

**THIRTY-FIRST SESSION OF THE IPCC**  
**Bali, 26-29 October 2009**

IPCC-XXXI/Doc. 4  
(28.IX.2009)  
Agenda Item: 3  
ENGLISH ONLY

**SCOPING OF THE IPCC 5<sup>TH</sup> ASSESSMENT REPORT**

**Background, Cross cutting issues and AR5 Synthesis Report**

(Submitted by the IPCC Secretariat)

## **SCOPING OF THE IPCC 5<sup>TH</sup> ASSESSMENT REPORT**

### **Background, Cross cutting issues and AR5 Synthesis Report**

#### **A. BACKGROUND AND INTRODUCTION**

Preparatory activity leading to the Fifth Assessment Report (AR5) started in January 2008 with an initial “vision paper” by the IPCC Chair, and calling for comments from governments, organisations and past authors on their expectations for general directions. The Panel at its 28<sup>th</sup> Session (Budapest, 9-10 April 2008), decided to carry out a 5<sup>th</sup> Assessment to be finalized in 2014, retaining the Working Group structure and focus, with three Working Groups (WGs) dealing respectively with the “Physical science basis”, “Impacts, adaptation and vulnerability”, “Mitigation of climate change”, and a Task Force on National Greenhouse Gas Inventories, and also retaining the current Bureau composition. The Panel also took the following decisions concerning the timing of fifth assessment cycle and the use of new scenarios:

- (1) The Panel invites the scientific community developing new scenarios for analysis of emissions, climate change, impacts, and response strategies to move forward actively and with strength, for timely delivery of the scenario results as indicated in timeline presented in the report “Further work on scenarios” presented at the 28<sup>th</sup> Session of IPCC.
- (2) The Panel requests the Bureau to assist timely transfer of the scenarios products outlined in the report “Further work on scenarios” into development of the Fifth Assessment report, in particular in relation to impacts, adaptation and vulnerability.
- (3) The panel requests the IPCC Bureau of the Fifth Assessment cycle that Working Group I (the physical science basis) to deliver its report by early 2013. It requests the Bureau to complete the other Working Group reports and the Synthesis Report at the earliest feasible date in 2014 to enable significant use of the new scenarios in developing the AR5, and noting its relevance to the work programme of the UNFCCC.

At its 30<sup>th</sup> Session (Antalya, 21-23 April 2009) the Panel adopted a set of additional decisions to guide the fifth assessment cycle (see document IPCC-XXXI/Doc.3).

A scoping meeting to prepare the outline of the Working Group contributions to the Fifth Assessment Report, and a first outline of the Synthesis Report was held in Venice, Italy, 13-17 July 2009 at the kind invitation of the Italian government. Governments and IPCC observer organizations were invited to submit nominations of experts and more than 500 nominations were received. 186 experts and government representatives participated in the five day meeting. The preparation for this meeting included a “Vision Paper” submitted by the IPCC Chair, with contributions from the Working Group Co-Chairs and others and the collection of inputs from governments and organisations, which had been invited to submit their views on issues and questions they would like to see addressed in the Fifth Assessment report.

The meeting discussed the outlines and structure of the three Working Group reports and the Synthesis Report as well as cross-cutting themes. A draft scoping paper was circulated to governments and IPCC observer organizations to provide their views on:

- The general approach towards the AR5 including the suggestion for amending the schedule for completion of the Working Group reports
- Scope and approach for the suggested cross cutting themes as described in Section D of the documents
- Overall approach and outlines of the Working Group contributions to the AR5 and specific comments on title and topics to be covered under each chapter as indicated in the Section C of the document
- Comments on structure, timing and implementation of the Synthesis Report; on the broad outline suggested and on issues and questions to be addressed under the four proposed main headings, as outlined in Section B of the document.

Comments were received from 31 governments and 19 organizations. They were considered by the IPCC Bureau at its 40<sup>th</sup> Session (Geneva, 18 September 2009). Revised outlines for the contributions of the three Working Groups were prepared, taking into consideration comments received. They are contained in documents IPCC-WG-I:11<sup>th</sup>/Doc.2; IPCC-WG-II:9<sup>th</sup>/Doc.2; IPCC-WG-III:10<sup>th</sup>/Doc.2.

