Implications of the IPCC AR5 Report for the UNFCCC Negotiations and Mitigation Options in AFOLU (Agriculture Forest and Other Land Use)

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Region/ region code	Trends in daytime temperature extremes (frequency of hot and cool days)		Trends in nighttime temperature extremes (frequency of warm and cold nights)		Trends in heat waves/warm spells		Trends in heavy precipitation (rain, snow)		Trends in dryness and drought	
	Observed	Projected	Observed	Projected	Observed	Projected	Observed	Projected	Observed	Projected
East Africa EAF, 16	Lack of evidence due to lack of literature and spatially non-uniform trends[a] Increases in hot days in southern tip (decrease in cool days)[a]	*Likely* increase in hot days (decrease in cool days)[b]	Spatially varying trends in most areas[a] Increases in warm nights in southern tip (decrease in cold nights)[a]	*Likely* increase in warm nights (decrease in cold nights)[b]	Insufficient evidence[a] Increase in warm spell duration in southern tip of the region[a]	*Likely* more frequent and/or longer heat waves and warm spells[b]	Insufficient evidence[a]	*Likely* increase in heavy precipitation[b]	Spatially varying trends in dryness[a]	Decreasing dryness in large areas[b]
Southern Africa SAF, 17	*Likely* increase in hot days (decrease in cool days)[a,c]	*Likely* increase in hot days (decrease in cool days)[b]	*Likely* increase in warm nights (decrease in cold nights)[a,c]	*Likely* increase in warm nights (decrease in cold nights)[b]	Increase in warm spell duration[a]	*Likely* more frequent and/or longer heat waves and warm spells[b]	Increases in more regions than decreases but spatially varying trends[a]	Lack of agreement in signal for region as a whole[b] Some evidence of increase in heavy precipitation in southeast regions[a]	General increase in dryness[a]	Increase in dryness, except eastern part[b,d] Consistent increase in area of drought[b]
Sahara SAH, 14	Lack of literature[a]	*Likely* increase in hot days (decrease in cool days)[b]	Increase in warm nights[a] Lack of literature on trends in cold nights[a]	*Likely* increase in warm nights (decrease in cold nights)[b]	Insufficient evidence[a]	*Likely* more frequent and/or longer heat waves and warm spells[b]	Insufficient evidence[a]	*Low agreement*[b]	Limited data, spatial variation of the trends[a]	Inconsistent signal of change[b]
West Africa WAF, 15	Significant increase in temperature of hottest day and coolest day in some parts[a] Insufficient evidence in other parts[a]	*Likely* increase in hot days (decrease in cool days)[b]	Increasing frequency of warm nights. Decrease in cold nights in western central Africa, Nigeria, and Gambia[a] Insufficient evidence on trends in cold nights in other parts[a]	*Likely* increase in warm nights (decrease in cold nights)[b]	Insufficient evidence for most of the region[a]	*Likely* more frequent and/or longer heat waves and warm spells[b]	Rainfall intensity increased[a]	Slight or no change in heavy precipitation indicators in most areas[b] Low model agreement in northern areas[b]	*Likely* increase but 1970s Sahel drought dominates the trend; greater inter-annual variation in recent years[a,c]	Inconsistent signal[b]

Symbols

Increasing trend or signal — Decreasing trend or signal — Both increasing and decreasing trend or signal — Inconsistent trend or signal or insufficient evidence — No change or only slight change

Level of confidence in findings

Low confidence — *Medium confidence* — *High confidence*

IPCC WG1 Storyline

•Each of the past 3 decades has been warmer than all preceding decades since 1850, with the period 2000-2010 being the warmest (p. SPM-3, line 3-4), <u>although</u> the rate of warming over the past 15 years (of 0.05C over the period 1998-2012) “is smaller than the trend since 1951” (which was at 0.12C per decade).

•CO2 atmospheric concentrations increased more than 20% since 1958 and by about 40% since 1750 due to human activity, from 278ppm in 1750 to 390.5ppm in 2011.

•Global mean surface temperatures are projected to increase, likely from 1-4.5C depending on the projection methodology used.

IPCC WG1 Storyline (continued)

•Continued emissions of GHGs would cause further warming, with global mean surface temperature changes relative to preindustrial levels likely to be more than 1.5C to more than 2C but unlikely to exceed 4C by 2081-2100. The upper ocean (sea level to few hundred meters deep) would likely see warming of more than 0.5C-2.5C.

NOTE: Working Group I SPM notes climate models were able to reproduce the warming of the second half of the 20th century but "do not generally reproduce the observed reduction in surface warming trend over the last 10-15 years" and that there is "medium confidence that this difference between models and observations is to a substantial degree caused by unpredictable climate variability, with possible contributions from inadequacies in the solar, volcanic, and aerosol forcings used by the models and, in some models, from too strong a response to increased greenhouse-gas forcing".

