Climate Change and Food Security

by

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[The views expressed herein are entirely those of the author and do not necessarily reflect the position of the agencies he is associated with]

OUTLINE:

1. **INTRODUCTION –**
2. **BACKGROUND – Climate Change – vulnerability in Asia, ASEAN, Myanmar**
3. **Climate Change Dynamics and impact on Food Security – new dimensions and dynamics and other considerations**
4. **Way Forward**
5. **CONCLUSION**

INTRODUCTION:

***Purpose*:**

Provide an appreciation of the new dimensions and dynamics in Climate Change and Food Security, within the context of ASEAN, with a Myanmar and Rice slant so as to stimulate discussion at this workshop and beyond.

***Underlying theme*:**

It is crucial to have public and policy dialogue so as to understand these new dimensions and dynamics in Climate Change and Food Security, in order to continue getting the 'basics' and 'balance right'.

The costs of climate change:

A recent study by the International Food Policy Research Institute (IFPRI), titled 'Climate change: Impact on agriculture and costs of adaptation', highlighted some of the anticipated costs of climate change:

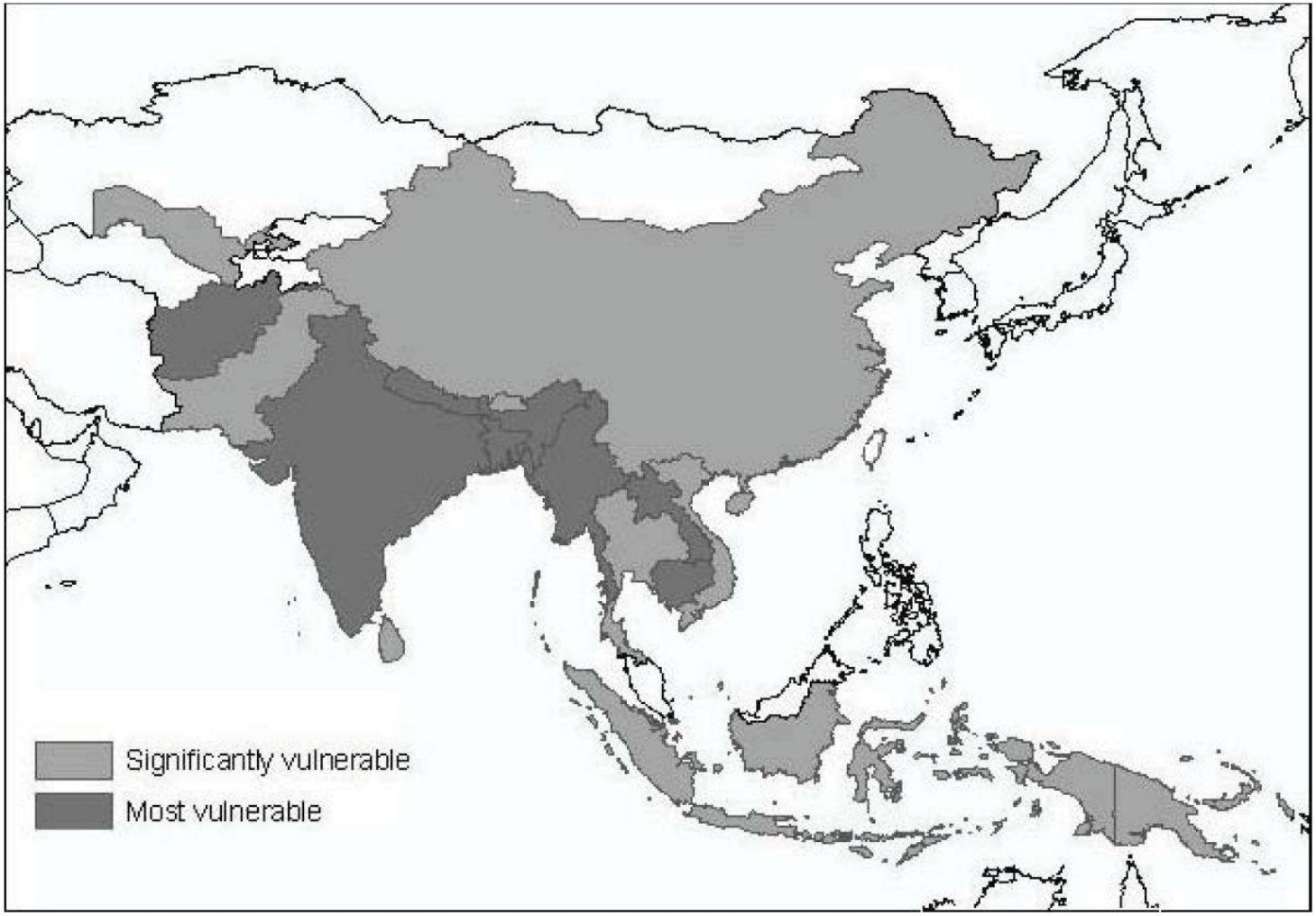
▸▸25 million more children will be malnourished in 2050 due to climate change without serious mitigation efforts or adaptation expenditures

▸▸Irrigated wheat yields in 2050 will be reduced by around 30% and irrigated rice yields by 15% in developing countries

▸▸Climate change will increase prices in 2050 by 90% for wheat, 12% for rice and 35% for maize, on top of already higher prices.

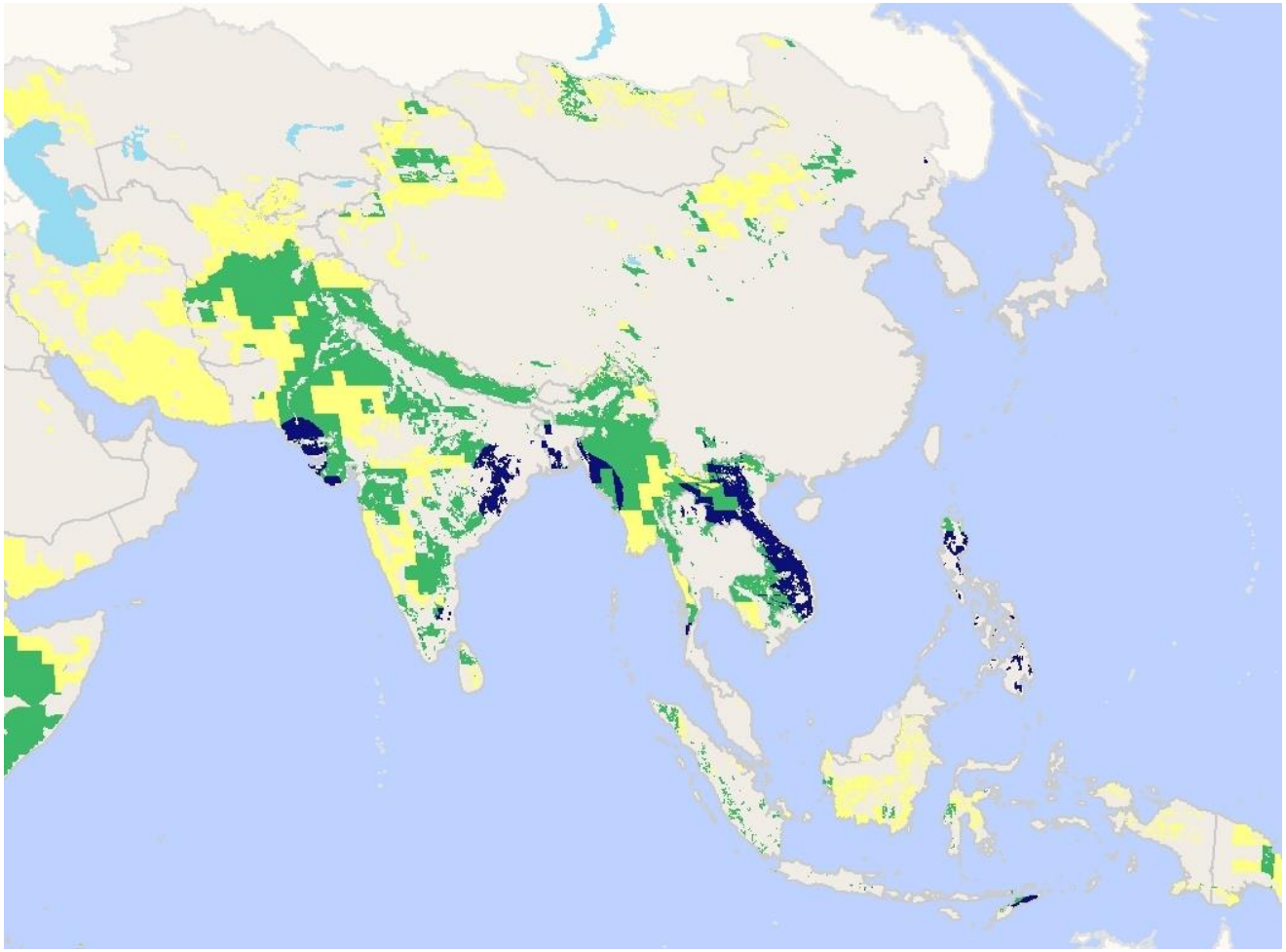
▸▸At least US$7 billion a year are necessary to improve agriculture productivity to prevent adverse effects on children

Countries Vulnerable to Climate Change in Asia



Source: ADB, 2009, Building Climate Resilience in the Agriculture Sector og Asia and the Pacific

Cumulative Hotspots of Humanitarian Risk for Floods, Cyclones, and Droughts



Legend:

Yellow = 1 hazard
Green = 2 hazards
Blue = 3 hazards

Note: Risk hotspots combine areas of significant ecological hazards with those of human vulnerability. This map shows cumulative hotspots of humanitarian risk for three climate-related hazards: floods, cyclones, and droughts. Areas at risk for more than one type of hazard are considered to be of most concern for humanitarian actors.

Source: Ehrhart et al. (2008).

