The challenge of policy relevance

Progress with the IPCC Working Group III Report

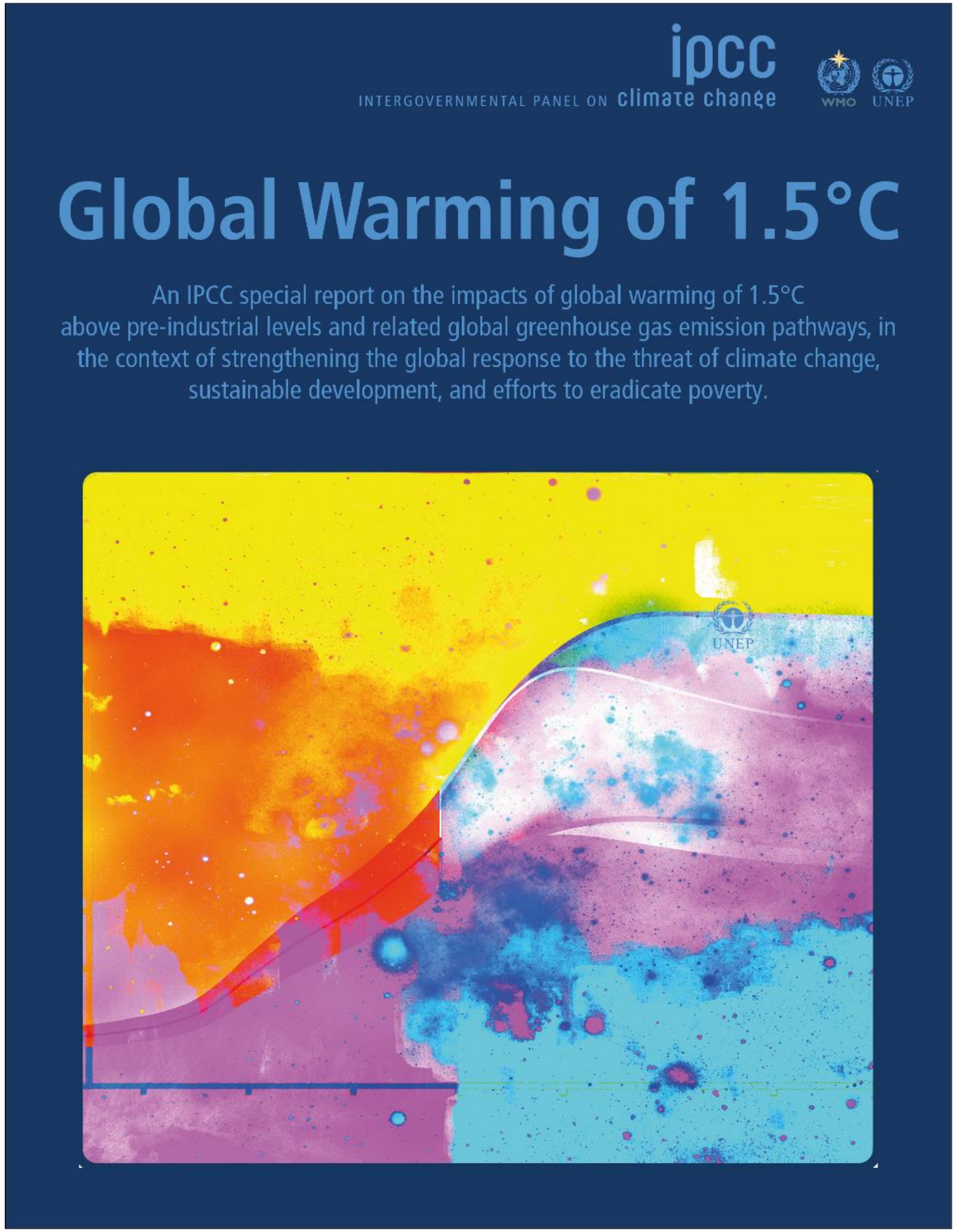
IPCC Symposium
Toranomon Hills Forum
Tokyo

