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Assessing the costs of adaption to climate change in developing countries (AdaptCosts)

Unterstützung bei der Ausgestaltung der Kopenhagen-Vereinbarung und der Verhandlung eines Post-2012-Abkommens

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Assessing the costs of adaption to climate change in developing countries (AdaptCosts)

Unterstützung bei der Ausgestaltung der Kopenhagen-Vereinbarung und der Verhandlung eines Post-2012-Abkommens

by

Luis Costa
Jürgen Kropp
PIK

Sven Harmeling
German Watch

On behalf of the Federal Environment Agency (Germany)

UMWELTBUNDESAMT

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Telegraphenberg A 31
14473 Potsdam

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Wörlitzer Platz 1
06844 Dessau-Roßlau
Germany
Phone: +49-340-2103-0
Fax: +49-340-2103 2285
Email: info@umweltbundesamt.de
Internet: http://www.umweltbundesamt.de
http://fuer-mensch-und-umwelt.de/

Edited by: Section I 2.1 Climate Protection
Dr. Thomas Voigt

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Kurzbeschreibung

Dieser Bericht besteht aus zwei Teilen, die weitgehend unabhängig voneinander im Rahmen des AdaptCosts vom Potsdam-Institut für Klimafolgenforschung und Germanwatch erarbeitet worden sind (siehe dazu Abbildung 1 zum “Work Flow"). Ziel der Untersuchungen war es, Wissenslücken zur Schätzung von Anpassungskosten zu bestimmen sowie ein Konzept zu entwickeln, welches eine vergleichende Schätzung dieser Kostenkategorie in Entwicklungsländern ermöglicht. Hierzu wird im ersten Teil ein konzeptioneller Ansatz entwickelt, welcher die Spezifika unterschiedlicher Sektoren berücksichtigt. Im zweiten Teil werden existierende Anpassungsprogramme auf nationaler Ebene ausgewertet und es erfolgt eine Bestandsaufnahme der momentanen politischen Initiativen zum Themenkomplex.

Im Detail wurde Literatur zu bestehenden Kostenabschätzungen zur Anpassung an den Klimawandel untersucht und die wichtigsten Lücken und Verbesserungsmöglichkeiten identifiziert. Auf dieser Grundlage entstand ein Entwurf einer wissenschaftlichen Veröffentlichung, in welcher verschiedene methodische Aspekte zu Kostenberechnungen diskutiert werden. Die Erkenntnisse dieser Arbeit erlauben es, sogenannte Logische Anpassungsprozesse (LAP’s) zu beschreiben, welche die bisher oft unzureichende Repräsentanz von Anpassungkosten in ökonomischen Studien auf der Basis eines Sektorzuganges verbessern. Im Rahmen dieses Vorschlages wurden Anpassungskosten für drei Teil-Systeme abgeleitet, und zwar für die Landwirtschaft, den Küstenbereich und den Bevölkerungssektor. Klimasimulationen und Untersuchungen potentieller Auswirkungen wurden für definierte Problemkomplexe innerhalb jeder Teilsysteme durchgeführt und diese Resultate in diesen Bericht integriert. Die vorliegende Analyse umfasst insgesamt 10 Schwellen- und Entwicklungsländer. Die Ergebnisse deuten auf substantielle Unterschiede hinsichtlich der notwendigen Anpassungskosten hin, die jeweils abhängig vom gewählten Klimaszenario und der konkreten Anpassungsmaßnahme sind.

Parallel hierzu erfolgte eine Untersuchung der momentanen Mittelallokation hinsichtlich der Anpassung an den Klimawandel in Entwicklungsländern. Diese Analyse basiert auf empirischen Daten (mehr als 1 000 ausgewertete Projekte aus den Jahren 2010 und 2011), d.h. sie berücksichtigt bisher bereitgestellte Finanzmitteln für Anpassungsmaßnahmen. Diese Analyse weist jedoch eine Reihe von Restriktionen auf. Zum Einen besteht Unklarheit darüber, was alles als Anpassungsmaßnahme gezählt werden soll. Zum Anderen fehlt bisher ein generelles Verständnis darüber, inwieweit für konkrete Projekte eingesetzte Finanzmittel “zusätzliche" Anpassungskosten zu sonst sowieso notwendigen Maßnahmen widerspiegeln. Aus politischer Sicht, z.B. zur Bestimmung von Schwerpunktregionen, ist die Analyse der Mittelallokationen pro Land dennoch als relevant einzuschätzen. Hierbei ist jedoch zu berücksichtigen, dass die Definition von Fokusregionen oder die Unterstützung von konkreten Maßnahmen einem ständigen Prozess der Veränderung unterliegen.

Fünf Hintergrundpapiere bezüglich des UNFCCC Verhandlungsprozesses und Kerndiskussionen wurden erstellt. Zwar wurden deutliche Fortschritte seit dem “Cancún Adaptation Framework" erzielt; so wurde zum Beispiel das begonnene Arbeitsprogramm “Loss and Damage” sehr intensiv verfolgt. Dennoch sind die politischen Ergebnisse, die bis zur COP18 zu erzielen sind noch weitgehend unklar. Die Verhandlungen in Bonn brachten einen Beschlussentwurf zu den Finanzierungsmodalitäten von Anpassungsmaßnahmen. Um aber im Rahmen des UNFCCC Verhandlungsprozesses einen rechtlich verbindlichen Vertrag bis 2015 (der 2020 in Kraft treten soll) zu entwickeln, haben notwendige inhaltliche Debatten bisher noch nicht stattgefunden.

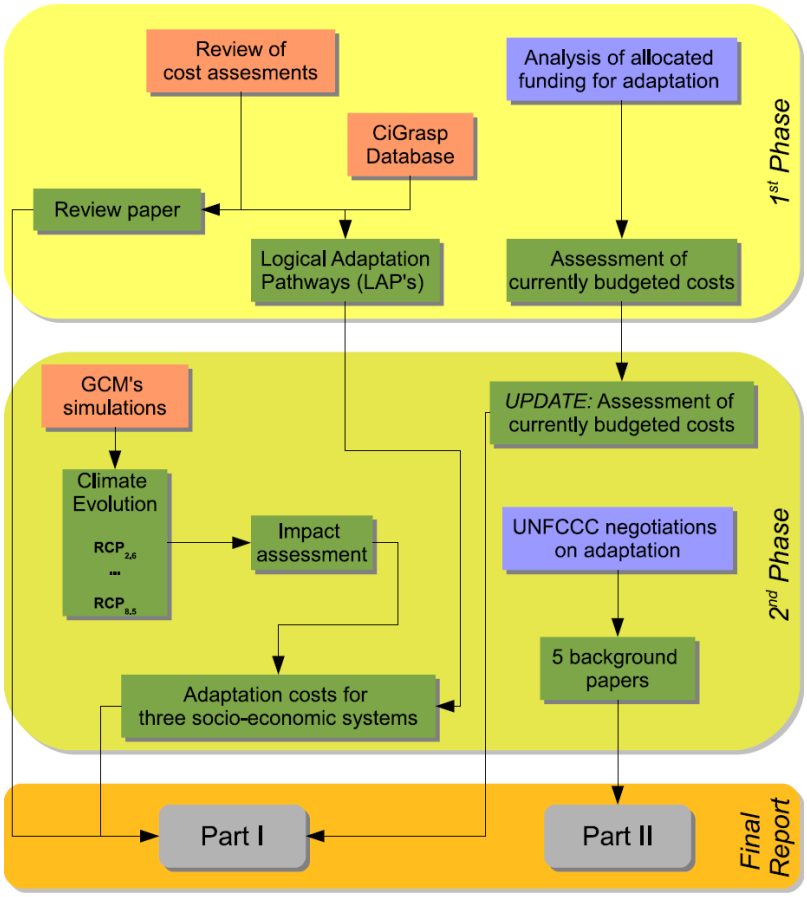
Abstract

This report consists of two parts, which have been developed mostly independent from each other within AdaptCosts by the Potsdam Institute for Climate Impact Research (PIK) and Germanwatch (regarding the work flow see Figure 1). The aim of the study was to fill knowledge gaps regarding the estimation of adaptation costs and to develop a concept towards comparing costs between developing countries. In the first part a conceptual approach is presented to estimate adaptation costs of various sectors. Based on a literature analysis, existing costs estimations regarding adaptation were identified and fields for potential advances explored. In the second part existing programs on the national level were assessed, followed by stock-taking of current political initiatives regarding adaptation financing.

In detail, a review of existing cost literature concerning adaptation to climate change was undertaken, the main limitations were gathered and the potential improvements identified. A draft publication reviewing several methodological aspects of adaptation cost assessments was produced. From the lesson learned, Logical Adaptation Processes (LAP's) were constructed that aim at mitigating to some extent the limitations on adaptation representation found in economic assessments of adaptation. Based on assumptions and newly developed methodologies, tentative adaptation costs for three socio-economic systems are derived, namely: agricultural, coastal and population. Climate simulations were conducted and potential impacts estimated for particular attributes of concern within each investigated system. The analysis covers a total of ten developing/transition countries. The results point for substantial differences of adaptation costs depending on climatic scenario and adaptation options chosen.

In parallel a comprehensive overview regarding the current state of allocated funding for adaptation to climate change in developing countries was prepared. The analysis of currently allocated adaptation finance was based on over 1000 projects for the years 2010 and 2011. These were however limited by a lack of clarity of what should be counted as adaptation and how far these costs reflect "additional" costs of adaptation in order to be able to compare them to overall adaptation cost estimates. Politically especially interesting is the analysis of allocations per country. However, this landscape is also in constant motion. Five background papers covering the UNFCCC negotiation process and key discussions were produced. Advances since the "Cancún Adaptation Framework" of 2010 are apparent, such as the intensification of the profile of loss and damage. However, the political outcome to be elaborated at COP18 is unclear. The negotiating session in Bonn produced a draft decision text on the funding modalities. Finally, regarding the new negotiating process of elaborating a new legally-binding agreement until 2015 (to come into effect in 2020), substantive discussions on content have not yet taken place.

Figure 1: Overall work flow of the AdapCosts project. The flow illustrates the work carried, the dependencies between intermediate results and the contributions for each part of the final report.



Inhaltsverzeichnis

List of Figures

List of Tables

1 Zusammenfassung

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2 Summary

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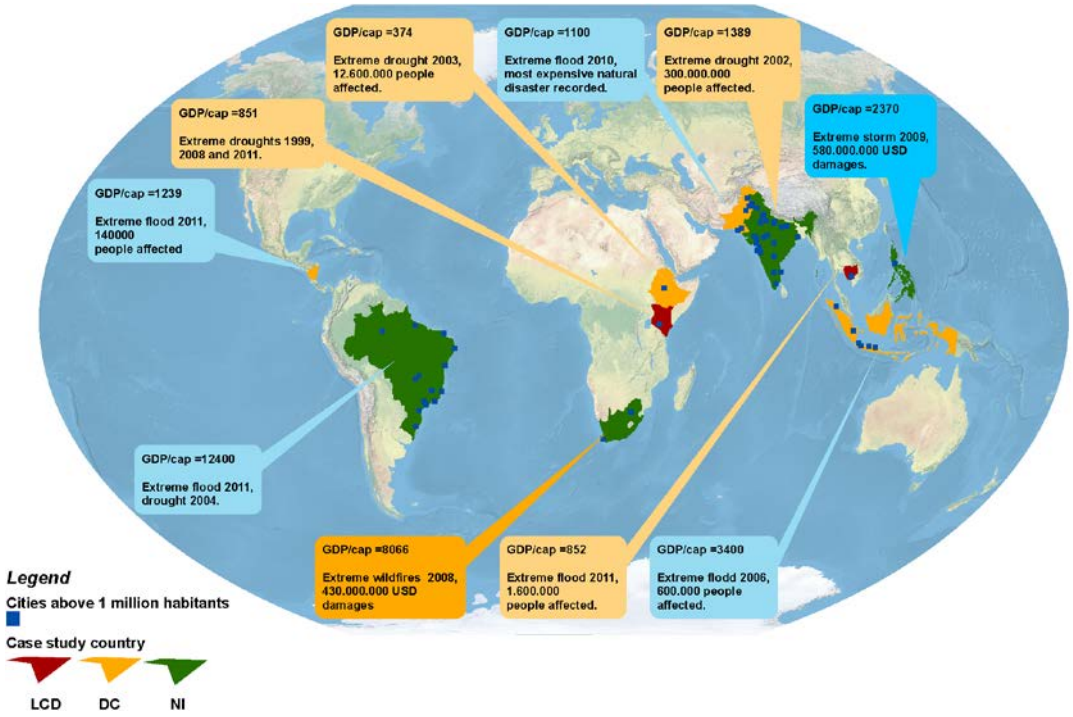
3 Introduction

The objectives of this report could hardly be more simple in their semantic formulation and more complex in their operational dimension. These are: (i) to evaluate the economic efforts necessary for climate change adaptation and (ii) to determine the financial and institutional capacities of countries to implement adaptation.

The work developed will not provide estimates for the full costs of climate change in a country or economic sector. This is still a matter of debate, although some progress has been made in the past (cf. DARA and the Climate Vulnerable Forum (2012)). In fact, any report where such a courageous promise is made should be looked at with particular reserve, in particular when the cost assessments refer to adaptation. The economic estimates were calculated for a total of 10 countries reflecting first order estimates of adaptation costs, i.e. for an implementation of multiple iterations of an adaptation process that targeted a particular impact expected from climate change. The most innovative feature of this work is the use of Logical Adaptation Processes (LAP's) as basis for the cost estimates. The rationality of using such conceptualization of adaptation is described in further detail in Section 4.2. Unlike previous estimates we do not envision adaptation as the implementation of isolated options, but rather as a process consisting of several steps and phases that ultimately constitutes an adaptation pathway. Consequently, this is expected to provide a better representation of the nature of the adaptation processes, i.e. as a policy cycle – although there is still a lack of understanding and scarce empirical data to attain robust and rigorous descriptions for some economic sectors.

The countries for which the proposed cost methodology is applied were chosen according to two main criteria. First, sample country should include cases that are illustrative of different stages of human and economic development, namely: Least Developed Countries (LDC's), Developing Countries (DC's) and Newly Industrialized Countries (NIC's). It is worth to mention that this distinction is somewhat artificial and a subject of discussion. Second, selected countries should belong to three broad geographical regions of the globe, namely: Africa, Central and South America, and South-East-Asia. The purpose is to highlight the global heterogeneity of environments, climate and impacts. The selected countries for investigation are (in alphabetical order): Brazil (NIC), Cambodia (LDC), Ethiopia (LDC), India (NIC), Indonesia (DC), Kenya (LDC), Nicaragua (DC), Pakistan (DC), Philippines (NIC) and South Africa (NIC) (Figure 2).

Figure 2: Overview of investigated countries, their development classification, climate-related extreme events and location of cities with more than 1 million inhabitants. Additionally information of economic losses and people affected in recent climate-related disasters is provided based on the EM-DAT database[1].



3.1 Main findings of the first project phase

Before discussing the work being done we will recall in this section the main messages of the first report delivered on 30th November 2011. The report has been condensed, further improved and submitted for publication to the Journal of Climate Policy. This retrospective look is necessary in order to better contextualize the gaps regarding the costs of climate change adaptation found in current literature and what to pinpoint the most significant advances accomplished in this work. The previous report identified the existence of two main categories of economic assessments of adaptation: assessments that make use of Integrated Assessment Models (IAM's) and assessments that investigate the Investment and Financial Flows (IFF) required for adaptation (de Bruin et al., 2009). A brief summary of the two categories as well as their advantages and disadvantages is provided in this section. This will help the reader to get familiar with the methodological richness of economic assessments in climate change before diving into the evaluation on how adaptation is represented.

Although IAM's were primary developed to inform on the benefits of mitigation (Fischer et al., 2007), substantial efforts have been made to incorporate the adaptation dimension (Füssel, 2009). In IAM's adaptation is typically understood as any action aimed at reducing adverse impacts or exploiting beneficial impacts of climate change. IAM's are useful tools for running extensive uncertainty analyses (Parry et al., 2009), a feature that is very much appreciated in policy contexts (Patt et al., 2005). The ability of IAM's to run over considerable time horizons (e.g., 100 years) makes them eligible for evaluating adaptation to long term climate impacts

[1] EM-DAT on-line database http://www.emdat.be/country-profile accessed on the 4-09-2012.

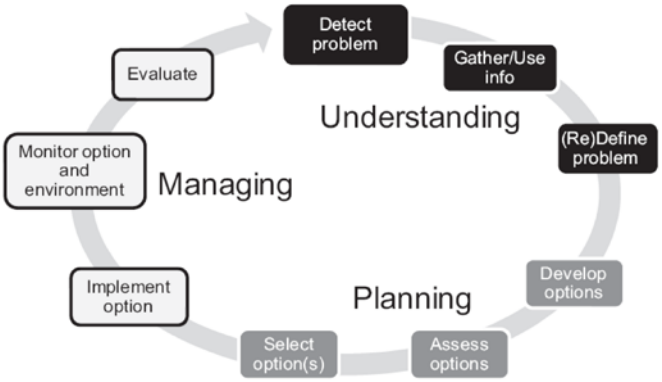
(e.g., sea-level rise (Nicholls and Cazenave, 2010)). Due to the fact that adaptation in IAM's is applied in an optimal way during each time step the decision to adapt will not draw funds from mitigation policy. This way of modeling adaptation benefits and costs is certainly debatable (de Bruin et al., 2009), especially since it is known that in the policy arena the choice of funding adaptation and mitigation in not independent (Smit and Wandel, 2006).

The second broad category of adaptation cost assessments are so called Investment and Financial Flows (IFF's). In this case adaptation is represented by the establishment of an investment (defined as the initial (capital) spending for a physical asset) or the re-reinforcement of an existing financial flow. IFF studies can be further subdivided into three categories. In the first sub-category the adaptation costs are determined by relying on educated guesses from experts (studies labeled as IFF-EG in Table 1). For example, UNDP (2007) assumes that adaptation costs constitute about 0.1% of developed countries total GDP. Due to these highly normative assumptions, economic estimates in IFF-EG studies are particularly sensitive to the quality of the guess. On the positive side, the approach can be useful in providing first order estimates of adaptation costs in cases where climate impacts are particularly hard to quantify, e.g., for impacts on biodiversity (James et al., 2001). The second sub-category is characterized by engaging on a bottom-up extrapolation of adaptation costs using specific collection of climate-related projects – often at local level (studies labeled as IFF-BE in Table 1). The extrapolation of costs is made using an independent variable like land area or population (Oxfam, 2007). One of the main limitations of this strategy is the lack of a consistent spatial coverage of climate-related projects/actions and the sensitivity of estimates to the independent variable used. On the positive side one should not overlook that in this case, economic estimates of adaptation are based on official numbers of climate-related projects (Agrawala and Fankhauser, 2008).

Finally, a third sub-category of IFF studies determines adaptation costs via a top-down quantitative analysis (studies labeled as IFF-TQA in Table 1) often associated with bio-physical modeling of specific climate impacts. What better characterizes this approach is the formulation of uniform cost rules to estimate costs of adaptation. The advantage of this strategy is that adaptation cost differences across regions reflect different conditions and needs. On a less positive tone, the formulation of uniform cost rules implies that some local specificities of countries and regions are disregarded. It was noted that because the economics of climate change pose such a unique challenge to orthodox styles of economic analysis their rigid economic assumptions often take the spotlight of discussions (Serban Scrieciu et al., 2011). This might deviate the attention from a far more crucial aspect of climate change economic assessments, namely, how is climate change adaptation represented in cost frameworks.

Previous reviews found that in some extreme cases, the representation of adaptation in climate change has been reported to be as simplistic as turning on the trade option of an agriculture production model (Füssel, 2009). Even if all the economic details where fixed and climate models would be 100% accurate, economic estimates resulting from such a representation of adaptation would hardly provide a metric on the costs of climate change adaptation. Hanemann (2000) frames the point we are trying to make well. In economic assessments of adaptation the most productive discussion is not if farmers act optimally or not in economic terms, but rather if farmers act in the specific manner as assumed by the analyst. Although reviews exist on how adaptation is represented in Integrated Assessment Models (IAM's) (Patt et al., 2010), a structured analysis on the representation of adaptation across a wider range of adaptation cost assessments is to our knowledge still missing.

Figure 3: Phases and sub-processes throughout the adaptation process. Extracted from Moser and Ekstrom (2010)



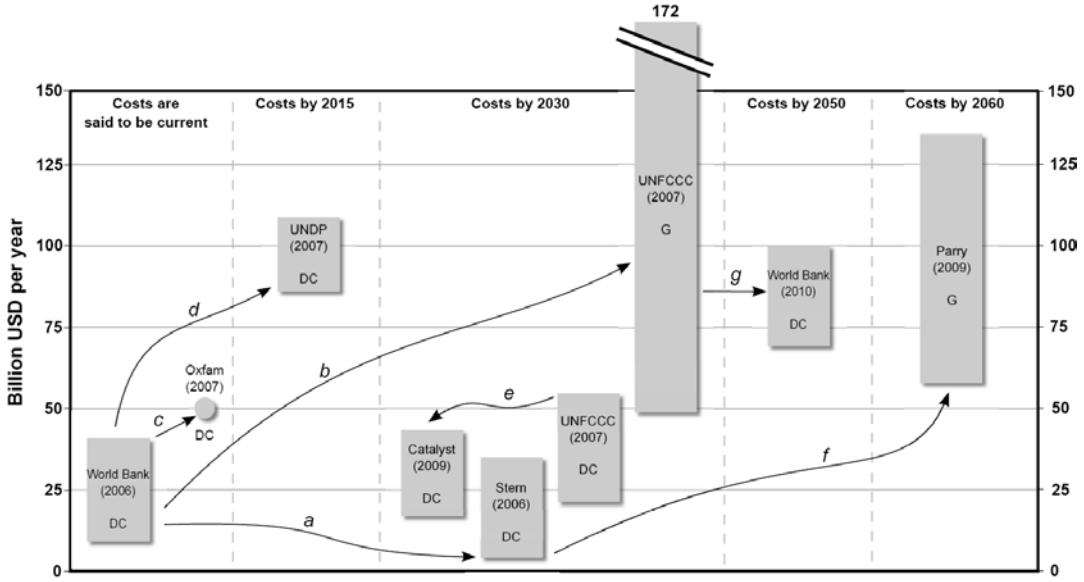
The 30th November report highlighted the need to consider adaptation as a process, proposing the use of an established conceptualization of adaptation (Moser and Ekstrom, 2010) as the "yardstick" to which the representations of adaptation in cost assessments are contrasted. The reason to choose the adaptation conceptualization of Moser and Ekstrom (2010) as reference is justified by its cyclic and stage dependent nature – thus highlighting the existence of delays and barriers to adaptation. Accordingly, adaptation to climate change consists of three phases understanding, planning and managing and multiple sub-processes (see top of Table 1 for the complete list of sub-processes). We postulate that an economic assessment evaluating the costs of adaptation to climate change should – as far as possible – consider the costs of, and the dependencies between, each adaptation phase. Building on these premises, a detailed analysis on how adaptation comes represented in economic assessments has been carried out.

The extent to which the three phases of the adaptation process are represented in each of the investigated assessments is shown in Table 1 For each phase of the adaptation two questions were asked; (1) are cost estimates available? and (2) are there dependencies between the several phases of adaptation?. If monetary estimates for a particular adaptation phase are available then a $ sign is attributed (see Table 1. In case cost estimates for a particular sub-processes (within a particular adaptation phase) are possible to discern, a larger $ sign is used. To answer the question regarding the dependencies between different phases of adaptation we evaluated the methodological descriptions of the investigated assessments. In cases when two or more phases of adaptation are dependent a • sign is given. Dependent in this context means that the outcomes of one adaptation phase have a discernible effect on the subsequent phase. This influence can be of different nature, e.g selection of appropriate options during the planning phase to be carried to the managing phase. In addition to the representation of adaptation, the 30th November report acknowledges the mutual dependence on cost assumption between several economic assessments. In particular we have suggested that the prevalence of dependencies between economic assessments can be connected with the deficient representation of adaptation. In Figure 4 upper and lower bounds of adaptation cost estimates for global and developing-world are shown. Arrows depict from and to which assessment cost assumptions are carried/modified. The purpose is to illustrate the extent to which assessments mutually rely on common assumptions and how in turn this can be linked to misrepresentations of adaptation.

The first evidence of In Figure 4 is the stark influence the World Bank (2006) assessment had on subsequent adaptation cost literature – either via a direct integration or updates/modifications to the original cost rules. In detail, the World Bank (2006) assumes that 40% of Official Development Assistance (ODA) is climate sensitive and suggests that 10 to 20% of the financial exposure is necessary to "climate proof investments". Stern (2006) updates the assumption of

climate sensitive investments from 40 to 20% suggesting that adaptation costs are between 5-20% of financial exposure (a). UNDP (2007) also modifies the World Bank (2006) fraction of climate sensitive investments on ODA from 40% to 17-33% range while directly lending the Stern (2006) assumptions on adaptation cost fractions (d). The lower-bound estimate of adaptation costs in World Bank (2006) is the starting point of the Oxfam (2007) assessment (c). To the 40 billion USD required in World Bank (2006), Oxfam (2007) adds adaptation costs faced by community-level actors and the ones required to climate-proof existing stocks of natural and physical capital. As net result "at least 50 billion USD per year" are required for climate change adaptation.

Figure 4: Adaptation cost estimates for Developing Countries (DC) and Globally (G) in selected assessments. Estimates are placed according to time frame of analysis, from present adaptation costs (far left) to mid-century estimates (far right). All costs in Billions USD per year. Costs from Catalyst (2009) were converted from EUR to USD using a 0.79 conversion rate. Although Oxfam (2007) does not provide a range of costs it frames the 50 Billion mark as "lower bound". Arrow direction depicts from and to which study the core assumptions/methodology were carried/modified.



In some cases the shared assumptions are rather intricate. Catalyst (2009) proposes that about 16 to 43 billion USD per year are required for adaptation in developing countries. This is close to the amount suggested by UNFCCC (2007) (DC). Such agreement can be partially explained by the fact that adaptation costs from UNFCCC (2007) are used to calculate the climate-resilient development component (40 to 60% of total costs in Catalyst (2009)) (e). Costs of adapting infrastructure in UNFCCC (2007) clearly outrank the cost with other sectors (70% of total costs) and were derived with the investment shares proposed in World Bank (2006) (b). Other dependencies observed include: UNFCCC (2007) and The World Bank (2010) making use of the same modeling approach (Hinkel et al., 2010) for coastal zone adaptation (g) – differing only on the inclusion of dike maintenance, upgrading sea-ports and evaluation of changing storm intensities aspects (The World Bank, 2010). Finally, Parry et al. (2009) broadly takes the assumptions of adaptation efficiency in Stern (2006) (f). In this case cost numbers should be interpreted as avoided damages.

What do we learn from this brief comparison? First, that the widespread use of similar cost rules makes the robustness of results difficult to evaluate, as also noted in Agrawala and

Fankhauser (2008). Second, in some cases economic estimates of adaptation have been based on fractions of investment primary thought for a development rather than a climate change context. This is evident for the case of assumptions adopted in World Bank (2006). The cost rules suggested are targeted to inform on "incremental costs of activities to make projects (in this case development projects) more resilient to climate effects". This is indicative of the minor importance given to the representation of adaptation in cost exercises. It seems apparent that economic assessments of adaptation have been primarily interested in populating discussions with "ball park" figures rather than to first conceptualize how does adaptation to climate change unfolds in practice.

3.1.1 Evaluation of the different adaptation phases as considered in investigated assessments

Table 1 summarizes the results of applying the approach outlined in the previous section to a number of adaptation cost estimates from previous publications. In the following the main outcomes for each adaptation phase will be presented. In order to distinguish economic sectors within a particular study the following abbreviations are used: water (Wat), agriculture (Agr), coastal (Cos) and Infrastructure (Inf).

The understanding phase

The investigated assessments broadly assume that adequate knowledge of climate change exists and, consequently, investments in the understanding phase of adaptation have been disregarded in most cases. This was particularly evident in case-studies whose scope runs from the national to sub-national level (see Table 1). The spatial scale and the fact that most of the assessments in this group refer to developed countries can partially explain this fact. In contrast, valuation of the understanding phase of adaptation was mostly observed in assessments focusing on a global scale and/or developing countries. The limitations have not hindered certain studies in providing estimates on necessary costs that can be understood as belonging to the understanding phase. The strategies ranged from enhancing current knowledge on climate change, e.g., via a promotion of concrete research activities (UNFCCC, 2007; World Bank, 2010) in the agricultural sector, an analogous allocation of annual budgets of leading climate research and weather forecasting in developed countries to developing countries (Catalyst, 2009), or the direct financing of concrete projects for climate monitoring (Oxfam, 2007). Nevertheless, all investigated assessments have neglected the potential implications of the understanding phase in subsequent phases of the adaptation process.

The planning phase

Cost estimates for the planning phase were found to be scarce in the sample of investigated assessments. In some cases planning costs can be partially included in implementation costs and therefore hard to discern. On the other hand such difficulties have not hindered case studies in explicitly including financial efforts required with planning of adaptation. This was done, for example, by evaluating the annual spending of national environmental agencies responsible for flood planning (Catalyst, 2009) or accounting for fiscal, legal and administrative costs for water treatment plants in the water sector (Kirshen et al., 2000). In only two of the examined cases had the planning phase a discernible outcome on the managing phase of the adaptation process. For example, in case of Ojea et al. (2009) only adaptation options considered as "feasible" by expert judgment were transferred to the managing phase for subsequent monetization. In case of coastal adaptation (World Bank, 2010), the options were subjected to a cost-benefit analysis regarding their implementation costs and amount of

damages avoided (benefits). Only options with a cost/benefit ratio below 1 were carried on to the managing phase.

Table 1: Phases and sub-processes of adaptation adapted from Moser and Ekstrom (2010). IAM - Integrated assessment model; IFF - Investment and financial flows; EG - Expert guess; BE - Bottom-up extrapolation of costs; TQA - Top-down quantitative analysis; Agr - Agriculture; Cos - Coastal; Eco - Ecosystems; Inf - Infrastructure; Hel – Health; Wat - Water; $ - Cost estimates available; $ - Differentiation of costs for sub-processes possible; • - Influenced subsequent adaptation phases.

Scope of investigated assessments	Assessment type	Adaptation phases		
		Understanding	Planning	Managing
Global and developing-countries				
World Bank (2006)	IFF-EG			$
UNDP (2007)	IFF-EG/TQA			$
Oxfam (2007)	IFF-BE	$		$
Catalyst (2009)	IFF-BE/EG	$	$	$
De Bruin et al. (2009)	IAM			$
$Sectoral estimates -Global				
UNFCCC (2007)Agr.	IFF-EG	$		$
World Bank (2010)Agr.	IFF-TQA	$		$
World Bank (2010)Inf.	IFF-TQA			$
World Bank (2010)Cos.	IFF-TQA		•	$
Ward e al. (2010)Wat.	IFF-TQA			$
National and sub-national estimates				
Kirshen et al. (2000)Cos.	IFF-TQA			$
Kirshen et al. (2000)Wat.	IFF-TQA		$	$
Hallegatte et al. (2007)Hel.	IFF-TQA/EG			•$
Larsen et al. (2008)Inf.	IFF-TQA			$
Ojea et al. (2009)Eco.	IFF-TQA		•	$
Neumann et al. (2011)Cos.	IFF-TQA			$

The managing phase

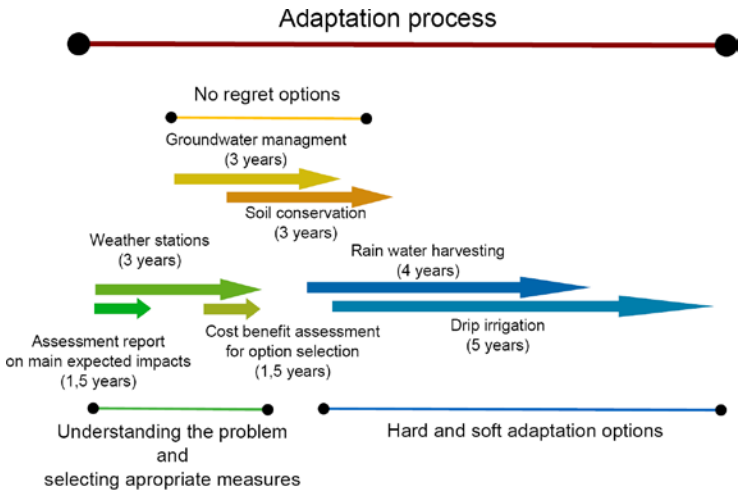
Most of the economic quantification of adaptation was found in the managing phase. Only in this phase it was possible to discern financial needs for particular sub-processes of the adaptation phases. Although costs were found to be biased towards the implementation sub-process, examples like Kirshen et al. (2000) (Wat) and World Bank (2010) (Inf) accounted for additional costs required with monitoring by incurring the costs of maintenance of infrastructure. There is a near-complete disregarding of the evaluation sub-process in all evaluated assessments. Although the extent and nature of future adaptation actions dependent on factors that cannot be fully anticipated – such as model uncertainty – our analysis revealed that a preliminary evaluation of proposed options is feasible. Hallegatte et al. (2007) does so by enumerating adaptation options that are implemented with a 2100 horizon with the level set according to two climate models. By 2050 options are reviewed according to the decision maker confidence on a certain model. Adaptation costs are then integrated taking into account

the costs of possible ill-adaptation due to wrong anticipations in a context of large uncertainty (see Hallegatte et al. (2007) for further details).

3.2 Moving forward: The construction of Logical Adaptation Processes (LAP's) for cost analysis

Considering the discussion in the previous section, the estimation of adaptation costs in this report starts with the understanding of adaptation as a process and the consequent formulation of Logical Adaptation Processes (LAPs). Before this is analyzed in detail, a few words should be mentioned about the crucial characteristics of our estimates. First, the understanding of logical and process in this particular context will be clarified. Starting with the later, the word process is used to highlight that adaptation is not restricted to the isolated implementation of measures, but rather a continuum of actions that unfold according to a "logical" sequence to achieve a particular result. The implication of this kind of thinking is that the application of a given adaptation measure cannot be implemented – or it will be deficient in its function – without previous ones being put in place. The LAP concept emerges therefore from an attempt to incorporate aspects of climate change adaptation largely overlooked in cost literature (see Table 1 and also the Section 3 of the 30th November report). The aspects identified (e.g., knowledge and institutional barriers) will be considered in this work as an intrinsic part of the adaptation process, a precondition for the unfolding of concrete actions. The word logical is used to highlight that the sequence of necessary measures within one adaptation process is not arbitrary, but rather a product of a collection of case studies that have highlighted barriers and constraints to adaptation. Of course the logic of the authors of this report might differ from the logic of the reader. In this sense, the adaptation processes should be understood as one possible adaptation process targeted at a particular impact. In addition, the processes elaborated here could be visioned as building blocks upon which more elaborated, case-specific adaptation processes can be derived.

Figure 5: Generic adaptation process prototype for a adaptation in agriculture systems as proposed in the 30th November report.



One final remark regarding the LAP's considered is that whenever possible they reflect a portfolio of interchangeable actions to achieve the same objective, i.e. mitigating negative impacts from climate change. This means that we do not limit ourselves to analyze the costs of one particular adaptation action, but rather we try to include as many actions as possible reflecting the different phases of adaptation (e.g. knowledge, regulatory, infrastructural). This is relevant because of two aspects. First, the uncertainty of climate change impacts calls for a

diversification of adaptation (Füssel, 2009). Second, adaptation actions set into force today need to be evaluated in the future, not only for their efficiency, but also in regard to their potentially negative side effects (Barnett and O'Neill, 2010). The LAP's, whose elaboration will be conveniently detailed, originated from generic adaptation-process prototypes suggested in the early report, In Figure 5 the initial conceptualization of a generic adaptation process for agricultural systems in shown.

3.3 Systems and attributes of concern focus of the economic assessment

Due to time/data constraints and the impossibility of deriving a comprehensive Logical Adaptation Processes for particular economic sectors, this work focuses its attention on the negative consequences of climate change in three socio-economic systems, namely: agriculture, coastal zones and population. It goes without saying that costs will not reflect the necessary adaptation efforts for the entire system, but rather for a particular attribute of concern within each system (see Table 2). For example, in the case of the agricultural systems, the particular attribute of concern is the anticipated losses or gains of yields of three major crops expected under climate change.

Agricultural systems have been reported to be heavily influenced by the impacts from climate change (Mendelsohn et al., 2004). Not only do these systems rely directly (temperature and precipitation in rain-fed systems) or indirectly (use of water from reservoirs) on weather and climate variations and change, they also provide the basic support of livelihood for many of the countries included in this report. As an iconic example, among India's population of more than one billion people, about 68% are directly or indirectly involved in the production of the agricultural sector (O'Brien et al., 2004). Although there has been extensive research on the benefits of adaptation of agriculture to climate change (Howden et al., 2007), the outcomes suggest that large uncertainties remain unsolved. For instant, there are indications that the potential gains due to CO_2 fertilization may offset, to some extent, the negative impacts due to changes in precipitation patterns and temperature increase (Erda et al., 2005).

Table 2 - The system under analysis and attribute of concern for the investigated focal countries.

