Adaptation options for climate sensitive development

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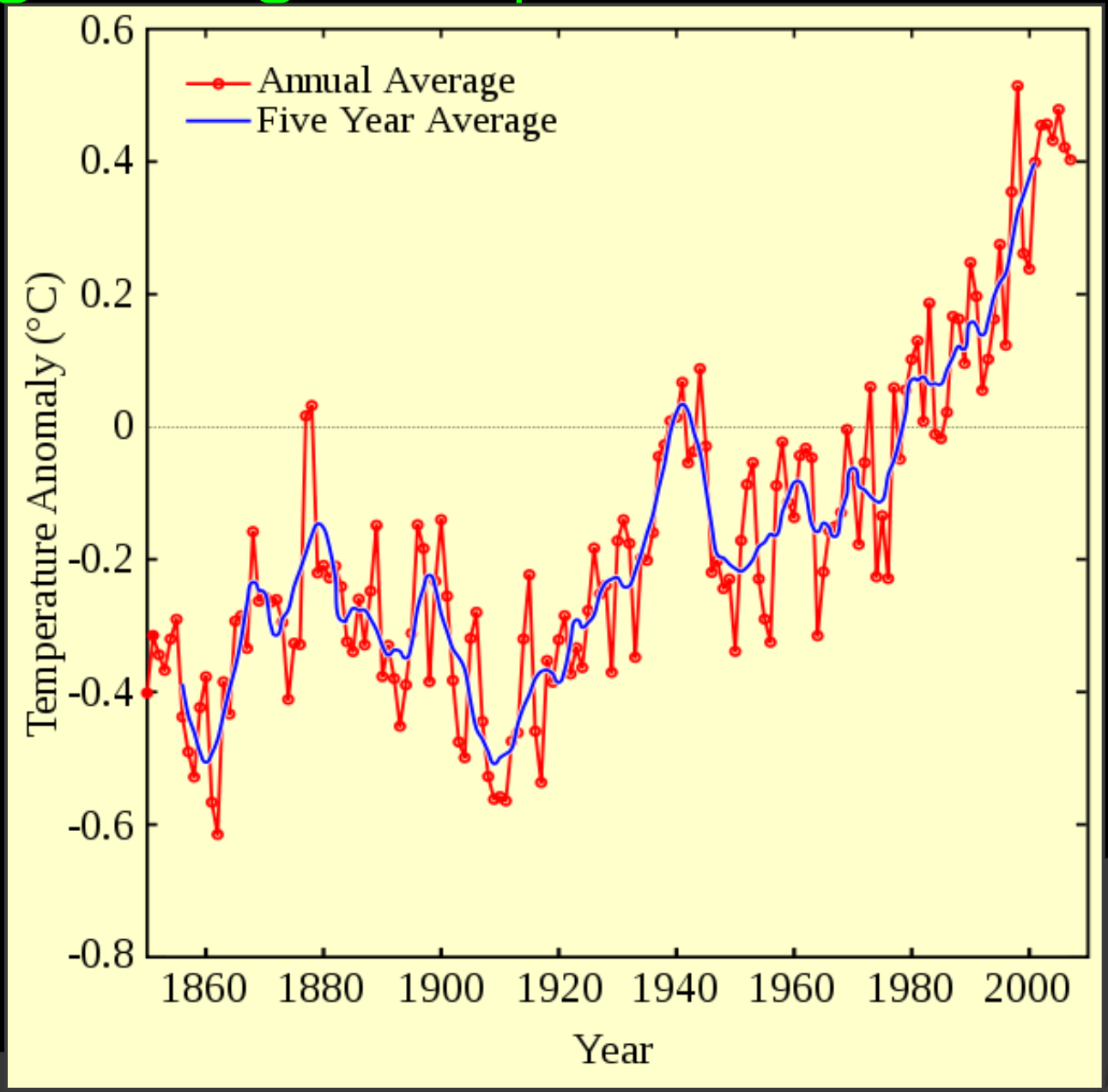
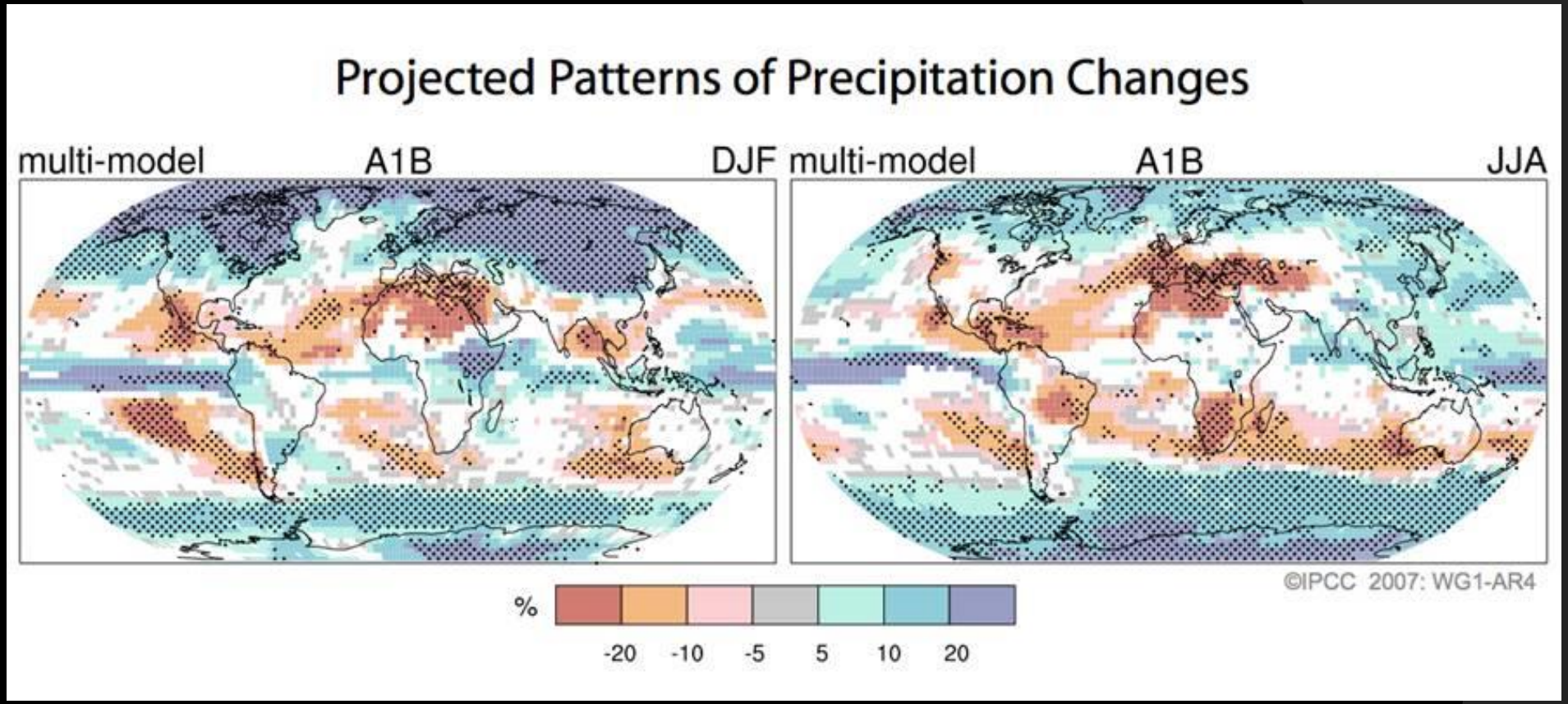
Act fast, get it right and make it work

