



El Colegio de Arquitectos e Ingenieros del estado de Morelos, México, AC y la Universidad Fray Luca Paccioli

**Invitan a**

Académicos, estudiantes, funcionarios públicos, empresarios, organizaciones políticas civiles y público en general a la

**Conferencia Magistral**



**CAMBIO AMBIENTAL GLOBAL,  
DESASTRES Y VULNERABILIDAD SOCIAL**

**Dra. Úrsula Oswald Spring**

Investigadora del Centro Regional de Investigaciones  
Multidisciplinarias **CRIM - UNAM**

**Viernes 16 de octubre 2015 a las 17:30 hrs**

**Sede: Auditorio Tlatoani de la Universidad  
Fray Luca Paccioli, Cuernavaca, Morelos**

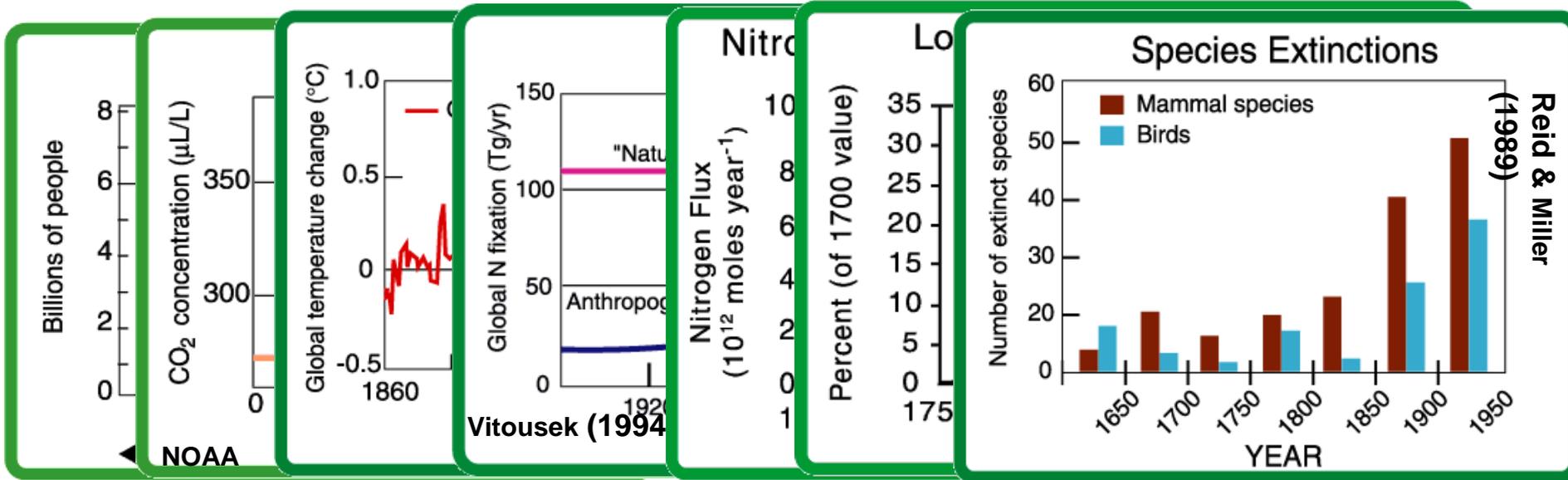
**Entrada libre**

# **Contenido**

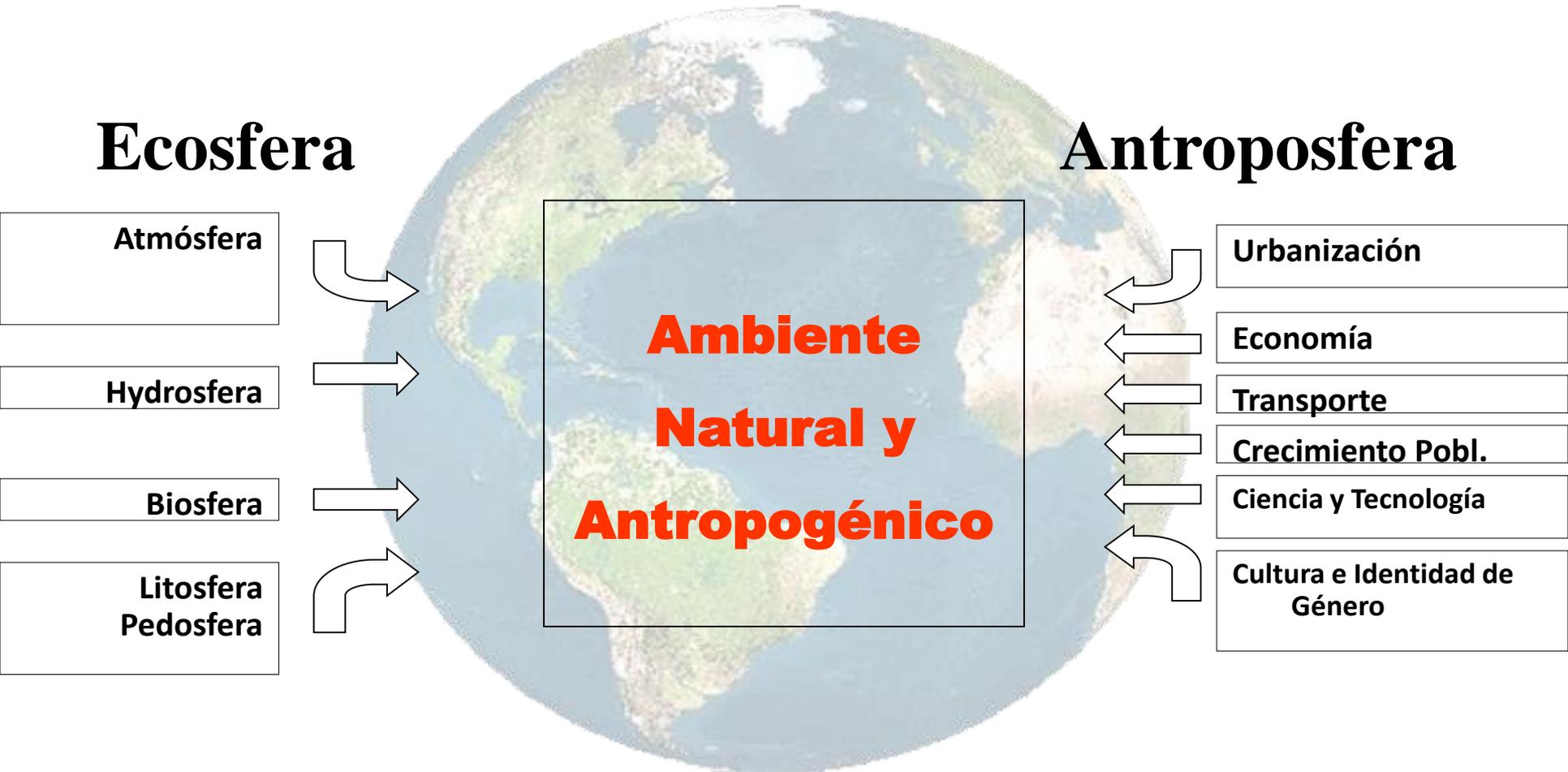
- 1. ¿Qué es el cambio ambiental global (CAG)?**
- 2. ¿Qué es el cambio climático (CC)?**
- 3. ¿Cómo impacta el CAG y el CC en México?**
- 4. Desastres**
- 5. Vulnerabilidad social**
- 6. Impactos en la seguridad de salud**
- 7. Impactos en la seguridad alimentaria**
- 8. Impactos en la seguridad del agua**
- 9. Perspectivas: ¿dilema de supervivencia o resiliencia?**
- 10. ¿Qué puedo yo hacer frente a estos procesos globales?**

# ¿Qué es el cambio global (CAG)?

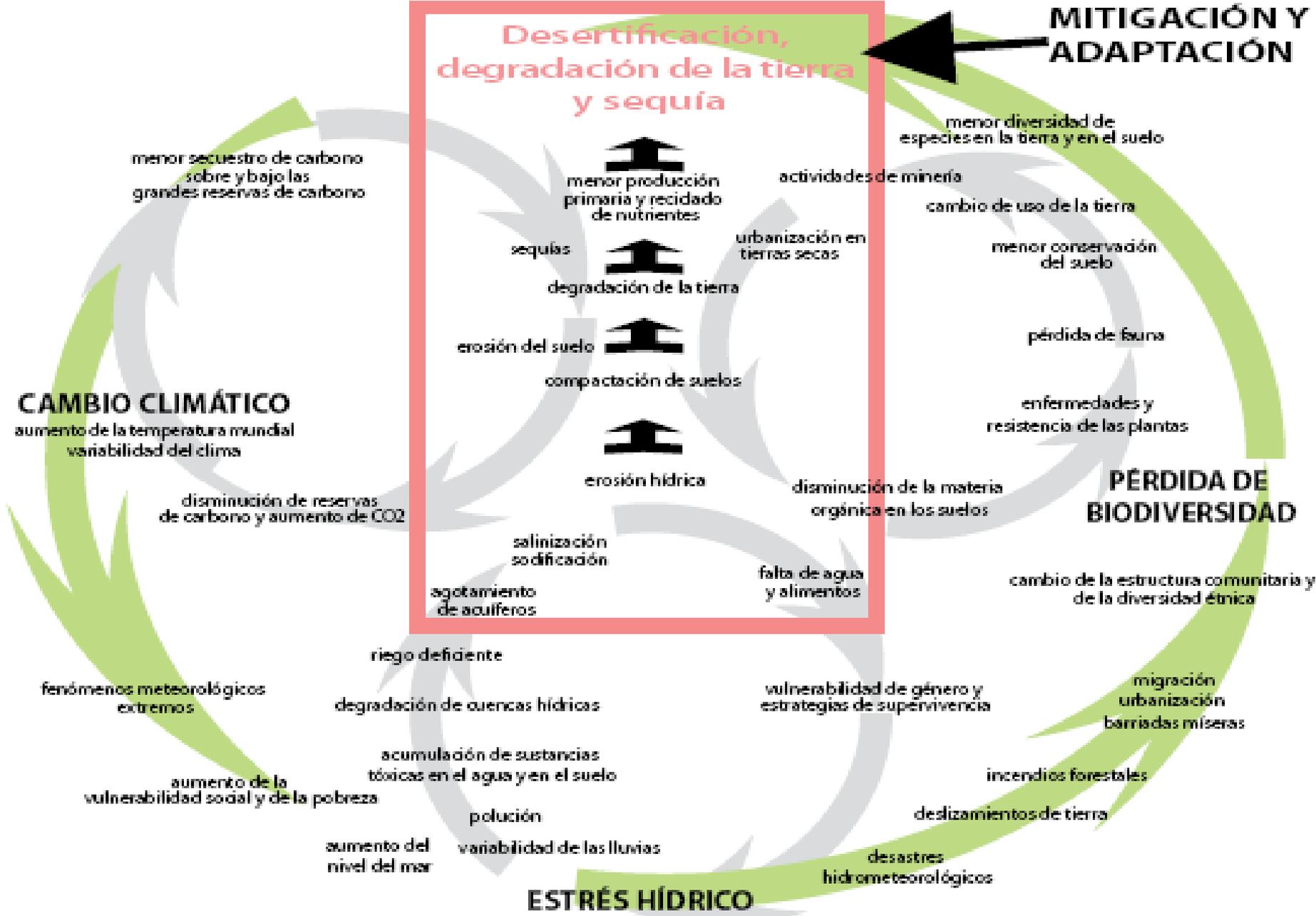
- Cambio global es **más** que cambio climático
- Cuenta con componentes naturales **más** los humanos
- Es un constelación de cambios en muchos dominios con interacciones no lineares, complejas e impredecibles. Se presenta entre otros en:



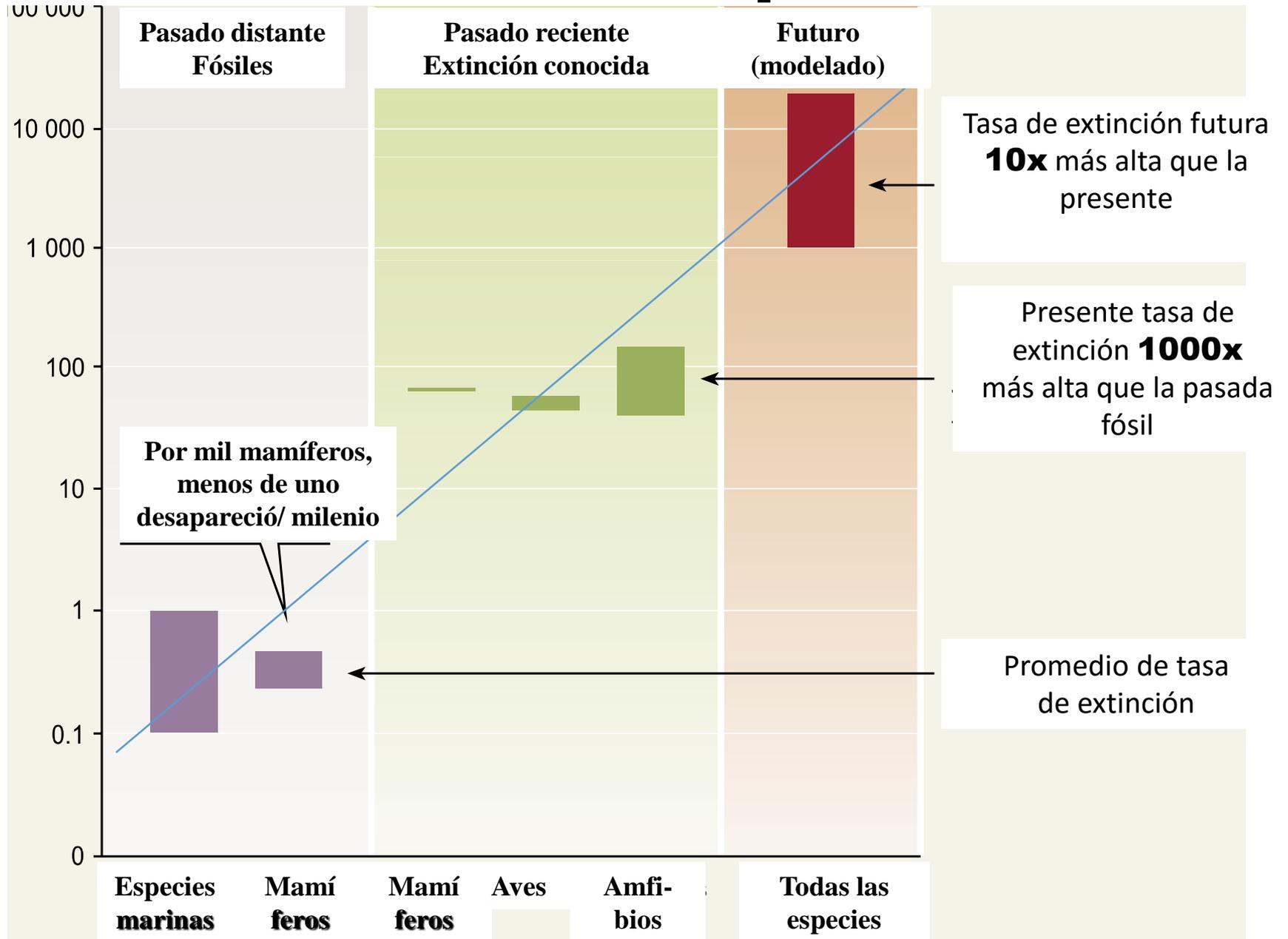
# El CAG aumenta peligros, vulnerabilidades, desafíos y riesgos para la supervivencia del planeta y la humanidad



