 **Climate Change and Sugarcane Production: Potential Impact and Mitigation Strategies**

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# ***Climate Change* Poses Greater Security Threat than *Terrorism***

**“Every *economic decision* is a climate decision and every *climate decision* is an economic decision”**

**(UK Chief Scientific Advisor- David King)**



# Points to Ponder

Climate variability has a major impact on sugar production and on national economy

## ***Nation's economic greatly influenced:***

- Food security
- Environment sustainability
- Water resources, crops, forests, livestock
- Reliability of transportation/communication systems
- Health care system



# Points to Ponder

- About 30% emissions of GHGs,  $\frac{1}{2}$  CH<sub>4</sub> and N<sub>2</sub>O are from Paddy, livestock production, fertilizers, manure & burning of residues
- GHGs and GW during climate change -  
Increase frequency and intensity of weather events
- Global warming is directly associated with increasing atmospheric CO<sub>2</sub> and GHG)



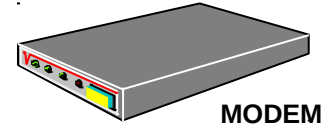
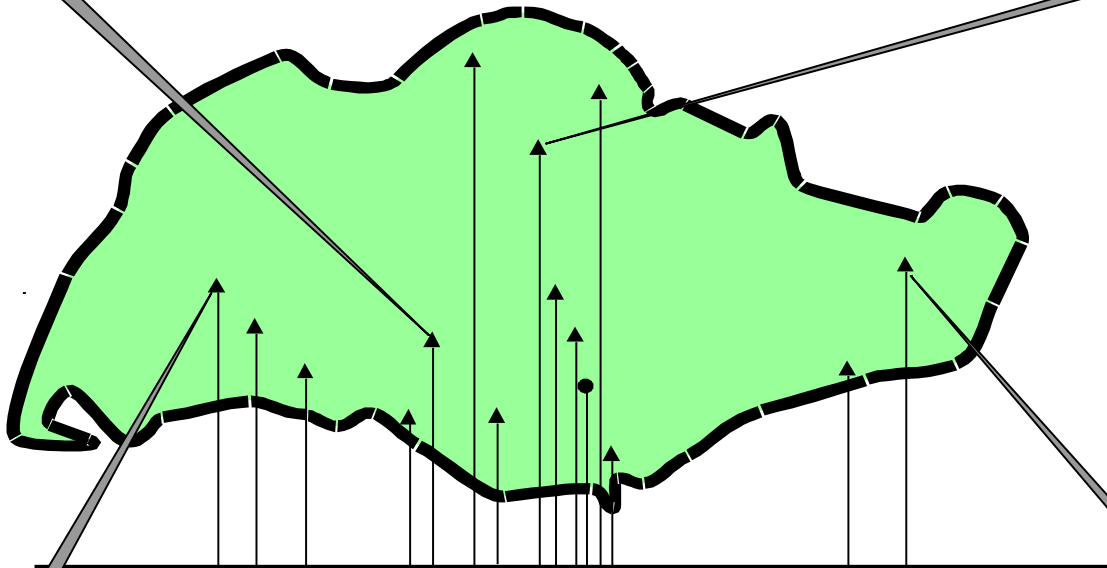
**ROADSIDE**



**SUB-URBAN**



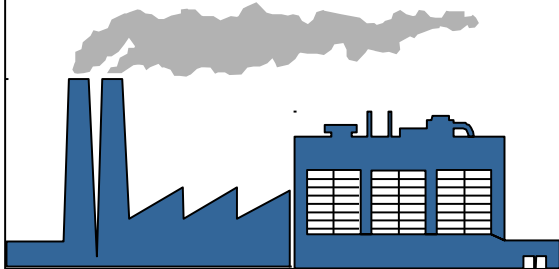
# Telemetric Air Quality Monitoring & Management System



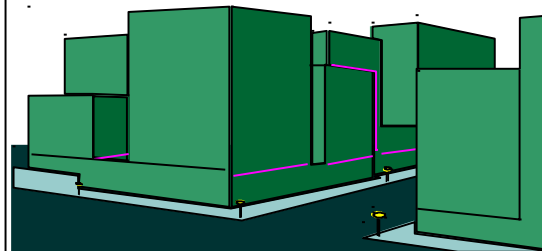
**CENTRAL CONTROL STATION**



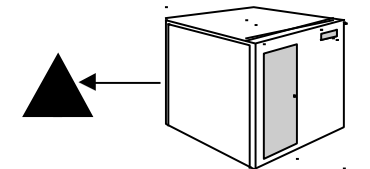
**INDUSTRIAL**



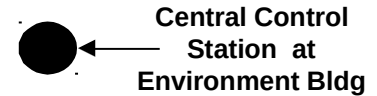
**URBAN**



**LEGEND**



Remote Station



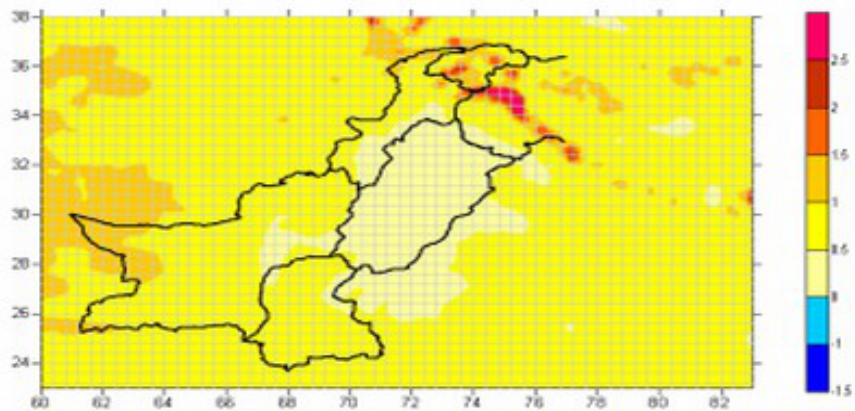
Central Control Station at Environment Bldg



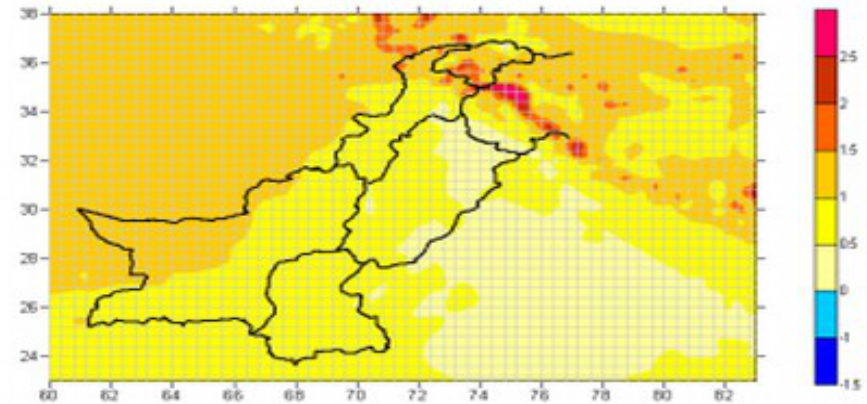
# The rise continued between 1.5°C and 2.0°C in the 2050s least the past 150 years.