30 January 2020

Jim Skea

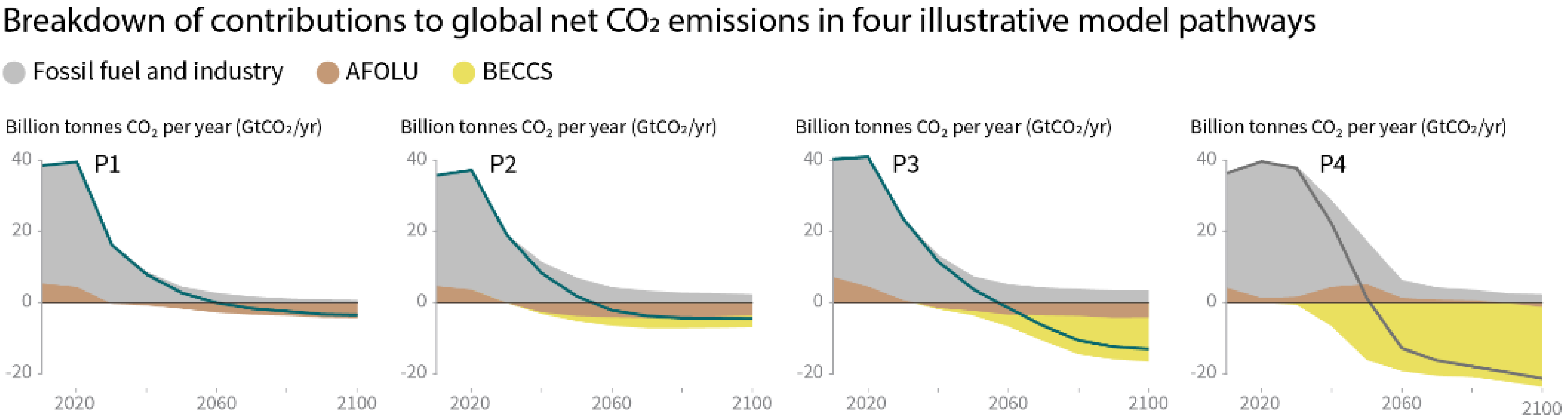
Co-chair

WG III IPCC



ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

SPM3b | Characteristics of four illustrative model pathways



P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

System transitions consistent with 1.5°C warming

"Rapid, far-reaching and unprecedented changes in all systems"

- A range of technologies and behavioural changes
- Renewables supply 70-85% of electricity in 2050
- Coal declines steeply, ~zero in electricity by 2050
- Oil and especially gas persist longer – gas use rises by 2050 in some pathways
- Deep emissions cuts in transport and buildings
- Transitions in global and regional land use in all pathways, but their scale depends on the mitigation portfolio
- Urban and infrastructure system transitions imply changes in land and urban planning practices

Robert van Waarden / Aurora Photos

Bridget Besaw / Aurora Photos

Carbon Dioxide Removal (CDR)

- All pathways that limit global warming to 1.5°C with limited or no overshoot use CDR
- The larger and longer the overshoot, the greater the reliance on CDR later in the century
- BECCS (bioenergy with carbon capture and storage) features in most scenarios but is avoided in a few
- CDR at large scale could have significant impacts on land, food and water security, ecosystems and biodiversity
- Some AFOLU-related CDR measures such as restoration of natural ecosystems and soil carbon sequestration could improve biodiversity, soil quality, and local food security

Special Report on Climate Change and Land

www.ipcc.ch/report/SRCCL

Agricultural landscape between Ankara and Hattusha, Anatolia, Turkey (40°00' N – 33°35' E)
©Yann Arthus-Bertrand | **www.yannarthusbertrand.org** | **www.goodplanet.org**

INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security

Panel A shows response options that can be implemented without or with limited competition for land, including some that have the potential to reduce the demand for land. Co-benefits and adverse side effects are shown quantitatively based on the high end of the range of potentials assessed. Magnitudes of contributions are categorised using thresholds for positive or negative impacts. Letters within the cells indicate confidence in the magnitude of the impact relative to the thresholds used (see legend). Confidence in the direction of change is generally higher.