System under Analysis	Attribute of concern
Agriculture	Future gains/losses of yields for three major crops
Coastal-zones	Future extent of urban areas in the flood-prone zone
Human population	Future elderly population living above the heat mortality threshold

In coastal zones, projected long-term changes in sea-levels have been reported as one of the most challenging consequences of global warming (IPCC, 2007). Post Fourth Assessment Report (AR4) literature indicates that an accelerated increase in sea-levels to 1.2 meters is plausible for high-end warming scenarios by the end of the 21st century (Vermeer and Rahmstorf, 2010; Pfeffer et al., 2008). When considering the full uncertainty band of projections sea-levels can rise up to 1.8 meters (Vermeer and Rahmstorf, 2010). These results are of course conditional to the development of future warming trends and the interaction with land-based ice masses such as Greenland and West-Antarctica. The destabilization of these components of the climatic system can add up to a substantial increment of sea-level (Solomon et al., 2009). If it is true that such phenomena develop over very long time scales, it has also been pointed that expected global warming during this century will likely push systems such as the Greenland ice sheet to the limits of stability (Robinson et al., 2012). An often disregarded aspect that shapes the potential negative outcomes of increase sea-levels is the current and future concentration of

assets in flood prone coastal areas. Historically, human population tends to concentrate at the world's coasts. The area less than 10 meters above sea-level makes up 2% of the World's land area but is home to about 10% of global population. In addition, coastal populations have been increasing around the world. Much of the growth has occurred in large cities in the developing world (Barnett and O'Neill, 2002).

The least developed countries have a higher proportion of their urban populations living along the coast (McGranahan et al., 2007), but only fairly weak infrastructure. The last investigated system of this work is human population. The analysis is restricted to one attribute of concern, specifically, the number of elderly population (above 65 years) living in regions whose future temperature is projected to be above the heat-mortality threshold. At first sight, investigating heat-related impacts in the context in developing countries might sound out of place. Usually heat related impacts in population are mostly investigated in developed world cities (D'Ippoliti et al., 2010). In developing countries the prevalence of health outcomes such as malaria usually overrides the effect of heat-related mortality (McMichael et al., 2008). Typically, heat-mortality studies have been mostly conducted in developed countries, whose aging population makes them more susceptible. With developing countries accelerating their socio-economic development changes in population structure, fast urbanizing trends and the prospect of higher temperatures due to global warming, temperature related deaths are expected to become a future topic of concern. In addition, timely planning for a climate impact that has yet to become relevant is certainly beneficial rather than adopting late measures.

4 Methods

This chapter provides a description of the methods, data, models and overall assumptions used to determine impacts of climate change for the three attributes of concern discussed in Section 4.3. Section 5.1 starts by reporting how LAP's are constructed, how the time for each particular phase is derived, and how indicative costs are estimated. To make the methodology transparent, the particular example of the LAP for agricultural systems is extensively described. Section 5.2 describes the main model, scenarios and overall data used to derive climate change impacts for the certain sub-systems and attributes of concern that are an objective of this report. Sections 5.3 to 5.5, detailed methodologies are described and used to quantify climate change impacts in the agricultural system, in coastal zones and human population respectively. Finally, Section 5.6 provides the main assumptions and strategies to quantify financial and institutional capacities of case-study countries in implementing adaptation measures.

4.1 The development of Logical Adaptation Processes

The conceptual starting point to define LAP's is the understanding of adaptation as a process according to Moser and Ekstrom (2010). Broadly, adaptation to climate change consists of three different phases: (i) understanding, (ii) planning, and (iii) managing of selected adaptation options. This conceptualization implies that knowledge and awareness are usually the initiators of climate action. Although it has been noted that knowledge on climate change does not per se translate into action (Patt et al., 2005), appropriate knowledge on climate change is a key factor shaping the capacities of population and institutions in adapting to climate change (Grothmann and Patt, 2005).

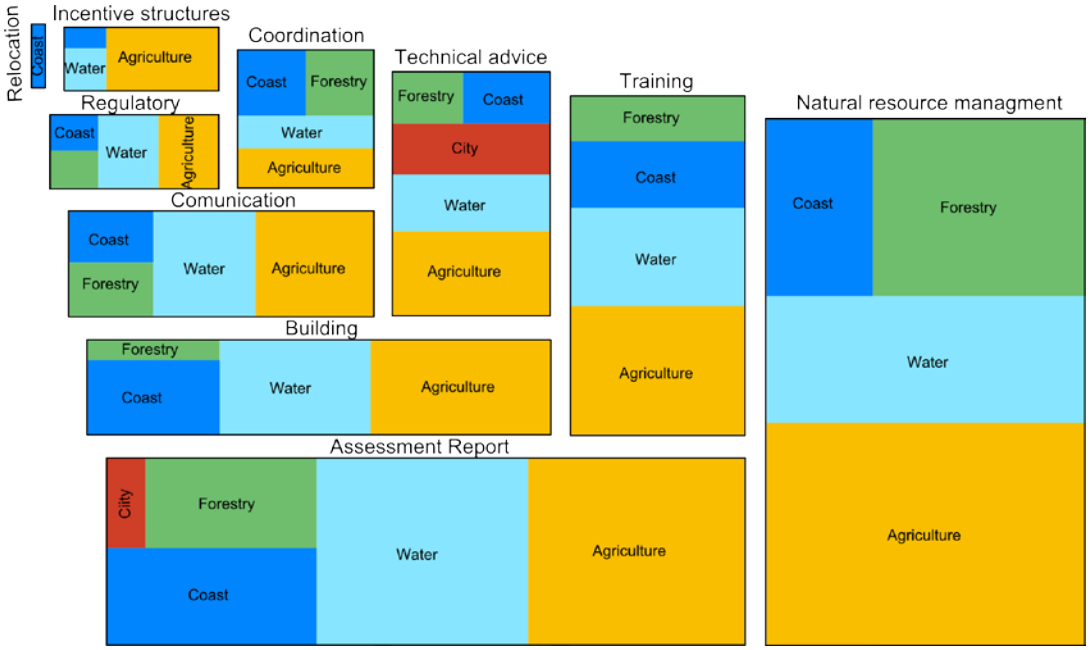
In order to construct an LAP for a given system four major steps are taken:

1. The first consists of determining what adaptation options are to be implemented during the managing phase of adaptation.
2. The second step is to identify from literature what are the pre-conditions in terms of understanding and planning capacities that make such actions likely to be implemented. The literature review was mostly restricted to peer-reviewed work, but also adaptation reports are investigated since they almost always add additional insights. For the particular case of agriculture, literature covered a broad range of developing countries such as Ethiopia, Nepal, India or South Africa.
3. The third step was to search the freely accessible CI:grasp[2] database for adaptation projects for entries that could be semantically related to the necessary actions that enhance the understanding and planning capacity of farmers as identified in the literature review. The CI:grasp platform contains adaptation project descriptions for about 300 adaptation projects currently being implemented or planned in 29 developing and transition countries. An overall picture on the distribution of adaptation projects within the platform database is shown in Figure 6.

[2] CI:grasp database http://cigrasp.pik-potsdam.de/ accessed on June 2012

4. The final step is to retrieve cost and time duration information for considered projects in order to enhance the understanding and planning phases of the adaptation process.

Figure 6: Tree map of the CI:grasp database according to climate impact and economic sector. As one can notice the distribution of projects is far from being homogeneous across project type (primary boxes) and sector (secondary colored boxes). The largest number of projects are dedicated to natural resource management and are mostly implemented, approximately half, in the sector agriculture. The agricultural sectors contain a fairly good distribution of projects across all project types considered, in some cases a particular project type is almost exclusively conducted in agriculture sector, for example in case of incentive structures. Regarding the remaining systems of interest, the coastal sector has a somehow weaker expression regarding the total number of projects when compared with agriculture while adaptation projects in cities constitute by far the smaller sample of all sectors within the CI:grasp platform.



Let us proceed with a practical example in order to better demonstrate the defined approach. With respect to agricultural systems, the main actions selected for the managing phase are: implementation of irrigation, soil conservation activities and crop shifting. These have been reported to be some of the most commonly anticipated strategies in adaptation agricultural systems to climate change (Agrawala and Fankhauser, 2008). In order to achieve the implementation of such actions some preconditions are advisable. For example, Deressa et al. (2009) identified that access to information on climate change is a determining factor for the farmer's choice to implement adaptation methods in the Nile Basin of Ethiopia. Further, raising public awareness on climate change has been pointed by Ghimire et al. (2010) to have a positive effect on the adaptive capacity of farmers in Nepal. Consequently, a good understanding of climate change seems important before subsequent adaptation phases start, i.e. the planning phase. In this case actions that could be linked to planning phase of farmers were (i) access to credit, financing and insurance (Yang et al., 2007), (ii) institutional and government support (Mwinjaka et al., 2010), and to a lower extent (iii) technical assistance and training (Ghimire et al., 2010).

The CI:grasp platform is searched for project types within the agricultural sector that can be semantically linked to the aspects highlighted forehand, e.g., infrastructure, information, incentive, awareness raising, institutional, credit. Once projects are selected they are allocated

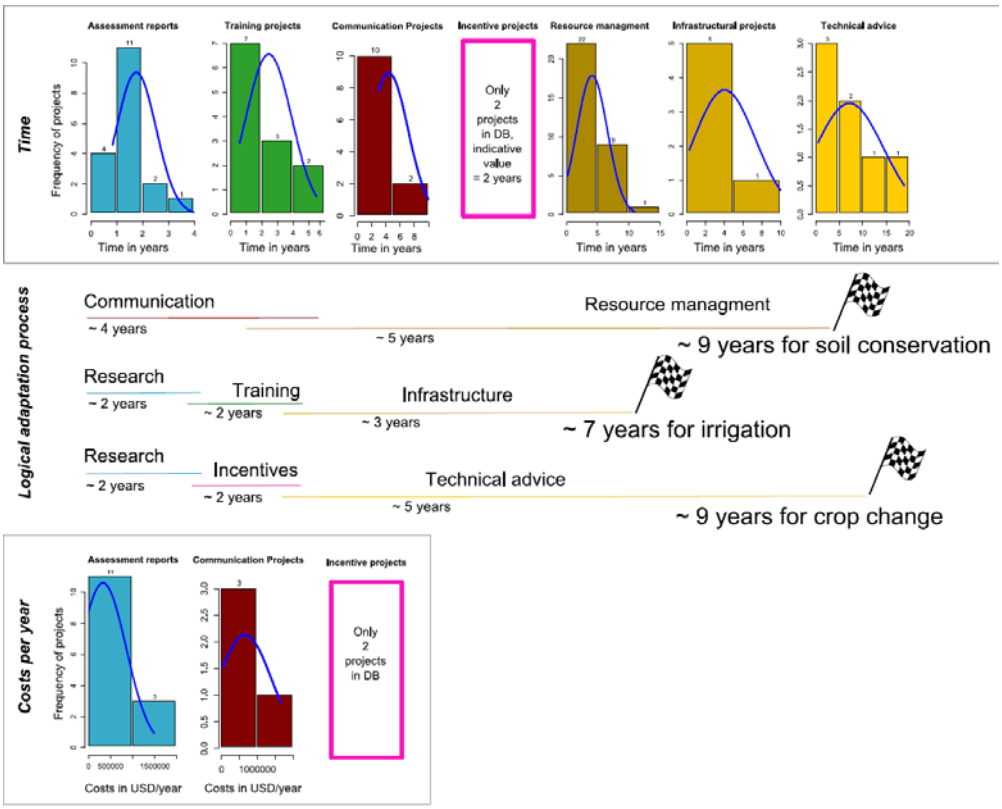
either to the understanding, planning or managing phases. Afterwards the average duration and cost of projects gathered is determined. It is worth to mention that due to the country-heterogeneity in reporting monetary cost estimates for each particular phase should only be taken as indicative. This said, the average cost gathered via this process is restricted to the understanding and planning phases. This is motivated by the fact that the amount of monetary efforts necessary for the managing phase is more related to the amount of impacts wile the financial requirements for the understanding and planning phases can be elaborated on a more general way. Regarding time duration of the projects it is assumed that these are reported in a more homogeneous way and can therefore be assumed as a more robust representation of the time requirements for adaptation. As a consequence, the average time of projects is determined for all the adaptation phases. Based on the described, three different adaptation paths were designed for the case of agricultural systems – one for each adaptation option identified for the managing phase.

4.1.1 LAP for agricultural systems

The LAP for agricultural systems was obtained via the methodological framework discussed in the previous section. It consists of three possible adaptation pathways, one for each adaptation action to be implemented during the course of the managing phase. The first adaptation pathway aims for the implementation of soil conservation to counteract possible negative effects related to climate change. Before one can envision the implementation of resource management programs the preconditions of the planning phase need to be addressed. Namely, it is assumed that effective training of soil conservation techniques is done among farmers. Filtering the adaptation database for communication projects applied in the agricultural sector the database returned a total 12 projects. These projects were found to last between one and seven years, averaging about four years. After training is implemented the typical time of implementation of resource management projects was determined. In total 32 projects were identified to address resource management via institutional or governmental support in the agriculture sector. The time required for implementation of such projects range from two to 15 years, with the most frequent value placed at five years. Summing up the required time for both training and the implementation of resource management actions in agriculture, the first LAP for agricultural systems will last at least nine years. The second adaptation pathways aims at the implementation of irrigation measures. Unlike the first path, the irrigation pathway starts with research. This is justified in the sense that a rigorous assessment of which areas will require irrigation is rational due to the high amounts of capital required for the set up of irrigation schemes. On the other hand, promoting soil erosion conservation is regarded as a win-win situation that does not require substantial research needs for its implementation.

Research activities in the case of agricultural sector where found to last between one and four years, with the most frequent value set between one and two years. The total sample comprised a total of 18 entries. Once research activities are finalized, training of farmers regarding water management is required. Generic training programs in agriculture were found to last up to six years with the most common values situated at two. After these preconditions are fulfilled the implementation of irrigation infrastructure can begin. Infrastructure projects in the agricultural sector in the Ci:Grasp database were found to be some of the longest running activities. In particular it was found they could last up to 10 years although the most frequent value was set at a considerable lower value of four years. Summing the time of all previous steps the irrigation pathway was estimated to last up to seven years.

Figure 7: Histograms of implementation times and yearly costs taken CI:grasp database are provided in order to exemplify the heterogeneous distribution of these variables across adaptation project. The example refers to the LAP's constructed for the case of adaptation of agricultural systems.



The final path proposed concerns adaptation to climate change via crop diversification. Here, the first pre-condition is to finance research activities in order to determine which crop varieties could be more suitable in a future climate and in which areas of a country a crop-change should be promoted. It is assumed that changes in crops can be facilitated if financial incentive schemes are provided to farmers. Unfortunately the number of entries of financial incentives in the Ci:Grasp database was very low (see Figure 6 and Figure 7) and no sound analysis on time and monetary efforts possible. In any case we will see further that this pre-condition has not been disregarded. Once the knowledge and the financial incentives are in place it can be assumed that technical advice, e.g. on how to efficiently grow the new crop variety, are necessary. In this sense the database was examined for projects that may provide technical advice to farmers. It was found that technical advice in the agricultural sector can last up to 20 years. Unfortunately, the total number of projects was not abundant (seven). The indicative value of five years for technical advice was taken.

It should be acknowledged also that adaptation projects in the CI:grasp database are multi-sectoral. This means that project entries are not exclusive to one particular sector. Rather, the same project can contribute to more sectors like water or forestry. This particular issue has been identified in the previous report as a relevant point but not to be tackled by this work. It is also important to note that so far adaptation costs phases of adaptation are limited to the understanding and planning phase, see bottom of Figure 7. Costs associated with the managing phase will be determined as a function of the impacts expected from climate change in the different attributes of concern.

4.2 Climate models used and representative concentration pathways considered

Climate models are useful tools for simulating the response of the global climate system to increasing levels of greenhouse gas (GHG) concentrations. To assess the variation and change of climate variables of temperature and precipitation, a total of eight General Circulations Models (GCMs) (see complete list in Table 3) were employed according to four different radiative forcings proposed in the new set of Representative Concentration Pathways (RCPs) (van Vuuren et al., 2011).

The four RCPs are defined by their radiative forcing (cumulative measure of human emissions of GHGs from all sources expressed in Watts per square meter) pathway and level by 2100. RCPs are named according to the radiative forcing in the year 2100 level: 2.6, 4.5, 6 and 8.5 W/m2. The radiative forcing is driven by greenhouse gases emissions and other forcing agents such as land-use. Following, some of the main characteristics of the RCP's used.

1. RCP2.6: Emission pathway representative of literature scenarios in the literature leading to very low greenhouse gas concentration levels. In order to reach such radiative forcing levels, greenhouse gas emissions (and indirectly emissions of air pollutants) are reduced substantially over time.
2. RCP4.5: Emission pathway leading to a stabilization scenario where total radiative forcing is stabilized before 2100 by employment of a range of technologies and strategies for reducing greenhouse gas emissions.
3. RCP6.0: Emission pathway where total radiative forcing is stabilized after 2100 without overshoot by employment of a range of technologies and strategies for reducing greenhouse gas emissions.
4. RCP8.5: Emission pathway characterized by increasing greenhouse gas emissions over time representative for scenarios in the literature leading to high greenhouse gas concentration levels.

The RCPs represent a broad range of climate outcomes based on literature review. They are neither forecasts nor policy recommendations. While each single RCP is based on an internally consistent set of socioeconomic assumptions, the four RCPs together cannot be treated as a set with consistent internal socioeconomic logic. For example, RCP8.5 cannot be understood as a non-climate-policy socioeconomic reference path for the other RCPs because for RCP8.5 the socioeconomic, technology, and biophysical assumptions differ from other RCP's.

Table 3: List of GCM's used in this report and the institution responsible for their maintenance.

Name	Institution
MIRI-CGCM3	Metereological research unit, Japan metereological agency
BCC-CSM1.1	Beijing climate center, China metereological organization
CSM4	National center of atmosferic research
CSIRO-Mk.3.6.0	Commonwealth scientific and industrial research organigation
GFDL-CM3	Geophysical fluid dynamics laboratory
GISS-E2-R	NASA Goodard institute for space studies
Had-GEM2-ES	Met office Hadley center
IPSL-CM5A-LR	Institute Pierre-Simon Laplace

The use of oil remains fairly constant in most of the pathways but it declines in the RCP2.6 as a result of depletion and ambitious climate policies. Additionally, the use of non-fossil fuels

increases in all scenarios, especially renewable resources, such as wind and solar, bio-energy and nuclear power. The RCP4.5 is comparable to a number of climate policy scenarios with its main characteristics similar to those in RCP2.6, but far less extreme (Vuuren et al., 2011). The RCP6.0 can be interpreted as medium baseline scenario. In terms of the energy-mix the scenario is characterized by a heavy reliance on fossil fuels with intermediate average energy intensity. Finally, The RCP8.5 is characterized by increasing greenhouse gas emissions over time representative of high greenhouse gas concentration levels.

Integrated Assessment Models (IAM's) are employed to derive emission trajectories and land-use transitions to achieve a particular level of radiative forcing. Finally, GCM's are used to translate emissions into climate variation using the forcing trajectories from the IAM's.

Projections on the potential evolution of monthly temperature and precipitation were investigated for the time periods 2015-2050 and 2055-2095. These were used to assess the dependency of agriculture production to climate change and to assess the effect of heat-stress on elderly people. For these two impacts the full set of climate models and well as RCP's were used (see above).

For coastal systems this work relies on sea-level change estimates Vermeer and Rahmstorf (2010) for the different SRES temperature scenarios of the AR4. In order to evaluate land use changes at the coast, such as changes in urban areas, we use land-use scenarios as provided by the AIM model (Asia-Pacific Integrated Model) according to RCP6.0. For the remaining RCP's land use scenarios that include urban-land transition were not available. It is worth to mention that land-use scenarios from AIM's are downscaled to 0.5×0.5 degrees. In RCP6.0 population development is based on the SRES B2 scenario (IPCC 2000), with population updated to the UN medium variant (UN 2007) up to 2050 and UN (2004) for beyond 2050. In RCP6.0, urban land-use increases due to population and economic growth. Crop land area expands due to increasing food demand and grassland area declines. Total forested area extent remains constant throughout the century.

4.3 Impacts of climate change on agricultural yields

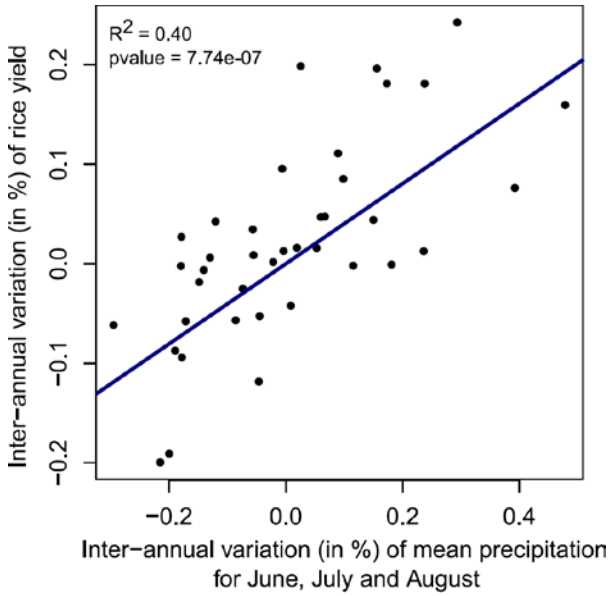
Yield data (in tons per hectare) for rice, maize and wheat crops between the years 1961 and 2009 as well as average price paid to the producer (USD) per ton of crop between the years 2000 and 2010 were retrieved from the Food and Agriculture Organization Corporate Statistical Database[3] covering the time frame 1961–2009. Area harvested (in hectares) for each crop was collected for each case-study country for the year 2009. The percentage of irrigated crop area for the investigated countries was obtained from the FAO AQUASTAT division[4]. Observed climate data of monthly mean precipitation and temperature was extracted from the Climate Research Unit (CRU), version TYN CY 2.0 (Mitchell et al., 2002). To analyze the dependency between agricultural yields and climate variations each time series of monthly temperature, precipitation and annual yield were first detrended and then correlated. This was done separately for the three crops investigated. The detrending procedure was performed by taking the difference between the values in each year i, and the values in the previous year *i-1* according to (Krishna Kumar et al., 2004). These values were then expressed as the percentage of change from the previous year. This method reduces any piecewise linear trends to small constant terms, attenuating the amplitudes of low-frequency signals by a factor of s*in(f,t)*,

[3] FAOSTAT: http://faostat.fao.org

[4] FAO AQUASTAT: http://www.fao.org/nr/water/aquastat

where f is the frequency and t is the time interval (in this case 1 year) between the samples (Krishna Kumar et al., 2004). Detrending the yield time series allows to remove the effect of technological progress that occurs from year to year and provides a more clear measure to what extent the variation in yield can be attributed mostly to intra-annual climate variation. The correlation between observed climatic variables and yield values for each country were tested using the averages of monthly precipitation and temperature for multiple combinations until the best fit was achieved. This was done for temperature and precipitation individually. For example, in the case of India and for the rice crop the best fit was obtained using the mean precipitation for the months of June, July and August. The conclusions about the degree and significance are based on pairwise Pearson's correlation between detrended yield and detrended climate series. Figure 8 shows the best fit found between the climatic and rice-yield time series for India.

Figure 8: Example of the best fit between detrended yield and detrended precipitation series for rice yield in India between 1962 and 2000.



It is assumed that crop area in the investigated countries remains constant to 2009 levels and that no yield improvements due to technological progress are made in the future. This implies that yields will either decline or improve in reference to the yield of the year 2009. This is of course a very rough approximation since that it ignores at some extent the effect that technological progress has in improving yields. Nevertheless, recent work by Lin and Huybers (2012) suggests that a stagnation of yield trends for several nations is already discernible from empirical data. For a 27 regions out of the 50 statistical evidences for yield stagnation have been shown Lin and Huybers (2012). These regions include the Western US, the majority of Western Europe, India, Bangladesh, Romania, Colombia, Albania, Egypt, Hungary, Japan, Pakistan, South Korea and Zambia (Lin and Huybers, 2012).

Past correlations between the detrended yield and detrended climate series are used to determine what fraction of yield variation can be attributed to climate change, assuming that the past relation holds also for the future. Using the projections of average monthly temperature and precipitation for all RCP's and models as independent variables the future variation of yield (in tons per ha) in relation to 2009 is assessed on a yearly basis. Using 2009 values of agricultural areas the magnitude of expected losses/gains of agricultural production in tons) is estimated. Using the average price paid to the producer between 2000 and 2010 (in USD per ton) the monetary losses/gains are determined.

4.4 Impacts of sea-level change at the coastal zones

To assess the economic impacts of sea-level changes in the coastal zones of investigated countries a long-term coastal management was favored in detriment of an event based one, namely, by looking at storm surge events. Storm surge statistics are mostly available with an adequate level of detail for return level calculation for particular coastal areas (see Boettle et al. (2011)). In developing countries data constraints make event-based analyses of storm surges a daunting task. But even if one is successful in retrieving storm statistics that are approximately representative of the surge dynamics for an entire coastal zone of a country a second problem arises. Global information on the terrain elevation of coastal zones is only available via products of low vertical resolution. The most comprehensive global dataset to date is the SRTM90 which provides 90×90 meter spatial resolution and a 1 meter vertical resolution. In practice this means that potential flood extent at the coastal zones can be evaluated in discrete steps of 1 meter. Considering yearly rates of sea-level in the order of millimeters per year it is obvious the existence of a scale mismatch between the phenomenon and available data.

Focusing on long term management rather than event-based seems for the moment to be a more rational step. This can be justified by two aspects. The first is that current long-run sea-level projections match more closely with the vertical resolution of digital elevation models at hand. The second aspect is that expected large fractions of damages in the coastal zones are shaped by socio-economic trends rather than by sea-level change. Modeling exercises have highlighted that in Europe, coastal impacts expected due to sea-level rise are predominantly driven by socio-economic development in the first half of the century, and to a less extent in second half (Hinkel et al., 2010). Thus we export a similar logic to the case of developing countries in the sense that a large fraction of their coastal infrastructure and associated assets might not yet be in place.

Taking the indicative long term sea-level rise values in Vermeer and Rahmstorf (2010) as a reference (approx 1.8 meters for high-end warming scenarios), current coastal land-use of flood prone areas can be estimated. Flood prone area is from now on defined in this work as the spatial extent of land that is hydraulically connected to the sea (flow chains) at an elevation of 2 meters or below in relation to current sea-levels. In order to determine the spatial extent the SRTM90[5] data set is reprocessed according with the eight-rule approach described in Poulter and Halpin (2008). This approach broadly states that a terrain cell is prone to flooding if any of its eight neighbors is (i) connected to the sea and below a given level of projected sea-level change or (ii) connected to a previously flooded cell. The chosen level of two meters broadly reflects the current the state of the art knowledge concerning the upper range of sea-level change within this century.

To evaluate the impacts from sea-level rise one needs not only to determine the potential spatial extent of terrain prone to flooding but also what are the human land-uses that unfold in the prone area. Data on the current land-use at the coastal zones of the investigated countries is taken from the MODIS Land Cover Type product MCD12Q1[6] for the year 2010. The land-use pixels assigned as agricultural and pasture land that fall within the flood prone area (2 meter elevation or below and hydraulically connected to the sea) were extracted. Subsequently the extracted land-use was spatially connected to the AIM grid that provides information on land transitions occurring under RCP6.0. For each year between 2015 and 2100 the AIM model

[5] SRTM90 dataset available at: http://srtm.csi.cgiar.org/

[6] MCD12Q1: https://lpdaac.usgs.gov/products

provides the fraction of grid cell that is expected to undergo in transition, for example, from pasture land to urban land. In this particular case we are only interested in changes from crop or pasture land to urban since as seen before forest land is kept constant in this particular RCP. Due to the fact that the AIM resolution is much coarser than the resolution of the SRTM90 (0.5 degree vs 90 meters) all agricultural or pasture area that fall within a grid cell of the AIM model will fully undergo a change.

The final step is to estimate how land-use changes projected by the AIM model at the prone zone translate into monetary value. It is therefore assumed that most of the capital added to the coastline in countries under investigation is associated with new urban area expected. In order to valuate in economic terms how much the newly added urban area is worth the average GDP per urban square kilometer is calculated using the gridded GDP data set by CIESIN[7]. The analysis is restricted to grid cells of the GDP at the coastline in order not to account for the GDP produced in urban areas located further inland.

4.5 Impacts of increase heat-stress in urban population

The starting point to determine the potential impacts of climate change in urban population was to collect a wide number of case studies that have evaluated the relation between temperature and heat-stress in urban areas (see a partial sample in Table 4 and the additional studies used in Table 35 of the Annex.

Heat-stress studies usually evaluate the statistical dependency between an independent climate variable and the observed number of mortality or morbidity cases recorded by health-care statistics. Two important quantifications are usually available in such studies. The first is a quantitative measure of the temperature thresholds beyond which the number of recorded mortality (and/or morbidity) cases experiences a significant increase when compared with the long term seasonal background of hospital admissions or recorded deaths. This threshold can be interpreted as an adaptability measure of the population regarding heat-stress. Individuals born in colder regions usually experience an average heat-stress at lower temperatures than individuals that live in warm regions. For instances, in Figure 9 the heat mortality threshold recorded for Stockholm (Sweden) is found to be about 20 degrees while for Rome (Italy) the heat mortality threshold is only observed at a maximum apparent temperatures of 30 degrees.

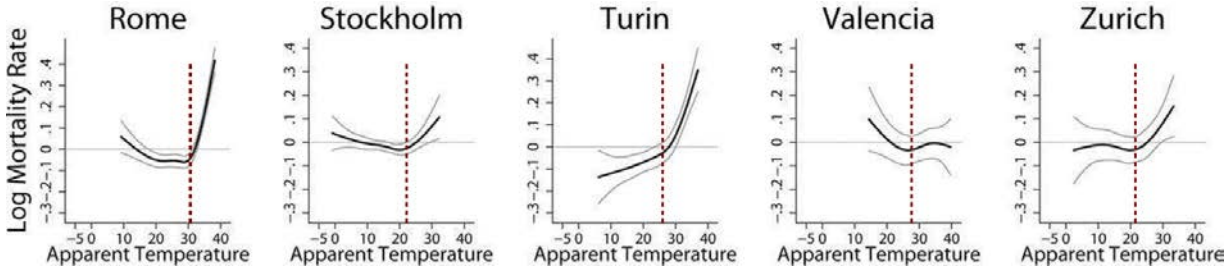
Table 4: Examples of thresholds and slope in heat-mortality studies. This selection is only a small sample of the full list of studies used in this report.

Author	City	Time	Threshold	Slope
McMichael et al. (2008)	Bucharest	1994-1997	22	3.3
	Sofia	1996-1999	16	2.9
	New Delhi	1991-1994	29	3.9
	Monterrey	1996-1999	31	18.8
	Chiang Mai	1995-1997	28	2.4
	Bangkok	1991-1992	29	5.8
	São Paulo	1991-1994	23	3.5
	Santiago	1988-1991	16	1.0

[7] Downscaled Income Data from: http://ciesin.columbia.edu/datasets/downscaled/

Author	City	Time	Threshold	Slope
	Cape Town	1996-1999	17	0.5
Kim et al. (2011)	Seoul	1994-2003	28	9.6
	Daegu	1994-2003	28	4.6
	Incheon	1994-2003	27	5.3
	Gwanzig	1994-2003	27	2.6
	Daejeon	1994-2003	28	3.9

Figure 9: Examples of regression splines describing the adjusted relationship between daily maximum apparent temperature and natural mortality adapted from Baccini et al. (2009). The red dashed lines show the city-specific temperature thresholds above which natural mortality experiences a sharp increase.



The second useful information that is usually available is the slope of the curve fitted to the data distribution. In other words, the additional number of deaths per degree of temperature. In this work the threshold and slope for a total of 36 urban areas was acquired from scientific literature, see Table 35 of the Annex.

Using spatial explicit data from CRU with 0.5 degree resolution, a correlation analysis between heat-mortality thresholds recorded at the 36 urban areas and the corresponding independent variable of mean annual temperature (between 1961 and 1990) was performed. The resulting statistical relation between annual mean temperature and heat-mortality threshold is then applied globally in order to obtain heat-mortality thresholds for regions in which studies as presented in Table 4 are not available. Projected temperature scenarios as described are then employed and future mean temperature anomalies for each country determined. The projected temperature anomalies are added to the current annual mean temperature values. Finally, the distance (in degrees Celsius) between the heat-mortality threshold and the annual mean temperature plus the projected anomalies is calculated for each CRU cell.

Using the Gridded Population of the World (GPW) V.3[8] in the year of 2010 from Socio Economic Data and Applications Center (SEDAC) and the age-class fractions of population from the United Nation Department of Economic and Social Affairs[9] the total number of elderly individuals (assumed here to be individuals, whose age is equal or above 65) was determined. Because the effect of heat-stress is not uniform among different social strata it is assumed that

8 http://sedac.ciesin.columbia.edu/data/

9 Population Division http://www.un.org/esa/population/

adaptation policies need to be prioritized for elderly population living below the poverty-line[10]. Accordingly, the total number of elderly people living below the poverty-line and above the heat-mortality threshold was determined for the current situation and future time frames of 2015-2050 and 2055-2095. In case of future population estimates the medium scenario of UN Population Division was used.

4.6 Evaluation of financial and institutional deficiencies

4.6.1 Financial deficiencies

In this section the main methods and data used to evaluate the financial and institutional capacities of selected countries to implemented climate change adaptation are detailed. It should be mentioned that the financial capacities of countries will be framed in the broader context of a country's socio-economic development. Development of a country is an inherent process that interacts with changes in environmental conditions. Moreover development is not only restricted to the economic dimension – although the economic dimension still play an important role – but also to more social dimensions such as health, equity, or education.

In order to investigate the temporal dynamics of development this report makes use of the Human Development Index (HDI) as an integrative measure of country's economic, health and knowledge capacities. These three dimensions have been reported to be determinants of adaptive capacity to climate change both at national and regional levels (Smit and Wandel, 2006; Brooks et al., 2005; Kienberger, 2012; Pandey and Jha, 2012). HDI values for all available countries were gathered the from United Nations Development Program repository for the 1980–2006 time frame[11]. The authors acknowledge that by using the HDI as a measure of a country's development some more complex dimensions (e.g., cultural, political) might be overlooked. On the other hand HDI has been reported to play an important role in raising the political profile of general health and educational policies (Atkinson et al., 1997). Further, the HDI has been consistently used by the United Nations Development Programme (UNDP) as a reference metric to compare social and economic development within and between countries across time. The statistical approach to evaluate the temporal dynamics of the HDI is detailed in Costa et al. (2011) and brief summarized below.

The evolution of HDI values in the future can be described by a logistic regression (Hosmer and Lemeshow, 2000). This choice is supported by the fact that the HDI is bounded to $0 \leq d_{i,t} \leq 1$ and that the high HDI countries develop slowly. Therefore, we fit for each country separately

Equation 1

$$\tilde{d}_{i,t} = \frac{1}{1 + \mathrm{e}^{-a_i t + b_i}}$$

to the available data (obtaining the parameters a_i and b_i), whereas we only take into account those countries for which we have at least 4 measurement points, which leads to regressions for 147 countries out of 173 in our data set. Basically, a_i quantifies how fast a country develops and

10 fraction of population living below the poverty-line taken from the CIA fact book www.cia.gov/library/publications/the-world-factbook

11 A note should be made that the HDI used in this report was calculated with the UNDP methodology of 2009. The raw indicators used in the new methodology have remained nevertheless unaltered and human development is measured as a function of of a country achievements in three broad indicators, GDP per capita, literacy rate and enrollment, and life expectancy.

b_i represents when the development takes place. Thus $a_i t - b_i$ expresses the time dimension in Figure 10.

Figure 10: HDI values are plotted for each country by using a time transformation so that HDI values of all countries (open circles) fall within their spreading on the curve which is used to fit the data.

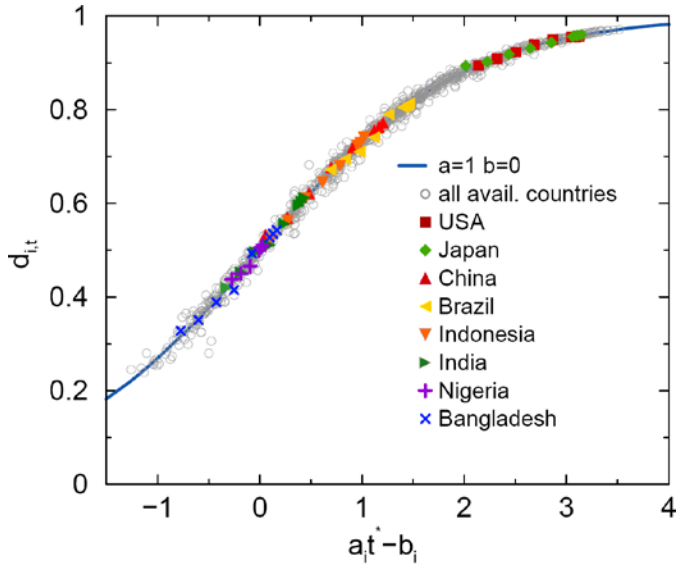


Figure 10 shows a so-called collapse of the past HDI as obtained from the logistic regression. It illustrates how the countries have been developing in the scope of this approach. Based on the obtained parameters, a_i and b_i, we estimate the future HDI of each country assuming similar development trajectories as in the past. The logistic regression, (Equation 1), is in physics also known as Fermi-Dirac distribution. It comprises three distinct points. The inflection point is located at $t=0$ and $d=0.5$ for $a_i=1$ and $bi=0$. Two other distinct points are those of maximum or minimum curvature. They are located at $t= - ln(2\pm\sqrt{3})$ and $t= - ln(3\pm\sqrt{3})$[1], i.e. $d\approx0.21$ and $d\approx0.79$. Accordingly, from a geometrical point of view, $d^*=0.8$ appears to be a reasonable threshold for HDI (per definition an OECD country exists above 0.8). Beyond this threshold value the development of the HDI starts to saturate, meaning that as time goes by the gains in HDI become smaller and smaller. In opposition, substantial gains in human development during small time frames are common for HDI values blow 0.8.