## Decadal Mean Temperature (°C) Change

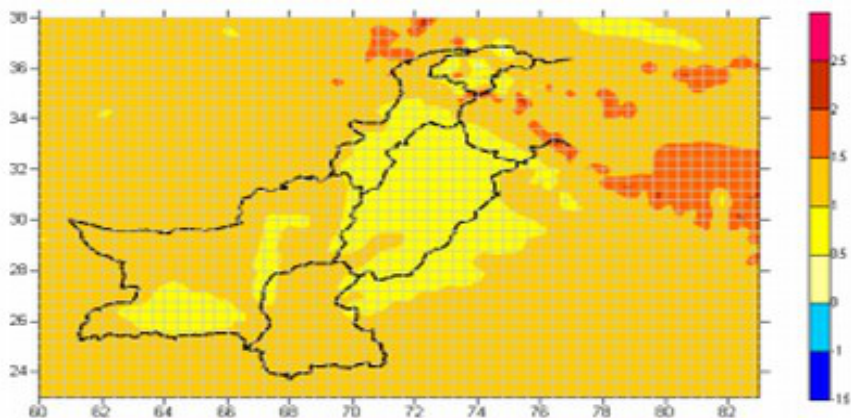
2011-2020



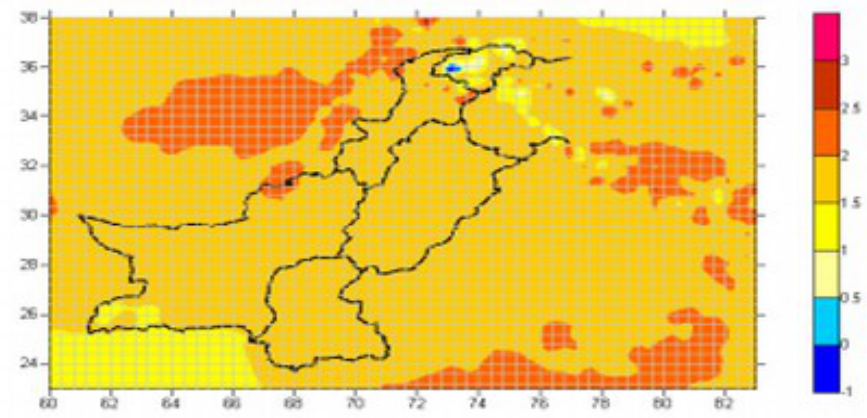
2021-2030



2031-2040



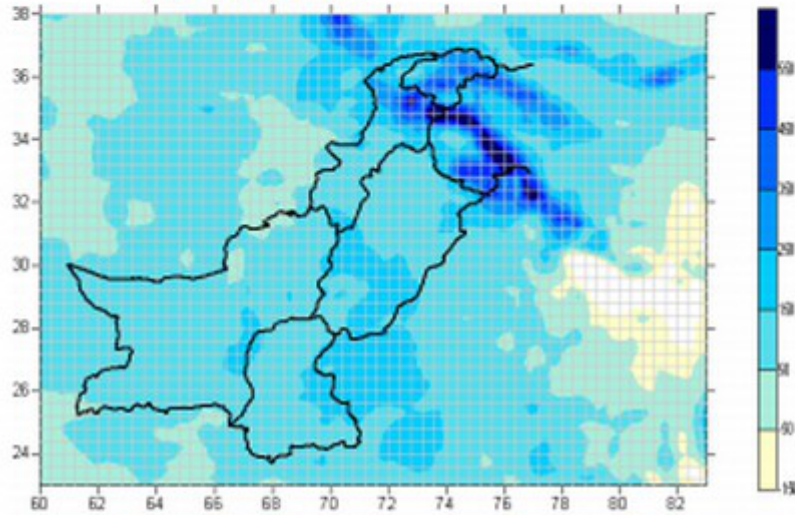
2041-2050



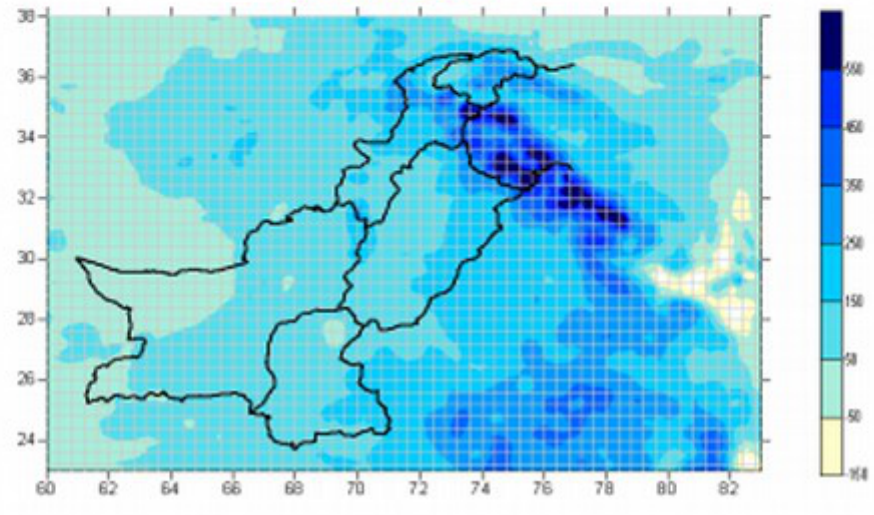


# Decadal Total Precipitation(mm) Change

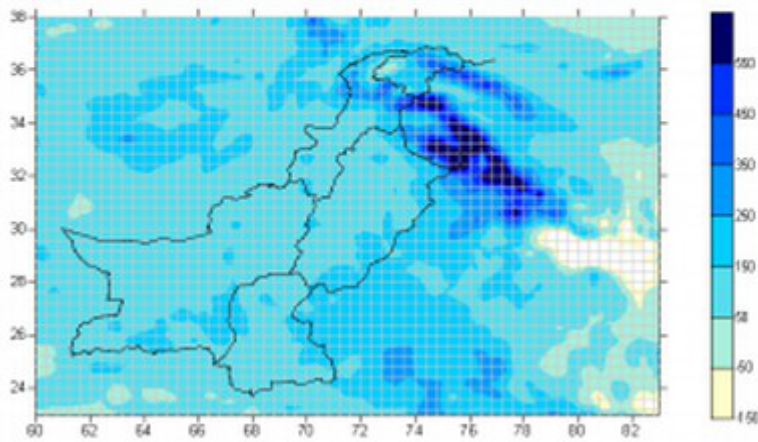
2011-2020



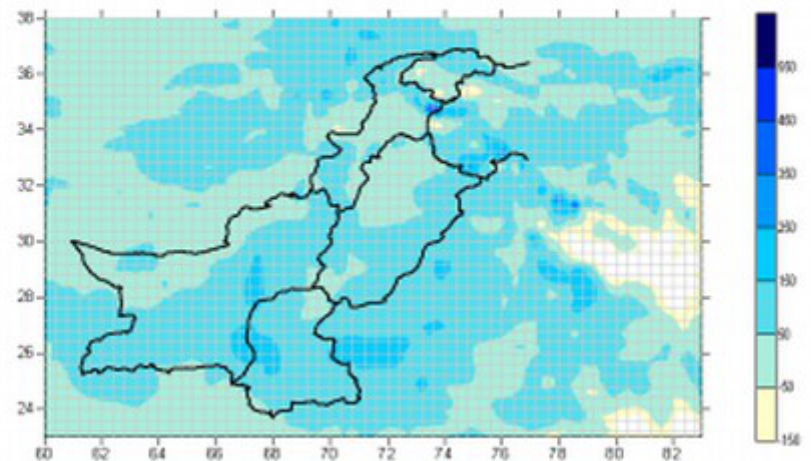
2021-2020



2031-2040



2041-2050





Which one of these  
contributes more to  
**Global Warming?**



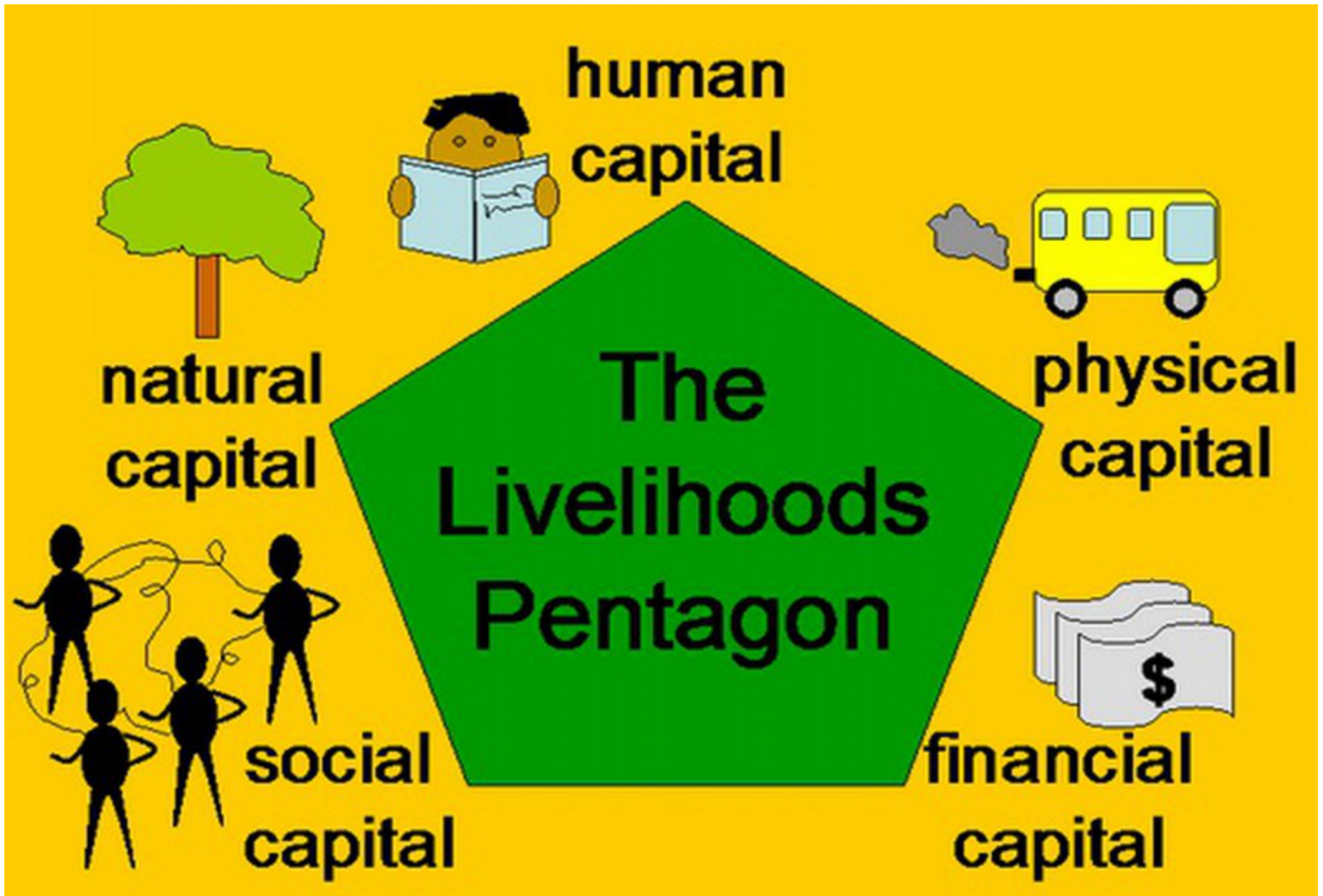
It's not the one that starts a car.





