

***Training-Workshop on Climate Change Adaptation in Watersheds
for Water, Food and Environmental Security in Southeast Asia***

SEARCA

College, Laguna, PHILIPPINES 4031

October 15-18, 2013

**PROMOTING SUSTAINABILITY OF WATERSHEDS
IN A CHANGING CLIMATE**

Part 1:

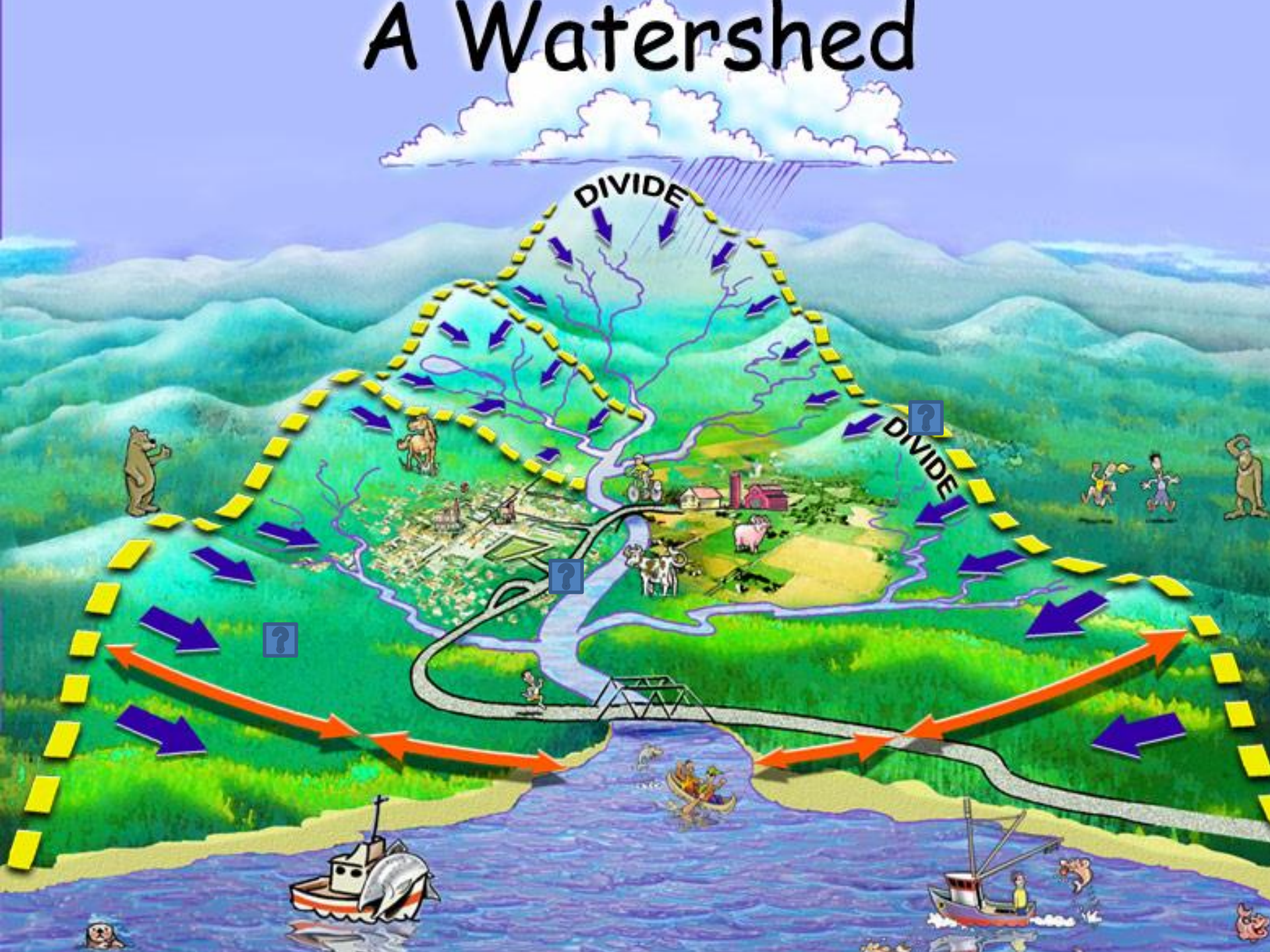
Issues and Challenges

Rex Victor O. Cruz, PhD

University of the Philippines Los Baños

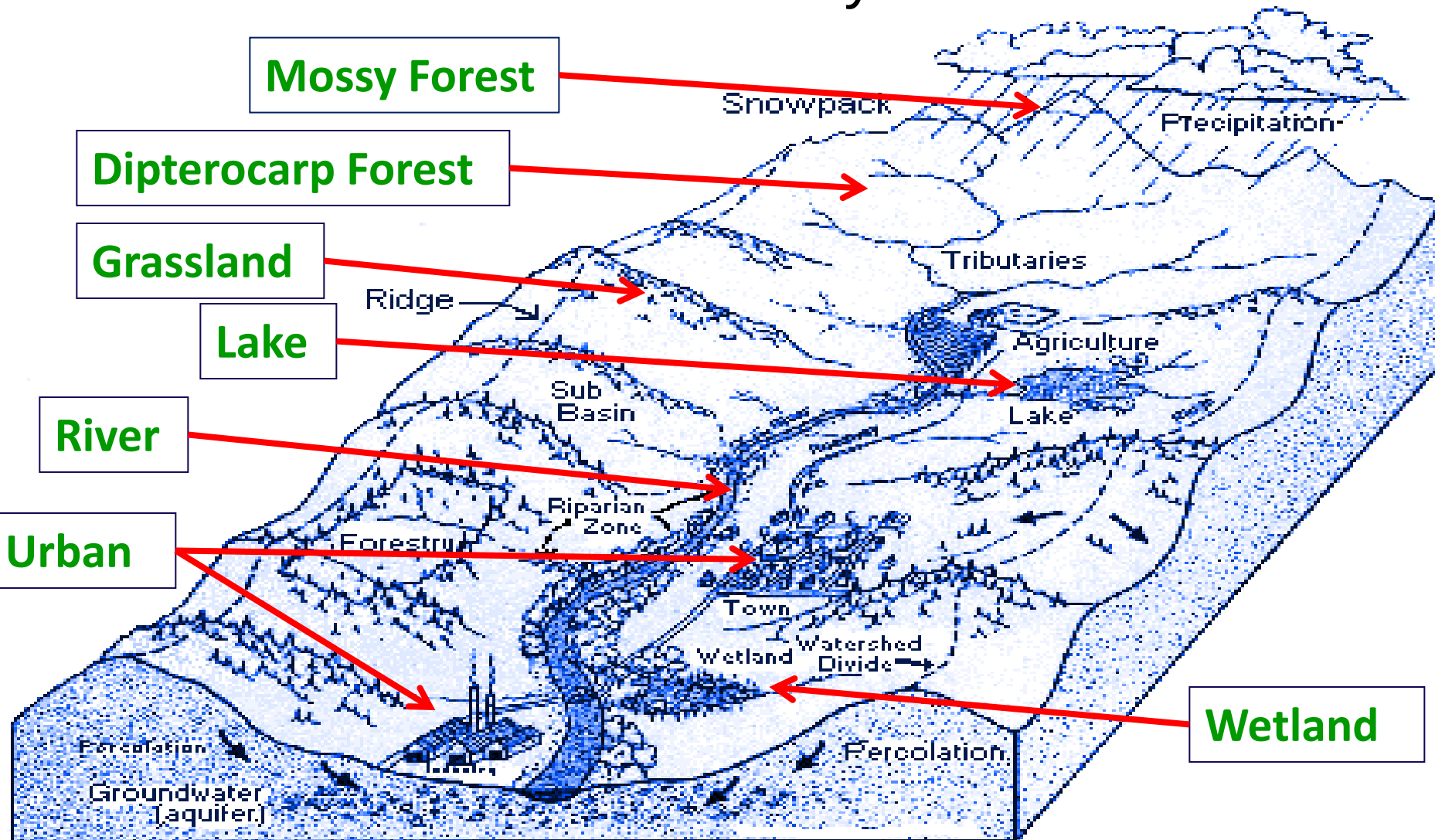
College, Laguna

A Watershed



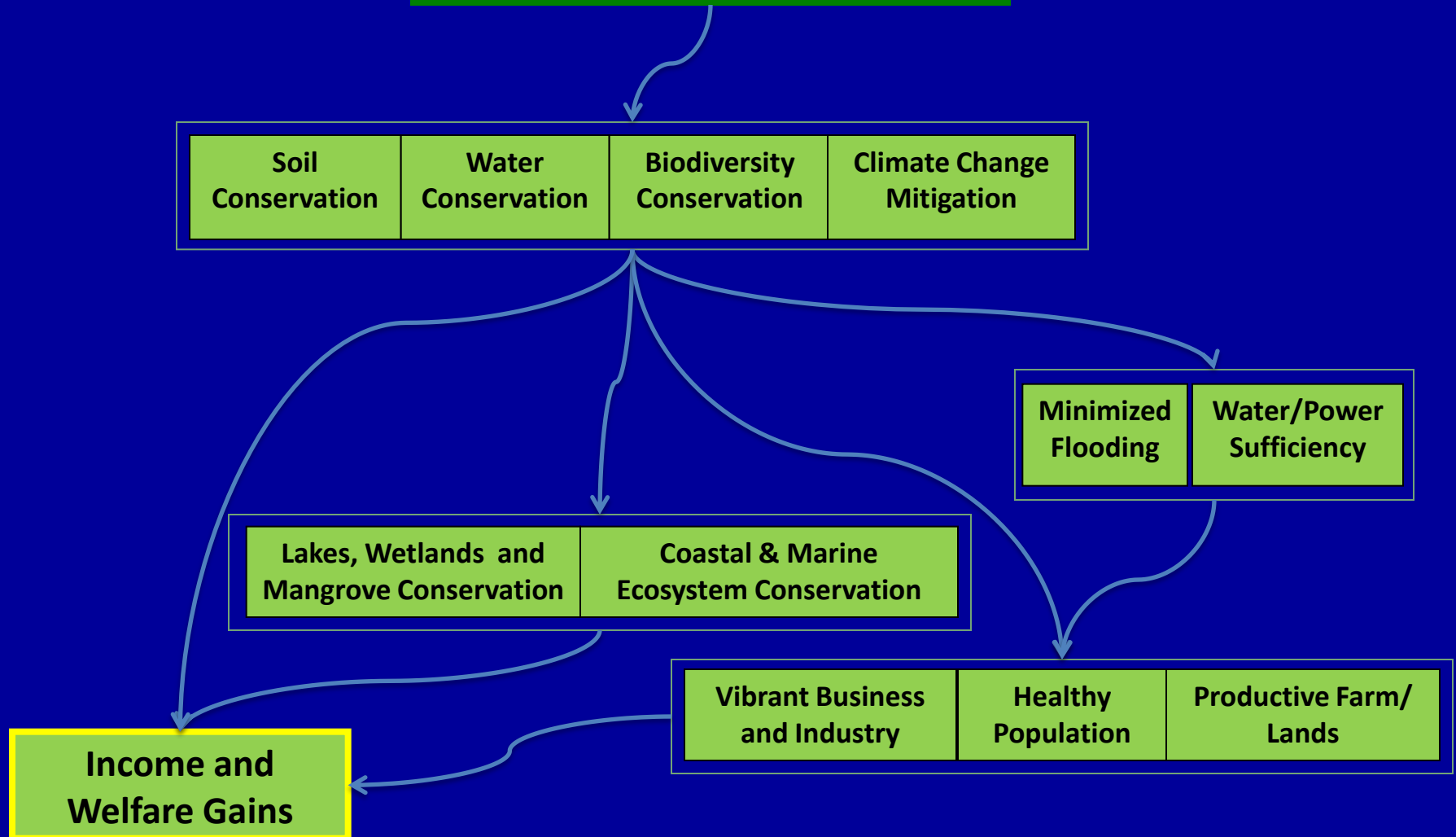
Values of a Watershed

Watershed contains vital ecosystems



Values of a Watershed

Healthy, Sustainable and Resilient Watershed



Watersheds Under Stress

Weak Governance

Poor Planning
and
Execution

Weak
Policies &
Enforcement
& Monitoring

Lack of
Capable
Actors and
Players

Absence of
Adequate
Information

Poor
Economy

inadequate
Livelihood

Population
Growth

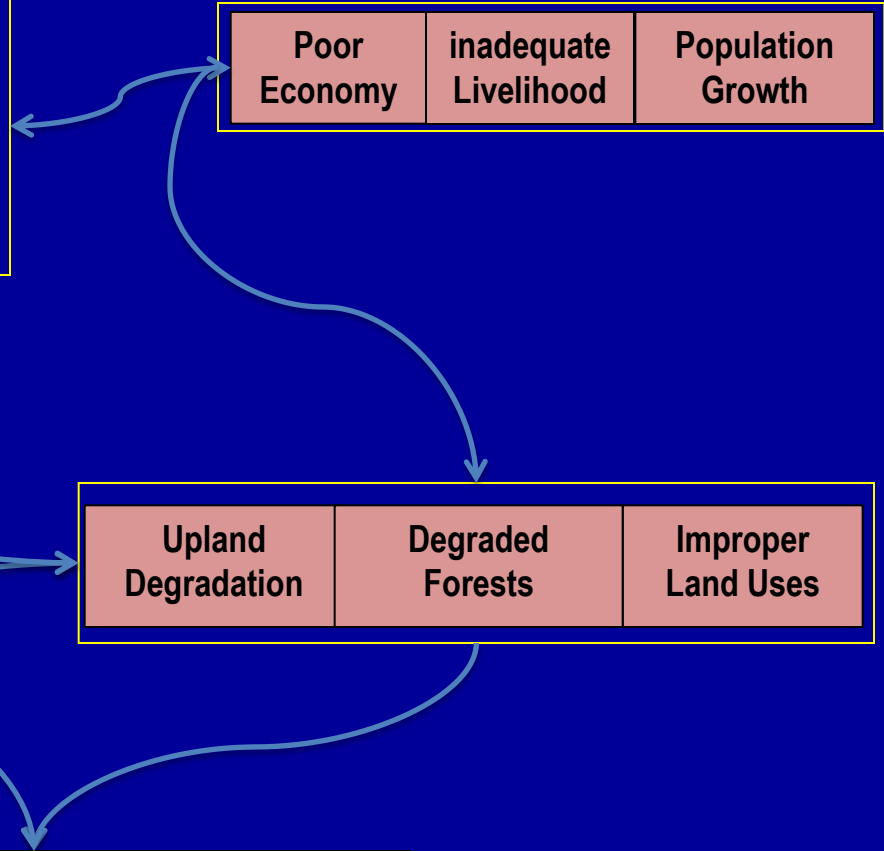
Climate Change
and other Natural
Stressors