# Complejas interacciones del CAG

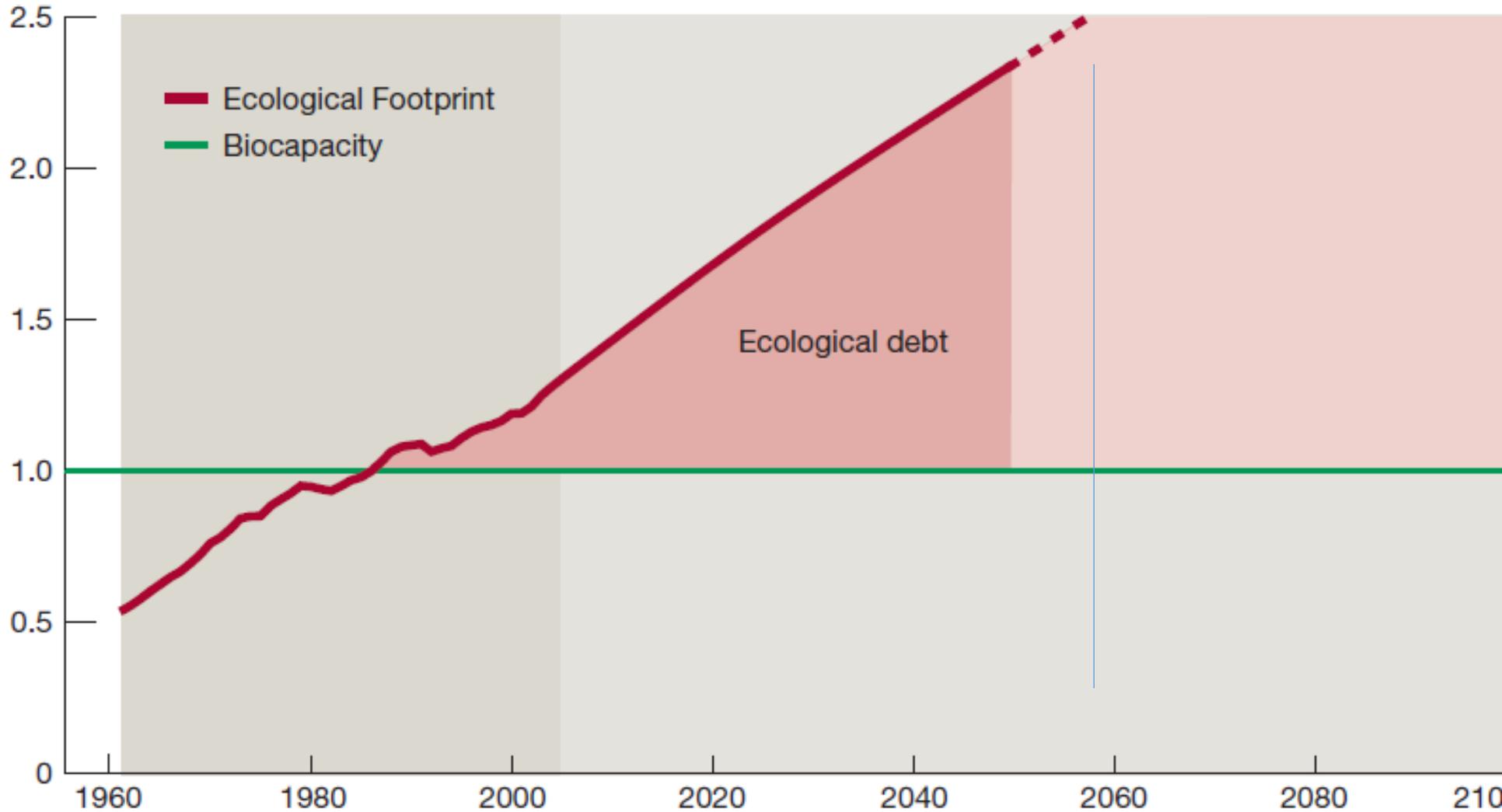


# Extinción de especies

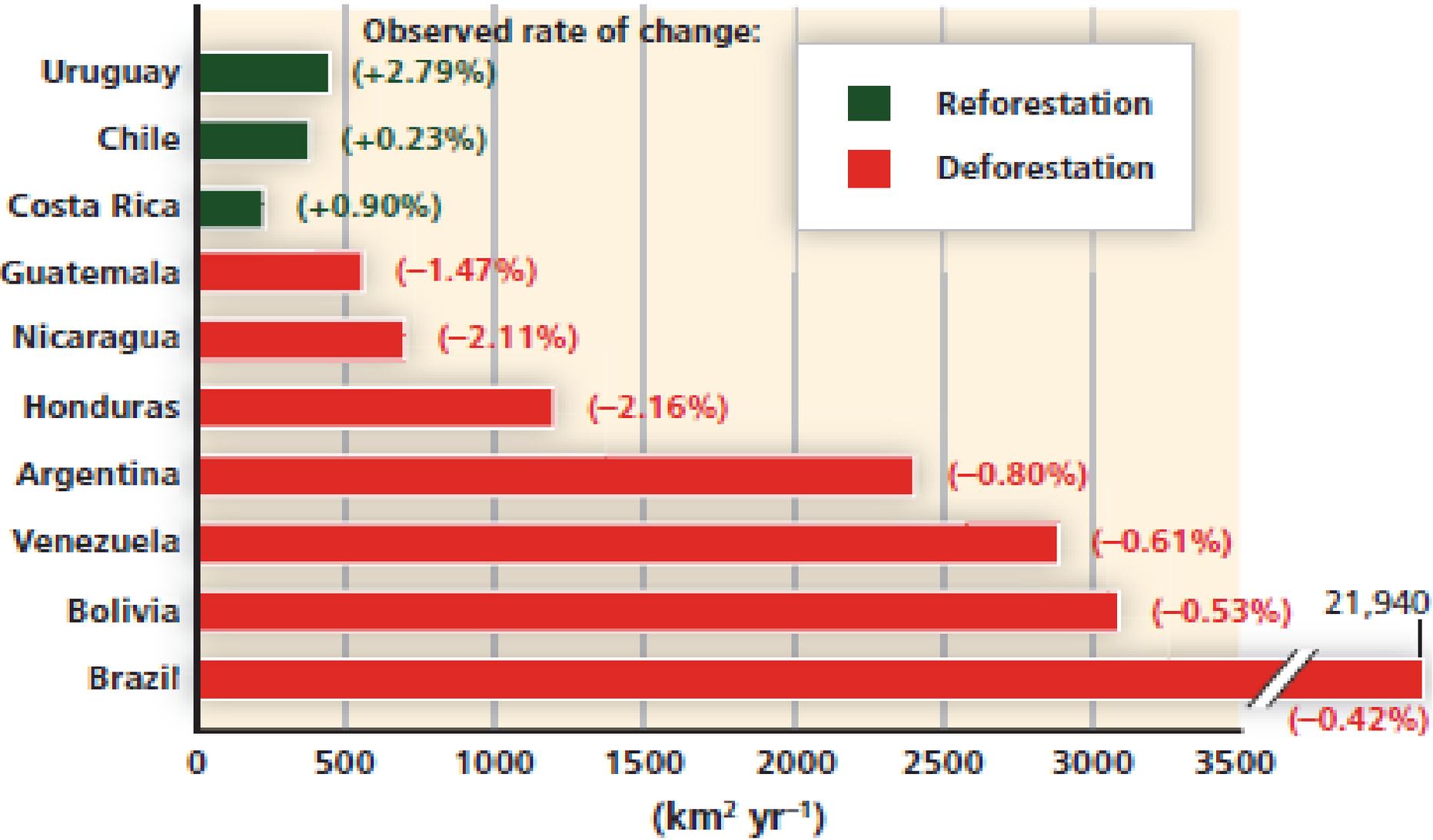


Source: Millennium Ecosystem Assessment

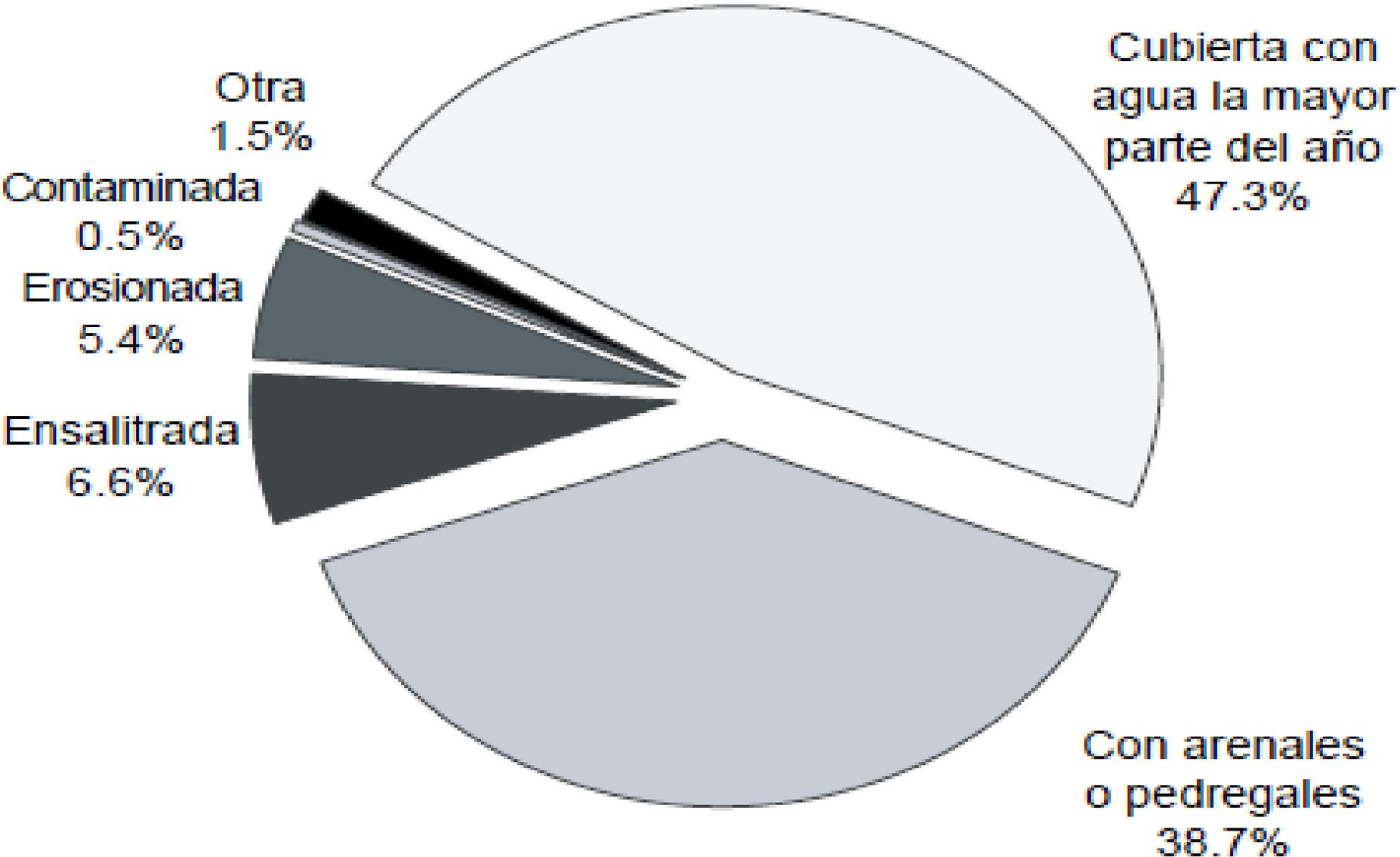
# Huella ecológica: con el consumismo presente necesitamos en 2050 2.5 planetas

