

# *IPCC Fifth Assessment Report* **Climate Change Impacts and Adaptation: Present and Future**

*or*

## **Working Group II: The Good, the Bad, and the Ugly**



Georgia Tech's School of Public Policy &  
Climate and Energy Policy Laboratory  
April 1, 2015

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Climate Change Science Institute  
Oak Ridge National Laboratory



**CLIMATE CHANGE SCIENCE INSTITUTE**  
OAK RIDGE NATIONAL LABORATORY



Great day for fog sports.



# New Climate Change Study Just ~~400~~<sup>1,820</sup> Pages Of Scientists Telling Americans To Read Previous Climate Change Studies

NEWS IN BRIEF · Science & Technology · Science · ISSUE 51-02 · Jan 14, 2015

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WASHINGTON—Co-authored by several dozen of the nation's top climatologists, a new climate change study released Wednesday by the U.S. Global Change Research Program reportedly consists of 400 pages in which scientists just tell Americans to read previous climate change studies. "Not sure if you saw this one from the Intergovernmental Panel on Climate Change from 2012 about how rising sea levels are putting billions of people in coastal cities at risk, or L.G. Thompson's 2009 paper on the loss of Kilimanjaro's glaciers, but really, you should check them out," read the study in part, which is titled "The Global Climate At Risk: A Broad Survey Of Climate Change Reports That We've Been Publishing For Decades And That You Should Actually, Seriously Read." "Look, there are hundreds of studies on Greenland's rapidly melting ice sheet



### RECENT NEWS

Man Thinks Going To Vegas For Things Other Than Gambling Somehow Less Sad

Troubling Report Finds Dreamily Sliding Down Back Of Door After Kissing Date On Porch Plummets 78%

Study Finds Growing Number Of Americans Would Be Comfortable With Female Pep Boy

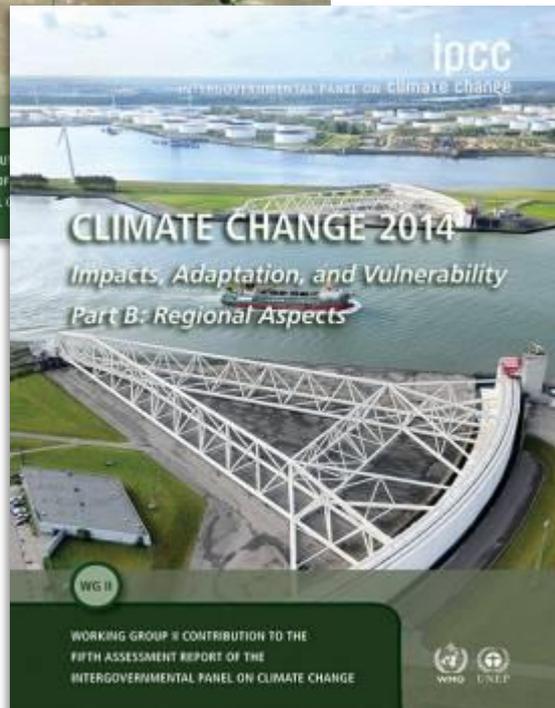
College Newspaper Staff Know Exactly How They Would Respond If Editorial Freedom Challenged

Siblings Quietly Relieved Oldest Brother Setting Bar So Low

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# WGII report in context



- 4 years
- 1,820 pages across two volumes
- 308 authors from 70 countries
- Four drafts
- Four lead authors meetings
- 50,492 peer review comments
- Week long summary approval process
- Post release media/communications



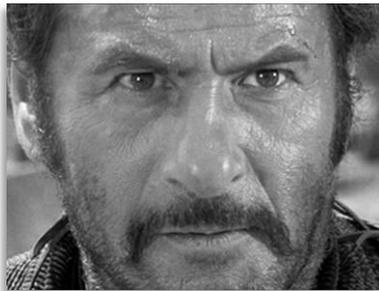
# Outline



- Where has research made important advances?



- What's still missing?