	Response options based on land management	Mitigation	Adaptation	Desertification	Land Degradation	Food Security	Cost
Agriculture	Increased food productivity	L	M	L	M	H	—
	Agro-forestry	M	M	M	M	L	●
	Improved cropland management	M	L	L	L	L	●●
	Improved livestock management	M	L	L	L	L	●●●
	Agricultural diversification	L	L	L	M	L	●
	Improved grazing land management	M	L	L	L	L	—
	Integrated water management	L	L	L	L	L	●●
	Reduced grassland conversion to cropland	L	—	L	L	- L	●
Forests	Forest management	M	L	L	L	L	●●
	Reduced deforestation and forest degradation	H	L	L	L	L	●●
Soils	Increased soil organic carbon content	H	L	M	M	L	●●
	Reduced soil erosion	←→ L	L	M	M	L	●●
	Reduced soil salinization	—	L	L	L	L	●●
	Reduced soil compaction	—	L	—	L	L	●
Other ecosystems	Fire management	M	M	M	M	L	●
	Reduced landslides and natural hazards	L	L	L	L	L	—
	Reduced pollution including acidification	←→ M	M	L	L	L	—
	Restoration & reduced conversion of coastal wetlands	M	L	M	M	←→ L	—
	Restoration & reduced conversion of peatlands	M	—	na	M	- L	●
	Response options based on value chain management						
Demand	Reduced post-harvest losses	H	M	L	L	H	—
	Dietary change	H	—	L	H	H	—
	Reduced food waste (consumer or retailer)	H	—	L	M	M	—
Supply	Sustainable sourcing	—	L	—	L	L	—
	Improved food processing and retailing	L	L	—	—	L	—
	Improved energy use in food systems	L	L	—	—	L	—
	Response options based on risk management						
Risk	Livelihood diversification	—	L	—	L	L	—
	Management of urban sprawl	—	L	L	M	L	—
	Risk sharing instruments	←→ L	L	—	←→ L	L	●●

Options shown are those for which data are available to assess global potential for three or more land challenges.
The magnitudes are assessed independently for each option and are not additive.

Key for criteria used to define magnitude of impact of each integrated response option

		Mitigation *Gt CO₂-eq yr⁻¹*	Adaptation *Million people*	Desertification *Million km²*	Land Degradation *Million km²*	Food Security *Million people*
Positive	Large	More than 3	Positive for more than 25	Positive for more than 3	Positive for more than 3	Positive for more than 100
	Moderate	0.3 to 3	1 to 25	0.5 to 3	0.5 to 3	1 to 100
	Small	Less than 0.3	Less than 1	Less than 0.5	Less than 0.5	Less than 1
	Negligible	No effect	No effect	No effect	No effect	No effect
Negative	Small	Less than -0.3	Less than 1	Less than 0.5	Less than 0.5	Less than 1
	Moderate	-0.3 to -3	1 to 25	0.5 to 3	0.5 to 3	1 to 100
	Large	More than -3	Negative for more than 25	Negative for more than 3	Negative for more than 3	Negative for more than 100

←→ **Variable**: Can be positive or negative — no data na not applicable

Confidence level
Indicates confidence in the estimate of magnitude category.
H High confidence
M Medium confidence
L Low confidence

Cost range
See technical caption for cost ranges in US$ tCO_2e^{-1} or US$ ha^{-1}.
●●● High cost
●● Medium cost
● Low cost
— no data

SPM Figure 3A

We looked at **28** different response options that can be implemented with **limited or no competition** for land.

Almost all response options have a **positive effect** on **mitigation, adaptation, desertification, land degradation** and **food security**.

INTERGOVERNMENTAL PANEL ON climate change

Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security

Panel B shows response options that rely on additional land-use change and could have implications across three or more land challenges under different implementation contexts. For each option, the first row (high level implementation) shows a quantitative assessment (as in Panel A) of implications for global implementation at scales delivering CO_2 removals of more than 3 $GtCO_2\ yr^{-1}$ using the magnitude thresholds shown in Panel A. The red hatched cells indicate an increasing pressure but unquantified impact. For each option, the second row (best practice implementation) shows qualitative estimates of impact if implemented using best practices in appropriately managed landscape systems that allow for efficient and sustainable resource use and supported by appropriate governance mechanisms. In these qualitative assessments, green indicates a positive impact, grey indicates a neutral interaction.