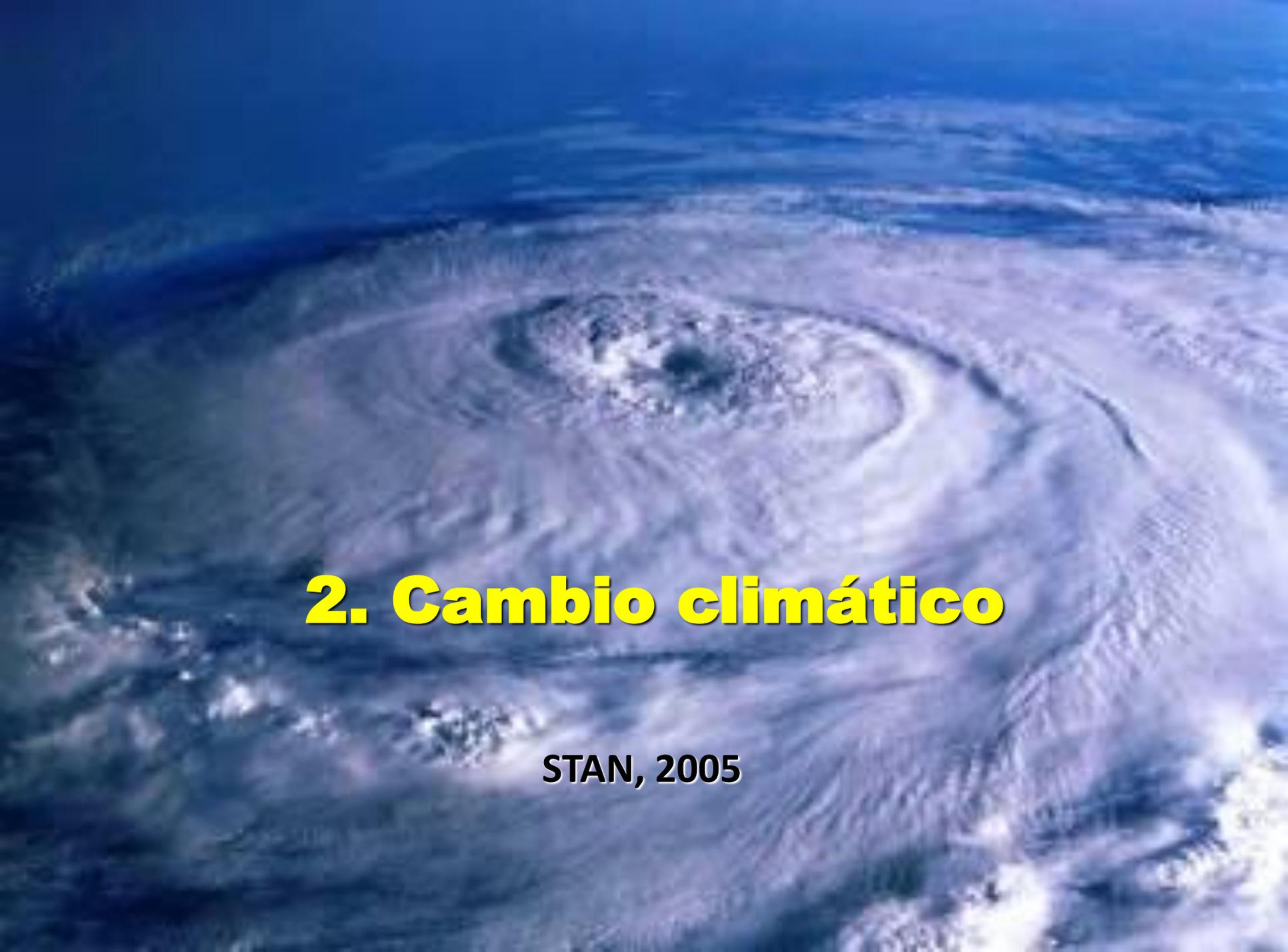


# Deforestación/ reforestación



# Severo deterioro de los suelos

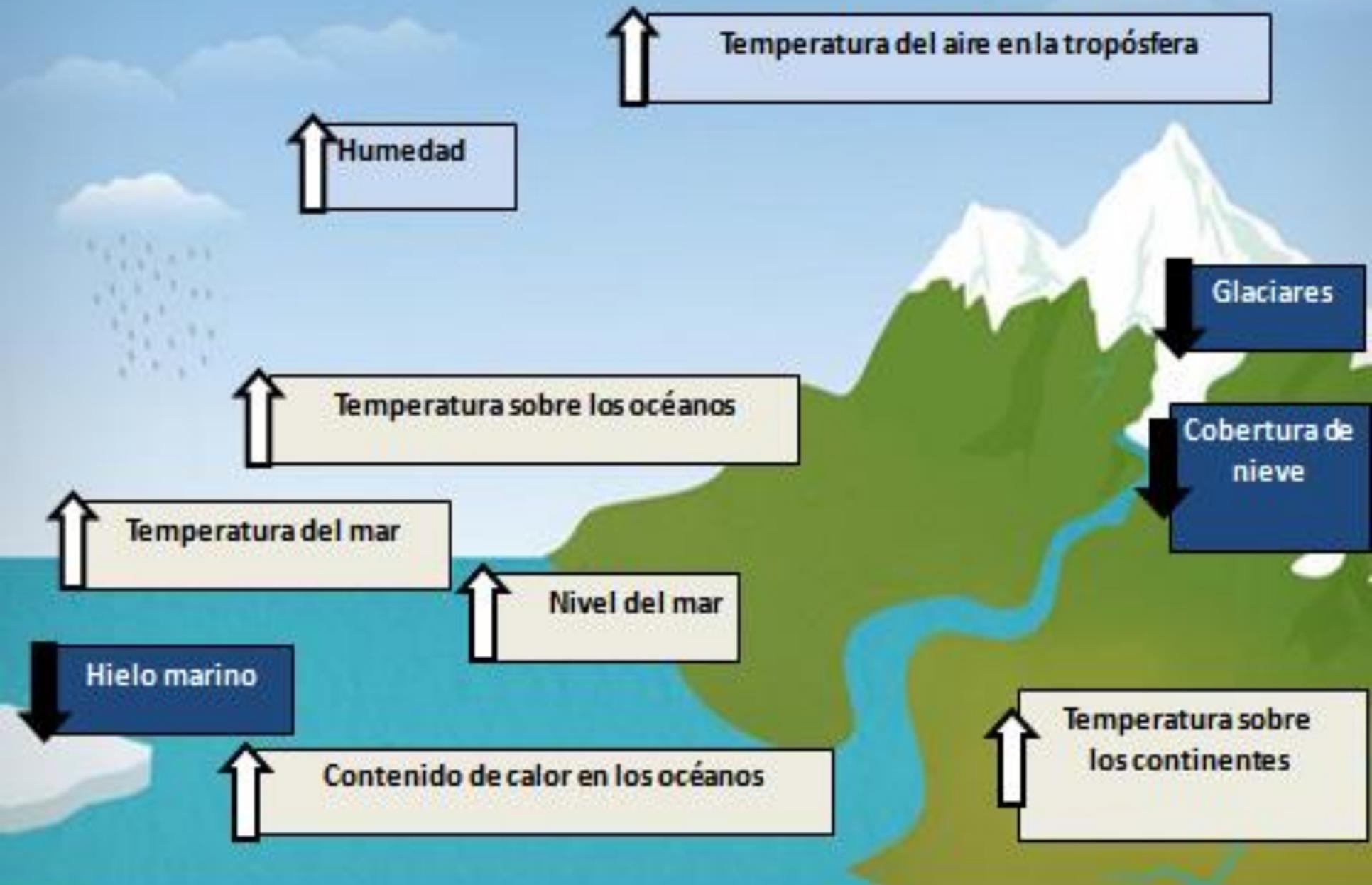




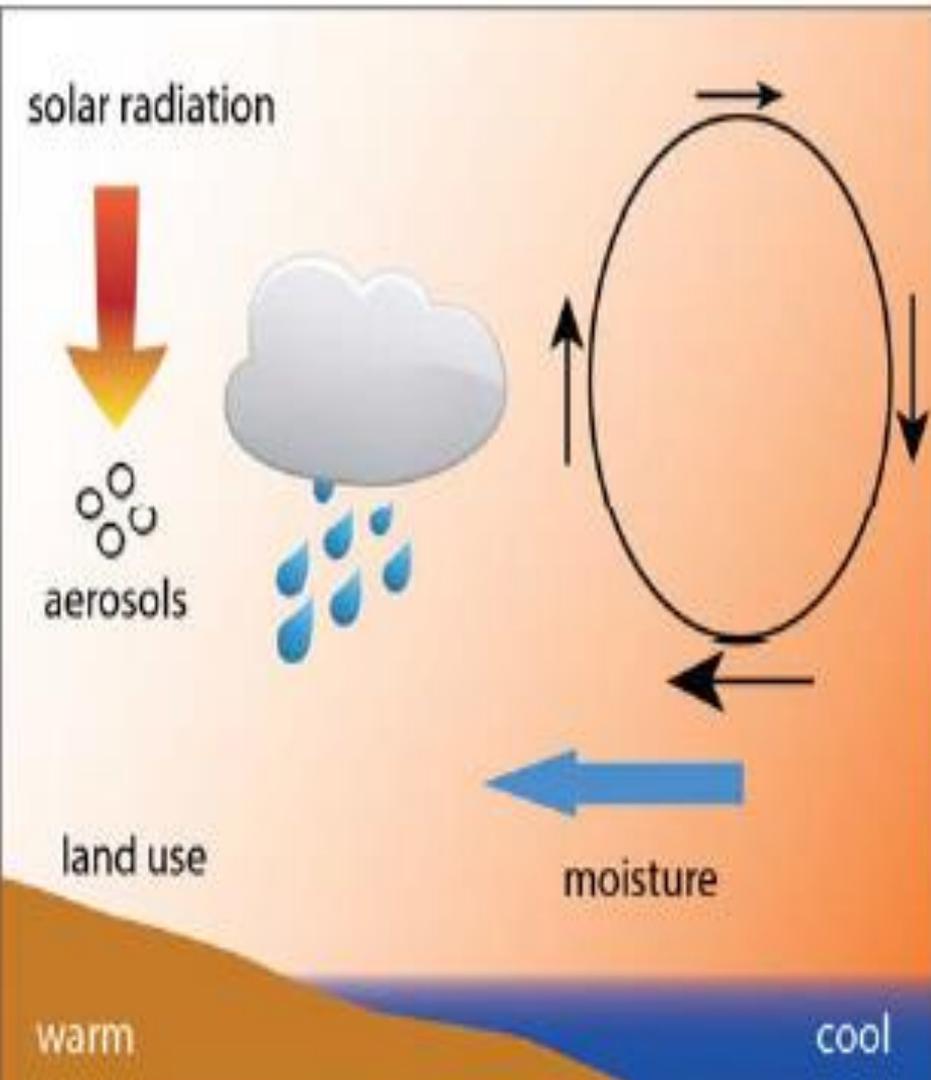
## **2. Cambio climático**

**STAN, 2005**

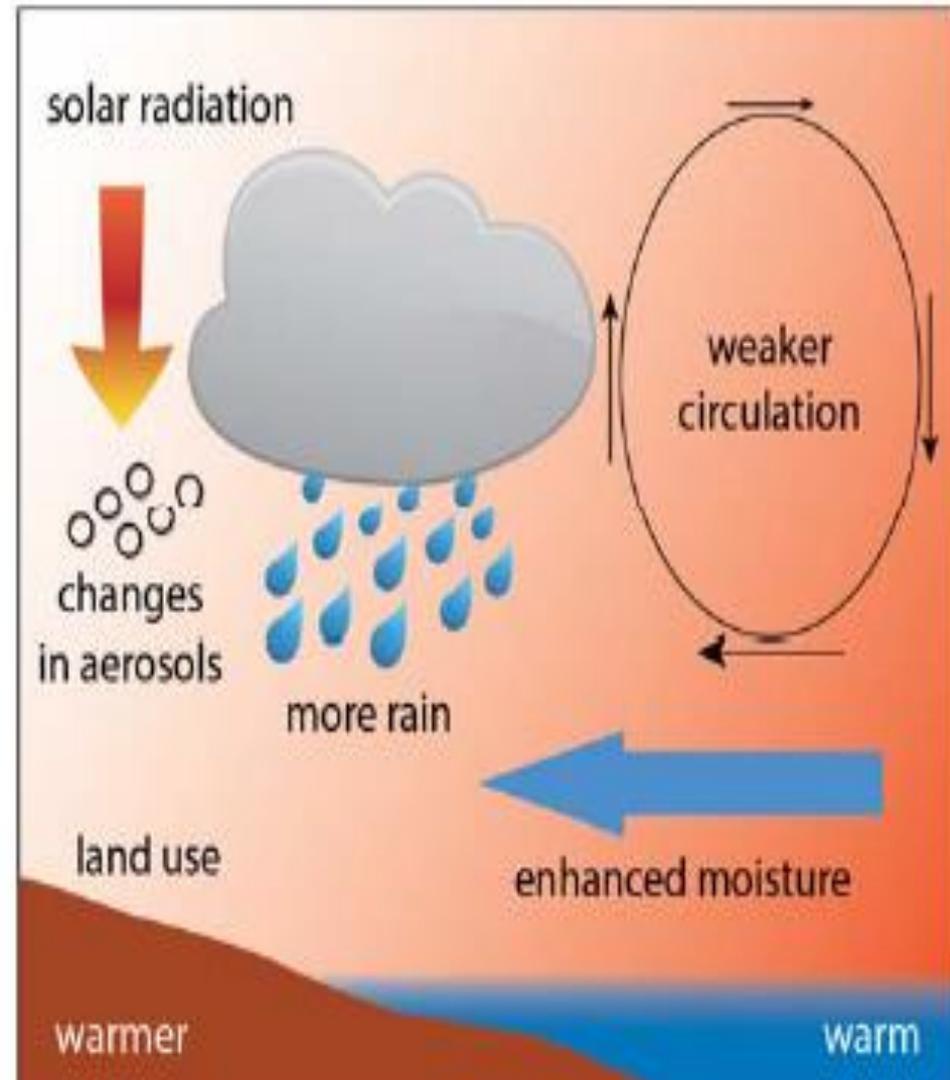
# Cambio climático y su impacto en México



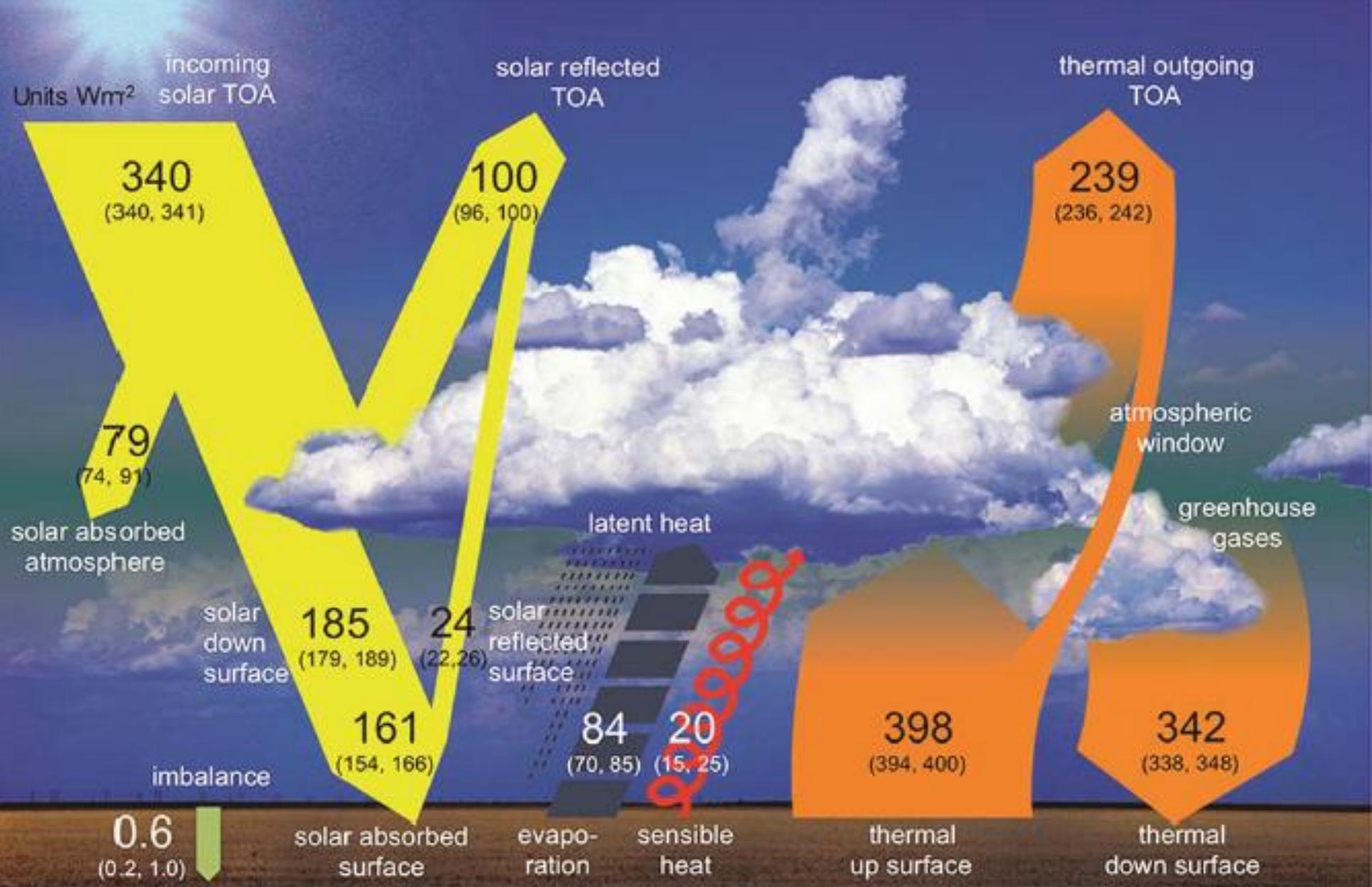
(a) present



(b) future

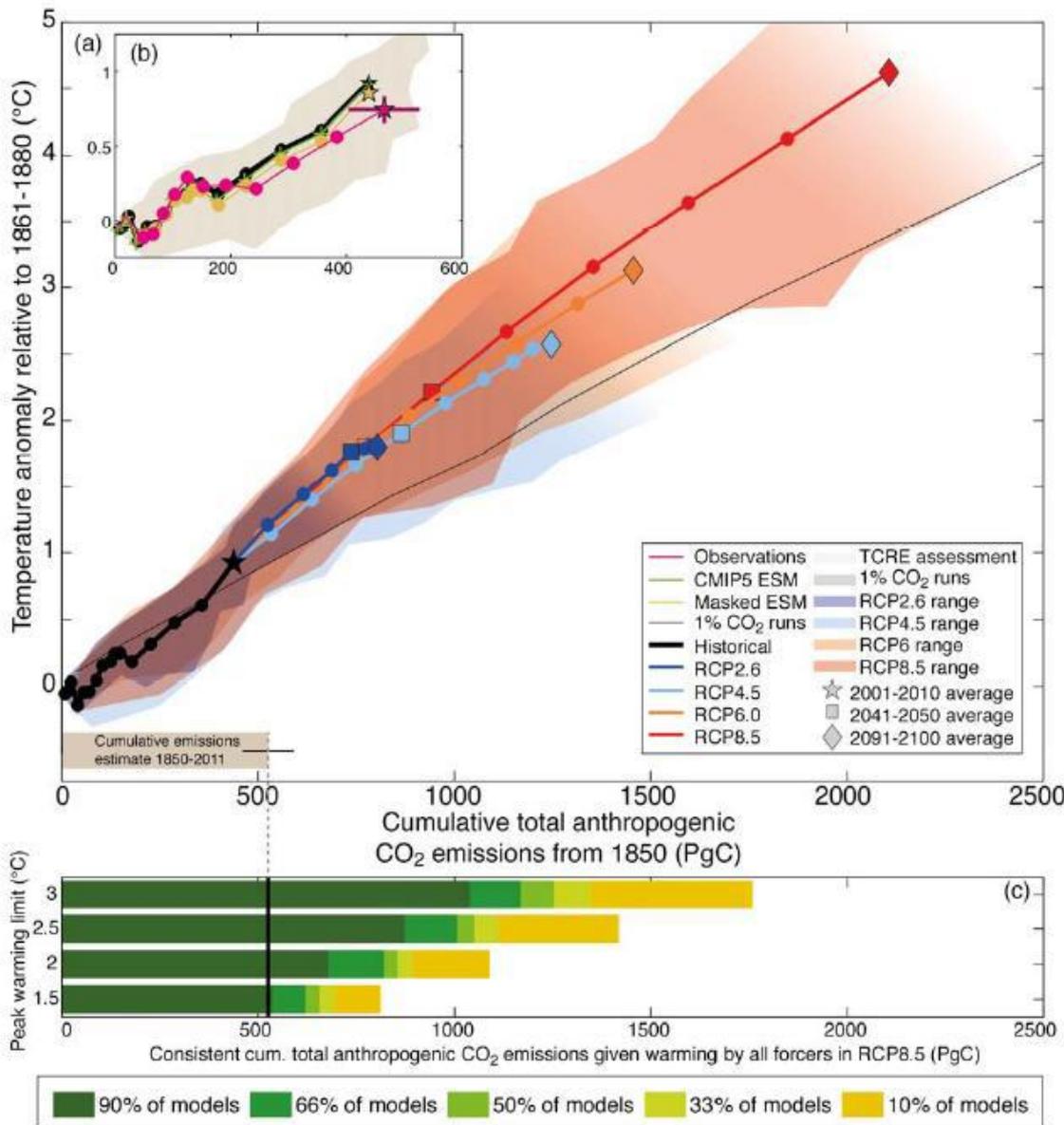


**¿Qué está cambiando?**



# El equilibrio general energético

# IPCC, 5th Assessment Report, 2013

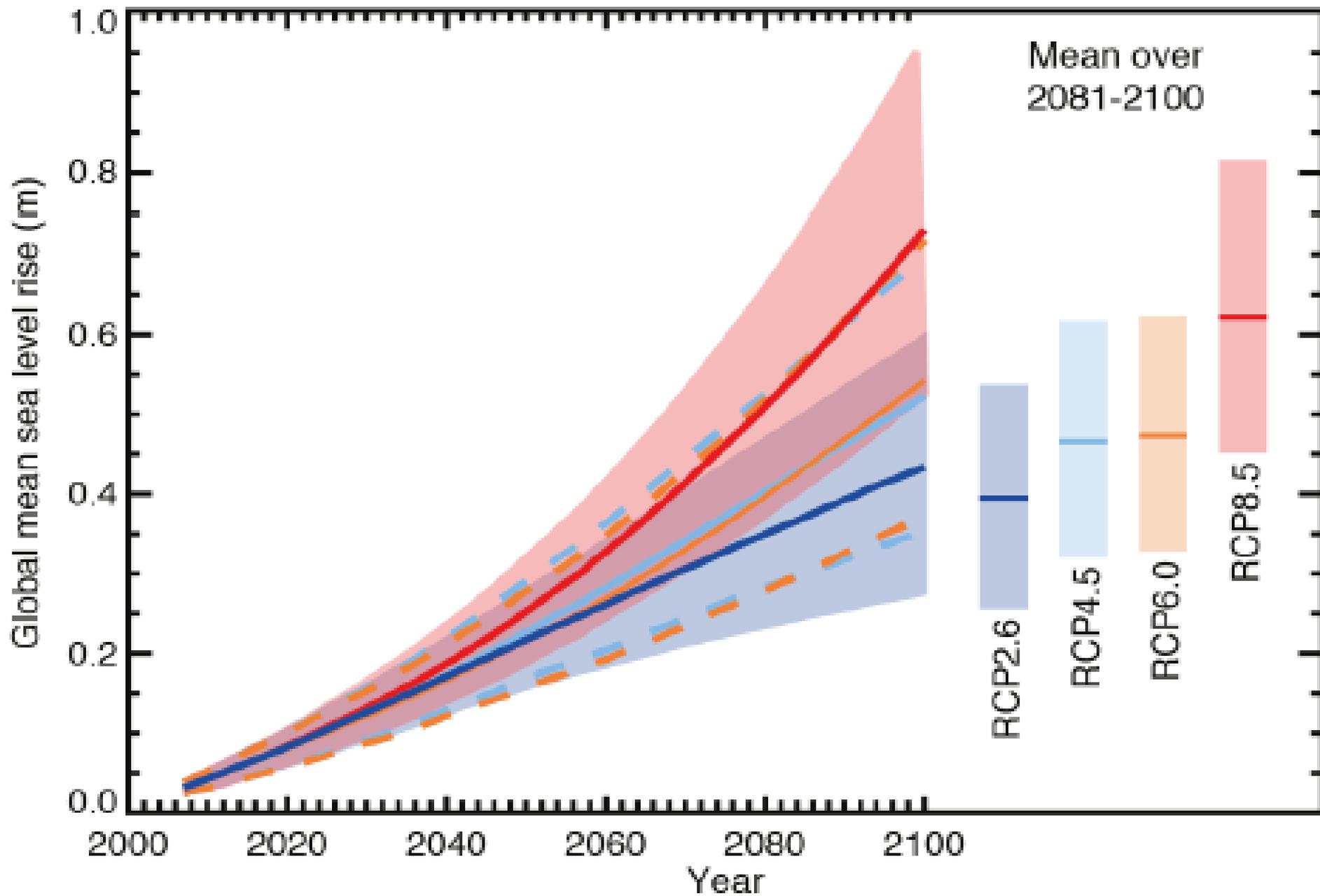


## Efectos físicos:

- Aumento de temperatura (CO<sub>2</sub> acumulado antropogénicamente desde 1870)
- Cambio en precipitación
- Aumento en el nivel del mar: arriba de 1 metro en 2100
- Eventos extremos
  - Tempestades tropicales (tifón, huracán, ciclón, depresión tropical)
  - Tempestades invernales
  - Inundaciones, avenidas
  - Deslizamiento de tierras
  - Sequía
  - Fundición de glaciares, polos

## Efectos sociales

- Migración
- Conflictos
- Adaptación
- Resiliencia
- Pérdida del hogar y bienestar

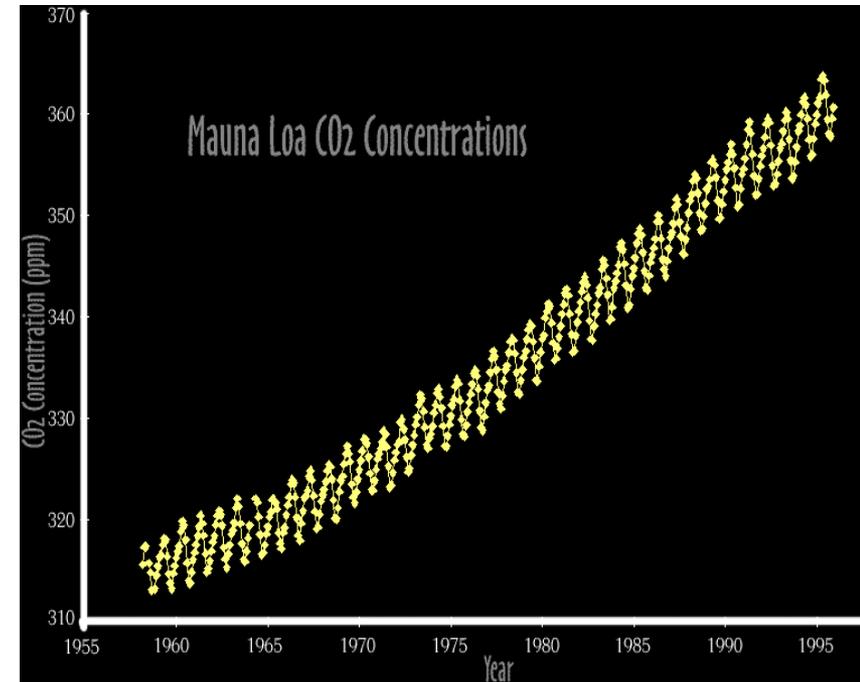
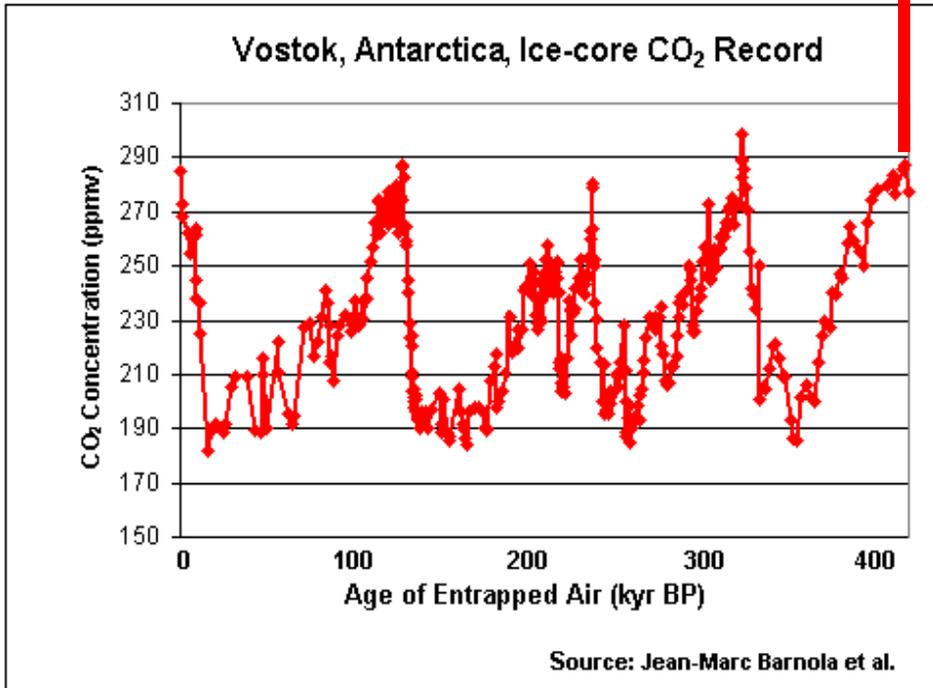


