




# Manna Center Program for Food Safety & Security Tel Aviv University



Dr. Efrat Oron  
Director of Research and Outreach

“And the people of Israel called the bread Manna” Exodus 16:31

# Food Security means different things in different parts of the world



# What is food security?

“Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”

1996 World Food Summit



# Pillars of Food Security



- Is enough food **available**?
- Economic access—is it **affordable**?
- Is it **nutritious**?

# Pillars of Food Security

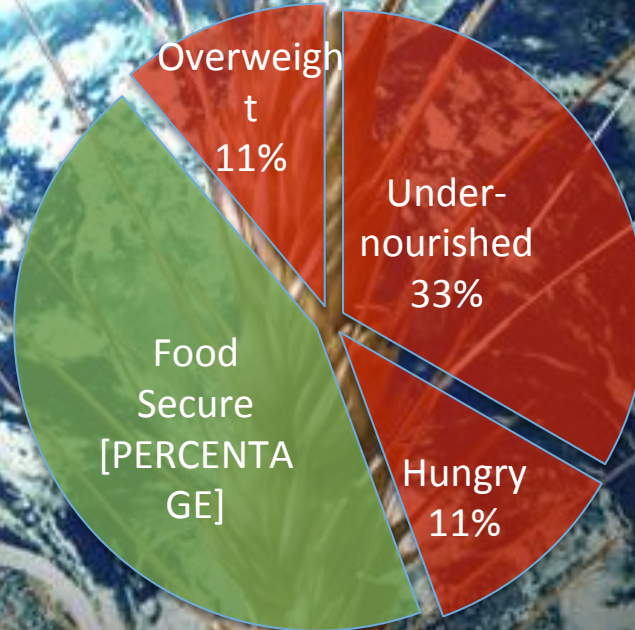


Out of 7 billion people in the world, ...

A pie chart is overlaid on a background image of the Earth from space. The chart is divided into four segments. Three segments are red and labeled 'Under-nourished 33%', 'Hungry 11%', and 'Overweight 11%'. The fourth segment is green and labeled 'Food Secure [PERCENTAGE]'. The text 'Out of 7 billion people in the world, ...' is at the top, and 'Over half suffer from food insecurity!' is at the bottom.

Category	Percentage
Under-nourished	33%
Hungry	11%
Overweight	11%
Food Secure	[PERCENTAGE]

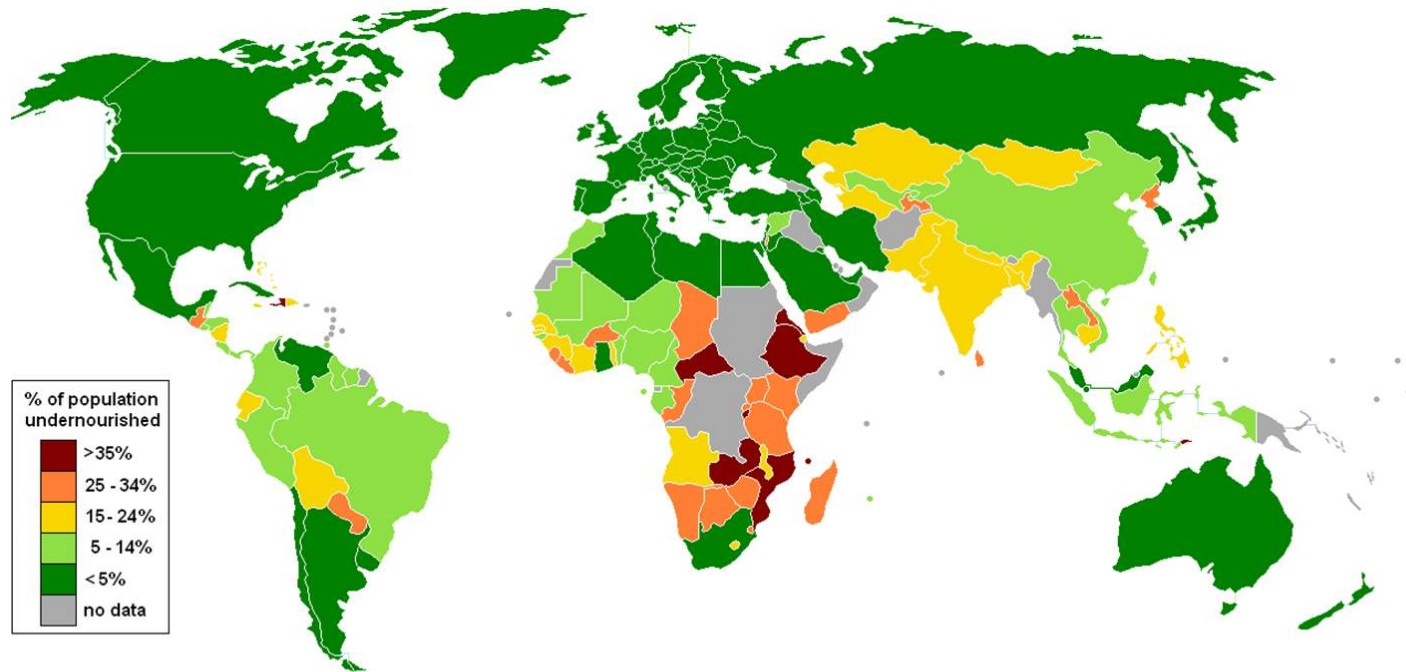
Over half suffer from food insecurity!



# Over half suffer from food insecurity!

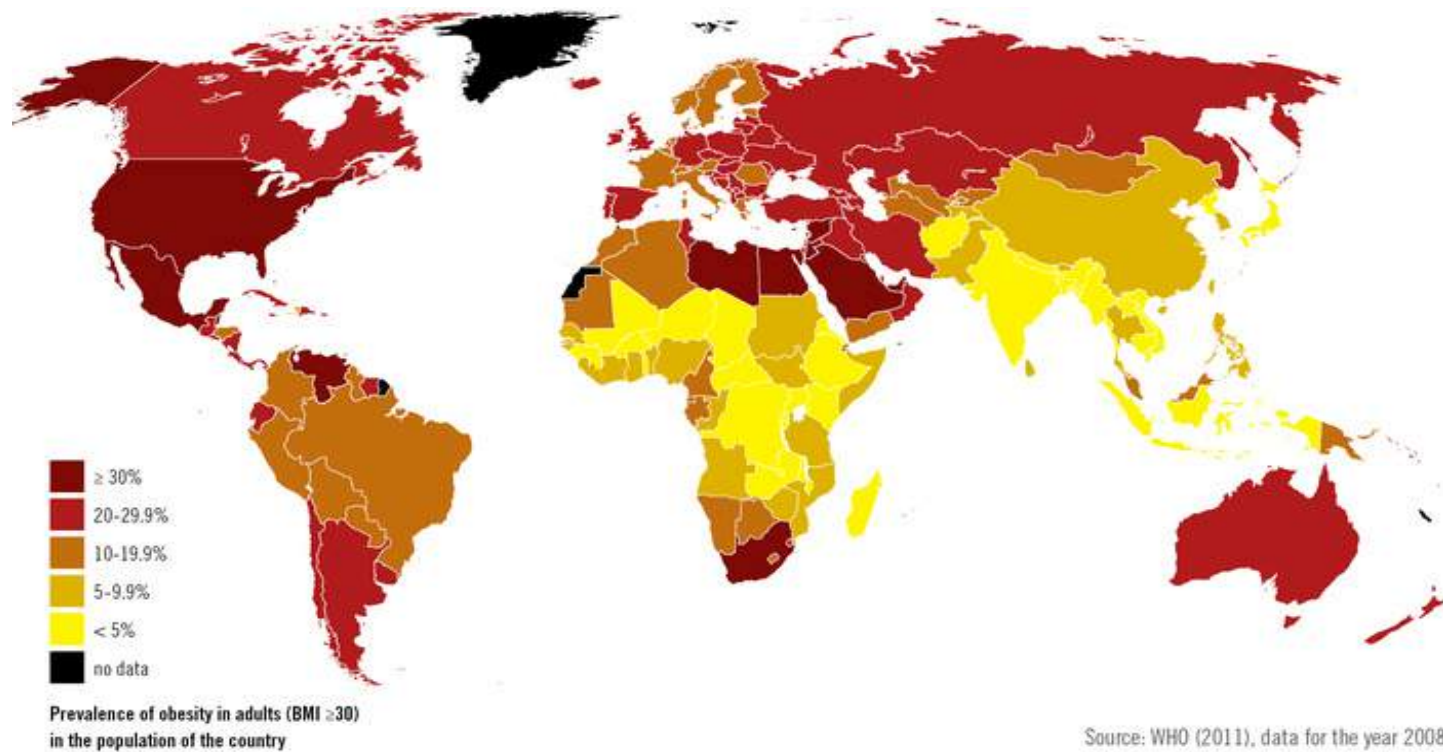


# Undernourishment



- The vast majority of hungry people live in developing countries
- Poor nutrition causes 45% of deaths in children under five
- One in four children suffer stunted growth

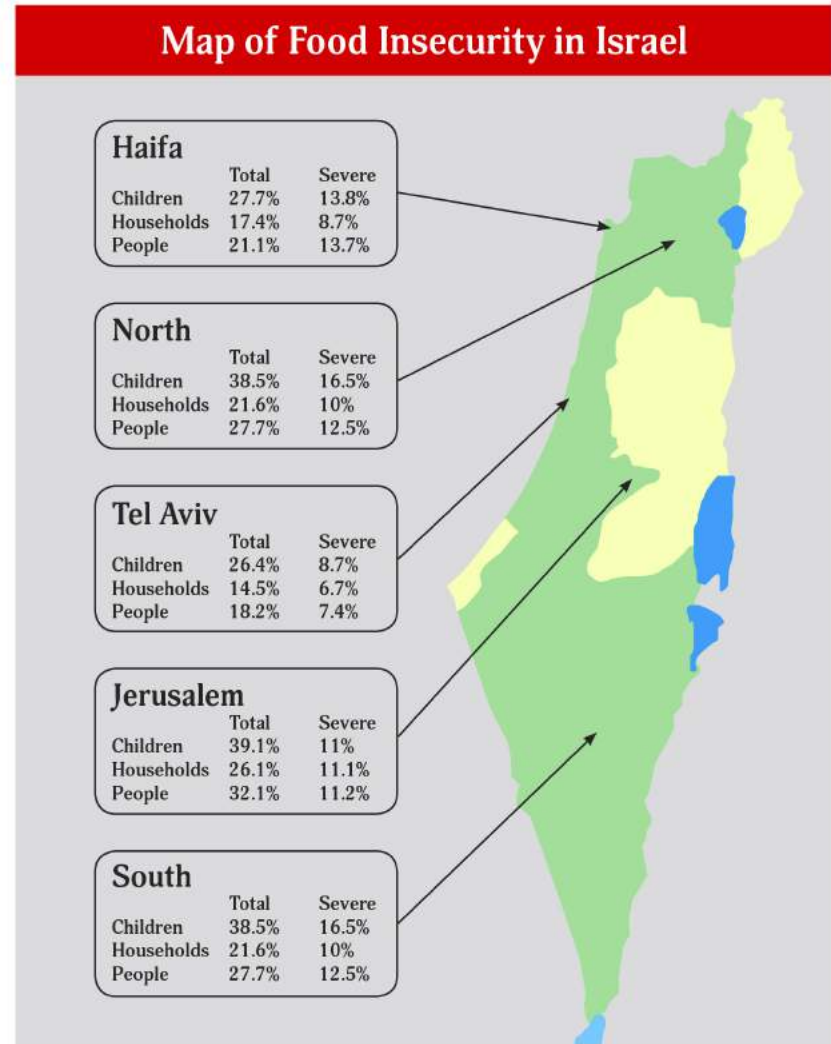
# Obesity





# Food security in Israel

- 18.7% of Israeli households experience food insecurity
- 50% of the Arab families and 25% of the orthodox Jew families live in a state of food insecurity
- 1 out of 3 children is food insecure
- 300,000 children suffer severe food insecurity, with expressions of hunger



# “Israel produces 80% of its food needs”

Plony from Agriculture ministry, December 2012

## ➤ Israel is self sufficient for:

- Vegetables
- Fruits
- Milk
- Poultry
- Eggs

## ➤ Israel imports:

- 90% of its cereals
- 60% of its legumes
- 90% of its sugar
- 50% of its beef

Does “Israel produces 80% of its food needs” mean that  
“Israel is 80% food self-sufficient”?

