Global Food Production

Global Food Security, Climate Change and Development

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Food Security, Climate Change and Development: An Overview

- Understanding global food security: conceptual overview
- Multiple challenges facing global food security
- Implications: how this relates to human health
- Adaptation to climate change and financing
- Case Study: focus on Bangladesh

Defining Food Security

- FAO UN: *"a situation that exists 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"*

Four main components of this:

- Availability

- Access

- Utilization

- Stability

- Climate Change/Climate Variability: Can make all four components worse

(Schmidhuber & Tubiello, 2007)

- Amaryta Sen: Famine and **Entitlements** / **Poverty** - Access to food

Global Food Security: Background

By 2030, the world will need…

- 50% more food
- 40% more available fresh water
- 50% more low carbon energy

By 2050…

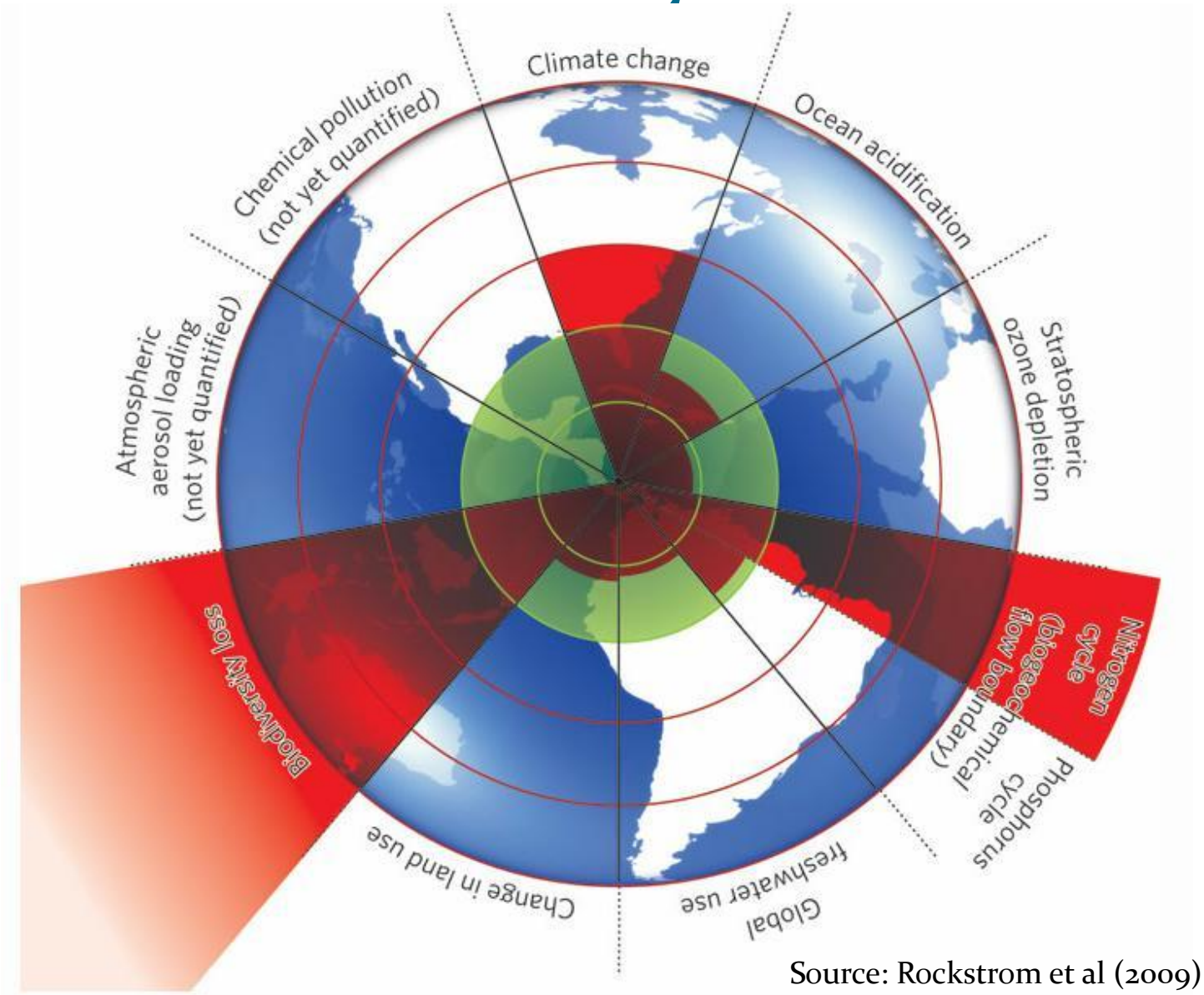
- 70-100% more food

-"a perfect storm" (Prof. Beddington)

Projected world population: 9 Billion in 2050

- Already 2 billion people suffer from malnutrition and food insecurity today (Source: WHO) while another billion over-consume

Global Planetary Boundaries

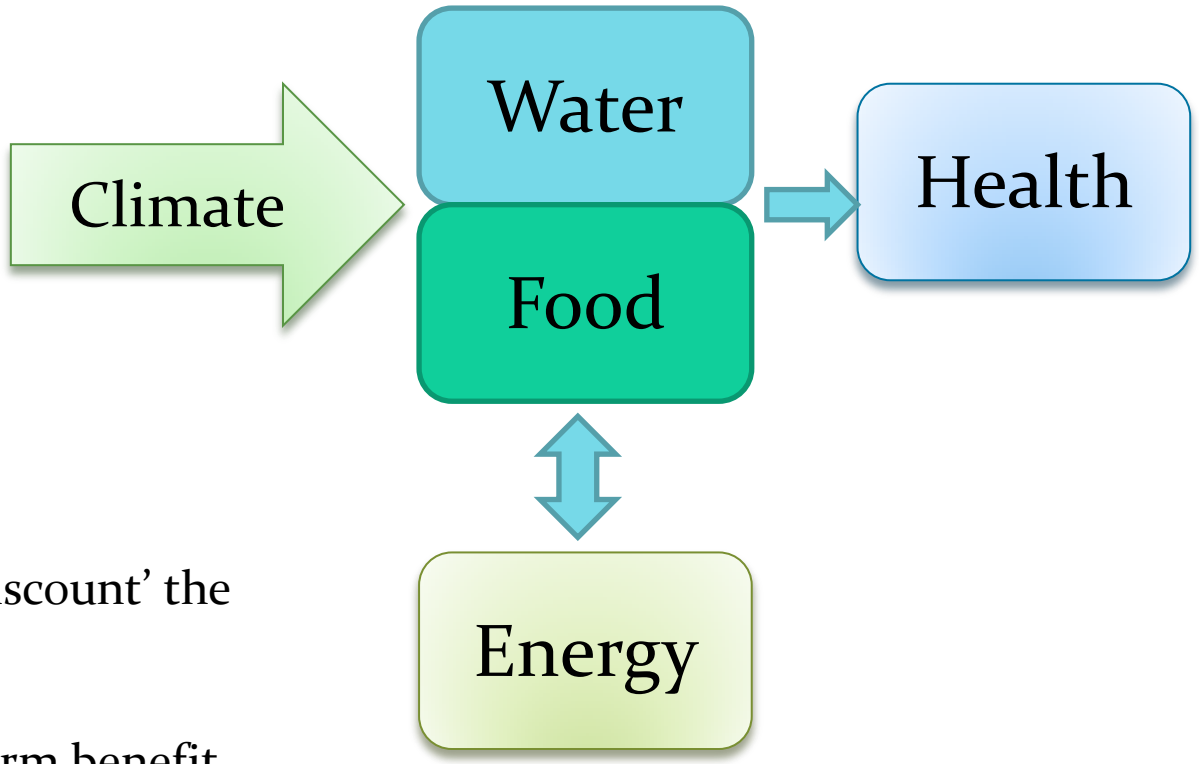


Source: Rockstrom et al (2009)

Systems Thinking

'Wicked problems' – complex interdependencies of systems

- No definitive solution
- Climate change as a 'super wicked' problem
- Psychological tendency to 'discount' the future
- Short-term costs and long-term benefit



Sources: Levin (2009) Lazarus (2009)

Emerging Global Challenges: Food

Supply end:

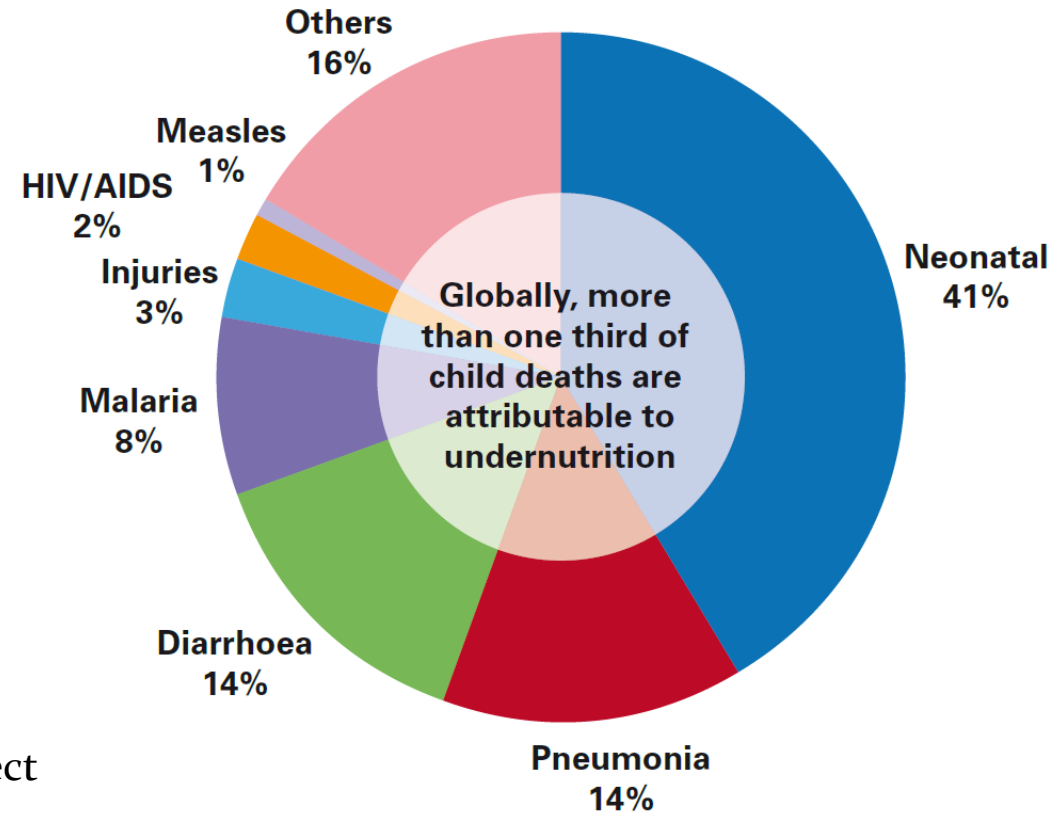
- Impact of **Rising Energy and Oil Costs** on Agriculture? I.e. energy for machinery, processes, transportation of goods, fertilisers and pesticides.
- **Water Scarcity:** 70 percent of global water is used for **irrigation** (Source: UNwater)
- **Peak Phosphate** (used for fertiliser) will occur in the next 30 years (although the exact timing is disputed) and may last only another 50-100 years (Cordell et al, 2009). Phosphate can also be found in excreta/crop residues.

Demand end:

- Demand and population pressure. Higher food prices trigger **social unrest**, e.g 2008 food crisis sparked a wave of civil unrest
- **Food Price increases** put pressure on the poorest + on malnutrition. Impact of global **biofuel production**.

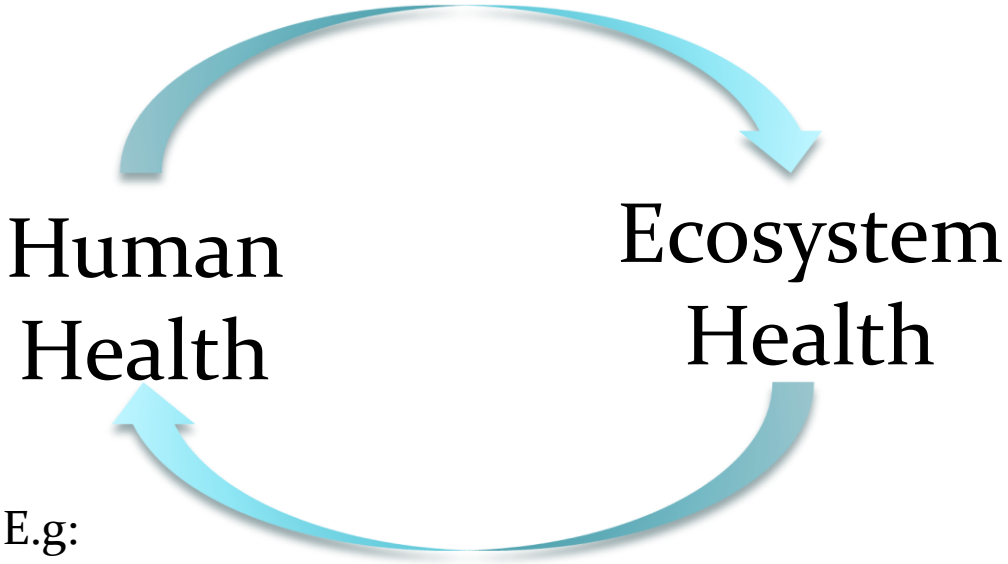
Health, Malnutrition and Poverty

- Hunger and malnutrition as the *'world's greatest health risk'* (WFP)
- Kills more people globally per year than AIDS, malaria and TB
- Underlying cause of death in more than 35% of under-fives
- In addition, climate change has direct health impacts on distribution of diseases with rise in temperatures, as well as indirect impacts on health