Countries Vulnerable to Rising Sea Levels and Extreme Weather Events

Southeast Asia:

	Rise in Sea Level	Floods	Droughts	Storms
Cambodia		X	X	
Indonesia	X	X	X	X
Lao People's Democratic Republic		X	X	X
Malaysia	X	X		X
Myanmar	X	X		X
Philippines	X	X	X	X
Singapore	X			X
Thailand	X	X	X	X
Viet Nam	X	X	X	X

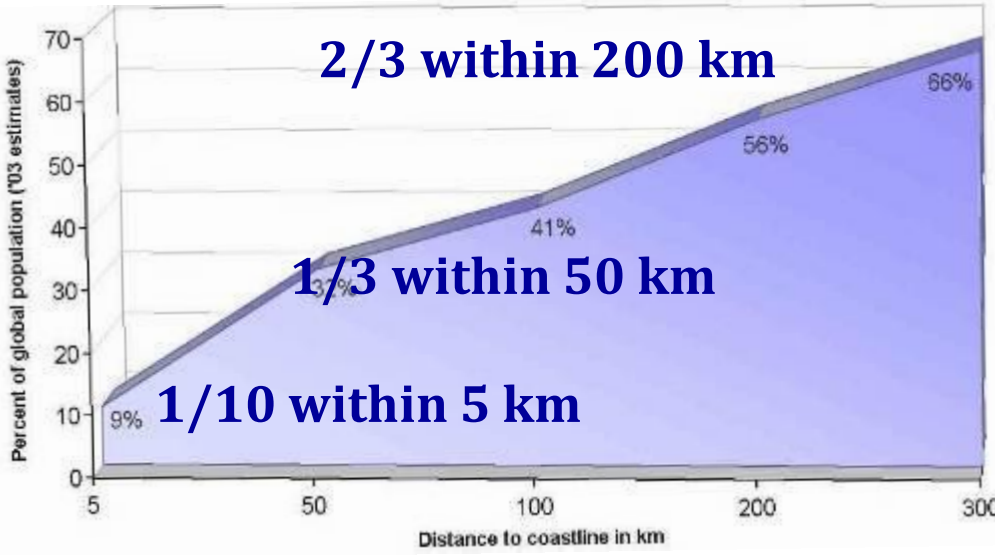
Note: Disasters were taken from EM-DAT lists and represent the top ten natural disasters by numbers of people affected, killed, and the costs of economic damage for the period 1900–2008. The "X" indicates that the country is vulnerable to the indicated climate event.

Source: EM-DAT 2009.

CONCENTRATION OF POPULATION IN COASTAL AREAS

The earth at night

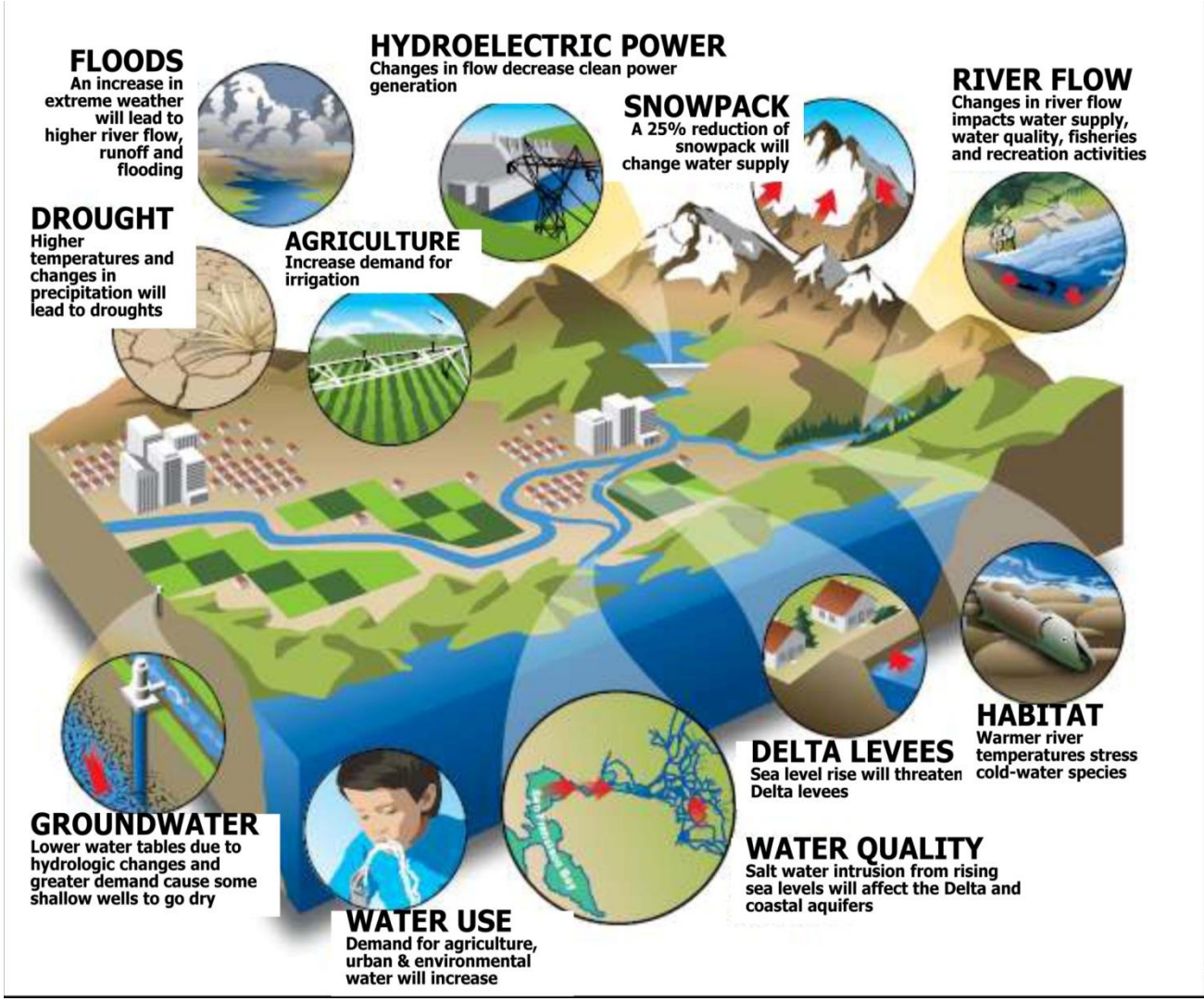
Population in coastal areas (2003)



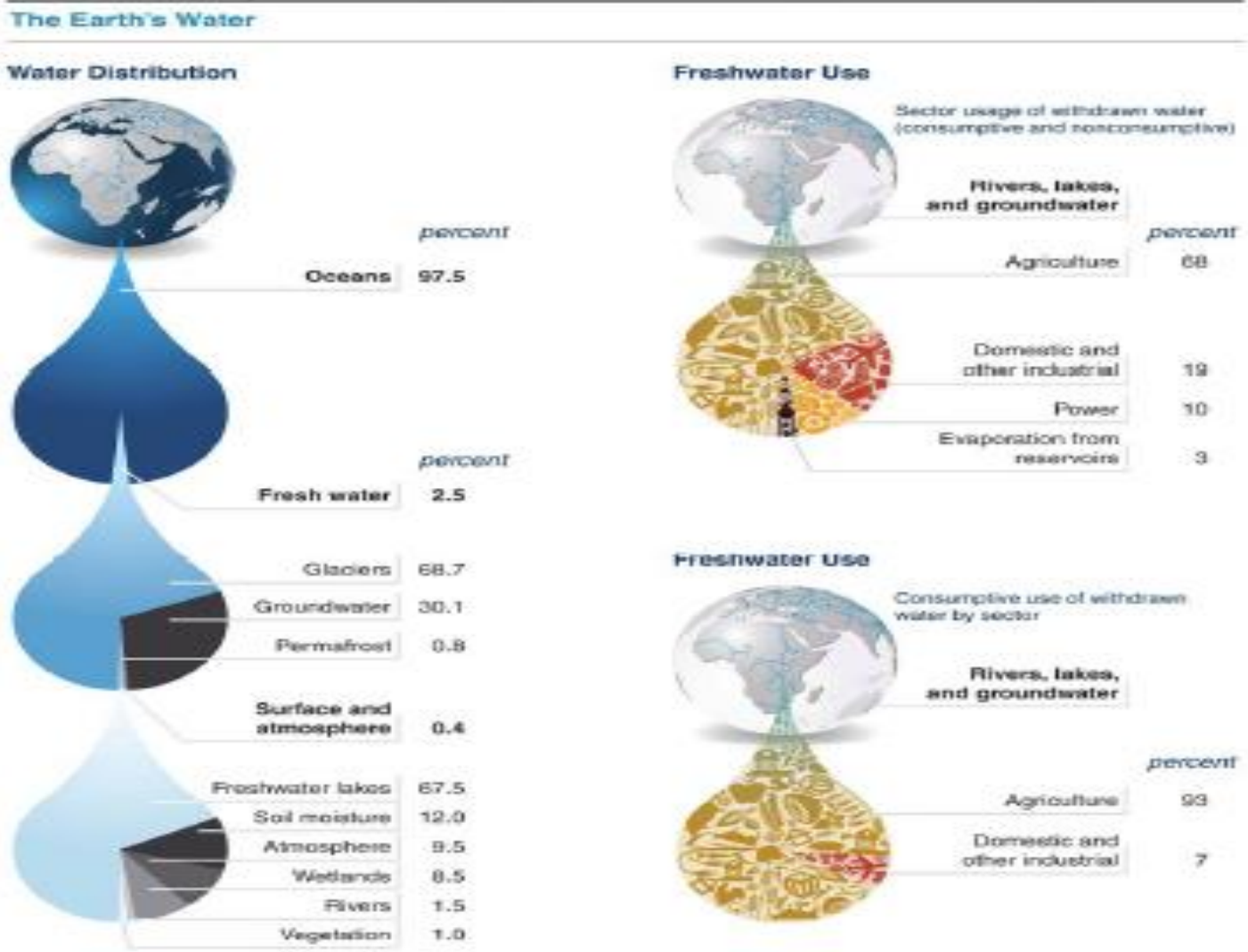
Value concentration along coasts

Climate Change Impact on Water - a web of interconnected uses and values

- Climate change affects all facets of the system and their interactions
- Some uses compete with one another
- Others are complementary
- Pervasive externalities exist