# **Why is climate change adaptation needed?**

- **Climate Change is undermining the sustainability of livelihood.**
- **Climate Change is overwhelmingly natural resources on which livelihood depends.**
- **Climate Change is increasing climate related disaster risk.**





# Socio-economic Impacts of Weather and Climate-Related Extremes on the Rise !

Hazard intensity and frequency increasing linked to climate variability and change!



Energy



Water Resource Management



Transportation



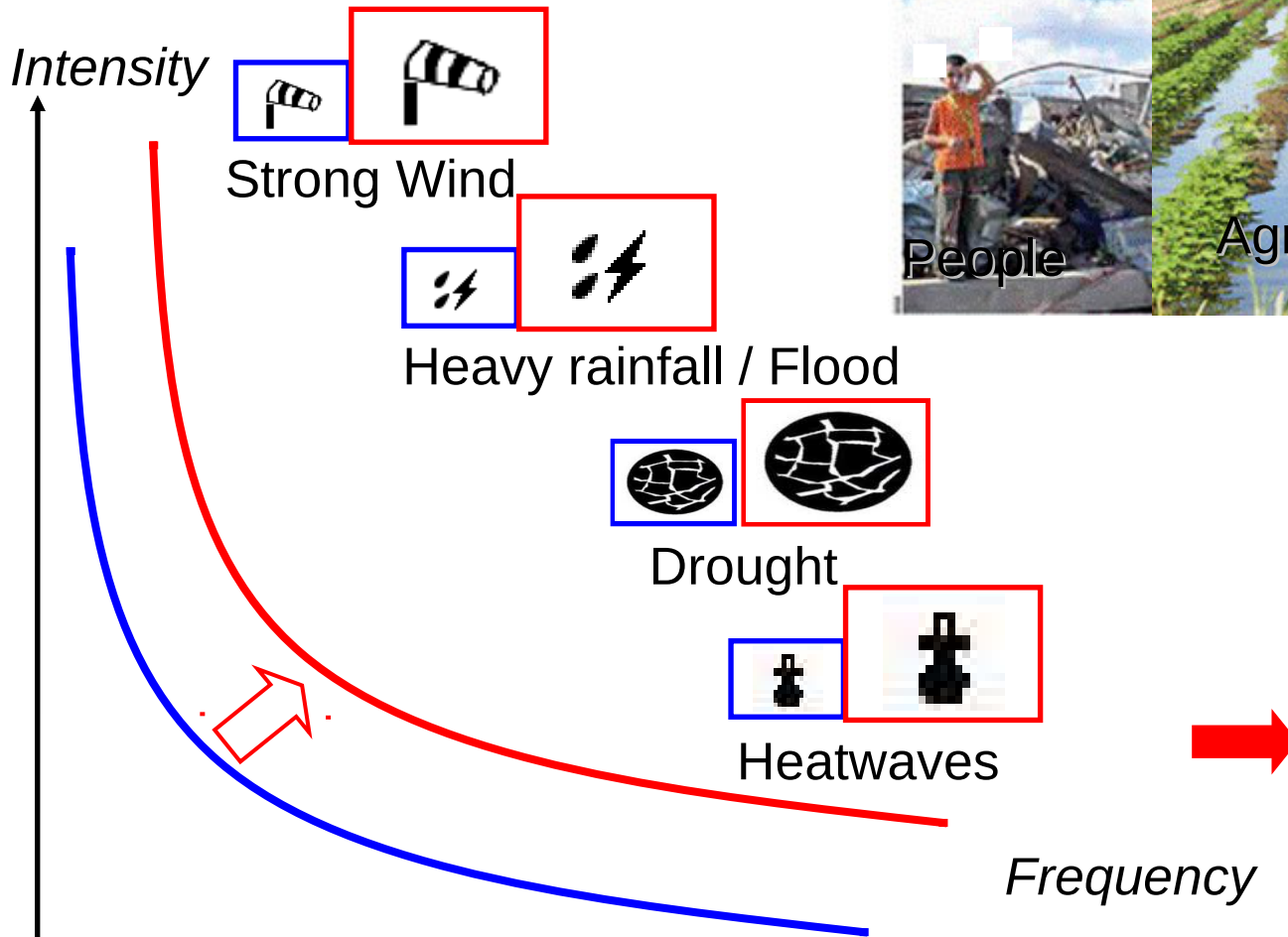
People



Agriculture

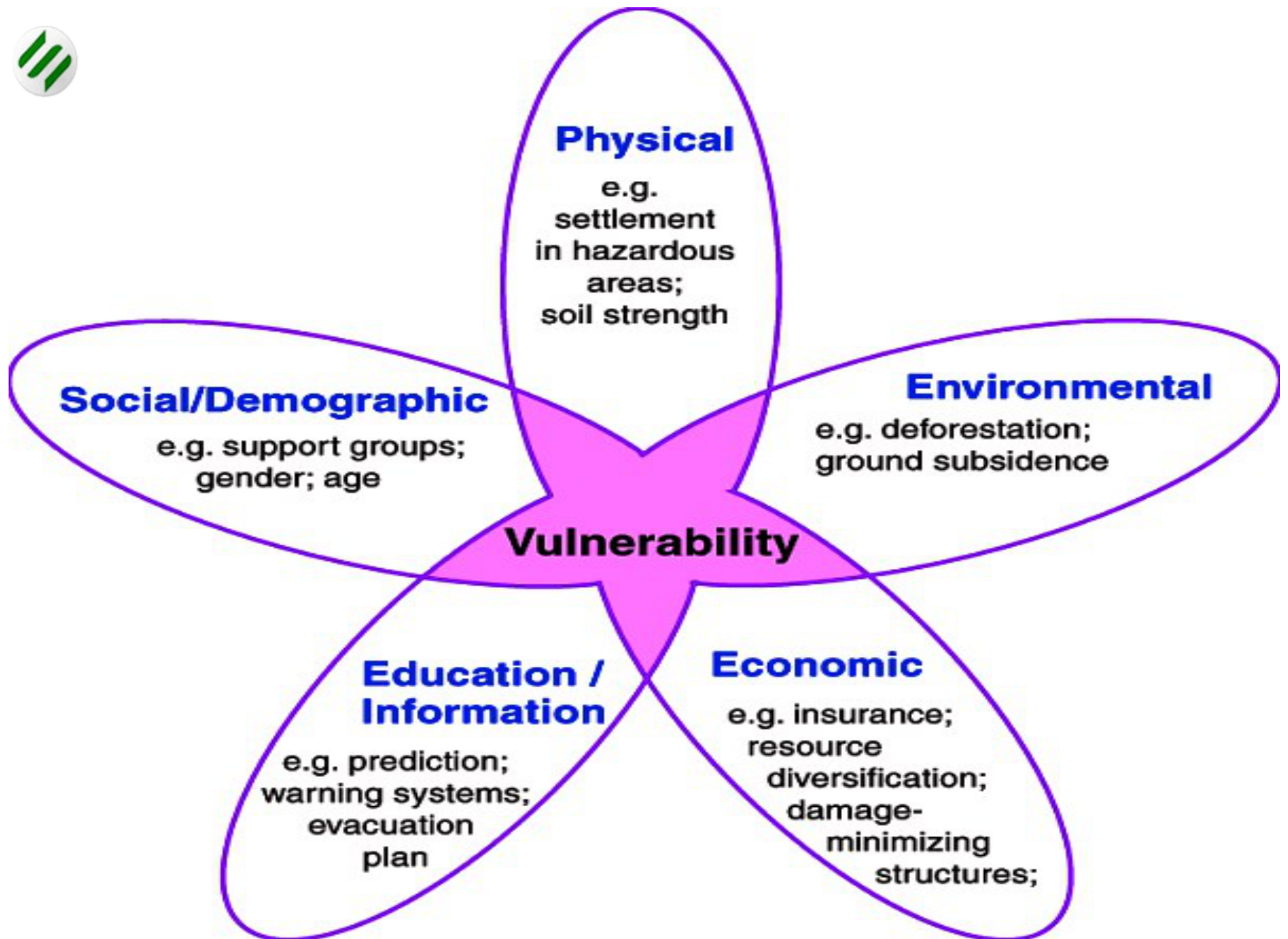


Urban areas



Vulnerability and exposure on the rise !