# Food security: challenges

## World population is Increasing

By 2050 we'll need to feed two billion more people

## Arable land is decreasing

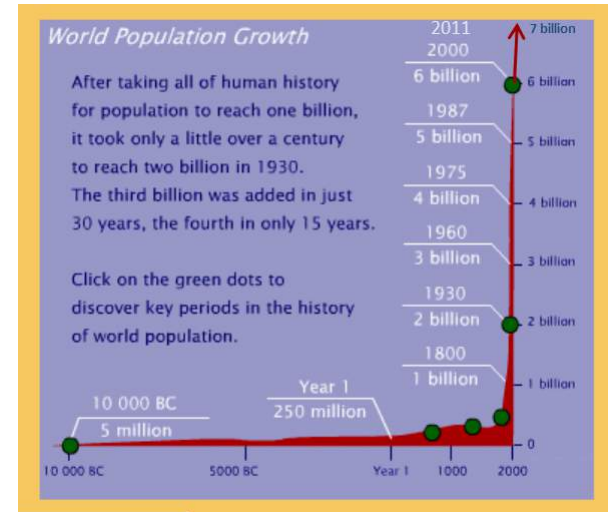
Projections are that while 24% of the earth's surface today is arable, less than 20% will be arable by 2050!

## Gains in yield are decreasing

World cereal production per person is 2000 kcal / day  
To maintain this level, yields have to increase 36% by 2025!

(Less land, Less water, Less phosphates)

## Global warming





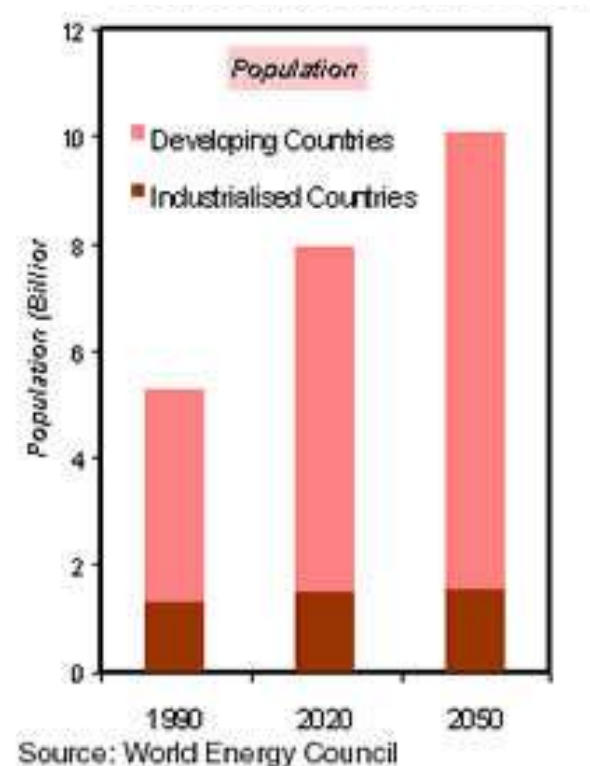
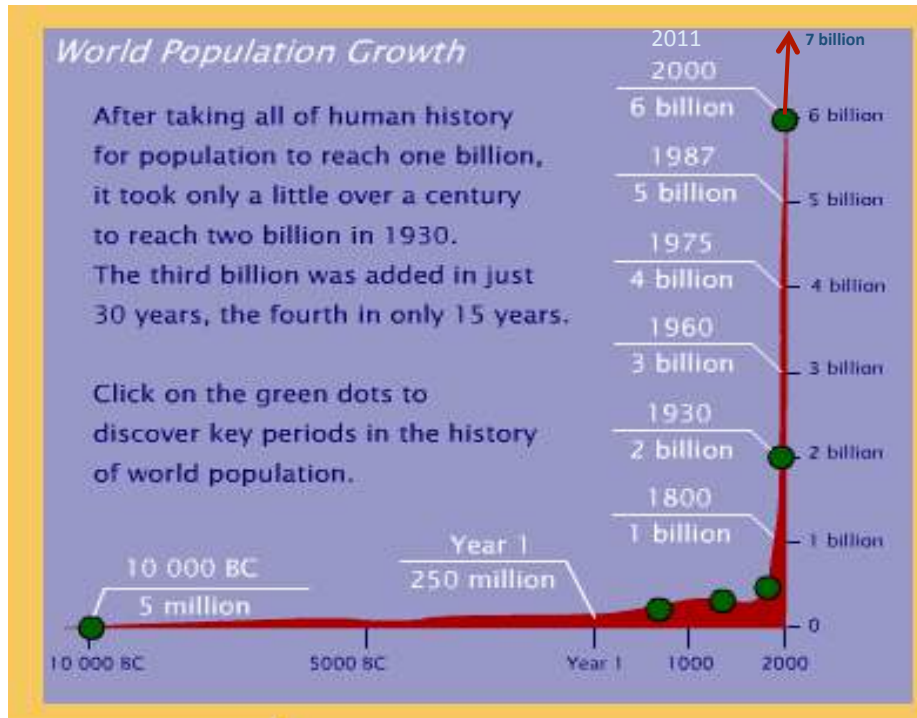
# Feast or famine: what does the future hold?



To achieve global food security we will need to:

- Match the rapidly changing demand for food
- Do so in ways that are environmentally and socially sustainable
- Ensure that the world's poorest people are no longer hungry

# World population is Increasing



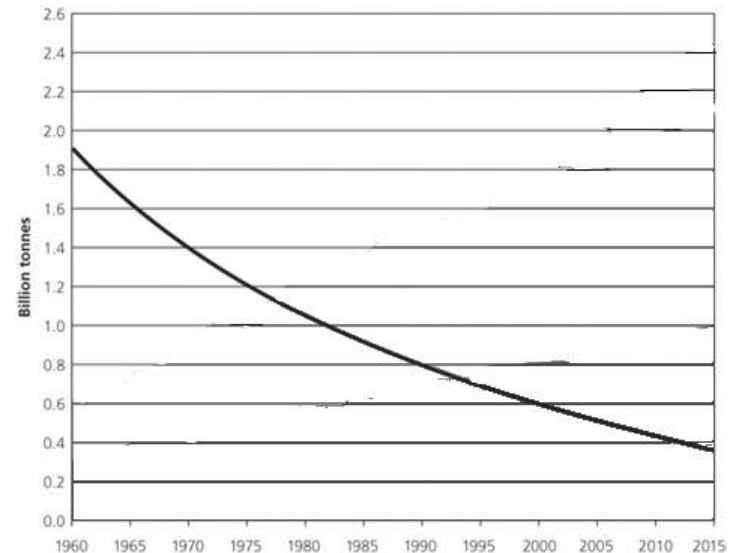
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# Arable land is decreasing

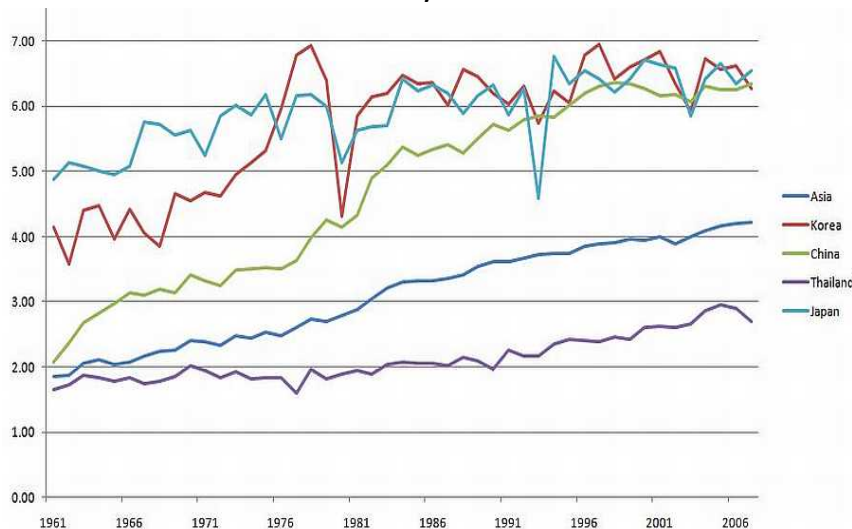
Arable land is decreasing by 100,000 km<sup>2</sup> per year

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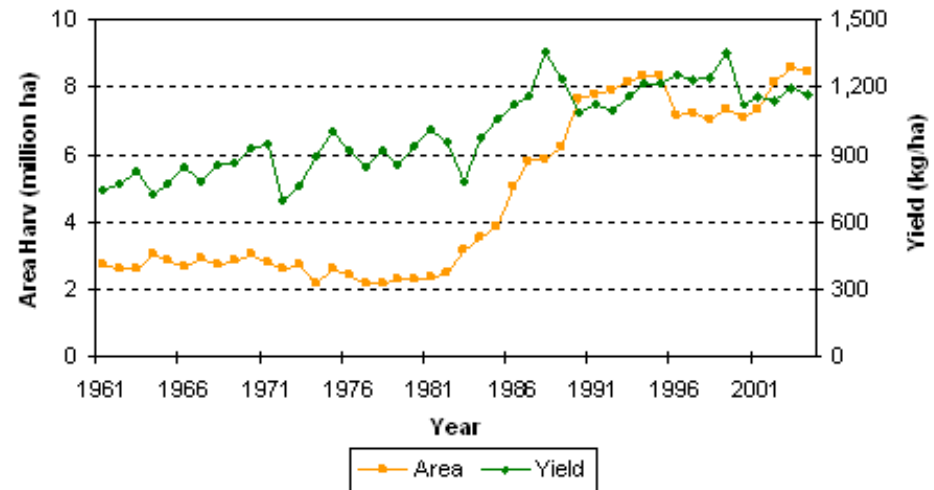


