

# Extreme Events and Risk Management

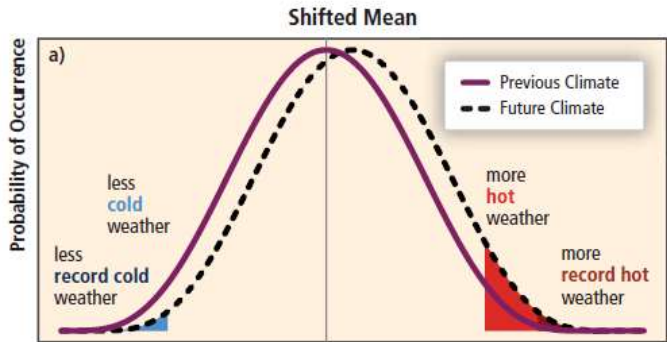
Evelia Rivera-Arriaga  
Lead Author Chapter 6

## Key questions:

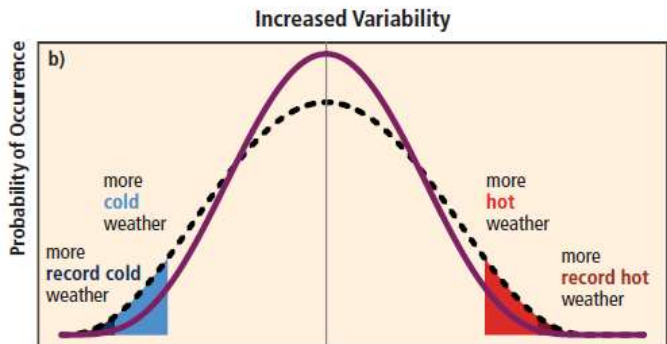
- What do we know?
- How do we know it?
- How confident do we know it?
- How much uncertainty can we accept before do something?



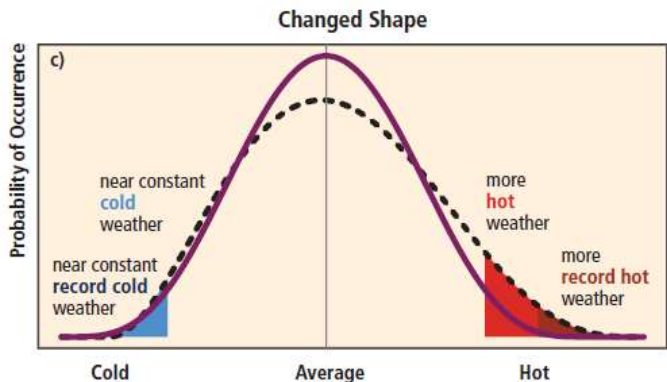
(Source: EAS 6792 Group Project Yufei Zou, Sean Miller, Tom Loadholt, 2013)



Changes in natural physical environment



Changes in ecosystems














Adverse effects on human conditions



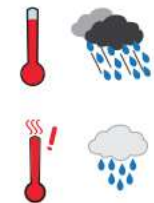
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INTERGOVERNMENTAL PANEL ON climate change















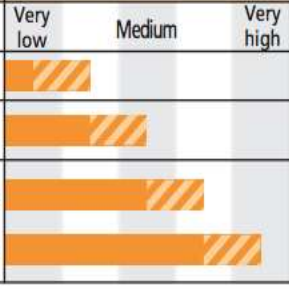

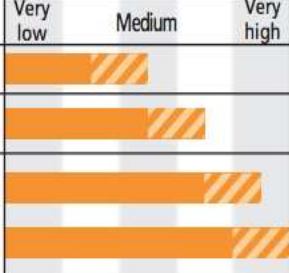
# Climate Drivers

Climate-related drivers of impacts										Level of risk & potential for adaptation
 Warming trend	 Extreme temperature	 Drying trend	 Extreme precipitation	 Precipitation	 Snow cover	 Damaging cyclone	 Sea level	 Ocean acidification	 Carbon dioxide fertilization	 <p>Potential for additional adaptation to reduce risk</p> <p>Risk level with <b>high</b> adaptation</p> <p>Risk level with <b>current</b> adaptation</p>