Bioenergy and BECCS

Mitigation	Adaptation	Desertification	Land degradation	Food security	Cost
H	L			L	● / ●●●

High level: Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 $GtCO_2\ yr^{-1}$ in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several $GtCO_2\ yr^{-1}$ when it is a low carbon energy source {2.7.1.5; 6.4.1.1.5}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.4.5.1.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km_2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.4.3.1.5; 6.4.4.1.5}.

Mitigation	Adaptation	Desertification	Land degradation	Food security

Best practice: The sign and magnitude of the effects of bioenergy and BECCS depends on the scale of deployment, the type of bioenergy feedstock, which other response options are included, and where bioenergy is grown (including prior land use and indirect land use change emissions). For example, limiting bioenergy production to marginal lands or abandoned cropland would have negligible effects on biodiversity, food security, and potentially co-benefits for land degradation; however, the benefits for mitigation could also be smaller. {Table 6.58}

Reforestation and forest restoration

Mitigation	Adaptation	Desertification	Land degradation	Food security	Cost
M	M	M	M	M	●●

High level: Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts assuming implementation of reforestation and forest restoration (partly overlapping with afforestation) at a scale of 10.1 $GtCO_2\ yr^{-1}$ removal {6.4.1.1.2}. Large-scale afforestation could cause increases in food prices of 80% by 2050, and more general mitigation measures in the AFOLU sector can translate into a rise in undernourishment of 80–300 million people; the impact of reforestation is lower {6.4.5.1.2}.

Mitigation	Adaptation	Desertification	Land degradation	Food security

Best practice: There are co-benefits of reforestation and forest restoration in previously forested areas, assuming small scale deployment using native species and involving local stakeholders to provide a safety net for food security. Examples of sustainable implementation include, but are not limited to, reducing illegal logging and halting illegal forest loss in protected areas, reforesting and restoring forests in degraded and desertified lands {Box6.1C; Table 6.6}.

Afforestation

Mitigation	Adaptation	Desertification	Land degradation	Food security	Cost
M	M	M	L	M	●●

High level: Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts assuming implementation of afforestation (partly overlapping with reforestation and forest restoration) at a scale of 8.9 $GtCO_2\ yr^{-1}$ removal {6.4.1.1.2}. Large-scale afforestation could cause increases in food prices of 80% by 2050, and more general mitigation measures in the AFOLU sector can translate into a rise in undernourishment of 80–300 million people {6.4.5.1.2}.

Mitigation	Adaptation	Desertification	Land degradation	Food security

Best practice: Afforestation is used to prevent desertification and to tackle land degradation. Forested land also offers benefits in terms of food supply, especially when forest is established on degraded land, mangroves, and other land that cannot be used for agriculture. For example, food from forests represents a safety-net during times of food and income insecurity {6.4.5.1.2}.

Biochar addition to soil

Mitigation	Adaptation	Desertification	Land degradation	Food security	Cost
M	—	—	L	L	●●●

High level: Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts assuming implementation of afforestation at a scale of 6.6 $GtCO_2\ yr^{-1}$ removal {6.4.1.1.3}. Dedicated energy crops required for feedstock production could occupy 0.4–2.6 Mkm^2 of land, equivalent to around 20% of the global cropland area, which could potentially have a large effect on food security for up to 100 million people {6.4.5.1.3}.

Mitigation	Adaptation	Desertification	Land degradation	Food security

Best practice: When applied to land, biochar could provide moderate benefits for food security by improving yields by 25% in the tropics, but with more limited impacts in temperate regions, or through improved water holding capacity and nutrient use efficiency. Abandoned cropland could be used to supply biomass for biochar, thus avoiding competition with food production; 5-9 Mkm^2 of land is estimated to be available for biomass production without compromising food security and biodiversity, considering marginal and degraded land and land released by pasture intensification {6.4.5.1.3}.