WATER In Perspective

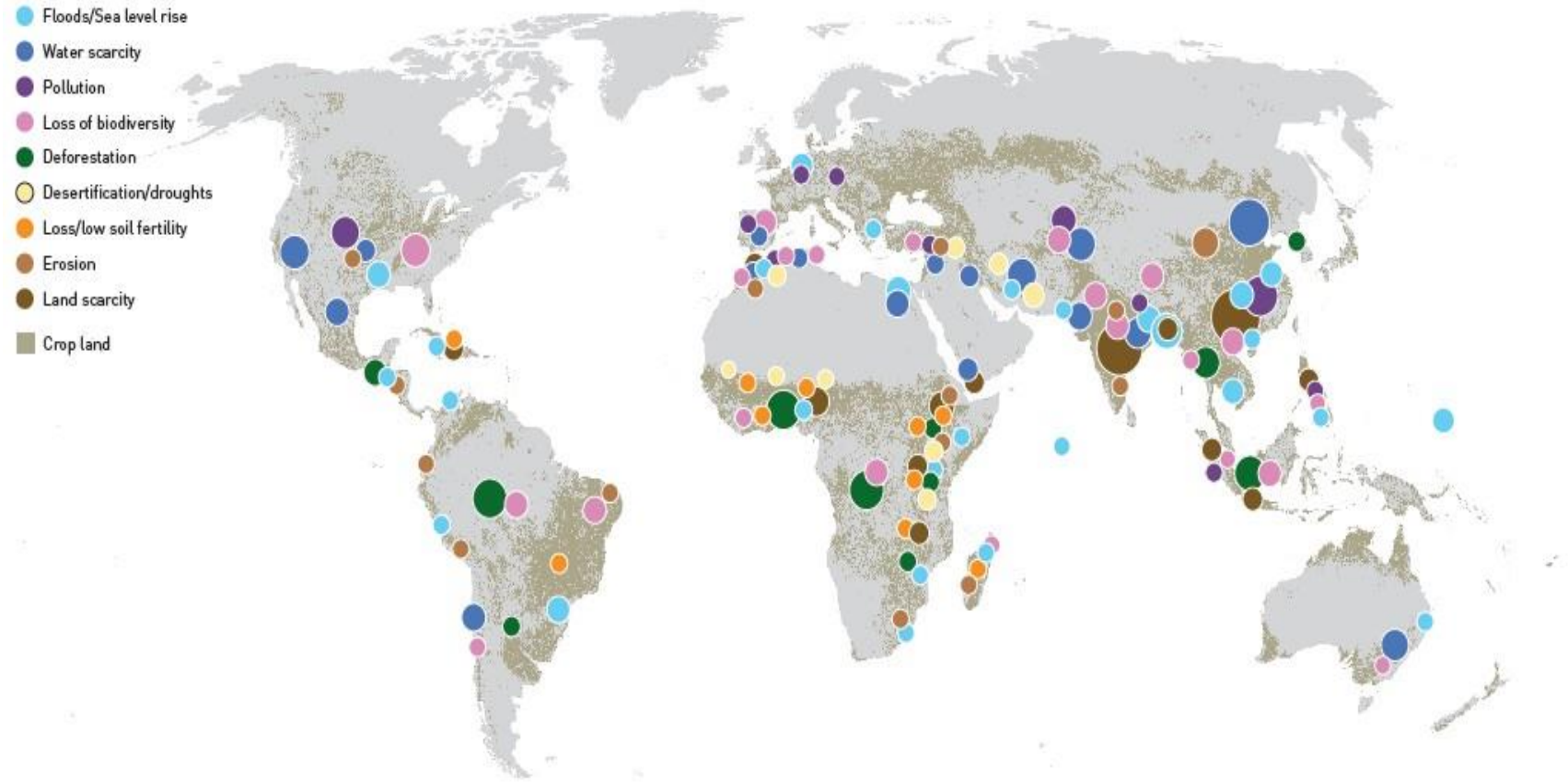


ASIDE: The Hindu Kush Himalayas – Water Towers of Asia


2009
Photography: David Breashears, GlacierWorks

Overview of Water and Food Security

FIGURE 3.3: GLOBAL DISTRIBUTION OF RISKS ASSOCIATED WITH MAIN AGRICULTURAL PRODUCTION SYSTEMS – A SCHEMATIC OVERVIEW



Source: This study

Geographical hot spots for water-food nexus
(Source: FAO, 2011)

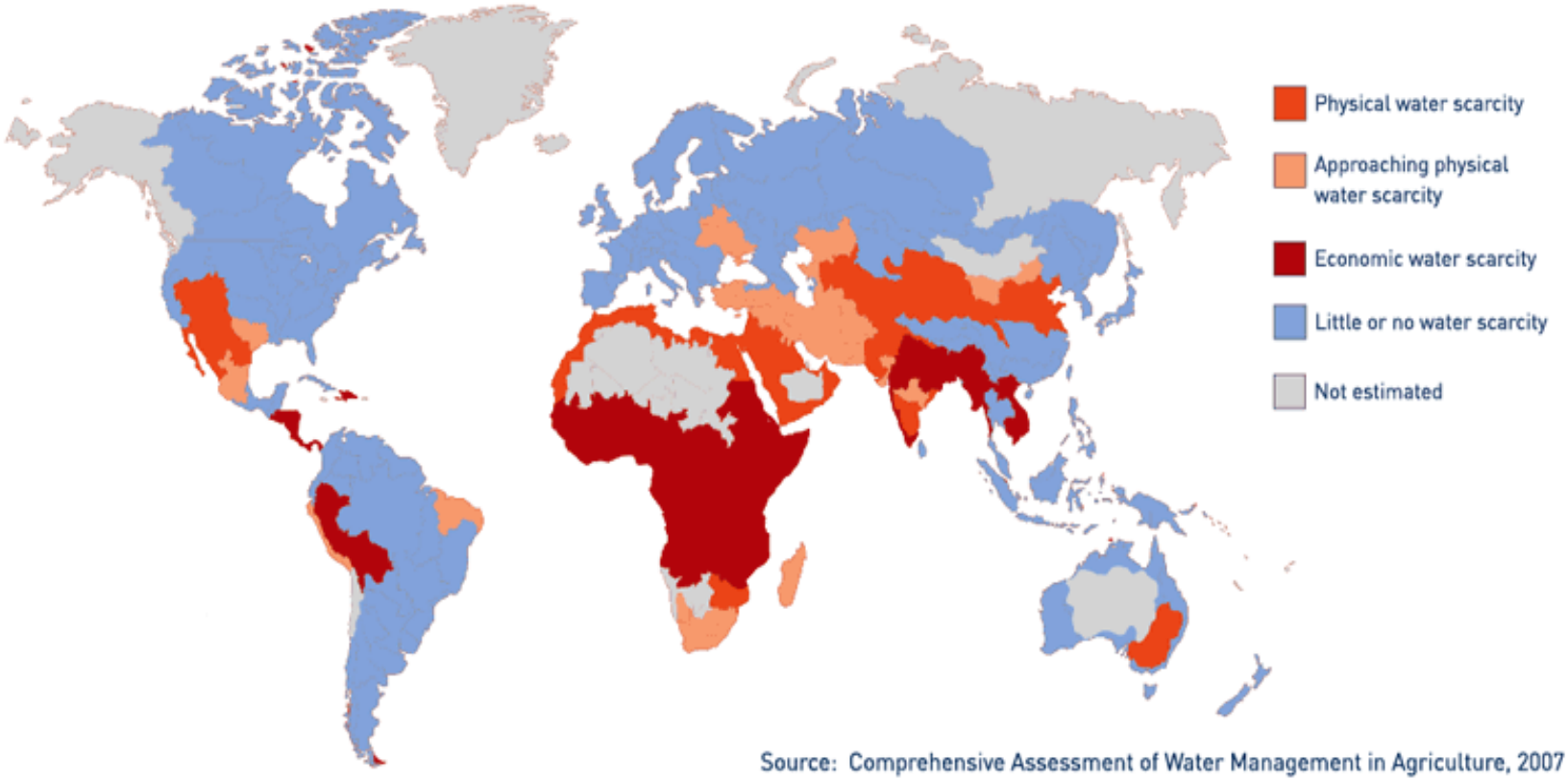
AREAS OF PHYSICAL AND ECONOMIC WATER SCARCITY

Physical water scarcity water resources development is approaching or has exceeded sustainable limits). More than 75% of the river flows are withdrawn for agriculture, industry, and domestic purposes (accounting for recycling of return flows). This definition—relating water availability to water demand—implies that dry areas are not necessarily water scarce.

Approaching physical water scarcity. More than 60% of river flows are withdrawn. These basins will experience physical water scarcity in the near future.

Economic water scarcity (human, institutional, and financial capital limit access to water even though water in nature is available locally to meet human demands). Water resources are abundant relative to water use, with less than 25% of water from rivers withdrawn for human purposes, but malnutrition exists.

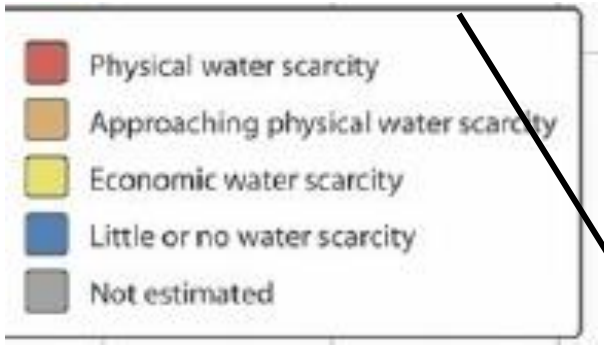
Little or no water scarcity. Abundant water resources relative to use, with less than 25% of water from rivers withdrawn for human purposes.



Source: Comprehensive Assessment of Water Management in Agriculture, 2007

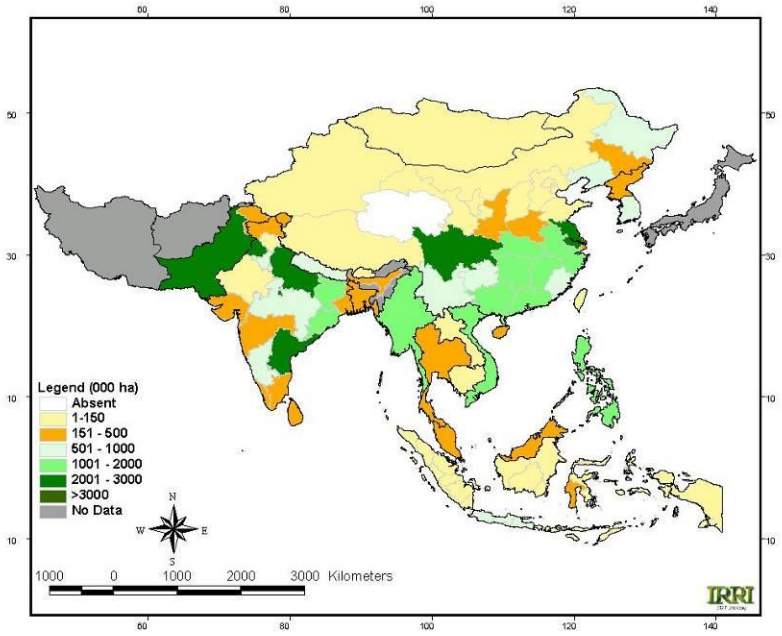
EXPECTED INCREASING WATER SCARCITY

Comprehensive Assessment Water Management in Agriculture 2007



2025: 15-20 million ha irrigated rice will suffer some water scarcity

Asia WS irrigated rice



IRRI Data base (GIS laboratory)

