World Meteorological Organization

Working together in weather, climate and water

Climate Variability, Climate Change & Climate Services Related to Sustainable Agriculture

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Outline

- WMO Commission for Agricultural Meteorology
- Sustainable Agriculture
- Role of Weather and Climate
- Some Examples
- Global Framework on Climate Services

WMO Technical Commissions

- Commission for Aeronautical Meteorology (CAeM)
- Commission for Agricultural Meteorology (CAgM)
- Commission for Atmospheric Sciences (CAS)
- Commission for Basic Systems (CBS)
- Commission for Climatology (CCl)
- Commission for Hydrology (CHy)
- Commission for Instruments and Methods of Observation (CIMO)
- Joint WMO-IOC Commission for Oceanography and Marine Meteorology (JCOMM)

Commission for Agricultural Meteorology (CAgM) – Terms of Reference

- Support applications of meteorology to **management of agriculture, livestock, forestry, rangelands and fisheries sectors**;
- Assist Member countries in **developing/establishing their agrometeorological services** particularly on:
  - Operational use of knowledge concerning **weather and climate for sustainable agricultural management** through conservation and better use of natural resources;
  - Use of weather and agrometeorological observations, forecasts and warnings for operational purposes;

Commission for Agricultural Meteorology (CAgM) – Terms of Reference (2)

- Use of **climate observations and predictions**;
- **Adaptation to climate variability and change** (developing countries);
- Combating unfavourable influences of weather and climate on agricultural subsectors, including **weather-related pests and diseases**;
- Protection of agricultural produce in storage/transit against damage due to direct and indirect influences of weather and climate;

Commission for Agricultural Meteorology (CAgM) – Terms of Reference (2)

- **Improve coordination and collaboration mechanisms** with users of weather and climate information in agricultural subsectors & liaise actively with weather and climate service providers;
- Formulate data and information requirements for agricultural purposes;
- Foster development and use of **effective communication methods** for acquiring and disseminating agrometeorological information, advice and warnings to agricultural subsectors and getting feedback;
- Promote a better understanding of the interactions and impacts of weather and climate in regards to **drought and desertification**;

Sustainable Agriculture

- Sustainable agriculture integrates three main goals-- environmental health, economic profitability, and social and economic equity.
- *Stewardship of both natural and human resources* is of prime importance
- *Systems perspective* is essential to understanding sustainability
- *Interdisciplinary efforts in research and education*
- *Making the transition to sustainable agriculture is a process*.

Source: UC Sustainable Agriculture Research and Education Program (SAREP)

FAO definition of SARD (Sustainable Agriculture & Rural Development)

- Ensures that the basic nutritional requirements of present and future generations, qualitatively and quantitatively, are met while providing a number of other agricultural products.

- Provides durable employment, sufficient income, and decent living and working conditions for all those engaged in agricultural production.

Source: UC Sustainable Agriculture Research and Education Program (SAREP)

FAO definition of SARD (Sustainable Agriculture & Rural Development)

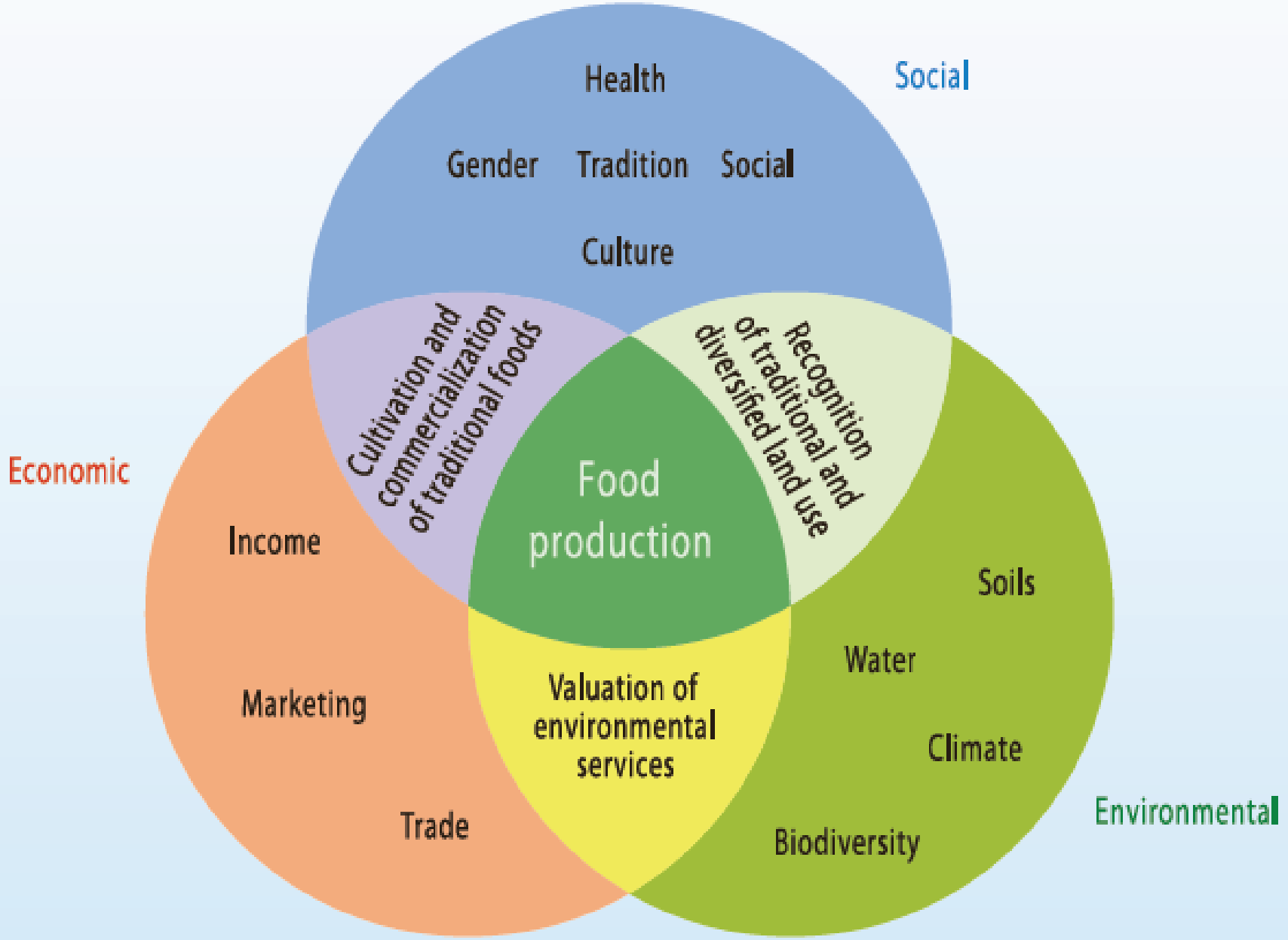
- Maintains and, where possible, **enhances the productive capacity of the natural resource base as a whole**, and the regenerative capacity of renewable resources, without disrupting the functioning of basic **ecological cycles and natural balances**, destroying the socio-cultural attributes of rural communities, or **causing contamination of the environment.**
- **Reduces the vulnerability of the agricultural sector to adverse natural** and socio-economic **factors and other risks**, and strengthens self-reliance.
- (From FAO Trainer's Manual, Vol. 1, "Sustainability issues in agricultural and rural development policies," 1995).