Undernutrition contributes to a range of diseases. Source: WTO, 2012

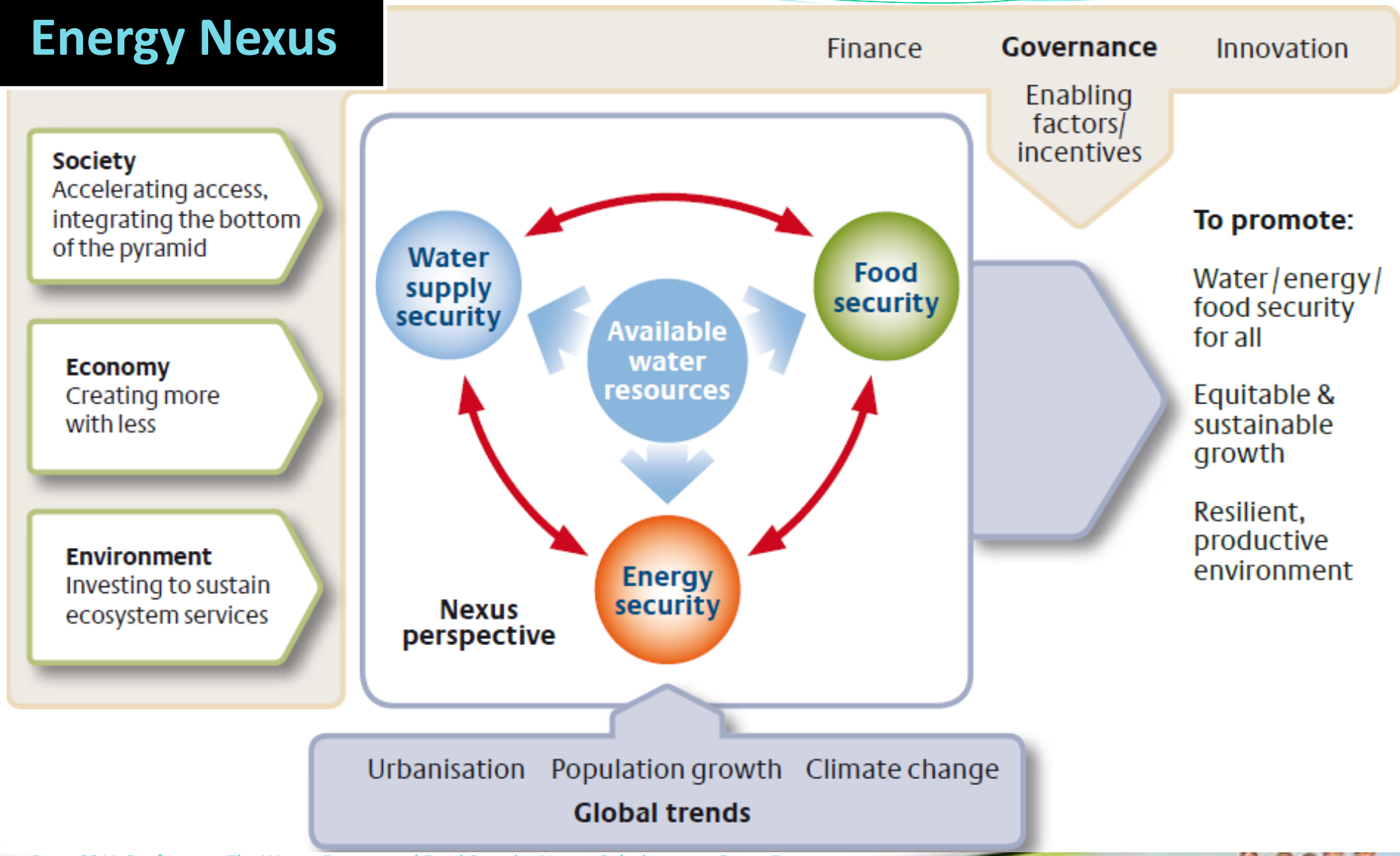
Ecological Public Health



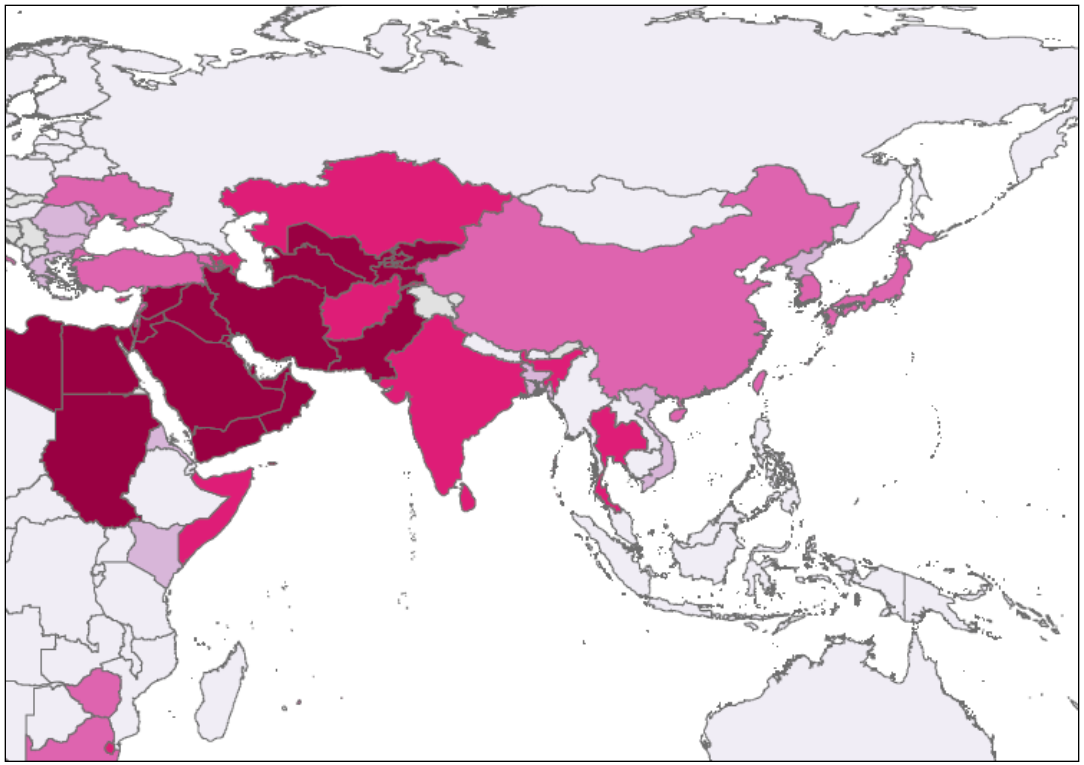
E.g:

- Climate change and obesity
- Animal health and public health; avian/swine flu, BSE
- Poverty and proximity to pollution
- Cycling, walking and health
- Urban environment and mental health
- Respiratory illness and coal mining
- Persistent chemicals
- National Parks in the UK

Water-Food Energy Nexus



Water and Food Security are closely linked



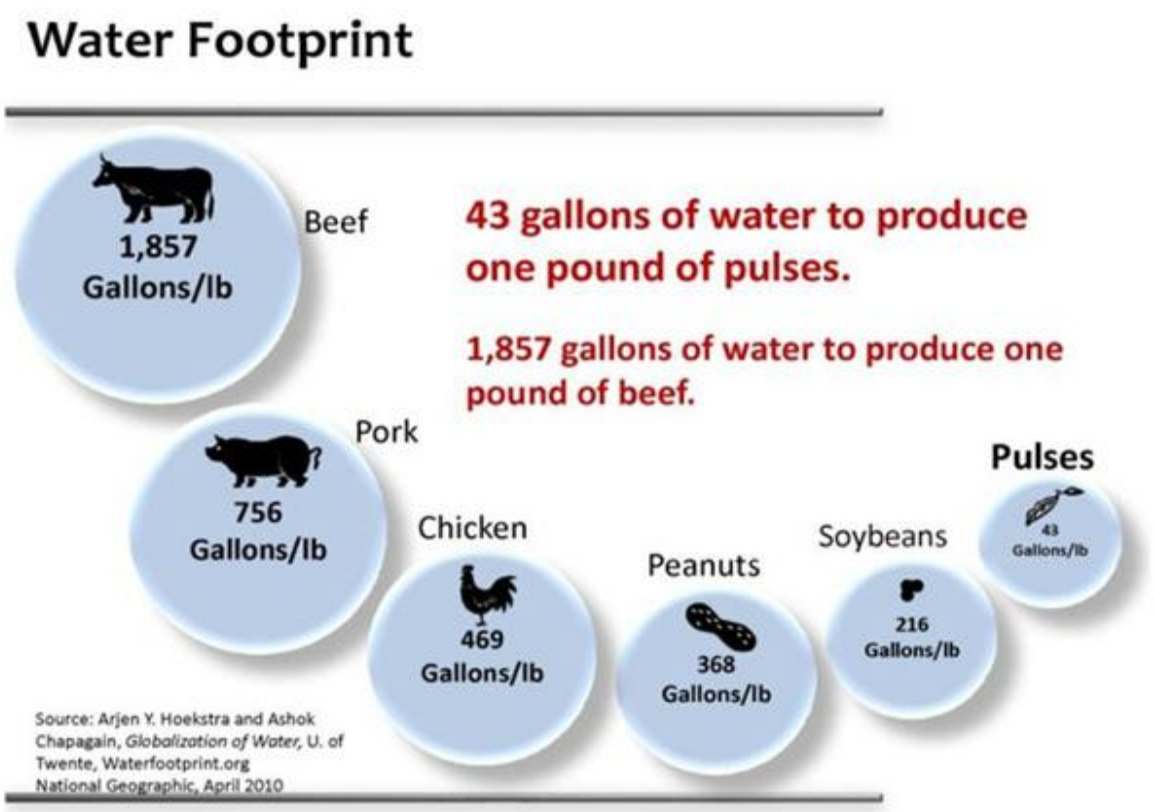
Freshwater withdrawal for agriculture

Map showing the proportion of renewable water resources withdrawn for agriculture (Source: Aquastat, 2000)

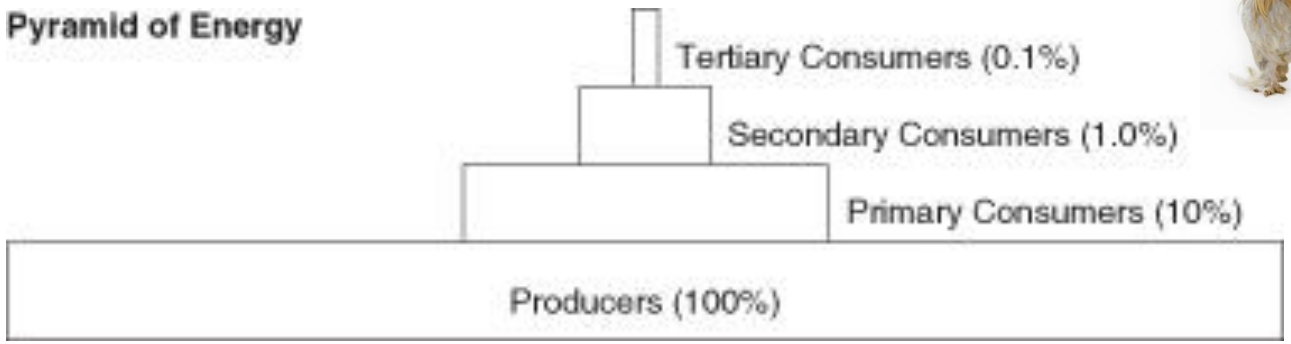
Legend

No data | < 5 | 5 - 10 | 10 - 20 | 20 - 40 | > 40 %

How much water is needed for food production?



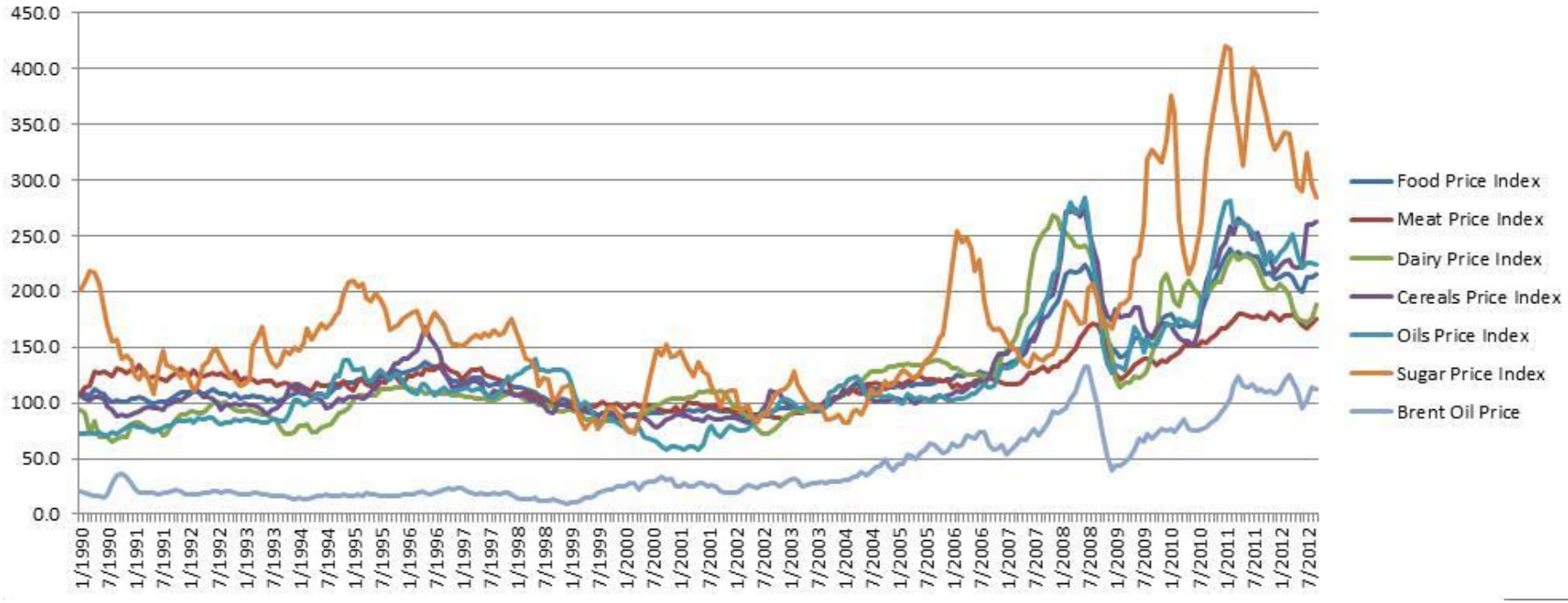
Energy for Food Production



10% energy passed on at each trophic level, the rest is lost to the environment

Energy intensity of agricultural production: fertilisers, mechanisation, food transport and preparation