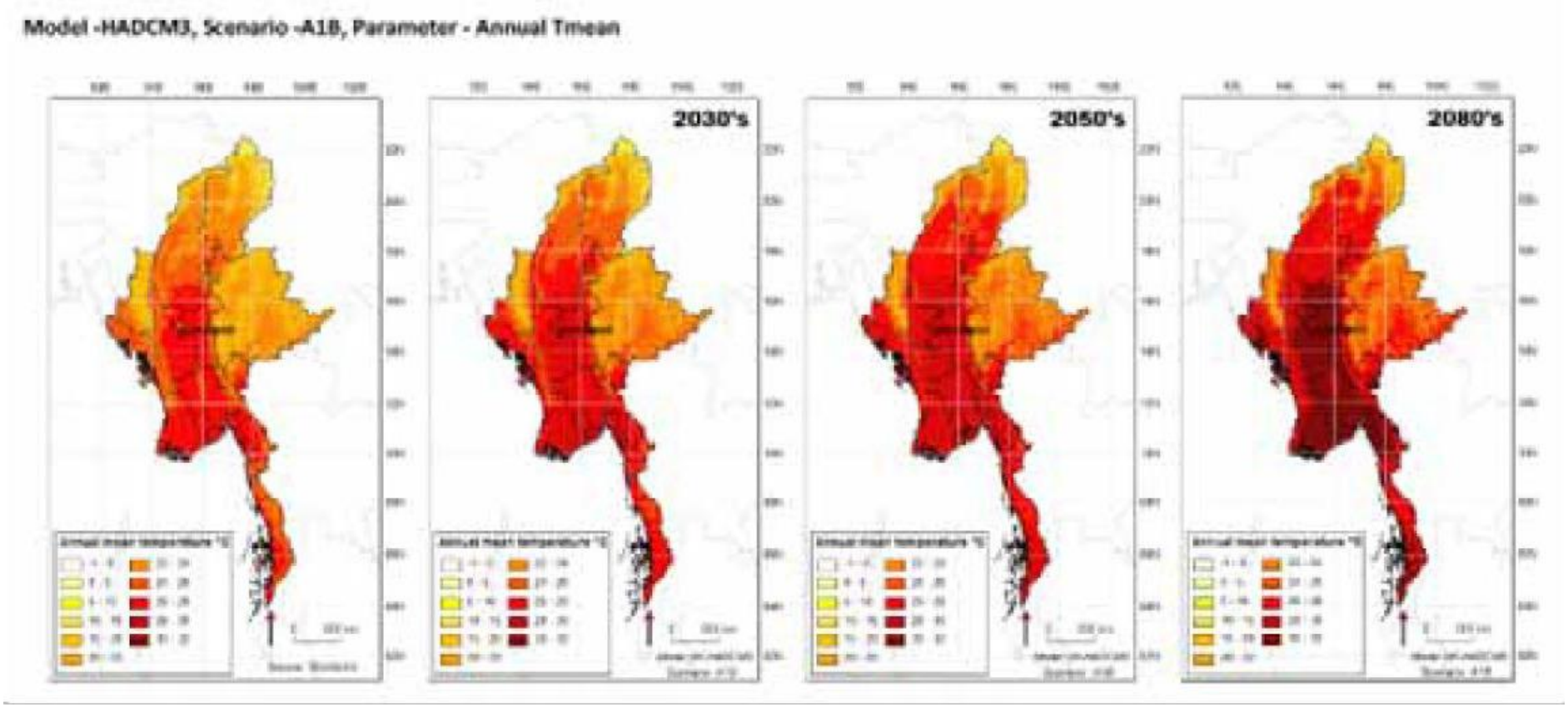
Major disasters in Myanmar triggered by hydro-meteorological hazards from 1936 - 2011

Disaster	Date	No. Total Affected
Storm	2-May-2008	2,420,000
Flood	15-Jul-1974	1,400,000
Storm	23-Oct-1965	500,000
Flood	13-Jul-1991	359,976
Storm	22-Oct-2010	260,049
Flood	Jun-1976	200,000
Storm	21-Apr-1936	150,000
Mass Movement Wet	17-Jun-2010	145,000
Flood	21-Aug-1997	137,418
Storm	17-May-1978	132,000

Source: EM-DAT: The OFDA/CRED International Disaster Database (www.em-dat.net - Université Catholique de Louvain, Brussels, Belgium)

Based on historical records, only about 6.4% (ADPC, 2009) of the cyclones that form in the Bay of Bengal reach or cross the Myanmar coast. Evidences of changes in the long-term cyclone frequencies are unclear at present, but any increase in frequency of cyclones could pose a substantial climate risk.

Observed (first from left) and Projected of annual temperatures for three future time-slices (2030s, 2050s, and 2080s), for SRES A1B emission scenario showing increase in temperatures (Data source: CIAT, 2011)

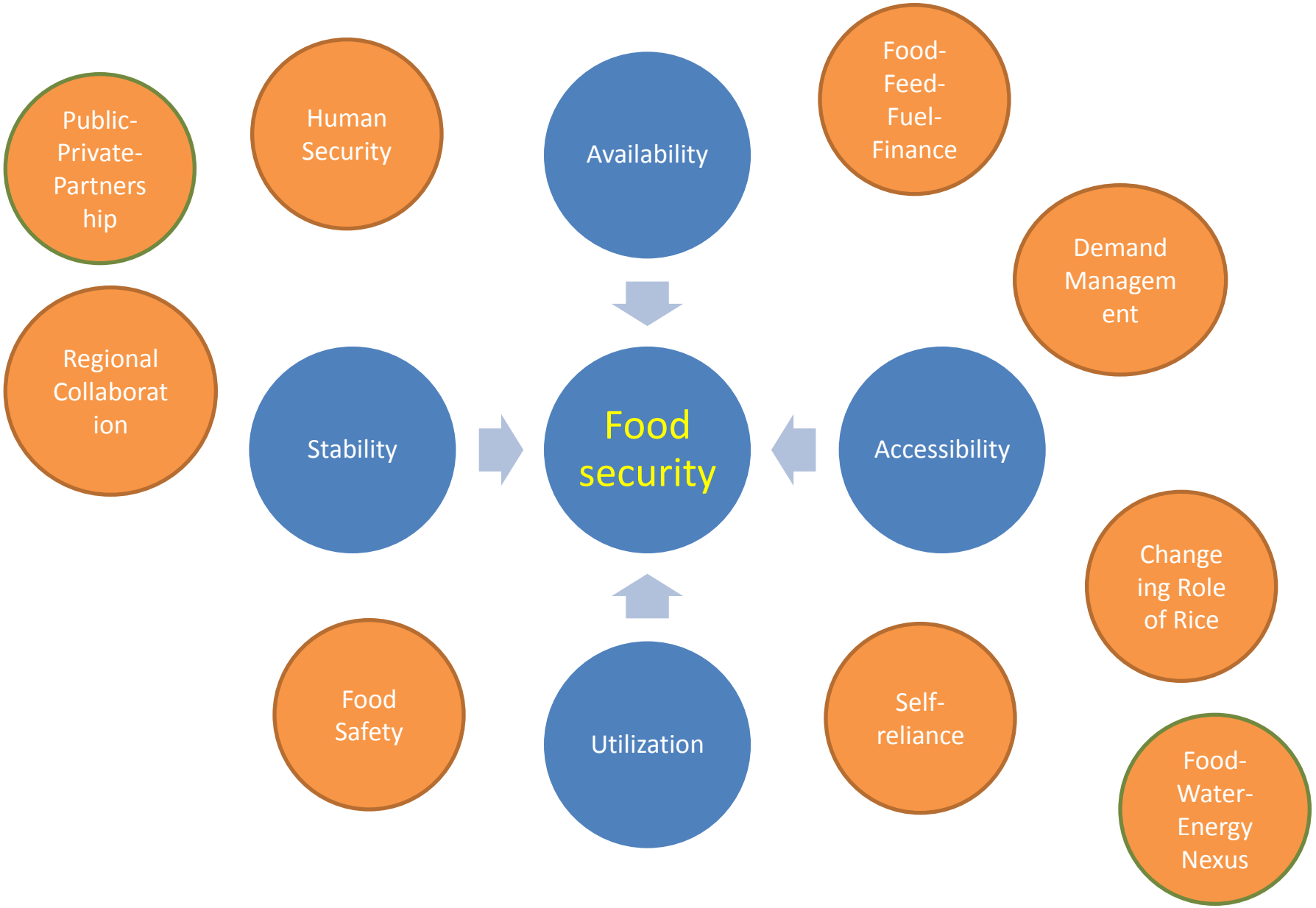


FOOD SECURITY:

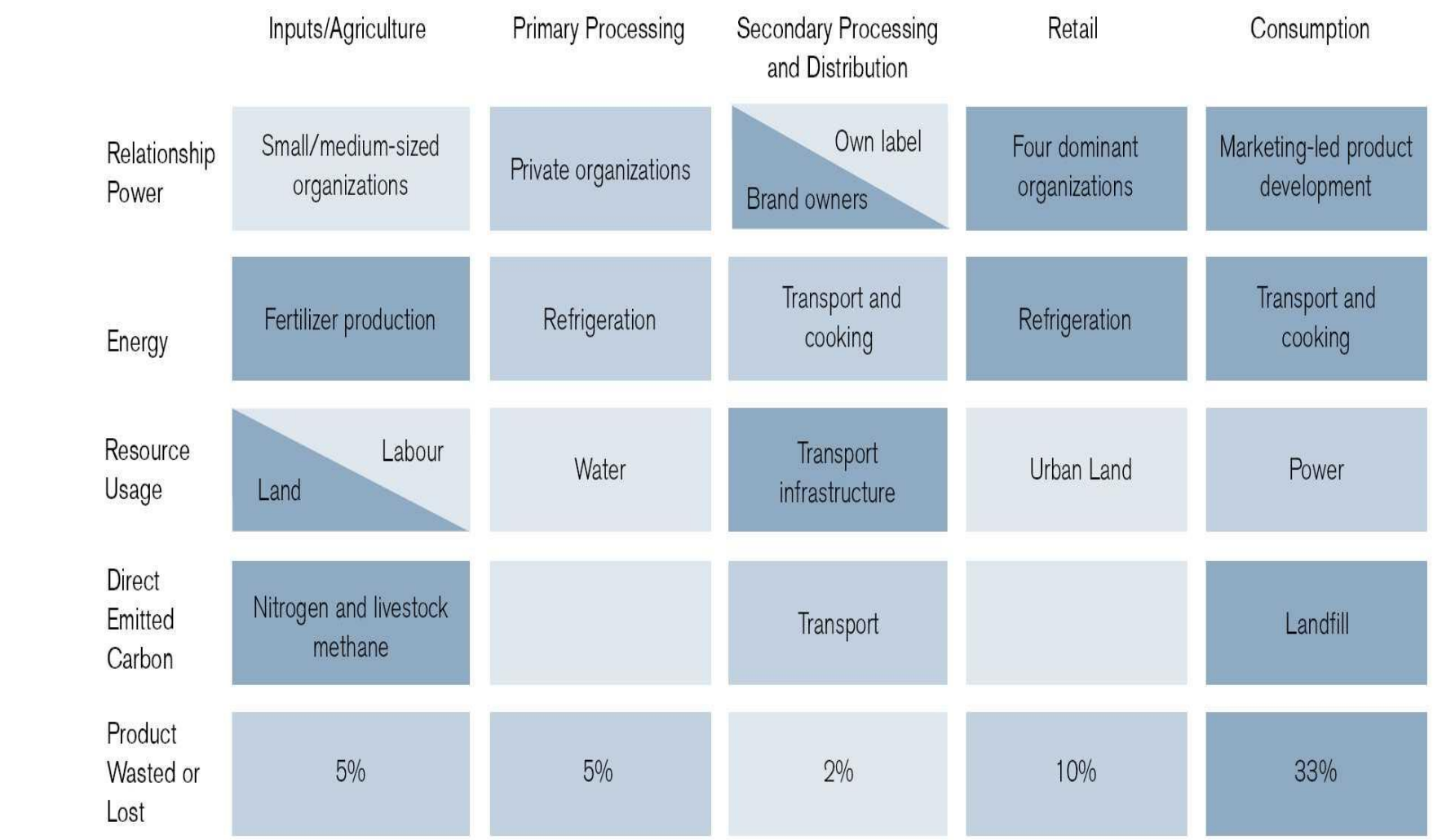
"…When **all people**, at **all times**, have **physical, social, and economic access to sufficient, safe, and nutritious food** that meets their **dietary needs and food preferences** for an **active and healthy life**"