IAASTD

- International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)
- Agriculture and agricultural knowledge, science and technology (AKST)
- IAASTD cosponsored by FAO, GEF, UNDP, UNEP, UNESCO, World Bank, WHO
- Unique hybrid of IPCC & nongovernmental Millennium Ecosystem Assessment
- 58 countries agreed; 3 did not fully approve; 400 experts selected

Source: UC Sustainable Agriculture Research and Education Program (SAREP)

The inescapable interconnectedness of agriculture's different roles and functions



Source: International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)

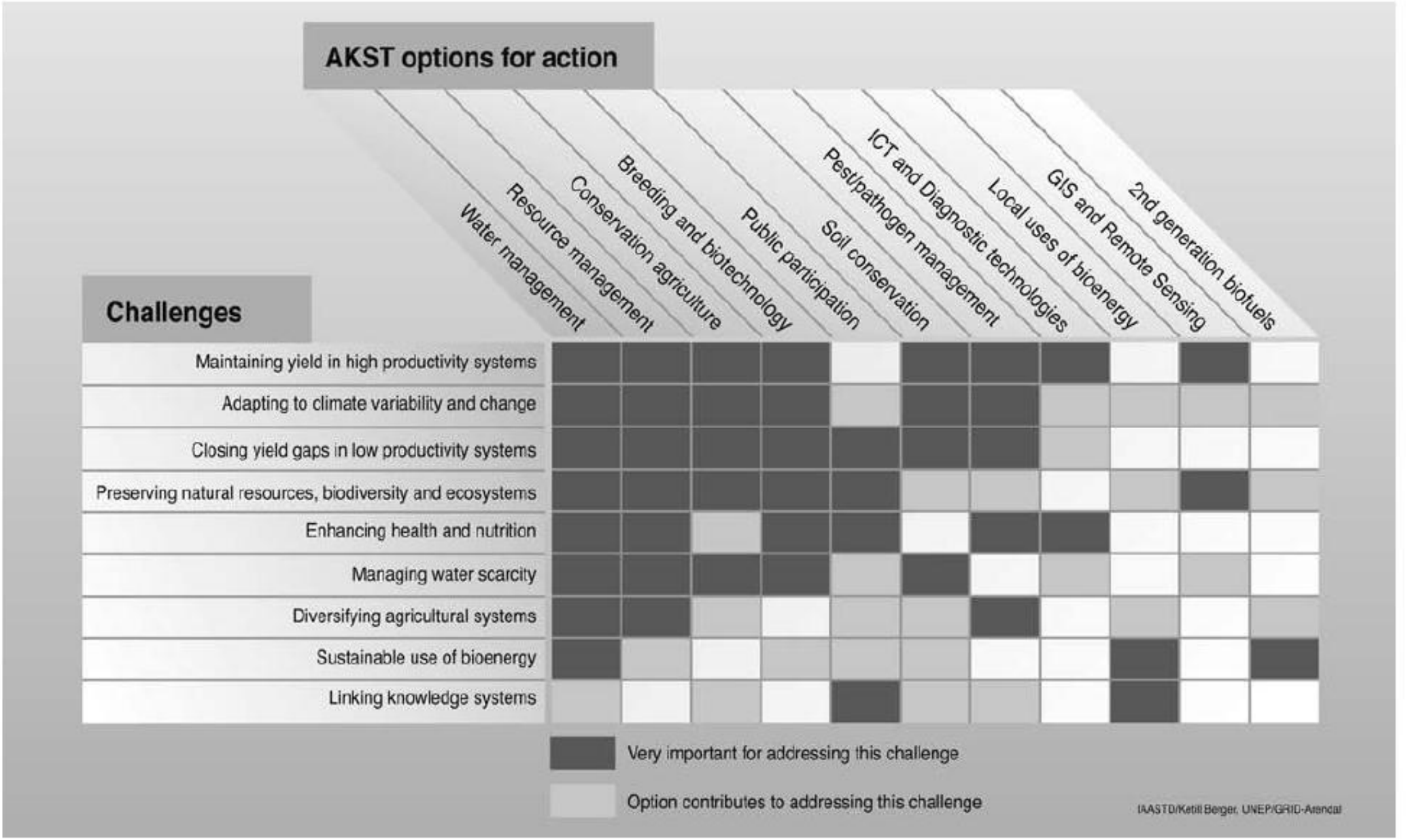
Table 2-1. Roles of agriculture.