# Gains in yield are decreasing

Rice yields

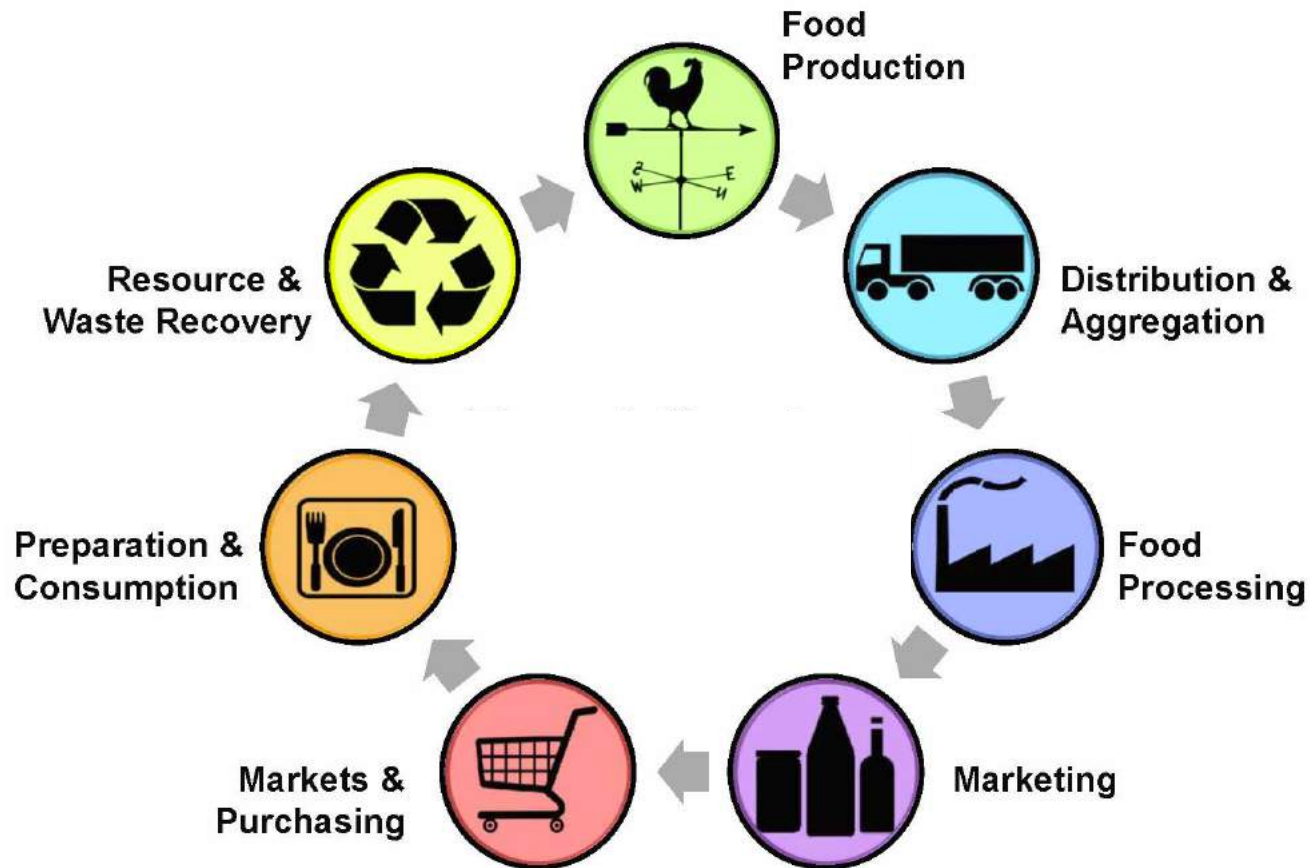


Corn in west Africa



- World cereal production per person is 2000 kcal / day
- To maintain this level, yields have to increase 36% by 2025!
- And this with: Less land; Less water; Less phosphates; Hotter world

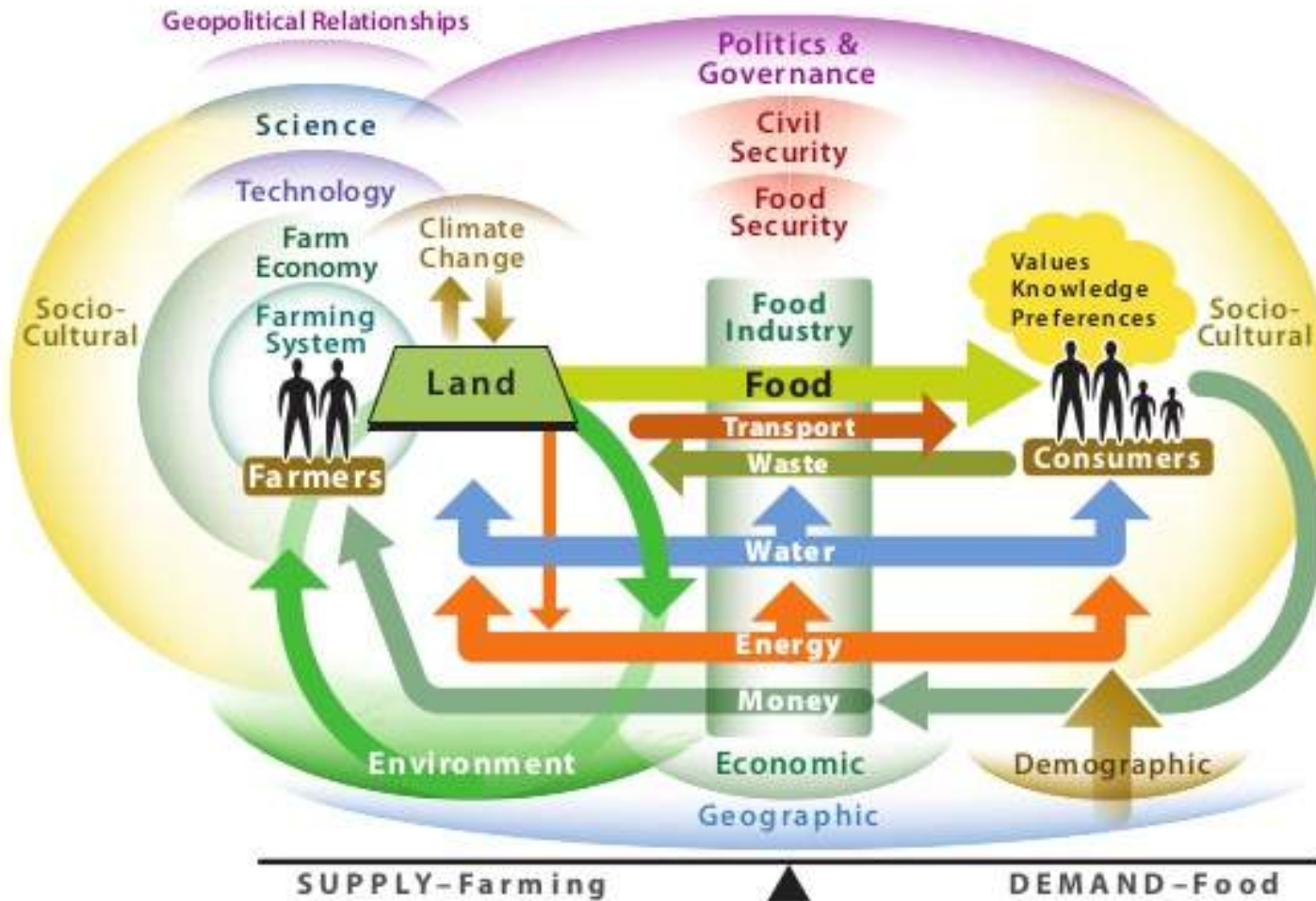
# Sustainable food systems



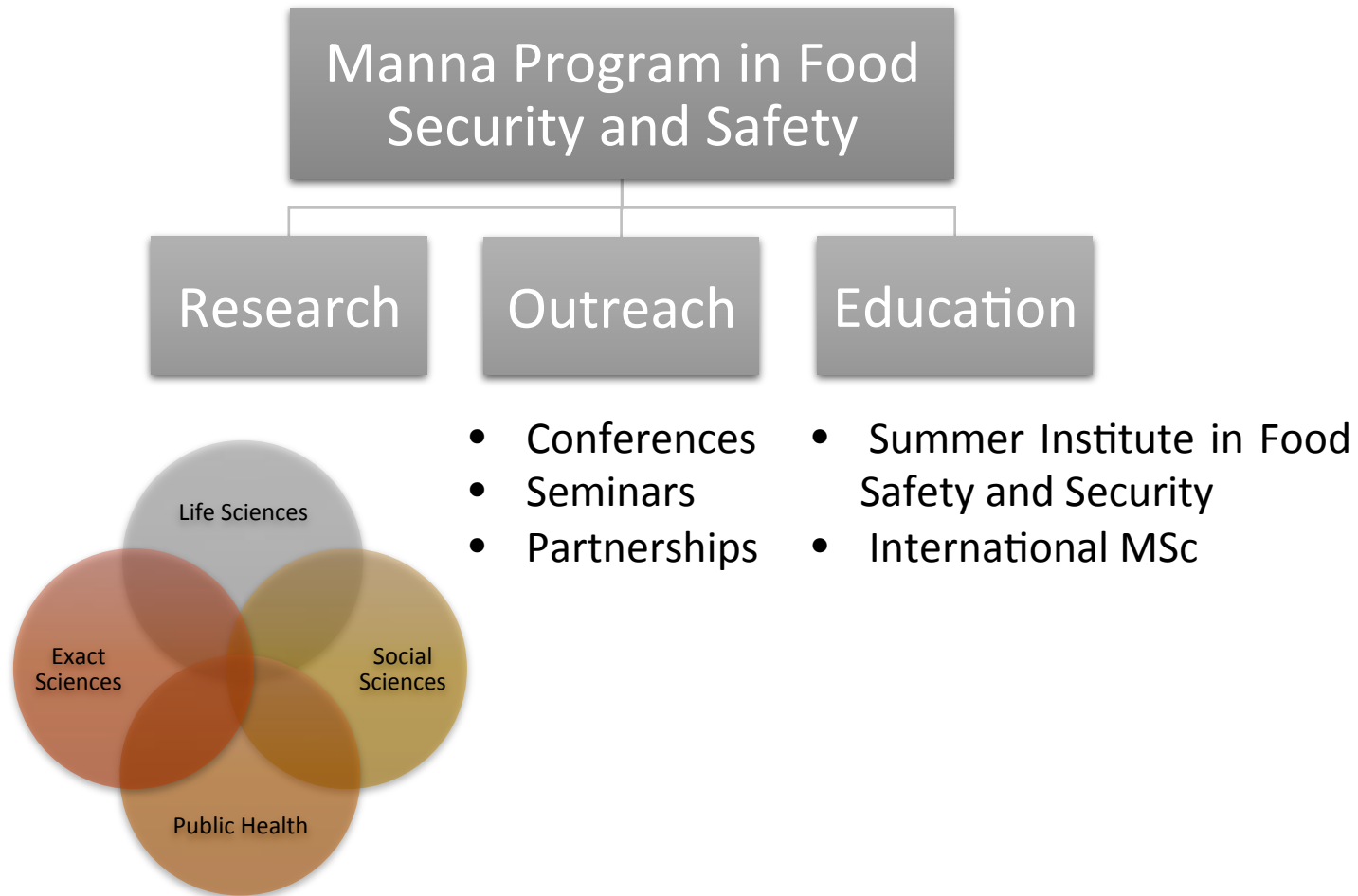


# Sustainable food systems: Stakeholders

### Food System Map – Basic Elements



# Mission: Improve Food Security



**Manna Center Program in Food Safety & Security**

The diagram illustrates the interdisciplinary nature of the program, centered around a globe and a wheat stalk. The central image is flanked by two triangles representing different domains of study and activity:

- Left Triangle (Upright):**
  - Top:** Biology, Chemistry and Engineering
  - Bottom:** Public Health Nutrition
  - Center:** Multidisciplinary Academics
- Right Triangle (Inverted):**
  - Top:** Education
  - Bottom:** Public Outreach
  - Center:** Multidisciplinary Activities
- Right Side (Vertical):** Research
- Bottom Center:** Economics, Law and Policy