Source FAO, 1996

FOOD SECURITY: FROM TRADITIONAL TO NEW DIMENSIONS



FOOD LOSES & RESOURCE UTILIZATION ALONG SUPPLY CHAIN



- This is an indicative interpretation of the UK supply network. Waste figures based on work undertaken by the Food Process innovation Unit at Cardiff University on behalf of the Food Chain Centre. WRAP estimates have been used for consumer waste figures. Available online at:
- http://www.wrap.org.uk/wrap_corporate/news/food_waste_set_to.html (15.10.08).

OTHER CONSIDERATIONS:

- FAO (2009) – future production growth – 10:20:70 rule (10% area expansion, 20% cropping intensity increases, BUT 70% from Technology, Innovation and Policy)
- Ambler-Edwards et al. (2009) –Future food production/Supply systems going to be more uncertain and prices more volatile; food wastage along supply chain – highest at consumer level
- Need to increase productivity along entire supply chain (not only at production level – where land, water, labour and capital are traditional sources of productivity increases) within context of structural transformation
- 'More with less', 'More Crop per Drop', Ecosystem Engineering Vs Genetic Engineering
- Hunger for Land and Thirst for Water
- Cross-border investments – can help develop comprehensive supply chains and trading networks, transfer of technology, export platforms – ASEAN as a common market and production base – AEC - ASEAN 2015; ADBI's ASEAN 2030 Study – 'Towards a Resilient, Inclusive, Competitive, and Harmonious (RICH) ASEAN'

FOOD SECURITY – PRESSURES, ISSUES AND RESPONSES

Pressures

- Population growth
- Climate Change
- Urbanization
- Globalization
- Increasing Demand
- Fragmented Governance

Food Security

Responses

- Integrated Management Frameworks
- Policy coherence
- Institutional Coordination
- Technology Fixes
- Market Mechanisms

Issues

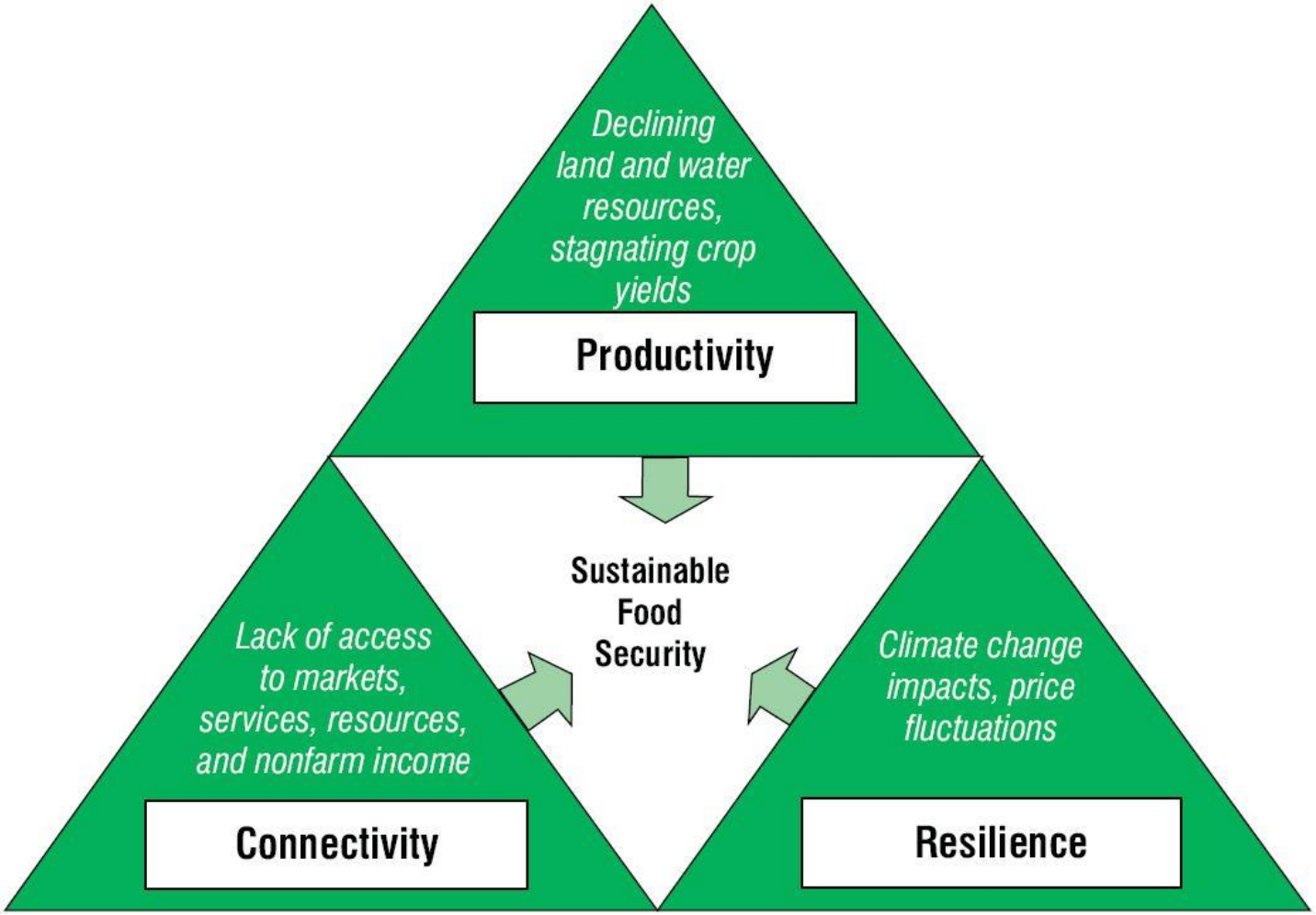
Trade-offs	Energy, Food and Water Security	Interlinkages	Accessibility
Water-energy nexus	Biofuels	Institutional Complexity	Systems-thinking
Price Volatility	Resource Scarcity	Trade and benefits	Productivity
Consequences	Productivity	Justice	Efficiency
Agriculture	Virtual-Water	Land Use	Availability
Demand	Distribution	Food Production	Green Economy