Aumento en el nivel del mar

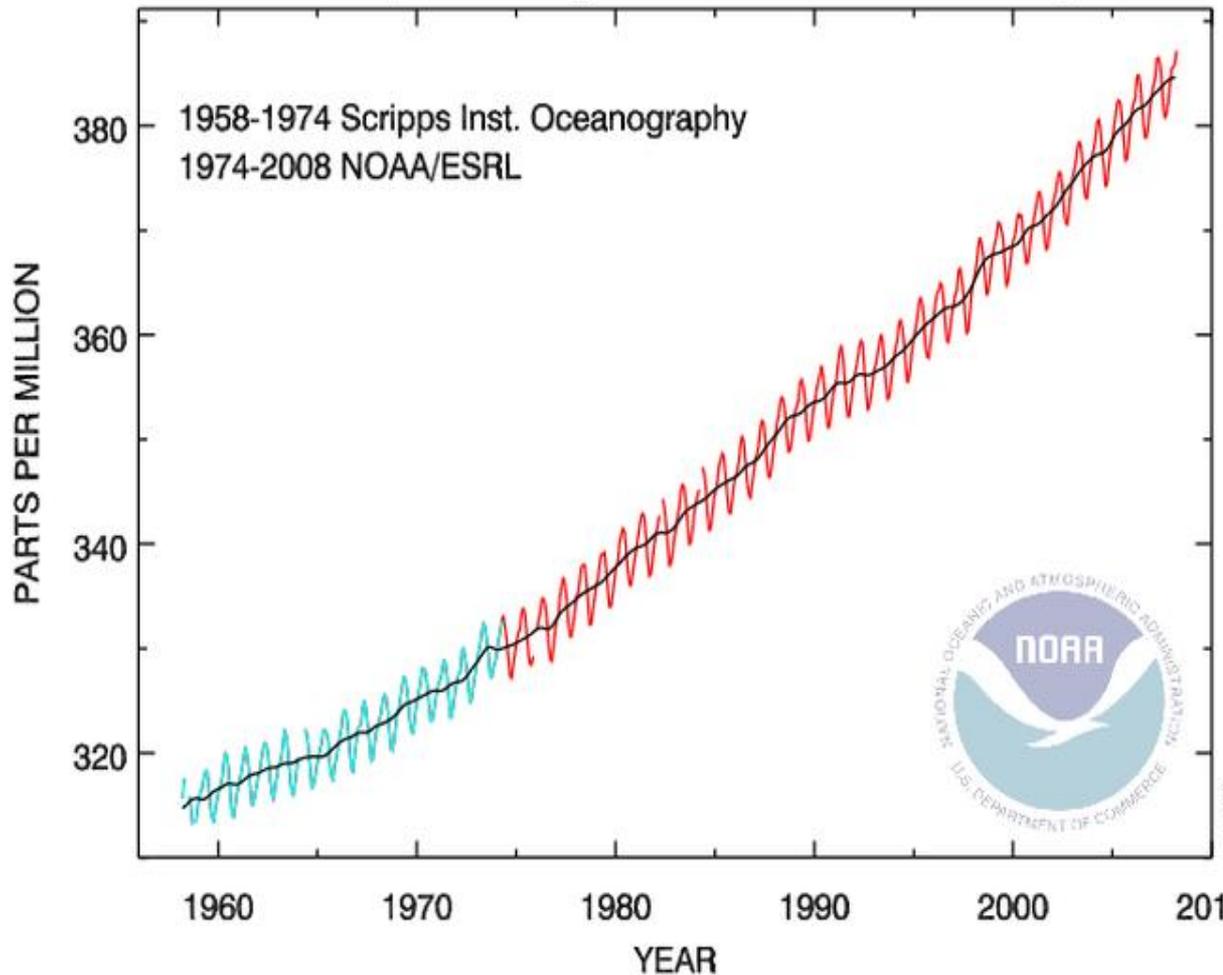
# Porqué se da el CC: Concentraciones atmosféricas de CO2 y Gases de efecto invernadero

Con 99% de confianza el calentamiento global en el siglo XX se debió a los gases de efecto invernadero

2014=400 ppm



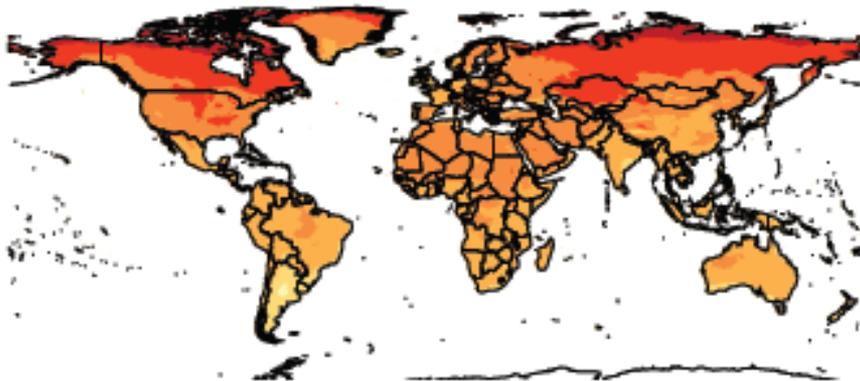
# Anthropogenic Climate Change in the Anthropocene



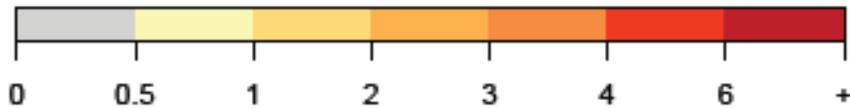
- GHG concentration in the atmosphere
- **1750: 279 ppm**
- **1958: 315 ppm**
- **1987: 387 ppm**
- **2011: 393 ppm**
- **2012: 396 ppm**
- **2014: 400 ppm**
- **1/3: 1750-1958:**
- **2/3: 1958-2015:**  
**315 a 405 ppm**

# Cambios calculado entre 1980-2010 y 2035 a 2065

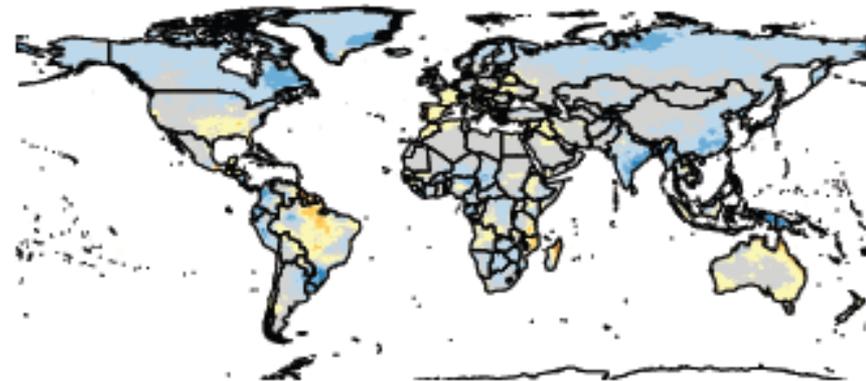
a) Temperature  
[HadGEM2-ES, RCP8.5]



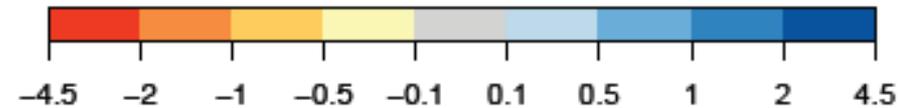
Absolute change [°C]



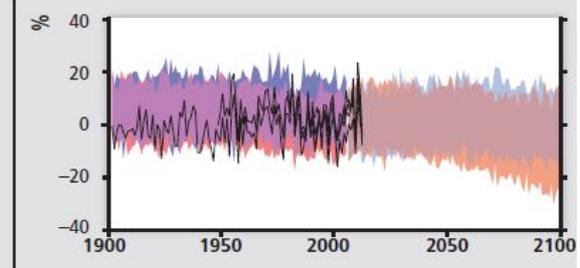
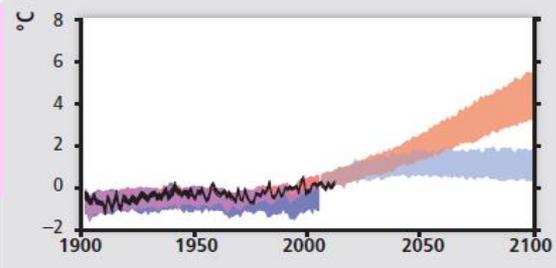
b) Precipitation  
[HadGEM2-ES, RCP8.5]



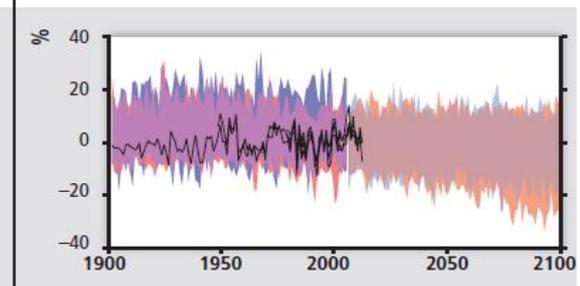
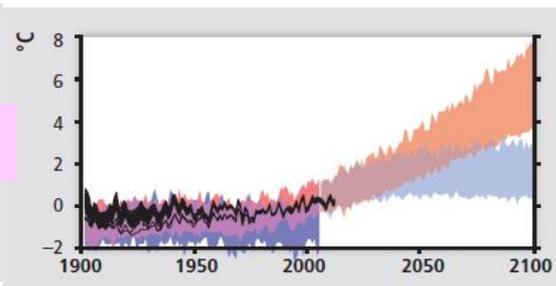
Absolute change [mm/d]



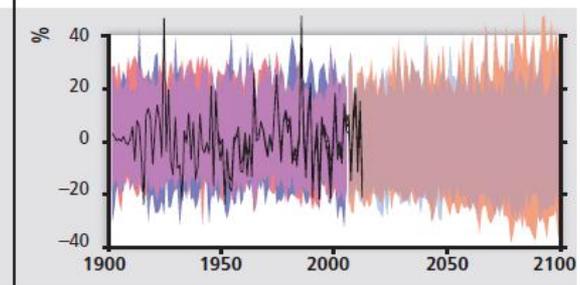
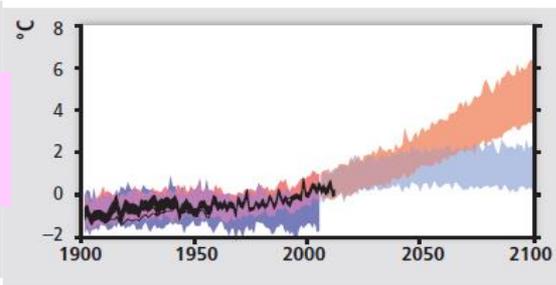
**México y  
Centroamé-  
rica**



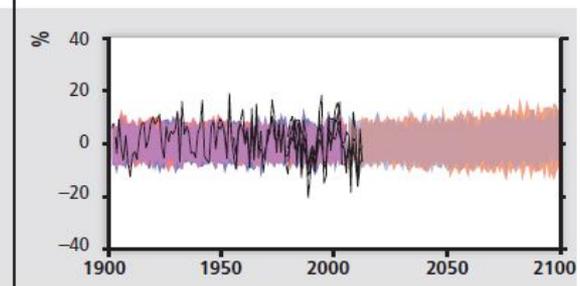
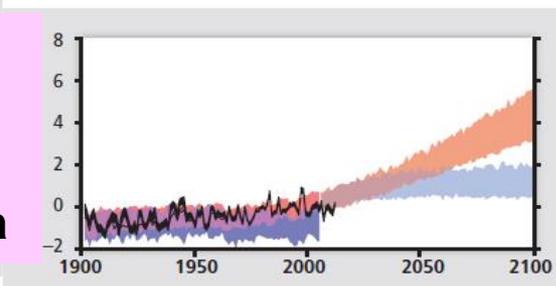
**Amazonas**



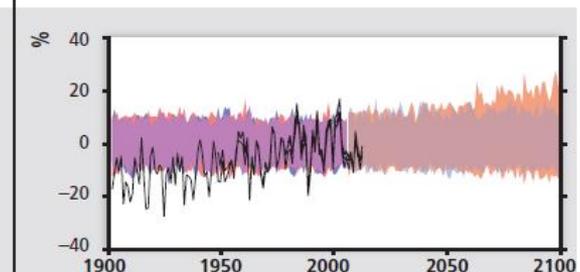
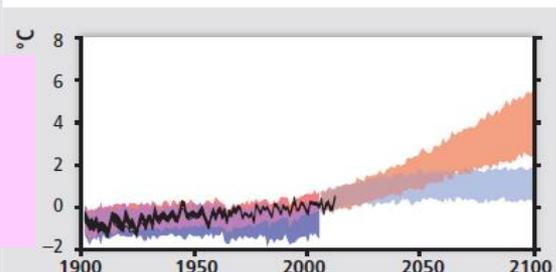
**Noreste de  
Brasil**



**Costa  
occidente  
de  
Sudamérica**

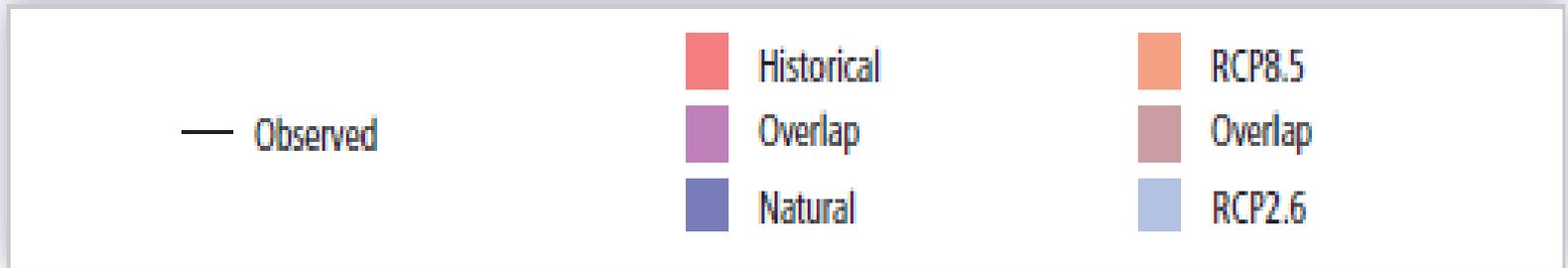


**Costa  
sudeste de  
Sudamérica**



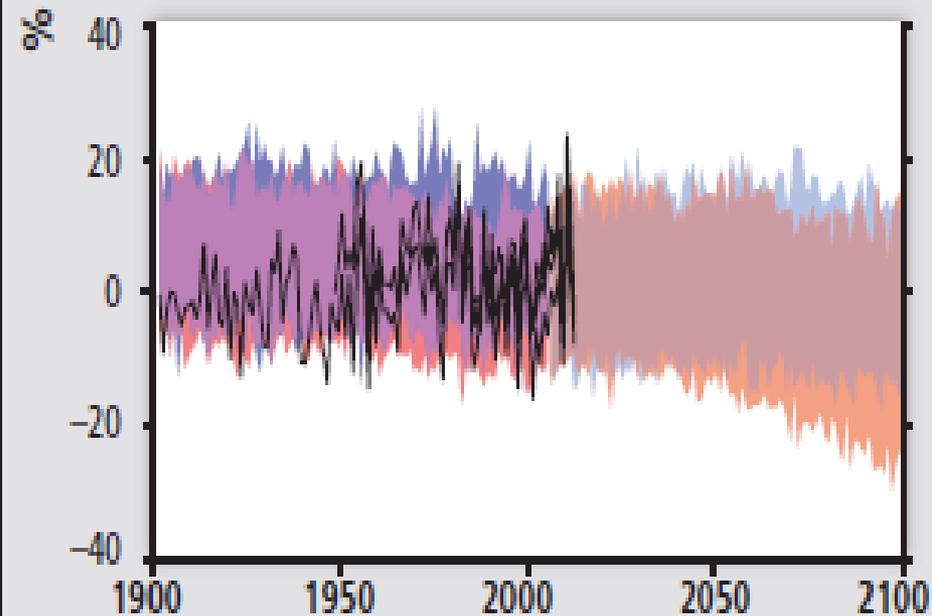
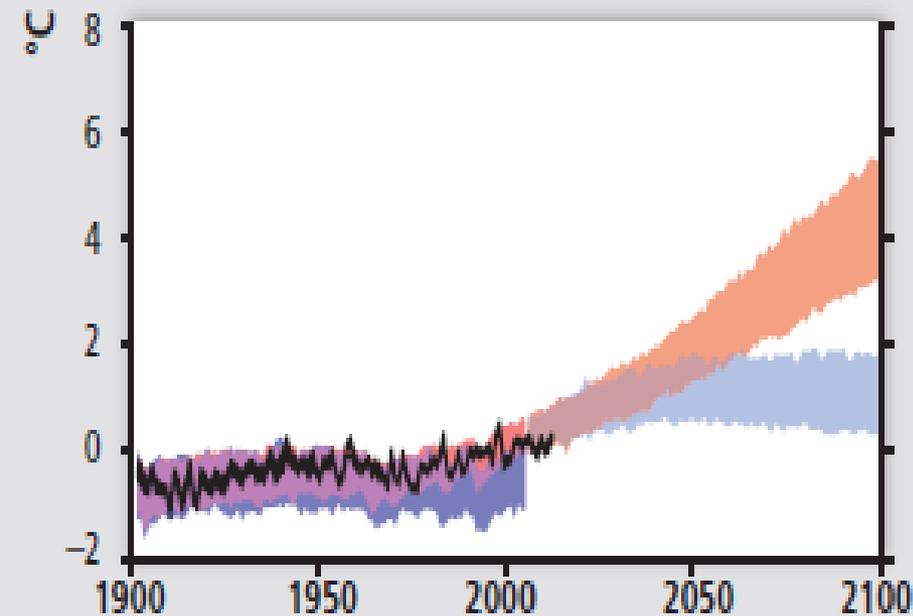
**Cambios  
de  
tempe-  
ratura y  
precipi-  
tación  
en  
América  
Latina**

