CLIMATE-SMART Agriculture 2015

Global Science Conference

March 16-18, 2015
Le Corum, Montpellier France

Climate Change Impacts in Watershed Management, Forest and Agriculture in the Yautepec River Basin in Mexico

Prof. Dr. Úrsula Oswald Spring

Regional Centre for Multidisciplinary Research at National Autonomous University of Mexico (CRIM-UNAM)

CLIMATE-SMART Agriculture 2015

Montpellier, March 16-18, 2015

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1. Research theme and research question

Climate change-induced extreme events -especially storms, floods and drought- have increased during the past decades, creating threats to human life, well-being, productive processes, and infrastructure.

How could an integrated watershed management -including forestry agriculture, job creation and urban planning- enhance the resilience of highly exposed people -especially the vulnerable ones- to avoid negative effects of climate change?

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2. Triple approach to the theme

1. **IPCC: global assessment on climate change 2013, 2014**
2. **PINCC: Mexican Assessment Report, 2015**
3. **Regional watershed assessment report, 2015**

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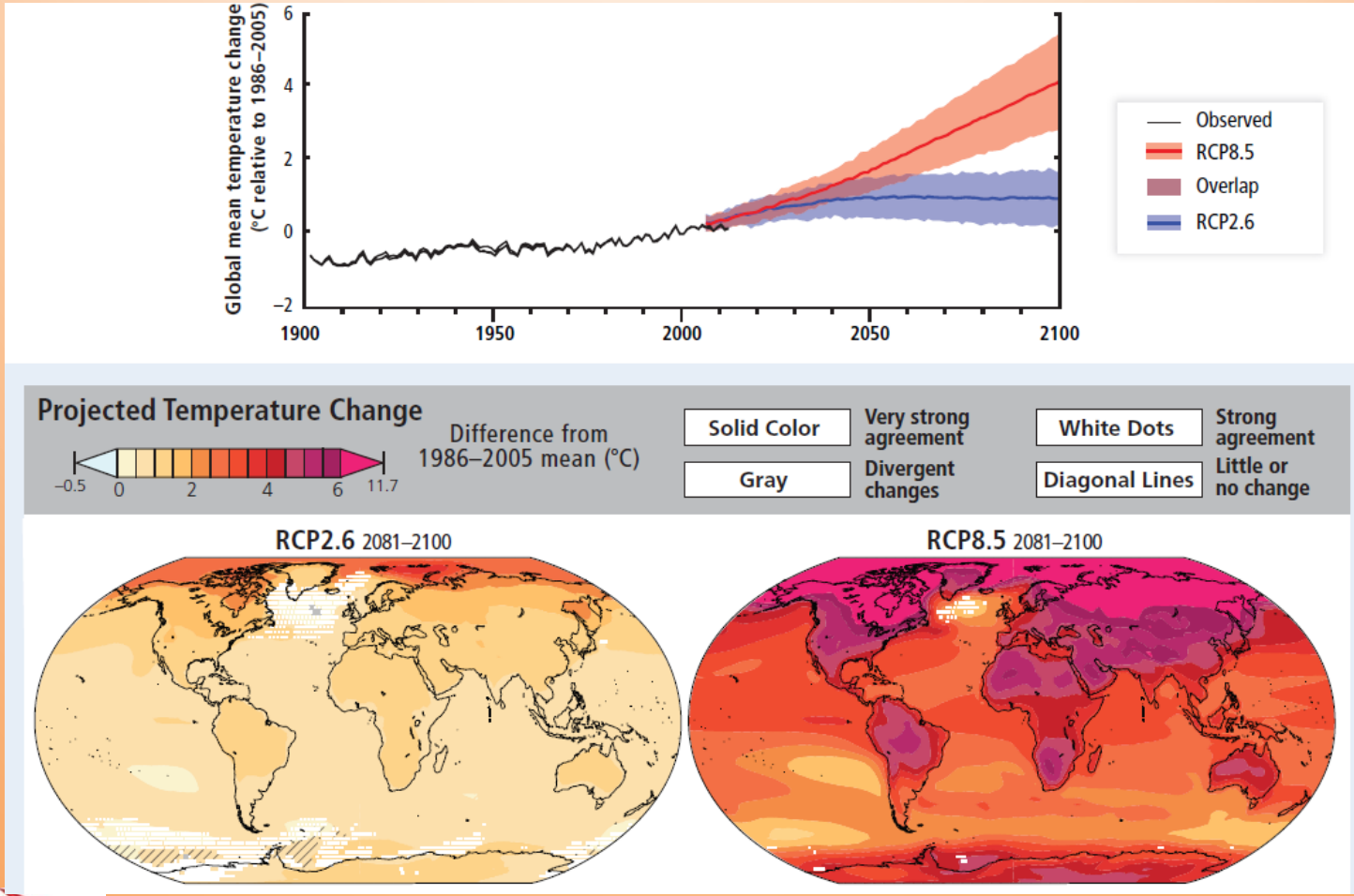
Observed and projected temperatura rise (IPCC, 2014: 10)



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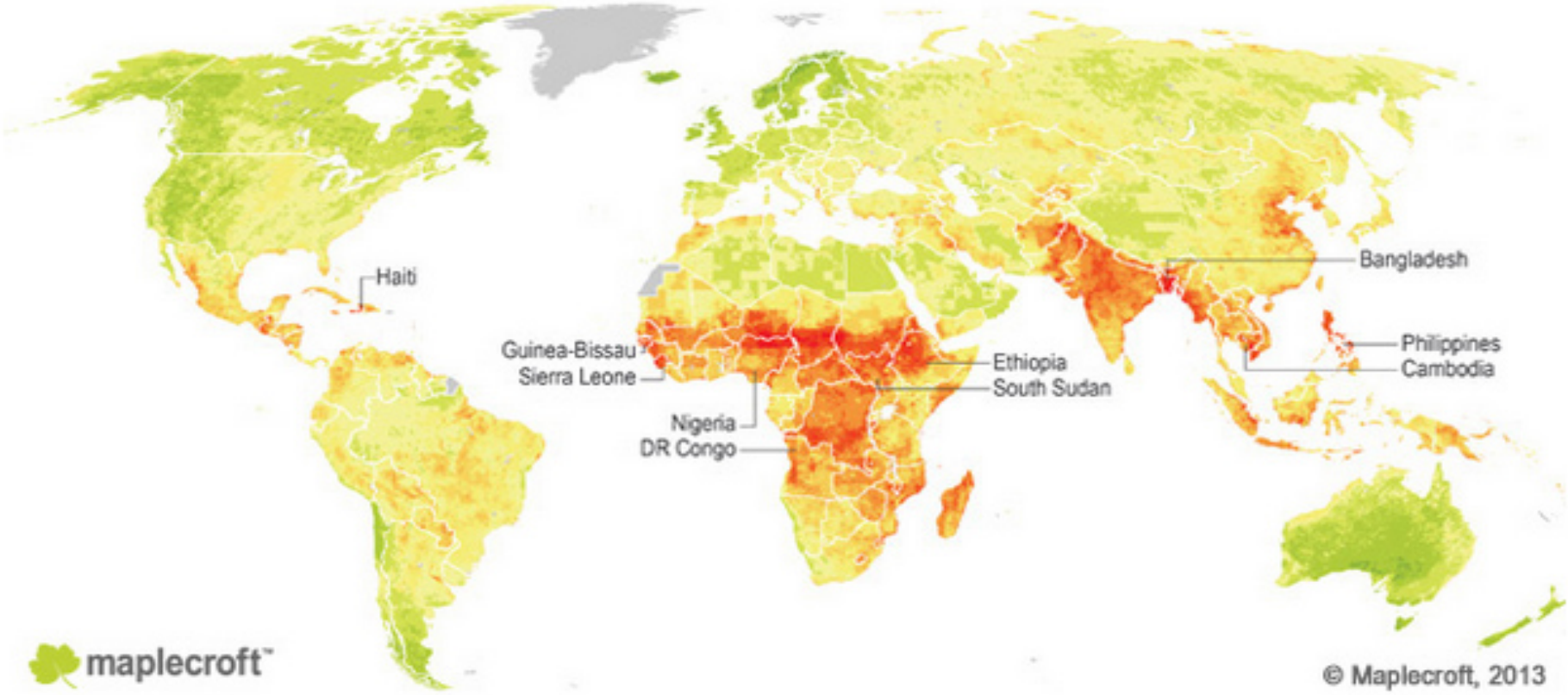
Risk Assessment

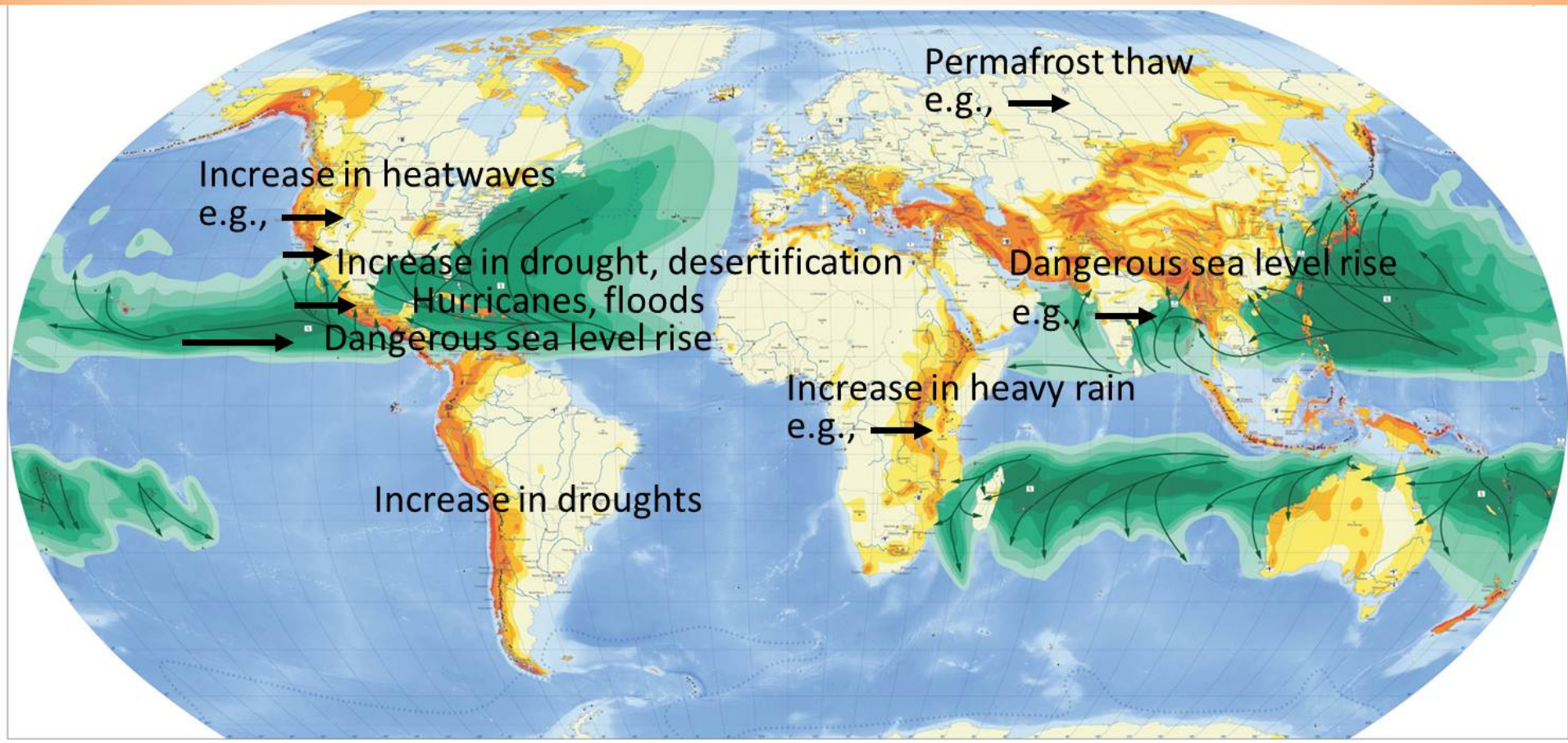


Rank	Country	Category
1	Bangladesh	Extreme
2	Guinea-Bissau	Extreme
3	Sierra Leone	Extreme
4	Haiti	Extreme
5	South Sudan	Extreme

Rank	Country	Category
6	Nigeria	Extreme
7	DR Congo	Extreme
8	Cambodia	Extreme
9	Philippines	Extreme
10	Ethiopia	Extreme

Legend
Extreme
Low
No data

Disaster impacts (MunichRe, 2008)



Earthquakes

- Zone 0: MM V
- Zone 1: MM VI
- Zone 2: MM VII
- Zone 3: MM VIII
- Zone 4: MM IX

MM: modified Mercalli scale

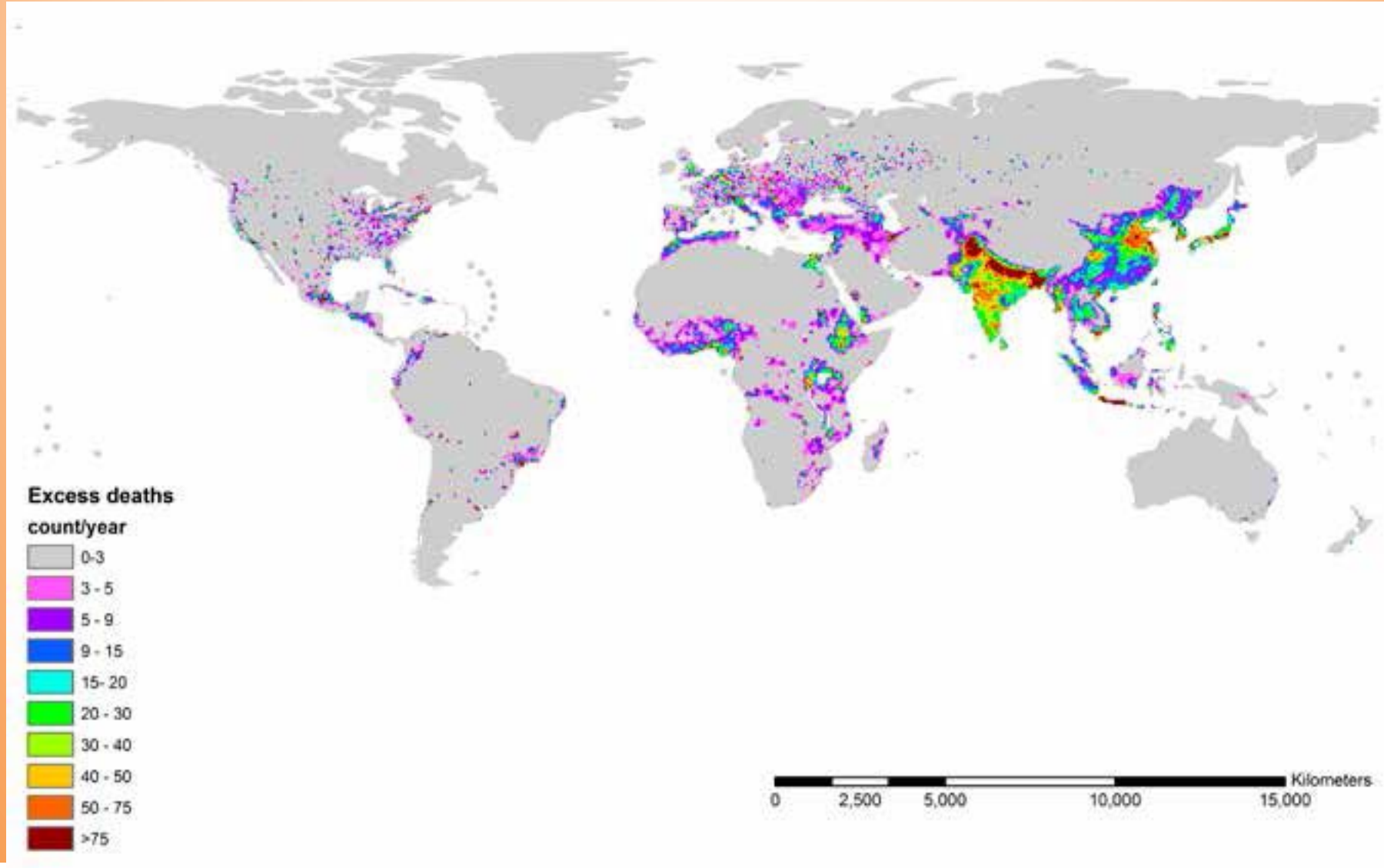
Tropical Hurricanes

- Zone 0: 76–141 km/h
- Zone 1: 142–184 km/h
- Zone 2: 185–212 km/h
- Zone 3: 213–251 km/h
- Zone 4: 252–299 km/h
- Zone 5: ≥ 300 km/h

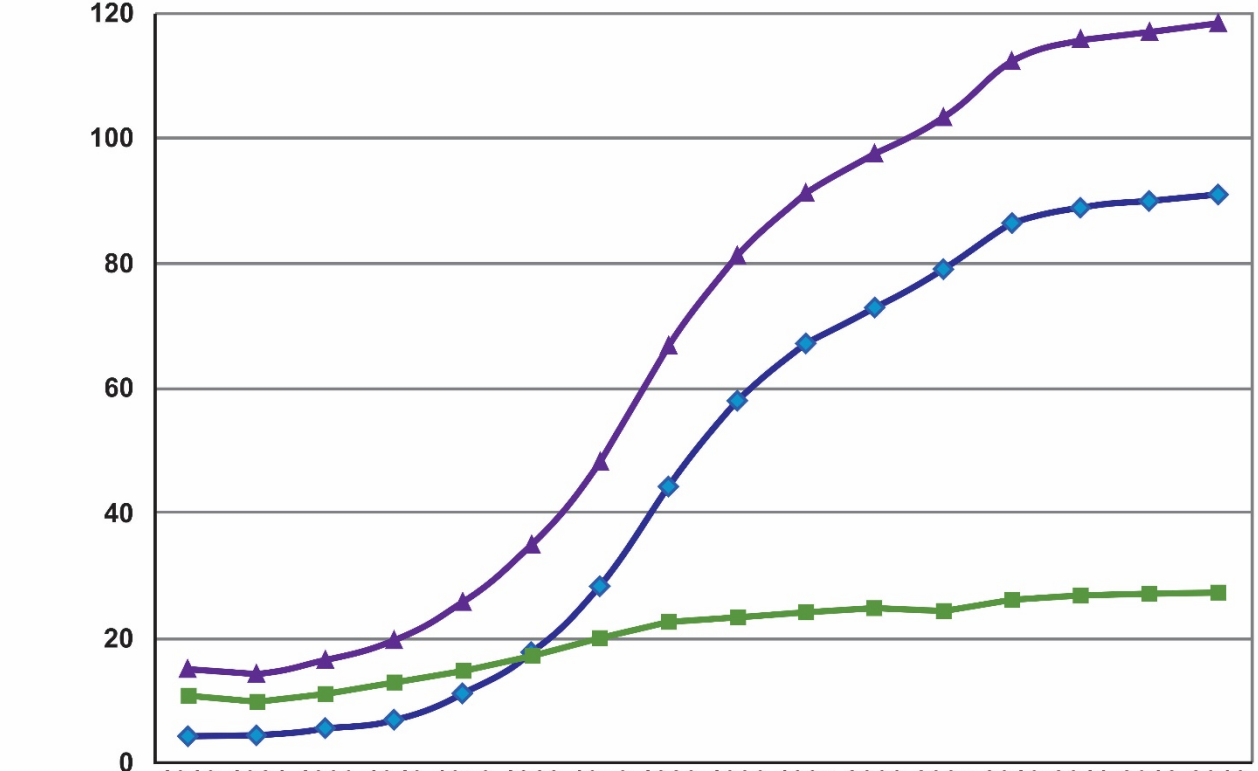
Münchener Rück
Munich Re Group

Heat related deaths of people >65 years

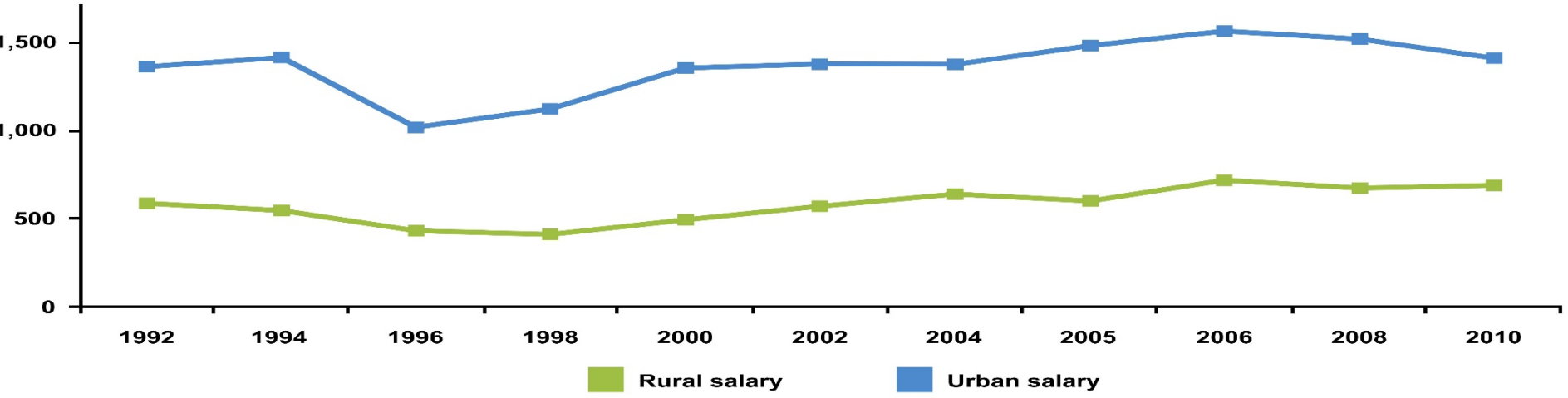
WHO 2014:22



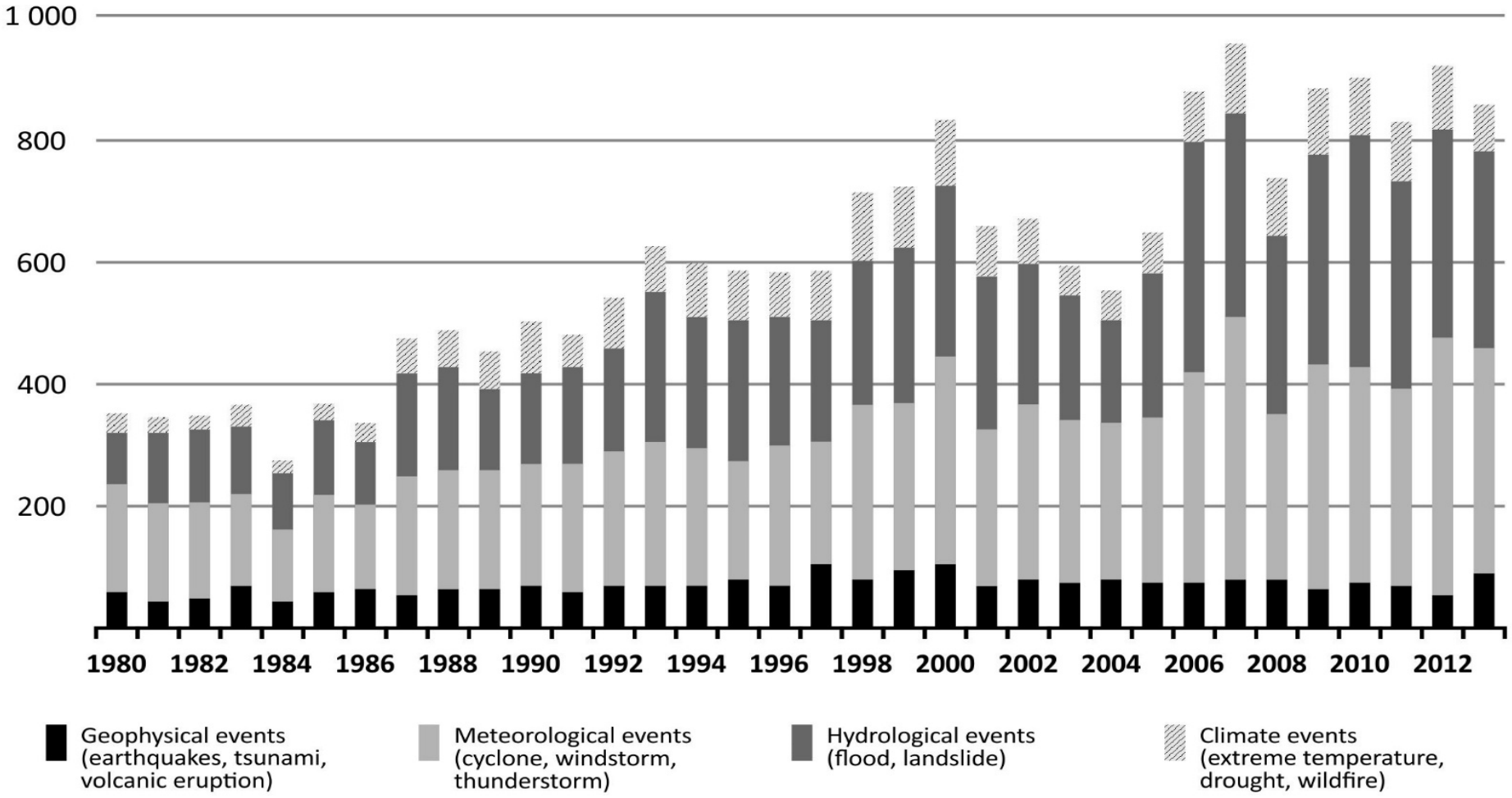
Population growth, rural/urban salaries in Mexico