Policy Message from IPCC WG1 Report that will play role in UNFCCC

•Limiting climate change would require substantial and sustained reductions of CO_2 emissions

•Require, in turn, ensuring that cumulative anthropogenic CO_2 emissions "would need to be limited to about 1000 PgC (petagrams of carbon) (1 PgC = 1 GtC) since the beginning of the industrial era, if the warming caused by anthropogenic CO_2 emissions alone is limited to be likely less than 2C relative to pre-industrial."

• Half of the budget, between 460-630 PgC, was already emitted by 2011, hence leaving only around half as the budget for the period 2012-2100.

•It is only under the scenario RCP2.6 that temperature change above 2C with respect to pre-industrial levels is unlikely.

•RCP2.6 requires limiting emissions to between 140-410 PgC between 2012-2100, or around 270 PgC.

•Achieving scenario RCP2.6 means that "an average emission reduction of 50% (range 14% to 96%) is required by 2050 relative to 1990 levels." This carbon budget is based on the 270 PgC mean carbon budget expressed in RCP2.6 as consistent with a scenario in which global mean surface temperature change would likely not exceed 2C relative to preindustrial levels. (The actual range of the carbon budget expressed for scenario RCP2.6 is 140-410 PgC, or equivalent to 513.38 $GTCO_2eq$ to 1503.47 $GTCO_2eq$.)

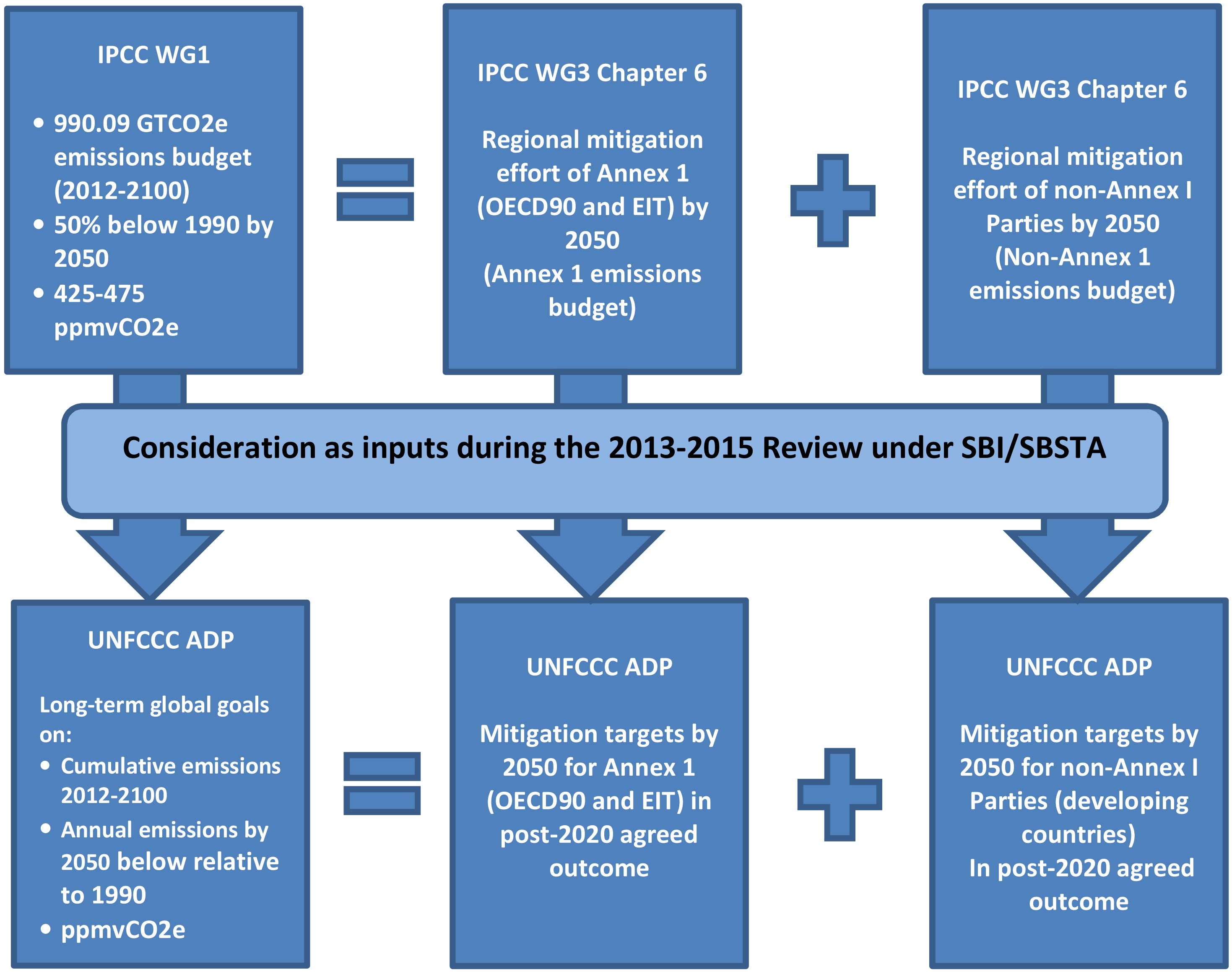
In the context of the 2013-2015 Review, and the on-going ADP negotiations, it is therefore likely that **developed countries** will use the IPCC Working Group I report and SPM as the "scientific" basis, through inclusion as one of the inputs for the 2013-2015 Review, for establishing a long-term global emissions reduction goal of 50% by 2050 relative to 1990 levels. This would mean establishing a global target that by 2050, global emissions should be limited to not more than 15.62 billion tons of CO2 equivalent (GTCO2eq), excluding LULUCF, so as to stay within the remaining carbon budget of around 990.09 GTCO2eq (270 PgC from RCP2.6) within the period 2012-2100.