Need for Disaster Risk Financing, Transfer and Multi-sectoral Risk Management





# Sustainable Development?

**“ Needs of the present without compromising the ability of future generations to meet their needs.”**



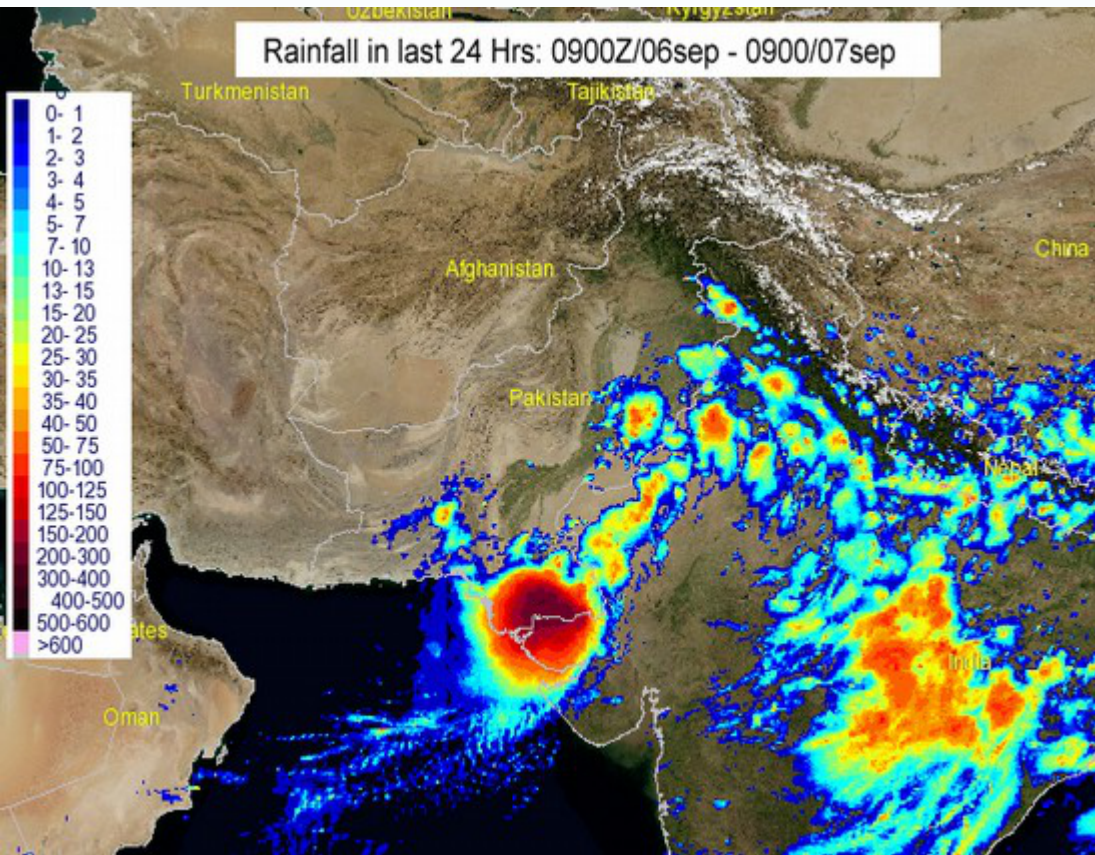


# Super Floods 2010

<b>Population affected:</b>	20 million
<b>Deaths:</b>	1985
<b>Houses damaged:</b>	1.89 million
<b>Area affected:</b>	132 million
<b>Economic Losses:</b>	US \$ 9.6 million



# SINDH FLOODS- 2011



- **Five Years rainfall in four weeks.**
- **Total rainfall water volume: 50 million acre feet.**

## Millions

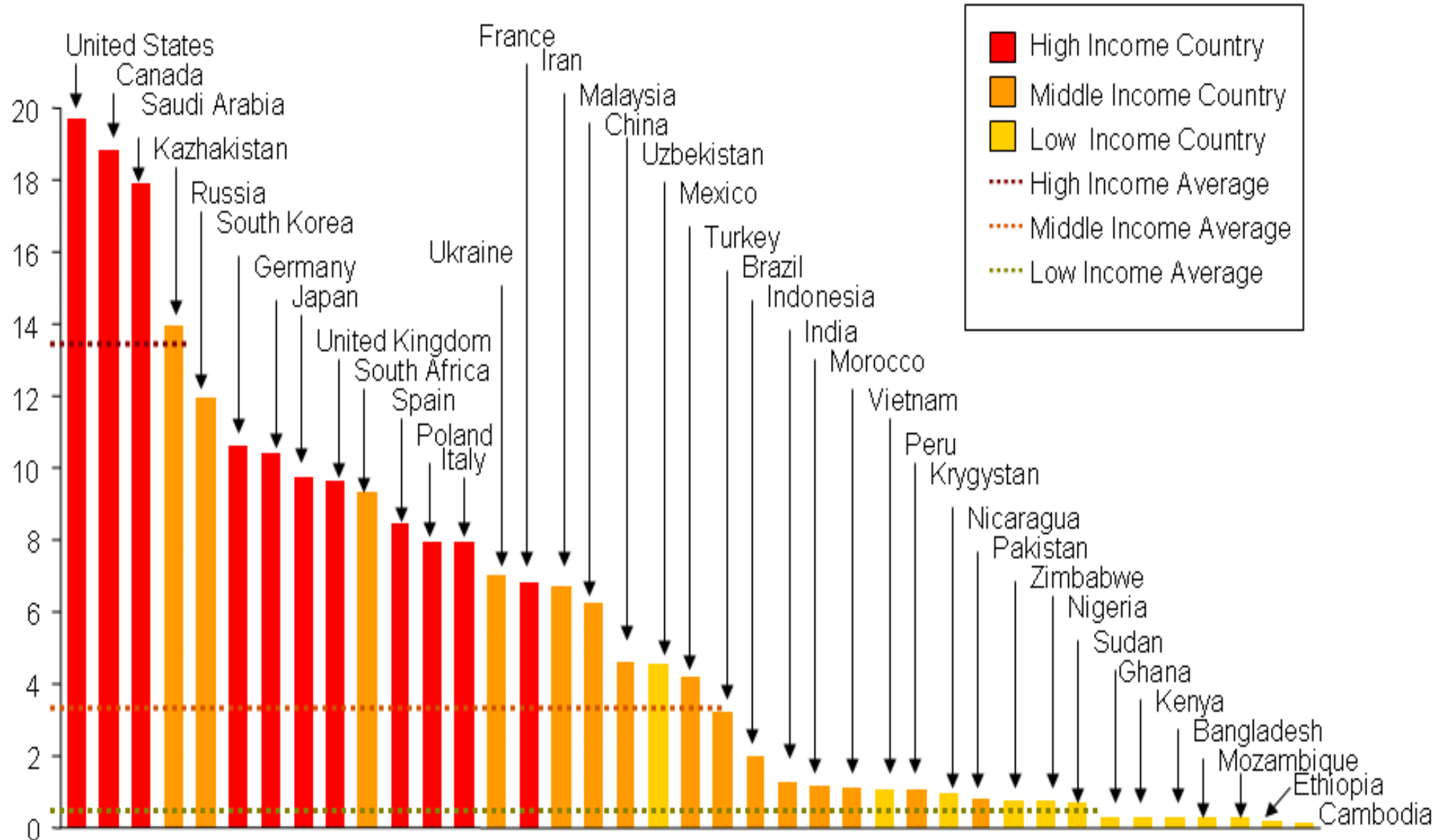
- **Persons affected : 9.72**
- **Houses damaged: 1.5**
- **Persons died : 456**
- **Cattles perished: 1.15**
- **Crops area damaged: 6.6**



