IPCC Working Group II progress & findings: How has TE contributed, and how could it contribute to the next round?

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Co-director, Science
IPCC Working Group II Technical Support Unit

*With thanks to these contributors:*
Chris Field (WGII co-chair), Graham Cogley (WGII AR5 Ch. 3), Richard Betts & Jonathan Overpeck (WGII AR5 Ch. 4), David Lobell (WGII AR5 Ch. 7), Wolfgang Cramer (WGII AR5 Ch. 18), Anna Michalak, Joe Berry, Mike Mastrandrea (WGII TSU co-director, science), & Eren Bilir (WGII TSU research assistant)
Outline of the talk

• Overview of the IPCC and its assessments

• WGII contribution to the Fifth Assessment Report

• Remote sensing in the WGII AR5
Fundamentals of IPCC assessment

- Comprehensive assessment
- Multiple layers of monitored scientific review
- Consensus approval by governments
- Policy relevant but not prescriptive
Timeline of IPCC assessment reports

- 1988: IPCC established by WMO and UNEP
- 1990: Second Assessment Report
- 1995: First Assessment Report
- 2001: Third Assessment Report
- 2007: Fourth Assessment Report
- 2012: Fifth Assessment Report
- 2013/14: Special Report on Extremes
IPCC Process

IPCC Approves Outline

Governments Nominate Experts as Authors

Bureaux Select Authors

Publication

IPCC Panel

Accept Report

Plenary Approval of SPM

Final Government Distribution

Stages of Report

Authors Prepare Draft 1

Authors Prepare Draft 2

Authors Prepare Final Draft

Expert Review

Expert & Gov. Review

Government SPM Review
The Working Group II contribution to the Fifth Assessment Report (WGII AR5)
Development of the WGII AR5

2009

IPCC Approves Outline

Governments Nominate Experts as Authors

Bureaux Select Authors

2012

Expert Review

Expert & Gov. Review

Government SPM Review

Stages of Report

Authors Prepare Draft 1

Authors Prepare Draft 2

Authors Prepare Final Draft

2013

March 28 - May 24, 2013

IPCC Panel

Accept Report

Plenary Approval of SPM

Publication

Final Government Distribution

March 2014
## Roadmap of the Report

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## Two volumes

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Enhanced sectoral assessment

1. introduction
2. decisionmaking
3. freshwater
4. terrestrial ecosystems
5. coasts
6. ocean systems
7. food
8. urban areas
9. rural areas
10. economic sectors
11. human health
12. human security
13. livelihoods & poverty
14. needs & options
15. planning & implementation
16. opportunities, constraints & limits
17. economics
18. detection & attribution
19. key & emergent risks
20. climate-resilient pathways
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22. Africa
23. Europe
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26. North America
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28. Polar Regions
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Enhanced assessment of oceans

1. introduction
2. decisionmaking
3. freshwater
4. terrestrial ecosystems
5. coasts
6. ocean systems
7. food
8. urban areas
9. rural areas
10. economic sectors
11. human health
12. human security
13. livelihoods & poverty
14. needs & options
15. planning & implementation
16. opportunities, constraints & limits
17. economics
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Enhanced assessment of adaptation

1. introduction 11. human health 21. regional context
2. decisionmaking 12. human security 22. Africa
3. freshwater 13. livelihoods & poverty 23. Europe
5. coasts 15. planning & implementation 25. Australasia
7. food 17. economics 27. Central & South America
8. urban areas 18. detection & attribution 28. Polar Regions
9. rural areas 19. key & emergent risks 29. Small Islands
10. economic sectors 20. climate-resilient pathways 30. Open Oceans
Topics assessed in each sectoral and regional chapter

- Observed impacts, with detection and attribution
- Projected impacts and future risks
- Vulnerabilities and socio-economic contexts
- Multiple interacting stressors
- Adaptation experiences, needs, opportunities, barriers, & limits
- Thresholds and irreversible changes
Basis of the comprehensive assessment

- Scientific, technical, and socioeconomic information
  - journal literature
  - non-journal literature

- **August 31, 2013** -- WGII AR5 literature cutoff date for “accepted papers”
Framing themes emerging in the assessment
Risk in the context of climate change

- **nature and severity of physical hazard**
- **vulnerability**
- **exposure**
Impacts of climate change are often experienced through extremes, not just mean changes.