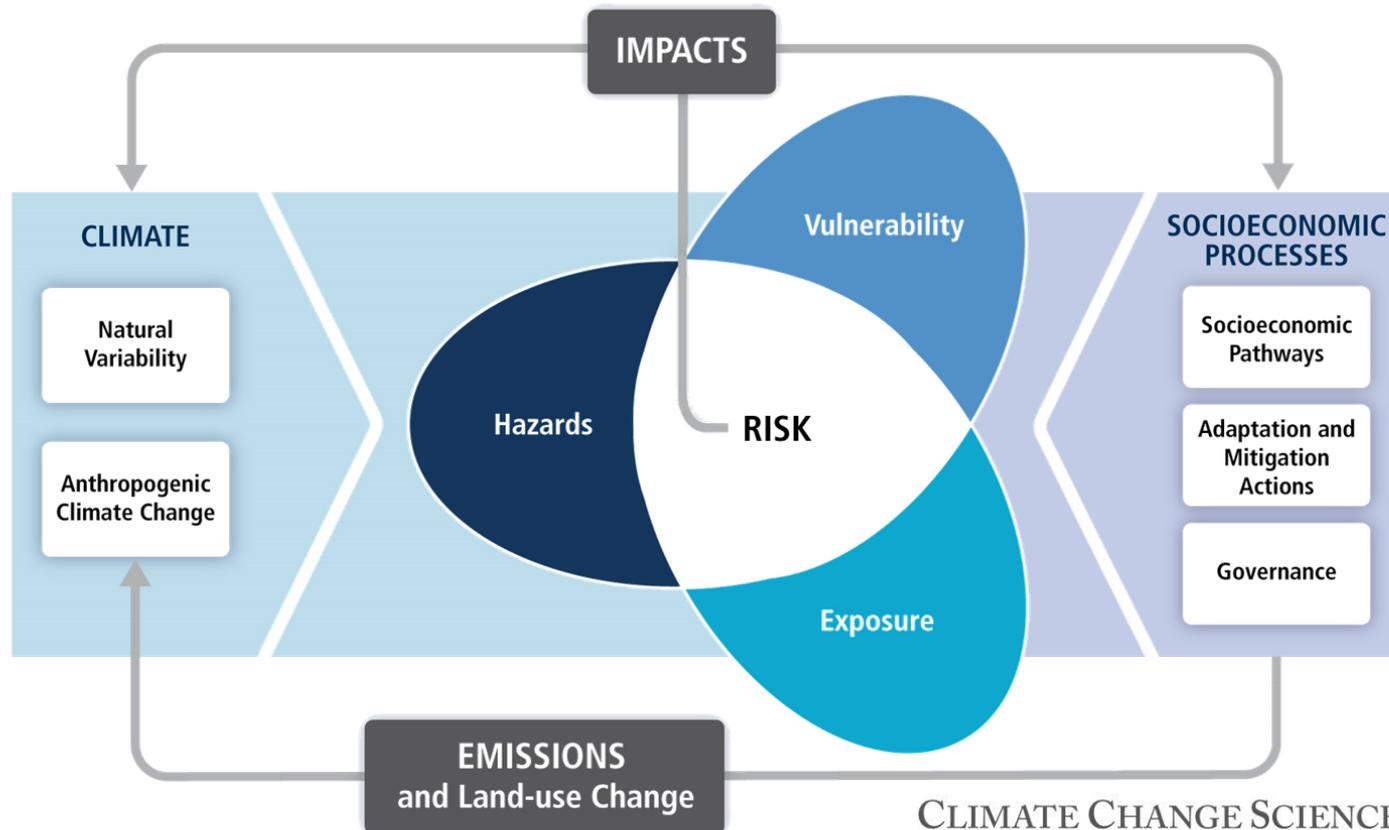
- What should be viewed suspiciously?



# Working Group II has embraced the concept of risk as an organizing framework for assessment

*“Risk is a function of hazards, exposure, and vulnerability”*

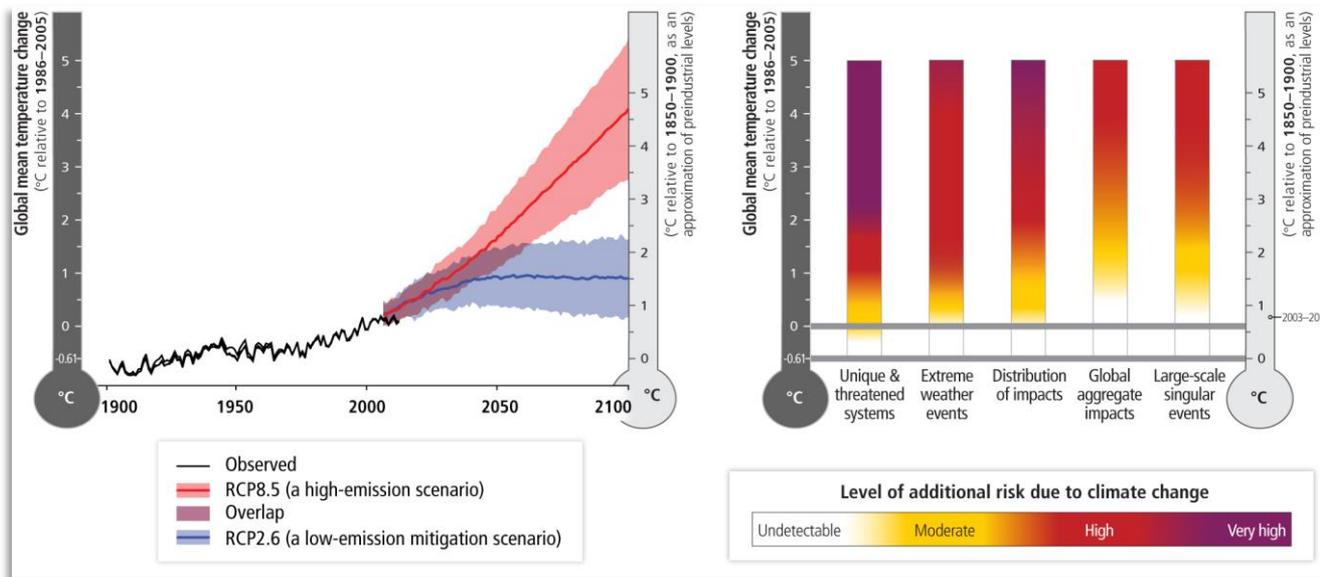
- Pursued in the AR4, but fell short
- Included in the SREX
- A consistent theme throughout the AR5



# The underpinning literature for WGII has expanded significantly

- We know more about ‘known knowns’

- “Increasing magnitudes of warming increase the likelihood of severe, pervasive, and irreversible impacts.” (WGII SPM)
- Expansion of sector and region-specific understanding of climate change consequences



