IPCC Scoping meeting for the Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and related Global Greenhouse Gas Emission Pathways, 15 to 18 August 2016, Geneva.

Contributing on Ecosystems and human systems: Attributing risks, avoided risks

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Humans have a major role in all the risks – for both ecosystems and human systems

- i.e. Human role is so intertwined with climate change
- ***A holistic approach to assessing risks is required – hence we have all WGs engaged here.***
- ***But also consider*** E.g. the concept of **Socio-Ecological Systems:**
  - *multi-scale pattern of resource use around which humans have organized themselves (within an ecological system) in a particular social structure i.e. distribution of people, resource management, consumption patterns, and associated norms and rules).*
- **Resilience -** capacity to absorb disturbance and reorganize while undergoing change but retaining essentially the same function, structure, identity etc.
- **Transformability** -Where ecological, economic, or social structures of a socio-ecological system cannot bounce back to its original equilibrium

(Walker et al. 2004)

- **This brings us to the Concept of the Anthropocene**

We have moved from the geological Holocene:

- **A period of stability** under which human civilizations evolved and thrived
- **Into the Anthropocene**

  Where *natural and human forces became intertwined* ***requiring new approaches across board***

(Steffen et al 2007)

- Anthropocene is represented by: extinction of species, climate change accumulated sediments, human insecurity etc.

Mozambique 2000 floods

The Anthropocene

- a holistic view -puts human systems at center stage of global changes including climate –
- **Demands transdisciplinarity in assessments**

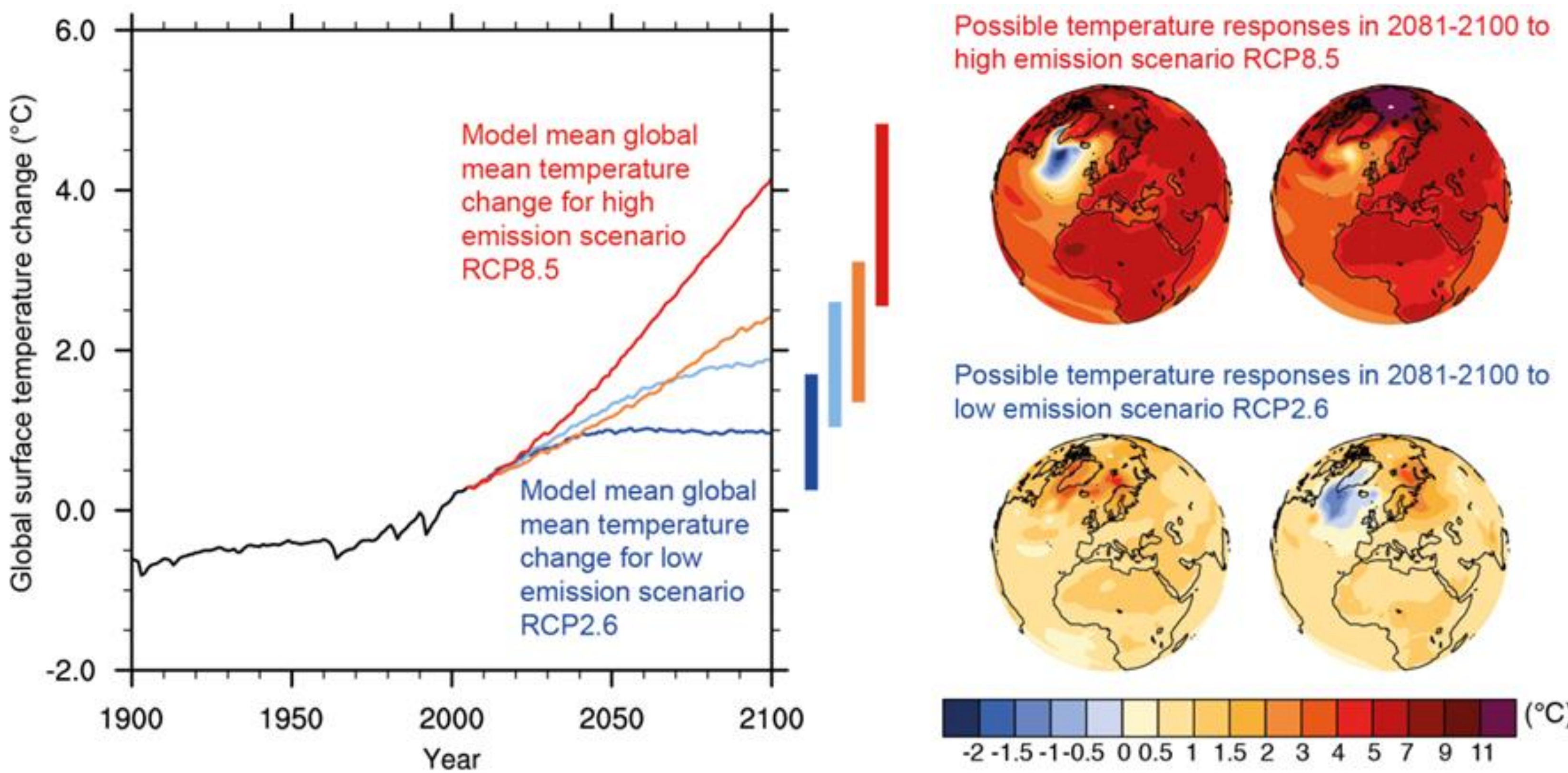
- **Is it about climate Change or living in the anthropocene?**