# Pakistan-One of the lowest emitters

## On total emissions ranked 30<sup>th</sup>

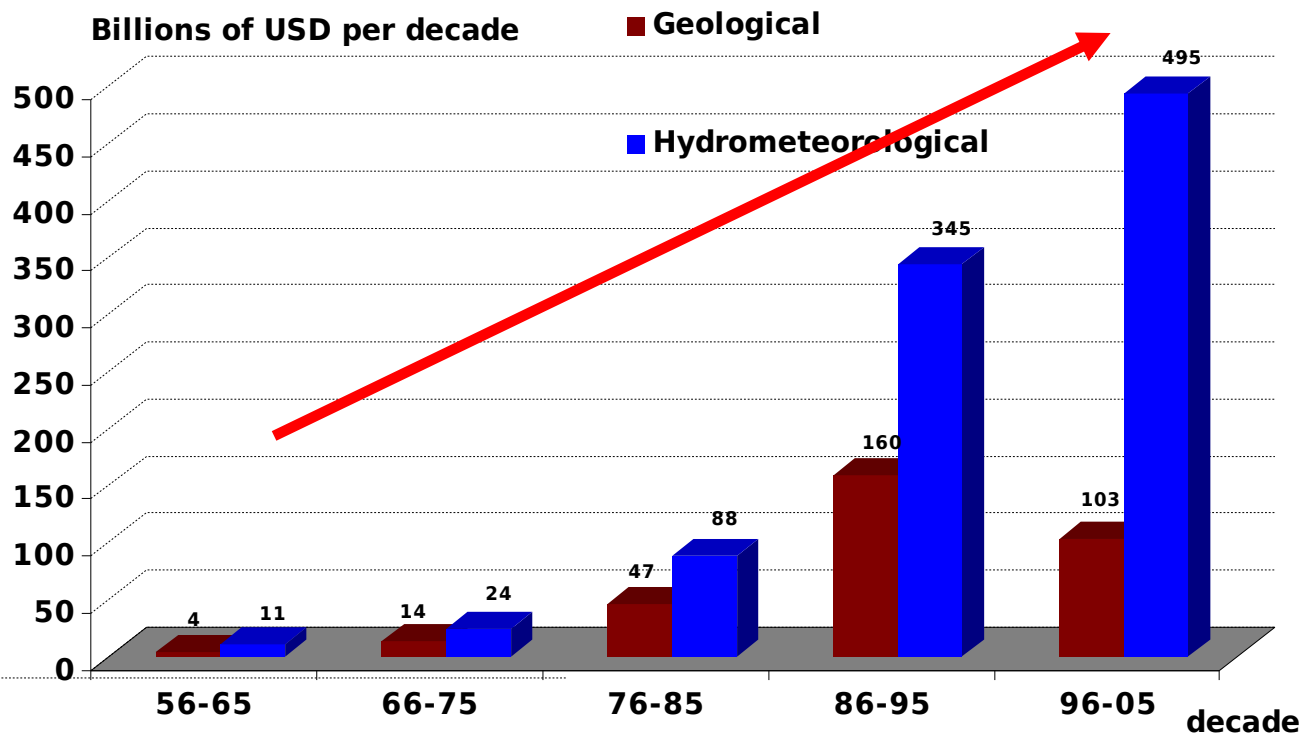
Tons CO<sub>2</sub> per capita



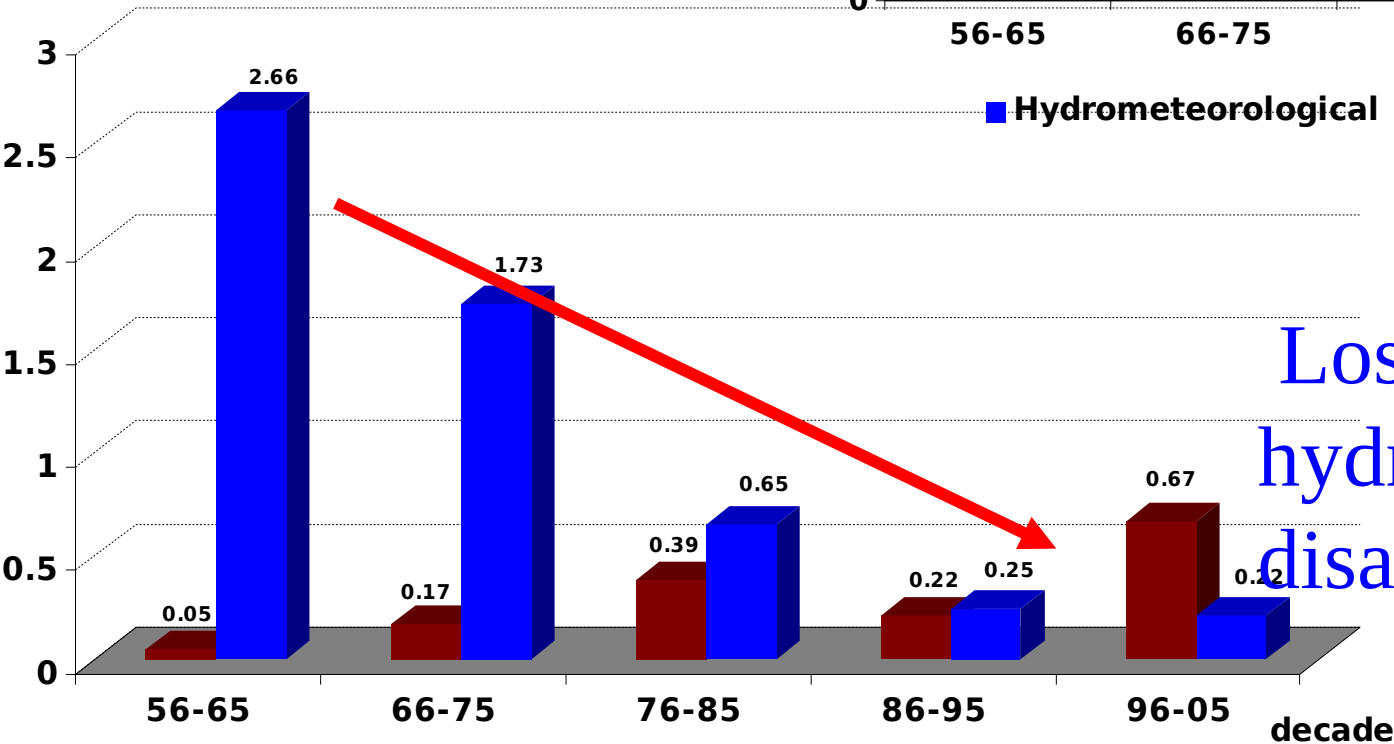




Economic losses are on the way up!



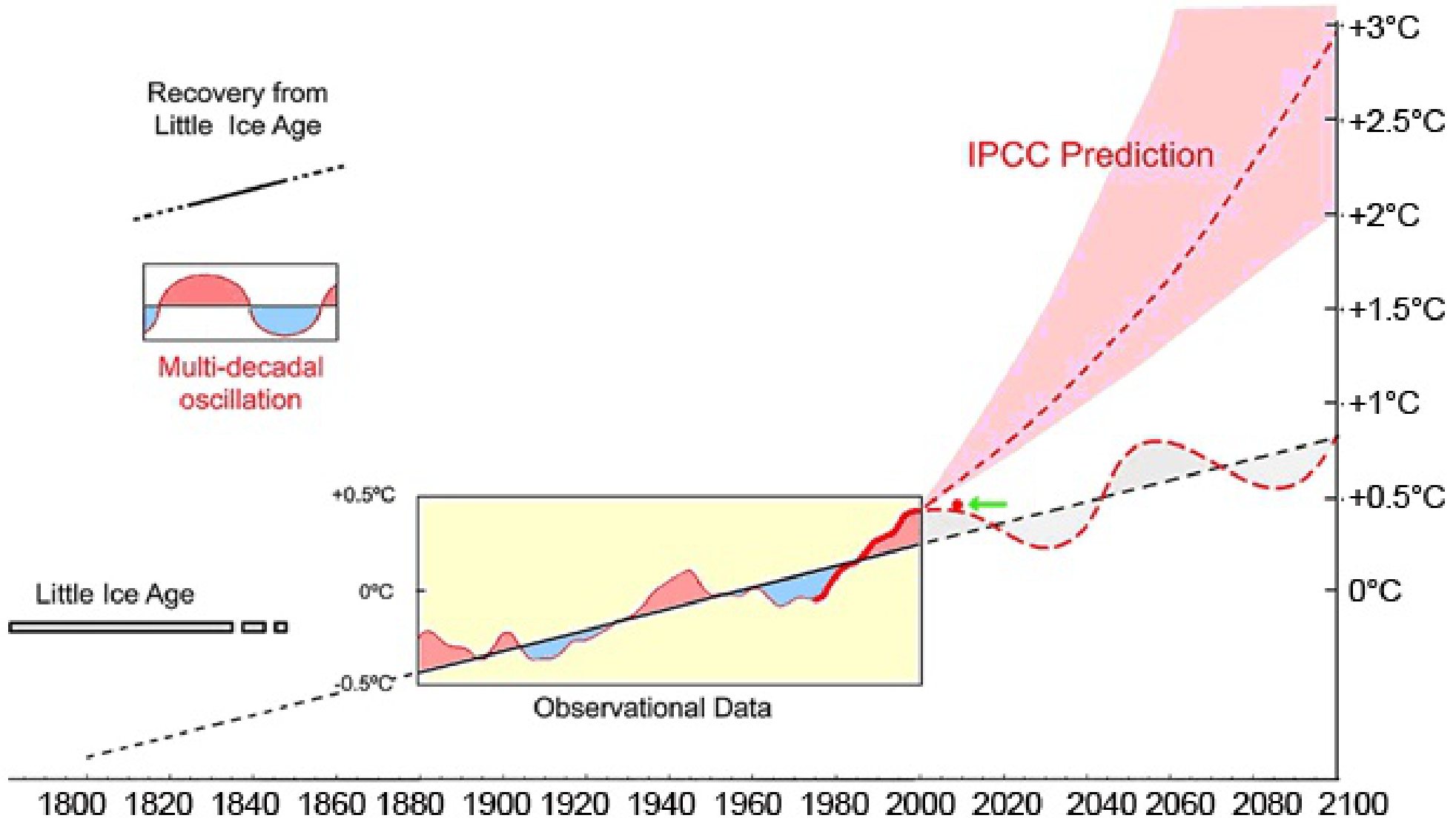
Millions of casualties per decade



Loss of life from hydro-meteorological disasters are decreasing!