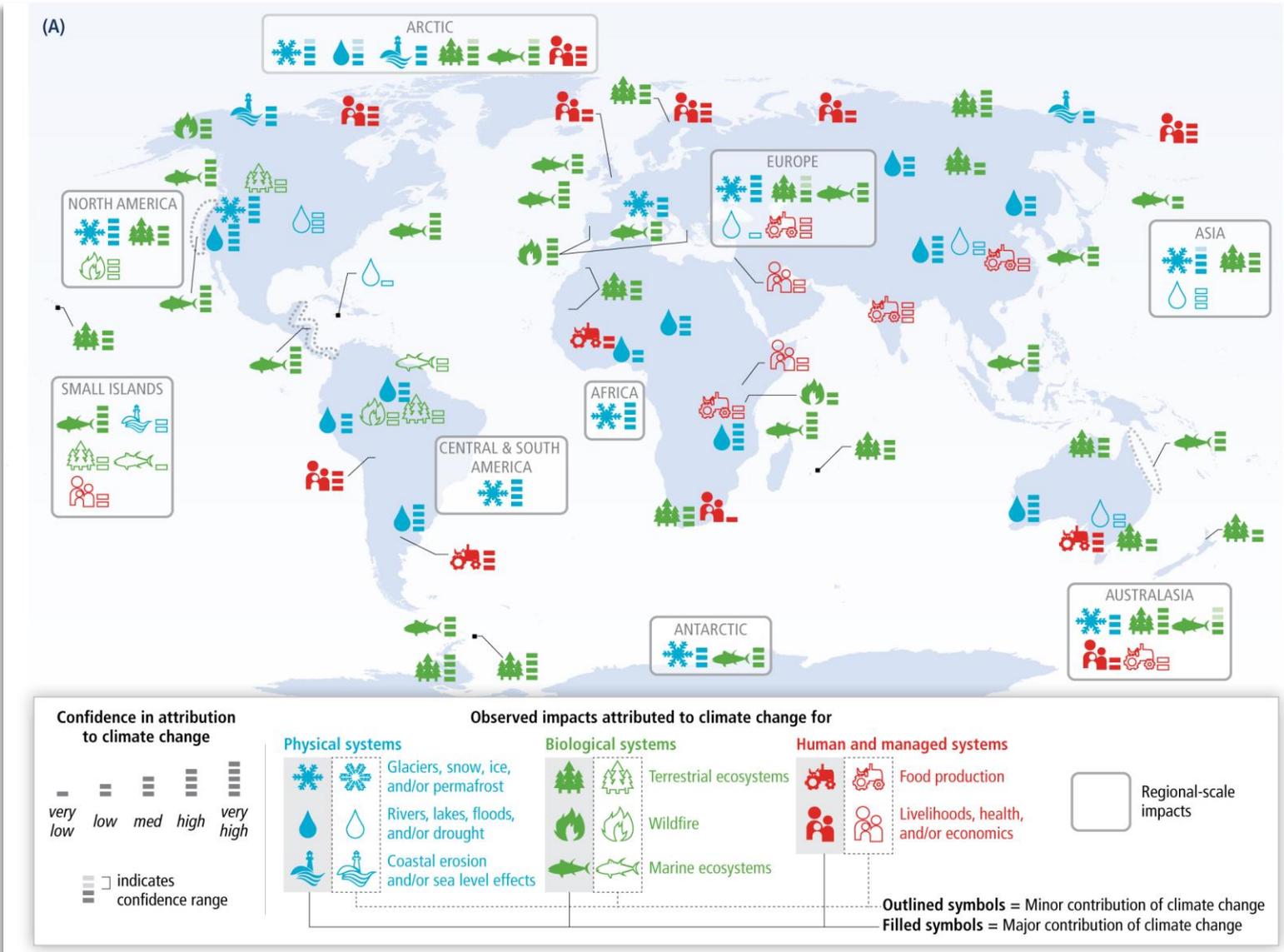
- We know more about ‘known unknowns’

