

Food Security: How to Feed Africa

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Commission on Sustainable Development

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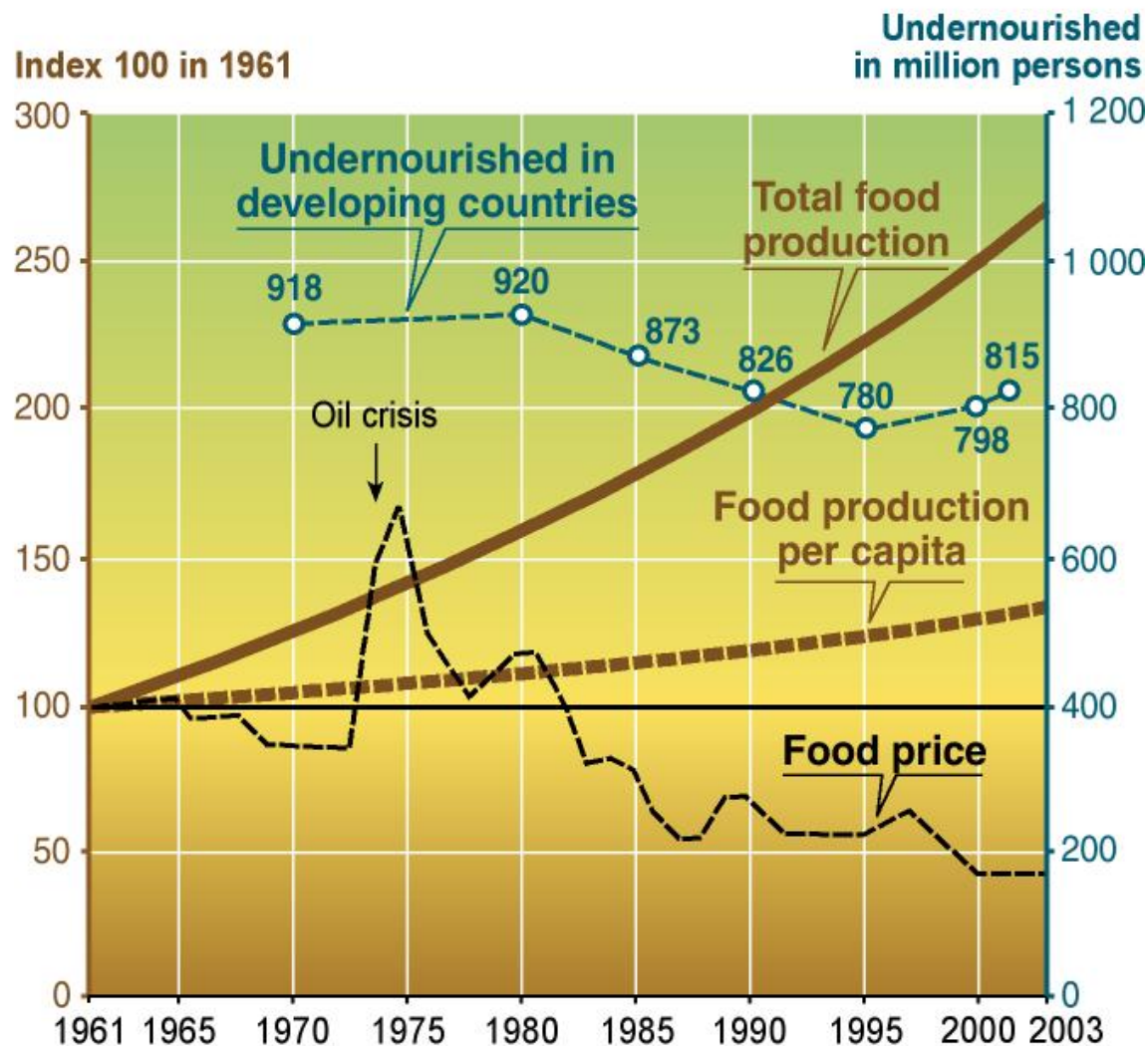
Key Findings from the International Assessment of Agricultural Science and Technology for Development (IAASTD)

In spite of major successes in agriculture, business-as-usual will not suffice, we need to increase productivity and reduce post-harvest loss

- Address the needs of farmers, especially small-scale farmers**
- Acknowledge the multi-functionality of agriculture**
- Emphasize agro-ecological practices (e.g., IPM, INRM) and the critical role of natural resources (e.g., soils and water) and biodiversity**
- Adapt to a changing climate - increase water efficiency**
- Acknowledge the role of, and empower, woman**
- Reform international trade and build appropriate national institutions**
- Invest in Science and Technology and improve extension services**
- Invest in rural development – roads, financing, education**

Current situation

- Food production has more than doubled since 1960
- Food production per capita has grown
- Food prices have fallen
- Percent of undernourished fallen
- Rural development in China, Thailand and parts of Latin America was the initial stimulus to their rapid economic growth



Sources: FAOSTATS, SOFI, Millennium Ecosystem Assessment

So what is the problem?



