

Summary of the 50th Session of the Intergovernmental Panel on Climate Change: 2-7 August 2019

On Wednesday afternoon, 7 August 2019, the 50th session of the Intergovernmental Panel on Climate Change (IPCC-50) adopted the Summary for Policymakers (SPM) of the Special Report on Climate Change and Land (SRCCL) and accepted the underlying report. The SRCCL represents the first ever comprehensive look at the whole land-climate system, addressing land as a critical resource, desertification and land degradation, food security, and land and climate change responses.

Although the meeting was initially scheduled to end on Tuesday, 6 August, delegates needed to work through the night to reach agreement on the SPM at the Second Joint Session of the three IPCC Working Groups, in cooperation with the Task Force on National Greenhouse Gas Inventories, before forwarding the SPM to the Panel for adoption.

IPCC-50 also: discussed collaboration between the IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; and took note of oral progress reports on the Synthesis Report of the Sixth Assessment Report and of the Task Group on the Organization of the Future Work of the IPCC in light of the Global Stocktake.

The SRCCL's official name is "Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems." It was prepared by 107 experts from 52 countries, including 15 Coordinating Lead Authors (CLAs), 71 Lead Authors, and 21 Review Editors. This is the first IPCC report in which a majority of the authors are from developing countries, with women accounting for 40% of CLAs. The report includes over 7,000 cited references. The author team considered over 28,275 expert and government review comments, including 3,043 on the final government draft.

IPCC-50 convened from 2-7 August 2019 in Geneva, Switzerland, and brought together more than 350 participants from over 120 countries.

A Brief History of the IPCC

The IPCC was established in 1988 by the World Meteorological Organization (WMO) and the UN Environment Programme (UNEP) to assess, in a comprehensive, objective, open, and transparent manner, the scientific, technical, and socio-economic information relevant to understanding human-induced climate change, its potential impacts, and adaptation and mitigation options. The IPCC is an intergovernmental and scientific body with 195 member countries. It does not undertake new research or monitor climate-related data; instead, it conducts

assessments of the state of climate change knowledge on the basis of published and peer-reviewed scientific and technical literature. IPCC reports are intended to be policy relevant, but not policy prescriptive.

The IPCC has three Working Groups:

- Working Group I (WG I) addresses the physical science basis of climate change.
- Working Group II (WG II) addresses climate change impacts, adaptation, and vulnerability.
- Working Group III (WG III) addresses options for reducing greenhouse gas (GHG) emissions and mitigating climate change.

Each WG has two Co-Chairs and seven Vice-Chairs, with the exception of WG II, which has eight Vice-Chairs. The Co-Chairs guide the WGs in fulfilling the mandates given to them by the Panel with the assistance of Technical Support Units (TSUs).

The IPCC also has a Task Force on National Greenhouse Gas Inventories (TFI) with two Co-Chairs to oversee the IPCC National GHG Inventories Programme, which is also supported by a TSU. The Programme aims to: develop and refine an internationally-agreed methodology and software for calculating

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and reporting national GHG emissions and removals; and encourage its use by parties to the United Nations Framework Convention on Climate Change (UNFCCC).

The Panel elects its Bureau for the duration of a full assessment cycle, which includes preparation of an IPCC assessment report, which usually takes seven years. The Bureau plans, coordinates, and monitors the IPCC's work, and is composed of climate change experts representing all regions. Currently, the Bureau comprises 34 members, and includes the IPCC Chair and Vice-Chairs, WG Co-Chairs and Vice-Chairs, and TFI Co-Chairs. In 2011, the IPCC established an Executive Committee to assist with intersessional work and coordination among the WGs. The IPCC has a permanent Secretariat, which is based in Geneva, Switzerland, and hosted by the WMO.

IPCC Products: Since its inception, the Panel has prepared a series of comprehensive assessment reports, special reports (SRs) and technical papers that provide scientific information on climate change to the international community.

The IPCC has produced five assessment reports, which were completed in 1990, 1995, 2001, 2007, and 2014. The Sixth Assessment Report (AR6) is expected to be completed in 2022. The assessment reports are structured in three parts, one for each WG. Each WG's contribution comprises a SPM, a Technical Summary and the full underlying assessment report. Each of these reports undergoes an exhaustive and intensive review process by experts and governments, involving three stages: a first review by experts, a second review by experts and governments, and a third review by governments.

Each SPM is then approved line-by-line by the respective WG. A Synthesis Report (SYR) is produced for the assessment report as a whole and integrates the most relevant aspects of the three WG reports and SRs of that specific cycle. The Panel then undertakes a line-by-line approval of the SPM of the SYR.

The IPCC has also produced a range of SRs and technical papers on climate change-related issues, including:

- Land Use, Land-Use Change and Forestry (2000);
- Carbon Dioxide Capture and Storage (2005);
- Climate Change and Water (2008);
- Renewable Energy Sources and Climate Change Mitigation (2011); and
- Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2011).

The sixth assessment cycle includes three Special Reports:

- Global Warming of 1.5°C (SR15), which was approved by IPCC-48 in October 2018;
- Climate Change and Land (SRCCL), which was approved by IPCC-50 in August 2019; and
- Ocean and Cryosphere in a Changing Climate (SROCC), which is expected to be approved by IPCC-51 in September 2019.

In addition, the IPCC produces methodology reports, which provide guidelines to assist countries in reporting on GHGs. Good Practice Guidance reports were approved by the Panel in 2000 and 2003. The IPCC Guidelines on National GHG Inventories was approved in 2006. In 2013, the IPCC adopted a Supplement to the 2006 IPCC Guidelines: Wetlands (Wetlands Supplement), and the Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement). A Refinement to the 2006 Guidelines on National GHG Inventories (2019 Refinement) was adopted at IPCC-49 in May 2019.

In 2007, the IPCC was awarded the Nobel Peace Prize, jointly with former US Vice President Al Gore, for its work and efforts "to build up and disseminate greater knowledge about manmade climate change, and to lay the foundations needed to counteract such change."

Sixth Assessment Cycle

IPCC-41 to IPCC-43: IPCC-41 (24-27 February 2015, Nairobi, Kenya) addressed future IPCC work and adopted decisions relevant to the sixth assessment cycle. IPCC-42 (5-8 October 2015, Dubrovnik, Croatia) elected Bureau members for the sixth assessment cycle. IPCC-43 (11-13 April 2016, Nairobi, Kenya) agreed to undertake two SRs (SRCCL and SROCC) and the 2019 Refinement during the sixth assessment cycle. In addition, in response to an invitation from the 21st session of the Conference of the Parties to the UNFCCC (COP 21) asking the IPCC to provide an SR in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels, IPCC-43 agreed to prepare the Special Report on Global Warming of 1.5°C (SR15).

The Panel also agreed at that time that an SR on cities would be prepared as part of the seventh assessment cycle.

IPCC-44: During this session (17-21 October 2016, Bangkok, Thailand), the Panel adopted outlines of SR15 and the 2019 Refinement. The IPCC also adopted decisions on, *inter alia*: an Expert Meeting on Mitigation, Sustainability, and Climate Stabilization Scenarios; communications and the AR6 scoping process; and a meeting on climate change and cities.

IPCC Cities and Climate Change Science Conference: This meeting (5-7 March 2018, Edmonton, Canada) brought together participants from the science, policy and practice communities to: discuss current and future sources of emissions; and identify pathways for cities to pursue emission reductions and resilience strategies. The meeting produced a research agenda to better understand climate change, its impacts on cities, and the critical role local authorities can play in addressing the climate challenge.

IPCC-45: This meeting (28-31 March 2017, Guadalajara, Mexico) approved the SRCCL and SROCC outlines, and discussed, *inter alia*: the strategic planning schedule for the sixth assessment cycle; a proposal to consider short-lived climate forcers (SLCFs); and options for resourcing the IPCC, which led to a decision to establish the *Ad Hoc* Task Group on the Financial Stability of the IPCC.

IPCC-46: During this session (6-10 September 2017, Montreal, Canada), the Panel, *inter alia*, approved the chapter outlines for the three WG report contributions to AR6.

IPCC-47: At this session (13-16 March 2018, Paris, France), the Panel agreed to, *inter alia*:

- establish a task group on gender;
- draft terms of reference for a task group on the organization of the future work of the IPCC in light of the Global Stocktake (GST) under the Paris Agreement;
- expand the IPCC Scholarship Programme to include funding for chapter scientists; and
- enhance developing country participation in IPCC activities.

The meeting was preceded by a 30th anniversary celebration of the IPCC, hosted by the Government of France.

IPCC-48: During this session (1-6 October 2018, Incheon, Republic of Korea), the IPCC accepted SR15 and its Technical Summary and approved its SPM. A Joint Session of the WGs considered the SPM line-by-line to reach agreement, representing the first time the three WGs had collaborated together, in an interdisciplinary fashion, on an IPCC SR. The SPM consists of four sections:

- Understanding global warming of 1.5°C;
- Projected climate change, potential impacts, and associated risks;
- Emission pathways and system transitions consistent with 1.5°C global warming; and
- Strengthening the global response in the context of sustainable development and efforts to eradicate poverty.

The SPM concludes, *inter alia*, that, limiting global average temperature rise to 1.5°C is still possible, but will require “unprecedented” transitions in all aspects of society.

IPCC-49: During this session (8-12 May 2019, Kyoto, Japan), the IPCC adopted the Overview Chapter of the 2019 Refinement and accepted the underlying report. The Overview Chapter consists of an introduction, a background section and sections on: Key Concepts Unchanged from the 2006 IPCC Guidelines; Coverage of the 2019 Refinement; Relationship with the 2006 IPCC Guidelines; and Specific Developments in the 2019 Refinement.

IPCC-49 also adopted decisions on:

- the terms of reference of the Task Group on Gender Policy and Gender Implementation Plan;
- guidance to the Board of Trustees on the use of the IPCC Scholarship Programme Fund; and
- beginning preparatory work during the sixth assessment cycle for a methodological report on SLCFs to be completed during the seventh assessment cycle.

Report of IPCC-50 and the Second Joint Session of WGs I, II, and III, in Cooperation with the TFI

IPCC Chair Hoesung Lee opened IPCC-50 and welcomed participants on Friday morning, 2 August, noting that the SRCLL is the first report produced by the three WGs, in cooperation with the TFI, that addresses all three UN Rio Conventions. He called the three SRs and the 2019 Refinement a bridge between scientific knowledge and policymakers, civil society, and consumers.

Elena Manaenkova, WMO Deputy Secretary-General, emphasized the importance of the SRCLL for WMO’s core work, given its recent strategic decision to move fully towards an integrated whole “Earth system” approach, linking land, atmosphere, ocean and hydrosphere, cryosphere, and even the biosphere. She also noted the WMO’s work addressing knowledge gaps identified by the IPCC, and the World Climate Research Programme’s improved horizontal coordination of WMO reports to better connect science with services and policymaking.

Via video message, UNEP Executive Director Inger Andersen welcomed the SRCLL as timely and underlined the need to translate the science to action toward restoring “our degraded planet.” She stated that UNEP’s work includes using ecosystem-based restoration approaches and reducing emissions from deforestation and forest degradation to ensure climate-smart and resilient land use.

Florin Vladu, UNFCCC Secretariat, said the SRCLL will guide policymakers and practitioners on the best climate adaptation and mitigation response measures. He noted efforts to accelerate climate change action in 2019, including through the UN Secretary-General’s Climate Action Summit in September, to achieve carbon neutrality by 2050. He noted that the continuing collaboration between the UNFCCC Subsidiary Body on Scientific and Technological Advice and the IPCC at the science-policy interface is effective in enhancing the flow of science into the UNFCCC.

Marc Chardonens, Director, Swiss Federal Office for the Environment, pointed to the fragile nature of land and the speed at which it can be destroyed, citing evidence that “we’re not using land sustainably.” He drew attention to the impacts of 2019’s heatwave and lack of water on Switzerland’s agricultural yield, which have already halved normal production. He cautioned against attempting to negotiate science or seeking to discredit IPCC reports and against engaging in “selective amnesia,” saying that “we cannot play with the facts.”

Approval of the Provisional Agenda: On Friday morning, IPCC Chair Lee presented the provisional agenda for adoption (IPCC-L/Doc.1). France raised concerns about the procedures that led to footnotes in the 2019 Refinement. Several countries echoed the concern, perceiving the matter as an unusual IPCC practice. Supported by Denmark, Germany, Luxembourg, Norway, the UK, and Saint Kitts and Nevis, France proposed time during this meeting to address this matter further, including the naming of countries associated with the footnotes. Saudi Arabia, supported by Egypt and Iran, objected, stressing that without the footnotes her delegation could not accept the 2019 Refinement. Taha Zatari, WGII Vice-Chair, cautioned against opening up discussions and strongly opposed naming countries, suggesting that to target some countries would be very unhelpful.

Sophie Schlingemann, Legal and Liaison Officer, IPCC Secretariat, recalled the decision taken during IPCC-49 to apply Principle 10(b) of the Principles Governing IPCC Work. She clarified that the procedure taken to reflect objections from various countries was correct. Stating that the IPCC-49 decision on adoption and acceptance of the 2019 Refinement stands, IPCC Chair Lee proposed, and the US supported, that countries with questions about the procedure meet with the Secretariat during IPCC-50 to enhance clarity and understanding regarding the footnote, which was agreed.

Switzerland, supported by the UK, Luxembourg, Denmark, and Norway, proposed adding an agenda item on cooperation between IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). India called for clarity on the modalities of such cooperative work. IPCC Chair Lee proposed addressing this under the agenda item on Other Business, which was agreed.

The UK requested an update on progress on the SYR and proposed adding this to the agenda, which was agreed.

The provisional agenda was then adopted.

On Wednesday afternoon during the closing IPCC plenary, noting that the Panel is scheduled to review its policies and procedures at IPCC-52, Schlingemann proposed, and the Panel agreed, to consider the Principles Governing the IPCC then, particularly Principle 10(b).

Adoption of the IPCC-49 Report: IPCC Chair Lee presented the draft report of IPCC-49 (IPCC-L/Doc. 2). Saudi Arabia called for removing a paragraph on causes of disagreement over methodologies on fugitive oil and gas emissions in the 2019 Refinement, noting it did not accurately reflect all the objections to it. The US called for revisions, citing an imbalance in the level of detail on different countries’ interventions. Chair Lee suggested postponing approval of the report of IPCC-49.

During Tuesday afternoon’s resumed plenary, IPCC Chair Hoesung Lee reported back of successful consultations on the IPCC 49 report and invited comments on the revised report (IPCC-L/Doc. 2, Rev.1) that was made available on IPCC web portal.

Tanzania and Belgium asked for a presentation of the changes. Noting time pressure at this meeting, Germany and Saudi Arabia cautioned against discussing the report on the screen.

IPCC Secretary Abdalrahman Mokssit informed briefly, that: the Secretariat received requests for amendments from some delegations; the Secretariat approached and consulted with these delegations; and agreement to add a minor explanatory note in the report was reached during informal consultations. On the particular changes, he informed that the added note in the draft report explains that IPCC rules and procedures were applied and followed. The Panel then adopted the revised IPCC-49 report (IPCC-L/Doc. 2, Rev.1).

Following the opening of IPCC-50 and adoption of the agenda, the IPCC plenary was suspended so the Joint WG/TFI Session could begin its work. The IPCC plenary met briefly on Tuesday afternoon, and reconvened on Wednesday afternoon to approve the SRCCL SPM and accept the underlying report.

Consideration and Approval of the SRCCL SPM

Opening of the Joint Session of WGs I, II, and III, in Cooperation with TFI: On Friday morning, WG III Co-Chair Jim Skea introduced the draft SRCCL SPM, highlighting the remarkable degree of cooperation between the WGs and TFI and the fact that, for the first time, the report involved more authors from developing countries than from developed countries. The WG Co-Chairs then provided an overview of the draft SPM, including its content, structure, and narrative, and the process for the approval session.

Delegates worked from Friday through Wednesday to approve the SPM line-by-line, working in plenary, contact groups, and informal huddles to reach consensus. They worked off of a final draft of the SPM, which incorporated the more than 3,000 government comments received on the Final Government Draft.

The SRCCL SPM has four sections:

- People, land and climate in a changing world;
- Adaptation and mitigation response options;
- Enabling response options; and
- Action in the near term.

For each subsection, the WG Co-Chairs first presented the headline statement, which was followed by discussions on the paragraphs in the subsection. For many of the subsections and paragraphs, delegates made general comments in plenary before text was sent to a contact group or huddle for further discussion and revisions. After agreement was reached on the paragraphs, delegates returned to the headline statement to ensure consistency across the subsection as a whole.

Introduction: This section provides an overview of the origins of the SRCCL and the SPM structure and was first addressed on Friday morning. WG I Co-Chair Valerie Masson-Delmotte noted a small number of editorial changes and the addition of footnotes with definitions of key terms as included in the draft SRCCL Glossary and as used by other relevant international organizations.