In this light, if a country possesses an HDI score equal or greater than 0.8 it is assumed that a country's financial, social and knowledge capacities provide an adequate basis for climate change adaptation to be implemented. This does not mean that adaptation to climate change should not take place for countries whose HDI trails below 0.8. It just implies that once the basic development achievements of a country are fulfilled the chances for adequate adaptation response to climate change are higher. Projections of HDI are conducted until the year 2050 but not beyond. While modeling bio-physical changes such as temperature can robustly be done for longer time scales, projecting socio-economic development is highly conditional to dimensions that cannot be fully anticipated (e.g., political, economic). To assess how long-term socio-economic dimension can develop it would require performing a scenario exploration for the countries in question.

4.6.2 Institutional deficiencies

We now arrive to the task of evaluating the institutional capacities of countries in implementing adaptation measures. This task can be related to the discussion in Section 5.6.1 where the overall adaptive capacity of countries is investigated. On the other hand, the knowledge and financial dimensions are not the only determinants of adaptive capacity of countries. One also needs to account for the fact that the existence of institutional barriers has a substantial effect on the adaptive capacity of individuals (Jones and Boyd, 2011).

In this report institutions are defined as "persistent, reasonably predictable arrangement, law, process, custom or organization structuring aspects of the political, social, cultural or economic transactions and relationships in a society" in accordance with Barnett and Adger (2007). Institutions can be further divided into formal and informal institutions. Formal institutions include: constitutions, rules and laws, formal government organizations and structures while informal institutions refer to social networks, behavioral norms and codes of conduct. In this work the main concern is on the quantification of the deficiencies regarding formal institutions in case study countries. It is noted, nevertheless, that the aspect of informality might be important in the context of developing countries as a complement to the lack of robust formal institutions. An artificial – but operationally useful – division is made regarding the formal institutional capacities of countries, see Table 5. The division consists in separating indicators that describe the efficient functioning of institutions and indicators that are more closely related with the implementation of environmental policies.

The starting point to evaluate the overall institutional deficiencies is to make use of indicators of good governance. Good governance implies the existence of both effective political institutions and the responsible use of political power and management of public resources by the state. Adger (2003) points out that good governance is an important factor of adaptive capacity, because it highlights the capacities of a state to provide social services, such as health care, education, and open spaces for development. Good governance strengthens human capital and the construction of a resilient social system, see Adger (2003). For this purpose we make use of the Good Governance aggregated indicator constructed in the context of the Worldwide Governance Indicators (WGI) project, see Table 5 for details.

Table 5: Set of indicators used to capture the institutional deficiencies of countries.

Indicator	Definition	Source
Good governance, aggregate indicator	This indicator attempts to capture the complex and multifaceted aspect of governance as a composite index based on six dimensions of governance. (1) Political stability (2) Government effectiveness (3) Regulatory quality (4) Rule of law (5) voice and accountability (6) Corruption Each of these dimensions is equally weighted in the indicator and normalized from 0 to1	The Worldwide Governance Indicators (WGI) project[12]
Enviromental policy, in particular:		
Does the government have an environmental protection strategy?	From 1 (poor environmental strategy) to 4 (good environmental strategy))	Institutional Profiles Database (IPD)[13]
Is government action guided by a long term strategic vision?	From 1 (poor long-term vision) to 4 (strong long-term vision)	

In the particular context of climate change, it is relevant to evaluate not only the overall institutional capacity of a country (measured by the Good Governance indicator) but also to what extent current institutions are able to reach objectives in the field of environmental policy. It is assumed that if a country possesses an environmental policy based on a long term strategy, then the country in question is more capable to adapt to climate change than a country with a short term of inexistent environmental policy. Adapting to climate change challenge is most meaningful in discussions focused on long-term planning (Adger et al., 2005). This is of course a deductive assumption that carries the usual drawbacks. In this work, the Good Governance indicator is backed up with information on the state of environmental protection strategies gathered from the Institutional Profiles Database (IPD), see Table 5 for details.

The problem with almost any kind of indicator – in particular for such subjective indicators like good governance – is to find a reference value to which allows the definition of a coordinate system for comparison. In order to find this reference value the indicators proposed in Table 5 were gathered for all available countries and combined with their respective HDI score. The average indicator score for countries with HDI equal or above 0.8 (rationale for this choice is explained in Section 5.6.1) was averaged and the standard deviation calculated. Finally, the arithmetic distance between the institutional indicators for each case study country and the average indicator score of developed (= 0.8) countries is determined. This method assumes that institutional settings of developed countries provide so far the best adaptive capacity to cope with climate change. It is not intended by this exercise to convey the idea that developing

[12] Taken from http://info.worldbank.org

[13] Taken from http://www.cepii.fr

countries should mimic the institutional settings of developed countries in order to enhance their adaptive capacity. What is meant is that a similar score of "government effectiveness" as observed in developed countries is a step to improve their adaptive capacity. The institutional settings via which this score is achieved are not for us to judge.

5 Results

5.1 Timing and costs of Logical Adaptation Processes

In this section the three resulting LAP's and their respective adaptation pathways will be presented. Three general points should be mentioned regarding the number of projects available within the CI:grasp database. The first is that the number of projects dealing with coastal and city adaptation is considerably smaller than the project entries targeting the agricultural sector. This reflects at some extent the relative importance given to adaptation in agricultural systems as one of the most pressing needs within developing countries in the moment. Due to the scarce number of adaptation projects targeted at the coastal sector the corresponding LAP's comprise only one pathway, while the LAP constructed for agricultural systems comprises three. The second aspect is related to adaptation of human population. Since human population is not a sector within the CI:grasp platform, adaptation projects targeted at the urban sector are used as proxy. In this case the number of project entries is rather limited implying that in some cases the pathways make use of average time and costs from equivalent adaptation phases for coastal or agricultural systems. Also in this case only one adaptation pathway is formulated. The last point has to do with the heterogeneity of currencies used to report the cost of each project entry. All costs were therefore harmonized to US Dollars (USD, 25/06/2011) according to the conversion factors of 1.60, 1.37, 0.01 and 1.06 in case of British pound sterling (GBP), Euro (EUR), Japaneses Yen (JPY) and Swiss Franc (CHF) respectively.

5.1.1 LAP for agricultural systems

Table 6 summarizes the time and monetary efforts required for the fulfillment of each pathway of the LAP for agricultural systems. The soil conservation pathway starts with the need for technical advice before natural resource management can be approached in an effective way it is noteworthy to say that in this path the phase of understanding is not considered. Usually soil conservation techniques do not require expert knowledge and often regarded as no-regret measures implying that there is not much research needed to justify their implementation. Communication is used to reflect that widespread knowledge about how to implement the techniques is needed. According to our analysis, communication projects in agricultural sector were observed to be on average comparatively cheap – about half of the annual costs (about 200.000 USD) when compared with research activities (about 400.000 USD). All cost numbers are presented as rounded averages.

Table 6: Costs and timing of the Logical Adaptation Process in agricultural systems.

Pathway	Understanding	Planning	Managing
Soil conservation		**Communication** 4 years 200.000USD/yr	**Resource Management** 5 years (according to impact)
Irrigation	**Research** 2 years 400.000USD/yr	**Training** 2 years 300.000USD/yr	**Infrastructure** 3 years (according to impact)
Crop changes	**Research** 2 years 400.000USD/yr	**Incentives** 2 years (according to impact)	**Technical Advice** 5 years (according to impact)

The Soil Conservation pathway in agricultural systems to climate change is revealed to be a rather complex pathway in which all phases of adaptation need to be considered. The starting point is the elaboration of research in order to evaluate for example which crops will suffer from higher losses and which can possibly benefit from climate change. Once the knowledge from and to which crops a change is possible, incentive schemes to support farmers to make the change are required together with technical advice.

5.1.2 LAP for coastal zones and population

Unlike the LAP for agriculture adaptation pathways for sea-level rise and population are restricted to only one. Typically in literature the adaptation options of coastal regions to sea-level rise are usually classified according to three broad points of view: i) protection, ii) accommodation, and iii) retreat (Klein et al., 2001). The focus of this categorization can be understood as a "holding the line" via dike construction and beach nourishment or as "managed retreat" that results in the re-location of infrastructure currently located in flood prone areas. The usual categorization misses, nevertheless, an important aspect. This is that developing countries are currently experiencing some of the highest urbanization rates recorded (Yin et al., 2011; Martinez et al., 2007; Tu and Nitivattananon, 2011) meaning that a substantial amount of (protection) infrastructure in the coastal zones will be added in the coming decades.

Table 7: Costs and timing of the Logical Adaptation Process in coastal and human systems.

Pathway	Understanding	Planning	Managing
Land-use planning	**Research** 2 years 400.000USD/yr		**Regulatory** 8 years (according to impact)

The pathway land-use planning (see Table 7) addresses the need for timely land-use planning. To examine this path any given country would first need to conduct appropriate research on the amount of urbanization expected in a certain region, compile current infrastructure information, and assess the regional or local variation on long-term sea-level rise. For our analysis this is ensured by conducting research for an average time of 2 years with annual costs of about 400.000 USD. Once the dynamics of urbanization is understood and sea-level scenarios developed, regulatory measures defining urbanization constraints can be implemented. Unlike research that can be performed within a relatively small time frame, implementing regulatory measures targeting future sea-level rise need longer implementation times. In our case approximately 8 years are estimated. The annual costs will depend on the amount of impacts and urbanization expected. In total the pathway is expected to last at least 10 years.

Also for the case of adaptation to increased heat-stress the CI:grasp revealed to be deficient to derive multiple adaptation pathways. In this sense we take also land-use planning as the expropriate pathway for adaptation of population to heat-stress. The land-use planning pathway starts with the need for research to determine particular sensitive population, calculate country-specific heat- mortality thresholds and assessing demographic changes for the region of interest – lasting approximately 2 years. After the knowledge is gathered the planning and managing phases can start. These are expected to last for about 8 years. Information on costs for the research phase is taken from the LAP for agricultural systems.

5.2 Financial efforts for adaptation in agricultural systems

Impacts of climate change in agriculture are often mentioned to be substantial, especially in the case of developing countries (World Bank, 2010). Considering past empirical data on crop yield and observed climate variation, Lobell et al. (2011) found that in the cropping regions and growing seasons of most countries (except in the United States) temperature trends from 1980 to 2008 exceeded one standard deviation of historic year-to-year variability (Lobell et al., 2011). Models that link yields of the four largest commodity crops to weather variations indicate that global maize and wheat production declined by 3.8 and 5.5% between 1980 and 2008, respectively, relative to a counter factual without climate trends. In some countries, climate trends were large enough to offset a significant portion of the increases in average yields that arose from technology, carbon dioxide fertilization, and other factors (Lobell et al., 2011).

In line with what was previously observed, Mendelsohn (2007) has examined the impact on agriculture of the climate change which has already taken place between 1960 and 2000. Temperature and precipitation changes together have caused estimated global impacts ranging from a loss of 0.05% to a gain of 0.9% per year of agricultural GDP. Given the rapid increase in agricultural production over the last 40 years, the contribution of climate change to the overall growth of agriculture has been small, contributing in total between 2.6% and 5.4% of overall growth.

5.2.1 Current dependencies between yield and climate in case study countries

The starting point of our analysis was to first evaluate what are the current dependencies between agricultural output – here illustrated by the usage of yield values – and the climatic variables of temperature and precipitation. Data on monthly temperature and precipitation and yield values from the time period 1960-2000 were applied for a correlation analysis. Details on methodological aspects can be found in Section 5.3. For each country the dependencies between climate and yield were evaluated for three crops, e.g. rice, maize and wheat. Wheat (*Triticum aestivum L.*), rice (*Oryza sativa L.*), and maize (*Zea mays L.*) provide about two-thirds of all energy in human diets and represent the foundation of human food supply (Cassman, 1999). Table 8 to Table 10 provide the correlation coefficients from the statistical analyses together with information on the months used for the fit.

Table 8: Correlation results between detrended climatic variable of temperature and precipitation and rice yields in case study countries. All correlation below 5% explained variability (R^2) was not considered. NS stands that climate variable was above 0.15 significance level for the fit.

Country	R^2		*pvalue*		Months	
	Prec.	Temp.	Prec.	Temp.	Prec.	Temp.
Brazil	0.37	-0.10	<0.001	<0.01	Jan-May	Jan-May
Cambodia	0.20	NS	<0.01	NS	Jun-Oct	
Ethiopia	0.27	NS	0.13	NS	Annual	
Nicaragua	NS	0.07	NS	<0.05		Jan-Mar
India	0.47	-0.15	<0.001	<0.05	Jun-Aug	Jan-Feb;Aug-Sep
The Philippines	NS	-0.20	NS	<0.01		Jul-Sep
South Africa	0.33	0.29	<0.05	<0.05	Dec	Jan-Mar

Table 9: Correlation results between detrended climatic variable of temperature and precipitation and maize yields in case study countries. All correlation below 5% explained variability (R^2) was not considered. NS stands that climate variable was above 0.15 significance level for the fit.

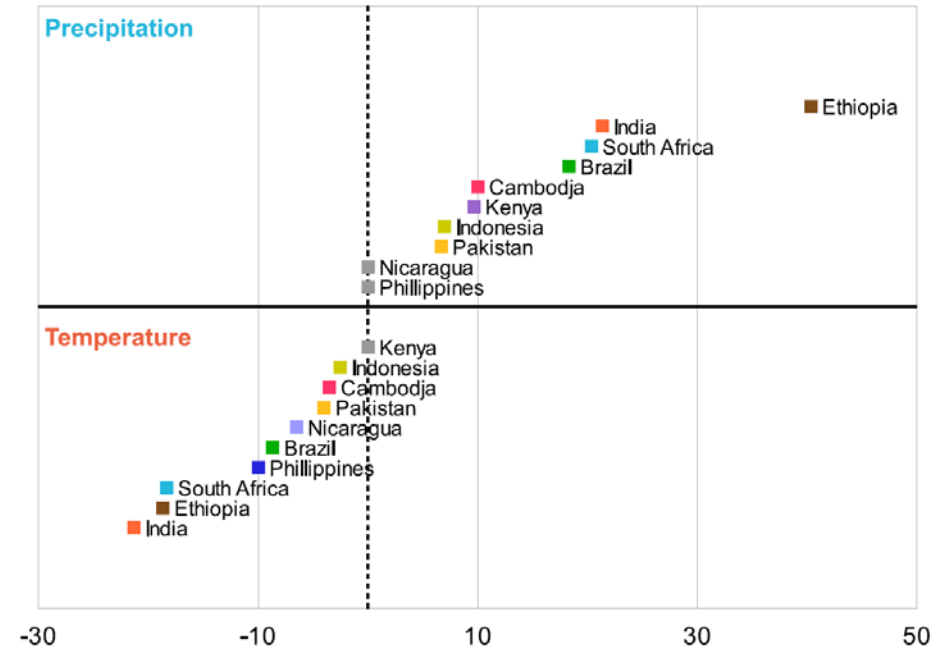
Country	R^2		*pvalue*		Months	
	Prec.	Temp.	Prec.	Temp.	Prec.	Temp.
Brazil	0.05	0.06	<0.05	<0.1	Nov-Dec	Jun-Aug
Cambodia	NS	-0.07	NS	<0.1		May-Sep
Ethiopia	0.62	-0.56	<0.05	<0.05	Jun-Sep	Apr-May
Nicaragua	NS	-0.20	NS	<0.01		Jul-Sep
India	0.17	-0.24	<0.01	<0.01	Sep	Sep
Indonesia	0.14	-0.05	<0.01	<0.1	Jul-Aug:Nov-Dec	Annual
Kenya	0.16	NS	<0.01	NS	Annual	
Pakistan	0.20	NS	<0.01	NS	Aug-Sep	
South Africa	0.28	-0.52	<0.05	<0.01	Feb-Mar	Feb-MAr

Table 10: Correlation results between detrended climatic variable of temperature and precipitation and wheat maize yields in case study countries. All correlation below 5% explained variability (R^2) was not considered. NS stands that climate variable was above 0.15 significance level for the fit.

Country	R^2		*pvalue*		Months	
	Prec.	Temp.	Prec.	Temp.	Prec.	Temp.
Brazil	0.11	-0.22	<0.05	<0.01	May	Jun-Sep
Ethiopia	0.32	NS	<0.1	NS	Mar-Apr	
India	NA	-0.25	NS	<0.01		Jan-Mar
Kenya	0.13	NS	<0.05	NS	Jul-Sep	
Pakistan	NS	-0.12	NS	<0.05		Feb-Aug
South Africa	NS	-0.31	NS	<0.05		Aug-Sep

Figure 11 summarizes the overall dependency of agricultural production in the case-study countries to observed climate variation. In the figure the explained variability of all crops is averaged in a single value meaning that some of the variation is masked. For the complete disaggregated analysis of the climatic dependency in yields for individual crops please confer Figure 26 to Figure 28 in the Annex. The x-axis in Figure 11 represents the average amount of explained variability in crop yields that can be attributed to intra-annual climate variations observed in the country. Countries that are placed on the top-right quadrant of the graphic were found to have a positive relation between annual yields and monthly precipitation. This can be interpreted in practice that if precipitation increases countries are likely to experience an average increase of expected yields. In this quadrant, Ethiopia appears as the investigated country in which precipitation has an higher effect on year-to-year yield changes (about 40% in average). The remaining countries follow an approximately linear relation regarding their crop dependency on precipitation – decreasing from about 20% in India to 6% in Pakistan. Under our approach, monthly average precipitation was found to have a little significant role in the agricultural production of counties like Nicaragua and the Philippines.

Figure 11: Average fraction (%) of inter-annual variability of crop yields explained by average precipitation (top) and temperature (down) in best fitting months. Grey boxes represent countries for which the independent climate variables studied have not returned a significant p-value or the amount of explained variability was below 5% of yield variation.



The relation between monthly temperature and yields (left-bottom quadrant) follows a different dynamic than the one observed for precipitation. In this case a positive deviation of temperature leads in average to a negative effect on annual yields. India is the country in which agricultural yields are more dependent on temperature variation as in others by about the same extent (about 20%) of what has been observed in the case of precipitation. Except for Ethiopia, the negative dependency of yields regarding monthly temperatures is at some extent comparable to the positive effect of precipitation. A country experiencing an average increase in temperature could, in theory, compensate its losses due to increasing temperature if precipitation values increase. The most critical situation will occur in countries that expect an increase of temperature and simultaneously a decrease of precipitation. This scenario is of course contingent to the respective magnitudes of change of climatic variables. Monthly temperature and precipitation projections of the best fitting months in each country are calculated using a total of 8 GCM's. The results are used as the independent variable in the functions to estimate the future variation of agricultural yields. The results will be used as the primary tool to determine which adaptation pathway/s seems more rational in the context of a particular country.

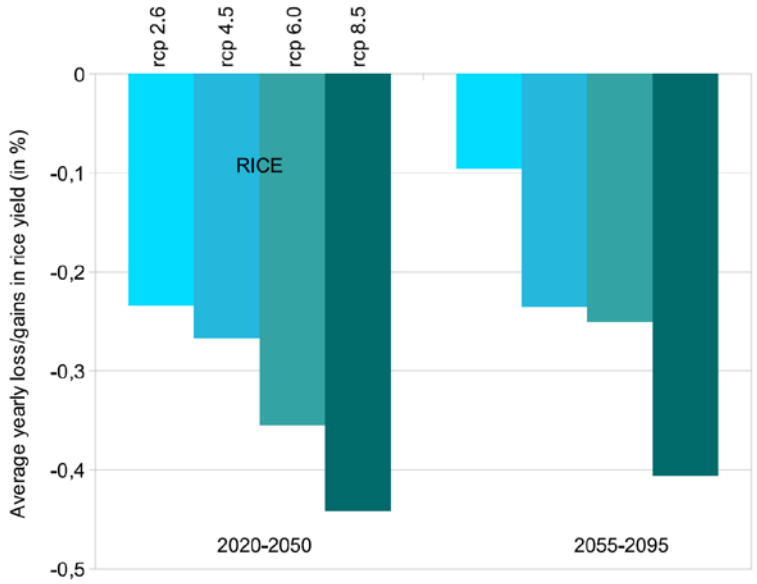
5.2.2 Future yield losses/gains under climate change

In the previous section it was estimated to what extent particular crop yields are dependent on year-to-year variations of temperature and precipitation. The dependencies were quantified and temperature and precipitation projections employed to estimate potential losses/gains of yield crops under a changing climate. The full results of this analysis can be found in Table 32 to Table 34 of the Annex for the time periods of 2015-2050 and 2055-2095 – all values expressed

in yearly averages. In order to make clear how adaptation pathways are selected with base on the potential losses/gains of yield crops under a changing climate let us focus our attention in three particular cases.

Let us start with the case of Philippines whose average yearly losses for rice are shown in Figure 12. According to the methodology adopted in this report an average decrease of rice yields for the time frame 2020-2055 is expected for the Philippines. Depending on the RCP followed, the average decrease was found to be bounded between about 0.2 and 0.4% a year for RCP2.6 and RCP8.5 respectively. This implies roughly a 7 to 12% loss of rice yields until mid-century. The loss pattern is maintained in the second time frame (2055-2095) of investigation by approximately same proportion. The loss is driven by a generalized increase of temperature projected for the Philippines and the apparent low significance of precipitation in compensating potential losses, see Figure 10.

Figure 12: Average yearly losses for rice crop in the Philippines between 2020-2050 and 2055-2095 for all scenarios.



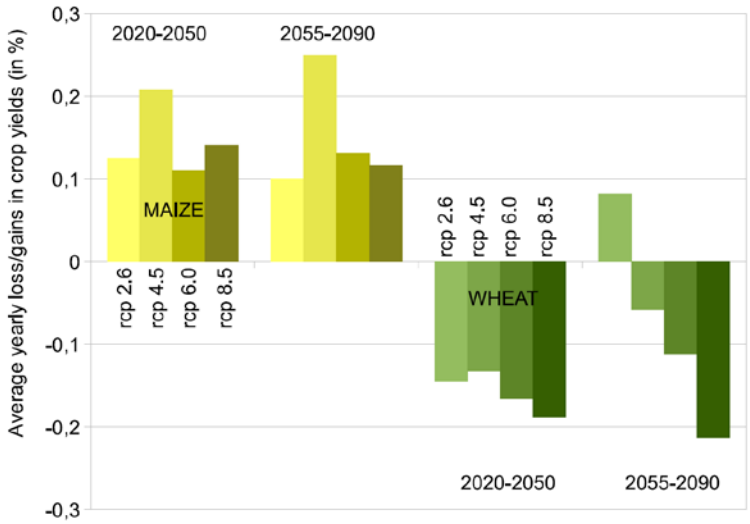
Rice crops in the Philippines were by far the most climate sensitive in our analysis while the contribution of climate in the yield variation of the remaining investigated crops was found to be non significant at national level. A priory all adaptation pathways in the LAP for agricultural systems are open possibilities to adapt rice production in the Philippines. We opted nevertheless to prioritize some adaptation pathways in detriment of other according to the future insights provided by climate models. For the Philippines the pathway soil conservation is prioritized during the first time frame of analysis, while the pathway irrigation is preferred during the second time frame. Let us further explain why this decision was made.

To start with, there can be some reluctance in employing cost intensive adaptation measures (e.g., irrigation infrastructure), while climate impacts are not fully perceived or felt. In addition, committing expensive infrastructure in the context of high climatic uncertainty can be economically irrational. Although economic and time dimensions are certainly relevant, they are not the only factors relevant to a decision. One additional aspect is to investigate the technical constraints of particular adaptation options. An examination of specialized literature investigating potential yields gains from the implementation of soil conservation techniques reveled that 21% of maize yield losses can be avoided by soil-erosion control techniques in the central highlands of Kenya (Mutegi et al., 2008) (between 2001 and 2003) and about 26% for Sub-Saharan Africa (Obalum et al., 2012). For the case of wheat, gains of about 21% (between

2001 and 2005) in yields were recorded when no-till with plastic film mulch treatment is applied rather than conventional tillage in the western Loess Plateau of China (Huang et al., 2008). Finally, for the case of rice a 22% (between 1987 and 1988) increase of rice yields has been observed when bunding (ridging) treatment of paddy rice was applied in comparison with non-treated plots for the Indian region of Himachal Pradesh (Pathania and Thakur, 1994).

In other words, soil conservation techniques have the potential to serve as an adaptation measure, when expected impacts remain within a tolerable range. In this case we take the range to be at about 20% for rice, wheat or maize yield. In other words, if the cumulative loss of yield within each time frame investigated is below or equal to 20%, then the LAP soil conservation can be a viable adaptation measure. Whenever the cumulative effect of climate change is higher, irrigation measures will be applied. As observed, for the case of the Philippines, worst case cumulative losses in the first time frame of investigation where placed at about 14%. This is within the range for which it is assumed that soil conservation techniques are able to offset climate impacts. The situation is distinct for Pakistan as expressed in Figure 13. According to the methodology developed, the results for Pakistan reveal distinct impacts depending if one focus on the crop or maize or wheat. During the first time-frame of investigation (2020-2050) annual wheat yield reductions between 0.1 and 0.2% are expected. Under RCP2.6 (strong mitigation) a recovery of wheat yields is observed during the second time frame of investigation. Also distinguishing the Pakistan case are the apparent gains in maize yields in about the same proportion as the losses expected for the case of wheat. When considering which adaptation pathway Pakistan could follow, it is necessary to look at the specificities of the country in question. Once again all pathways could be an option but a small examination of the irrigation system in Pakistan would reveal that approximately 93%[14] of agricultural land is already subjected to irrigation. Since the gains and losses of the crops in question roughly unfold in the same proportion, crop changes pathway is prioritized in both time frames of investigation.

Figure 13: Average yearly losses/gains for maize and wheat crops in Pakistan between 2020-2050 and 2055-2095 for all scenarios.

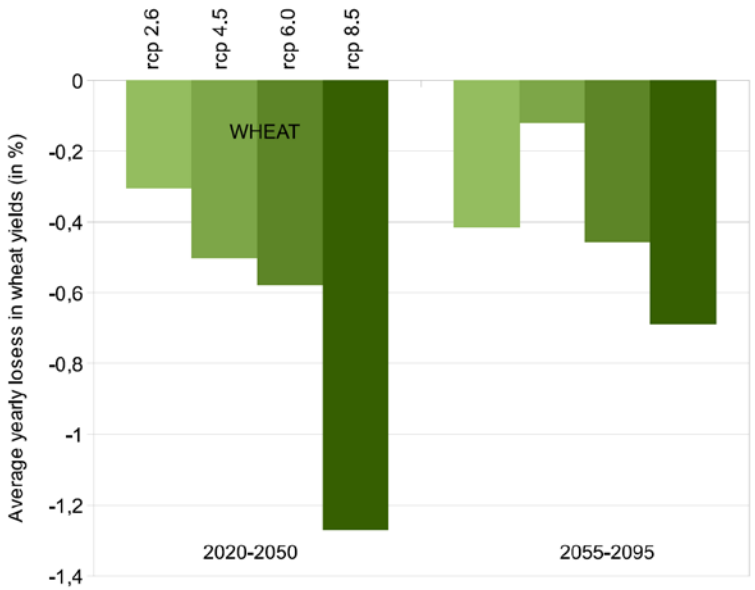


[14] Average yearly losses/gains for maize and wheat crops in Pakistan between 2020-2050 and 2055-2095 for all scenarios.

At this point the reader might notice the nearly complete disregard of the irrigation pathway. This pathway is not fully excluded since there are cases in which yield losses are expected to be so substantial that the soil conservation and crop changes pathways will have to be complemented by more "hard" adaptation measures. To illustrate such situation consider the expected wheat yield losses for the case of South Africa as shown in Figure 13.

Unlike the two previously described cases in which cumulative yield losses did not transgress the mark of 20% during both time frames of investigation, for South Africa average annual yield losses of wheat are expected to be bounded between 0.3 and 1.3% per year between 2015 and 2050. The sensitivity of South Africa to the RCP choice appears to be considerable. Expected losses for RCP8.5 are approximately double the losses expected for RCP6.0. Under our strict assumptions, by 2050 cumulative losses of wheat yield could reach approximately 30% of the 2009 yield numbers. For the second time period of investigation, yield seems to recover slightly with losses bounded between 0.1 and 0.7% per year. Because of the substantial yield losses, the irrigation pathway appears to be meaningful in the case of agricultural adaptation to climate change in South Africa. In addition, South Africa is a comparatively "rich" country in the set of selected case studies, meaning that more expensive adaptation options can in principle be taken into account. Although the magnitude of losses appears to call for more extreme measures, the substantial dependency of impacts on particular scenarios make the option for irrigation a risky one. Imagine implementing irrigation measures using RCP8.5 as reference and by 2050 realizing that RCP4.5 (under which projected losses are less than half of the ones in RCP8.5) is the scenario closer to the reality. These important pathways dependencies remain to be explored in future work.

Figure 14: Average yearly losses in % for wheat crop in South Africa between 2020-2050 and 2055-2095 for all scenarios.



In order to diversify the risk and improve the chances of success, the irrigation pathway needs to be complemented with others. In the particular case of South Africa all three pathways are at some extent necessary. The Soil conservation pathway will offset a substantial fraction of the impacts, making the irrigation pathway less capital intensive. Crop changes are additionally employed in order to take advantage of the expected increase in rice yields, see Table 32 in the Annex.

It was so far explained the logic behind choosing the appropriate adaptation pathways for a particular set of examples. The same exercise was made for the full set of investigated countries taking into account the economic capacity of the countries, the impact heterogeneity of climate scenarios, the technical feasibility of some adaptation measures and the particularities (such as the extent of irrigation) of investigated agricultural systems. In Table 11 the reader can find the summary of the expected impacts of climate change on yield losses/gains and the chosen adaptation pathways for all case-study countries. Finally, it is worth to mentioning that the logic used to select adaptation pathways are of course subjective (although not entirely) and a matter of further discussion.

5.2.3 Costs of adaptation

Once the adaptation pathways are defined one can start estimating the financial efforts to implement them. As it holds for any economic valuation of adaptation measures, the monetary values obtained by this study result from the application of rather weak assumptions. For sake of clarity the main assumptions are discussed.

Starting with the soil conservation pathway the monetary costs of the implementation part are derived according to the impact on yield losses translated into its monetary dimension by multiplying tons of crop lost by USD per ton paid to the producer (2005–2010 average). Pimentel et al. (1995) calculated the cost benefit ratio of implementing soil erosion control and conservation measures as approximately 1 to about 5.2 of investment made. This ratio is applied to the monetary value of crop loss due to climate change in order to derive the costs of the implementation phase of the soil conservation pathway. It is also assumed, in line with literature (see previous section), that soil conservation measures can increase yields by about 20%. Cumulative yield losses over the investigated time horizons that transgress such reference need to be offset by the implementation of irrigation. With regard to the irrigation pathway, the implementation phase is calculated by first determining the area extent in need of irrigation.

This is performed by calculating the extra amount of agricultural area necessary to offset the yield losses that cannot be eliminated via the implementation of the soil conservation pathway. The additional crop area required is then multiplied an indicative value of setting up irrigation schemes per ha taken from the FAO AQUASTAT database. For the purposes of this study an indicative value of 1800 USD per ha is used. This value reflects the mean value found across Brazil, Cambodia, Kenya, Ethiopia, India, Philippines and Indonesia[15].

Table 11: Country specific impacts of climate change in crop yields and adaptation pathways prioritized.

Country	Rice	Maize	Weat	Pathway
Brazil	Moderate losses according to all scenarios except RCP 4.6.	Moderate gains according to all scenarios.	Substantial losses in all scenarios except RCP2.6 that results in almost no change.	Crop changes from rice to maize, irrigation of wheat, soil conservation of wheat crop.

[15] FAO AQUASTAT http://www.fao.org/nr/water/aquastat

Country	Rice	Maize	Weat	Pathway
Cambodia	Moderate gains in all scenarios.	Substantial losses in all scenarios. Slight recovery in late century under RCP2.6.		Crop changes from maize to rice and irrigation of maize.
Ethiopia	Substantial losses of rice yield under all RCP's.	Substantial losses of maize yield under all RCP's.	Moderate gains of wheat in all RCP's.	Crop changes from rice to wheat, conservation and irrigation of maize.
Nicaragua		Moderate losses of maize according to all scenarios.		Changes from maize to either rice or wheat.
India	Moderate losses of rice yield for all scenarios except for late century under RCP2.6.	Moderate losses of maize yield for all scenarios except under RCP2.6.	Moderate losses of wheat.	Soil conservation and irrigation of all crops.
Indonesia		Moderate losses of maize in the near (2020-2050) future according to all scenarios.		Soil conservation of wheat.
Kenya		Moderate losses of maize yields for all RCP's.	Moderate gains of wheat yields in all RCP's.	Crop changes from maize to wheat.
Pakistan		Moderate gains in maize according to all scenarios.	Moderate losses of wheat in all scenarios.	Crop change from maize to wheat.
The Philippines	Moderate losses in rice according to all scenarios.			Soil conservation on rice crops.
South Africa	Moderate gains in rice yields for all scenarios.	Substantial losses in maize according to all scenarios except RCP2.6.	Moderate losses in wheat according to all scenarios.	Soil conservation in wheat and maize crops. Irrigation of maize.

Finally, with regard to the crop change pathway the costs with the implementation phase are equal to the monetary value of a crop expected to be loss. This value is assumed to be necessary in compensating farmers so they engage on changes to a less climate sensitive crop. It needs to be said that for this path the costs of technical advice will be disregarded and only the costs of research and incentives are considered. The reason for such is that it was not possible to develop a sound methodology to account for the costs of implementing technical advice. In this sense the planning phase of the crop change pathway will be extended to last for the five years primarily allocated for technical advice. Table 12and Table 13 summarize the necessary economic efforts for adapting agricultural systems in the case-study countries according to the economic assumptions and impact methodologies developed.

Table 12: Costs per year for each considered pathway in the LAP of agricultural systems. Values in million USD.

Country	2015-2050	2055-2095
Brazil		
Soil Conservation		
RCP2.6	0.2	0.3
RCP4.5	0.7	0.3
RCP6.0	0.4	3.4
RCP8.5	3.2	6.7
Irrigation		
RCP2.6	0.8	1.7
RCP4.5	8.0	1.8
RCP6.0	4.5	52.1
RCP8.5	49.3	105.2
Crop Change		
RCP2.6	2.9	42.1
RCP4.5	8.7	789.0
RCP6.0	3.9	514.7
RCP8.5	11.4	968.6
South Africa		
Soil Conservation		
RCP2.6	0.3	0.3
RCP4.5	0.9	0.3
RCP6.0	1.1	4.4
RCP8.5	7.2	5.2
Irrigation		
RCP2.6	6.7	1.9
RCP4.5	10.4	5.6
RCP6.0	11.1	21.0
RCP8.5	24.0	22.7
Pakistan		
Crop Change		
RCP2.6	68.4	38.3
RCP4.5	63.0	27.4
RCP6.0	78.5	52.0
RCP8.5	89.0	98.3
Ethiopia		
Soil Conservation		
RCP2.6	0.7	0.2
RCP4.5	2.2	4.3
RCP6.0	1.7	0.4

Country	2015-2050	2055-2095
RCP8.5	0.5	2.1
Irrigation		
RCP2.6	1.6	1.6
RCP4.5	4.5	9.6
RCP6.0	3.5	1.1
RCP8.5	1.3	4.9
Crop Change		
RCP2.6	0.2	0.2
RCP4.5	0.3	0.3
RCP6.0	0.2	0.3
RCP8.5	0.3	0.3
Cambodia		
Crop Change		
RCP2.6	1.4	1.0
RCP4.5	1.6	1.4
RCP6.0	1.9	2.4
RCP8.5	2.1	3.5
Irrigation		
RCP2.6	2.8	1.2
RCP4.5	3.2	2.0
RCP6.0	3.9	4.1
RCP8.5	4.3	6.3
Kenya		
Crop Change		
RCP2.6	3.1	3.2
RCP4.5	9.2	9.2
RCP6.0	27.6	14.0
RCP8.5	18.7	21.2
India		
Soil Conservation		
RCP2.6	2.5	1.6
RCP4.5	3.3	2.4
RCP6.0	1.9	3.8
RCP8.5	3.4	2.5
Irrigation		
RCP2.6	29.5	18.2
RCP4.5	37.3	25.4
RCP6.0	22.9	46.7
RCP8.5	33.5	29.9

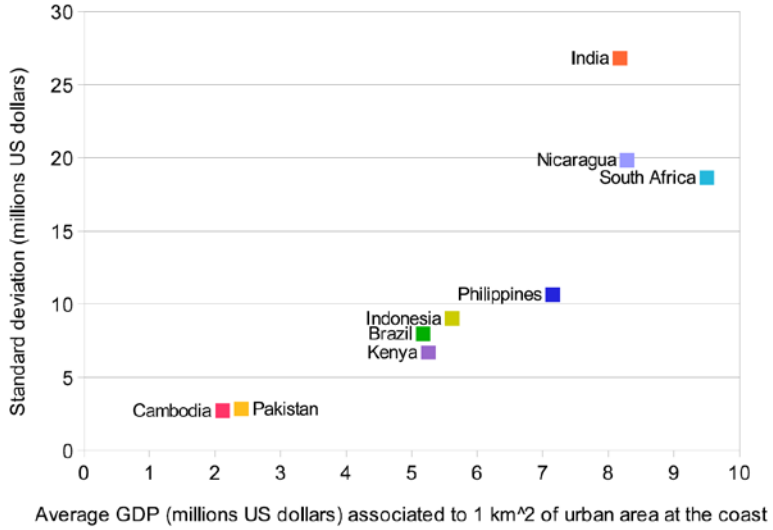
Country	2015-2050	2055-2095
Indonesia		
Soil Conservation		
RCP2.6	0.6	0.4
RCP4.5	1.6	0.3
RCP6.0	16.	1.4
RCP8.5	1.5	2.3
The Philippines		
Soil Conservation		
RCP2.6	2.5	1.7
RCP4.5	2.6	2.8
RCP6.0	2.4	2.8
RCP8.5	1.9	2.4

5.3 Financial efforts for adaptation on coastal systems

5.3.1 Current sensitivity of investigated coastal zones

The current sensitivity of the coastal zones in case-study countries was determined by evaluating the average GDP (in millions USD) associated with 1 km2 of urban area located next to the coastline (consult Section 5.4 for methodological details). Figure 15 provides a first idea of the extent and distribution of GDP associated with urban areas located at the coast. Beyond the obvious result that countries are massively different in terms of GDP associated with urban areas, it is also valuable to note that the distribution of this GDP can be more or less heterogeneous within a country's coastal zone. On the y-axis of Figure 15 the standard deviation of GDP associated with coastal urban areas within one country is shown.