Upland
Degradation

Degraded
Forests

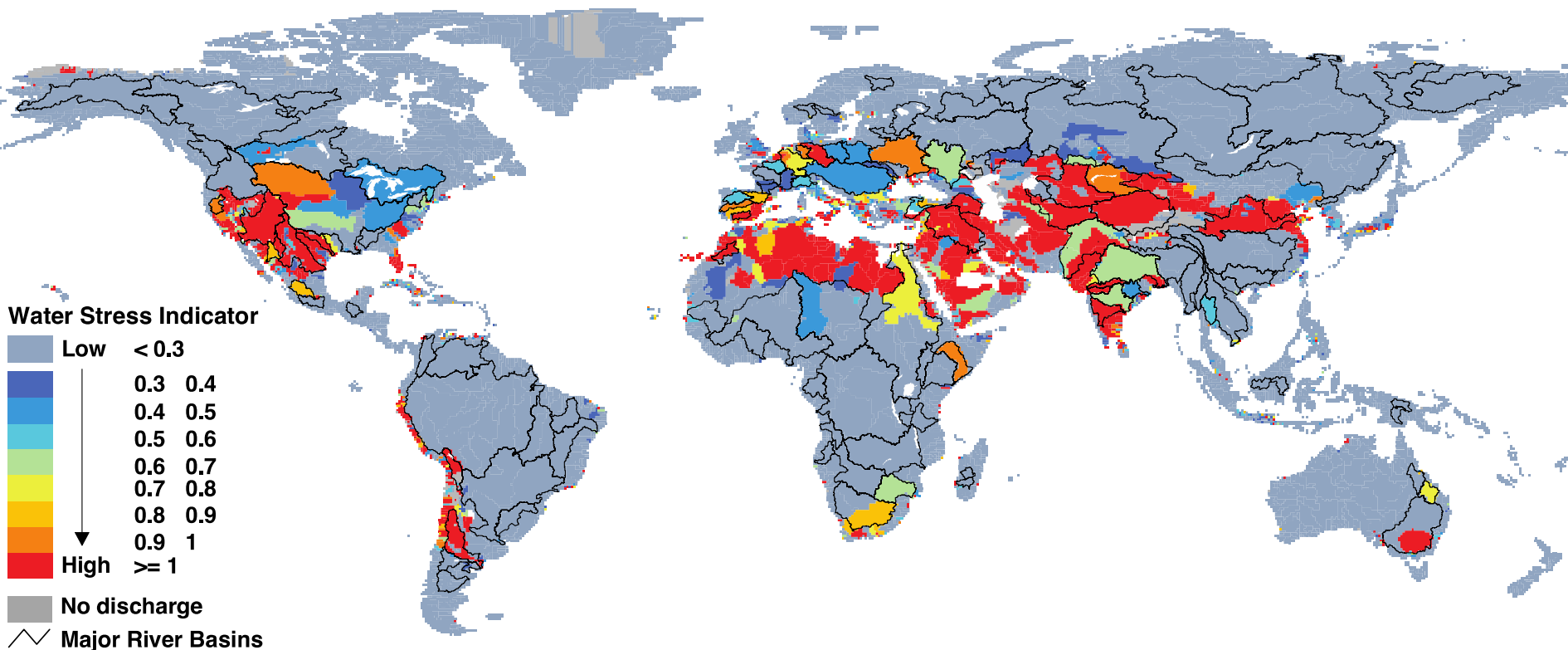
Improper
Land Uses

**Degraded, Unsustainable,
Vulnerable Watershed
Functions**



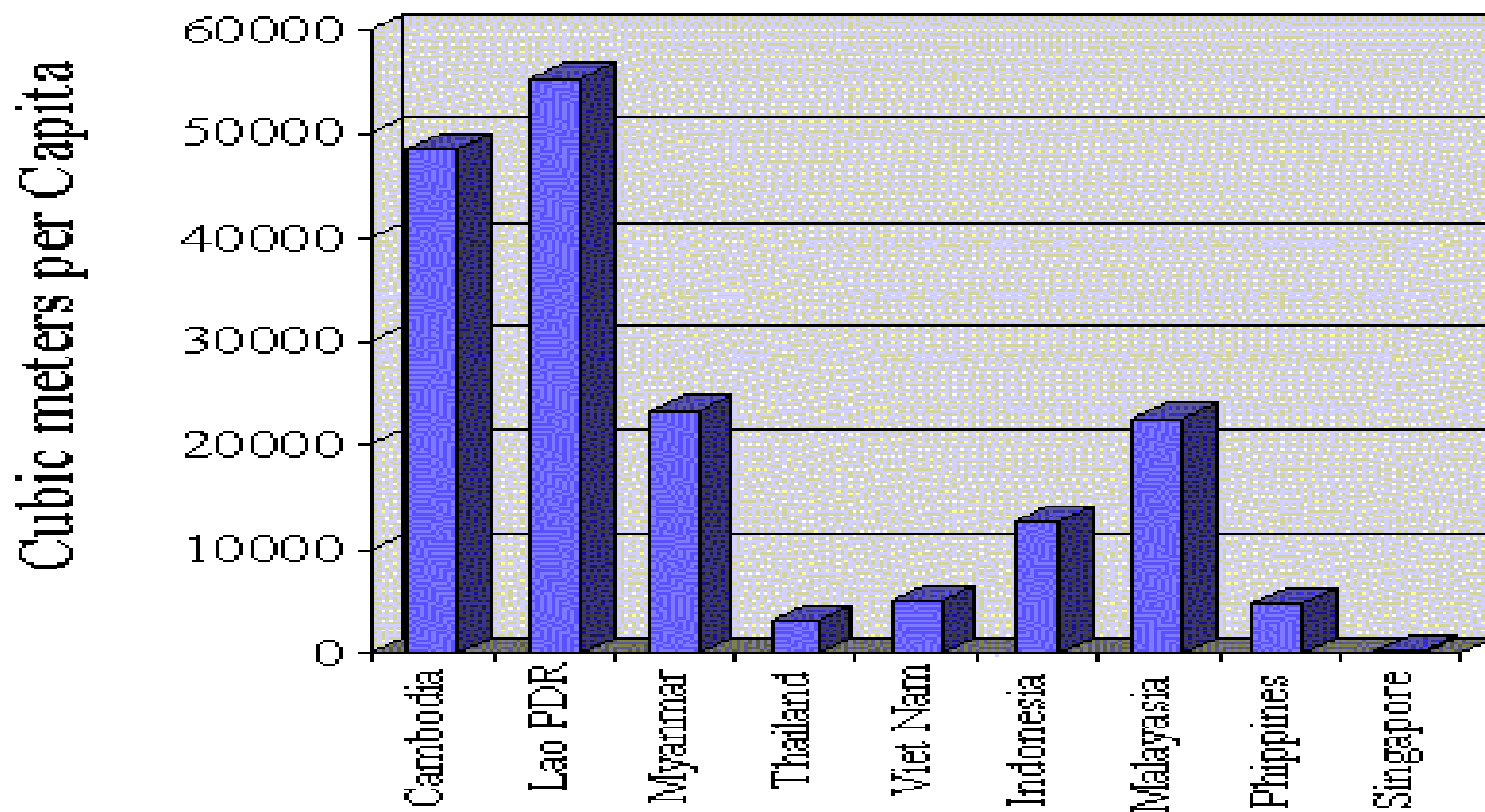
Watersheds Under Stress

Global Water Stress Indicator



Watersheds Under Stress

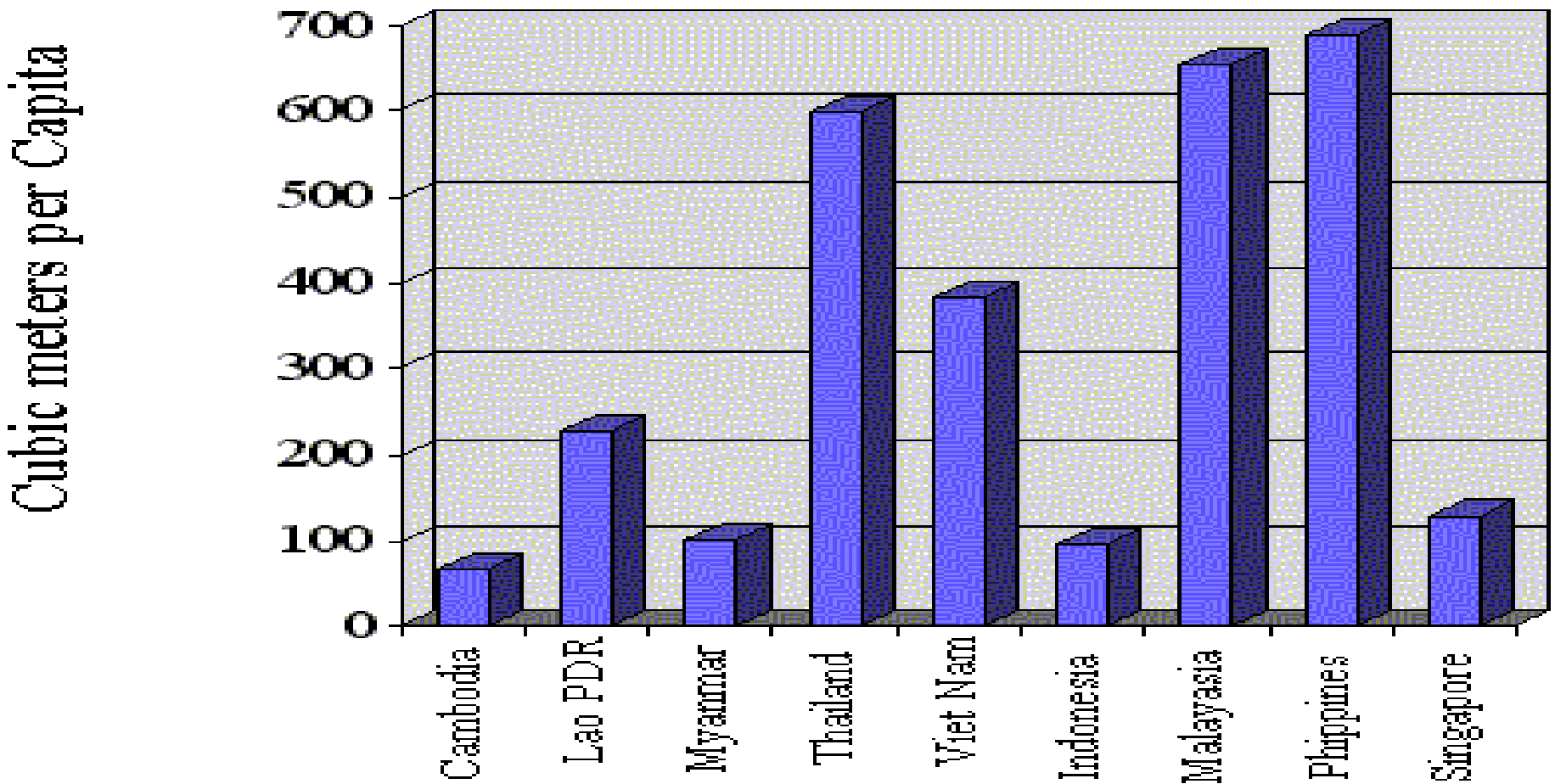
Annual Internal Renewable Water Resources in South East Asia (1995)



Source: World Resources (1996-97)

Watersheds Under Stress

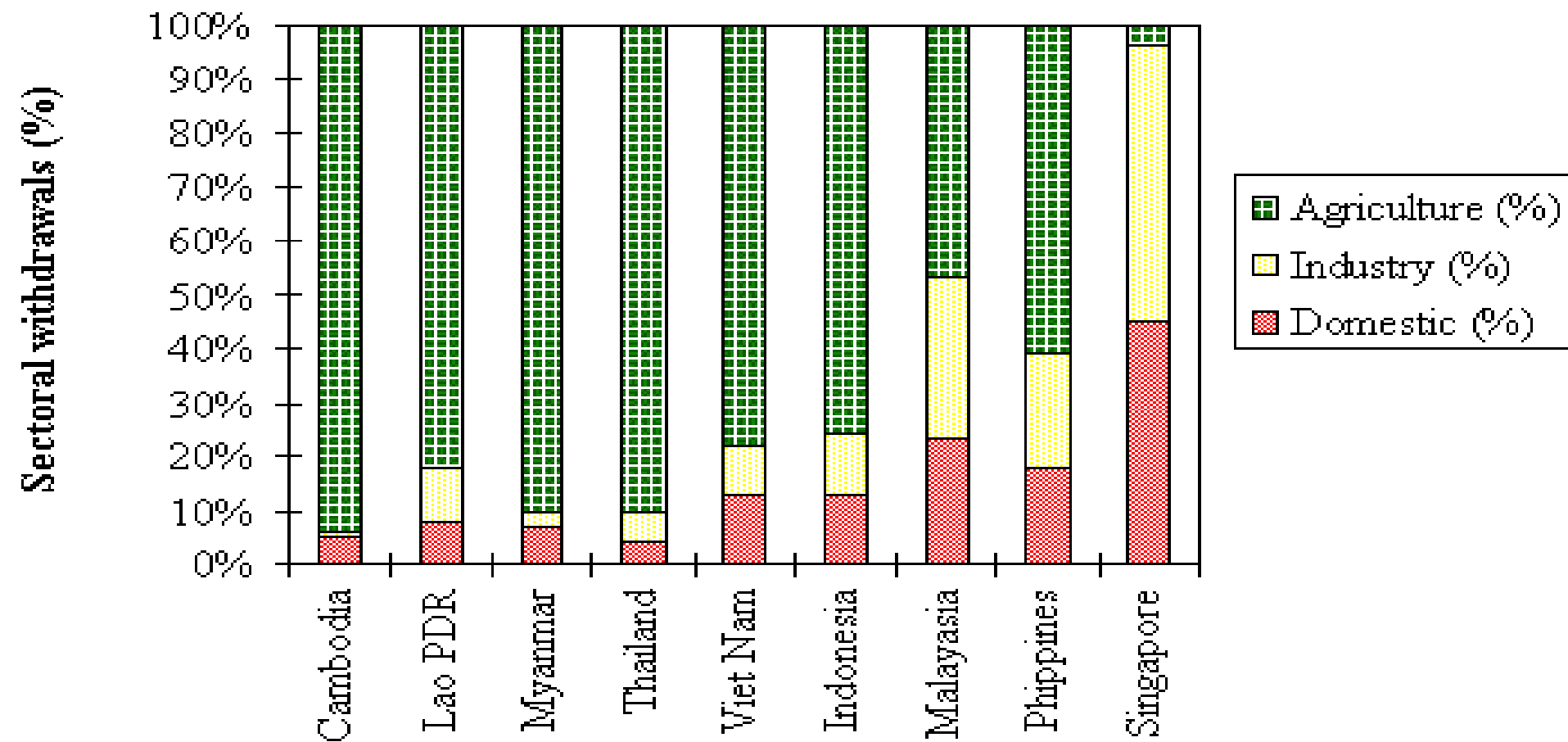
Total Fresh Water Withdrawals in SEA



Source: SoE in Asia-Pacific 1995 (ESCAP)