Food security can't wait, neither can action on climate change

Rising average temperatures

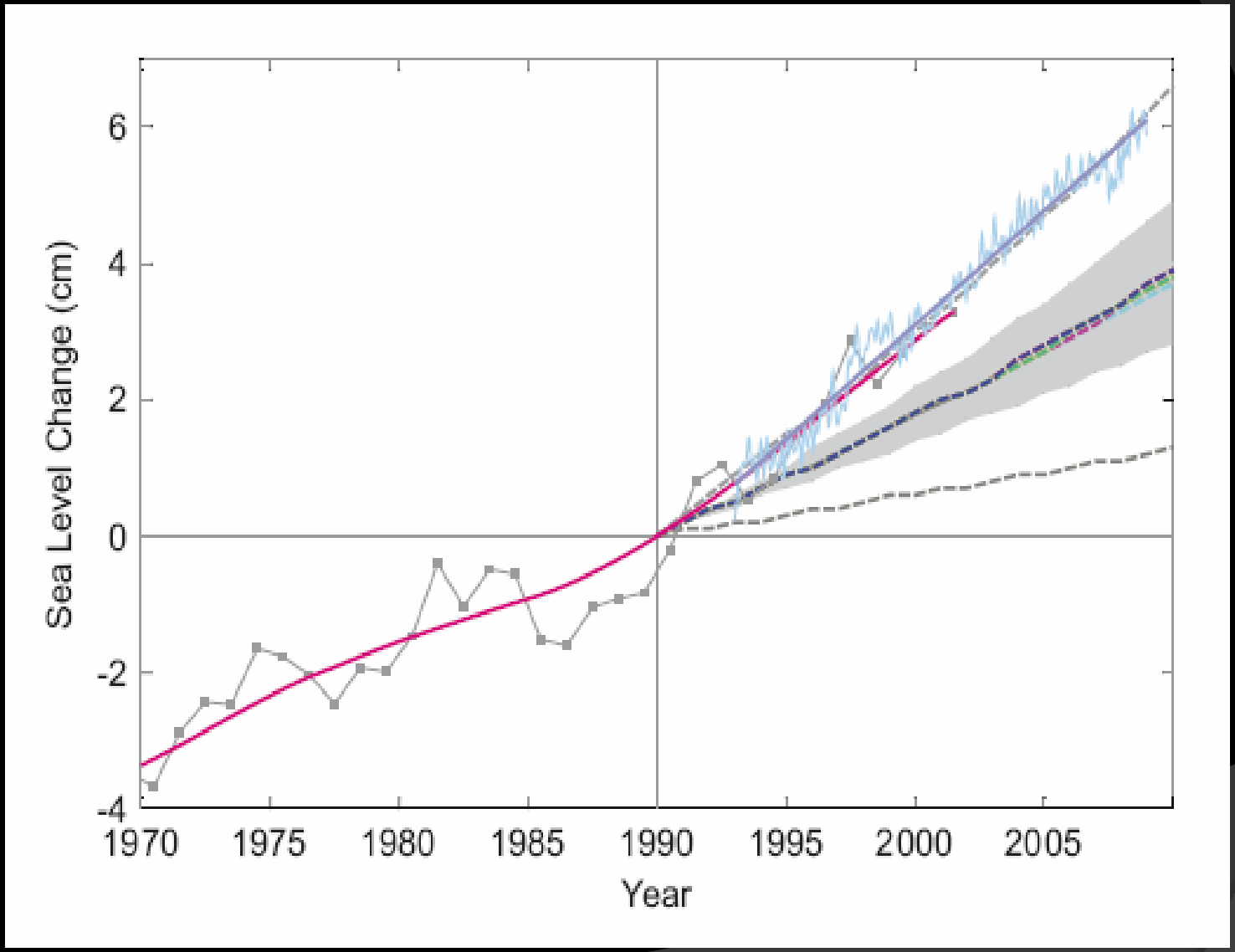




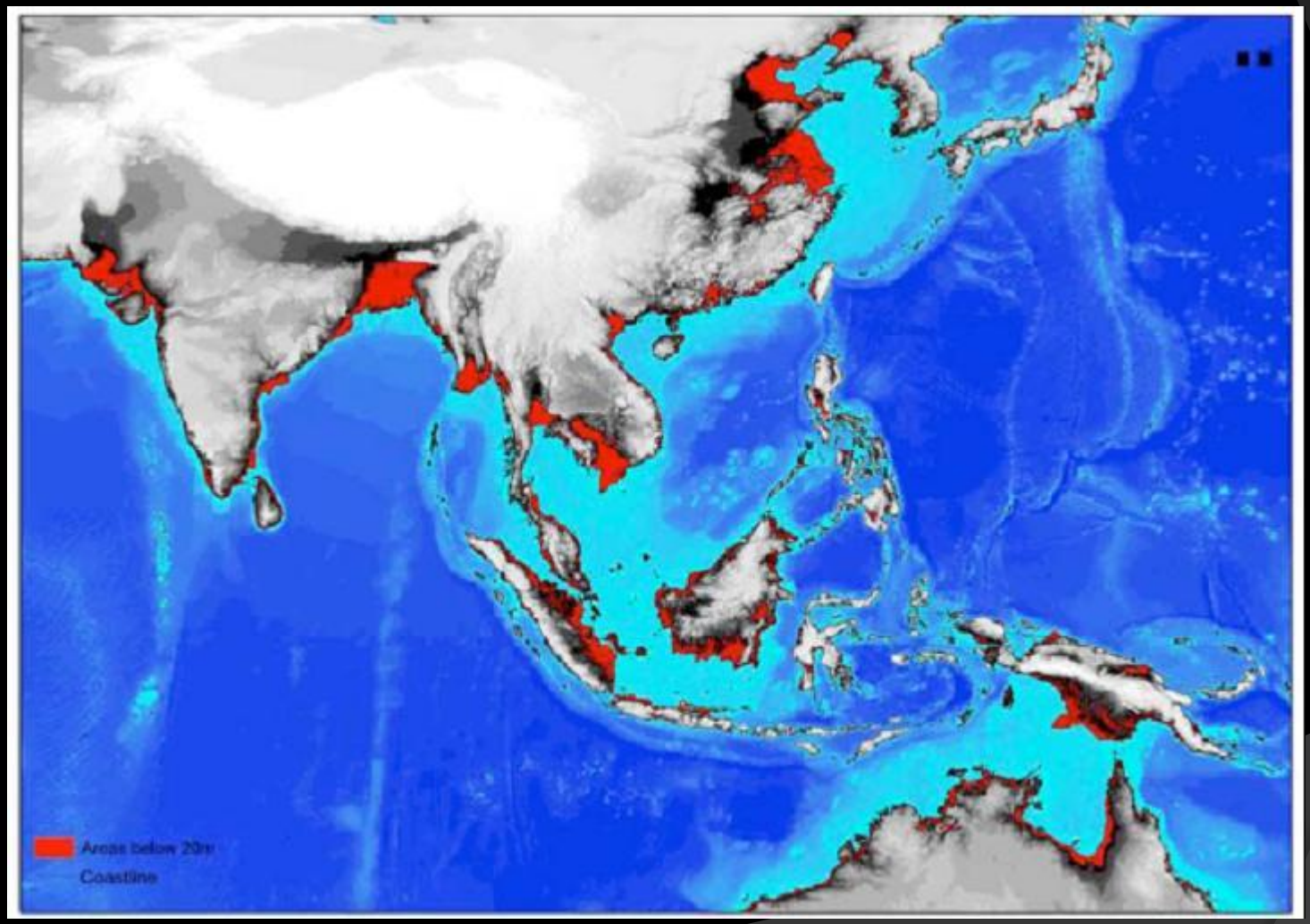
Precipitation increases *very likely* in high latitudes

Decreases *likely* in most subtropical land regions

Sea-level rise

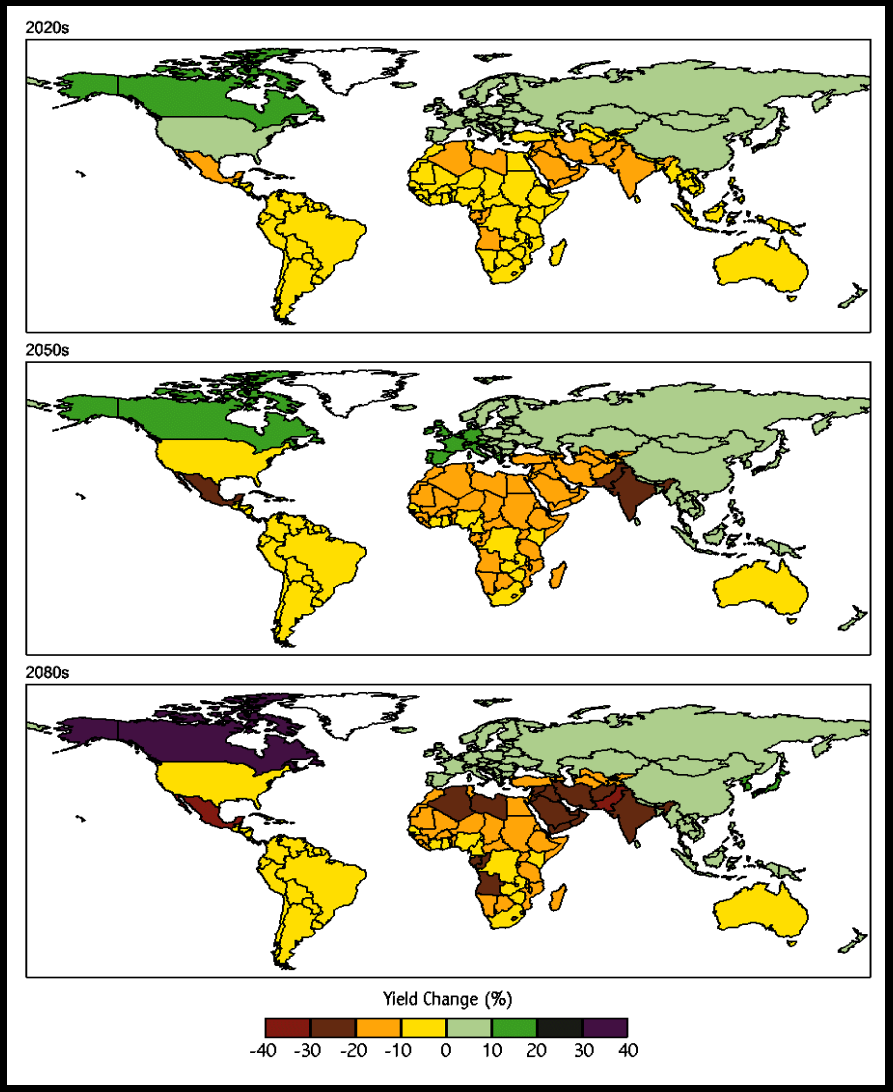


Vulnerability to sea level rise



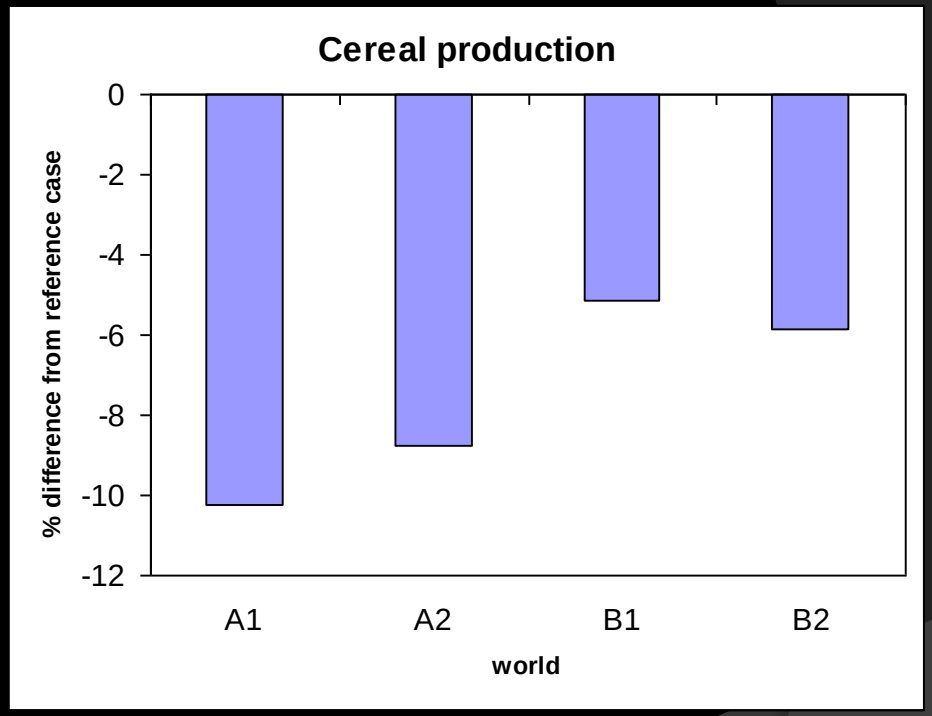
Impacts of Salt water intrusion on Copra trees are already visible in Kiribati

Climate Change Impacts on Grain Yields



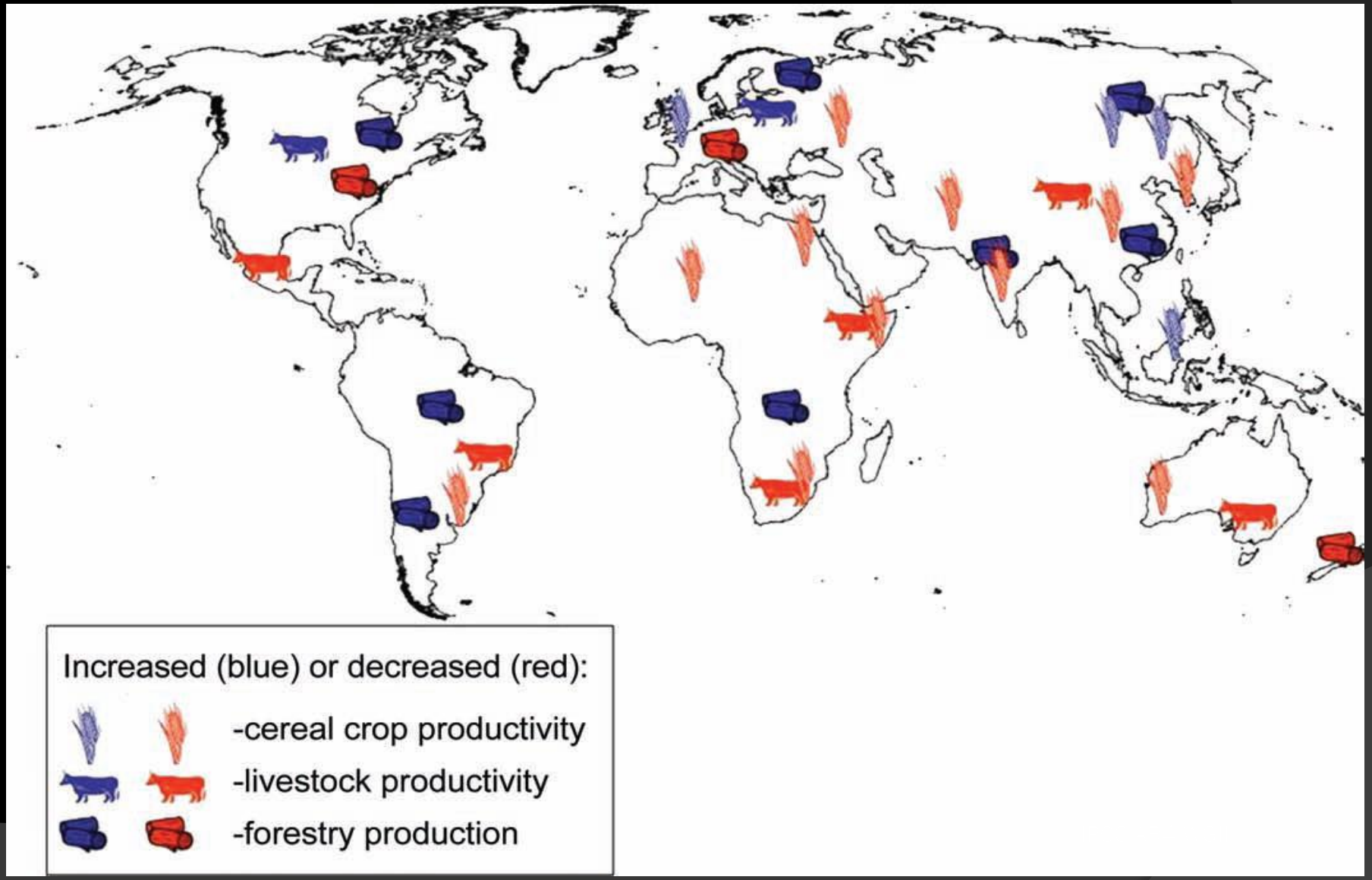
Parry et al. (2005)

Global production



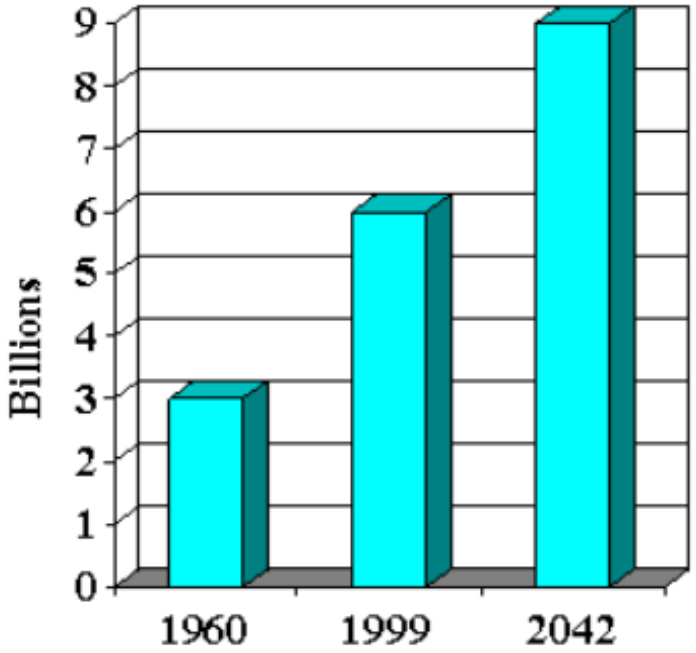
Percentage change in average crop yields. Effects of CO_2 are taken into account. Crops modelled are: wheat, maize and rice.