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
Most regions of the world are vulnerable to climate change but in different ways.
Limiting global temperature increase to 2ºC is not a guarantee for preventing “dangerous anthropogenic interference”

- Risks of extremes have already changed
- Climate change impacts are widespread and consequential
- “Danger” requires judgments about risk beyond IPCC scope
Near-term investments in mitigation don’t yield much near-term benefit in decreased impacts

- Era of climate responsibility
  - Next few decades
- Era of climate options
  - Second half of 21st century (and beyond)
Facilitating smart decision making is not just about reducing uncertainty about impacts

- Managing risks of climate change
- Decisionmaking under uncertainty
- Limits to adaptation
- Transformation towards climate resilience
Remote sensing in the WGII AR5
Opportunity for contribution

**WGII AR5 Expert and Government Review**

Through **May 24, 2013**

E-mail [tsu@ipcc-wg2.gov](mailto:tsu@ipcc-wg2.gov) to participate

Assessment based on remote sensing in the WGII AR5
Assessment based on remote sensing in the WGII AR5

*Freshwater resources*

- Glacier mass balance (Ch. 3, 22, 24, 27)
- Groundwater depletion (Ch. 18)
- Decline in snow cover extent (Ch. 18, 21)
Assessment based on remote sensing in the WGII AR5

*Terrestrial ecosystems: phenology*

- Shifts in seasonal activities of terrestrial species (Ch. 4, 18, 24)
  - Increasing measurement coverage since the AR4
  - Advance of spring events (earlier greening)
  - Delayed senescence in autumn
  - Longer growing season
Assessment based on remote sensing in the WGII AR5

Terrestrial ecosystems: biome shifts

• Shifts in the boreal-tundra biome (Ch. 4, 18, 24, 28)
  – Increase in shrub growth in many areas of the Arctic tundra
  – Fire and insect disturbance
  – Primary production and microbial respiration
  – Vegetation composition and phenology
  – Tree line
  – Active layer depth and permafrost thaw

• Changes in the Amazon (Ch. 4, 18, 27)
Assessment based on remote sensing in the WGII AR5

*Terrestrial ecosystems: land cover and change*

- Land cover trends (Ch. 4)

- LUCC and climate change as multiple, simultaneous stressors on ecosystems, complicating attribution of impacts (Ch. 4)
Assessment based on remote sensing in the WGII AR5

*Terrestrial ecosystems: biomass and carbon stocks*

- Measurements of forest carbon stock (Ch. 4)

- Forests currently a net sink for carbon at the global scale (Ch. 4)

- Terrestrial ecosystems currently net carbon sinks over much of northern hemisphere and parts of southern hemisphere (Ch. 4, 24)
Assessment based on remote sensing in the WGII AR5

Coastal systems

- Extent of coral bleaching (Ch. 5, 18)
- Surface area of vegetative habitats (Ch. 5)
- Area of atoll islands (Ch. 5)
- Large-scale changes in shoreline (Ch. 5)
- Mangrove forest distribution (Ch. 24, 27)
Assessment based on remote sensing in the WGII AR5

*Food production systems*

- Temporal and spatial changes in agricultural land use (Ch. 7)
- Changes in sowing dates, phenology, crop types (Ch. 7)
- Negative impacts on yield from increasing concentrations of surface ozone (Ch. 7, 18)
Assessment based on remote sensing in the WGII AR5

Adaptation to climate change and human dimensions

• Co-production of knowledge: oral histories & remote sensing (Ch. 2)

• Data for index-based weather insurance (Ch. 10)

• Decision support systems (Ch. 15)
  − Mapping local vulnerability factors to inform planning (Ch. 11)
    − e.g., for heat waves

• Understanding climate change and conflict (Ch. 12)
Author perspectives on satellite data & climate change impacts, adaptation, & vulnerability
Great strengths:

- Completeness of coverage
- Big data: fine detail over several decades
- Readily accessible free data
Some important areas of research:

- Glaciers and sea ice
- Soil moisture
- Disturbance: wildfire, diebacks
- Indicators of vegetation “health”
- Potential regime shifts
Author perspectives
on satellite data & climate change impacts, adaptation, & vulnerability

Core needs:

• Credible long-term record
  – fusion of data from diverse sources, instruments
  – baseline for detecting change
  – followed by investigation of changes detected

• Continued use of multiple lines of evidence

• Tightened error bands in remote-sensing products

• Better incorporation of remote-sensing inputs in Earth system models

• Place-based information on variables of concern to stakeholders
  – for example, vegetation health for forest managers
  – more proactive use as satellite imagery in disaster response
  – improved measures of vegetation and land-use types, biodiversity
Author perspectives on satellite data & climate change impacts, adaptation, & vulnerability

New generation of work with satellite data?

• “Re-analysis” of the Earth system
  − focused on CO$_2$, hydrology, water stress, changes in land-use, disturbance, etc.
  − interpretation and re-interpretation of existing data
  − how well can we understand changes and mechanisms?

• Satellites providing wider range of constraints on prognostic models

• Deeper exploration of the role of humans on the future of Earth's vegetation
Take-home message

WGII AR5 Expert and Government Review

Through May 24, 2013

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