Role	Environmental	Social	Food Security	Economic	Cultural
Global	Ecosystem resilience Mitigation of climatic change (carbon sequestration, land cover) Biodiversity	Social stability Poverty alleviation	Food security	Growth	Cultural diversity
Regional/ National	Ecosystem resilience Soil conservation (erosion, siltation, salinization) Water retention (flood and landslide prevention) Biodiversity (agricultural, wild life) Pollution abatement/generation	Balanced migration Social stability (and sheltering effects during crisis) Unemployment prevention Poverty alleviation Gender relations	Access to food National security Food safety	Economic stability Employment Foreign exchange Tourism	Landscape Cultural heritage Cultural identity Social capital
Local	Ecosystem resilience Soils conservation Water retention Biodiversity Pollution abatement/generation	Social stability (employment, family)	Local and household food safety	Employment effects on secondary and tertiary sectors	Landscape Indigenous and local knowledge Traditional technologies Cultural identity

Source: Adapted from FAO, 2008

Source: International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)

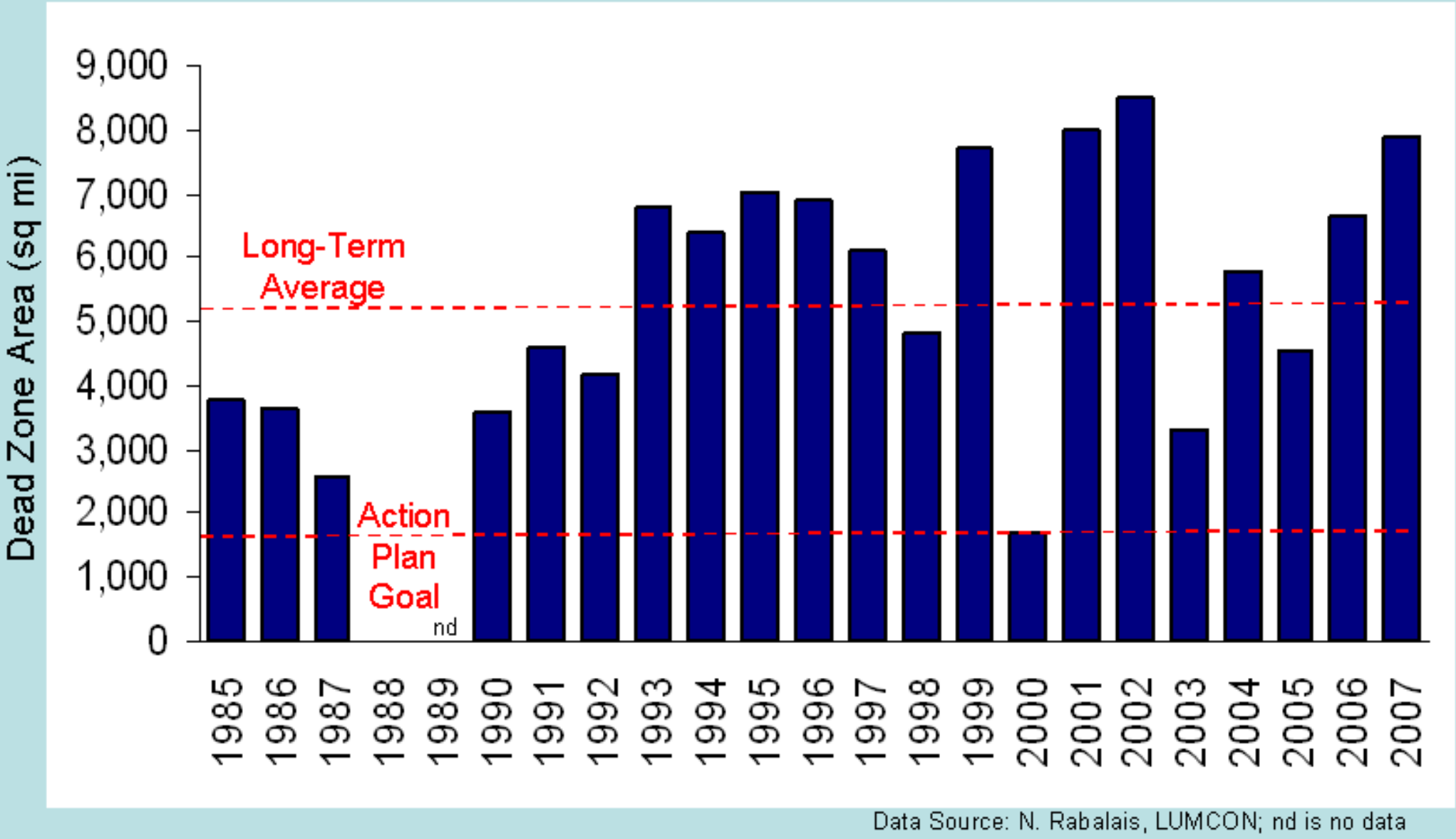
Table 6-1. Key Relationships between Future Challenges and Agricultural Knowledge, Science and Tecnology (AKST) Options for Action