Central and South America																						
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation																		
<p>Water availability in semi-arid and glacier-melt-dependent regions and Central America; flooding and landslides in urban and rural areas due to extreme precipitation (<i>high confidence</i>)</p> <p>[27.3]</p>	<ul style="list-style-type: none"> <li>• Integrated water resource management</li> <li>• Urban and rural flood management (including infrastructure), early warning systems, better weather and runoff forecasts, and infectious disease control</li> </ul>		<table border="1"> <tr> <td></td> <td>Very low</td> <td>Medium</td> <td>Very high</td> </tr> <tr> <td>Present</td> <td colspan="3"></td> </tr> <tr> <td>Near term (2030–2040)</td> <td colspan="3"></td> </tr> <tr> <td rowspan="2">Long term (2080–2100)</td> <td>2°C</td> <td colspan="2"></td> </tr> <tr> <td>4°C</td> <td colspan="2"></td> </tr> </table>		Very low	Medium	Very high	Present				Near term (2030–2040)				Long term (2080–2100)	2°C			4°C		
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<p>Decreased food production and food quality (<i>medium confidence</i>)</p> <p>[27.3]</p>	<ul style="list-style-type: none"> <li>• Development of new crop varieties more adapted to climate change (temperature and drought)</li> <li>• Offsetting of human and animal health impacts of reduced food quality</li> <li>• Offsetting of economic impacts of land-use change</li> <li>• Strengthening traditional indigenous knowledge systems and practices</li> </ul>		<table border="1"> <tr> <td></td> <td>Very low</td> <td>Medium</td> <td>Very high</td> </tr> <tr> <td>Present</td> <td colspan="3"></td> </tr> <tr> <td>Near term (2030–2040)</td> <td colspan="3"></td> </tr> <tr> <td rowspan="2">Long term (2080–2100)</td> <td>2°C</td> <td colspan="2"></td> </tr> <tr> <td>4°C</td> <td colspan="2"></td> </tr> </table>		Very low	Medium	Very high	Present				Near term (2030–2040)				Long term (2080–2100)	2°C			4°C		
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	4°C																					
<p>Spread of vector-borne diseases in altitude and latitude (<i>high confidence</i>)</p> <p>[27.3]</p>	<ul style="list-style-type: none"> <li>• Development of early warning systems for disease control and mitigation based on climatic and other relevant inputs. Many factors augment vulnerability.</li> <li>• Establishing programs to extend basic public health services</li> </ul>		<table border="1"> <tr> <td></td> <td>Very low</td> <td>Medium</td> <td>Very high</td> </tr> <tr> <td>Present</td> <td colspan="3"></td> </tr> <tr> <td>Near term (2030–2040)</td> <td colspan="3"></td> </tr> <tr> <td rowspan="2">Long term (2080–2100)</td> <td>2°C</td> <td colspan="2">not available</td> </tr> <tr> <td>4°C</td> <td colspan="2">not available</td> </tr> </table>		Very low	Medium	Very high	Present				Near term (2030–2040)				Long term (2080–2100)	2°C	not available		4°C	not available	
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# Climate Drivers

Climate-related drivers of impacts										Level of risk & potential for adaptation
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Small Islands				
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
<p>Loss of livelihoods, coastal settlements, infrastructure, ecosystem services, and economic stability (<i>high confidence</i>)</p> <p>[29.6, 29.8, Figure 29-4]</p>	<ul style="list-style-type: none"> <li>Significant potential exists for adaptation in islands, but additional external resources and technologies will enhance response.</li> <li>Maintenance and enhancement of ecosystem functions and services and of water and food security</li> <li>Efficacy of traditional community coping strategies is expected to be substantially reduced in the future.</li> </ul>		<p>Present</p> <p>Near term (2030–2040)</p> <p>Long term (2080–2100) 2°C 4°C</p>	<p>Very low Medium Very high</p> 
<p>The interaction of rising global mean sea level in the 21st century with high-water-level events will threaten low-lying coastal areas (<i>high confidence</i>)</p> <p>[29.4, Table 29-1; WGI AR5 13.5, Table 13.5]</p>	<ul style="list-style-type: none"> <li>High ratio of coastal area to land mass will make adaptation a significant financial and resource challenge for islands.</li> <li>Adaptation options include maintenance and restoration of coastal landforms and ecosystems, improved management of soils and freshwater resources, and appropriate building codes and settlement patterns.</li> </ul>		<p>Present</p> <p>Near term (2030–2040)</p> <p>Long term (2080–2100) 2°C 4°C</p>	<p>Very low Medium Very high</p> 