This document contains a revised version of those sections of the scoping paper which cut across the three Working Groups. The section on scope of the Synthesis Report remains as presented in the scoping paper (section B) taking into consideration that a special scoping meeting for the SYR is planned in mid 2010. To assist the IPCC Chair in planning for the scoping meeting and to ensure all comments received so far are adequately reflected in the process, it is intended to form a small committee composed of representatives from the three Working Groups, and chaired by an IPCC Vice-Chair.

The section on cross cutting themes (Section D of the scoping paper) had been amended to reflect comments received.

In the context of the scoping process attention has been paid to the overall schedule and completion dates of each Working Group report, within the context of the decision taken at the 28<sup>th</sup> Session. Concern was expressed that too much time would have passed between the completion of the Working Group I report and the Synthesis Report (SYR) and new and emerging findings may lead to the perception that the AR5 SYR would not be fully up to date. It is therefore suggested that all elements of the AR5 should be completed within a time frame of 12 months, while taking into consideration the need to make best use of information from the new scenarios currently being developed by the scientific community in all volumes of the AR5. In this case the completion date of the Working Group I report would be somewhat delayed towards mid 2013.

In an attempt to better address regional issues it is suggested that the contribution of Working Group be split in part A and part B. Part B would be structured around regions and would integrate relevant information from Working Groups I and III. Further explanation can be found in documents IPCC-WG-II:9<sup>th</sup> /Doc.2; Doc.3 and INF.1 To allow for incorporation of relevant Working Group III information in a proposed Part B of the Working Group II contribution only a short interval between the approval sessions of Working Group II and III is suggested.

In considering the AR5 outline and timetable it should be recalled that the IPCC is currently preparing two Special Reports on “Renewable Energy Sources and Climate Change Mitigation” to be completed in December 2010, and one on “Extreme Events and Disaster: Managing the Risks” to be completed in mid 2011. Information resulting from these two Reports will be reflected and integrated in all relevant volumes of the AR5.

A draft timetable that reflects these considerations and meets the requirements of the Panel decision will be provided as Addendum to this document.

## **B. SCOPE OF THE SYNTHESIS REPORT (SYR)**

### **1 Introduction**

The mandate for consideration of the SYR at the scoping meeting was defined in decision 1 taken at the 30<sup>th</sup> session of the IPCC held in Antalya on the 21<sup>st</sup>-23<sup>rd</sup> of April 2009:

“The scoping of the AR5 Synthesis Report (SYR) and the identification of cross-cutting issues begins with the first scoping meeting, but, in line with past procedure, provision is made for a special meeting dedicated to scoping the SYR structure and content. It is expected that the scoping meeting in Venice (13-17 July 2009) would come up with chapter outlines for the Group contributions to the AR5 and prepare a broad outline for the SYR.”

In the preparation for this meeting the Secretariat had invited governments to provide suggestions on the structure and content of the SYR. These suggestions are compiled in AR5-SCOP/INF. 1 (26 June 2009) that was prepared by the IPCC Secretariat. In AR5-SCOP/INF. 1 a common suggestion was that the report should be a synthesis and not just a cut and paste job. However, there were mixed views on whether the report should be framed around questions or topics. While the relevant government submissions were taken into account and were considered in developing this material, it is suggested that the Secretariat of the IPCC manage a comparison of the AR5-SCOP/INF. 1 relevant government submissions with the proposals outlined in this paper, for consideration at the SYR scoping meeting.

## **2 Structure, timing and implementation**

### **Government Feed-back**

It is suggested that governments be invited to provide feed-back on the process, and the general structure, as well as providing further comments on material to be covered under the individual broad headings. The questions provided by governments should also serve as guidance in the preparation of the SYR.

### **Length**

It is suggested that the synthesis report would be a short document similar in length to the AR4 synthesis report. As mandated by the IPCC procedures the complete output would consist of an SPM and a longer report.

### **Topics rather than questions**

It is suggested that the SYR would be framed around a series of topics rather than questions (it may be recalled that the TAR was framed around questions whereas the AR4 was framed around topics).

### **Frequently ask questions (FAQs)**

The Scoping meeting also discussed the usefulness of a set of FAQs within the framework of the SYR. It was agreed that there is value-added in having FAQs, either in the main text or added as an appendix at the end of the text. It is suggested that any FAQs would be developed by the SYR author team in consultation with the Working Group Co-Chairs.