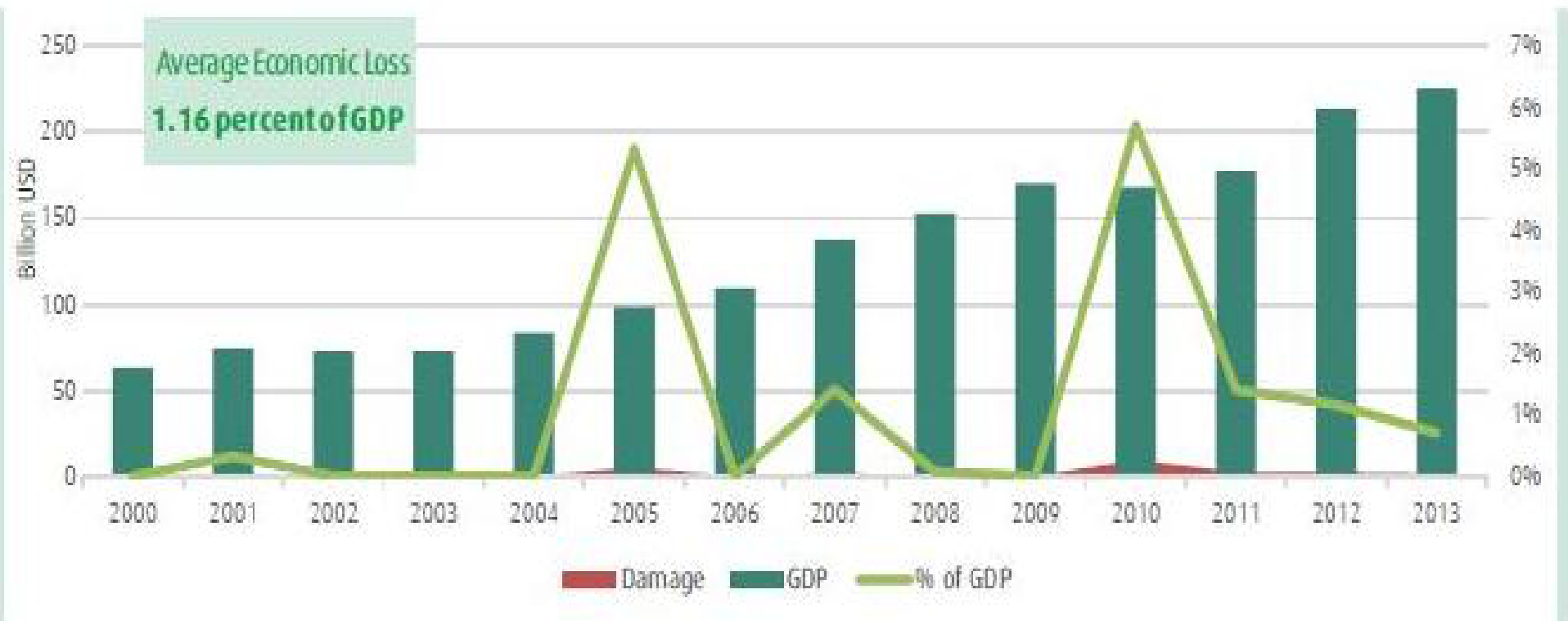
# Future Hazards ?? Let's ask them !!





# Economic losses from disasters

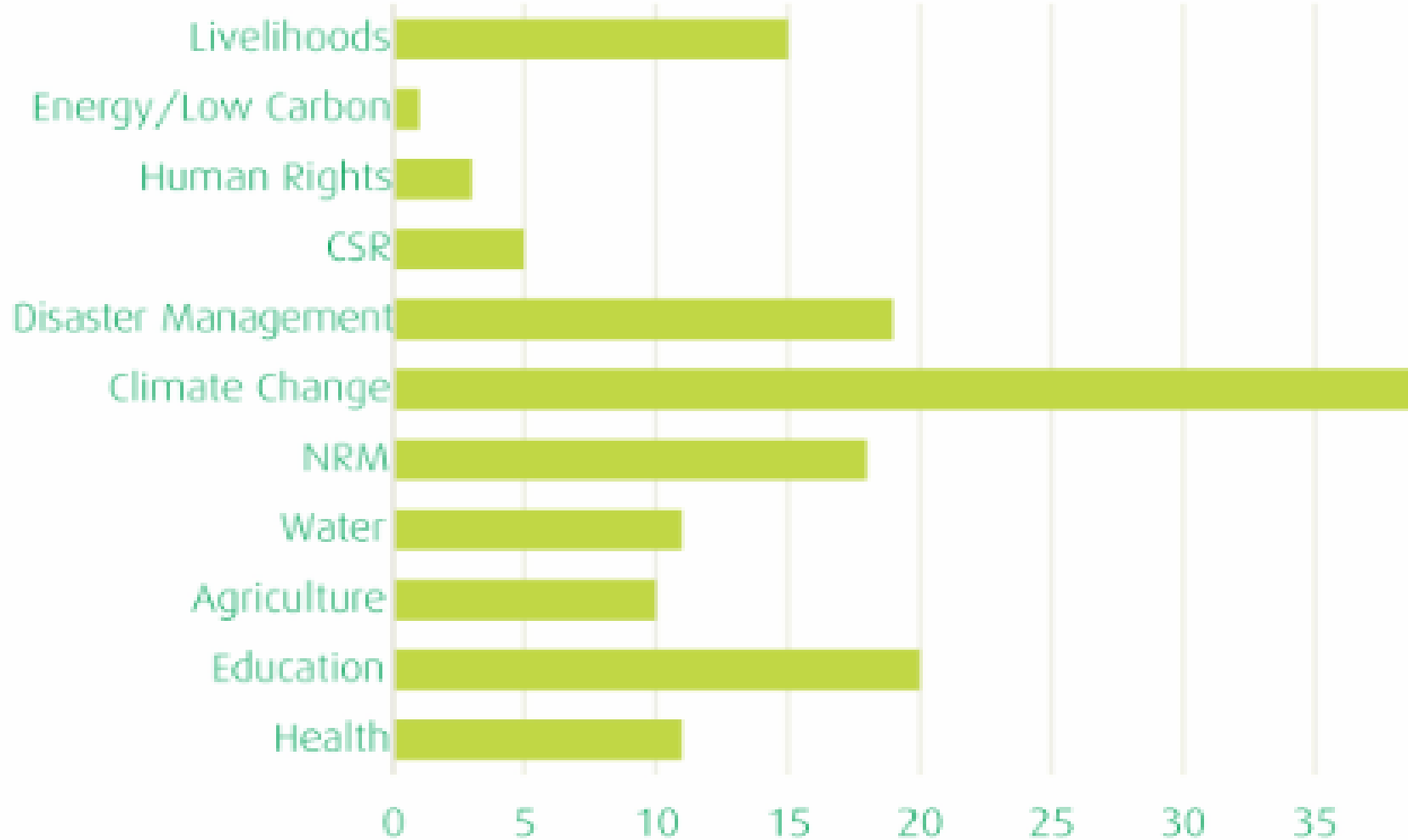
This briefing note provides information relevant to the agreement of target (ii) of the draft Post-2015 Framework for Disaster Risk Reduction (DRR) for national monitoring, which reads: [Substantially] reduce direct disaster economic loss [by a given percentage] in relation to GDP by 2030.