Climate Change Impacts on crop, livestock and forest production: IPCC estimates



Pressures on food supplies

- World population increased from 1.6 to 6 billion last century
- It is projected to rise to 9 billion by 2042
- Consumption per head will also increase (change from grain/ vegetables to meat)
- Most good quality land is already in use



US Census bureau

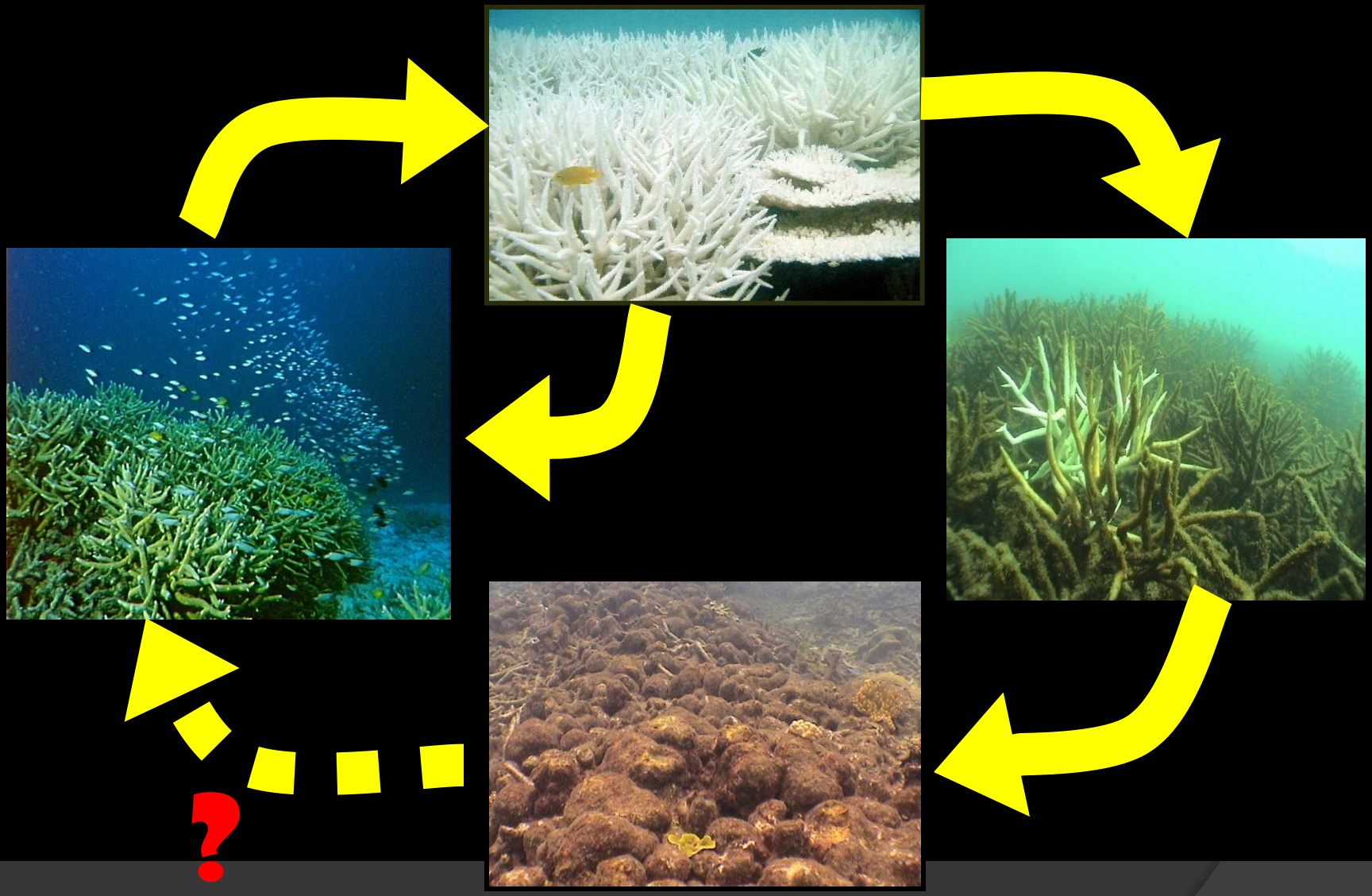
impacts


IMPACTS ON WATER RESOURCES
WATER QUALITY
CHANGES IN WATER SUPPLY
INCREASED COMPETITION FOR WATER

impacts


IMPACTS ON COASTAL AREAS
COSTS TO DEFEND COASTAL COMMUNITIES
EROSION OF BEACHES
INUNDATE COASTAL LANDS

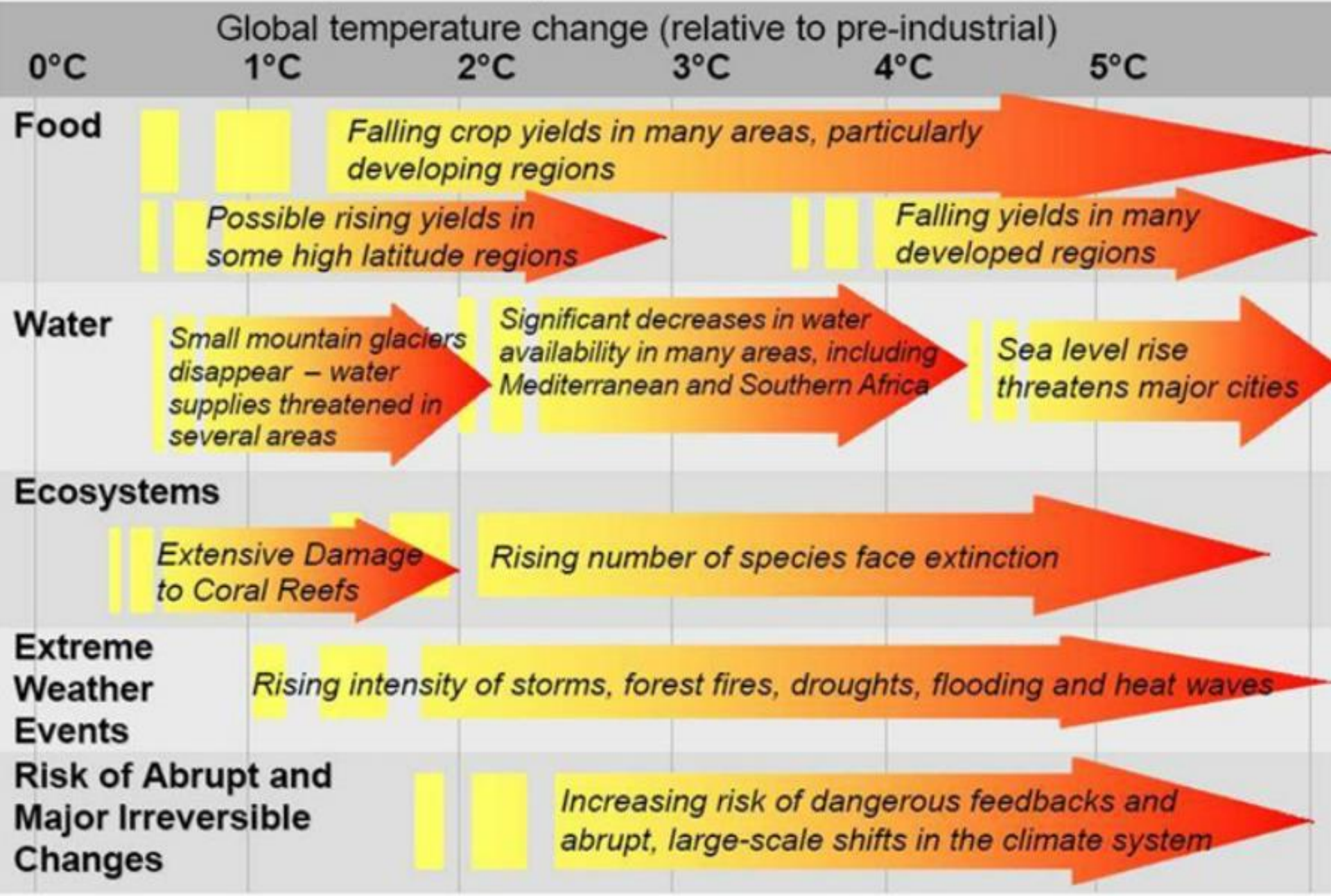
The ecological stability of mangroves and coral reefs is threatened in PICs



impacts


IMPACTS ON SPECIES AND NATURAL AREAS
LOSS OF HABITAT AND SPECIES
SHIFT IN ECOLOGICAL ZONES

Projected Impacts of Climate Change



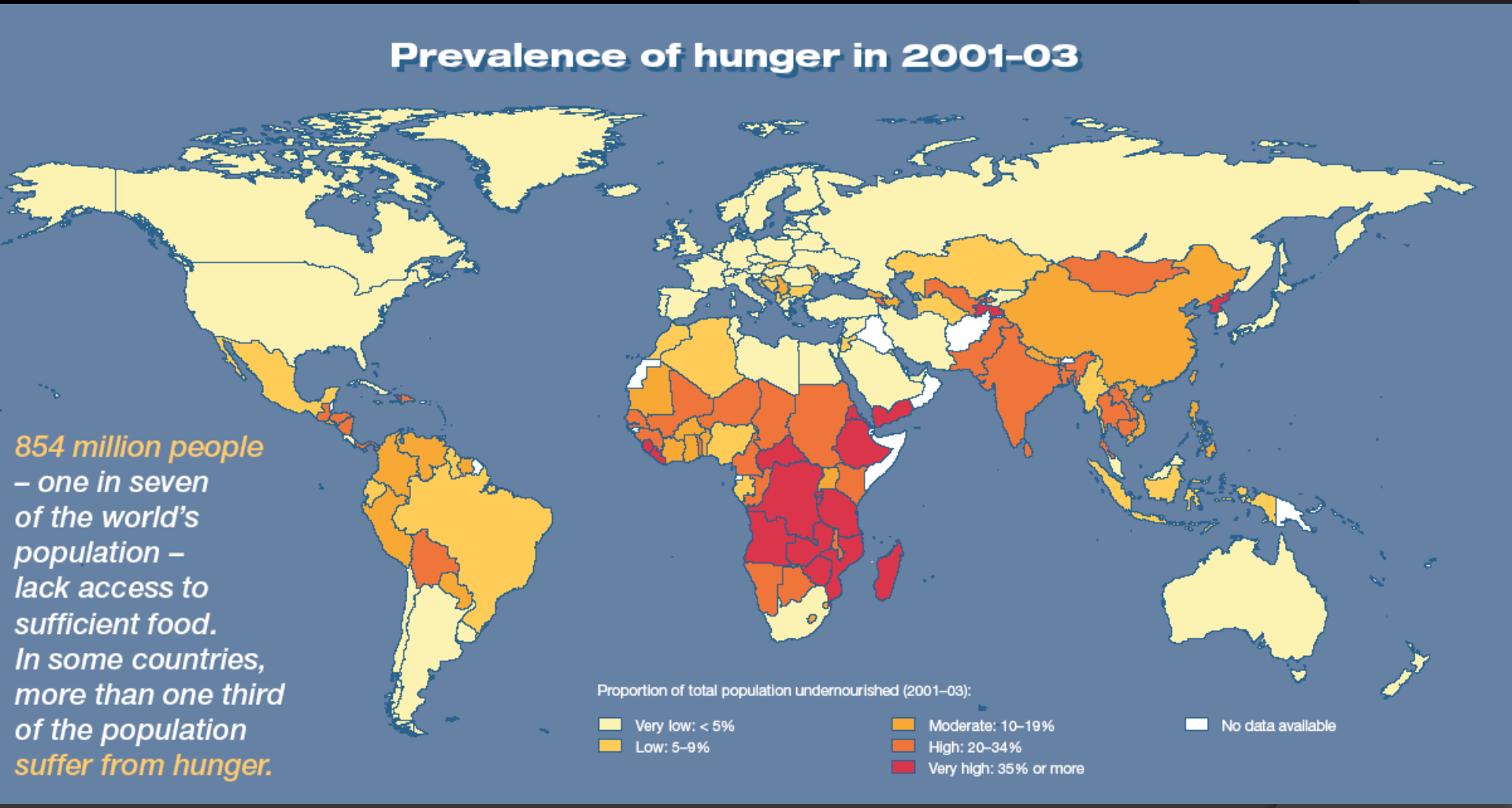
Food security…

… exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

(World Food Summit 1996)