SPM Figure 3B

We looked closely at 4 land-based response options with potential **implications** for **land challenges**.

Their potential **contribution** to **adaptation** and **mitigation** was also analysed.

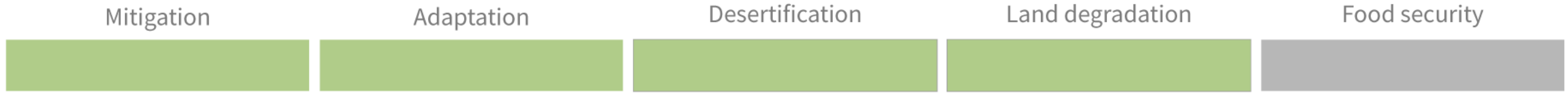
INTERGOVERNMENTAL PANEL ON climate change

SPM Figure 3 – 3

When implemented using best-practice, the response option almost always has a positive impact on land challenges.

Bioenergy and BECCS

High level: Impacts on adaptation, desertification, land degradation and food security are maximum potential impacts, assuming carbon dioxide removal by BECCS at a scale of 11.3 $GtCO_2\ yr^{-1}$ in 2050, and noting that bioenergy without CCS can also achieve emissions reductions of up to several $GtCO_2\ yr^{-1}$ when it is a low carbon energy source {2.7.1.5; 6.4.1.1.5}. Studies linking bioenergy to food security estimate an increase in the population at risk of hunger to up to 150 million people at this level of implementation {6.4.5.1.5}. The red hatched cells for desertification and land degradation indicate that while up to 15 million km_2 of additional land is required in 2100 in 2°C scenarios which will increase pressure for desertification and land degradation, the actual area affected by this additional pressure is not easily quantified {6.4.3.1.5; 6.4.4.1.5}.



Best practice: The sign and magnitude of the effects of bioenergy and BECCS depends on the scale of deployment, the type of bioenergy feedstock, which other response options are included, and where bioenergy is grown (including prior land use and indirect land use change emissions). For example, limiting bioenergy production to marginal lands or abandoned cropland would have negligible effects on biodiversity, food security, and potentially co-benefits for land degradation; however, the benefits for mitigation could also be smaller. {Table 6.58}

ipcc INTERGOVERNMENTAL PANEL ON climate change WMO UNEP

WG III Co-chairs' ambitions for AR6

- To assess the linkages between high-level climate stabilization goals and scenarios on the one hand and the practical steps needed in the short- and medium-term to make the realisation of these goals possible
- To make greater use of social science disciplines, in addition to economics, especially for gaining insight into issues related to lifestyle, behaviour, consumption, technological choices and socio-technical transitions.
- To link climate change mitigation better to other agreed policy goals nationally and internationally (e.g. the Sustainable Development Goals - SDGs).

Chapter 1 Introduction and Framing

Chapter 2: Emissions trends and drivers
Chapter 3: Mitigation pathways compatible with long-term goals
Chapter 4: Mitigation and development pathways in the near- to mid-term

Chapter 5: Demand, services and social aspects of mitigation

Chapter 6: Energy systems
Chapter 7: Agriculture, Forestry, and Other Land Uses (AFOLU)
Chapter 8: Urban systems and other settlements
Chapter 9: Buildings
Chapter 10: Transport
Chapter 11: Industry
Chapter 12: Cross sectoral perspectives

Chapter 13: National and sub-national policies and institutions
Chapter 14: International cooperation
Chapter 15: Investment and finance
Chapter 16: Innovation, technology development and transfer

Chapter 17: Accelerating the transition in the context of sustainable development

Annex C: Scenarios and modelling methods

The outline of the IPCC Working Group III report to be published in 2021

In the context of sustainable development

Chapter 1: Introduction and Framing

Chapter 17: Accelerating the transition in the context of sustainable development

The past and the future: a helicopter perspective

Chapter 2:	Emissions trends and drivers
Chapter 3:	Mitigation pathways compatible with long-term goals
Chapter 4:	Mitigation and development pathways in the near- to mid-term