### **Timing**

The possibility of significant new information or data appearing between the WGI SPM approval and the AR5 SYR approval was noted. The proposed period between WGI SPM and AR5 SYR approval of 12 months minimizes the risks this would occur.

It was proposed that the AR5 SYR scoping meeting would be held before the WGI LA1 meeting which is scheduled to be held in August 2010.

### **Implementation**

These are suggested steps to be taken in order to complete the AR5 SYR:

- Selection of the initial core author team (drawn from all three Working Groups) soon after approval of the AR5 SYR outline. At a later stage in the process the core author team may be augmented by other authors from the Working Groups.
- A Technical Support Unit for the AR5 SYR should be established headed by an appropriate expert. It would be desirable for at least one member of this TSU to be appointed before the AR5 SYR scoping meeting.

### 3 Broad Outline for the Synthesis Report

It is suggested that the Synthesis Report be organized under four broad headings: 1. Observed Changes and their Causes; 2. Future Changes (in the Short and Long-Term); 3. Response; and 4. Transitions and Transformations.

Material that could be covered under each of these headings includes:

#### *i. Observed Changes and their Causes*

Observed changes in climate, natural and human systems, and their effects; Drivers of change in these systems (attribution and linkage).

#### *ii. Future Changes (in the Short and Long-term)*

Future drivers; Future changes in climate, natural, and human systems (due to other causes as well as climate change), and key risks (this material on changes and key risks would be framed around representative scenarios, including Representative Concentration Pathways); The wider context – including sustainable development; Reasons for concern (e.g. high risk uncertain probability, impacts on society and ecosystems, limits to adaptation...).

#### *iii. Response*

Reduction of vulnerabilities; The solution space; Risk Management and framing of response (noting this is a dynamic process, and is informed by the on-going policy process under the UN Framework Convention on Climate Change (UNFCCC) including consideration of Article 2); Effect of existing climate-related policies; Adaptation options, including technologies (food security, fresh-water and terrestrial ecosystems, coastal and marine ecosystems, human health, built environment (all sectors), and urban and rural communities); Mitigation options (policies and measures, technologies; all sectors and systems - land-use, energy, transport (including aviation and shipping), agriculture, industry, built environment); Co-benefits and externalities; Bottom-up and top-down Integration; Greenhouse gas metrics; Multi-metric valuations; Reduction of scientific uncertainty to assist decision-making; Investment in R&D to expand technological options and reduce response cost; “Geoengineering” proposals (e.g. carbon removal from the atmosphere, radiative forcing management); Equity and sustainable development dimensions; Interactions between adaptation, mitigation and development.

#### *iv. Transitions and Transformation*

Pace and scale (dynamics); Equity dimensions over different time and space scales; Development pathways including a global transition to a climate-resilient, low carbon society; Behavioural and societal changes; Benefits and costs (including co-benefits); Governance and institutional arrangements; Investment needs; Development issues; Climate and security.

*Notes:* The development of material for the future change section and the response section will pick up on and be influenced by outcomes of COP15 of the UNFCCC (Copenhagen, December 2009). Issues to be addressed in several sections include: Extremes, Commitment, Reversibility, Inertia, and Lock-in. More detailed consideration needs to be given to how regional aspects are addressed within the AR5 SYR. Note that “Transitions and Transformation” includes both adaptation and mitigation.

## 4 Issues for Consistent Treatment across Working Groups

In developing the broad outline, the SYR Breakout Group noted several issues for which a consistent treatment by all three Working Groups is highly desirable so that a coherent synthesis can be developed. These issues include: Risk (short and long-term); Uncertainty / confidence; Regions; Sectors; Ethics and value systems (recognizing pluralism in these); Cost framework and metrics; Technologies; Timescales; Sustainable development perspective; Scenarios; and Extremes and Reversibility.

### C. CROSS CUTTING THEMES

One of the objectives of the AR5 scoping process was to address the treatment of “cross-cutting themes” (CCTs) in the Fifth Assessment Report. As requested by the Panel at its 30<sup>th</sup> Session an analysis of the treatment of cross cutting themes during the TAR and AR4 cycles was carried out and brought to the attention of the participants of the scoping meeting.