# Pakistan - Focus

## Sectoral Focus (20 Years)



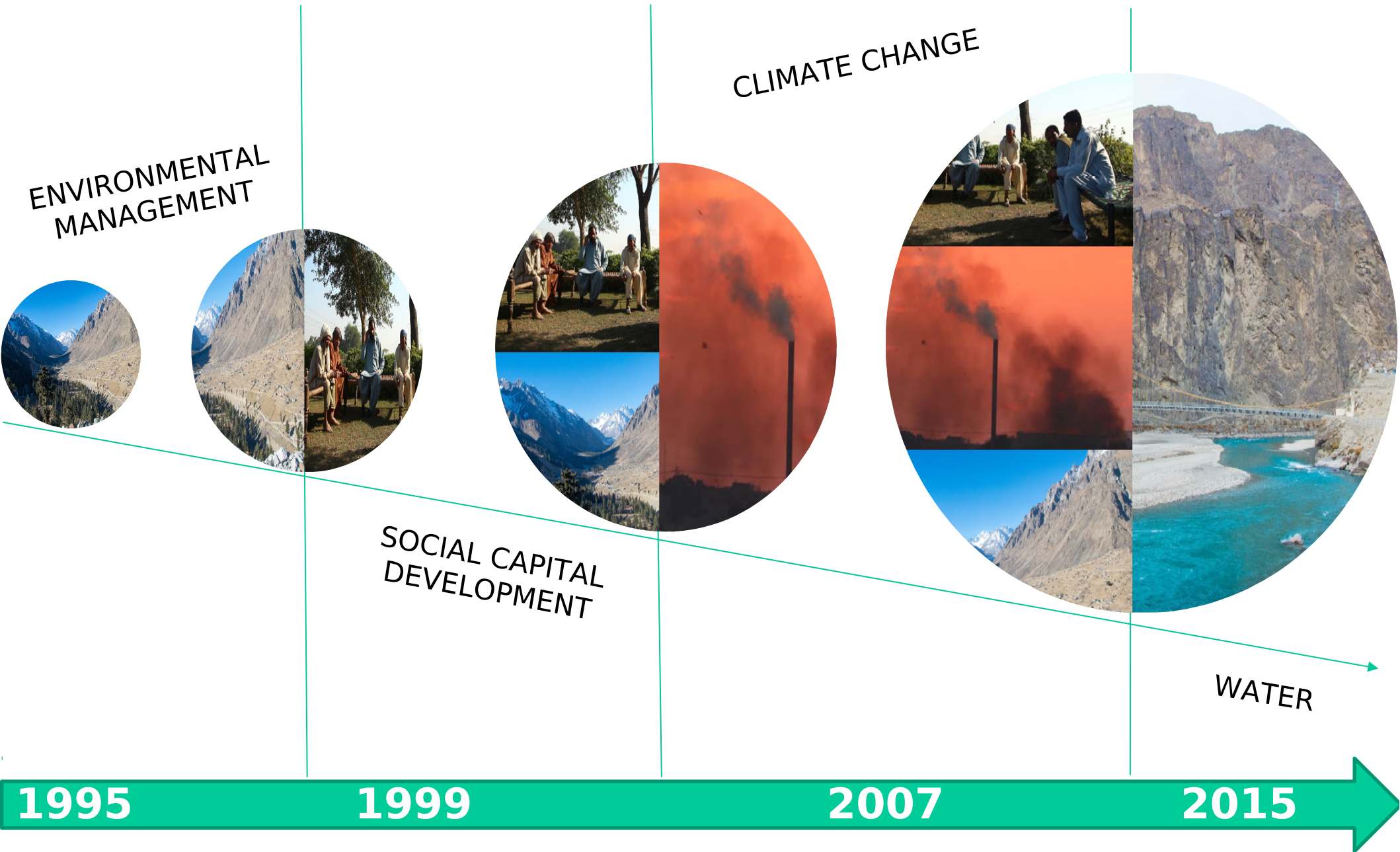


# Question? How many people Earth can sustain?

**1950      2-Billion-      2015      7-Billion**



# Evolution over Years





# Climate Change Pattern

**A combination of long-term change in the weather patterns such as:**

- **Increasing atmosphere [CO<sub>2</sub>]**  
280 ppm (1789) ---- 380 ppm (2004) ----  
– 550 ppm (2050)
- **Rising surface temperature**  
Last century ---- 0.6-1.0°C;  
– Projections for 2100 ----1.6-5.8°C
- **Changing rainfall patterns**
- **Rising sea levels**



# Climate change

## **Impact on sugarcane:**

- **Geographic location**
- **Adaptive capacity**
- **Increases in combustion of fossil fuels**
- **Industrial processes**
- **Deforestation**





# Sugarcane Production

## Water stress

- Reduction of rainy days (400 -700 mm)  
90 % in monsoon 10 percent in winter

## Increasing temperature

- » The biochemical processes 8°C to 34°C
- » GGP is terminated less than 21°C.
- » Yield decline 10% for every 1°C increase
- » Irrigation demand 10% for an increase in 1°C



# Why Climate Change Negative Impact on Sugarcane Production and Profitability

- ✓ More precipitation extremes
- ✓ More events of heavy rain (floods)
- ✓ More droughts
- ✓ More hurricanes





# Why Climate Change Negative Impact on Sugarcane Production and Profitability

- ✓ More over-wintering pests
- ✓ More pathogens due to higher humidity
- ✓ More vigorous weed growth





# Why Climate Change Negative Impact on Sugarcane Production and Profitability

- ✓ More water use => less cooling
- ✓ Considerably increase input costs(pesticides, fuels, water)



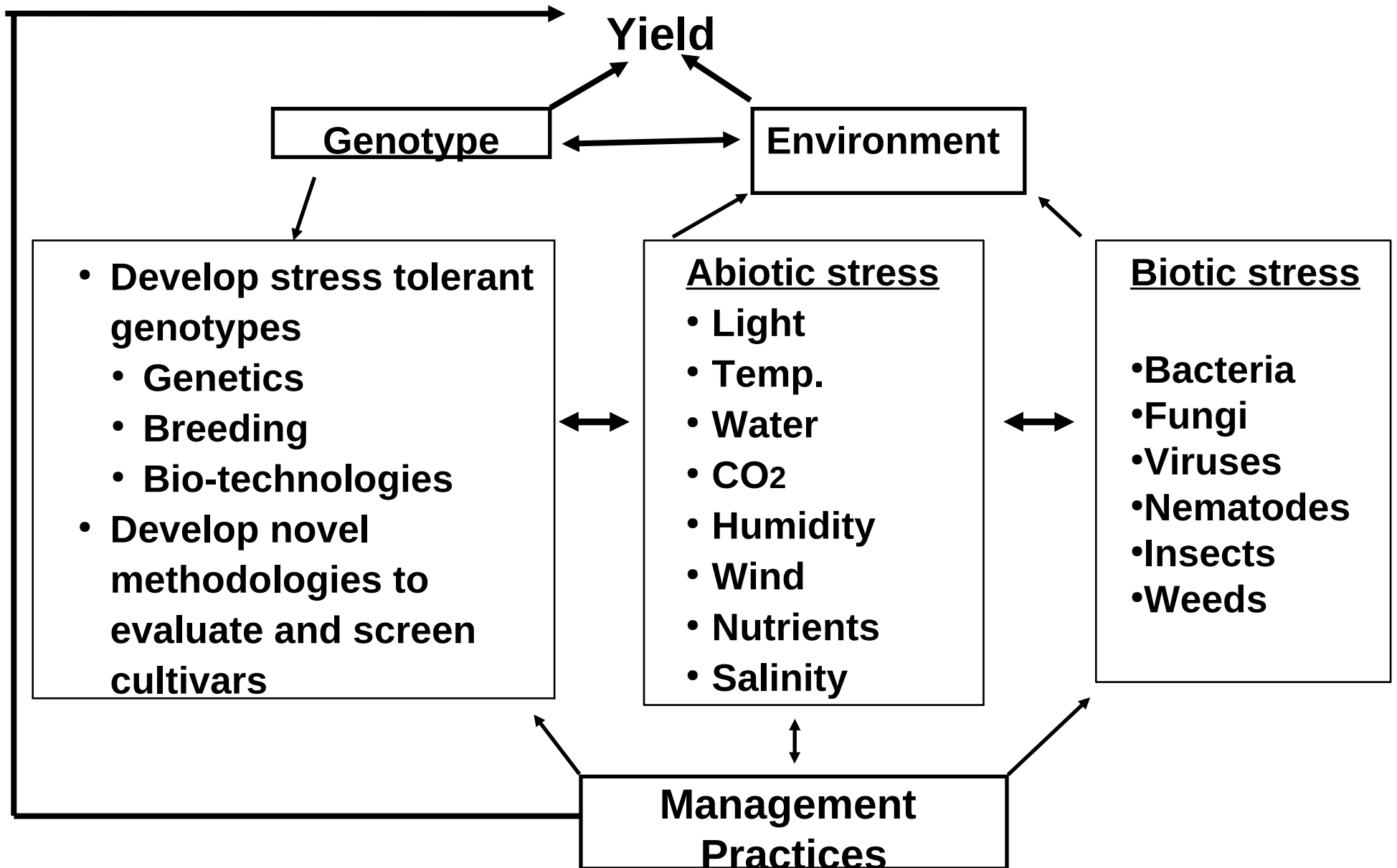


# Top 10 Sugarcane Production

Country	Production		Area		Yield	
	Million Mg	R	(000) ha	R	Mg ha-1	Rank
Brazil	739.27	1	9835	1	75.17	29
India	341.20	2	5060	2	67.43	40
China	126.14	3	1827	3	69.03	39
Thailand	100.10	4	1321	4	75.74	26
Pakistan	63.75	5	1128	5	56.48	51
Mexico	61.18	6	782	6	78.16	25
Colombia	34.88	7	405	9	85.95	19
Indonesia	33.70	8	450	7	74.89	31
Philippines	32.00	9	435	8	73.49	37
USA	27.91	10	368	11	75.71	27