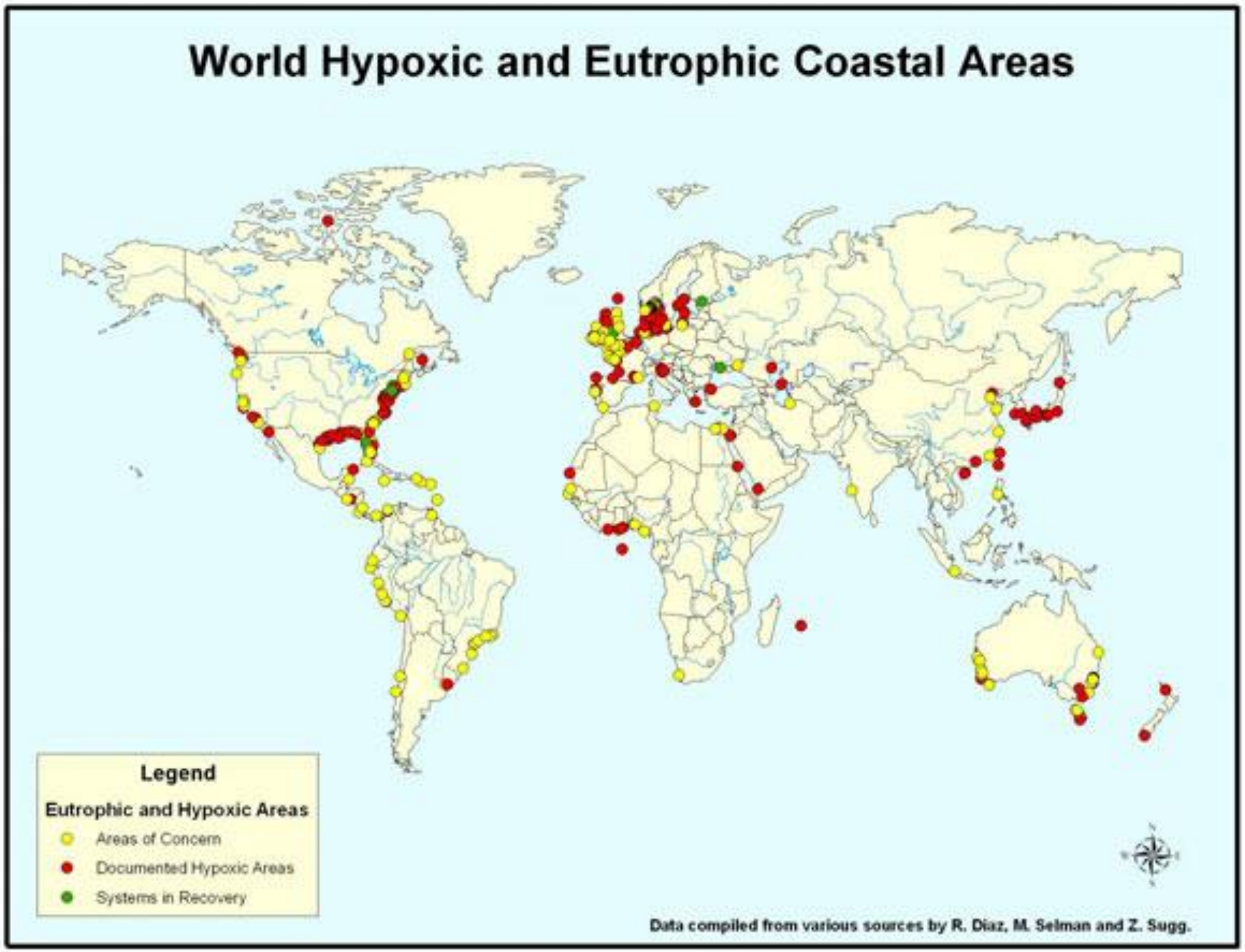
Source: International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)

Media Credit: Stephanie Clark

This map illustrates the Dead Zone in the Gulf of Mexico. The red area shows the least oxygenated water, gradually shifting to well-oxygenated (blue) water.



Data Source: N. Rabalais, LUMCON; nd is no data


World Hypoxic and Eutrophic Coastal Areas
Legend
Eutrophic and Hypoxic Areas
Areas of Concern
Documented Hypoxic Areas
Systems in Recovery
Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

Source: I

Some Questions

- How will future climate change impact the sustainability of agriculture?
- Can current agricultural production systems be sustained into the future?
- What new sustainable systems can be developed?

Climate Variability

- These can be addressed by examining how current climate variability impacts the development of sustainable agriculture.

- Much more research still needs to done on how current climate variability impacts agriculture systems and their sustainability (ENSO, NAO).

Climate Variability

- Therefore, in order to provide sustainable management of agricultural systems (current, new) with respect to impacts of climate variability (droughts, floods, etc) and to adequately address likely future climate change impacts, decision-makers at all levels need to be aware of all aspects of the climate system.