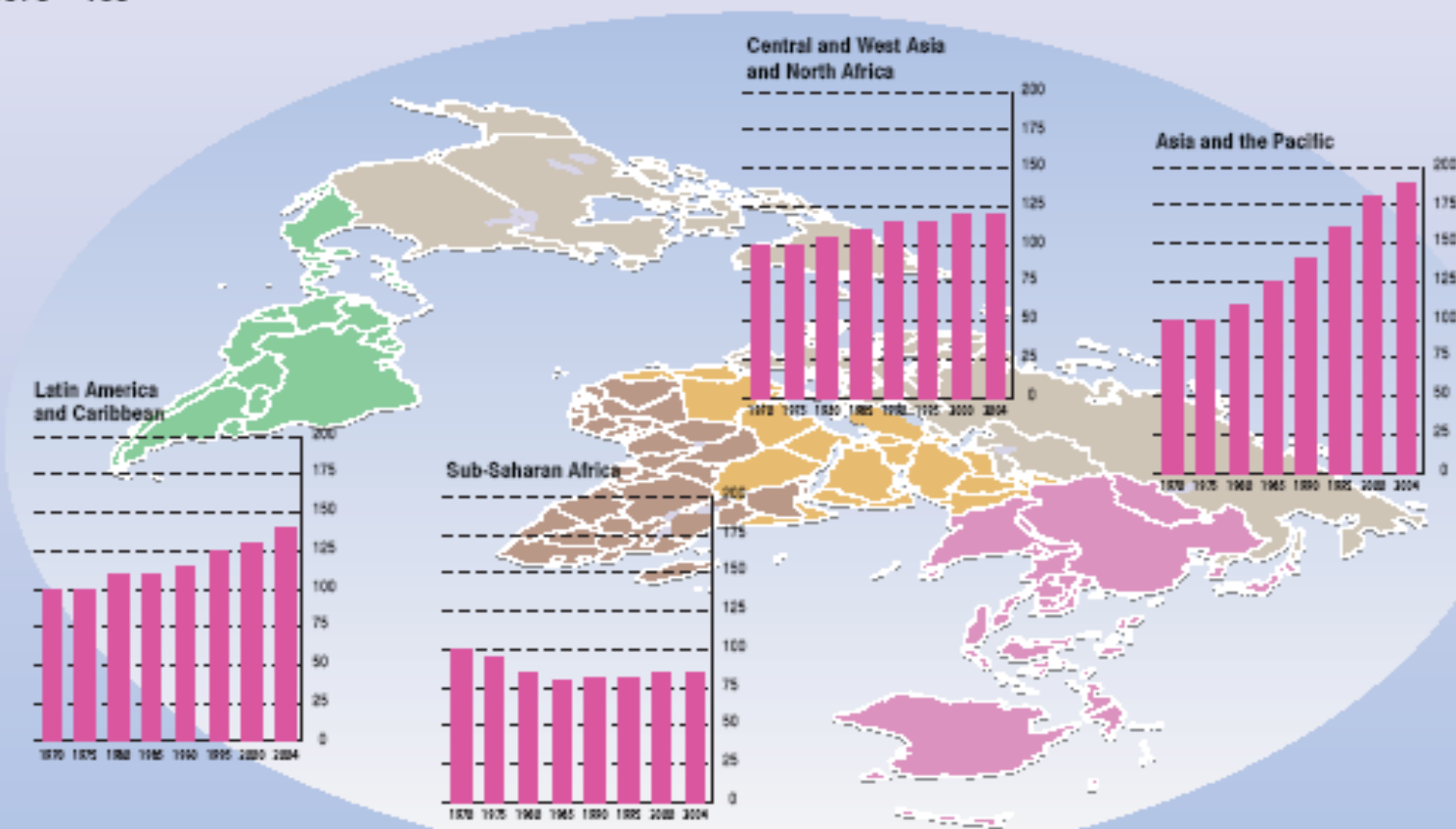
People have benefited unevenly from these yield increases across regions, in part because of different institutional and policy environments

Emphasis on increasing yields and productivity has in some cases had negative consequences on environmental sustainability – soils, water, biodiversity, climate change



Total agricultural output 1970–2004

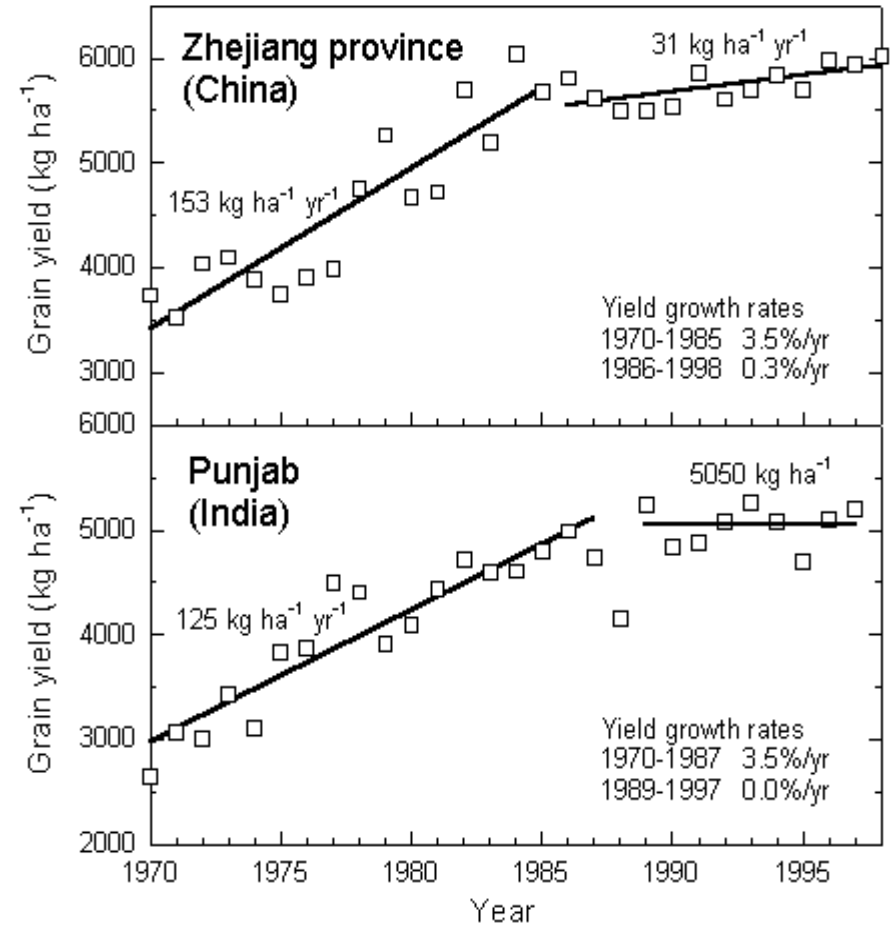
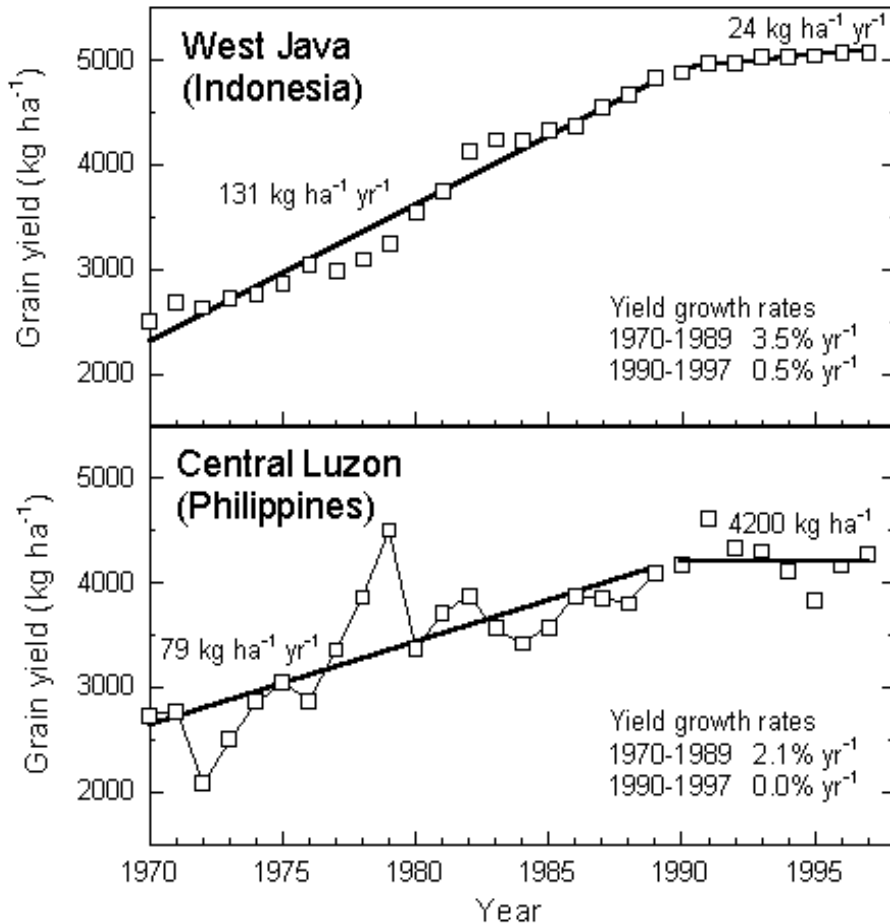
1970 = 100