# Cambios en temperatura y precipitación en Centroamérica y México



Near-surface air temperature (land)

Precipitation (land)



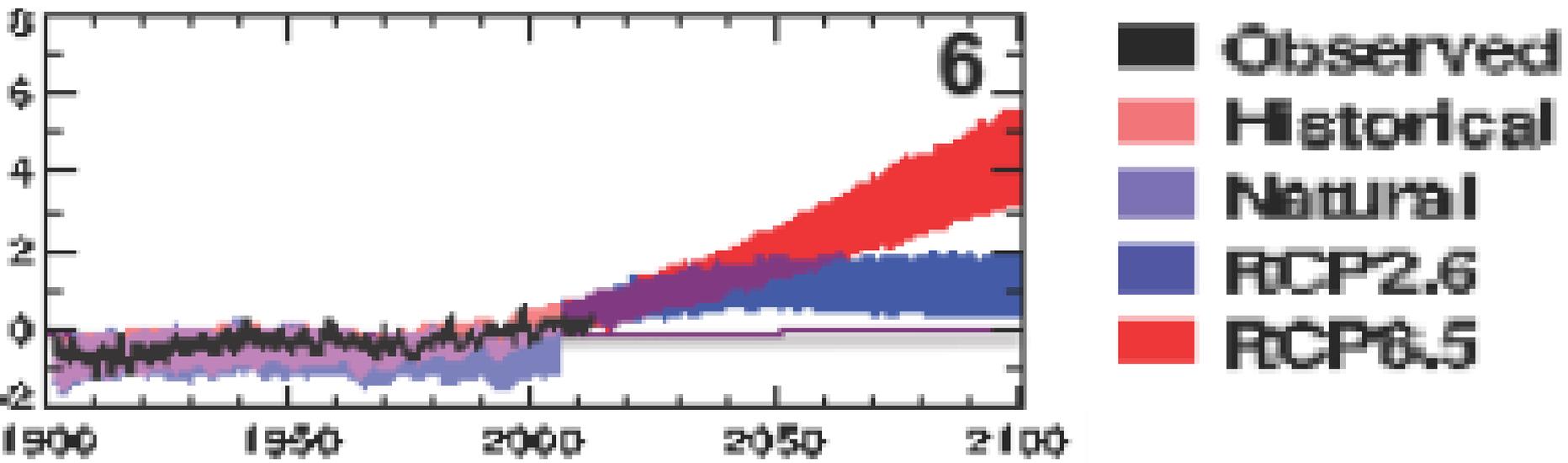
# Impactos en Centro y Sudamérica

- Tendencias significativas en **precipitación y temperatura** se han observado con cambios en la variabilidad del clima y fenómenos extremos
- Se vieron cambios en el caudal y **disponibilidad del agua** que seguirán afectando a regiones ya vulnerables
- **Cambios en el uso de suelo:** principal causa de la pérdida de biodiversidad, lo que agrava efectos negativos del cambio climático y aumenta las tasas de extinción de especies
- **Condiciones socioeconómicas** se han mejorado, pero persiste todavía nivel elevado de pobreza (CA: 50%: SA: 30%), lo que aumenta **vulnerabilidad y riesgos** ante variabilidad y cambio climático
- **Aumento en el nivel del mar** y actividades humanas afectan ecosistemas costeros y marinos, amenazan peces, corales, manglares, recreación, turismo, el control de enfermedades y eventos extremos
- **Cambios en productividad agrícola** impacta en seguridad alimentaria por el cambio climático, pero existe gran variabilidad espacial
- Cambios en los patrones climáticos están afectando negativamente a **la salud humana:** aumento de morbilidad, mortalidad y discapacidad; hay enfermedades en las áreas previamente no endémicas

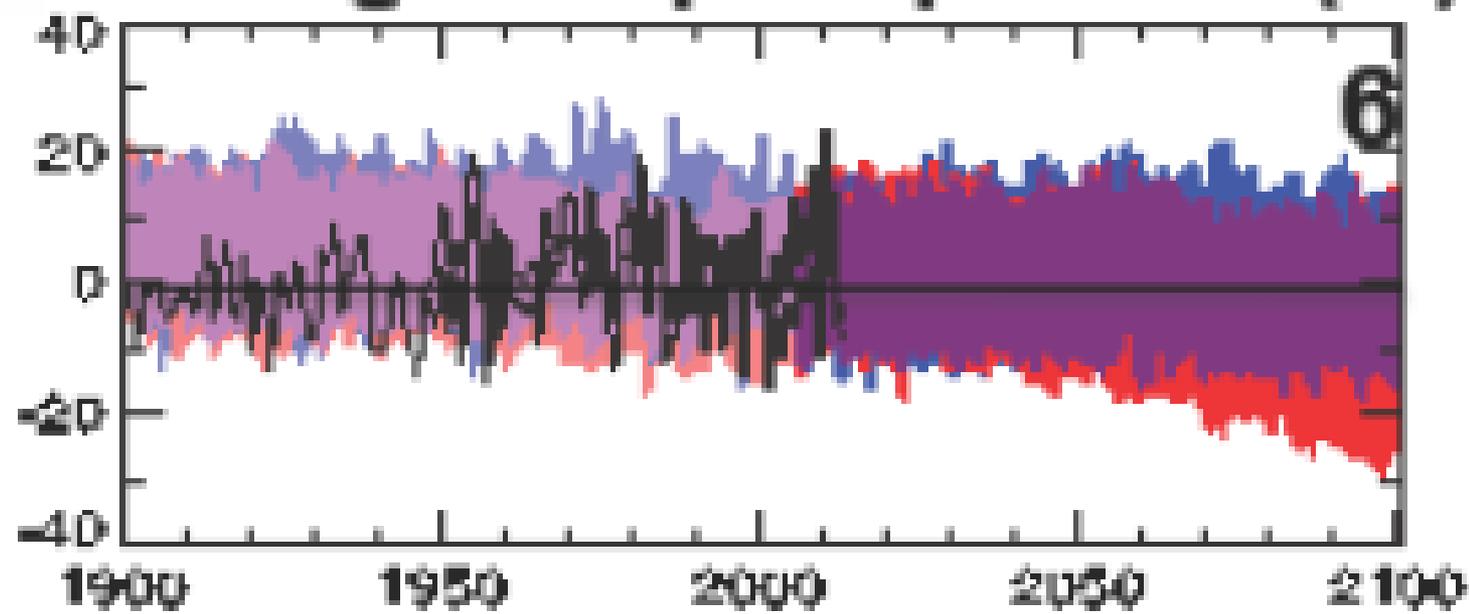
# Hallazgos principales

- **El cambio climático es una amenaza al desarrollo equitativo y sustentable. La adaptación, la mitigación y el desarrollo sustentable están estrechamente interrelacionados y tienen un potencial de sinergias.**
- **El cambio climático presenta un multiplicador de amenazas y afecta al desarrollo equitativo y sustentable.** Exacerba la vulnerabilidad social y natural. Cierta modernización aumenta el riesgo climático, la vulnerabilidad y erosiona aún más el desarrollo sustentable.
- **Políticas de cambio climático con desarrollo sustentable manejan simultáneamente adaptación y mitigación.** Algunas opciones para enfrentar al cambio climático implican riesgos al ambiente y costos sociales; tienen efectos distributivos adversos y desvían recursos de las prioridades de desarrollo o la erradicación de la pobreza.
- **Co-beneficios:** (i) Mejoramiento de la calidad del aire; (ii) mayor seguridad energética, (iii) reducción en el consumo de energía y agua en zonas urbanas mediante ciudades verdes y reciclaje de agua; (iv) agricultura y silvicultura sustentable; y (v) protección de ecosistemas para almacenar carbono y otros servicios ecosistémicos.

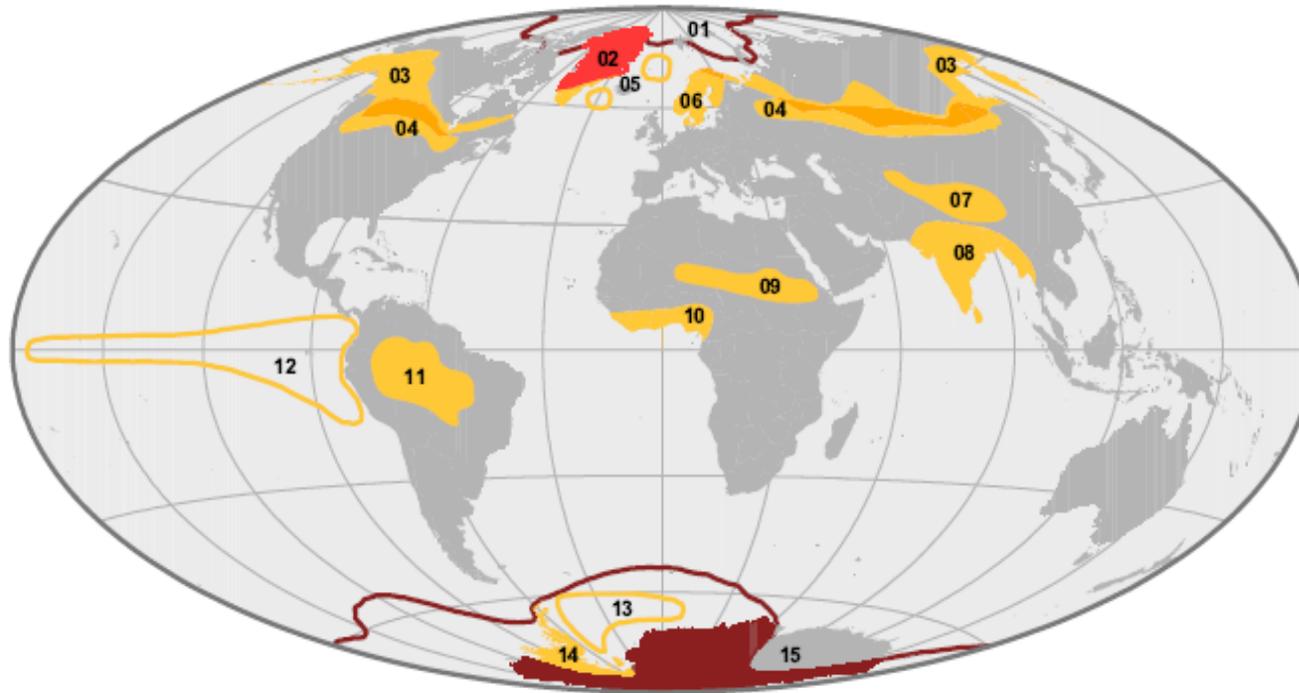
# Cambios en temperatura (C°) y precipitación (%) en México y Centroamérica



Overlap  
Overlap



# Potenciales puntos de ruptura en el sistema tierra por CC



Fuente: H.J. Schellnhuber (2008)

 tipped already       in limbo       still stable

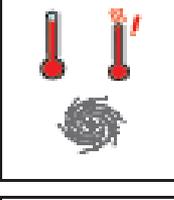
- |  |  |  |
|--|--|--|
| 01 Arctic Sea Ice Loss                             | 06 Climatic Change-Induced<br>Ozon Hole over Northern Europe | 11 Dieback of Amazon Rainforest                            |
| 02 Greenland Ice Sheet                             | 07 Albedo Tibetan Plateau                                    | 12 Southern Pacific Climate Oscillation                    |
| 03 Thawing Permafrost /<br>Methan Escape           | 08 Indian Monsoon  | 13 Antarctic Deep Water Formation /<br>Nutrients Upwelling |
| 04 Boreal Forest Dieback                           | 09 Re-Greening Sahara /<br>Sealing of Dust Sources           | 14 Westantarctic Ice Sheet                                 |
| 05 Suppression of Atlantic<br>Deep Water Formation | 10 West African Monsoon                                      | 15 Antarctic Ozone Hole                                    |



**3. ¿Cómo impacta el CAG y el CC en América Latina y México?**

# Cambio climático y sus efectos

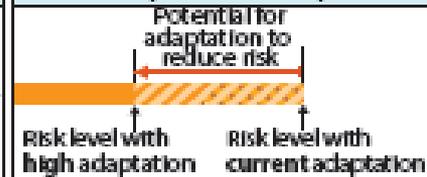
1. Aumento en la temperatura; ondas de calor y frío
2. Aumento en el nivel del mar
3. Tempestades e inundaciones
4. Sequías, desertificación, pérdida de fertilidad de suelos y erosión
5. Incendios forestales por sequías e inducidos
6. Cambios irreversibles ambientales y destrucción de ecosistemas
7. Pérdida y erosión de la biodiversidad
8. Urbanización caótica con crecimiento poblacional
9. Afectación del bienestar, alimentación, producción, seguridad del agua y calidad de vida
10. Aumento de migración interna y externa
11. Conflictos en zonas delicadas
12. Posible cambios de gran dimensión (Amazonas, Corriente del Golfo, monzón en Asia, etc.)
13. nuevas plagas y enfermedades (gripe aviar, ébola, chikungunya)

Example risks	Adaptation issues and prospects	Climatic risks	Supporting ch. sections	Time frame	Risk for current and high adaptation																			
Displacement associated with extreme events (high confidence)	Adaptation to extreme events is well understood but poorly implemented even under present climate conditions. Displacement and involuntary migration are often temporary. With increasing climate risks, displacement is more likely to involve permanent migration.		12.4.1	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Near term (2030 – 2040)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Long term 2°C (2080 – 2100)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>4°C</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Bar chart showing risk level]			Near term (2030 – 2040)	[Bar chart showing risk level]			Long term 2°C (2080 – 2100)	[Bar chart showing risk level]			4°C	[Bar chart showing risk level]		
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4°C	[Bar chart showing risk level]																							
Loss of land, cultural and natural heritage disrupting cultural practices embedded in livelihoods and expressed in narratives, world views, identity, community cohesion, and sense of place (high confidence)	Cultural values and expressions are dynamic and inherently adaptable and hence adaptation is possible to avoid losses of cultural assets and expressions. Nevertheless cultural integrity will be compromised in these circumstances.		12.3.2, 12.3.4	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Near term (2030 – 2040)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Long term 2°C (2080 – 2100)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>4°C</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Bar chart showing risk level]			Near term (2030 – 2040)	[Bar chart showing risk level]			Long term 2°C (2080 – 2100)	[Bar chart showing risk level]			4°C	[Bar chart showing risk level]		
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4°C	[Bar chart showing risk level]																							
Violent conflict arising from deterioration in resource-dependent livelihoods such as agriculture and pastoralism (high confidence)	Adaptation options: Buffering rural incomes against climate shocks, e.g., through livelihood diversification, income transfers, and social safety net provision; Early warning mechanisms to promote effective risk reduction; Well-established strategies for managing violent conflict that are effective but require significant resources, investment, and political will.		12.5.1	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Near term (2030 – 2040)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Long term 2°C (2080 – 2100)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>4°C</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Bar chart showing risk level]			Near term (2030 – 2040)	[Bar chart showing risk level]			Long term 2°C (2080 – 2100)	[Bar chart showing risk level]			4°C	[Bar chart showing risk level]		
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4°C	[Bar chart showing risk level]																							
Geopolitical competition over access to Arctic resources that escalates into dangerous tensions and crises (high confidence)	There are international organizations and elements of international law that regulate competition and access and provide mechanisms for resolving disputes. There are strong transnational networks that are relevant for joint problem solving. Hence adaptation action has significant potential to reduce risks associated with geopolitical rivalry.		12.6.2	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Near term (2030 – 2040)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Long term 2°C (2080 – 2100)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>4°C</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Bar chart showing risk level]			Near term (2030 – 2040)	[Bar chart showing risk level]			Long term 2°C (2080 – 2100)	[Bar chart showing risk level]			4°C	[Bar chart showing risk level]		
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New or exacerbated conflict through land acquisition for climate change mitigation and adaptation (medium confidence)	Climate change mitigation (e.g., expansion of biofuel production area) and adaptation action (e.g., set-back of coastal land) can exacerbate conflicts when they are already manifest around land and water availability and scarcity. The extent of insecurity and instability from such mitigation and adaptation activities depends on the displacement of populations and the inclusiveness of the planning processes. Careful planning processes can therefore be used to ameliorate the risk of conflict.		12.5.2	<table border="1"> <thead> <tr> <th></th> <th>Very low</th> <th>Medium</th> <th>Very high</th> </tr> </thead> <tbody> <tr> <td>Present</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Near term (2030 – 2040)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>Long term 2°C (2080 – 2100)</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> <tr> <td>4°C</td> <td colspan="3">[Bar chart showing risk level]</td> </tr> </tbody> </table>		Very low	Medium	Very high	Present	[Bar chart showing risk level]			Near term (2030 – 2040)	[Bar chart showing risk level]			Long term 2°C (2080 – 2100)	[Bar chart showing risk level]			4°C	[Bar chart showing risk level]		
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Long term 2°C (2080 – 2100)	[Bar chart showing risk level]																							
4°C	[Bar chart showing risk level]																							

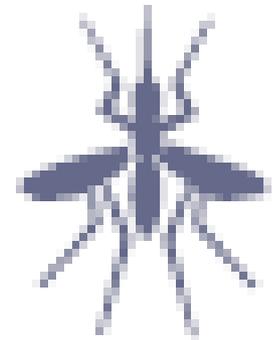
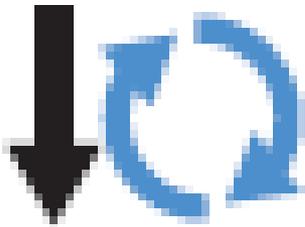
### Climatic drivers of impacts

 Warming trend	 Extreme temperature	 Drying trend	 Extreme precipitation	 Sea level
 Storm surge	 Carbon dioxide concentration	 Extreme wind episodes	 Ocean acidification	