# What can a small country like Israel offer?

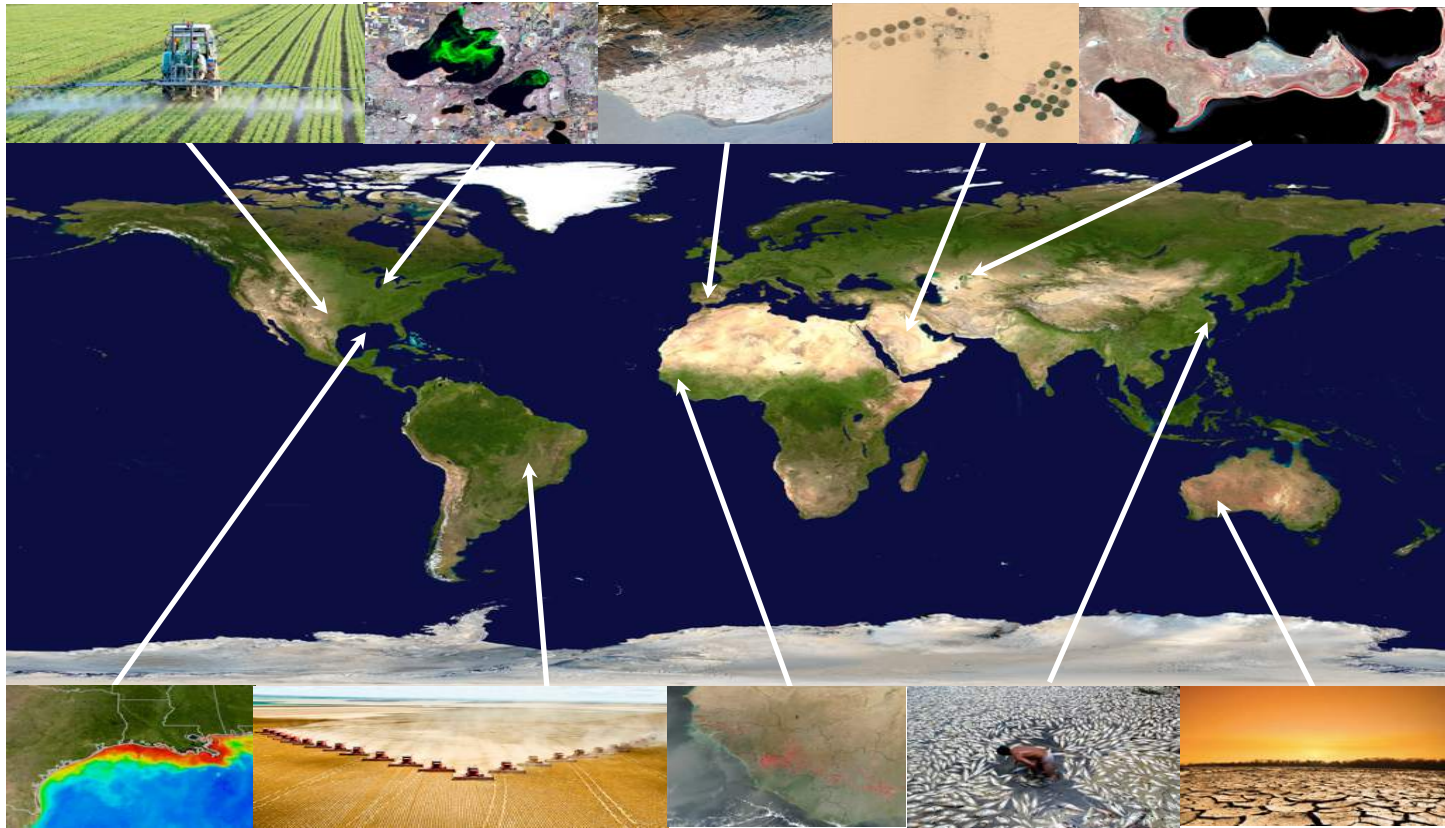
- Great universities
- Great history of success in applied agriculture
  - Outstanding water management
    - Leaders in Irrigation
    - Recycling of waste water
    - Sharing water across tense borders
- Market-oriented agriculture---fruits, vegetables, flowers
- Lessons from the kiibbutzim for small-holder farmers?
- Climate—a good lab for phenotyping for drought/salinity, temperature
- A “Can Do” attitude that finds innovative solutions



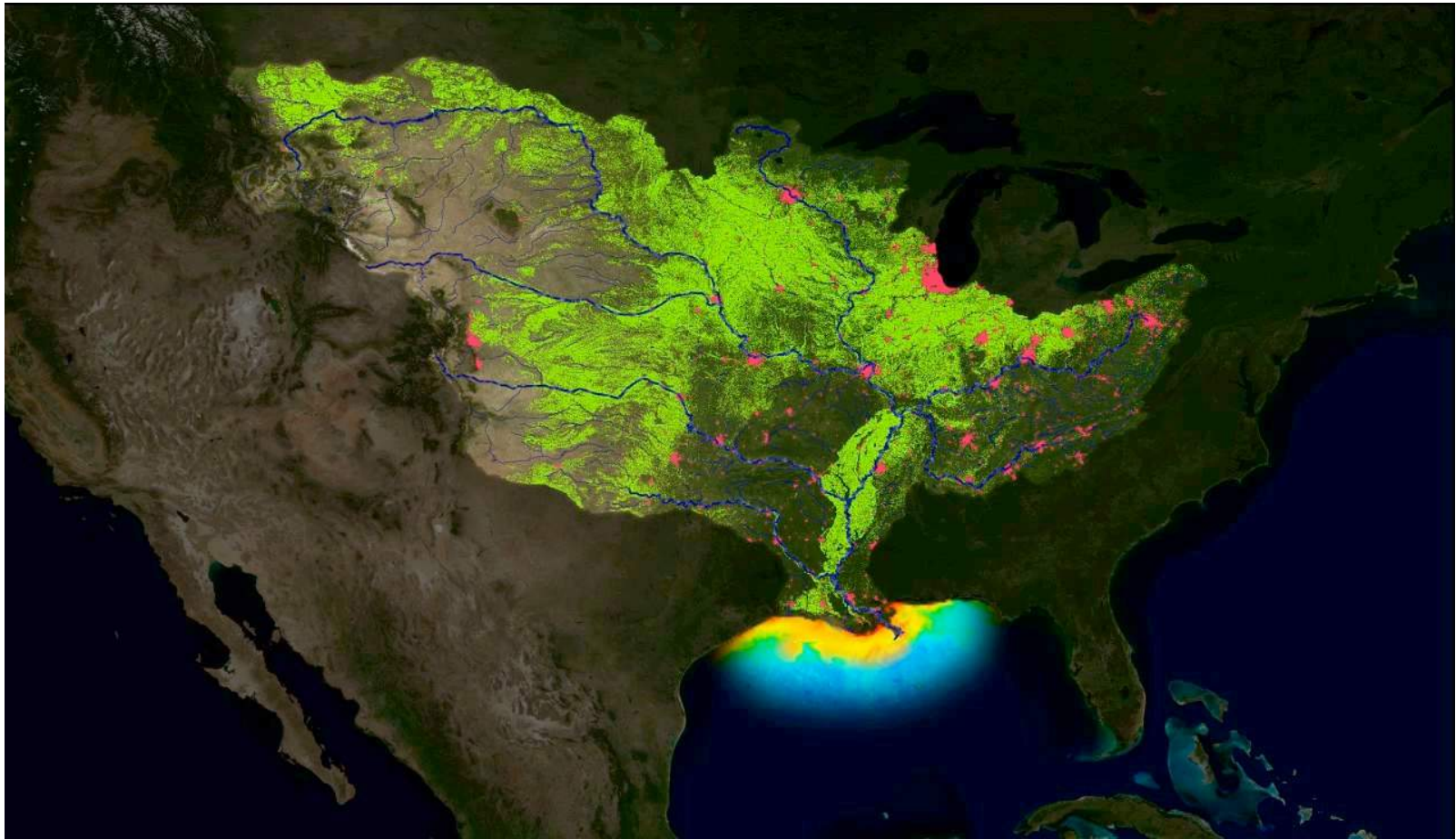
# Sustainable food systems: open questions

- Governments work to solve land tenure problems; can we find a better models to optimize farm sizes?
- Urbanization will continue to increase; how will agriculture adapt?
- Remote sensing---for soil composition, water content, type of vegetation, content of global dust storms, changes in aquifers
- Could cheap energy lead to rapid expansion of desalinization as in Israel?
- Double photosynthetic efficiency without lowering water use efficiency!! Could this double yields?
- Predict seasonal weather---tell farmers when and what to plant

## Challenge: Agriculture must be sustainable



## Global Nitrogen Cycle: The dead zone in the Gulf of Mexico





# Looking into the future:

World population is Increasing

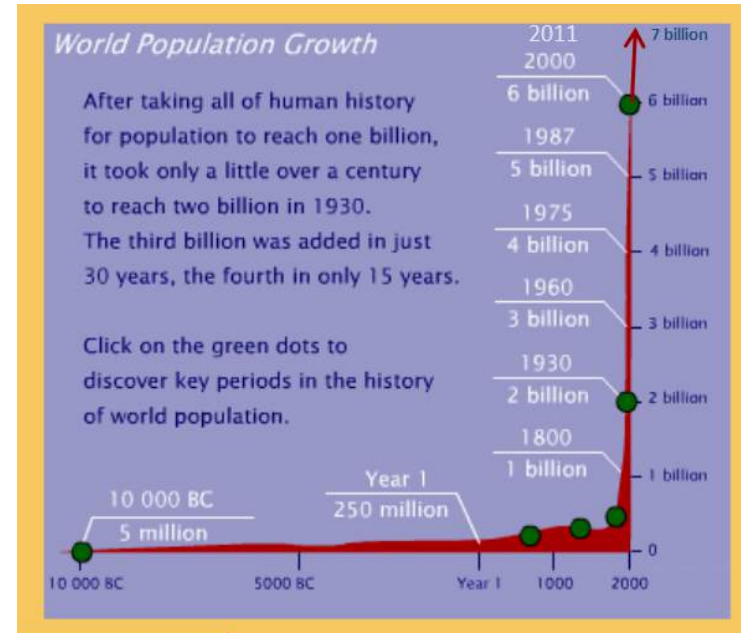
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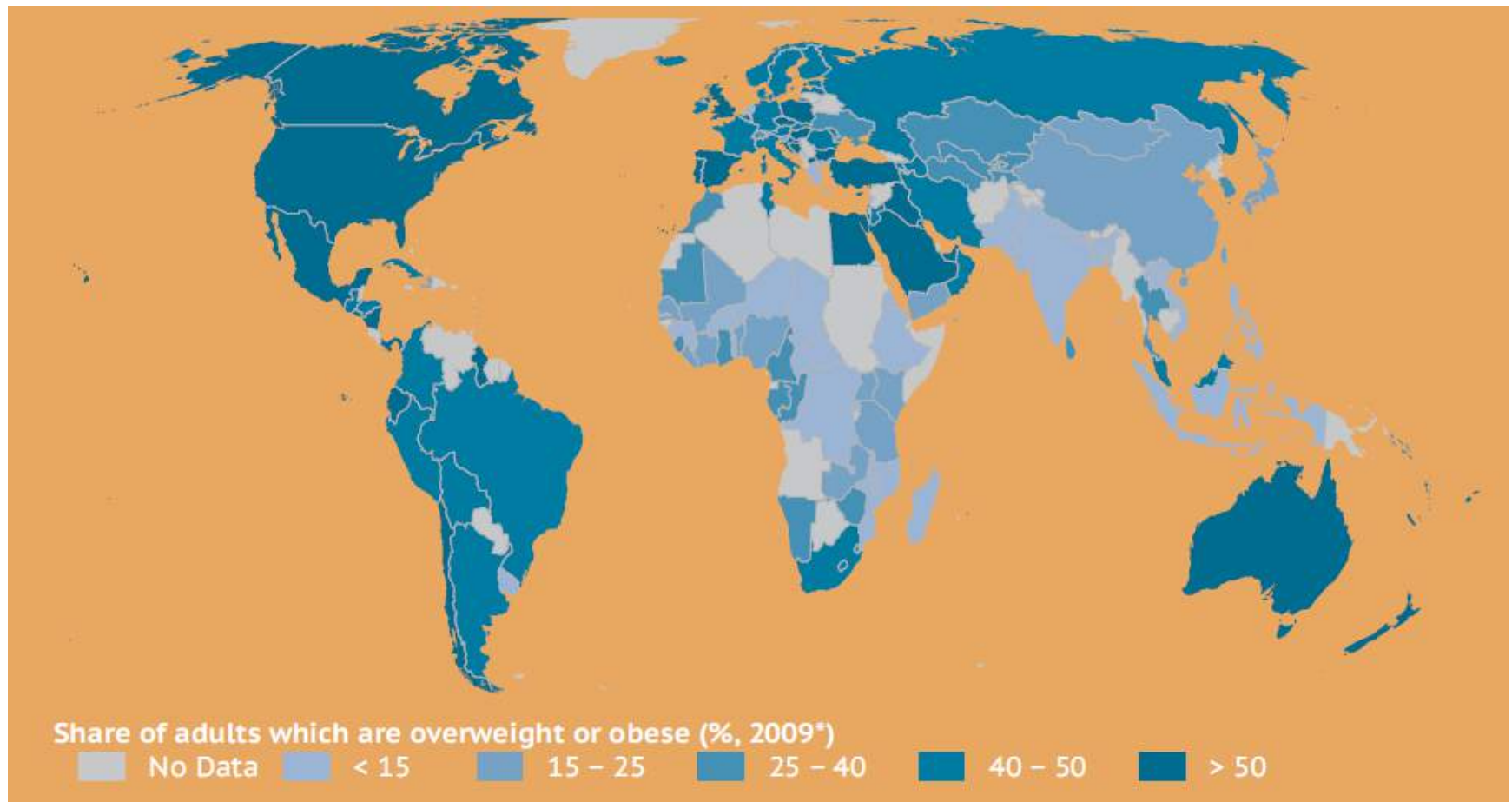
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(Less land, Less water, Less phosphates, Hotter world)