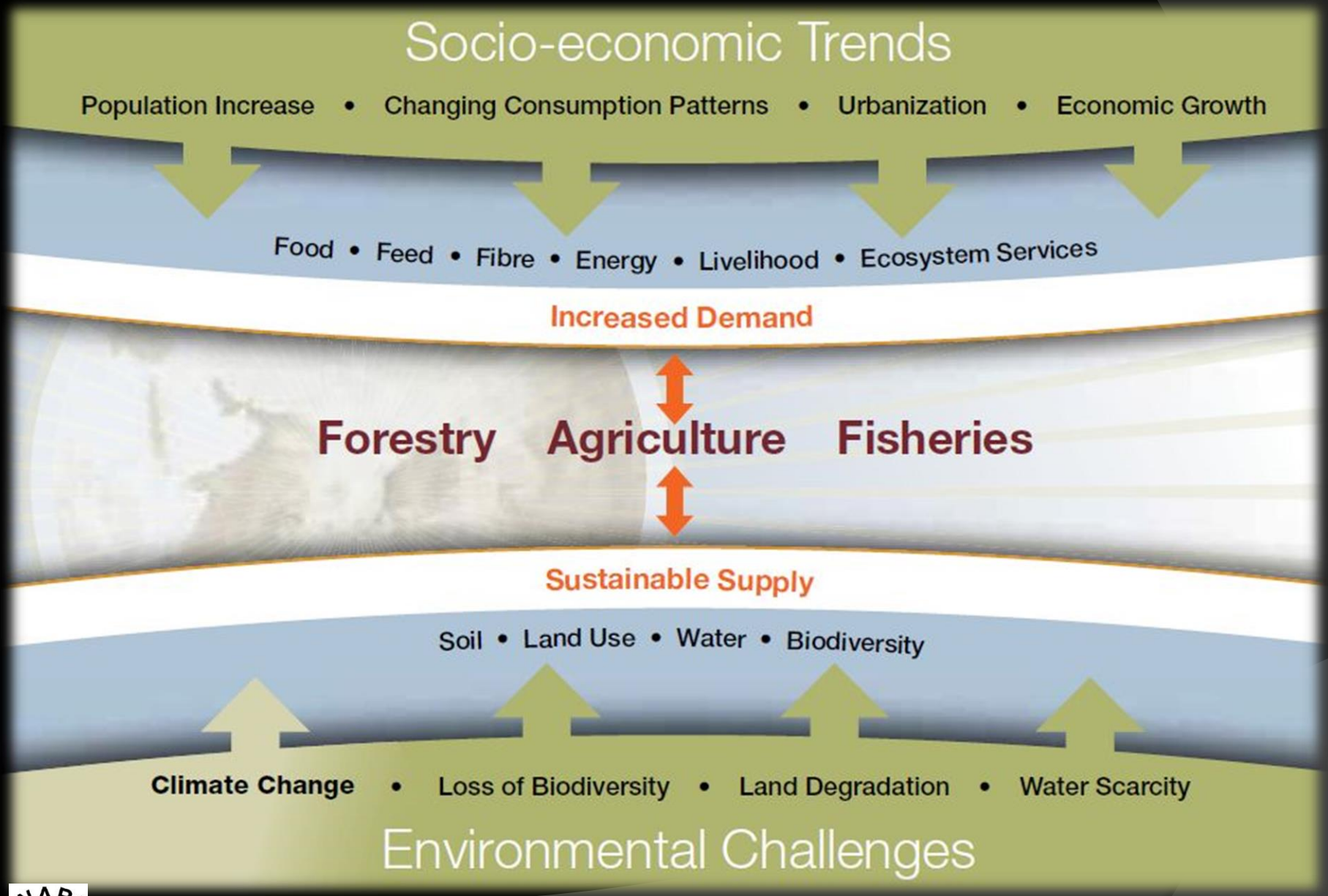
… is underpinned by Food Systems.

Negative impacts where food insecurity high



Source: FAO State of Food Insecurity 2006

Pressures on Agriculture



Two Goals of Current Time

1. Achieving Food Security
   - 17.5 million by 2050
   - Food production has to increase 70% by 2050
   - Adaptation to Climate Change
2. Mitigation and Adapation to Climate Change
   - Agriculture and Land use = 30% of emissions..
   - ..and needs to be part of the solution

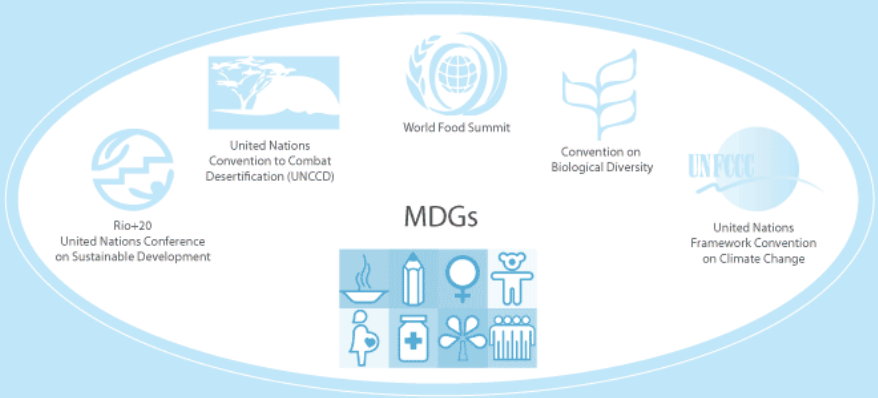
A Paradigm shift is needed

SUSTAINABLY INCREASES
FARM PRODUCTIVITY AND INCOME

STRENGTHENS RESILIENCE
TO CLIMATE CHANGE AND VARIABILITY

REDUCES AGRICULTURE'S
CONTRIBUTION TO CLIMATE CHANGE
- greenhouse gas emissions
+ carbon storage on farmlands

ENHANCES THE ACHIEVEMENT OF NATIONAL FOOD SECURITY
AND DEVELOPMENT GOALS



Why Build Resilience?

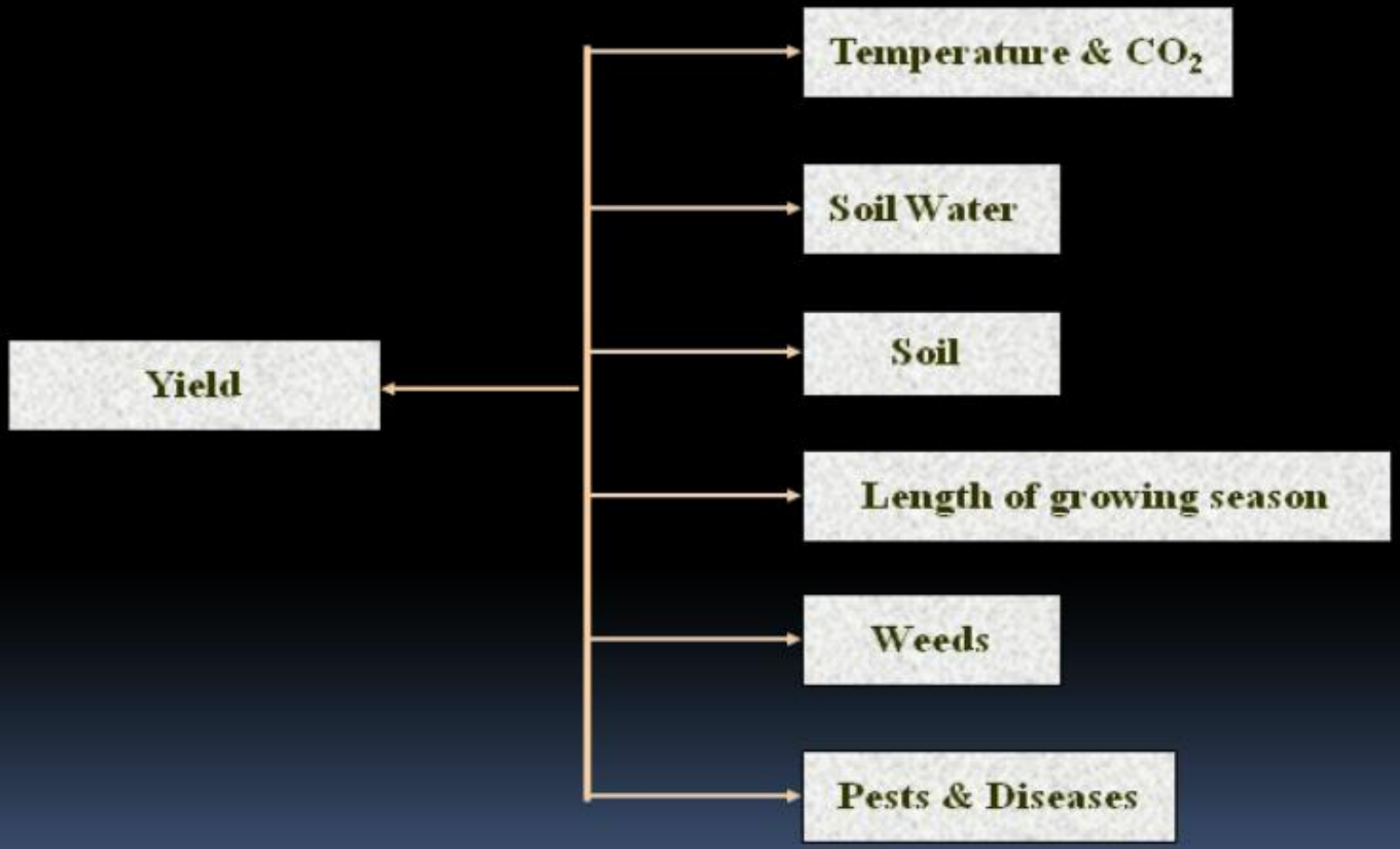
- A key adaptation and mitigation strategy is to build the resilience of agroecological systems because these systems determine our capacity to produce food and clean water

- Building ecosystem resilience will enhance the capacity of these systems to withstand shocks and rebuild after damage

Outcomes of Improved Resilience

Examples of improved resilience outcomes in the agriculture sector include:
increased adaptation of crops and livestock to climate stress,
enhanced access and utilization of technology and information,
increased income generation,
increased use of resource-conserving technologies,
open and transparent trade regimes, and
improved risk sharing

Factors effecting crop production in changing climate



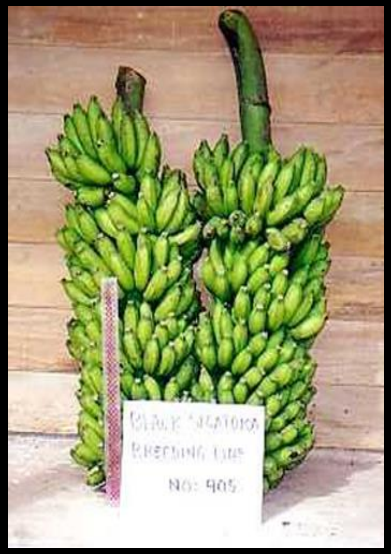
Key components of new and innovative adaptation measures to climate change

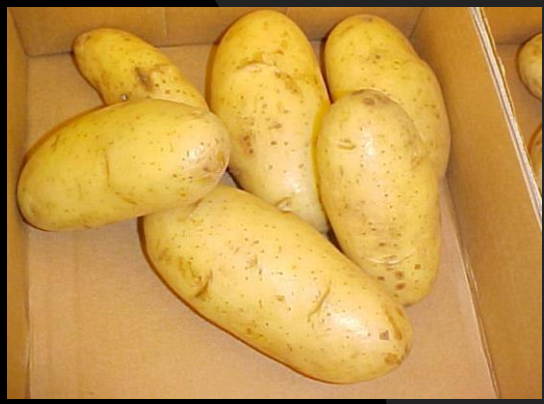
- changes in agricultural practices to improve soil fertility and enhance carbon sequestration;
- changes in agricultural water management for more efficient water use;
- agricultural diversification toward enhanced climate resilience;
- agricultural science and technology development, agricultural advisory services, and information systems; and
- risk management and crop insurance.