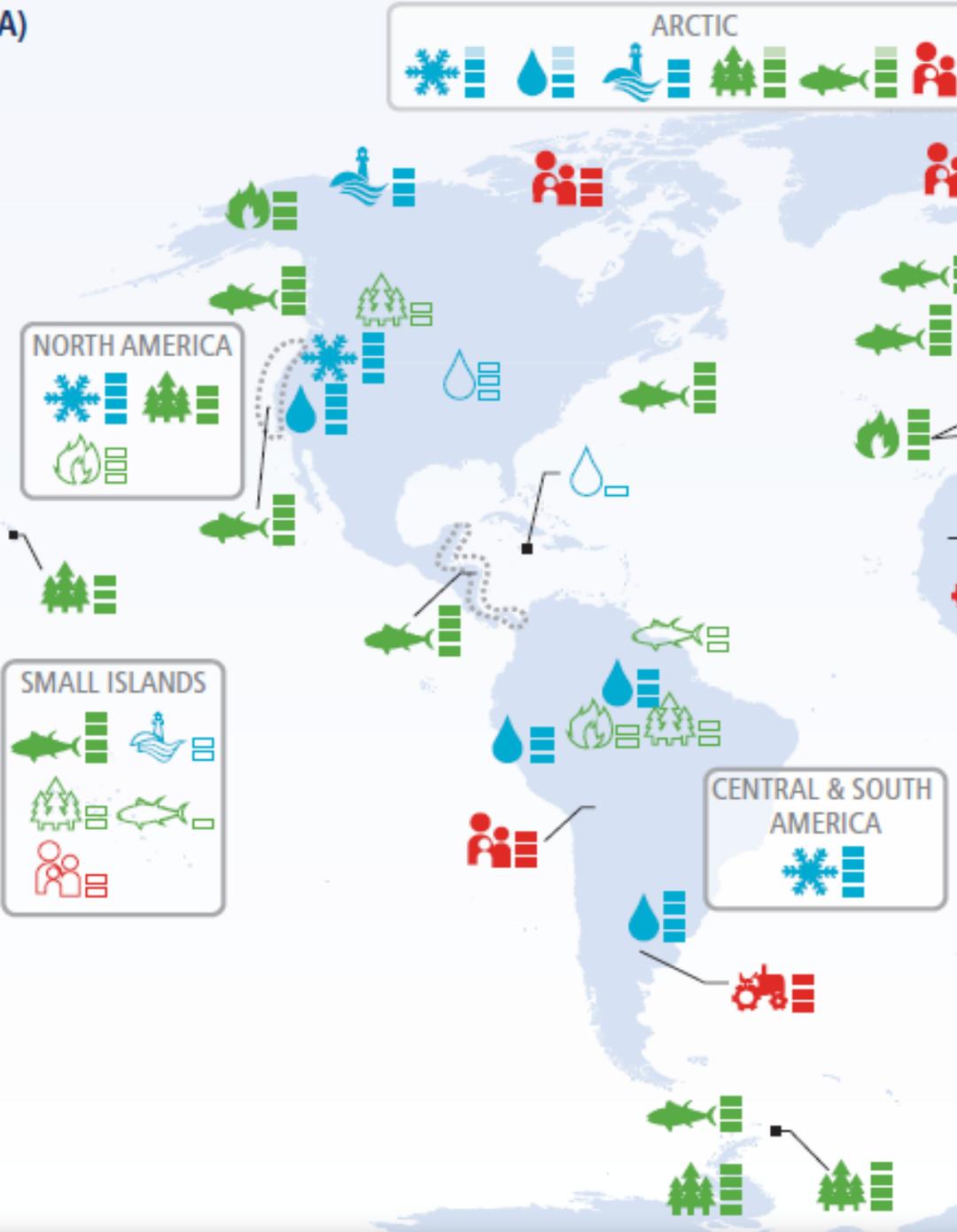
### Risk & potential for adaptation



# Impacto por el cambio climático



(A)



# Cambio climático e impactos globales en el sistema físico, biológico y humano en América

## Physical systems

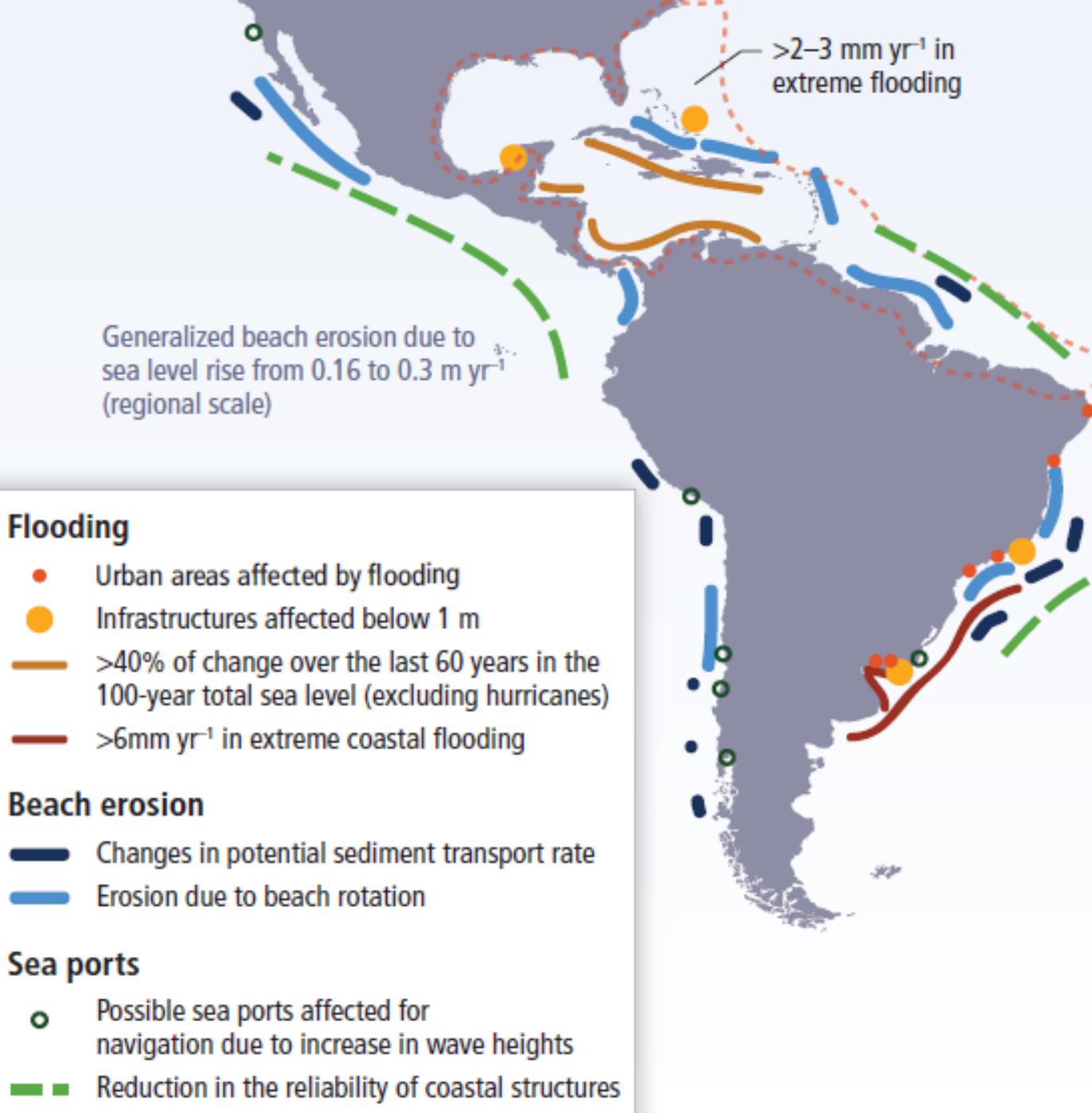
		Glaciers, snow, ice, and/or permafrost
		Rivers, lakes, floods, and/or drought
		Coastal erosion and/or sea level effects

## Biological systems

		Terrestrial ecosystems
		Wildfire
		Marine ecosystems

## Human and managed systems

		Food production
		Livelihoods, health, and/or economics



# Impactos en América Latina por el aumento en el nivel del mar

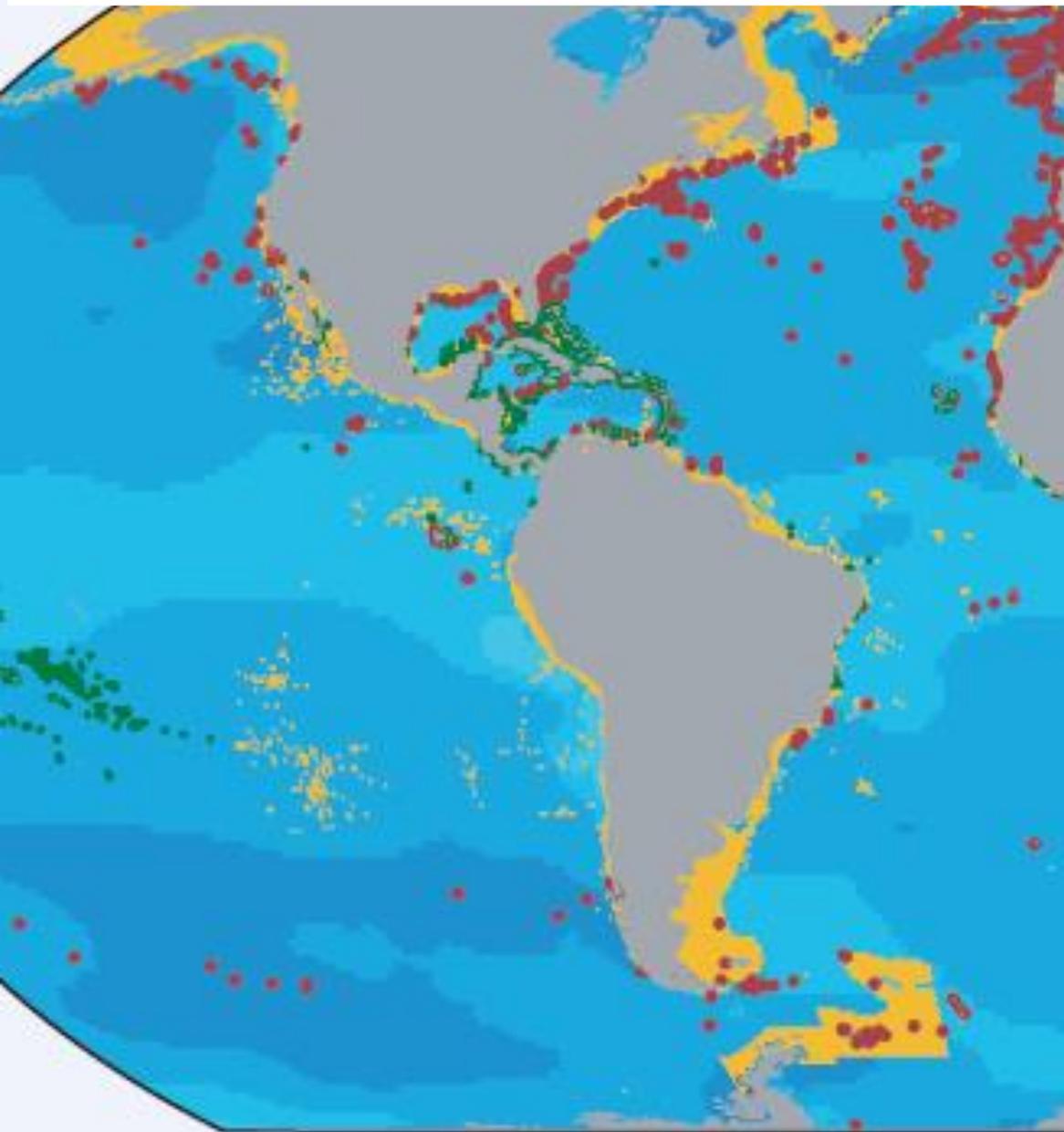
Change in pH (2081–2100 compared to 1986–2005, RCP8.5)



Mollusk and crustacean fisheries  
(present-day annual catch rate  $\geq 0.005$  tonnes  $\text{km}^{-2}$ )