- Observed impacts of climate change
- Adaptation planning & constraints



# Impacts of climate change are already being observed

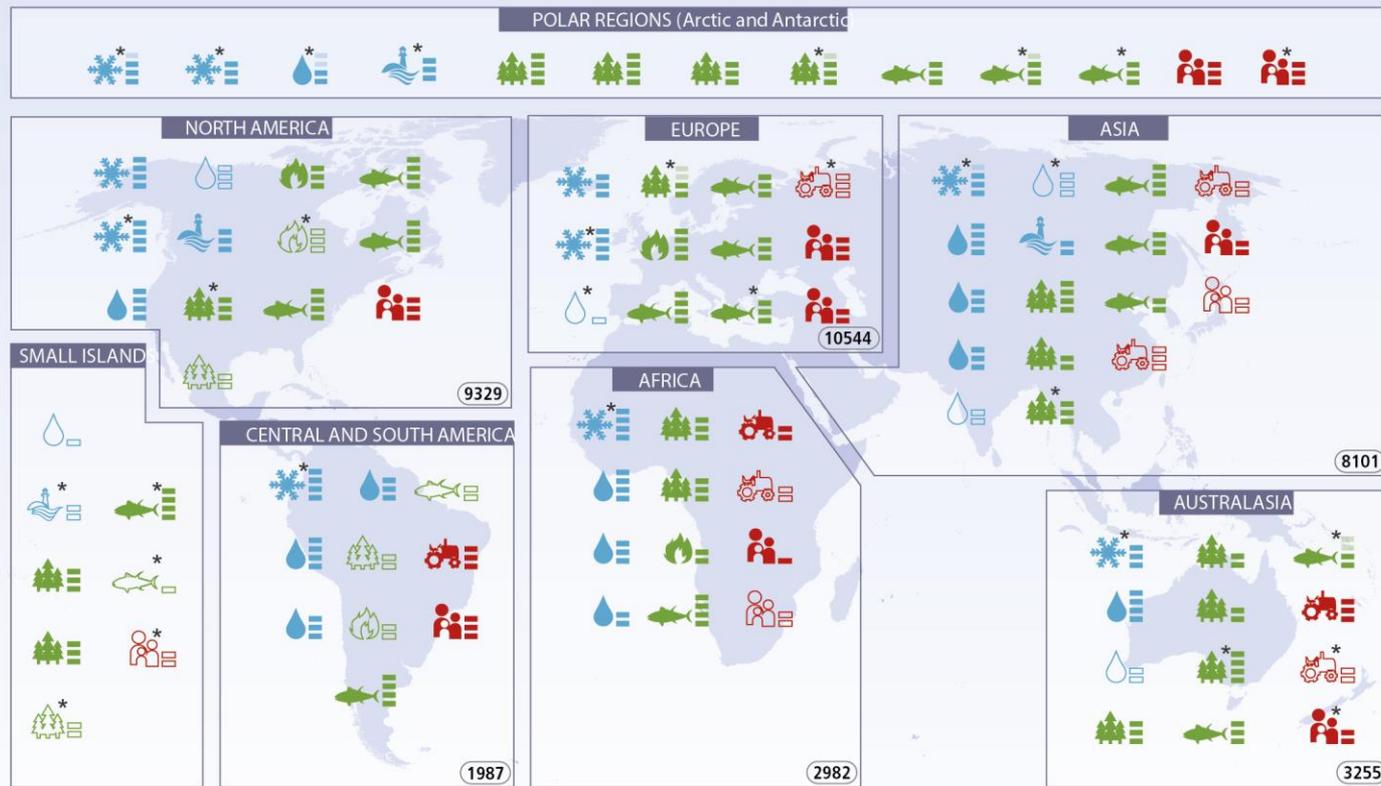
## Working Group II Report



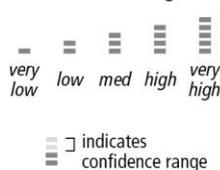
# Impacts of climate change are already being observed

## Synthesis Report

(a) Widespread impacts attributed to climate change based on the available scientific literature since the AR4



Confidence in attribution to climate change



Observed impacts attributed to climate change for

Physical systems



Biological systems



Human and managed systems

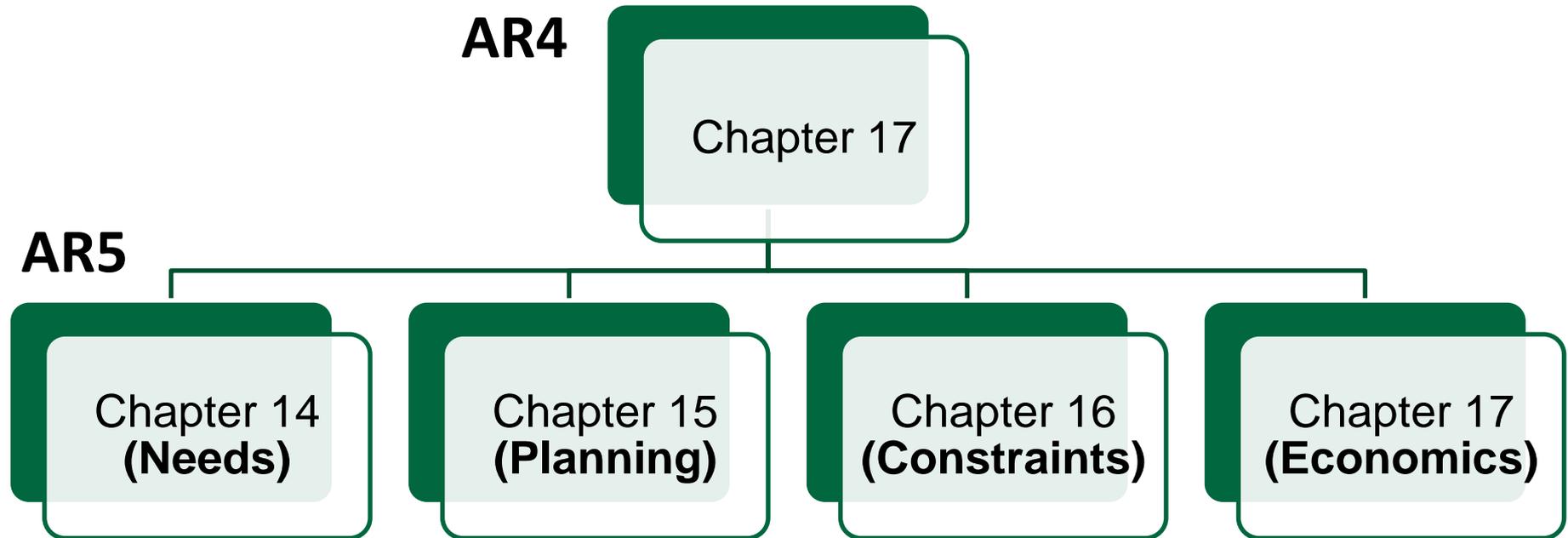


\* Impacts identified based on availability of studies across a region

Outlined symbols = Minor contribution of climate change  
Filled symbols = Major contribution of climate change