Figure 15 - Average GDP per square kilometer of urban area and associated standard deviation in the investigated countries. Note that Ethiopia is a landlocked country and therefore absent from the analysis.



As an example we discuss the countries of Philippines and India in Figure 15. Although the average GDP associated with one square kilometer of coastal area is approximately the same (7–8 millions USD) the distribution along the coastal zone is remarkably different between both countries. The standard deviation of India's GDP associated with urban areas at the coast is about the three times that found in the Philippines. This indicates that India possesses a far more heterogeneous distribution of GDP at the coast, implying, for example, the existence of GDP "hotspots" associated with urban areas. In case of Indonesia, Brazil and Kenya (5–6 millions USD) the average amount of GDP associated with urban areas and the dispersion of this GDP within the coastal zone is rather similar and considerably lower when compared with India. On the lowest end of the distribution are the countries of Cambodia and Pakistan. The comparatively lower GDP associated with coastal urban areas and its relative homogeneous distribution along the coastline is the main characteristics of these countries.

When devising possible adaptation measures, the amount of GDP associated with coastal urban areas is of particular importance since it does determine in many cases if one particular segment of a coastline that is worth protecting. On the other hand if GDP associated with urban areas is one important parameter to account for, it is now relevant to evaluate potential changes in the coastal urban extent of the investigated countries. Urban expansion at the coasts leads to an exacerbation of the sensitivity of coastal systems due to the negative outcomes posed by changes in sea-level. In this work, a long term perspective on the evolution of sea-level is taken and the extent of future urban area added to the prone zone (land below 2 meter elevation and hydraulically connected to the sea, for the methodological concepts see 2.4) is evaluated.

5.3.2 Future urbanization in case study countries

To determine the future urbanization extent on the coastlines of investigated countries, information on the land use transitions from Asian-Pacific Integrated Model (AIM) was used. The AIM model is maintained at the National Institute for Environmental Studies (NIES). As mentioned earlier the land use transitions in the AIM model are driven by the RCP6.0 only. This implies that the magnitude of impacts is limited by the use of one single model. Absolute

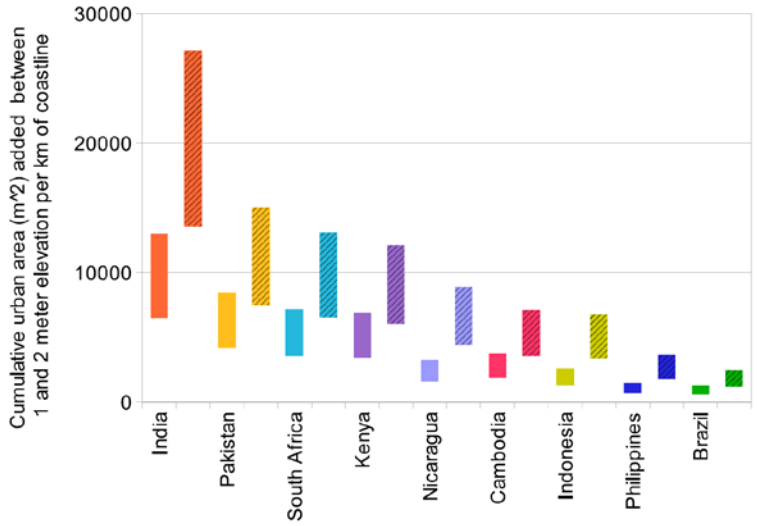
results of urban area added to the prone zone are presented in Table 14. Figure 16 illustrates the relative increase of urban area expected in both the 1 and 2 meter elevation mark per kilometer of coastline.

Table 13: Cumulative urban area in km^2 added to the prone zone of investigated countries.

Country	New expected urban area by 2050	New expected urban area by 2095
Indonesia	244.4	648.2
India	223.9	466.5
The Philippines	48.2	112.2
Brazil	42.3	80.8
South Africa	26.8	49.4
Pakistan	21.8	39.1
Kenya	10.9	19.2
Nicaragua	6.2	17.0
Cambodia	4.2	8.0

A look on the absolute values of urban area expected to be added to the prone zone would result in a ranking found in Table 14. Accordingly, Indonesia, India and the Philippines would experience the highest increase of urban area that could be subjected to increase flooding under current sea-level rise projections. This is consistent with the opinion of other authors that South-East Asia is a particular "hotspot" of potential impacts associated with sea-level (Anthoff et al., 2010). The top three countries are followed by Brazil, South Africa and Pakistan in terms of projected urban expansion at the prone zone. The countries of Kenya, Nicaragua and Cambodia are those with the lowest amount of urban area estimated to be added to the prone zone. Independent of the country, the amount of area added by the year 2050 considerably increases by 2095. In some cases the result is approximately a doubling the urban area added to the prone zone; for example in Kenya and Cambodia. The new urban area at the prone zone expected for Indonesia by 2095 is projected to be about 2.6 times the value obtained for 2050. This was observed to constitute the most extreme example of coastal urban expansion under our assumptions. For a complete view on the temporal dynamics of urban area added to the prone zone in each country please refer to Figure 34 of the Annex.

Figure 16 - Projected increase of urban area (in square meters) to be added between the 1 and 2 meter elevation mark per kilometer of coastline in the case-study countries. The hatched bars refer to cumulative urban are added to the flood prone zone by 2095, the non hatched bars refer to the same dimension but for 2050.



It is obvious that countries with longer coastlines will very likely experience higher amounts of urbanization; this is just a scaling effect. The important question to ask is how intense this urbanization will be per segment of coastline. In this sense, the total amounts of urban area added to the prone area present in Table 14 are recalculated to their relative expression regarding the full extent of coastline of case-study countries (see Figure 16). One can observe that the relative country-ranking changes when compared with Table 14. India ranks now the highest in terms of new urban area added to the prone zone for each kilometer of its coastline while Indonesia is now the last country in this ranking scheme. This highlights that although substantial (in a absolute sense), the process of coastal urbanization in Indonesia is expected to be less intense than the one in India. Countries that previously accounted for a rather low number of new urban area added to the prone zone (e.g., Kenya) are now accounted has regions in which the coastal urbanization process will be rather intense. By the end of the century (2095) the amount of urban area in the prone zone per segment of coastline in Kenya is in the same order of magnitude as the urbanization intensity expected in India by mid century (2050).

5.3.3 Costs of adaptation

In accordance with the LAP adopted for the case of coastal systems, the adaptation strategy for the case-study countries would be to avoid urbanization of low lying coastal areas. In practice this would imply to set-up policies that limit further urbanization on agricultural and pasture land (the land-use types in AIM that are expected to be converted to urban area) within the prone area. In order to do so, agricultural areas should retain their economic value, since they are usually one of the primary sources of land for urbanization (Rounsevell et al., 2006; Pijanowski and Robinson, 2011; Guan et al., 2011). In this light, land use planning should divert future urbanization pressure in coastal regions with higher terrain elevation by maintaining agriculture and pasture lands economically attractive. The effect of agricultural subsidies in the rates of urban expansion has been empirically observed in work by Seto et al. (2011). In particular, the presence of farm subsidies drives down the annual urban expansion rate by about 2.4% (Seto et al., 2011).

Table 14: Costs per year for the land-use planning pathway in the LAP of coastal systems. Values in million USD.

Country	2015-2050	2055-2095
Indonesia	10.2	14.6
India	13.5	22.1
The Philippines	2.9	3.7
Brazil	2.0	1.7
South Africa	2.2	1.7
Pakistan	0.8	0.7
Kenya	0.8	0.7
Nicaragua	0.8	1.0
Ccambodia	0.5	0.5

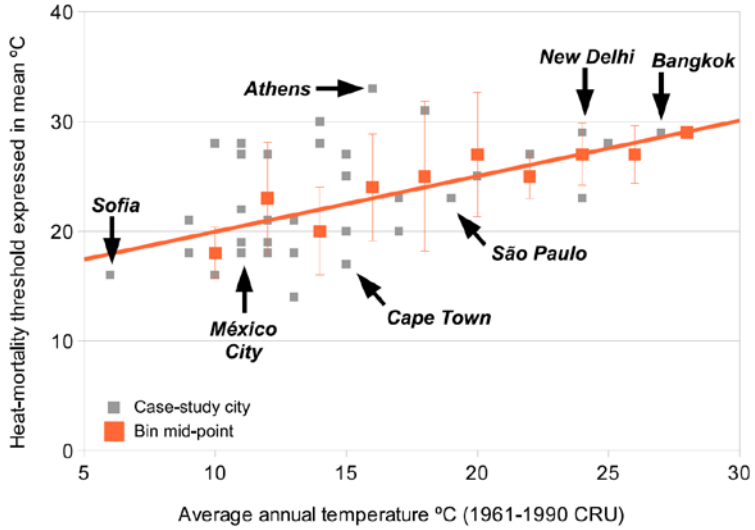
In this study it is assumed that potential damages in case of flooding of urban areas at the prone zone accounts for 50% of the urban area times its average GDP. Such assumptions are based on a review of three damage function that have evaluated the empirical relation between flood levels and the fraction of ensured value loss from buildings. The three empirical damage functions used are Dutta et al. (2003); van Eck et al. (2003); USACE (2000) and their shape is shown in Figure 35 of the Annex. In addition, the selected damage functions were acquired in different geographic and socio-economic contexts and are commonly used in flood damage case studies Jonkman et al. (2008); Dutta et al. (2003). It is assumed that the government must spend at least half of the potential damages value in incentives to agriculture and pasture land in order to avoid urbanization. Table 15 shows the yearly costs for adaptation obtained under the described methodology.

5.4 Financial efforts for adaptation of population

5.4.1 Current sensitivity of population to heat-related mortality

In line with what was accomplished during the preceding chapters also in case of urban systems, the first step is to quantitatively evaluate the current dependencies between the attribute of concern and climate variables. To achieve this task a total of 36 cities (see both Table 4 and Table 35 of the Annex) covering 15 different countries were investigated and temperature-mortality thresholds were correlated with annual mean temperature between 1961-1990 from taken from the Climate Research Unit (CRU), version TYN CY 2.0 (Mitchell et al., 2002). The resulting fitting curve is shown in Figure 17. Due to the large dispersion of values for mortality thresholds below 20 degrees of annual mean temperature, a data binning procedure was employed with breaks equal to two degrees. The binning mid-points are shown in orange in Figure 17 together with the error bars depicting the dispersion of the values in each bin. Background data for the binning procedure is represented by the gray squares. The relation between annual mean temperature and heat-mortality threshold was found to be a linear one of expression $y = 0{,}51\,x + 14{,}88$ and returning an R^2 of 0.81. There is quite a lot of dispersion for mean temperature values below 20 degrees, highlighted also by the large error bars of the bins. The dispersion decreases nevertheless as one move to higher annual temperatures. Urban areas located in higher latitudes (colder climates) have a comparatively lower heat-mortality threshold than cities located in equatorial-like latitudes (warmer climates). This demonstration of acclimatization depicts at some extent the inherent adaptability of population to the environment they live in.

Figure 17 - Relation between heat-mortality thresholds and average annual temperatures for full set of case-study cities.



The city of Sofia and the city of Bangkok bound the sample distribution between annual mean temperatures of 6 and 29 degrees respectively. Heat-mortality thresholds for these two cities are, by extension, substantially distinct. For the case of Sofia, heat-related mortality increases at mean temperatures of 15 degrees, while for Bangkok such an increase is only noted at mean temperatures around the 30 degree mark. The city of Athens appears in our sample to possess a much higher heat-mortality threshold than cities situated in warmer climates, for example New Delhi. This can be related with the effect of humidity that is not captured by purely temperature-based heat-mortality thresholds. There are studies that use apparent temperature values (which include the effect of relative humidity) to determine the heat-mortality thresholds. Unfortunately it was not possible to collect a significant number of studies to engage on a similar analysis. The mathematical relation devised previously is applied to annual temperature values of the CRU data set in order to obtain estimates of heat-mortality thresholds for the full areal extension of case-study countries. An example for South Africa and Kenya is provided in Figure 37 of the Annex.

5.4.2 Future population numbers exposed to increased heat-stress

The main objective of this section is to estimate the number of elderly people below the poverty-line that are expected to be living in areas with projected annual mean temperatures above the heat-mortality thresholds calculated in the section before. In order to do this, first the cumulative percentage of population living in areas according to the difference between annual mean temperature and heat-mortality thresholds was determined. The results are shown in Figure 18. The spatial distribution of population was extracted for the year of 2010 from the Gridded Population of the World (GPW) version3 dataset[16]. Subsequently, the increase in annual temperatures for each of the case-study countries according to the climate models used in this report was determined for the time periods 2020-2050 and 2055-2095 using 1961-1990 values as reference. The yearly temperature anomalies for all countries are shown in Figure 36 of the Annex. Note that only the mean temperature values are represented; see Table

[16] http://sedac.ciesin.columbia.edu/data/

36 of the Annex for the mean annual temperature anomalies for both time frames of investigation. A sample of Table 36 is provided in the main body of the report, see Table 16.

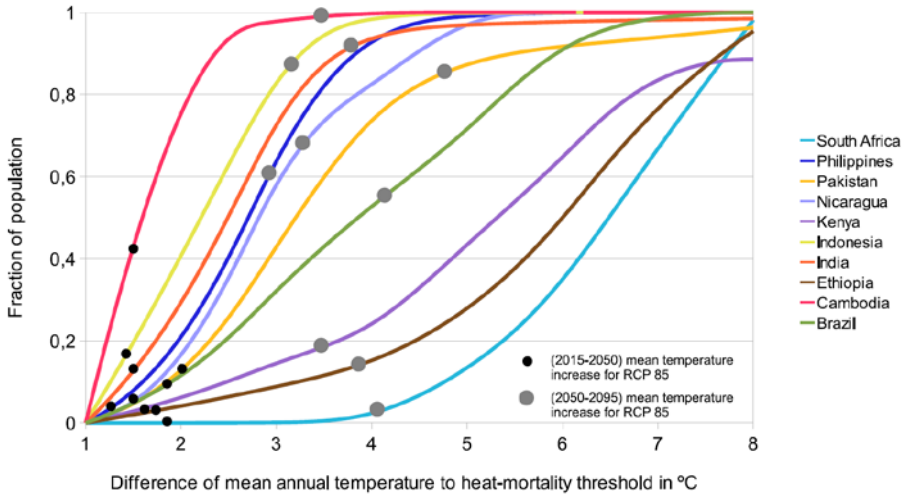
Finally, the increase in annual temperature for each country calculated under RCP8.5 is superimposed (as black and gray dots) on the population distribution of Figure 18. Due to the amount of information shown simultaneously it will be explained step by step how to correctly interpret this figure. In Figure 18 the x-axis represents the difference between the annual mean temperature recorded between 1961 and 1990 and the heat-mortality thresholds obtained via the function shown previously. The smaller the value on the x-axis, the closer a given region is to the heat-mortality threshold obtained by the approach of this study. This measure is per se still not enough to make statements on the current exposure of a country. For that, we need to look at our attribute of concern, in this particular case, population. The y-axis represents cumulative population in %.

Table 15: Sample of Table 36 of the Annex showing mean annual temperature anomalies in ºC for 8 climate models in respect to the 1961-1990 baseline for India and South Africa.

Country	2015-2050	2055-2095
India		
RCP2.6	1.2	1.6
RCP4.5	1.3	2.4
RCP6.0	1.3	2.5
RCP8.5	1.5	3.8
South Africa		
RCP2.6	1.4	1.7
RCP4.5	1.6	2.5
RCP6.0	1.5	2.8
RCP8.5	1.8	4.1

If one now intends to integrate these two variables in a statement, for example for Brazil, the outcome would be: About 57% of the current population if Brazil lives in areas whose mean temperature differs from the heat mortality threshold by 4 degrees or less. Similarly, 95% of the population in South Africa lives in regions whose mean temperature differs from the heat mortality threshold by 4 degrees or more.

Figure 18: Cumulative percentage of population according to the difference between annual mean temperature and heat-mortality thresholds. For each country the small black dots depict the average temperature increase for the time frame 2015-2050 according to 8 GCM's running under RCP8.5 forcing. The larger grey dots are identical to the back one but referring to the time frame 2050-2095



Additionally, Figure 18 provides a country-specific metric of the mean temperature anomaly projected under RCP8.5 for the time frames of 2015-2050 (small black dots) and 2055-2095 (larges gray dots). This provides an indication on how will the annual mean temperatures of a country evolve and how close they are to matching the value of heat-mortality threshold. It is important to highlight that an annual mean temperature equal to a heat-mortality threshold does not imply that population suffers from death related to heat during the entire year – since there will be periods of the year that are colder and warmer than the average. The distance only indicates that if the average mean temperature approximating the heat-mortality threshold than the likelihood to experiencing heat-related deaths will start to increase.

A more detailed look on Figure 18 will reveal that the exposure of the case-study sample is lower-bounded by South Africa and upper-bounded by Cambodia. While Cambodia shows most of its population (˜80%) in areas whose annual mean temperature is equal to or below two degrees of the heat-mortality threshold, almost all of the South African population (˜80%) lives in areas whose annual mean temperature is below the heat-mortality threshold by seven degrees. Kenya and Ethiopia present a similar population distribution per degree difference, to the mortality threshold the one observed for South Africa. On the other end of the spectrum one finds countries like Cambodia, Indonesia, India, Philippines and Nicaragua. The slope of these countries is rather steep, implying that a small increase in annual mean temperature leads to large fractions of the population to experience heat stress. Pakistan and Brazil present an intermediate situation from the ones discussed before.

Let us consider the country-specific projections of average annual temperature increase under the highest RCP (RCP8.5 between the years 2015 and 2050 (black dots). The black dots indicate how the mean annual temperature of a country is projected to increase and by extension how much of population fraction is expected to be affected. Using Pakistan as an example, by 2050 it is expected that the average annual temperature of Pakistan will increase by approximately 2 degrees for the highest RCP (see full values for each country in Table 36 of the Annex). This translates into about 17% of the population in Pakistan to living at or above temperatures equal to the heat-mortality threshold by 2050. If one extends the temperature projection to the period 2055-2095 (gray dots) the percentage of population increases to about 85%.

The final step is now to translate the sensitivity and exposure of the countries into more concrete numbers of population affected. In order to do so it is assumed – in line with previous evidences (Kovats and Kristie, 2006) – that elderly individuals are the ones more susceptible to suffer from heat-stress. Using the medium population projections by age class of the United Nations Population Division it was derived the estimated amount of elderly expected to be living above the heat-mortality threshold by 2050 and 2095, see Table 17. It is important to notice that the country-specific values of population protections are imposed on the current (2010) spatial distribution of population in a country. In practice this means that possible spatial movements in population within a country are at this point disregarded.

Table 16: Number of elderly population in millions living in areas with annual mean temperature above the heat-mortality threshold in 2050 and 2095 under RCP8.5.

Country	2050	2095
India	59	364
Indonesia	26	66
Brazil	5	37
Cambodia	2.6	3.1
Pakistan	2	32
Ethiopia	0.5	6
Kenya	0.3	3.7
The Philippines	0.2	3.5
Nicaragua	0.08	2
South Africa	0	0.07

At the first glance Table 17 will reveal the large contrast of numbers between countries and time frames of examination. The top spot is occupied by India with a total elderly population of about 364 million expected to live above the heat-mortality threshold by 2095. In the near future, 2050, the number is expected to be of about 59 millions. Nicaragua and South Africa are the countries with the lowest expected number of elderly population living above the minimum of heat mortality function by 2095. Pakistan, Nicaragua and Ethiopia are the countries in which a higher relative increase of population exposed is expected.

In case of Pakistan the increase is approximately of 16-fold in 2095 in relation to 2050. It is worth to mentioning that these numbers are the ones obtained for the highest RCP considered in this study and therefore are to be interpreted at upper indications of exposure. Finally, similarly to the LAP for the coastal systems, in case of population affected by heat-stress only one pathway is constructed. Thus the selection of multiple adaptation pathways is in this case not feasible.

5.4.3 Costs of adaptation

The main assumption for calculating the costs of adaptation of population to heat-stress is that the government must engage on land use policies that promote the migration of elderly population to regions in which the annual mean temperatures are expected to be kept below the heat-mortality threshold. It is assumed that the monetary incentive for elderly population

living below the poverty-line to re-locate is equal to half of the per capita income as in 2011[17]. The per capita GDP is kept at 2011 values and so is the poverty rate, meaning that adaptation costs constitute only a very rough approximation. Table 18 summarizes the necessary economic efforts for adapting population to heat-stress in the case-study countries according to the economic assumptions and impact methodologies developed.

Table 17: Costs per year for the land-use planning pathway in the LAP of population systems. Values in million USD.

Country	2015-2050	2055-2095
Indonesia		
RCP2.6	32.1	12.2
RCP4.5	37.9	29.8
RCP6.0	35.1	36.1
RCP8.5	40.8	67.3
India		
RCP2.6	75.0	137.8
RCP4.5	81.2	237.8
RCP6.0	81.2	251.1
RCP8.5	93.7	411.3
The Philippines		
RCP2.6	0.8	2.6
RCP4.5	0.8	4.0
RCP6.0	0.8	4.0
RCP8.5	0.9	6.1
Brazil		
RCP2.6	41.3	87.3
RCP4.5	40.0	148.8
RCP6.0	41.3	158.6
RCP8.5	49.5	250.2
South Africa		
RCP2.6	0.4	0.4
RCP4.5	0.4	0.4
RCP6.0	0.4	0.4
RCP8.5	0.4	0.8
Pakistan		
RCP2.6	2.1	8.3
RCP4.5	2.1	13.2

[17] Data refer to the year 2011. World Development Indicators database accessed on 2 October 2012 http://data.worldbank.org

Country	2015-2050	2055-2095
RCP6.0	2.1	13.8
RCP8.5	3.4	22.0
Kenya		
RCP2.6	0.8	1.7
RCP4.5	0.9	2.7
RCP6.0	0.9	3.0
RCP8.5	0.9	4.5
Nicaragua		
RCP2.6	0.6	1.6
RCP4.5	0.6	2.5
RCP6.0	0.6	2.5
RCP8.5	0.6	4.0
Cambodia		
RCP2.6	2.4	0.2
RCP4.5	2.6	0.5
RCP6.0	2.4	0.7
RCP8.5	3.0	1.7
Ethiopia		
RCP2.6	0.6	0.7
RCP4.5	0.6	1.1
RCP6.0	0.6	1.2
RCP8.5	0.6	1.8

5.5 Institutional and financial deficiencies

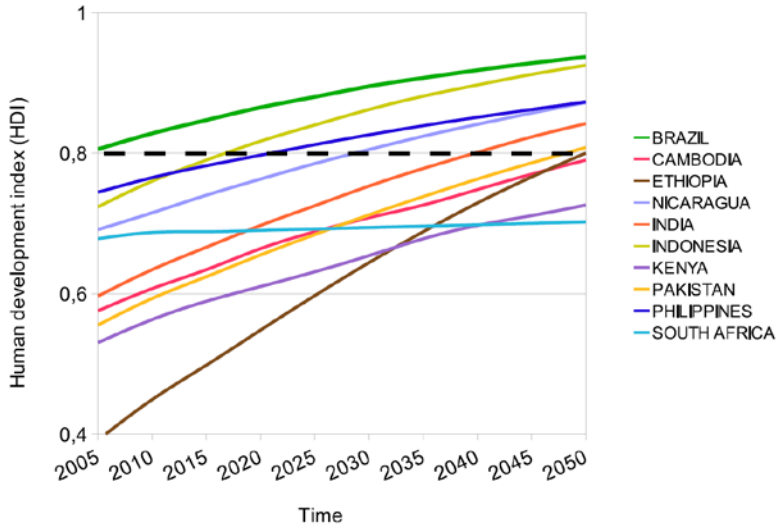
5.5.1 Overall financial capacities

Figure 19 shows the expected evolution of HDI for the case-study countries according with the methodology described in Section 5.5. A general increase of HDI values for all case studies is expected, although the speed and final HDI scores present considerable discrepancies between counties. The dashed back line depicts the HDI score of 0.8 and is taken in this report as the indicative threshold for minimum human development achievements of a country. This threshold value is also equivalent to the definition of an OECD country by the United Nations (UNDP, 2009). The HDI projections are taken from previous work done in Costa et al. (2011).

Figure 19 reveals the existence of basically two groups of counties. The countries that are expected to achieve minimum development standard within the next 40 decades and countries whose HDI value is expected to remain below or about 0.8 by mid-century. Kenya, Cambodia, Pakistan, Ethiopia and South Africa are the example countries belonging to the latter group. Of these, Cambodia and Pakistan present very similar development dynamics in terms of the HDI

increasing from 0.6 in 2005 to about 0.8 in 2050. Ethiopia is by far the country in which the largest progress in development is expected in the future. Its HDI value will jump from sub-0.4 in 2005 to the 0.8 threshold in the year 2050.

Figure 19: Projections of HDI values for the case-study countries according to the time-dependent relations observed in the past.



The second group of countries is projected to undergo on a transition from low development standards to medium, and some time medium-high HDI scores by mid-century. Brazil and Indonesia are the countries for which higher HDI scores are expected within the time-frame investigated – 0.95 and 0.93 respectively. While the development standard of Brazil are above the minimum mark of 0.8 throughout the full time period considered, Indonesia is expected to perform a transition to developing-country HDI standards around the year 2015. Philippines and Nicaragua are expected to perform the same transition as Indonesia but only by the years 2020 and 2030 respectively. The results obtained demonstrate that development scores are expected to converge for the different countries analyzed. Nevertheless, the path and velocity varies considerably. Adaptation options for a given country should take into consideration such dynamics. Regarding the analyses performed, Brazil, Indonesia, Philippines and Nicaragua stand as the countries for which higher HDI scores are expected. By 2050 the population living in these countries would have the economic capacities, knowledge level and health standards that are on par with the ones in the developed world. In theory, adapting to climate change should be easier as the higher the financial, knowledge and heath dimensions achievements of a country increase.

Although most countries analyzed converge to HDI scores of 0.8 or above, the speed by which development occurs highlights that the capacities for adaptation are not evenly distributed across time. Let us consider for example the case of Ethiopia. Although Ethiopia and India are projected to obtain similar HDI values by 2050 (differing only by 0.4 HDI), the development path of Ethiopia is substantially more "steep" that the one expected for India. This means that the financial, knowledge and health capacities of the Ethiopian population are considerably below the ones of India for most of the time frame. While India roughly increases its HDI from 0.6 in 2010 to 0.8 in 2040, Ethiopia is expected to achieve 0.6 HDI only by 2025 and 0.8 in 2050.

5.5.2 Institutional capacities

As mentioned previously in the respective methodological section (recall Section 43), institutional capacities are assessed via the distance of institutional-indicator scores in the case-study countries to the average score of the same indicator in developed countries (developed country is here assumed to be a country with HDI score in 2010 above or equal to 0.8). In addition, the analysis is divided into institutional indicators (the same quoted in Table 5) that provide an idea of the general institutional deficiencies of a country and those that are environmental policy-specific and assumed to be relevant in the case of climate change adaptation.

The results obtained are represented in Figure 20 and Figure 21 for the case of general institutional indicators and climate-relevant institutional indicators respectively. In Figure 20 the distance of each individual components of the Good Governance indicator to the average score of developed countries is shown. The grey area shows the range of +/- 1 standard deviation (SD) of the indicator-score distribution found in developed countries. The indicator score for Germany is given as reference.

Figure 20: Overall institutional deficiencies of case study countries measured as the distance of seven institutional indicators to the average value of developed countries. Data taken from the Worldwide Governance Indicators (WGI) project, available at http://info.worldbank.org.

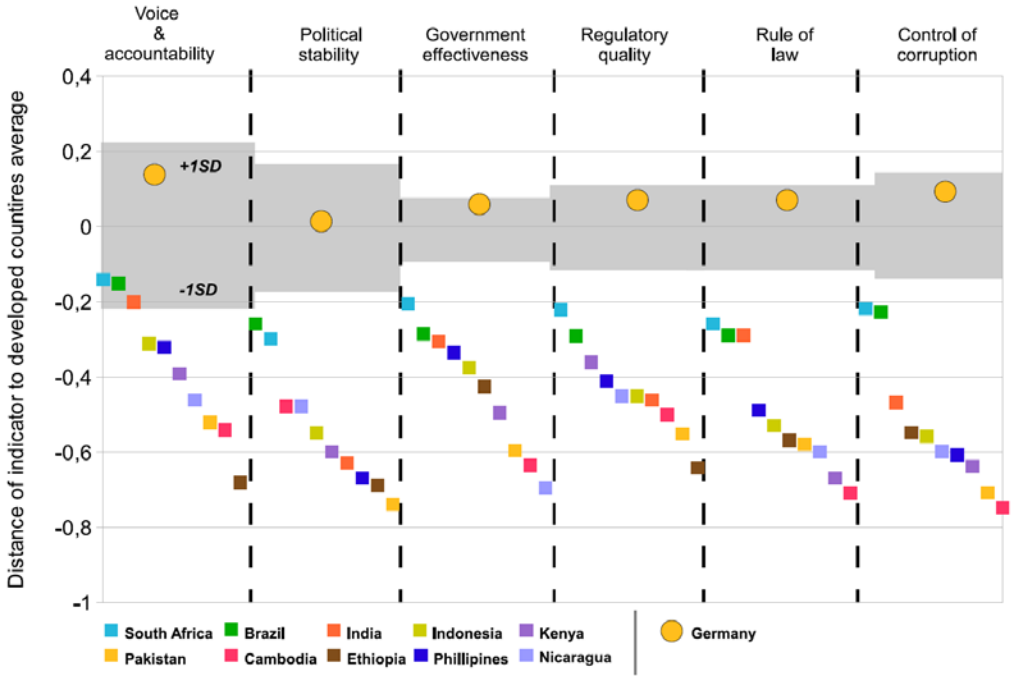


Figure 20 highlights that indicator scores for the institutional dimensions investigated in this report broadly trail behind the average found for developed countries. Nevertheless, some countries are drawing close to developed world standards in the dimensions of voice and accountability and freedom of press. South Africa, India, Brazil and the Philippines are the best representatives of our sample when the above dimensions are considered. For all the other indicators investigated, the sample of case-study countries remains below one SD (standard deviation) of the score found in developed countries. Achievements on the dimensions of regulatory quality and government effectiveness remain rather distant from developed world standards. In these particular dimensions South Africa and Brazil appear to be the best positioned countries although their overall score is respectively about 0.2 and 0.3 points below the developed country's mean.

It is interesting to notice the high sensitivity of particular countries to some institutional indicators. For example, Ethiopia, although scoring the lowest in case regulatory quality it outranks Kenya, Pakistan, Cambodia and Nicaragua in respect to government effectiveness indicator. Nicaragua, although scoring the lowest in case government effectiveness outranks Philippines (generally considered to be a new industrialized country) in the corruption control dimension. The opposite is also true, while India ranks third highest on the government effectiveness indicator it trails below six other countries when the regulatory quality dimension is considered.

Figure 21: Climate relevant institutional deficiencies of case study countries measured as the distance of two institutional indicators to the average value found in developed countries. Data taken from the Institutional Profiles Database (IPD), available at http://www.cepii.fr.

Regarding the institutional indicators that are more climate-oriented, the situation in reference to the level found in developed countries largely improves. In fact only Nicaragua fails to get close to developed world standards for both indicators considered, see Figure 21. For the first time in our analysis it was observed that some countries are above the average indicator score for developed countries. Brazil and India appear to have the most strong and long-term governmental action by governments. Interestingly this indicator can be misleading at times. For example, if the long-term strong action of a government is to base its economic growth by the exploration of fossil fuels, it is hard to conciliate such actions with its ability to adapt to climate change. A better picture emerges if in parallel the characteristics of environment protection strategy are also considered. Keeping with the example of India, although it scores high in the long-term strategic planning of the government, its environment policy score ranks bellow the average of developed countries and on pair with countries such as Ethiopia, Pakistan and Kenya. Brazil, which like India performed well in terms of long-term strategic planning of the government, stays above developed countries average with respect to the characteristics of its environmental protection policies. In particular to this indicator, a general drop of countries was observed when compared with the scores obtained in the case of government action.

6 Costs of adaptation in developing countries: An assessment of currently budgeted costs

6.1 Executive Summary

This paper[18] contributes to the research undertaken in the UFOPLAN project Options for adaptation in the international climate regime: support in the design of the post-Copenhagen agreements and the negotiations on a post-2012 agreement (FKZ 3710 41 141). It envisages providing more in-depth information on what the current state of allocated funding for adaptation to climate change is in developing countries. The assumption behind is that his analysis constitutes at least an approximation to the current adaptation costs, since hardly any actual cost estimates are available. The current version is an update of the version presented at the project workshop in March 2012, taking into account substantial further information submitted by developed country Parties to UNFCCC in the course of 2012 on their fast-start finance.

This paper consists of two parts. The first part analyses the data available on international funding for adaptation in more than 100 developing countries (as of September 2012). The database compiled for this research contains roughly 1200 projects, of which more than 80% have been approved during the fast-start finance period. The focus is on aggregating the funds provided per developing country in order to understand to which developing countries the finance has been allocated. The second part takes a closer look at 10 selected countries. It also takes into account information on allocation in national budgets, cost estimates from UNFCCC studies and National Communications, where available. In both aspects - external and domestic adaptation finance - similar methodological challenges become apparent. There is no uniform definition and approach of what to count as adaptation projects. Part of the problem is of course the complexity of adaptation, cutting across reducing underlying vulnerability drivers as well as addressing specific climate change impacts. An overview analysis of the OECD adaptation marker which has been applied for the first time for projects from 2010 underlines this challenge, with many projects counted as adaptation where a specific climate change focus is at least questionable, if not unlikely. Overall, one has to conclude that it is almost impossible to provide a reliable estimate of what current adaptation finance allocations as an approximation of perceived costs are.

6.2 International funding for adaptation in developing countries: Introduction

This chapter provides an overall assessment of adaptation costs in developing countries as reflected in instruments which provide financial assistance to developing countries, both bilateral and multilateral. Since adaptation is a relatively new issue and since it has emerged primarily through the international debate about climate change, it can be assumed that for most developing countries external funding provides a significant, if not the major source of adaptation funding.

Therefore it is reasonable to pay attention to these sources. Furthermore there is a relatively transparent (while still far from perfect) reporting system while it is much more difficult to find out from national budgets in developing countries what resources have been allocated for adaptation. It has to be noted that the information available is quite dynamic in the sense that

[18] For correspondence: harmeling@germanwatch.org or sharmeling@careclimatechange.org,

continuously new projects are being approved, and that updating the information frequently may be desired. However, a specific difficulty stems from the fact that there is no uniform definition of what to count towards adaptation finance. That means projects marked as adaptation by donors do usually not mean that the associated costs are full adaptation costs, and not necessarily that adaptation is the prime objective of the measure. The share of real adaptation in these project budgets may vary significantly.

6.2.1 The OECD adaptation marker

An important development in this regard is the OECD-DAC Rio marker adaptation, which all OECD countries do now apply in their reporting to OECD-DAC. The Rio marker has two main categories and distinguishes projects whether adaptation to climate change is 1) the principal objective (marker 2, 100% of the project costs counted) or 2) a significant objective (marker 1, 50% of the project counted as adaptation) (see (OECD, 2010)). The Rio marker has now been applied for the first time for the reporting year 2010. Overarching results have been published on 6th December 2011 on the OECD website (see Figure 22). The full list of classified projects is just available since early March. However, already on the overall level of analysis there are significant inconsistencies. Figure 22 shows that 6% of the climate-related funding have been marked 2, which would result in ca. 1.45 billion USD. However, Figure 23 from the same publication sums up to 3.4 billion USD for marker 2. The same holds for marker 1 (principal objective), where Figure 22 would result in ca. 3.9 billion USD, while Figure 23 sums up to 5.8 billion USD.