Annex C: Scenarios and modelling methods

Sectors and systems

Chapter 6:	Energy systems
Chapter 7:	Agriculture, Forestry, and Other Land Uses (AFOLU)
Chapter 8:	Urban systems and other settlements
Chapter 9:	Buildings
Chapter 10:	Transport
Chapter 11:	Industry
Chapter 12:	Cross sectoral perspectives

Enabling climate change mitigation

Chapter 13: National and sub-national policies and institutions

Chapter 14: International cooperation

Chapter 15: Investment and finance

Chapter 16: Innovation, technology development and transfer

And don't forget people……

Chapter 5: Demand, services and social aspects of mitigation

We’re people too!

Chapter 2: Emission trends and drivers

1. Past and present trends of territorial emissions and sinks on an annual and cumulative basis (by region, sector, GHG, etc.), including estimates of uncertainty
2. Past and present trends of consumption-based emissions on an annual and cumulative basis (by region, sector, GHG, etc.), including estimates of uncertainty
3. Socio-economic and demographic drivers (e.g. GDP, population, international trade) and their trends
4. Overview of sectoral emission drivers and their trends
5. Climate and non-climate policies and measures at different scales and their impacts on missions
6. Technological choices and changes and impacts of technological breakthroughs
7. Emissions associated with existing and planned long-lived infrastructure
8. Behavioral choices and lifestyles at individual and societal levels

Chapter 5: Demand, services and social aspects of mitigation

1. Mitigation, sustainable development and the SDGs (human needs, access to services, and affordability)
2. Patterns of development and indicators of wellbeing
3. Sustainable consumption and production
4. Linking services with demand, sectors, systems - implications for mitigation and sustainable development
5. Culture, social norms, practices and behavioural changes for lower resource requirements
6. Sharing economy, collaborative consumption, community energy
7. Implications of information and communication technologies for mitigation opportunities taking account of social change
8. Circular economy (maximising material and resource efficiency, closing loops): insights from life cycle assessment and material flow analysis
9. Social acceptability of supply and demand solutions
10. Leapfrogging, capacity for change, feasible rates of change and lock-ins
11. Identifying actors, their roles and relationships
12. Impacts of non-mitigation policies (welfare, housing, land use, employment, etc.)
13. Policies facilitating behavioural and lifestyle change
14. Case studies and regional specificities

Chapter 6: Energy systems

1. Energy services, energy systems and energy sector, integrations with other systems (including food supply system, buildings, transportation, industrial systems)
2. Energy resources (fossil and non-fossil) and their regional distribution
3. Global and regional new trends and drivers
4. Policies and measures and other regulatory frameworks; and supply and demand systems
5. Fugitive emissions and non-CO2 emissions
6. Global and regional new trends for electricity and low carbon energy supply systems, including deployment and cost aspects.
7. Smart energy systems, decentralized systems and the integration of the supply and demand
8. Energy efficiency technologies and measures
9. Mitigation options (including CCS), practices and behavioral aspects (including public perception and social acceptance)
10. Interconnection, storage, infrastructure and lock-in
11. The role of energy systems in long-term mitigation pathways
12. Bridging long-term targets with short and mid-term policies
13. Sectoral policies and goals (including feed-in tariffs, renewables obligations and others)
14. Mainstreaming climate into energy policy