# The WGII report represents a turning point with respect to the treatment of adaptation



- Adaptation is now a mainstream risk management strategy across different levels of organization (local → global)
- Adaptation finance, limits to adaptation, and loss & damage are now key points of negotiation under the United Nations Framework Convention



# AR5 adaptation highlights

## Ch 14: Adaptation Needs

*“Since the Fourth Assessment Report (AR4), the framing of adaptation has moved further from a focus on biophysical vulnerability to the wider social and economic drivers of vulnerability and people’s ability to respond.”*

## Ch 16: Opportunities & Constraints

*“Understanding of how the adaptive capacity of societal actors and natural systems influences the potential for adaptation to effectively manage climate risk has improved since the Fourth Assessment Report.”*

## Ch 15: Adaptation Planning

*“Adaptation to climate change is transitioning from a phase of awareness to the construction of actual strategies and plans in societies.”*

## Ch 17: Economics

*“In the presence of limited resources and a range of objectives, adaptation strategy choices involve trade-offs among multiple policy goals.”*

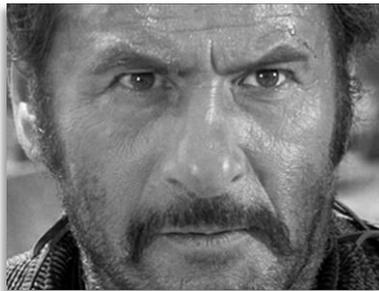
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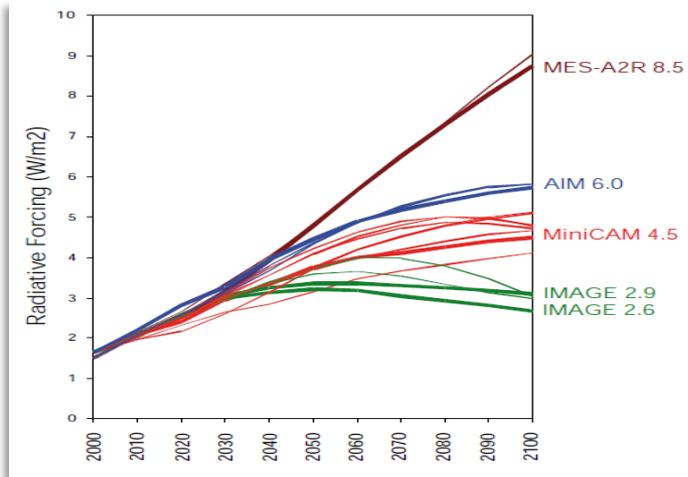


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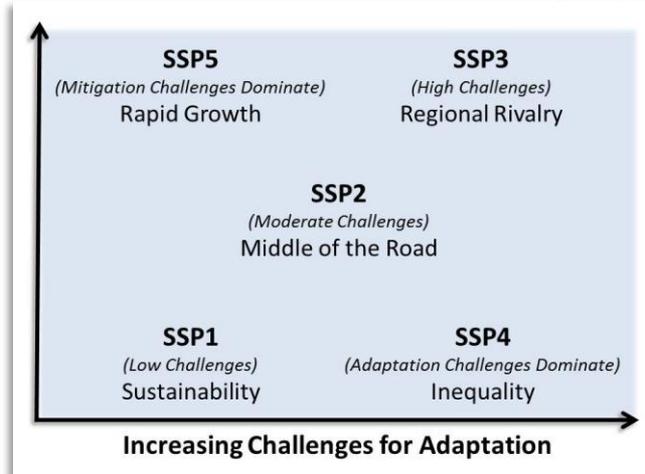
# The AR5 lacks a consistent set of scenarios for exploring future conditions and outcomes

## Representative Concentration Pathways (RCPs)



- Climate projections based on the RCPs are relatively recent
- RCPs lack extensive information regarding socioeconomic futures
- SSP narratives were published post-AR5
- There is no consistent way of communicating about alternative climate and socioeconomic pathways in the AR5

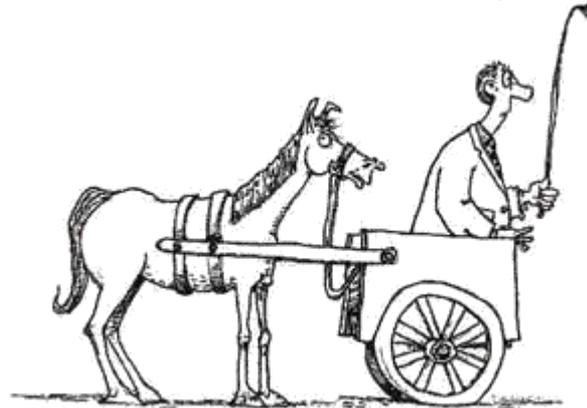
## Shared Socioeconomic Pathways (SSPs)



# Disconnects between WGI and WGII remain

- **Very little of the latest science reported in the AR5 WGI report is used in the WGII report**
  - Time lags in publishing
  - Underpinning framework for assessment (science-driven rather than value-driven)