Energy and Food Prices



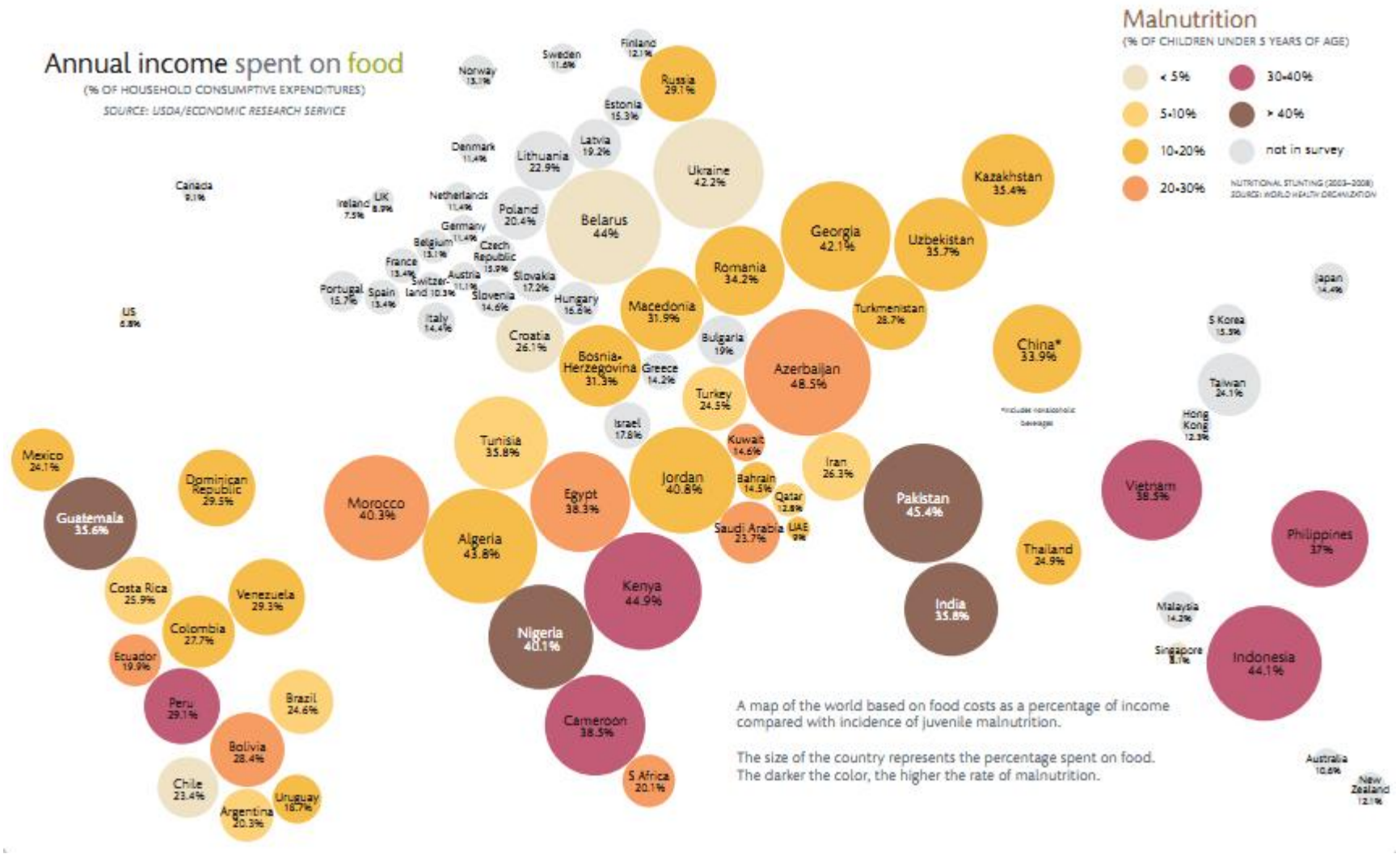
FAO food price index and brent crude oil price, 1990-2012

Food for Energy: Case of Biofuel

- IFPRI estimates that around 30% of food price rise was due to biofuel
- Food crops such as corn are being used as biofuel for vehicles
- Increases interlinkages between the food and energy price indices

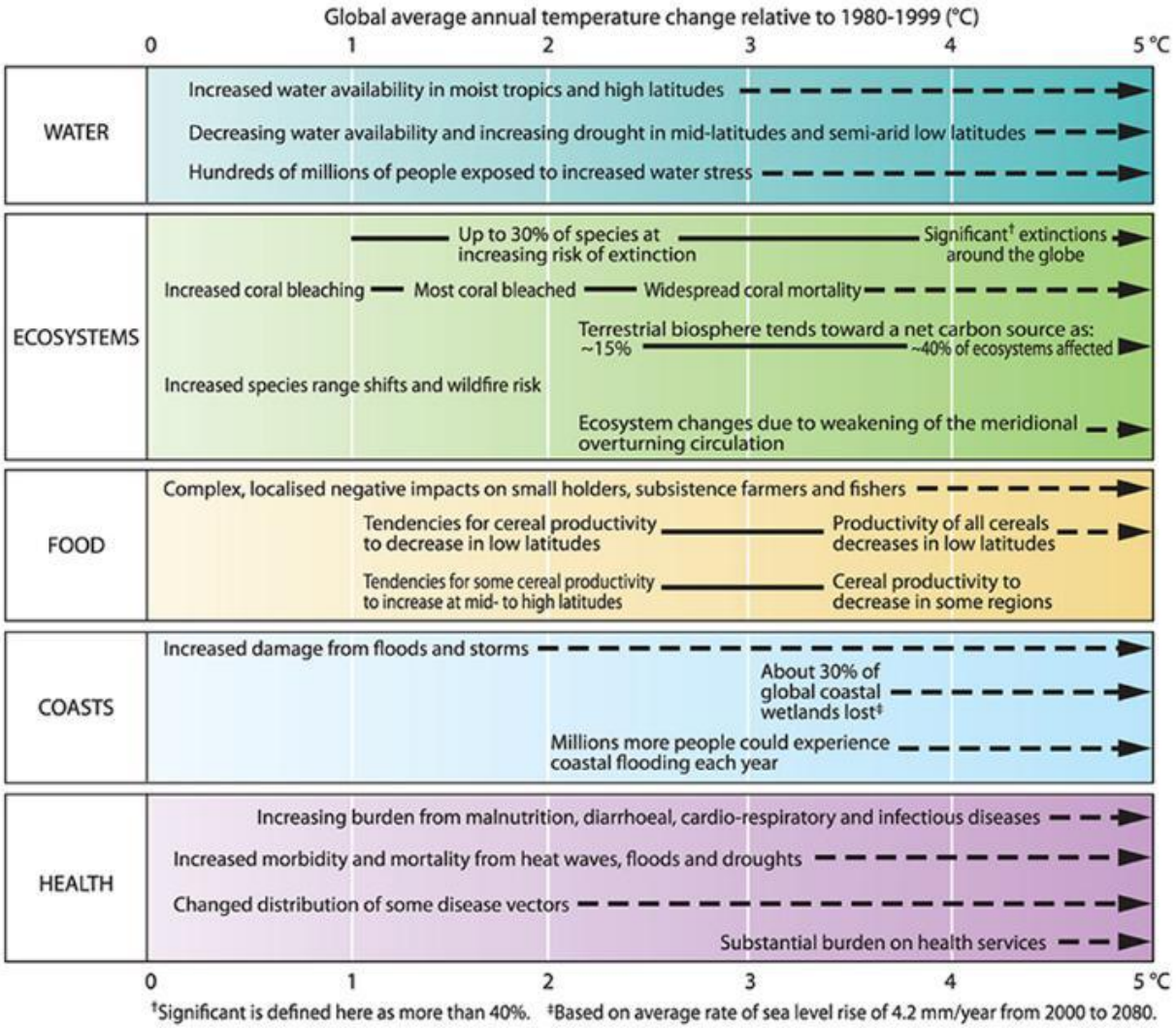
Deforestation due to palm oil production: cutting through rainforest during development of a palm oil plantation in Borneo

Income of poorest spent on food



Source: Maug, 2011

Climate Change Impacts

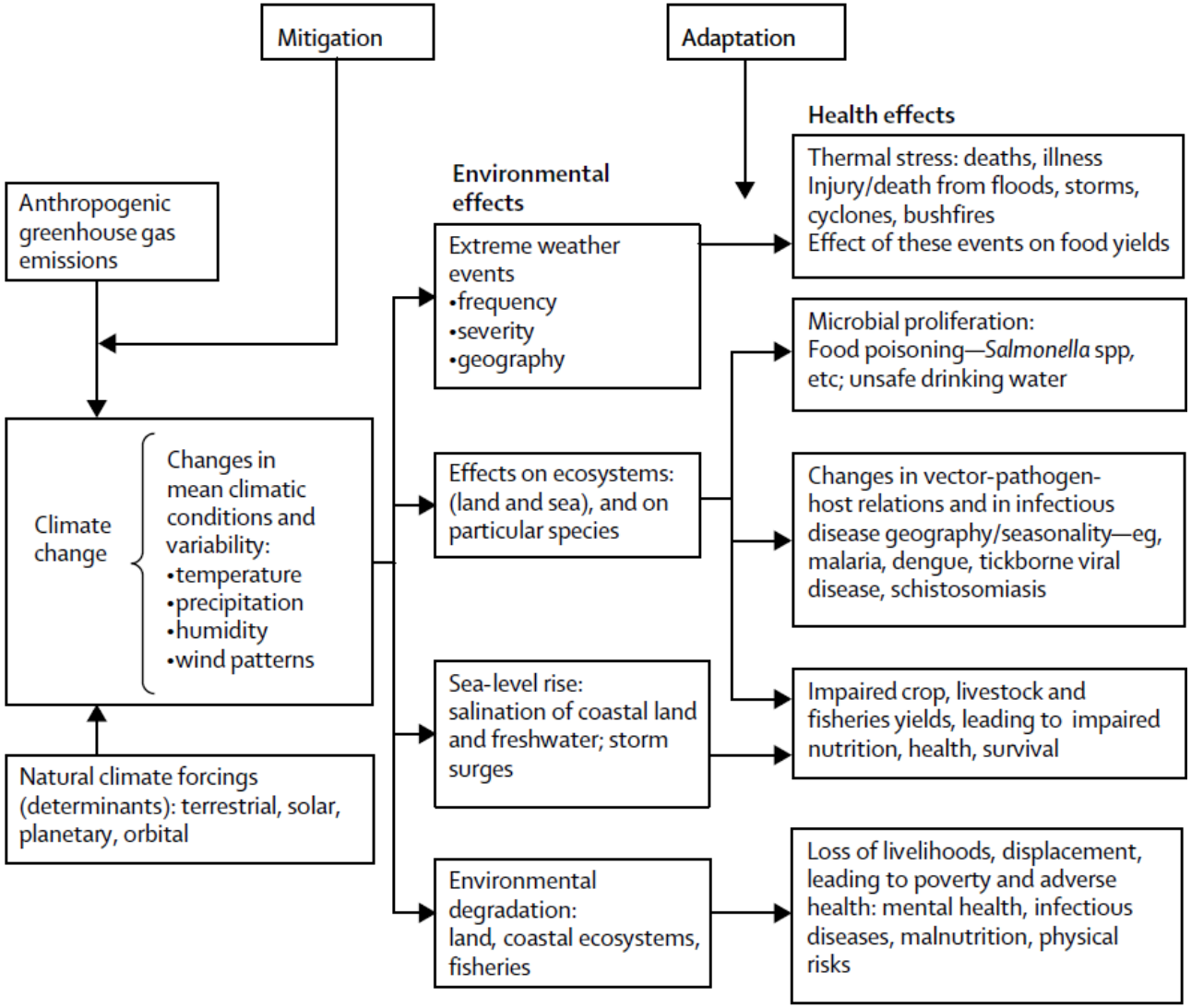


Source: IPCC WG2, Technical Summary, 2007

October 2012: 391.01 ppm
October 2011: 388.92 ppm

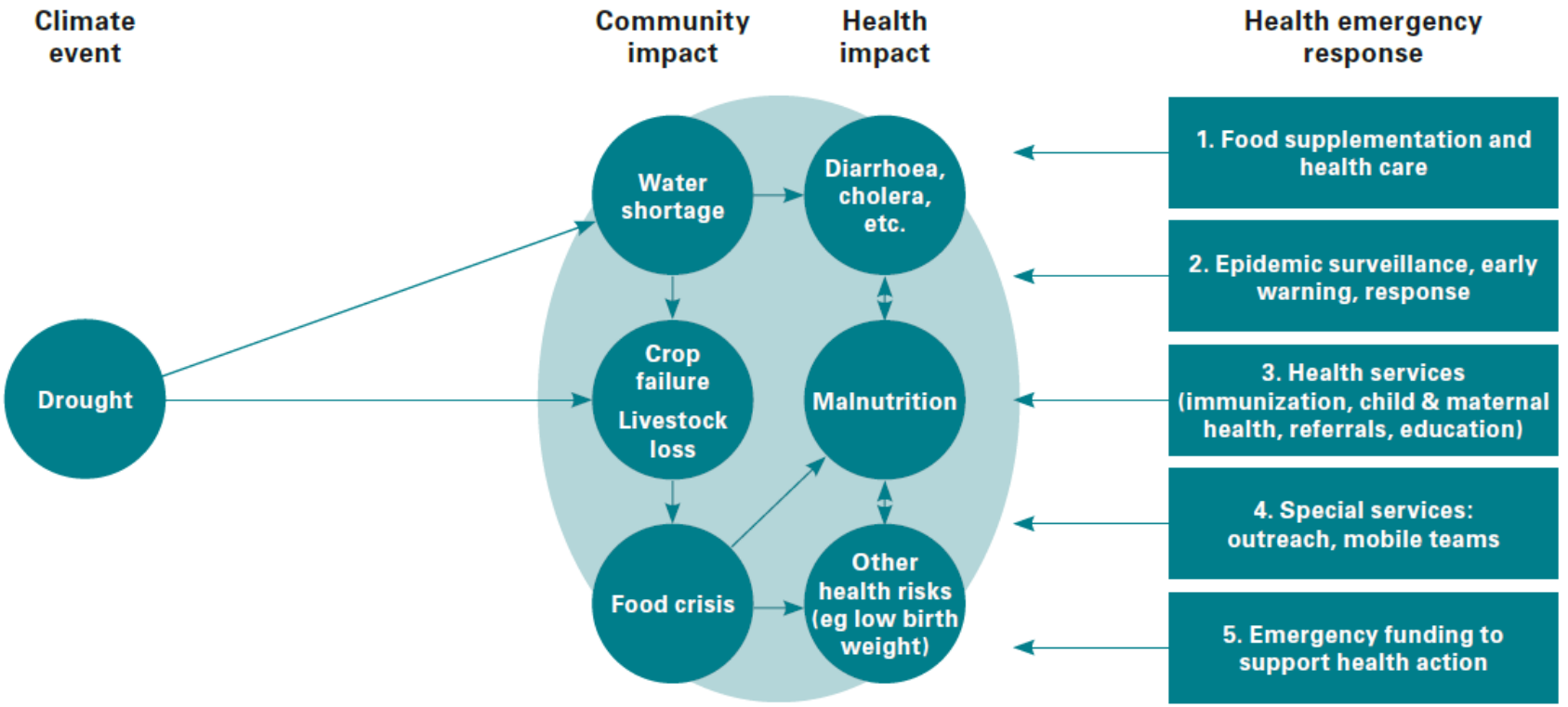
- **Heat waves / stress**
- **Air quality**
- **Diseases (Water-borne, Vector-borne)**
- **Extreme events**
- **Food insecurity and malnutrition**