Seven cross cutting themes had been identified by the scoping meeting. The list and scope of CCTs proposed results from past experience, preparatory work and comments received and from a number of considerations raised at the scoping meeting, with respect to the importance of the topics for the quality and relevance for society and policy decisions, of information expected to be available in AR5, and taking into account planned Special Reports and Expert Meetings. The most appropriate method of coordination for CCTs among the Working Groups will be devised at the level of Working Group Co-Chairs. Some specific suggestions are listed under the individual CCTs. To assist the IPCC Chair in the CCT process it is suggested that a small committee be appointed, composed of representatives from the three Working Groups, and chaired by an IPCC Vice-Chair

In response to comments on the draft scoping paper and further consultations it is suggested to group CCTs in two clusters, cross cutting methodologies (CCM) that comprise methodology issues that apply to the presentation or content of the report, and cross cutting themes (CCT) that cover subjects that require adequate emphasis and need to be considered by more than one Working Group (CCT). The list of the original cross cutting themes is therefore rearranged to start with the three CCMs - Consistent Evaluation of Uncertainties and Risks; Costing and Economic Analysis; and Regional Aspects, followed by the four CCTs - Water and the Earth System: Changes, Impacts and Responses; Carbon Cycle including Ocean Acidification; Ice Sheets and Sea-Level Rise; and Mitigation, Adaptation and Sustainable Development

Following consideration of comments received after the scoping meeting potential additional cross cutting matters were noted as follows

- Treatment of Scenarios
- Treatment of GHG Metrics

Both issues would fall under the CCM category. While acknowledging the importance of these issues it needs to be noted that they are already addressed by ongoing activities and processes.

It was also suggested to consider scientific technical issues related to Article 2 of the UNFCCC and key vulnerabilities as a new CCT. That CCTs would cover issues such as climate impacts as a result of a range of temperature targets, costs for implementing those targets, and adaptation capacity related to the targets, tipping points and reasons for concern. If the Panel agrees, the scope and approach for addressing this CCTs could be developed by a task group either at the 31<sup>st</sup> Session of the Panel or shortly thereafter. The Secretariat will submit an information document to the Session that summarizes how this issue had been addressed and handled in the past assessments.

It should also be noted that an assessment of future needs for observations and of the impact of current observational gaps on uncertainty needs to be covered in the relevant Working Group contributions.

## **1. Consistent Evaluation of Uncertainties and Risks (CCM)**

### **1.1 Background and scope**

The quality of the uncertainty guidance notes for AR4 was recognized, but it was noted that their application has been uneven across and within Working Groups. Aspects of risks have not been treated consistently among Working Groups.

Further, the increased awareness and concern of policy makers regarding low-probability, high-consequence events, and the increased interest in risk assessment and risk management was recognized, even though these concepts are understood differently in different disciplines and Working Groups.

The overarching goal of refining and conveying consistent information on uncertainty and risk is to serve as a useful input for decision making on climate change.

### **1.2 Working Group involvement**

All three Working Groups are and should continue to be involved, with the Co-Chairs of the Working Groups taking the lead.

### **1.3 Suggested approach**

- The Working Group Co-Chairs to discuss their needs for guidance in the area of risk and uncertainty, and engage a process for updating and extending the existing guidance prior to the first LA meeting of each Working Group;
- The distinction between likelihood and confidence and the use of the confidence scale needs to be further clarified;
- The guidance paper to include a discussion of the meaning and significance of risk, specifically to address the treatment of low-probability, high-consequence events;
- Concerning risk assessment and risk management, to use a common language among Working Groups and Special Reports, without being prescriptive regarding its application;
- Once authors have been designated, for each Working Group to designate a small group of authors in order to ensure communication, coordination, and consistency of this issue across Working Groups and throughout the assessment process;
- Early on in the guidance development process, to use concrete case studies to test the approach recommended to deal with uncertainty and risk.

## **2. Costing and Economic Analysis (CCM)**

### **2.1 Background**

Economic analysis has been widely applied across the climate change domain – analyses of the economic cost of climate-related damages, the costs and benefits of mitigation options, the costs and benefits of adaptation options, the economic implications of policy design and instrument choice, the economic consequences of alternative architectures for international treaties on climate policy, and the economics of decision-making under uncertainty are primary examples. Past IPCC Reports have assessed these analyses, and this tradition will continue in the AR5.