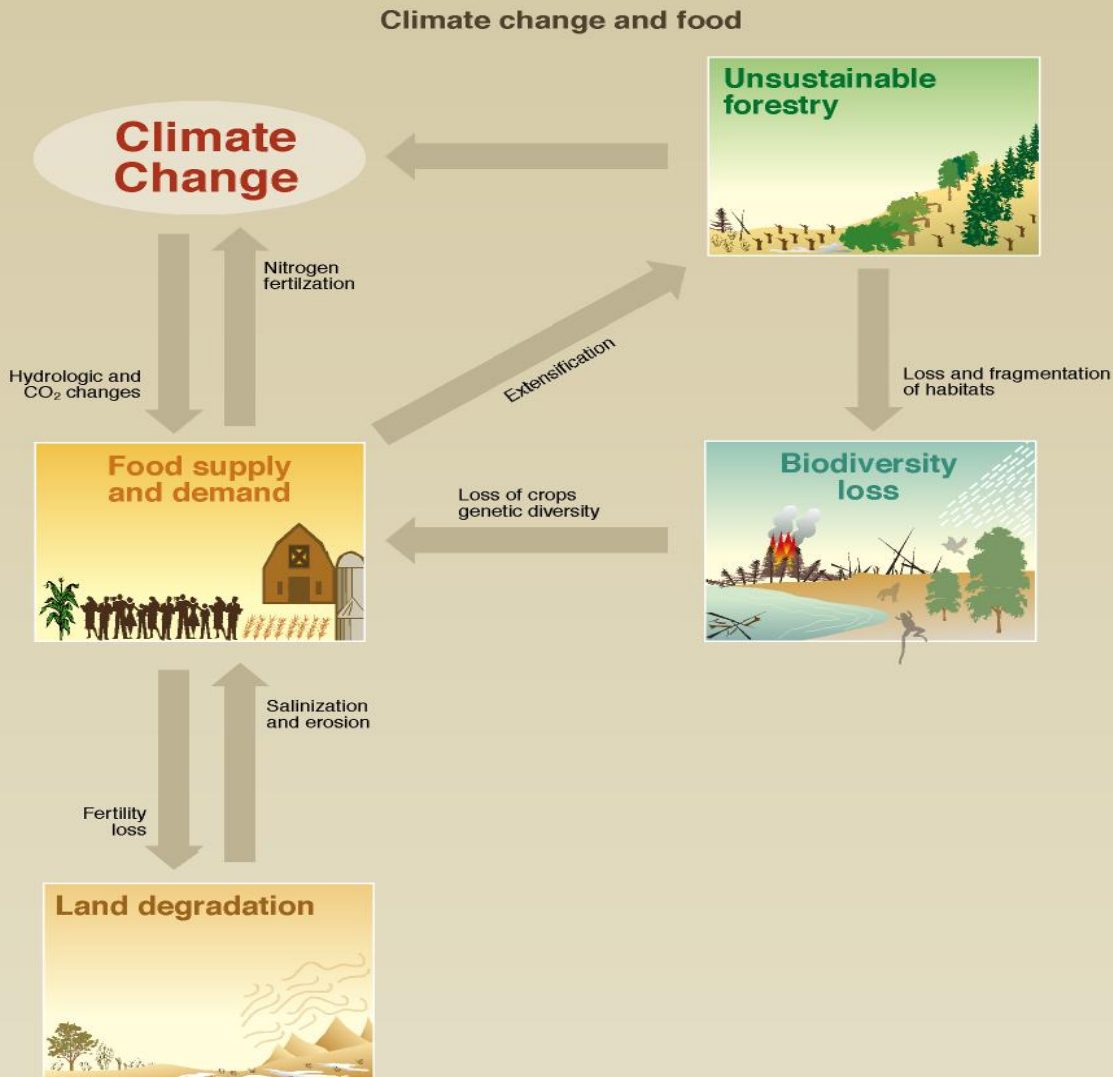
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Agriculture and Environmental Degradation

FIGURE 8.2



Can crop, animal and fish traits be improved to address the projected changes in climate – what are the roles of traditional breeding and modern forms of biotechnology?

How will the loss of genetic diversity affect future agriculture?

Can soil degradation be reversed and productivity enhanced?