Role of Weather and Climate Information to Agriculture

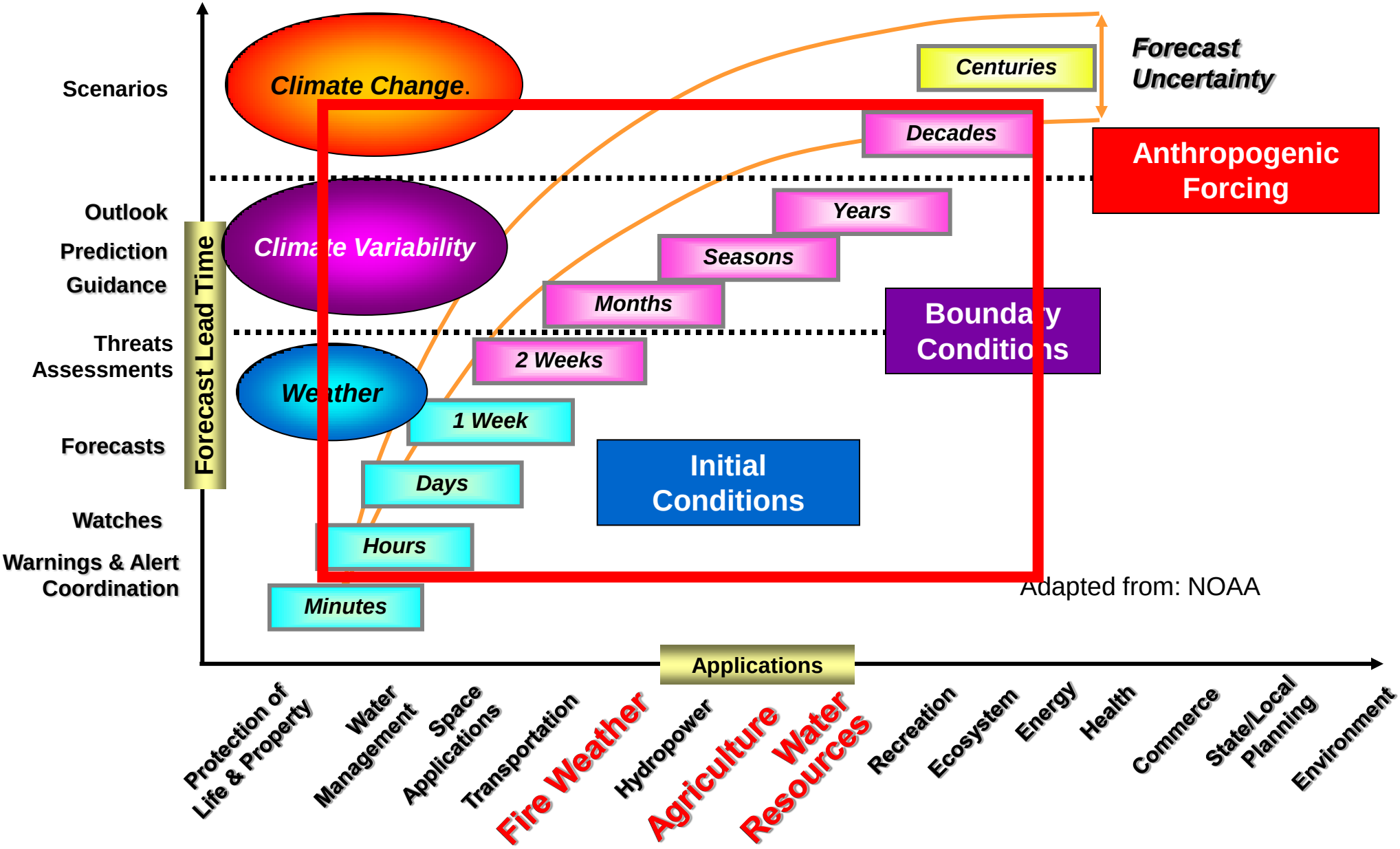
Agrometeorology

Users of Agrometeorological Information

Any agricultural decision-maker:

- International officials (i.e. Red Cross, WFP, UN)
- Government official
- Extension agent
- Farmers, ranchers, foresters, fishers
- Media
- General public

Weather and Climate Prediction Framework



Tactical vs Strategic

- **Tactical Applications - Weather**
  - Operational decisions from a few hours to a few days.
  - Decisions based on crop state and current or forecast weather
  - Cultivating, irrigating, spraying, and harvesting.
- **Strategic Applications - Climate**
  - Issues and decisions on seasonal or yearly basis or planning
  - specific crop or crop variety to plant
  - designing and planning where or if greenhouses or animal shelters should be built
  - aiding governments in setting agricultural pricing polices.

Key Questions in AgroMeteorology

- What are the weather / climate events that impact agricultural decision-making?

- How to relate weather / climate information to meaningful agricultural actions / practices?

2009 Seminar - Mali Met Service Presentation

2009 Seminar – Farmers ask Questions

2009 Seminar – Demonstration of Raingauge

Example of Crop Planting Advice based on Rainfall

- **Crops:** Millet and Sorghum
- **Crop Cycle:** 90 – 120 days
- 1 – Avoid planting before 10 June, but proceed to make field preparations.
- 2 – From 11 to 30 June, plant long-cycle crops (120 days) as soon as the 10-day cumulative recorded rainfall which reaches or surpasses 20 mm.
- 3 – From 1 to 20 July, plant short-cycle crops (90 days) as soon as the 10-day cumulative recorded rainfall reaches or surpasses 10 mm.

Due to the high spatial variability of rainfall, each farmer or village can make planting decisions based on their own raingauge.

Crop	Development zone	Field type	Area (ha)	Average yield (kg/ha)	Gross income (US$/ha)	Income gain in agromet fields (%)
Pearl millet	OHVN	Agromet	2,600	1,204	175	26
		Non-agromet	67,168	957	139	
	DRAMR	Agromet	750	757	110	10
		Non-agromet	45,790	690	100	
	ORS	Agromet	10,400	1,247	181	48
		Non-agromet	461,915	840	122	
Sorghum	OHVN	Agromet	5,375	1,427	193	42
		Non-agromet	470,996	1,005	136	
	DRAMR	Agromet	28,275	955	129	10
		Non-agromet	222,662	871	118	
	ORS	Agromet	2,850	1,562	212	56
		Non-agromet	179,853	1,002	136	
Maize	OHVN	Agromet	6,075	1,984	249	80
		Non-agromet	27,079	1,105	139	
Groundnut	DRAMR	Agromet	6,060	874	237	25
		Non-agromet	102,113	702	190	

Crop yields and farm incomes for farmers taking management decisions with and without agrometeorological information, in the 2003–2004 season.

"*Agriculture in Mali"* in Climate Risk Management in Africa: Learning from Practice. Hellmuth, M.E., Moorhead, A., Thomson, M.C., and Williams, J. (eds) 2007 IRI

Economic impact of Agro-Advisories in India

Crop	Station name	% change in cost of Prod. (per acre)	% change in crop yield (per acre)	% change in profit (per acre)
Cotton	Hissar	1	14	10
	Coimbatore	-4	16	16
Rice	Ludhiana	-6	9	18
	Kalyani	-3	21	29
Wheat	Ludhiana	-6	9	17
Mustard	Hissar	-3	8	13

DMCSEE

Drought Management Centre for Southeastern Europe

Drought Management Centre for Southeastern Europe - DMCSEE

Drought is a normal part of climate in virtually all regions of the world. South Eastern Europe is no exception; in past decades the drought-related damages have had large impact on the economy and welfare. Therefore the need to establish a Drought Center for SE Europe to alleviate the problems caused by drought in the area became evident at the end of the past century. The idea was further elaborated by International Commission on Irrigation and Drainage (ICID) and UN Convention to Combat Desertification (UNCCD). The UNCCD national focal points and national permanent representatives with the World Meteorological Organization have agreed upon the core tasks of the Drought Management Center for South Eastern Europe (DMCSEE) and the proposed project document.