It is also noteworthy that some countries, in particular France and USA, have only applied adaptation marker 2. Taking a closer look at the list of projects reveals that these countries seem to have a very broad understanding of principal objective adaptation. In the case of the US, projects in many countries titled Administration and Oversight (Environment) have been allocated under Rio marker 2. This does not really impact the overall budget, since the financial commitments are set as NULL. Nevertheless it questions the credibility of the application of these markers. However, even among the highest single funding commitments in the so-called adaptation projects there are some projects marked 2 where it is obviously questionable that the principal objective is adaptation to climate change (see Table 19). While for some of these one could construct a positive contribution to adaptation, it is either clear that adaptation is not the principal objective (e.g. Scaling-up Renewable Energy Program support by Switzerland), or it remains unclear whether adaptation to climate change is explicitly addressed (e.g. the Japanese project for the improvement of water supply system in Abottabad).

Figure 22: Climate change aid by OECD countries. Source: OECD (2012a)

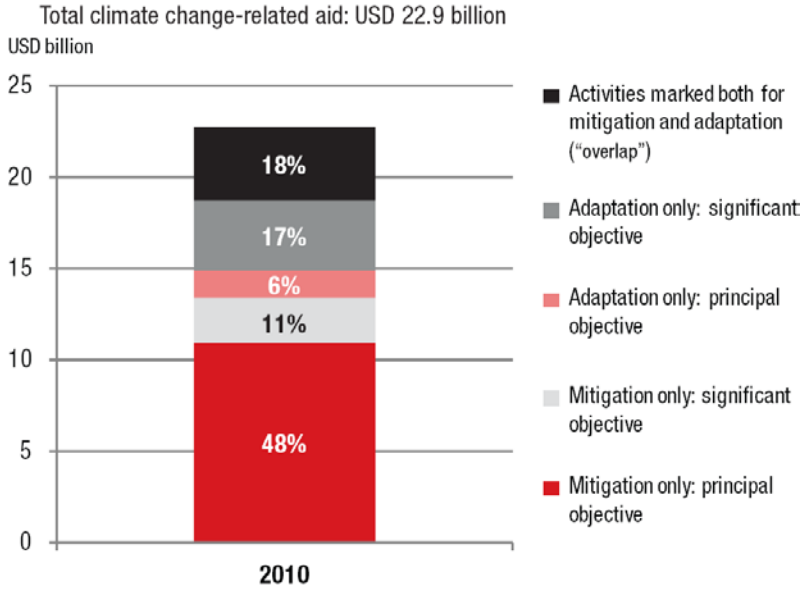


Figure 23: Climate change mitigation and adaptation related aid by DAC members in 2010. Source: OECD (2012a).

	Bilateral contributions marker-based statistics, commitments, USD million					
	Climate change mitigation-related aid		Climate change adaptation-related aid		*for reference*	Total climate change-related aid
	Principal objective (a)	Significant objective (b)	Principal objective (c)	Significant objective (d)	*aid marked both mitigation and adaptation (e)*	(a+b+c+d-e)
Australia	130.9	216.1	104.2	348.3	*288.3*	511.2
Austria	10.6	11.8	2.3	3.3	*2.4*	25.6
Belgium	83.3	113.0	2.4	258.8	*107.5*	350.0
Canada	11.5	66.9	26.5	10.2	*0.0*	115.2
Denmark	231.6	402.7	99.1	433.2	*448.3*	718.3
EU institutions	337.3	495.0	114.0	572.2	*263.9*	1254.5
Finland	21.9	128.1	17.2	186.4	*93.3*	260.3
France	2420.4	86.9	403.7	0.0	*257.0*	2653.9
Germany	1625.2	1594.6	66.1	480.4	*290.0*	3476.3
Greece	2.7	0.6	4.4	0.0	*3.4*	4.4
Ireland	1.2	0.0	n.a.	n.a.	*n.a.*	1.2
Italy	0.0	35.7	1.5	3.0	*2.4*	37.9
Japan	5980.1	151.6	1170.2	1090.2	*635.0*	7757.0
Korea	22.8	38.4	82.1	162.3	*40.5*	265.1
Luxembourg	0.9	1.7	1.3	4.3	*2.1*	6.1
Netherlands	28.3	25.9	26.2	600.7	*27.1*	654.0
New Zealand	1.0	2.2	4.7	29.0	*2.2*	34.7
Norway	762.0	109.5	68.1	86.3	*79.5*	946.4
Portugal	0.1	52.8	0.0	2.0	*1.4*	53.5
Spain	105.5	227.1	71.2	831.4	*220.8*	1014.4
Sweden	34.8	346.0	47.1	401.1	*272.9*	556.1
Switzerland	68.5	51.4	61.9	121.4	*52.9*	250.3
United Kingdom	836.2	149.9	841.9	246.1	*978.3*	1095.8
United States	616.6	0.0	249.3	0.0	*0.0*	865.9
TOTAL	13333.4	4307.7	3465.3	5870.6	*4069.1*	22907.9

Furthermore, it can also be seen from the OECD figures that the problem of double-counting prevails, despite the explicit and public warnings of the OECD that this poses a problem. More than 500 projects in the OECD database are marked with marker 2 both for mitigation and adaptation which means 100% allocation of the committed funds to both areas. Theoretically, the split should then be 50/50, marker 1 for both. This fact even becomes apparent in the official OECD publication reference in Figure 23 (second-last column on the left side), with more than USD 4 billion surplus compared to the actual sum of committed funding (so overall OECD countries were able to allocate 117% of their own commitments). What is of course remarkable is the transparency applied by the OECD which can be a basis for a future

improvement of the application of OECD adaptation (and mitigation) marker. Thus, it is not necessarily completely intended double-counting for false classification.

Table 18: Selected large size projects with adaptation marker 2 but questionable classification. Source: own compilation based on OECD (2012b).

Donor	Project description	Commited funding in million USD
France	Programme de carbone rural au Yunnan	46.357
Japan	the Project for the Improvement of Water Supply System in Abbottabad	41.522
Switzerland	Scaling-up Renewable Energy Programme	22.154
USA	Improve sustainability of a productive and clean environment by reducing risks to the health of the workforce and the population in general, communities, and ecosystems from environmental pollution and other environmental risks associated with industrial and agricultural production, urbanization, energy use, transport, and other human activity. [through U.S. Government - National Aeronautics and Space Administration]	17.750
EU Institutions	The objective is to support sustainable economic development. It will do so by strengthening the capacity of the government to improve trade and investment climate in Indonesia. The programme is complementary to civil society grant programme 22274.	16.556
Japan	Project for Energy Conservation through Upgrading Water Supply Network in the Hashemite Kingdom of Jordan	12.898
Japan	The Project for Introduction of Clean Energy by Solar Electricity Generation System)	6.153
Spain	Health and nutrition, strengthening the process of implementation of the community model of family health with interculturality and the program of un	5.43
EU Institutions	Forest Carbon Partnership facility - readiness Fund	5.298

These figures have been analyzed further in an in-depth analysis of the markers by Germanwatch, which was published in September 2012, with the following overarching results: "In brief, we find that roughly 65% of all activities listed in the original OECD dataset are unrelated to adaptation or at least do not state adaptation as principal (adaptation marker 2) or significant objective (adaptation marker 1). Further, from the remaining 35% only about half of the projects are coded correctly while most of the remaining activities are over-coded. This means that they were marked with marker 2 and thus fully counted as adaptation, while marker 1 would be more appropriate.

The country that is particularly striking is the United States, which on the one hand realizes the largest share of adaptation relevant projects but on the other hand has over-coded more than

80% of those projects. Japan is another country that has raised our attention as it sponsors four out of the ten financially largest activities, yet all of them over-coded according to our assessment. High-budget projects as well as coding errors appear less frequent in the figures provided by Germany." (Junghans and Harmeling, 2012) Therefore, this first-year application does not yet justify the hopes that the adaptation marker could significantly increase the understanding of how much is done to close the adaptation finance gap. The figures communicated by the OECD do not display the real adaptation action supported through international finance.

6.2.2 Funds provided by developed countries in fast-start finance

Among other commitments, developed countries promised at the COP 15 in Copenhagen to provide 30 Billion USD for climate change projects in developing countries between 2010 and 2012. All measures implemented in connection with this commitment are summarized as fast start finance projects. The fast start finance reports of the developed countries give indication on how this commitment was put into practice. For a transparent and proper implementation, the donor countries are supposed to submit these reports going into detail on all the measures, programs and projects arising from their initiatives. Besides descriptions of the particular measures and their background, the countries are supposed to add listings of cost estimates. Of course, the reports should be as complete and detailed as possible.

For the preparation of this paper, we have compiled all the information of the available reports from 2012 from the most important donor countries. Reports are available for Australia, Canada, Hungary and the European Commission, Iceland, Japan, Liechtenstein, New Zealand, Norway, Switzerland and United States of America. The level of detail of these reports varies significantly (see references for more details). Furthermore the web portal Climate Funds Update[19] has been used since it provides frequently updated information on projects approved in multiple multilateral and bilateral funds. It covers information from the following adaptation-relevant funding mechanisms:

- Global Climate Change Alliance (EC)
- Indonesia Climate Change Trust Fund
- International Climate Fund (UK)
- International Climate Initiative (Germany)
- Japan´s fast-start finance
- Least Developed Countries Fund
- MDG Achievement Fund
- Pilot Program for Climate Resilience
- Special Climate Change Fund
- Strategic Priority on Adaptation

[19] www.climatefundsupdate.org, 20 October 2011.

Where the latter ones also appeared in the above-mentioned country reports, avoidance of double-counting has been assured in our analysis. Together these sources provide a potentially almost complete overview of all projects categorized by the donors as adaptation. Information provided includes the funds, donor and receiving countries, approved and received funding and other indicators within the fast start finance[20]. Given the only recent publication of the OECD adaptation marker figures for 2010, the marker figures could not yet be taken into account. However, the mere size of the OECD adaptation marker funding in 2010 suggests that a) the definition of adaptation applied in the OECD markers seems to be broader and incorporated more projects than what has officially been reported in the UNFCCC context or provided through multilateral funds, and that b) not all ODA finance has been counted towards the fast-start finance commitment, even if it is marked as mitigation or adaptation under OECD approach.

For the following analysis of course only the projects specifically attributed to adaptation were considered, mitigation and REDD+ projects were left out. The database hereby compiled results in more than 1,200 projects in developing countries classified by donors as contributing to adaptation in their own fast-start finance reporting. We have focused the analysis to what has been reported as Fast-start finance by developed countries in the years 2010 to 2012 (roughly 1,000 projects and thereby more than 80% stem from this period).

6.2.3 Challenges identified in donor country reports

In some cases, the fast start finance country reports lack relevant information on particular projects. Despite a certain effort of ensuring quality and quantity, there is no guarantee given for the completeness and correctness of the represented data.

Projects: In the U.S. reports on fast start climate financing, usually no official project and program names are available. In these cases, there are just descriptions of the projects given. The fast-start finance report from Norway does not inform about any project details in the particular countries or regions.

Funding: In many cases, there is no data available on how much of the approved funding has already been received. In exceptional cases, the data in the Climate Funds Update website and in the countries Fast Start Finance reports do not match. Then the presented data is based on the Climate Fund Update data where it is the more recently updated data source. Funding from Australia, EU and New Zealand is presented in the reports in the countries own currency, to present it in US$ like the other data sets, it was converted with the currency rate of the publication date of the reports.

The data sheets are according to our knowledge, the most comprehensive ones regarding fast-start finance, since the Climate Funds Update website does not include all bilateral reporting. The following analysis focuses on a comparison between the receiving countries and on how much money is provided to them.

6.2.4 Some overview facts

The data base compiled contains more than 1,200 projects categorized as adaptation funding actions in roughly 120 countries. A number of these are also implemented not in a single country, but in a bigger region or even globally. According to our analysis, overall projects with

[20] The full rankings can be found in Table 37 of the Annex.

the value of USD 5.2 billion were approved multilaterally and bilaterally as adaptation finance, according to the climate finance reporting. USD 3.6 billion can be directly attributed to receiving countries, which forms the core of the analysis. There is no comprehensive information available how much of the money has already been disbursed, why we limited the following analyses on the approved funding. The developed countries of course are expected to receive the approved funding in near future if they haven't already.

6.2.5 Developing countries supported most by FSF

In the following, three tables present rankings of the 10 countries for which most of the adaptation funds have been approved, a) in absolute terms, b) per capita and c) in % of GDP[21] . Niger, Bangladesh and Mozambique have been identified to be the countries in which shall be invested the biggest amount of funding in total. They are followed by Nepal, China and Lebanon. Table 20 shows the ten highest ranked countries, with their approved funding in total, per capita and per unit GDP in %, as well as the number of their projects.

Table 19: The 10 countries with the most approved funding in total.

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank
Niger	227.32	1	15.07	22	3.77	7
Bangladesh	216.98	2	1.46	62	0.19	51
Mozambique	204.78	3	9.30	27	1.63	14
Nepal	179.76	4	5.90	36	0.95	21
China	147.06	5	0.11	108	0.00	101
Lebanon	146.05	6	36.90	14	0.37	34
Cambodia	137.77	7	9.12	28	1.07	20
Zambia	120.21	8	8.85	31	0.63	25
Ethiopia	117.85	9	1.36	66	0.37	34
Kenya	110.54	10	2.70	49	0.32	37

As can be seen, in particular Niger and Bangladesh are to receive an outstanding amount of US dollars. But also the following countries were promised a very high sum. Surprising countries are Lebanon and Italy. Most of the funding here comes from Italy. In Lebanon it is a big waste water treatment plant in six regions. Whether this actually takes into account climate change and can be adequately called "adaptation" remains questionable.

An important factor in the other countries is the Pilot Program for Climate Resilience (PPCR) under the World Bank's Climate Investment Funds. Since the PPCR envisages to provide 50 USD million per pilot country (in grants, plus a potential 60 million USD loan) it is quite obvious that this fund has a significant impact on the funding allocations per country. For example, in Bangladesh USD 110 million out of the total amount of roughly USD 150 million will come from the PPCR. Even though not all of this has been approved for specific projects, it is dedicated to activities in the country why it has been taken into account here (as in other PPCR

[21] The full rankings can be found in Table 37 of the Annex.

countries). An interesting insight is also provided when only the grant allocations in the PPCR are considered. This changes the results to some extent, though the list of Top 10 countries remains almost the same, see Table 21.

Table 20: The 10 countries with the most approved funding in total, excluding PPCR loans.

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank
Mozambique	168.78	1	7.67	30	1.34	15
Niger	167.32	2	11.09	25	2.78	8
Bangladesh	156.98	3	1.06	71	0.14	57
China	147.06	4	0.11	108	0.00	101
Lebanon	146.05	5	36.90	14	0.37	34
Nepal	143.76	6	4.72	38	0.76	22
Ethiopia	117.85	7	1.36	65	0.37	34
Kenya	110.54	8	2.70	49	0.32	37
Cambodia	101.77	9	6.74	33	0.79	21
Bolivia	94.62	10	8.90	28	0.39	33

In comparison, Table 21 lists the 10 countries with the most approved funding per capita. According to our datasets, the Cook Islands, Samoa and Kiribati take the first three places, followed by Grenada, St. Vincent and the Grenadines and the Maldives.

Table 21: The 10 countries with the most approved funding per capita, excluding PPCR loans.

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank
Tokelau	1.70	110	1204.30	1	N/A	N/A
Tuvalu	7.84	78	712.73	2	21.78	1
Cook Islands	8.22	77	441.98	3	4.49	3
Grenada	36.68	25	352.69	4	4.48	4
Samoa	56.36	19	308.00	5	8.89	2
St. Vincent and the G.	22.00	45	200.04	6	3.20	8
St. Lucia	23.07	41	138.14	7	1.88	12
Maldives	27.63	36	85.02	8	1.44	16
Kiribati	7.26	80	69.12	9	4.35	5
Cape Verde	35.09	27	67.48	10	1.84	13

When the focus is put on how much funding is approved per capita, the ranking changes completely. All of the first 10 countries belong to the Small Island Developing States (SIDS). Actually, Guyana on number 12 is the first country not being one of the SIDS on this ranking. SIDS are especially affected by climate change. In particular sea-level rise is seen as a threat, and the figures reflect that this special vulnerability is recognized to a certain extent. Some of

these 10 countries are also covered by a regional pilot program under the PPCR, with lesser but still significant amounts of resources provided than for the pilot countries mentioned in the previous table. As a third ranking, in Table 23 are shown the countries which got approved the most funding per unit GDP. Tuvalu, Samoa and Cook Islands have been identified to be the countries with the most funding per unit GDP in %. Grenada, Kiribati, São Tome and Principe come next.

Table 22: The 10 countries with the most approved funding per unit GDP in %, incl. PPCR rants.

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank
Tuvalu	7.84	78	712.73	2	21.78	1
Samoa	56.36	19	308.00	5	8.89	2
Cook Islands	8.22	77	441.98	3	4.49	3
Grenada	36.68	25	352.69	4	4.48	4
Kiribati	7.26	80	69.12	9	4.35	5
Sao Tome and Principe	9.44	72	55.86	11	3.81	6
Niger	227.32	1	15.07	22	3.77	7
St. Vincent and the G.	22.00	45	200.04	6	3.20	8
Solomon Islands	27.77	35	50.40	13	3.20	8
Comoros	12.59	63	18.51	18	2.05	10

Just like the previous ranking, also Table 23 is dominated by the SIDS. This can be attributed to the reasons said before. Niger is the only countries of the Top 10 not being islands states. Again, the first position, here Tuvalu with more than 20% is way ahead of the others following. The footprint of the PPCR is also apparent.

6.2.6 Developing countries with the least funding

In comparison, there are other countries which are considered in very few projects and will get only little support, see Table 24. The last ones in the ranking of approved funding in total are Panama, Singapore and Botswana. There can be various reasons why these countries receive so little support. Some are not classified as particularly vulnerable to climate change or poor, such as Singapore or Panama. Others would really need more assistance, but political or social circumstances make it hard to do research work or implement measures (this may be true for Syria and Chad). In the case of these countries, it would be very important to find better ways for assisting them in their adaptation efforts.

Table 23: The 10 countries with the least approved funding in total.

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank

Receiving country	Approved funding					
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank
Syria	0.67	118	0.03	118	0.00	101
Montenegro	0.56	119	0.90	79	0.01	89
Ukraine	0.50	120	0.01	123	0.00	101
Dominica	0.30	121	4.23	39	0.06	67
Oman	0.22	122	0.07	113	0.00	101
Chad	0.20	123	0.02	120	0.00	101
St. Kitts and Nevis	0.09	124	1.61	61	0.01	89
Panama	0.04	125	0.01	123	0.00	101
Singapore	0.02	126	0.00	125	0.00	101
Botswana	0.00	127	0.00	125	0.00	101

However, it is important to again note that these analyses are not static. For example, Tonga is one of the PPCR countries in regional program. So far no funds have been approved for the country, but it would likely be in the order of 10 to 25 million USD and this would definitely change significantly its position in such a ranking. Benin has recently proposed a project for funding to the Adaptation Fund with a volume of several millions of dollars.

6.2.7 Conclusions

Overall the analysis provides a good overview of where most of the money classified as adaptation in reporting to the UNFCCC is supposed to go to. Many of the countries ranking high (such as Bangladesh or Mozambique) are also frequently identified as being particularly vulnerable. However, the role of the PPCR as the biggest multilateral funding channel which is supposed to provide large amounts of money to a very limited number of countries is extremely significant for these analyses. For a number of countries covered by the PPCR the large amounts of resources have not yet been formally approved. The case of Lebanon is one outstanding example which questions the reliability of the fast-start finance reporting, when developed countries decide themselves which projects to count, without clarity whether they really address adaptation or not. As stated before, the landscape of adaptation funding is quite dynamic and changes frequently, although major changes would only come with very large-size approvals which can hardly be expected at the moment apart from the PPCR. The recent OECD adaptation marker figures allow for an additional in-depth analysis, which, however, will not necessarily contribute to a clearer picture of what the currently allocated funding for adaptation in a more limited sense (additional adaptation costs) sums up to.

6.3 Analysis for selected countries

The second part of this paper contains a specific analysis of the counties selected by PIK and UBA in the context of this project. An important basis is of course the database of external finance compiled which serves as a basis for the analyses. Table 25 contains the data available for the 10 selected countries.

Table 24: Approved external funding categorized as adaptation for selected countries. Population number and GDP refer to 2011 values.

Receiving country	Approved funding						Population in mn (2011)	GDP 2011 (USD billions)
	in total (USD, mn)	Rank	Per capita	Rank	per unit GDP in %	Rank		
Brazil	17.10	53	0.09	109	0.00	101	194.93	2492.91
Cambodia	137.77	7	9.12	28	1.07	20	15.10	12.89
Ethiopia	117.85	9	1.36	66	0.37	34	86.83	31.72
Haiti	12.82	62	1.28	67	0.17	53	10.01	7.39
India	45.84	22	0.04	116	0.00	101	1206.92	1826.81
Indonesia	34.71	29	0.14	104	0.00	101	241.03	846.45
Kenya	110.54	10	2.70	49	0.32	37	40.91	34.06
Nicaragua	23.33	39	3.96	42	0.32	37	5.89	7.30
Philippines	31,90	31	0,33	95	0,01	89	95.86	224.77
South Africa	8.69	73	0.17	102	0.00	101	50.59	408.69

The OECD Adaptation Marker – which has already been discussed earlier – paints a somewhat different picture regarding the externally funded projects labeled adaptation. This picture underlines that there is no real answer to the question of budgeted adaptation costs, not even if only the external funds are looked at. Of course the figures can hardly be compared, since the OECD marker only covers the year 2010. However, there are some interesting examples. For Brazil, markers 1 and 2 add up to more than ten times the amount of adaptation finance communicated in the climate finance arena (mostly projects from 2010 and 2011, and some from 2008). A reasonable explanation is that biodiversity/REDDplus-related projects have been counted under adaptation in the OECD, but have not been communicated as adaptation finance in the climate finance reporting. In Indonesia the case is more extreme, but the explanation the same. In Kenya and Ethiopia there are remarkably high sums of Marker 1 finance.

However, it is of course also important to look at estimates of current adaptation costs and the specific allocations that have been made within national funding instruments, such as national budgets. The following sources have been taken into account to the extent possible:

- National Communications (NC): as the primary communication channel to the UNFCCC on activities undertaken: however, the NCs are mostly relatively old and provide almost no relevant information;
- National budgets: information has been reviewed with regard to the specific mentioning of adaptation allocations
- NEEDS: the NEEDS project under UNFCCC tries to provide more in-depth analysis of the costs of climate change. Out of the list of countries, only Philippines has been covered by this project, and the NEEDS report does not contain information on adaptation costs.
- NAPAs: for LDCs the NAPAs have been developed to address immediate and urgent adaptation needs and can therefore be regarded as near-term cost estimates. Only Cambodia, Haiti and Ethiopia have prepared NAPAs. The level of

implementation of NAPA projects remains unclear, but usually the countries chose to seek funding from the Least Developed Countries Fund; if such project funding has been approved, it is contained in the allocations through external funding.

Table 25: Approved adaptation-related funding according to the OECD adaptation marker.

Country	Approved funding of the last years	OECD Marker 2 (2010) (in millions)	OECD Marker 1 (2010) (in millions)
Brazil	17.10	36.48	88.68
Cambodia	137.77	16.87	32.15
Ethiopia	117.85	23.15	150.19
Haiti	12.82	4.04	33.45
India	45.84	17.84	49.43
Indonesia	34.71	341.19	106.75
Kenya	110.54	5.28	226.99
Nicaragua	23.33	6.96	38.74
Philippines	31,90	13.35	65.22
South Africa	8.69	4.63	5.22

Table 26 gives an overview of the findings for the selected countries. What becomes apparent is that there is only very few information available on the current adaptation cost estimates or allocations in relevant reports. What appears as a challenge in the external funding, namely lack of clarity whether a project/activity categorized as adaptation is actually designed under the specific perspective of climate change risks in a stricter sense. There are of course a number of budget posts in the area of water, environment, forestry which to some extent can contribute to climate resilience. However, whether the need to adapt is a relevant driver for these allocations can not be identified for the different countries. However, there are indications that climate change impacts might be addressed more specifically in future budgets, e.g. in Kenya, where the challenge of climate change has been addressed in different contexts in the Environment, Water and Irrigation Sector Report 2010 which includes the medium-term expenditure framework 2011/12- to 2013/2014.

For some countries there is analytical work going on to identify climate-related public expenditure. A recent example is the Nepal climate public expenditure and institutional review (CPEIR) prepared by Nepalese and British scientists (Bhattarai et al., 2011). This has been a comprehensive undertaking where the whole national budget (or more specifically: the budget of the most relevant line ministries) has been reviewed. The work categorized spending identified as climate-related in high, moderate and low (and unrelated). The results of the review are that approx. up to 6.7% of public expenditures went into activities that are categorized as climate-relevant according to the three categories. This would make up roughly. 1.7% of GDP (Bhattarai et al., 2011).

Table 26: Current adaptation/climate change finance allocations and estimated costs/ allocated funds (in million USD). Source: own compilation, based on various country-specific sources, see list of references after Table 37 of the Annex.

Country	Estimated costs/ allocated funds (in million USD)

	National Communications	National budget	NEEDS	NAPAs (estimated costs)	Approved external funds
Brazil	n/a	n/a	-	-	-
Cambodia	n/a	n/a	-	124.75	92.50
Ethiopia	n/a	n/a	-	769	50.68
Haiti	n/a	n/a	-	24.463	6.88
India	n/a	Climate change project allocation, adaptation not specified	-	-	18.61
Indonesia	n/a	Overall climate change investment estimates	Only mitigation costs	-	6.27
Kenya	n/a	Min. 8.6 million	-	-	22.85
Nicaragua	n/a	n/a	-	-	14.88
Philippines	n/a	n/a	-	-	10.97
South Africa	n/a	0.36	-	-	7.00

Figure 24: Criteria for the Categorization of Programs within Ministries. Source: Bhattarai et al. (2011)

Relevancy of Code[11]	Criteria
High	Programs/Projects and cost centres with major activities on climate change adaptation/ mitigation (in term of biodiversity, energy, land, water, resource management). It has specified climate change activities in their programs. It has intensive field level implementation of the activities related to climate change.
Moderate	Programs/Projects and cost centres with significant activities related to environmental management. It does not have specific climate change headings in their project /program but those activities ultimately help in environmental protection and management.
Low	Programs/Projects and cost centres with some activities related to environmental conservations and management. Those environment related activities are not so significant in the magnitude and coverage area. These are mainly administrative activities.
Unrelated	The Programs/Projects and cost centres which have no climate change activities neither field level activities on land, water and forest nor education activities are considered as unrelated to climate change expenditure. Similarly the programs/projects without any environment conservation measures are also categorized as unrelated programs /projects.

It might be considered whether such categories could also be applied to review other government expenditures. However, what becomes apparent as well is that it is even more difficult to track adaptation finance as a sub-component of climate-related finance, and even less spending which are primarily motivated through the objective of adaptation to climate change (in the sense of the OECD Rio marker for adaptation category 2). Analyzing the expenditures of the 10 selected countries in such a depth would require substantial more work than could be undertaken in the context of this specific paper.

Overall, the non-external finance allocations for adaptation underline the current limitations of available estimates already identified for the external funding. Further research and progress for the future will be required to develop a better understanding of what to count towards adaptation. For the external funding, more transparent reporting is desired, including a better

application of the OECD adaptation marker. It would also be interesting to understand in how far the recipient countries themselves regarding the funded projects categorized by the donors as adaptation. An interesting initiative could therefore be a joint peer-review process of the reporting, which has not been established yet. This could also build mutual capacity and understanding.

7 Conclusions on Adaptation drawn from International Negotiations

Introductory remarks

This section is composed by a total of five papers prepared by Germanwatch in relation to the UNFCCC negotiations on adaptation during the project time-frame. These include:

1. Assessment of the UNFCCC negotiation session in Bonn (June 2011) in the area of adaptation (June 2011)
2. Adaptation to climate change: key discussions and outcomes at COP17 (December 2011)
3. Adaptation to climate change: key discussions and outcomes of SB36 (May 2012)
4. Adaptation to climate change: What role for the Durban Platform for Enhanced Action?
5. UNFCCC negotiations on adaptation: current discussions and their relevance for the International Climate Initiative (November 2011)

The Section 8.1 and 8.2 cover the suggested activities under activity area 4. Sections 8.3 to 8.5 fall under activity area 3 of the original project proposal.

7.1 Assessment of the UNFCCC negotiation session in Bonn in the area of adaptation

7.1.1 General atmosphere

Negotiations about adaptation in Bonn at the 34th session of the Subsidiary Bodies to the UNFCCC (SB34) have taken place in different negotiating forums; on the one hand under the Convention track which was initiated at COP13 in Bali (Ad-hoc Working Group on Long-term Cooperative Action, AWG-LCA), and on the other hand during negotiations of the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA), that are regularly taking place every year in Bonn as well as at the Conference of the Parties. After a generally pleasing conclusion of the COP in Cancún, especially regarding adaptation (see e.g. Enting and Harmeling (2010) for the preparation of COP16), the following negotiation meeting in Bangkok (March 2011) was characterized by different disputes about the agenda that did not allow any official, substantial negotiations. Conflicts about the agenda of negotiation also occurred during the negotiation round in Bonn, particularly regarding the agenda of the AWG-LCA that could partly be traced back to adaptation issues. One factor contributing to this was the aggressive negotiating style of the Saudi-Arabian delegation that continued its struggle to manifest a connection between adaptation to climate change and the adaptation to response measures[22].

Once the agenda fight was settled, the adaptation discussions were definitely constructive, and there are measurable results as well as different lines of conflict within the issue of adaptation

[22] Saudi Arabia and some other oil-exporting countries have connected adaptation to climate change with adaptation to response measures (support for shrinking oil export revenues) since the beginning of the Convention. On a political level, this has led to stagnation in many adaptation activities like e.g. the "Buenos Aires program of work on adaptation and response measures". Indeed the issue of response measures was officially added to the reduction negotiations, but in Saudia Arabia particular has continued to integrate the topic in all adaptation negotiation texts. The political compromise of Cancún planed to establish an specific forum for this issue, moreover, adaptation was not further implemented in the adaptation framework.

that became apparent for Durban. The negotiations of adaptation as a highly relevant topic to developing countries are always dependent on progress in other issues of negotiation (transparency of emissions, emission levels, degree of legal obligation regarding the industrializing countries). That is why a prognosis for the success of Durban can not yet be made. At least there have not been as severe problems as those caused by a difficult negotiation issue particularly regarding emission reduction. In the following, a detailed report of the negotiations within the individual components of adaptation will be given.

7.1.2 AWG-LCA: Adaptation Committee

During the UNFCCC conference in Cancún, an adaptation framework ("Cancún Adaptation Framework") was decided. As one operative element, it includes the decision to establish an international Adaptation Committee. By this, a blind spot of the international climate regime with features like the bundling of adaptation issues under the Convention, the creation of an overview of adaptation needs and recommendations for the strengthening of adaptation measures, has been addressed.

The elaboration of the concrete modalities for the Adaptation Committee is the only negotiation item on adaptation that has remained on the agenda of the AWG-LCA[23] and is supposed to be completed at COP17 in South-Africa at the end of this year. Aspects that require further clarification are the modalities and initial rules of procedures (composition, board, decision making, secretariat, access of observers during the meetings), the connection and relation to existing institutions of the UNFCCC, as well as the place of the meetings (a fixed place or changing). In the run-up to the negotiations in Bonn there were more than 30 official inputs by the Parties. Their core aspects are summarized in a synthesis paper of the secretariat (UNFCCC, 2011c). During the negotiations in Bonn there was only limited space for concentrated exchange, but at least the text of the chairman of the negotiation parties from Trinidad/Tobago has been accepted as a basis for the actual negotiations during the next preparatory meeting in Panama.

7.1.3 SBI: Loss & Damage Work Program

Another outcome of the COP 16 in Cancún was the establishment of the work program concerning climate-related damages (Loss & Damage). The goal of the work program is to prepare recommendations for COP 18. The thematic focus in the decision from Cancún specifically mentioned: 1) the elaboration of a climate insurance facility, 2) strategies of risk reduction, avoidance and transfer, as well as 3) long-term damages of climate change (for instance sea level rise and desertification) as areas of work. In Bonn the Parties did agree on dividing the different subject areas into one thematic sequence UNFCCC (2011a). In a first step, experiences concerning risk and damage assessment are to be worked out. In a second step, different means to address loss and damage associated with the adverse effects of climate change on different levels should be worked on. A third step concerns the clarification of the role of the Convention in addressing climate-related damages. Furthermore, the Parties have agreed on including a workshop under the work program that was set up in Cancún which will

[23] The negotiations on the adaptation committee are continued under the agenda item "Enhanced Action for Adaptation". Indeed, this would leave space for more adaptation issues (and was also claimed at the beginning of the negotiations in Bonn – e.g. by the G77 coordinator), however the chair of the negotiation Parties has achieved a consensus within the negotiation partners.

probably take place in Lima/Peru in October. As a further activity it was decided that an expert meeting before the next meeting of the Subsidiary Bodies in summer 2012 in Bonn will be held. As a procedural element, another call for submissions to countries and relevant organizations was agreed, as well as a mandate for the Secretariat to prepare a synthesis report on the submissions. The negotiations related to the work program can be described as very difficult. One reason was the behavior of the Saudi Arabian delegation that balked at the elaboration of the activities of the work program. Some African countries also presented themselves skeptical towards a fast implementation of the work program. An explanation for this apparently contradictory behavior (since Africa is particularly at risk from loss and damage) is a perceived situation of rivalry between the work program and other negotiation issues of adaptation under the SBI (for example national adaptation plans, see below). Negotiations concerning the work program were accompanied by several other events. There was a workshop organized by Australia and Barbados ahead of the negotiations that could be used to exchange information (the presentation of the USA was given by the Chief of Delegation).

The UNFCCC Secretariat organized a side event (representatives of WMO, UNISDR, insurance industry, Caribbean Climate Risk Insurance Facility) to determine the contribution of international organizations and the private sector. The "Adaptation & Knowledge Day", organized by UNEP, devoted a substantial part of the proceeding to this issue. This interest shows the important contribution that stakeholders can and want to make. Governments payed attention to this by the integration of a range of diverse, non-governmental actors like the private sector in the execution of the work program.

7.1.4 National adaptation planning

One outcome of the conference in Cancún was the establishment of a process to facilitate long-term adaptation planning in the Least Developed Countries (UNFCCC, 2010a). It is explicitly supposed to build on the experiences of the previous NAPA-process (National Adaptation Program of Action), that is mainly short-term and project oriented. In the Cancún decision, the elaboration of corresponding guidelines for the SBI negotiations in Bonn was defined with the goal to achieve a detailed decision in Durban. The agenda item concerning the national adaptation planning was a main point of contention at the negotiations in Bonn, especially in the group of developing countries itself, and was one reason for the long debate concerning the adoption of the agenda under the SBI. Because the decision in Cancún allowed different interpretations, the SBI was requested to work out modalities that explicitly can be applied by other developing countries the LDCs were afraid of losing their preferential treatment in this planning process. Finally the countries decided to address both concerns separately: a) modalities to support LDCs in their planning and b) ways how other developing countries can apply the modalities (UNFCCC, 2011a). Because of the conflicts about the agenda there was not sufficient time left to work on all aspects in a substantial way during the negotiations. For this reason the countries decided to organize an expert workshop ahead of Durban that is supposed to supply a broad professional perspective for the decisions in Durban.

Moreover, the countries and other stakeholders were requested to make submissions on how they imagine the further process in advance of the workshop. All in all it seems that the NAPs process will not end in relatively inflexible guidelines for the creation of another planning document. A controversial question is the question of support. Many of the LDCs push for the full financing of the NAPA projects and also want to ensure a corresponding support for long-term adaptation plans. This will be an even more important point of discussion in the future.

7.1.5 SBI: Matters related to the Least Developed Countries

In addition to the negotiation items listed above, the work program for the Least Developed Country Expert Group (LEG) for 2011 and 2012 was decided under the SBI (UNFCCC, 2011a). The work program includes different core areas, which include among others, advice for the further implementation of the NAPA projects, the integration of long-term strategies, gender aspects, monitoring and evaluation of adaptation projects as well as the revision of old NAPA documents. The LEG was also requested to prepare publications on public relations.

The Parties have realized that fortunately there are more funds available for the Least Developed Country Fund although the finance still does not correspond to the identified needs. The work of the LEG will be fed into the process of the national adaptation planning.

7.1.6 SBI: NEEDS country studies

The NEEDS country studies (National Economic, Environment and Development Studies) seek first to identify core sectors for particular developing countries (on the basis of national reporting, as well as long-term development plans), then itemize the required and received financing for mitigation and adaptation activities in these sectors and after this establish a consensus concerning the necessary activities within government departments[24]. 11 countries have been selected so far for the NEEDS program, according to the principle first come, first served . These are Costa Rica, Egypt, Ghana, Indonesia, Jordan, Lebanon, the Maldives, Mali, Nigeria, the Philippines and Pakistan. After the secretariat summed up the Information in a synthesis paper (UNFCCC, 2010b) ahead of the conference in Cancún, the Parties had the opportunity to express their opinion in advance of the negotiations in Bonn (UNFCCC, 2011d).