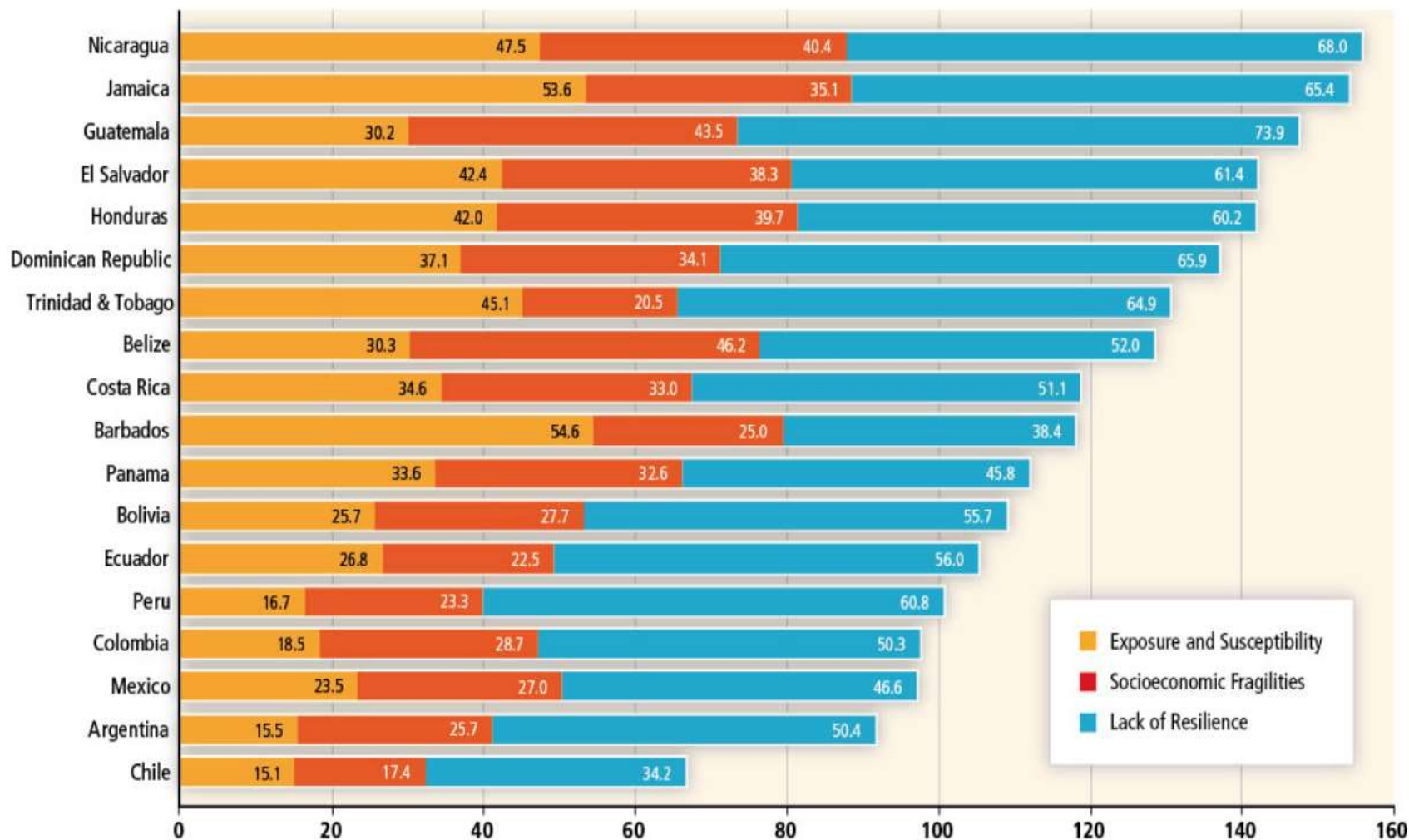
Source: AR5

# What is the impact of climate change on extreme events???

Extremes	Observed	Projections
Hot days frequency and magnitude increasing	Very likely ↑	Virtually certain ↑
Cold days frequency and magnitude	Very likely ↓	Virtually certain ↓
Heavy precipitation extremes	Likely more regions with ↑	Likely ↑ in many regions. Very likely in mid-latitudes and tropics
Droughts	Medium confidence in some regional trends ↑↓	Medium confidence in ↑ in some regions. Likely ↑ in some dcurrently dry regions
Storms	Low confidence	Low confidence in dealied regional projections
Floods	Low confidence (because of human and vegetation wáter use)	Low confidence in regional projections. Medium confidence related to ↑ in heavy precipitation events
Tropical cyclones	Low confidence	More likely than not ↑ in intensity in some basins

(Source: IPCC SREX 2012)

## Prevalent Vulnerability Index (PVI) Evaluated for 2007



Determinants of Risk:

Hazard:

“changes in exposure and in some cases vulnerability are the main drivers behind observed trends in disaster losses”

Exposure:

**Environmental dimension**

- Vulnerable natural systems
- Impacts on systems
- Mechanisms causing impacts
- Responses

**Social dimension**

- Population groups
- Education
- Health and well-being
- Culture

Vulnerability:

**Economic dimension**

- Economic system
- Work and livelihoods



## CLIMATE DRIVERS & TIPPING POINTS

- More frequent & intense precipitation
- More intense hurricane rainfall
- Sea level rise-related increases in storm surge
- Increasing snowmelt & rain-on-snow events

## ENVIRONMENTAL & INSTITUTIONAL CONTEXT

- Development in vulnerable coastal areas, floodplains, or watersheds
- Flood control (both human-managed systems & ecosystems services)
- Water, power, transportation, communication, & health care infrastructure
- Preparedness (early warning systems, evacuation assistance)
- Emergency response & disaster relief

## SOCIAL & BEHAVIORAL CONTEXT

- Social determinants of health
- Storm preparation & evacuation warnings
- Occupation
- Dependency on caregivers or medications
- Limited language communication (indigenous people)
- Homelessness or institutionalization (prisons, psychiatric facilities, nursing homes)

## EXPOSURE PATHWAYS

- Flood waters & debris
- Loss of essential infrastructure
- Contaminated drinking water
- Evacuation & population displacement

## HEALTH OUTCOMES

- Drownings
- Injuries
- Mental health consequences
- Gastrointestinal & other illness