Ecosystems and human systems: Attributing risks, avoided risks (Main source: AR5 Report)

- Focusing on the following
- **Water**
- **Terrestrial Ecosystems**
- **Food security**
- **Urban systems**

- In the highest Representative Concentration Pathway (RCP8.5) by 2100:
  - some of the world's land area will be experiencing 4°C to 7°C higher temperatures due to anthropogenic climate change (WGI AR5 SPM).

- Climate related risks increase and become difficult to avoid from 2050/80-2100.



(WGI AR5 SPM).

FAQ 12.1, Figure 1. Global mean temperature change averaged across all Coupled Model Intercomparison Project Phase 5 (CMIP5) models (relative to 1986–2005) for the four Representative Concentration Pathway (RCP) scenarios: RCP2.6 (dark blue), RCP4.5 (light blue), RCP6.0 (orange) and RCP8.5 (red); 32, 42, 25 and 39 models were used respectively for these 4 scenarios. Likely ranges for global temperature change by the end of the 21st century are indicated by vertical bars. Note that these ranges apply to the difference between two 20-year means, 2081–2100 relative to 1986–2005, which accounts for the bars being centred at a smaller

High risk of elevated stress on water resources linked to multiple interactive factors e.g.

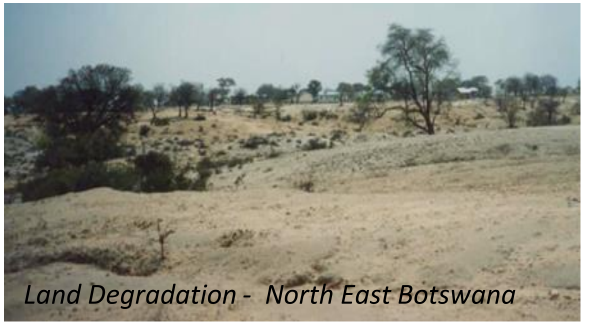
- 1. **Direct human pressure** –increasing water demand, high extraction and failed water resource management - degradation of water catchment areas
- **2. Climate:** High evaporation, frequent drought- *Increases in evapotranspiration are projected in southern Europe, Central America, southern Africa, and Siberia*
  - Though uncertain -an increase in potential evapotranspiration has been associated with global warming (Kingston et al., 2009).
- For each degree of global warming, ~ 7% of the global population is projected to be exposed to water shortages of at least 20% (multi-model mean).
- Dry subtropical regions projected to become drier and face water shortages- e.g. northern Africa and parts of southern Africa.
- Droughts: projected to become longer and more frequent in the Mediterranean, central Europe, central North America, and southern Africa