The mission of the proposed DMCSEE is **to coordinate and facilitate the development, assessment, and application of drought risk management tools and policies in South-Eastern Europe with the goal of improving drought preparedness and reducing drought impacts**. Therefore DMCSEE will focus its work on monitoring and assessing drought and assessing risks and vulnerability connected to drought.

www.dmcsee.org

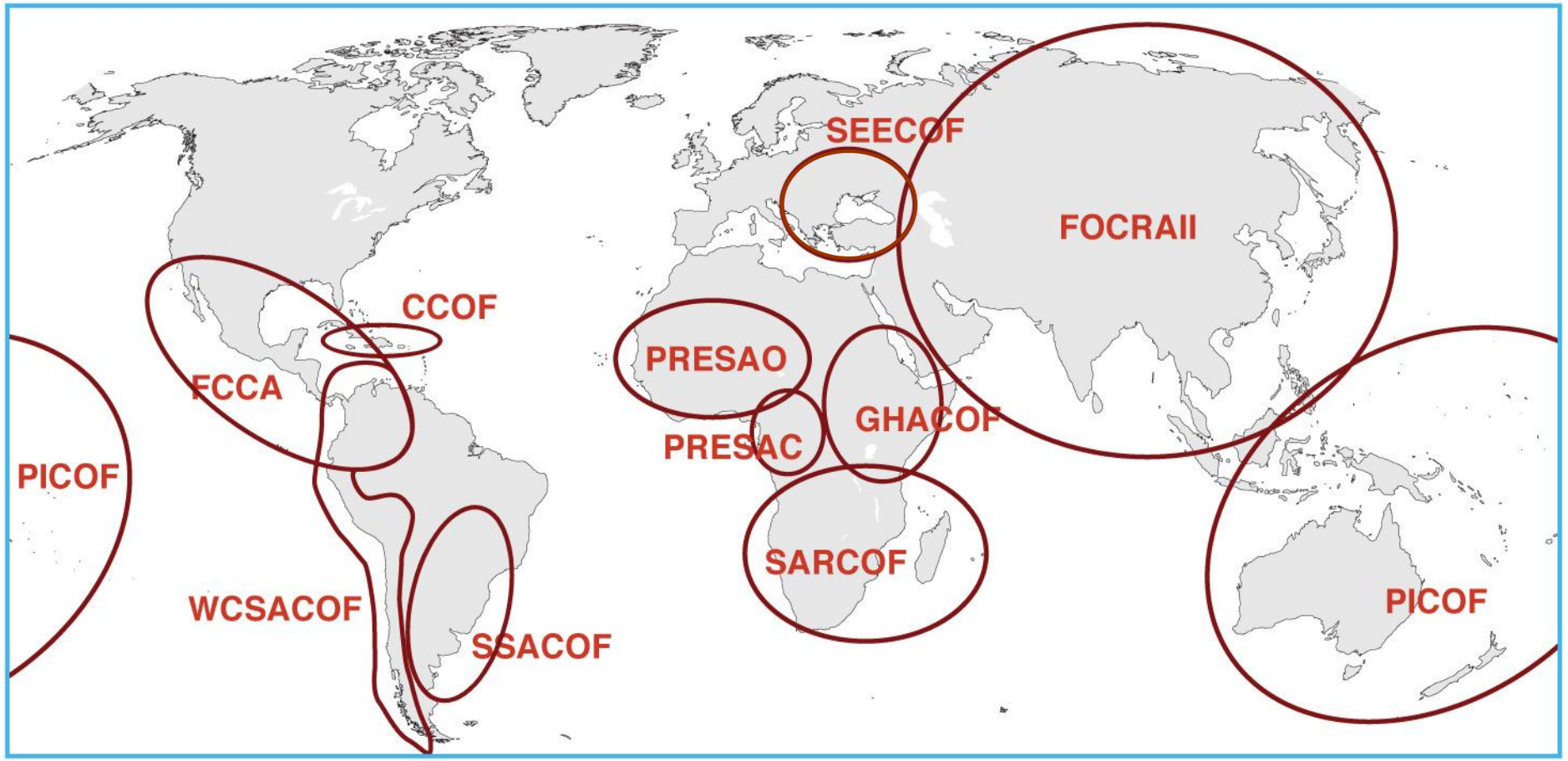
Founding countries:

- → Albania
- → Bosnia and Herzegovina
- → Bulgaria
- → Croatia
- → FYROM
- → Greece
- → Hungary
- → Moldova
- → Romania
- → Slovenia
- → Turkey
- → Montenegro
- → Serbia

Founding agencies:

- → WMO
- → UNCCD

Regional Climate Outlook Forums (RCOFs)