**Societal Values**  
**System Thresholds**  
**Risk Tolerance**



**Biophysical drivers**  
**Climate projections**  
**Risk Tolerance**

- **A proper risk-based approach would analyze the likelihood of exceeding a pre-defined standard or threshold (Jones and Preston, 2010)**
  - WGII would establish the reasons for concern
    - Magnitudes of change and risks that are tolerable or intolerable
  - WGI would evaluate future climate against identified risks



# Robust participation by developing nation authors and practitioners remains challenging

- **Report authorship (and source literature) is heavily dominated by authors from developed nations**

- Easy access to literature
- Connections to research networks
- Few language barriers
- But, limited perspective

*“The structure and author composition of WGII, as it is, could limit the extent to which Indigenous content is captured and examined in AR5.”*

Ford et al. (2012)

- **Author selection favors academic researchers over practitioners (Viner & Howarth, 2014)**

- Architects?
- City planners?
- Water resource managers?
- Public health practitioners?
- Farmers?
- Emergency managers?

*“the IPCC should recognize that different people in different cultures possess different ways of seeing and knowing nature and society: science published in the “conventional style” (journals, books etc.) is not the only valid knowledge about climate and its changes.”*

Beck et al. (2014)



# Insights regarding policy-relevant questions remain elusive

- **What are the critical thresholds for human and natural systems?**
- **What is the likelihood of exceeding different thresholds over different time scales?**
- **At what point will climate and other changes exceed our capacity to adapt?**
- **What trade-offs are associated with alternative adaptation decisions?**
- **What level of compensation is appropriate for anticipated loss and damage?**





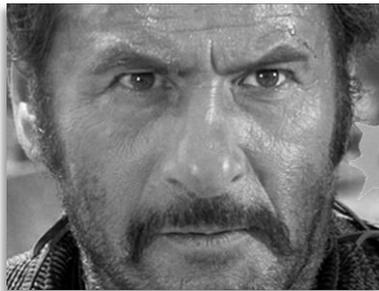
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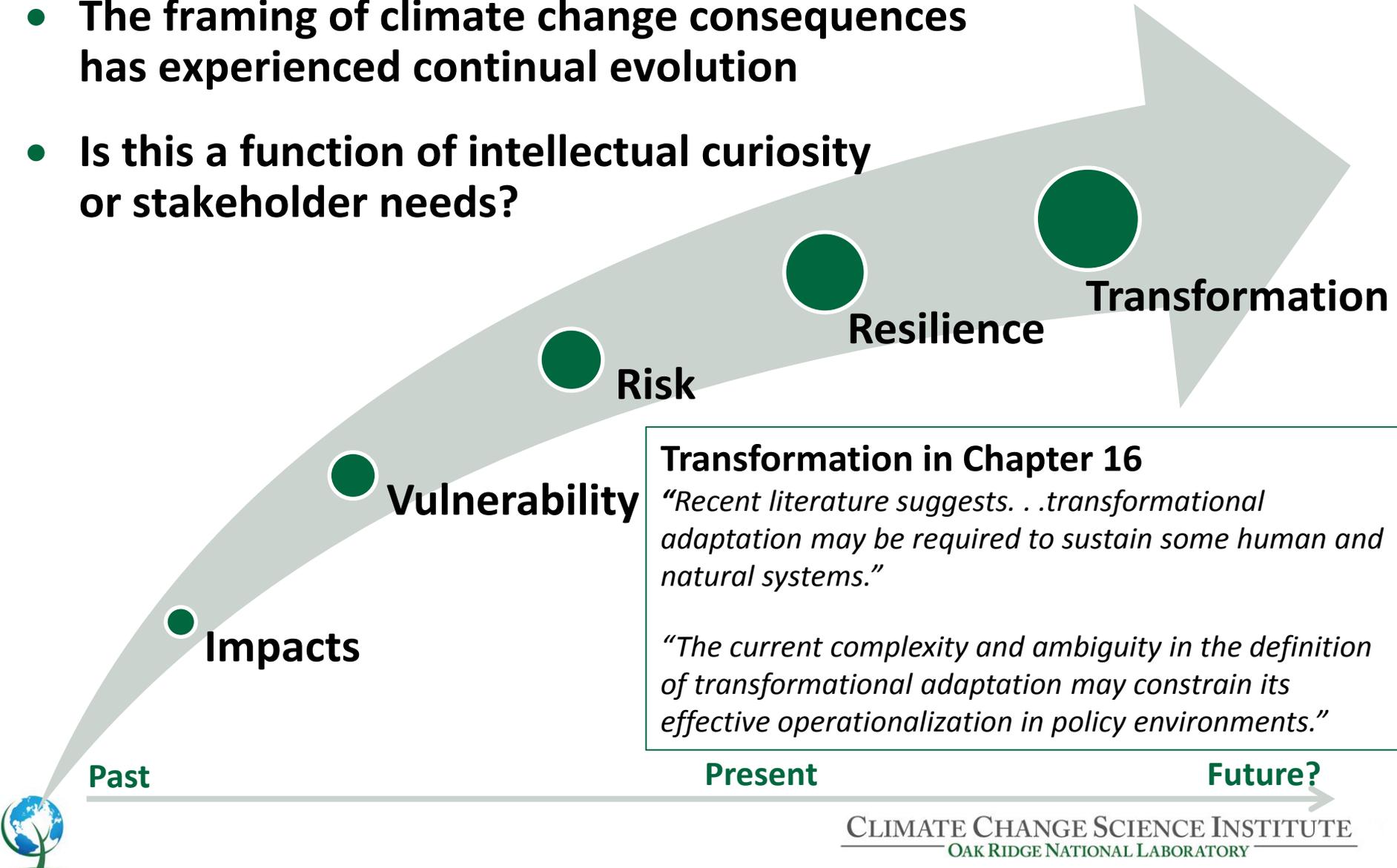


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# There are too many conceptual cooks in the assessment kitchen

- The framing of climate change consequences has experienced continual evolution
- Is this a function of intellectual curiosity or stakeholder needs?