Watersheds Under Stress

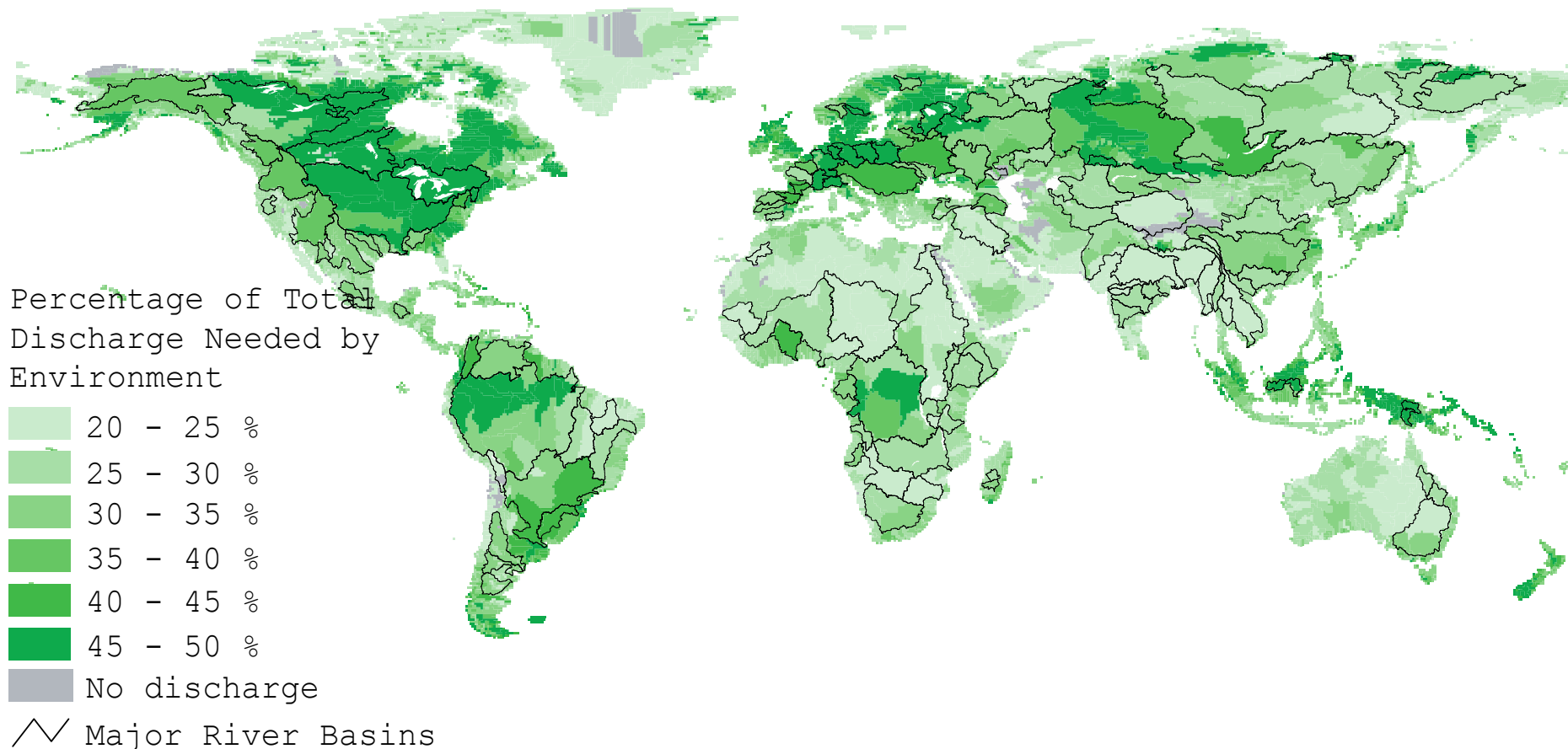
Sectoral Fresh Water Withdrawals in SEA



Source: World Resources 1996-97

Watersheds Under Stress

Streamflow Needed for Environmental Purposes



Watersheds Under Stress

People Lacking Access to Improved Water Source

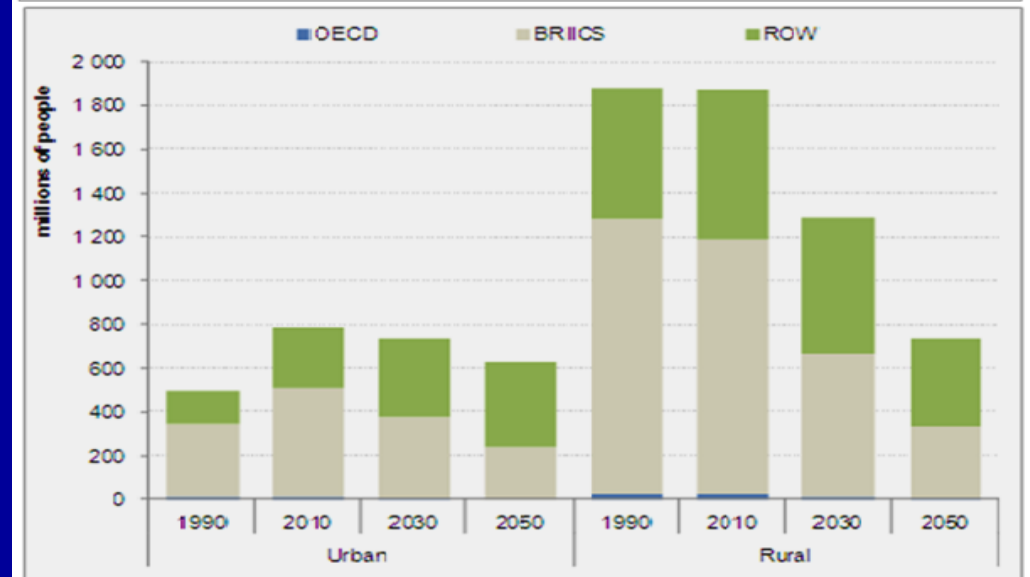
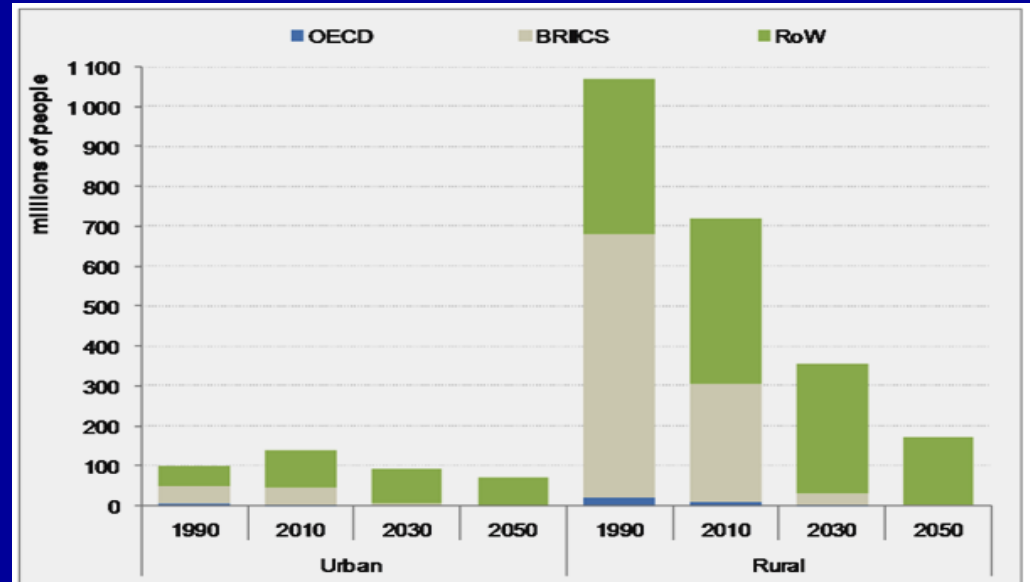
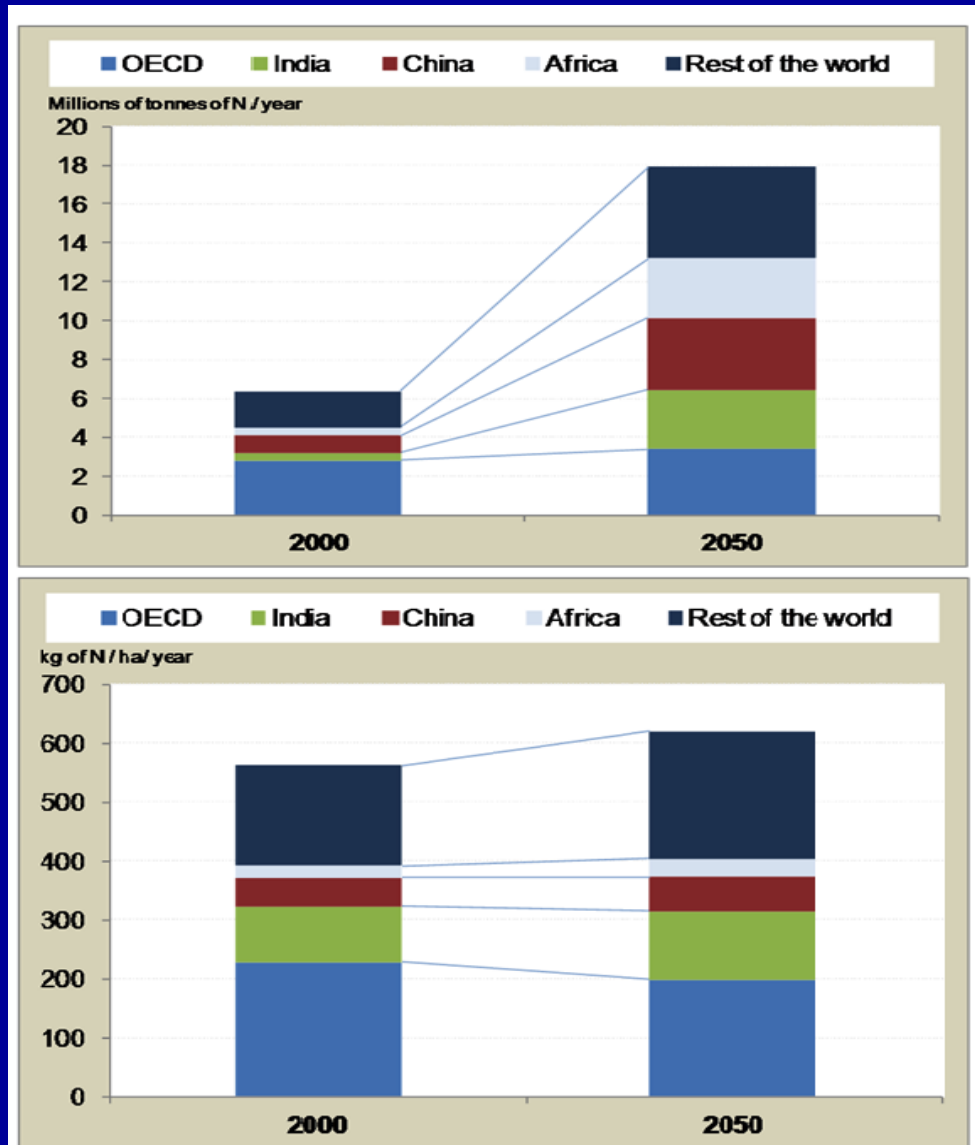


Fig. 3a (top) Population lacking access to an improved water source: Baseline, 1990-2050.
Fig. 3b (bottom) Population lacking access to basic sanitation facilities: Baseline, 1990-2050.
Source: OECD (2012a); output from IMAGE.

Watersheds Under Stress

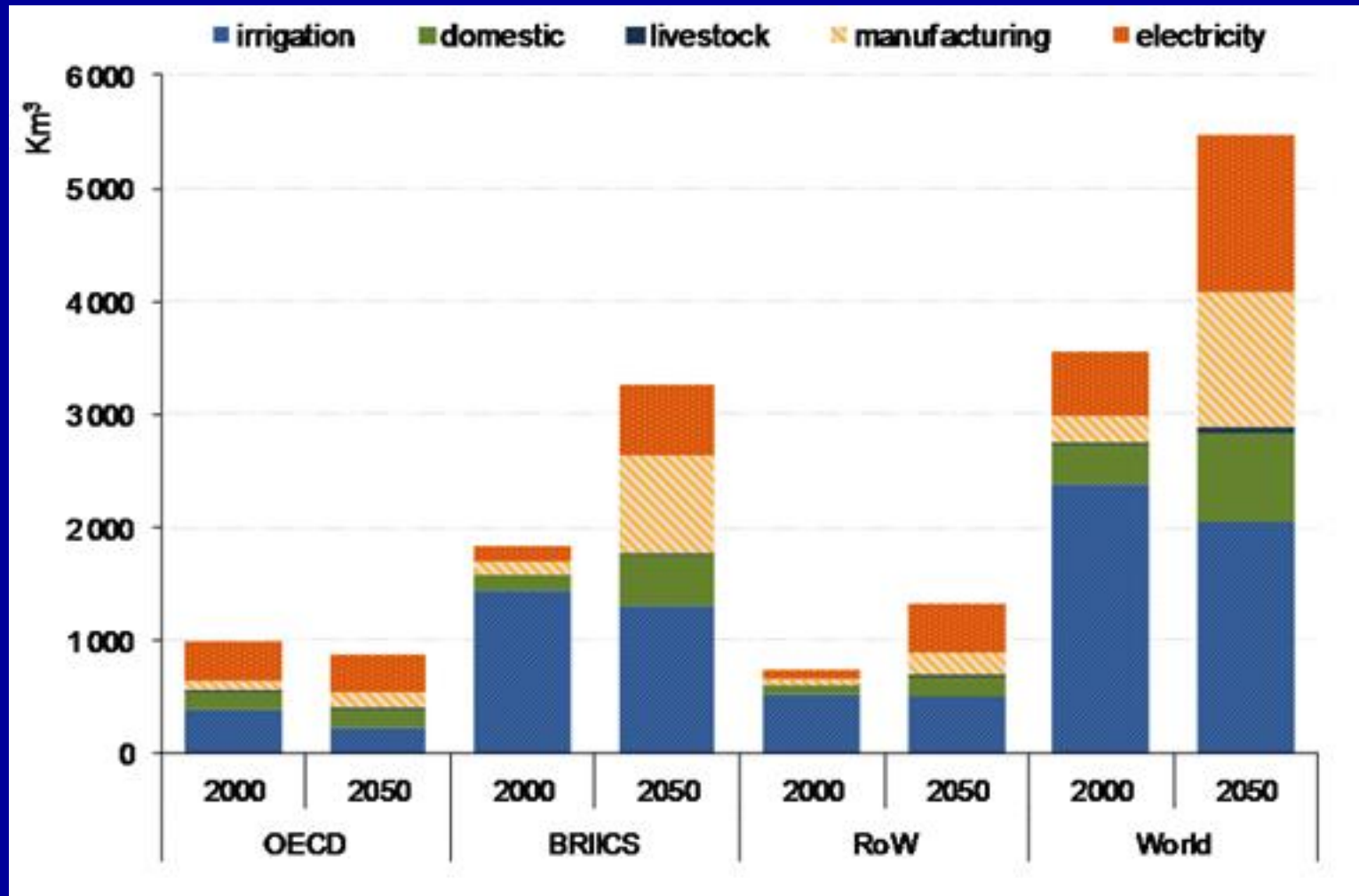
Nitrogen Effluents Increasing

Fig. 2a (top) Nitrogen effluents from wastewater: Baseline, 2000 and 2050. Fig. 2b (bottom) Nitrogen surpluses per hectare from agriculture: Baseline, 2000 and 2050. Source: Based on data from OECD (2012a).



Watersheds Under Stress

Nitrogen Effluents Increasing

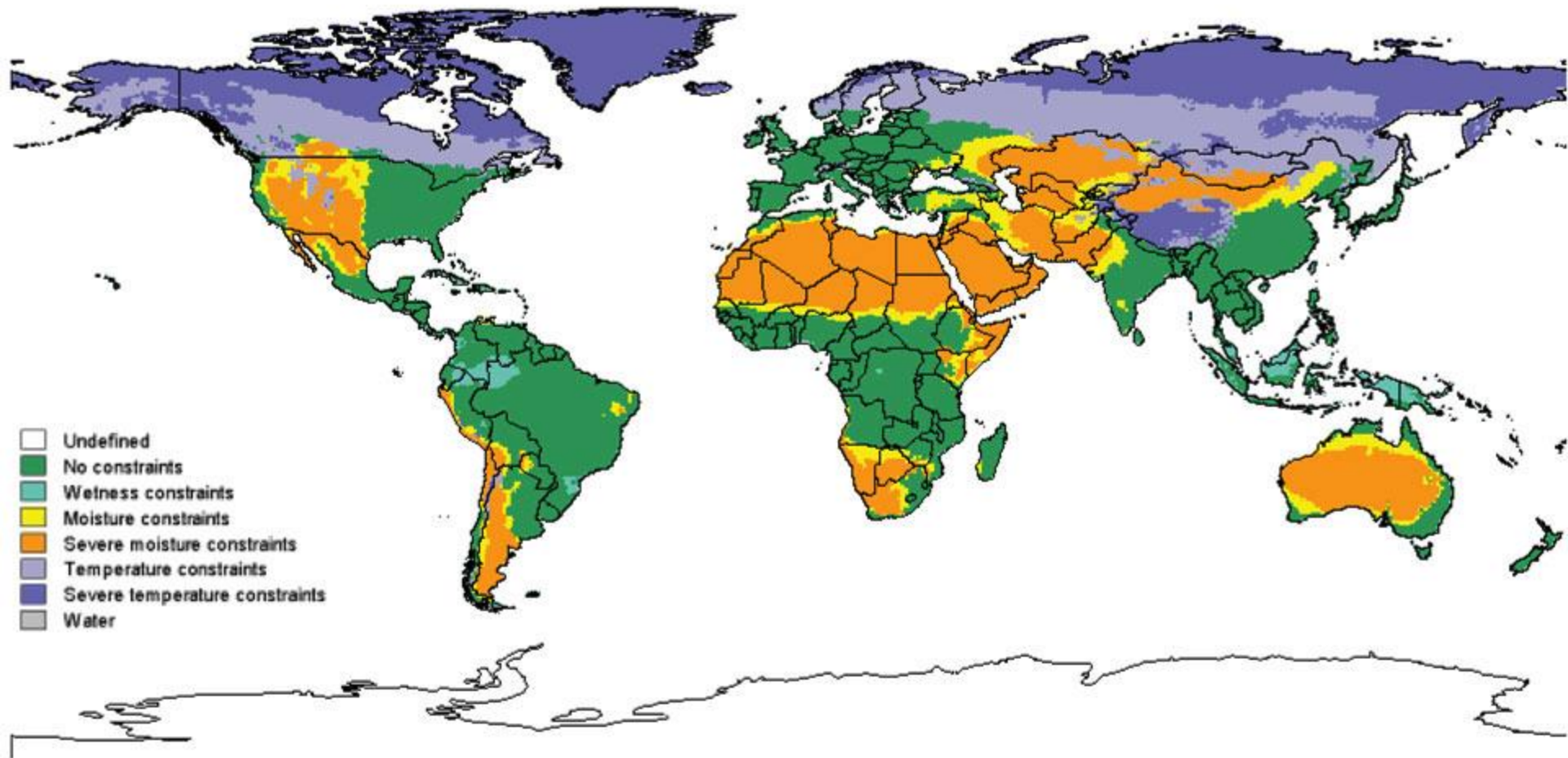


Global water demand: Baseline scenario, 2000 and 2050. Source: OECD (2012a); output from IMAGE.