Impacts of Climate Change on Health



Source: McMichael et al, 2006

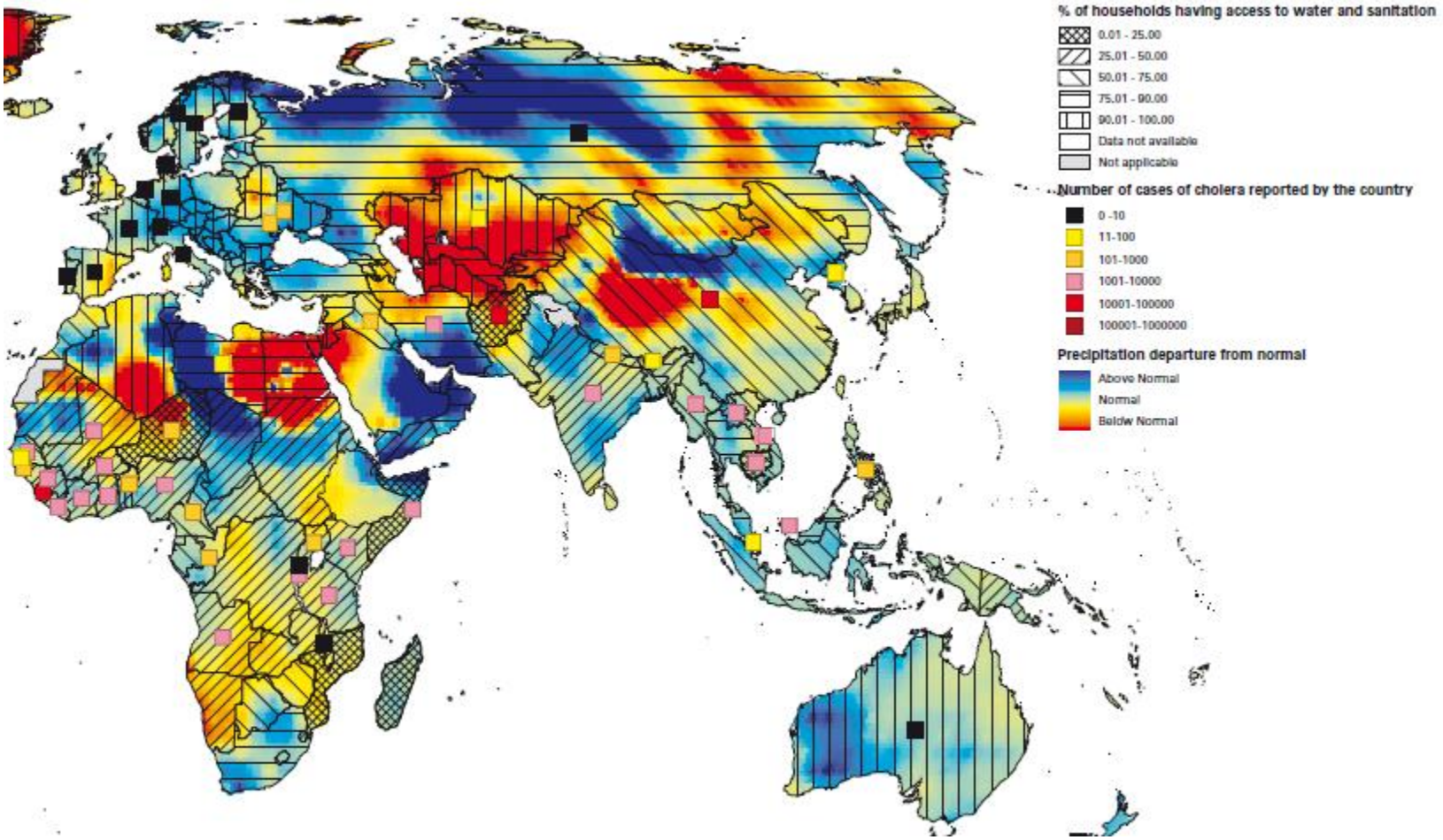
Climate Events have a range of Health Impacts



Drought as a risk factor for complex public health impacts and the possible areas for public health response[12]

Source: WTO, 2012

Correlation between cholera, water access and sanitation, and precipitation anomalies



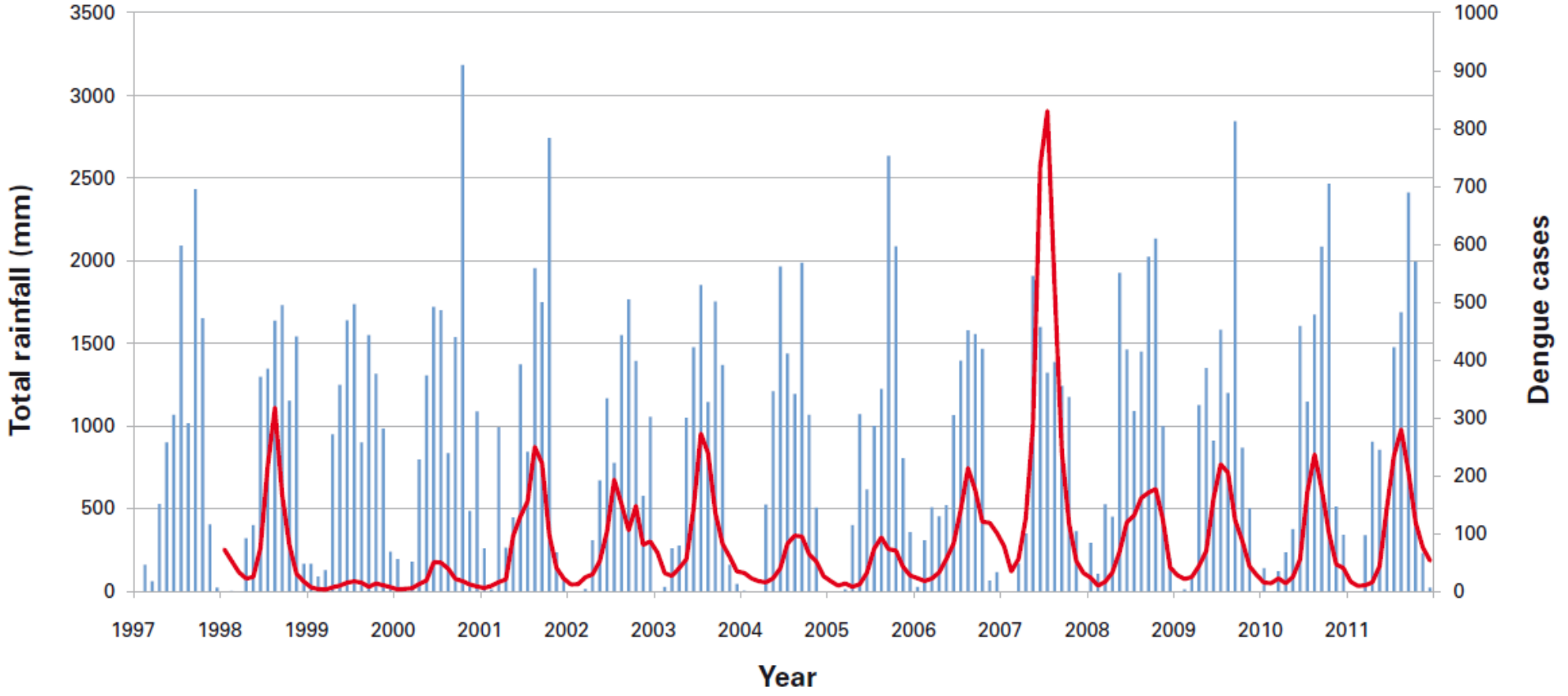
Source: WTO, 2012

Adaptation

- **IPCC 2007: Adaptation** is *"any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities"*

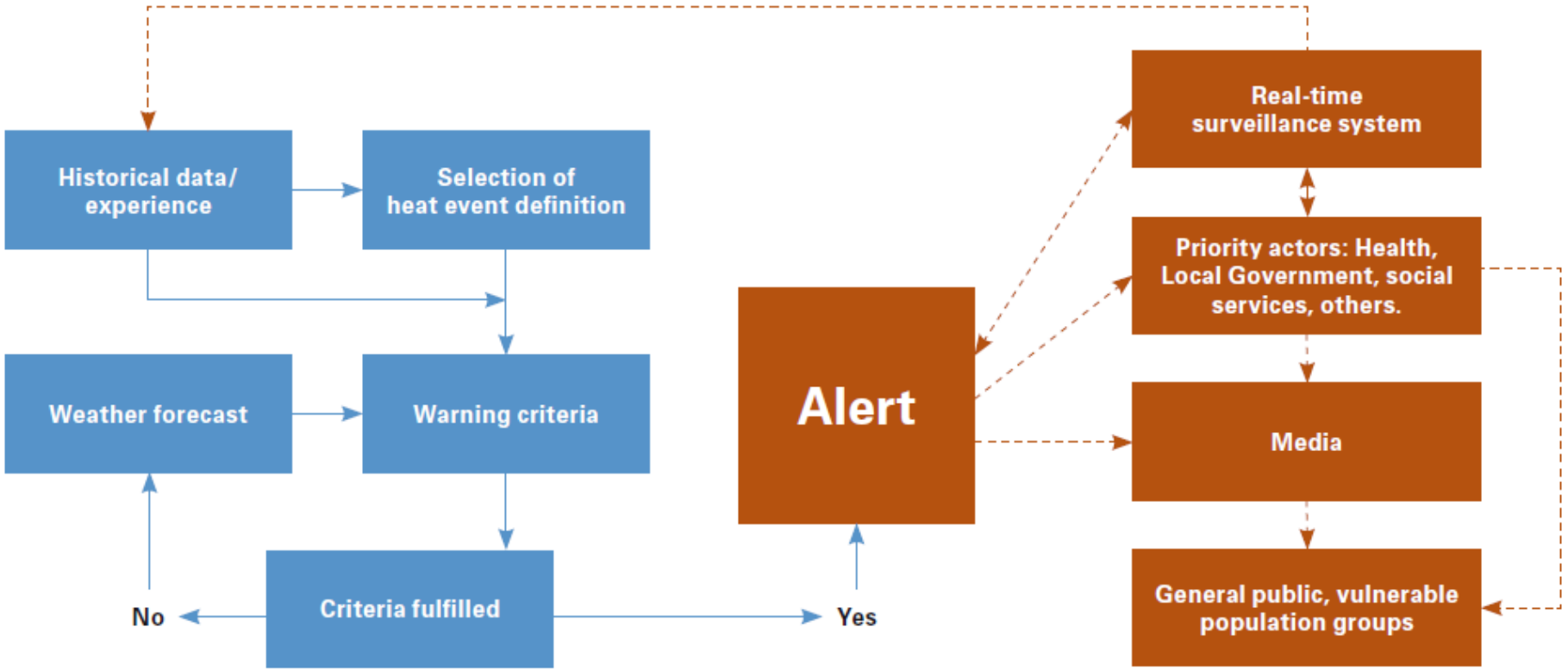
- Stern Review: "The objective of **adaptation** is to reduce vulnerability to changes in the climate"

Dengue Fever



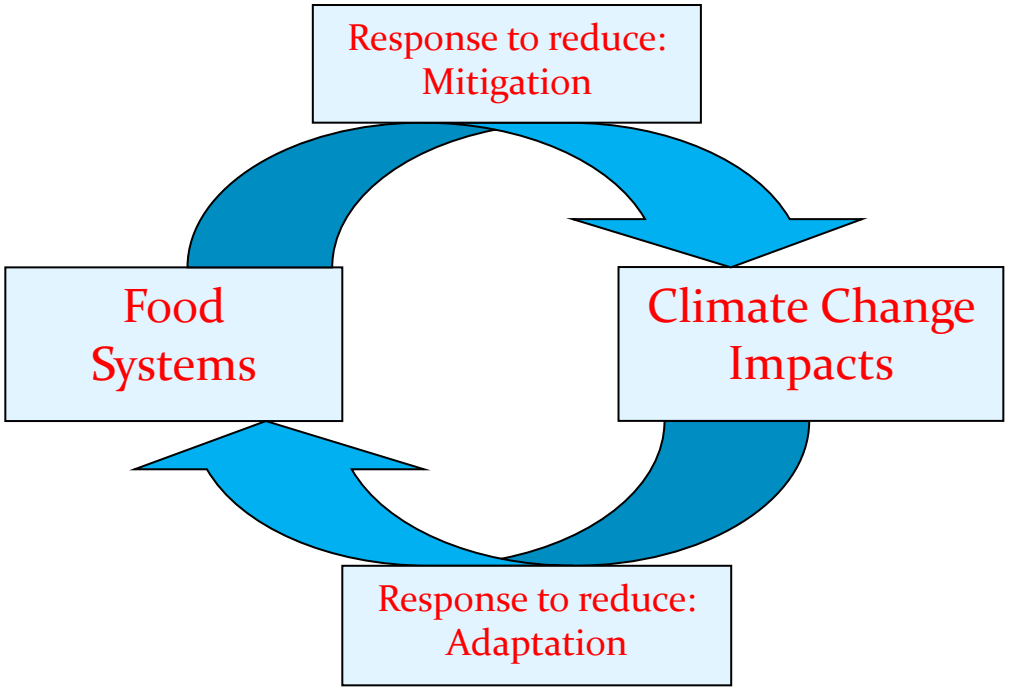
Dengue incidence (red line) and monthly precipitation.
Source: WTO, 2012

Dengue Fever: Heat Health Action Plans



Source: WTO, 2012

Adaptation and mitigation in food systems



Mitigation

-Food and agriculture may contribute 30% total global GHG emissions if we include deforestation and ILUC

-Fast growing source of global emissions e.g. changing diets

-Linkages with biofuel use

Adaptation

-Agriculture one of the most vulnerable sectors, dependence on natural systems

-Multiple risk pathways; temperature, rainfall, extreme events

-Multiple stressors on food systems

The Costs of the Impacts of Climate Change

Even if global action achieves a limitation in GHG emissions, the climate needs time to recover from the damage caused already. Impacts already starting now.