**Transformation in Chapter 16**  
*“Recent literature suggests. . .transformational adaptation may be required to sustain some human and natural systems.”*

*“The current complexity and ambiguity in the definition of transformational adaptation may constrain its effective operationalization in policy environments.”*



# Aggregate assessments of risk are largely expert opinion and often rather speculative

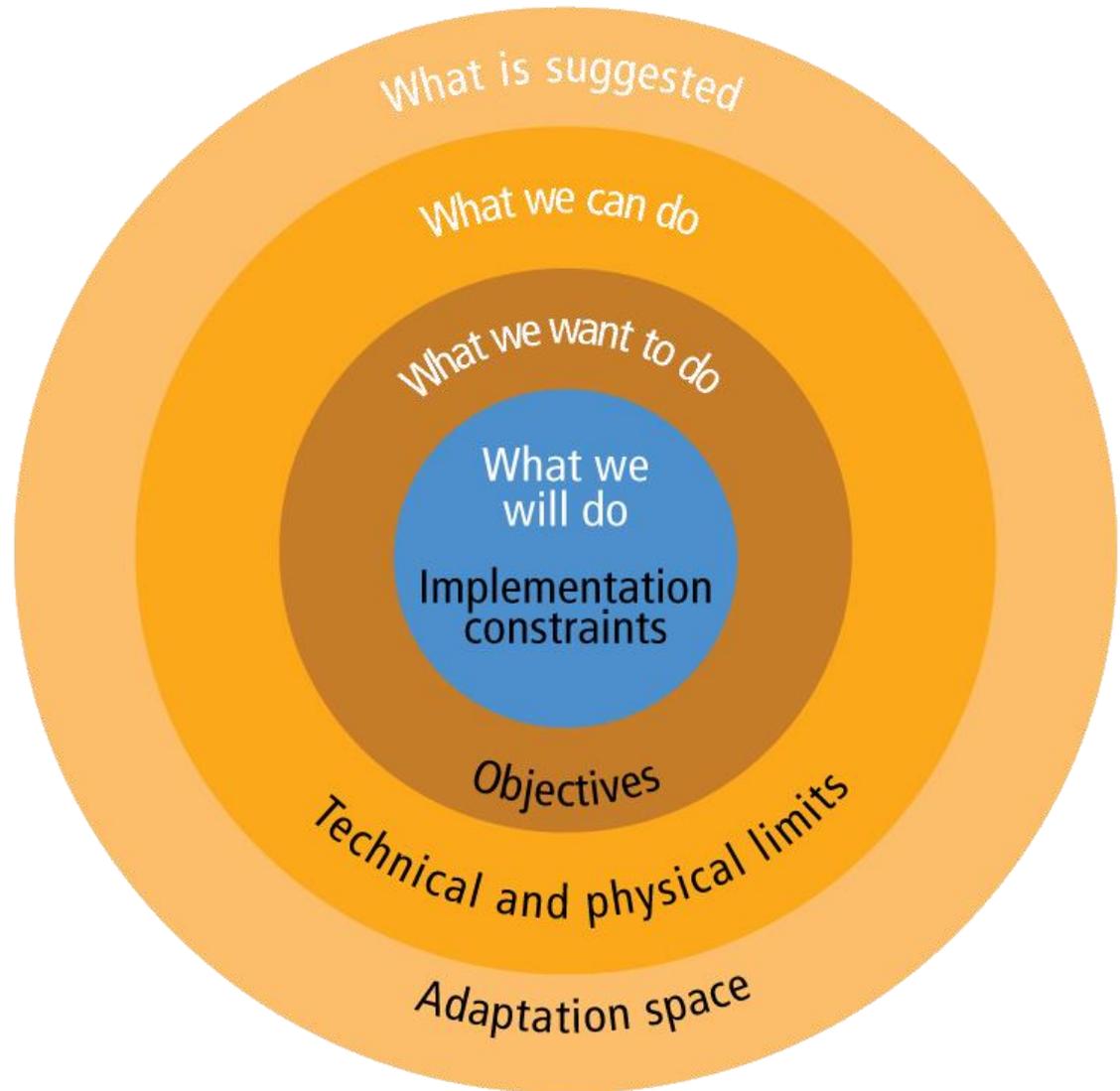
- The impacts literature remains difficult to assess, due to inconsistencies in methods and assumptions
- Understanding of the effectiveness of adaptation is particularly weak