	1910	1921	1930	1940	1950	1960	1970	1980	1990	1995	2000	2005	2010	2011	2012	2013
Total	15.2	14.3	16.6	19.7	25.8	34.9	48.2	66.8	81.2	91.2	97.5	103.3	112.3	115.7	117.1	118.4
Urban	4.3	4.5	5.5	6.9	11.0	17.7	28.3	44.3	58.0	67.0	72.8	79.0	86.3	88.9	90.0	91.1
Rural	10.8	9.9	11.0	12.8	14.8	17.2	19.9	22.5	23.3	24.2	24.7	24.3	26.0	26.8	27.0	27.3



Disaster impacts in Mexico (La Red 2014)



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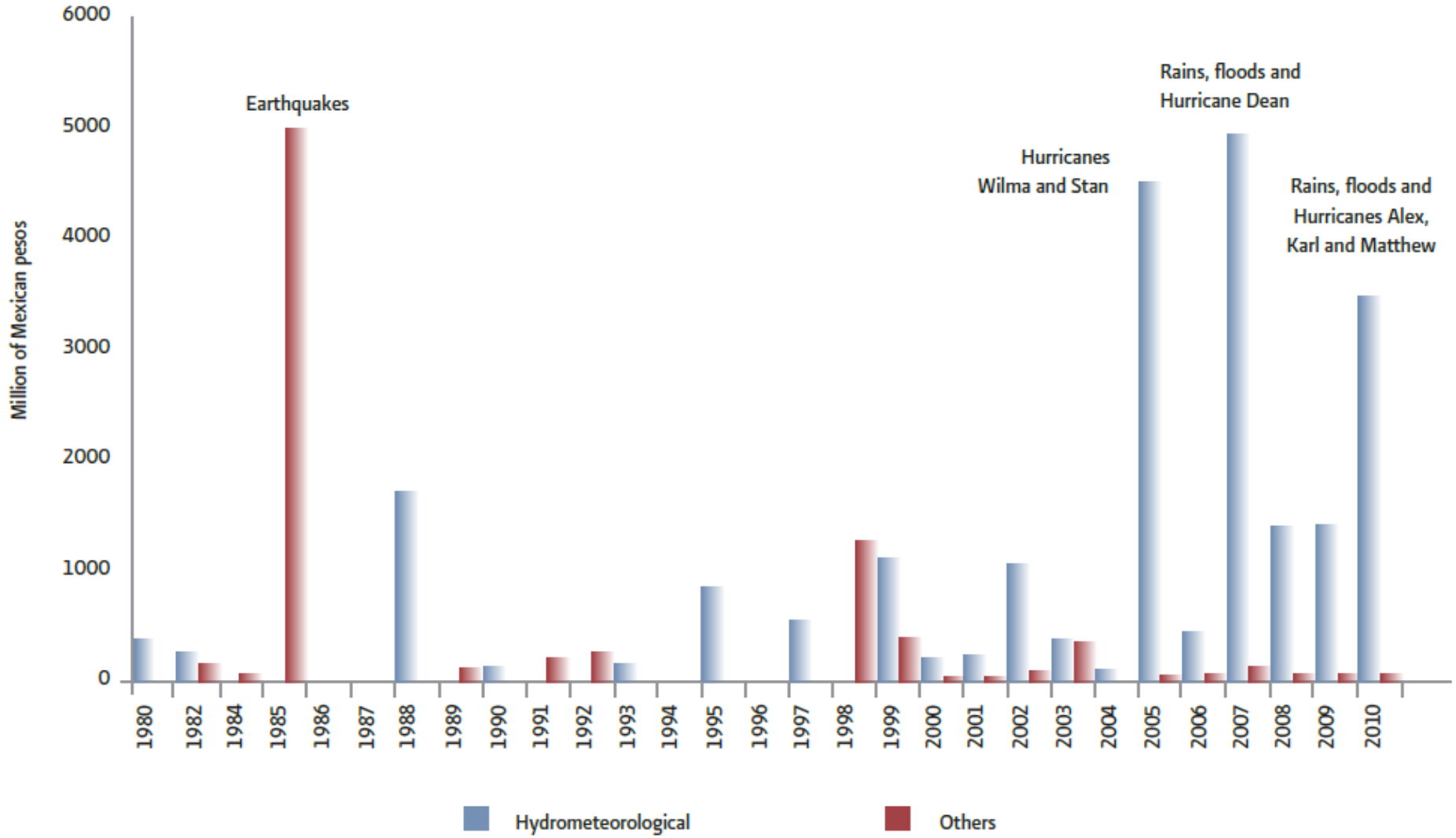
Disaster costs in Mexico (Cenapred 2013)



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River Yautepec: Centre of the country

Transect from volcano Popocatéptl (5,452 m) to the Sierra Madre del Sur

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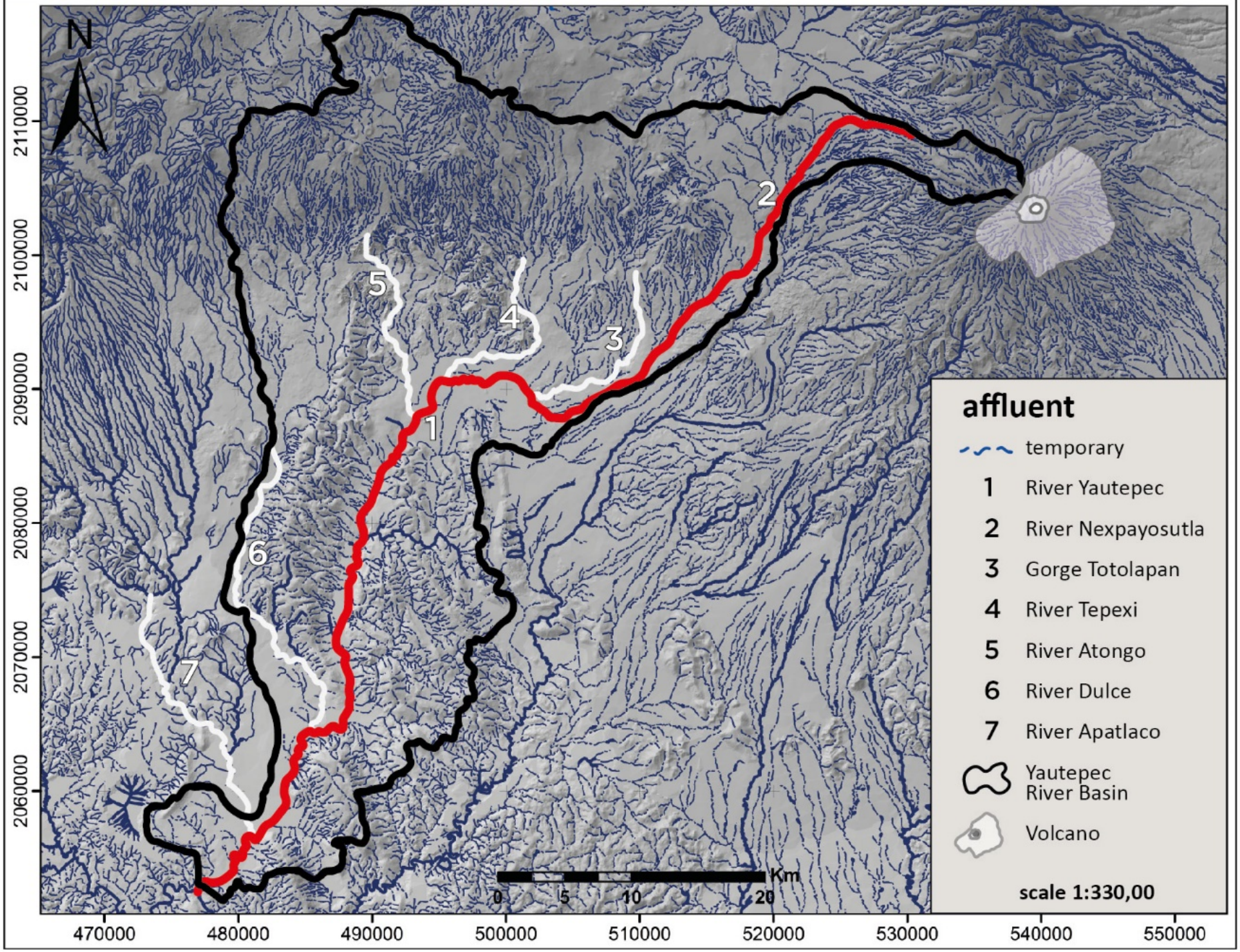
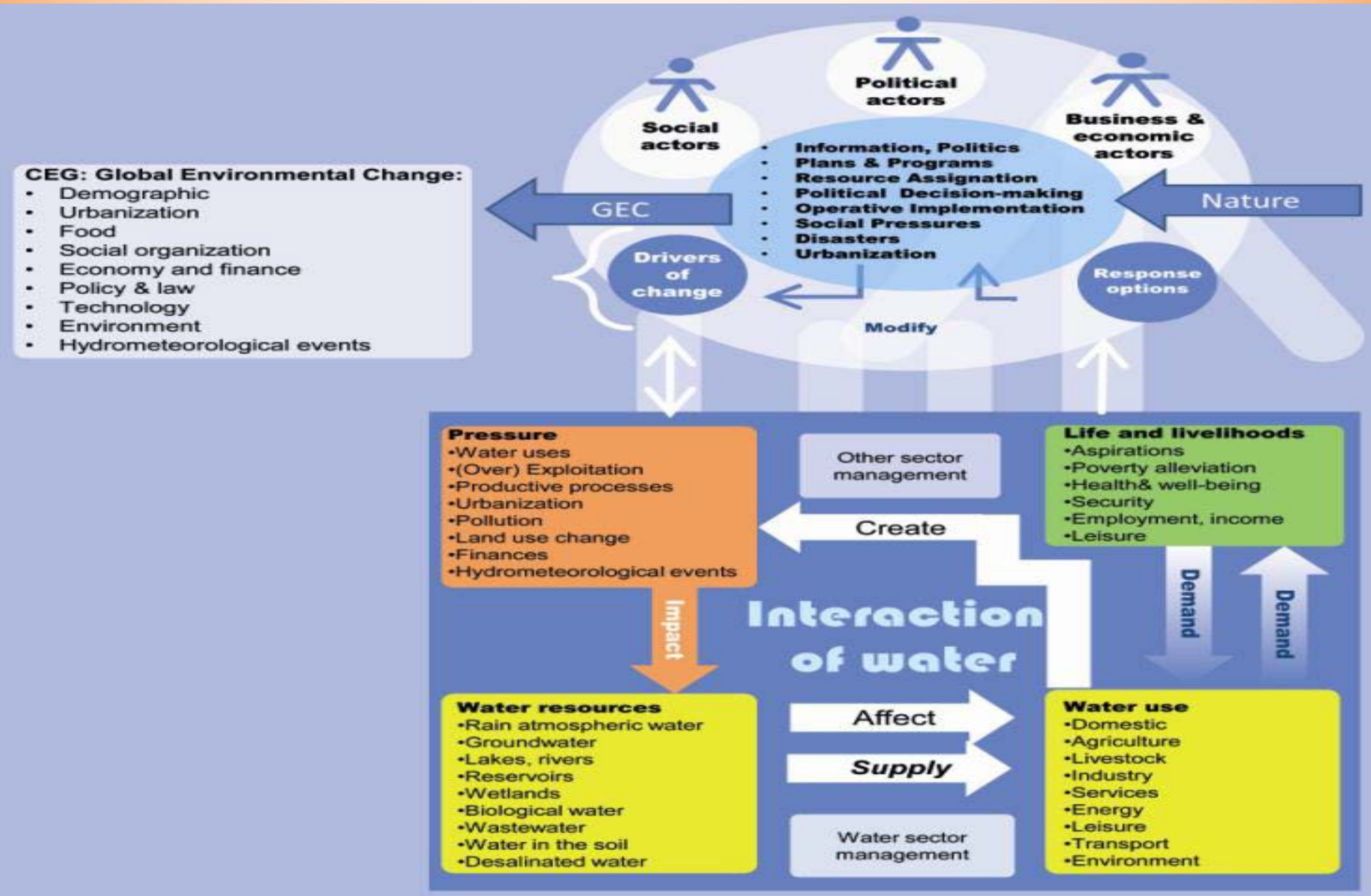
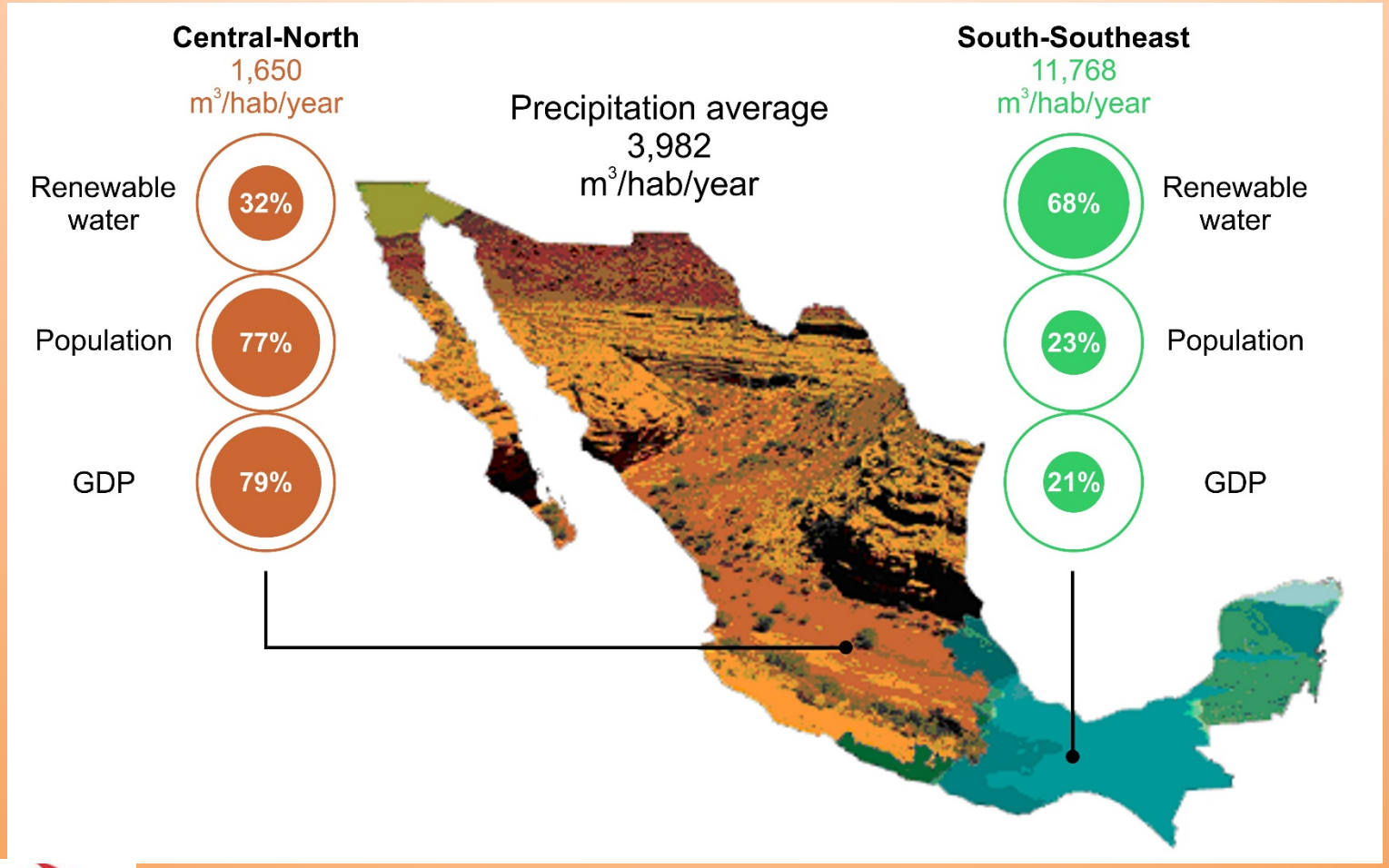

N
2110000
2100000
2090000
2080000
2070000
2060000
470000
480000
490000
500000
510000
520000
530000
540000
550000
1
2
3
4
5
6
7
affluent
temporary
1 River Yautepec
2 River Nexpayosutla
3 Gorge Totolapan
4 River Tepexi
5 River Atongo
6 River Dulce
7 River Apatlaco
Yautepec River Basin
Volcano
scale 1:330,00
0 5 10 20
Km

3. Triple impact of climate change on watershed, forest, soil, and agriculture

Systemic water management



Watershed management (Conagua, 2014)



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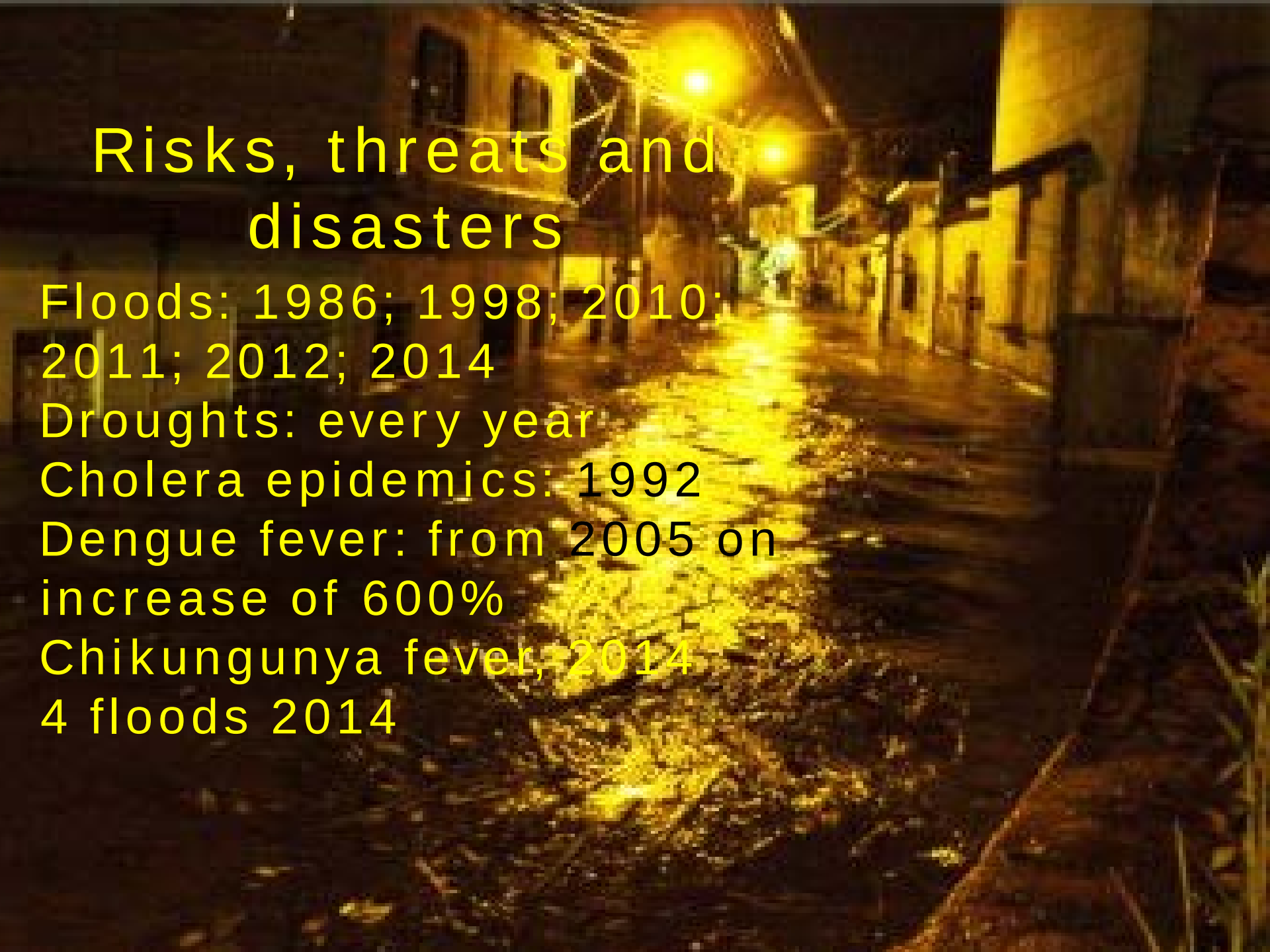
Risks