FOOD SECURITY PRESSURES

FOOD SECURITY ISSUES

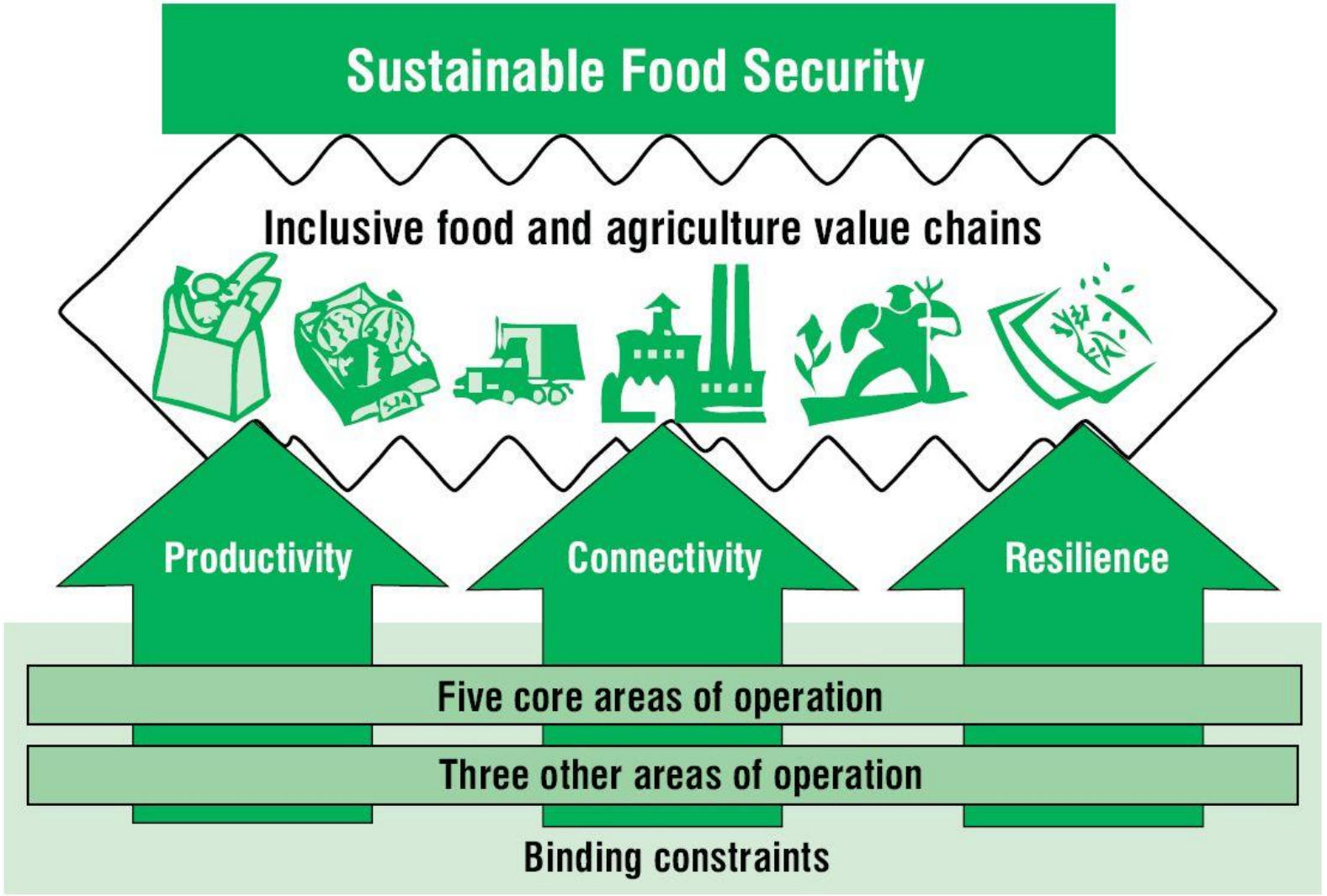
FOOD SECURITY RESPONSES

Three Dimensions of Sustainable Food Security *a la ADB*



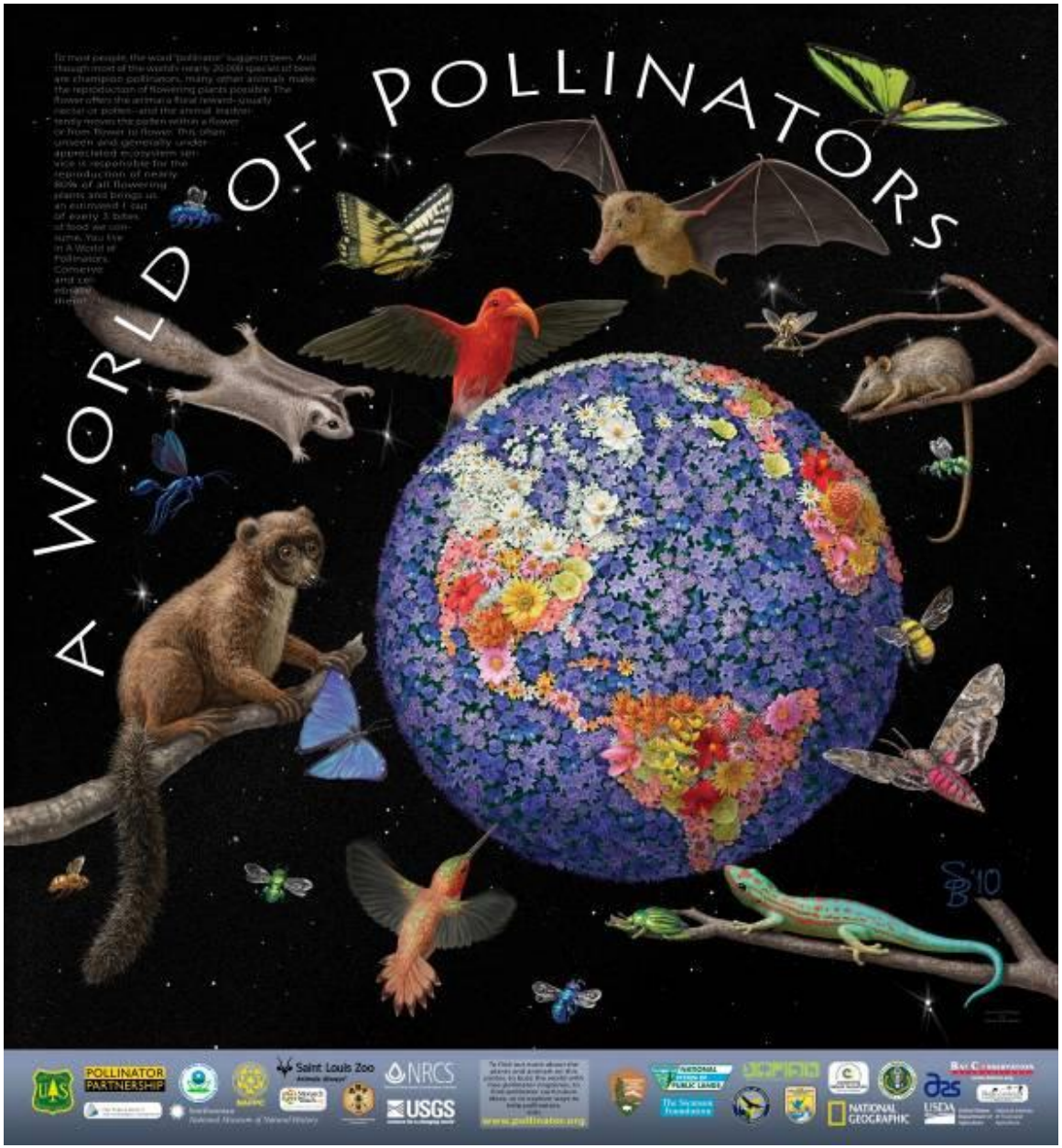
Source: Regional and Sustainable Development Department–Agriculture, Rural Development and Food Security Unit.

Inclusive Food and Agriculture Value Chain for Sustainable Food Security



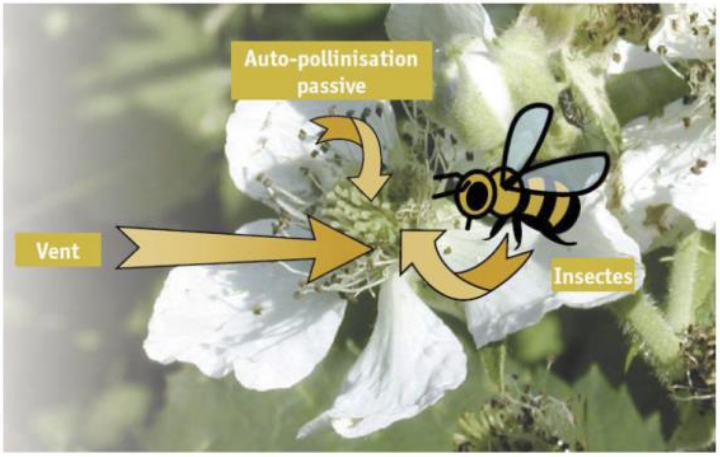
Source: Regional and Sustainable Development Department–Agriculture, Rural Development and Food Security Unit.

Indirect Impact of Climate Change: Pollination



The importance of pollinators

- 90 major crops (good for 35% world food production) depend on pollinators
- Key nutrients: 90-100% from pollinator mediated crops (vit C, antioxidants, lycopene, β-tocopherol, vit A and folic acid
- Value in Europe: 14.2 billion Euro / yr
- 80% of all flowering plants on earth depends on 25000 bee species for reproduction and evolution



Some crops pollinated by bees[3]

Alfalfa
Apple
Almond
Artichoke
Asparagus
Blackberry
Blueberry
Broccoli
Brussels sprouts
Cabbage
Cacao
Cantaloupe
Carrot
Cashew
Cauliflower
Celery
Cherry
Citrus
Dill
Eggplant/ Aubergine
Fennel
Garlic
Kale
Kola nut
Leek
Lychee
Macadamia
Mango
Mustard
Nutmeg
Onion
Passion fruit
Peach
Pear
Plum
Pumpkin
Raspberry
Sapote
Squash
Sunflower
Tangerine
Tea
Watermelon

The value of bees and pollination to agriculture

- Produce important food
- Larger fruits
- More tasty fruits
- More vital plants (no inbreeding)
- Seed production