- **Drivers of the recent increase in food prices**
 - **Increased demand from rapidly developing countries, e.g., China**
 - **Poor harvests due to variable weather - possibly related to human-induced climate change**
 - **Increased use of biofuels, especially maize in the US**
 - **High energy prices, hence fertilizer prices**
 - **Export bans from some large exporting countries**
 - **Speculation on the commodity markets**

These issues will continue to be important over the next several decades and need to be addressed urgently

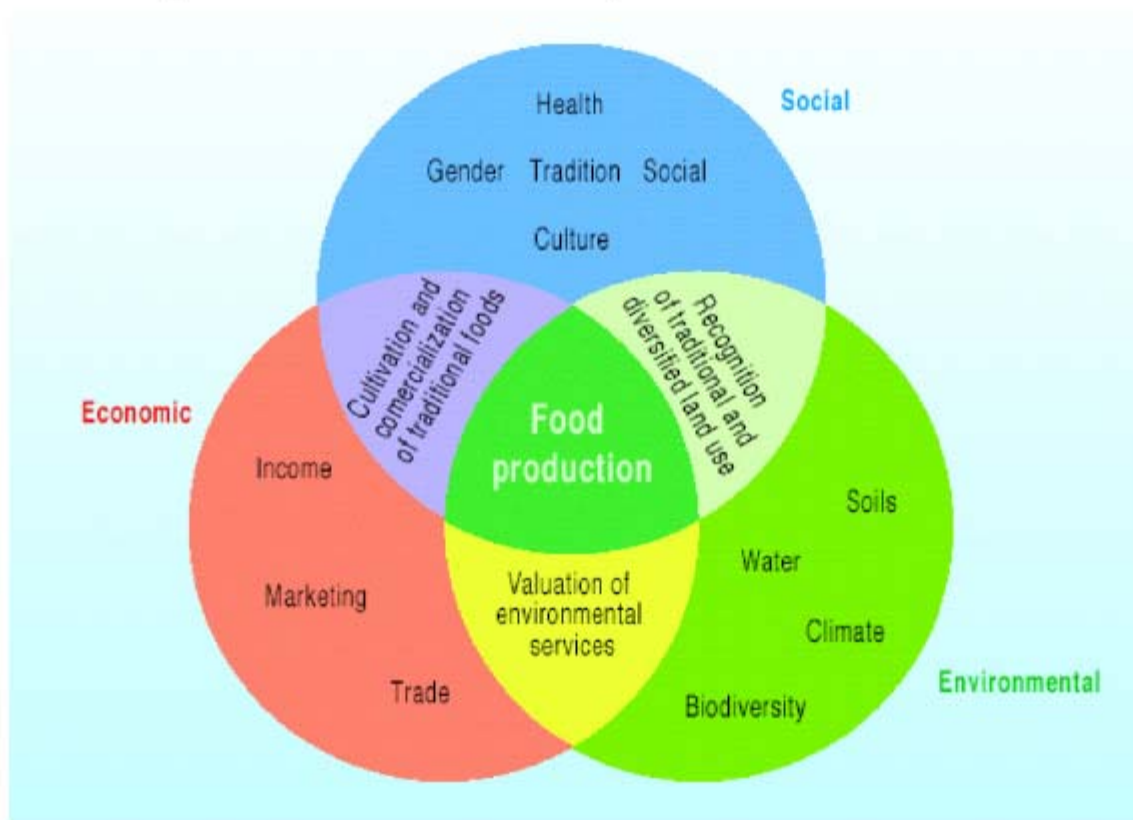
Future Challenges

- The demand for food will double within the next 25-50 years, primarily in developing countries, **and** the type and nutritional quality of food demanded will change
- We need sustained growth in the agricultural sector (crops, livestock, fisheries, forests, biomass, and commodities):
 - to feed the world
 - to enhance rural livelihoods
 - to stimulate economic growth
- Meet food safety standards
 - **environmentally and socially sustainable manner**

Limitations

- **Less labor (rural to urban migration) and disease**
- **Less water – sectoral competition and climate change**
- **Less arable land – competition from bioenergy and infrastructure**
- **Continuing land policy conflicts**
- **Loss of biodiversity: genetic, species and ecosystem**
- **Increasing levels of pollution – acid deposition and surface ozone**
- **A changing and more variable climate**

The inescapable interconnectedness of agriculture's different roles and functions



Embed agriculture within an ecosystems approach for conserving, managing and enhancing the natural environment