7.1.7 SBSTA: Nairobi Work Program

The Nairobi Work Program on Impacts, Adaptation and Vulnerability serves as a mean of capacity building for Parties to enable them to make adaptation decisions. After 5 years (two periods of the NWP) of all in all successful work, it was decided to continue with the activities under the SBSTA. Until the final development of a new work phase, some preliminary activities where identified in Bonn. Among other things, a new work area on water was agreed (UNFCCC, 2011b). The secretariat is requested to implement the following activities until Durban:

a) Conduction of a survey at national focal points to identify prior needs for the distribution of products under the NWP;

b) To compile information concerning approaches of ecosystem-based adaptation;

c) To prepare a technical paper on water and climate change impacts and adaptation strategies;

d) To organize a SBI/SBSTA workshop during Durban to identify the results of the NWP that are considered as relevant for the SBI process.

[24] The NEEDS Assessments is of particular importance for the second part of the UFO-plan project because they will be integrated in the assessment of adaptation costs. In the negotiations in Bonn they were negotiated under "Financial Mechanism of the Convention".

In particular a) and d) are activities that address the previous weaknesses of the NWP and should therefore be appreciated. An attempt of Saudi Arabia to integrate the issue of Response Measures was prevented successfully.

7.2 Discussions and outcomes on adaptation at the COP17

7.2.1 Introduction

With regards to adaptation, the expectation for Durban was to further anchor the progress embodied in the Cancun decisions. After the Adaptation Framework agreed in Cancun determined the major guidelines for adaptation to climate change in the coming years, concrete implementation decisions had to be achieved in Durban. Finally, COP17 can be regarded as relatively successful from an adaptation point of view since all items on the agenda could be concluded, and in particular in the bigger issues – Adaptation Committee, Loss and Damage Work Program and National Adaptation Plans. It remains to be seen what the practical implications will be. On an overarching level, a challenging task will be to identify the exact role of adaptation in the negotiations towards a post-2020 agreement which have been launched in Durban through the Durban Platform for Enhanced Action (ADP) which should be concluded in 2015.

7.2.2 Operation of the Adaptation Committee (AC)

In Cancún, the establishment of an Adaptation Committee was agreed, which should support adaptation policies within and outside the UNFCCC (UNFCCC, 2011c). In Durban, this Committee was operationalized, with the following key elements of the decision 2/CP.17 (UNFCCC, 2011f):

1. Governance composition, resembling the model of the Adaptation Fund with a slight majority for developing countries;
2. Reporting: while the AC will be under the authority of the COP, it was agreed after intense and controversial debates that the AC should report to the COP through the SBs; while some Parties argued this would increase coherence, others were skeptical whether this would downplay the importance and the profile of the AC;
3. Linkages to financial institutions: the mandate to more strongly direct financial mechanisms, e.g. to make more money available for adaptation, was only weakly (in the form of recommendations) reflected in the text;
4. Work program: Part of the decision was a work program for the first year (see Annex I), which gives the AC some guidance to kick-off its work immediately;
5. Linkages to other institutions: the importance of developing linkages with other important bodies, such as the Least Developed Countries Expert Group, but also the relation to work programs (Nairobi, Loss and Damage), was underlined;
6. Meetings: the AC shall meet at least twice a year, the first meetings is expected to happen until the May SB session;
7. The AC will engage with other relevant stakeholders, international institutions, private sector, civil society, and the meetings will be open to observers;
8. Review: the progress and performance of the AC will be reviewed by COP22, which would be 2016.

9. Parties are invited to nominate members with relevant expertise by 31 March 2012.

7.2.3 National Adaptation Plans: Long-term adaptation strategies for vulnerable countries

Cancún agreed to the establishment of a process for the support of middle- and long-term adaptation planning in the least developed countries (UNFCCC, 2011c). In Durban, the development of concrete guidelines, recommendations and modalities was on the agenda. The negotiations were surprisingly difficult, in part because self-declared vulnerable countries (e.g. South American countries) wanted to receive more attention vis-a-vis the least developed countries (LDCs). Financing was a further point of contention. Although long-term financing through the Green Climate Fund is conceivable, until the fund is really operational, in particular the LDC would have wished that the GEF (Global Environment Facility) as well as the UNDP and UNEP would be more concretely directed to provide support. Furthermore, the GEF was tasked in the decision with the development of guidelines for its support for countries with the formulation of long-term adaptation plans. Key elements of the decision 5/CP.17 further includes (UNFCCC, 2011e):

1. Modalities: a general list of activities to support LDCs;
2. a request to the Least Developed Countries Expert Group (LEG) to provide guidance and further technical guidelines, in addition to those contained in the Annex of the decision (see Annex II of this document) to LDCs for the NAPs process;
3. Support: developed countries are urged to provide support for the process; a call for submission to Parties to provide views and information on the support and a synthesis report of the submissions to be undertaken by the Secretariat; consideration of further guidance by SB 36 and COP18;

7.2.4 Work program to address loss and damage from climate change

The problem of climate change damages (in the UNFCCC jargon, "loss and damage") is being granted increasing weight in the negotiations, in part because climate change mitigation is advancing only slowly. With a temperature increase of 2 degrees, and even more so in a 4 degree world, we will not be able to adapt to all the consequences of climate change, there will necessarily be damages. Therefore, in Cancún, a work program was formed to prepare further decisions of the parties at COP18 (UNFCCC, 2010a). Durban had to initiate activities for the work program. Given its increasing importance and its intensity in 2012, this outcome will be analyzed more in depth. Decision 7/CP.17 outlines the underlying ideas and specific activities that will be undertaken between COP17/SB35 and COP18/SB37 under the SBI work program on loss and damage (UNFCCC, 2011j). Some of the main characteristics of the decision include:

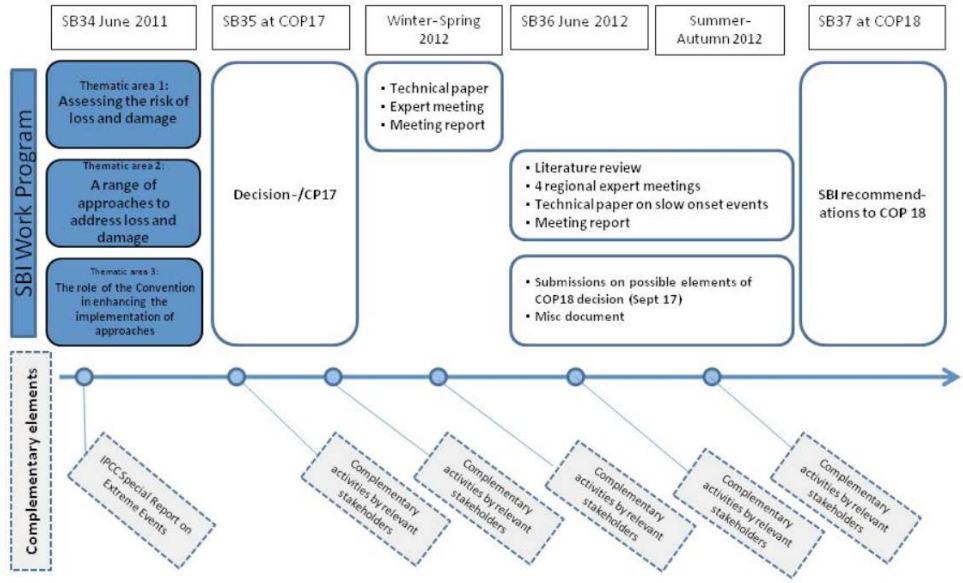
1. requesting “the Subsidiary Body for Implementation to continue the implementation of the work program on approaches to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change and to make recommendations on loss and damage to the Conference of the Parties for its consideration at its eighteenth session;
2. accounts for Party questions articulated in the annex (Annex III to this text) when implementing the work program in 2012
3. invites Parties, relevant intergovernmental organizations, regional centers and networks, the private sector, civil society and other relevant stakeholders to

consider the three thematic areas of the Work Program in their own activities. The goal of this inclusive approach is to assist Parties in understanding and building expertise for addressing loss and damage. Such organizations or initiatives, like the CDKN project, are invited to share the outcomes, lessons learned, and good practice related to the implementation of existing risk assessment and risk management approaches. With the CDKN project, that addresses vulnerable developing country needs, this is an ample opportunity to get vulnerable country content into to official process.

4. This inclusive approach extends to a large and diverse representation of experts, especially those from developing countries (of note: least developed countries and small island developing States) in undertaking the work under the three thematic areas;

5. Appreciates the need to explore a range of possible approaches and potential mechanisms, including an international mechanism, to address loss and damage, with a view to making recommendations on loss and damage to the Conference of the Parties for its consideration at its eighteenth session, including elaborating the elements set out in decision 1/CP.16, § 28 (a-d); this can be viewed as a success for AOSIS, which mechanism proposal found its first mentioning in an official consensus document.

Figure 25: Approximate timeline and deliverables for SBI work program on loss and damage 2012.



Following these first five paragraphs, the rest of the decision is devoted to three thematic areas and an annex containing Party questions for thematic areas one and two. Note that below the deliverables/milestones are organized chronologically, reflected in Figure 25.

Thematic area 1: Assessing the risk of loss and damage associated with the adverse effects of climate change and the current knowledge on the same

1. Expert meeting on this issue before SB36 (June 2012), and taking into account inputs from relevant organizations and other stakeholders. The goal of this expert meeting is to draw on a range of expertise and experience (within and outside the Convention) to

prepare for and build a knowledge base for Party discussion of thematic area 2. It is likely that the event will be hosted before the end of March.

2. To support this expert meeting, the Secretariat will undertake:

    a) Technical paper. The Secretariat will prepare a technical paper before the expert meeting (in collaboration with relevant organizations and stakeholders). This technical paper will summarize current knowledge on relevant methodologies, address data requirements, lessons learned, gaps in assessment approaches at different levels, and existing relevant work and literature. A realistic estimate of the time-line suggests that the secretariat will choose the relevant consultants before Christmas. If countries have suggestions for (developing country) experts who could nicely frame the debate, they should contact the secretariat very soon.

    b) Meeting report. The Secretariat will make the report from this expert meeting available to the SBI meeting in May (14 to 25).

Thematic area 2: A range of approaches to address loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events, taking into consideration experience at all levels

For this thematic area the Secretariat will

a) Literature review of existing information and case studies on the topics in the context of this thematic area, to feed into four regional expert meetings

b) 4 regional expert meetings. The Secretariat will organize four expert meetings, three at the regional level and one for small island developing States, (in conjunction with other related events where possible) before SB37 at COP18 (Dec 2012). These workshops will take into account the outcomes of the expert meeting on assessment.

c) Technical paper on slow onset events, taking into consideration the outcomes of the regional expert meetings

d) Meeting report: The Secretariat will make available the report from this expert meeting to SBI at COP18.

Thematic area 3: The role of the Convention in enhancing the implementation of approaches to address loss and damage associated with the adverse effects of climate change

e) Invites submissions of views on possible elements to be included in the recommendations on loss and damage to COP18. These submissions should be submitted to the Secretariat from Parties and relevant organizations and other stakeholders by 17 September 2012. The submissions should take into account the activities and insights gained during the implementation of the work program on loss and damage prior to that date. From a vulnerable country perspective, it would be important to have a substantial submission by this date in order to get this into a negotiation text at COP 18.

f) Misc document of all these submissions for consideration by SBI at SB37 / COP18.

g) Encourages the Subsidiary Body for Implementation to take into account outcomes of the work program up to SB37, submissions, actions by relevant organizations in the context of the work program, and inputs from processes related to loss and damage.

h) Discuss financial matters related to the realization of the above-noted activities between SB35 and SB37 for the SBI Work Program on Loss and Damage.

7.2.5 Nairobi Work Programme

The negotiations on the Nairobi Work Program absorbed relatively little time and could be concluded at the last day of the SBSTA. The decision contains inter alia

1. a call for submissions to provide views on the activity areas of the NWP by 17 September 2012, with a view to prepare for a decision at COP19;
2. request to the Secretariat to organize a technical workshop on climate change and water before SB37/COP18 and on ecosystem-based adaptation before SB 38 (June 2013)
3. request to the Secretariat to prepare a compilation of case studies on national adaptation planning processes by SB37 (UNFCCC, 2011d).

7.2.6 Least Developed Countries Matters

Subject of discussion was the progress of the Least Developed Countries Fund which is managed by the GEF. The negotiations absorbed relatively little time, and the outcome is a decision which contains some more guidance to the GEF, including on technical aspects such as

1. To continue to provide information to the least developed countries to further clarify project baselines and the application for accessing funding from the Least Developed Countries Fund;
2. To support the development of a programmatic approaches for the implementation of national adaptation programs of action by those least developed country Parties who wish to do so (UNFCCC, 2011c).

7.2.7 Adaptation Fund at COP17/CMP7

7.2.7.1 Report of the AFB to the CMP17

As usual at the CMP, the Adaptation Fund Board (AFB) reported back on its progress as well as on all activities it has undertaken during the year according to its mandate. In doing so, the Chair, Ana Fornells de Frutos from Spain, in her statement to the CMP mentioned that the Fund is fully operational and is now focusing on it core business, which is to finance concrete adaptation actions in developing countries Furthermore, she stated that the accreditation process for the AFB is in full swing and has held two workshops during the (in Africa and in Latin America) to familiarize developing countries in these regions with the accreditation process. In addition, the Fund has so far approved 11 project proposals (before the 16th AFB meeting) in developing countries and endorsed 12 project concepts. It is expected that these will soon submit fully developed projects. However, the AFB chair expressed her deep concern that during the fiscal year 2011 no new financial pledges were made by wealthy nations to the

Fund. The increasing decline of the carbon price obligated the Trust Fund to revise down its estimate of potential resources available for funding projects at the end of 2012.

As usual, a contact group was set up by the CMP in order to acknowledge the work accomplished by the Adaptation Fund Board and to guide it further. The CMP in its decision, took note of the report of the AFB and acknowledged the positive outcomes achieved by the Board and encourages to further do so (UNFCCC, 2011g). It also explicitly encourages wealthy nations to provide funding to the Adaptation Fund, which will be additional to the share of proceeds from clean development mechanism project activities.

7.2.7.2 Review of the institutional arrangements of the AFB

Also on the agenda of the AF at the CMP was the review of the institutional arrangements of the AF (UNFCCC, 2011h). The purpose of the review is to assess all matters relating to the arrangement between the Adaptation Fund and both trustee and secretariat with a goal of ensuring its effectiveness and adequacy, including in relation to its institutional arrangements. In the first working group meeting set to study the findings of the review, the representative of the G77 and China at the very beginning mentioned that it is very difficult to consult on the review since the report of the independent consultant[25] hired to undertake the review, was published only some days before the CMP, which did not allow the Parties time to adequately study the document, particularly due to the number of other tough agenda issues to be discussed during the CMP. Moreover he noticed that both the secretariat and the trustee have commented on the consultant document (see Annex II of the report). However, the Board itself as a core player in this performance review has not commented on it yet.

He therefore suggested enabling the AFB to provide its point of view pertaining to the different options proposed by the consultant. Having said this, to which extent the Board "- if deemed as necessary – could implement certain propositions of the performance review text on its own was discussed. With respect to this, divergent views emerged in the discussion. While developed countries wanted that the AFB should provide as well its comments on the review in the form of a submission to the UNFCCC. Developing countries were in favor of allowing the Board to start implementing some findings of the review as soon as possible. In doing so, one could avoid any delay that would affect the activities of the fund. After a long discussion, Parties agreed to request the Adaptation Fund Board to submit its views on the report on the Review as soon as possible after its first meeting in March 2012. In addition it requested the Subsidiary Body for Implementation to consider the initial review of the Adaptation Fund at its thirty-sixth session (UNFCCC, 2011h).

7.2.8 Further relevant decisions outside the adaptation agenda

7.2.8.1 The Green Climate Fund

In Durban, Parties succeeded in operationalizing the Green Climate Fund (UNFCCC, 2011b). The decision includes an annex on the governing instrument, which lays out the fundamental structures and procedures of the fund. Part of this is the decision to fund adaptation, which is likely to be interpreted as funding eligible activities under the Cancun Adaptation Framework § 14. Now there is a comprehensive list of work for the GCF Board. The first meeting of the Board is expected to happen by the end of April 2012 in Geneva, provided that the

[25] The report can be found under AFB, 2011

nominations for Board members will come in time. It remains to be seen when the GCF will be fully operationalized and able to disburse funds.

7.2.8.2 Addressing the emission and the finance gap

A key outcome of COP17 was the agreement on the new Ad-hoc Working Group "Durban Platform for Enhanced Action" which is envisaged to result in a legally binding agreement encompassing all countries by 2015 and coming into effect by 2020, connected with a second commitment period of the Kyoto Protocol (UNFCCC, 2011a). What has only been addressed procedurally are the two key outstanding gaps: the emission gap which describes the fact that current mitigation pledges if fully implemented would lead to an increase of 3.5 to 4°C instead of the promised 2°C, and the climate finance gap which describes the lack of clarity on how climate finance mobilized by developed countries for action in developing countries is expected to increase from current levels up to the USD 100bn pledged by 2020. On both issues work programs have been launched through COP17 to further address the issues in 2012, which at least keeps them on the agenda and might result in some progress. Nevertheless, it is clear that lack of progress would for the first issue (emission gap) in the long-term increase the expected loss and damage from climate change by potentially resulting in the crossing on dangerous tipping points in the climate system. For the second issue, lack or delay of delivery of climate finance limits the ability of vulnerable Parties to prepare for the adverse effects of climate change which could help reducing loss and damage from climate change (see Harmeling et al. (2011)). Adaptation will be part of the Durban Platform, but so far it is rather unclear how and which aspects of adaptation should be addressed more specifically.

7.2.9 Next steps

Summarizing the developments in recent years, "one can, therefore, visualize the UNFCCC negotiating process as having shifted from a phase of exploration and experience building to a phase of design. Following the start of the implementation of the newly-designed processes, the UNFCCC adaptation discourse will enter into a new phase of monitoring, evaluation, review and revision of the Durban adaptation regime, at which point the next level of action on adaptation could constitute a further scaled-up adaptation regime" (Nassef, 2012). The activities in 2012 will be one step closer to building up this regime. The adaptation debate under the UNFCCC has an extensive work agenda as shown in Table 28. Loss and damage will be the most intensive issue. The Adaptation Committee will have to constitute itself and find its place in the new institutional set-up of different committees, such as on finance and technology. The NAPs process will have to face the issue of financial support in the next months, but will hopefully result into the initiation of the requested planning processes. Much is still unclear on the role of adaptation in the Durban Platform, and this will be an issue which requires further consideration in the context of the overall priorities and the need to increase ambition on the mitigation side. In principle, links between the Durban Platform and the adaptation agenda need to be considered. Some preliminary thoughts:

1. the Adaptation Committee could include in its work program the identification of adaptation needs post-2020 which could feed into the DPA negotiations;
2. the NAPs could serve as an important tool to inform about the post-2020 needs, including on financial support, provide substantial NAPs will be available until 2015;
3. loss and damage will likely be further conceptualized, including the need to clearer identify the delineations to the adaptation agenda in order not to repeat

the same discussions under a new heading; but given the lack of ambition in mitigation the issue will have to stay (and potentially climb up) on the political agenda.

UBA and ICI could think about working towards a strategy how they can support the adaptation negotiations, through e.g. the experience gained in the ICI with different adaptation approaches, through supporting the strengthening of the emerging alliance between the EU and vulnerable countries. Working out such a strategy for the time until 2015 could also help promote the Durban Platform process to the extent adaptation will be placed there, but also under the other negotiating tracks.

Table 27: Work agenda for the adaptation debate under the rooftop of the UNFCCC.

	Ref.	in 2012	Feb	Apr	May	Sep	Dec	2013
1. Adaptation Committee								
Adaptation Committee to develop a three-year workplan (milestones, activities, deliverables and resource requirements)	AWG-LCA para 97	during the first year						
Adaptation Committee to initiate some of the activities contained in the annex V (Finance, technology and capacity-building needs and support)	AWG-LCA para 98	during the first year						
1st meeting of the Adaptation Committee	AWG-LCA para 115	soon after the COP 17						
2. NAPs (SBI)								
B. A process to enable least developed country Parties to formulate and implement national adaptation plans								
Parties and relevant organizations to submit to the secretariat information on their experiences with the application of the guidelines for the NAP process for LDC Parties	NAP, para 7							untill 13 February
the secretariat to prepare a synthesis report on experiences with the application of the guidelines for the national adaptation plan process in the LDSs	NAP, para 8							consider ation at the 38th session of the SBI
United Nations organizations to support the NAP process in the LDCs and to submit to the secretariat information	NAP, para 23		untill 13 February					

on how they have responded to this invitation								
Parties and relevant organizations as well as bilateral and multilateral agencies to submit to the secretariat information on support to the NAP process in the LDCs	NAP, para 24		untill 13 February					
GEF to submit information to the SBI on how they could enable activities undertaken as part of the NAP process in the LDCs	NAP, para 25		untill 13 February					
the secretariat to prepare a synthesis report on the support for the NAP process for the LDCs	NAP, para 26							consideration at the 38th session of the SBI
consider guidance on policies and programmes to enable support for the national adaptation plan process					SB 36			Consideration by COP18
C. An invitation to developing country Parties that are not least developed country Parties to employ the modalities for national adaptation plans								
the Adaptation Committee to consider, in its workplan, the relevant modalities for supporting interested developing country Parties (not LDCs) to plan, prioritize and implement their NAP measures and to report at the COP 18	NAP, para 30						COP18	
3. Nairobi work programme on impacts, vulnerability and adaptation to climate change (SBSTA)								
the SBSTA to reconsider the work areas of the NWP on impacts, vulnerability and adaptation to climate change with a view to making recommendations at the	NWPI para 1							COP 19

COP19 on how to best support the objectives of the Nairobi work programme								
Parties and relevant organizations to submit to the secretariat their views on potential future areas of work of the NWP	NWPI para 2					17. Sep		
the secretariat to compile those submissions into a miscellaneous document for consideration by the SBSTA	NWPI para 3							consideration at the 38th session of the SBSTA
the secretariat to organize a technical workshop on water and climate change impacts and adaptation strategies	NWPI para 4 a)							before the 37th session of the SBSTA
the secretariat to organize a technical workshop on ecosystem-based approaches for adaptation to climate change	NWPI para 4 b)							before the 37th session of the SBSTA
the secretariat to prepare reports on the workshops (from para 4(a), (b))	NWPI para 5							available at 37th/38th session of the SBSTA
5. Loss and Damage Work Programme (SBI)								
expert meeting				26 to 28 (Tokyo)				
regional expert meetings								
III. Thematic area 3: The role of the Convention in enhancing the implementation of approaches to address loss and damage associated with the adverse effects of climate change								
Parties and relevant organizations and other stakeholders to submit to the secretariat views and	L&D, para 9					17. Sep		

information on the possible elements to be included in the recommendations on L&D								
the secretariat to compile those submissions into a miscellaneous document	L&D, para 10							consideration at the 37th session of the SBI
6. LDCF								
The Financial mechanism of the Convention: Least Developed Countries Fund								
the LDC Expert Group to provide further specification of the elements of the LDC WP in consultation with the GEF and report to the SBI, with a view to informing the COP on guidance to be provided to the GEF on support for the implementation of the elements of the LDC WP other than the NAPA	LDCF, para 2				report at the 36th session of the SBI			
LDCs to provide details on project processing to the LDC Expert Group for it to compile and analyse, with a view to providing results of the analysis to the COP	LDCF, para 3						consideration at COP 18	
7. Adaptation Fund								
two regional workshops to assist in the accreditation of national implementing entities, planned for the Asia and the Pacific region	AFB report, para 3	during the first half of 2012						
First meeting Adaptation Fund Board	AFB review, para 1							
the SBI to consider the initial review of the Adaptation Fund with a view to recommending a draft decision for adoption to the CMP 8	AFB review, para 2				consider at the 36th session		draft decision for the CMP8	
the CMP to complete the initial review of the Adaptation Fund	AFB review, para 3						CMP8	

7.3 Adaptation to climate change: key discussions and outcomes of SB36

7.3.1 Introduction

Following up the climate summit in Durban, the adaptation negotiations at the 36th session of the Subsidiary Bodies in Bonn in May 2012 focused primarily on the issues of loss and damage associated with climate impacts and National Adaptation Plans. However, some other issues were also on the agenda. On all issues conclusions were reached, however with still unclear prospects on what kind of decisions to expect at COP18 in Doha (UNFCCC, 2012c, 2012d).

7.3.2 Adaptation Committee (AC)

In Cancún, the establishment of an Adaptation Committee was agreed. In Durban, this Committee was operationalized, including with a decision on the composition as well as the work plan for the first year of the Adaptation Committee. Parties in Durban were invited to nominate their representatives to the AC by 31 March. However, due to an complex overall set up of nominations to be agreed by Parties on various bodies - Green Climate Fund Board, Adaptation Committee, Standing Committee on Finance - the whole process has experienced significant delays. By July, 13 out of 16 members of the Adaptation Committee were nominated, but the first meeting still could not take place due to the outstanding nominations from the Asian group and was not expected before the end of September. Therefore it remains to be seen how much of the original year 1 work plan (see Annex 1) of the Adaptation Committee will be realized. The following table contains the nominations and future members of the Adaptation Committee. While only general criteria regarding expertise of the members were agreed in Durban, one provision - namely to take into account gender balance - can be definitely assessed, and it seems the first set up of the Committee will not perform very well in this regard. Only four out of the 13 current nominations are women, constituting a relatively strong imbalance. If the remaining three members would be women, there would be 7 women and 9 men which would be almost a 50:50 balance (see Table 29).

Table 28: The current Adaptation Committee. Members are automatically selected once nominated. Source: http://unfccc.int/files/bodies/election ffandfmembership/application/pdf/cov ffand ffkp ffmembership ffchart.pdf, 17 July 2012.

Constituency	Nomination
Africa	Ms. Margaret MUKAHANANA-SANGARWE (Zimbabwe)
Africa	Mr. Zemouri ZOUBIR (Algeria)
Asia and Pacific	N.N.
Asia and Pacific	N.N.
GRULAC (Latin America and Caribbean)	Mr. Juan Pablo HOFFMAISTER
GRULAC (Latin America and Caribbean)	Mr. Clifford MAHLUNG (Jamaica)
Eastern Europe	Mr. Tomasz CHRUSZCZOW (Poland)
Eastern Europe	Mr. Andro DRECUN (Montenegro)
Western Europe and Others Group	Ms. Annemieke NIJHOF (The Netherlands)
Western Europe and Others Group	Mr. Klaus RADUNSKY (Austria)
SIDS	Mr. Luke DAUNIVALU (Fiji)
LDC	Ms. Sumaya Ahmed ZAKIELDEEN (Sudan)
Non-Annex I	Mr. Fredrick KOSSAM (Malawi)

Constituency	Nomination
Non-Annex I	N.N.
Annex I	Mrs Christina CHAN (USA)
Annex I	Mr. Naoya TSUKAMOTO (Japan)

7.3.3 National Adaptation Plans: Long-term strategies for vulnerable countries

While in Cancún, Parties agreed on the establishment of a process to support middle- and long-term adaptation planning in least developed countries (LDCs), the development of concrete guidelines, recommendations and modalities turned out to be rather difficult in Durban, particularly on finance matters. By the end of COP 17, Parties had agreed on a process to enable LDC Parties to formulate and implement NAPs and also laid the groundwork for a reporting, monitoring and evaluation system. As input for the 36th session of the Subsidiary Body, a number of Parties had prepared submissions on views and information on how to facilitate and support the NAP process. In addition, the Secretariat had put together a synthesis report, taking into account all available submissions (UNFCCC, 2012e). In the initial consultations at the 36th session, Parties outlined a number of issues to include in the draft conclusion and decision text. Many developing country parties, inter alia Bhutan (for LDCs), Ghana (for the African Group), Vanuatu (for AOSIS), Mexico, and Norway stressed the importance of NAPs to be driven by country-specific needs and priorities. Furthermore, they emphasized the need for a natural transition from short- to long-term adaptation and a separate institutional set-up for LDCs.

While on financial matters, the European Union (EU), Philippines, and Bolivia highlighted accessibility and scaling up of financial assistance for NAPs, the United States (US) called attention to non-financial aspects such as knowledge-sharing on best practices as well as peer-to-peer networks. In the subsequent days several draft conclusion and decision texts were issued by the Co-Chairs. Continuously adjusted based on comments from the sessions, additional submissions by G77/China and other Parties as well as on the basis of informal drafting meetings were made. The following topics emerged as most important and under most dispute: Bhutan (for LDCs), Bolivia, and Ghana (for the African Group) proposed the implementation of support programs (capacity development, technology transfer, institutional capacity building) as well as better guidance on finance. In this regard Swaziland highlighted the need to scale up financial and technology support, and to include NAPs for both LDCs and vulnerable developing countries. Furthermore, several parties emphasized the importance of strengthening the draft text on activities and programs to support the NAP process as well as the LDC Expert Group (LEG).

On finance issues, Bolivia, the Philippines, Bhutan (for LDCs), the EU, Norway, and several other Parties discussed to strengthening of references to support the NAP process for LDC Parties through bilateral and multilateral channels, including the LDC Fund (LDCF). Bangladesh complemented this finance discussion by highlighting that there is the need to have clear guidance that the funding is not solely provided by Global Environmental Facility (GEF) and that the NAPs should neither be thoroughly funded by the LDCF. Ultimately this ended in some deep line-by-line discussions, particularly concerning the role of the GEF and its mandate to operate the financial mechanism of the Convention for the operation of the LDCF. Further on this matter, Vanuatu (for AOSIS), Ghana (for the African Group), Bolivia, Bhutan (for LDCs), and Mexico emphasized that there is the need for a clear linkage to and a comprehensible financial arrangement regarding the Green Climate Fund (GCF), particularly on long-term finance. Yet as

the GCF Board had at that time not been nominated, the US noted that such links should not yet be made.

In the context of the draft decision, the Philippines started demanding the establishment of a spin-off group on adaptation to discuss on the issue of the NAP process in Non-LDCs as the Ad hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) will close by the end of COP 18. This happened despite the fact that the Adaptation Committee has been mandated to consider modalities for non-LDCs to apply NAPs guidelines. This statement was supported by Argentina, Nicaragua and other developing country Parties who stressed the limited attention given to Non-LDCs in the context of the NAPs. Thereupon Ghana (for the African Group) emphasized the need to replace the LDCF and SCCF by some funding institution that also supports Non-LDC African countries.

Ultimately in its closing plenary the SBI adopted the draft conclusion and decision (see (UNFCCC, 2012c). Key elements of the draft conclusion text include:

1. invitation to Parties to strengthen engagement with regional centers and networks
2. through bi- and multilateral channels developed country Parties are urged to mobilize financial support and provide technology as well as capacity building
3. the guidelines for the NAP process are expected to be completed at COP 18
4. the Adaptation Committee is requested to consider modalities for supporting Non-LDC Parties to plan, prioritize and implement NAPs

Most of the Preamble of the decision and the whole decision text remains bracketed, with two options addressing the funding modalities. The difference lies mainly in the guidance given to the GEF as the operating entity of the LDCF, with option 1) elaborating important details for this guidance, including that funds for NAPs should be separated from funds for NAPA implementation, and option 2) remaining very vague. Option 1 reflects more the LDCF position.

7.3.4 Work program to address loss and damage from climate change

The problem of climate change damages (in the UNFCCC jargon "loss and damage") is being granted increasing weight in the negotiations, in part because climate change mitigation is advancing slowly. With a temperature increase of 2°C, and even more so in a 4°C world, we will not be able to adapt to all the consequences of climate change, there will necessarily be damages. Therefore, in Cancun a work program was agreed to prepare further steps of the parties at COP18, including the need to explore a range of possible approaches and potential mechanisms, including an international mechanism, to address loss and damage, with a view to making recommendations on loss and damage to the Conference of the Parties for its consideration at its eighteenth session.

Decision 7/CP.17 mandated the UNFCCC Secretariat to organize an expert meeting on the thematic area 1 (Assessing the risk of loss and damages) before the thirty-sixth session of the Subsidiary Body for Implementation with a view to generating an adequate knowledge base for the discussion under thematic area 2 (Identifying a range of approaches to address loss and damage) (UNFCCC, 2011j). By the same decision Parties also requested the secretariat to make available the report of the expert meeting for consideration by the Subsidiary Body for Implementation at its thirty-sixth session. Furthermore, the Secretariat should prepare a technical paper, before the expert meeting in collaboration with relevant organizations and

other stakeholders, summarizing current knowledge on relevant methodologies and addressing data requirements.

This paper was prepared by the secretariat and titled "Current knowledge on relevant methodologies and data requirements as well as lessons learned and gaps identified at different levels, in assessing the risk of loss and damage associated with the adverse effects of climate change" in a draft version before the expert meeting held in Tokyo, Japan, from 26 to 28 March 2012. The final version was made available before SB36 (UNFCCC, 2012a). This technical paper basically assessed 18 selected approaches, methods and tools in terms of their data and information requirements, strengths, weaknesses, lessons learned, gaps at different levels and relevance for social and environmental impacts, as well as discussed capacity needs for applying risk assessment methods in developing countries. It also considered risk assessment application to decision-making. The Secretariat also prepared the notes of the expert meeting on assessing the risk of loss and damage associated with the adverse effects of climate change, held in Tokyo, Japan, from 26 to 28 March 2012. These elaborated on the discussions focused on the different aspects of the risk assessment process, including (a) the data and information requirements for assessing impacts and climate risks; (b) methods and tools for risk assessment, including their requirements, strengths and weaknesses; (c) capacity needs for applying risk assessment methods on the ground; and (d) linking risk assessment with decision-making. The report included a summary of the key issues addressed at the meeting and common issues/areas identified in furthering the work on loss and damage in developing countries that are particularly vulnerable to adverse effects of climate change.

7.3.4.1 SBI-36 and Conclusions proposed by the Chair

The first informal consultations on loss and damage associated with adverse impacts of climate change were held on Tuesday, 15 May 2012, and Parties considered ways to move forward. Bolivia, on behalf of the G-77 and China suggested to draw a conclusion along with an annex, based on the outcome from SBI, in order to providing further guidance for the upcoming four regional expert meetings, and to facilitate the discussions prior to take decision in Doha COP 18. Bolivia also suggested to include the reference to the international mechanism in the conclusions, as contained in Decision 7/CP.17, and to avoid a unified approach to loss and damage taking into account national and regional contexts of adverse impacts of climate change.

Timor Leste, on behalf of LDCs, welcomed the technical paper on assessing the risk of loss and damage and the report on the expert meeting held in Japan as a good basis for substantive discussions. Timor Leste expressed its great concern over capacity constraints of Least Developing Countries. AOSIS also expressed concerns on identification of the support needed for SIDS to assess potential risks associated with adverse impacts of climate change. The US put emphasis on the necessity for data on physical determinants and socio-economic drivers of risk as well as on human vulnerability in assessing the risk of climate impacts. They also cautioned against conflating assessment of risk associated with adverse impacts of climate change.

Further informal consultations, held on 17 and 18 May, led to drafting sessions. The following lengthy and contradictory drafting process finally led to the agreement on the conclusions adopted at thirty-sixth session of the Subsidiary Body for Implementation. The main conflicting issues in the drafting session included listing the non-economic losses and the mentioning of the need to consider an international mechanism, which was agreed in the decision of the COP 17. G77 and China, AOSIS and the LDCs provided some lists of non-economic losses such as loss of territory, ecosystem, cultural heritage, values, livelihoods, local and indigenous knowledge. Finally, however a compromise was achieved by not listing those and only referring to the non-

economic losses in general. The draft conclusions were agreed on 22 May (see also Section 10.8 t 10.10 of the Annex). Of particular importance is the agreement on an informal meeting before COP18; since loss and damage will not be dealt with in the extra negotiating session in Bangkok, and since neither the regional expert meetings have the mandate to draft decision text, this meeting is crucial to go into COP18 with some kind of text basis for negotiations. Since, according to the decision from Durban, Parties will at least have to take into account institutional aspects such as an international mechanism or a Climate Risk Insurance Facility, substantial conceptual work is required in the remaining months. By 17 September, Parties and relevant organizations are also invited to make submissions on the role of the Convention (thematic area 3) in addressing loss and damage.

Overall one can summarize that - from a vulnerable countries' perspective - little more could have been expected from this meeting. The upcoming regional expert meetings are now of great importance to better understood the available approaches and the implementation constraints. Ideally they would also help in understanding where assistance and cooperation by the international community, for example through some kind of international mechanism, is needed (even if this particular aspect is not in the explicit mandate of the regional meetings).