Watersheds Under Stress

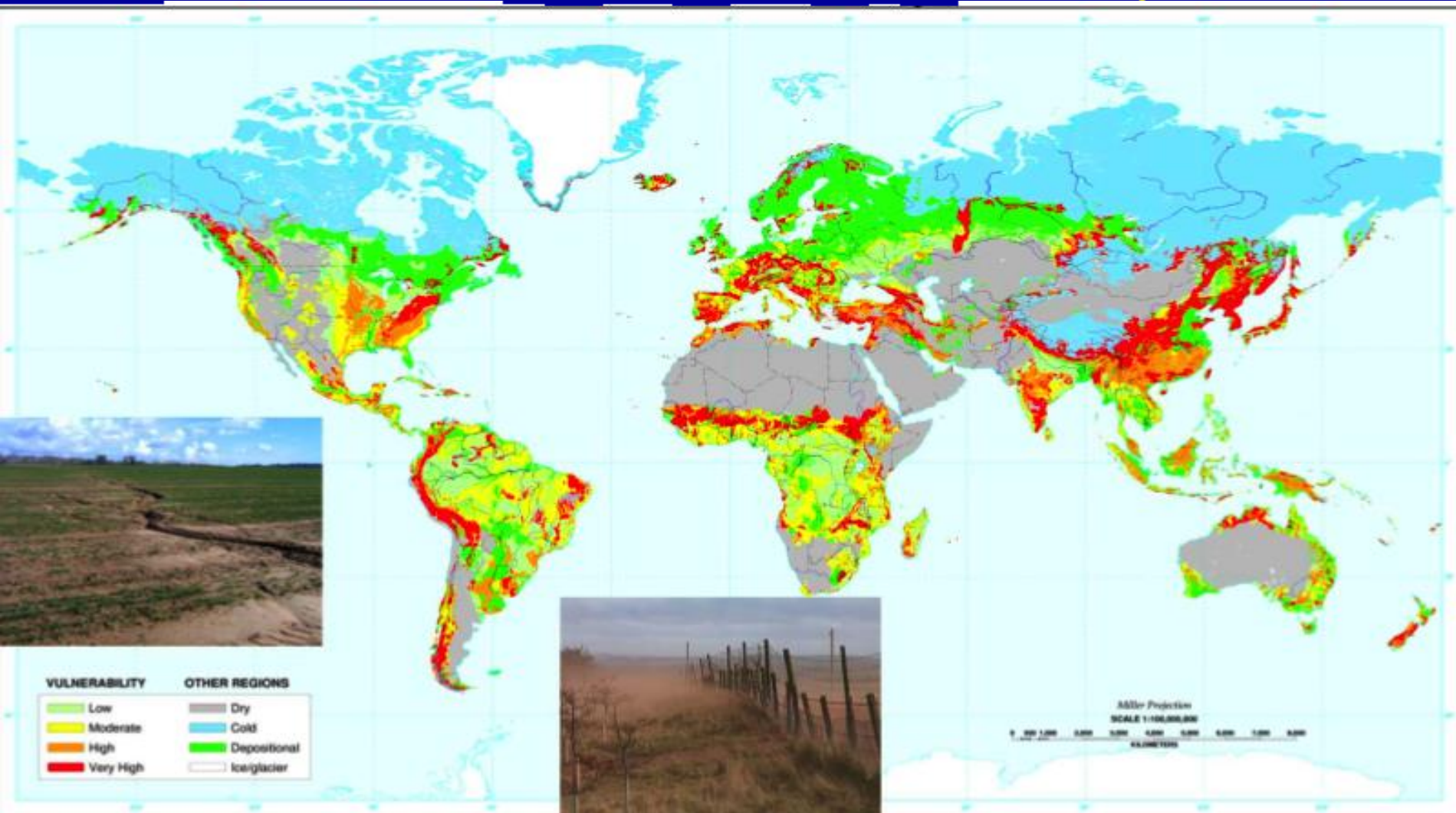
Climate Related Constraints

Plate 20. Climate constraints

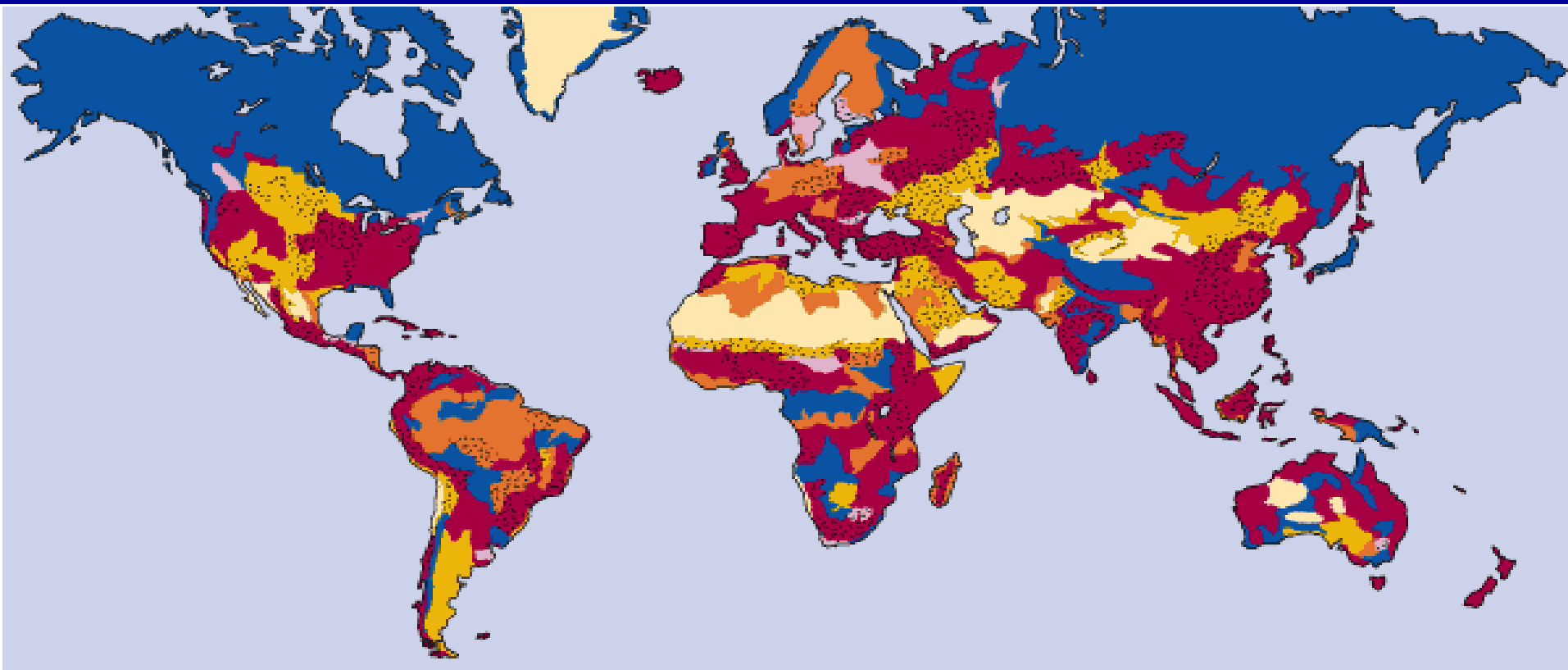


Watersheds Under Stress

Global Water Erosion Vulnerability



Watersheds Under Stress



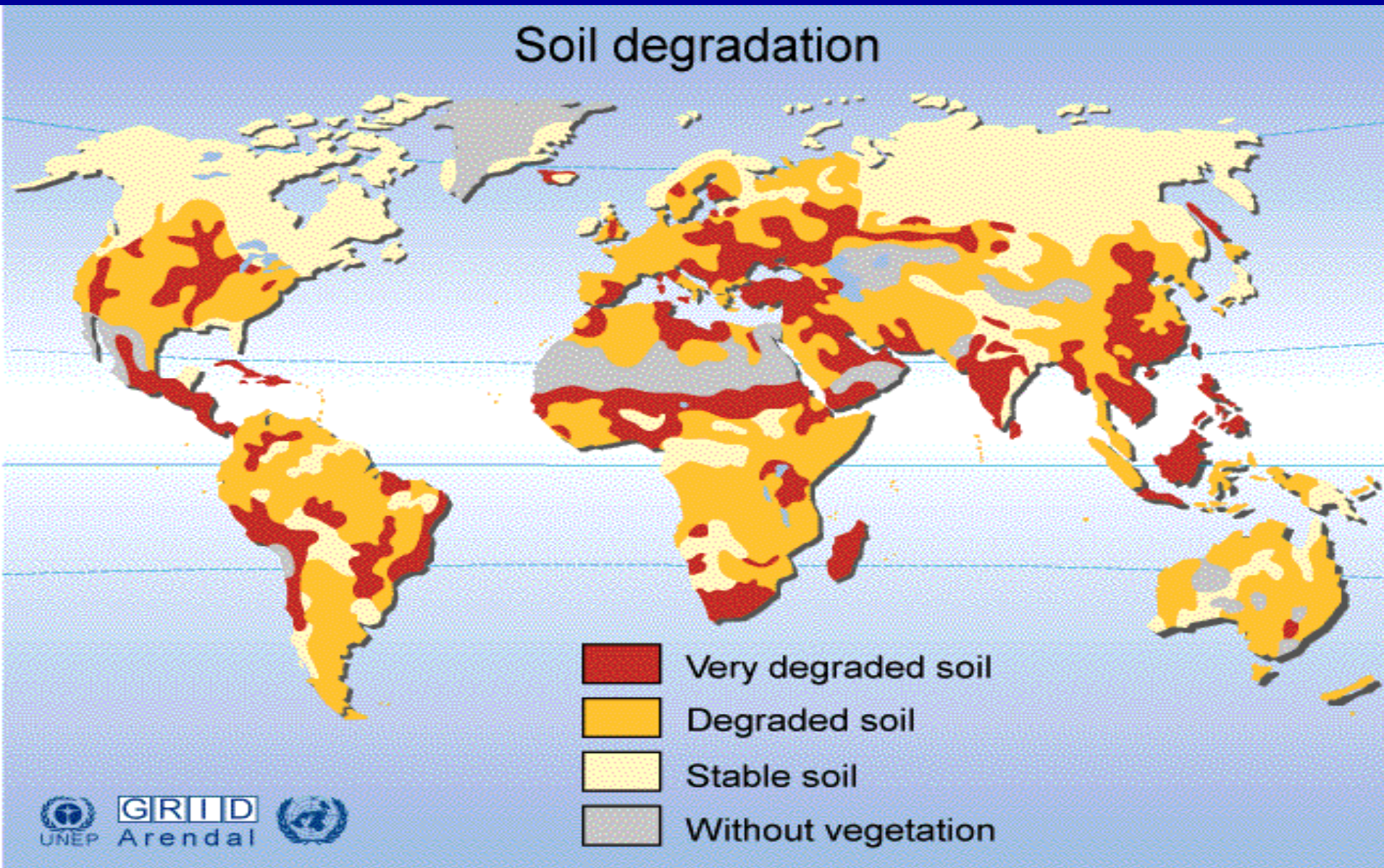
Soil degradation types

	Water erosion		Physical deterioration
	Wind erosion		Severe degradation
	Chemical deterioration		

Other symbols

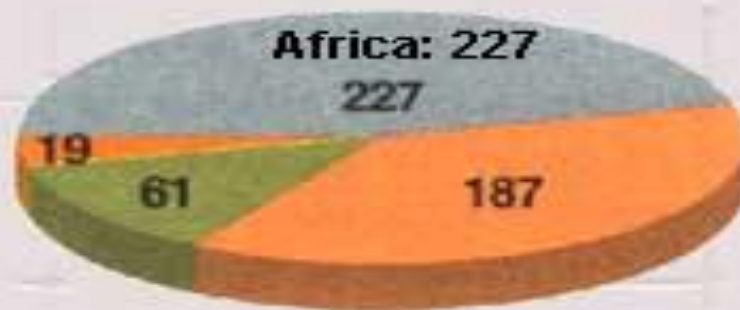
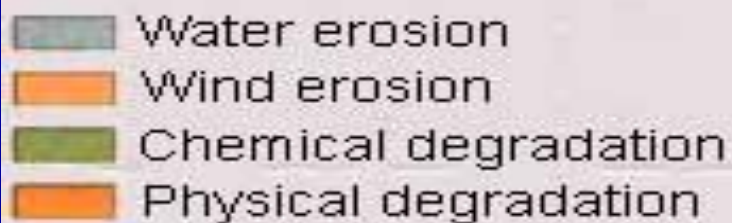
	Stable terrain
	Non-used wasteland
	Water bodies

Watersheds Under Stress

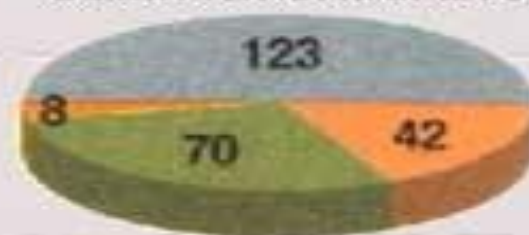


Soil degradation by area and type

Million hectares



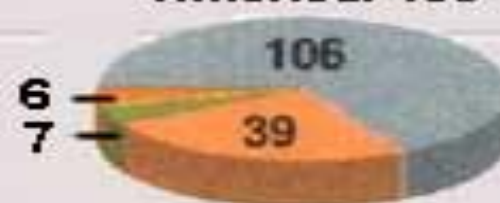
South America: 243



Europe: 219



North and Central America: 158

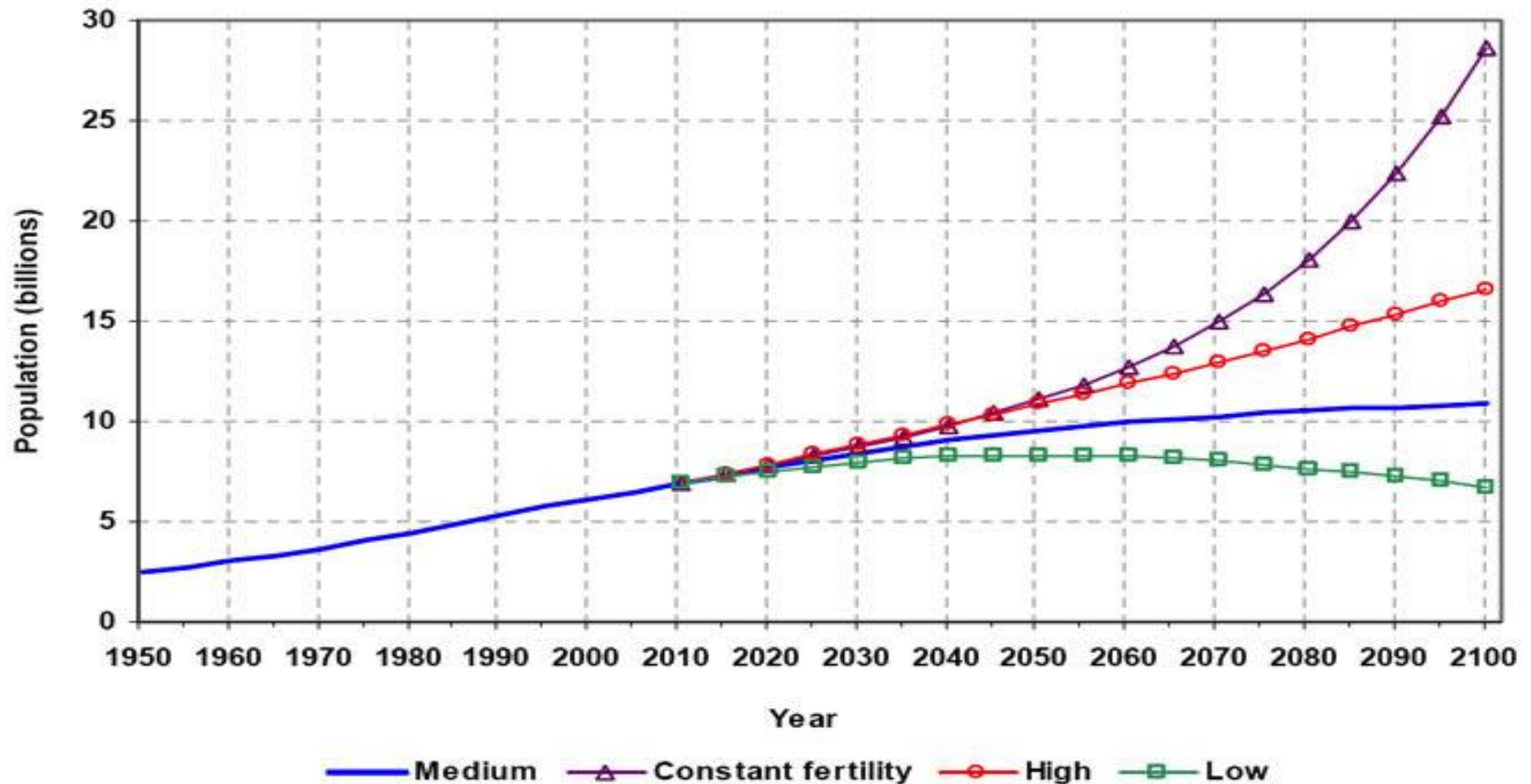


Southwest Pacific: 103



Human Stressors

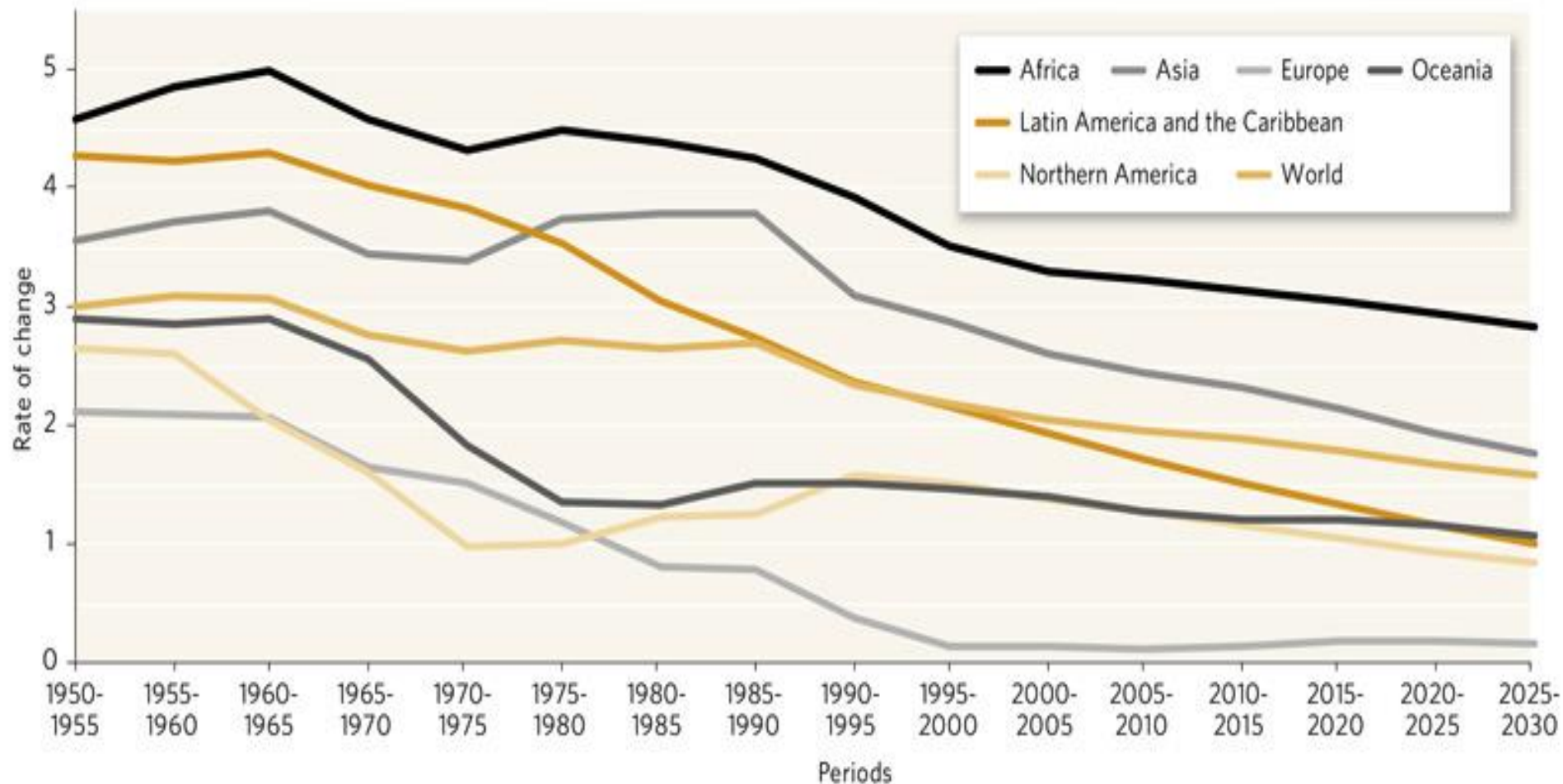
Figure 1. Population of the world, 1950-2100, according to different projections and variants



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2013). *World Population Prospects: The 2012 Revision*. New York: United Nations.