How to build Resilience?

- The adoption of resource-conserving technologies—such as rainwater harvesting; conservation tillage; and integrated crop, water, and pest management—will form the backbone of actions to sustain and enhance agroecological systems.
- Promote research for development and the adoption of new drought- and heat-resistant crop varieties, strengthen water-use productivity and performance, and promote synergies between adaptation and mitigation.
- Support knowledge, coordination, collaboration, information exchange, and institutional responsiveness will be the backbone for building technical skills needed to prepare, plan, and respond to unpredictable contingencies

Early Maturing Sweet Potato



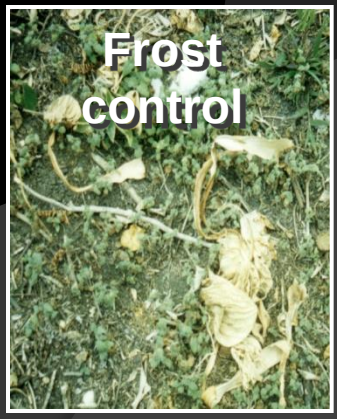



C2-E3

Conservation Agriculture

Strategy for Adaptation to CC impacts

Dissemination of CC-coping strategies



Changes in Agricultural Practices

Key changes in farm management practices include

- application of new technologies and changes in input use including organic and low external-input agriculture
- application of new land-management techniques, such as zero till
- changes in crop and livestock varieties
- changes in planting dates
- introduction of water-use efficiency techniques (drip, sprinkler, wet and dry)
- effective use of pest-, disease-, and weed-management systems through application of integrated pest and pathogen management techniques and development and use of crop varieties resistant to pests and diseases
- Crop diversification with legumes (atmospheric N; improve OM and low GHG emissions) and green manure (soil structure)

How to enhance Farmer's ability to Resilience?

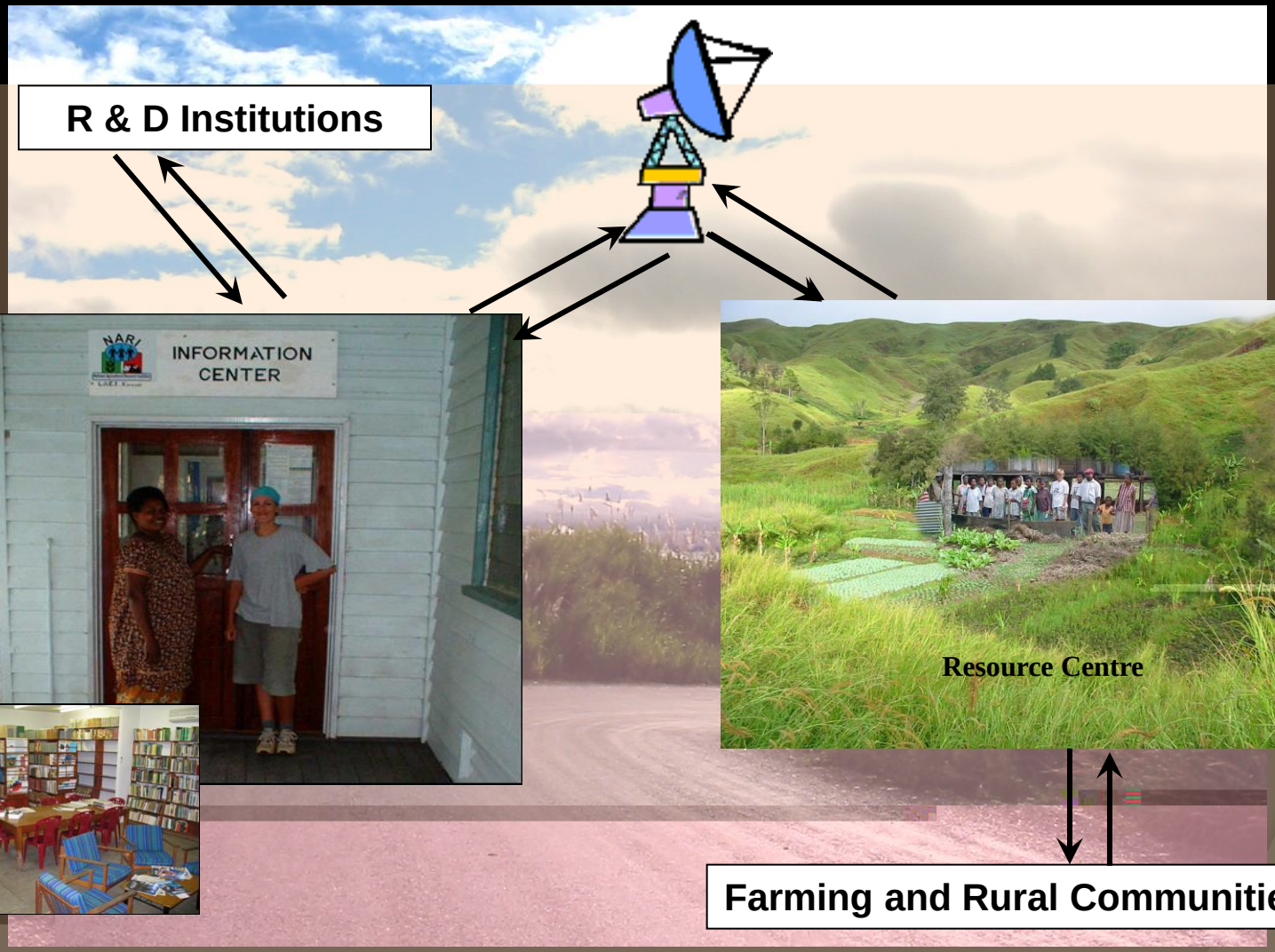
- Enhancing farmers' ability to respond to climate variability and climate change will require significant improvements in developing and disseminating agricultural technologies targeted at the major evolving biotic and abiotic stresses generated by climate change
- Innovative responses to climate change needed for agricultural adaptation are
- Improved crop varieties have the potential to be more drought-tolerant and enable both an increase in nutrient- and water-use efficiency as well as a decrease in pesticide use

Agricultural Advisory Services & Information Systems

- Effective dissemination of modern technologies is essential for success in agriculture.
- Successful action in agricultural adaptation requires better and clearer information combined with investment and advisory services to disseminate the information to users
- Improved information systems allow for more informed decisions, heightened awareness to change crops and adopt practices to enhance management sustainability.
- As a basis for adaptation planning Pacific countries alongside their international partners, will need to conduct comprehensive climate change monitoring and forecasting.
- Collection of systematic meteorological data and the development of stronger human capacity in climate change analysis and research is needed.
- Until this capacity is developed, the international research community will remain critical to these efforts.

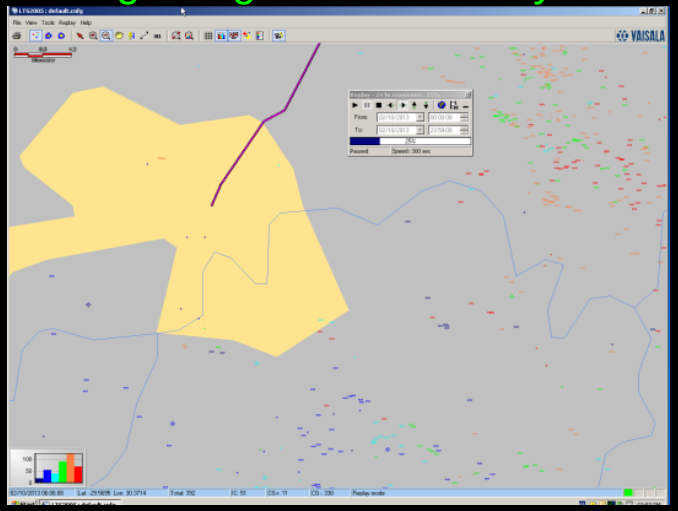
What is needed?

Linking Existing Information Centres to Resource Centres in Remote Areas



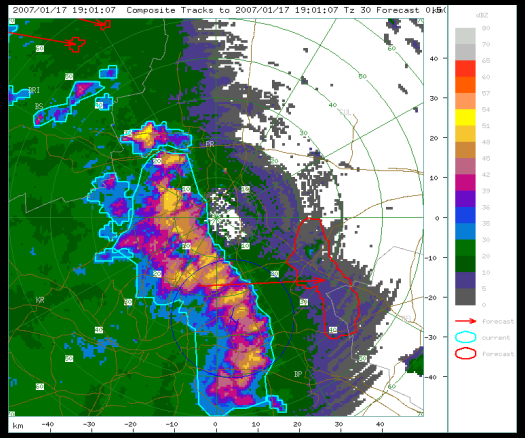
and… Real-time data

Lightning strokes as they occur



Instrumentation

Storm tracking



Benefits:

- Real-time data enables visual monitoring of weather conditions as it occurs
- Farm safety
- Tracking of lightning and storm activity increases capability to react quickly to address pertinent issues eg. fires, power outages

Forecasts or predictions

Target – Agricultural and other economic sectors

Record Reference: MF-FORECAST-WCUFPA-04_03_2016 Date: Fri 04 Mar 08:03:35 2016

FIRE DANGER INDEX AND WEATHER FORECAST issued @ 08:03 on Fri 04 Mar 2016

Lowveld FDI Description	Colour	Category	Lowveld FDI Precaution
SAFE	BLUE	0 - 20	Low fire hazard. Controlled burn operations can normally be executed with a reasonable degree of safety
MODERATE	GREEN	21 - 45	Although controlled burning operations can be executed without crating a fire hazard, care must be taken when burning on exposed, dry slopes. Keep constant watch for unexpected wind speed and direction changes
DANGEROUS	YELLOW	46 - 60	Controlled burning not recommended when fire danger index exceeds 45. Aircraft should be called in at early stages of a fire.
VERY DANGEROUS	ORANGE	61 - 75	No controlled burning of any nature should take place. Careful note should be taken of any sign of smoke anywhere, especially on the upwind side of any plantation. Any fire should be attacked with maximum force at hand, including all aircraft at the time.
EXTREMELY DANGEROUS	RED	75<	All personnel and equipment should be removed from the field. Fire teams, labour and equipment are to be placed on full stand-by. At first sign of smoke, every possible measure sjoud be taken in order to bring the fire under control in the shortest possible time. all available aircraft are to be called for without delay.

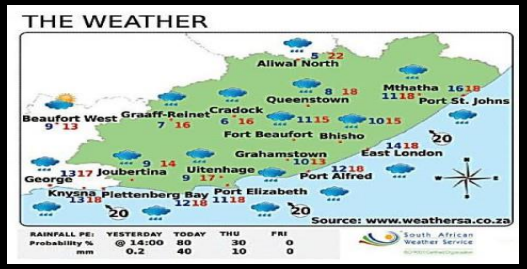
3. CAPE PENINSULA FPA - Cape Metropolitan

Forecast for Fri 04 Mar 2016	Min Temp(C)	Max Temp(C)	Max Hum (%)	Min Hum (%)	Prob Rain %	Rain (mm)	Low-veld FDI-D	Low-veld FDI-W
City Of Cape Town 1 / Cape Point	18	24	85	75	0	0	43	43

Time	Temp C	Weather	Wind Speed	Wind Gusts
08:00	18	Clear skies	SE 28 km/h	0 km/h
14:00	24	Clear skies	W 19 km/h	0 km/h
20:00	20	Clear skies	S 19 km/h	0 km/h

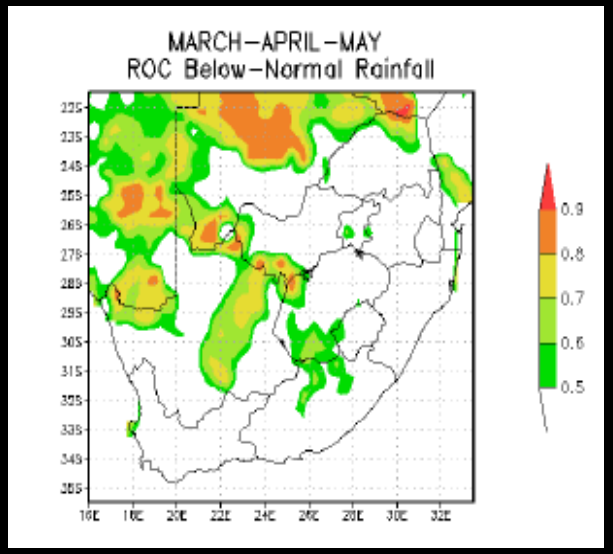
Forecast for Sat 05 Mar 2016	Min Temp(C)	Max Temp(C)	Max Hum (%)	Min Hum (%)	Prob Rain %	Rain (mm)	Low-veld FDI-D	Low-veld FDI-W
City Of Cape Town 1 / Cape Point	19	23	90	75	0	0	47	47

