IPCC Fifth Assessment Report
WGI, WGII, WGIII, Synthesis Report
2013/2014

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IPCC AR5 Synthesis Report
CLIMATE CHANGE
UNDERSTANDING, REDUCING, AND MANAGING RISKS
Warming over the past century

Based on WGII Figure SPM 4
Warming since 1970

Change in Energy Content ($10^{21}$ Joule)

- Upper Ocean
- Deep Ocean
- Ice
- Land
- Atmosphere
- Uncertainty

Based on WGI Box 3.1 Figure 1
Human influence on the climate system is clear.

**Worldwide Effects**

- atmosphere, land, ocean
- extreme events
- water cycle
- sea ice, glaciers, ice sheets
- global mean sea level
GHG EMISSIONS GROWTH HAS ACCELERATED DESPITE REDUCTION EFFORTS
GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.
GHG emissions rising with growth in GDP and population

Based on WGIII Figure SPM 3
OBSERVED IMPACTS OF CLIMATE CHANGE ARE WIDESPREAD AND CONSEQUENTIAL
Widespread impacts attributed to climate change based on the available scientific literature since the AR4

Confidence in attribution to climate change:
- Very low
- Low
- Medium
- High
- Very high

Indicates confidence range

Observed impacts attributed to climate change for:
- 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

* Impacts identified based on availability of studies across a region

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change
VULNERABILITY AND EXPOSURE AROUND THE WORLD
PEOPLE, SOCIETIES, AND ECOSYSTEMS AROUND THE WORLD VULNERABLE AND EXPOSED IN DIFFERENT WAYS
ADAPTATION IS ALREADY OCCURRING
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Adaptation is already occurring

- Combining Traditional and Scientific Knowledge
- Adapting Communications Infrastructure

- Municipal-Level Actions
- Adapting Energy & Public Infrastructure

- Coastal & Water Management
- Environmental Protection & Land Planning
- Disaster Risk Management

- Development Planning
- Early Warning Systems
- Mangrove Reforestation
- Water Resources Management

- Disaster Risk Management
- Basic Public Health
- Livelihood Diversification

- Ecosystem-Based Adaptation
- Water Resources Management
- Resilient Crop Varieties

- Planning for Sea-Level Rise
- Planning for Reduced Water Availability

- International Cooperation
- Marine Spatial Planning
INCREASING MAGNITUDES OF WARMING INCREASE THE LIKELIHOOD OF SEVERE AND PERVERSIVE IMPACTS
Warming over the 21st century
Warming over the 21st century

1901-2012

End of 21st century

Projected Temperature Change

Difference from 1986–2005 mean (°C)

Solid Color
Very strong agreement

White Dots
Divergent changes

Gray

Diagonal Lines
Strong agreement

Little or no change

RCP2.6 2081–2100

End of 21st century

RCP8.5 2081–2100

Based on WGII Figure SPM 4
Assessing risk

Risk Level with Current Adaptation

- Very Low
- Med
- Very High

Present

Near Term (2030-2040)

Long Term (2080-2100)

2°C

4°C

Assessing risk with potential for additional adaptation to reduce risk.
Based on WGII Box SPM 2 Table 1
### Changes in Ecosystem Productivity
- Options limited, include translocation of industrial fishing & expansion of aquaculture

### Shifts in Fish & Invertebrate Populations
- Evolutionary adaptation limited; translocation, flexible management & expansion of aquaculture

### Hypoxia Expansion & Effects
- Large-scale translocation of fisheries, a few fisheries may benefit, limiting pollutant runoff
Variability in pelagic fishes in E. boundary upwelling systems

New & specific management tools & models, reduced fishing intensity

Decreased catch & diversity in tropical coral reefs

Restoration of overexploited fisheries, alternate livelihoods, aquaculture

Risks to current spatial management units, especially MPAs

Continuous revision and shifts of MPA borders and goals
Maximum speed at which species can move (km per decade)

- **Trees**
- **Herbaceous Plants**
- **Split-hoofed Mammals**
- **Carnivorous Mammals**
- **Rodents**
- **Primates**
- **Plant-feeding Insects**
- **Freshwater Mollusks**

Legend:
- Upper Bound
- Median
- Lower Bound

**Average Climate Velocity 2050-2090**

- **RCP2.6** Flat Areas and Global Average
- **RCP4.5** Flat Areas
- **RCP6.0** Flat Areas
- **RCP8.5** Flat Areas
- **RCP8.5** Global Average
CHANGE IN MAXIMUM CATCH POTENTIAL (2051-2060 COMPARED TO 2001-2010, SRES A1B)

<50%  -21 - 50%  -6 - 20%  -1 - 5%  No data  0 - 4%  5 - 19%  20 - 49%  50 - 100%  >100%
Based on WGII Box SPM 1 Figure 1
LIMITING WARMING TO 2°C INvolves substantial tecnological, economic and institutional challenges
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.
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INCREASING FRACTION OF EMISSIONS COVERED BY MITIGATION PLANS AND STRATEGIES
Increase in national and sub-national mitigation policies

Based on WGIII Figures 15.1 and 13.3
EFFECTIVE CLIMATE CHANGE RESPONSES
A MORE VIBRANT WORLD
**Vulnerability & Exposure**
- Vulnerability & exposure reduction
- Low-regrets strategies & actions
- Addressing multidimensional inequalities

**Adaptation & Interactions with Mitigation**
- Incremental & transformational adaptation
- Co-benefits, synergies, & trade-offs
- Context-specific adaptation
- Complementary actions

**Risk**
- Risk assessment
- Iterative risk management
- Risk perception

**Socioeconomic Pathways**
- Diverse values & objectives
- Climate resilient pathways
- Transformation

**Governance**
- Decision-making under uncertainty
- Learning, monitoring, & flexibility
- Coordination across scales

**CLIMATE**
- Natural Variability
- Anthropogenic Climate Change

**EMISSIONS and Land-use Change**
- Anthropogenic Climate Change
- Mitigation

**IMPACTS**
- Vulnerability
- Risk
- Exposure
- Adaptation and Mitigation Actions
- Governance
Substantial emissions reductions linked to new investments

Average Changes in Annual Investment Flows from 2010 to 2029 (430–530 ppm CO₂eq Scenarios)

Based on WGIII Figure SPM 9
CLIMATE CHANGE
REDUCING AND MANAGING RISKS