Regarding a sentence on the SRCCL referring to other IPCC reports and related reports from other intergovernmental bodies, Egypt, Saudi Arabia, and India proposed deleting specific reference to SR15. Norway, Switzerland, Luxembourg, France, Ireland, Germany, the UK, Colombia, Chile, Belgium, Canada, Cuba, Trinidad and Tobago, Mexico, Turkey, Venezuela, Indonesia, Friends World Committee for Consultation, Climate Action Network (CAN), and others objected, stressing the importance of referring to SR15 since SRCCL complements SR15. WG III Co-Chair Skea proposed, and delegates agreed, to move reference to other related reports identified in a footnote into the main text alongside SR15, namely the IPBES thematic assessment on Land Degradation and Restoration, the IPBES Global Assessment Report on Biodiversity and Ecosystem Services, and the Global Land Outlook of the UN Convention to Combat Desertification (UNCCD).

Participants postponed consideration of a paragraph on the SPM's structure pending approval of the rest of the SPM. This final paragraph of the introduction was then approved on Wednesday afternoon.

Final Text: The introduction explains that the SRCCL addresses GHG fluxes in land-based ecosystems, land use, and sustainable land management in relation to climate change adaptation and mitigation, desertification, land degradation, and

food security. The introduction also provides the background of the SRCCL, noting that it responds to the IPCC's 2016 decision to prepare three SRs during the sixth assessment cycle and provides an updated assessment of the current state of knowledge.

A. People, Land and Climate in a Warming World

On Friday afternoon, WG I Co-Chair Panmao Zhai introduced this section, which was then addressed throughout the session, and agreed in full on Wednesday. Zhai said the report, and this section in particular, shows how land is both impacted by climate, and has an influence on climate. Saudi Arabia expressed concern that many findings with significant relevance to her region, such as intensity of dust storms and impacts on oasis areas, should be better reflected in the SPM.

A1. This subsection was first addressed in plenary and then, along with Figure SPM.1, in a contact group. The subsection addresses the **importance of land for human livelihoods and well-being**, including the supply of food, freshwater, and multiple other ecosystem services, as well as biodiversity. The headline statement for this subsection also notes that human use affects more than 70% of the global, ice-free land surface, and that land has an important role in the climate system.

A1.1: This paragraph discusses **land providing many ecosystem services and functions that are essential for humanity**. Discussions focused on a sentence stating that people currently use one-quarter to one-third of terrestrial potential net primary production (NPP) for food, feed, fiber, timber, and energy. Views among delegates differed on the need to define NPP, and the need to clarify that potentially only a fraction of this NPP is available for human use. The European Union (EU) explained that living beings other than humans use NPP

The authors, supported by Switzerland but opposed by the US, proposed referring to IPBES's use of the "nature's contribution to people" (NCP) concept as embodying ecosystem services. Bolivia, with Cuba, asked if a reference to IPBES's ecosystem services and "functions" could be reflected in the main paragraph. Germany asked to include reference to cultural ecosystem services in the paragraph. Delegates agreed to these amendments and to reference in a footnote that, in its conceptual framework, IPBES uses NCP, which includes ecosystem goods and services.

A sentence on the total annual economic value of the world's terrestrial ecosystem services was also debated at length. Some participants called for a firm number regarding the social and economic value of ecosystem services. Bolivia and India noted the existence of various approaches to valuing terrestrial ecosystems, making suggestions to clarify that economic valuation in terms of gross domestic product (GDP) is only one of those approaches. After further clarification by the authors, the group agreed to: specify that "in one economic approach," the world's terrestrial ecosystem services have been valued on an annual basis to be approximately equivalent to the annual global GDP; and reference in a footnote that GDP is estimated at USD 75 trillion for 2011, based on US dollars for 2007.

A1.2: Following general comments on this paragraph on **land as both a source and a sink of GHGs**, delegates discussed revised text on Saturday night. There was substantial discussion regarding whether to specify anthropogenic climate change, with the Russian Federation, Ukraine, and Saudi Arabia arguing that vulnerability applies to all climate change. The CLAs, Morocco, Norway, and Mexico preferred emphasizing "anthropogenic" climate change as the subject of the entire report, and WG II Co-Chair Hans-Otto Pörtner agreed. IPCC Vice-Chair Ko Barrett noted that extreme weather events are not always a result of anthropogenic climate change. WG II Co-Chair Pörtner proposed stating that "land ecosystems and biodiversity are vulnerable to

ongoing climate change and weather and climate extremes, to different extents.” With this addition, the paragraph was agreed.

A1.3: On a paragraph addressing **population growth and changes in per capita consumption** causing unprecedented rates of global land and freshwater use, many participants called for greater precision in the statements and their relation to climate change, distinguishing between regionally-specific and global trends, and adding clarity on the drivers.

India stressed the importance of clearly reflecting differentiation across the world in terms of, *inter alia*, food production, irrigation and population growth, and, with others, called for clarification on the meaning of consumption and its role in what is presented as population growth impacts.

Cuba called for referring to economic or GDP growth as well as population growth, as done in other IPCC reports. Zimbabwe asked for clarity on what is included in per capita consumption. Bolivia noted too much emphasis on consumption and not enough on production and, with Germany and others, proposed referring to “unsustainable” consumption and production.

India, Norway, and others also called for clarity on the definitions of—and assumed links between—consumption and diet.

Spain, supported by the US, India, Ireland, Norway, and others, queried whether food waste also included food loss, and called for consistency in the use of terms. India highlighted differences regarding food lost due to lack of technology and infrastructure versus food wasted because of overproduction and a food waste culture.

Ireland, the US, and France said the observed increase in the overweight population is multi-causal and cautioned against implying that it is the result of a single cause. The US and Brazil called for including reference to the fact that agricultural intensification has allowed for greater crop production without necessarily leading to an increase in land area. Indonesia suggested a reference to overexploitation as a cause of habitat destruction.

The CLAs introduced revised text, including changes to accomplish a greater balance in the emphasis on production versus consumption, and replacement of a reference to “irrigation” with “agriculture.”

India suggested and the group agreed to specify the time period of these changes, possibly since 1850-1900 and to add reference to differences between developed and developing countries or variation across development levels when addressing regional variations.

On Monday afternoon, after consideration by a contact group, the text was agreed.

A1.4: Regarding a paragraph that mentions the **doubling of the per capita supply of vegetable oils and meat globally**, Germany and India proposed, and the group agreed, to provide a clearer link between the consumption of vegetable oils and climate change.

On Monday afternoon, the paragraph was agreed based on text from the contact group.

A1.5: Regarding a paragraph on **human-induced land degradation**, Botswana underscored the need to include dryland information from countries in the southern African region. On a sentence addressing people negatively affected by climate change, Spain and India called for specifying the type of poverty referred to, such as “material poverty” or “vulnerability of people.” Following CLA revisions to the paragraph, Saudi Arabia opposed a sentence that listed regions according to the numbers of people affected.

Following a further revision of the text on Monday, Tanzania and the EU expressed concern with the statement that since 1961

the trend in an increase in the drylands area affected by drought is just over 1% per year. They noted this could be misleading and suggested expressing this increase as the total change over the period 1961-2018. In a sentence on people affected by desertification, some delegates sought reference to their respective regions, including the impact of desertification in South America (Bolivia) and the Sahel (Chad and Nigeria), but this was not accepted.

On Tuesday morning, this paragraph, following additional modifications, was approved without further comment.

Figure SPM.1: Land Use and Observed Climate Change: This figure was first addressed on Saturday morning, discussed in the contact group on A1.1, and agreed to on Monday. Delegates agreed to refer to “observed” climate change in the figure’s caption rather than to “anthropogenic” climate change, which was in the original formulation.

On a graph on **GHG emissions**, Switzerland and the EU asked for dividing the graph into more specific sectors, including deforestation and cropland expansion, so policymakers could better understand developments since 1961. This was not agreed.

Delegates then discussed a bar chart on **global land use in 2015**. Bolivia, the US, and others called for disaggregating a reference to “other land.” The EU cautioned against including a figure that only shows a static snapshot of a situation rather than changes over time.

A graph depicting agricultural production was changed when India noted that land use intensification, as the graph was originally formulated, has itself contributed to desertification and land degradation.

On an **agricultural production** graph, India and others expressed concern about references to “food production intensity” as an indicator of land-use change. Several delegates suggested acknowledging in the text that increases in agricultural production have multiple drivers, including intensification, rather than simply land use change. Brazil suggested using productivity per unit of area as an indicator.

On a **food demand** graph, India noted lack of clarity regarding the link between the prevalence of obesity and climate change. Brazil, supported by Ukraine, suggested using food loss and waste as an indicator rather than prevalence of obesity. Spain suggested using undernourishment and malnourishment as indicators.

On a **desertification and land degradation** graph, the EU and the US suggested depicting population growth and desertifying areas separately. Switzerland noted that population in desertifying areas is increasing faster than population in general.

On Monday afternoon, delegates reviewed the contact group’s proposed modifications to the figure, such as:

- clarifying emission sources;
- changing classifications to refer to what land is used for;
- using demand rather than production of food as an indicator;
- replacing “meat calories consumed” per capita with “total calories consumed”; and
- using 1961 as the base year for graphs on land use intensification, food systems, and desertification and land degradation.

The figure and the legend were approved, as presented by the contact group, with slight modifications.

A2: This subsection on **observed climate change over land and related impacts** was first taken up on Saturday afternoon, and was then discussed in a contact group. WG I Co-Chair Masson-Delmotte presented revisions, including a reorganization to separate projections from observations. In plenary on Monday, delegates approved the subsection and headline statement with minor changes as revised by the CLAs. The headline statement notes that the land surface air temperature has risen nearly twice

as much as global average temperature, and that climate change has adversely impacted food security and terrestrial ecosystems and contributed to desertification and land degradation in many regions.

Following a request from India, the Joint WG Session agreed to move three paragraphs on projections from this subsection to Subsection A5, which addresses risk.

A2.1: A paragraph on the **difference in the rise of mean land surface air temperature compared to global land-ocean mean surface temperature** was discussed at length. Luxembourg, with France, Zimbabwe, Germany, India, Spain, and others, called for consistency with the figures in SR15 for the sake of clarity, while Switzerland preferred referring to the latest data, even though it refers to a slightly different time period up to 2018. Ireland, supported by Bolivia and the US, called for focusing on key messages for policymakers and avoiding use of numbers.

Following various revisions by the authors to improve ease of communication, delegates finally agreed to language on the “observed mean land surface air temperature” having risen “considerably more” than the “global mean (land and ocean) surface temperature.” Figures for this difference from 1850-1900 to 2006-2015, in line with the time period used in SR15, were also included and the paragraph was then agreed.

A2.2: Regarding a paragraph on **increased frequency, intensity, and duration of heat-related events**, Saudi Arabia called for reference to the West Asia region; Afghanistan, to South Central Asia; and Bolivia, Chile, and Uruguay, to the entire South American continent, especially Amazonia and Patagonia.

Spain called for mentioning inclusion of “duration” in addition to frequency and intensity of heat waves. Antigua and Barbuda called for specifying other experiences beyond heat waves, including “hot spells with amplified temperatures over several months,” as well as “dry spells,” which often follow droughts.

The EU cautioned against adding regions, other experiences, or other qualifiers, such as “duration,” explaining that although these may be valid experiences on the ground, that phenomenon must also be substantiated in the literature assessed.

On Sunday evening, delegates discussed revised text, with Trinidad and Tobago proposing a footnote utilizing already-approved IPCC language defining a heat wave as a period of abnormally warm weather and noting that heat waves and warm spells have overlapping definitions.

The CLAs proposed and delegates agreed on a footnote defining droughts and heat waves and specifying that heat waves are periods of abnormally hot weather and that heat waves and warm spells have various and, in some cases, overlapping definitions.

In response to Trinidad and Tobago, the CLAs said the current definition of “drought” does not include dry spells, but said they are included in paragraphs on assessment of extreme events related to land degradation. A sentence on increased frequency and intensity of droughts in some regions was modified to specify the Mediterranean, West Asia, many parts of South America, much of Africa, and Northeastern Asia as affected regions. With this, the paragraph was approved.

A2.3: Regarding a paragraph on **satellite observations having shown vegetation greening over the last three decades**, France urged inclusion of current observations of browning, and Germany asked for quantification of greening. An author explained that “greening” refers to increases, and “browning” to decreases, in photosynthetically active leaf cover, as seen through satellite observations of reflectivity.

On Sunday evening, delegates discussed a revised paragraph, with Tanzania requesting clarification on the relevance of other

observations. Algeria suggested that measurements carried out on the ground could be more accurate than satellite observations.

WG I Vice-Chair Carolina Vera reminded delegates that studies combining satellite with *in situ* observations are not available for all regions of the world. Switzerland underscored the need to inform policymakers of the value in combining satellite with *in situ* observations.

CLAs proposed, and delegates agreed, to clarify in a footnote that the interpretation of satellite observations can be affected by insufficient ground validation and spatial resolution can make it difficult to resolve small-scale changes. With this, the paragraph was approved.

A2.4: CLAs presented a new paragraph on the **increasing intensity and frequency of dust storms and their negative impacts on health over the last few decades** was added at the request of Saudi Arabia. CLAs presented to the group on Sunday evening. Germany requested, and the CLAs agreed, to add a time-period for the observed trend.

India proposed referring to impacts not only on health but also in other areas and sectors, but the CLAs explained that the literature available for the trends only covered health in the Arabian Peninsula and broader Middle East, and Central Asia, as mentioned in the paragraph.

Drawing attention to abundant literature on this for the Sahel region, Algeria called for referring also to the existing literature and for including Northern Africa. The CLAs reiterated that the scientific literature covered only the regions mentioned in the paragraph, and, with WGI Co-Chair Masson-Delmotte, explained that references to literature that had not been assessed could not be added at this point. France suggested that a clarifying statement be added to note that the absence of literature did not imply an absence of evidence. The CLAs with WGI Co-Chair Masson-Delmotte proposed a footnote reflecting that evidence regarding dust storms and health impacts in other regions is limited in the literature assessed in this report.

A2.5: Regarding a paragraph on **increased land surface air temperature and evapotranspiration and decreased precipitation in some dryland areas**, Iran and Saudi Arabia requested including West Asia in a list of areas affected by desertification resulting from climate variability and human activities. This was not agreed after a CLA explained that the list should not include areas with drylands that were not affected by climate change. After reviewing revisions by CLAs, delegates approved the paragraph as presented.

A2.6: India, opposed by Botswana, questioned the added value of a paragraph on **global warming leading to shifts of climate zones in many world regions**. Switzerland and Bolivia proposed adding reference to mountain zones and Colombia pointed to degradation of glaciers. Germany and Sweden asked to add reference to the decrease in area and extent of permafrost.

On Sunday evening, during a review of revised text, a CLA noted that permafrost glaciers and high mountain areas were being assessed in the SROCC and, thus, not assessed in the SRCCL. She also specified that an assessment of adaptive capacity was not undertaken on specific climate zones and species. A CLA also said an assessment on observed changes in permafrost was not undertaken, but that permafrost is mentioned in text related to climate change impacts on land degradation.

The paragraph was then agreed with minor changes.

A2.7: India and Botswana called for more region specificity and reference to the rate of coastal erosion in a paragraph on **climate change exacerbating land degradation processes** and coastal erosion impinging on more regions. The EU called for being more explicit regarding the role of local human intervention.

This paragraph was also identified as an appropriate place to include a reference to dry spells, in a list of heat events, and to permafrost thaw in the listed land degradation processes. With these and other modifications, the paragraph was approved.

A2.8: Emphasizing the importance a paragraph on **climate change impacts on food security**, Ireland, supported by Luxembourg and others, emphasized the importance of this message for policymakers and proposed reflecting its substance in the headline statement, which was agreed.

India preferred referring to effects on yields in higher and lower latitude regions rather than specifying regions below and above 45°N latitude, which is not as clear for policymakers. He also preferred referring to impacts indicated by indigenous and local knowledge sources.

Regarding a sentence in a revised text, reflecting that climate change is affecting food security in drylands based on indigenous and local knowledge, Bolivia proposed modifying the text to reflect knowledge of indigenous peoples and local communities.

On Monday afternoon, following overnight huddle consultations, delegates agreed to footnote proposed by the CLAs stating that the assessment covered literature whose methodologies included interviews and surveys with indigenous peoples and local communities. The paragraph was then agreed.

A3: This subsection addresses **agriculture, forestry and other land use (AFOLU)-related GHG emissions** and was discussed in plenary and in a contact group and huddle. The headline statement, as modified in a contact group to ensure consistency with the subsection's paragraphs, addresses AFOLU-related emissions, sinks caused by the natural response of land to human-induced environmental change, and emissions associated with pre- and post-production activities in the global food system.