Time	Temp C	Weather	Wind Speed	Wind Gusts
08:00	19	Fog	SSE 19 km/h	0 km/h
14:00	24	Partly cloudy	SW 19 km/h	0 km/h
20:00	20	Partly cloudy	SW 28 km/h	0 km/h



HEAT AND FIRE DANGER INDEX

Seasonal Climate Watch



Benefits:

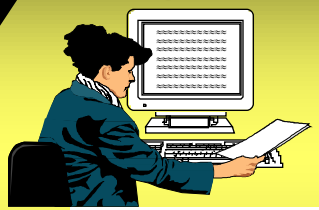
- Forecasts provided ahead of time to enable careful planning of resources around severe weather events
- Instrumentation with cameras enable visuals with key parameters to be viewed in key locations supporting quick decision making
- This product can assist farmers to put their safety measures such as ventilation when the heat value exceed certain threshold

Traditional Forecasting Process

- Schedule Driven
- Product Oriented
- Labor Intensive

National Centers
Model Guidance

Field Offices
Type Text Products



SNOW LIKELY ABOVE 2500 FEET. SNOW ACCUMULATION BY LATE AFTERNOON 1 TO 2 INCHES ABOVE 2500 FEET. COLDER WITH HIGHS 35 TO 40. SOUTHEAST WIND 5 TO 10 MPH SHIFTING TO THE SOUTHWESTEARLY

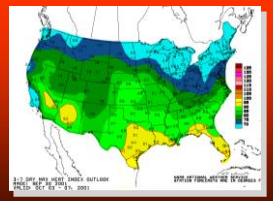
EASTON

PTCLDY	CLOUDY	PTCLDY	PTCLDY	SUNNY	PTCLDY
60/52	63/54	65/47	55/40	55/37	50/33
POP 20	POP 20	POP 20	POP 20	POP 10	POP 10

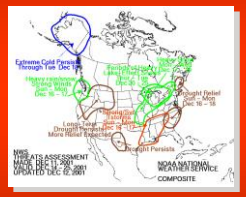
National Centers
Generate Graphical Products

U.S. Drought Monitor

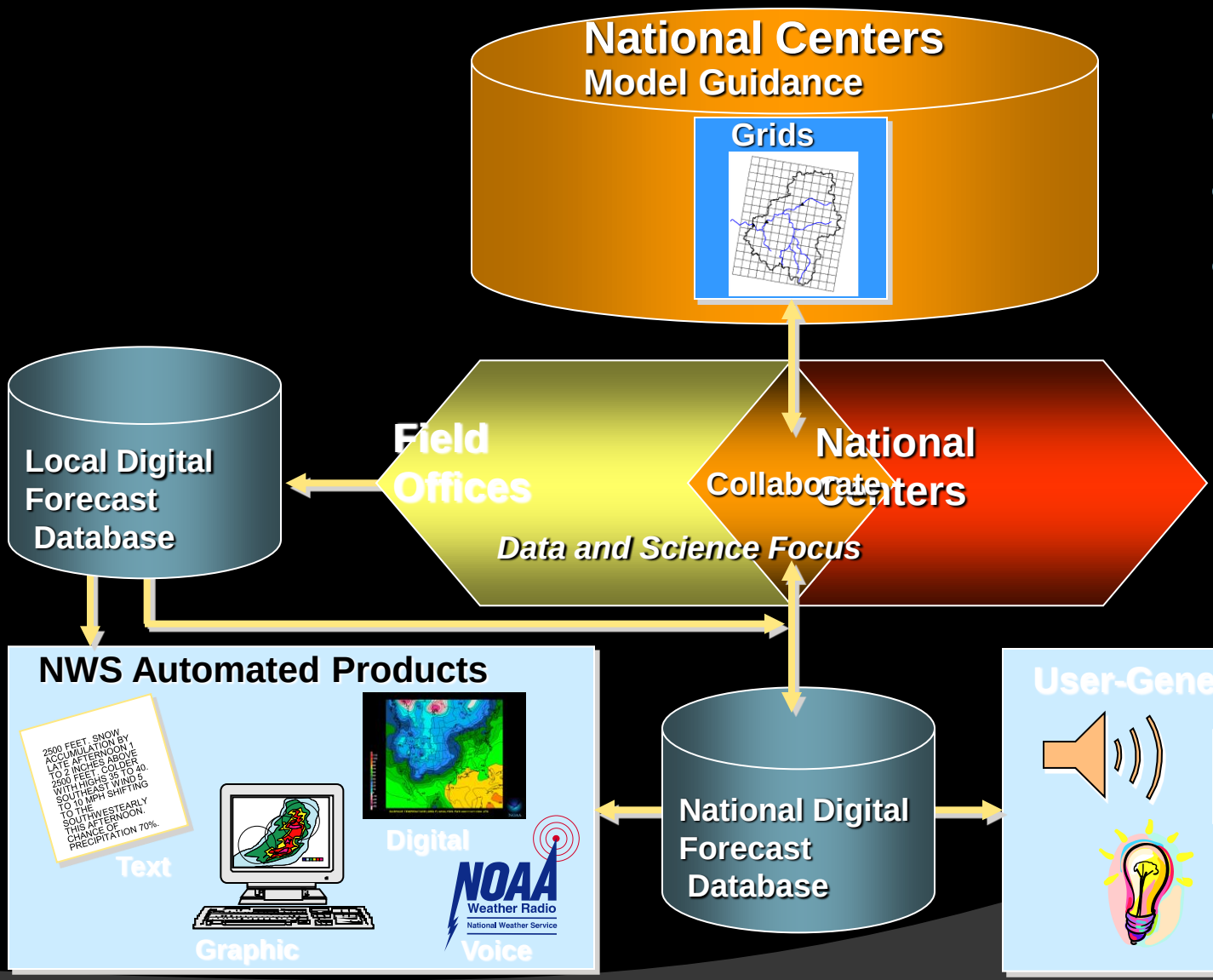
Excessive Heat Products



Threats Assessments



New Forecasting Process



- Interactive
- Collaborative
- Information Oriented

From Text to 3Ds:
Digital, Detailed and Displayable

Traditional Process

TODAY...RAIN LIKELY. SNOW LIKELY ABOVE 2500 FEET. SNOW ACCUMULATION BY LATE AFTERNOON 1 TO 2 INCHES ABOVE 2500 FEET. COLDER WITH HIGHS 35 TO 40. SOUTHEAST WIND 5 TO 10 MPH SHIFTING TO THE SOUTHWESTEARLY THIS AFTERNOON. CHANCE OF PRECIPITATION 70%

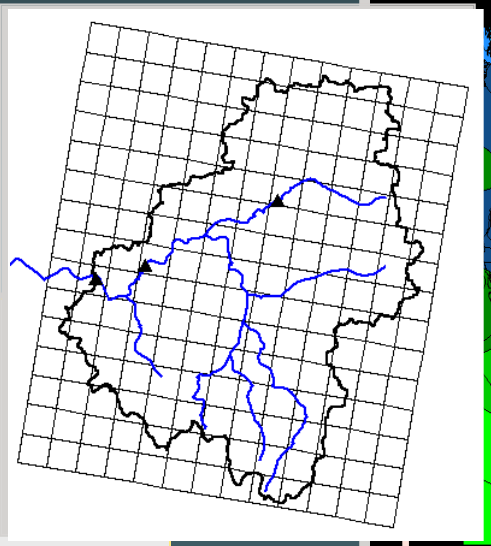
New Forecast Process

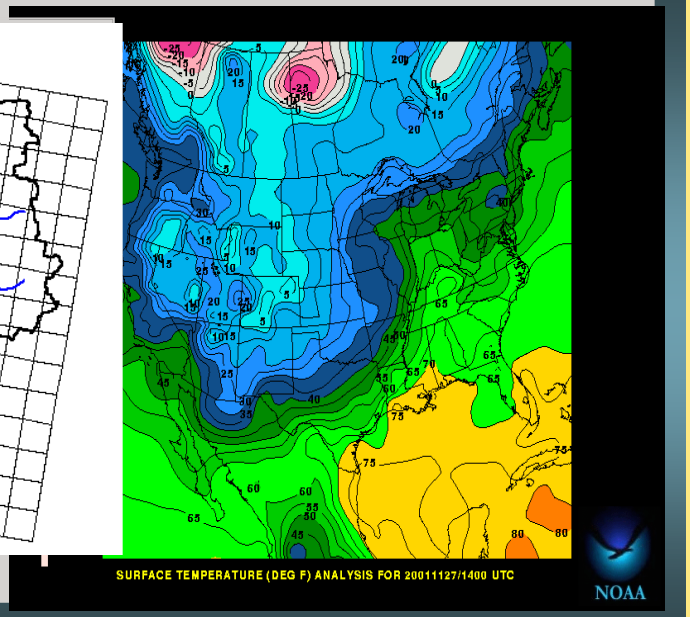
TODAY...RAIN LIKELY. SNOW LIKELY ABOVE 2500 FEET. SNOW ACCUMULATION BY LATE AFTERNOON 1 TO 2 INCHES ABOVE 2500 FEET. COLDER WITH HIGHS 35 TO 40. SOUTHEAST WIND 5 TO 10 MPH SHIFTING TO THE SOUTHWESTEARLY THIS

MARYLAND EASTERN SHORE

EASTON

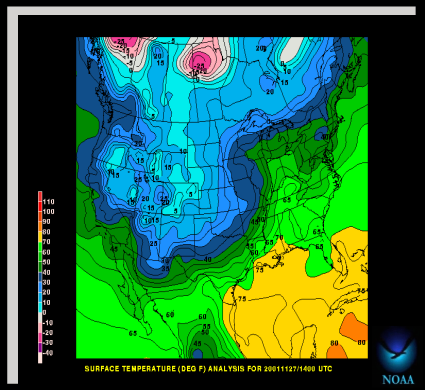
PTCLDY	CLOUDY	PTCLDY	PTCLDY	SUNNY
60/52	63/54	65/47	55/40	55/37
POP 20	POP 20	POP 20	POP 20	POP 10



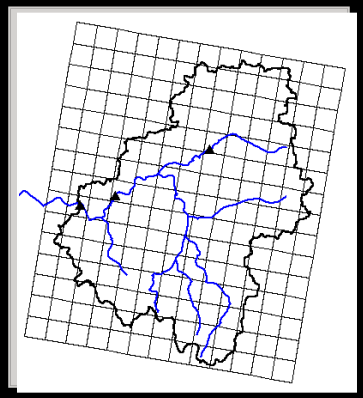


National Digital Forecast Database Gives Customers What They Want

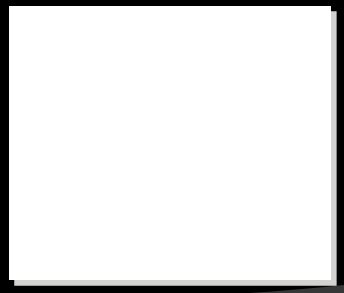
Different Products for Different Customers



The public, emergency managers and city planners use Internet graphic products for detailed forecasts



Commercial weather companies & emergency managers use grids to generate tailored products



Radio stations & public read text forecasts

- ✓ More weather data
- ✓ Higher resolution forecasts
- ✓ Visual displays of probability
- ✓ User-defined products create business opportunities