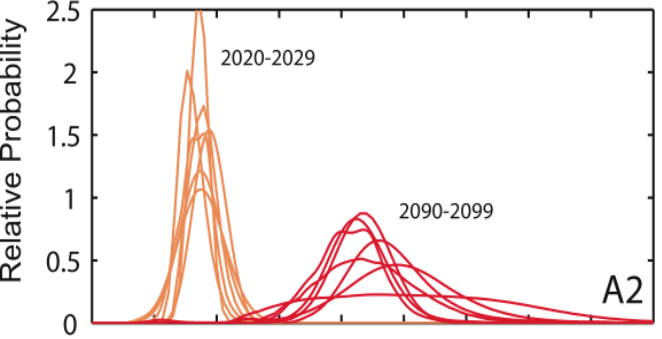
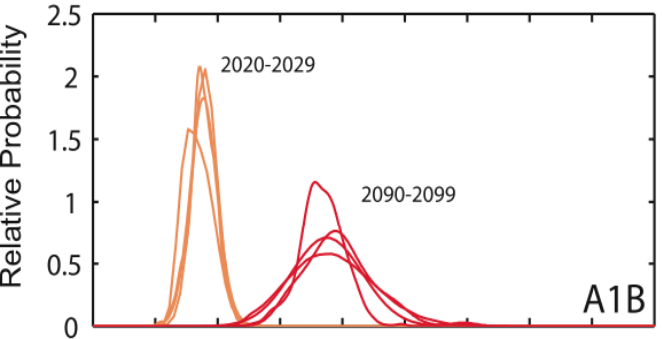
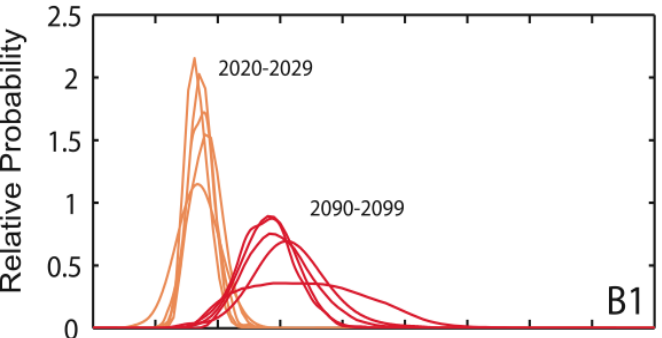
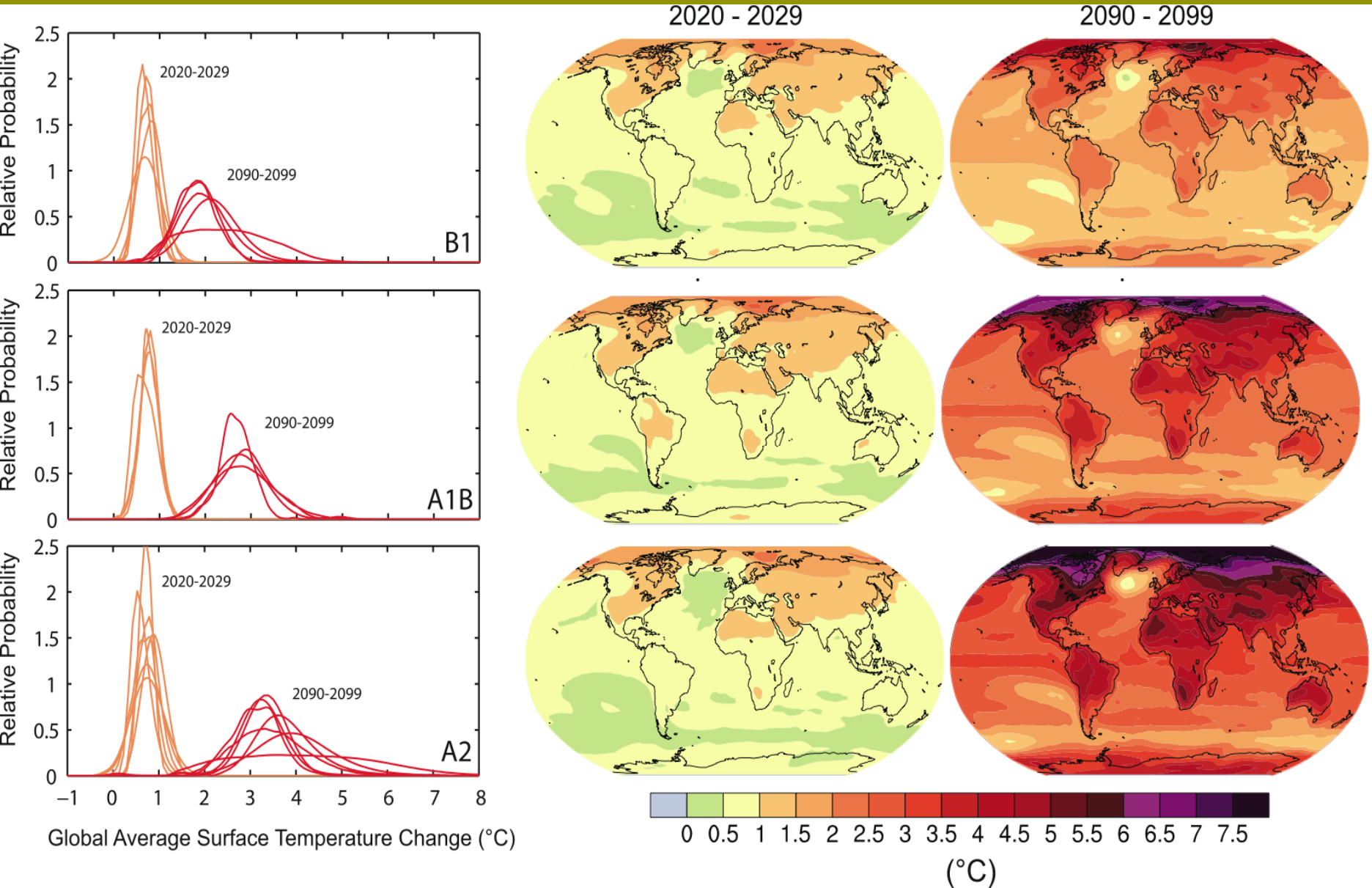
- Identifying opportunities for mainstreaming an ecosystems approach
- Using case studies that demonstrate the benefits of taking an ecosystems approach
- Developing ways of valuing ecosystem services
- Developing a robust evidence base



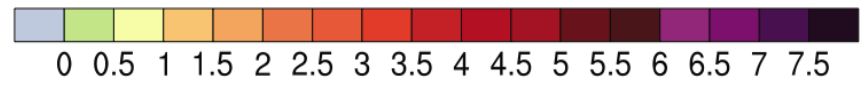
Surface Temperature



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Global Average Surface Temperature Change (°C)



(°C)

Precipitation



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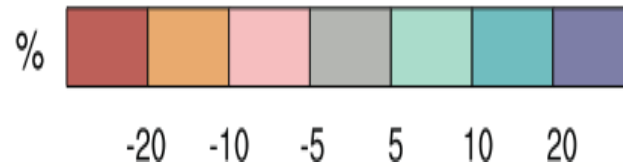
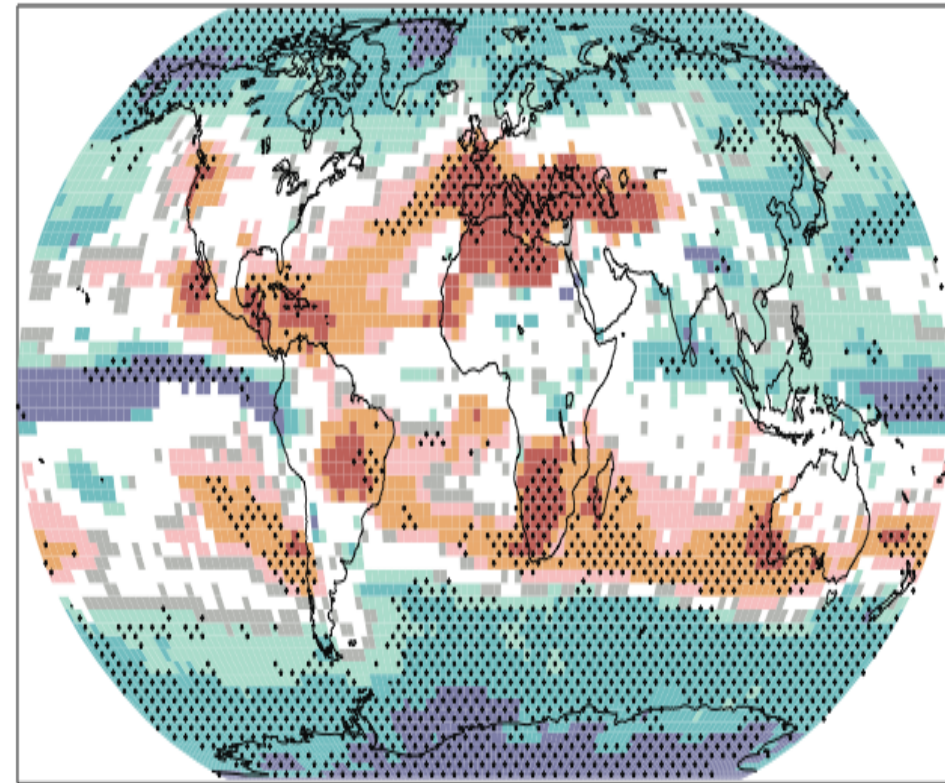
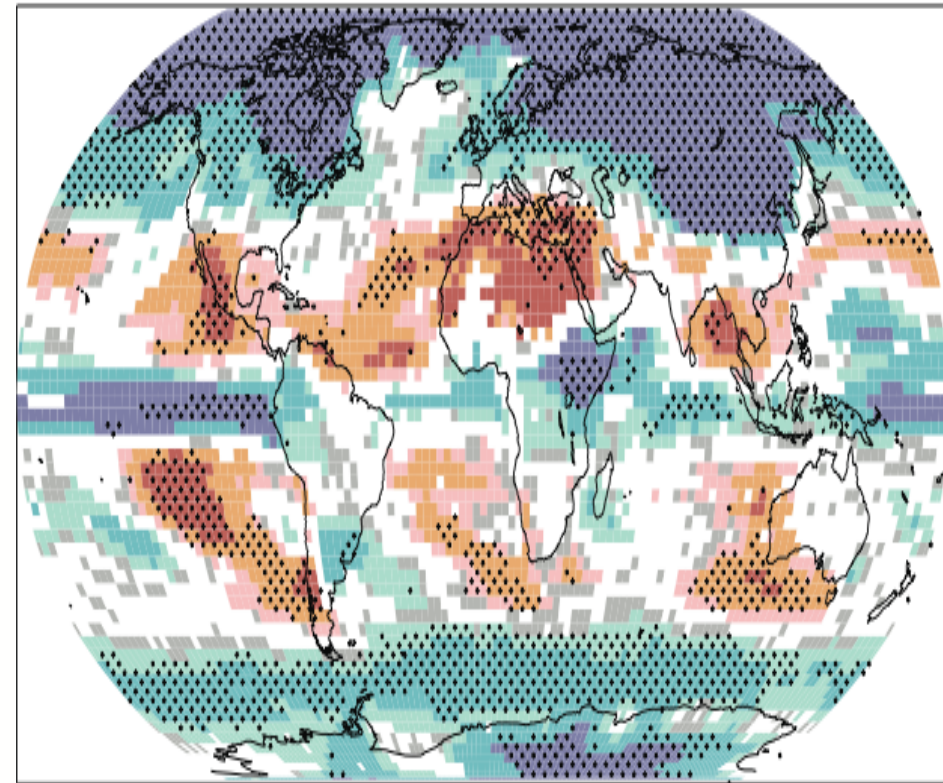
multi-model