http://www.wmo.int/pages/prog/wcp/wcasp/clips/outlooks/climate_forecasts.html

GHACOF Products & Applications

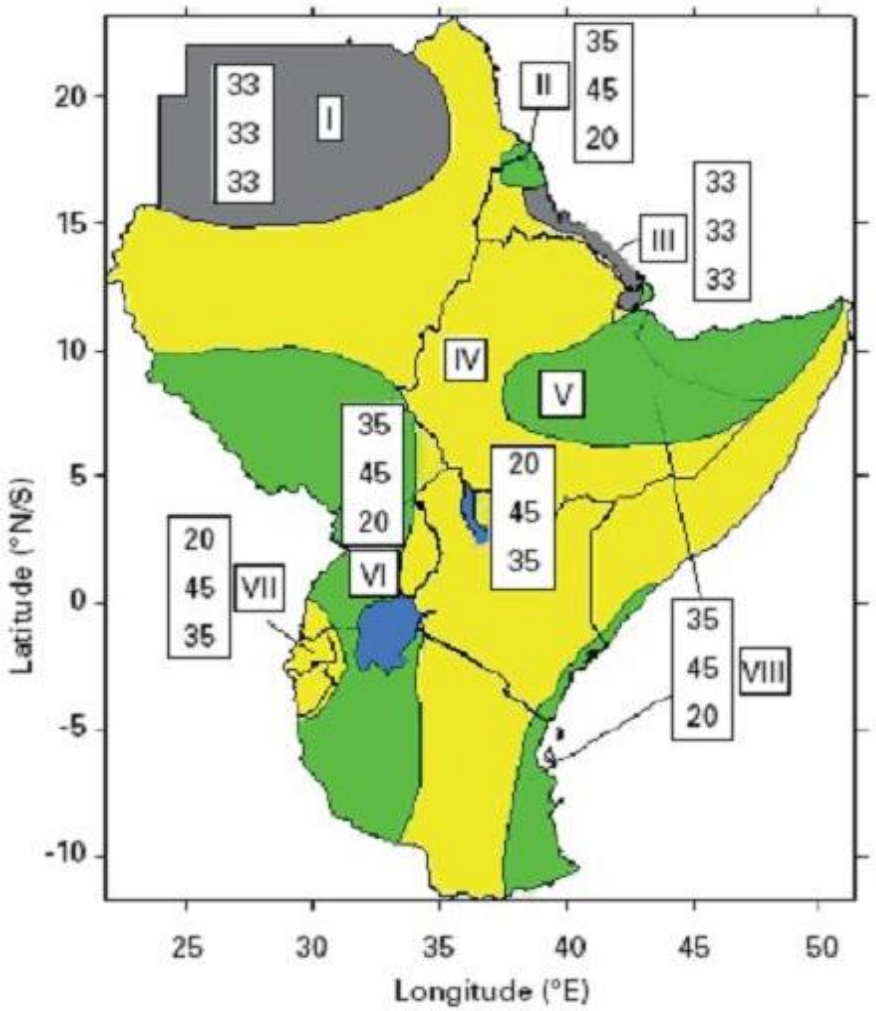


Figure 2(a) — Greater Horn of Africa Consensus Climate Outlook for March to May 2008 by ICPAC and partners including WMO and IRI.

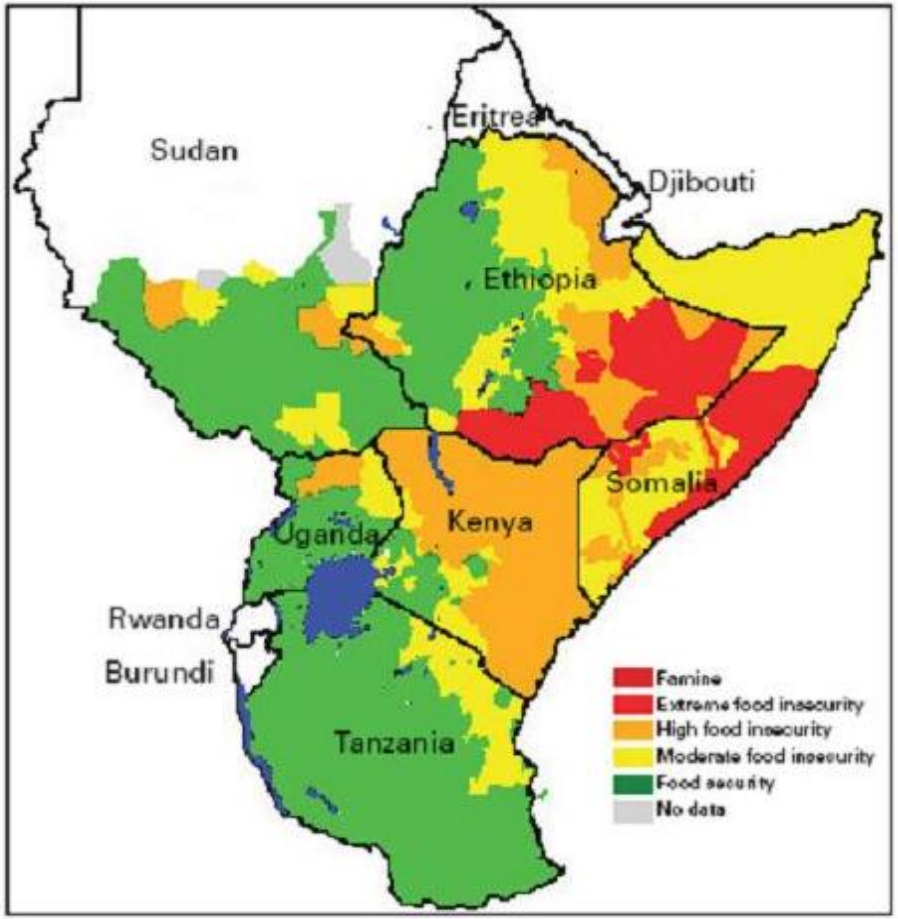
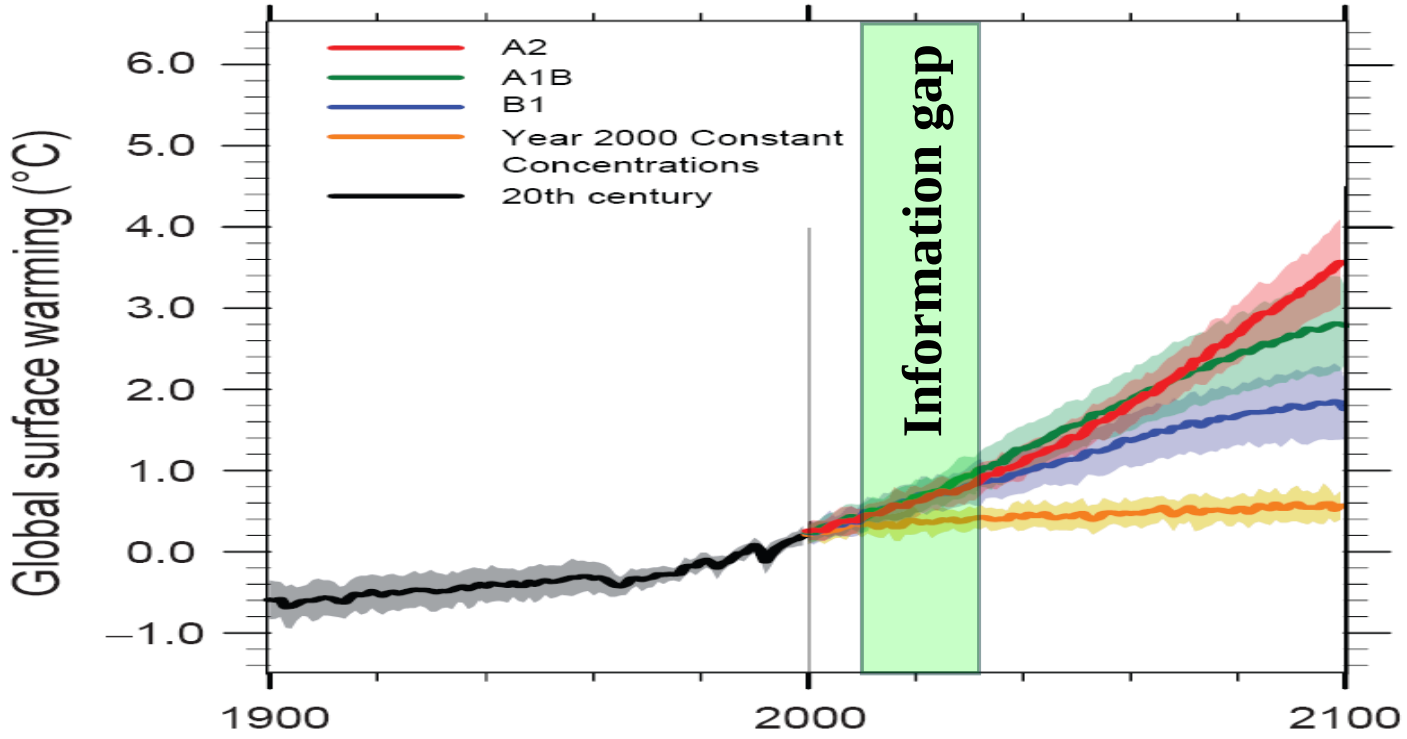