- Cost estimate models assume climate change would be capped at 2 degrees.

Source	US$ billion p.a.	Comments
World Bank (2006)	9 - 41	Cost of climate-proofing FDI, GDI and ODA flows
Stern (2006)	4 - 37	Update, with slight modification of World Bank (2006)
Oxfam (2007)	50	Based on World Bank, plus extrapolation of costs from NAPAs and NGO projects
UNDP (2007)	86 - 109	World Bank plus costing of PRS targets, better disaster response
UNFCCC (2007)	49 - 171	$28-67 Billion of this would be in developing countries. Sectors such as mining, energy, retail, finance and tourism were not included. Parry et al (2009) argued this may be underestimated by a factor of 2 or 3.
World Bank (2009)	$75 - 100	Higher estimates under the wetter NCAR scenario than the drier CSIRO scenario

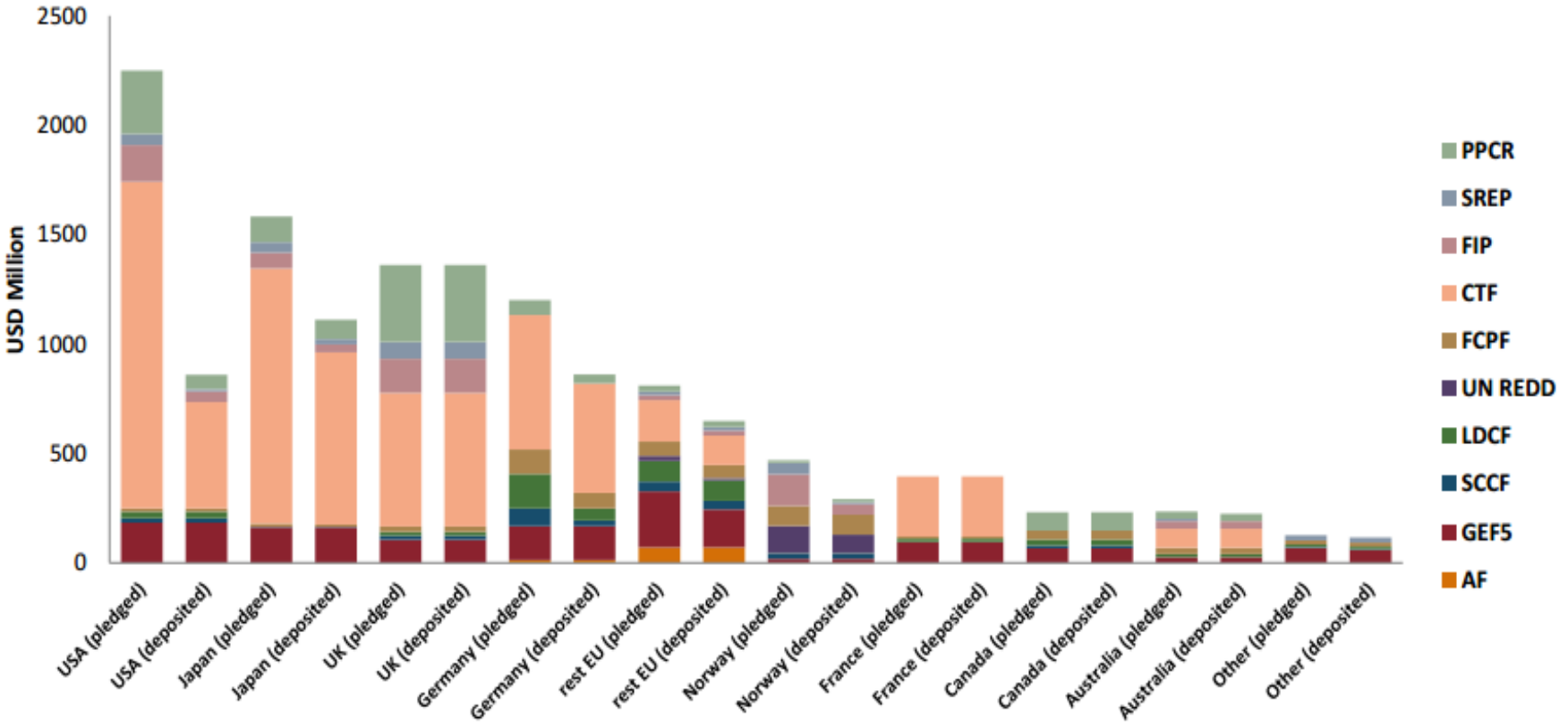
International Climate Adaptation Finance

- Funding committed at UN Level: $100Bn/year by 2020 for adaptation and mitigation (Cancun Agreement, 2010) including $30bn fast start finance, 2010-12
- Only 22% of fast start finance went to adaptation
- OECD's DAC markers, shows mitigation-related aid was USD 17.6 Billion in 2010, with adaptation-related aid at USD 9.3 Billion.
- Green Climate Fund – World Bank serves as interim trustee, *"subject to a review three years after operationalization"*
- 'Agricultural sector is already under-funded as a percentage of ODA (~5% in 2007)
- Despite the fact FAO calculates around ½ the world's hungry people are smallholder farmers

Emerging Issues for Adaptation Finance

- Adequacy, predictability, transparency and disbursement of funds.
- Grants vs Loans for Adaptation: debt distress. 'Polluter pays'?
- Suitability of microfinance.
- 'Additionality' to ODA (overseas development aid) - funding diverted?
- Already a pre-existing 'development gap'
- Tracking finance: Difficulty differentiating adaptation + development
- Who should manage the international fund? Representation issues.
- Accessibility; "complex design of the funds; and unclear guidance and transaction costs" (Bapna & McGray, 2008).
- Uncertainty: Difficult to predict impacts with a high degree of accuracy

Climate Change Finance Disbursement

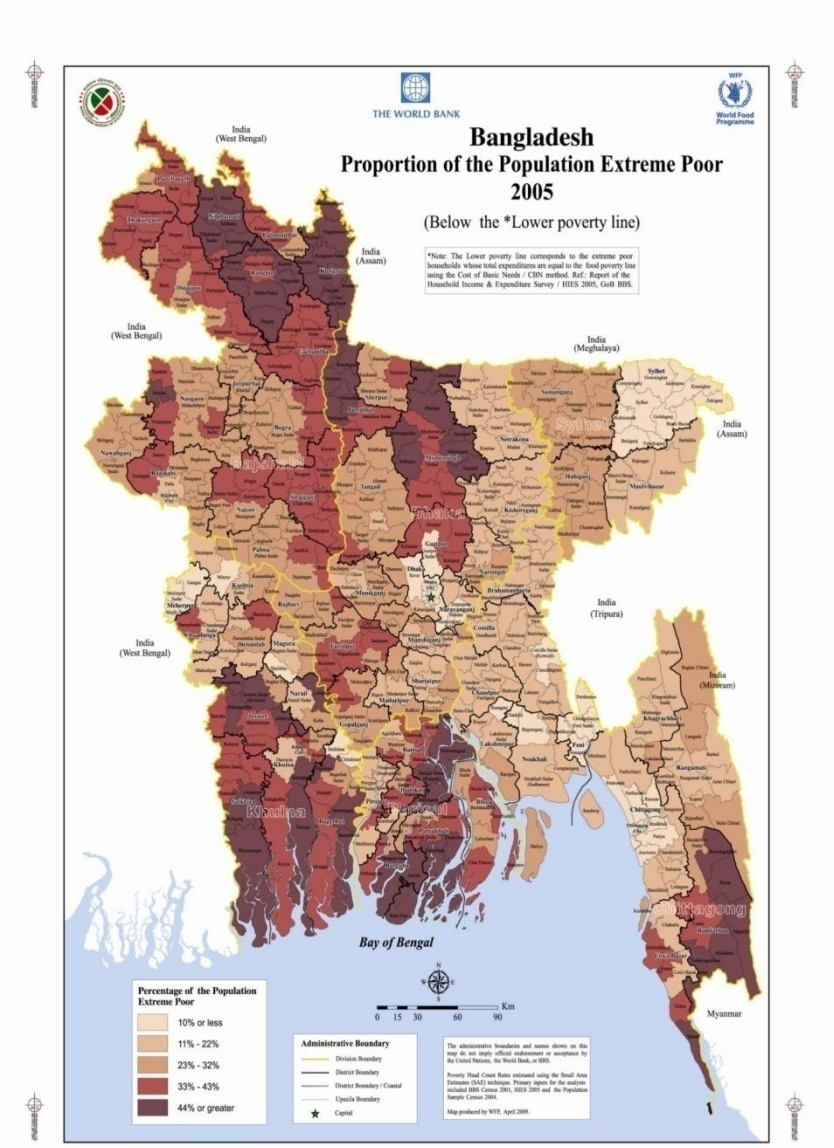


Community-Based Adaptation to Climate Change (CBA)

- Least developed countries (LDCs) have *highest vulnerability* to climate change & high dependence on natural resources

- Effective climate change finance will reach the most vulnerable communities. Stakeholder participation needed to build trust/transparency
- **Community participation** is crucial for project sustainability and ownership – so options do not "fall into disrepair" (Harvey & Drouin, 2006)
- Stakeholder engagement also builds social capital; less easily quantifiable
- Climate finance needs to target not only investment at the macro-level but also choices at the micro-level
- **Monitoring and Evaluation** is needed but challenging

Case Study: Focus on Bangladesh



Case Study: Focus on Bangladesh

- Mixed-methods research (Cresswell and Clark, 2011);
  case study approach is an opportunity to investigate the real-life context (Yin, 2011)

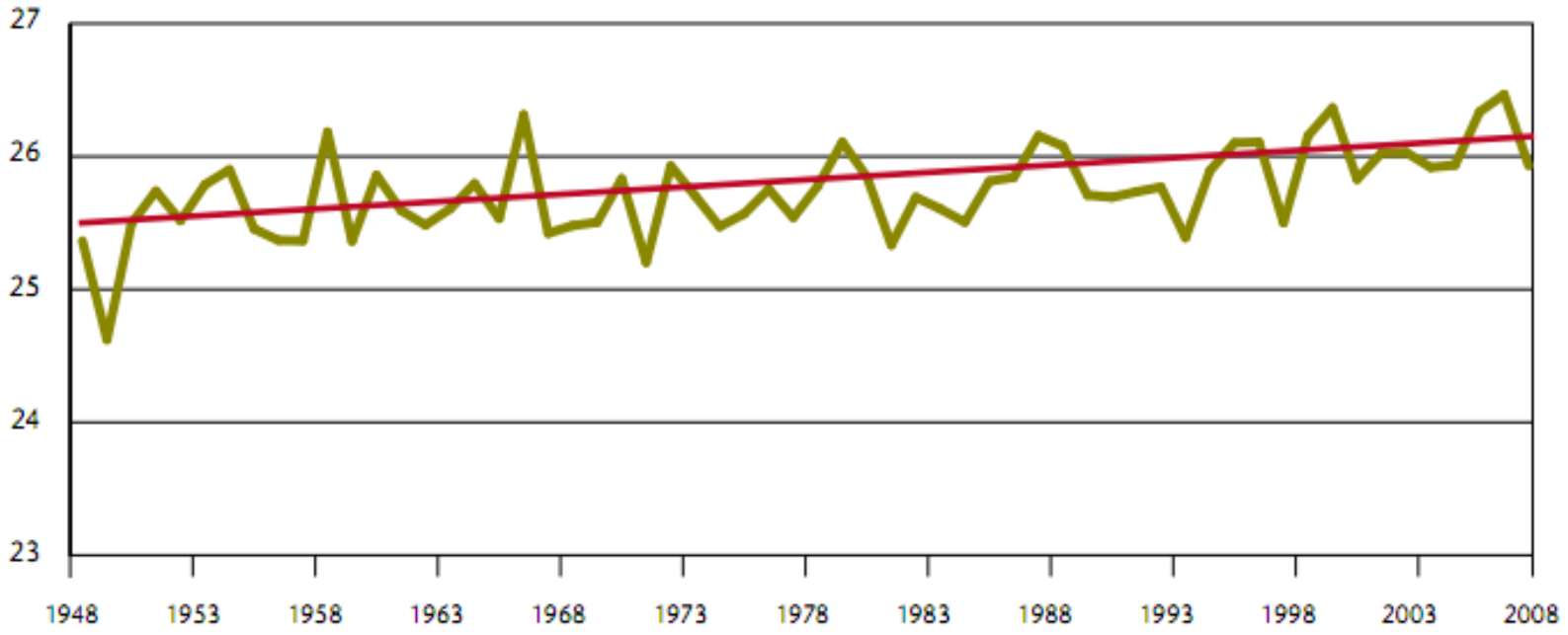
- Qualitative analysis: finance for climate change adaptation