A3.1: A paragraph on **land being simultaneously a source and a sink of carbon dioxide (CO₂) due to both anthropogenic and natural drivers**, making it difficult to separate anthropogenic from natural fluxes, was taken up on Sunday morning. Canada, opposed by Saudi Arabia, suggested changes to the text to reflect advanced approaches to separate anthropogenic from natural fluxes. The CLA explained that despite new methodological and conceptual approaches there was no objective way to separate such fluxes. The sentence was approved as presented.

Regarding a sentence on global estimates of emissions from land use change, India, supported by Saudi Arabia, suggested adding that CO₂ emissions from AFOLU are “highly uncertain” “with no clear trend observed in the last decade,” as stated in the Global Carbon Project. IPCC Vice-Chair Thelma Krug asked for confirmation of this. The CLAs agreed to add language to reflect a certain level of uncertainty and unclear trends.

On a sentence stating that fluxes from land use and land use change are mostly due to deforestation, the US called for referring to “other fluxes” in addition to those from deforestation. France and Luxembourg, opposed by Saudi Arabia, suggested moving, to the main text, a footnote elaborating on CO₂ fluxes from land use and land use change, which included reference to various drivers other than deforestation and afforestation/reforestation.

The Republic of Korea, supported by the EU, the UK and the US, proposed referring to “activities” instead of drivers. The paragraph was agreed as presented by the CLAs.

A3.2: This paragraph addresses **the natural response of land to human-induced environmental changes**. On a sentence stating that this includes increasing atmospheric CO₂ concentration, nitrogen deposition, and climate change, which resulted in net removals of CO₂, TFI Co-Chair Eduardo Calvo explained that these three phenomena normally remove CO₂ because CO₂ promotes plant growth. Delegates agreed to Turkey's proposal to specify human “-induced” changes. In

response to New Zealand, India and the EU on the amount, time period and extent, respectively, of CO₂ removal, the CLA proposed specifying that these resulted in global net removals of 11.2 Gt CO₂, +/- 2.6, per year during 2007-2016. In response to a question from Italy, she acknowledged that this figure also includes some naturally occurring CO₂.

On a sentence on future increases in CO₂ emissions from vegetation and soils due to climate change counteracting increased sinks due to CO₂ fertilization and longer growing seasons, delegates agreed to qualify this language to read that “projected” future CO₂ emission increases “would” counteract increased sinks.

There were a few comments and requests for clarification on a sentence that thawing of high-latitude/altitude permafrost is projected to accelerate the loss of soil organic carbon. Saudi Arabia asked whether the paragraph includes all GHGs. The authors noted a lack of literature on other GHGs but said permafrost melting may also entail methane emissions. After lengthy discussion, delegates agreed to address a lack of literature on other GHGs in relevant paragraphs.

This paragraph was agreed following further contact group discussions and modifications.

A3.3: This paragraph addresses comparing **methods used by global models and national GHG inventories to estimate anthropogenic CO₂ emissions and removals for the land sector**. During the discussions, the EU requested language stating that country inventories consider larger areas of forested lands than the models and the current net global sinks on managed lands due to the effects of environmental change to be anthropogenic “in most cases.” Japan noted limitations in IPCC methodologies, while India, supported by the US and Saudi Arabia, noted diversity in types of data and their quality. The US stressed that different ways of measuring get different results, but said researchers already acknowledge differences in the modeling and inventory communities. WG II Co-Chair Pörtner noted that this discrepancy applies to the total summation of inventories rather than to individual ones. Following huddle discussions and revisions, this paragraph was agreed.

Table SPM.1: This table consists of **Panel 1 on net anthropogenic emissions due to AFOLU and non-AFOLU** and **Panel 2 on global food systems (average for 2007-2016)**: Participants first addressed this table on Sunday afternoon in plenary, with Switzerland requesting disaggregated data per sector and gas.

Spain asked to specify the meaning of “land response” to anthropogenic environmental change and, with Luxembourg and the UK, asked for consistency in terminology, including on net fluxes where applicable.

Several delegates expressed confusion over the reference to food systems in the table, with Spain noting that not all food derives from land, and that agriculture also produces non-food products, such as in tobacco, textiles and pharmaceuticals. Several countries called for more clarity in the table with regard to fossil fuel and industrial emissions from storage, processing, transport, packaging, and the retail sector, with China noting uncertainty around the figures presented. The EU proposed adding a footnote explaining which emissions stem from AFOLU and which from non-AFOLU sectors, to provide clarity to policymakers regarding pre- and post-farming emissions.

The UK suggested clarifying that the table is a subset of AFOLU emissions, and that non-CO₂ emissions are only shown to be from food systems due to lack of data availability from, for example, the forest sector. Canada and Ireland suggested adding a column to reflect total anthropogenic GHG emissions to better compare and understand the data presented.

On Tuesday morning, delegates considered the revised table and accompanying footnotes presented by the CLAs. Ireland called for using original values besides CO₂ equivalents. India opposed that it presented the food system as a percentage of total anthropogenic emissions and called for clearly presenting emissions by sector. The CLAs referred to the SRCCL mandate, approved during the scoping process, which included: a framing in the context of food and nutrition security; food systems as including trade and markets; and farming systems.

Following additional huddle consultations, delegates approved the revised table as presented by the CLAs.

A3.4: On Sunday, regarding a paragraph on **increasing concentrations of methane**, the EU, supported by Ireland and France, suggested adding more detail on methane emissions to the SPM from the underlying report. New Zealand asked to specify methane emissions from AFOLU. The EU asked to express methane concentrations in CO₂ equivalents.

The authors suggested, and delegates agreed, to begin this paragraph with a sentence specifying global AFOLU emissions in the period 2007-2016.

Delegates then engaged in lengthy discussions on how to communicate the specific trend in increasing methane concentrations to policymakers.

Responding to a request from India to specify the growth rate, the authors said the rate varies greatly from year to year. This variability, the authors explained, is reflected in a statement on increasing atmospheric methane concentrations despite a pause in the growth rate between 2000 and 2006.

Spain, with others, requested clarification on the pause in the emissions growth rate. Ireland and Italy, opposed by Saudi Arabia, suggested focusing only on emissions and deleting reference to the pause in the growth rate. The authors explained that attributing the cause of this pause to specific sources or sinks was not possible, given that this is an active science area.

After lengthy discussions, delegates agreed to language reflecting: a steady increase in atmospheric methane concentrations since the mid-1990s; a slower growth until 1999; a period of no growth between 1999-2006; and resumed growth in 2007.

On a subsequent sentence, Bolivia, supported by India, noted that the paragraph confused anthropogenic and natural emissions and, with others, preferred keeping wetlands separate from agriculture. India and the EU requested numerical clarification on the differing contributions of activities. Mexico recalled that the paragraph focused on overall methane emissions, including biogenic and other sources, and urged “keeping the whole picture in mind,” given the significance of methane emissions and their impact on natural systems. Ireland suggested referring to emissions rather than concentrations. Brazil and India suggested adding a reference to food security. Following contact group discussions and modifications based on comments made in plenary, a revised paragraph was agreed.

A3.5: On a paragraph on **anthropogenic nitrous oxide emissions** from AFOLU, the EU and Ireland requested, and the group agreed, to add a line on the overall trend and the time period 2007-2016.

India and Brazil suggested language reflecting that the pastures referenced are managed, with Brazil proposing to add reference to unsustainable management. The CLA explained that the data does not allow for distinguishing between sustainable and unsustainable management of pastures in this instance, but agreed that reference to managed pastures would be acceptable. The US suggested, and the group agreed, to specify the growth of emissions from livestock on managed pastures and rangelands.

In response to a question from Uruguay, the CLA clarified that fertilization used in managed pastures is not included since it is reported separately.

The paragraph was then agreed.

A3.6: This paragraph focuses on **total net GHG emissions from AFOLU and agricultural emissions and land use change from other approaches, such as the global food system**. In general comments, Switzerland, the UK, and Saudi Arabia urged inclusion of all emissions from the entire global food system. The EU asked for inclusion of fertilizer manufacturing under energy emissions from the global food system. India, supported by China, called for deleting the paragraph due to doubts regarding the UN Food and Agriculture Organization’s (FAO) life cycle analysis used. China suggested that including energy emissions in this paragraph would entail double counting.

On a sentence in the original formulation, Germany stated that, without intervention, emissions from the food system are projected to increase by about 30-40% by 2050; and called for specifying that increased emissions come from transitioning to higher GHG emission diets, not simply from income growth or dietary changes. Bolivia called for explaining in the text how supply-side production trends affect emission increases. India, with Brazil, rejected the sentence’s apparent implication that the poorest, malnourished people are responsible for future emissions on a global scale.

Algeria noted that industrial production is very different from non-industrial production in terms of emissions produced. Switzerland called for including all elements, particularly regional differences and stratification of income in all countries, in any statement about emissions from the global food system. Tanzania and Indonesia called for deleting this paragraph. Saudi Arabia requested text on the ways in which farm subsidies in developed countries are exacerbating emissions. Rutgers University asked for information on addressing food waste through circular systems.

The paragraph was agreed as revised by the contact group based on comments received in plenary.

A4: This subsection addresses **changes in land conditions** and was first introduced on Monday morning. Following contact group discussions, the subsection and headline statement were agreed on Tuesday morning. The headline statement says that changes in land conditions, either from land-use or climate change, affect global and regional climate, and that at the regional scale, changing land conditions can reduce or accentuate warming and affect the intensity, frequency, and duration of extreme events.

A4.1: A paragraph on **changes in land cover due to human activities** was approved following revisions made by the CLAs.

A4.2: Delegates briefly considered a paragraph on **the likelihood, intensity, and duration of extreme events being significantly modified by changes in land conditions**. Trinidad and Tobago called for emphasizing that heat waves are only one of many heat-related events, and text was modified to reflect this. This paragraph was then agreed.

A4.3: A paragraph on **climate change altering land conditions with feedbacks on regional climate** was approved as presented.

A4.4: Regarding a paragraph on **desertification amplifying global warming**, Sweden asked whether increasing albedo in drylands always leads to surface cooling or simply amplifies other effects. A CLA said that all the literature identifying increases in albedo in drylands identifies a cooling effect associated with it. Following deletion of a sentence noting no estimate of regional effects of these processes, the paragraph was approved.

A4.5: A paragraph on changes in forest cover, for from afforestation, reforestation and deforestation, directly affecting regional surface temperature through exchanges of water and energy prompted lengthy discussion over whether the paragraph should refer to “sustainable” forest management, supported by Germany with India objecting, or whether it should refer to management at all, which New Zealand, the EU, and Republic of Congo said could be deleted. Friends World Committee for Consultation and El Salvador suggested mentioning forest restoration and India and Bolivia proposed language to reflect an increase in forest cover. A CLA suggested dropping the reference to “management” altogether and delegates agreed to refer to changes in forest cover, for example from afforestation, reforestation, and deforestation.

A4.5: A paragraph on changes in forest cover directly affecting regional surface temperature through exchanges of water and energy prompted lengthy discussion over whether the paragraph should refer to “sustainable” forest management (supported by Germany and Republic of Congo, with India objecting) or management at all (proposed by New Zealand, EU and Republic of Congo), forest restoration (mentioned by Friends World Committee for Consultation and El Salvador) or an “increase in forest cover” (supported by Italy and Bolivia). A CLA suggested to drop reference to “management” altogether and proposed referring to an “increase in forest cover, including afforestation and reforestation.” Delegates agreed to “changes in forest cover.”

On a sentence on cooling being offset by the warming effect of reduced surface albedo during the snowy season, Finland asked about the aerosol effect and Uruguay, with Ukraine, argued that not all boreal and temperate regions have snow.

Following huddle discussions, delegates reviewed and approved a revised version of the paragraph and a related footnote without further comments on Tuesday morning.

A4.6: On a paragraph addressing warming and urbanization trends, Ireland and the US cautioned that statements about future outlooks should be avoided since only past trends were assessed. The text was modified accordingly.

Sweden, Ukraine, Ireland, and India called for a more nuanced statement on urbanization, encompassing both positive aspects of urbanization as well as growing pressures on natural resources. WG II Co-Chair Debra Roberts explained that this paragraph focused on only one aspect of urbanization, mainly the heat island effect. She also stressed that other aspects were not assessed in this report and noted ongoing work on a special report on cities and climate change. India called for reflecting the knowledge gap regarding natural resource pressures related to urbanization. This paragraph was then revised and agreed.

Figure SPM.2: Risks to land-related human systems and ecosystems from global climate change, socio-economic development, and mitigation choices in terrestrial ecosystems: Delegates began discussions on this figure on Monday afternoon, with many expressing concerns about both the information and its presentation. Further discussions took place in a contact group.

Regarding Panel A, on **risks to humans and ecosystems from changes in land-based processes as a result of climate change**, the Russian Federation, supported by the US, the EU, and Canada, cautioned that the “burning embers” bars did not reflect the findings in the underlying report.

Regarding Panel B, on **different socio-economic pathways affecting levels of climate-related risks**, Norway, with Germany, Kenya, the UK, the US, Tanzania, Trinidad and Tobago, Luxembourg, and India, stressed that many natural systems will be harmed by a temperature rise of 3°C even under Shared Socio-economic Pathway 1 (SSP1), which assumes high adaptive

capacity. Kenya and the UK noted that the figure does not capture regional differences such as for Sub-Saharan Africa and small island developing states (SIDS). The US noted that the burning ember format does not reflect the amount of existing information on the topics represented. Bolivia cautioned against stressing population growth and, with Bhutan and Brazil, called for assessing the effects of meat production as well as consumption.

Regarding a panel that was initially in the figure on risks from converting land to dedicated bioenergy, the Netherlands queried the specific impacts of using land for bioenergy on food security, and Switzerland described the panel as “fully unusable.”

Brazil argued that the panel:

- singles out bioenergy production as a risk (supported by the EU), without also discussing risks from other mitigation options or risks to food security from other land uses, such as for fiber crops or tobacco;
- discusses its risks while only acknowledging “token” benefits (supported by Sweden);
- omits discussion of risks associated with not using bioenergy as a mitigation option;
- overestimates projections of expansion of land use for bioenergy as even greater than the most extreme figure in the underlying report; and
- ignores the possibility of multi-cropping bioenergy crops with other crops, as well as the amount of organic waste that goes into bioenergy production.

Supported by Sweden, Brazil called for, and the group agreed to, deleting this panel and reworking the information for a later figure in a different section of the SPM. Brazil also called for developing a table on how to promote synergies between bioenergy and other crops and land uses.

The EU, supported by Luxembourg and India, added that including more realistic risks and benefits from other potential mitigation options, such as afforestation and other renewable fuels, could provide more useful information to policymakers.

On Tuesday evening, the CLAs explained changes they had made on the basis of delegates’ comments, including replacing the panel on bioenergy risks with illustrative examples of what the embers of food insecurity and land degradation mean.

The Russian Federation expressed concern about the lack of transparency on how the development of the diagrams was related to the underlying literature and asked that her statement be included in the report of IPCC-50.

Figure SPM.2 was approved with an additional editorial change.

Box SPM.1: Shared Socio-economic Pathways (SSPs): This box introduces the five SSPs used in the SRCCL, which span a range of challenges to climate change adaptation and mitigation.

Following a suggestion by the US to refer to “adaptive capacity” in the box instead of “adaptation,” the CLAs proposed, and the group agreed, to describe the level of adaptive capacity for each SSP.

In response to a request from France and Algeria, the group agreed to add further information specifically on the treatment of agriculture and land management in each SSP, given their relevance to the report, but as suggested by Luxembourg, to do so in such a way as to enable the SSP Box to be used elsewhere in the future.

Noting an unbalanced focus on consumption, Bolivia called for referring to both production and consumption patterns in the SSPs. The CLA explained that production is covered under “technological progress,” but Bolivia pointed out that problems with production are not simply a matter of technological progress and/or inefficiencies, but of unsustainable production patterns. The CLAs proposed, and the group agreed, to refer to

technological progress, production, and consumption patterns in the SSPs.

There was some discussion on the terms “medium” versus “moderate” challenges to adaptation and mitigation, with the group agreeing to a CLA proposal to refer to “medium” as a term of comparability with high and low pathways, and to reflect, in the SSP descriptions, that this is relative to other pathways.

Delegates approved text on SSP1, SSP2, SSP3, and SSP4 with these modifications.

On SSP5, Algeria questioned the focus in a sentence on GHG-intensive lifestyles and demand for livestock. The CLAs proposed, instead, referring to resource intensive lifestyles, which Switzerland opposed, and deleting reference to livestock, which Norway and Germany opposed.

On a concluding paragraph to Box SPM.1, views diverged regarding a statement that SSPs can be juxtaposed with Representative Concentration Pathways (RCPs), which imply different mitigation levels. Germany suggested spelling out the actual levels of mitigation that are connected to different RCPs. The group agreed to state that the SSPs can be combined with RCPs, which imply different levels of mitigation,

Following further consultations on SSP5 and the concluding paragraph, Box SPM.1 was approved.