**Disaster risk management:**

disaster risk reduction +  
disaster management



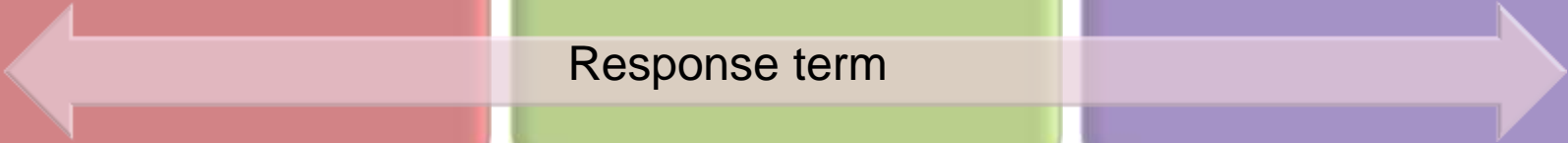
**Disaster risk:**

likelihood of severe  
alterations due to  
hazardous physical  
events



**Climate change**

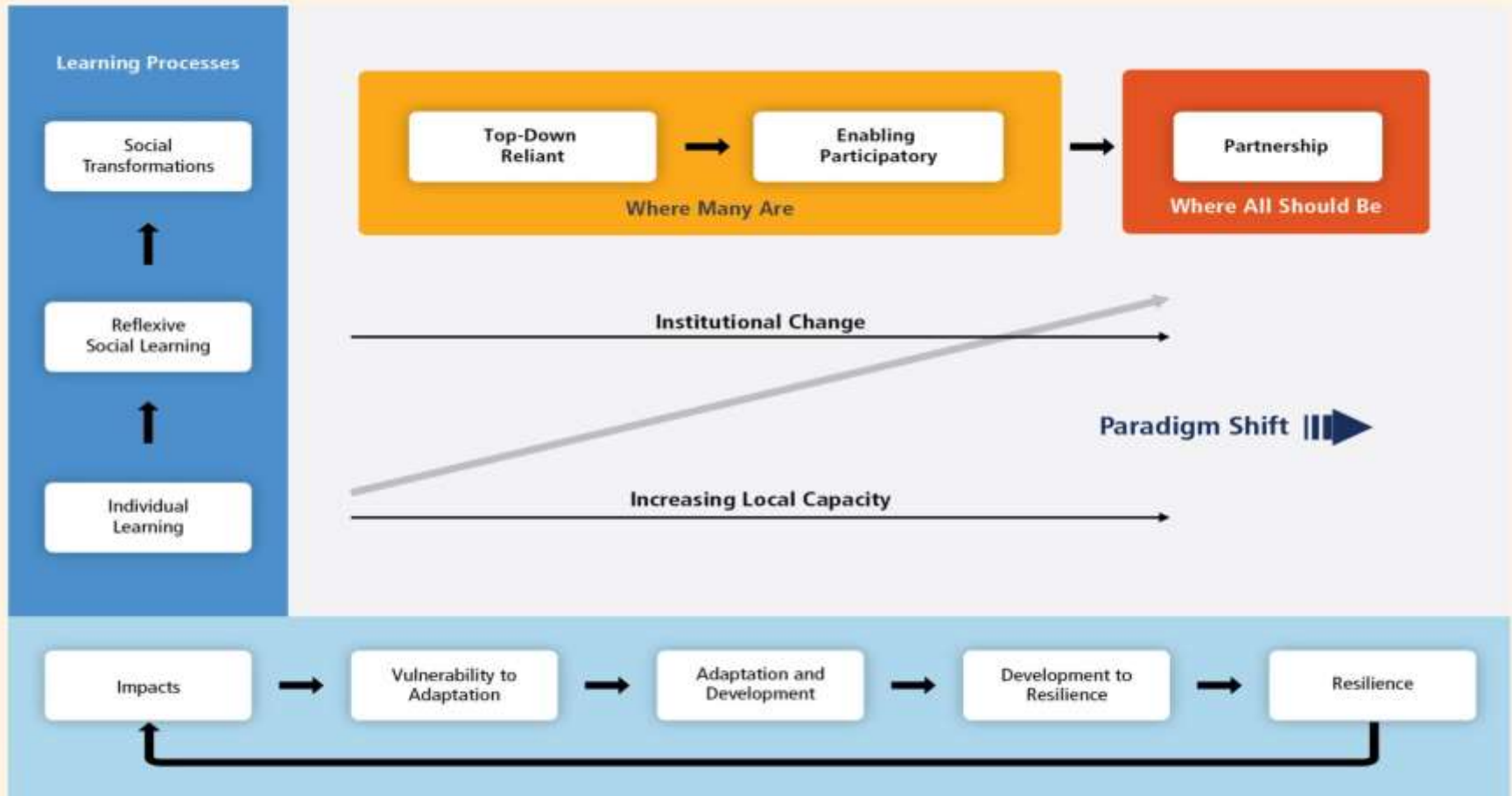
**adaptation:**  
human & natural  
systems