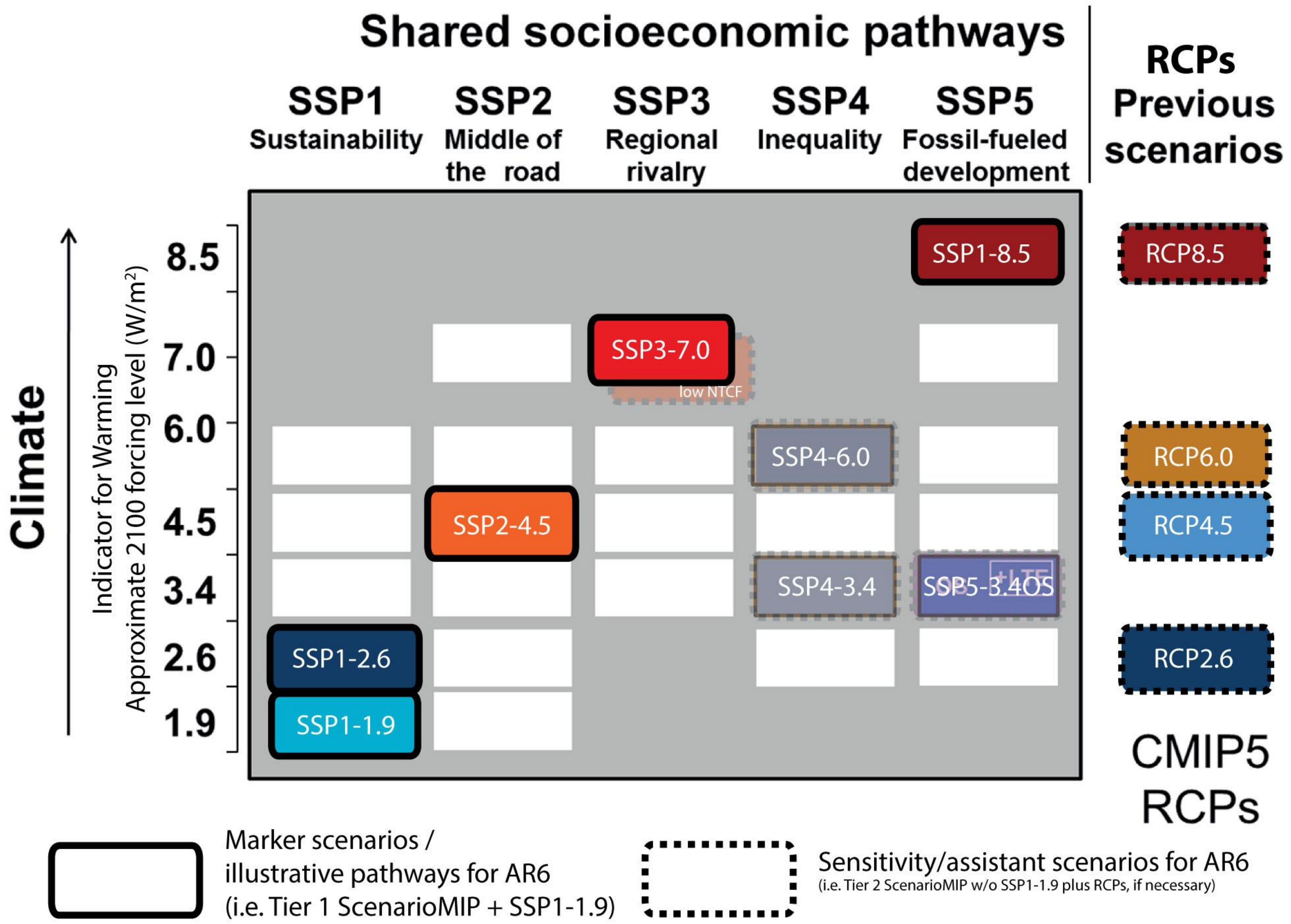
Chapter 16: Innovation, technology development and transfer

1. Key findings from AR5 and recent developments
2. Role of innovation, technology development, diffusion and transfer in contributing to sustainable development and the aims of the Paris Agreement, including mitigation pathways
3. Innovation and technology as systemic issues, evaluating literature on cases of technological innovation systems and innovation policy
4. Assessment of international institutions partnerships and cooperative approaches relevant to technology, innovation and R&D
5. Capacity for transformative change, including capabilities for innovation, engineering, governance, R&D cooperation and deployment incentives
6. Assessment of experiences with accelerating technological change through innovation policy for climate change at the national level, including successful case studies
7. Specific challenges in emerging economies and least-developed countries, e.g. SIDS and land-locked countries
8. Acceptability and social inclusion in decision-making, communication and information diffusion
9. Characterisation and implications of new disruptive technologies
10. Links to adaptation and sustainable development (including co-benefits, synergies and trade-offs)