1. High altitude from Popocatepetl to Yautepec: 5452m down to 1200m in 27 km
2. High speed of water with rocks and trees
3. Complex hydrology: with a lot of small rivers, often dried out and eroded
4. Deforestation, also in national parks
5. Soil erosion (80%)
6. High sedimentation in river bed
7. Extreme rainfalls
8. Large drought periods
9. Invasion of the river basin
10. Lack of infrastructure
11. Waste in the river
12. Lack of municipal planning
13. Initial cooperation among the three levels of government
14. Few participation of citizens



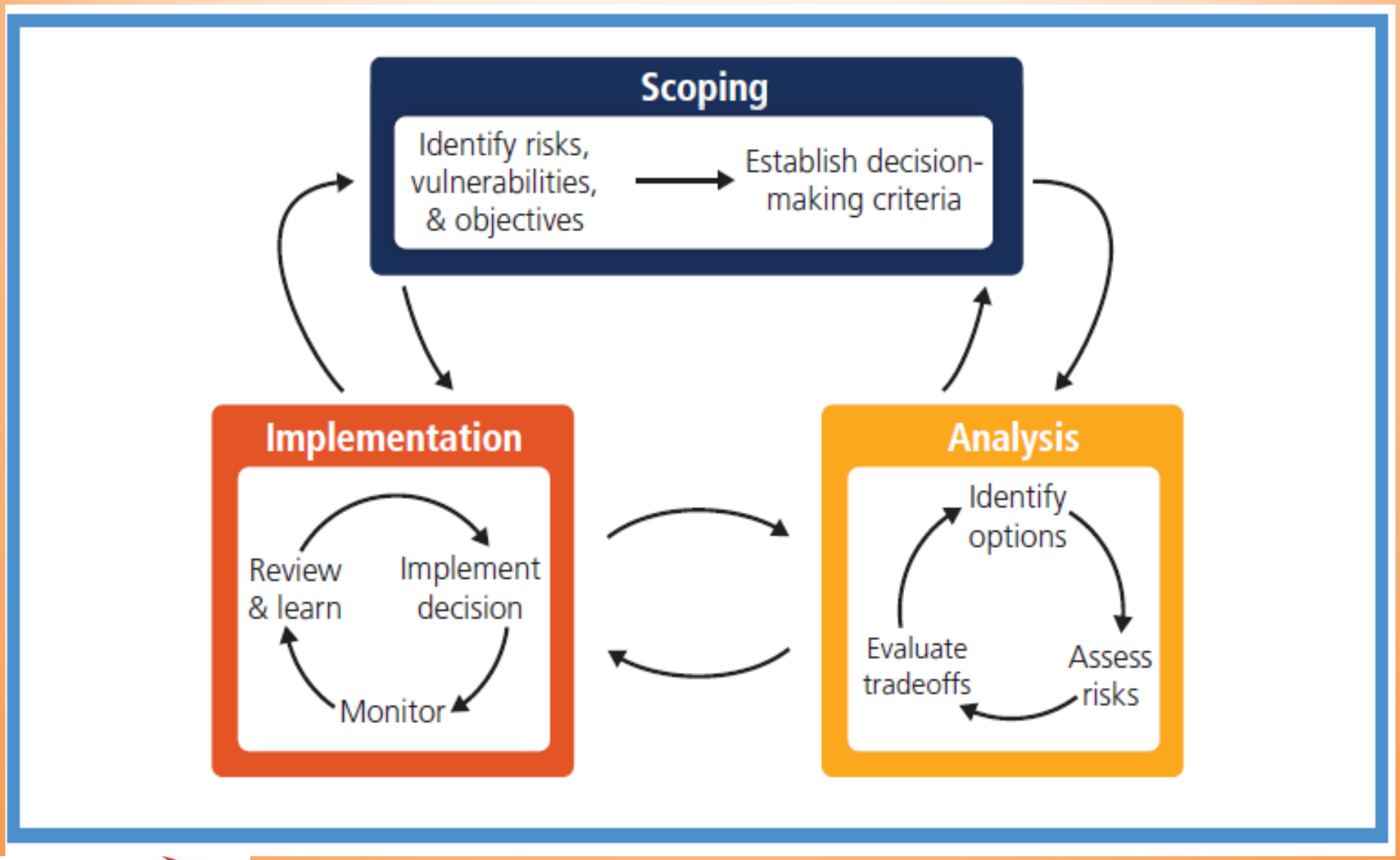
Risks, threats and disasters

Floods: 1986; 1998; 2010; 2011; 2012; 2014
Droughts: every year
Cholera epidemics: 1992
Dengue fever: from 2005 on increase of 600%
Chikungunya fever, 2014
4 floods 2014


People, water
and livelihood

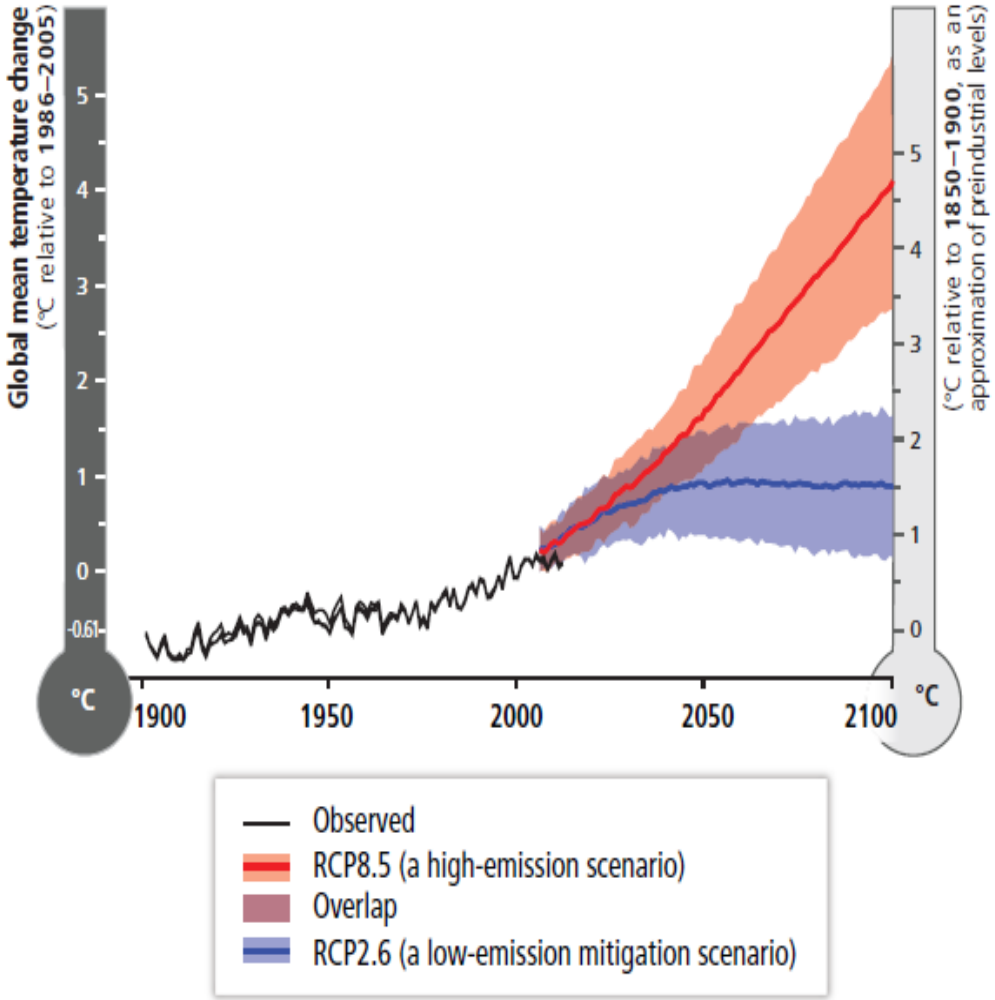
Climate change impacts on watershed management: from the Pacific through the Popocatepetl to the Atlantic

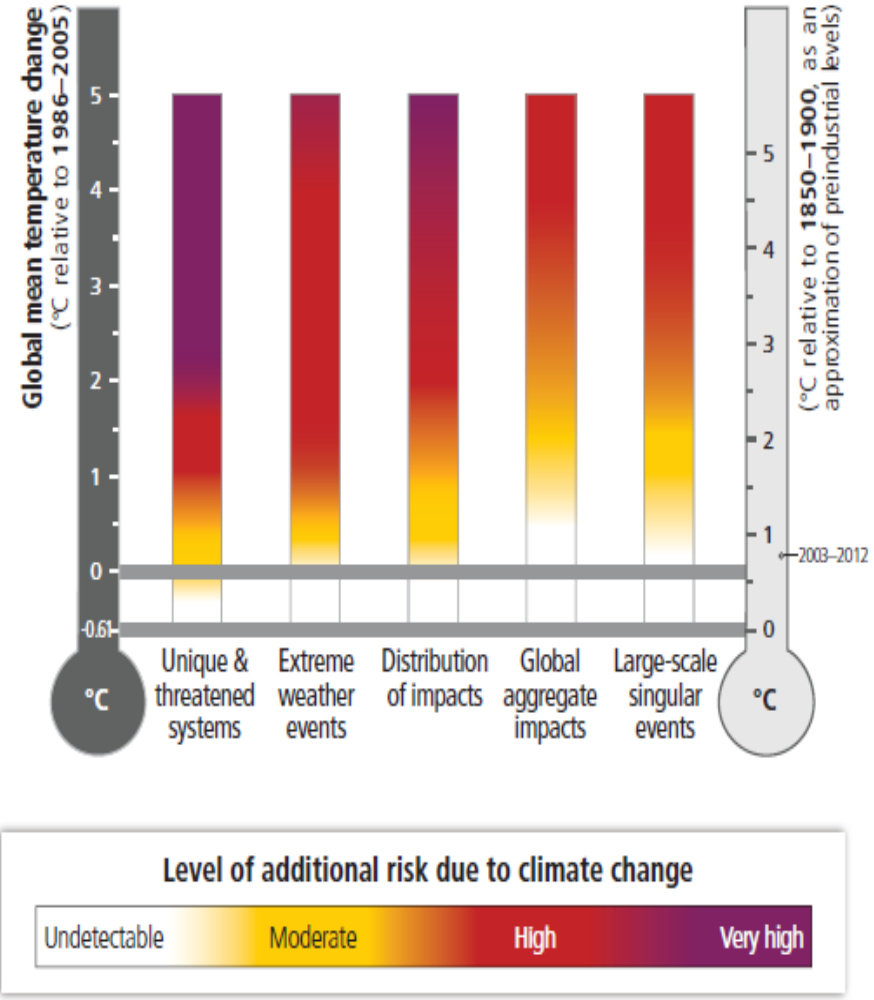
IPCC assessment (2014: 9)



IPCC Climate change-related risks

(IPCC, 2014: 13)





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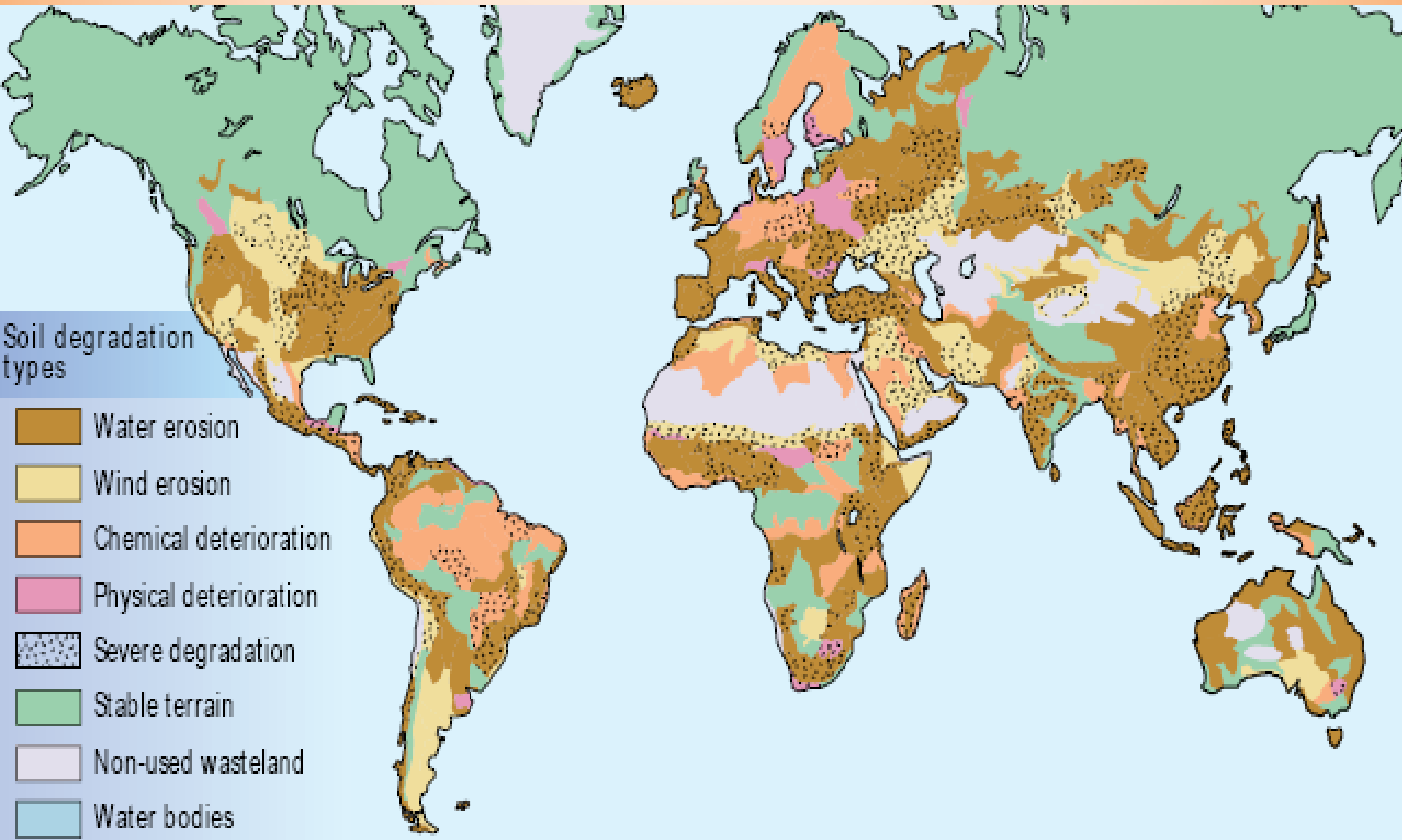
Degradation of soils due to anthropogenic impacts

Source: ISCRIC-UNEP (1996: 12)



Coastal impacts in LA

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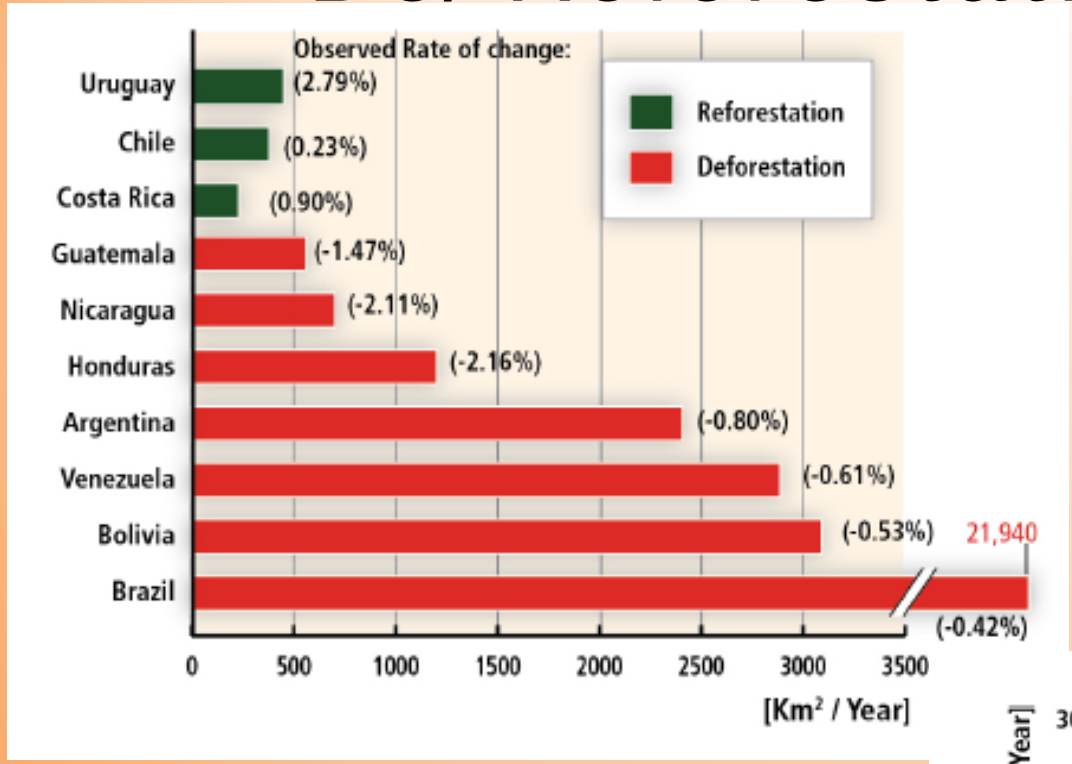
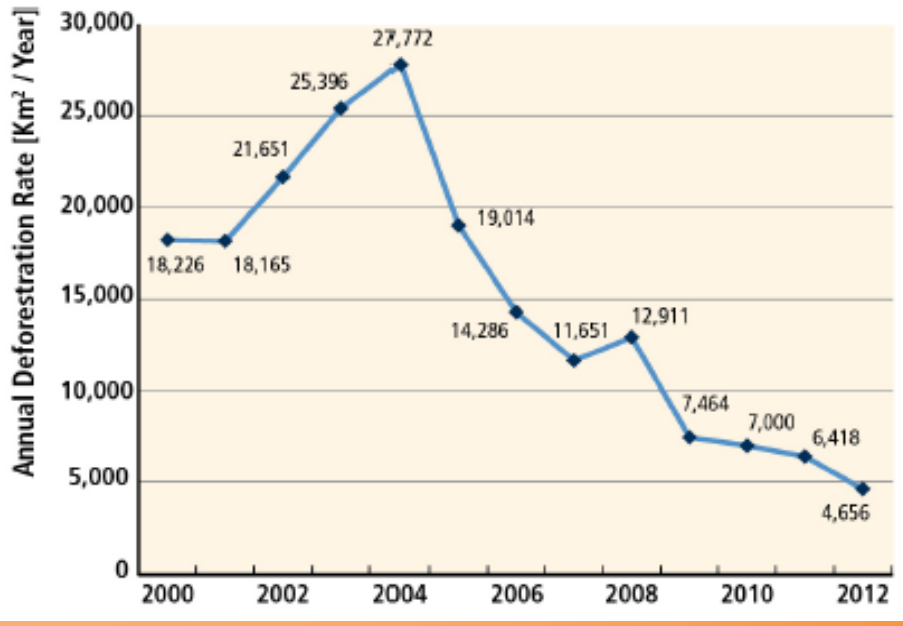
De/ Reforestation in LAC





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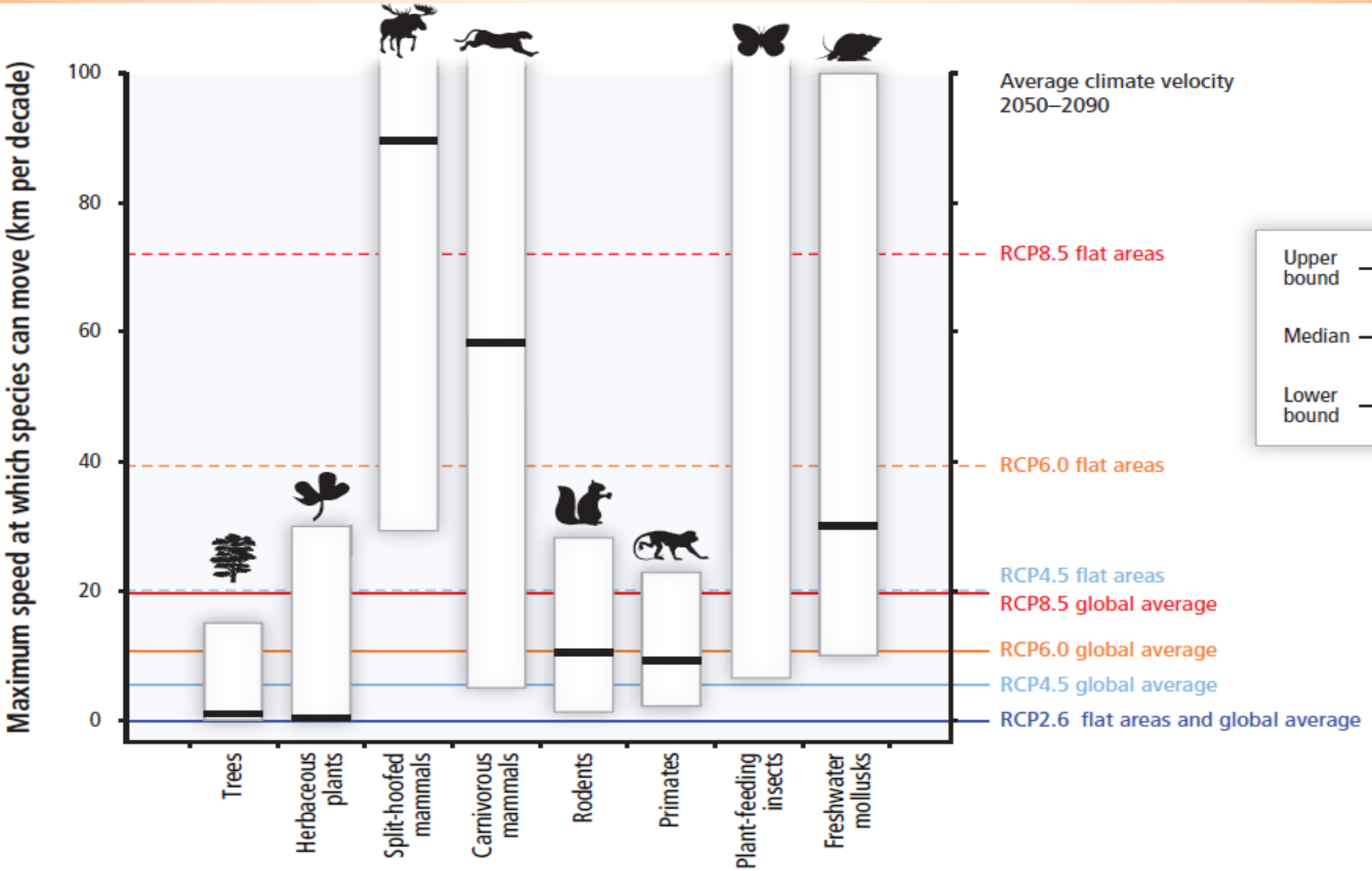
Animal diversity loss (IPCC, 2014: 15)