**Risk = Probability x Consequence**

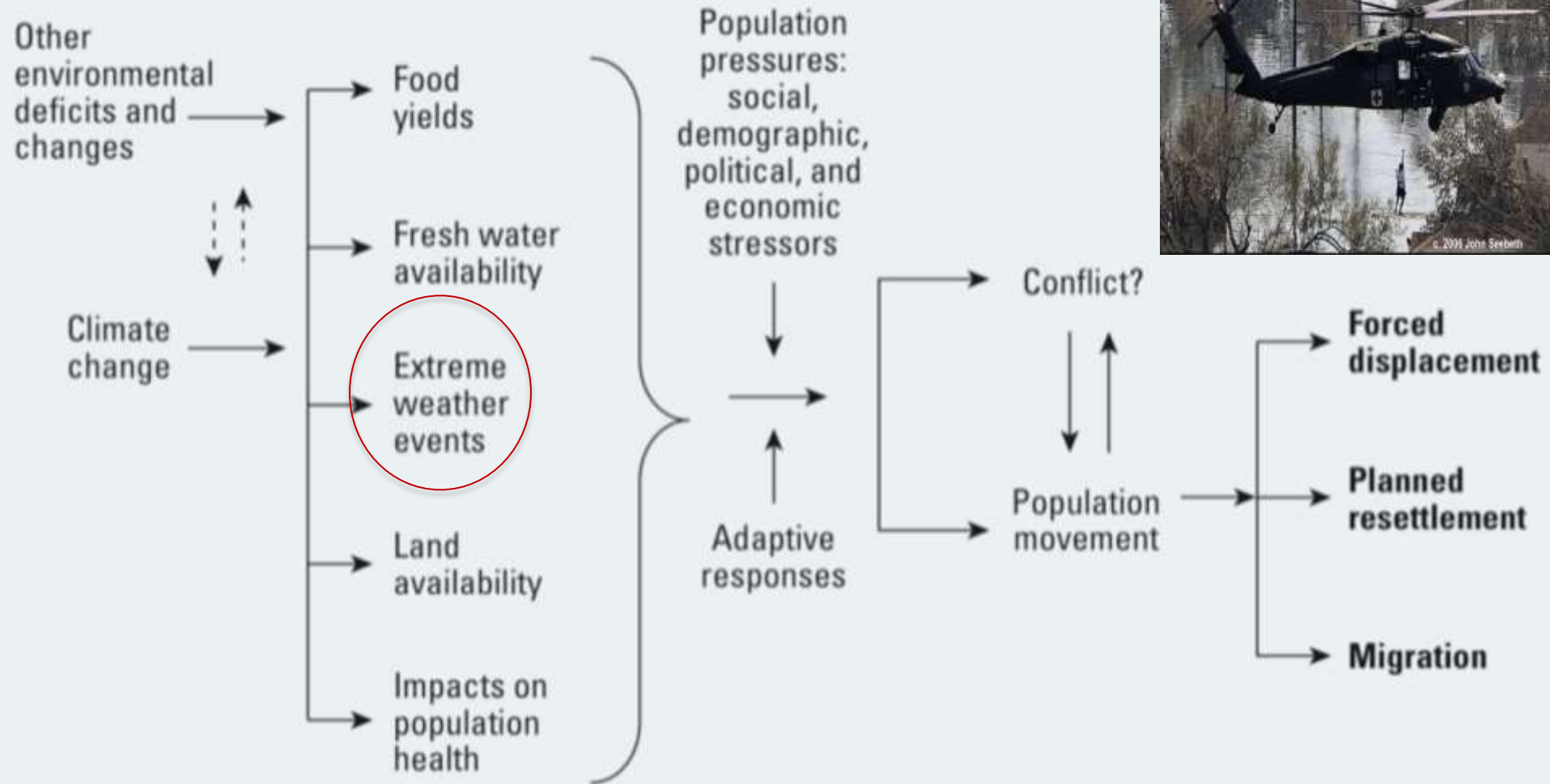
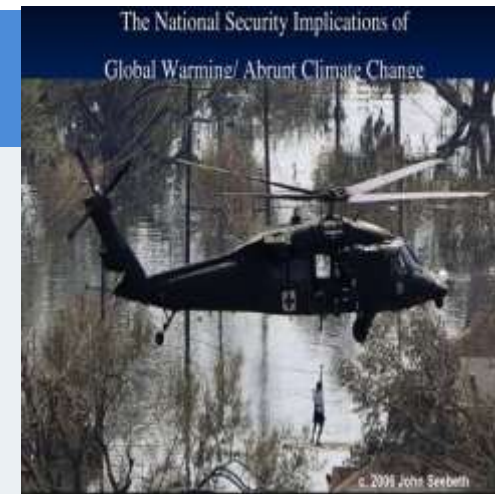
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# What are IPCC reports used for?