Key cross-cutting issues

- Scenarios
- Metrics
  - Temperature
  - Net emissions
  - Carbon budgets
- Land and integrated assessment models
- “Feasibility”

Cross-Working Group approach to scenarios



Metrics

Temperature

- Global mean surface temperature (GMST)
  - Used by WMO for Statement on State of the Global Climate
  - Based on observations, used by WG II and WG I observation community
- Global surface air temperature (GSAT)
  - Metric used in most models, used by WG I modellers and WG III
  - Has risen faster than GMST

Net emissions

- Model based emission estimates diverge from UNFCCC inventories by ~4 GtCO2e per annum
- Reasons are understood:
  - Scope of 'managed land'
  - Treatment of natural fluxes on managed land

Carbon budgets

- Net zero CO_2 or net zero GHG
- SR1.5: "The remaining carbon budget is defined here as cumulative CO2 emissions from the start of 2018 until the time of net-zero global emissions"
- Mitigation requirements for limiting warming to specific levels can be quantified using a carbon budget that relates cumulative CO_2 emissions to global mean temperature increase
- Net cumulative emissions over the 21st century

Land and integrated assessment modelling

- Integrated assessment models (IAMs) rely heavily on the large scale CO_2 removal (CDR) to meet high levels of climate ambition
  - Assumed availability of land may not fully reflect social/food security/ ecosystem service constraints
  - Relatively high social discount rates favour expensive, negative emission response options deployed in the long-term
- Lack of explicit treatment of many “nature-based solutions” in most models

“Feasibility”

- The Special Report on Global Warming of 1.5°C treated “feasibility” in two ways
  - It established a conceptual framework based on six dimensions, or sets of enabling conditions
  - It applied that framework to individual response options
- Feasibility dimensions from SR1.5
  - Geophysical
  - Environmental
  - Technical
  - Economic
  - Socio-political
  - Institutional
- The WG III AR6 challenge is to apply the feasibility framework at the *system* level.
- Emerging “just transition” concept (COP24)

WG III Timeline

2019	APR	**1-5 April** First Lead Author Meeting (LAM1)
	SEP	**30 September - 4 October** Second Lead Author Meeting (LAM2)
2020	JAN	**13 January - 8 March** Expert Review of First Order Draft
	APR	**15 - 19 April** Third Lead Author Meeting (LAM3)
	SEP	**19 September** Literature deadline: cut-off date for submitted papers Literature for consideration by report authors must be submitted to publishers by this date
	OCT	**19 October – 13 December** Expert & Government Review of the SOD & the First Draft of the Summary for Policymakers (SPM)
2021	JAN	**11 – 15 January** Fourth Lead Author Meeting (LAM4)
	APR	**5 April** Literature deadline: cut-off date for accepted papers Literature for consideration by report authors must be accepted for publication by this date
	MAY	**3 May – 27 June** Final Government Distribution (FGD)
	SEP	**3 – 4 September** SPM Meeting **6 – 10 September** Approval Plenary

ipcc INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

Impacts of previous IPCC Assessment Reports

FAR (1990)	led to	UNFCCC
SAR (1995)	input for	Kyoto Protocol
TAR (2001)	focused attention on	Impacts of climate change and need for adaptation
AR4 (2007)	input for	Decision on 2ºC limit; basis for post Kyoto Protocol agreement
AR5 (2013/2014)	input for	Paris Agreement

ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

UNFCCC Timeline

2020

- Subsidiary Bodies meeting: Bonn, June 2020
- Conference of the Parties (COP 26), Glasgow, November 2020

2020-2022

- Second Periodic Review
- Adequacy of and overall progress toward achieving the long-term global goal in the light of the ultimate objective of the Convention
- Starts 2020; three Structured Expert Dialogues SB 53-55; concludes COP 28 2022

2023

- Conference of the Parties (COP 29)
- First Global Stocktake (GST)

2023 onwards

- IPCC Seventh Assessment Cycle
- Second Global Stocktake, 2028

Thank you for your attention!

www.ipcc.ch

www.ipcc-wg3.ac.uk