- **Water quality will also suffer – affecting fresh water supply**

(WGII AR5 Chapters 3 and 4)

Terrestrial systems *(AR5-Chapter 4)*

Firewood



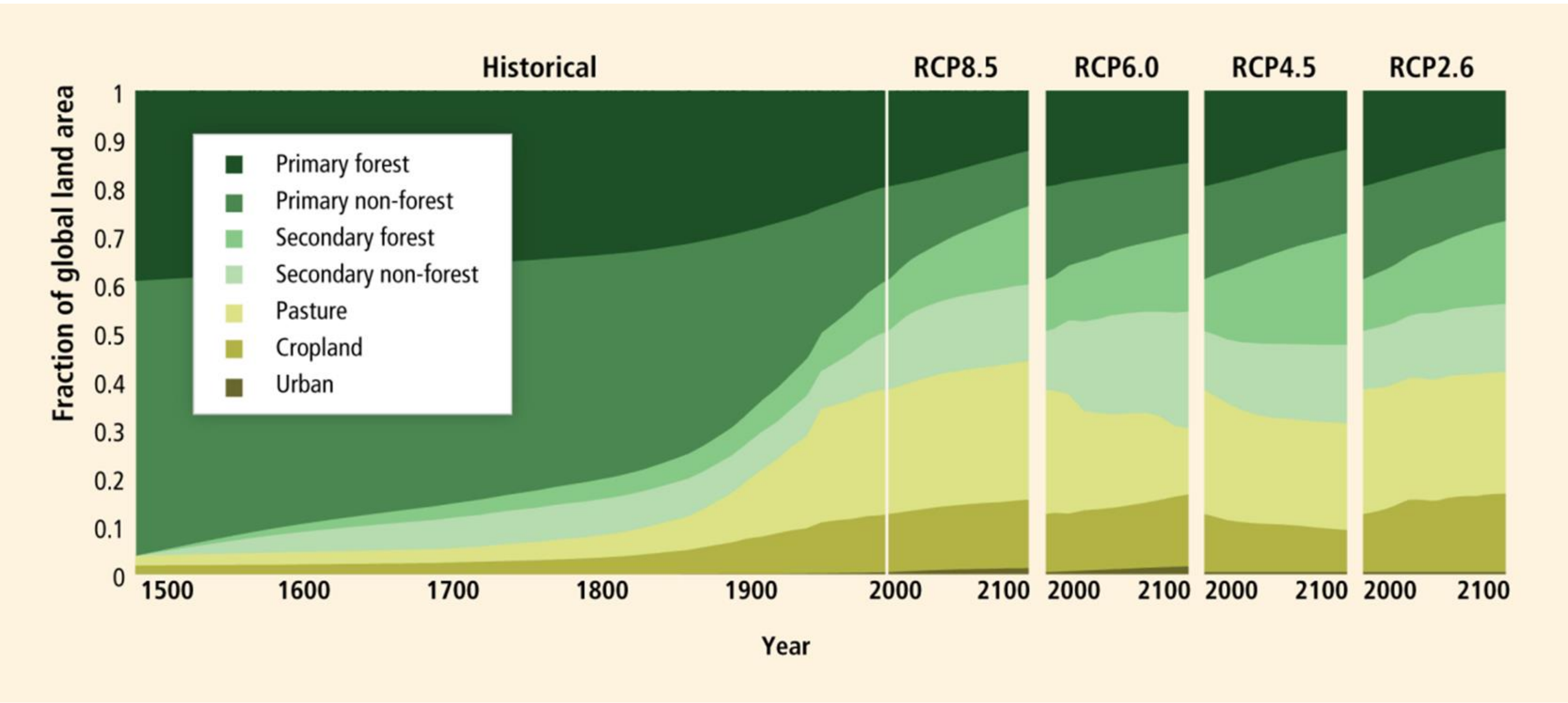
Land Degradation - North East Botswana

- Shifts in geographic ranges, seasonal activities, migration patterns, etc. in several terrestrial systems in response to ongoing climate change have been observed.
  - But only a few recent species extinctions have been attributed as yet to climate change
- Other stressors, e.g. habitat modification, over-exploitation, pollution, and invasive species have a role .
- The net transfer of CO_2 from the atmosphere to the land is projected to weaken during the 21st century (medium confidence):
  - Natural carbon sink provided by terrestrial systems is partially offset at the decadal time scale *by carbon released through the conversion to farm and grazing land and degradation (high confidence).*

Table 4-1 | Biome shifts of the 20th century from published field research that examined trends over periods >30 years for biomes in areas where climate (rather than land use change or other factors) predominantly influenced vegetation, derived from a systematic analysis of published studies (Gonzalez et al., 2010). Pre-AR4 publications are included to provide a comprehensive review. Shift type: elevational (E), latitudinal (L), examined but not detected (N). The biome abbreviations match those in Figure 4-1. Rate of change in temperature (Temp.) and fractional rate of change in precipitation (Precip.) are derived from linear least squares regression of 1901–2002 data (Mitchell and Jones, 2005; Gonzalez et al., 2010). The table provides general regional climate trends at 50 km spatial resolution because the references do not give uniform site-specific climate data to compare across locations. The regional trends are consistent with local trends reported in each reference. *Rate significant at $P \leq 0.05$.