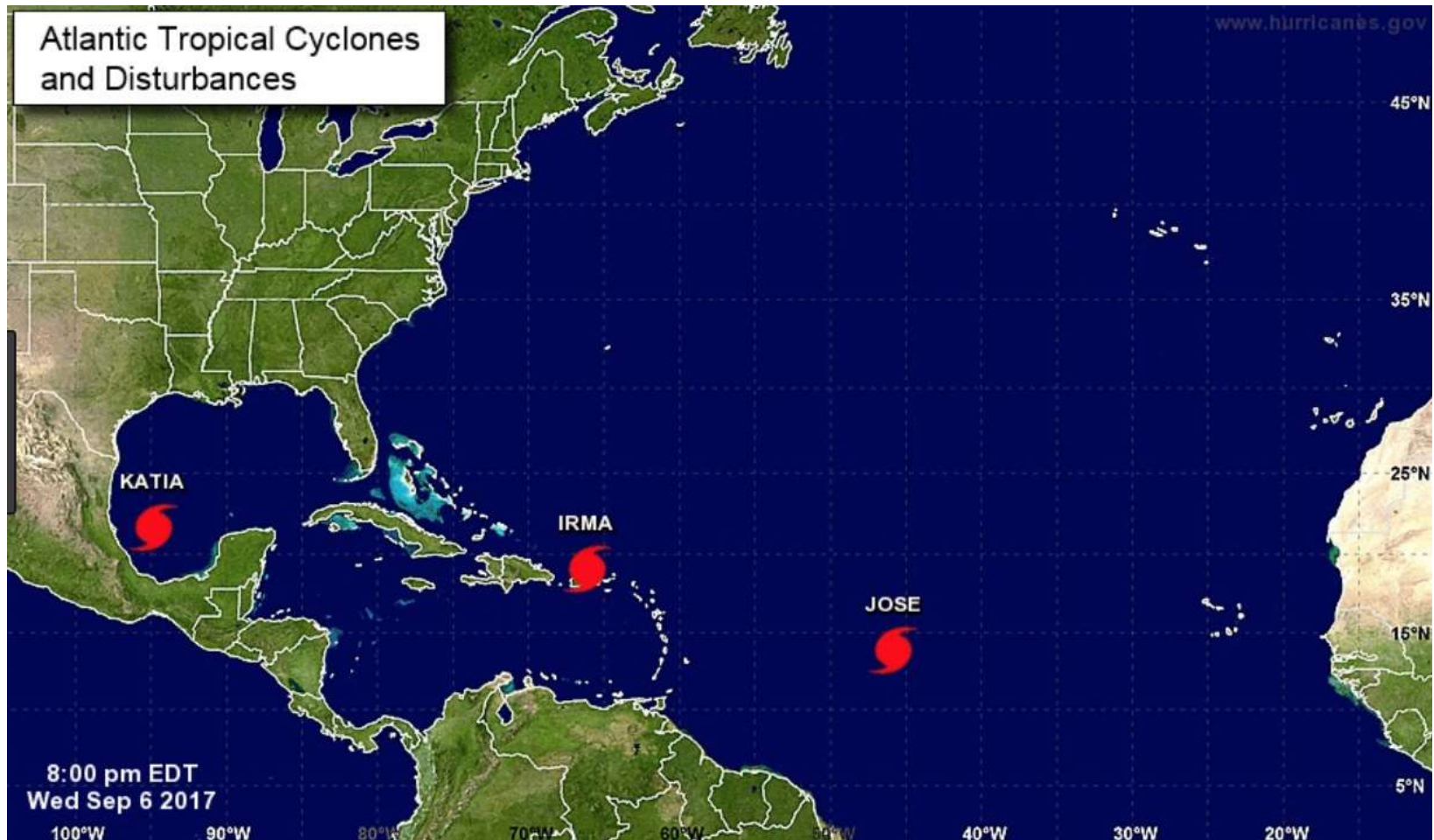
(Source: EAS 6792 Group Project Yufei Zou, Sean Miller, Tom Loadholt, 2013)

# As individuals and as a nation, are we prepared for the consequences of abrupt and extreme climate events?



Muchas gracias!!!!

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# THANK YOU FOR YOUR ATTENTION!

## For more information:

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