A5: This subsection addresses **risks from climate change** and was first addressed on Monday afternoon. Following general comments in the plenary and contact group discussions, delegates agreed to move three paragraphs from subsection A2 to this subsection.

The headline statement notes that climate change creates additional stresses on land, exacerbating existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure, and food systems.

Many delegates, including the EU, Estonia, the US, Luxembourg, Botswana, and others, proposed deleting a paragraph in this subsection with **estimates of the effect of accelerating changes in land and climate on GDP**, given problems with the numbers and lack of clarity regarding the estimates. While Germany, Bolivia, and Saudi Arabia concurred regarding problems with the numbers, they suggested retaining reference to the impacts on GDP and adding more economic details. Saudi Arabia expressed concern about the underlying report’s chapter on risk management and decision making in relation to sustainable development, from which the figures were derived.

A5.1: A paragraph on the **projected increases in the frequency, intensity, and duration of heat related events, including heat waves, through the 21st century** was moved from subsection A2. During initial discussions, Tanzania, Spain, and India suggested adding “frequency and intensity” of drought. France proposed including reference to soil erosion and land degradation, while Canada suggested reinforcing the message by adding that extreme events are themselves drivers of land degradation processes.

The US called for specifying the timeframe of the statements, especially when dealing with projections, and Turkey suggested inserting reference to the scenarios. India urged addition of examples on the impacts of extreme events. Saudi Arabia, supported by Iran, called for including West Asia in the regions affected by drought, which was not accepted.

A5.2: Paragraphs on the **projected shift poleward of climate zones in the middle and high latitudes and warming increasing disturbance in boreal forests** were moved from subsection A2 and merged into one paragraph. During initial comments, the EU called for mentioning the speed of change.

This paragraph was agreed as modified during contact group discussions.

A5.3: Regarding a paragraph on identifying **risks at 1.5°C, 2°C, and 3°C of warming**, Trinidad and Tobago, supported by Saint Kitts and Nevis, called for reference to changes in the intensity of tropical cyclones and to SIDS. France supported mentioning impacts on hydrology and water resources.

Bhutan, Saint Kitts and Nevis, India, Canada, Tanzania, and others called for including impacts of 1.5°C warming, with Japan and Canada emphasizing damage to permafrost at 1.5°C.

India, supported by Tanzania, said regional aspects were not properly represented, and proposed a dedicated paragraph on risks for agriculture and food security.

Norway, with Sweden and the US, asked for clarification on “food system instability” and the reference was ultimately deleted. Norway also proposed moving a sentence on global exposure to multi-sector risk quadrupling between 1.5°C and 3°C warming to the headline statement, but this sentence was ultimately deleted.

A5.4: Regarding a paragraph on the **stability of food supply decreasing as the magnitude and frequency of extreme weather events that disrupt food chains increases**, the EU and India questioned the percentage figures on impacts on cereal prices according to global crop and economic model projections. Following contact group modifications, this paragraph was agreed, including a reference to the “most vulnerable” people instead of “low-income countries.”

A5.5: On a paragraph on the **impacts of climate change and desertification on drylands**, Japan asked for clarification on the projected number of vulnerable people, and Spain questioned the low confidence statement attached to the sentence on population vulnerability. The US emphasized the need for clarity on the scenarios used for the projections, and India stressed consistency with SR15. After clarifying the projected number, this paragraph was agreed with some modifications.

A5.6: On a paragraph on **regional impacts**, Bolivia, Germany, and others asked for confidence levels to be attached to the statements. Sweden suggested reference to the boreal zone, Sri Lanka to land degradation from intense rains, and Trinidad and Tobago to tropical cyclones. The paragraph was approved as presented.

A5.7: A paragraph on **climate change amplifying environmentally induced migration both within countries and across borders** was accepted with minor modifications.

A5.8: A paragraph was added to this subsection, stating that **unsustainable land management has led to negative economic impacts**, which climate change is projected to exacerbate.

A6: This subsection on the **level of risk posed by climate change depending on various factors**, was first considered in plenary on Monday afternoon, discussed in a contact group and agreed on Wednesday morning. Following general comments, a contact group, co-chaired by France and the Republic of Korea, further discussed this subsection. The headline statement states that the level of risk depends both on the level of warming and on how population, consumption, production, technological development, and land management patterns evolve.

A6.1: On Monday, on a paragraph stating that **increases in population and income, combined with changes in consumption patterns, result in increased demand for food, feed, and water**, Bolivia called for referencing “production” in addition to references to consumption decisions that affect food insecurity, water scarcity, and GHG emissions. India expressed concern about a statement that development pathways in which incomes increase and the demand for land conversion is reduced

can lead to reductions in food insecurity. This paragraph was agreed, following minor modifications by the contact group.

A6.2-4: These paragraphs on risks were approved as forwarded by the contact group and relate to: water scarcity in drylands; climate change-driven land degradation; and food security.

A6.5: Regarding a new paragraph on **urban expansion leading to conversion of cropland and losses in food production**, India lamented that several dimensions of urban expansion were not considered, expressed concern regarding the absence of reference to impacts of urbanization on land and water resources, and requested a statement that the report did not consider the impact of urban settlements on resources, particularly land. The US stressed the importance of considering the impacts of urban lands on overall land use.

Following huddle discussions, delegates considered revised text on this paragraph and its footnote. The text was approved without comment, while a proposed footnote considers concerns raised by India. The approved footnote states that the land systems considered in the report do not include urban ecosystem dynamics in detail.

Final SPM Text: Section A addresses people, land, and climate in a warming world.

Subsection A1 addresses how **land provides the principal basis for human livelihoods and well-being**, and stresses that:

- land provides the basis for many other ecosystem functions and services, including cultural and regulating services;
- land is both a source and a sink of GHGs and plays a key role in the exchange of energy, water, and aerosols between the land surface and atmosphere;
- about a quarter of the Earth's ice-free land area is subject to human-induced degradation;
- expansion of areas under agriculture and forestry have supported consumption and food availability for a growing population, and, with large regional variation, have contributed to increasing net GHG emissions; and
- per capita supply of vegetable oils and meat and of food calories has increased while 25-30% of total food produced is lost or wasted, both associated with additional emissions.

Subsection A1 also contains **Figure SPM.1** showing the status and trends in selected land use and climate variables that represent many of the core topics covered in the report.

Subsection A2 addresses how **climate change has adversely impacted food security and terrestrial ecosystems and has contributed to desertification and land degradation** in many regions. This subsection underscores that:

- since the pre-industrial period, the observed mean land surface air temperature has risen considerably more than the global mean surface (land and ocean) temperature;
- warming has resulted in an increased frequency, intensity, and duration of heat-related events, including heat waves in most land regions;
- globally, vegetation greening has occurred over a larger area than vegetation browning;
- frequency and intensity of dust storms have increased over the last few decades due to land use and land cover changes and climate-related factors in many dryland areas resulting in increasing negative impacts on human health;
- in some dryland areas, increased land surface air temperature and evapotranspiration and decreased precipitation amounts, interacting with climate variability and human activities, have contributed to desertification;
- global warming has led to shifts of climate zones in many regions, including expansion of arid climate zones and contraction of polar climate zones, and, as a consequence,

many plant and animal species have experienced changes in their ranges, abundances, and shifts in their seasonal activities;

- climate change can exacerbate land degradation processes, including through increases in rainfall intensity, flooding, drought frequency and severity, heat stress, dry spells, wind, sea-level rise and wave action, permafrost thaw; and
- climate change has already affected food security due to warming, changing precipitation patterns, and greater frequency of some extreme events.

Subsection A3 addresses how **AFOLU activities accounted for GHG emissions from human activities globally during 2007-2016**, and emphasizes that:

- land is simultaneously a source and a sink of CO₂ due to both anthropogenic and natural drivers, making it hard to separate anthropogenic from natural fluxes;
- future net increases in CO₂ emissions from vegetation and soils due to climate change are projected to counteract increased removals due to CO₂ fertilization and longer growing seasons, the balance between these processes is a key source of uncertainty for determining the future of the land carbon sink, and projected thawing of permafrost is expected to increase the loss of soil carbon;
- global models and national GHG inventories use different methods to estimate anthropogenic CO₂ emissions and removals for the land sector, and both produce estimates that are in close agreement for land-use change involving forest (e.g., deforestation, afforestation) and differ for managed forests;
- global models consider as managed forest those lands that were subject to harvest whereas, consistent with IPCC guidelines, national GHG inventories define managed forest more broadly, and, consideration of differences in methods can enhance understanding of land sector net emission estimates and their applications;
- the globally averaged atmospheric concentration of methane shows a steady increase between the mid-1980s and early 1990s, slower growth thereafter until 1999, a period of no growth between 1999-2006, followed by a resumption of growth in 2007, and biogenic sources make up a larger proportion of emissions than they did before 2000;
- anthropogenic AFOLU nitrous oxide (N₂O) emissions are rising, anthropogenic N₂O emissions from soils are primarily due to nitrogen application, including inefficiencies;
- total net GHG emissions from AFOLU emissions represent 23% of total net anthropogenic emissions;
- other approaches, such as the global food system, include agricultural emissions and land use change (i.e., deforestation and peatland degradation), as well as outside farm gate emissions from energy, transport, and industry sectors for food production, and, given the diversity of food systems, there are large regional differences in the contributions from different components of the food system; and
- emissions from agricultural production are projected to increase.

Subsection A3 also contains **Table SPM.1** showing net anthropogenic emissions due to AFOLU and non-AFOLU, and global food systems.

Subsection A4 addresses how **changes in land conditions affect global and regional climate** and the magnitude and direction of these changes vary with location and season. This subsection emphasizes that:

- changes in land cover due to human activities have led to both a net release of CO₂ contributing to global warming and an increase in global land albedo causing surface cooling;

- the likelihood, intensity, and duration of many extreme events can be significantly modified by changes in land conditions;
- climate change is projected to alter land conditions with feedbacks on regional climate;
- desertification amplifies global warming through the release of CO₂ linked with the decrease in vegetation cover;
- changes in forest cover, for example from afforestation, reforestation, and deforestation, directly affect regional surface temperature through exchanges of water and energy; and
- both global warming and urbanization can enhance warming in cities and their surroundings (heat island effect), especially during heat-related events, such as heat waves.

Subsection A5 addresses how **climate change creates additional stresses on land, exacerbating existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure, and food systems**. This subsection stresses that:

- with increasing warming, the frequency, intensity and duration of heat-related events, including heat waves, are projected to continue to increase through the 21st century;
- in high-latitude regions, warming is projected to increase disturbance in boreal forests, including drought, wildfire, and pest outbreaks, and, in tropical regions, warming is projected to result in the emergence of unprecedented climatic conditions;
- current levels of global warming are associated with moderate risks from increased dryland water scarcity, soil erosion, vegetation loss, wildfire damage, permafrost thawing, coastal degradation, and tropical crop yield decline;
- the stability of food supply is projected to decrease as the magnitude and frequency of extreme weather events that disrupt food chains increases, increased atmospheric CO₂ levels can also lower the nutritional quality of crops, and the most vulnerable people will be more severely affected;
- in drylands, climate change and desertification are projected to cause reductions in crop and livestock productivity;
- Asia and Africa are projected to have the highest number of people vulnerable to increased desertification;
- North America, South America, Mediterranean, southern Africa and central Asia may be increasingly affected by wildfire;
- the tropics and subtropics are projected to be most vulnerable to crop yield decline;
- land degradation resulting from the combination of sea level rise and more intense cyclones is projected to jeopardize lives and livelihoods in cyclone prone areas;
- within populations, women, the very young, elderly, and poor are most at risk;
- changes in climate can amplify environmentally-induced migration both within countries and across borders, reflecting multiple drivers of mobility and available adaptation measures, and extreme weather and climate or slow-onset events may lead to increased displacement, disrupted food chains, and threatened livelihoods; and
- unsustainable land management has led to negative economic impacts, and climate change is projected to exacerbate these negative economic impacts.

Subsection A6 addresses how **the level of risk posed by climate change depends both on the level of warming and on how population, consumption, production, technological development, and land management patterns evolve**. This subsection emphasizes that:

- projected increases in population and income, combined with changes in consumption patterns, result in increased demand for food, feed, and water in 2050, and these changes, combined

- with land management practices, have implications for land-use change, food insecurity, water scarcity, terrestrial GHG emissions, carbon sequestration potential, and biodiversity;
- risks related to water scarcity in drylands are lower in pathways with low population growth, less increase in water demand, and high adaptive capacity;
- risks related to climate change-driven land degradation are higher in pathways with a higher population, increased land-use change, low adaptive capacity, and other barriers to adaptation;
- risks related to food security are greater in pathways with lower income, increased food demand, increased food prices resulting from competition for land, more limited trade, and other challenges to adaptation; and
- urban expansion is projected to lead to conversion of cropland leading to losses in food production, and this can result in additional risks to the food system.

Section A also contains **Figure SPM.2** showing risks to land-related human systems and ecosystems from global climate change, socio-economic development, and mitigation choices in terrestrial ecosystems. The implications of future socio-economic development on climate change mitigation, adaptation, and land use are explored in the report and illustrated in the figure using SSPs. The SSPs can be combined with RCPs which imply different levels of mitigation, with implications for adaptation.

Box SPM.1 introduces the five SSPs, which are used in the SRCLL to explore the implications of future socio-economic development on climate change mitigation, adaptation and land-use. The SSPs span a range of challenges to climate change adaptation and mitigation

B: Adaptation and Mitigation Response Options

The section was introduced on Monday afternoon. The Republic of Korea, with Angola, Uzbekistan, France, South Africa, Colombia and Tanzania, emphasized the importance and relevance of Land Degradation Neutrality (LDN) and called for reintroducing this concept and terminology.

B1: This subsection addresses **land-related responses that contribute to climate change adaptation and mitigation that can also combat desertification and land degradation and enhance food security**.

Regarding the headline statement, India called for acknowledging the burden of adaptation on a large part of the world's population who are among the most vulnerable. The CLAs explained that the literature and focus of the work was limited to a focus on response options with regard to adaptation, making it difficult to compare countries' situation in this regard. India proposed text stating that the potential for, and nature of, land-related responses, especially in the balance between adaptation and mitigation, depends on the degree of vulnerability and adaptive capacities of specific communities and regions. A CLA said referencing vulnerability here would be difficult, given that the section relates to both mitigation and adaptation, and that the assessment focused on the degree to which the response option would enable people to adapt. In some but not all cases, the CLA said, this does relate to vulnerability.

Following informal discussions, delegates agreed with the authors on text highlighting that the potential for land-related responses and the relative emphasis on adaptation and mitigation is context specific, including the adaptive capacities of communities and regions. The headline statement also includes a sentence on barriers to adaptation and limits to the contribution that land-related responses can make to mitigation.

B1.1: On a paragraph on **action already being taken to contribute to climate change adaptation, mitigation, and sustainable development**, India and the EU noted the need to

qualify this statement. The UK and New Zealand also suggested adding examples and more detail on the scale of actions. South Africa, Jamaica, and Trinidad and Tobago cautioned against maladaptation and limits to adaptation.

Norway and Climate Action Network International proposed, and the group agreed, to add reference to conservation of natural ecosystems.

Stressing consistency, Bolivia, Poland, Nicaragua, Peru, and Estonia preferred referring to sustainable forest management instead of “improved” forest management. The CLAs agreed to this change.

China called for adding afforestation and reforestation, but the CLAs explained their potential negative impacts at a large scale made them unsuitable for a paragraph on contributions to adaptation, mitigation and sustainable development.

Sweden asked for reference to residue and post-consumer waste for energy use, but this was not accepted. Following huddle discussions, this paragraph was agreed with minor amendments.

B1.2: On this paragraph, which explains that **while some response options have immediate impact, others take decades to deliver measurable results**, Italy stressed the need to send a positive message and suggested mentioning that some options deliver results in the short term, given that this was not highlighted in the original formulation. France explained that reforestation and afforestation can have short-term benefits. The CLA suggested text to reflect Italy’s proposal, which was approved.

India expressed concern that a sentence discussing both adaptation and mitigation options might “misdirect the burden of mitigation” by combining the two. Others noted that the two were treated together in SR15, and that treating them separately would give the impression that they work independently. Mexico reiterated that afforestation and reforestation are related to both. Sweden reminded delegates that adaptation and mitigation sometimes, but not always, go together. France, supported by Italy, suggested reordering the paragraph to describe short-term options first, followed by those that take longer.

The CLAs proposed to divide the paragraph into examples of response options with, first, immediate impacts and, then, those that take more time. With small additions by Uruguay and Bolivia, the paragraph was approved.

B1.3: Regarding a paragraph on **successful implementation of response options depending on local and socio-economic conditions**, Turkey, with Angola and supported by the UNCCD, asked for reference to LDN. Delegates agreed to language reflecting that achieving LDN depends on integrating multiple responses across multiple scales and sectors.