- Quantitative analysis: household-level survey data

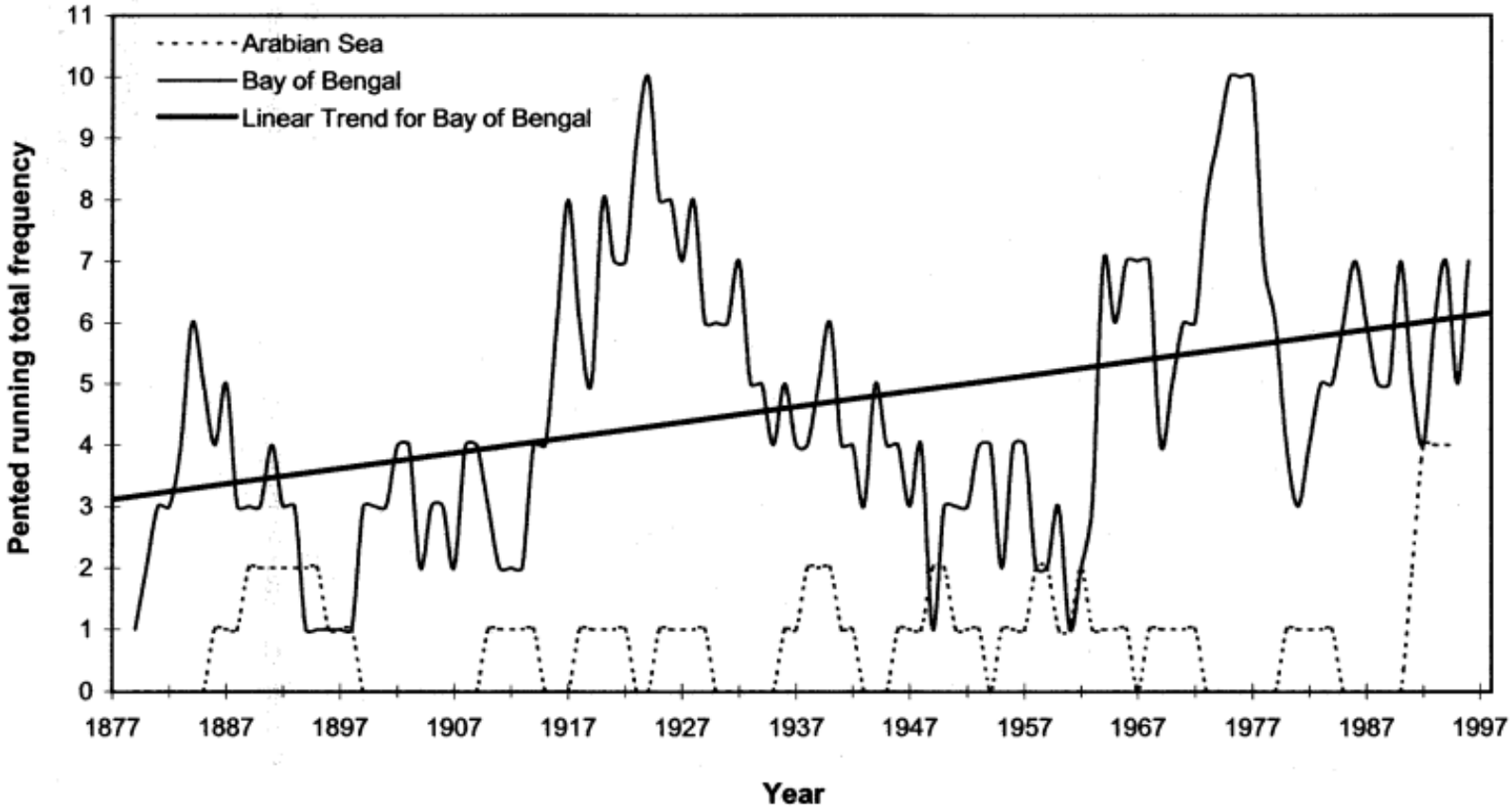
Trends in Bangladesh: Temperature

Observed surface air temperatures for Bangladesh

Source: Bangladesh Met Department

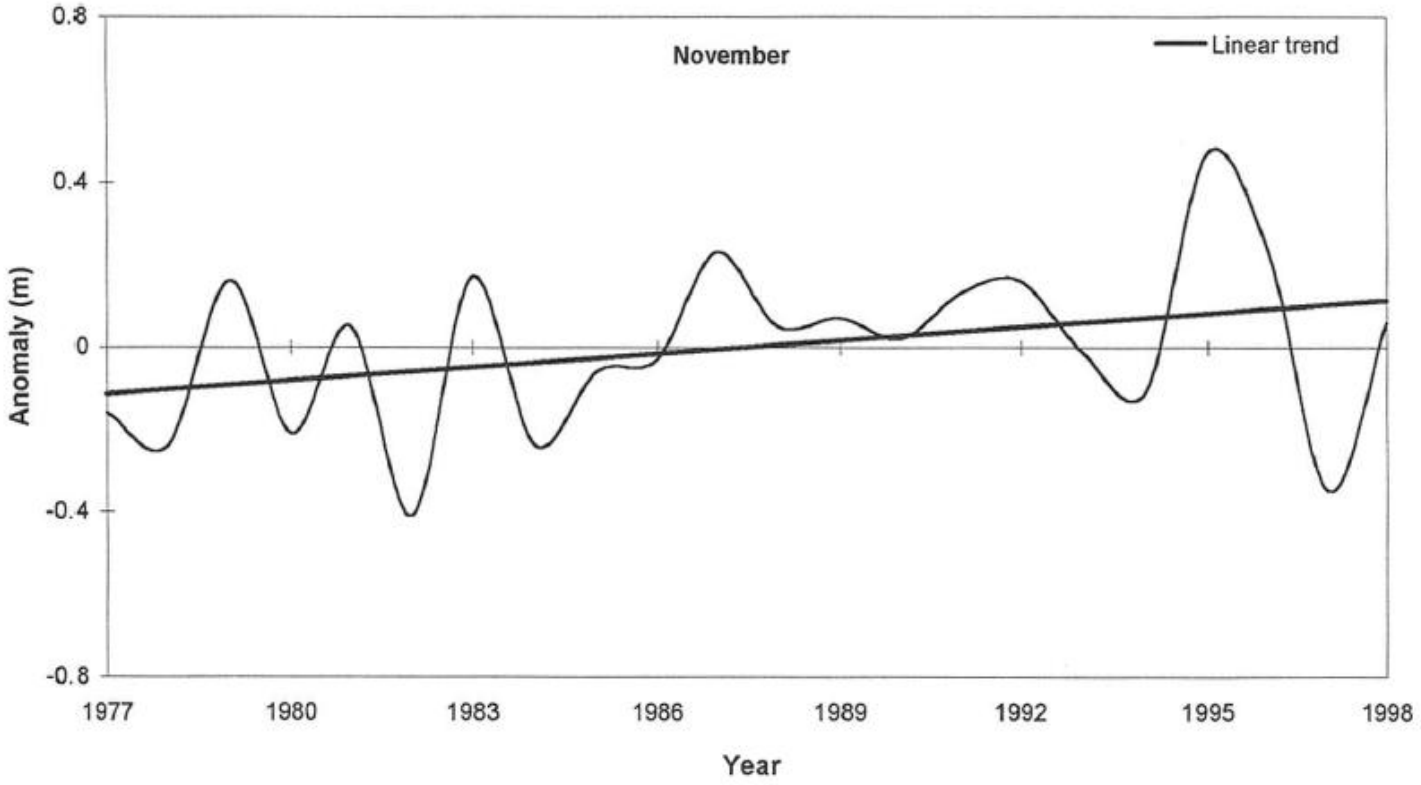


Trends and Impacts: Cyclones



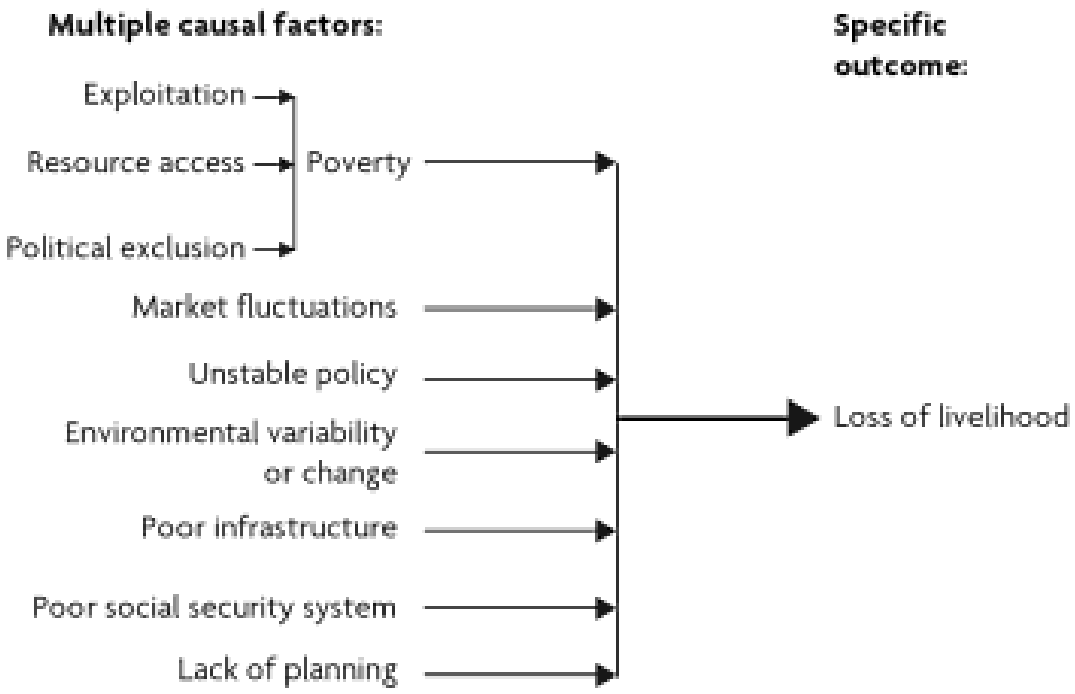
Frequencies of cyclonic storms over the Bay of Bengal and the Arabian Sea for the month of November (Source: Singh et al, 2001)

Trends: Sea Level Rise



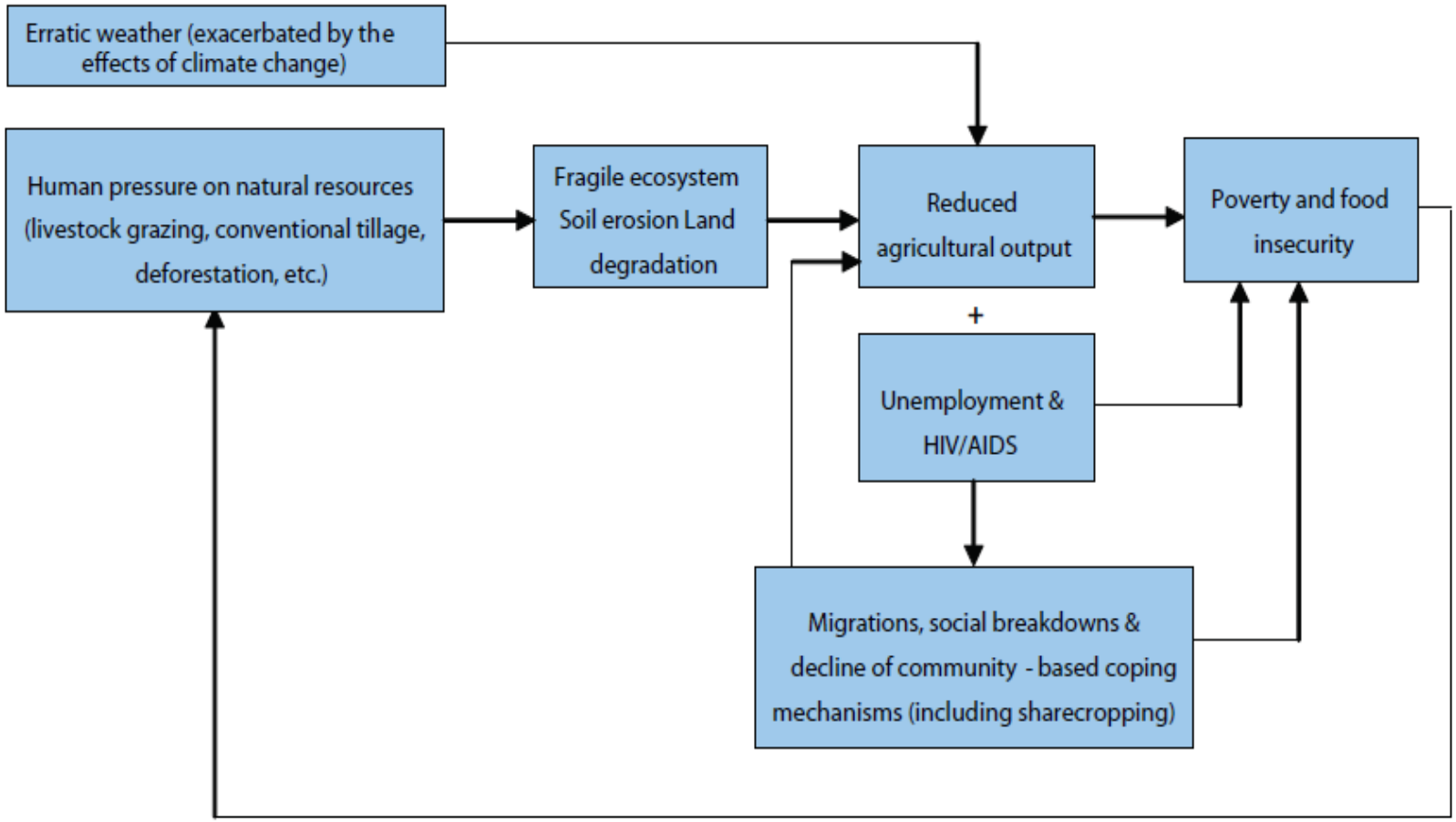
Anomaly of the Mean Level Tide at Cox Bazar in November 1977 – 1998
(Source: Khan et al 2000)