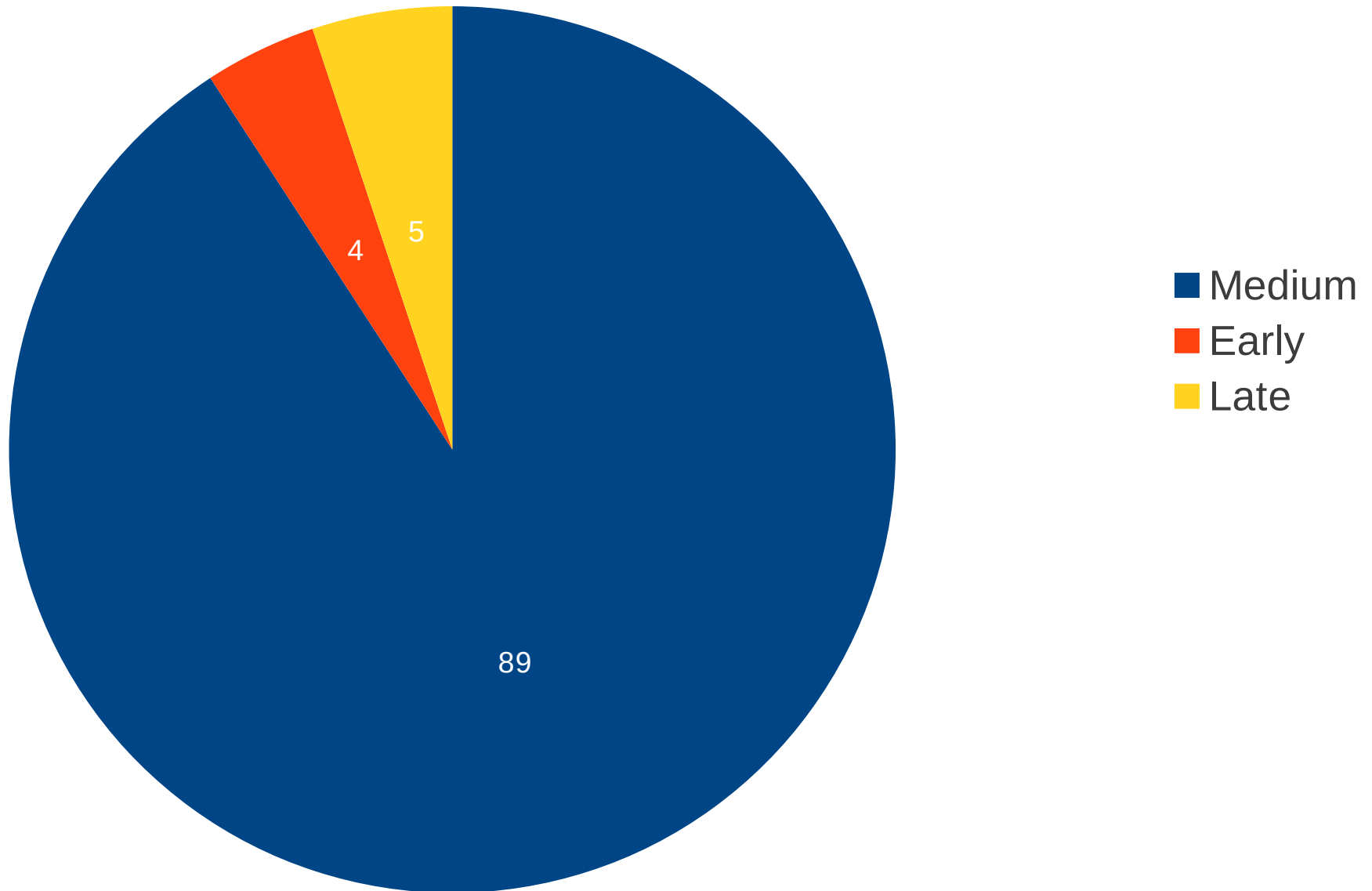


# Factors Influencing Sugarcane Yield



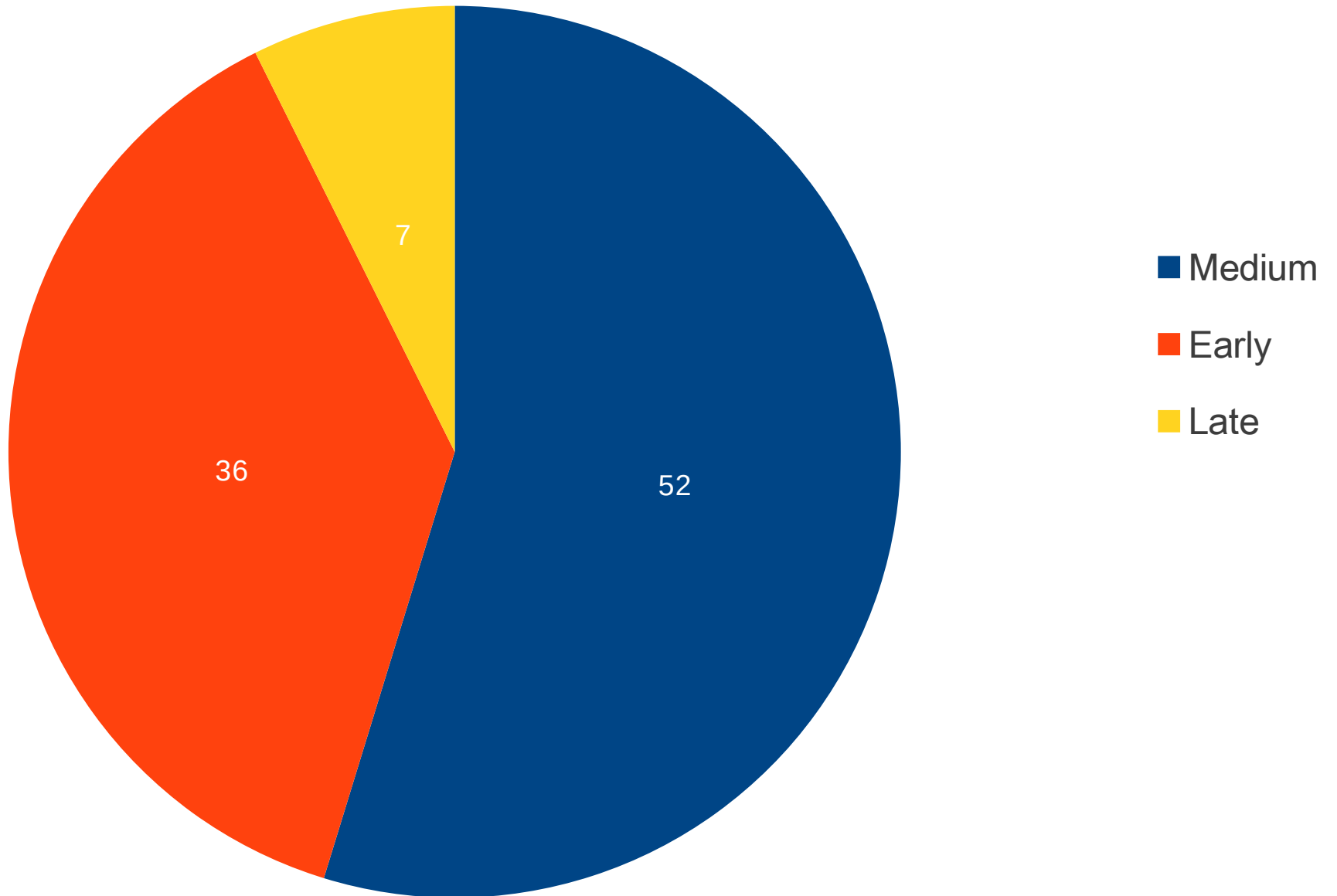


# Maturity wise variety composition in Punjab 2016





# Maturity wise variety composition in Sindh 2016







# Threats

- *Yield of sugarcane and sucrose accumulation is expected to decrease by 10% for every 1°C temperature increase*
- *Sugar production as sucrose accumulation could be affected with increased minimum temperature accompanied by low frequency of precipitation.*



# Mitigation and adaptation strategies for climate change in sugarcane production

- **R & D at Sugar Industry Level**
- Development of the stress tolerant and high-yielding sugarcane cultivars that can contribute to adaptation to climate change (especially for elevated CO<sub>2</sub> and temperature)
- Develop GM sugarcane varieties with herbicide resistance, drought tolerance, high sugar content, pest insects and disease resistance



# Mitigation and adaptation strategies for climate change in sugarcane production

- Investing irrigation infrastructure
  - Improving irrigation efficiency and drainage systems
  - Improving cultural and management practices
  - Discovering and introducing desirable genes for agronomic trait development
  - Improve nutrient use efficiency



# Mitigation and adaptation strategies for climate change in sugarcane production

- Promote development of agricultural weather information systems
- Increase capacity for utilizing climate predictions in management decisions
- Cope the climate change with main strategies and adaptations
- Advanced knowledge of climatic conditions in other countries



# The Global Goals





# Climate Smart Solutions

- ✓ **Climate Smart Agriculture**
- ✓ **Climate Smart Infrastructure**
- ✓ **Climate Smart Cities**
- ✓ **Energy Conservation**
- ✓ **Energy Efficiency**
- ✓ **Renewable Energy**



# Sustainability at Sugar Industry





# Sustainability at Sugar Industry







# Sustainability at Sugar Industry





# Resourcefulness

- **It's not about resources; it's about resourcefulness**
- **Being flexible and open to change**





*Thank you*