### **2.2 Scope**

The application of common economic fundamentals and measurement processes to analyses of adaptation and mitigation depends on the constraints that define their context. Even though these analyses accommodate enormous diversity in context, common fundamentals suggest that common criteria can be applied in the assessment of the resulting disparate literature. The point is not to decide whether the underlying analytical approach of any specific study is right or wrong; it is, instead, to judge the degree to which its specific application recognizes, to the extent practicable, elements that have played critical roles in driving results in one direction or another. The scope of this CCM would also comprise matters related to finance and investment.

## **2.3 Working Group Involvement Coverage**

Costing and economic analysis will permeate the work of Working Groups II and III. Exploiting common language and common fundamentals should help in making the confidence assessments of economic conclusions that will be offered in both Reports more comparable and more transparent than in the past.

## **2.4 Suggested Approach**

An Expert Meeting is proposed to assist authors in conducting their upcoming work. The expert meeting will not conduct a comprehensive assessment of literatures involved. It will, instead, work to incorporate a diverse set of views and to suggest how assessment frameworks can be created so that confidence levels drawn from economic analyses of all types can be more comparable. If the Meeting were scheduled after the author teams had been assembled but before the writing had begun, Lead Authors who will be responsible for the economic and valuation parts of the various chapters in both Working Groups could attend, participate, and begin the collaborative relationships that will, themselves, facilitate integration. The Expert Meeting should produce a volume that contains invited papers, discussant comments, and summaries of subsequent audience discussions. A Guidance Paper could then be created based on the content of the Meeting Report and other documents. This Paper would be designed to promote quality in the assessment of economic literature included across the various chapters of Working Groups II and III as well as consistency in judgments of quality across multiple chapters and both Working Groups. Elements of the guidance paper might even be incorporated into the both Working Group contributions to the AR5.

## **3. Regional Aspects (CCM)**

### **3.1 Background and Scope**

At its 30th Session held in Antalya, Turkey, in April 2009, the IPCC decided that much greater attention was required to improve the treatment of regional issues in AR5. The scoping meeting was also tasked to consider options for a more detailed regional division. The Scoping meeting took note of the following documents: the guidance paper on regional issues prepared for AR4, the report of the Task Group on the Future of IPCC (IPCC-XXX/Doc. 10), the draft report of the 30<sup>th</sup> session of the IPCC, the compromise proposal on the improved treatment of regional information in AR5 (AR5-SCOP/INF.3), and a document titled "Consideration of regional division for the IPCC AR5" prepared by the IPCC Secretariat for this meeting.

### **3.2 Reflection of Regional Information in the AR5 Working Groups**

In order to improve the treatment of regional information in AR5, for the benefit of all users of the AR5 reports, it is suggested that the WGII contribution is split in two parts, completed at the same time and subject to a single review and SPM/TS approval process (There would be only one SPM and one TS, both included in each part, so that the overall context is present in each part.):

General title: *Vulnerability, Impacts, and Adaptation*

- Part A scope and subtitle: *"Global and sectoral aspects"*
- Part B scope and subtitle: *"Regional aspects"*. The cover for this Part would also mention: *"Contribution of IPCC WGII, incorporating inputs from IPCC Working Group I "The Physical Science Basis" and Working Group III "Mitigation of Climate Change"*

For further details see outline of the Working Group II report contained in IPCC-WG-II:9<sup>th</sup>/Doc.2.

**To make this regional Part possible, a number of suggestions were made:**

- Ensure consistency in the presentation and transfer of regional information on observed and projected climate changes (including changes in extreme events), future scenarios, and mitigation and adaptation issues between Working Groups I, II and III;
- Holding an IPCC Workshop or an Expert Meeting on Regional Aspects of Climate Change jointly between Working Groups I, II and III at an appropriate stage of the development of the AR5 would be very useful to help achieving this consistency, increase the knowledge base from region specific literature and promote mutual understanding around the regional aspects. One possibility is to organize it in conjunction with a TGICA meeting;
- As in AR4, make use of detailed case studies in specific regions ("hot spots") that focus on different aspects of the climate issue, often spanning different Working Groups;
- Offer mechanisms for making the most efficient use of regional expertise on chapters in different Working Groups requiring the transfer and presentation of regional information, e.g.: WGI and WGIII nominate authors who would be willing to review, from the outset, draft regional chapters in WGII; A small number of Lead Authors from one Working Group accustomed to working in an interdisciplinary perspective be nominated as "Attending" Contributing Authors for another Working Groups. At the invitation of the Co-Chairs they can attend relevant parts of LA meetings (they would be LA in one WG and CA in another WG);
- Make the draft texts of Part A of WGII available in a timely manner to WGIII so that WGIII can take into account the latest information available for integrated assessment. Similarly, timely exchanges of relevant draft texts between WGI and WGII will be useful.
- Promote the use of Geographical Information Systems (GIS) and Internet tools to present and communicate regional information both during AR5 preparation (for technical exchange) and after its completion (for outreach), and could possibly be aided by TGICA and DDC.
- Consider scheduling the WGII final plenary *after* both WGI and WGIII have completed their volumes. This would allow the WGI and WGIII material to be available in an approved form, and allow the WGI and WGIII author teams and TSUs to be able to contribute effectively with their material to the regional Part B of the WGII report. This would facilitate the effective contribution of WGIII to the regional WGII Part B, and the approval process of this Part B, so that WGIII-related material in WGII Part B can be founded on already approved WGIII material. This is particularly important given the number of WGII chapters.