Location	Reference	Plots	Time period	Shift type	Retracting biome	Expanding biome	Temp. change (°C century^{-1})	Precip. change (% century^{-1})
1. Alaska Range, Alaska, USA	Lloyd and Fastie (2003)	18	1800–2000	L	UA	BC	1.1*	3
2. Baltic Coast, Sweden	Walther et al. (2005)	7	1944–2003	L	TC	TB	0.6*	8
3. Becca di Viou, Italy	Leonelli et al. (2011)	1	1700–2008	E	UA	BC	0.9*	–6
4. Garibaldi, British Columbia, Canada	Brink (1959)	1	1860–1959	E	UA	BC	0.7*	16*
5. Goulet Sector, Québec, Canada	Payette and Filion (1985)	2	1880–1980	E	UA	BC	1.4*	19*
6. Green Mountains, Vermont, USA	Beckage et al. (2008)	33	1962–2005	E	BC	TB	1.6*	6
7. Jasper, Alberta, Canada	Luckman and Kavanagh (2000)	1	1700–1994	E	UA	BC	0.6	21*
8. Kenai Mountains, Alaska, USA	Dial et al. (2007)	3	1951–1996	E	UA	BC	0.7	6
9. Kluane Range, Yukon, Canada	Danby and Hik (2007)	2	1800–2000	E	UA	BC	0.7	5
10. Low Peninsula, Québec, Canada	Payette and Filion (1985)	1	1750–1980	N	—	—	1.4*	19*
11. Mackenzie Mountains, Northwest Territories, Canada	Szeicz and Macdonald (1995)	13	1700–1990	N	—	—	1.4*	3
12. Montseny Mountains, Catalonia, Spain	Peñuelas and Boada (2003)	50	1945–2001	E	UA	TB	1.2*	–3
13. Napaktok Bay, Labrador, Canada	Payette (2007)	2	1750–2000	L	UA	BC	1.1*	5
14. Noatak, Alaska, USA	Suarez et al. (1999)	18	1700–1990	L	UA	BC	0.6	19*
15. Putorana Mountains, Russian Federation	Kirdyanov et al. (2012)	10	1500–2000	E	UA	BC	0.3	10
16. Rahu Saddle, New Zealand	Cullen et al. (2001)	7	1700–2000	N	—	—	0.6*	3
17. Rai-Iz, Urals, Russian Federation	Devi et al. (2008)	144	1700–2002	E	UA	BC	0.3	35*
18. Sahel, Sudan, Guinea zones; Senegal	Gonzalez (2001)	135	1945–1993	L	RW	RG	0.4*	–48*
19. Sahel, Burkina Faso, Chad, Mali, Mauritania, Niger	Gonzalez et al. (2012)	14	1960–2000	L	RW	RG	–0.01* to 0.8*	–31* to 9
20. Scandes, Sweden	Kullman and Öberg (2009)	123	1915–2007	E	UA	BC	0.8*	25*