7.3.5 Nairobi Work Program

The negotiations on the Nairobi Work Program absorbed relatively little time. The conclusions contained inter alia

- a recognition of the progress made in the implementation of the NWP;
- a reminder that COP 19 (2013) should decide on future areas of work (2013), based on recommendations by SB38;
- and recalled that Parties and relevant organizations are invited to submit to the secretariat, by 17 September 2012, their views on potential future areas of work of the Nairobi work programme. (UNFCCC, 2012d)

7.3.6 Least Developed Countries Matters

Matters related to the LDCs usually include the work of the Least Developed Countries Expert Group (LEG) and the implementation of the LDC work program 2012-2013, as well as the operation of the Least Developed Countries Fund. Currently, an important part of the LEG work program links into the the NAPs debate (see above), since it was mandated by decision 5/CP.17 to develop further technical guidelines and support for the NAP process on the basis of the ones agreed in Durban. In early August, the LEG will meet in Vienna to continue its work on the NAPs guidelines. Moreover, the conclusions agreed in Bonn

- encouraged the LEG to enhance collaboration with relevant organizations, agencies and regional centers in carrying out activities under its work program, as appropriate;
- request the LEG to keep it informed of the efforts of the LEG in implementing the work program over the period 2012–2013;
- invite Parties in a position to do so to continue to provide resources in support of the implementation of the LEG work program;

- invite the GEF as the operating entity of the LDCF to support the organization of the regional training workshops mentioned in the LEG work program for 2012–2013. (UNFCCC, 2012c)

7.3.7 Review of the interim arrangements of the Adaptation Fund

The Adaptation Fund Board (AFB) was established in Bali in 2007 at the third meeting of the Conference of the Parties serving as Parties to the Kyoto Protocol (CMP) as the operating entity to supervise and manage the Adaptation Fund. The CMP also decided at the same session that the AFB should work under the authority of and fully accountable of the CMP, which is in charge of its overall polices. Upon invitation, the Global Environmental Facility was selected to provide the AFB, the secretariat services and the International Bank for Reconstruction & Development of the Word Bank to serve as trustee. Both arrangements were on an interim basis. Accordingly, it was also adopted that the effectiveness and adequacy of these institutional arrangements should be reviewed with a view to the CMP adopting an appropriate decision on this matter at its seventh session in Durban.

The review of the institutional arrangements of the AFB is a long standing issue that was supposed to be closed in Durban, but was delayed however due to a longer time period required for the preparation of the independent consultancy work that should feed into the review. This situation made very difficult for Parties to adequately negotiate this important item in Durban. In the consultation in Durban, it was unanimously agreed among all Parties, that the review could not satisfactorily be undertaken as long as the AFB - as operating entity of the fund involved with the trustee and secretariat - had not provided its view on the findings of the consultant. The CMP7 therefore decided to request the AFB to submit its view on the findings for inclusion in an information document by March 2012 so that Parties could be able to start reviewing the AFB institutional arrangements at the SBI in May in Bonn. It was foreseeable that the AFB would not be able to meet this deadline, as the March meeting was the subsequent one of the AFB after the CMP7, during which it is supposed to build and formulate its view on the review. Since there was not enough time and space at the meeting to review the fund's arrangement and at the same time to formulate the conclusion for the SBI, the AFB set up an ad-hoc group to undertake the review. The ad-hoc group continued working and circulated its preliminary conclusions to the Board between sessions. Further inputs will be provided to the SBI upon consideration by the Board of the final conclusions by the working group, which is planned for end of June 2011. So once again, like in Durban, Parties were confronted during the SBI36 meeting with the same problems "Not being able to review the AFB" because of the lacking information from the AFB on the review. Nevertheless, a working group was set up by the SBI, which, in closed informal meetings, discussed the way ahead in the review.

In this informal meeting, Parties first debated whether they could start the review despite the missing information with the goal of updating it as soon as the conclusions and recommendations of the AFB were available. Some other Parties pointed out that this is not a good approach to deal with such a review. Other Parties asked the chair of the AFB, bearing in mind the workload and the range of agenda items to be discussed in Doha, whether it could not be possible to disclose the information that is currently available at the AFB level so Parties can start the review and save sufficient time in Doha. The AF Chair clearly mentioned that the ad-hoc group has not terminated its work. The AFB as a group has to decide about the disclosure of the information as long as decision on the review. In addition to the missing information from the AFB, some Parties raised several other issues related to the current institutional arrangement such as the functioning of the trustee, the access to funding and

funding availability. Furthermore, some other Parties also drew the attention to the issues regarding the sustainability, predictability, adequacy of the AF resources by recalling the continuous decrease of CERs price on the carbon market. Parties further emphasized the need to find a way to bolster the only functioning fund under the convention, which is financing several adaptation projects on the ground in developing countries.

After a long discussion on other more or less important issues related to the review, Parties finally adopted the SBI draft conclusion proposed by the chair (UNFCCC, 2012c). The SBI draft conclusion recognized that further information is needed in addition to the inputs required in para 1 and those listed in the annex decision 6/CMP.6 para 5(a-d). After a long discussion about finding common ground and understanding on how to undertake the review, the SBI requested to the AFB in addition to its conclusion, to provide information on the administrative cost of the AFB and to submit it to the UNFCCC secretariat by 13 August 2013. The SBI then requested the secretariat to compile synthesized information including in relation to the Least Developed Countries Fund and the Special Climate Change Fund into an information document to be considered at its 37th meeting in Doha, for the purpose of issuing a comparative analysis by Parties of the current institutional arrangement. The SBI further invited Parties and relevant organizations to submit their views on the review by 17 September 2012. The UNFCCC secretariat was moreover requested to compile the view of the all stakeholders submitted to the UNFCCC into a miscellaneous document.

To sum up, one can assume that the discussion on the review of the AF will be tough in Doha. Not only, because the negotiators will be confronted with several financial items, but also because of the sensitivity of the AFB as a fund seen by developing countries as the solidarity fund they always call for. Furthermore, the review could leverage experience relevant for issues related to the permanent trustee and secretariat of the Green Climate Fund.

7.3.8 ADP and AWG-LCA

In Bonn, the new Ad-hoc Working Group Durban Platform on Enhanced Action (ADP) met for the first time. Parties struggled hard to find agreement on key modalities, which included the set-up of chairmanships until 2015 from different constituencies - it was agreed in which year representatives from which regional groups would chair the ADP, but individuals were only agreed for 2012 and 2013 - and the agenda for this year. On the latter point, Parties established an agenda which can roughly be described as having two items, one on the negotiations for a 2015 agreement, and the other one on the work program to increase the ambition in mitigation (and potentially means of implementation) before 2020. Since the ADP founding decision (1/CP.17) also mentions adaptation as one area of work, the ADP will have to address also this negotiation block as well. However, in Bonn there have not been any substantive discussions on how to approach this area of work due to the difficult procedural negotiations (see UNFCCC (2012b) for the report of the session).

In principle, at least the following links between the Durban Platform and the adaptation agenda need to be considered, as some preliminary thoughts:

1. the Adaptation Committee could include in its work program the identification of adaptation needs post-2020 which could feed into the DPA negotiations;
2. the NAPs could serve as an important tool to inform about the post-2020 needs, including on financial support, provide substantial NAPs will be available until 2015;
3. loss and damage will likely be further conceptualized, including the need to clearly identify the delineations to the adaptation agenda in order not to repeat the same

discussions under a new heading; but given the lack of ambition in mitigation the issue will have to stay (and potentially climb up) on the political agenda.

The AWG-LCA is expected to be closed at COP18. However, the discussions in Bonn showed that there are different interpretations among Parties as to whether this will only be the case if the AWG-LCA has really achieved "an agreed outcome" as mandated in the Bali Action Plan. Since this is hard to measure given the vague nature of the Bali Action Plan, in the upcoming sessions controversial negotiations can be expected. However, since COP17 there has not been a specific adaptation issue to the AWG-LCA agenda since remaining issues were shifted either to SBI (loss and damage, National Adaptation Plans) or to the Adaptation Committee (e.g. regional centers). At SB36, some Parties re-introduced adaptation on the agenda of the AWG-LCA by inserting the original language from the Bali Action Plan and asked for a contact group to be held on adaptation. This seems to be motivated by tactical considerations. Potential explanations include concerns over the delay of the Adaptation Committee since little progress can be expected in 2012 (see also chapter on NAPs), the attempt to keep adaptation strong on the AWG-LCA agenda to ensure adequate treatment under the ADP and to hold another bargaining chip.

7.3.9 Next steps

With the Bonn negotiations concluded, almost half of the negotiating year 2012 is already over. On all issues under SBI and SBSTA, conclusions were reached. Some of these already provide a good basis for negotiating a decision in Qatar (National Adaptation Plans), but most of them rely on further work to be undertaken over the course of 2012 (loss and damage work program, submissions on the NWP). The delay in starting the work of the Adaptation Committee is unfortunate and therefore results in outstanding work on some relevant issues. The commencement of the new negotiation process towards a 2015-agreement under the ADP has not yet reached a level where the role of adaptation is being addressed in detail. The Green Climate Fund has so far also been stalled due to a delay in nominations for Board members. Since the GCF will be of particular relevance to the funding of adaptation, its progress will have to be observed from an adaptation perspective as well.

In the upcoming preparatory negotiations to be held in early September in Bangkok, adaptation will hardly be addressed since only the AWGs will meet but not the SBs. Nevertheless, it may provide negotiators with an opportunity to informally conduct further work and exchange on the key matters for which agreement is envisaged in Qatar.

Loss and damage and the National Adaptation Plans process are undoubtedly in the focus of this year's negotiations. The regional expert meetings and - likely building on that - submissions by Parties will be the key input for the elements of a decision to be made in Qatar. Given the lack of text basis as of now, the scope of potential decisions in Qatar is quite broad. However, in light of the increasing importance of the issue and the continued failure of the governments to put adequate mitigation pledges on the table, it can be expected that there will be intense and controversial discussions. Also, there is good reason for seeing a decision in Qatar rather as a starting point in a longer-term journey than just the conclusion of the work program, with loss and damage potentially playing a role for the negotiations towards a 2015 agreement.

With regard to NAPs, COP18 could set a positive signal through clear support initiatives to move forward the application of the NAPs guidelines by assisting LDCs in expanding their work on longer-term planning. This can also become an important basis for the ADP to consider adaptation-relevant aspects, including financial needs, for the time post-2020, as well as for the

Green Climate Fund to take into account in elaborating funding modalities. At the same time, work has to begin to think about the longer-term perspective of adaptation in the negotiations and its role in the ADP process. Furthermore, one can only hope that the Adaptation Committee will at least have one initial meeting - ideally two - before COP18 to be able to at least report on some progress. Overall, adaptation will continue to be an important building block on the UNFCCC agenda in Qatar, heavily impacted by the progress in the mitigation and finance arena.

7.4 Adaptation to climate change: What role for the Durban Platform for Enhanced Action?

7.4.1 Background

The Durban climate summit concluded with a set of decisions relevant to adaptation. COP decisions were adopted on the Adaptation Committee (under the AWG-LCA) (UNFCCC, 2011f), the process on National Adaptation Plans (UNFCCC, 2011e), the work program on loss and damage (UNFCCC, 2011j), matters related to the Least Developed Countries (under the SBI) (UNFCCC, 2011c), the Nairobi Work Programme on Impacts, Adaptation and Vulnerability (under SBSTA) (UNFCCC, 2011d). The Conference of the Parties to the Kyoto Protocol (CMP) took decisions on the Adaptation Fund (UNFCCC, 2011g, 2011h). Under the AWG-LCA due to the establishment of the Adaptation Committee (AC) and the decision to shift many tasks to the AC, no adaptation items were specifically mandated for 2012. Thereby, COP17 also moved forward the operationalization of the Cancún Adaptation Framework (CAF) adopted at COP16. The CAF has to be regarded as a key milestone in the adaptation negotiations. The most politically controversial outcome in Durban was the decision to establish the Ad-hoc Working Group Durban Platform for Enhanced Action (ADP) (UNFCCC, 2011a). This decision primarily outlines a process for negotiating a protocol, another legal instrument or agreed outcome with legal force applicable to all Parties until 2015, and which should come into effect by 2020. It was also decided to conclude the AWG-LCA at COP18. The concrete tasks of the new AWG remain undefined, and concretizing these is part of the discussions in 2012.

After the last negotiation session before COP18 in Doha, the climate change talks held at the end of August/early September in Bangkok, the discussions on substance under the ADP have just begun, since the previous session in Bonn spend most of the time on agreeing on the agenda of the ADP (two agenda items) and selecting the chairmanships for the next years (see also 6.8). The exchange of views in Bangkok under the ADP took place in a number of round-tables which did not focus on any of the building blocks. Only a few Parties (only from developing countries) addressed adaptation explicitly, e.g. by

- highlighting the role of adaptation in the ADP;
- pointing to a potential distinction between the participation of Parties in the 2015 agreement depending on whether it is only about mitigation or also on adaptation;
- underlining the importance of addressing barriers to technology dissemination in adaptation;
- stressing the need to enable countries to implement programmatic structural approaches and response to specific challenges from different sectors;
- referring to a loss and damage mechanism;
- stressing the need for adaptation finance and

- mentioning climate refugees[26].

Overall, one can summarize that so far, the negotiations on adaptation under the ADP are far from providing a clearer idea of how adaptation might be treated in the 2015 agreement. However, this makes it even more important to put thoughts into this question in order to inspire the discussions. This has to happen against the background of the changing and emerging institutional architecture under the Convention. SBI and SBSTA currently have a number of tasks on adaptation, partially resulting from decisions to shift issues out of the LCA as a consequence of decisions 1/CP.16 and 2/CP.17. The Adaptation Committee has met for its first meeting in September 2012 and has included in its report to COP18 a three-year work plan (Adaptation Committee, 2012). It has been established, after continuous demands from developing countries, in order to assist the COP in taking decisions related to adaptation. An initial list of activities was contained in decision 2/CP.17, as a basis for the ACÂ´s first task, to develop a 3 year work program. Also the Technology Executive Committee (TEC) and the Standing Committee on Finance (SC) address tasks which are relevant to adaptation. For the implementation of adaptation actions it is expected (and hoped) that the Green Climate Fund will play a much greater role than current multilateral funds were able to perform. Nevertheless, the instruments such as the Adaptation Fund or the Least Developed Countries Fund will continue to assist developing countries in addressing urgent adaptation needs at least for some time, depending on any future rationalization of the financial mechanism.

In the following sections, this chapter will discuss options for approaching adaptation under the ADP, with the aim of considering ways for the effective support for particularly vulnerable developing countries. This will be based on some general considerations of how to approach the ADP negotiations, an analysis of Parties ADP submissions and the coverage of adaptation therein and a review of Parties proposals made in the run-up to COP15. Finally, some preliminary conclusions will be drawn. The intention is to kick-off the discussion about the role of adaptation in the ADP (and the 2015 agreement), rather than providing concrete answers.

7.4.2 The scope of the ADP negotiations and strategic considerations

The key purpose of the Durban platform is to negotiate a new legally-binding agreement (hereafter named "Protocol"). Secondly, the decision on the Durban platform initiated a work program to increase ambition, which, though not explicitly defined, is usually regarded as an option to increase mitigation ambition in the near-term, even before 2020 (or ideally before 2015 to avoid lock-in and the burial of the 2°C objective). However, there are also discussions about how far this ambition increase would also relate to means of implementation such as finance and technology support, including for adaptation.

In order to explore the concrete content of a 2015 agreement which will be negotiated under the Durban Platform, it is important to be aware that the Protocol is supposed to come into effect only in 2020. Furthermore it is important to see that a rectifiable Protocol will face higher barriers of agreement than COP decisions. It must also be considered whether the political demands one would like to follow need to be secured through a ratified Protocol which will not come into effect before 2020, or whether COP decisions are sufficient for the overall demand (or specific elements of it). The advantage of COP decisions can be that they can be implemented immediately, that negotiators/ministers at COP can flexibly negotiate and agree on something without the need to secure agreement by their parliament. Rectifiable,

[26] Notes from ADP discussions in Bangkok, 30 August to 5 September 2012

legally-binding agreements of course have the advantage of the higher bindingness, which is particularly important where country-specific commitments are being addressed and where (ideally long-term) reliability and predictability are crucial (e.g. for investors). Of course, such an agreement can also include and thereby strengthen ex-post previously agreed COP decisions, so it is not necessarily an either-or. This implies that it would be at least questionable to approach the Durban Platform in a way where one now throws everything into that process which one always wished to be addressed (and that is still on the agenda of other negotiating tracks) in the different areas (such as finance, adaptation, technology etc.), but rather think strategically how to approach the Durban Platform most effectively and efficiently. Other issues which are required earlier than 2020 may be concluded under the AWG-KP and AWG-LCA in 2012, as mandated by the Durban decisions, or thereafter under SBI/SBSTA or the relevant committees. This could also mean to work towards a Protocol which is not as comprehensive as possible but as comprehensive as necessary. It could include all the building blocks, but not necessarily all the demands within a building block, since some of them maybe dealt with sufficiently under the SBs. Therefore, the exploration of the concrete inputs into the 2015 agreement could be guided by the following questions, and the timing of the needs is a crucial factor here:

1. What do we need on adaptation post-2020? One could argue that only this is relevant for the Protocol negotiations. Everything we would need to happen before 2020 is not directly relevant for the Protocol negotiations (with the certain exception of the near-term mitigation increase as mandated by the Platform but not as part of the Protocol). It may be relevant as part of a package deal in 2015, which would include the Protocol, but also additional COP decisions which would be implemented immediately thereafter.
2. What of these needs need to be dealt with in a legally-binding instrument (Protocol), and what of these could be sufficiently pursued on a COP decision level (and therefore would not be directly relevant for the Protocol negotiations)? Of course it is important to identify the parameters that allow this distinction.
3. What do we need to do until 2015 (research, step-by-step decisions) to identify the needs for post-2020? Who or what instruments (inside and outside the UNFCCC process) could play a role in identifying these needs (e.g. the new Committees, Low-carbon and climate-resilient development strategies, National Adaptation Plans process)? This could be a central place also for enhancing the science-policy linkages and to identify requests to the scientific community which can move forward the negotiation process.
4. What actions should be taken between 2015 and 2020 in order to prepare countries to implement the agreement coming into effect from 2020?

The above provides a relative rational approach leaving aside for a moment negotiation tactics. However, it is likely that a major deal like the envisaged 2015 agreement would have to include adaptation elements in order to present a certain balance between adaptation and mitigation. Given the fact that adaptation has a much higher prominence now compared to the time when the Kyoto Protocol was agreed which is overall weak on adaptation, and given the already locked-in climate change impacts, this seems indispensable. This could mean that the 2015 Protocol would include adaptation elements which by their very nature would not necessarily qualify as requiring ratification, but which would be required to achieve a balanced outcome.

7.4.3 Treaty proposals before Copenhagen

A key starting point for identifying potential adaptation issues for a future Protocol is to look back at what those Parties which mostly demand ambitious adaptation actions requested as part of a legally-binding deal back before and in Copenhagen, and then assess how much these demands have already been fulfilled. Therefore, the following table contains an overview of the demands contained in the AOSIS treaty and the African treaty proposal, and in its 3rd column identifies what is the state of the negotiations.

What conclusions can be drawn from this analysis? First, most of the issues that were raised by AOSIS and the African group in the context of the Copenhagen discussions were at least addressed in the Cancun Adaptation Framework adopted through decision 1/CP.16 (most of the text equaled the state of discussion in Copenhagen). Second, some progress has been achieved on some of the issues through the process since Copenhagen (such as National Adaptation Plans, loss and damage under SBI), while on other issues almost no discussions and therefore no formal decisions happened although they are part of the Cancun Adaptation Framework (e.g. regional centers, national-level institutional arrangements, reporting of action and support). However, the progress on these issues generally lacks behind the desires of the two Party groups. Third, the institutional demand of a specific body has been fulfilled through the establishment of the Adaptation Committee. Because of delays it has only recently started its work. Fourth, a number of issues have hardly been further addressed since Copenhagen, and the ADP process may provide an opportunity to bring these up again. These include:

1. the link between mitigation and adaptation, including historical responsibilities;
2. finance for adaptation, where no specific figure for adaptation finance has been agreed as a goal, where important qualitative criteria such as additionally to ODA Commitments is not really on the table; however, the Green Climate Fund now exists with a specific adaptation window (but yet without substantial resources)
3. adaptation as a standing agenda item: adaptation remains scattered across different agenda items; in contrast, for example finance is an own agenda item under the COP, under which different processes report[27];

Table 29: Adaptation-related aspects in treaty proposals from Copenhagen, 2009, and how far they have been addressed in succeeding negotiations. Source: (UNFCCC, 2009).

Key adaptation elements of AOSIS treaty proposal	African group proposal	State of policy implementation under UNFCCC
1. Parties agree that enhanced action on adaptation is urgently required to enable, support and implement action to reduce vulnerability and build resilience to the impacts of climate change.	7. Adaptation to the adverse impacts of climate change arising from the historical cumulative green house gases (GHG) emissions of developed country Parties, poses a serious threat to economic and social development, and is an additional burden on developing country Parties efforts to reduce poverty and achieve their development goals. Adaptation activities	Addressed in a similar manner in para 11 of CAF, but referecen to GHG emissions and responsibility of developed countries missing

[27] see e.g. COP18 agenda: http://unfccc.int/files/bodies/cop/application/pdf/prov_agenda_cop_18.pdf

	encompass urgent and immediate, short, medium and long term actions at national, regional and international levels.	
	8. An institutional framework on adaptation to climate change is hereby established under the Convention to enable developed country Parties to fulfill their commitments to fund the full incremental costs incurred by developing country Parties of implementing programmes to facilitate adequate adaptation to climate change, and to meet the costs of adapting to the adverse effects of climate change as elaborated in para 21 of this document. It shall enhance and support adaptation to climate change in all developing country Parties and in particular African countries, Least Developed Countries and Small Island Developing States. The institutional arrangements shall comprise:	a framework established through the CAF, broadly with a similar objective, less specific with regard to finance
2. Developing countries, especially the particularly vulnerable developing countries, shall be provided with the necessary financial, technological and capacity-building support by developed country Parties through the Multilateral Fund on Climate Change (MFCC), established in Article 12, for the full range of adaptation actions undertaken pursuant to this Protocol. Adaptation actions shall include, inter alia: action at the project, sectoral and national levels; administrative and legislative actions; protection of people displaced by the impacts of climate change; and addressing loss and damage arising from the adverse effects of climate change.	(ii) A new adaptation fund window under the Convention to finance the full costs of adaptation activities and actions and the related transfer of technology sharing and capacity building in developing country Parties, with sources of funding be new, substantial and sustained public funding from developed countries, with an annual scale not less than 2.5% of the GNP of developed countries, and including through fullfiling thier financial commitments under the convention. (b) Provide support, including finance, technology development and transfer and capacity-building, by developed country Parties for adaptation actions in developing country Parties (in accordance with Articles 4.1, 4.3 and 4.5 of the Convention), especially those that are most vulnerable to impacts to climate change;	Addressed in a weaker form through CAF paras 14 (list of adaptation actions), and para 18 requesting support from developed countries, however without explicit link to Green Climate Fund (but ensured through GCF governing instrument approved in Durban); no scale of funding defined
3. Financial support for		Such qualification of the financial

implementing adaptation action shall be grant-based, long-term and over and above existing official development assistance commitments. Developing country access to this financial support shall be simplified, expeditious and direct, with priority given to particularly vulnerable developing countries.		support not addressed, but enhanced role for direct access in GCF
4. National adaptation actions may be developed and implemented at different time scales reflecting the diverse national circumstances of Parties		In principle addressed through para 14 CAF
5. All Parties shall develop, update periodically and make available to the Conference of the Parties, their National Adaptation Priorities (NAPs), drawing where available on existing strategies and plans. The absence of a NAP shall not be an impediment to eligibility for financial, technological and capacity-building support for adaptation actions and priorities.	(a) Support the formulation of national adaptation measures (in accordance with Article 4.1) in particular in developing country Parties;	National Adaptation Plan (strong focus on LDCs) process established through CAF (para 15ff); further advanced through decision 5/CP.17 on NAPs, the work undertaken by the LEG, and the mandate for the Adaptation Committee to elaborate on related issues for non-LDCs
6. Developing country Parties shall be supported to establish or strengthen designated national level institutional arrangements for adaptation to enhance work on the full range of adaptation actions from planning to implementation, including risk management planning for the international mechanism for addressing loss and damage.		Strengthening of national-level arrangements through paras 14 (list of adaptation actions), para 18 (request to developed countries for support) and para 32 of CAF
7. Regional centres for adaptation shall be established or strengthened to assist developing country Parties with the implementation of adaptation action. The mandate, control and contribution to the funding of regional centres will be guided by the developing country Parties in the relevant region, supported by developed country Parties.	(c) Establish and where appropriate strengthen regional centers, networks, initiatives and coordinating bodies for adaptation, building upon and complementing national adaptation action on all levels.	Strengthening and establishment in principle enhanced through para 30 of CAF, no action taken yet, but mandate for Adaptation Committee to work on
8. The Conference of the Parties		Specific adaptation agenda item not

shall consider the implementation of adaptation as a standing item on its agenda. The consideration of adaptation issues by the Conference of the Parties shall be supported by the Adaptation Committee, established below, which shall provide an annual report to the Conference of the Parties on its activities, together with any recommendation for actions by the Conference of the Parties.		yet formally established; Adaptation Committee will report annually to the COP; SBI items on NAPs and loss and damage work programme
9. An Adaptation Committee under the authority and guidance of the Conference of the Parties is hereby established. The Adaptation Committee shall be comprised of Parties to this Protocol and have a majority of Parties not included in Annex I to the Convention, and may also include representatives from relevant international organizations.	(i) An adaptation executive body under the authority and guidance of the Conference of Parties and that comprises equitable geographical representation, to promote international cooperation on adaptation and other relevant activities under the Convention, set the criteria and parameters of activities to be funded and where appropriate help mobilize financial resources from public and other sources of finance, to support the implementation of country driven strategy, programs and projects, including at the regional levels.	Adaptation Committee established through para 20 of CAF, operationalised through Durban, three-year work plan to be approved in Doha
10. The purpose of the Adaptation Committee shall be to support the work of the Conference of the Parties in assisting developing country Parties to implement adaptation actions, paying special attention to the needs of particularly vulnerable developing countries. The functions of the Committee shall include, inter alia: (a) interacting with Parties and bodies currently engaged in adaptation implementation; (b) analysing existing work and identifying best practice; (c) helping countries to access adaptation related funding and support; (d) identifying adaptation gaps and enhancing action to respond to		See above, but with different functions, in particular not addressing direct support to specific Parties (like suggested through 10c of the AOSIS proposal, reports through SBI to COP, but not directly to COP

such gaps; (e) assessing delivery of financial, technological and capacity-building support; and (f) advising on technical matters building on work of existing Convention bodies and expert groups.		
11. An international mechanism addressing risk management and risk reduction strategies and insurance related risk sharing and risk transfer mechanisms, including mechanisms to address loss and damage from the impacts of climate change, is hereby established and defined. The purpose of the international mechanism shall be to support developing country Parties, especially the particularly vulnerable developing countries, to build resilience through addressing the risks associated with climate-related extreme weather events; and compensation and rehabilitation for loss and damage resulting from climate-related slow onset events, including sea level rise, increasing temperatures and ocean acidification.	(iv) An international mechanism to address the unavoidable loss and damage resulting from the adverse effects of climate change, and associated lost opportunities for development, with the following components: (a) An international facility to address risks associated with climate-related extreme weather events, that incorporates measures to reduce, manage and prevent risk; (b) A compensation and rehabilitation component for climate-related slow onset events (v) A compliance mechanism under the Convention for measuring and verifying the provisions of financial resources and transfer of technology from developed country Parties (within the new operating entity under the Convention Financial mechanism).	Work programme on loss and damage established in CAF (para 26), further detailed in Durban, including the objective of considering further action at COP18 (incl. the option of an international mechanism)
12. Financial support for planning and implementing adaptation actions that address loss and damage in developing countries shall be provided by developed countries through the adaptation and insurance windows of the Multilateral Fund on Climate Change.		Financial support requested from developed countries through para 18 of CAF; Green Climate Fund established through 1/CP.16 and Durban decision, with an adaptation (but no insurance) window;
13. All Parties should enhance reporting on the implementation of adaptation actions through national communications funded and submitted pursuant to Article 4, paragraph 3, and Article 12 of the Convention.		Reporting addressed in para 33 of CAF

Fifth, none of the demands have been linked to needs expected or assessed for a specific time-frame, largely because they are (yet) more of a procedural and aspirational nature. Therefore,

they do not provide information on specific needs beyond 2020, but operationalizing the provisions concretely can of course help identifying these needs. The proposals were silent on the question of what would, for example, happen with the multilateral funding architecture once the new fund - in reality the GCF, in the above proposals the Multilateral Fund on Climate Change (AOSIS) or the new operating entity under the financial mechanism (African group) - would have been established. Rationalization of the financial mechanism could e.g. also mean the closing of existing funds to reduce the fragmentation.

7.4.4 The adaptation discussions under the ADP

As has been shown above, the ADP discussions have not yet achieved a stage where adaptation matters have been discussed in more detail, it was not even decided which adaptation matters to discuss in the ADP context. However, it is worth looking at the submissions that were made to the ADP for identifying some further aspects for this discussion (see Table 31). Generally, the CAF seems to be a key starting point, but Parties identify the need to follow up on the key issues included therein. The following key points can be highlighted:

1. generally increasing the level of ambition (India)
2. strengthen the institutional arrangements, including regional centers and various platforms of cooperation (Honduras)
3. promote integration of adaptation into development plans (Uzbekistan)
4. work on loss and damage, including establishing an international mechanism (Honduras, LDCs)
5. National Adaptation Plans, including their full implementation (LDC)
6. Financing adaptation:
7. substantial increase of predictable and adequate funding (AOSIS, Ecuador, India, Honduras)
8. equitable distribution between mitigation and adaptation (Ecuador)
9. link between mitigation and adaptation (AOSIS, EU)
10. rationalization of the financial mechanism regarding adaptation finance (LDCs)
11. strengthen integrated approaches and mechanisms to mitigation and adaptation (Honduras, Switzerland for hte area of agricultural sector).

In addition, one of course also has to recognize that other issues under the ADP - such as finance and the equity discussions - are relevant to adaptation, but they are not considered more closely here.

Table 30: Excerpts from Parties submission to the ADP. Source: (UNFCCC, 2012a,b).

Country	Elements
AOSIS	14. The new protocol should give balanced treatment to the areas identified in decision 1/CP.17, namely mitigation, adaptation, finance, technology development and transfer, transparency of action and support, and capacity-building. 16. Enhancing action on adaptation should also be considered in the context of the global temperature goal. Initial discussions on adaptation should focus on: • The climate change impacts at various temperature rise scenarios; • The economic and social costs of those impacts;

	• The scale of the means of implementation required to adapt to those impacts, including the scale of financial resources, technology transfer and development, and capacity building; and • Transparency of action, particularly the provision of the means of implementation. 17. Discussions should focus on ways to dramatically scale up the provision of new and additional financial resources to ensure adequate and predictable flows of climate finance to enable the implementation of mitigation and adaptation actions in developing countries.
Australia	The agreement should also assist efforts by all countries, and in particular the most vulnerable dev eloping countries, to adapt to the adverse effects of climate change. The Cancun Adaptation Frame work created a number of institutions and processes that foster adaptation with a long-term, strat egic outlook. The new agreement should build off and improve this framework whilst maintaining th e flexibility and creativity to continue to address the local and immediate adaptation needs of deve loping countries. Financial, technology and capacity-building arrangements should support adaptation efforts in tandem with mitigation efforts
Ecuador	3. One of the key objectives of the Durban Platform should be to create and to strengthen the conditions required to effectively implement mitigation and adaptation measures and actions. 6. The Durban Platform should focus on creating and strengthening the capacity of the social, economic, cultural and environmental systems to address the adverse impacts of climate change. 29. Adaptation to climate change is a priority for the Government of Ecuador, as well as for other developing countries. The Durban Platform should focus on this issue. 30. Under the Platform of Durban, it is necessary to strengthen the implementation and promotion of adaptation activities of developing country Parties, with the international support of developed country Parties. 31. Financing to climate change should prioritize to developing countries, recognizing those countries that are particularly vulnerable to the adverse effects of climate change. 32. There should be an equitable distribution of financial resources between adaptation and mitigation. 33. The actions related to adaptation should focus on the sectors outlined below and each one should be analyzed in detail in the negotiations of the Durban Platform: ☐Food sovereignty/security and agricultural production; Productive and strategic sectors; Natural heritage; Water heritage; Human health; Vulnerable groups that require attention priority; Comprehensive risk reduction and management of natural disasters related to climate change; Human settlements and climate refugees. 39. Ecuador proposes that the rights of the technologies that contribute to mitigation and adaptation in developing countries should become more flexible. 42. Funding for adaptation and mitigation must come largely from public resources provided by developed countries to developing countries. Without concrete commitments of funding, it is unlikely that developing countries can achieve the goals of mitigation and adaptation required to cope the climate crisis.
EU	21. Adaptation to the adverse impacts of climate change is necessary for countries to minimise negative impacts and make full use of the opportunities for climate resilient growth and sustainable development. Successful mitigation implies a higher likelihood for ecosystems, societies and economies to adapt in a timely manner, while failure to mitigate would make adaptation efforts extremely costly or even unfeasible. How can the ADP work plan acknowledge the intrinsic link between mitigation ambition and adaptation needs? 22. How can we reap the benefits of the significant progress that has been made in consolidating adaptation work under the Convention, as well as draw on the work of existing institutions and the adaptation architecture being implemented, in order to facilitate action by Parties? 23. Should the ADP work plan address enhanced reporting on vulnerability and adaptation? Should the ADP also look at how to follow up on observed impacts of climate change and measures undertaken to facilitate adequate adaptation, drawing on the ongoing work under the Convention?

	How can systematic collection and exchange of information on adaptation actions best support cost effective actions, and favour the exchange of knowledge e.g. about appropriate technologies? 24. The ADP will need to discuss how to mobilise the most appropriate and efficient tools and resources to enable the implementation and delivery of ambitious mitigation efforts, as well as to provide support for adaptation, in a way that is a catalyst for positive and sustainable change.
Honduras	Increase the level of ambition, according to the common but differentiated responsibilities and respective capabilities, to achieve stabilization of the climate system below 1.5C and take the necessary measures to support adaptation to allow ecosystems to adapt naturally to climate change ensuring that food production is not threatened and enable economic development to proceed in a sustainable manner. Adaptation a) Strengthening of the various platforms of cooperation related to implementation of adaptation work currently outside the framework of the UNFCCC, including bilateral and multilateral financing; b) Increase funding for adaptation in accordance with the observed and projected impacts, including in IPCC studies; c) Strengthen the institutional system, including regional centers and networks and institutional arrangements; d) Inclusion of the work related to damages and losses associated with climate change impacts within the Platform, including a mechanism to respond to these; e) Incorporation in the work on the adaptation with adequate space for the consideration of cultural and social losses, especially among indigenous, local, women and children; f) Strengthening national capacities to assess and respond to vulnerability to climate change; g) Consideration of knowledge related to the Nairobi Work Programme, including sectoral issues such as water, forests and agriculture; Mitigation e) Strengthening of mechanism that support synergies and complementarity of adaptation and mitigation in a manner that incentivizes activities that generate co-benefits, such as those related to land use, including REDD Finance a) Increase and ensure the availability, additionality and distribution of financial resources in accordance with the scale of action needed to meet the specific objectives and in accordance with the principles and commitments of the Convention, maintaining the commitment for a equitable distribution of resources for mitigation and adaptation, considering that that the latter is vital for particularly vulnerable regions, such as Central America; Technology b) Support and finance for the development of endogenous technologies for mitigation and adaptation;
India	31. Work under the adaptation pillar must draw upon work already done in the AWG-LCA. There must be predictable and adequate Annex II funding for adaptation, and the means must be put in place to ensure this. The Cancun Adaptation Framework, including the work program on 'loss and damage', must be carried forward and implemented. 33. [...] India strongly supports a facilitative IPRs regime that balances rewards for the innovators with the common good of humankind and thereby enables developing countries to take early and effective mitigation and adaptation actions at the national level. In the absence of such a facilitative IPRs regime, the objective of advancing nationally appropriate mitigation and adaptation actions at the scale and speed warranted by the Convention will not be achievable. 41. Further, as pointed out earlier, this work of increasing the level of ambition must include in its scope not only mitigation but all other aspects of adaptation, finance, technology development and transfer and capacity building.
LDCs (Gambia)	The discussions of what to include in the new legally binding agreement will also need to take into account that new institutions launched as a result of COP-16

	and COP-17 relating to finance, technology and adaptation that are starting their work. These include the Green Climate Fund, the Standing Committee, the Adaptation Committee and the Technology Executive Committee and Climate Technology Center and Networks. Also work undertaken under the SBI and SBSTA should be fed into the ADP continuously. Furthermore, the LDCs believe that the work programme on Loss and Damages 4 should result in an international Loss and Damages mechanism that should also be a key architectural element of the new regime. Additional commitments and actions relating to adaptation, including means of implementation an d a new international mechanism for loss and damage, should be included in the new Protocol. The se will need to be decided and elaborated based on the work and inputs of other technical bodies u nder the Convention, such as the completion of the work of the AWG-LCA, the work that will be do ne by the technical bodies under the Convention (Adaptation Committee, Standing Committee, Technology Executive Committee), and adaptation-related issues under SBI and SBSTA. Of particular importance for LDCs is the National Adaptation Plans process. Significant progress in the elaboration and delivery of these plans can inform the ADP, e.g. regarding post-2020 finance needs. Full implementation of NAPs should be a key objective for the new Protocol. Furthermore, the work programme on loss and damage should elaborate beyond COP18 options to address loss and damage, including. an international mechanism, to feed into the ADP. Rationalising and improving the financial mechanism from an adaptation point of view should also be considered, ensuring full consideration of LDC´s particular needs and vulnerabilities. Additionally, many mitigation, adaptation and financing issues are covered by treaties and bodies outside the UNFCCC. It would be important to examine the role of the Convention in supporting the work of others bodies as well as potentially requesting or inviting them to contribute to mutually beneficial tasks. An initial mapping report of such bodies and efforts might help scope the work of the ADP.
Switzerland	and the mitigation of emissions from the agriculture sector, including consideration of synergies with adaptation efforts.
Uzbekistan	For the development and further realization of NAMA and NAPA in the developing countries and countries with economy in transition which are Not-Annex I Parties it is needed to establish the additional institutional structures including training of experts, mastering of methods and instruments of economical analysis of adaptation and mitigation. Adaptation is a process which should be included to the national plans of development and strategy. Adaptation to climate change can not be considered separately from the other problems related to the economy and sustainable development. Uzbekistan supports the establishment of regional centres and institutional mechanisms in the Convention framework, in particular, the centres on adaptation which will enhance the national efforts and provide for the methodical, technological and financial support to the developing countries, including development of NAPA, elimination of barriers and facilitating the access to the new adaptation technologies, in the development and introduction of technologies. More attention should be paid to the best practice in the area of the non-market technologies.

