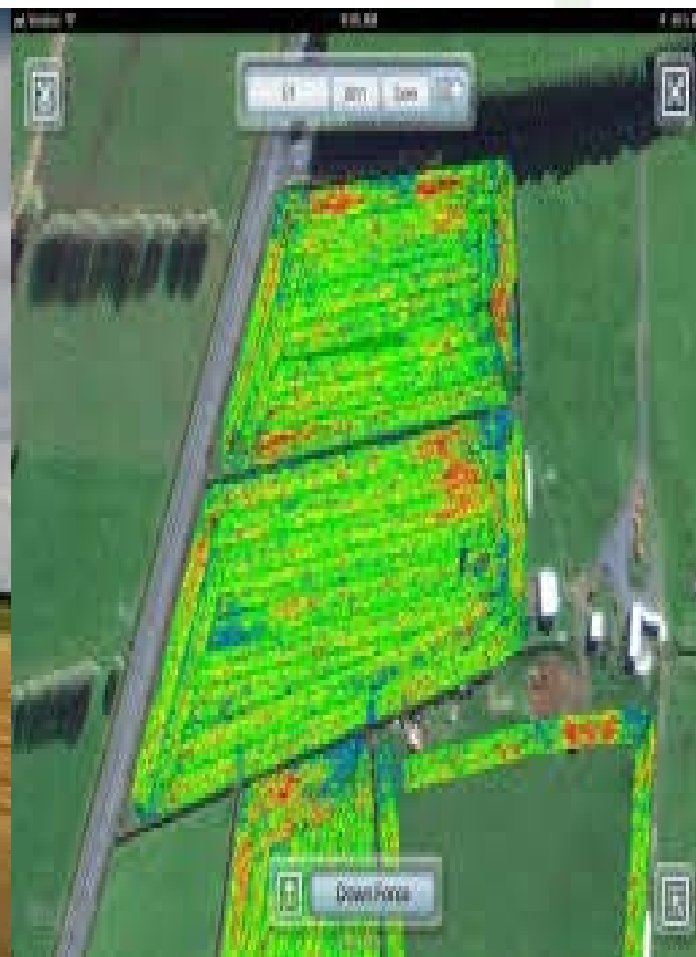
CGIAR is a global research partnership for a food secure future