AR5-Chapter 4



Increased tree mortality and associated forest dieback are projected to occur in many regions over the 21st century

- Due to increased temperatures and drought (medium confidence) - posing risks for carbon storage, biodiversity, wood production, water quality etc.
- High temperatures, rising ozone concentrations, and in some places drought decrease plant productivity by amounts comparable in magnitude to the enhancement by rising CO_2. (*Medium confidence*)

(AR5-Chapter 4)

climate change affects all aspects of **Food security** e.g.: production, access, utilization, and price stability


Cooking m*aize meal papa*

Temperature trends are important for determining past and future crop yields at sub-continental to global scales.

- **Global temperature** of ~4°C or more above late-20th-century levels, combined with increasing food demand, would pose large risks to food security globally and regionally (*high confidence)*.
- Risks to food security are generally greater in low-latitude areas.
- **Local temperature** increases of e.g. 2°C or more above late-20th-century levels will negatively impact production in major crops i.e. wheat, rice, and maize, in tropical and temperate regions despite regional variations
  - In Africa Maize reduction: 18% for southern Africa to 22% aggregated across sub-Saharan Africa : Wheat: 35% by 2050 while minimum reductions for sorghum and millet as temperature increases they too will be affected
- (WGII AR5 Chapters 7 and Regional Africa Chapter, 22)

Estimated losses of roughly 10% for wheat and soybean and 3 to 5% for maize and rice *Linked to suppressed global production of major crops due to Ozone-O3 increases*

(Van Dingenen et al., 2009)

- Impacts most severe over India and China. Also USA for soybeans .

- Work on the interactive effects of O3 with other environmental factors such as CO2, temperature, moisture, and light on crop yields is needed
- Changes in temperature and precipitation, without considering effects of CO2, *will contribute to increased global food prices by 2050, with estimated increases ranging from 3 to 84%*

Urban Systems:

Rapid urbanisation - in mega-deltas and coastal areas (where land management is overpowered by complex cross-scale socio-economic factors including population growth)

- **Occurring with rising climate change driven** flood risks, increasing sea level rise, coastal erosion etc. increase the risk of economic losses and human mortality

- E.g. about 1 billion poor people are in coastal area,

- Asia exhibits the greatest exposure in terms of population and assets

- Sub-Saharan Africa will continue to have the largest increases in exposure

(WGII AR5,Chapter 8)

Flood risk generally found closely linked to exceptionally high rainfall in areas of high exposure

- \- Annual maxima of daily precipitation that are observed to have 20-year return periods in 1986–2005 are projected to have shorter return periods in 2081–2100:
  - about 14 years for RCP2.6, 11 years for RCP4.5, and 6 years for RCP8.5

More than 95% flood-related deaths are in developing countries

Flood Risks have been reduced by:

- Applying flood protection technologies, shelters, and Early warning
- Cities e.g. Tokyo and Shanghai have protected themselves against local sea level rise of several meters during the 20th century
- But this is too costly for low income countries acting on their own and not feasible for islands states
- Progressive warming may deem most flood risk measures less effective even for the most developed countries