B1.4: On a paragraph on **land-based options that deliver carbon sequestration in soil or vegetation**, delegates agreed to clarify that land-based options, such as afforestation, reforestation, agroforestry, soil carbon management on mineral soils or carbon storage in harvested wood products, do not sequester carbon indefinitely. Following a request by the EU, they also specified that peatlands, however, can sequester carbon for centuries. Following a CLA clarification that carbon stock increases with age, while carbon sink strength decreases, the delegates agreed to text stating that when vegetation matures, or when soil carbon reservoirs reach saturation, net annual CO₂ removal from the atmosphere declines towards zero but that carbon stocks can be maintained. The paragraph was approved with these changes.

B2: This subsection highlights that **response options assessed contribute positively to sustainable development and other societal goals**. Following general comments, this subsection was further discussed in a contact group, together with subsection B3 and Figure SPM.3.

B2.1: A paragraph on **land management options that do not require land use change or create demand for land conversion** was approved as presented by the contact group without further comment.

B2.2: On a paragraph dealing with a **wide range of adaptation and mitigation responses**, Norway proposed referring to restoration as well as preservation of natural ecosystems. Following further discussions, a Bolivian proposal for wording on enhancement of ecosystem functions and services was accepted and the paragraph was approved.

B2.3: On a paragraph on **land management-based response options that do not increase competition for land and can contribute to eradicating poverty and eliminating hunger**, India expressed concern with reference to “value chain management” if the term is referring to market aspects. Saudi Arabia said it could not accept Bolivia’s proposal to state that many mitigation “and adaptation” response options can be applied without competing for land. The paragraph was approved as presented.

B3: This subsection discusses **response options and competition for land** and, following general comments from the floor, was further discussed in a contact group together with subsection B2 and Figure SPM.3. The headline statement and the subsections were agreed on Wednesday.

B3.1: On a paragraph stating that **afforestation, reforestation and the use of land to provide feedstock for bioenergy** with or without carbon capture and storage, or for biochar, could greatly increase demand for land conversion, Sweden, with Luxembourg, France, and Norway, highlighted the potential of bioenergy from waste. This paragraph was agreed as presented by the contact group.

B3.2: On a paragraph on **limits to bioenergy crops**, Brazil proposed removing references to risks of bioenergy or bioenergy with carbon capture and storage (BECCS) at ranges of millions of square km. This paragraph was agreed as presented by the contact group.

B3.3: A new paragraph, stating that the **production and use of biomass for bioenergy** can have co-benefits, adverse side effects, and risks for land degradation, food insecurity, GHG emissions, and other environmental and sustainable development goals, was agreed as presented by the contact group.

B3.4: A paragraph addressing the **transition from low to moderate risk to food security, land degradation, and water scarcity in drylands** was agreed as presented by the contact group.

B4: There was some debate on the headline statement for this subsection, on **activities that contribute to combating desertification while also contributing to mitigation**. Following India’s call for only mitigation to be cited as a co-benefit of combating desertification, the sentence was modified accordingly. In response to a query from El Salvador, WG II Co-Chair Pörtner explained that language on residual risks and maladaptive outcomes covers limits to adaptation. The headline statement was then approved.

B4.1: On a paragraph on **solutions that help adapt to and mitigate climate change while contributing to combating desertification**, India objected to overemphasizing “local” solutions and “native” plants, while Mexico noted that local solutions are part of the definition of sustainable adaptation. Indonesia expressed concern with invasive alien species and preferred specific reference to native species, while El Salvador proposed “locally suitable plants.” Saudi Arabia said the paragraph did not address ways to adapt to desertification and suggested including other measures such as water desalinization.

Belgium questioned reference to the efficacy of zero-tillage practices given their site specificity.

Discussions continued in a huddle, following which IPCC Vice-Chair Barrett reported that the huddle agreed on the need for: site and regional specificity; wording on local appropriateness; and deletion of conservation agriculture from the list of solutions.

Luxembourg objected to deleting conservation agriculture from this paragraph given that it had been deleted from a paragraph on measures to combat desertification promoting soil carbon sequestration. Belgium noted that conservation agriculture can sometimes lead to carbon emissions. The EU cautioned that whatever is done is always site- and region-specific, but that conservation agriculture does not in all cases sequester carbon. Belgium noted that it is not just a matter of carbon sequestration but of climate mitigation. Bolivia added that while conservation agriculture may not aid in mitigation it is still useful for adaptation.

A CLA noted a small positive sequestration rate in dryland areas. With the deletion of reference to agroforestry and other agroecological and ecosystem-based adaptation practices, and of conservation agriculture from a list of local solutions, the paragraph was accepted.

B4.2: Delegates briefly discussed a paragraph stating that **reducing sand dune movement and dust and sand storms** can lessen the negative effects of wind erosion and improve air quality and health. On the role of afforestation in this regard, Bolivia agreed that afforestation can reduce impacts of sand storms, but noted that afforestation may not solve other problems. Saudi Arabia said that afforestation is not a practical policy option for his country, and delegates agreed to specify that “depending on water availability and soil conditions,” afforestation, tree planting, and ecosystem restoration programmes can reduce sand storms, avert wind erosion, and contribute to carbon sinks, while improving micro-climates, soil nutrients, and water retention. The paragraph was agreed as modified in the contact group.

B4.3: This paragraph, which states that **measures to combat desertification can promote soil carbon sequestration**, was accepted with minor modifications.

B4.4: In a paragraph stating that **eradicating poverty and ensuring food security can benefit from applying measures promoting LDN**, Saudi Arabia, with India, and Tanzania, stressed that poverty eradication is an overriding priority, not simply a co-benefit, and the text was changed to reflect this. India further requested specifying that LDN refers to avoiding, reducing, and reversing land degradation. Delegates agreed to modify the paragraph accordingly and the paragraph was accepted.

B4.5: This paragraph notes that **without new or enhanced adaptation options, the potential for residual risks and maladaptive outcomes is high**. In general comments on the original formulation of the text, the Netherlands favored referring to “limits to adaptation.” India called for explaining a reference to residual risks. Switzerland, supported by India, recalled that this concept was formulated to avoid use of the term “loss and damage” and recognized that limits to adaptation exist, noting that residual risks arise if limits are exceeded.

Delegates considered a revised paragraph that acknowledges a lack of knowledge on adaptation limits and potential maladaptation to combined effects of climate change and desertification. They also agreed to add text to reflect that even when solutions are available, social, economic, and institutional constraints raise their costs and could pose barriers to their implementation. The paragraph was then agreed.

B4.6: Regarding a paragraph on **enabling access to cleaner energy sources through decreasing the use of traditional biomass for energy**, Norway suggested that this also helps fight forest degradation and contributes to combating desertification.

Morocco favored reflecting that dust and sand storms make wind and solar energy infrastructure installation and maintenance challenging in North Africa. Zimbabwe stressed the need for access to clean energy technology. CLAs agreed to reflect both comments.

Germany and Belgium proposed reflecting that renewable energy falls under the umbrella of “cleaner energies,” which Saudi Arabia, India, and Iran opposed. This issue was further discussed in a huddle, following which text was presented stating that cleaner energy sources can contribute to adaptation and mitigation and combating desertification and forest degradation, which delegates accepted.

After delegates agreed to India’s proposal to emphasize women and “children” rather than “youth” as beneficiaries of socio-economic and health benefits of decreasing the use of traditional biomass, the paragraph was approved.

B5: This subsection discusses how **sustainable land management can prevent and reduce land degradation**, maintain land productivity, and sometimes reverse the adverse impacts of climate change on land degradation. Following a request from Belize, delegates added a sentence noting that even with sustainable land management, limits to adaptation can be exceeded in some situations. Delegates discussed and agreed to include two footnotes to the headline statement on sustainable land management and sustainable forest management.

B5.1: A paragraph on **addressing land degradation in agriculture systems through sustainable land management** was split into two to emphasize options that also have mitigation potential. Responding to a suggestion from Bolivia, supported by Colombia, the CLAs proposed reference to “agroecological principles.” Switzerland and the US preferred a formulation related to sustainable land management focused on ecological functions. India proposed also referring to a socio-economic focus. The group agreed to refer to both an ecological and a socio-economic focus.

B5.2: A new paragraph on **management options that also have mitigation co-benefits** was agreed with minor modifications.

B5.3: Regarding a paragraph on the **mitigation potential of reducing deforestation and forest degradation**, Spain and India suggested including further detail, given the very large range in mitigation potential of these options. The CLAs explained that breaking down the estimated potential would require lengthy elaboration since it derived from many studies examining different conditions. They said the estimate is included in the underlying chapter.

In response to a suggestion by Sweden, the CLAs proposed adding a sentence explaining that wood residues used to generate energy release carbon quickly and can be a substitute for fossil fuel energy. Saudi Arabia opposed language referring to the substitution of fossil fuels.

B5.4: On Tuesday evening, delegates discussed text revised in a contact group on a paragraph stating that **sustainable forest management can maintain or enhance forest carbon stocks, and can maintain forest carbon sinks**, thus addressing the issue of sink saturation. In response to India, a CLA explained that “sink saturation” was a phrase to bring together the issues of carbon stocks increasing and sinks decreasing under sustainable forest management. The paragraph was approved.

B5.5: This subsection also includes a paragraph on **climate change leading to land degradation, even with the implementation of measures intended to avoid, reduce, or reverse it**. During general comments, Spain, with the US, noted that the message as originally formulated, stating that land degradation due to climate change is unavoidable despite implementing measures, appears negative. In spite of Bolivia's preference to maintain reference to "unavoidable" land degradation, the group decided to delete this qualification.

On a sentence stating that limits to adaptation are dynamic, site specific, and determined through the interaction of biophysical changes with social and institutional conditions, Belize sought to emphasize that in some cases limits depend purely on biophysical changes. But CLAs pointed to lack of examples of this in the literature.

Regarding a sentence reflecting that exceeding adaptation limits will trigger escalating losses or result in undesirable changes, such as forced migration, conflicts or poverty, the US, supported by Luxembourg, cited lack of consensus in the literature that these three outcomes will occur when adaptation limits have been exceeded. The CLAs proposed revising the sentence to reflect that exceeding the limits of adaptation "can trigger" undesirable changes.

Trinidad and Tobago, Bolivia, and India opposed such changes. Belize asked to add that outcomes include not only undesirable but also "transformational" changes. Trinidad and Tobago asked for due consideration to the concerns raised by SIDS.

Following CLA revisions based on comments by countries, Belize, supported by Saint Kitts and Nevis, suggested qualifying the text with undesirable transformational changes, citing consistency with the underlying report, which was agreed.

B6: This subsection addresses **response options throughout the food system**. The headline statement was agreed without comment.

B6.1: On a paragraph on **practices that contribute to adaptation and mitigation in cropland**, India expressed mounting discomfort with the lack of reference to smallholders and pastoralists in developing countries or a sense of differentiation among development levels. After various attempts to address this, including from Bolivia, the US, and others, and huddle discussions, the group agreed to refer to different farming and pastoral systems and level of development, and to add a new sentence stating that many livestock-related options can enhance the adaptive capacity of rural communities, in particular smallholder and pastoralists.

There was also some discussion regarding reference to genetic improvement, with interventions by Bolivia, France, and Germany leading to agreement to refer to "use of varieties and genetic improvements for heat and drought tolerance." This paragraph was accepted as modified.

B6.2: Several delegations made textual proposals on a paragraph that states that **diversification in the food system can reduce risks from climate change**. Proposals focused on a sentence that diets rich in plant-based foods, such as those based on coarse grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in low-GHG emission systems, present major opportunities for adaptation and mitigation while generating co-benefits in terms of human health. Norway, Germany, and France sought to highlight the specific mitigation potential of dietary changes, such as reduced consumption of meat and dairy.

Bolivia said the focus lies on "resilient" and low-GHG emissions systems, and this was reflected in the text. France sought examples of animal-sourced food produced in low-GHG emission systems. CLAs underscored the need to reflect regional

differentiation to balance human health objectives in terms of nutrition and reduced excess consumption, and the objective of reducing emissions. The US, supported by Tanzania, offered, as a compromise, referring to "balanced" diets, and delegates agreed.

On a sentence stating that transitions towards low-GHG emission diets may be constrained by local production practices and associated livelihoods and cultural habits, Tanzania questioned reference to cultural habits. India sought a reference drawing attention to technology and financial barriers, which delegates agreed to.

Norway called for specifying the technical mitigation potential of dietary changes is estimated to 0.7-8.0 gigatonnes of CO₂ equivalents per year. China wondered about the confidence level of such a wide range. The CLAs verified that literature confirms high confidence in the range. The US objected to introducing a carbon price on food.

B6.3: Regarding a paragraph on the **reduction of food loss and waste lowering GHG emissions and contributing to adaptation**, Spain, France, Luxembourg and others proposed including figures on the mitigation potential on food loss and waste. Following huddle discussions, this paragraph was approved.

B7: This subsection, which focuses on **future land use depending, in part, on the desired climate outcome and the portfolio of response options deployed**, was discussed in a huddle, along with Figure SPM.4. In a sentence in the headline statement that clarifies that the inclusion of additional response options in models could reduce the projected need for carbon dioxide removal (CDR), delegates added a reference to "projected need for bioenergy" per request by India. Delegates approved the headline statement without further comment.

B7.1: A paragraph on **modeled pathways limiting global warming to 1.5°C include more land-based mitigation than higher warming level pathways** was approved following clarifications regarding consistency in the level of pathways with previous reports.

B7.2-5: The remaining paragraphs in this subsection were agreed following huddle discussions. These relate to, *inter alia*: pathways that limit global warming to 1.5°C and 2°C and project a 2 million km² reduction to a 12 million km² increase in forest area; land area needed for bioenergy; and pathways that include substantial deployment of bioenergy technologies.

Figure SPM.3: Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security: A CLA described the figure's structure, which includes three groups of response options (based on land management, value chain management, and risk management) in rows that can be matched to any of the five types of response denoted as mitigation, adaptation, desertification, land degradation, and food security, as well as cost. She noted that cell colors convey the magnitude of the contribution of each option to any response.

Brazil and Sweden lamented that bioenergy and BECCS were treated as one entity, with high cost and "low technical potential," noting this does not reflect the full reality.

The figure was revised by dividing response options into panels showing land management-based response options and options relying on additional land-use change, which could have greater implications, respectively. A CLA noted that cost ranges caveats are built into the text, figure, and caption. Delegates approved the figure as presented.

Final SPM Text: Section B addresses adaptation and mitigation response options.

Subsection B1 discusses **land-related responses that contribute to climate change that can also combat desertification and land degradation and enhance food security**, noting that their potential is context specific, including the adaptive capacities of communities and regions, and describes barriers to adaptation and limits to their contribution to global mitigation. The subsection also includes that:

- land-related actions are already being taken that contribute to adaptation, mitigation, combating desertification and land degradation, food security, and sustainable development;
- actions include sustainable food production, improved and sustainable forest management, soil organic carbon management, ecosystem conservation and land restoration, reduced deforestation and degradation, and reduced food loss and waste;
- some response options have immediate impact, others take decades to deliver measurable results;
- the successful implementation of response options depends on consideration of local environmental and socio-economic conditions;
- land-based options that deliver carbon sequestration in soil or vegetation do not continue to sequester carbon indefinitely, while peatlands can continue to sequester carbon for centuries;
- when vegetation and soil carbon reservoirs reach saturation, the annual removal of CO₂ from the atmosphere declines towards zero; and
- carbon stocks can be maintained, while accumulated carbon in vegetation and soils is at risk from future loss.

Subsection B2 states focuses on **land management options that do not require land use change and do not create demand for more land conversion**. The subsection states that:

- a number of response options can reduce demand for land conversion;
- a wide range of adaptation and mitigation responses have the potential to make positive contributions to sustainable development, enhancement of ecosystem functions and services, and other societal goals; and
- most land management-based response options and options based on value chain management and risk management can contribute to eradicating poverty and eliminating hunger, while promoting good health, clean water and sanitation, climate action, and life on land.

Subsection B3 emphasizes that **some response options can increase demand for land conversion, which could lead to adverse side effects for adaptation, desertification, land degradation, and food security**. The subsection includes paragraphs stating that:

- if applied at large scales to remove CO₂ from the atmosphere, afforestation, reforestation, and the use of land to provide feedstock for bioenergy with or without carbon capture and storage, or for biochar, could greatly increase demand for land conversion;
- widespread use of land-based mitigation measures over several millions of km² globally could increase risks for desertification, land degradation, food security, and sustainable development;
- the production and use of biomass for bioenergy can have co-benefits, adverse side effects, and risks for land degradation, food insecurity, GHG emissions, and other environmental and sustainable development goals;
- the use of residues and organic waste as bioenergy feedstock can mitigate land use change pressures associated with bioenergy deployment, but residues are limited and the removal of residues that would otherwise be left on the soil could lead to soil degradation;

- for projected SSPs with low population, effective land use regulation, food produced in low-GHG emission systems, and lower food loss and waste (SSP1), the transition from low to moderate risk to food security, land degradation, and water scarcity in dry lands occur between 1 and 4 million km² of bioenergy or BECCS; and
- in pathways with high population, low income, and slow rates of technological change (SSP3), the transition from low to moderate risk occurs between 0.1 and 1 million km².