Figure 2(b) — Food Security Outlook for March to July 2008 by Famine Early Warning Systems Network (FEWSNET)

Global Framework on Climate Services (GFCS)

Climate information gap

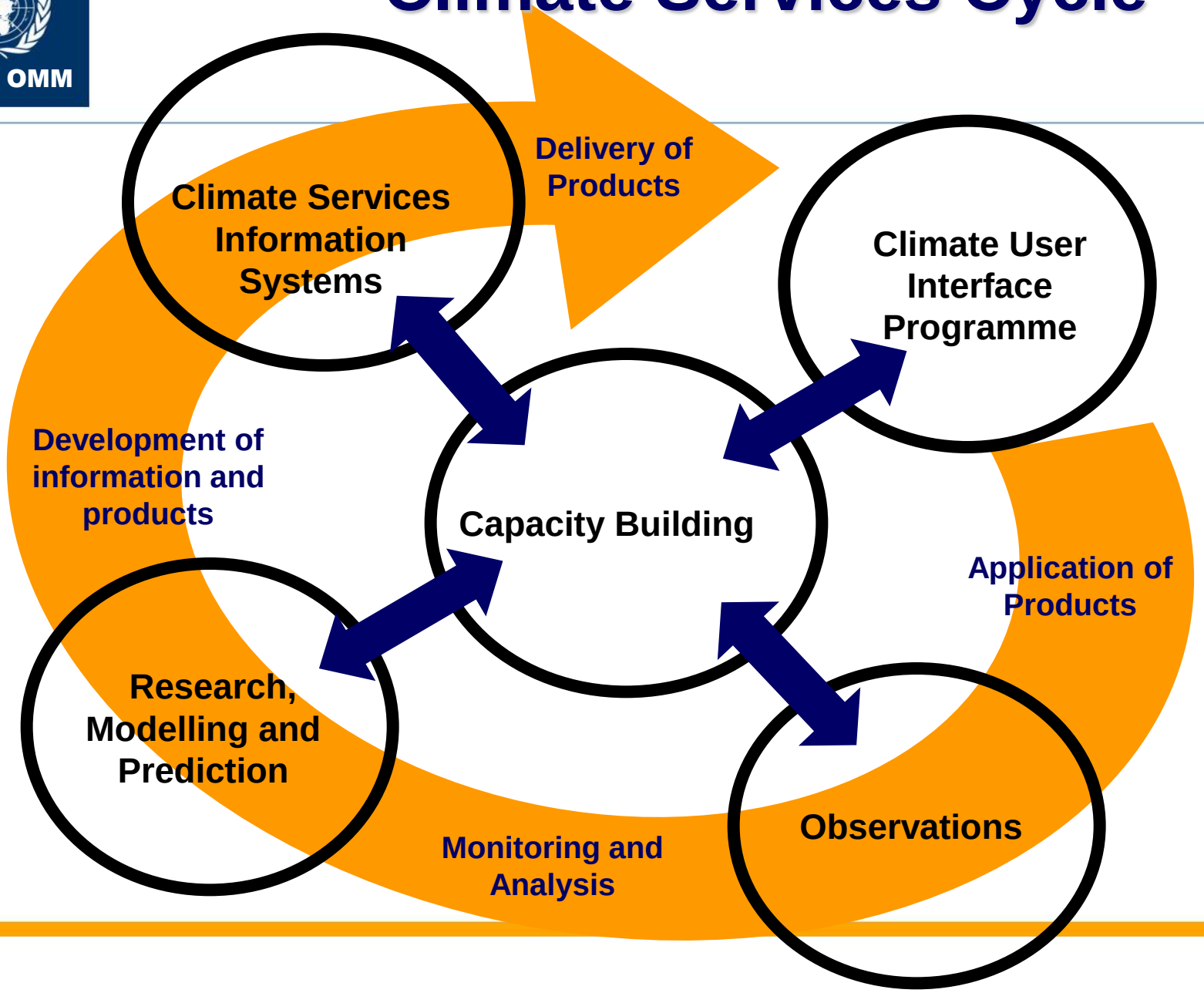


The IPCC process provides useful information for the time post 2050. But there is a information gap to support management of regional and shorter term climate risks.

GFCS: Objectives

- **Provide a cooperative framework in which all nations, International organizations, scientists and sectors will work together to meet the needs of users;**
- **Enable users to benefit from improved climate information and prediction;**
- **Mobilize climate science globally to advance the skills of seasonal-to-interannual and multi-decadal climate predictions to generate and provide future climate information on an operational basis;**
- **Cooperative global infrastructure to foster sharing new advances in science and information.**

Climate Services Cycle



Thank You

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www.wmo.int/agm