The Path to NOAA's Seamless Suite of NWS Products and Forecast Services

Observe

Process

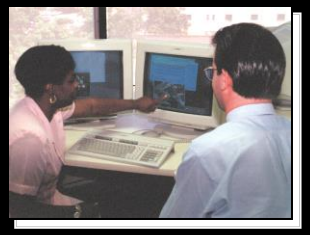
Products & Forecast Services

Central Guidance → Local Offices

e.g., National Association of State Energy Officials, Emergency Managers

Respond & Feedback

IBM Supercomputer at Gaithersburg, MD Computer Center



Distribute

Research, Development and Technology Infusion

Feedback

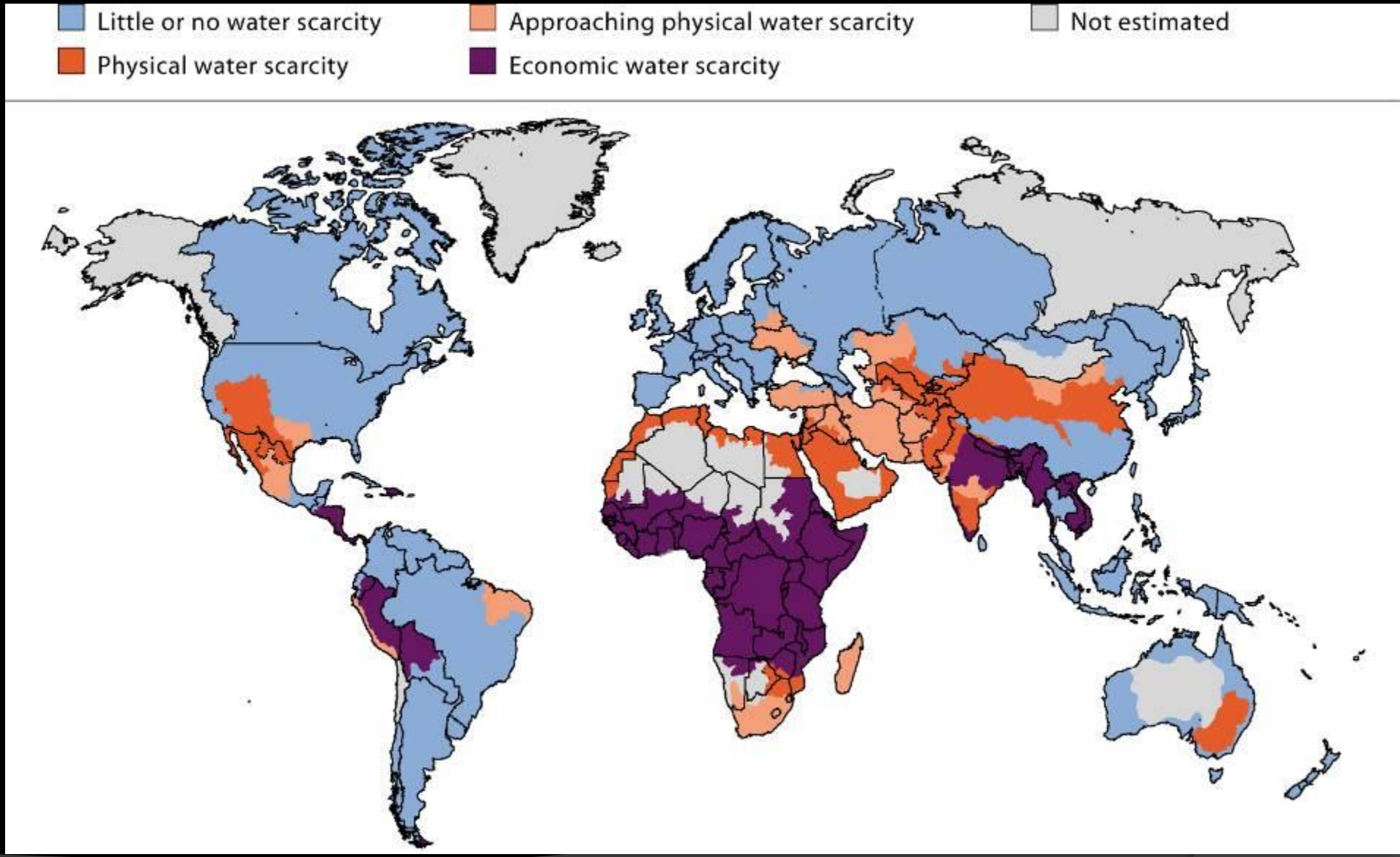
While you can go almost
a month without food…

your body
can't survive
one week
without water.

According to the U.N., a child dies from a water-related disease

every 15 seconds.

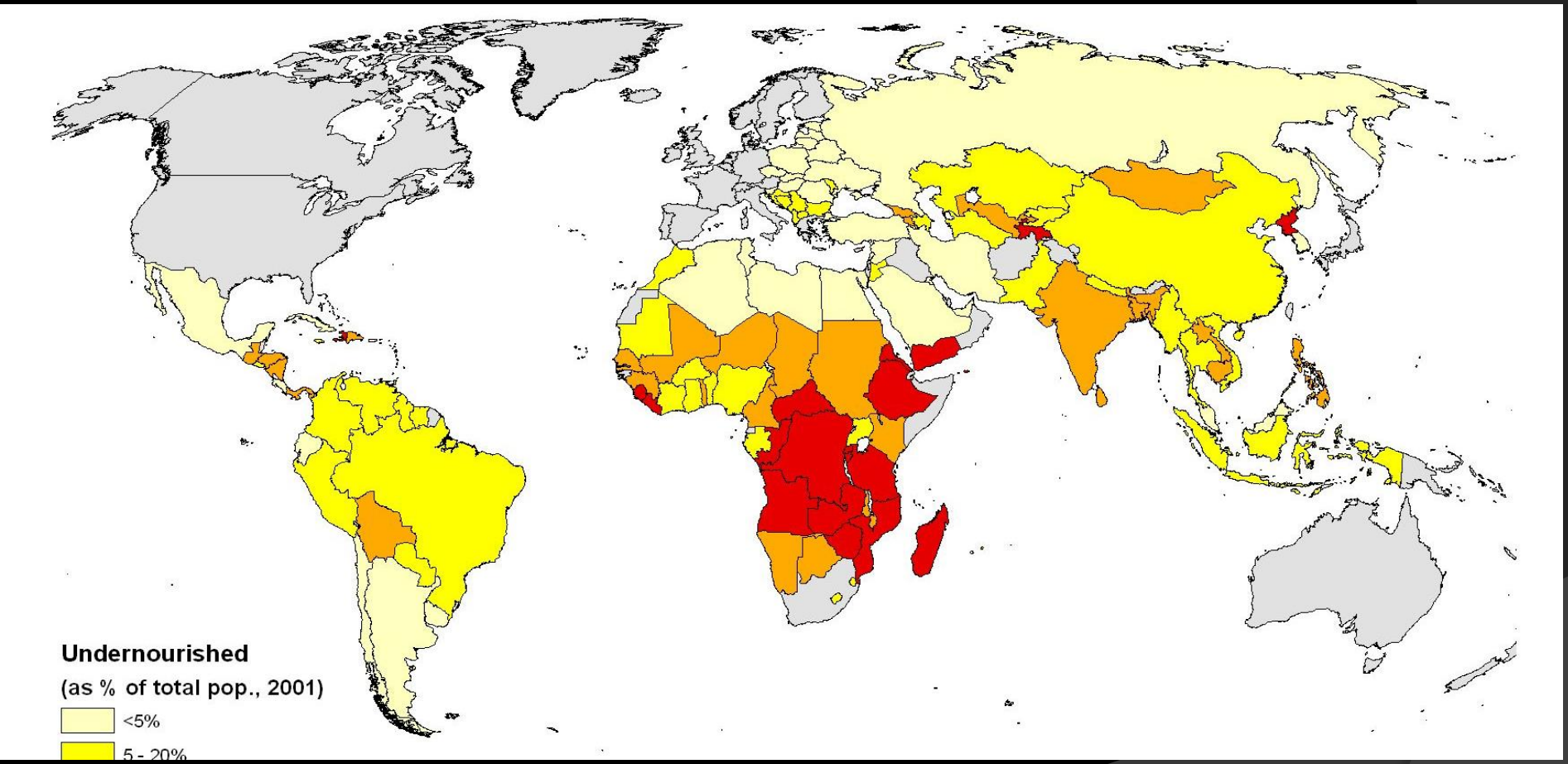
Water Scarcity 2000



1/3 of the world's population live in basins that have to deal with water scarcity

MOST HUNGRY AND POOR PEOPLE LIVE WHERE WATER CHALLENGES POSE A CONSTRAINT TO FOOD PRODUCTION

840 million malnourished people remaining



Hunger Goal Indicator: Prevalence of undernourished in developing countries, percentage 2001/2002 (UNstat, 2005)

Answer from the Comprehensive Assessment –

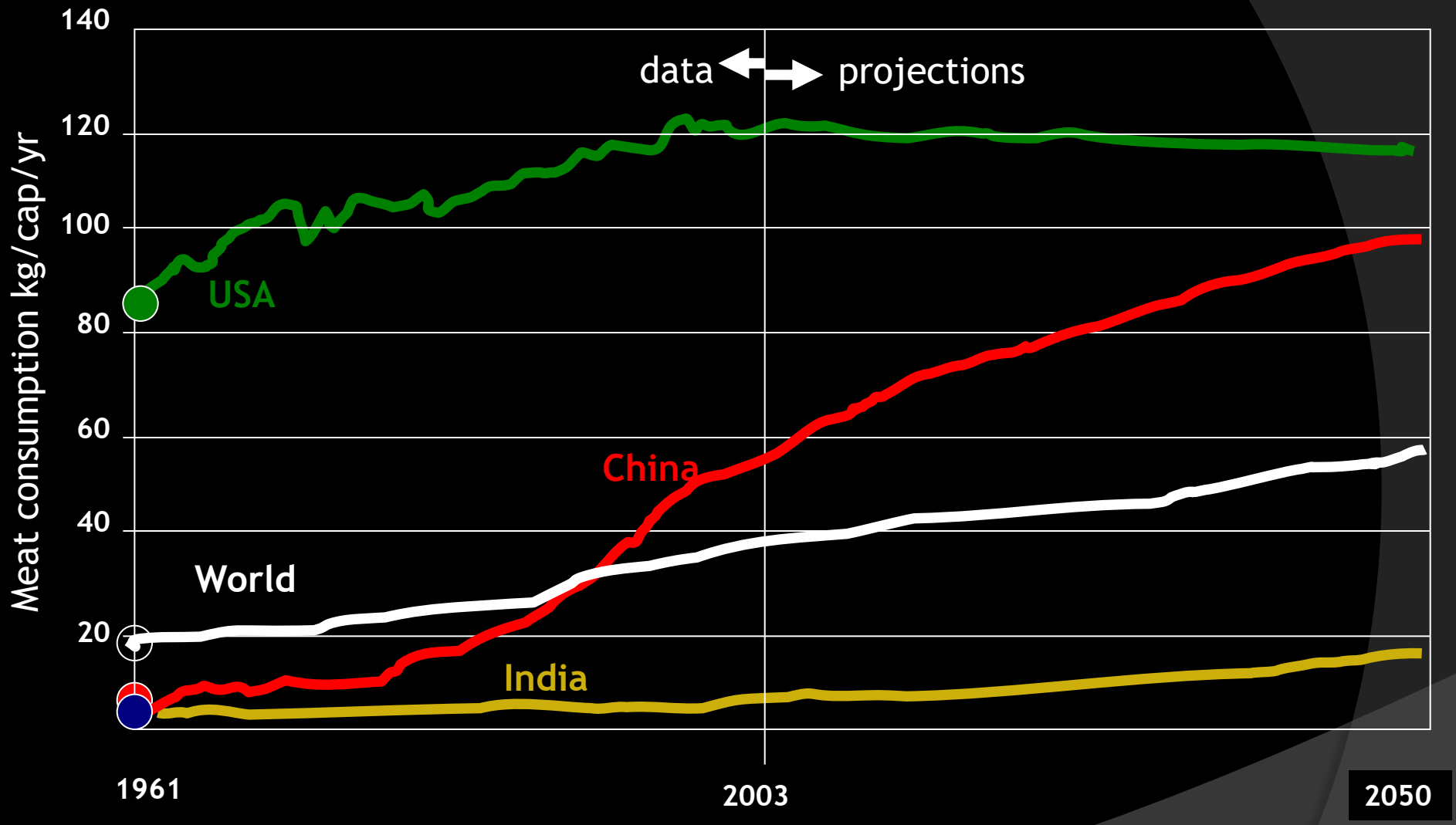
Will there be enough water to grow enough food, reduce poverty and support ecosystems?

No, unless ….

We change the way we think and act on water issues.