Subsection B4 explains that **many activities for combating desertification can contribute to climate change adaptation with mitigation co-benefits**, as well as to halting biodiversity loss with sustainable development co-benefits to society. The subsection states that:

- solutions that help adapt to and mitigate climate change while contributing to combating desertification are site and regionally specific;
- reducing dust and sand storms and sand dune movement can lessen the negative effects of wind erosion and improve air quality and health;
- depending on water availability and soil conditions, afforestation, tree planting, and ecosystem restoration programmes can reduce sand storms, avert wind erosion, and contribute to carbon sinks, while improving micro-climates, soil nutrients, and water retention;
- measures to combat desertification can promote soil carbon sequestration;
- modeled rates of carbon sequestration following the adoption of conservation agriculture practices in drylands depend on local conditions;
- eradicating poverty and ensuring food security can benefit from applying measures promoting LDN;
- currently there is a lack of knowledge of adaptation limits and potential maladaptation to combined effects of climate change and desertification;
- some adaptation options can become maladaptive due to their environmental impacts;
- developing, enabling, and promoting access to cleaner energy sources and technologies can contribute to adaptation and mitigating climate change and combating desertification and forest degradation through decreasing the use of traditional biomass for energy while increasing the diversity of energy supply, which can have socio-economic and health benefits, especially for women and children.

Subsection B5 addresses **sustainable land management preventing and reducing land degradation, maintaining land productivity, and sometimes reversing the adverse impacts of climate change on land degradation**. It explains that even with implementation of sustainable land management, limits to adaptation can be exceeded in some situations.

The subsection's paragraphs state that:

- options having mitigation co-benefits include agroforestry, perennial pasture phases, use of perennial grains, and the application of certain biochars;
- reducing deforestation and forest degradation lowers GHG emissions;
- sustainable forest management provides long-term livelihoods for communities, can reduce the extent of forest conversion to non-forest uses, can lower GHG emissions, and can contribute to adaptation;
- sustainable forest management can maintain or enhance forest carbon stocks, and maintain forest carbon sinks, including by transferring carbon to wood; and
- climate change can lead to land degradation, which in some cases can trigger escalating losses or result in undesirable

transformational changes, such as forced migration, conflicts, or poverty.

Section B6 details that **response options throughout the food system can be deployed and scaled up to advance adaptation and mitigation**. It states that:

- different farming and pastoral systems can achieve reductions in the emissions intensity of livestock products, which may lead to absolute reductions in GHG emissions and enhance the adaptive capacity of rural communities;
- diversification in the food system can reduce risks from climate change while generating significant co-benefits in terms of human health; and
- reduction of food loss and waste can lower GHG emissions and contribute to adaptation through reduction in the land area needed for food production.

Section B7 states that **future land use depends in part on the desired climate outcome and the portfolio of response options deployed**. It emphasizes that:

- all assessed modeled pathways that limit warming to 1.5°C or well below 2°C require land-based mitigation and land-use change;
- a small number of modeled pathways achieve 1.5°C with reduced land conversion and, thus, reduced consequences for desertification, land degradation, and food security;
- modeled pathways limiting global warming to 1.5°C and 2°C project a 2 million km² reduction to a 12 million km² increase in forest area in 2050 relative to 2010;
- 3°C pathways project lower forest areas, ranging from a 4 million km² reduction to a 6 million km² increase;
- the land area needed for bioenergy varies depending on the SSP, the warming level, and the feedstock and production system use;
- pathways with large levels of land conversion may imply adverse side-effects, whereas best practice can have co-benefits;
- most mitigation pathways include substantial deployment of bioenergy technologies;
- a small number of modeled pathways limit warming to 1.5°C with reduced dependence on bioenergy and BECCS and other CDR options;
- these pathways have even more reliance on rapid and far-reaching transitions in energy, land, urban systems and infrastructure, and on behavioral and lifestyle changes compared to other 1.5°C pathways; and
- the inclusion of additional response options in models could reduce the projected need for bioenergy or CDR that increases the demand for land.

Section B also includes **Figure SPM.3** on the potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security. The figure includes two panels illustrating: 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; and response options that rely on additional land-use change and could have implications across three or more land challenges under different implementation contexts.

C: Enabling Responses

This section was taken up in plenary early Wednesday morning.

C1. This subsection states that **appropriate design of policies, institutions and governance systems can contribute to land-related adaptation and mitigation**. The headline statement was agreed as presented.

C1.1: On a paragraph on **land-use zoning, spatial planning, integrated landscape planning, regulations, incentives, and voluntary or persuasive instruments achieving positive adaptation and mitigation outcomes**, Bolivia proposed, and the group agreed, to add reference to local and indigenous knowledge and collective action, and reference to adaptation in relation to LDN. The group also agreed to a suggestion by Switzerland to add scientific knowledge.

C1.2: Delegates approved a paragraph on **insecure land tenure** affecting the ability and motivation of people, communities and organizations to make changes to land that can advance adaptation and mitigation, without comment.

C1.3: Colombia, supported by Angola, Tanzania, and the Republic of Korea, proposed a paragraph on **LDN** in this subsection. She explained this refers to other multilateral environmental agreements and would strengthen synergies in the promotion of LDN to mitigate climate change and increase positive effects for biodiversity. The Republic of Korea emphasized that enhancing food security through optimized sustainable land use and LDN is one of the great examples of a mix of policies. The US preferred including a reference to LDN into an existing paragraph. Germany said supporting LDN deserved a separate paragraph.

Following a proposed change by the US stating that achieving LDN “will involve” a balance of measures, the paragraph was approved.

C2: This subsection looks at **policies that operate across the food system**, including those that reduce food loss and waste and influence dietary choices, and enable more sustainable land-use management, enhanced food security, and low emissions trajectories. On the headline statement, the group agreed to a proposal by Bolivia to add “local and community collective action” and to one by Tanzania and India to refer to poverty eradication instead of reduction. The headline statement was then agreed.

C2.1: On a paragraph on **policies that enable and incentivize sustainable land management**, the group agreed to a proposal by Bolivia to reference “enhanced local and community collective action,” and to strengthen the link to climate change, as suggested by Norway. Iran preferred removing reference to “levels of governance” and to add international aspects. The group agreed to “levels of governance, including at the international level.” The paragraph was then agreed.

C2.2: On a paragraph stating that the **environmental costs of land-degrading agricultural practices can incentivize more sustainable land management**, India, supported by Tanzania, asked for the addition of a reference to developed countries, but the UK opposed. The EU asked for a more practical and positive reflection that land-preserving practices are environmentally beneficial and therefore to be incentivized. Delegates agreed to this first sentence without any change.

Delegates also agreed to delete two sentences on: examples of relevant policies, namely: emissions pricing and support for the growing market for low GHG-emission and more sustainable food production; and redistribution of revenues from carbon pricing to strengthen the climate response and resolve potential adverse side effects for a range of Sustainable Development Goals (SDGs), particularly those related to hunger, poverty and energy access.

The paragraph was then agreed.

C2.3: On a paragraph on **comprehensive risk management facilitating adaptation and enhanced resilience to extreme events** impacting food systems, the group agreed to delete reference to index-based weather insurance, as proposed by India.

C2.4: On a paragraph on **public health policies** that can potentially influence food demand, reduce healthcare costs, and contribute to lower GHG emissions, Bolivia proposed, and the group agreed, to also add reference to enhanced adaptive capacity.

C3: This subsection explains that **co-benefits and trade-offs when designing land and food policies can overcome barriers to implementation**. The headline statement was agreed with a minor amendment.

C3.1: This paragraph on **addressing desertification, land degradation, and food security in an integrated, coordinated and coherent manner** was agreed as presented.

C3.2: This paragraph on technological, biophysical, socio-economic, financial, and cultural **barriers that can limit the adoption of land-based response options** was approved with one change proposed by Bolivia. In a sentence focusing on reasons for why many sustainable land management practices are not widely adopted, he proposed including “unequal private and public incentives” to the list of reasons.

C3.3: This paragraph states that **land and food sectors coordinating with other sectors can increase co-benefits**. Switzerland sought to also include a reference to the environmental sector, and Bolivia, to reference the water sector, which was agreed.

C3.4: This paragraph states that some **response options and policies may result in trade-offs**. Bolivia, supported by India, requested deletion of reference to “ecosystem service trade-offs.” Delegates agreed to the paragraph with this deletion and two minor editorial changes.

C4: This subsection addresses the **effectiveness of decision-making and governance being enhanced by the involvement of local stakeholders** (particularly those most vulnerable to climate change including indigenous peoples and local communities, women, and the poor and marginalized). Regarding the headline statement, the group agreed to add local communities and the poor and marginalized, as suggested by Bolivia and India, respectively, to those identified as most vulnerable.

C4.1: A paragraph on **successful implementation of sustainable land management practices requiring accounting for local environmental and socio-economic conditions** was approved with a minor amendment.

C4.2: A paragraph on **measurement, reporting, and verification of the performance of policy instruments supporting sustainable land management** was agreed as presented.

C4.3: A paragraph on **agricultural practices that include indigenous peoples and local communities** was revised by Canada, and supported by Norway, to better reflect that, among other things, indigenous knowledge does not imply the absence of innovation. The paragraph was then agreed.

C4.4: Regarding a paragraph on **women’s empowerment and policies that can address barriers to women’s participation in sustainable land management**, Tanzania expressed concern with reference to religious practices hindering women’s land rights, noting that this information was drawn from a single study. Saudi Arabia, supported by Egypt, Tanzania, Algeria, and Morocco, called for deleting this sentence, noting that it was overly policy prescriptive.

The UK, Luxembourg, Norway, France, Sweden, New Zealand, the Netherlands, and Canada supported keeping the reference. Attempting to reach a middle ground, Bolivia suggested, and Saudi Arabia supported, reflecting, in the text, that the information was drawn from one study. The US suggested adding language to reflect that the promotion of land rights for women is among the policies that address the barriers to

women’s participation in sustainable land management, noting the contentious phrase would no longer be necessary. The paragraph was then agreed.

Figure SPM.4: Pathways linking socio-economic development, mitigation responses and land: This figure includes three graphs showing sustainability focused, middle of the road, and resource intensive pathways and a table showing land use and land use change in the SSPs. The figure originally included four graphs showing sustainability focused pathways at 1.5°C and 3°C and resource-intensive pathways at 1.5°C and 3°C. However, during the discussions, Trinidad and Tobago expressed concern with the figure in general given the 3°C pathway when “the world has spoken” regarding the need for a 1.5°C pathway. While noting some benefits in terms of food consequences at 3°C, he said that with such a temperature rise, no one will be left to enjoy the benefits of 3°C, particularly in SIDS. The figure was restructured taking these and other comments into account and agreed.

Final SPM Text: Section C addresses enabling response options.

Subsection C1 addresses **how appropriate design of policies, institutions and governance systems at all scales can contribute to land-related adaptation and mitigation while facilitating the pursuit of climate-adaptive development pathways**. This subsection stresses that:

- policies promoting the target of LDN can also support food security, human well-being, and climate change adaptation and mitigation;
- land policies, including recognition of customary tenure, community mapping, redistribution, decentralization, co-management and regulation of rental markets, can provide both security and flexibility in climate change responses;
- the pursuit of LDN provides an impetus to address land degradation and climate change simultaneously; and
- policy mixes can strongly reduce the vulnerability and exposure of human and natural systems to climate change.

Subsection C2 addresses how **policies that operate across the food system, including those that reduce food loss and waste and influence dietary choices, enable more sustainable land-use management, enhanced food security and low emissions trajectories**. It also explains that the adoption of sustainable land management and poverty eradication can be enabled by improving access to markets, securing land tenure, factoring environmental costs into food, making payments for ecosystem services, and enhancing local and community collective action.

This subsection emphasizes that:

- policies that enable and incentivize sustainable land management for climate change adaptation and mitigation include improved access to markets for inputs, outputs, and financial services, empowering women and indigenous peoples, enhancing local and community collective action, reforming subsidies, and promoting an enabling trade system;
- reflecting the environmental costs of land-degrading agricultural practices can incentivize more sustainable land management;
- adaptation and enhanced resilience to extreme events impacting food systems can be facilitated by comprehensive risk management, including risk-sharing and transfer mechanisms;
- agricultural diversification, expansion of market access, and preparation for increasing supply chain disruption can support the scaling up of adaptation in food systems;
- public health policies to improve nutrition can potentially influence food demand, reduce healthcare costs, contribute to lower GHG emissions and enhance adaptive capacity; and

- influencing demand for food, through promoting diets based on public health guidelines, can enable more sustainable land management and contribute to achieving multiple SDGs.

Subsection C3 addresses how acknowledging co-benefits and trade-offs when designing land and food policies can overcome barriers to implementation. This subsection underscores that:

- addressing desertification, land degradation, and food security in an integrated, coordinated, and coherent manner can assist climate resilient development and provide numerous potential co-benefits;
- technological, biophysical, socio-economic, financial, and cultural barriers can limit the adoption of many land-based response options, as can uncertainty about benefits;
- the land and food sectors face particular challenges of institutional fragmentation and often suffer from a lack of engagement between stakeholders at different scales and narrowly focused policy objectives; and
- some response options and policies may result in trade-offs, including social impacts, and ecosystem functions and services damage, that cannot be well-managed, even with institutional best practices, and addressing such trade-offs helps avoid maladaptation.

Subsection C4 addresses how the effectiveness of decision-making and governance is enhanced by the involvement of local stakeholders in the selection, evaluation, implementation, and monitoring of policy instruments for land-based climate change adaptation and mitigation. This subsection stresses that:

- sustainable land management in the context of climate change is advanced by involving all relevant stakeholders in identifying land use pressures and impacts, as well as preventing, reducing, and restoring degraded land;
- inclusiveness in the measurement, reporting, and verification of the performance of policy instruments can support sustainable land management;
- involving stakeholders in the selection of indicators, climate data collection, land modeling, and land-use planning, mediates and facilitates integrated landscape planning and choice of policy;
- agricultural practices that include indigenous and local knowledge can contribute to overcoming the combined challenges of climate change, food security, biodiversity conservation, and combating desertification and land degradation;
- coordinated action across a range of actors, including businesses, producers, consumers, land managers, and policymakers in partnership with indigenous peoples and local communities, better enables the adoption of response options; and
- empowering women can bring synergies and co-benefits to household food security and sustainable land management.

Section C also contains **Figure SPM.4** illustrating pathways linking socio-economic development, mitigation responses and land, and land use and land cover change in the SSPs.

D: Action in the Near Term

This section was first taken up on Tuesday morning.

D1: This subsection discusses **actions that can be taken in the near-term to address desertification, land degradation, and food security, while supporting longer-term responses** that enable adaptation and mitigation. Regarding the headline statement, Zimbabwe, India, and Bolivia stressed the need for the provision of finance. Switzerland, with Chile, stressed the relevance of governance in the statement, but India opposed introducing concepts, such as governance, in the headline statement when it is not mentioned in subsequent subsection

paragraphs. The EU proposed to refer to a previously negotiated and agreed upon sentence on near-term capacity-building, technology transfer, and deployment, and enabling financial mechanisms, which was agreed. With these changes and CLA proposals to modify the list of actions that can be taken, the headline statement was agreed

D1.1: This paragraph addresses **strengthening adaptation and mitigation in the land sector through near-term capacity-building efforts, technology transfer and deployment, and enabling financial mechanisms.** Delegates worked with CLAs to refine this paragraph, including by adding reference to “sustainable” use of natural resources for food security, as requested by India. Following further informal consultations on this paragraph, agreement was reached.

D1.2: A paragraph on **measuring and monitoring land use change, including land degradation and desertification,** engendered lengthy discussion. The original draft wording on measuring progress in addressing desertification and climate-induced land degradation was changed in response to a US call for reference to continuous monitoring of trends. The CLAs added a parenthetical list of new technologies to the sentence as per a question from India about expanded use of technologies.

India proposed, and delegates agreed, to merge this paragraph with the subsequent one on a list of events and phenomena for which seasonal forecasts and early warning systems are critical. Comments to this list called for additional elements to be covered and for distinguishing between those that need early warning systems and those that simply need seasonal forecasts.

India, Madagascar, and the EU queried the inclusion of language on food security and biodiversity needing early warning systems, but New Zealand supported the text, citing expansion of pests. Norway and Bolivia called for including disaster risk management.

Delegates agreed on a CLA proposal to split the list into two, one on early warning systems and one on seasonal forecasts, with the addition of various modifications proposed by delegates. These included that: early warning systems are critical for protecting lives and property and enhancing disaster risk reduction and management; and seasonal forecasts and early warning systems are critical for food security, drought and desertification, and biodiversity monitoring. This paragraph was agreed.