Human Stressors

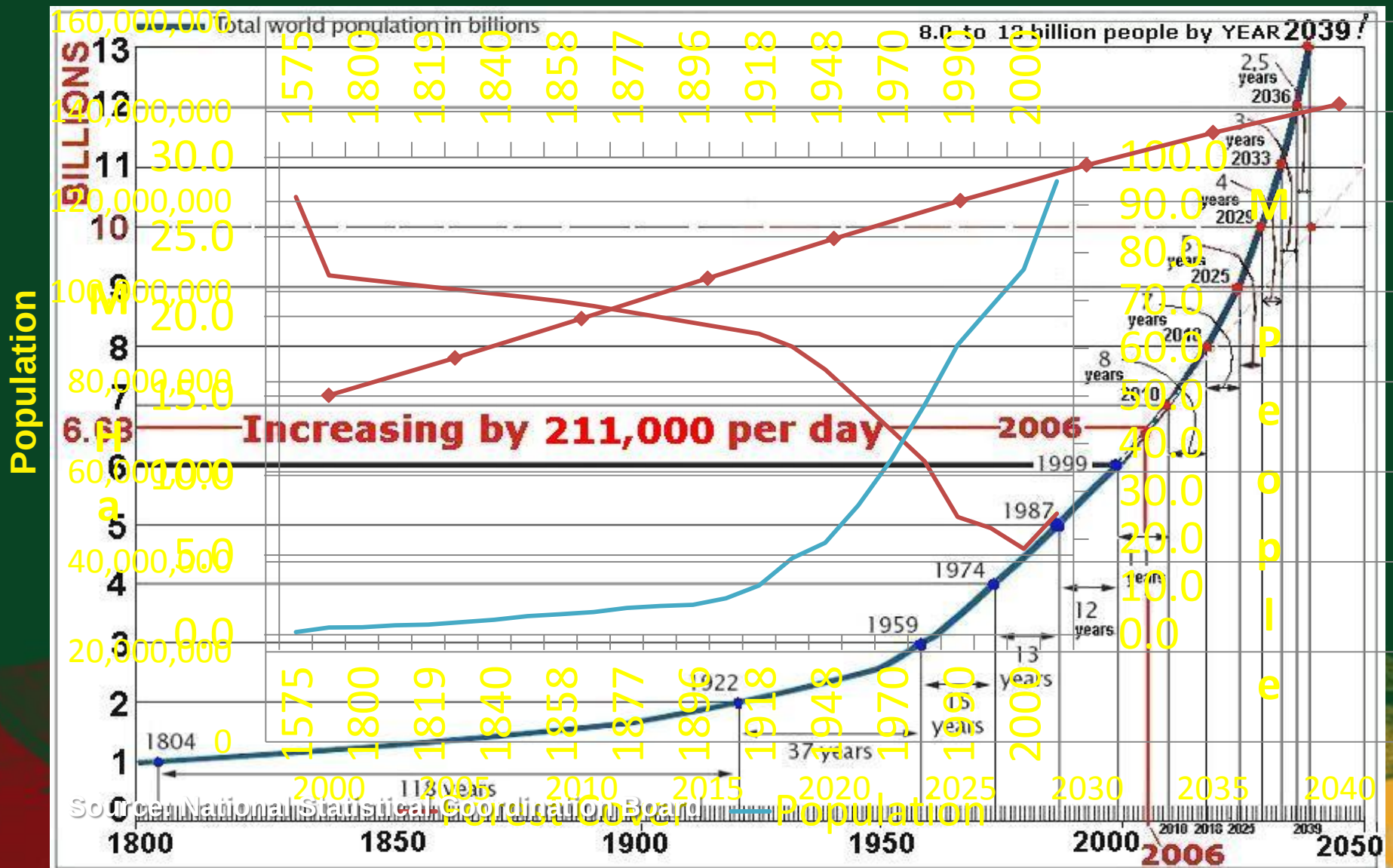
Figure 1: Average Annual Rate of Change of the Urban Population, by Region, 1950-2030



Source: United Nations. 2006. *World Urbanization Prospects: The 2005 Revision*, Table A.6. New York: Population Division, Department of Economic and Social Affairs, United Nations.

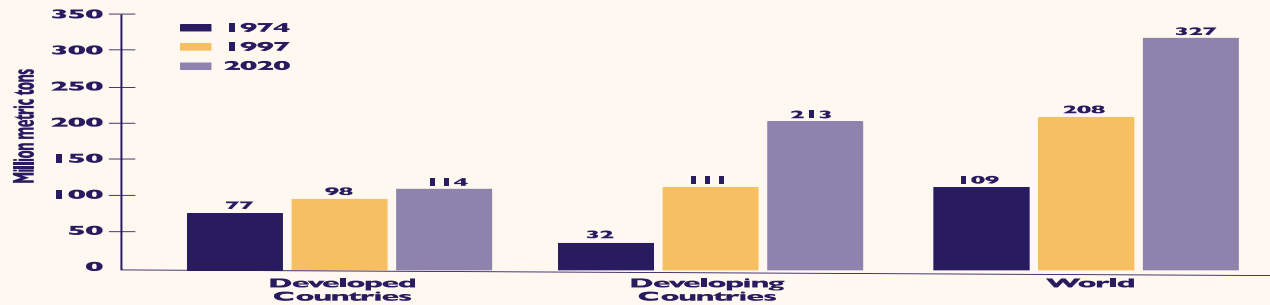
Human Stressors

Philippine Forest Cover and Population Trends (Cruz 2010)



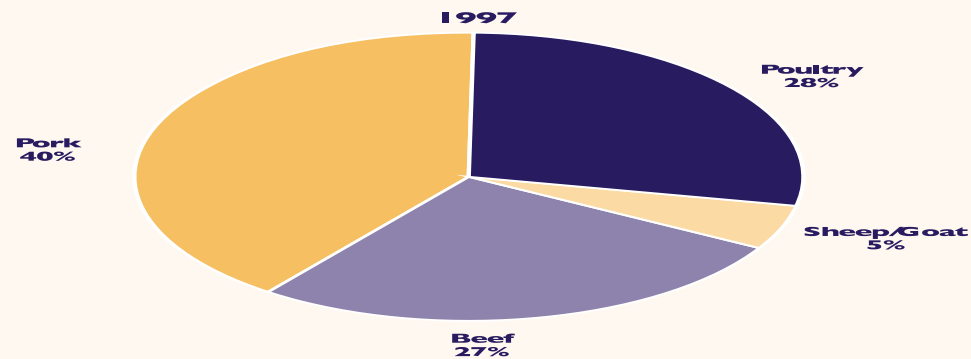
Human Stressors

Figure 5 World demand for meat, 1974, 1997, and 2020



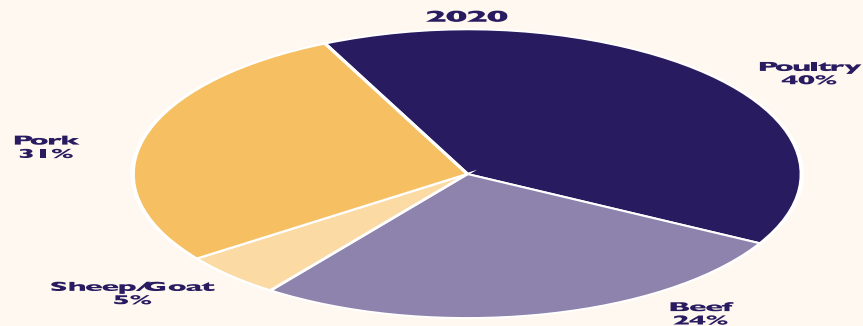
SOURCE: IFPRI IMPACT projections, June 2001, and FAOSTAT (www.fao.org) for 1974 data.

Figure 6 Types of meat demanded globally, 1997, and increase, 1997–2020



Total meat demand: 208 million metric tons.

Increase in meat demand, 1997–2020

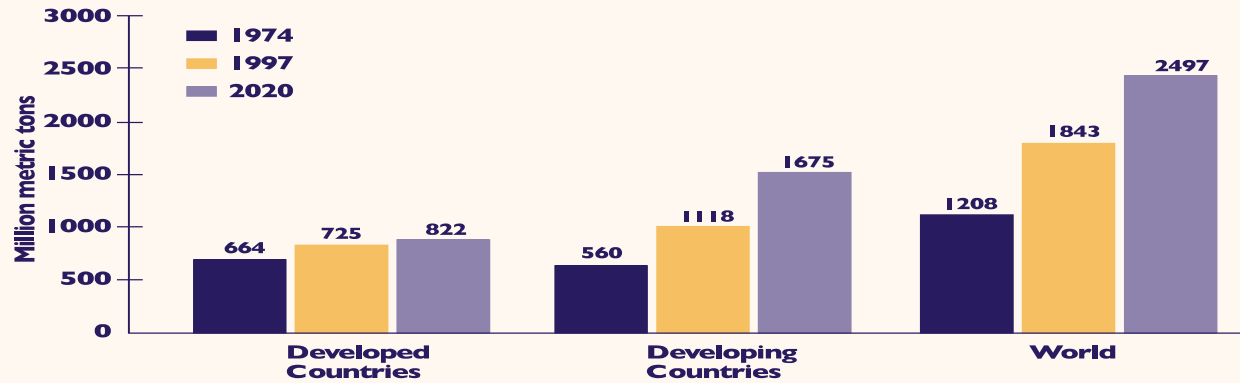


Total meat demand increase: 119 million metric tons.

SOURCE: IFPRI IMPACT projections, June 2001.

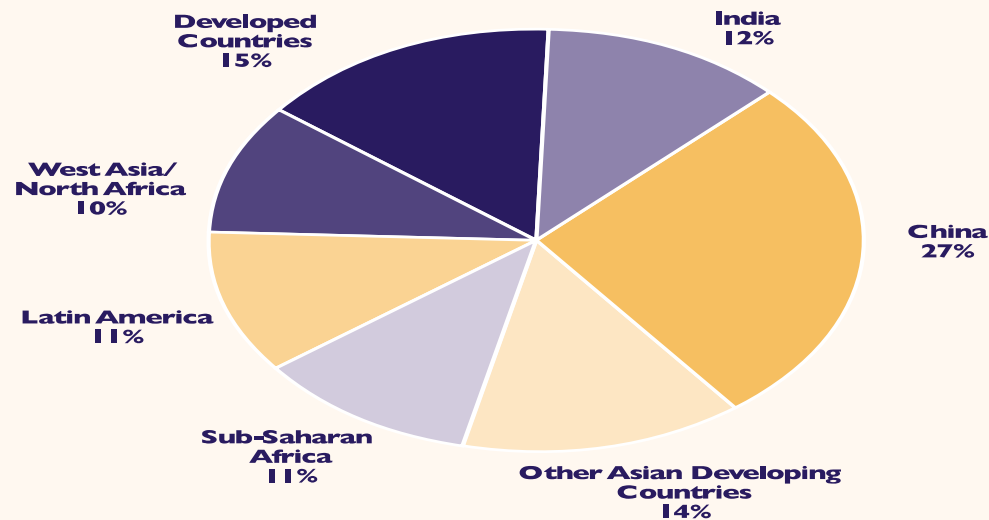
Human Stressors

Figure 3 World demand for cereals, 1974, 1997, and 2020



SOURCE: IFPRI IMPACT projections, June 2001, and FAOSTAT (www.fao.org) for 1974 data.

Figure 4 Regional shares of increased cereal demand, 1997–2020

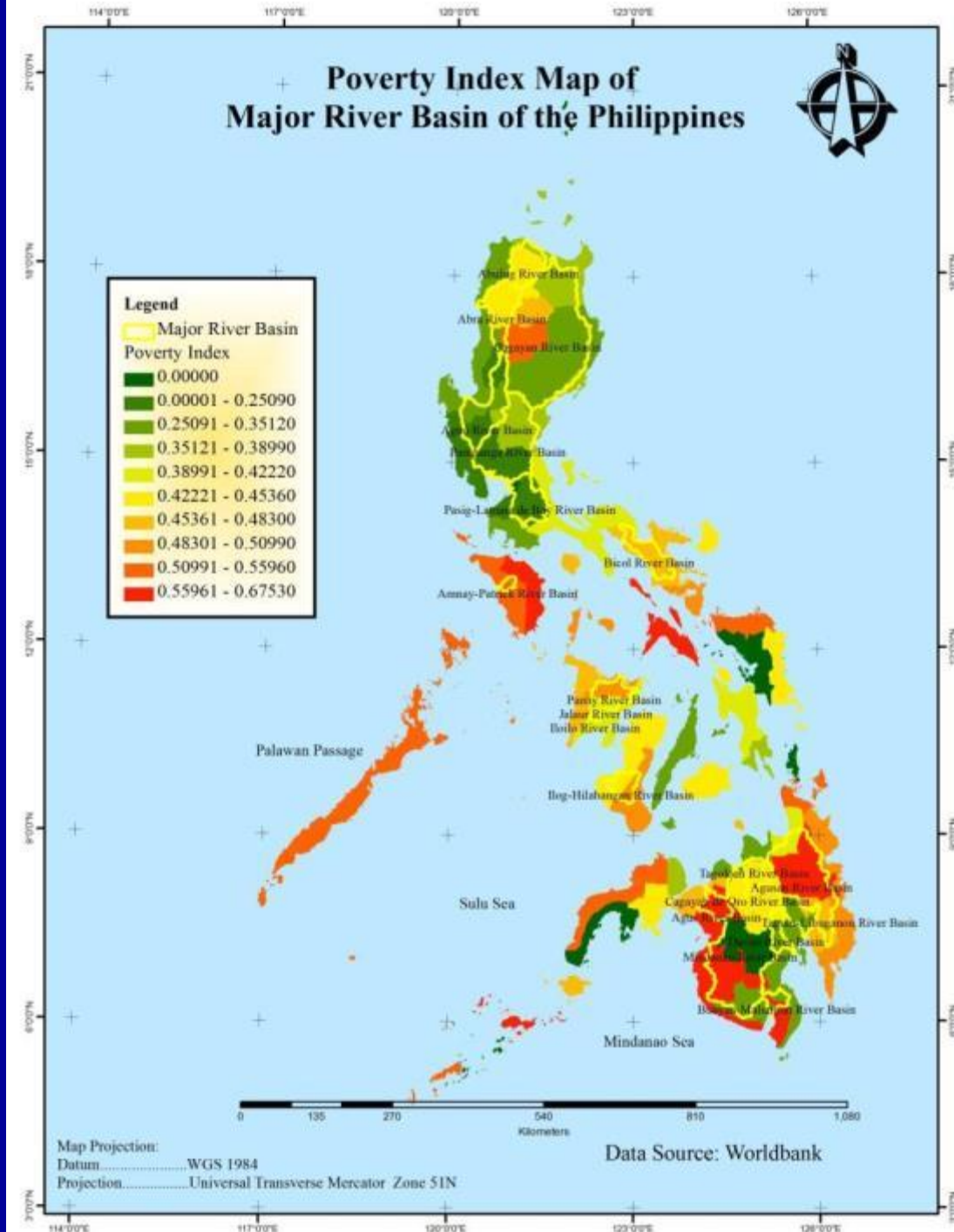


Total Increase: 654 million metric tons.

SOURCE: IFPRI IMPACT projections, June 2001.