Drivers of change

Habitat loss, fragmentation & degradation

Pathogens

Agro-chemicals

Interactions

Invasives

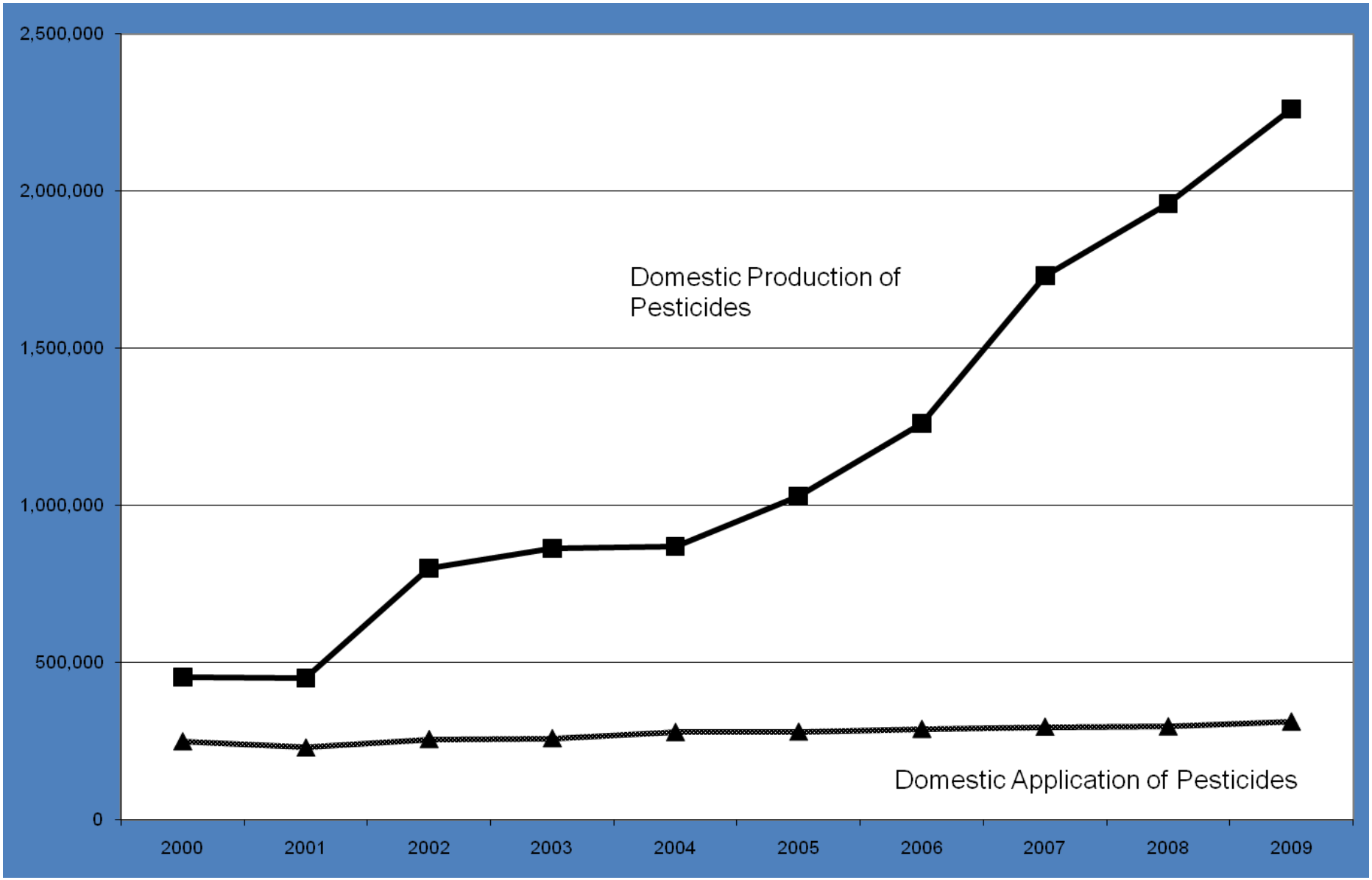
Climate change

PESTICIDES UTILIZED FOR SELECTED CROPS

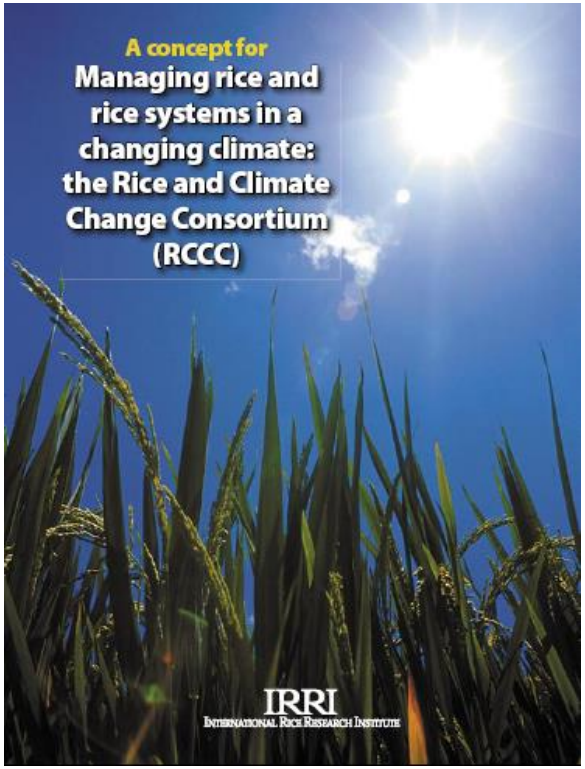
S.N.	Crop	Unit	1990-91	1995-96	2000-01	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11 p.a
1	Paddy	pound	105662	127670	-	8382	110	27424	1331813	1342174	1352514	1359424
		gallon	20232	71568	8388	15688	3653	15532	366830	413781	438680	600369
2	Maize	pound	28442	1496	2579	-	-	14062	6482	6548	6614	6666
		gallon	-	2364	521	555	607	550	3607	3651	3685	25976
3	Sesamum	pound	26195	990	-	-	-	-	48105	48414	48722	49060
		gallon	1460	3682	240	333	289	330	7581	7627	7678	30029
4	Pulses	pound	20172	10890	-	-	490	375	6217	6283	6371	1986446
		gallon	1549	12936	1242	11816	2346	12600	98392	132640	167086	547644
5	Sugarcane	pound	27665	770	2185	-	126	-	238	1087	2483	957
		gallon	716	752	74	12	72	3	7	-	69	269
6	Fruits and Vegetables	pound	6750	9123	9198	-	1819	-	58687	60451	61840	723624
		gallon	962	11748	192	555	143	550	15146	37650	15971	16600
7	Others	pound	93578	41499	25503	11955	5627	3958	133177	136744	141152	1245660
		gallon	18981	63818	6866	7829	4456	3849	26438	26585	26953	72786
	TOTAL	pound	308464	192438	39465	20337	8172	45819	1584719	1601701	1619696	5371837
		gallon	43900	166868	17523	36788	11566	33414	518001	621934	660122	1293673

Sources : 1. Department of Agriculture.
2. Department of Industrial Crops Development.

ASIDE: China's Pesticide Production (metric tons a.i.) 2000 – 2009. [source: ICAMA]



CLIMATE AND RICE

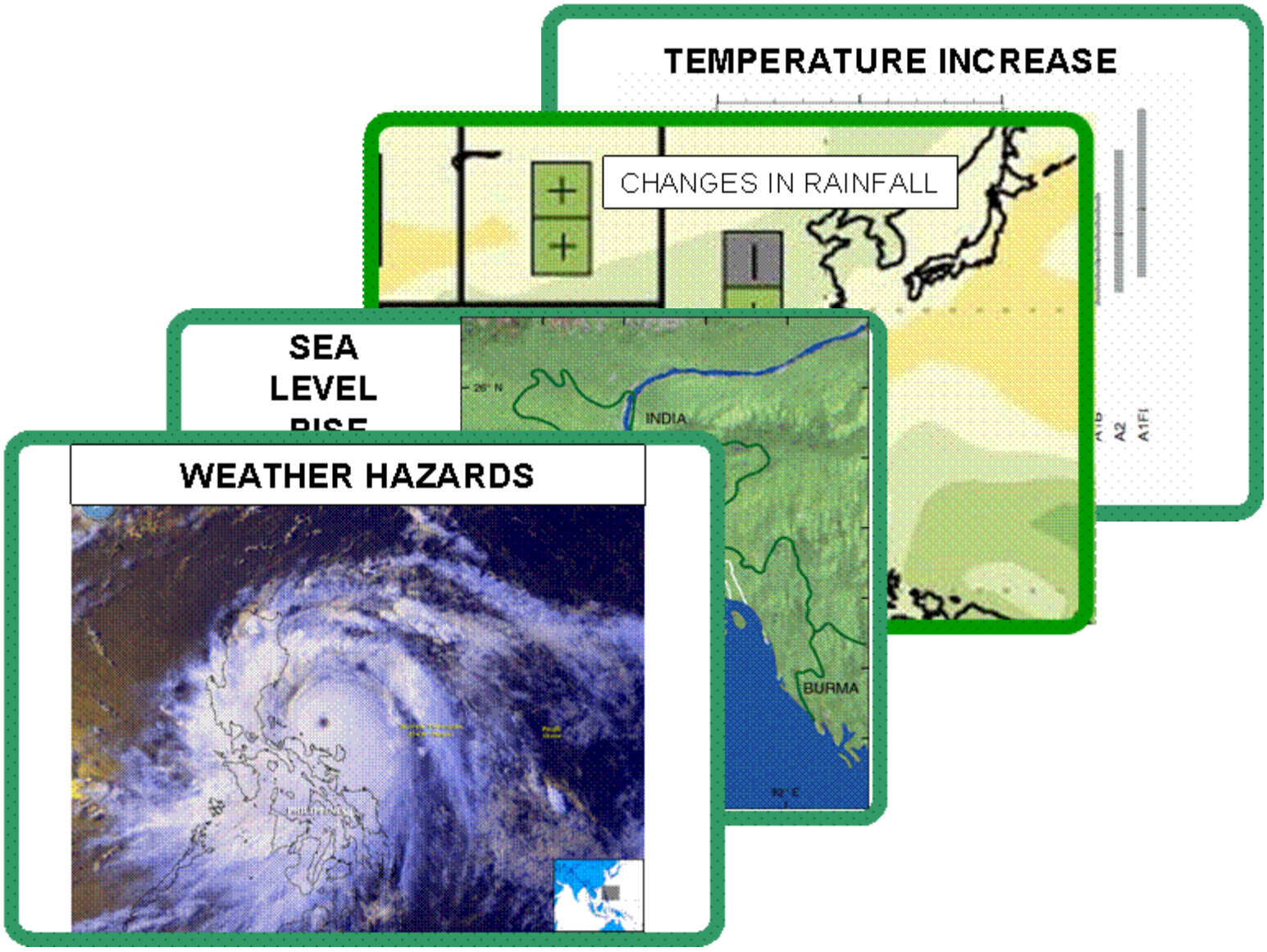


- Global climate change will affect rice farmers for decades to come.
  - *–Rising temperatures can negatively affect yield. (+1°C = 10% yield drop!)*
  - *–Extreme environmental events can increase frequency of drought, flooding, and sea water intrusion.*
- Changing rice production systems will change GHG emissions from rice fields

The occurrence, distribution and severity of rice pests will almost certainly change with climate change.

IN NEED OF A DOUBLY GREEN REVOLUTION!

CLIMATE CHANGE EFFECTS IN ASIA WILL HIT RICE PRODUCTION HARD



WATER SAVING OPTIONS FOR RICE – More Crop per Drop

	Conventional	Safe AWD	Dry seeded	Aerobic rice
Land prep	Puddled	Puddled	Not puddled	Not puddled
Establishment	Transplant; wet seed	Transplant; wet seed	Dry seed	Dry seed
Water	Flooded; saturated	Saturated; mild drying	Early: drained; then saturated	Drained
Soil aeration	Anaerobic	Anaerobic; mild drying	Aerobic; then anaerobic	Aerobic

Conventional

Safe Alternate Wet & Dry (AWD)

Dry seeded

Aerobic rice

MAKING RICE CLIMATE-READY – Genetic Engineering

BUT: NOTE THE CHANGING ROLE OF RICE

- Rice increasingly food of the poor and rural segment – impacted most by volatility as well as 'high stable' (incentive) prices as mechanism to achieve food security at macro level and high level of self-sufficiency
- Urbanization lowers per capita consumption of rice – variety of substitutes – changing diets
- Better food supply chains/systems – rural h/h can afford to be < self-sufficient in food production and consumption, especially rice
- Relatedly, modern supply chains/supermarkets have linked and changed interactions between farmers, markets and consumers
- Share of total calories from rice declining, food budget share of rice declining even faster < 20% (higher for poor); > 80% on other food, including processed & convenience
- Consequently, share of rice in agricultural output and in overall economy also declining rapidly

Unfortunately, current food security debate still mired in the mindsets of the 1970s .. rice-centric, production-centric, public sector-centric, nation-centric (self-sufficiency), etc… we can and should do better

POSER: ELEPHANT IN THE ROOM FOR WATER-FOOD-ENERGY SECURITY

The SEA!

- **70% Earth's surface, 97% total water**
- **Growth medium for animals and plant-life – fish, crustaceans, mollusks – sea weed, algae (especially spirulina)**
- **Wave and geothermal – for energy**
- **Desalination using microbes**
- **Futurist group**
- **'Blue Economy' (Expo 2012 in Yeosu, Korea)**

Sea – the next frontier?