IPCC WG1 + IPCC WG3 Ch6 = Mitigation Targets and Allocation Scheme

•The IPCC AR5 Working Group I report and SPM suggest that keeping below 2C above pre-industrial levels would require achieving scenario RCP2.6:
→ limiting cumulative global emissions to between 140-410 PgC, or equivalent to 513.38 GTCO2eq to 1503.47 GTCO2eq, with a mean of 270 PgC (990.09 GTCO2eq)
→ limiting atmospheric GHG concentrations to between 425-475 ppmvCO2eq (mean of 450ppmv)
→ reducing global annual GHG emissions to 50% below 1990 levels by 2050 (i.e. no more than 15.62 GTCO2eq)

•Chapter 6 of the IPCC AR5 Working Group III report will then suggest what the regional emission allowances and the regional distribution of the global mitigation effort should be that would be consistent with scenario RCP2.6 – i.e. the extent to which Annex I and non-Annex I Parties, categorized according to geographical regions, could emit GHGs (and conversely the extent to which they would have to reduce emissions).

Transforming IPCC AR5 Results into Negotiated UNFCCC Commitments



AFOLU (Agriculture Forestry and Other Land Uses in IPCC

- IPCC AR2 (1996) and AR4 (2007) agriculture and forestry -- separate chapters
- IPCC AR3 (2001) – no separate chapter on agr or forestsry
- IPCC AR5 (2014) – AFOLU chapter (vast majority of terrestrial land surface)

Key Findings

- Agriculture, Forestry and Other Land Use (AFOLU) is unique among the sectors considered in this volume, since the mitigation potential is derived from both an enhancement of removals of GHGs, as well as reduction of emissions through management of land and livestock
- The AFOLU sector is responsible for just under a quarter (~9-12 Gt CO2eq/yr) of anthropogenic GHG emissions mainly from deforestation and agricultural emissions from livestock, soil and nutrient management
- Opportunities for mitigation include supply-side and demand-side options

Key Findings (contd.)

- The nature of the sector means that there are potentially many barriers to implementation of available mitigation options, including accessibility to AFOLU financing, poverty, institutional, ecological, technological development, diffusion and transfer barriers

- AFOLU forms a significant component of mitigation in transformation pathways, offering a variety of mitigation options and a large, cost-competitive mitigation potential

Key Findings (contd.)

- Economic mitigation potential of supply-side measures in the AFOLU sector is estimated to be 7.18 to 10.60 (full range: 0.49-13.78) $GtCO_2eq/yr$ at carbon prices up to 100 US$/ tCO_2eq, about a third of which can be achieved at <20 US$/ tCO_2eq

- The size and regional distribution of future mitigation potential is difficult to estimate accurately as it depends on a number of inherently uncertain factors

Key Findings (contd.)

- Land use change associated with bioenergy expansion, afforestation or deforestation can affect GHG balances, albedo and other climate drivers in several ways

- Bioenergy could play a critical role in stabilizing climate change, if conversion of high carbon density ecosystems (forests, grasslands and peat-lands) is avoided and best-practice land management is implemented

Key Findings (contd.)

- Any large-scale change in land use, for biomass for energy, or for sequestration in vegetation, will likely increase the competition for land, water, and other resources, and conflicts may arise with important sustainability objectives such as food security, soil and water conservation, and the protection of terrestrial and aquatic biodiversity

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Key Findings (contd.)

- Policies governing practices in agriculture and in forest conservation and management need to account for both mitigation and adaptation
- One of the most visible current policies in the AFOLU sector is the implementation of REDD+, that can represent a cost-effective option for mitigation with economic, social and other environmental co-benefits (e.g. conservation of biodiversity and water resources)

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