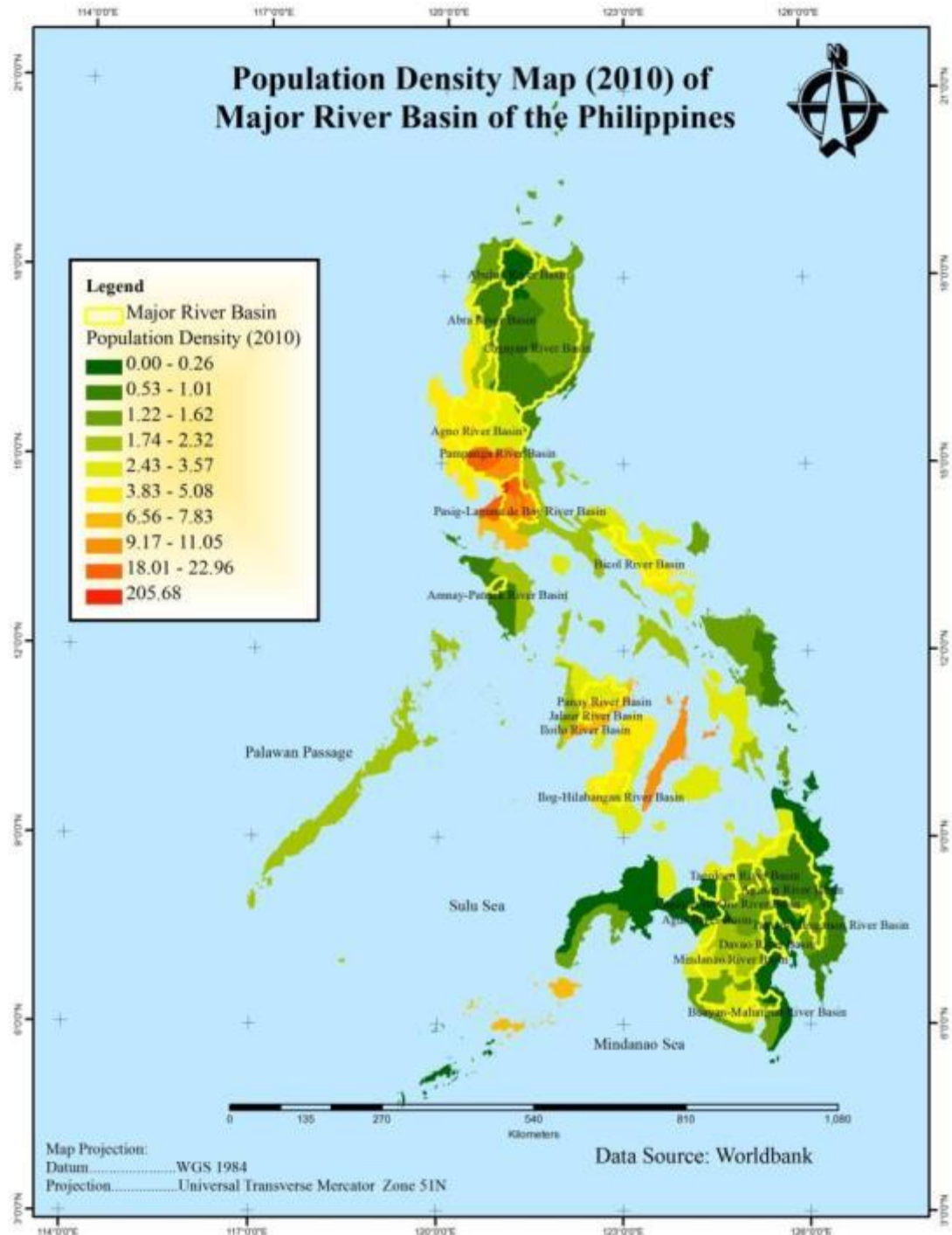
Human Stressors

Poverty and
absence of
viable
livelihoods



2010
2000
1990
1980

Population density by river basins



Human Stressors

2010

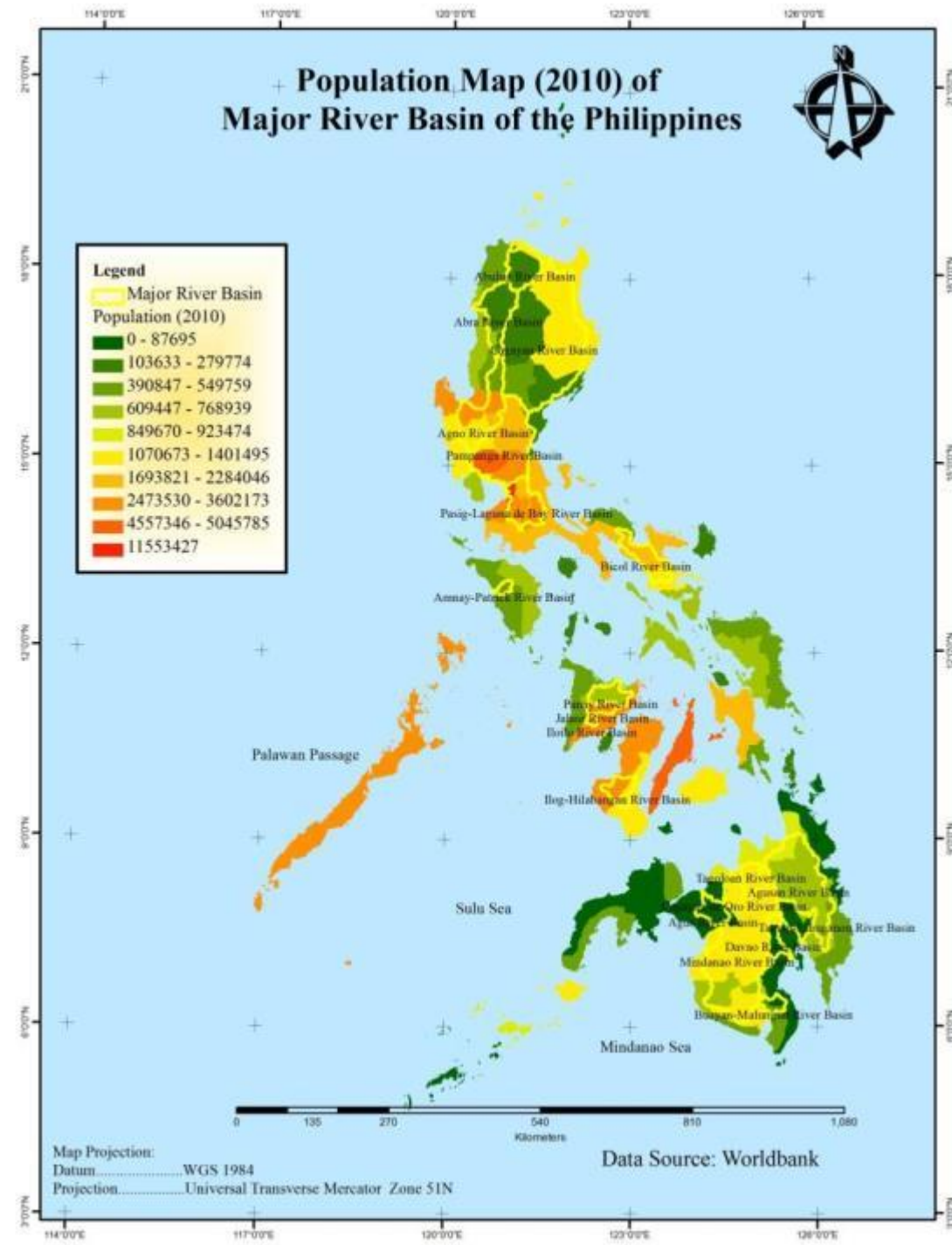
2000

1990

1980

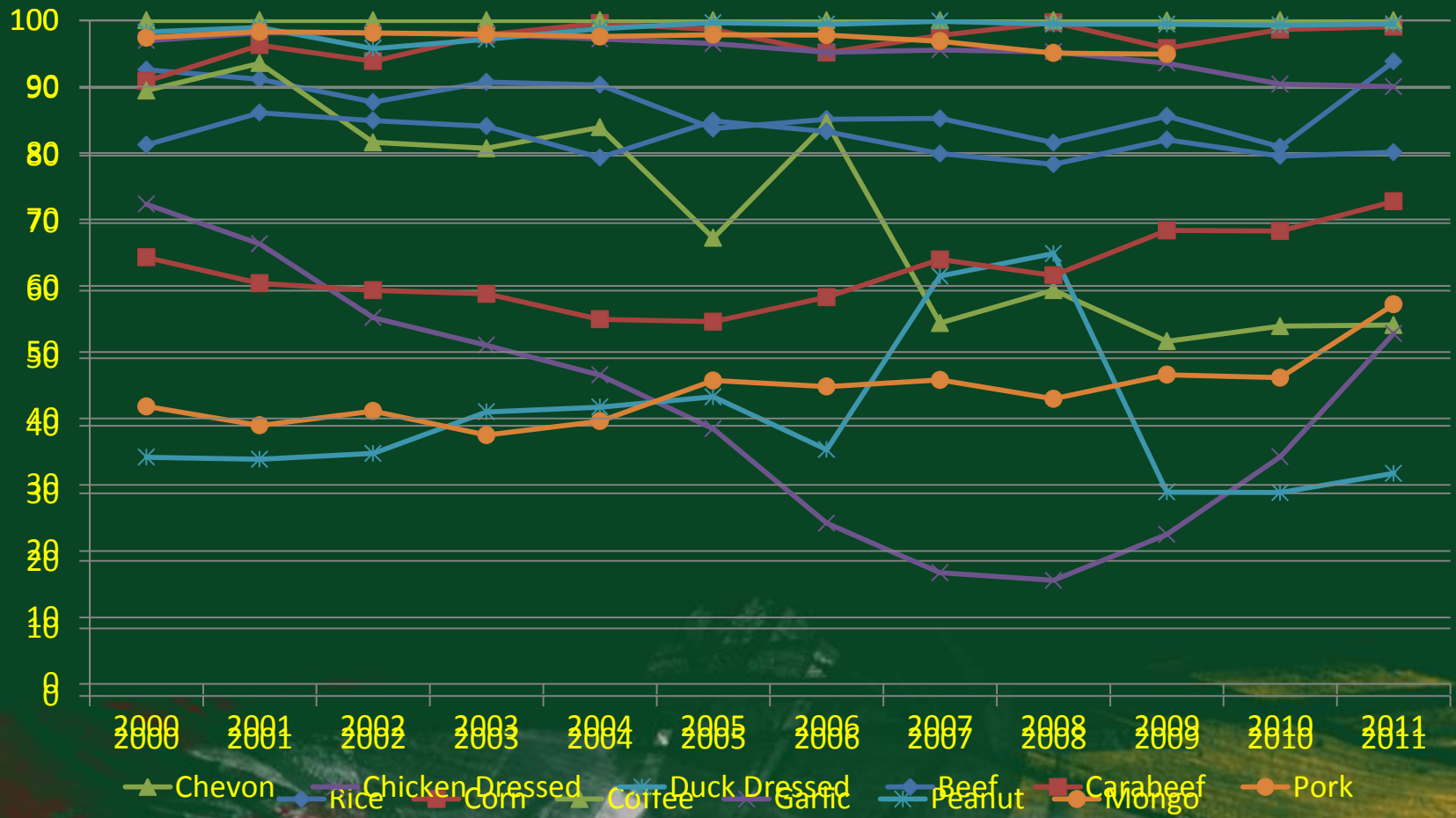


Population
growth and
development



Human Stressors

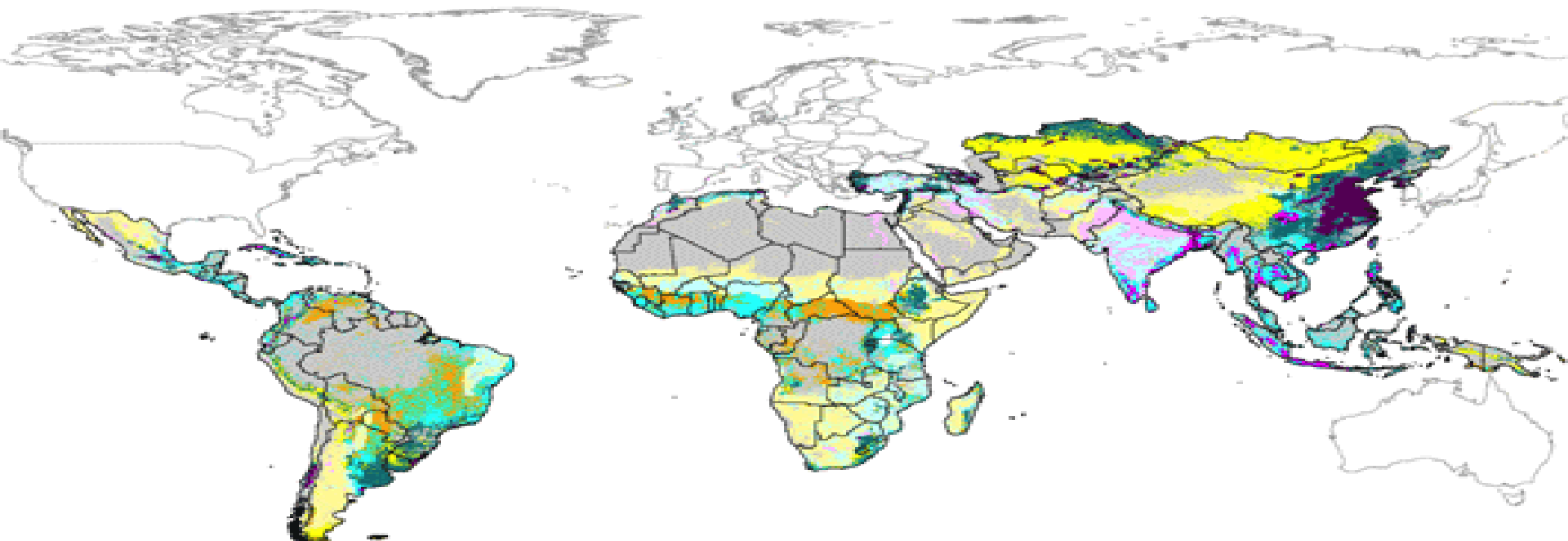
Efficiency Ratio of stock body (2000-2011)