MYANMAR: Climate Change – Threat & Opportunity

Largest continental ASEAN member country – 67.6 mil ha – 1,900 km coastline

A. Lower Myanmar

1.Delta region

2.Coastal region

B. Upper Myanmar

3.Central dry zone region

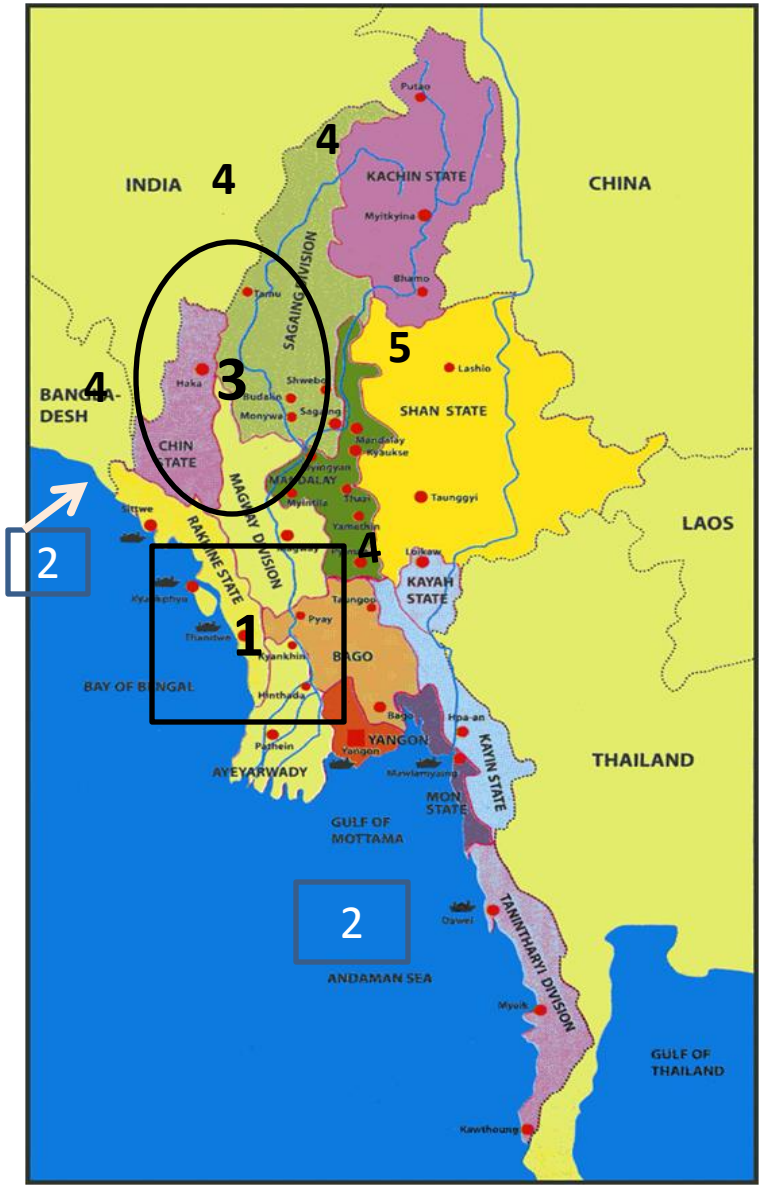
4.Mountainous region

5. Shan Plateau

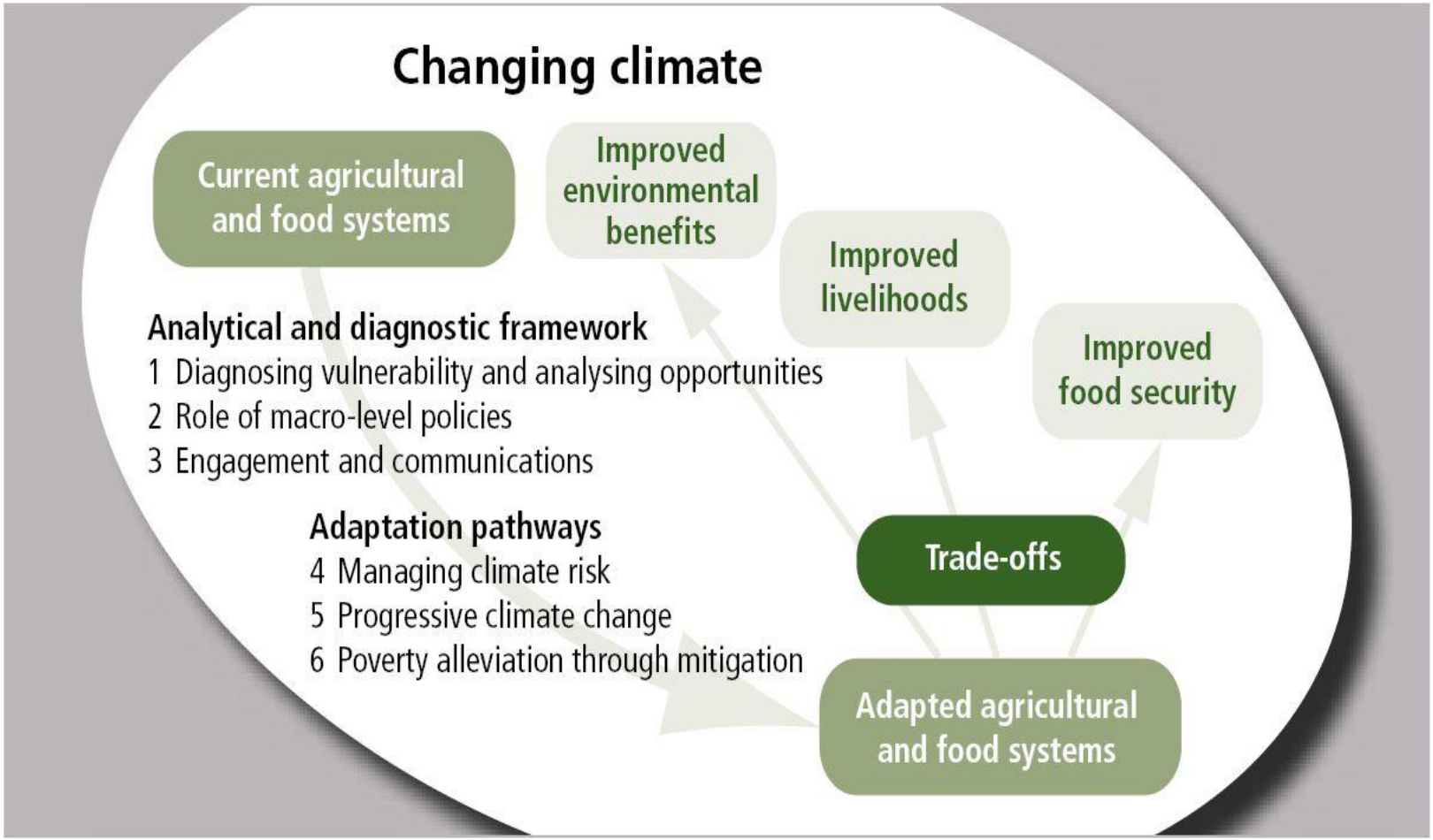
Wide ranging agro-climatic zones and abundant water resources (3 of 4 major rivers originate within own border) – can grow crops ranging from tropical to moderate temperate – rice (50% cropped area), pulses (20%), oil seeds (15%), maize, cotton, sugar cane, rubber, vegetables, tropical fruits – also coffee and tea

Also Livestock and Fisheries

Virgin and fallow land – 5.67 mil ha plus Forest land – 33.6 mil ha – Myanmar's reputation of having significant land frontier

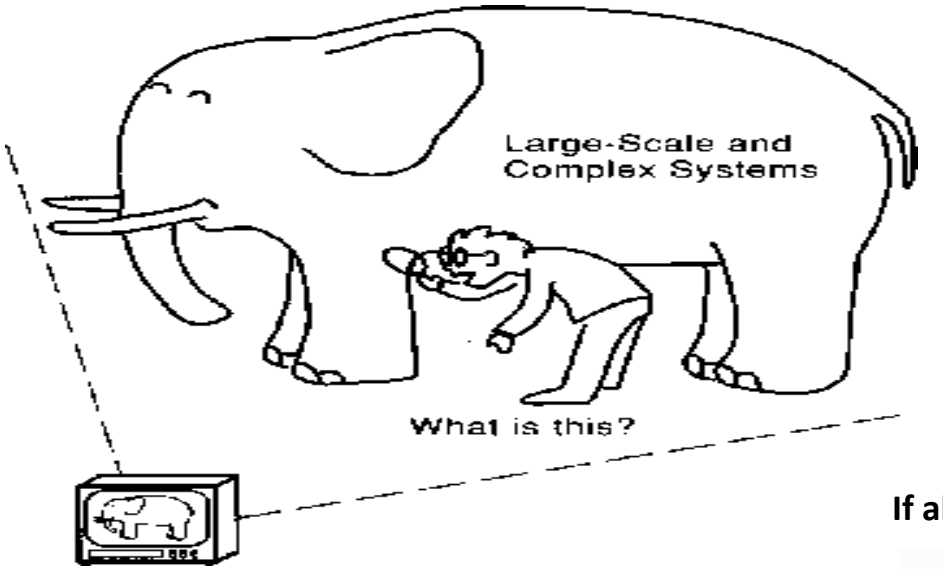


Way Forward:



The Climate Change, Agriculture and Food Security(CCAFS) Challenge Program. Research under the six themes will help current agricultural and food systems adapt to a changing climate, while managing trade-offs between food security, livelihood and environmental goals.

WE ARE DEALING WITH… ‘WICKED PROBLEMS’



Synoptic View

If all you have is a hammer, then everything looks like a nail!

Stakeholders have different perspectives of the best solution to the problem & will continue to adhere strongly to them

Requires Issues Based Information System & more participatory Public and Policy Dialogue

CONCLUSION:

- Climate Change and Food Security – increasingly more complex, multi-scale and interdependent – so, need to continuously (re)frame problems well

- Need trans-disciplinary, networked solutions factoring in supply chains and trading networks and new dimensions rather than isolated solutions aimed at just one problem, issue or even sector in an increasingly interlinked food-water-energy security nexus that is increasingly private sector driven - Public Vs Private goods dichotomy increasingly blurred

- Guided by the new dynamics in climate change and food security, we should be wary of being trapped in the mindset of the 1970s - ignoring realities & opportunities of the 2010s when formulating food security policy and strategies – rice-centric, production-centric, public sector-centric, and nation-centric

- Role of the Sea - the next frontier for food (and water and energy) security? – 'Blue Economy' (Expo 2012 in Yeosu, Korea)

CONCLUSION (Cont'd) :

- With increasing interconnectivity/interdependence in Climate Change and Food Security – need to view as food ecosystem – increasingly develop and apply systems and trans-disciplinary approach,

- Interesting work is being conducted incorporating 'complex theory' – involving systems approach innovatively combining hard and soft systems analysis, coupled with systems to manage information/knowledge for 'wicked' problems

- New dimensions and dynamics of climate change and food security requires an urgent rethink of food security and climate change and the development of a new framework for regional/national/policy dialogue in order to get the basics and balance right, ultimately targeted at inclusive and sustainable growth at all levels.

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