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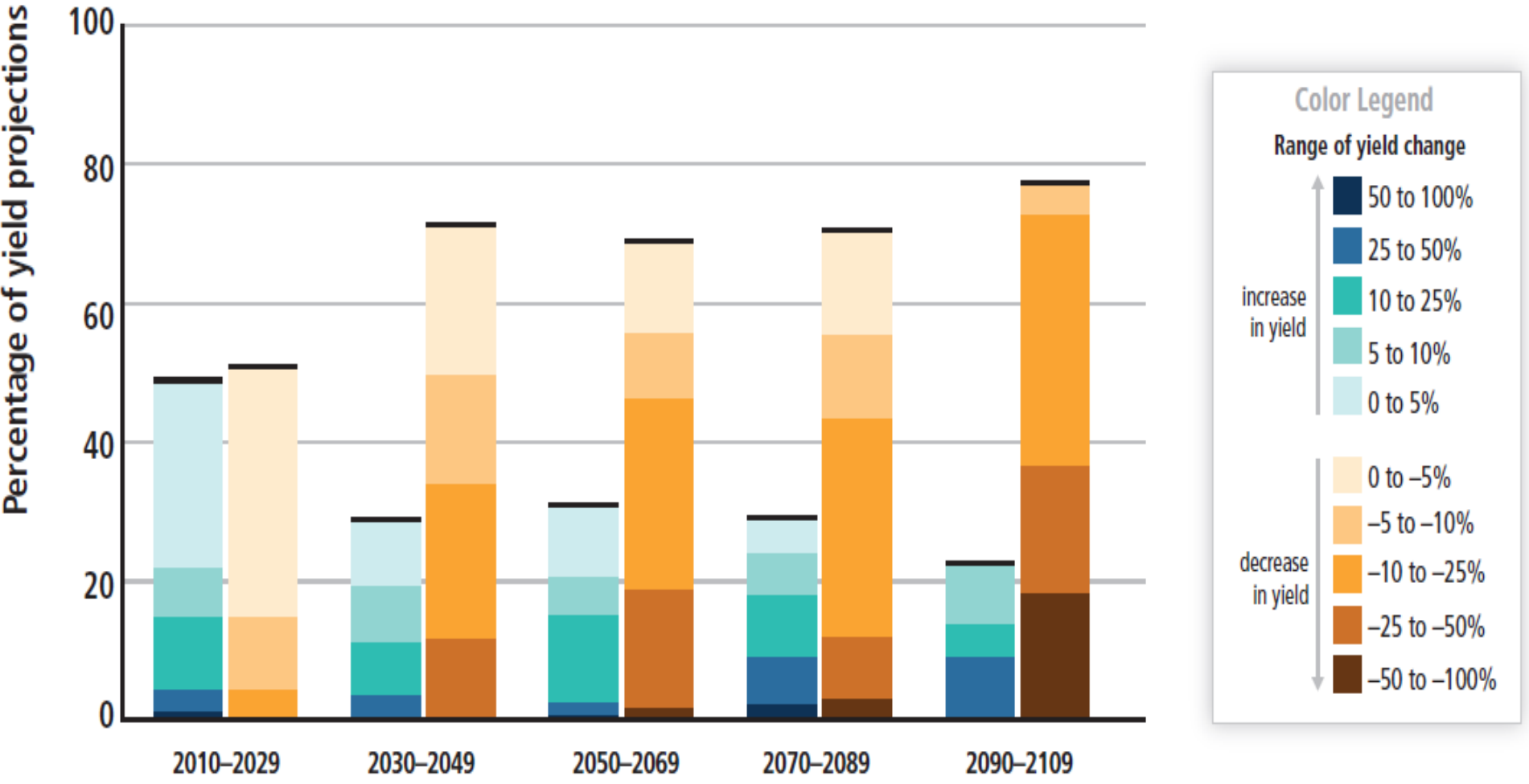
Projected crop yield changes (IPCC, 2014: 18)



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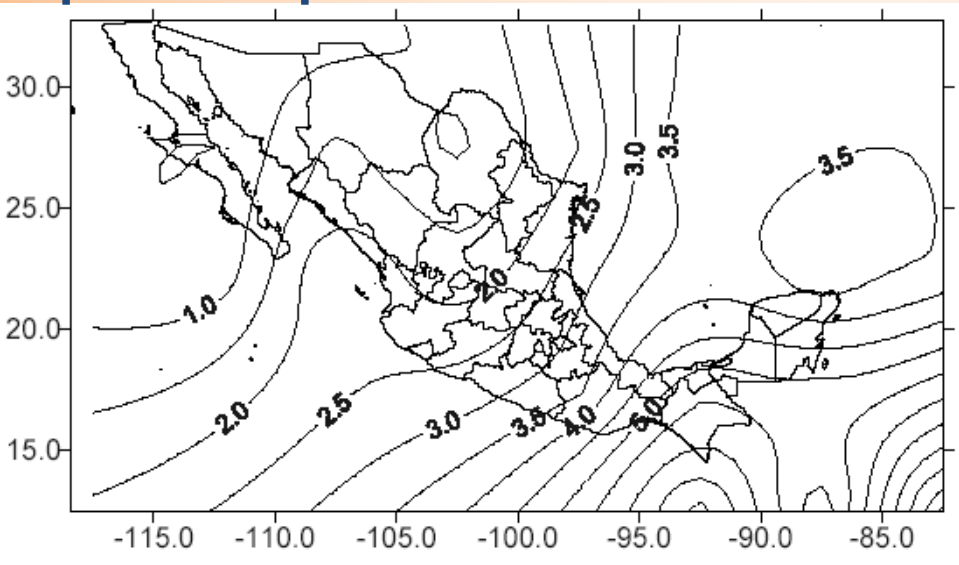
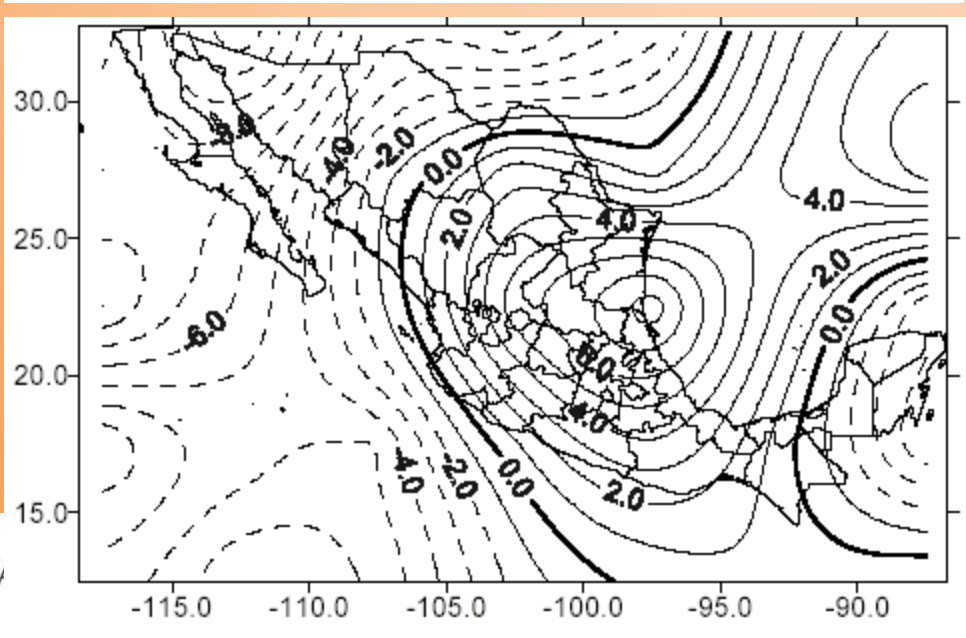
Potential changes in annual precipitation in Mexico for 2050



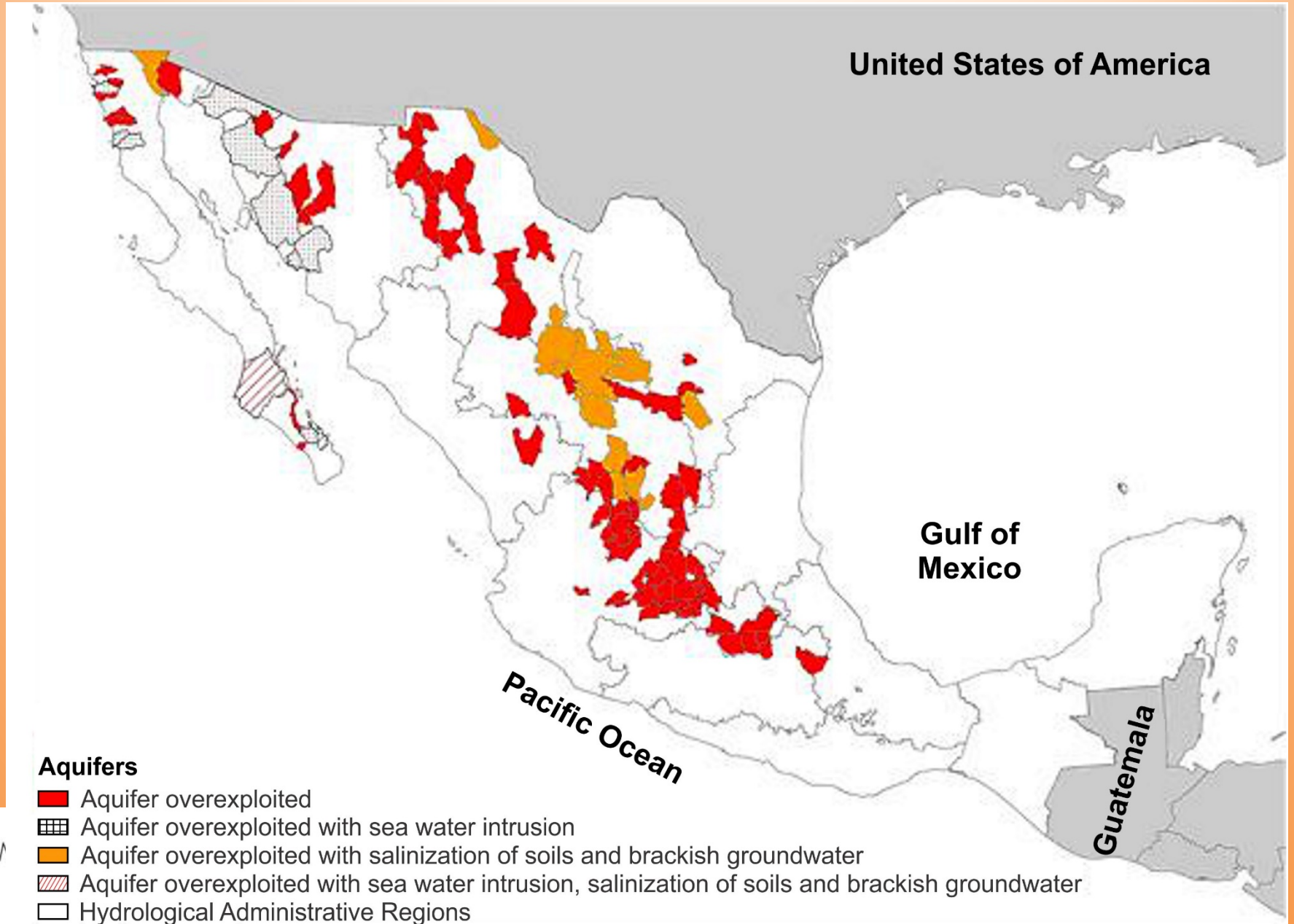
Scenario base (1961 – 1990) of average precipitation/year annual (mm/day)



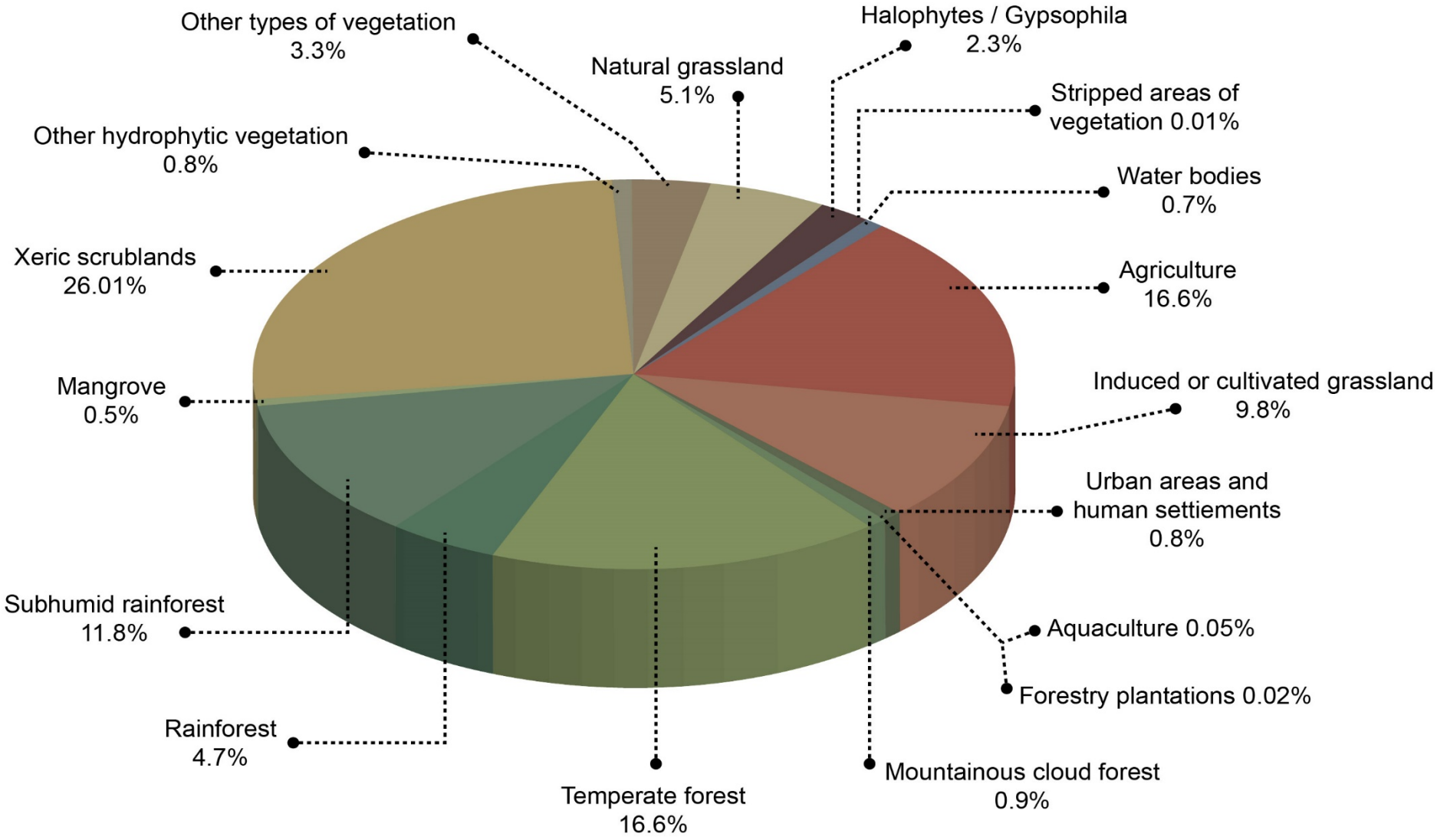
% of changes in average annual precipitation depending on medium sensitivity. The interrupted lines represent decrease. Model ECHAM4

Conde C., 2006

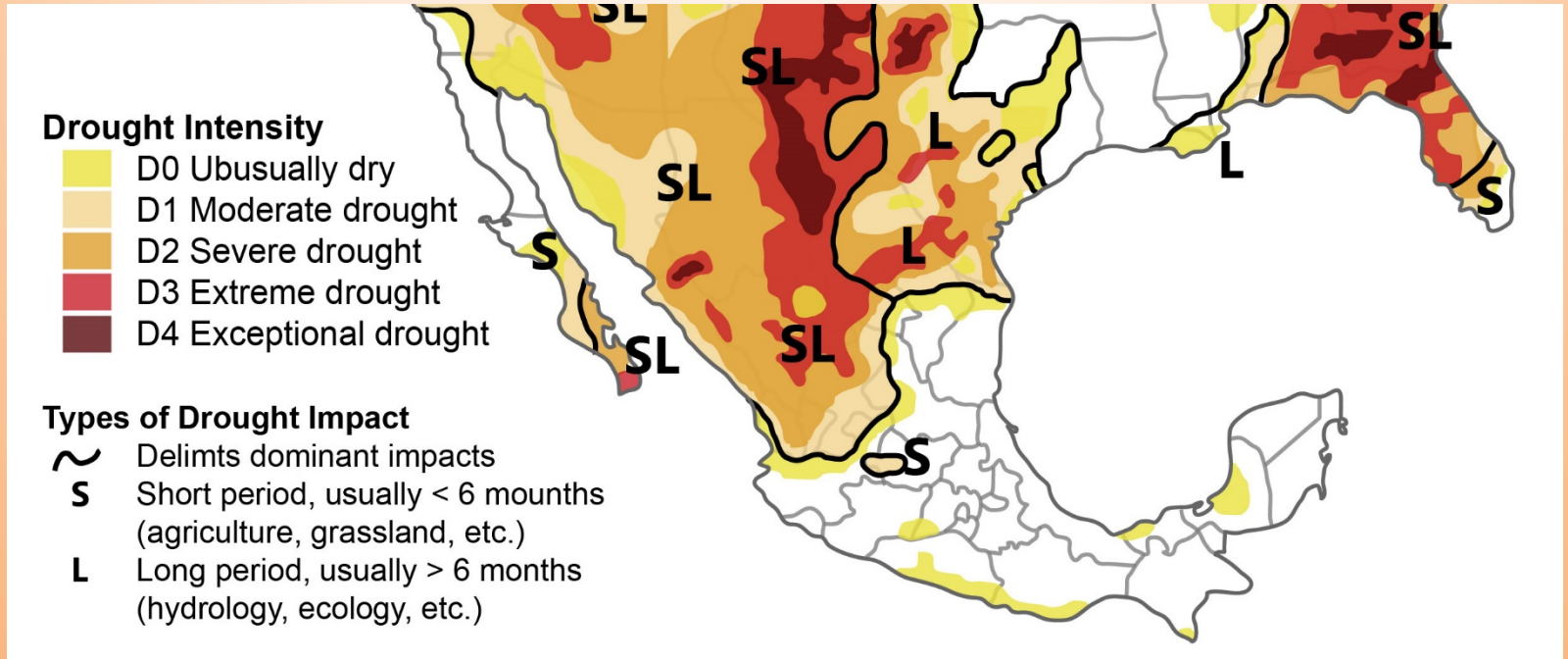
Intrusion of salt water on soil/ aquifers