North America				
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Wildfire-induced loss of ecosystem integrity, property loss, human morbidity, and mortality as a result of increased drying trend and temperature trend ( <i>high confidence</i> ) [26.4, 26.8, Box 26-2]	<ul style="list-style-type: none"> <li>• Some ecosystems are more fire-adapted than others. Forest managers and municipal planners are increasingly incorporating fire protection measures (e.g., prescribed burning, introduction of resilient vegetation). Institutional capacity to support ecosystem adaptation is limited.</li> <li>• Adaptation of human settlements is constrained by rapid private property development in high-risk areas and by limited household-level adaptive capacity.</li> <li>• Agroforestry can be an effective strategy for reduction of slash and burn practices in Mexico.</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	2°C  4°C 
Heat-related human mortality ( <i>high confidence</i> ) [26.6, 26.8]	<ul style="list-style-type: none"> <li>• Residential air conditioning (A/C) can effectively reduce risk. However, availability and usage of A/C is highly variable and is subject to complete loss during power failures. Vulnerable populations include athletes and outdoor workers for whom A/C is not available.</li> <li>• Community- and household-scale adaptations have the potential to reduce exposure to heat extremes via family support, early heat warning systems, cooling centers, greening, and high-albedo surfaces.</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	2°C  4°C 
Urban floods in riverine and coastal areas, inducing property and infrastructure damage; supply chain, ecosystem, and social system disruption; public health impacts; and water quality impairment, due to sea level rise, extreme precipitation, and cyclones ( <i>high confidence</i> ) [26.2-4, 26.8]	<ul style="list-style-type: none"> <li>• Implementing management of urban drainage is expensive and disruptive to urban areas.</li> <li>• Low-regret strategies with co-benefits include less impervious surfaces leading to more groundwater recharge, green infrastructure, and rooftop gardens.</li> <li>• Sea level rise increases water elevations in coastal outfalls, which impedes drainage. In many cases, older rainfall design standards are being used that need to be updated to reflect current climate conditions.</li> <li>• Conservation of wetlands, including mangroves, and land-use planning strategies can reduce the intensity of flood events.</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
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# Assessments of risk are largely expert opinion and often rather speculative

- Understanding of the likelihood of different climate change consequences remains weak
- We have limited practice upon which to base evaluations of adaptation effectiveness
- Much of our understanding of adaptation benefits is based on “first best world” assumptions
- Adaptation implementation will be less than optimal



# Estimation of adaptation costs remain poorly constrained due to analysis challenges

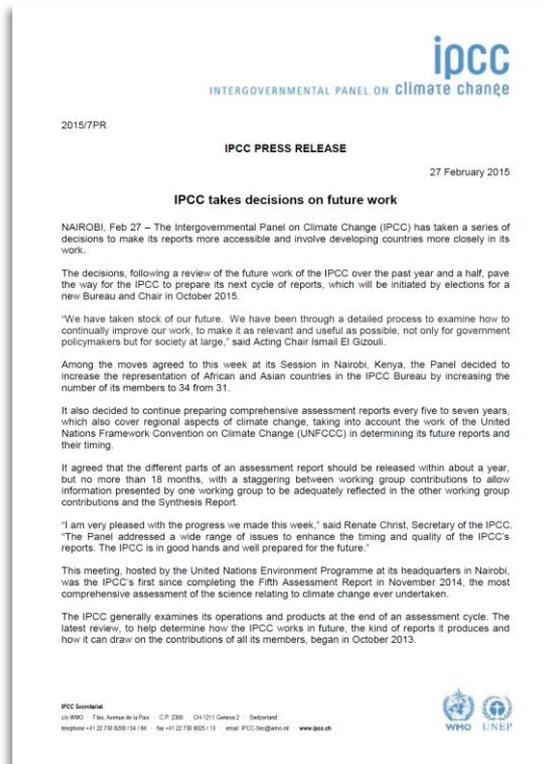
- ***“The practical challenges of conducting global adaptation cost studies are apparent in the literature.”*** (Chapter 17)
  - Limited scenarios of future climate
  - Limited sectoral coverage
  - Limited portfolios of adaptation options
  - Different methods of assessment (econometric vs. simulation)
  - Non-market benefits and co-benefits are difficult to assess

Study	Results (billion US\$ per year)	Time frame	Sectors	Methodology and comments
World Bank (2006)	9–41	Present	Unspecified	Cost of climate proofing foreign direct investments, gross domestic investments, and Official Development Assistance
Stern (2007)	4–37	Present	Unspecified	Update of World Bank (2006)
Oxfam (2007)	>50	Present	Unspecified	World Bank (2006) plus extrapolation of cost estimates from national adaptation plans and NGO projects
UNDP (2007)	86–109	2015	Unspecified	World Bank (2006) plus costing of targets for adapting poverty reduction programs and strengthening disaster response systems
UNFCCC (2007)	28–67	2030	Agriculture, forestry and fisheries; water supply; human health; coastal zones; infrastructure	Planned investment and financial flows required for the international community
World Bank (2010a)	70–100	2050	Agriculture, forestry and fisheries; water supply; human health; coastal zones; infrastructure; extreme events	Improvement on UNFCCC (2007): more precise unit cost, inclusion of cost of maintenance and port upgrading, risks from sea level rise and storm surges

Source: Modified from Agrawala and Fankhauser (2008) and Parry et al. (2009) to include estimates from World Bank (2010a).

# The IPCC assessment process is now associated with institutional path dependence and lock-in

- At the conclusion of each assessment cycle, the IPCC elicits input on future directions



- The value of continuing the current assessment paradigm is open to question
  - Significant undertaking for the research community
  - Diminishing returns with respect to substantive new findings
- Nevertheless, there are strong incentives to maintain the current path

## *“Frequency and scheduling of reports*

*-Continue to produce assessment reports every 5 to 7 years;*

*-Parts of an assessment report to be issued within about a year and at most 18 months of each other.”*



**TO BE  
CONTINUED** 

**IN THE AR6**