Human Stressors

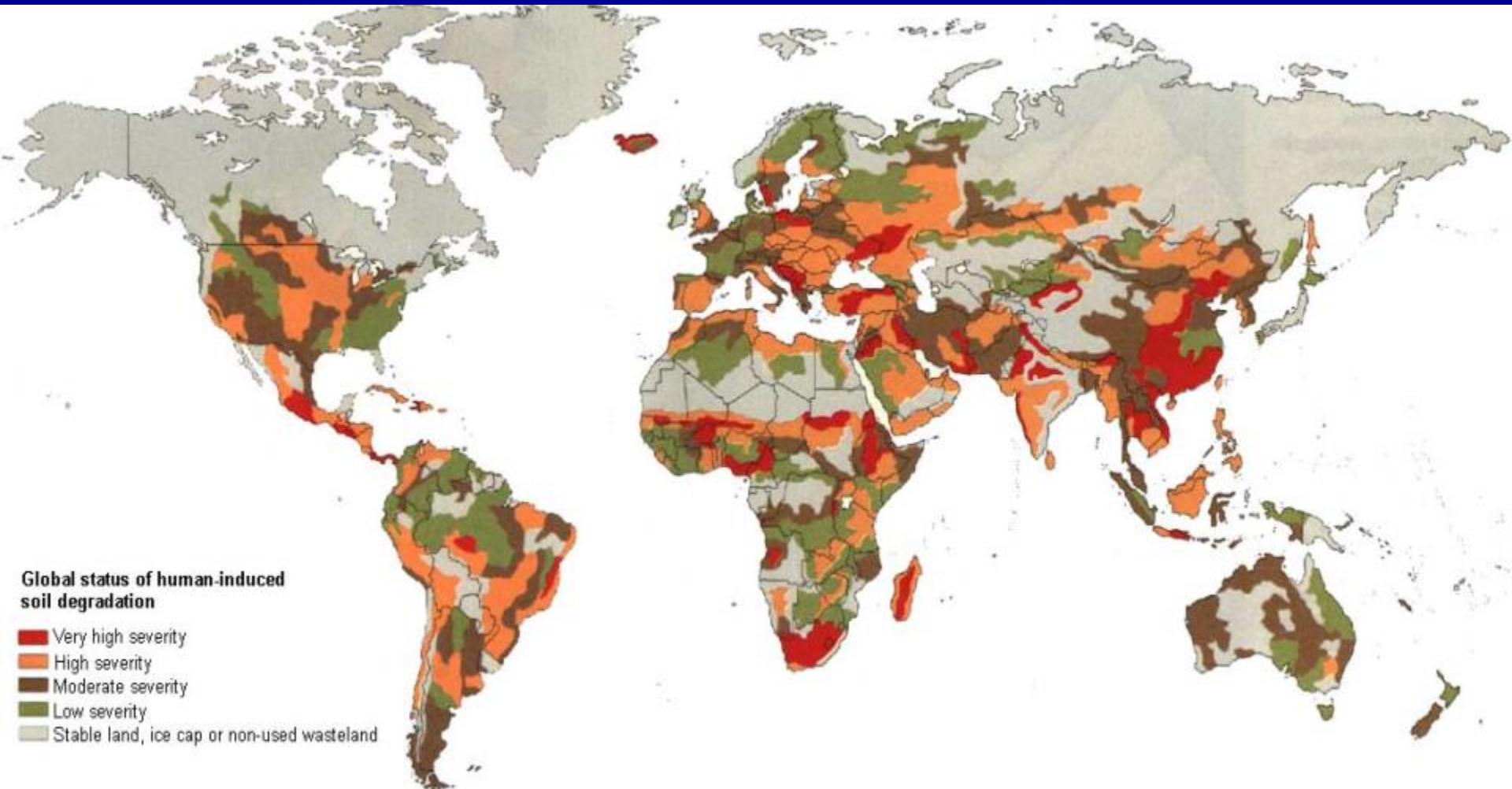
Map 6

Global Livestock Production Systems

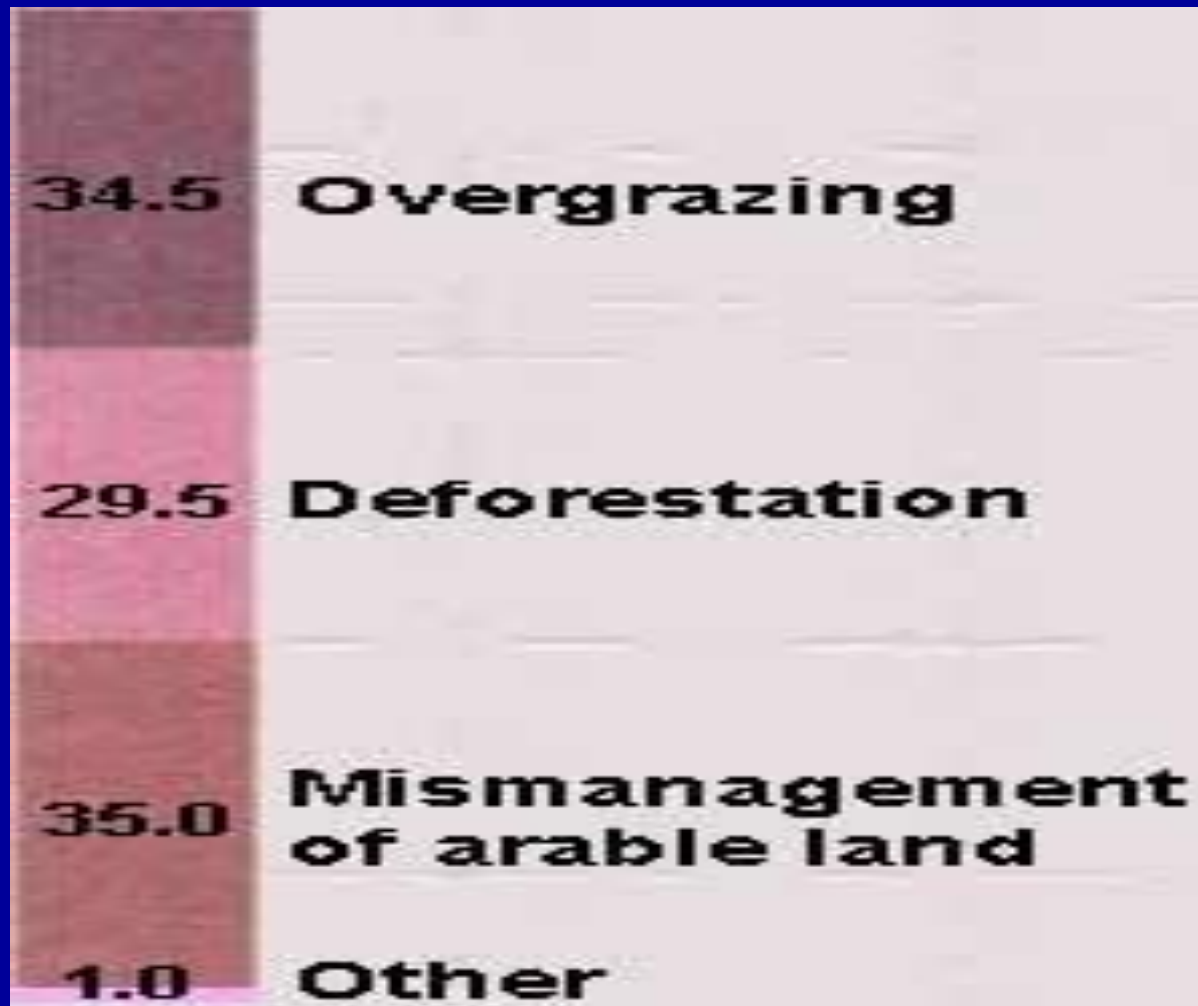


Thorton P.K., Kruska R.L., Henninger N., Krisjanson P.M., Reid R.S., Atieno F., Odero A.N. and Ndegwa T. 2002. *Mapping Poverty and Livestock in the Developing World*. ILRI (International Livestock Research Institute), Nairobi, Kenya. 124pp

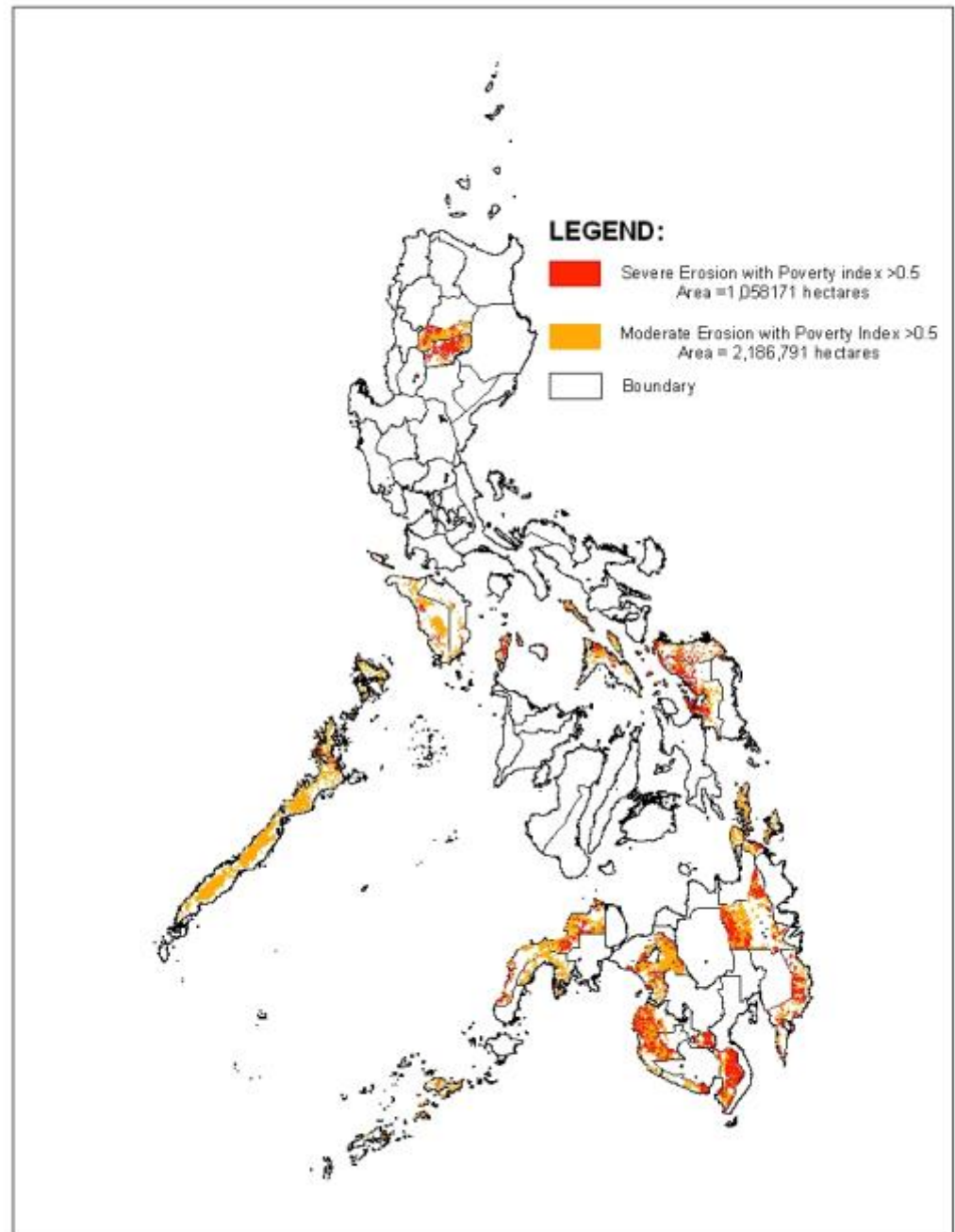
Global Status of Human-Induced Soil Degradation



Human-Related Drivers of Global Soil Degradation (%)



Human-Related Drivers of Soil Degradation



Human Stressors

Poor infrastructure

Lack of good roads and markets constrains the opportunities for viable livelihoods

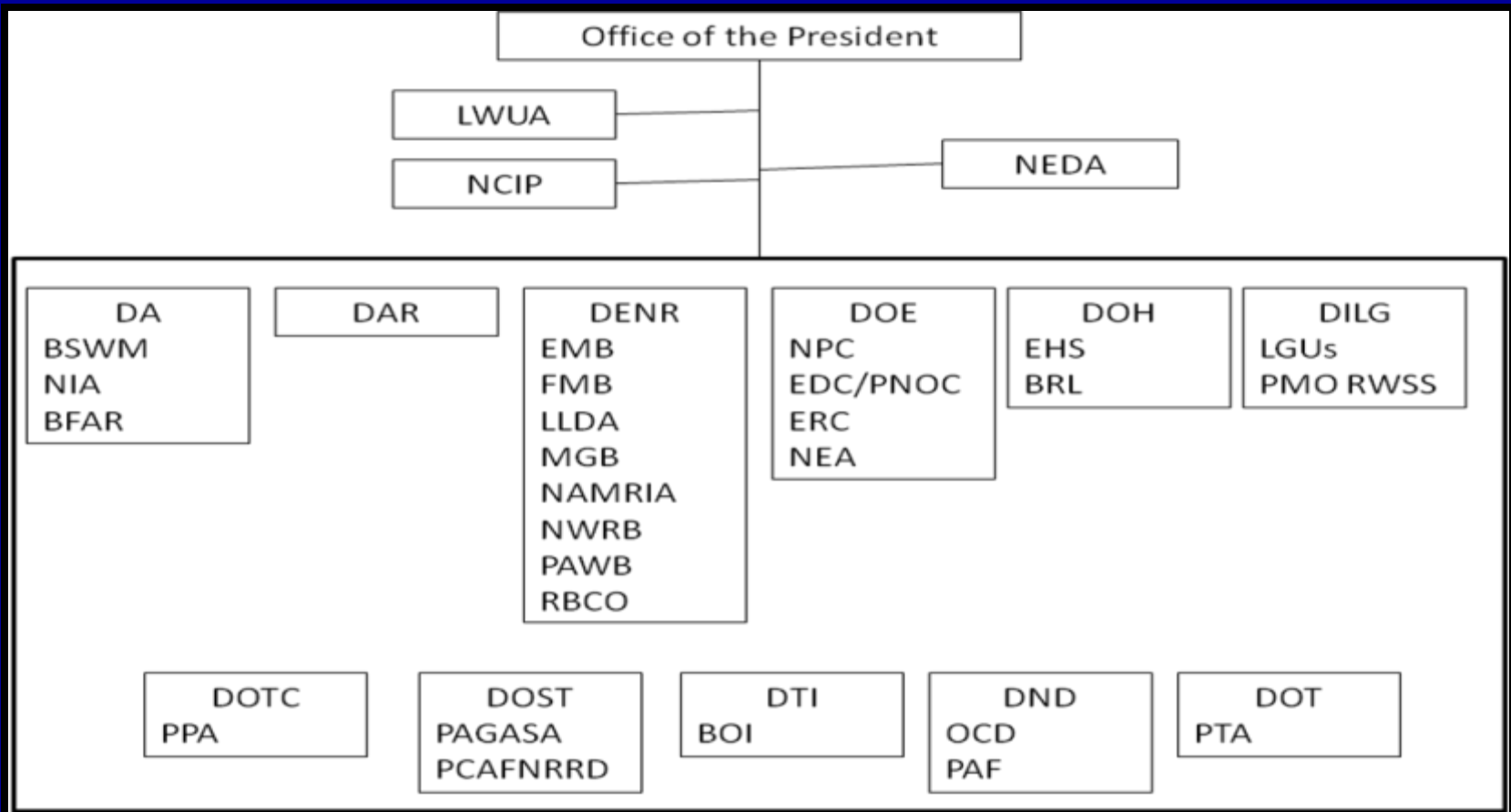
Insufficient capital assets

Failure of watershed users to adopt conservation effective technologies that usually require added inputs

Human Stressors

Complicated institutions

30 government agencies with overlapping sometimes competing mandates and programs



Human Stressors

Under valuation and under appreciation of watershed resources

Several studies had been conducted on the valuation and pricing of water and other watershed resources (Cruz *et al.*, 1997; Calderon *et al.* 2000; and Francisco *et al.*, 2000)