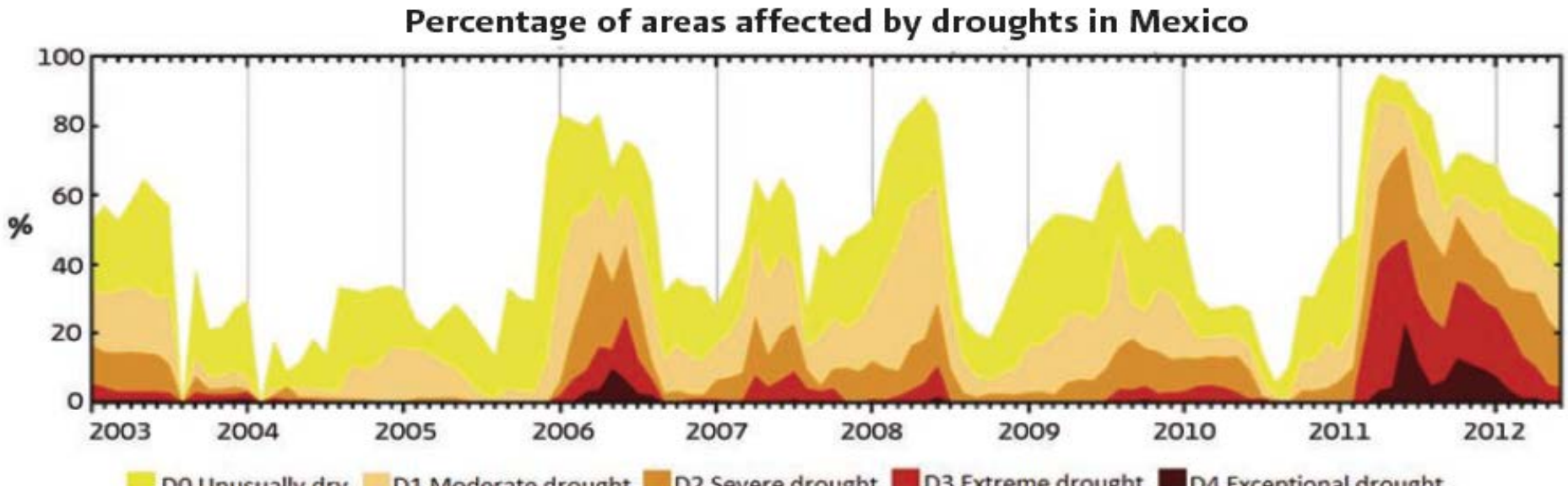


Land use change

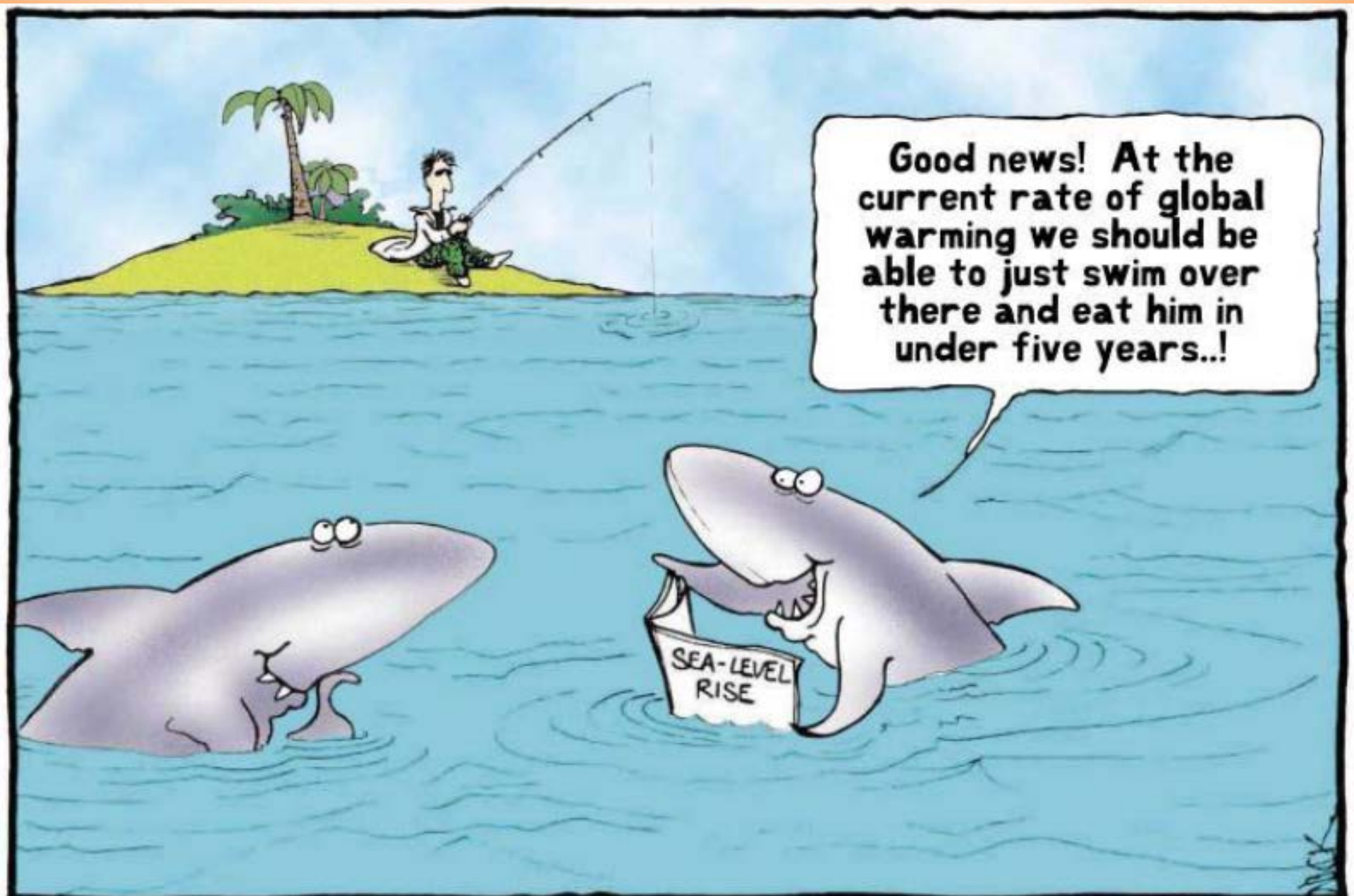


Droughts

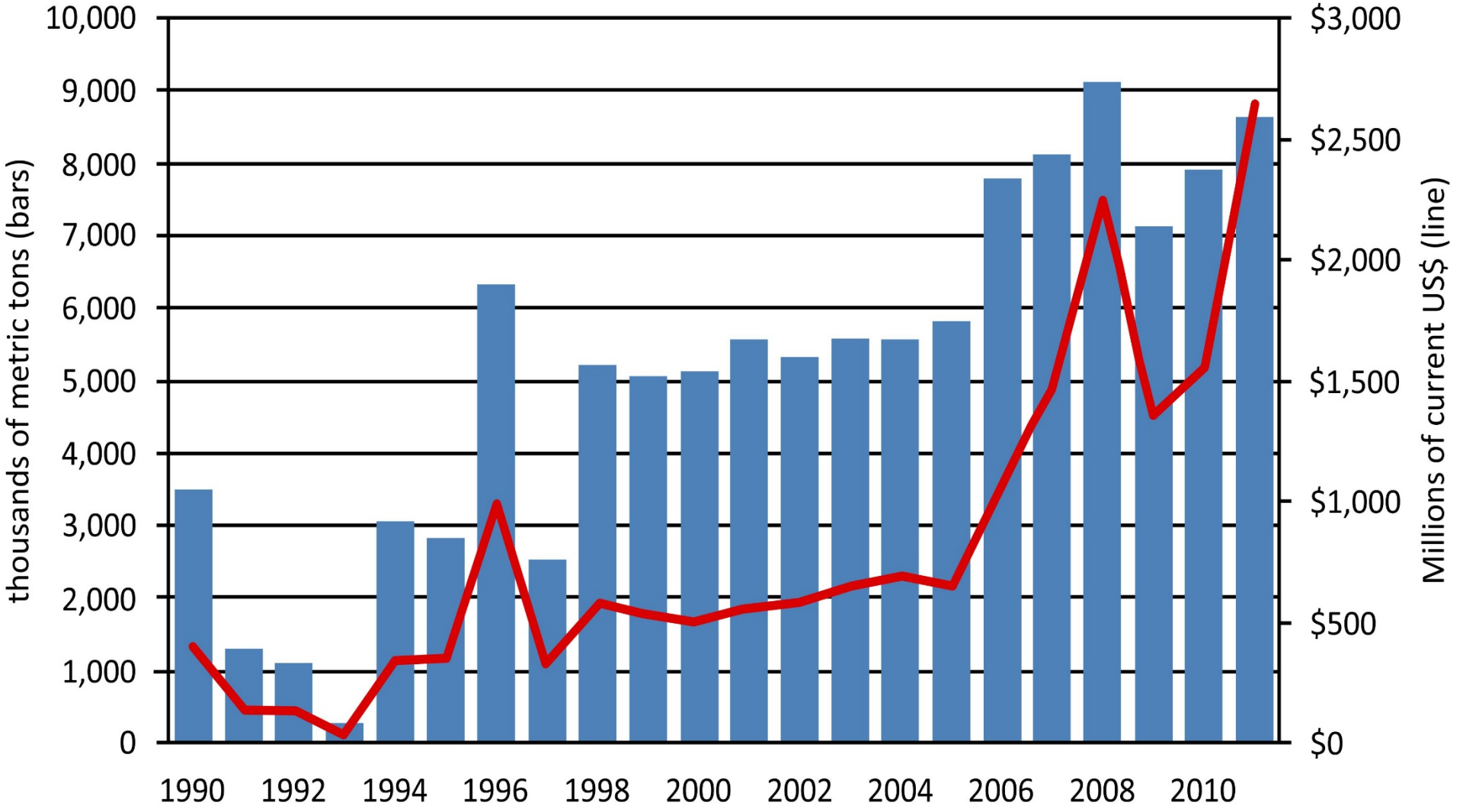

Drought Intensity
D0 Ubusually dry
D1 Moderate drought
D2 Severe drought
D3 Extreme drought
D4 Exceptional drought
Types of Drought Impact
~ Delimts dominant impacts
S Short period, usually < 6 mounths (agriculture, grassland, etc.)
L Long period, usually > 6 months (hydrology, ecology, etc.)
SL
L
S


Percentage of areas affected by droughts in Mexico
100
80
60
40
20
0
%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
D0 Unusually dry
D1 Moderate drought
D2 Severe drought
D3 Extreme drought
D4 Exceptional drought

Sea level rise: 11,000 km of coast (Conagua 2013: 22)



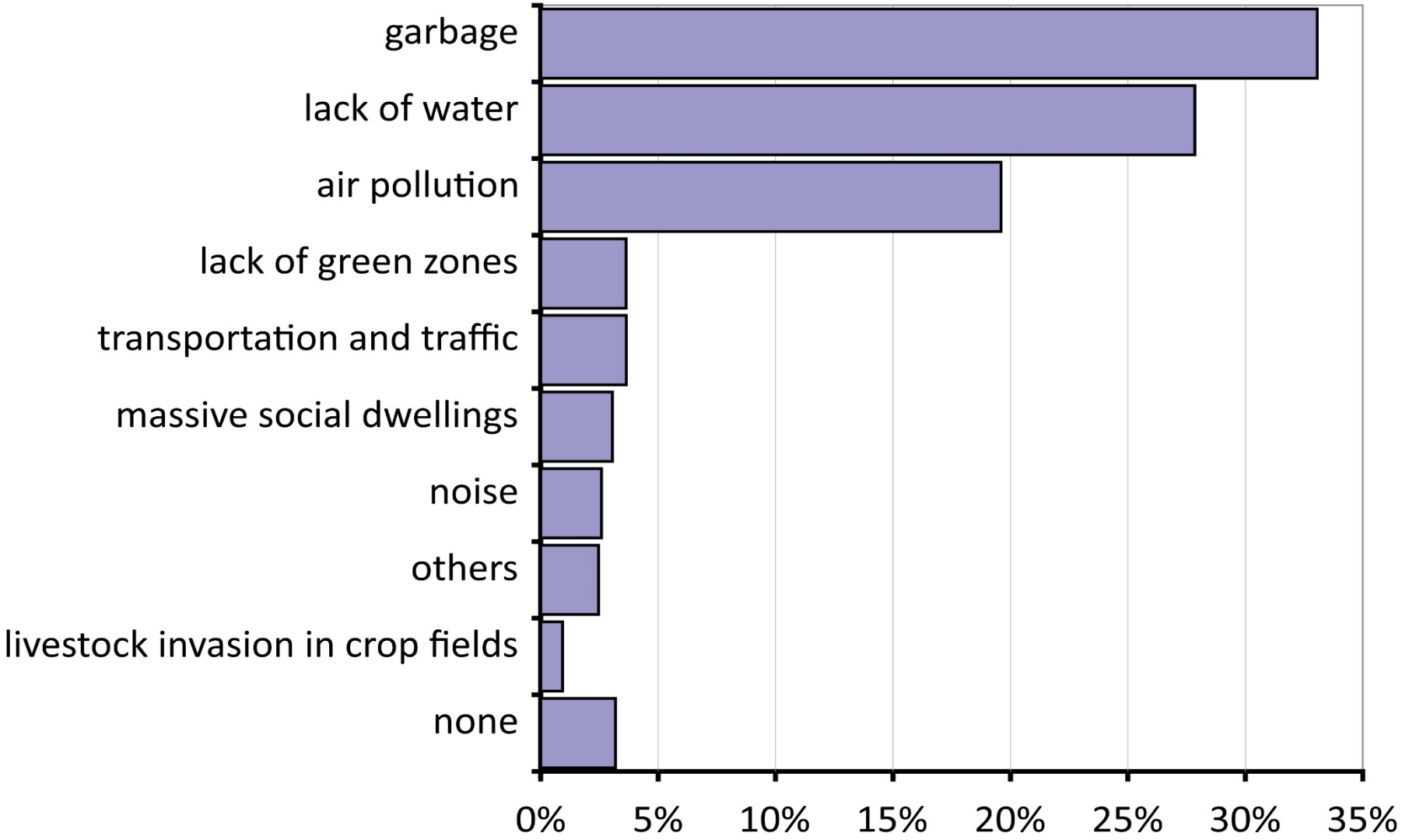
Loss of food security (Siap 2013)



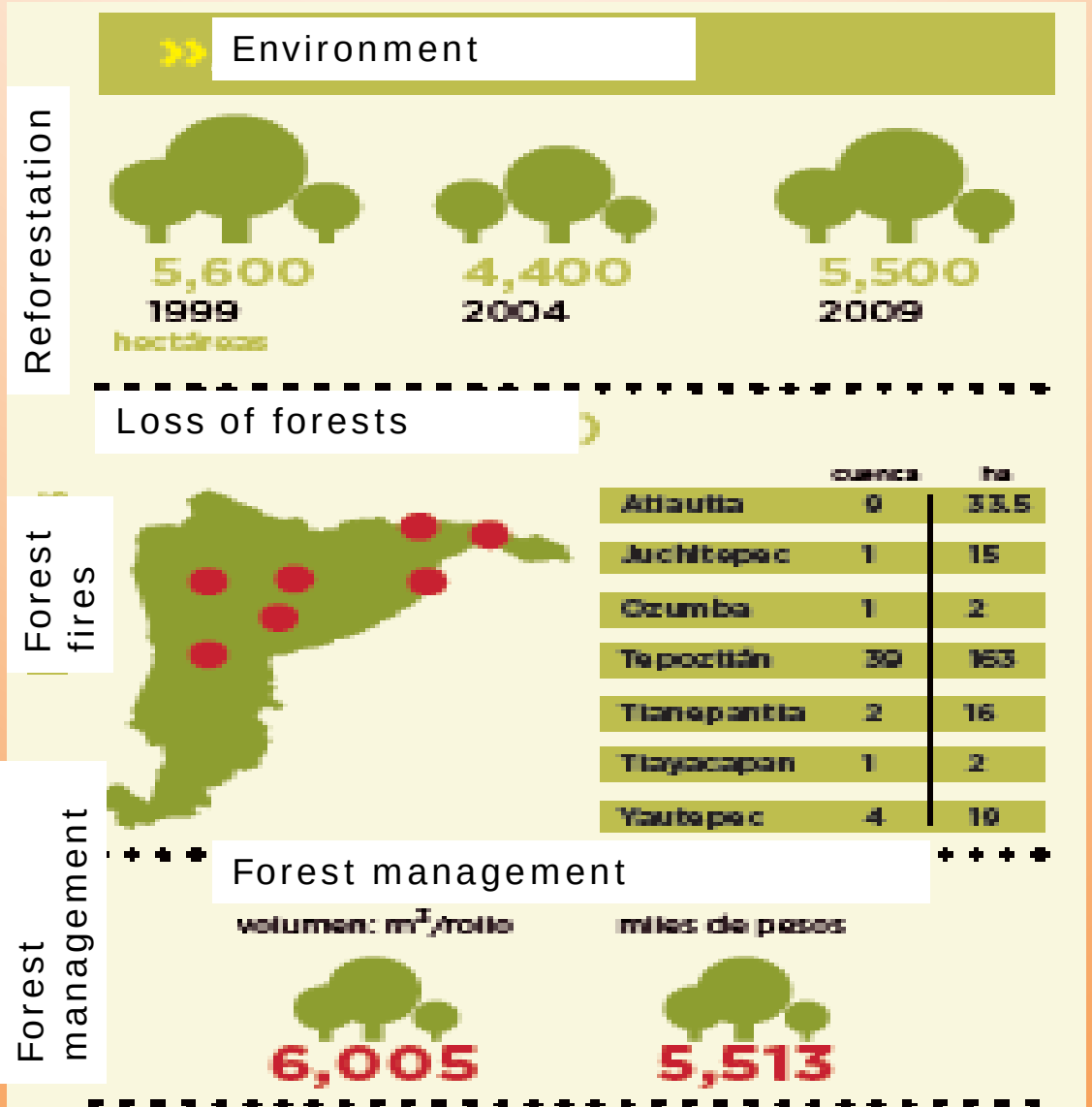
Agriculture 2015

54. Gocal impacts of climate change

Existing risks in the river bassin



Forest management



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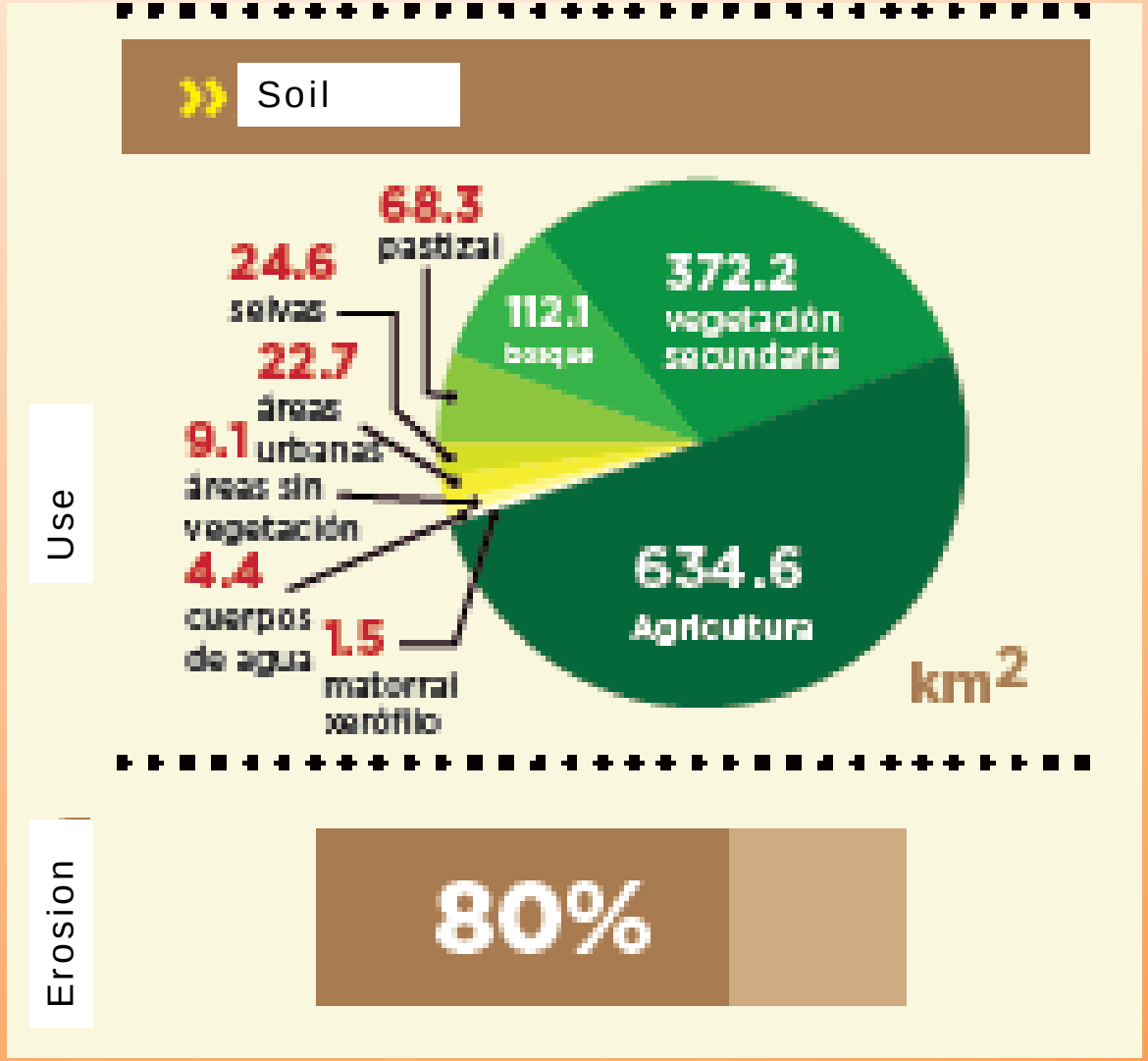
Soil mangement



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Agriculture and watershed management in the Yautepec River

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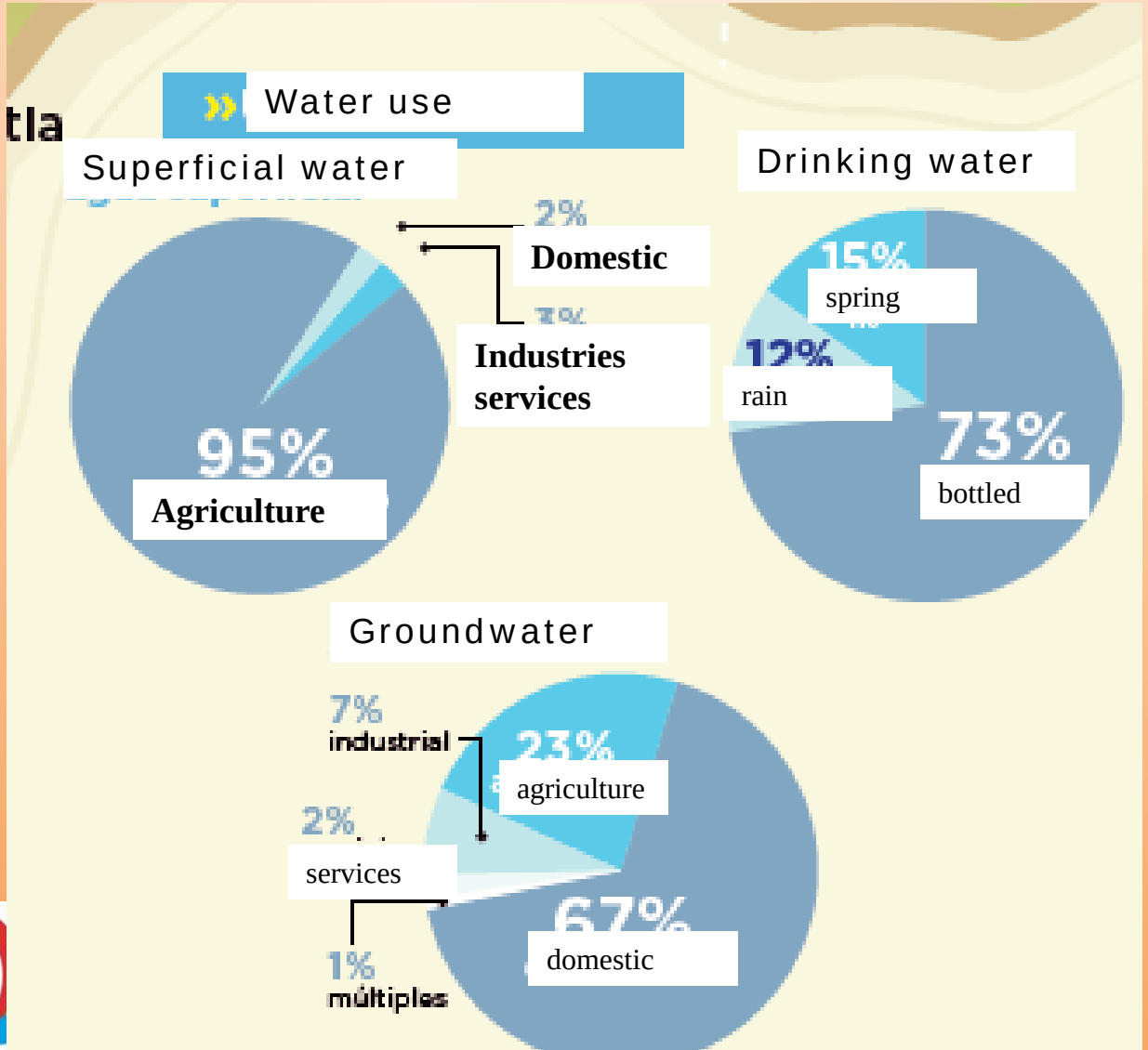
Unsustainable water use