### **3.3 Suggested approach for the division of the world into regions**

For the division of the world into regions to be used in AR5 a number of different criteria, depending of the kind of analysis intended or the discipline concerned need to be considered, while noting that there is no regional division which can satisfy perfectly all needs. A number of principles were suggested, including: no area should be left out of the division, and the sum of the parts should cover the entire globe; a geographical approach is suggested to divide the world into regions, with additional sub-regional information as feasible.

Some of the advantages of such an approach are that it is easy to communicate and widely recognized, and that geography does not change fast. Users can easily know where they can find the information immediately relevant to them. Any other disaggregation (for example socio-economic) could be incorporated in those regions. This is also consistent with AR4.

A regional division and an indicative regional subdivision has been proposed for the regional Part B, but it is suggested that the regional subdivision be finalized by the chapter authors after the Workshop/Expert meeting suggested in section 7.2. For further details see outline of the Working Group II report contained in Section C.

## 4. Water and the Earth system: changes, impacts and responses (CCT)

### 4.1 Background

The title was changed from “*Hydrological cycle*” to “*Water and Earth system: changes, impacts and responses*” to better reflect the main interests of stakeholders. There needs to be more consistency among Working Groups and more involvement of WGIII on this topic.

### 4.2 Scope

The following outlines the main variables and activities that should be covered. These are broken into areas relevant to the three IPCC Working Groups. It is recommended that all three Working Groups undertake a synthesis of their components of this CCT.

### 4.3 Working Group involvement

**WG I** – There should be a comprehensive assessment of information available on variables related to the water cycle including observations, modeling capabilities, attribution of the changes to causes, predictions from daily to decadal time scales, projections of the longer term future, and an assessment of all of these for use by decision makers. Variables of particular interest include the following: precipitation; temperature; water vapor; extremes; runoff, river flow, discharge into the oceans; water storage, soil moisture, lakes, ground water; drought, evaporation; sea level; cryosphere changes; and air pollution. There is a need to use observations to evaluate models and factor these results into model projections, because there are still limitations in simulating precipitation. Simulation needs to be improved of the diurnal cycle, tropical storms, ENSO, and other phenomena. Down-scaling uncertainties need to be properly accounted. Issues include observational networks that are becoming degraded, especially for *in situ* observations, and the science on the attribution of changes to variables beyond temperature should be advanced.

**WG II** – Stakeholder needs should be addressed by:

- *defining the main drivers of change.* In addition to changes in climatic variables, non-climatic drivers include increasing population and water demand, economic development, urbanization; changing diet and lifestyle; and governance on water.
- *addressing fresh water issues on regional scales through observations, attribution, predictions and projections of impacts on the following:* resources; agriculture, food security, fisheries; human well-being, security; desertification, erosion; built environment; infrastructure; ecosystems; sea level; lake storage, ground water, frozen ground; snow cover, glaciers and ice caps, river and lake ice; rivers; trans-boundary aquifers (relationships between ground and surface water, aquifer recharge); extreme frequency and intensity; water quality; virtual water.
- *identifying vulnerabilities of fresh water systems.*
- *addressing coping strategies and responses* including short and long term adaptation.
- *addressing sustainable development.*

**WG III** - Water and climate change mitigation issues include:

- *low carbon energy:* bioenergy, biofuels (use of water, added pollution); nuclear power (cooling); hydro power; co-benefits and tradeoffs; side effects of solar, wind, etc.
- *land use change:* sequestration of carbon; fires.
- *infrastructure:* energy/water efficiency, energy recovery; technology;
- potential changes in precipitation and water quality with some geoengineering options
- questions exist on whether CCS would have side effects
- *non-conventional water:* (desalination, etc.).