Global warming

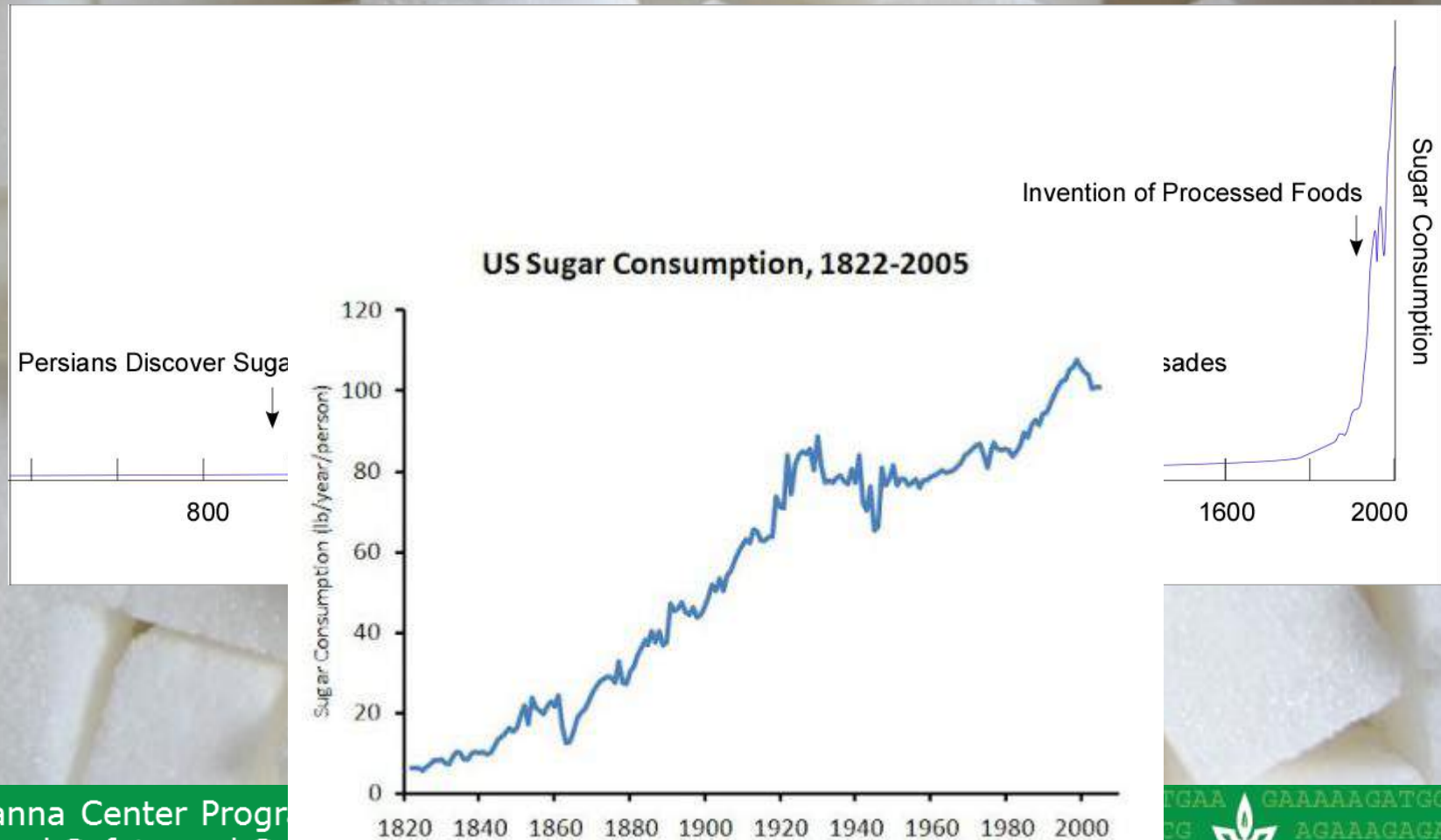




# Over 10% of the world is fat



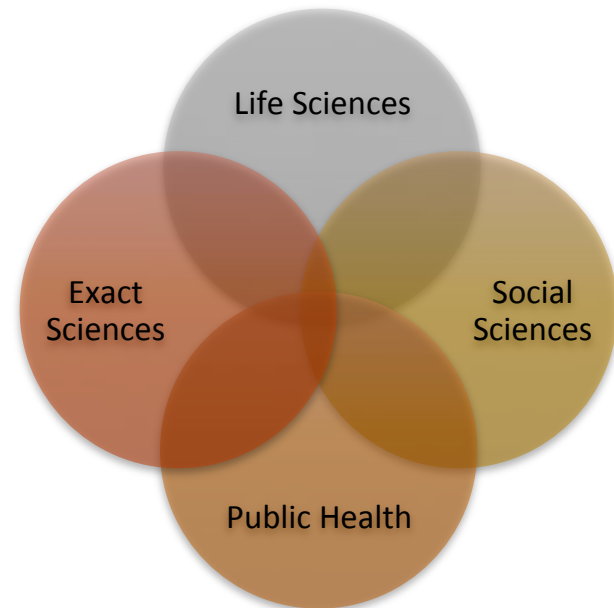
# Sugar consumption has increased 10 fold in 200 years



# Mission: Improve Food Security



- Bring together researchers from diverse academic disciplines to promote innovative research

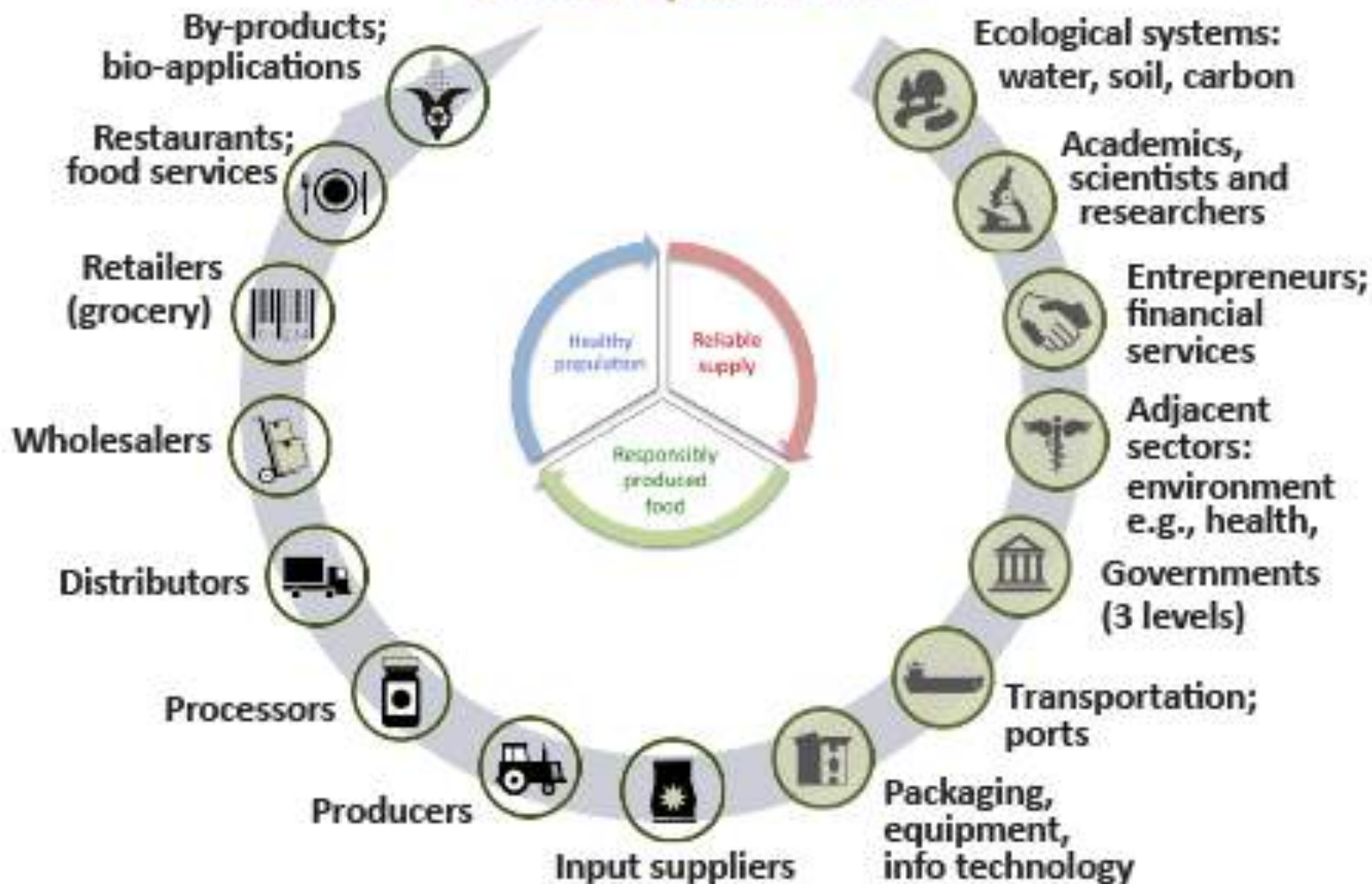


# Multi-Disciplinary Research is ESSENTIAL





## A Food Systems View



# Food Security Research at Tel Aviv University



## Faculty of Life Sciences

- Manna Center for Plant Biosciences
- Institute for Cereal Crop Improvement
- Microbiology