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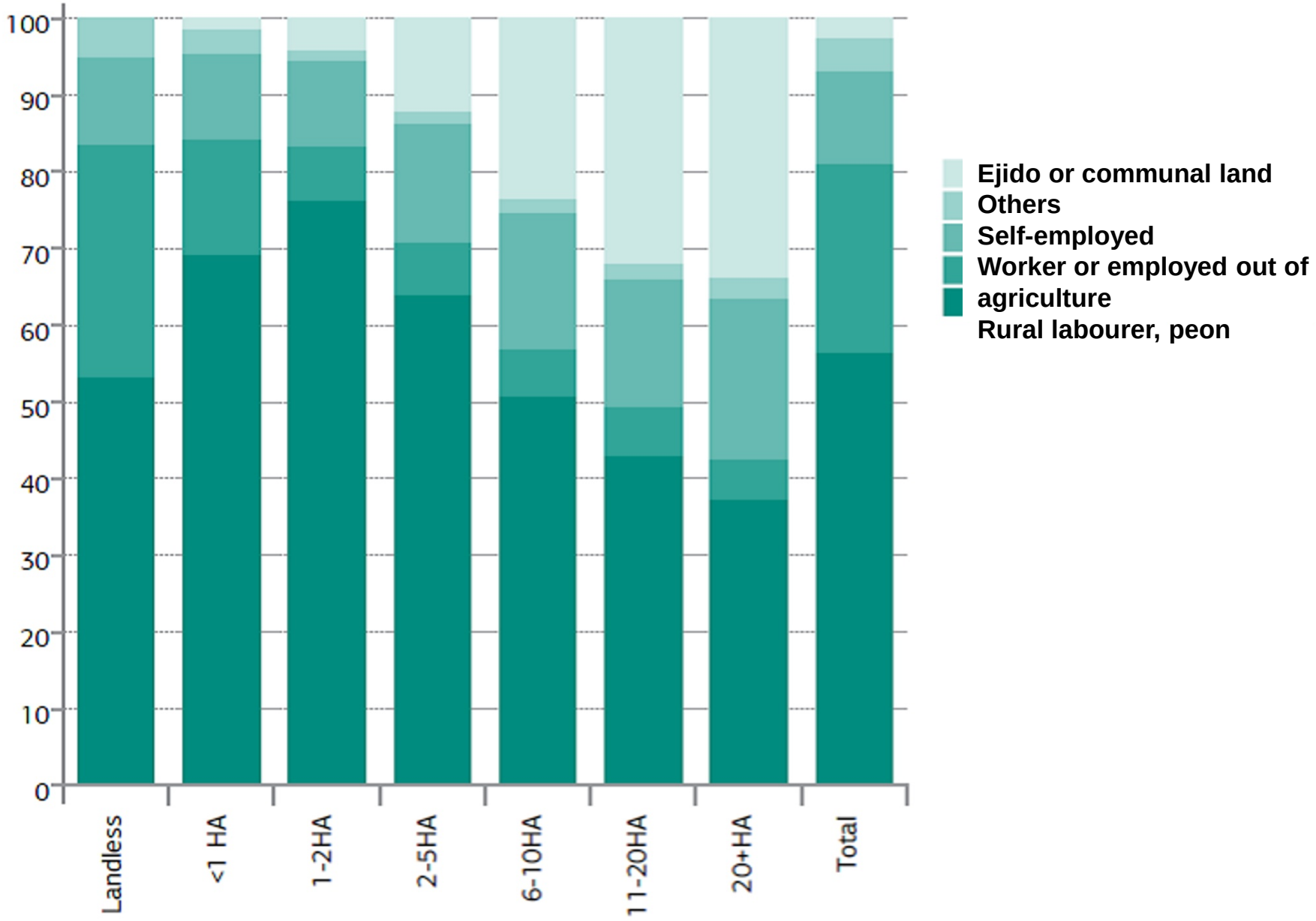
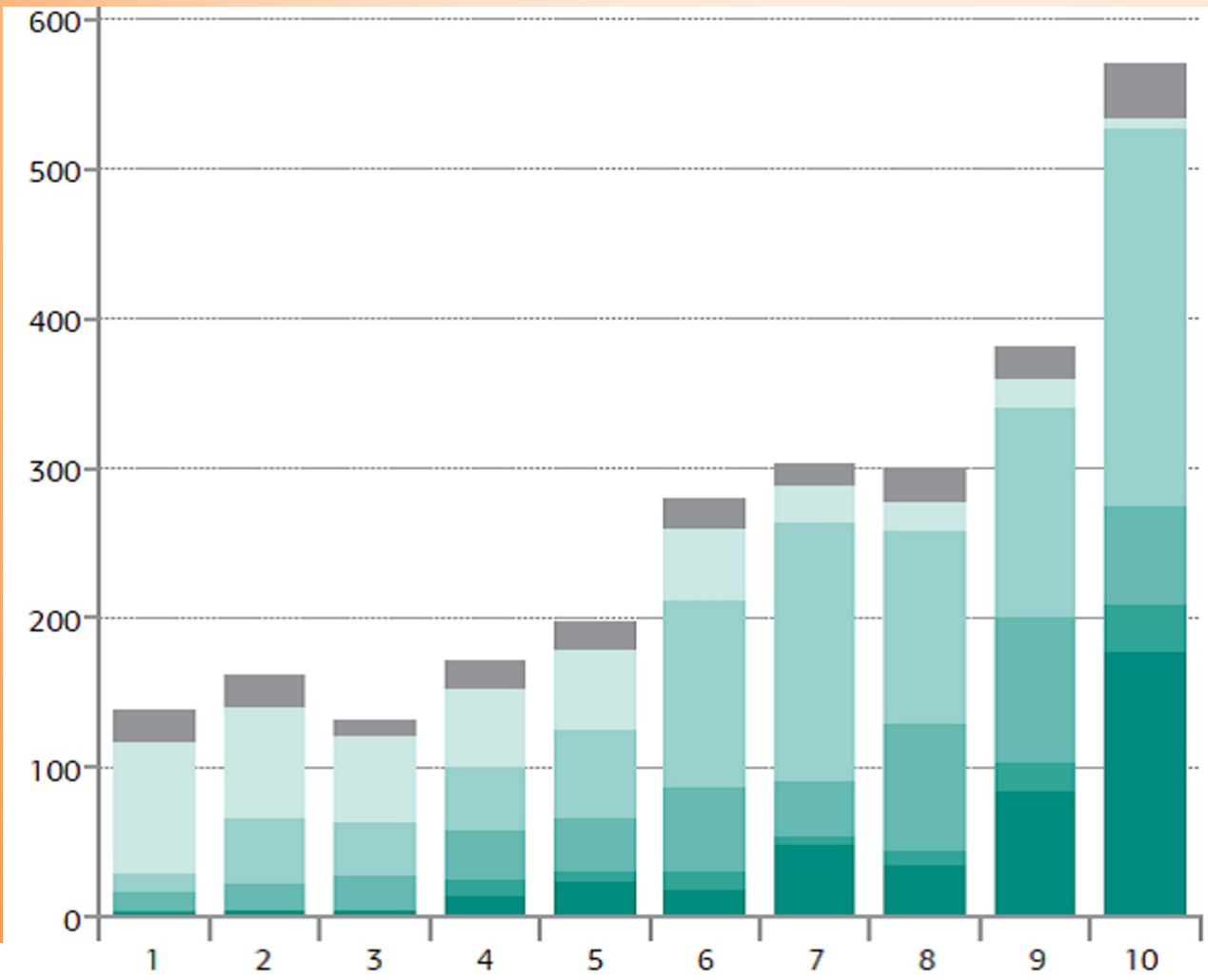
Land tenure

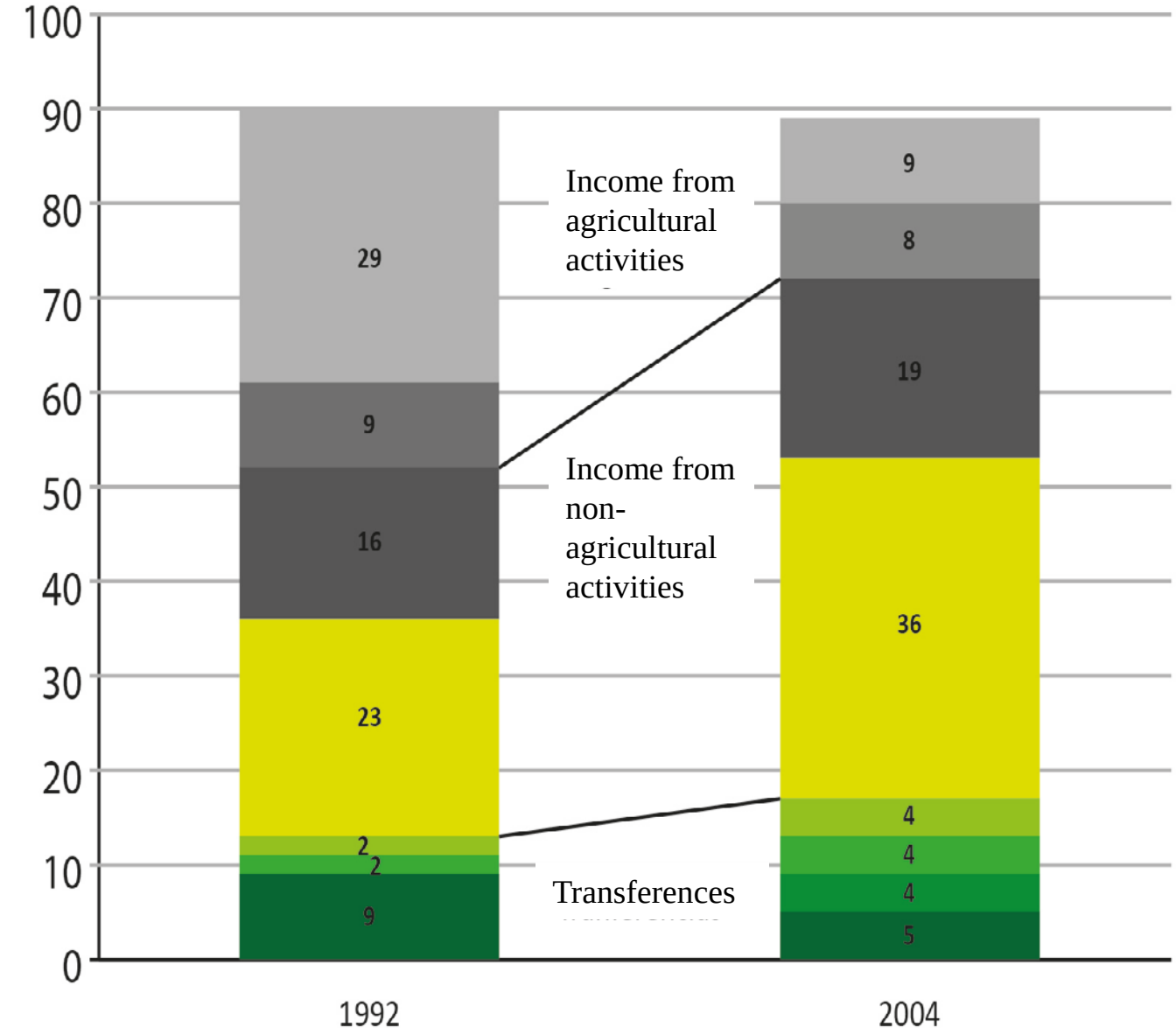

100
90
80
70
60
50
40
30
20
10
0
Landless
<1 HA
1-2HA
2-5HA
6-10HA
11-20HA
20+HA
Total
Ejido or communal land
Others
Self-employed
Worker or employed out of agriculture
Rural labourer, peon

Complexity of economic incomes



PROCAMPO (rural subsidy)
Oportunidades (poverty alleviation)
International remittances
National remittances
Other public support
Pension

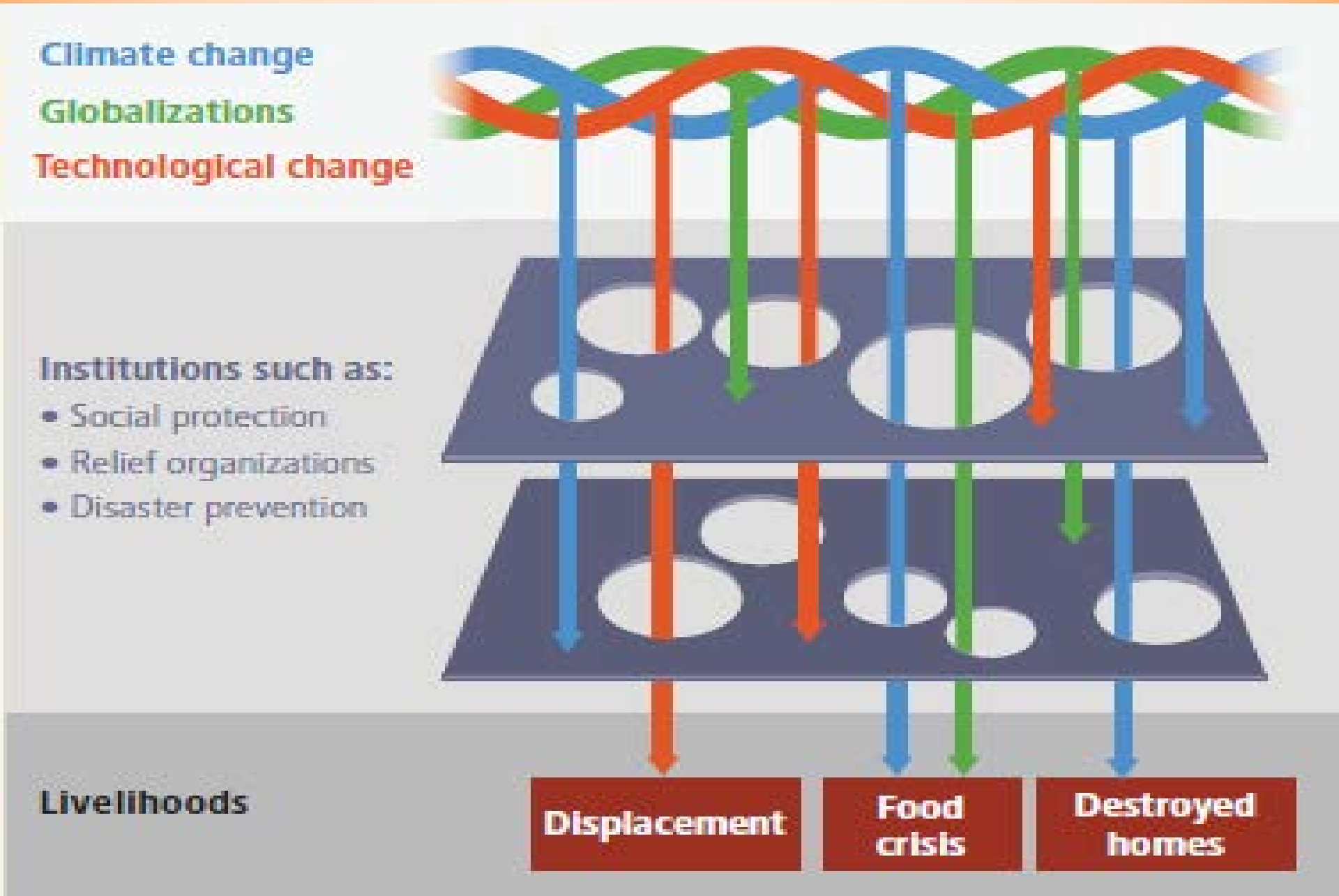
Nonfarm incomes dominates



Independent agricultura activities
Farm wage labourer
Independent non–farm activities

Nonfarm wage labour
Pensions
International remittance
Governmental support: Oportunidades/Procam
National remittances among households

Multiple stressors



4.3 Disaster management in the Yautepec River

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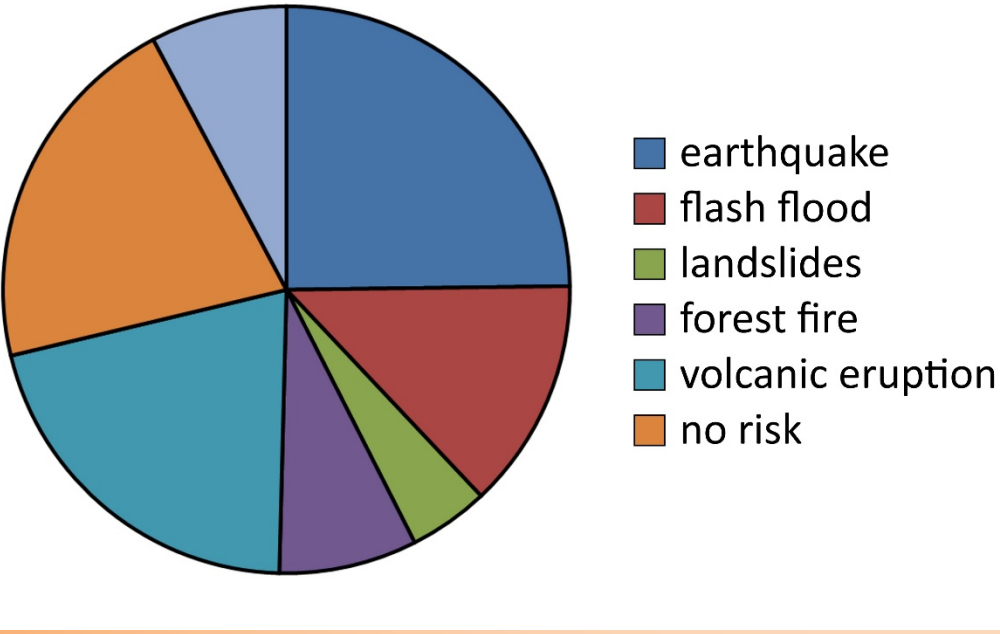
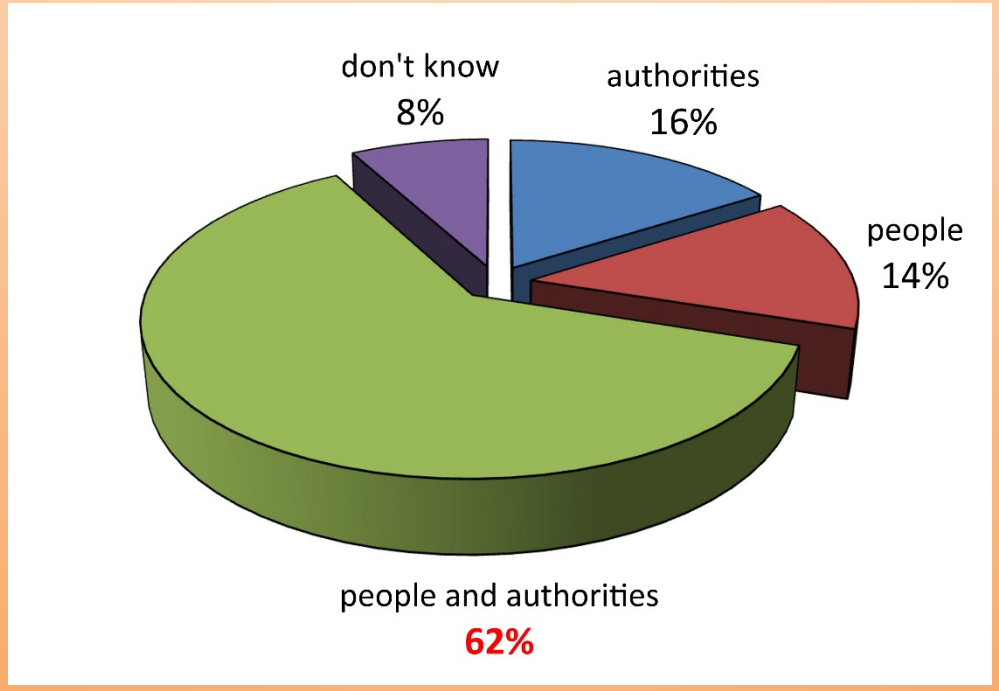


River Yautepec bassin risks and disaster management



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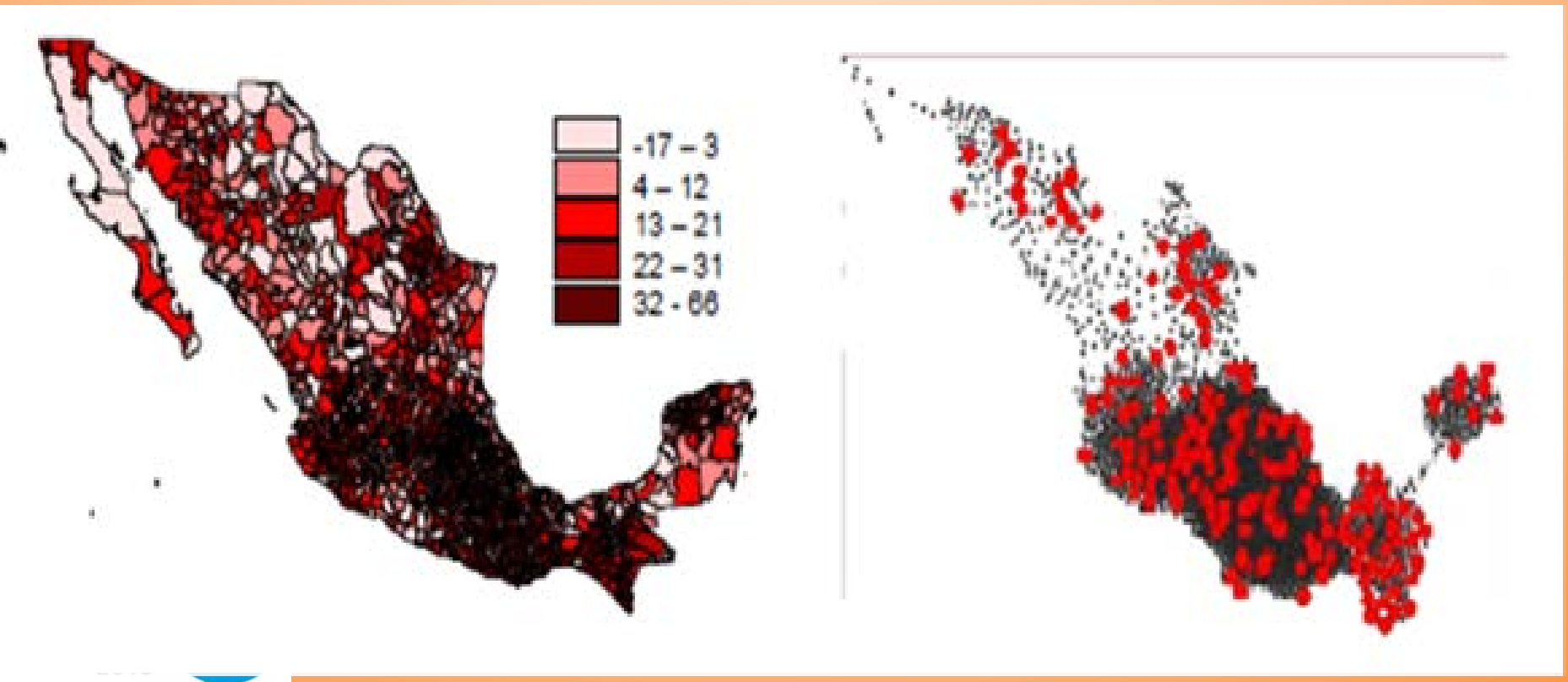
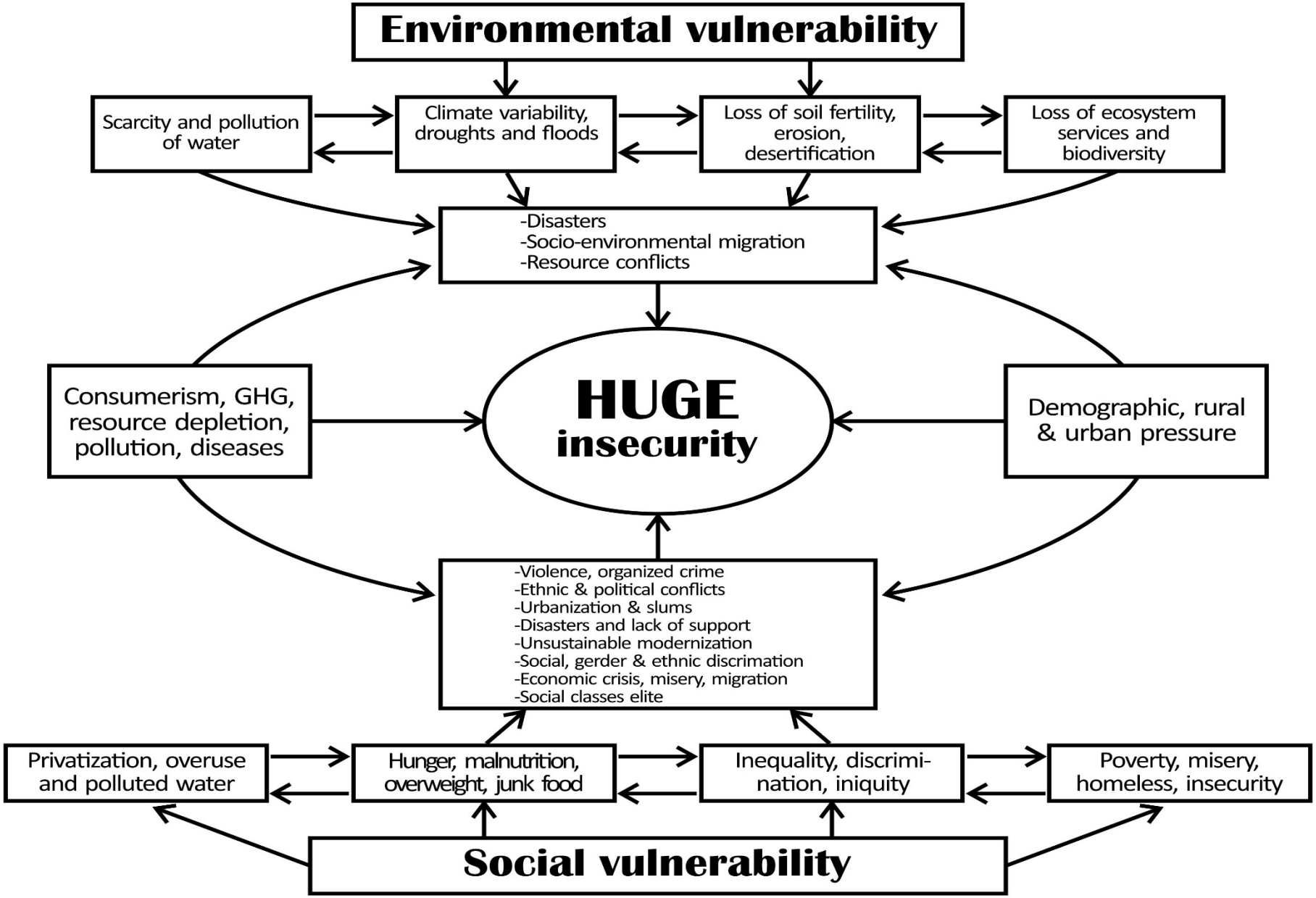
5. Risks, mitigation and adaptation from bottom-up and top-down