Convert Global Challenges of the 21st Century into new opportunities



Data Drives Yields

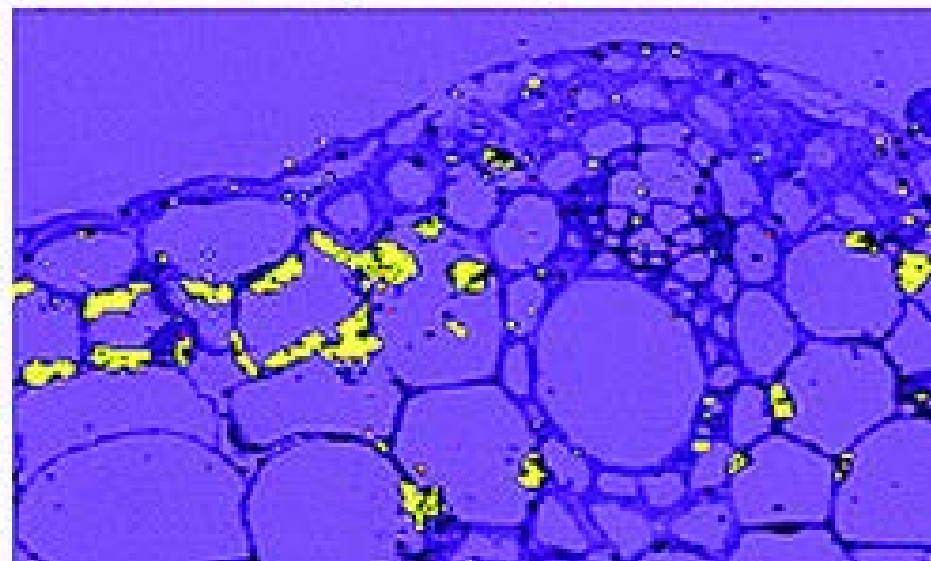
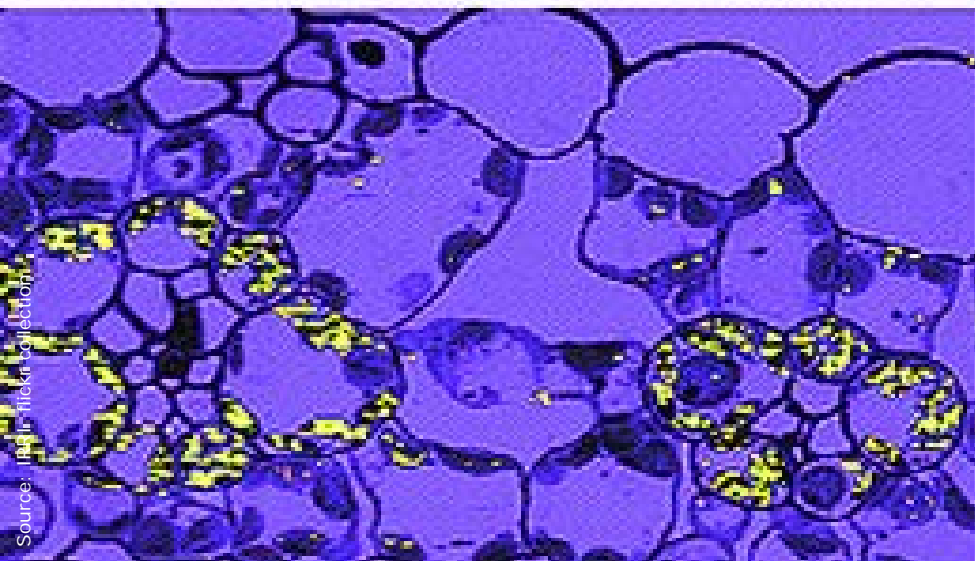
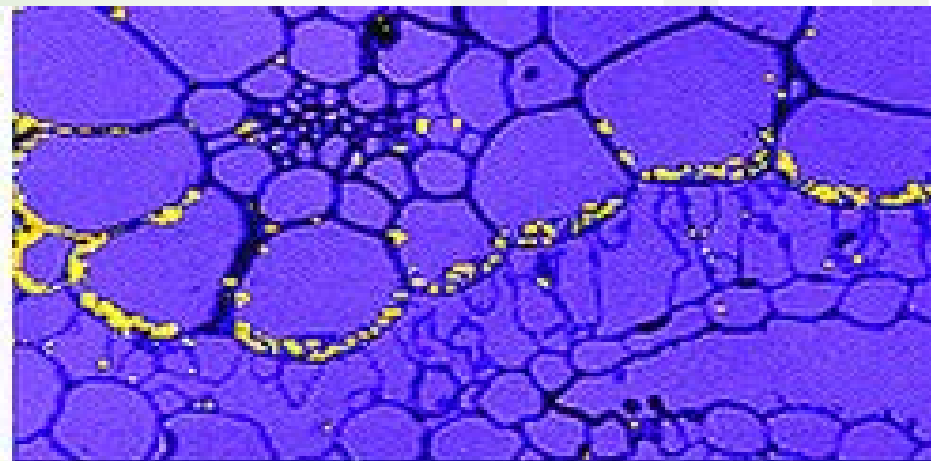
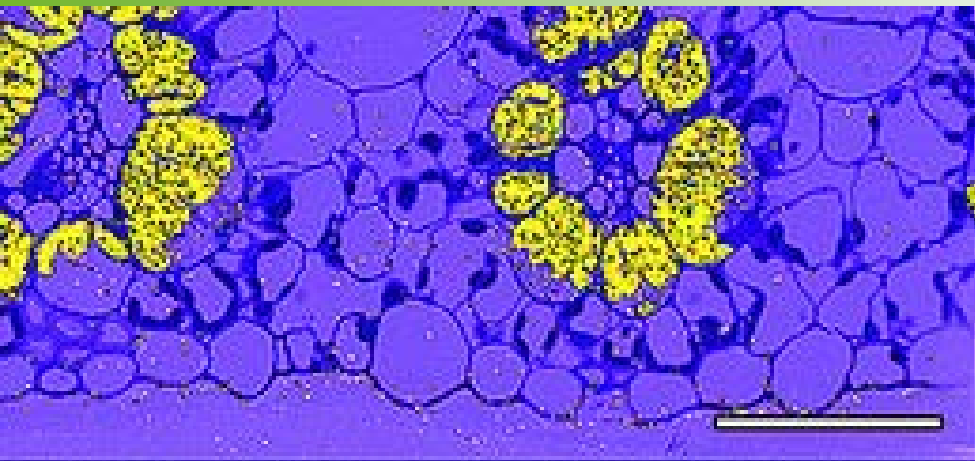


Consortium



CGIAR is a global research partnership for a food secure future

Producing resilient crops in arid conditions



Source: flickr-collective

Re-greening desolate landscapes and delivering results to millions of farmers



Source: CIFOR Flickr collection.

CGIAR is a global research partnership for a food secure future



Increased and Sustained Investment: Doubling of CGIAR funding in five years (2008-2013)

CGIAR Total Funding Trends
Nominal and in 1972 dollars