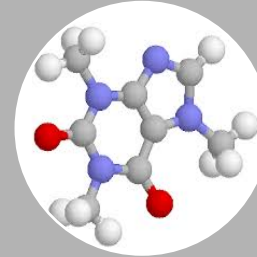
## School of Public Health

- Nutrition
- Food Safety and Epidemiology



## Social Sciences / Business / Law

- School of Public Policy
- Law
- Center for Ethics
- Economics

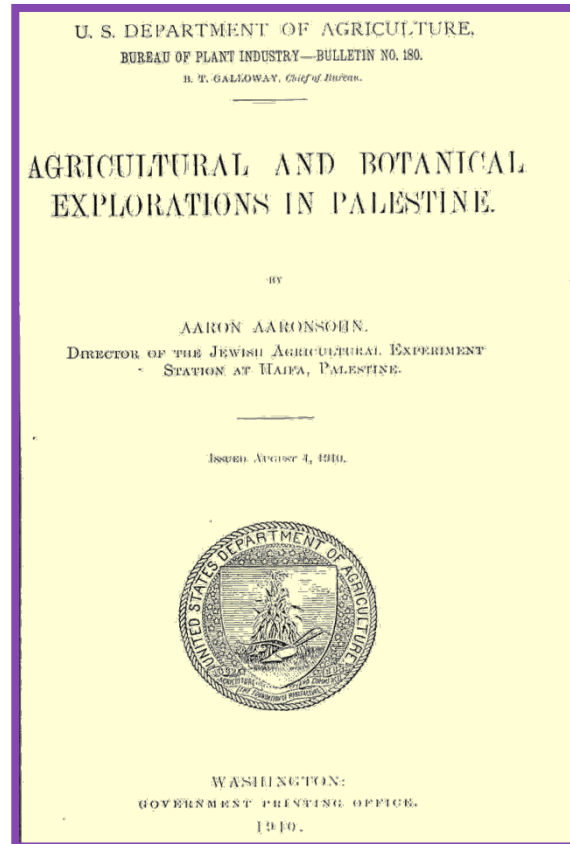


## Exact Sciences / Engineering

- School of Chemistry
- Safra Center for Bioinformatics
- Electrical Engineering



# Food Security: Aaron Aaronsohn and the “Mother of Wheat”



“.....The cultivation of wheat may be revolutionized by the utilization of these wild forms.”  
(Aaronsohn, 1910)

## 62 AGRICULTURAL AND BOTANICAL EXPLORATIONS IN PALESTINE.

the best advantage in the creation of new cultural races. It is impossible to foresee the importance of the results that may be thus obtained. Those who know what is being done at present in the way of creating interesting races by selection and with our present methods of hybridization will agree with me in saying that the cultivation of wheat may be revolutionized by the utilization of these wild forms.

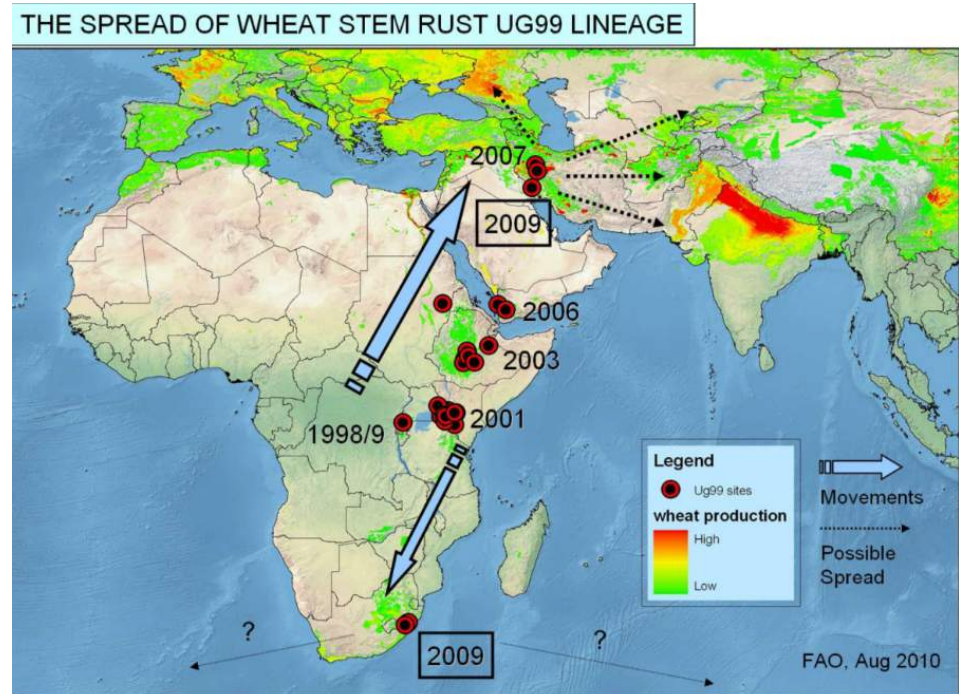
It seems to me that we are justified in hoping to produce races better adapted to the semiarid regions of Algeria, Tunis, Syria, Egypt, Turkestan, and America. If we secure races that will enable us to increase the yield by as much as 1 bushel per acre on these vast areas, the world's total production of wheat will be very materially augmented.

The study of the wild types of our cereals should not serve merely botanical and historical ends. It has a practical, an economic—I may even say a social—importance. Its ultimate aim is to produce a little more bread at a little less expense where production is difficult and costly, and to render this production possible where up to the



# WHEAT STEM RUST - UG99

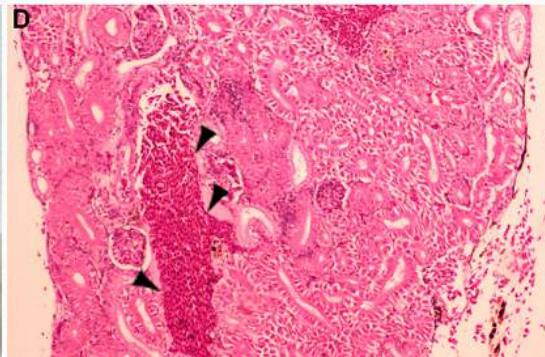
Wheat stem rust (*Puccinia graminis* f. sp. *tritici*) is historically the most damaging disease of wheat



**TAU's *Institute for Cereal and Crop Improvement* identified the resistance gene in its wheat banks which will help to prevent a global catastrophe!**



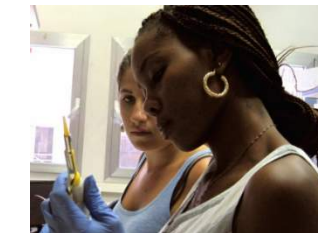
# Identification of a Novel RNA Virus Lethal to Tilapia



Dr. Avi Eldar,  
Kimron Veterinary Inst.



Prof. Marcelo Ehrlich



Japhette Esther Kembou



Prof. Eran Bacharach

# Hyperspectral Remote Sensing (HSR) and Soil Spectroscopy



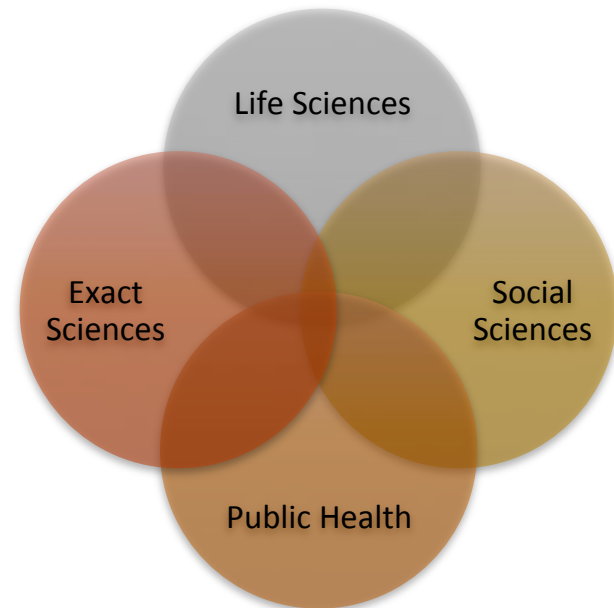
Prof. Eyal Ben Dor



# Mission: Improve Food Security



- Educate and prepare the next generation of scientists and policymakers





# International Summer Institute in Food Security



JULY 3-22, 2016

TEL AVIV UNIVERSITY  
THE MANNA CENTER PROGRAM FOR FOOD SAFETY & SECURITY

## SUMMER INSTITUTE IN FOOD SAFETY AND SECURITY

### PROGRAM OVERVIEW

The Summer Institute in Food Safety and Security provides students with a multidisciplinary understanding of global food security issues. Intensive theoretical and lab courses will be taught by leading experts from Israel and around the world.

The courses will meet the growing need for a new generation of well-rounded academics and policy makers, who have expertise in a specific field, with broad knowledge of biology, public health, law, international development, and more.

### COURSES AND TRACKS

Tracks offer students the ability to delve deeper into specific fields. They are three weeks in length and offer individual week-long courses. Both tracks begin with the *Introduction to Food Security* course covering global food security issues.

**The Agriculture Track** covers advanced topics in plant biology including the courses *Desert Agriculture*, and *Plant Epigenetics and Gene Expression in Changing Environments*. Additional courses include *Molecular Plant Breeding Lab* for students with lab experience, and *Bioethics*.

**The Policy and Nutrition Track** includes the courses *Policy and Economics of Food Security*, *Bioethics*, and *Food Security and Nutrition*.

Tracks are a recommendation; students may choose to take any individual course.

### PRACTICAL DETAILS

- Courses are one week in duration and taught in English.
- Tuition costs are \$900 for the lecture courses, \$1200 for the lab course.
- Scholarships are available, including for those signing up for more than one course. Students from developing countries are especially encouraged to apply.
- A limited number of dormitory rooms are available for program participants.

### WHO SHOULD APPLY

- Graduate students
- Professionals in relevant fields

APPLICATION DEADLINE MAY 20, 2016



# M.Sc. Academic Program



## Masters Degree Program

Tel Aviv - Central Arava



Tel Aviv University and the Arava International Center for Agricultural Training (AICAT) are pleased to invite students to participate in a unique and innovative MSc degree in Plant Science, with an emphasis in Food Safety and Security.

The program is intended for students with BSc degrees in relevant fields (such as biology, agriculture, biotechnology) from recognized universities around the world. The program will be held over four semesters, with most of the studies physically taking place on the Arava campus. The summer semester is an intensive session given on the Tel Aviv campus. For most of the year, the students will live on farms in the Arava region where they will be able to gain relevant agriculture experience as part of their studies for the Msc degree.

## Our Partners

**Tel Aviv University**

Tel Aviv University is Israel's largest university, attracting over 30,000 talented students and renowned faculty from around the globe. The university has a strong interdisciplinary focus and collaborates closely with leading institutions worldwide. The campus is located in Tel Aviv, which is known for its entrepreneurial atmosphere and large number of start-up companies. With the growth of high-tech industries, the Tel Aviv metropolis has become an international hotspot for business and innovation – an ideal setting for an enriching study experience.

## Manna Center Program for Food Safety & Security

The International MSc Program in Plant Science is housed in the Faculty of Life Sciences and is operated by the Manna Program for Food Safety and Security at Tel Aviv University. The Program seeks to bring together researchers from diverse academic disciplines to promote innovative research, to forge ties with professionals and academics around the world, and to prepare the next generation of scientists and policymakers to guide global food security issues.

## AICAT

AICAT was established in 1994, with the support of the Ministry of Foreign Affairs and the Ministry of Agriculture. The Center trains 1,000 students from academic institutes in Asia (Vietnam, Myanmar, Nepal, Indonesia, Cambodia, Thailand, Laos, East Timor) as well as Africa (Ethiopia and South Sudan).

The Center provides theoretical and practical knowledge, as well as professional skills in agriculture. Additionally, students are exposed to modern and advanced technology in the Arava farms, Israel's vegetable basin.