Dual vulnerability: poor and exposed to extreme events transformed into disasters

Left: income less 2 US$/day; right: Disaster costs over 500,000US$

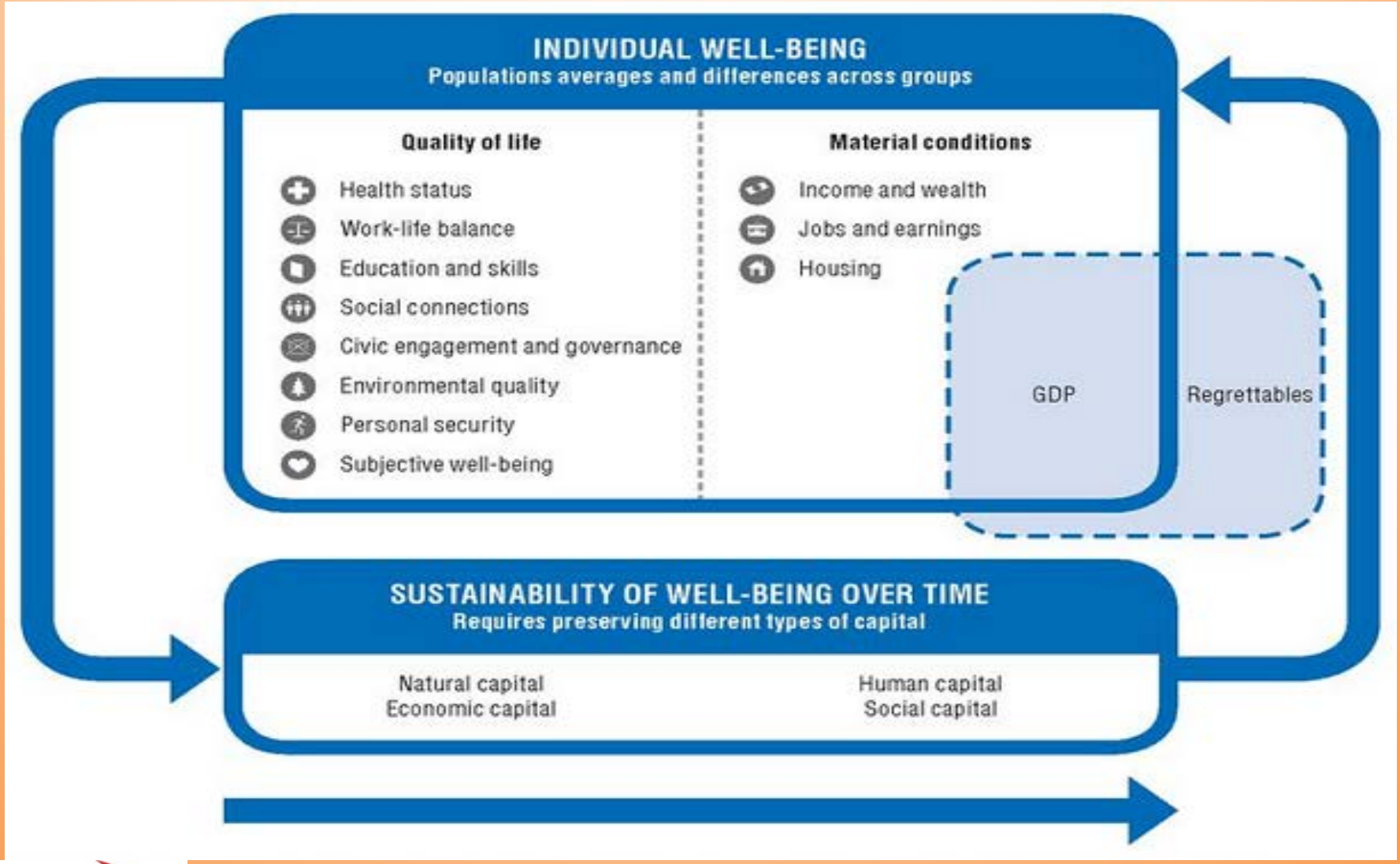


Dual vulnerability

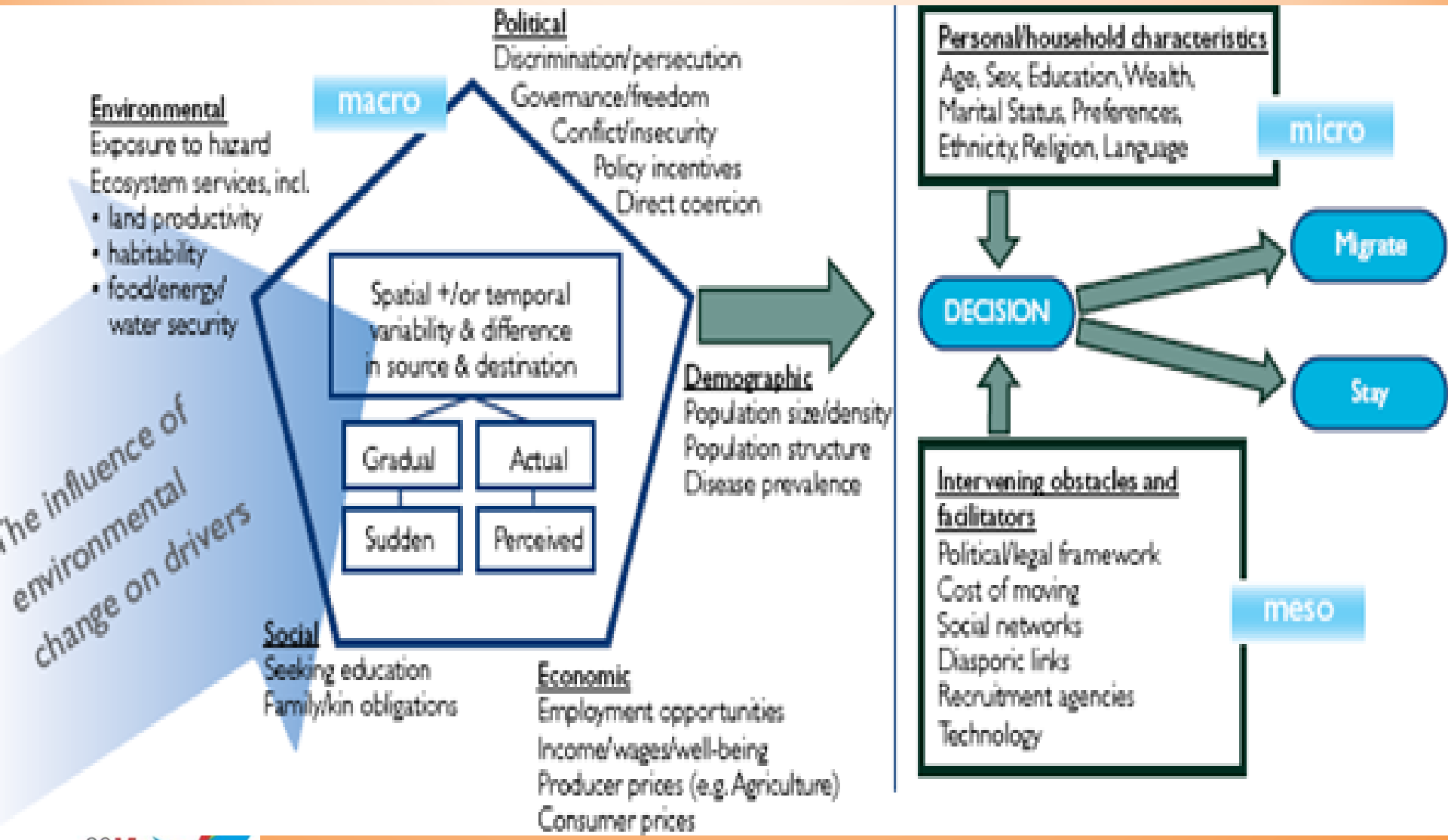


OECD wellbeing conceptual framework

2013



Complex factors & levels of environmental induced migration



Environmental perception

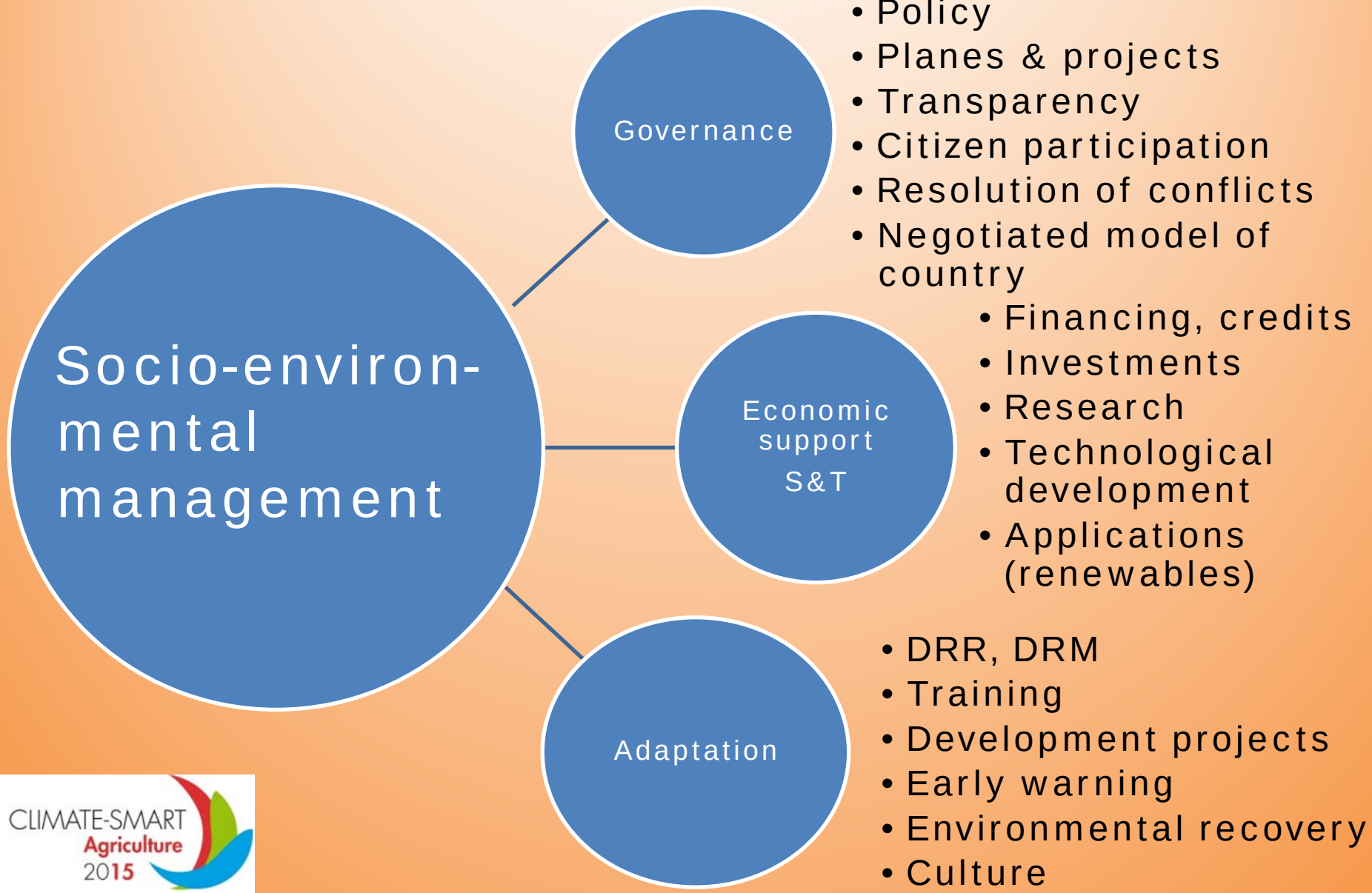
	Environmental understanding
Lorenzo Vázquez	62.6%
Villa Nicolás Zapata	75.8%
La Cañada	59.0%
El Pañuelo	56.3%

Index of social and environmental vulnerability

Both indexes	Lorenzo Vázquez	Nicolás Zapata	La Cañada	El Pañuelo
Index of social vulnerability	253.12	263.8	202.58	290.11
Index of environmental perception	273.4	286.6	220.3	307
Diferences in % between both indexes	8.01	8.64	8.75	5.82

Adaption without migration?

Obstacles to a dignified livelihood without migration



- Policy
- Planes & projects
- Transparency
- Citizen participation
- Resolution of conflicts
- Negotiated model of country

- Financing, credits
- Investments
- Research
- Technological development
- Applications (renewables)

- DRR, DRM
- Training
- Development projects
- Early warning
- Environmental recovery
- Culture

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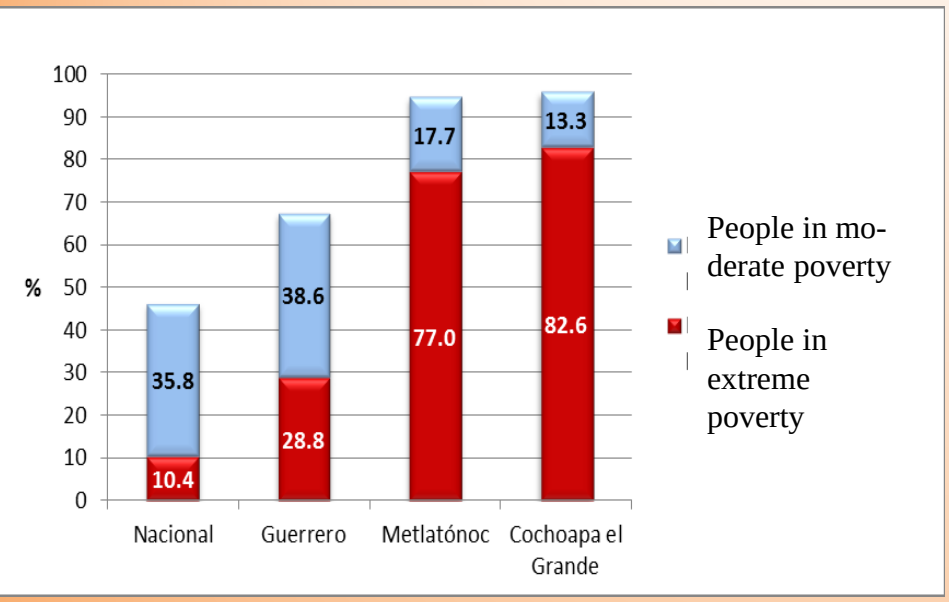
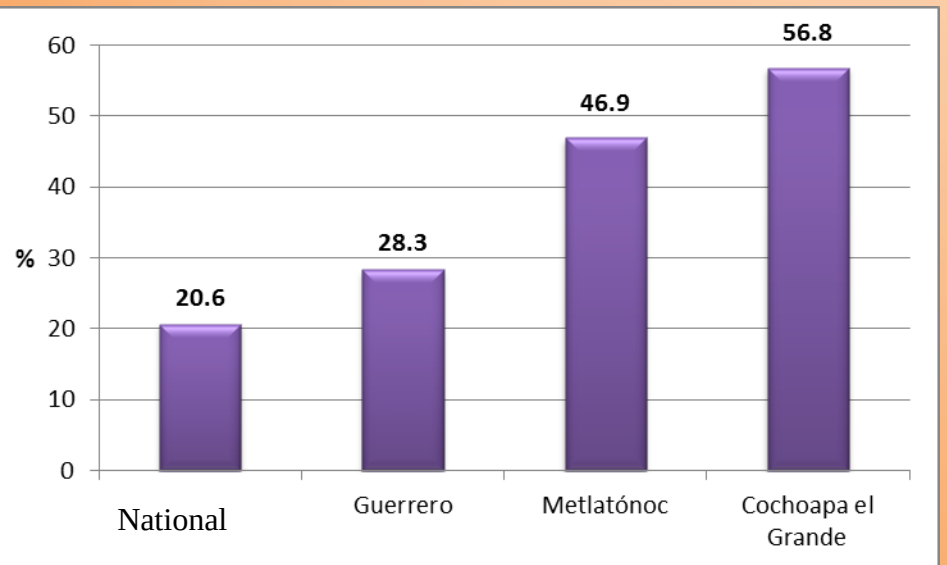
Economic deadlocks in Cochoapa



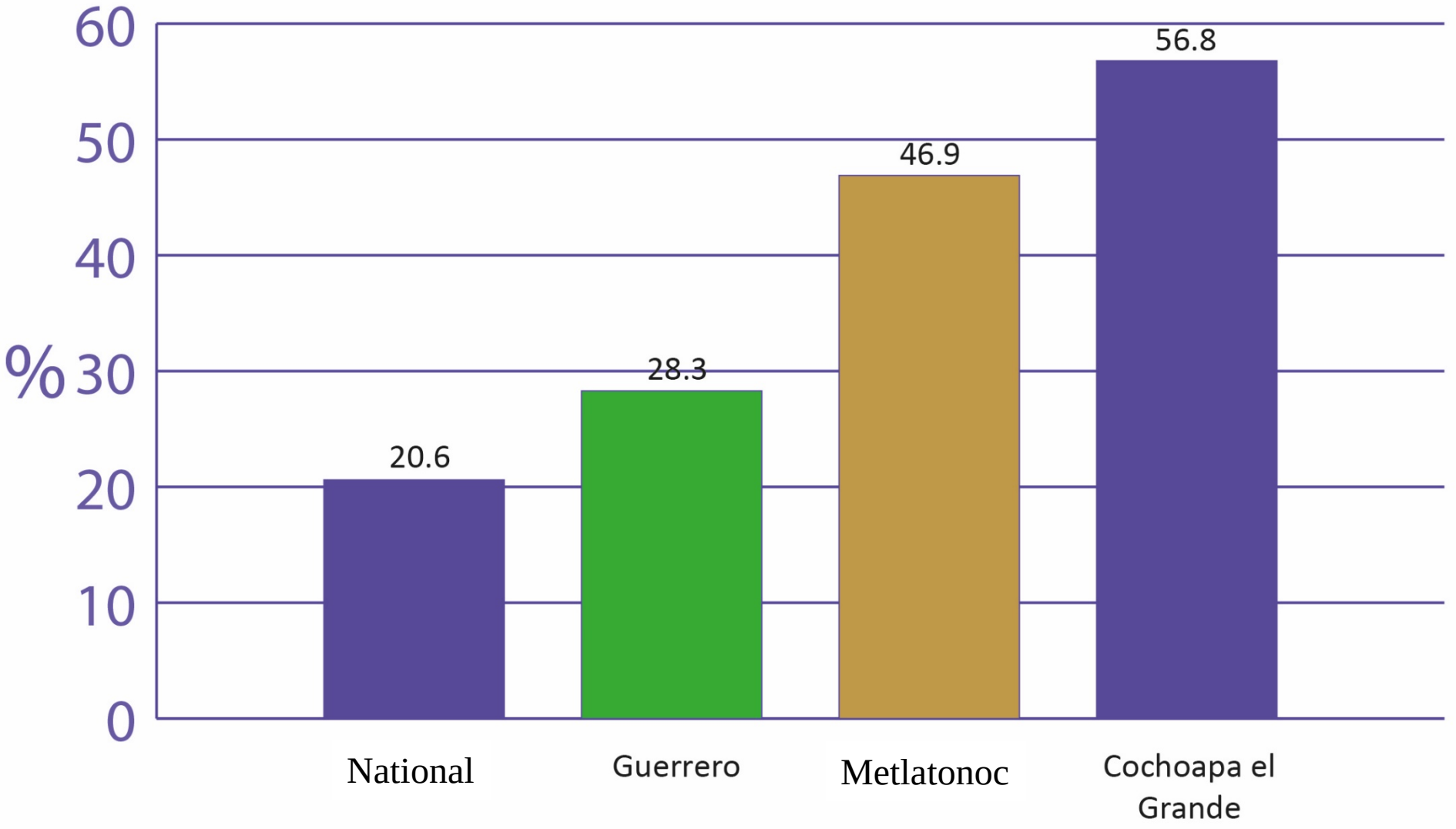
1. Poorest municipality in Mexico
2. 82.6% extreme poor
3. 98% indigenous
4. 56.8% analphabets
5. 70% of women without school
6. Studying prevents marriage
7. Girls at 12 years are sold for marriage
8. Temporary and permanent migration: Day laborers & family in the fields with toxic pesticides (including children)