#### 4.4 Suggested approach

Working Group II should have the lead in addressing this CCT, but all three Working Groups need to be included. All Working Groups should recognize the need for a water cycle theme and provide appropriate insights, including on regions and extremes. There is a need to ensure exchange of information and coordination of information among the three Working Groups and accomplish the coordination among Working Groups. The most appropriate and effective way of doing this would be developed by the Co-Chairs (e.g. designated contributing authors). Links should be established with other activities including the special report on extreme events, the CCT on regions, and the planned *"Human Settlement and Infrastructure"* expert meeting; and water related extreme events should be taken into account at the proper level in each chapter. It is not expected that a new Technical Paper would come from this activity.

### 5. Carbon Cycle including ocean acidification (CCT)

#### 5.1 Background

The carbon cycle is a central component of the Earth system. It integrates multiple forcings, responses and feedbacks related to climate change over a range of different time-scales, concerns additional biogeochemical cycles and is therefore a theme of paramount importance for all Working Groups of the AR5, as well as for the Synthesis Report. Since the completion of the IPCC-TAR, ocean acidification has been identified as a further critical and direct consequence of increasing atmospheric GHG concentrations – a full assessment of it will have to be presented by AR5. Multiple types of active management of the carbon cycle are now envisaged by many governments. Given the emergence of substantial new scientific literature on these themes, it is recommended that all the issues described in this document are reviewed and updated by all AR5 WGs, and that a mechanism is put in place to ensure this coverage, as well as ensuring the avoidance of inconsistencies between different sections of the assessment.

#### 5.2 Scope

- Major *issues* concerning CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O including ocean acidification, feedback mechanisms between biogeochemical cycles and climate, and aspects of land use and land management including competition between bioenergy and food production, etc;
- *process* knowledge including direct CO<sub>2</sub> effects ('fertilization') on physiology and functioning of land ecosystems, variability of carbon pools, ocean acidification, the marine biological pump, nutrient interactions with terrestrial and marine carbon dynamics, interactions among CO<sub>2</sub> effects, climate, and other stressors, carbon feedbacks from land/ocean ecosystems to climate;
- *knowledge of past dynamics* of biogeochemical cycles, ocean pH, anthropogenic GHG emissions, including budgets of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, DIC and other quantities;
- *present day budgets* with improved attribution to different sources and sinks;
- *projections* of atmospheric CO<sub>2</sub>, other GHGs and ocean pH including of relevant feedbacks, the longer-term (beyond 2100) scope, and reversibility;
- sensitivity of major carbon pools to changes in climate, land use etc. including stratification by climate zones (land and ocean) and major regional case studies (coral reefs, Amazon forest, polar oceans);
- impacts of changing biogeochemistry on biological productivity, food web structure, biological resources, fisheries, crops, fibre, bioenergy;
- carbon management for mitigation, changes in energy systems with implications for biogeochemistry and climate, urban carbon metabolism, impacts from agroindustrial system development to GHG emissions from transport, packaging and distribution.
- It is likely that further issues related to global biogeochemistry and climate arise during the coming few years – these will have to be considered as well by the AR5 assessment.

### **5.3 Working Group involvement**

An important role will likely be played by the WGI chapter on carbon cycle and other biogeochemical cycles: it should assess the full range of Earth system wide implications for climate change of changing biogeochemistry. WGII and WGIII should implement suitable sections to summarise this, as well as accounting for any outstanding issues as they are relevant for the respective WG.

### **5.4 Suggested approach**

Coordination meetings (e.g., after completion of the zero-order draft from all WGs) may be held to ensure implementation of the goals stated above. No specific “product” is being envisaged, rather adequate coverage of biogeochemistry and ocean acidification issues across the AR5 are of high importance.

## **6. Ice Sheets and Sea-Level Rise (CCT)**

### **6.1 Background**

The potential significant contribution of the ice sheets to future sea-level rise has raised concern about the implications for adaptation and mitigation policy options. To build on the experience gained in the AR4, there is strong interest in ensuring good communication between all three Working Groups (WGs).