Causal Pathways



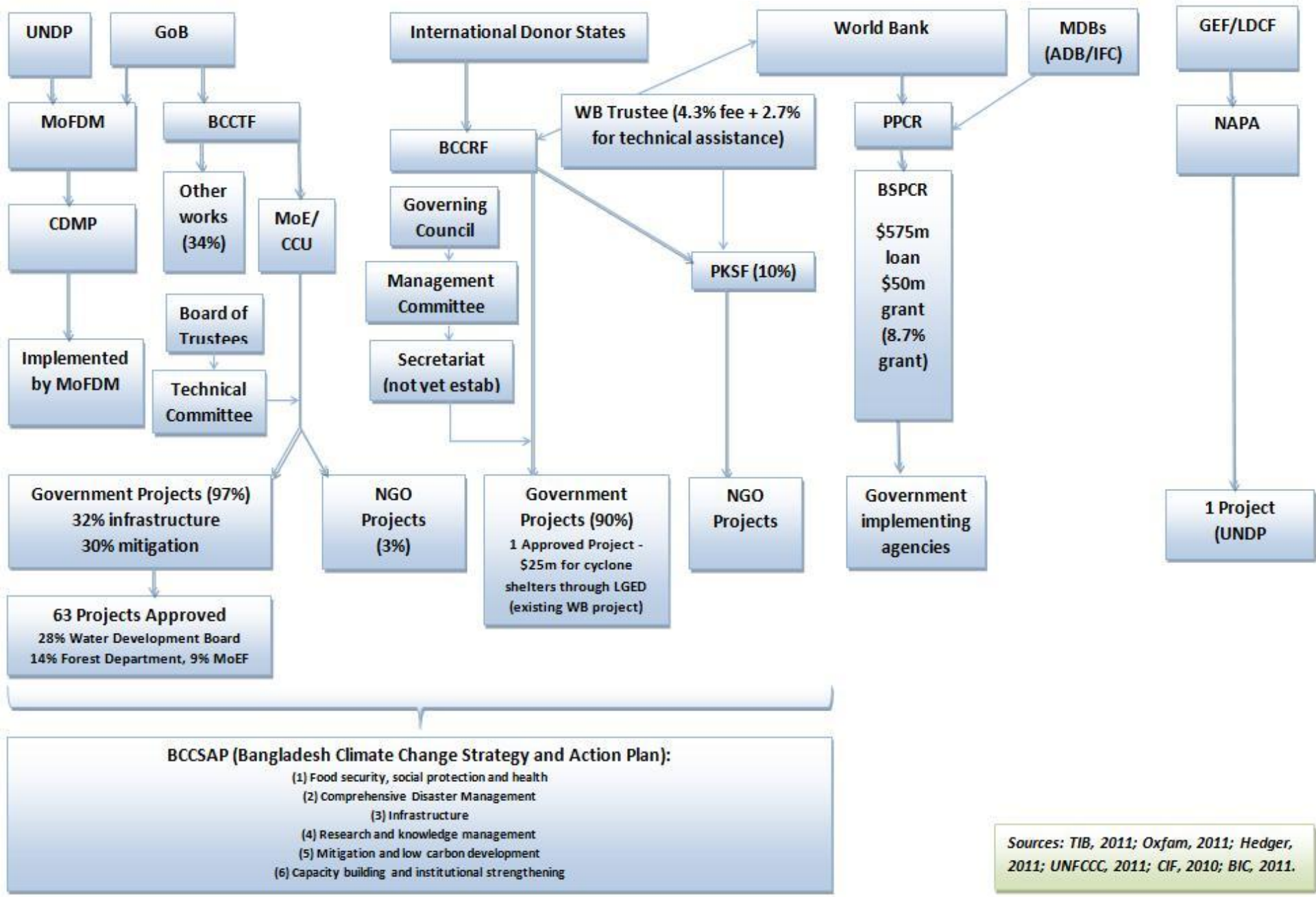
Source: Ribot, 2010

Impacts of Climate Change on Food Security and Poverty



Source: Silici, 2010

Climate Finance Architecture in Bangladesh



Sources: TIB, 2011; Oxfam, 2011; Hedger, 2011; UNFCCC, 2011; CIF, 2010; BIC, 2011.

Preliminary Qualitative Analysis – Civil Society Interviews

Coordination, Prioritisation and Transparency:
"No coordination between the Trust Fund and Resilience Fund - left hand doesn't know what the right hand is doing"
"It's just distributed on a first come first serve basis, not on the basis of need"
"All three sectors are highly vulnerable to corruption " [infrastructure, water and rehabilitation]
"For the cross-dam had to cut down 40,000 trees, there was no consultation"
"Each body blames each other for disclosure of documents"

Role of World Bank:
"Aid funding is political"
"Loans are not suitable for adaptation because it may not generate an income"
"Government are getting a World Bank loan and distributing it as a grant"
"There's a disclosure problem with the World Bank. We don't know the real modalities."
"Claiming there's 1% service charge but there are hidden costs of 6% technical assistance"

[Note: All comments anonymous]

Preliminary Qualitative Analysis – Donor Interviews

Government Capacity: *"No one holds the vision – it's partly the donors fault, we didn't take time to set up institutions to make it sustainable"*
"Ministry of Environment hasn't had staffing, time or space… it's a junior ministry"
"Readiness shouldn't mean they never get climate change funding but may need capacity building first"
"MoE is thin on the ground with people – there is a problem with retaining good staff for long periods in the civil service" … "frequent transfer of staff"
"Each department is territorial – they keep themselves in silo's"
"WB will be managing for some years – building the capacity of government to manage funds – and then will hand over"
"bureaucratic system for approval of projects… is a major challenge"

Role of World Bank: *BCCRF larger infrastructure projects "mainly because it's the World Bank managing it and they find it easier"*
"hoping the World Bank would facilitate dialogue on coordination but they haven't "
"Performance indicators are a sore point for me – for a solid 22 months I've been asking for a projectised results matrix" [from the WB]
"They don't even have an annual workplan"

[Note: All comments anonymous. Some donors have not yet been consulted.]

Preliminary Qualitative Analysis – Government Officials

Government Capacity:

"it's difficult to find people who know about ficudiary management"
"MoE is very overburdened with forests and pollution"
"the right people are not being used for the right cause – capacity is not a real problem"
"the fund will be transferred to government after institutional capacity is there"

Role of World Bank:

"World Bank is the most highly bureaucratic organisation on earth"
"it is not even their full time job" [of the World Bank official]
"it's the system that was created that way"
"I don't blame the World Bank – this is the system they have"
"the first project [cyclone shelters] is part of an existing WB project"

Prioritisation and Disbursement:

"if the topic is urgent, the criteria are not a problem"
"most development partners want software or policy-level change but for people, they need hardware"
Project were allocated to the districts of Ministers, but "the priority should have been the coastal area"

[Note: All comments anonymous]

Key Themes

Civil Society:

- Efficacy of adaptation 'loans'
- Costs of the World Bank control and approach
- Transparency, corruption and lack of civil society consultation

Donors (UK/UNDP/ADB):

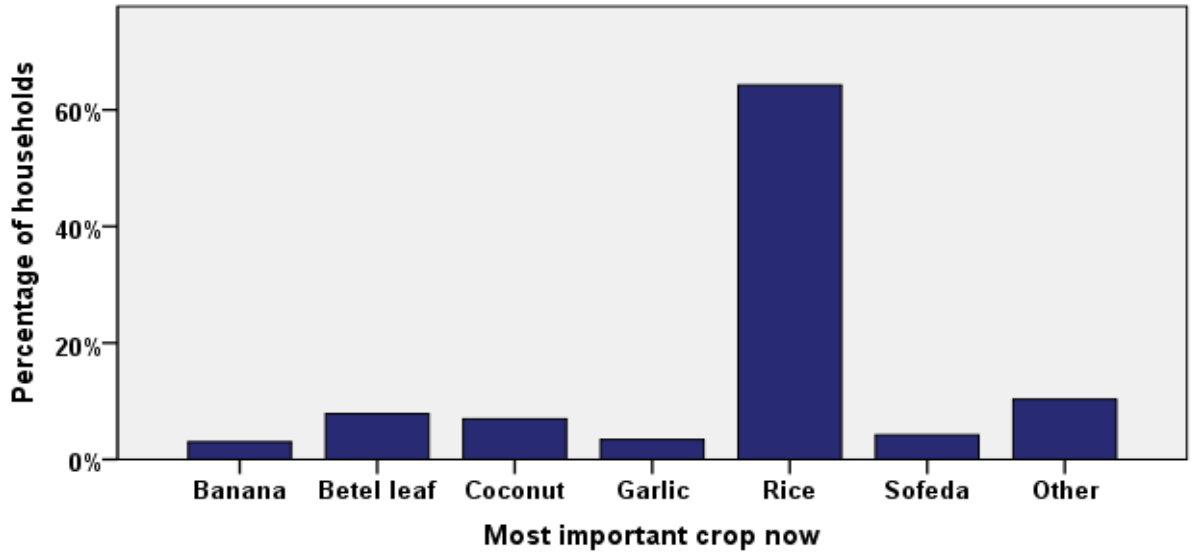
- Lack of coordination
- WB has not delivered results matrix or annual workplan
- MoE/Government lacks capacity in terms of staff
- WB is bureaucratic

Government:

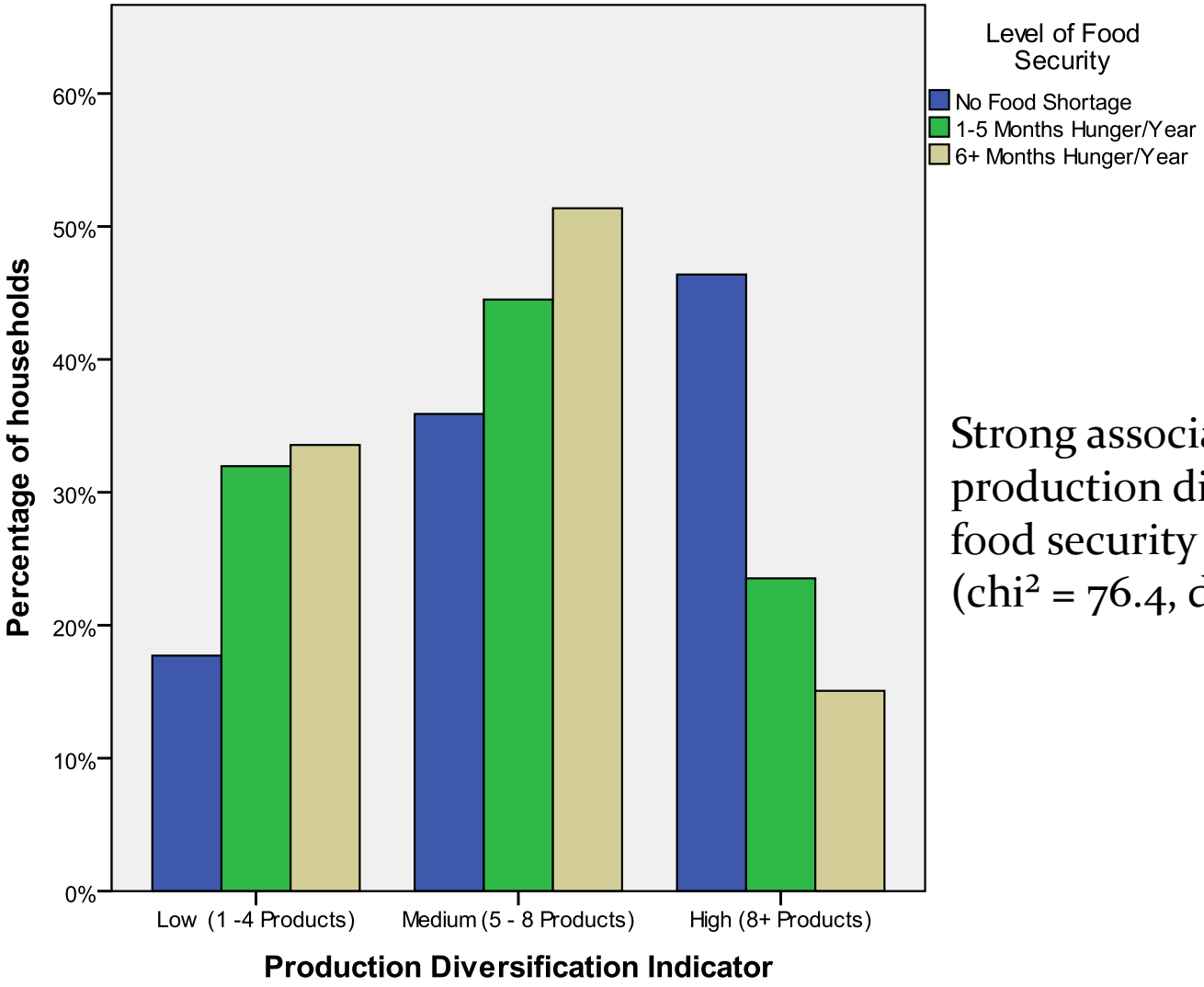
- Bureaucracy of the WB
- Priority is rapid disbursement and hard results
- Capacity is being improved

Survey Data (CCAFS)

- CCAFS research programme led by CGIAR in 12 countries. Households surveyed on food security, household assets, agricultural production, and changes to farming practices; used to develop indicators.
- 7 Bangladeshi sites (10kmx 10km blocks) and 980 households sampled
- **15% of households** said they had food shortages for more than 6 months/year
- **One third** had little formal education
- **58%** owned less than half an acre of land (50 bighas)

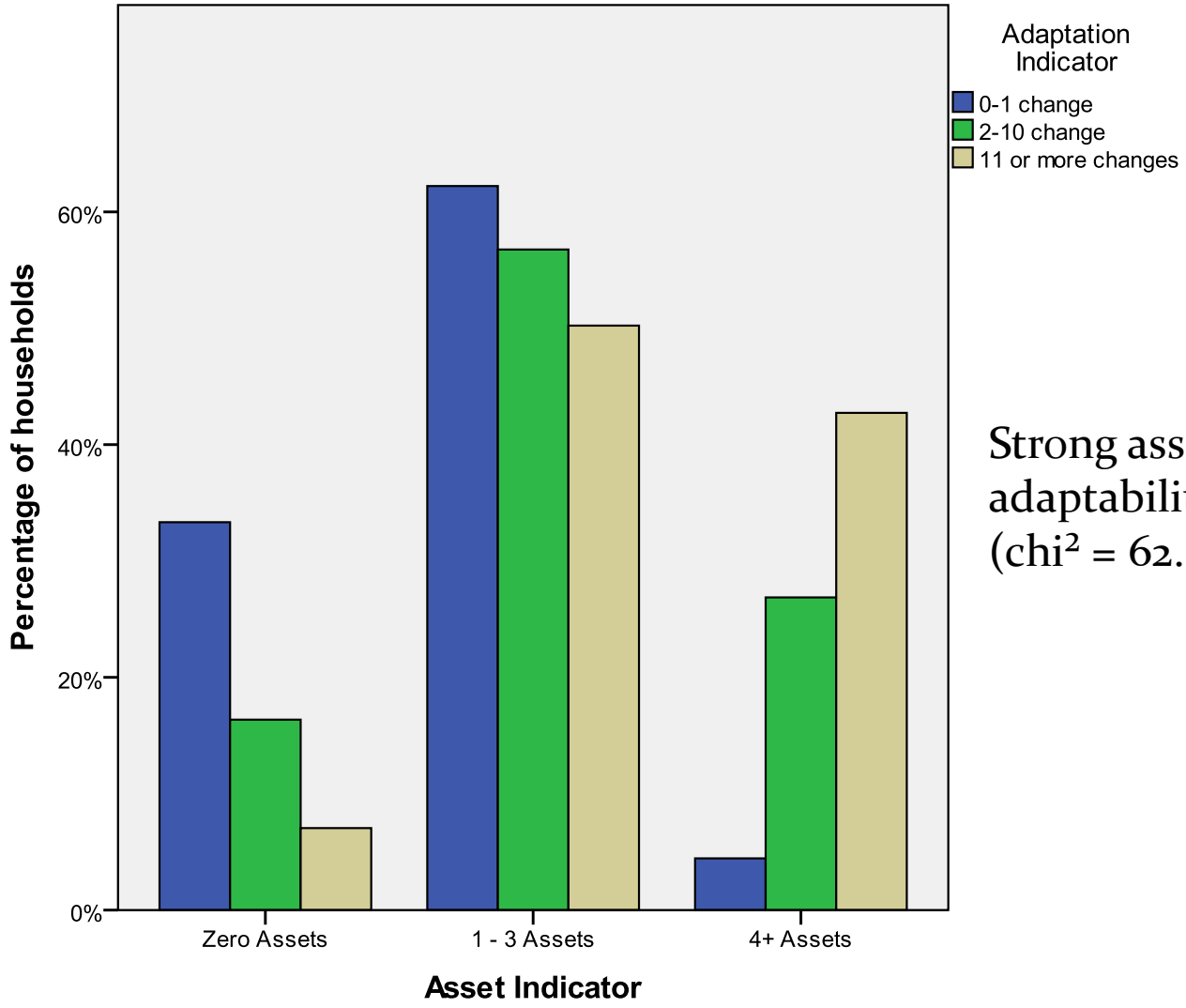


Data Analysis: Food Security



Strong association between production diversification and food security
($chi^2 = 76.4$, d.f.=4, $p<0.001$).