Without school training

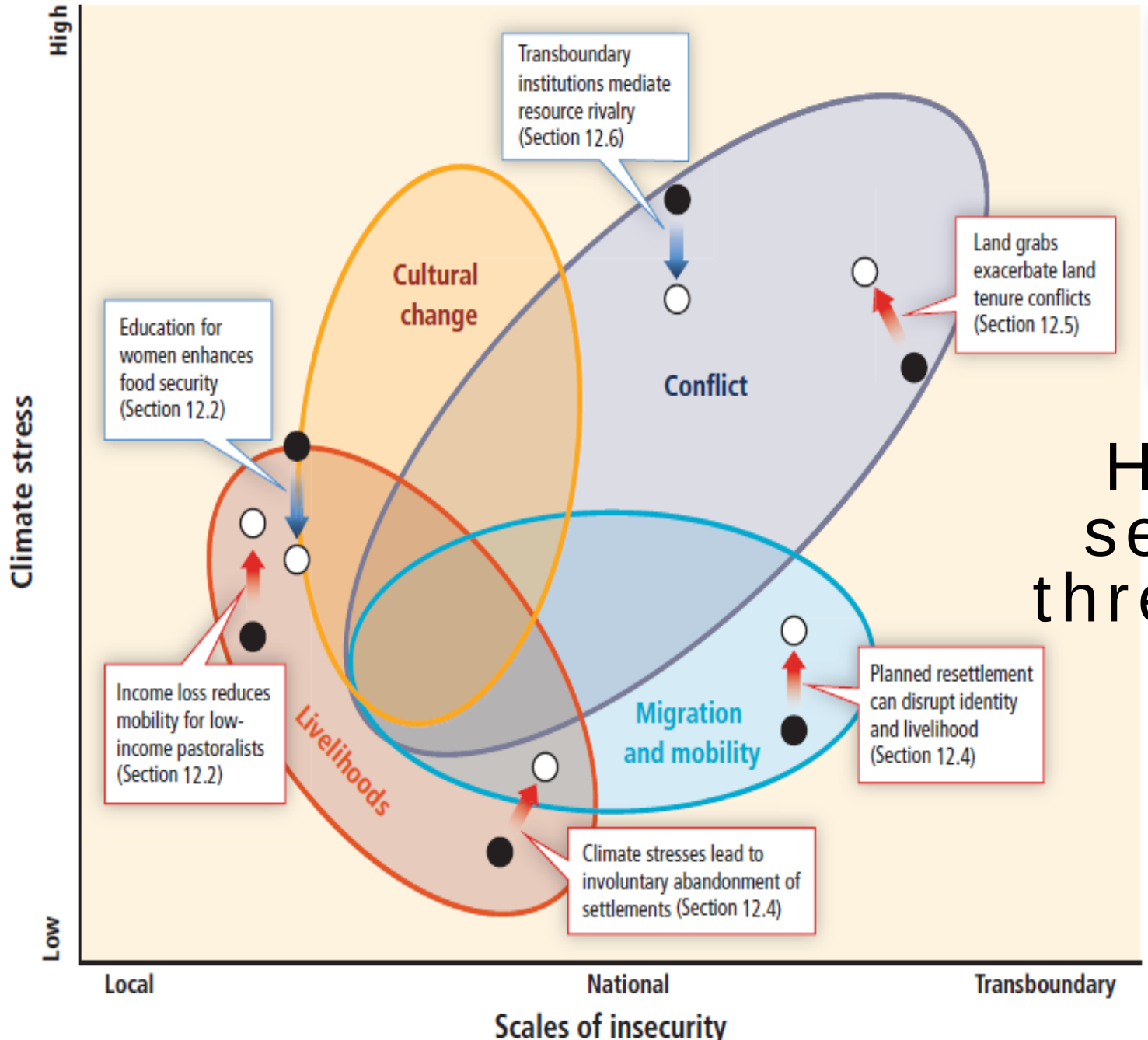


Discrimination: Poor, woman, indigenous and migrant

Educational backwardness



Culture and traditions



Human security threatened

6. Conclusion: integrated watershed management

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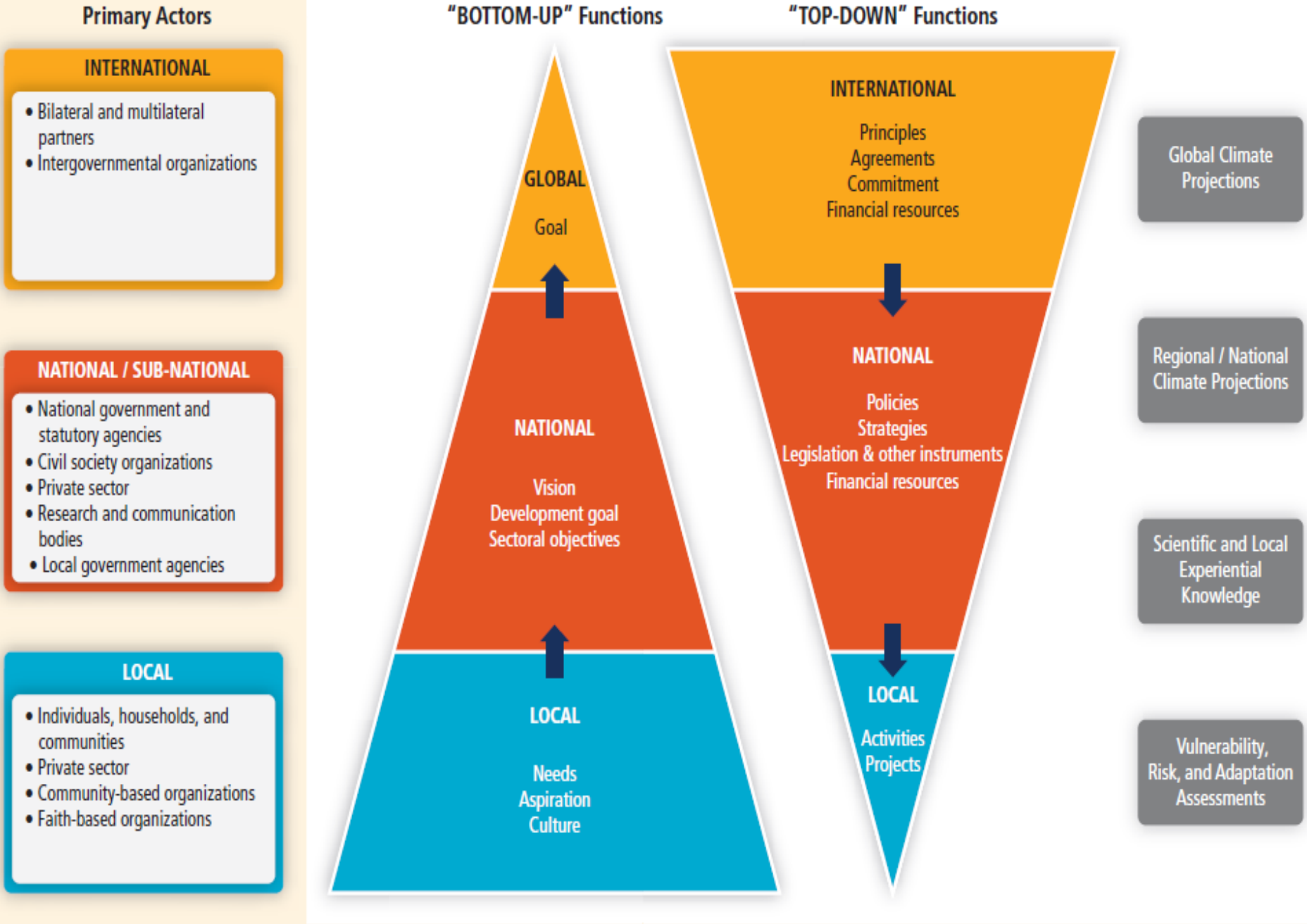
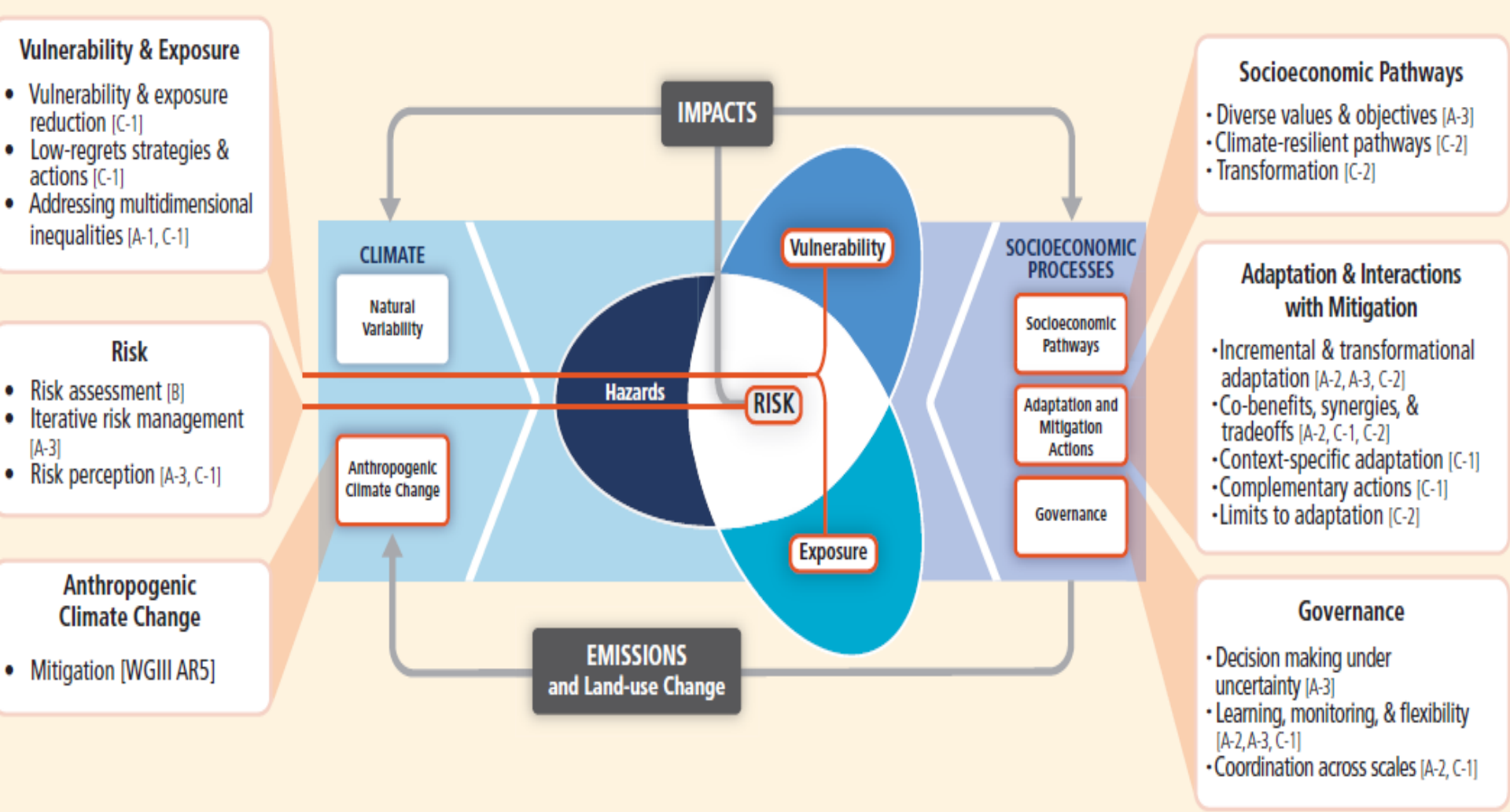
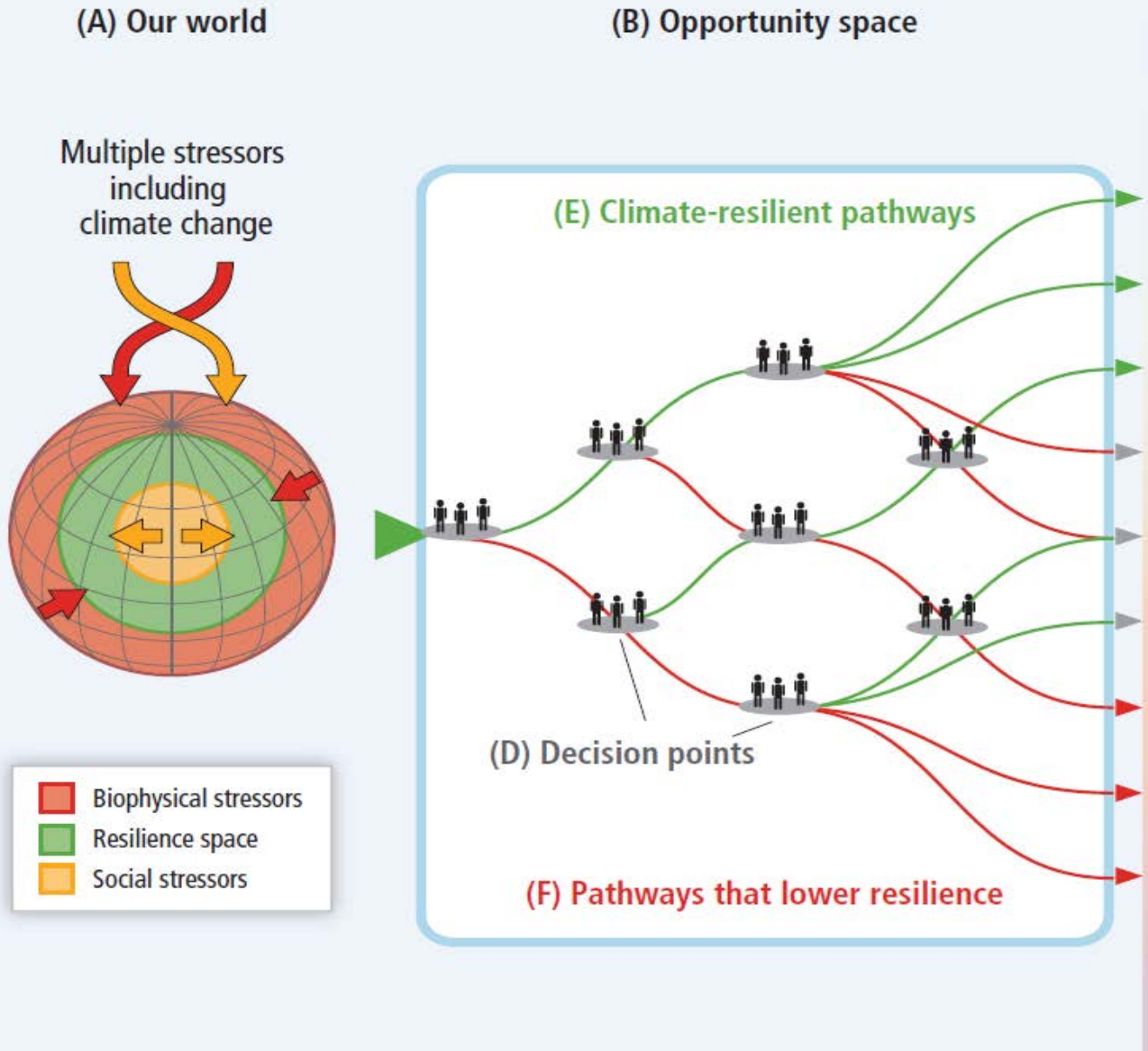
Glocal


Primary Actors
"BOTTOM-UP" Functions
"TOP-DOWN" Functions
INTERNATIONAL
• Bilateral and multilateral partners
• Intergovernmental organizations
NATIONAL / SUB-NATIONAL
• National government and statutory agencies
• Civil society organizations
• Private sector
• Research and communication bodies
• Local government agencies
LOCAL
• Individuals, households, and communities
• Private sector
• Community-based organizations
• Faith-based organizations
GLOBAL
Goal
NATIONAL
Vision
Development goal
Sectoral objectives
LOCAL
Needs
Aspiration
Culture
INTERNATIONAL
Principles
Agreements
Commitment
Financial resources
NATIONAL
Policies
Strategies
Legislation & other instruments
Financial resources
LOCAL
Activities
Projects
Global Climate Projections
Regional / National Climate Projections
Scientific and Local Experiential Knowledge
Vulnerability, Risk, and Adaptation Assessments

Integration of epistemic communities (IPCC: 26)

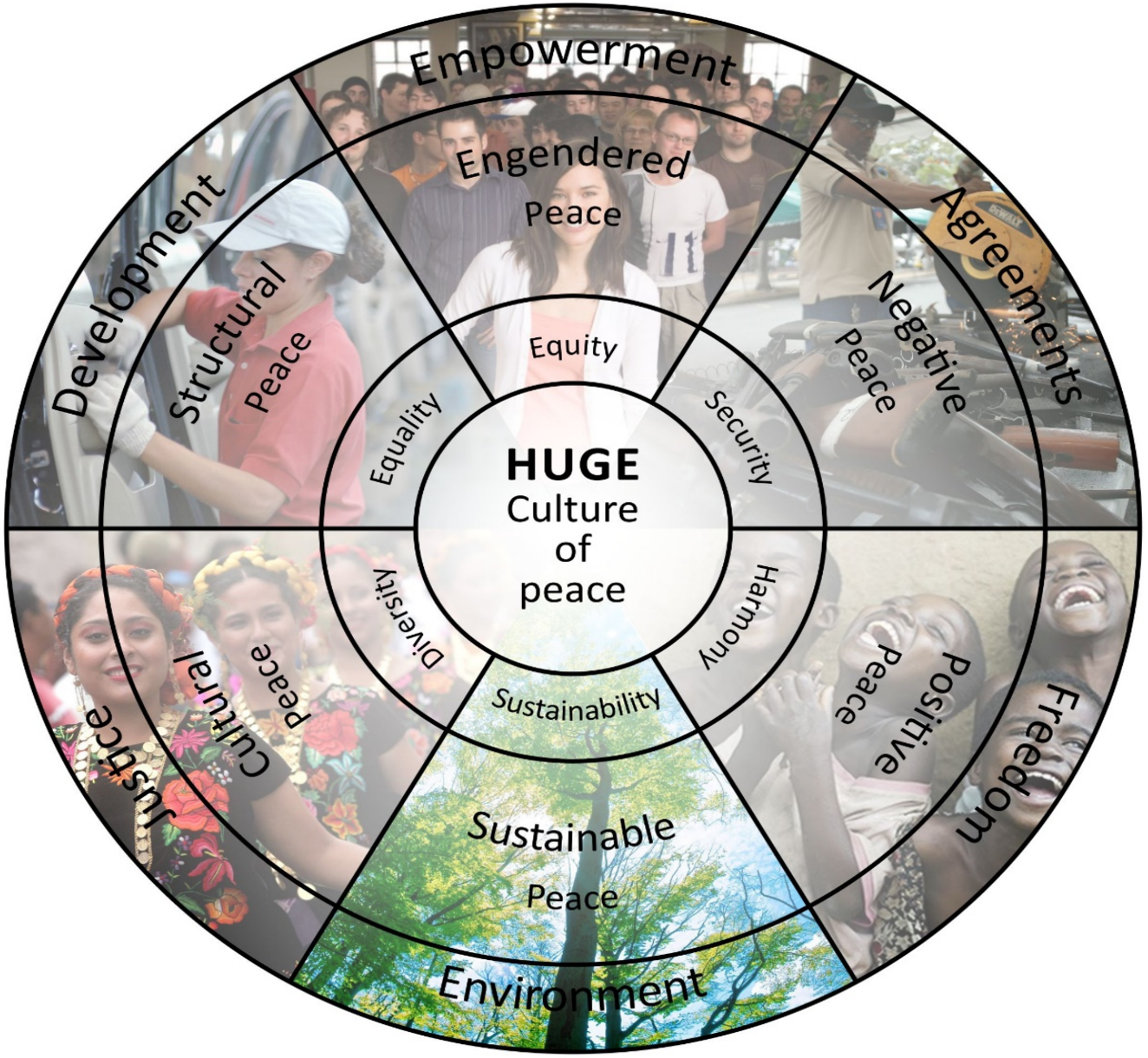


Opportunity spaces (IPCC: 29)




Metropolitan Valley of Mexico City (MVMC)
Biological Corridor Chichinautzin
Mexico City
State of Mexico
Ayequeme State Park
Izta-Popo Iztaccihuatl-Popocatepetl National Park
Ajusco National Park
Huitzilac
State of Morelos
Juchitepec
River Nexpayosutla
Tepozteco National Park
Tepoztlan
River Apanquetzalco
River Tepexi
Tlalnepantla
Totolapan
Ozumba
Atlautla
Tlayacapan
Tepetlixpa
River Atongo
Atlatlahucan
industrial zone of Cuernavaca (CIVAC)
Amilcingo
Tepexi
Gorge Totolapan
Nexpa
Yecapixtla
River Yautepec
El Texcal State Park
Yautepec
Relief channel La Nopalera
vacation center Oaxtepec
Sierra Montenegro State Park
Cuautla
E. Zapata
La Nopalera
Morelos II (projected)
River Dulce
Ticuman
Ciudad Ayala
Las Juntas
Las Estacas (private park)
River Apatlaco
Zacatepec
Tlaltizapán
Tlaquiltenango
Jojutla
Biosphere Sierra of Huautla
River Amacuzac
dam
STP: sewage treatment plant
well
spring of the River Yautepec
magic village
sugar cane
tomato
maize
nopal (cactus leave)
national and state parks
sugar factory
projected river relief channel
limit of state and Mexico D.F
limit of municipality

Glocal integrated management




CLIMATE CHANGE BUILDING
UNDER CONSTRUCTION
Durban 2011
ADAPTATION
MITIGATION
scepticism
fear
indifference
blame
MEDIA
ENERGY SECURITY
MONTREAL PROTOCOL
COPY
PASTE
HUMAN RIGHTS
PRECAUTIONARY PRINCIPLE
NO GLOBAL DEAL
COMMON BUT DIFFERENTIATED RESPONSIBILITIES
SOLAR ACTIVITY
LAW AND GOVERNANCE
POLLUTERS PAY
Health
LUXURY EMISSION
SOCIAL TRANSFORMATION
FOOD SECURITY
SOCIAL COST
SOCIETY
FUTURE GENERATIONS
RESPONSIBILITY
CLIMATE JUSTICE
RELIGION & CLIMATE
VALUES
Cap-and-Trade System
COMMODIFICATION
AIR
H_2O
STERN
INVESTMENT
MONEY
PROFIT
LIMITS TO GROWTH
BIOFUELS
CARS
USSR Hot Air
low carbon economy
ECONOMY
CLEAN DEVELOPMENT
POVERTY REDUCTION
MILLENNIUM GOALS
Under Construction by
UNFCCC IPCC
EU USA
China India
AOSIS WMO
Greenpeace
OPEC
Umbrella Group
G2 / G20/ G77/ G7?
Annex I / Annex II
Non-Annex
PROBABILITY
ALTERNATIVE ENERGY
CO_2 STORAGE
DATA EVIDENCE
AGRICULTURE
UNCERTAINTY
MODELING
ICE SHEET
MELTING GLACIERS
OCEAN ACIDIFICATION
SEA LEVEL RISE
DROUGHT
DEFORESTATION
UNDER CONSTRUCTION
SCIENCE
BIODIVERSITY
OIL
DIPLO
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