A1B

DJF multi-model

A1B

JJA



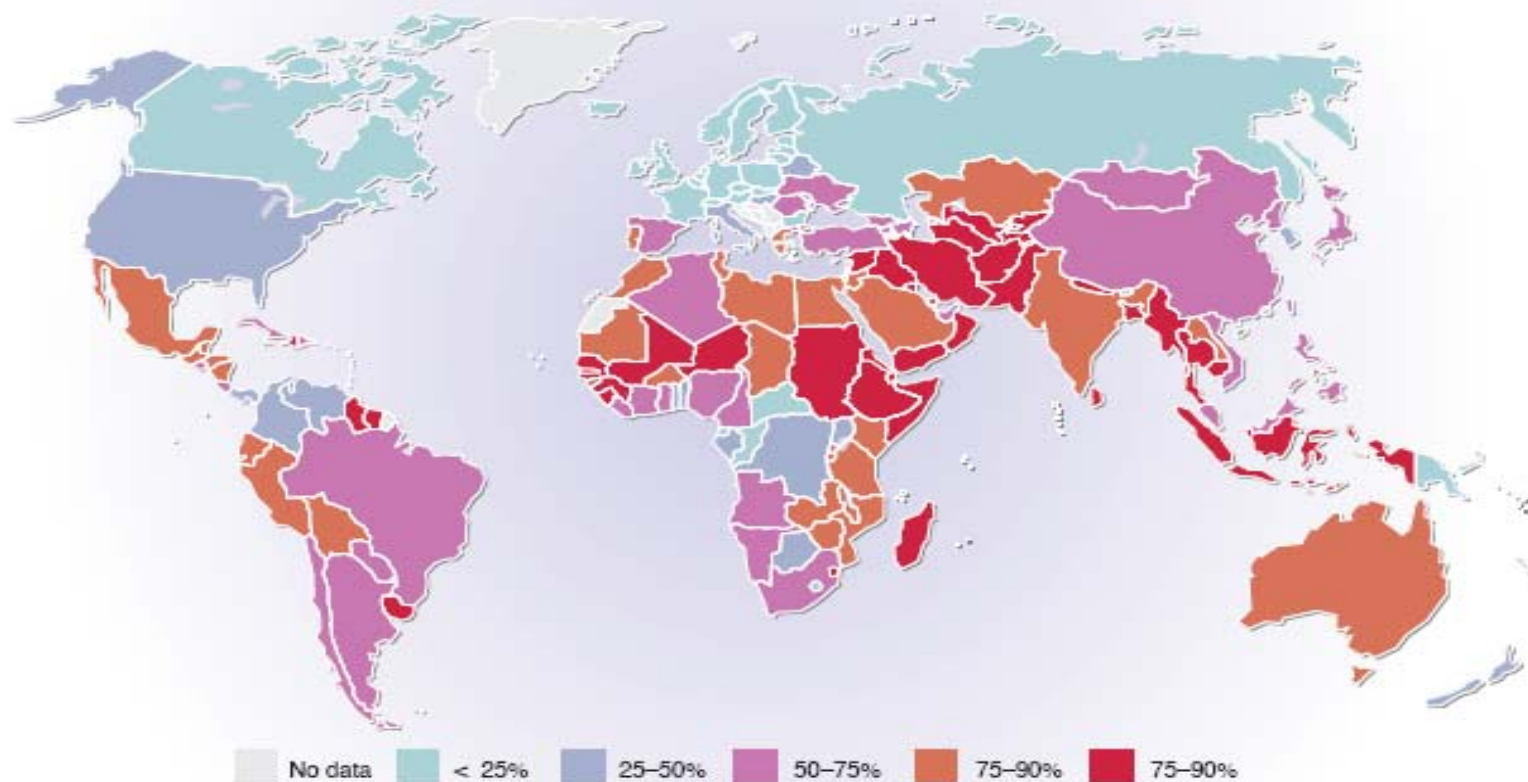
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Proportion of water withdrawal for agriculture, 2001