### **6.2 Scope**

The focus of the cross-cutting theme was on sea-level rise and its implication for coastal zone and island adaptation and vulnerability. A particularly important focus was the heavily populated megadeltas. For understanding the adaptation issues, there is a need for scenarios of sea-level rise, including the upper and lower end of the range and not just the central estimates. The regional distribution of sea-level rise and trends in extreme events and surface waves (both amplitude and direction) were recognized as important issues. There are also potential implications for mitigation policy.

### **6.3 Working Group involvement**

WGI and WG II (and potentially WG III) have strong interest in this cross-cutting theme. Leadership would depend on the appointment of lead authors but would naturally lie in either or both of WGI and WG II. A range of issues will be addressed in the appropriate WGI and WGII chapters.

### **6.4 Suggested approach**

Mechanisms for ongoing communication across the Working Groups proposed were:

- exchange of outlines between WGI and WG II;
- video conferences between relevant lead authors. The IPCC budget may need to consider providing financial support to ensure adequate regional representation;
- explore the ability to use the IPCC Data Distribution Centre as a resource to facilitate inter-WG data exchange.

The Co-Chairs of WGI will propose to the Panel at its 31<sup>st</sup> Session an IPCC Workshop on Sea Level Rise and Ice Sheet Instability to be held in June 2010.

Joint lead authors or joint lead author meetings were not seen as essential. No need for a guidance paper or Technical Paper was identified.

There is a need to ensure optimum use is made of authors' time and to facilitate attendance and the communication of outcomes with Working Groups. IPCC Lead Author participation in the relevant workshops should be encouraged.

## **7. Mitigation, Adaptation and Sustainable Development (CCT)**

### **7.1 Background**

This cross-cutting theme was addressed in both WGII and WGIII of the IPCC Fourth Assessment Report (AR4). It addresses the ways that processes, responses and outcomes affect for individuals, communities, social-ecological systems, etc., which are experiencing climate change within the context of multiple, interacting stresses. The theme includes not only assessments of the economic, social and environmental costs and benefits of responses to climate change, but the human security implications for present and future generations.

### **7.2 Scope**

This CCT can be considered an overarching framework for considering climate change impacts, adaptation, and vulnerability. Within the AR5, this theme involves identifying the linkages between adaptation and mitigation; and assessing the social, economic, and ecological consequences of adaptation and mitigation responses, evaluating implications for sustainable development, while at the same time highlighting the new challenges to sustainable development raised by climate change. Attention would be paid to all relevant sectors, technologies and practices including biodiversity, land use planning and development, lifestyle and behavioral changes and geo-engineering.

### **7.3 Working groups involved**

The theme is very relevant to both WGII and WGIII, and to the SYR. There is a need to coordinate and integrate approaches and outputs among the chapters and groups.

### **7.4 Suggested approach**

Questions that can be considered within assessments in both WGII and WGIII:

- How do climate change responses influence a wider transition to sustainability and resilience?
- How do adaptation and mitigation policies and strategies influence vulnerability and equity? What are the implications for sustainable development (SD)?
- What types of strategies and approaches to poverty reduction and disaster risk reduction contribute to mitigation, adaptation & SD?
- How does a “sustainable” development pathway influence adaptation and mitigation?
- What is the role of transversal sectors such as energy, transport, tourism, agriculture, and fisheries
- What types of approaches and tools are being used to evaluate costs and benefits, of adaptation and mitigation measures from the perspective of SD? (i.e., what are the “co-costs” and “co-benefits”?)
- Are the metrics and values that are being used to evaluate impacts and responses explicit and transparent?

The relationship and interactions among mitigation, adaptation & SD could be framed and discussed up front in WGII, WGIII and the SYR, and assessed in the concluding chapters or sections. The empirical evidence on the consequences of adaptation and mitigation policies including synergies and conflicts and strategies for SD could also be assessed in relevant chapters. Human and societal implications and significance for SD could be included in each sectoral and thematic chapter that discusses responses to climate change. Equity dimensions of climate change responses and implications for SD could be raised in the introductory chapters of both WGs and in the SYR. Finally, individual authors that take an integrated perspective could be included in key chapters in WGII, WGIII and the SYR, and there is a need for interactions and consultations among CLAs and LAs within and among WGII, WGIII and the SYR. Inputs for dealing with this theme would also be provided from the proposed expert meeting on “*Human Settlements and Infrastructure*”.