Human Stressors

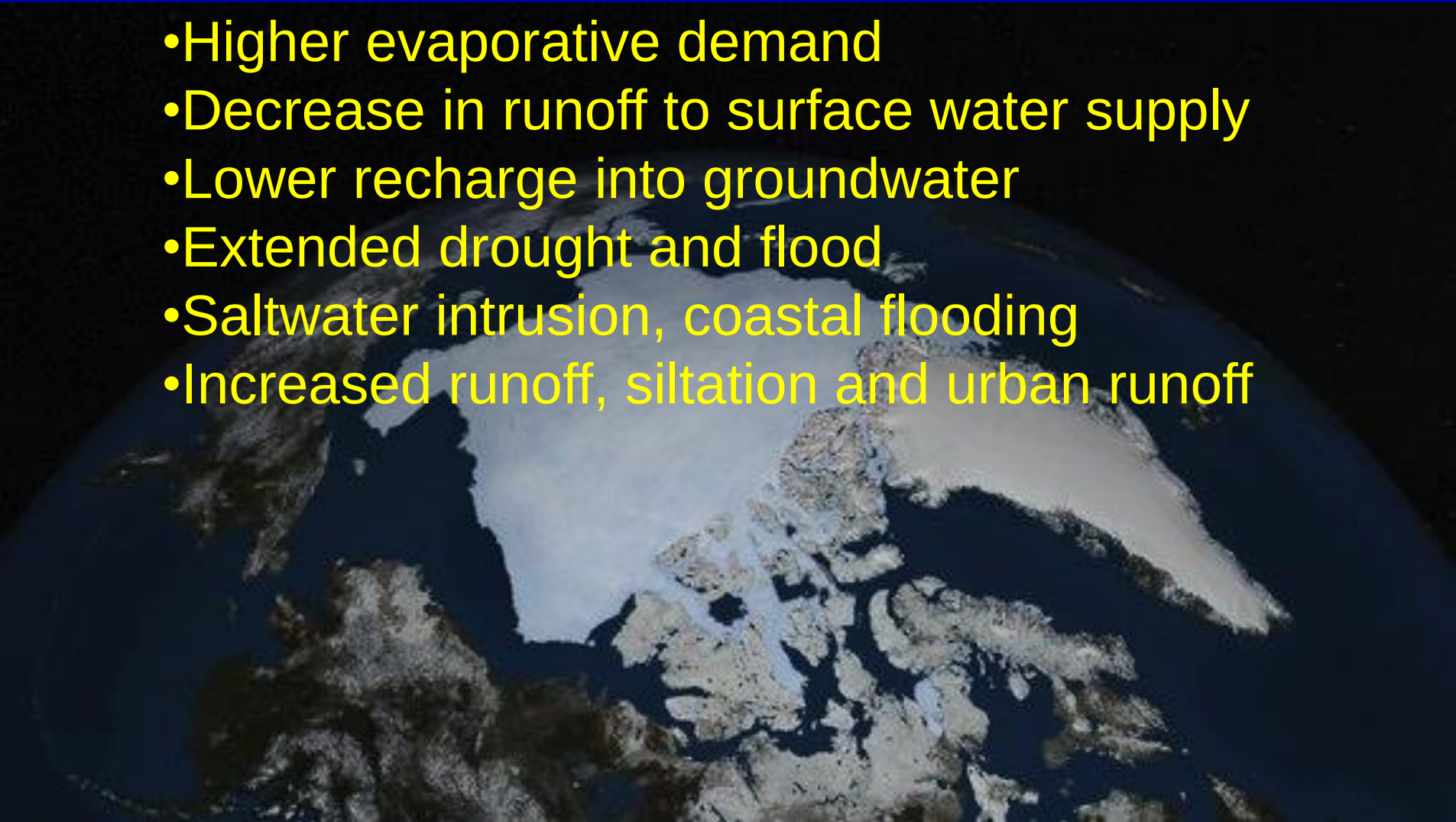
Watershed Management Plan



Absence and/or poor execution of land use and management plans

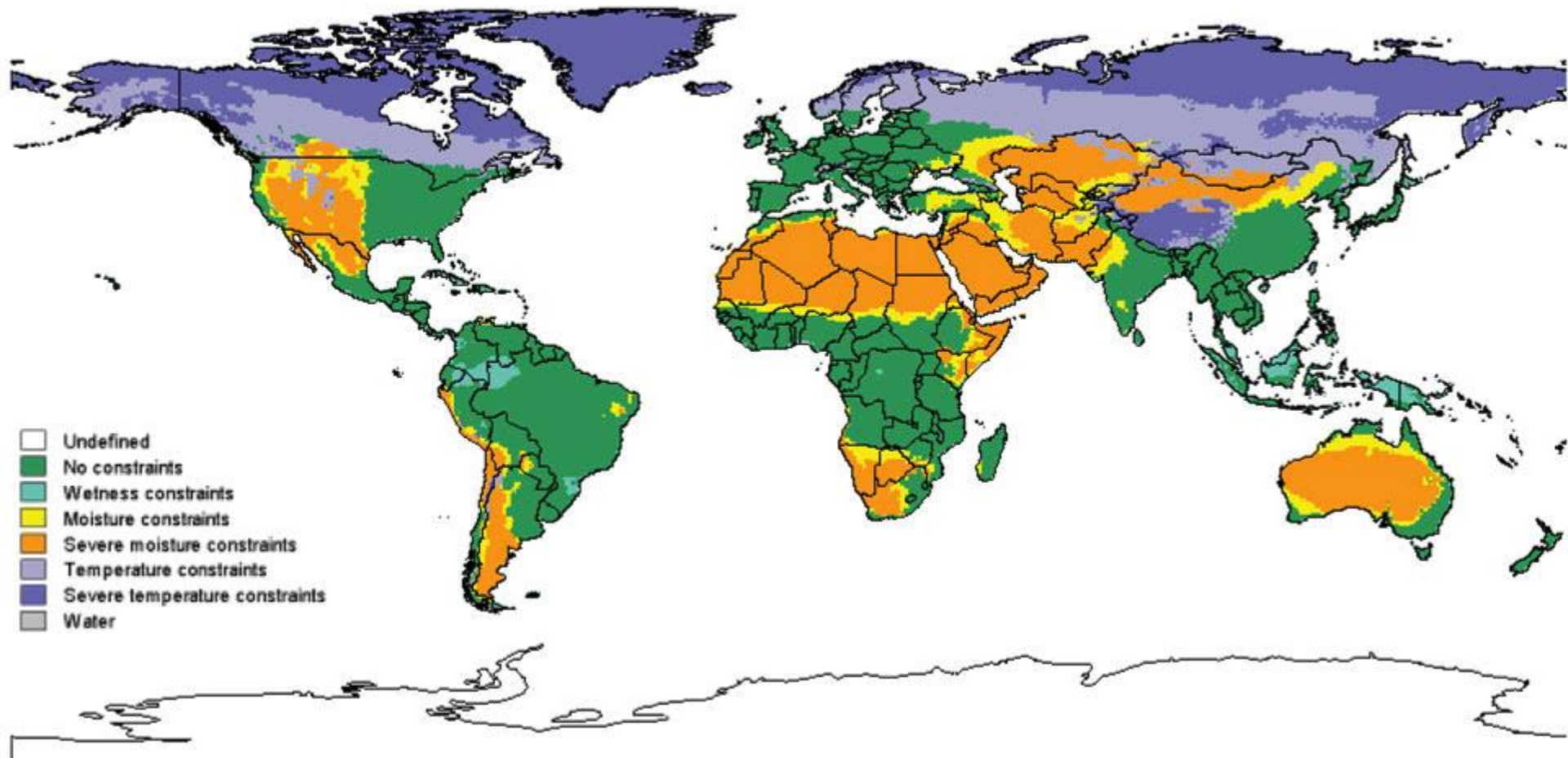
Climate Change Related Stressors

- Higher evaporative demand
- Decrease in runoff to surface water supply
- Lower recharge into groundwater
- Extended drought and flood
- Saltwater intrusion, coastal flooding
- Increased runoff, siltation and urban runoff



Climate Change Related Stressors

Plate 20. Climate constraints



Climate Change Related Stressors

Source: NDCC in Mainstreaming Disaster Risk Reduction into Development: Challenges and Experience in the Philippines, Charlotte Benson, 2009.



Potential Impacts of Climate Change

- Species could become out of range
- Alteration of species composition, distribution and interactions
- Alteration of fruiting and flowering
- Pest and disease outbreak
- Species loss
- Ecosystem functions and services may be altered
- Changes in quality and area of forests and other critical habitats

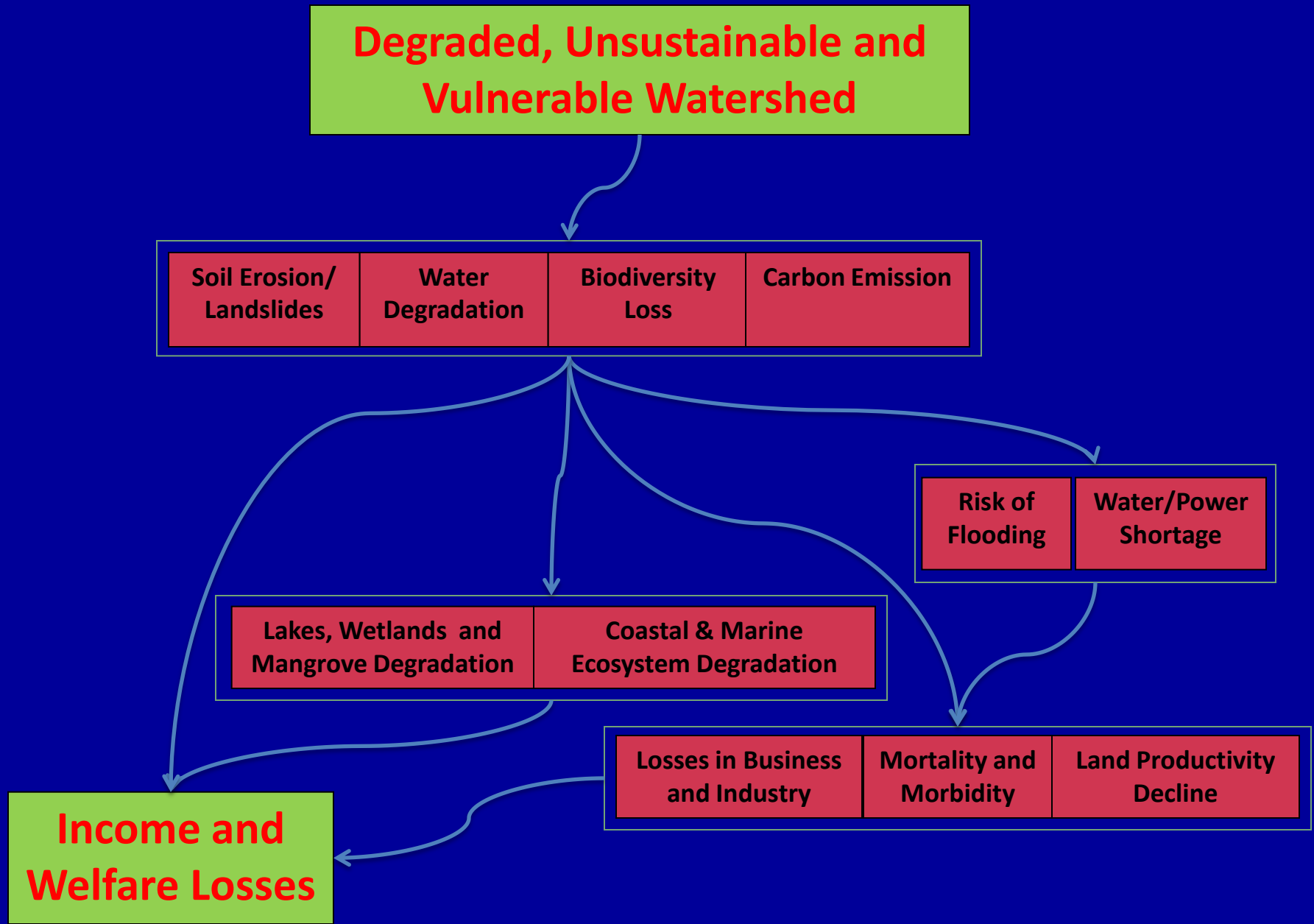


Climate Change and other Natural Stressors

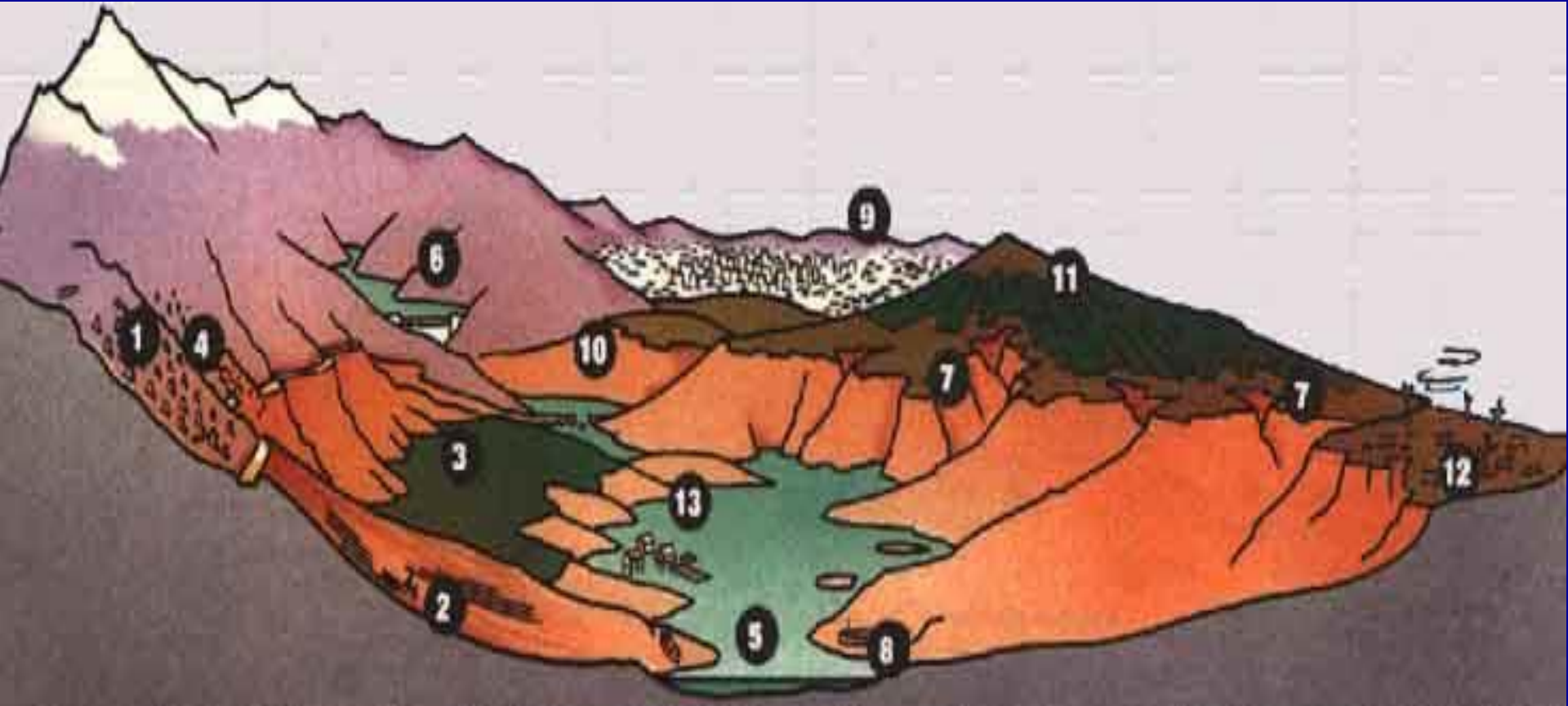


Biodiversity in protected areas and other resources that are already vulnerable due to human threats may be more quickly and/or more severely affected by climate change

Impacts of Watershed Degradation



Impacts of Soil Erosion (www.fao.org)



1. Deforestation
2. Steep land cultivated down the slope
3. Monocrops grown over large areas
4. Landslide blocks road
5. Fish catch reduced in shallow waters
6. Reduced hydropower plant's life
7. Gully erosion eats into crop land

8. Mud banks reduce navigability of rivers
9. Urban slums grow as rural population migrates to the city
10. Bridge destroyed by floods
11. Crops on large unprotected fields
12. Erosion in badly managed pasture
13. Frequently flooded village is deserted

Watershed Management in a Changing Climate: Impelling Considerations

1. *Sustainable watersheds and water resources are vitally linked to major development concerns and must be properly managed to promote*
 - a. Sustainable terrestrial, aquatic and marine ecosystems
 - b. Sustainable agriculture and fishery
 - c. Poverty eradication
 - d. Food security
 - e. Water security
 - f. Energy security
 - g. Livelihood and community development
 - h. Climate change adaptation, mitigation and DRR
 - i. Public health

Watershed Management in a Changing Climate: Impelling Considerations

2. *Inadequate focus on watershed management as a key to national and local development programs*
 - a. Inadequate appreciation on the value of watersheds to development
 - b. Lack of synergy and coordination of watershed programs and development agenda
 - c. Competition of sector targets

Watershed Management in a Changing Climate: Impelling Considerations

3. *Ever growing value of watersheds to cultural, environmental and ecological integrity*
 - a. Climate change mitigation, adaptation and DRR
 - b. Biodiversity conservation
 - c. Soil and water conservation
 - d. Community and livelihood development

Watershed Management in a Changing Climate: Impelling Considerations

4. *Continuing growth in the demand for water*

- a. Agricultural
- b. Domestic
- c. Environmental/ecological
- d. Commercial/industrial

Watershed Management in a Changing Climate: Impelling Considerations

5. *Increasing climate and non-climate related stressors on watersheds*

- a. Climate variability, warmer temperature, extreme rainfall and cyclones
- b. Land use and cover change that increases erodibility and impermeability of soil
- c. Population growth
- d. Increasing urbanization
- e. Increasing demands for wood, food, fuel

Watershed Management in a Changing Climate: Impelling Considerations

6. *Demand for greater participation of LGUs, local communities, private sector and other local stakeholders in watershed governance i.e., in*
 - a. Planning
 - b. Execution and monitoring of plans
 - c. Search for workable mechanisms for stakeholder participation

Watershed Management in a Changing Climate: Impelling Considerations

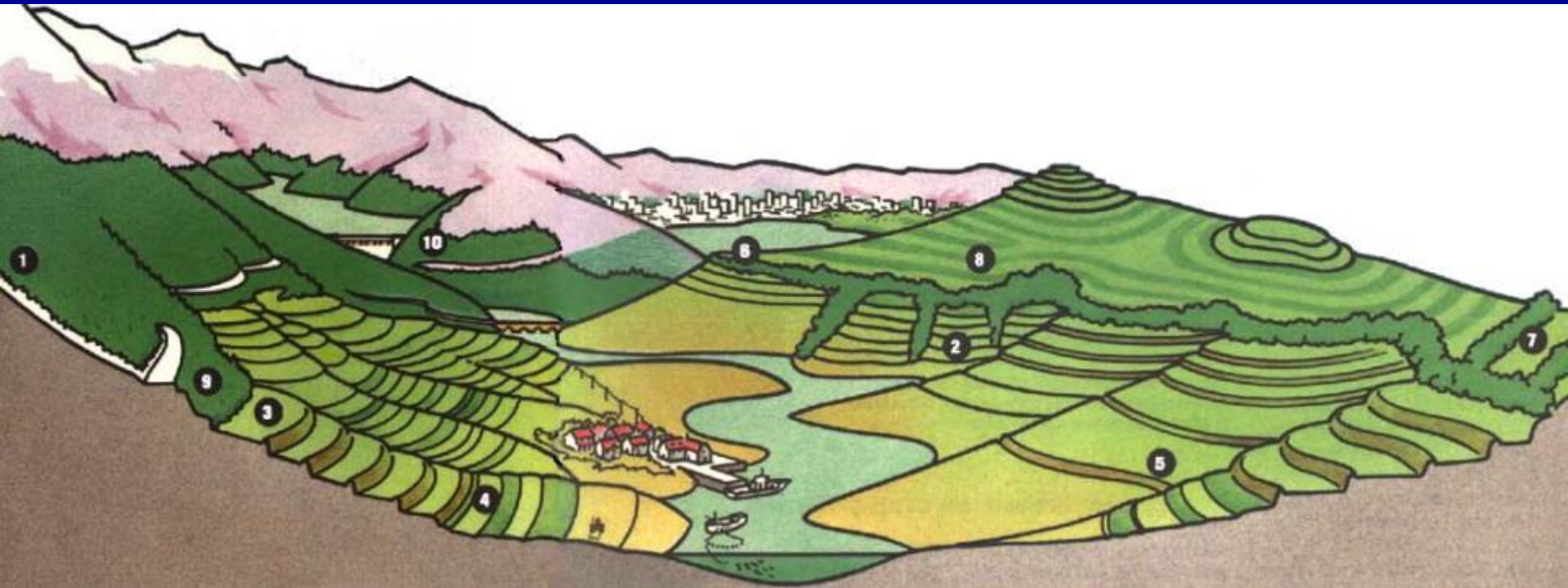
7. *Weak link between science and policy and management decisions – dominance of intuitive approach and excessive politicizing of policy/management decisions*
 - a. Limited site-specific research and empirical data
 - b. Limited understanding on watershed dynamics
 - c. Poor communication of research results to policy makers and managers
 - d. Waning responsiveness of research to current and emerging needs
 - e. Science and policy makers think in different time scales

Watershed Management in a Changing Climate: Impelling Considerations

7. *Governance crisis*

- a. Leadership crisis
- b. Financial crisis

Seeing Clearly the Right Vision



1. Reforested land
2. Gully control by check dams and trees planted on gully banks
3. Steep land is bench-terraced
4. Contour farming
5. Bunds are built to control surface runoff
6. New reservoir supplies power to nearby villages
7. Shelter belts reduce wind erosion, protect pastures
8. Crop rotation practiced in strips along contours
9. Tree crops grown on eyebrow terraces on steep land
10. Forested slopes prevent siltation of reservoirs

THANK YOU