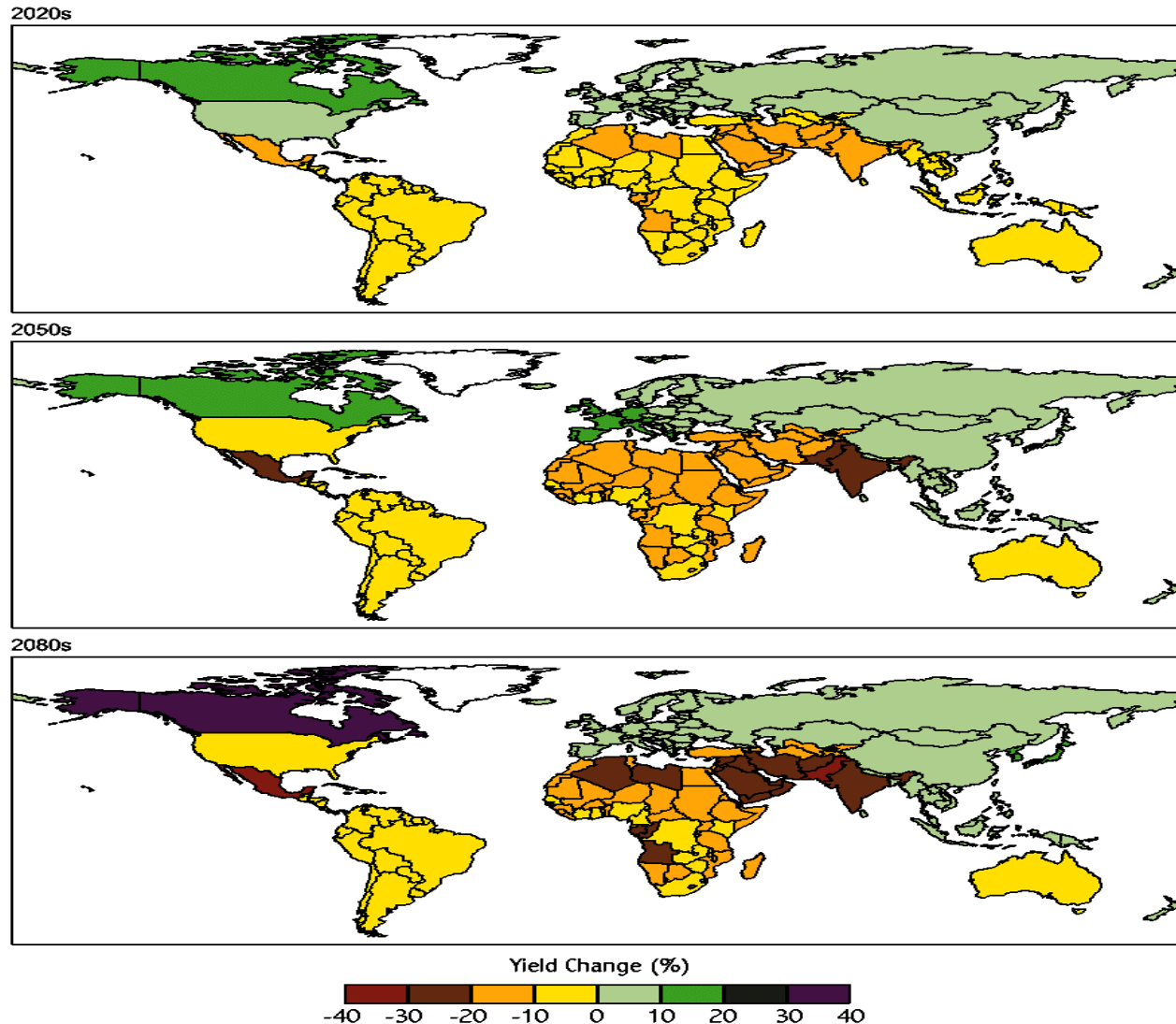
Crop yields decrease in the tropics and sub-tropics, but initially increase at high latitudes?



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Percentage change in average crop yields for a mid-range climate change scenario

Even as soon as 2020 crop yields in SSA and parts of Asia are projected to decrease by up to 20%



Animal Diseases – Climate Change

- ***Ectoparasite infections***
- ***Arthropod vector-borne diseases***
- ***Diseases caused by anaerobic spore-forming bacteria***
- ***Avian diseases***
- ***Liver flukes and parasites***

Agricultural S&T Challenges

Produce, by region, the diversified array of crops, livestock, fish, forests, biomass (for energy) and commodities needed over the next 50 years in an environmentally and socially sustainable manner

- to address water deficit problems, e.g., through improved drought tolerant crops, irrigation technologies, etc
- to address soil fertility and salinization of soils
- to improve the nutritional quality of food
- to improve the temperature tolerance of crops
- to combat new or emerging agricultural pests or diseases
- to reduce external and energy-intensive inputs
- to reduce post harvest losses
- to improve nutrient cycling
- to improve food safety

Knowledge, Science and Technology

- Many technologies already exist
- Need for appropriate and complementary integration of local and traditional knowledge with formal AKST