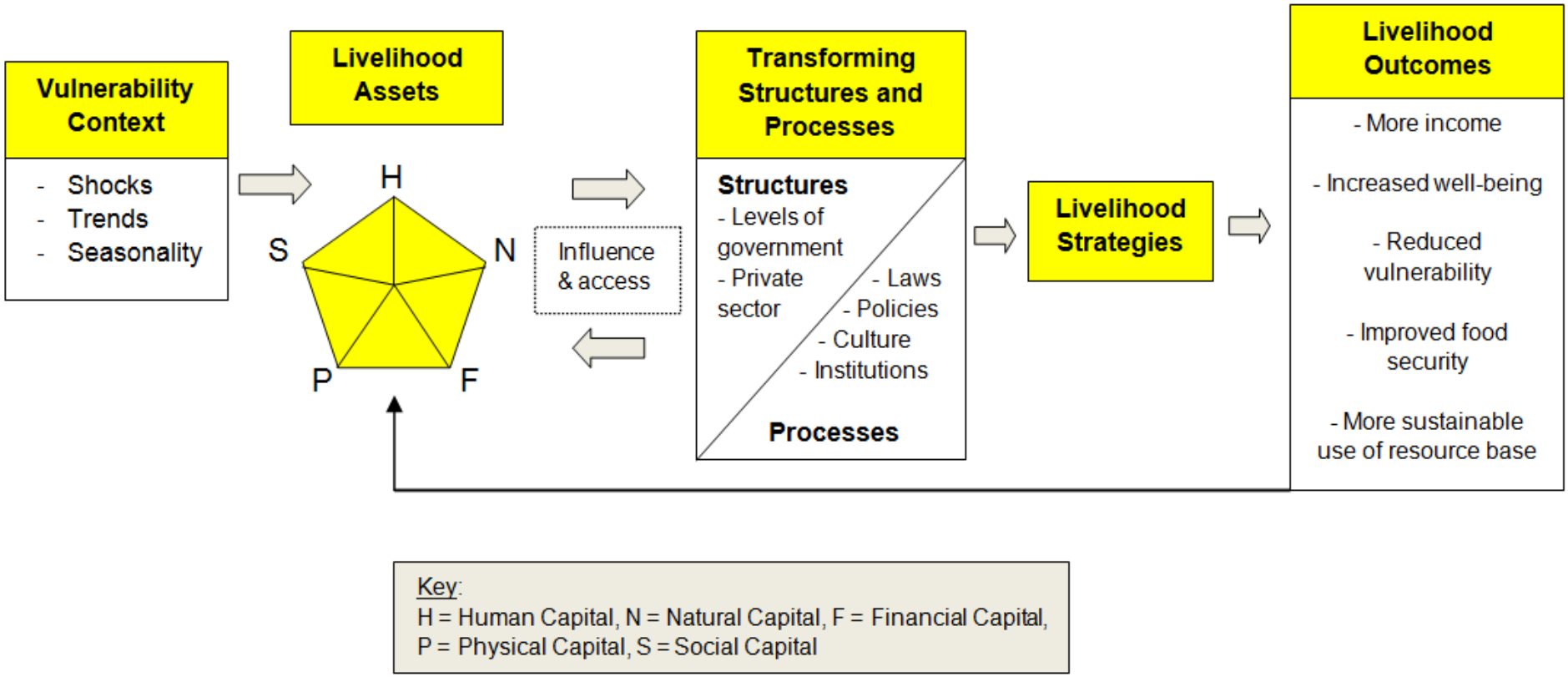
Data Analysis: Adaptability



Strong association between adaptability and assets ($chi^2 = 62.5$, d.f.=4, $p<0.001$).

Sustainable Livelihoods and Agriculture

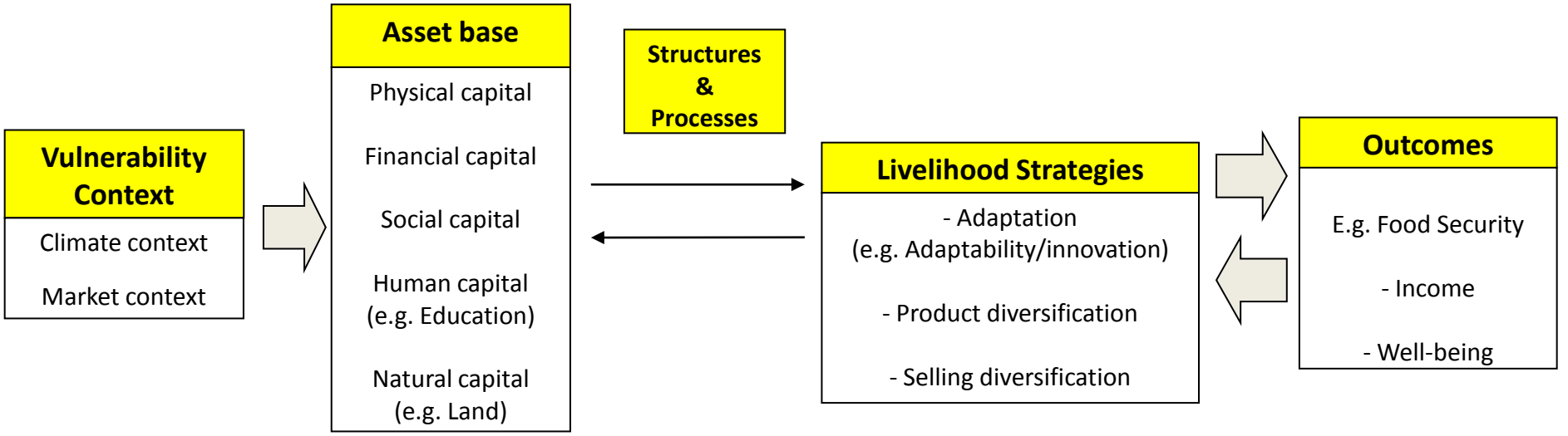
- **Sir Gordon Conway** helped develop SLA in the 1990's
- Application to understanding vulnerability to climate change



Key:
H = Human Capital, N = Natural Capital, F = Financial Capital,
P = Physical Capital, S = Social Capital

Re-Interpretation/Adaptation of the SLA

- Demonstrates how the SLA relates to this study and to adaptation:



- Structures and processes were not assessed in the household survey, neither was the presence of social capital.

Other Interesting Results

- **Market reasons were more often given as reasons for changing practices than climate reasons**

- 54% of households stated 'better price' and 'better yield' compared to 25% for higher salinity

- Strong relationship between land ownership and food security (chi=164, d.f.=6, p<00.1). Of households will higher food insecurity (6+ mths of hunger/year), more than 80% had less than ½ acre of land.

- Households with less land often worked on other's land as laborers.

- Agricultural labour is strongly differentiated by gender; i.e. men did fishing, women tended to small livestock.

- Strong positive association between adaptability and education levels ($chi^2 = 96.7$, d.f.=6, p<0.001), i.e. majority of households that made 11+ changes in agricultural practices in past 10 years had at least 1 household member with secondary or post-secondary education.

Relationship Tested:	Pearson's Chi Square Value	Cramer's V (measure of association)
Working on someone else's farm (yes, no) and food insecurity	175.9	0.424
Land ownership and food security status	164.0	0.289
Asset Indicator and food security status	140.5	0.268
Education and food security status	99.8	0.226
Production diversification and food security status	76.4	0.199
Sales diversification and food security	49.0	0.158
Adaptability and production diversification	393.3	0.451
Adaptability and selling diversification	268.0	0.370
Adaptability and land ownership	165.0	0.290
Adaptability and Education Level	96.7	0.222
Adaptability and Asset Indicator	62.5	0.179
Adaptability and food security status	38.4	0.140

Barriers to Effective International Climate Finance

Financial, economic, social, political and legal barriers.

E.g. insecure land tenure; farmers with private land rights have an incentive to make investments "that farmers with insecure rights will not" (Mendelsohn, 2009; FAO, 2008)

- WTO Doha 'Development Round' has stalled and fossil fuel subsidies still exist as well as perverse agricultural subsidies in OECD countries + import/export tariffs
- Deficit in agricultural R&D investment (e.g. for CGIAR)
- Market access
- IP Rights as a barrier?
- Institutional momentum/debt finance
- Inherent complexity – multiple stresses on food security
- Legal and institutional barriers; political instability, lack of market access and education, information or knowledge. Lack of effective governance / conflict

‘Win-Win’ Adaptation Options

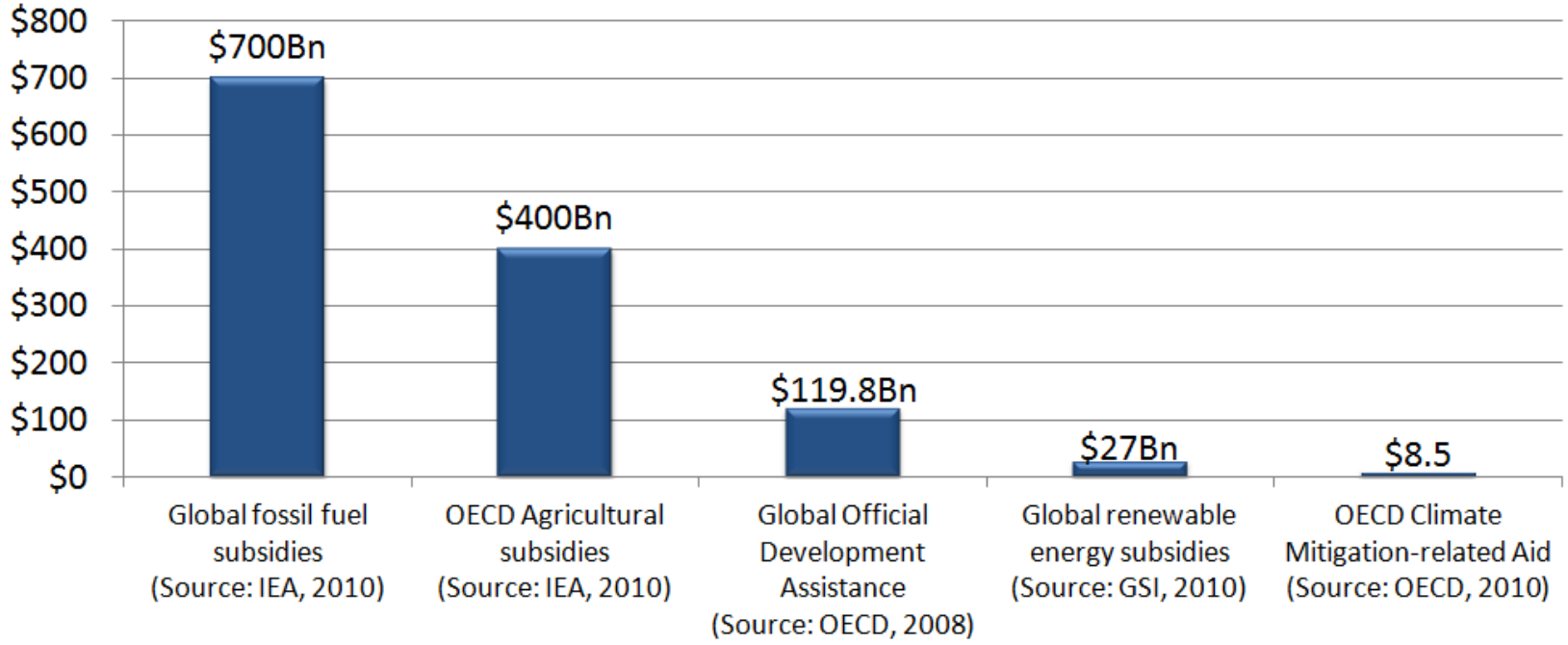
‘**No Regrets measures**’ – improve outcomes under any scenario

- Urban areas: urban green spaces improve air quality, reduce heat island effect, benefit health and improve drainage to reduce flooding

- Improving public transport, cycling and walking benefits public health and environment

‘Win-Win’ Adaptation Options / Solutions

- Access to sanitation and clean water – reduce vulnerability
- Dietary choices: reducing emissions, improving food security, & health benefits
- Reducing food waste: benefits food security and reduces resource use
- Removing fossil fuel subsidies and agricultural subsidies



Thanks for Listening

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Aid Effectiveness

The Paris Declaration on Aid Effectiveness enshrines five principles which are also useful for the evaluation of adaptation finance (OECD, 2005):

1. Ownership by developing countries
2. Alignment using local systems
3. Harmonisation to avoid duplication
4. Results and measuring of results:
5. Mutual accountability for results

OECD's CPEIR (Climate Public Expenditure and Institutional Review) has been undertaken in several countries.

Need to go beyond these principles?
(Bird and Glennie, 2011)