Cold-water corals

Warm-water corals

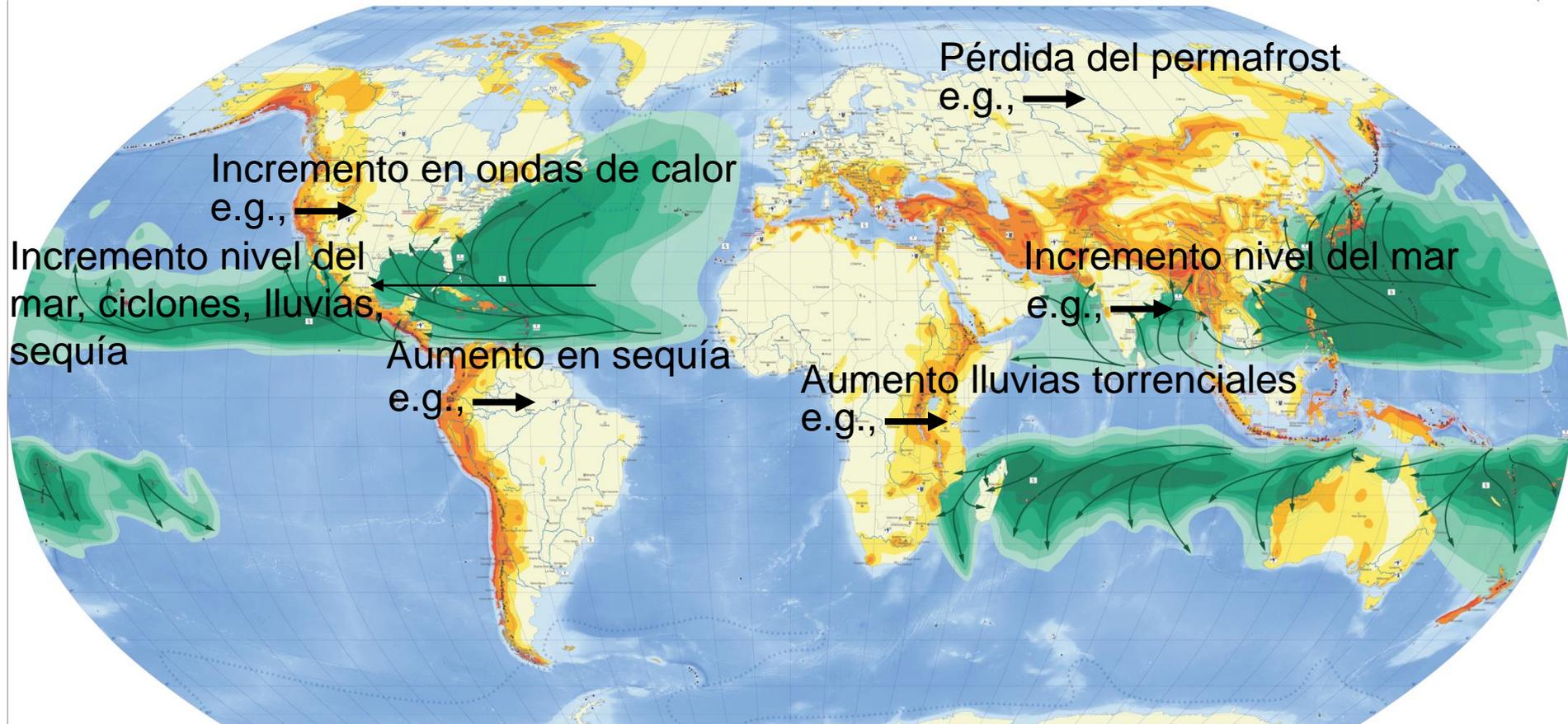


# Impactos del CC en arrecifes, moluscos y crustáceos en América

# 4. Desastres



# México altamente expuesto ante el cambio climático: Seguridad ambiental



## Temblores

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

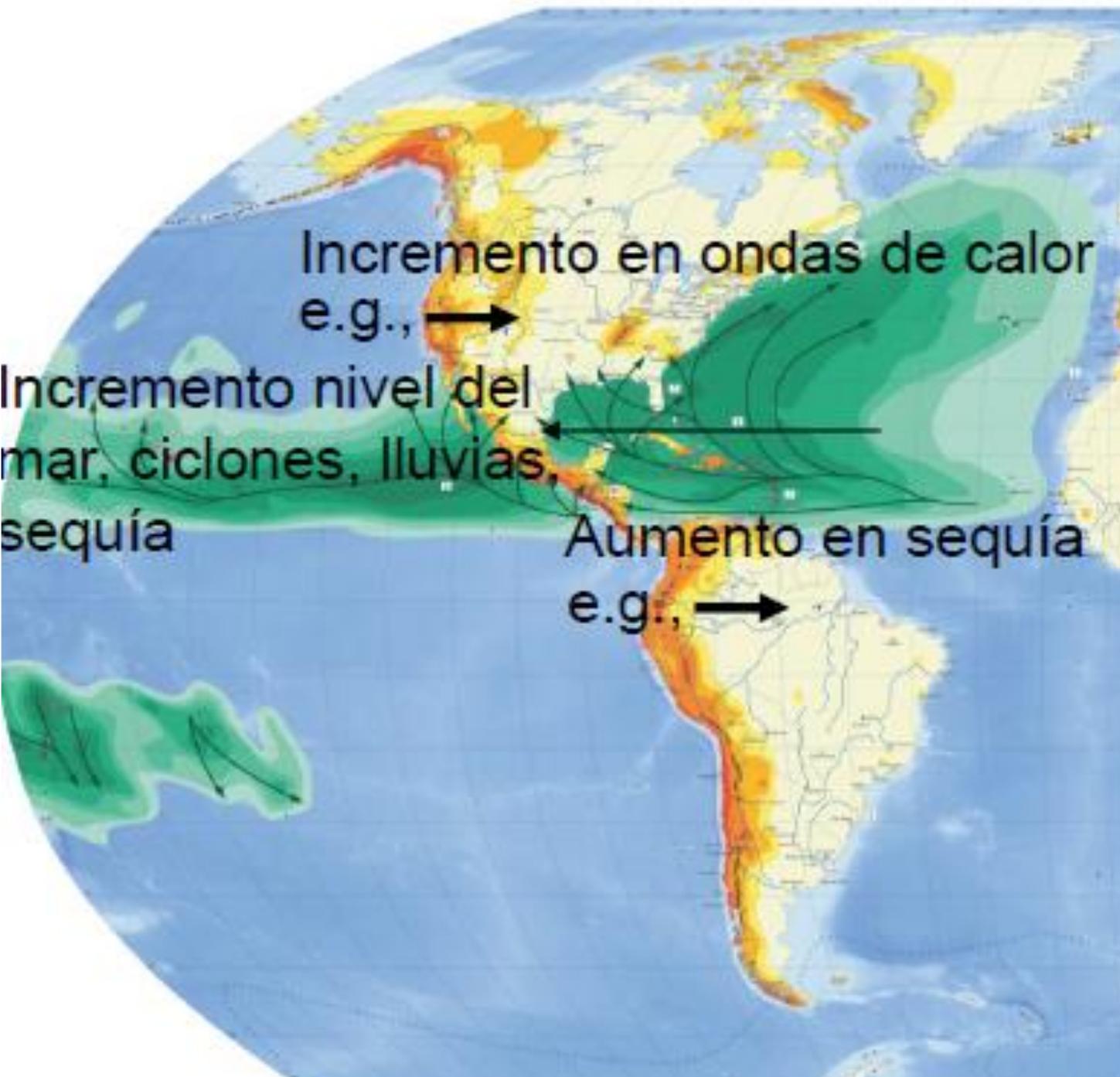
MM: modified Mercalli scale

## Huracanes tropicales

- 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:  $\geq 300$  km/h



Münchener Rück  
Munich Re Group



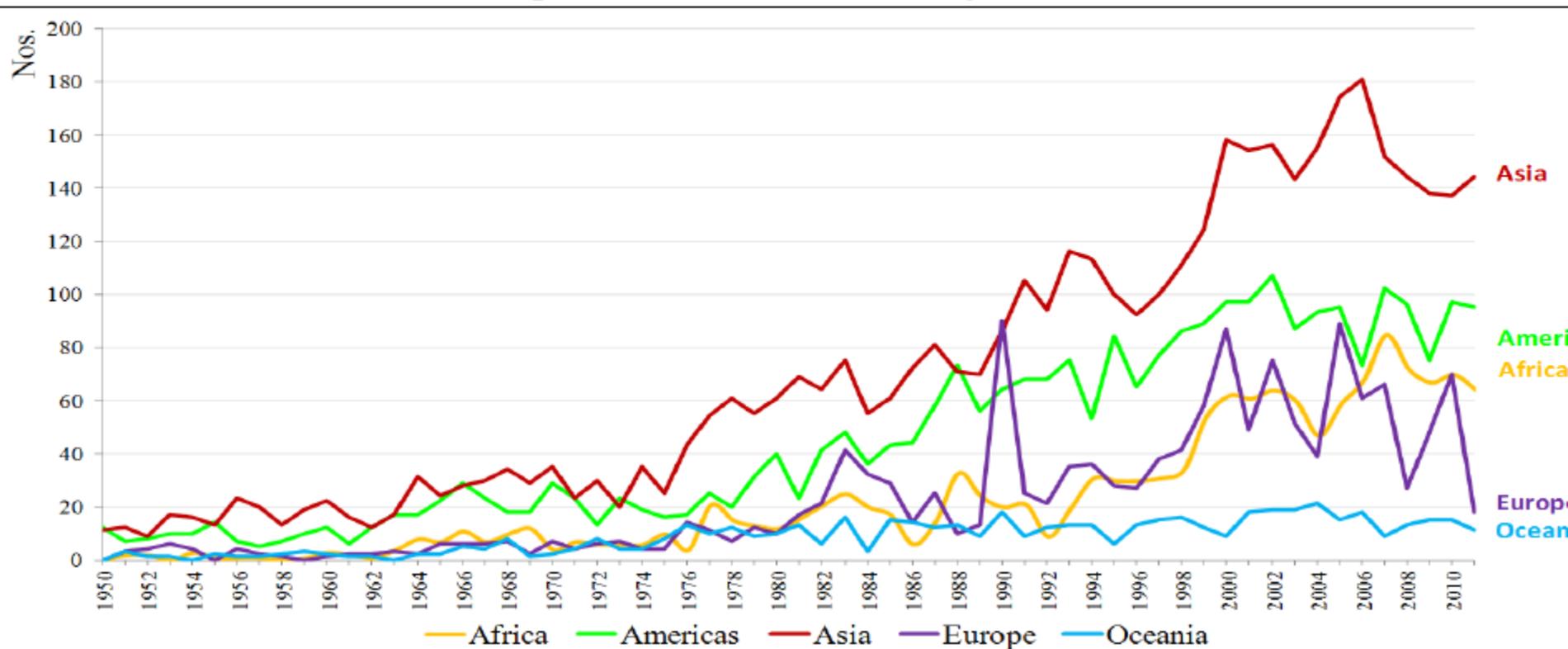
Incremento en ondas de calor  
e.g., →

Incremento nivel del  
mar, ciclones, lluvias,  
sequía

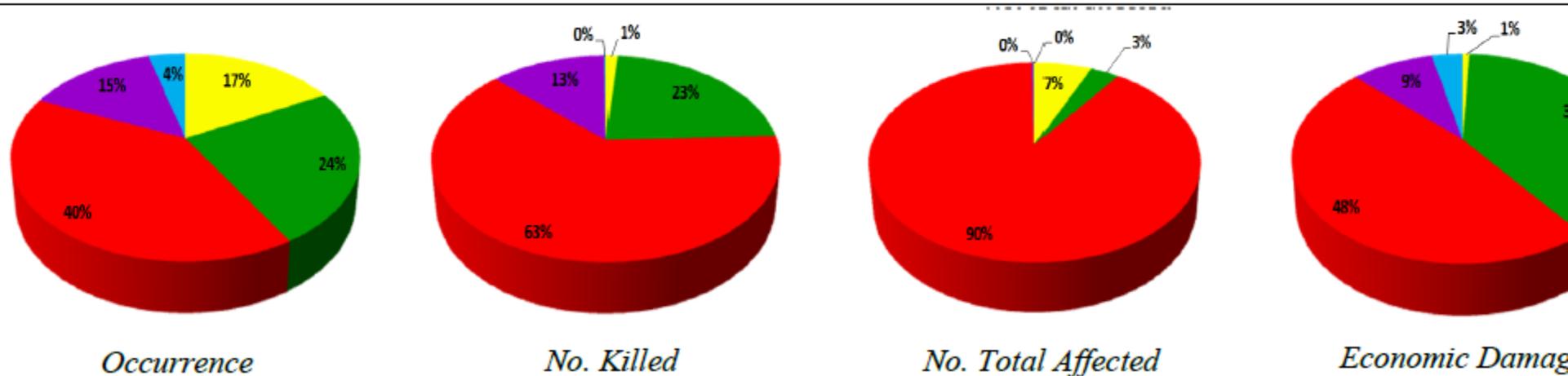
Aumento en sequía  
e.g., →

# Riesgos en México (MunichRe 2008)

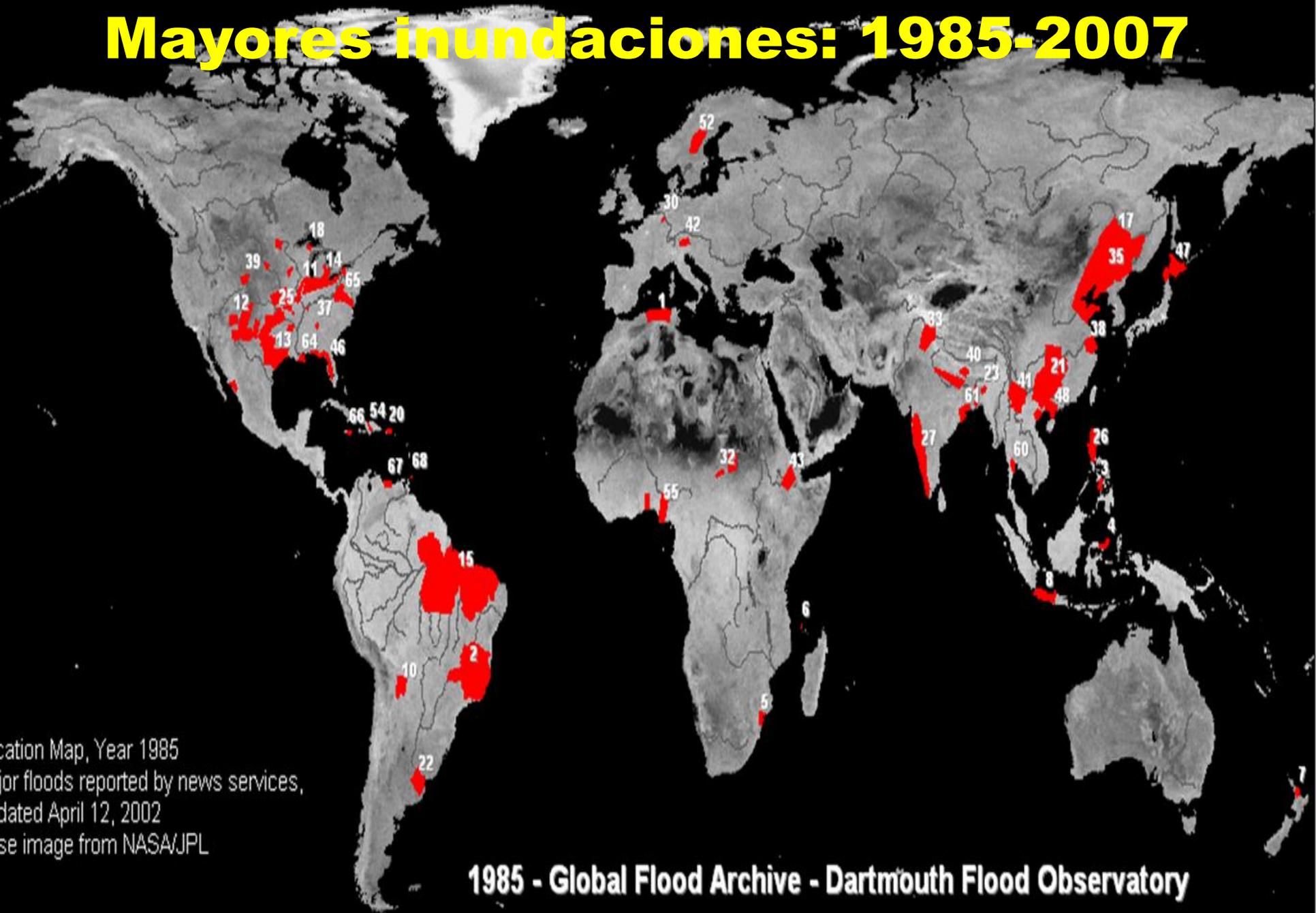
## Occurrence of reported natural disasters by continent: 1950 to 2011



## Asia's share: 2002-2011

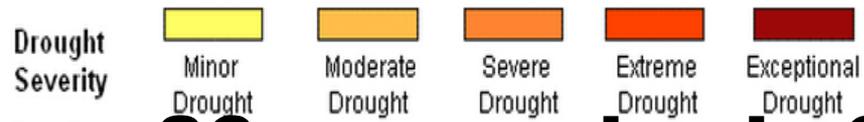
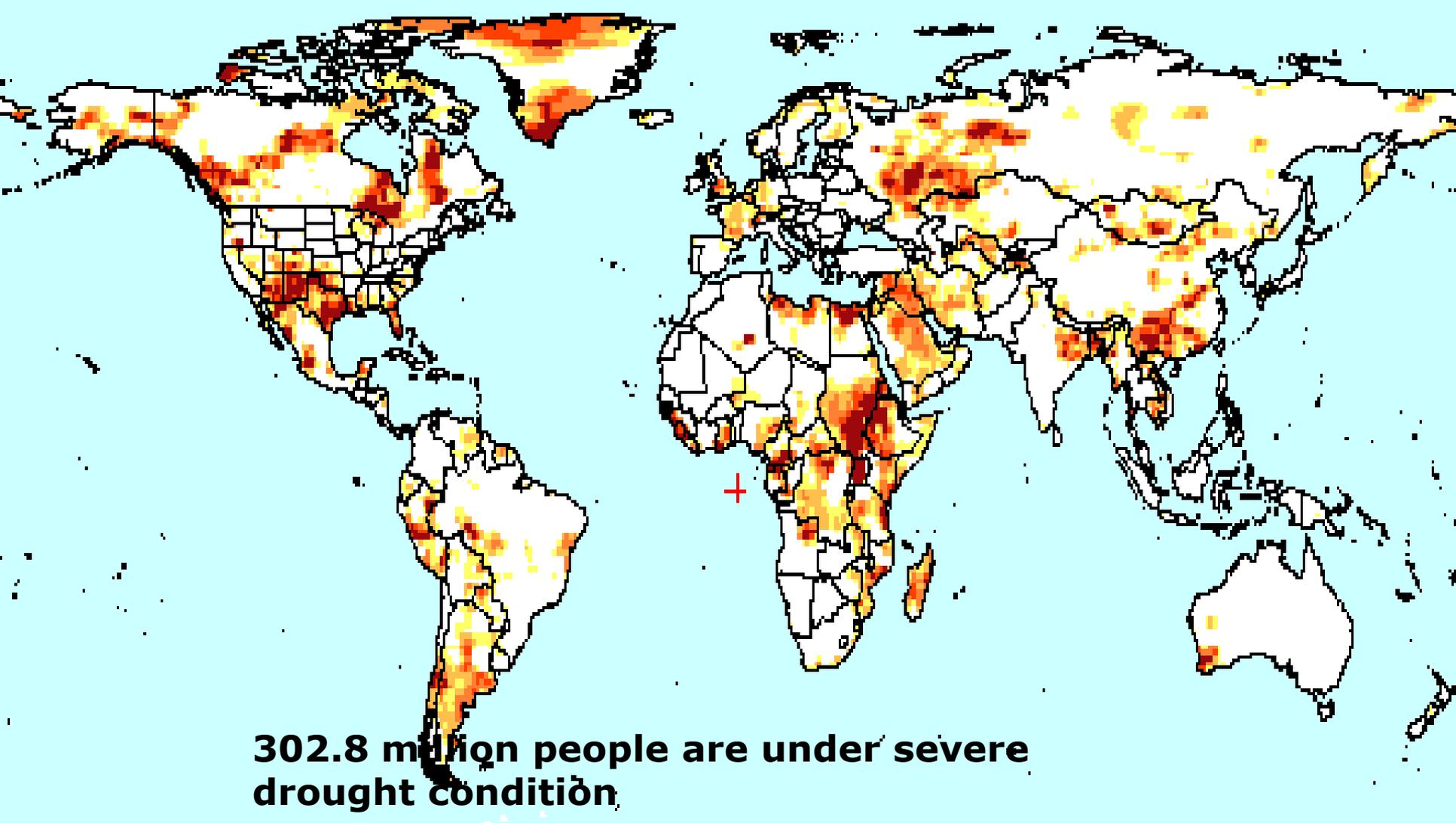


# Mayores inundaciones: 1985-2007



Information Map, Year 1985  
for floods reported by news services,  
dated April 12, 2002  
use image from NASA/JPL

1985 - Global Flood Archive - Dartmouth Flood Observatory



**Sequías: 36 meses desde Sept 2011**

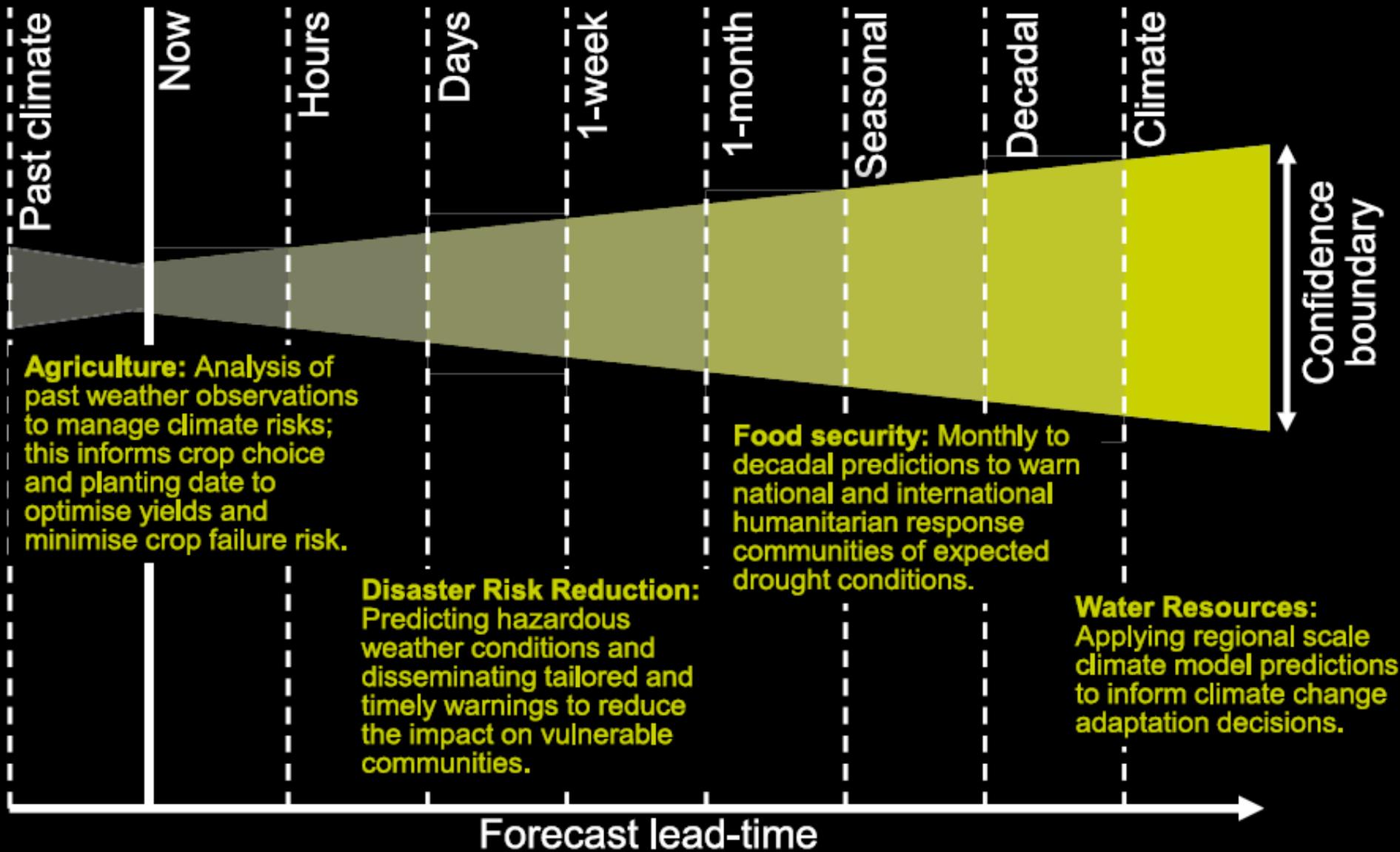
Data from UCL global drought monitor. Based on 36 months standardized precipitation in