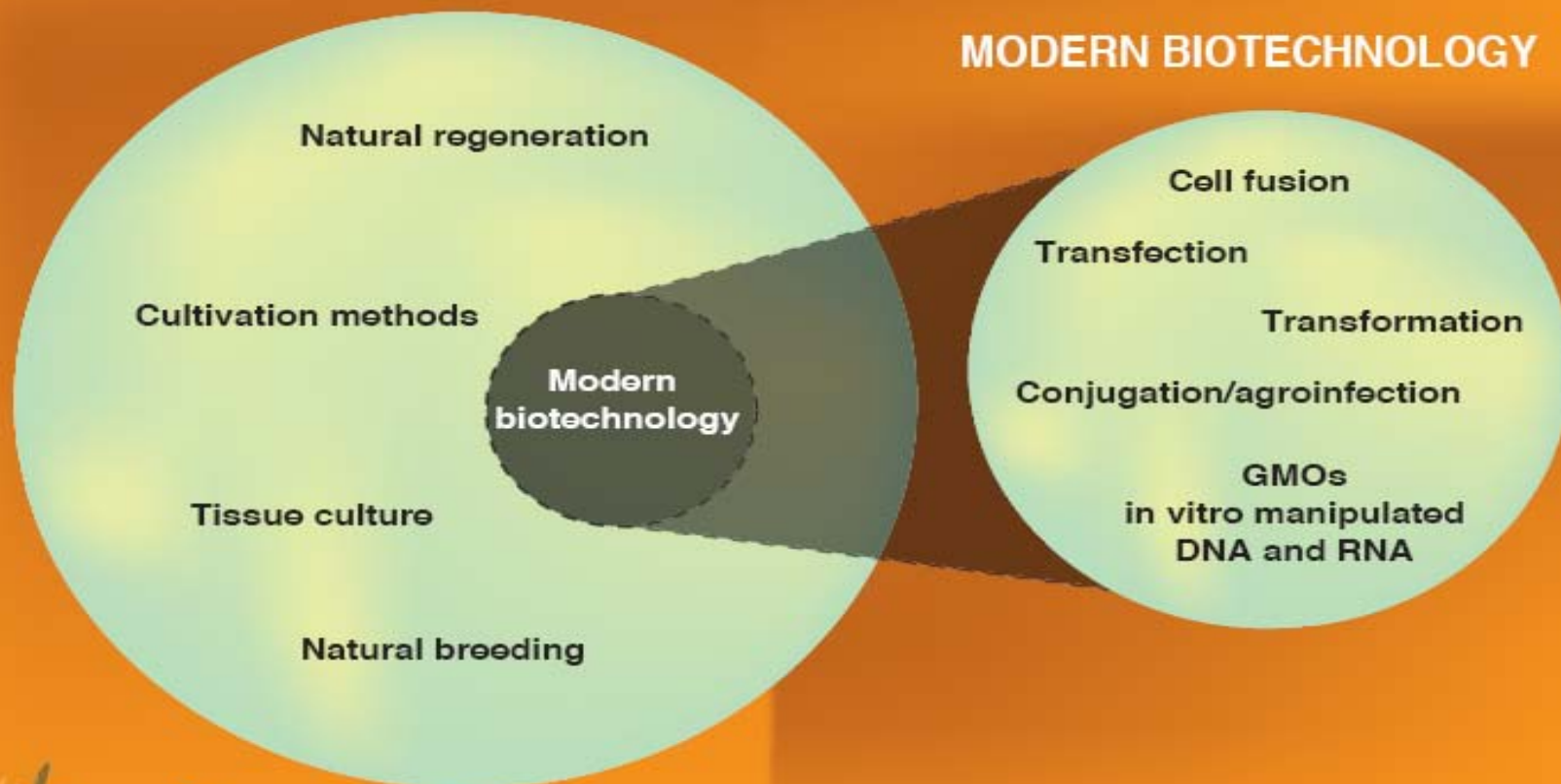
However some challenges will primarily depend on development of new and emerging AKST – e.g. Biotechnology





Biotechnology

MODERN BIOTECHNOLOGY





C₄ and C₃ comparison for current CO₂ conditions. WUE (transpiration) is water-use efficiency, RUE is radiation-use efficiency, PNUE is photosynthetic nitrogen-use effectiveness

	WUE g DW/kg H ₂ O	RUE g DW/MJ	PNUE mg DW s ⁻¹ /gN
Zea Maize	2.9 ^a	3.3 ^b	1.6 ^d
Oryza Sativa	1.6 ^{a,c}	2.2 ^b	0.6 ^d
C₄/C₃	1.8	1.5	2.7

Maize is C₄ --- Rice is C₃

Key Issues to be Considered

- Safety must be the top priority
- Evidence-based approach and case-by-case assessment
- Potential benefits – research must continue – field trials must be protected, open and transparent
- Proportionate and enforceable GM labelling rules to facilitate consumer choice.
- Need to develop measures to manage the coexistence of GM and non-GM crops

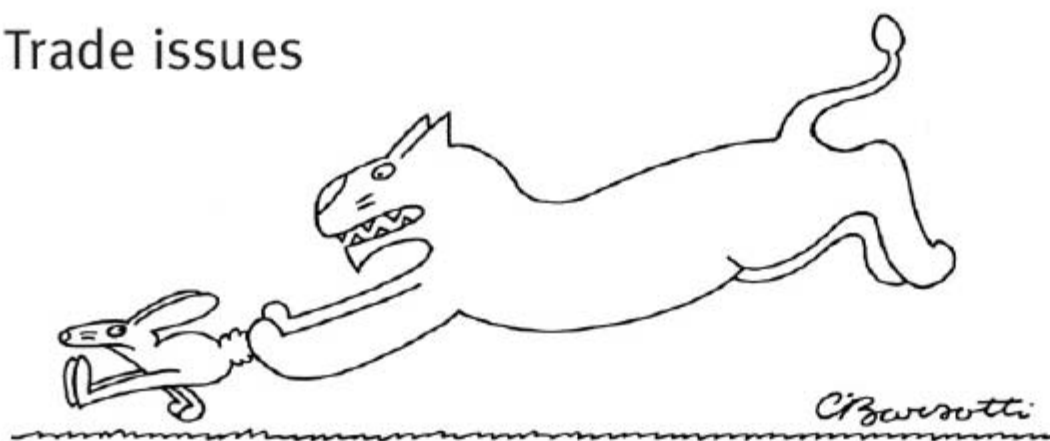
AKST Investments

Shifts in funding levels and sources for agriculture

- Public sector research funding, especially that relevant to developing countries has been irregular and has not increased with time
- Private sector funding growing, but the focus is primarily on OECD markets
- Targeted investments in S&T can yield enormous benefits –but are the current public and private sector research activities adequate and effective?



Trade issues



"What are you complaining about? It's a level playing field."

Opening national agricultural markets to international competition can offer economic benefits, but can lead to long term negative effects on poverty alleviation, food security and the environment without basic national institutions and infrastructure being in place



In Summary: Options for Action

- **Most of today's hunger problems can be addressed with appropriate use of current technologies, emphasizing agro-ecological practices (e.g., no/low till, IPM and INRM), coupled with decreased post-harvest losses**
- **Advanced biotechnologies may be needed to address future demands for increased productivity and emerging issues such as climate change and new plant and animal pests – but the risks and benefits must be fully understood**
- **Place the farmer in the middle – understand their needs and integrate as appropriate their local and traditional knowledge with formal AKSTD – innovation involving all relevant stakeholders along the complete food chain**

In Summary: Options for Action

- **Recognize the critical role of women and empower them (e.g., education, property rights, access to financing)**
- **Reform international trade, e.g., eliminate OECD production subsidies, eliminate tariff escalation on processed products, recognize the special needs of the least developed countries through non-reciprocal market access**
- **Provide payments to the farmer for maintaining and enhancing ecosystem services**
- **Increase public and private sector investment in research and development, extension services, and weather and market information**

We can feed the world with affordable food, while providing a viable income for the farmer, but business-as-usual will not work