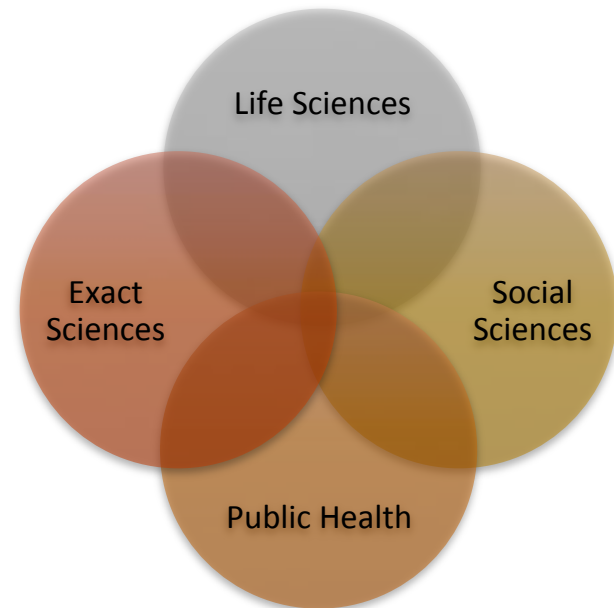
## Manna Center Program for Food Safety and Security

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# Mission: Improve Food Security



- Forge ties with professionals and academics around the world



# SUSTAINABLE FOOD SYSTEMS

AGRICULTURE, ENVIRONMENT & NUTRITION



**JUNE 20-21 2016**

TEL-AVIV UNIVERSITY, ISRAEL

The Manna Center Program for Food Safety and Security at Tel Aviv University, the Israeli Forum for Sustainable Nutrition and New York University are pleased to invite you to an interdisciplinary conference bringing together academia, industry, government and NGOs to discuss current food systems from field to fork including science, policy and action.



## KEYNOTE SPEAKERS:

**Marion Nestle**, Paulette Goddard Professor in the Department of Nutrition, Food Studies, and Public Health at New York University and an award winning author.

**Sandro Dernini**, FAO, UN Consultant on sustainable diets and sustainable food systems, Coordinator of the Forum on Mediterranean Food Cultures, Plexus International and General-Secretary of IFMeD.



## FEATURED TOPICS

- Food & Nutritional Security
- Food and Health
- Towards Sustainable diets
- Food Choice
- Food Ethics, Policy and Politics
- Food in Urban and Rural Environments
- The Role of Industry in Advancing Sustainable Diets and Food Security
- Future of Israeli Farming
- Food and Culture
- Sustainable development Goals
- Food Waste

## Registration

The conference is free of charge but registration is required as places are limited.

Register at: <http://foodsystemsconferenceisrael.com>

In collaboration with the Israel Society  
of Ecology & Environmental Sciences



The Annual Conference  
by **SCIENCE to ENVIRONMENT**

31-33 June 2016  
Tel Aviv University

Manna Center Program for  
Food Safety and Security

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# Pillars of Food Security

- Availability
- Accessibility
  - Use
- Stability



# Sustainable Development Goals



# GLOBAL FOOD SECURITY INITIATIVES

U.N. Secretary-General's High-level task force on the Global Food Security Crisis (HLTF)

Committee on World Food Security (CFS)

A New Vision for Agriculture

Think.Eat.Save

Food Security Cluster

UN Millenium Development Goal 1

CGIAR Fund

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Global Agriculture and Food Security Program (GAFSP)

L'Aquila Food Security Initiative (AFSI)

Global Crop Diversity Trust

The Economist Food Security Index

Global Food Safety Partnership (GFSP)

Zero Hunger Challenge

New Alliance for Food Security and Nutrition

FOODSECURE

Save Food

AgResults

Scaling Up Nutrition (SUN)

1,000 Days

REACH

Flour Fortification Initiative

United Nations System Standing Committee on Nutrition (UNSCN)

The International Council for the Control of Iodine Deficiency Disorders (ICCID)

Manna Center Program for  
REGIONAL  
Food Safety and Security



# Really Big Players



- \$65 billion total; \$8-10\$ Billion annually for the Ag Action Plan
- New focus on value chains and developing ag as a business; working with private sector, although focus remains on smallholder farmers



- 5.5 Billion annually
- Sustainable Development; Global “talk” centers
- Climate and crisis intervention
- Governance and peacemaking

- Other key issues: land tenure; integrating nutrition into agriculture, gender issues;



~\$2 billion/hr

Emergency food relief



# Other Major Players

- **US AID: Feed the Future;** 19 countries; ~\$1 billion/yr;
  - focus on climate effects, inclusive ag growth, nutrition and focus on women, work with private sector, research and capacity bldg
  - total US AID; budget is about \$23 billion/yr)
- **NEW ALLIANCE FOR FOOD AND AGRICULTURE**

African countries and private sector; G8 support and others. \$1.1 billion in 2013
- **BILL & MELINDA GATES FOUNDATION**

HEALTH, GLOBAL DEVELOPMENT (INCLUDING AG), US FOCUS, POLICY—about \$4 billion/yr  
Ag program now focuses on only Bangladesh, 2 states in India and 7 in Africa
- **IN SUM: AROUND \$20 BILLION ARE SPENT/YR IN ATTEMPTS TO TACKLE THE PROBLEMS OF AGRICULTURAL DEVELOPMENT AND FOOD SECURITY**



# The Green Revolution--India

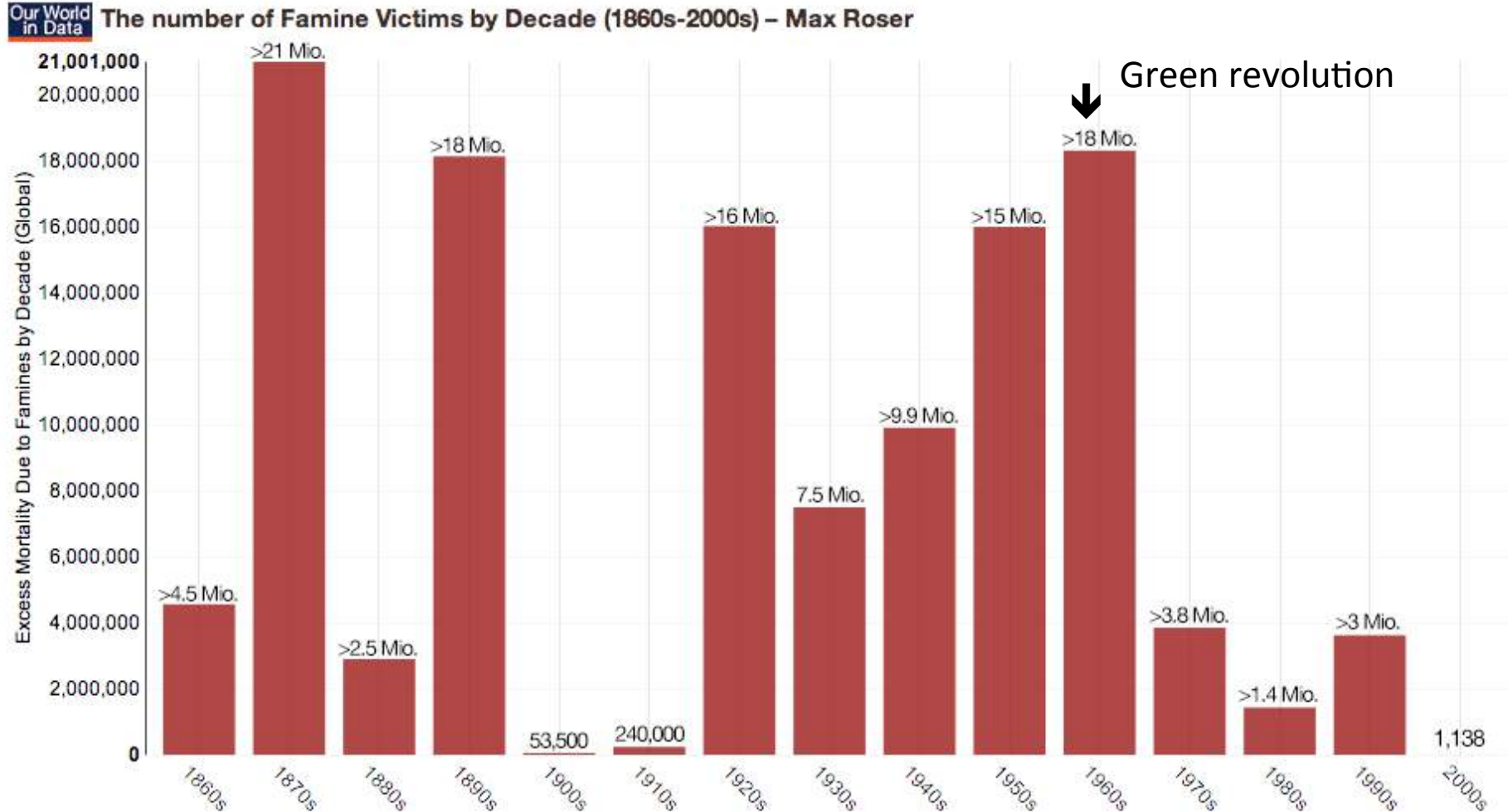
1960s. Repeated famines in India led Rockefeller to send Borlaug to India to assess situation. With support from World Bank, Rockefeller and Ford Foundations, Borlaug led an effort that resulted in India's Green Revolution

The state of Punjab was targeted: the heart of the great Rice-Wheat Rotations

Rice grown during the Khatif rainy season, followed by irrigated wheat in Rabi



# Recurring Famines in India



The author Max Roser licensed this visualisation under a [CC BY-SA license](#). You are welcome to share but please refer to its source where you

find more information: [www.OurWorldinData.org/data/food-agriculture/famines](http://www.OurWorldinData.org/data/food-agriculture/famines)

Data sources: EM-DAT, Devereux (2000), and others

# The Green Revolution

## Some History

1943 Mexico requests technical help in agricultural research from U.S.; Rockefeller Foundation sends 3 of their staff, one of whom was Norman Borlaug.



1944 Borlaug begins a decade-long effort to improve wheat:

- **Resistance to rust**
- **Resistance to climate and soil variations**  
(shuttle breeding hot lowlands/cool highlands)
- **Resistance to lodging (dwarf gene from Japanese variety)**

# The GR: A “Systems” Approach

- Development of rust-resistant, dwarf wheat by Borlaug et al
- Local production of Borlaug’s wheat seed; distribution to farmers
- Government subsidies for fertilizer, water, power
- Improved irrigation systems
- Pest and weed control and better agricultural practices
- Demonstrations to farmers
- Improved transport

**YIELDS OF WHEAT VIRTUALLY DOUBLED AND FAMINES CEASED**



# Criticisms of the Green Revolution

- Overuse of fertilizers and pesticides---environmental issues
- Increased salinity buildup and over-pumping of wells for irrigation of wheat
- Loss of crop diversity—less acreage for pulses (chickpea, pigeon pea)
- Smallholder farmers were slower to adopt, but eventually did so