D1.3: Regarding a paragraph, which states that **framing land management in terms of risk management plays an important role in adaptation,** Tanzania and India questioned the usefulness of singling out “index-based” weather insurances and delegates agreed to delete this reference. They also agreed to modify a sentence stating that providing information on climate-related risk can improve capacity of land managers and enable timely decision making. Tanzania expressed reservations that simply providing information would not be enough, and that capacity building would be necessary as well. Noting that this was understood, the paragraph was agreed.

D1.4: This paragraph addresses **improving sustainable land management by increasing the availability and accessibility of data and information.** A sentence on knowledge gaps existing with upscaling and the widespread deployment of some response options was modified to also include institutional and financial gaps and challenges, following proposals by the EU and India. The example of soil carbon management as one response option was also added.

D2: This subsection addresses **near-term action bringing social, ecological, economic, and development co-benefits.** The headline statement was agreed with slight modifications.

D2.1: This paragraph addresses **near-term action to promote sustainable land management**. India requested deletion of “food security” from a list of benefits of near-term action, noting it is covered under “food vulnerabilities.” Upon further suggestions by Tanzania and the CLA, respectively, the paragraph was modified to focus on near-term “actions” to “promote” rather than stimulate, sustainable land management.

Japan queried why slash and burn agriculture was not included in the paragraph. Noting that the phrase had received many objections during the government comment period, a CLA said it had been replaced with language on the potential for co-benefits from near-term action. Upon questions from India, a CLA suggested replacing poverty “reduction” with “eradication.”

India questioned wording on increasing access to markets and called for wording on non-market benefits. Following informal consultations, delegates accepted Bolivia’s request to add wording on ecosystem “functions and” services and approved the paragraph.

D2.2: On Wednesday morning, on a paragraph on **investments in land restoration**, delegates agreed to a CLA suggestion giving the estimated economic value range of restored ecosystem services that can result from investments land restoration in drylands. After some discussion on sentences stating that many sustainable land management technologies and practices are profitable within 3-10 years and that actions to ensure sustainable land management can improve crop yields and the economic value of pasture, the paragraph was approved.

D2.3: This paragraph discusses **upfront investments in sustainable land management technologies**. A sentence in the original formulation of the paragraph stating that dietary changes can ease the economic burdens of ill health caused by malnutrition, potentially allowing redirection of revenues to incentivize sustainable intensification and sustainable land management practice, was debated at length. Germany, supported by Luxembourg, called for a clearer link with GHG emissions, with Germany suggesting reference, instead, to low GHG emission diets. The US, the EU, India, Tanzania, Algeria, and Saudi Arabia preferred deleting this sentence. This paragraph was agreed with a reformulated sentence to state that near-term change to balanced diets can reduce the pressure on land and provide significant health co-benefits through improving nutrition.

D3: This subsection addresses **rapid reductions in anthropogenic GHG emissions that hold global warming to well below 2°C** limiting the negative impacts of climate change on land ecosystems and food systems. On the headline statement, Luxembourg, supported by Germany, the UK, Ireland, Jamaica, France, Chad, and the EU, queried why language on rapid reductions in anthropogenic GHG emissions “that hold global warming to well below 2°C” in the previous draft had been replaced with language on “following ambitious mitigation pathways,” and insisted on reinstating the former version.

The US suggested referencing ambitious mitigation pathways “approximating” or “along the lines of” well below 2°C. A CLA noted little literature exists regarding ambitious mitigation pathways but said they would be addressed in AR6, particularly on short pathways and how quickly impacts are felt.

Saudi Arabia stated that any further deviations from the authors’ draft would not be acceptable to her. France pleaded for the former draft’s phrase on the basis of the global warming impacts it has already felt in 2019. WG II Co-Chair Pörtner reiterated that new science must be undertaken on this and be in line with recent IPCC assessments. The paragraph was approved as presented without reverting to the previous draft’s text.

D3.1: This paragraph focuses on **delayed action across sectors leading to an increasing need for widespread deployment of land-based adaptation and mitigation options**. India proposed and delegates agreed to delete a reference to “positive returns on investment” in a sentence stating that acting now may avert or reduce risks and losses and generate benefits to society.

Views diverged on a sentence stating that prompt action on climate mitigation and adaptation aligned with sustainable land management and sustainable development could deliver immediate benefits in most countries and reduce the vulnerability of millions of people to climate extremes, desertification, land degradation, and food and livelihood insecurity.

Delegates agreed to refer to the reduction of risks of millions of people to climate extremes rather than the vulnerability. Bolivia, supported by South Africa, proposed clarifying that prompt action “and support for” climate mitigation and adaptation, but others did not support this addition. India, supported by Saudi Arabia, urged clarifying that adaptation is context and region specific, and that action requires support in terms of finance, technology, and capacity building, as agreed in various SPM sections. The CLA proposed differentiation by stating that “climate mitigation and adaptation action depended on the region,” which the US strongly opposed.

Norway, supported by Finland, Japan, Ukraine, and Sweden, called for reference to SLCFs. Norway proposed language stating that reductions of emissions of SLCFs can provide near-term global and regional climate mitigation, with significant co-benefits for crop yields, food security, and human health. India opposed introducing the issue at this late point and said the IPCC is dealing with these gases elsewhere. Saudi Arabia and Ukraine lamented that, due to time constraints, this text could not be properly considered. A CLA noted that SLCFs were not sufficiently assessed in this report but will be addressed during AR6 WG I and II assessments. Delegates agreed on the paragraph without Norway’s proposal.

D3.2: This paragraph stating on **deferral of GHG emissions reductions implying tradeoffs that lead to higher costs and risks** was approved without comment.

D3.3: This paragraph states that **deferral of emissions reductions from all sectors implies trade-offs, including irreversible loss in land ecosystem functions and services** required for food, health, habitable settlements, and production, and leads to increasingly significant economic impacts on many countries in many regions. The UK, the EU, and Luxembourg stressed the need for action in all delayed action scenarios. Following other modifications, including a request by Bolivia to add reference to ecosystem “functions,” the paragraph was approved.

Final SPM Text: Section D addresses actions in the near term, including:

- how near-term action can bring social, ecological, economic, and development co-benefits, which can contribute to poverty eradication and more resilient livelihoods for those who are vulnerable;
- that rapid reductions in anthropogenic GHG emissions across all sectors following ambitious mitigation pathways reduce negative impacts; and
- that delaying climate mitigation and adaptation responses across sectors would lead to increasingly negative impacts on land and reduce the prospect of sustainable development.

Subsection D1 focuses **actions that can be taken in the near-term, based on existing knowledge, to address desertification,**

land degradation, and food security while supporting longer-term responses that enable adaptation and mitigation to climate change. The headline statement lists actions to:

- build individual and institutional capacity;
- accelerate knowledge transfer;
- enhance technology transfer and deployment;
- enable financial mechanisms;
- implement early warning systems;
- undertake risk management; and
- address implementation and upscaling gaps.

This subsection highlights that:

- near-term capacity building, technology transfer and deployment, and enabling financial mechanisms can strengthen adaptation and mitigation in the land sector;
- knowledge and technology transfer can help enhance the sustainable use of natural resources for food security under a changing climate;
- raising awareness, capacity building, and education about sustainable land management practices, agricultural extension and advisory services, and expansion of access to agricultural services to producers and land users, can effectively address land degradation;
- measuring and monitoring land use change is supported by the expanded use of new information and communication technologies;
- early warning systems for extreme weather and climate events are critical for protecting lives and property and enhancing disaster risk reduction and management;
- framing land management in terms of risk management, specific to land, can play an important role in adaptation through landscape approaches, biological control of pest and disease outbreaks, and improving risk sharing and transfer mechanisms; and
- sustainable land management can be improved by increasing the availability and accessibility of data and information relating to the effectiveness, co-benefits, and risks of emerging response options and increasing the efficiency of land use.

Subsection D2 addresses how near-term action can bring social, ecological, economic, and development co-benefits, and emphasizes that:

- near-term actions to promote sustainable land management will help reduce land and food-related vulnerabilities, and can create more resilient livelihoods, and reduce land degradation, desertification, and biodiversity loss;
- maximizing existing synergies between sustainable land management, poverty eradication efforts, access to market and non-market mechanisms and the elimination of low-productivity practices can lead to adaptation, mitigation, and development co-benefits;
- investments in land restoration can result in global benefits and in drylands can have benefit-cost ratios of between three and six in terms of the estimated economic value of restored ecosystem services;
- upfront investments in sustainable land management practices and technologies can range from about USD 20 ha⁻¹ to USD 5000 ha⁻¹, with a median estimated to be around USD 500 ha⁻¹; and
- government support and improved access to credit can help overcome barriers to adoption, especially those faced by poor smallholder farmers.

Subsection D3 addresses how delaying climate mitigation and adaptation responses across sectors would lead to increasingly negative impacts on land and reduce the prospect of sustainable development. This subsection stresses that:

- prompt action on climate mitigation and adaptation aligned with sustainable land management and sustainable development depending on the region could reduce the risk to millions of people from climate extremes, desertification, land degradation, and food and livelihood insecurity;
- in future scenarios, deferral of GHG emissions reductions implies trade-offs leading to significantly higher costs and risks associated with rising temperatures;
- the potential for some response options, such as increasing soil organic carbon, decreases as climate change intensifies, as soils have reduced capacity to act as sinks for carbon sequestration at higher temperatures;
- deferral of GHG emissions reductions from all sectors implies trade-offs including irreversible loss in land ecosystem functions and services required for food, health, habitable settlements, and production, leading to significant economic impacts on many countries in many regions; and
- delaying action as is assumed in high emissions scenarios could result in some irreversible impacts on some ecosystems, which in the longer-term has the potential to lead to substantial additional GHG emissions from ecosystems.

Closure of the Second Joint Session of WGs I, II and III

On Wednesday afternoon, the WGs approved the SPM and accepted the underlying report and forwarded everything to the IPCC Plenary. The Joint Session closed at 12:20 pm.

Progress Report of the Task Group on the Organization of the Future Work of the IPCC in light of the Global Stocktake

This issue was addressed in Friday morning's IPCC plenary. Éric Brun, Co-Chair, Task Group on the Organization of the Future Work of the IPCC in light of the GST, presented an oral progress report on the Task Group's work. He reported that they identified two alternatives for future IPCC work: further development of seven options for the IPCC's future work, to be presented at IPCC-52; or launching a review in 2020 to provide information to the IPCC and the UNFCCC before a decision on future work is taken. He noted the formulation of elaborate criteria to inform the choice between the alternatives and said governments were invited to identify the pros and cons of each. One government provided suggestions, which were incorporated into a revised formulation.

The Panel took note of the Task Group's report.

Progress Report on the AR6 SYR

During the IPCC plenary on Tuesday afternoon, IPCC Chair Hoesung Lee shared his "philosophy" on the AR6 SYR, noting he expected the report to be scrutinized intensely, more so than any other report in the IPCC's history. He highlighted the significance of the April 2022 release date, and AR6's usefulness for the GST. But more concerning, he said, was that when the report is released, the world will have a huge deficit in emissions reductions, global economic stagnation, and a surplus in nationalism. He stressed that the utility of AR6 will depend on its usefulness in triggering immediate climate action and an understanding that climate action serves job growth and poverty reduction.

IPCC Deputy Secretary Kerstin Stendahl provided an update on progress in SYR preparation, noting, *inter alia*, that the scoping meeting will convene 20-23 October 2019 in Singapore, and 546 nominations were received for the scoping meeting, 32% of which were women.

The UK, Norway, and Germany urged that the TSU be established as soon as possible and said a scientific steering committee should play a role in the scoping and preparation of the SYR. The US emphasized the importance of ensuring that the SYR review and approval process do not overlap with the work of other WGs. He also stressed that the SYR should “synthesize” and “integrate” the WG reports in a balanced manner and the TSUs should work closely with the WGs. He recommended that the SYR should have WG authors on the writing team and involve the WG Co-Chairs. Saudi Arabia emphasized consistency among WGs. France lauded the unprecedented current cooperation among the WGs.

The Panel took note of the SYR progress report, as orally presented.

Acceptance of the Actions Taken at the Second Joint Session of WGs I, II, and III in Cooperation with the TFI

When IPCC-50 resumed Wednesday afternoon, IPCC Chair Hoesung Lee reviewed the actions of the joint WGs/TFI and invited the Panel to approve the SPM and accept the underlying report. He then opened the floor for comments.

The Russian Federation reminded the Panel of her statement to the Joint WG Session regarding the burning embers diagram (Figure SPM.2) and that the methodology to develop the figure was carried out improperly. She asked that her statement be recorded in the IPCC-50 report.

Jamaica called the report very important for small island states but expressed serious concerns regarding the meeting’s process, saying that some countries were disadvantaged by the time spent on some sections, which forced them to rush through other sections, and cautioning against making this standard IPCC practice.

Zimbabwe agreed, noting that IPCC-50’s mode of working made it difficult for small developing country delegations to engage in all discussions in reviewing the SPM, and asked that this issue be addressed for subsequent sessions. He also proposed having special briefings for developing countries on key issues in IPCC reports.

IPCC Chair Lee recognized the need to improve the approval process.

Several delegations made recommendations. Norway suggested all countries submit comments during the review to enable authors to prepare and avoid too many footnotes in future SPMs. Cuba suggested increasing the number of developing country authors in upcoming reports.

Saudi Arabia, India, Brazil, and Nigeria thanked all participants, particularly the authors, and underlined the importance of the SRCCL for their countries, with Ireland noting that some time will be required to fully understand the implications of the report’s findings.

Mexico, with India, thanked IPCC Chair Lee for his analysis of the current world’s state of play during his progress report on the SYR, lauding this as very useful to highlight environmental, economic, and political realities and different world views that helped overcome sticky points in the discussions.

Reiterating concerns expressed during the meeting, Belgium, Japan, and Austria called for reducing the length of SPMs.

The EU: praised the IPCC’s rigor, stressing continued prioritization of evidence-based science; urged that SPMs be written in plain language for policymakers and the public; and called on scientists to answer the crucial questions for which policymakers need answers.

France said that IPCC-50’s results will be essential for implementing the Paris Agreement. Denmark expressed appreciation for the cross-WG collaboration and the way in which the WGs/TFI session was conducted.

The US echoed the EU’s call for clear messages and recommended focusing on this during development of materials. He expressed appreciation that the IPCC brings together governments and the world’s experts to address the existential threat of climate change to our species.

Chad asked that the IPCC scientists include French-language literature in their assessments in order to reflect some regional issues such as in the Sahel. Chair Lee confirmed that this suggestion would be recorded in the report of IPCC-50.

Canada observed that the worth of the IPCC’s work can be measured by the impact of IPCC documents and its influence on international policy.

The IPCC then accepted the action taken by the Joint Session of the WGs/TFI and approved the SPM and accepted the underlying report.

Reading a formal statement, the US stated that the acceptance by the IPCC of the SPM should not be misunderstood as a US endorsement of the report and its findings.

Other Business

Collaboration between IPBES and IPCC: This issue was taken up by the IPCC plenary on Wednesday afternoon, following requests during the opening plenary to add it to the agenda. IPCC Deputy Secretary Stendahl reported that IPBES-7 approved the preparation of a technical paper on biodiversity and climate change to be finalized by COP 15 of the Convention on Biological Diversity in 2020 and wished to explore possible joint activities with IPCC in this regard. She reported that both IPBES and IPCC Secretariats and WG II Co-Chairs had discussed this during the most recent UNFCCC Subsidiary Bodies session in June 2019 in Bonn, Germany. While reporting great interest and scope to increase collaboration, Stendahl said the IPCC’s heavy workload and schedule makes such collaboration a challenge at this time.

Switzerland called for flexibility and proposed, in order to be more efficient in closing knowledge gaps and producing policy-relevant information on interlinkages between climate change and biodiversity, that the IPCC consider a joint international conference or workshop. He said Switzerland stood ready to provide financing for such a workshop to be organized in Geneva. Norway supported this idea as a way forward, asked this be reflected when considering timelines and said such collaboration would be useful for the AR6.

WGII Co-Chair Pörtner expressed hope that a way forward could be found for a co-sponsored meeting and encouraged government representatives that are active in both bodies to make efforts in this regard.

Germany and the US said a longer discussion on this issue was warranted, with the US cautioning against creating a third body or process, stressing efficiency, clarity, and coherence in procedures.

Saudi Arabia recommended that the IPCC Bureau take this up and provide advice as to how the Panel should proceed.

Climate Action Network International urged overcoming “bureaucratic compartmentalization” so that IPBES and the IPCC can work together.

Deputy-Secretary Stendahl proposed that the IPCC Secretariat, in collaboration with the IPBES Secretariat, prepare a background note including mandates and highlighting different options for consideration by the IPCC Bureau at its next meeting in Singapore in November 2019 and for presentation at IPCC-52. The Panel took note of the proposal.