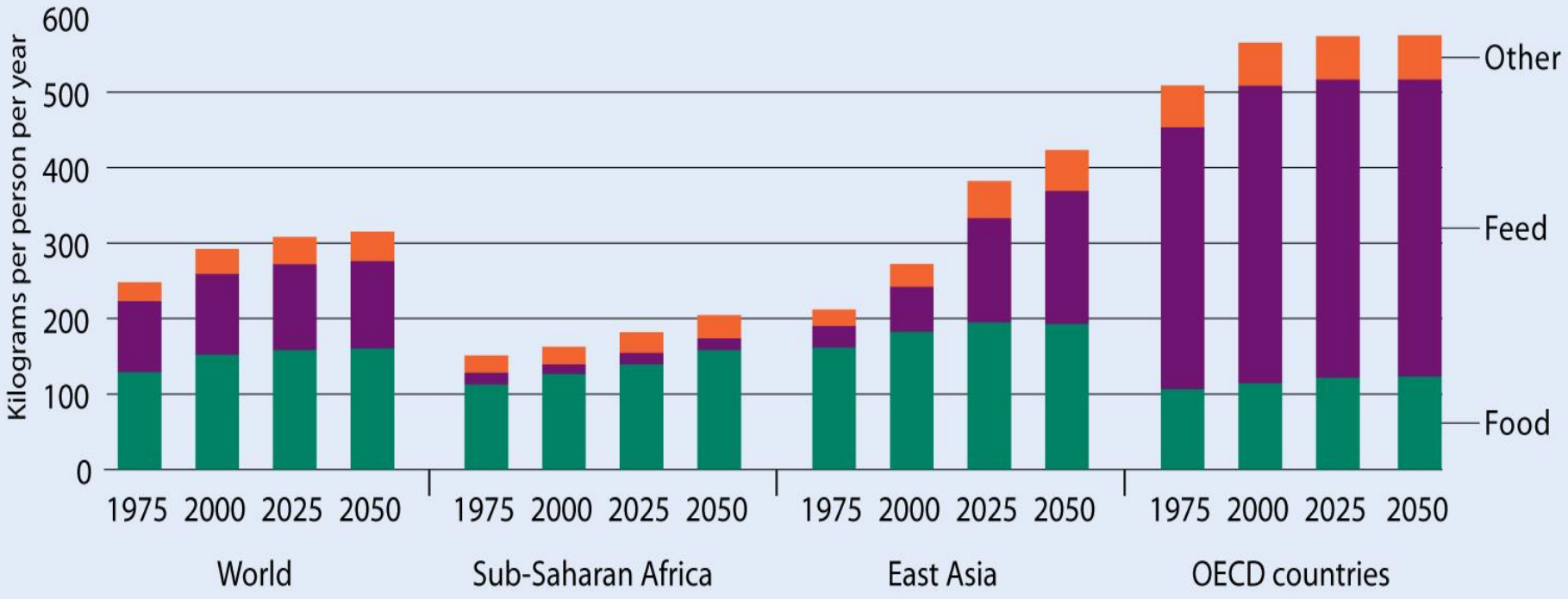

WHAT OF THE FUTURE?

Per capita meat demand (kg/cap/yr)



Food demand doubles over the next 50 years because of diet and population growth

Water Needs (ET) will double – without water productivity gains



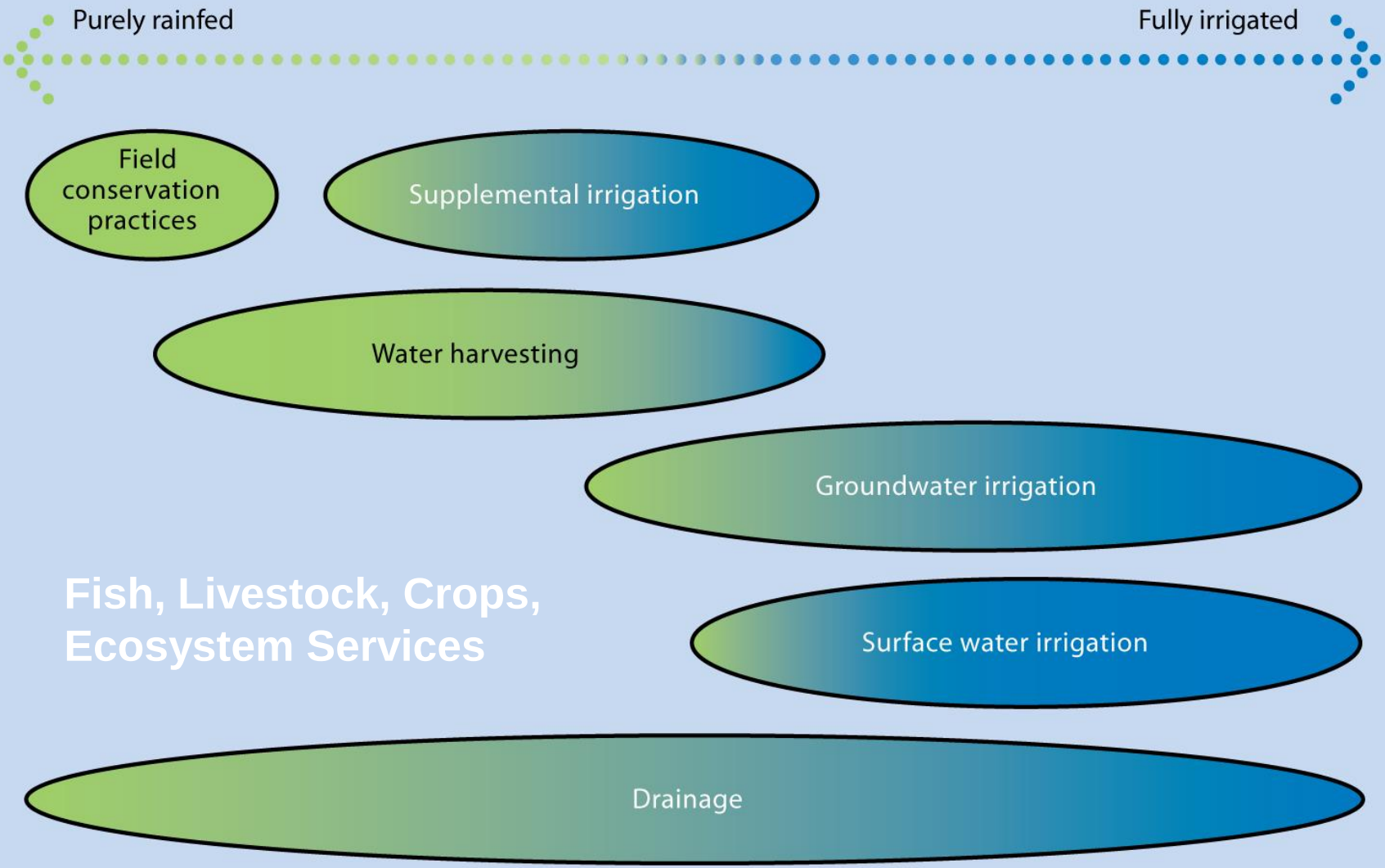
Source: For 1975 and 2000, FAOSTAT 2006; for 2025 and 2050, International Water Management Institute analysis done for the Comprehensive Assessment of Water Management in Agriculture using the Watersim model.

Climate Change

Mitigation is about gases.

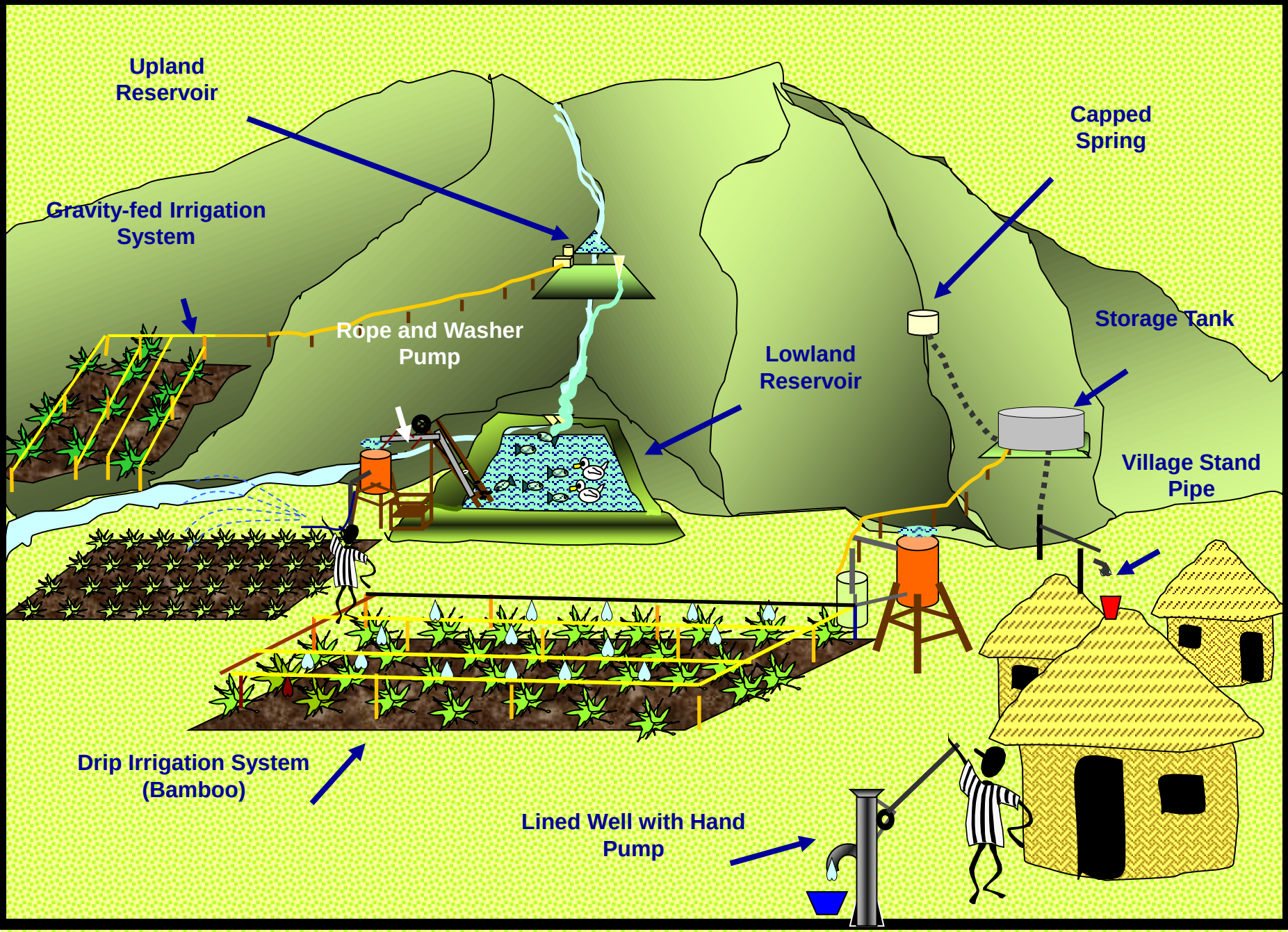
Adaptation is about water.

Consider A Range of Agricultural Water Management Options



Increase Water Productivity

- Physical Water Productivity – more crop per drop
  - To reduce future water needs
  - For food production increases
- Economic Water Productivity – more value per drop
  - For more income, growth
  - Integrated, multiple use systems


Upland Reservoir
Capped Spring
Gravity-fed Irrigation System
Rope and Washer Pump
Storage Tank
Lowland Reservoir
Village Stand Pipe
Drip Irrigation System (Bamboo)
Lined Well with Hand Pump

Adapt yesterday's irrigation to tomorrow's needs

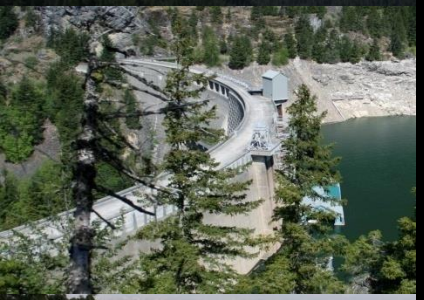
1. To reduce rural poverty
2. To improve performance of systems
3. To keep up with changing food demand
4. To adapt to changes – water scarcity, competition, climate change, energy
5. To increase multiple benefits and ecosystem services, while reducing negative impacts

Get water to poor people, use it better

Around 70% of the world's under-nourished live in rural areas where non-agricultural livelihood options are limited.

Improve and Safeguard Water Access

Access to Technologies


Manage Externalities

Deal with negative impacts of water development

- Ecosystem degradation
- Negative health impacts
- Inequitable benefits
- Loss of biodiversity

Address Drivers of Change

Our policies and actions on

- Agriculture
- Trade
- Response to climate change
- Diets
- Energy/biofuels

have a profound impact on water resources.

Photos from Diet for a Small Planet

Key messages 1: Practices

- Climate-smart practices exist
- Ecosystem approach at landscape level is crucial
- Investments are needed in
  - filling data and knowledge gaps
  - R&D of technologies, methodologies
  - conservation and production of varieties and breeds

Key messages 2: Policies

- Smallholders need institutional and financial support for the transition
- Strengthened institutions for dissemination and coordination
- Consistency between agriculture, food security and climate change policies

Key messages 3: Finance

- Available financing, current and projected, are substantially insufficient
- Combining finance (public/private, climate change/food security) improves options
- Fast-track financing must take sector-specific considerations into account

Two Goals

1. Achieving Food Security

2. Avoiding Dangerous impacts of Climate Change

We must reach both.

EM TASOL