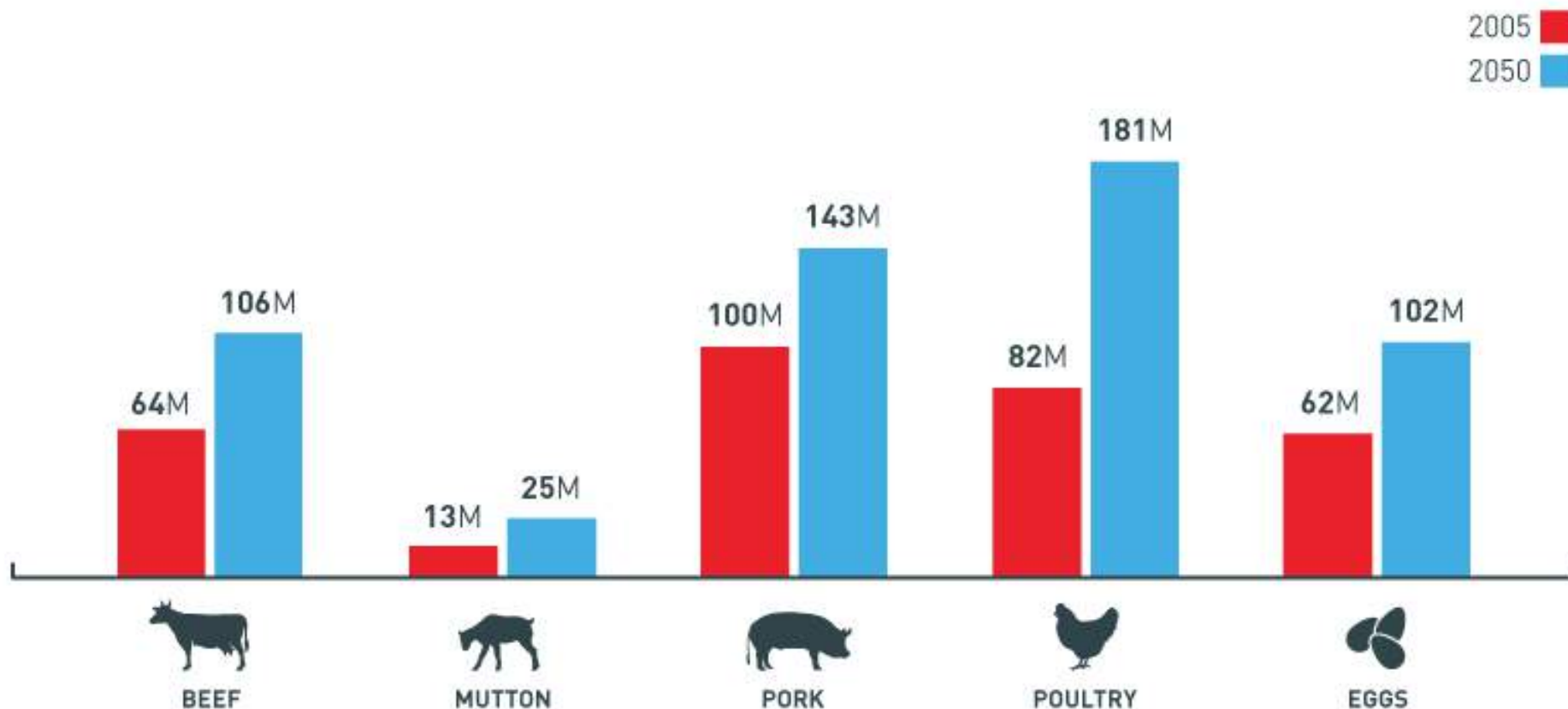
# A Major Opportunity? ADDRESSING FOOD LOSS AND FOOD WASTE

- **ABOUT ONE-THIRD OF ALL FOOD PRODUCED IS LOST OR WASTED**
  - **LOSS:** OCCURS DURING PRODUCTION, HARVEST, TRANSPORT, MARKETING---A DEVELOPING WORLD PROBLEM
  - **WASTE:** PRIMARILY A SOCIAL ISSUE INVOLVING CONSUMERS---A DEVELOPED WORLD PROBLEM

# GLOBAL DEMAND FOR MEAT

2005 vs. 2050

(in tonnes)



Source: Food and Agriculture Organization of the United Nations, ESA Working Paper No. 12-03, p. 131



Food Insecurity leads to social and political insecurity



# Tackling Soil Degradation

- Use remote sensing to create global digital soil map
- Reduce over-grazing
- Promote no-till agriculture
- Address soil fertility---inorganic and organic fertilizers

# Hunger

- Globally, one in nine people in the world today (795 million) are undernourished.
- The vast majority of the world's hungry people live in developing countries, where 12.9 per cent of the population is undernourished.
- Asia is the continent with the most hungry people – two thirds of the total. The percentage in southern Asia has fallen in recent years but in western Asia it has increased slightly.
- Southern Asia faces the greatest hunger burden, with about 281 million undernourished people. In sub-Saharan Africa, projections for the 2014-2016 period indicate a rate of undernourishment of almost 23 per cent.

# Hunger

- Poor nutrition causes nearly half (45 per cent) of deaths in children under five – 3.1 million children each year.
- One in four of the world's children suffer stunted growth. In developing countries the proportion can rise to one in three.
- 66 million primary school-age children attend classes hungry across the developing world, with 23 million in Africa alone.

# Food Security

- Agriculture is the single largest employer in the world, providing livelihoods for 40 per cent of today's global population. It is the largest source of income and jobs for poor rural households.
- 500 million small farms worldwide, most still rainfed, provide up to 80 per cent of food consumed in a large part of the developing world. Investing in smallholder women and men is an important way to increase food security and nutrition for the poorest, as well as food production for local and global markets.



# Food Security

- Since the 1900s, some 75 per cent of crop diversity has been lost from farmers' fields. Better use of agricultural biodiversity can contribute to more nutritious diets, enhanced livelihoods for farming communities and more resilient and sustainable farming systems.
- If women farmers had the same access to resources as men, the number of hungry in the world could be reduced by up to 150 million.
- 1.4 billion people have no access to electricity worldwide – most of whom live in rural areas of the developing world. Energy poverty in many regions is a fundamental barrier to reducing hunger and ensuring that the world can produce enough food to meet future demand.

# Goal Two Targets

- By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
- By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
- 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
- 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

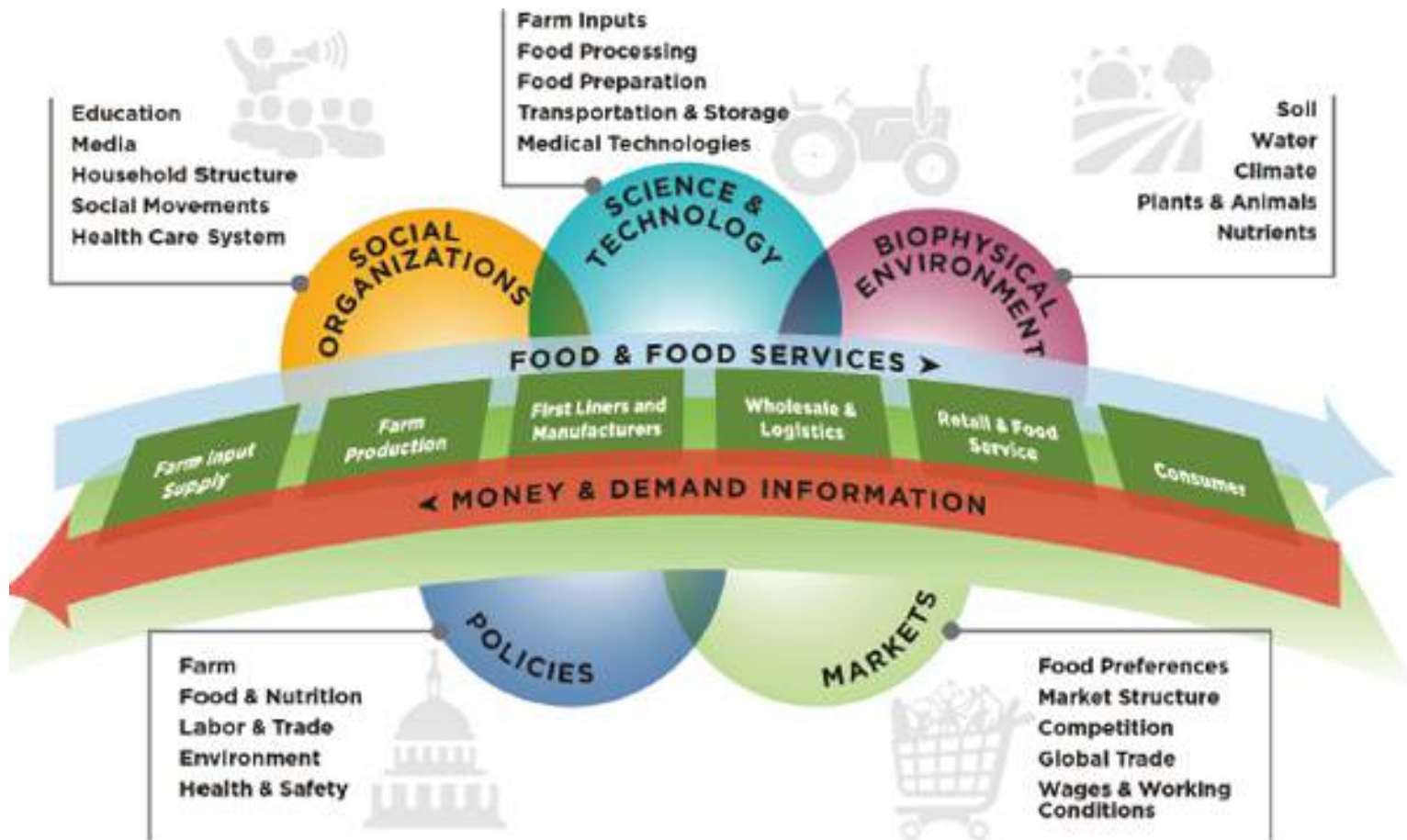


*"Hunger is not an issue of charity. It is an issue of justice."-- Jacques Diouf, FAO*

## Goal Two Targets Continued

- By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed
- Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
- Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round
- Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility



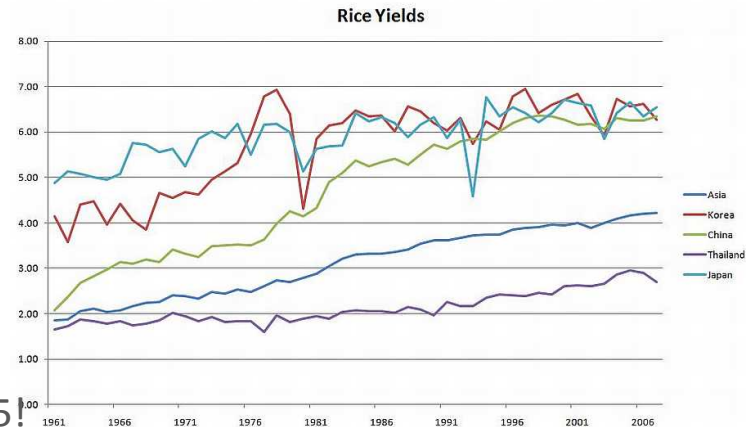


- World cereal production per person is 2000 kcal / day
- To maintain this level, yields have to increase 36% by 2025!

## Gains in yield are decreasing

- And this with:

- Less land
- Less water
- Less phosphates
- Hotter world



## Gains in yield are decreasing

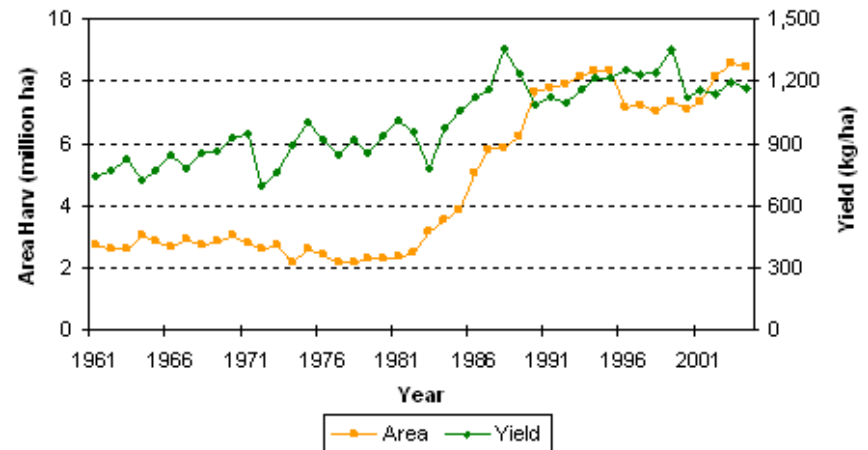
World cereal production per person is 2000 kcal / day

To maintain this level, yields have to increase 36% by 2025!

(Less land, Less water, Less phosphates, Hotter world)

## Global warming

Corn in west Africa



# What is food security?

- Is enough food **available**?
- Economic access—is it **affordable**?
- Is it **nutritious**?