Closing Plenary

IPCC Secretary Abdalah Mokssit announced that IPCC-51 will be held in Monaco from 20-23 September 2019 and will be dedicated to approving the SROCC.

In closing, IPCC Chair Lee observed that IPCC-50 had comprised “six momentous days of the best of science and policymaking,” leading to the most up-to-date understanding of the relationship between climate change and land. He expressed the hope that the SRCCL will help policymakers in their national policy development and in international deliberations. Recalling UN Secretary-General Guterres’s recent words that preventing climate disruption is the race of our lives, he said he believes that the Special Report finalized at IPCC-50 will provide us with the energy to win this race.

Chair Lee gaveled the meeting to a close at 3:16 pm on Wednesday, 7 August.

A Brief Analysis of IPCC-50***On the Impossibility of Isolation***

As delegates, scientists, and observers gathered in Geneva for the 50th session of the Intergovernmental Panel on Climate Change (IPCC), July 2019 was confirmed as the warmest July on record, worldwide. The new July mark follows a global record for June, which easily tops the record for any June since instrumental temperature measurements began.

Meanwhile, 60 km away from Geneva, approximately 440 members of civil society from more than 35 countries were also gathering for a one-week meeting. Organized by Fridays for the Future, a movement inspired by Greta Thunberg, the Summer Meeting in Lausanne Europe (SMILE) convened to discuss strategy to organize and increase awareness on climate change, given that the movement continues to gather strength and become more complex as it becomes global.

It was in this context that the IPCC met to adopt the Special Report on Climate Change and Land (SRCCL) and approve its Summary for Policymakers (SPM), following a line-by-line review.

Accounting for around 23% of total net anthropogenic GHG emissions, agriculture, forestry, and other land use have a critical role to play in CO₂ removal if there is any chance of staying at global warming of 1.5°C or 2°C. Sustainable land management is also critical for adapting to the impacts of climate change everywhere. But policies beyond land make a big difference, as the potential for mitigation in this key sector is reduced with increased warming. As a result, early action is most cost-effective. Tackling this challenge, however, requires a coordinated response. As the SRCCL makes clear, a diversification of options, coordination, and integration are key.

This diversification and coordination were on full display in Geneva in various ways, with the SRCCL breaking ground on integration. It is the first IPCC Special Report to encompass the missions of all three Rio Conventions—climate change (UNFCCC), biodiversity (CBD), and desertification (UNCCD). It is also the first report of its kind to be undertaken jointly by all the IPCC bodies: the three Working Groups (WGs) as well as the Task Force on National GHG Inventories. It has also been called the first Special Report to take a more systemic approach to a sector or area—in this case, the food system. It is also the first one to have more authors from developing countries than from developed countries.

This analysis provides a brief overview of the negotiations in Geneva focusing on the SRCCL, its significance among IPCC products, and its approval process.

SRCCL: Integration All Around

The SRCCL involved 107 leading scientists from 52 countries across all regions of the world, plus 93 contributing authors, assessing over 7,000 peer-reviewed papers. A total of 28,275 comments from expert reviewers and governments were received and addressed by the writing team. All 195 IPCC member governments were invited to comment on the report and approve its SPM, line by line.

This phenomenal two-year effort was made even more challenging by the need to integrate findings from different disciplines in an attempt to convey a comprehensive picture of the whole land cover system in all the regions of the world. Climate change has long been recognized to be a systemic problem, requiring systemic solutions. The relation between climate change and land is a prime example of this interdependence and interconnection: positive impacts in one area have cascading effects on other areas and, unfortunately, so do negative ones.

The focus of the SRCCL is, therefore, squarely on sustainability—it notes the damaging effects of social and economic inequality, including, for example, the impact of women’s lack of access to land. But the emphasis is on solutions: a wide diversity of solutions exists at every scale and for every actor, from small-scale farmers to large corporations. In this respect, the SRCCL is unique among IPCC reports in that it includes options for individuals—at least in developed countries—to act upon, including those that are as simple as avoiding wasting food and paying greater attention to daily food consumption.

In all of its assessments, the IPCC has always recognized the need for integration, and the IPCC Synthesis Report, presenting findings from the three WGs, is a key pillar of the Panel’s work. This integration, however, was also a challenge, with calls for greater collaboration among the WGs after each assessment cycle.

In Geneva, many participants commended the degree of cooperation among the WG Co-Chairs, evidenced in the report itself, where, by necessity, impacts, mitigation, and adaptation had to be considered together: an agro-ecological and soil-enriching agroforestry system not only absorbs more carbon but avoids land degradation and reduces vulnerability, whereas land degradation exacerbates climate change and its impacts, and increases vulnerability to desertification, food insecurity, and loss of habitat for both humans and other species.

The move to leave disciplinary and other silos and pursue integration at multiple levels was echoed in IPCC-50’s growing openness towards future cooperative work with other organizations. Several delegates referred, in particular, to IPBES, and there was discussion and acceptance of concepts such as “nature’s contribution to people” from that process. The IPCC referred to IPBES’s Global Assessment Report on Biodiversity and Ecosystem Services and its thematic assessment report on land degradation and restoration, among others.

The UNCCD’s work was also in delegates’ minds at the meeting, with frequent mentions of the Land Degradation Neutrality (LDN) concept and references to the UNCCD’s Global Land Outlook. This is important for the upcoming UNCCD COP in September 2019, which will present not only policy-relevant scientific findings, as presented in the SRCCL and the IPBES land and global assessments, but also for the policy recommendations that follow from those findings.

The SRCCL SPM Approval Process

After almost 30 hours of non-stop deliberations, the SRCCL SPM was finally approved “on the sixth day of the five-day meeting,” as one delegate put it. The process was grueling and frustrating particularly for small delegations, many from

developing countries, who found it impossible to follow all the discussions and were disappointed that so much time was spent on some parts of the report while other sections were rushed through in the middle of the night or in multiple, parallel huddles or contact groups. The length of the SPM was identified as a problem early on, and this was compounded by the fact that everyone had something to say on each section of the report regarding their own country, its land, and its interests. However, in spite of the long hours spent in plenary, many delegates noted that the approval process was remarkably constructive.

Another difficulty is providing an accurate picture for all regions, a challenge well known to the IPCC, in particular Working Group II, which is in charge of looking at regional aspects. Since IPCC reports only cover existing peer-reviewed literature, some obvious observations might not be included due to a lack of literature. This is especially upsetting for developing countries, who find that glaring problems in their regions appear as “low confidence” statements or are bypassed altogether. Fortunately, the IPCC process also allows for gaps in knowledge to be noted and provides a direct invitation to scientists to close these gaps in subsequent reports.

Room for Optimism?

The SRCCL is arguably the most optimistic assessment one might expect from the IPCC. The report speaks volumes—literally—about the potential of actions with multiple co-benefits at various levels and across multiple areas, from food security to human health to biodiversity to water resources. The main message of the report is clear: there is an array of solutions in the land sector; they are for the most part well known and readily available; context matters greatly; and enormous power comes from deploying them together. The challenge lies in integrating policy frameworks toward the required systemic transformation to be able to meet the least destructive and least costly goals.

During the closing plenary, IPCC Chair Hoesung Lee shared his views on a near future when a global economic downturn, coinciding with clearer impacts of climate change, could make countries attempt to focus inward in a hopeless attempt at saving themselves. He shared this scenario as a warning to the plenary of more challenging times ahead. Yet, as WG II Co-Chair Hans-Otto Pörtner said during the SRCCL press conference, we might take some comfort in how the youth movement around the world has taken policymakers by surprise. The youth get it and are acting.

Meanwhile, in Lausanne, Greta Thunberg expressed hope that the IPCC SRCCL will be widely shared by the media. In this regard, many delegates noted that the SPM could be improved with clearer language. The IPCC will soon have another chance at this—both in terms of a shorter SPM and clear language—when it meets in four weeks’ time in Monaco to approve the Special Report on the Ocean and Cryosphere in a Changing Climate.

As Greta Thunberg said in Lausanne, “When people understand the situation, they will wake up. I will continue to present the facts.” Many trust the IPCC continues to do so as well. Its relevance depends on it. And as noted by some in Geneva, it would be good if it could do so more clearly....like Greta does.

Upcoming Meetings

Latin America and Caribbean Climate Week 2019:

Latin America and Caribbean Climate Week (LACCW) 2019 is designed to advance regional climate action, and support implementation of LAC countries’ nationally determined contributions (NDCs) under the UNFCCC and action to deliver on the SDGs. The event is envisioned as a stepping stone toward

the UN Climate Action Summit in September. LACCW is part of Regional Climate Weeks that are held annually in Africa, LAC and the Asia-Pacific. Regional Climate Weeks are organized by the Nairobi Framework Partnership (NFP), which supports developing countries in preparing and implementing their NDCs. **dates:** 19-23 August 2019 **location:** Salvador, Brazil **www:** <https://www.regionalclimateweeks.org/>

IPCC WG I AR6 Third Lead Author Meeting: The third Lead Author meeting of IPCC Working Group I will convene to continue preparations for the Sixth Assessment Report. **dates:** 26-30 August 2019 **location:** Toulouse, France **www:** <http://www.ipcc.ch/calendar>

First meeting of the CBD Open-ended Working Group on the Post-2020 Global Biodiversity Framework: Among other matters, this meeting will consider reports of consultations and other contributions to the post-2020 process, the potential elements of the structure and scope of the post-2020 Global Biodiversity Framework, the future work programme of the Open-ended Working Group, and allocation of tasks to other intersessional bodies and processes. **dates:** 27-30 August 2019 **location:** Nairobi, Kenya **www:** <https://www.cbd.int/conferences/post2020/wg2020-01/documents>

UNCCD COP 14: The 14th meeting of the Conference of the Parties to the UN Convention to Combat Desertification is expected to review the progress made to control and reverse further loss of productive land from desertification, land degradation, and drought. **dates:** 2-13 September 2019 **location:** New Delhi, India **www:** <https://www.unccd.int/>

Asia-Pacific Climate Week 2019: Asia-Pacific Climate Week (APCW) 2019 is designed to advance regional climate action, and support implementation of Asia-Pacific countries’ NDCs and action to deliver on the SDGs. APCW is envisioned as a stepping stone toward the UN Climate Action Summit in September. Regional Climate Weeks are organized by the NFP, which supports developing countries in preparing and implementing their NDCs. **dates:** 2-6 September 2019 **location:** Bangkok, Thailand **www:** <https://www.regionalclimateweeks.org/>

International Mountain Conference 2019: This conference aims to encourage in-depth cross-disciplinary discussions towards a new understanding of mountain systems, their vulnerabilities to climate change, and adaptation strategies. The conference is being organized by Innsbruck University, with the UNESCO University Twinning and Networking Programme Chair in Sustainable Mountain Development, the University of Highlands and Islands in the UK, and the Mountain Research Initiative, among others. **dates:** 8-12 September 2019 **location:** Innsbruck, Austria **www:** <https://www.uibk.ac.at/congress/imc2019/index.html.en>

19th Meeting of the Technology Executive Committee (TEC 19): Created in 2010, the Technology Executive Committee, the policy arm of the UNFCCC Technology Mechanism, focuses on identifying policies that can accelerate the development and transfer of low-emission and climate-resilient technologies. **dates:** 16-19 September 2019 **location:** Bonn, Germany **www:** <https://unfccc.int/tteclear/tec/meetings.html>

IPCC WG I/II Preparatory Meeting of the Drafting Authors for SROCC: This preparatory meeting of the drafting authors for the Special Report on the Ocean and Cryosphere in a Changing Climate is being organized by WG II. **dates:** 17-18 September 2019 **location:** Monaco **www:** <http://www.ipcc.ch/calendar>

IPCC-51: The 51st session of the IPCC is expected to approve the SPM of the Special Report on the Ocean and Cryosphere in a Changing Climate. **dates:** 20-23 September 2019 **location:** Monaco **www:** <https://www.ipcc.ch/meeting-doc/2nd-joint-session-wgi-ii-ipcc51/>

UN 2019 Climate Summit: UN Secretary-General António Guterres is convening the UN Climate Action Summit under the theme “A Race We Can Win. A Race We Must Win,” to mobilize political and economic energy at the highest levels to advance climate action that will enable implementation of many of SDGs. It aims to challenge states, regions, cities, companies, investors, and citizens to step up action in nine areas: mitigation; social and political drivers; youth and public mobilization; energy transition; climate finance and carbon pricing; industry transition; nature-based solutions; infrastructure, cities and local action; and resilience and adaptation. **date:** 23 September 2019 **location:** UN Headquarters, New York **www:** <https://www.un.org/en/climatechange/>

SDG Summit: The High-level Political Forum on Sustainable Development (HLPF), under the auspices of the UN General Assembly, will assess progress achieved so far since the adoption of the 2030 Agenda in September 2015 and provide leadership and guidance on the way forward that would help accelerate implementation of the 2030 Agenda and the SDGs. **dates:** 24-25 September 2019 **location:** UN Headquarters, New York **www:** <https://sustainabledevelopment.un.org/sdgsummit>

IPCC WG III AR6 Second Lead Author Meeting: The second Lead Author meeting of IPCC Working Group III will convene to continue preparations for the Sixth Assessment Report. **dates:** 30 September-6 October 2019 **location:** TBD **www:** <http://www.ipcc.ch/calendar>

African Climate Risks Conference 2019: The African Climate Risks Conference 2019 will convene under the theme, “Dismantling Barriers to Urgent Climate Adaptation Action.” It will convene in parallel to the eighth Conference on Climate Change and Development in Africa. **dates:** 7-9 October 2019 **location:** Addis Ababa, Ethiopia **www:** <https://www.africanclimaterisksconference2019.org>

34th Meeting of the Adaptation Fund Board: The Adaptation Fund (AF), established under the Kyoto Protocol, finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. The Fund is supervised and managed by the Adaptation Fund Board, which is composed of 16 members and 16 alternates and convenes meetings throughout the year. The World Bank serves as AF trustee on an interim basis. **dates:** 7-11 October 2019 **location:** Bonn, Germany **www:** https://www.adaptation-fund.org/event/34th-adaptation-fund-board-meeting/?instance_id=165

Committee on World Food Security (CFS 46): The 46th session of the CFS will discuss, among other issues, the report on the State of Food Security and Nutrition in the World 2019 and its policy implications in the context of the SDGs. **dates:** 14-18 October 2019 **location:** FAO Headquarters, Rome, Italy **www:** <http://www.fao.org/cfs/cfs-home/en>

SYR Scoping Meeting: A scoping meeting for the SYR for the IPCC Sixth Assessment Report will take place in Singapore. This will be followed by the 57th session of the IPCC Bureau. **dates:** 20-23 October 2019 **location:** Singapore **www:** <http://www.ipcc.ch/>

10th Meeting of the Executive Committee of the Warsaw International Mechanism for Loss and Damage: The tenth meeting of the Executive Committee (ExCom) of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts will convene in Bonn, Germany. **dates:** 23-25 October 2019 **location:** Bonn, Nordrhein-Westfalen, Germany **www:** <https://unfccc.int/wim-excom>

31st Meeting of the Parties to the Montreal Protocol (MOP31): MOP31 will consider issues, including hydrofluorocarbon management, implementation, and other

matters. **dates:** 4-8 November 2019 **location:** Rome, Italy **www:** <http://conf.montreal-protocol.org/meeting/mop/mop-31/SitePages/Home.aspx>

Santiago Climate Change Conference (UNFCCC COP 25): The Santiago Climate Change Conference, which will feature the 25th session of the Conference of the Parties (COP 25) to the UNFCCC, the 15th session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP 15), and the 2nd session of the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement (CMA 2), will convene along with meetings of the UNFCCC subsidiary bodies. The pre-session period will be from 26 November - 1 December 2019. **dates:** 2-13 December 2019 **location:** Santiago, Chile **www:** <https://unfccc.int/santiago>

For additional meetings, see <http://sdg.iisd.org>

Glossary

2019 Refinement	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
AFOLU	Agriculture, forestry and other land use
AR6	Sixth Assessment Report
BECCS	Bioenergy with carbon capture and storage
CBD	Convention on Biological Diversity
CDR	Carbon dioxide removal
CLA	Coordinating Lead Author
COP	Conference of the Parties
GDP	Gross domestic product
GHG	Greenhouse gases
GST	Global stocktake
IPCC	Intergovernmental Panel on Climate Change
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
LDN	Land Degradation Neutrality
RCPs	Representative Concentration Pathways
SDGs	Sustainable Development Goals
SIDS	Small island developing states
SLCFs	Short-lived climate forcers
SPM	Summary for Policymakers
SR	Special Report
SR15	Special Report on Global Warming of 1.5 °C
SRCCCL	Special Report on Climate Change and Land
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
SSP	Shared socio-economic pathways
SYR	Synthesis Report
TFI	Task Force on National Greenhouse Gas Inventories
TSU	Technical Support Unit
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WG	Working Group
WMO	World Meteorological Organization