Met Office

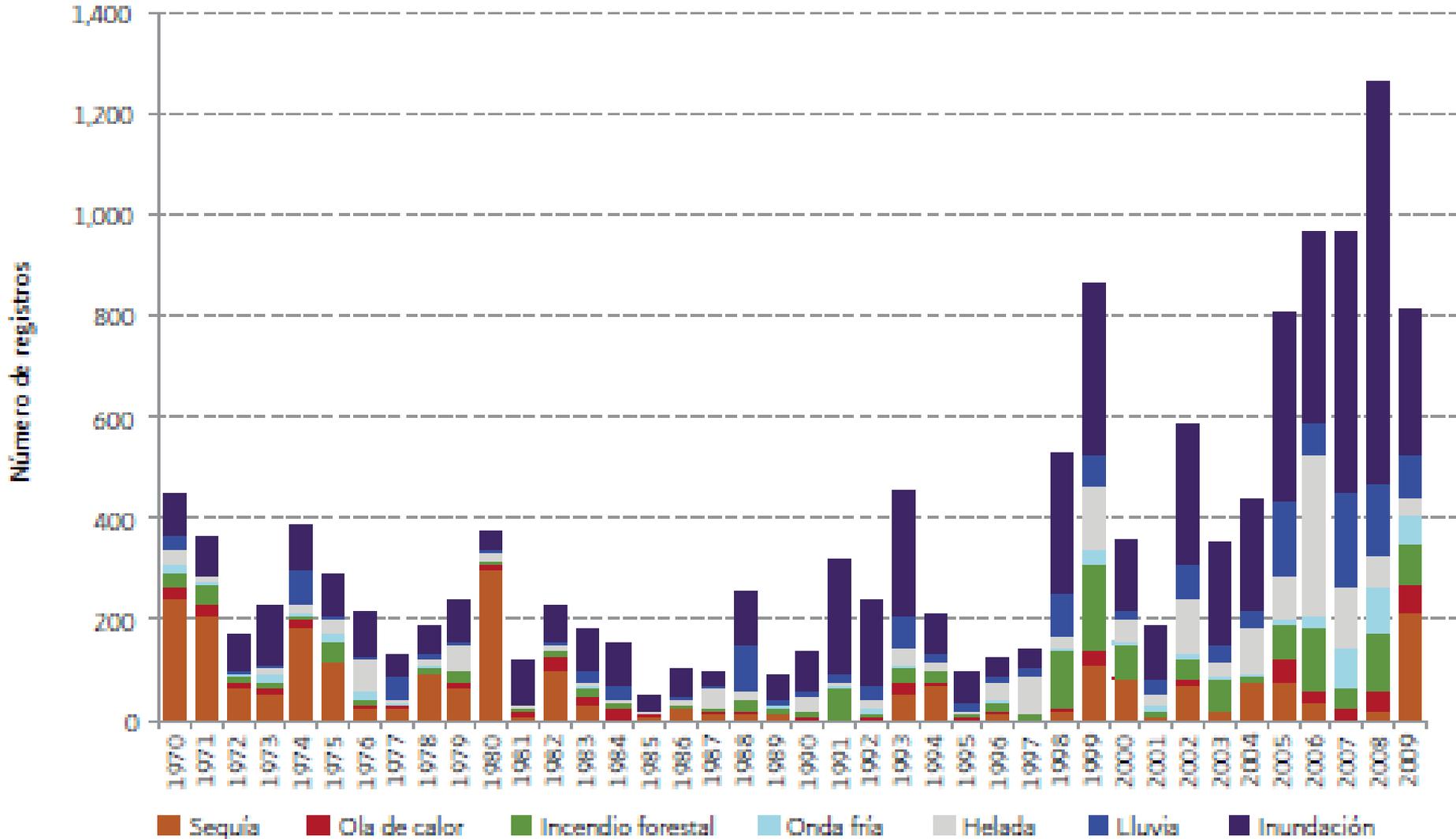
# Prediction on all timescales

Supporting decision making for international development

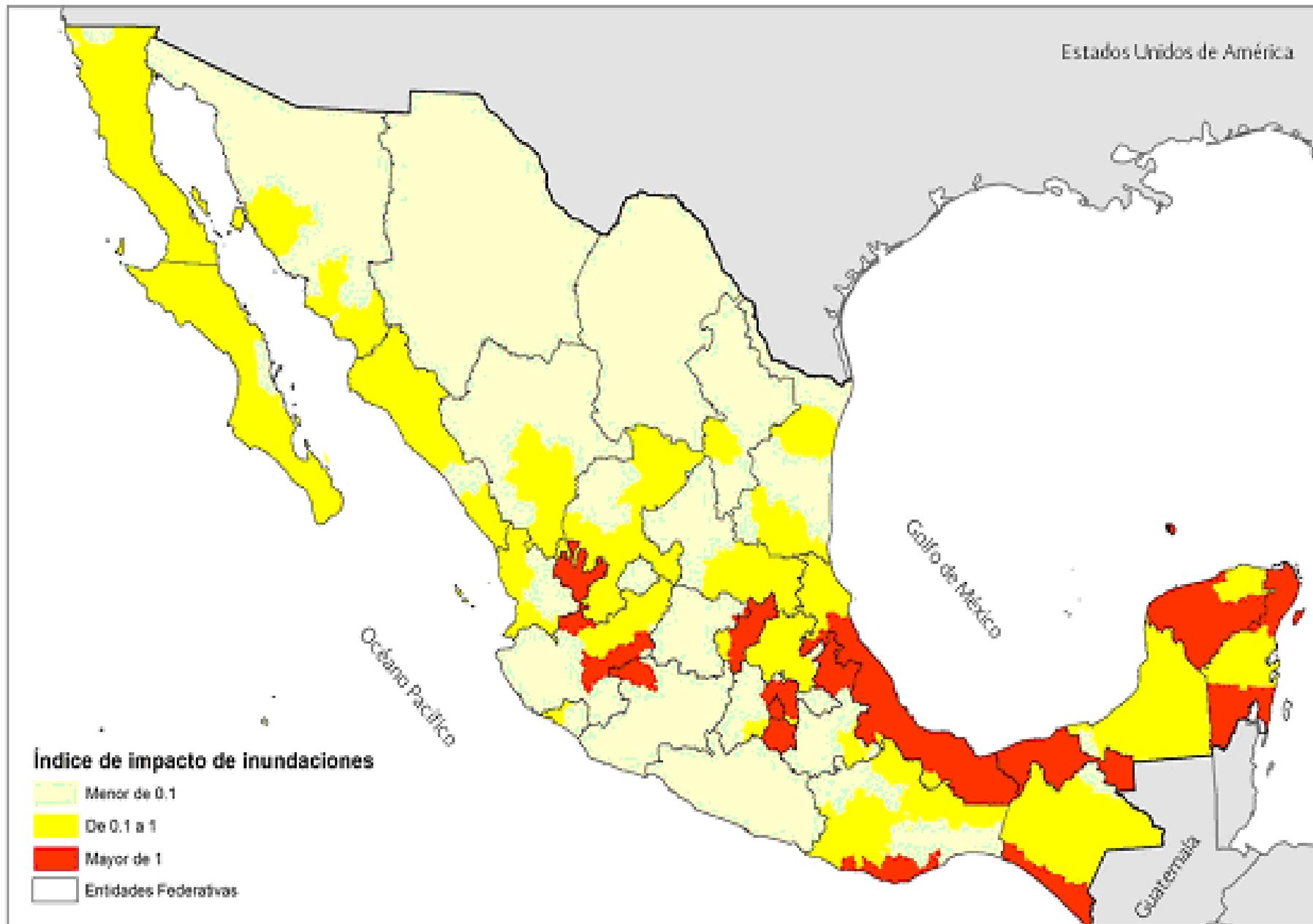


# Eventos extremos y desastres

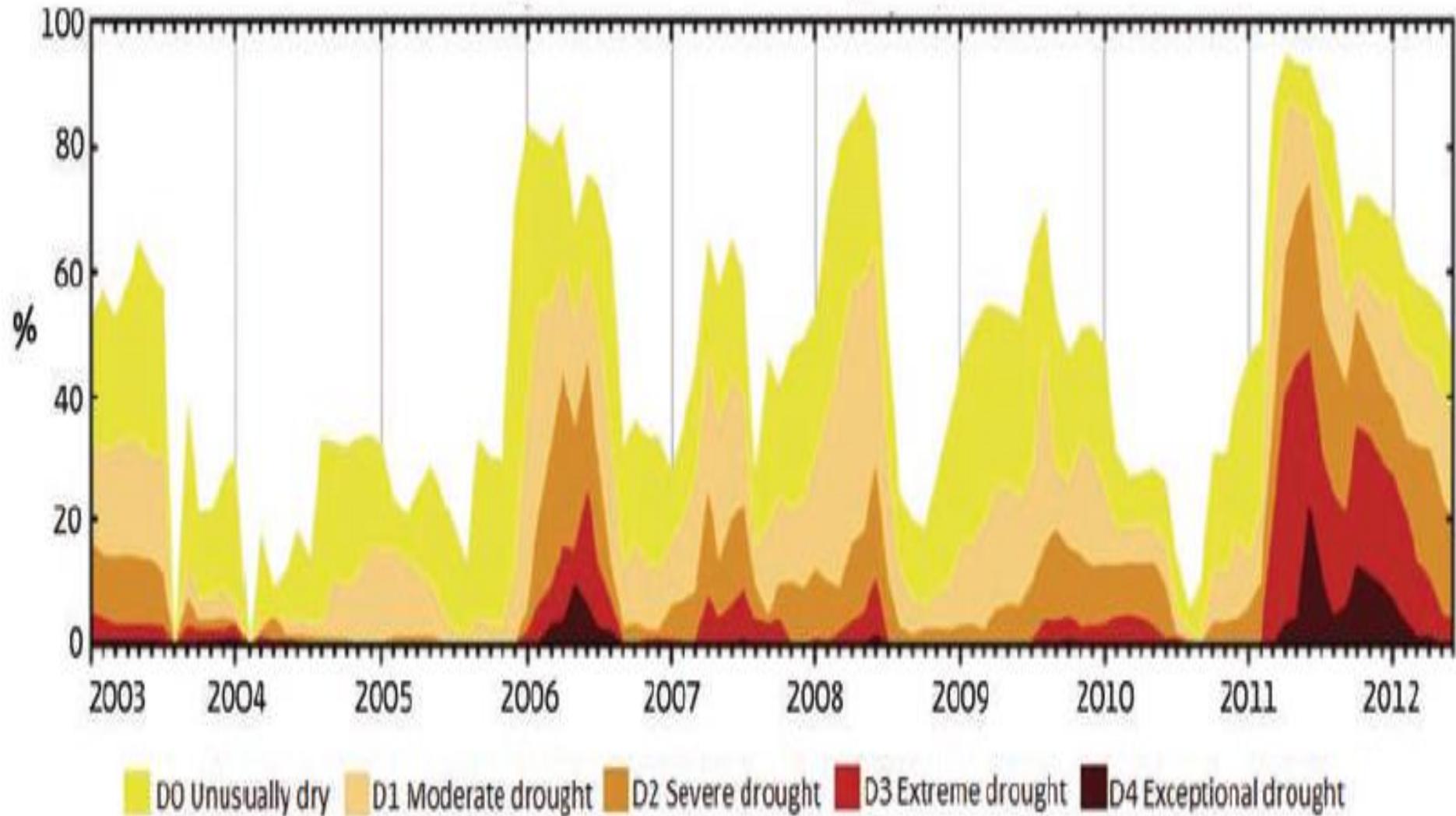
(La Red, 2013)



# Impacto de inundaciones (Conagua, 2014)



# Sequías en México



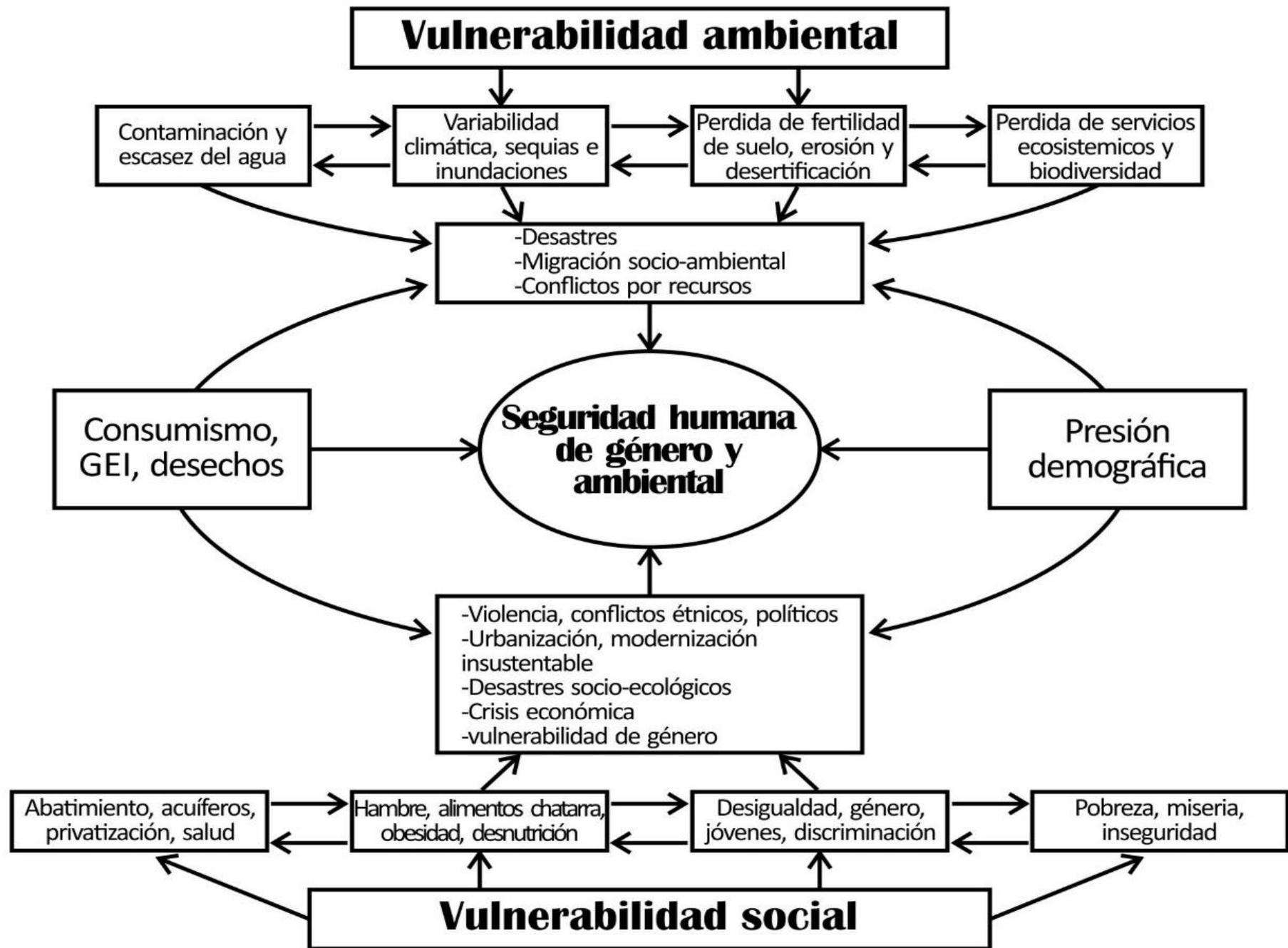
*Affected surface (%) in Mexico due to the drought from 2003 to 2012*

# 5. Vulnerabilidad social



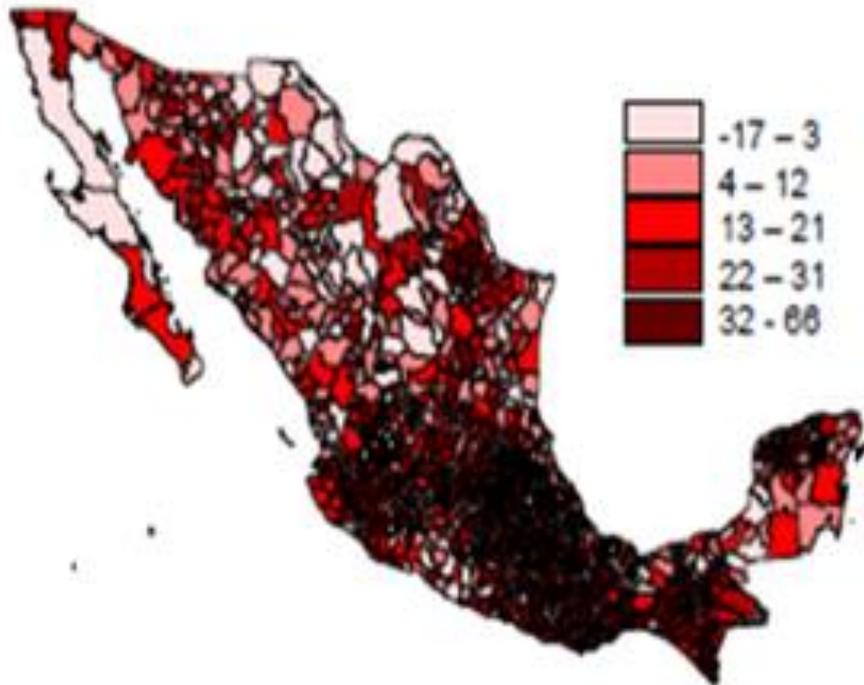
# **Vulnerabilidad, impactos, eventos y riesgos**

- **Vulnerabilidad:** La propensión o predisposición a verse afectado.
- **Impactos:** Efectos sobre los sistemas naturales y humanos que afectan la vida, la supervivencia, la salud, los ecosistemas, las economías, las sociedades, las culturas, los servicios y la infraestructura.
- **Eventos:** Los impactos del cambio climático incluyen inundaciones, sequías, deslizamiento de tierras, incendios forestales y aumento en el nivel del mar.
- **Riesgo:** La posibilidad que la vida, su calidad, la salud y la vivienda están amenazadas por **una interacción entre vulnerabilidad, impactos y gravedad del evento.**



# **Doble vulnerabilidad: pobre y expuesta a eventos extremos**

**Izq: con menos de 2 US\$/día; der. Desastres con costos mayores de 500,000US\$**



**40% de las tierras y bosques fueron destruidos**



**Poco sobrevivió**



**Una niña encargada de sus dos hermanos**

**Muchas gracias por su atención**  
**[http://www.afes-press.de/html/download\\_oswald.html](http://www.afes-press.de/html/download_oswald.html)**