7.4.5 Preliminary conclusions

The above analyses have shown that the debates under the ADP regarding the role of adaptation in a future legally-binding agreement are still in a very nascent stage. While there are some important left-overs, at least most of the issues raised in treaty proposals in the Copenhagen context have been addressed to some extent, either through concrete further negotiation work or through defining a work track for them (in the future in particular through the Adaptation Committee). In order to draw preliminary conclusions, it is important

to come back to some of the questions highlighted as guidance for how to approach the ADP in the following sections. What do we need on adaptation post-2020, and what do we need to do until 2015 to identify these needs? There is little specific information available yet on the overall needs, including in the submissions from Parties. But the following step could provide helpful inputs for getting a clearer idea of the needs:

1. Consider in how far the IPCC Fifth Assessment Report could deliver information for this question; the deadline for peer-reviewed articles to be taken into account is 31 January 2013; the Second Order Draft Review of the Working Group on Impacts, Adaptation and Vulnerability, which could be used for providing related comments or questions to IPCC authors will take place from 29 March to 24 May 2013;
2. Update the UNFCCC Secretariat paper on investment and financial flows: the previous editions of this study have been useful in informing the debate about mitigation and adaptation finance needs; updating the paper with a view of a better understanding for the time between 2020 and 2030 could provide useful information and could be initiated e.g. in Doha at COP18;
3. Launching and accelerating the National Adaptation Plans process: while rushing through the adaptation planning process is also not advisable, it should be envisaged to pursue the development of National Adaptation Plans immediately; the preparation of these plans could also include adaptation cost estimates for the time beyond 2020; where these already exist in developing countries, they could be updated or their methodology used to inform other countries. If substantial results would be available before the end of 2015 this could inform the ADP negotiations;
4. Benefit from work of the Adaptation Committee: in Doha it is expected that the work plan (2013-2015) developed by the Adaptation Committee will be approved. While it currently does not contain an explicit mandate to inform the ADP negotiations, there are entry points in the work plan which can help answer some of the questions around what is needed post 2020, e.g. the periodic overview reports to be prepared which should also address gaps and needs identified in adaptation and the provision of support.
5. A permanent agenda item on adaptation could help developing a more coherent picture of the adaptation negotiations and its tasks, with the Adaptation Committee playing an important role to inform this process and to suggest further action by the COP.

What of these needs need to be dealt with in a legally-binding instrument (Protocol)? If one looks at the areas identified in Sections 8.4.3 and 8.4.4, there are few things which by their very nature seem to need ratification to be put into place. The operationalization of issues like the promotion of regional centers or national-level institutional arrangements or even the Adaptation Committee does not necessarily seem to be impacted by a ratified international treaty. Of course including them on a higher level can signal the appreciation of steps undertaken since the Cancún Adaptation Framework and outline that further work needs to be done. This may be different with certain overarching principles, such as the link between mitigation (or failure thereof), adaptation and also residual loss and damage, which got largely lost in the Cancún Adaptation Framework or other decisions. The potential role of loss and damage in the ADP can be better discussed against the background of the decision expected to be taken in Doha, e.g. related to the role of the mechanism. Issues related to the potential

rationalization of the financial mechanism, such as the potential merger of existing funds with the Green Climate Fund, may not necessarily have to be dealt with through a Protocol but can likely be achieved through COP decision. In contrast, achieving more reliable and predictable financial contributions from developed countries, but also from e.g. innovative mechanisms could likely be better achieved through formalized commitments.

What actions should be taken between 2015 and 2020 in order to prepare countries to implement the agreement coming into effect in 2020? This will also depend on the implementation progress on the elements contained in the CAF. The more progress there, in enhancing the institutional capacity of developing countries, in achieving concrete adaptation supported by finance, the better countries will be prepared to scale-up their actions beyond 2020. Further development and implementation of the NAPs may be one important task for that period, as well as enhancing the understanding on loss and damage. In any way, it is likely that assuming there will be a new legally-binding agreement at COP21 in 2015 envisaged to come into effect from 2020, it should be accompanied by concrete decisions which result in action for the years between 2015 and 2020.

7.4.5.1 Implications for ADP discussions in Doha and the workplan of the ADP

When Parties continue to discuss the vision and the future work of the ADP at COP18 in Doha, they should recognize the important role that other process and bodies under the Convention can play in informing the ADP. This also allows to avoid duplication of efforts, but rather to use these bodies to prepare the ADP considerations efficiently. Having an initial stocktaking of the implementation of the CAF and associated implications for the ADP would be an important starting point for 2013. These discussions could then be guided by some of the strategic considerations outlined in this paper.

7.5 UNFCCC negotiations on adaptation: current discussions and their relevance for the International Climate Initiative (October 2011)

7.5.1 Summary

The Cancún Adaptation Framework, a result of long-lasting discussions and negotiations under the UNFCCC, is one of the major milestones for international cooperation on adaptation. The International Climate Initiative (ICI) as an innovative tool of German bilateral climate cooperation considerably contributes to mitigation and adaptation actions as well as to reduced deforestation in developing countries. This paper examines how the adaptation work of the ICI could relate to the components of the Cancún Adaptation Framework, for instance the national adaptation plans or regional centers.

7.5.2 Introduction

The International Climate Initiative of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has developed as an important instrument of German climate finance. The process of developing this instrument was influenced by positive signals from the UNFCCC negotiations towards a global agreement and a global climate partnership. Since 2010 the "importance of the partner country in the context of the international climate negotiations" is explicitly mentioned as a selection criterion in the funding criteria (BMU, 2010).

With regard to the Cancún Adaptation Framework (CAF) the paper examines which concrete recommendations for the ICI can be drawn, particularly looking at how to maximize its effect

towards an international agreement on climate change. While it will first introduce general elements of the CAF it will later discuss their relevance for the ICI. The paper closes with some broad recommendation on how to enhance the profile of the ICI in the context of the UNFCCC.

7.5.3 The Cancún Adaptation Framework (CAF)

The CAF is a milestone in international climate change adaptation policy. There were three years of intensive negotiations in the context of the Bali Action Plan before agreements, which are now forming the Cancún Agreements, under the Ad-hoc Working Group on Long-term Cooperative Action (AWG-LCA, decision 1/CP.16) could be reached at COP16 in Cancún (see (UNFCCC, 2010a)). The CAF consists of general principles and criteria, which provide guidance for implementing adaptation actions. Furthermore it includes important subjects to be discussed and negotiated under the UNFCCC, in particular national adaptation plans and the loss and damage associated with the adverse effects of climate change. Moreover, with the CAF Parties decided to establish an Adaptation Committee to promote the implementation of enhanced action on adaptation in a coherent manner under the Convention.

The Cancún Adaptation Framework is defined as follows:

Decides to hereby establish the Cancun Adaptation Framework encompassing the provisions laid out below, with the objective of enhancing action on adaptation, including through international cooperation and coherent consideration of matters relating to adaptation under the Convention; (UNFCCC, 2010a) *para* 13.

As undertakings by the ICI can be understood as international cooperation on adaptation and since Germany has agreed to the Cancún Agreements, a binding influence of the CAF in the ICI can be assumed.

7.5.4 Principles and criteria

In paragraph 12 of the Cancún-Agreement (1/CP.16) general principles and criteria are outlined, indicating the way adaptation activities should be realized. In the following paragraphs, the relevance of those principles for the ICI is highlighted.

Country-driven: This criterion, which resembles the principle of ownership in the context of development cooperation, suggests that adaptation activities should be initiated and executed by the target countries themselves. However, it must be taken into account that how this criterion is approached depends on the interpretation of "country-driven". Certainly the principle ultimately means that particularly financial decisions within the context of projects are assigned to the responsibility of the countries. A model fund that applies the "country-driven" principle is the Adaptation Fund (AF) under the Kyoto Protocol, in which the project implementation and supervision can be carried out by national entities. (Under the AF, the principle is named "direct access" and is carried out by the so called "National Implementing Entities" (NIE), which beforehand need to be accredited by the AF).

As of late 2012, 15 countries are able to apply the "direct access" modalities[28]. Since 2009 the ICI defines the "integration in national strategies and international cooperation" as a selection criterion (BMU, 2010) for projects to guarantee at least a basic level of coherence of funded actions with the national policy and planning frameworks.

[28] A list of NIEs including contact details is presented under: http://www.adaptation-fund.org/national-implementing-entities

It is important to keep in mind that with the ICI as a German bilateral funding instrument, there is a certain tension with the principle of country-drivenness. A short analysis of the funded adaptation activities for example shows that by far the largest part of activities are implemented by the GIZ and KfW, as well as some by international organizations. Almost no projects are implemented primarily by domestic organizations[29]. To strengthen the principle of country-drivenness, a higher number of implementation activities by institutions of the target countries would be desirable. The accreditation of NIEs under the AF is bound to some internationally agreed fiduciary standards, which can be seen as a seal of quality for the institutions' capacity. With regard to the ICI, Germany could send a strong signal to developing countries by supporting their domestic responsibility through arranging concrete cooperation activities with respective institutions.

Moreover this would fill a gap in German development cooperation on climate change adaptation as the idea of "direct access" and the strengthening of NIEs has so far received only little attention in the German development sector. A similar signal to developing countries could be send by supporting national climate funds in developing countries (see (UNDP, 2011)).

In addition there is the idea of supporting such projects by the ICI that systematically puts the countries who are able to apply direct access in a leading position. This could for example be activities to support direct access under the AF or capacity building for the application for accreditation of NIEs.

Gender-sensitive: This principle is based on the awareness that climate change is affecting men and women often in very different ways and that also adaptation strategies in their implementation should reflect gender aspects in order to be successful. So far, adaptation processes (but also mitigation and REDD) do not have to respond to the needs of men and women in a disaggregated manner. Certainly it would be worth thinking about integrating the gender sensitivity into the ICIÂ´s modalities. Another thought would be to support women's rights in particular in the context of climate change impacts through concrete projects.

Participatory: The participatory approach must be split between the development phase of a project proposal (incl. decision making) and the project implementation. At the level of project development this refers to the consultation processes when planning activities. Depending on the size of the project these consultation processes can be extensive and in some cases also expensive. A solid participation should in particular include the integration of the people in affected project relevant regions. Experiences show that early participation is highly relevant for the sustainability and success of the project implementation. One tool to guarantee wide-ranging consultation in the phase of the development of the project would for example be to provide the possibility of interest-free loans or special grants for a participatory approach when developing project proposals. This would only take place after project concepts would have been endorsed. Another relatively reasonable and rather inexpensive tool as applied by different institutions (compare e.g. in the case of the AF, CDM) is the possibility to allow web-consultations on project proposals.

At the level of project implementation it is necessary to chose an approach that is as participatory as possible for a wide range of activities. There are already participatory practices in the sense of good professional practice anchored in many ICI projects. This should be continued.

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[29] Analysis undertaken on the basis of the available project list: http://www.bmu-klimaschutzinitiative.de/de/projekte_iki

Fully transparent approach: With regard to selection and prioritization of projects, the ICI is not as transparent as other bilateral initiatives. There is no clarity about the weighting of different criteria for the overall assessment. Furthermore, the public has no possibility to participate in the decision-making process. In this regard multilateral funds are often more transparent. In terms of the AF for example, all submitted projects (concepts and full proposals) are made available on the website several weeks before their first discussion in the decision making body. Moreover there is the possibility to comment on the projects in public before they are accepted. In the Pilot Program for Climate Resilience (PPCR), one of the Climate Investment Funds, selected observers from civil society can comment on project proposals. Overall, this procedure is much more compatible with the principle of transparency. Only in individual cases it can be legitimate not to publish information for reasons of confidentiality.

With regard to reporting, the ICI must be awarded a high level of transparency. In contrast to other actors of German climate finance that only provide aggregated quantitative data, the ICI allows the following of financial flows according to country, project topic and concrete topic (see Grießhaber (2011)). Therefore, in this area the ICI can be regarded as a positive example for the principle of transparency.

Taking into consideration vulnerable groups, communities and ecosystems: This principle indicates that particularly vulnerable groups and ecosystems should profit from adaptation activities. However, it is important to note that a stronger version of this principle is already part of the strategic guidelines of the AF which were agreed upon by all member states of the Kyoto Protocol (Adaptation Fund, 2009). In general this principle should not only refer to hazards (for example through physical exposure maps) but must also consider the socio-economic vulnerability of groups and ecosystems.

For the ICI we have identified the following relevance: A special focus on country groups who are generally considered as particularly vulnerable (for example the Least Developed Countries) seems appropriate on the project level[30]. It can be assumed that the percentage of vulnerable groups in Least Developed Countries is higher than in other countries. An analysis of ICI projects in the area of adaptation indicates that less than a third of the activities of the ICI took place in countries that were "defined" as particularly vulnerable by the outcome documents of Bali & Copenhagen (Enting and Harmeling, 2010). However, a full implementation of this prioritization is also not desirable as especially the Small Island States receive very high per capita support that can not be assessed as fair.

The project level seems even more relevant as well as the fact that particularly vulnerable population groups or ecosystems (in case of the ecosystem approach) have to be part of the proposal structure and the selection criteria. From an operational point of view this could mean that project proposals need to layout e.g. by vulnerability analyses, why certain project areas have been chosen or why the needs of the particularly vulnerable are first priority. Moreover, a consistent application of this principle could also facilitate evaluating the impact of the ICI concerning this principle, which is also characterized by a high public legitimacy.

[30] As well at the climate conference in Bali as also in the Copenhagen Accord the particular vulnerability of the Least Developed Countries, of the Small Developing Island States and of African countries was acknowledged. Although contained in negotiation texts ahead of Cancún, especially Central American and Central Asian Countries insisted on a further definition. Therefore a fixed arrangement on country prioritization could not be found.

Based on and guided by the best available science and, as appropriate traditional and indigenous knowledge: As in the area of mitigation, adaptation work should be based on the latest scientific standards. In some activity areas (for instance in Community-based Adaptation) traditional knowledge and traditions are relevant. On a programmatic level, a more efficient knowledge management strategy can contribute to the systematic integration of this knowledge. For example tracing the work of the newly established Adaptation Committee under the UNFCCC may be relevant to the ICI, as one of its functions is the synthesis and collection of information and trends concerning adaptation[31].

Integration in view to integrating adaptation into relevant social, economic and environmental policies and actions, where appropriate: As mentioned above the ICI has introduced the "integration in national strategies and international cooperation" as a selection criterion since 2009. In the context of concrete project activities which support the integration into other policy areas, this can be seen as a contribution of the ICI to this objective.

7.5.5 "Eligible" measures

The CAF declares, besides a range of principles, also a list of areas of activity that the Parties are "invited" to consider. This list can broadly be interpreted as a definition of what is acknowledged as an adaptation activity by the international community, so that these activities can be regarded as "eligible" (UNFCCC (2010a) para 14):

a) Planning, prioritizing and implementing adaptation actions, including projects and programs and actions identified in national and subnational adaptation plans and strategies, national adaptation programs of action of the least developed countries, national communications, technology needs assessments and other relevant national planning documents;

b) Impact, vulnerability and adaptation assessments, including assessments of financial needs as well as economic, social and environmental evaluation of adaptation options;

c) Strengthening institutional capacities and enabling environments for adaptation, including for climate-resilient development and vulnerability reduction;

d) Building resilience of socio-economic and ecological systems, including through economic diversification and sustainable management of natural resources;

e) Enhancing climate change related disaster risk reduction strategies, taking into consideration the Hyogo Framework for Action, where appropriate, early warning systems, risk assessment and management, and sharing and transfer mechanisms such as insurance, at the local, national, subregional and regional levels, as appropriate;

f) Measures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at the national, regional and international levels;

g) Research, development, demonstration, diffusion, deployment and transfer of technologies, practices and processes, and capacity-building for adaptation, with

[31] It is planned that the Adaptation Committee is operationalized by a corresponding decision at the COP in Durban and will be able to begin its work in 2012.

a view to promoting access to technologies, in particular in developing country Parties;

h) Strengthening data, information and knowledge systems, education and public awareness;

i) Improving climate-related research and systematic observation for climate data collection, archiving, analysis and modeling in order to provide decision makers at the national and regional levels with improved climate-related data and information; Source: Decision 1/CP16"

The goals of the projects supported by the ICI so far can be embedded easily into the extensive list of eligible measures of the CAF. In turn this means that activities in these areas should at least basically be acknowledged as "adaptation strategies" (in the sense of the ICI goal dimension). However, it would be worth considering the possibility of communicating specific goals in which the ICI has been able to build up a profile so far (in particular ecosystem approaches to adaptation and climate insurance systems) with regard to the CAF. Alternatively, it could be worth thinking about supporting topics that are mentioned in the CAF but not covered by other donors. One area would be the still new topic of climate migration[32]. A basic analysis of the international division of labor in this area would be helpful.

7.5.6 Financial support

The CAF also established a connection between adaptation and climate finance. Developed countries are requested to provide increased long-term, new and additional finance, technology and capacity building support for adaptation (UNFCCC, 2010a: para 18). The ICI can certainly be considered a part of this support. Through its innovative funding basis with resources raised from the European Emission Trading System and in the future from the special energy and climate fund ("Sondervermögen Energie- und Klimafonds"), the ICI resources seem to entail relatively good longer term predictability. This should be communicated pro-actively.

Concerning the criterion of "new and additional" there is no internationally agreed upon definition at present. But experience from fast-start finance has shown that only few resources provided are really "new" (raised after 2009) and "additional" to the previous development finance (not counted towards the 0.7% ODA target). However, the problem of a competition between existing climate and development finance in the case of the ICI is at least partially mitigated by the additionality of the financing instrument. During the next years the lessons learned from fast-start finance have to be translated into improvements for the future climate finance architecture. Especially the positive features of the ICI - financing structure and financing sources - should be introduced into this debate.

7.5.7 Adaptation Committee

In Cancún the establishment of an Adaptation Committee (AC) under the UNFCCC was decided. The AC is supposed to facilitate a coherent approach to adaptation under the UNFCCC, since until now adaptation has been addressed under the UNFCCC in a rather fragmented manner. In Cancún, certain functions were attributed to the Adaptation Committee. However, the Parties have to elaborate further modalities such as reporting procedure, size, meeting locations until Durban to operationalize it.

[32] The issue was introduced into the negotiations for the first time in 2009.

Intended functions of the AC are: 1) Providing technical support and guidance to the Parties; 2) Sharing of relevant information, knowledge, experience and good practices; 3) Promoting synergy and strengthening engagement with national, regional and international organizations, centers and networks; 4) Providing information and recommendations, drawing on adaptation good practices, for consideration by the COP when providing guidance on means to provide incentives for the implementation of adaptation actions, including finance, technology and capacity-building; 5) Considering information communicated by Parties on their monitoring and review of adaptation actions, support provided and received." (UNFCCC, 2010a)

Where relevant to the adaptation measures funded by the ICI, the results and recommendations of the Adaptation Committee should be seriously assessed. At the same time the ICI should participate actively in integrating own experiences and findings into the work of the AC. Financial support of the work of the committee should be considered by the ICI (or other instruments of the German climate finance) in the long run because of its potential and important catalytic function. Moreover it is very likely that the committee will usually hold its meetings at the headquarters of the UN Climate Secretariat in Bonn.

7.5.8 Loss & Damage

After the relatively basic recognition of loss and damage associated with the adverse effects of climate change in the Bali Action Plan, a work program on this issue was established in Cancún. As in the previous negotiations there is still disagreement between developing countries, in particular Small Island Developing States, and industrialized countries related to the question of which topic should be envisaged: rather pragmatic questions of implementation like climate risk management, prevention of extreme events, risk transfer and insurance solutions especially in cases of extreme events; or compensation solutions especially in cases of slow-onset events like sea-level rise. As a compromise formula, besides the announcement of strengthening international cooperation in this area, a work program was established under the SBI that addresses issues connected to climate-related loss and damage. It is supposed to generate recommendations for COP 18. The concrete arrangement of the work program is a matter subject to the negotiations before and in Durban.

The ICI has already decided in an early stage to support climate-related insurance approaches - one part of the loss and damage debate. Therefore the previous experience of the ICI projects should be fed into the activities of the work program.

7.5.9 Regional adaptation centers

The CAF sees the strengthening, and where necessary establishment, of existing regional adaptation centers as an important element to promote regional exchange of information (UNFCCC (2010a) para 30). Although the importance of regional centers, especially in their possible bridging function between the national and international level is not questioned, no negotiation process in this area has been initiated yet. To date, Small Island Developing States and LDCs have expressed the position that regional institutions and networks should not compete against support for developing countries under the Convention. Even though it is captured in the elaboration of the Green Climate Fund, for example, this speaks for a funding focus of bilateral donors in this area. The ICI could for example intensify its cooperation with renowned regional institutions - for instance with the Caribbean Community Climate Change Center (5C) in Belize that provides a wide range of services for CARICOM countries, or also the Secretariat of the Pacific Regional Environment Program (SPREP) that plays a similar role in the

pacific region - or could communicate its own experience to strengthen or establish other regional centers and networks. The establishment of institutions (or special capacities in established institutions) in regions that do not possess anything like regional adaptation centers would yet be desirable as well.

7.5.10 National institutions

In addition to the establishment of regional centers, the CAF emphasizes the support, strengthening, establishment and appointment of nationally organized structures to advance the work on adaptation from the stage of development to the stage of implementation (UNFCCC (2010a) para 32). Moreover the national institutional integration of adaptation in developing countries has to be strengthened.

One instrument is the elaboration of specific adaptation strategies that can of course also be part of larger-scale climate strategies (which also address mitigation) and should contribute to the integration of adaptation into other (for example sectoral) policy and planning areas. During recent years further institutional innovations have developed in the battle against climate change. One example is Bangladesh that - besides an adaptation strategy - has also developed a fund that facilitates the implementation of the strategy by government authorities as well as stakeholders of civil society (see Müller (2011); UNDP (2011)). For the ICI this raises the question of strengthening national institutions especially in connection with intensive cooperation with countries. Supporting such countries that have or are developing innovative mechanisms that transfer responsibility to national structures could be an important role model for other countries.

7.5.11 Reporting procedure

Reporting procedures are also part of the CAF. According to paragraph 30, information concerning support, progress of activities, experiences, challenges and gaps have to be provided also in view of project work. The main instruments concerning this are National Communications. In relation to the ICI there are still many improvements required. At the moment the ICI is only listed in the area of "research and systematic monitoring" in the German national communication (German Government, 2010). The level of detail of the reporting procedure lags far behind the information that is available on the website of the ICI and does in no way catch up with the requirements of the CAF.

For the next national communication a more comprehensive presentation of the ICI is desirable. But therefore, the way the ICI is included in this reporting obligation has to be consolidated to be able to depict the program impact of the ICI. An important part of this strategy would be a specific knowledge management strategy within the ICI. Moreover, case studies of individual ICI projects under the heading of "international cooperation" should be integrated into the German National Communication, as already happened in the case of specific projects supported by the BMZ. Another step is to provide information for responsible bodies in beneficiary countries so that the information can also be contained in the national communications of those countries.

7.5.12 Approaches for a higher profile of the ICI in the UNFCCC Adaptation negotiations

In general the ICI has a good presence at the climate negotiations, through regular side events, but also through an exhibition stand at the climate negotiations. In order to raise the profile of the ICI during the negotiations another recommendation could be to conduct more projects

with stakeholders from the negotiations. As mentioned already there are only few projects that rely on implementing entities in developing countries. To cooperate closely with institutions that are quite important in the negotiations could be a strategy to further raise the profile of the ICI in general. In addition, the ICI should systematically present its contribution to the CAF. One possibility could be a side event with adaptation negotiators, stakeholders of civil society and international organizations. As a product it would also be advisable to develop and present an "official" strategy of the ICI in the area of adaptation in relation to the CAF.

8 Conclusions

In this work we make the first attempt to determine costs of the adaptation process to climate change, named Logical Adaptation Process (LAP). This differs from previous works by considering adaptation a time and stage dependent sequence of actions that take place in a logical order. This is done in order to mimic the existence of potential adaptation barriers like for example, delays in overcoming knowledge or institutional gaps. The starting point of our analysis is to guarantee that adaptation to climate change within a particular system (in this case, agricultural, coastal and population) is properly represented. We have therefore empirically determined typical time and costs for the adaptation phases of understating and planing from an open-access database of adaptation projects (Ci:Grasp). Costs of the management phase of the adaptation process are determined according to particular impacts on the attribute of concern in the highlighted systems.

The costs of adaptation obtained via the methodologies described can be rather low. For example, yearly costs in million USD for agricultural adaptation between 2015 and 2050 can be as low as 0.2-3.2 for the case of soil conservation pathway in Brazil. For the same country, the irrigation pathway leads to costs in order of 0.8-49.3 for the same time period. The use of different pathways in the agricultural system has been reflected for each country individually. For example, in cases for which impacts of climate change could be offset by the application of soft adaptation (crop changes/soil conservation) the irrigation pathway (more cost intensive) was excluded altogether. For the remaining systems (coastal and population) the Ci:Grasp database did not allow for the construction of elaborated LAP's. In this case, adaptation was operated in a more simple, although not less meaningful way. For the case of adaptation of coastal systems to sea-level rise, India is expected to be the country in which most investment is required, about 13 millions USD per year between 2015 and 2050. For the time period 2055-2095 costs are expected to be of about 22 millions USD per year. It should be pointed that these costs include investments in knowledge and planning activities to take place before the phase of implementation.

The relative low costs obtained reflect the spatial scale of analysis and the way adaptation is represented in the report. For example, previous studies have pointed out that adaptation to sea-level rise takes the form of hard protection measures. The implementation of this measure implies that a large amount of data is available, e.g., storm surge statistics for the entire coastal length. In addition, the implementation of hard infrastructure will further put pressure on already stressed coastal ecosystems and probably lead to the concentration of further coastal developments. Because the cost analysis developed is country-based and because there are drawbacks to the implementation of hard coastal infrastructure, this report opted for land-use planning activities as adaptation to sea-level rise.

With costs of climate change adaptation increasingly seen by decision makers as being on par with the ones required for mitigation, we suggest that discussions are moved from technical issues regarding costing of adaptation (e.g., discount rates employed, implications of fat-tailed structural uncertainty, rationality behind using cost-benefit analysis to prioritize adaptation) to a comprehensive representation of adaptation as a process.

An analysis of the financial and institutional deficiencies is also undertaken in this report. In order to be operational we have restricted the analysis of financial capacities to the evolution of Human Development Index (HDI). This aggregated measure of the development status of a country goes beyond the mere analysis of GDP although it was found that the HDI components (GDP, enrollment rate, life expectancy) are strongly cross correlated. The analysis reveals a large heterogeneity of HDI dynamics. While some countries such as Brazil and Indonesia are

expected to achieve a comparable HDI to the one found in developed countries by 2015, other countries (e.g., Ethiopia, Cambodia) are expected to remain below developed world standards by 2050. The implication of such findings is that financial capacities of countries to implement adaptation are variable in time. This further reflects the need to first reflect what adaptation pathways are in agreement with the economic capacities of certain countries.

The same could be said in regard of the institutional capacities, although in this report we do not elaborate on the temporal dynamics of the institutional indicators used. Rather, we contrast the average score of institutional indicators found in developed countries (defined as countries with HDI above or equal to 0.8) with the individual scores observed in the investigated countries. Results show that the overall institutional capacities of investigated countries trail behind the ones found for developed countries. On the other hand, when the focus of the institutional indicators is placed on the existence of a long term strategic vision, the indicators score for the investigated countries generally improves. In some cases (Brazil, India) the score is even above average (of developed countries) and on par with the one for Germany.

The analysis of currently allocated adaptation finance was based on projects approved in the context of fast-start finance for the years 2010 and 2011. Substantial data analysis of more than 1000 projects provide a starting point for estimating adaptation costs, but with several limitations. These include lack of clarity of what should be counted as adaptation and lack of understanding in how far these costs reflect "additional" costs of adaptation in order to be able to compare them to overall adaptation cost estimates. The analysis of allocations per country is politically interesting (in absolute and relative terms), however, this landscape is also in constant motion, since new projects are continuously approved. Projections and estimates of adaptation costs hardly exist for the near-term, in particular not for domestic adaptation actions in developing countries. Interesting research initiatives include attempts to review national budgets with regard to potential adaptation-related allocations. Overall, there are significant knowledge gaps and conceptual challenges. With regard to adaptation in the UNFCCC negotiations, COP17 in Durban in 2011 operationalized further several processes initiated through the Cancún Adaptation Framework, which was adopted in 2010. However, the progress in 2012 was different. On loss and damage, the work program started in Cancún became very intense. By the time of finalization, the political outcome to be elaborated at COP18 was unclear, however the profile of loss and damage was raised. The Adaptation Committee, could only start its work in September, aiming to deliver to COP18 a 3-year work program. Regarding National Adaptation Plans, the negotiating session in Bonn produced a draft decision text on the funding modalities. Finally, regarding the new negotiating process launched in Durban towards elaborating a new legally-binding agreement until 2015 (to come into effect in 2020), substantive discussions on content have not yet taken place. Linking these negotiations with the work of the other processes, such as the AC, will be an important approach when it comes to relevant and effective proposals on how to treat adaptation in the future agreement.

Overall, one can summarize that since the adoption of the Cancún Adaptation Framework (CAF) at COP16 (2011), the UNFCCC negotiations have made progress, in particular in 2012. For example, while in 2011 the loss and damage work program remained largely an empty shell, in 2012, based on the decision from COP17, substantial activities were undertaken. Also on National Adaptation Plans, progress could be achieved. However, the COP18 results, which can not be covered by this project, will decide on the next steps particular with regard to loss and damage and the NAPs. For some areas under the CAF (e.g. regional centers, national-level institutional arrangements), there has been no progress, primarily because they were shifted into the Adaptation Committee, which, however, could only start its work in September 2012.

Its three-year work plan is expected to be approved by COP18, so much more conceptual work will be done there. The adaptation discussions under the new process launched in Durban towards a post-2020 agreement, the ADP, are in a very nascent stage, which is why this report contains preliminary views and thoughts which need to be developed further in the course of the negotiations. Overall, the adaptation negotiations currently progress more on a technical level, with less political controversy than the mitigation negotiations. Whether this will change in the ADP negotiations, in the face of the current mitigation failure, remains to be seen.

This report elaborated an innovative methodological concept to evaluate and compare the costs of adaptation to climate change between countries. The methodology puts the main emphasis on the representation of adaptation as a process rather than the technicalities of monetizing adaptation. This is of course debatable. Nevertheless, results do point the possibility that adaptation can be lowered if a proper representation of adaptation as a process is undertaken.

9 Annex

9.1 Agricultural systems

Figure 26: Average fraction of variation in expected rice yields explained by precipitation (top) and temperature (down) in the best fitting months. Grey boxes represent countries for which the climate variables studies have not returned a significant pvalue or the amount of explained variability was below 5% of yield variation.

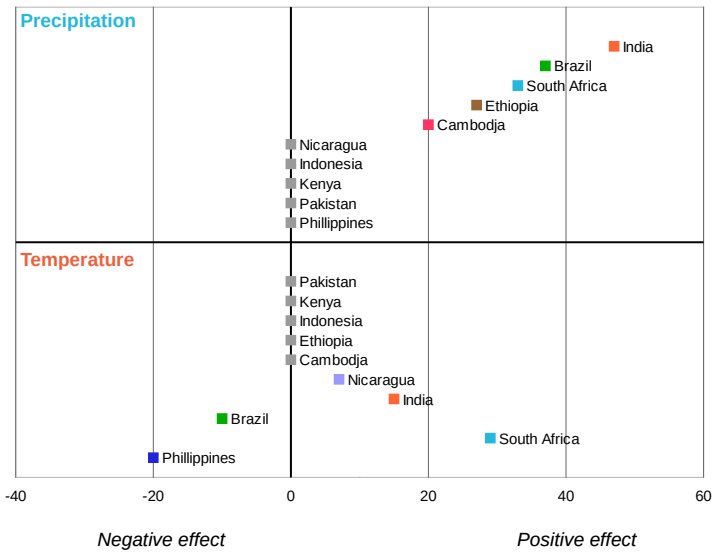


Figure 27: Average fraction of variation in expected maize yields explained by precipitation (top) and temperature (down) in the best fitting months. Grey boxes represent countries for which the climate variables studies have not returned a significant pvalue or the amount of explained variability was below 5% of yield variation.

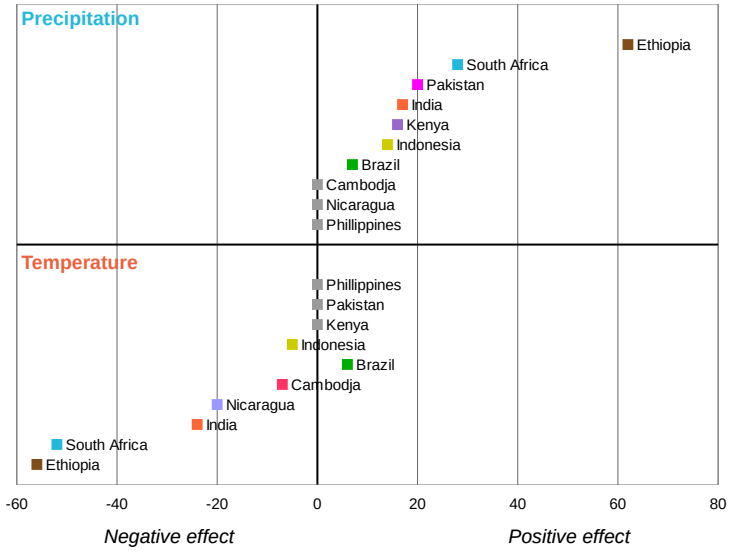


Figure 28: Average fraction of variation in expected wheat yields explained by precipitation (top) and temperature (down) in the best fitting months. Grey boxes represent countries for which the climate variables studies have not returned a significant pvalue or the amount of explained variability was below 5% of yield variation.

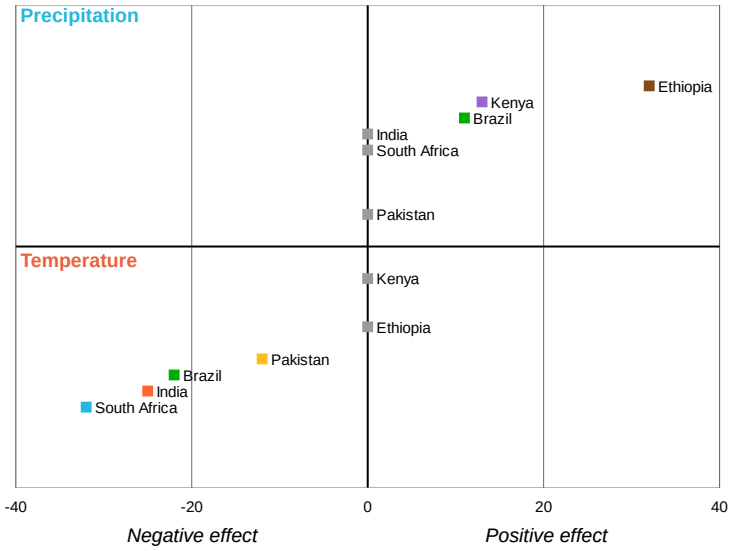


Table 31: Average yearly losses/gains of rice yields in tons per ha for the investigated case-studies.

Country	2015-2050	2055-2095
Cambodia		
RCP2.6	0.29	0.50
RCP4.5	0.16	0.16
RCP6.0	0.02	0.19
RCP8.5	0.13	0.34
Ethiopia		
RCP2.6	-0.40	-0.29
RCP4.5	-0.48	-0.51
RCP6.0	-0.46	-0.47
RCP8.5	-0.71	-0.65
India		
RCP2.6	-0.12	0.06
RCP4.5	-0.21	-0.12
RCP6.0	-0.09	-0.29
RCP8.5	-0.44	-0.47
Brazil		
RCP2.6	-0.07	0.01
RCP4.5	-0.24	0.25
RCP6.0	-0.10	-0.16

Country	2015-2050	2055-2095
RCP8.5	-0.32	-0.31
The Philippines		
RCP2.6	-0.23	-0.10
RCP4.5	-0.27	-0.24
RCP6.0	-0.35	-0.25
RCP8.5	-0.44	-0.41
South Africa		
RCP2.6	0.33	0.45
RCP4.5	0.47	0.69
RCP6.0	0.46	0.53
RCP8.5	0.95	1.05

Table 32: Average yearly losses/gains of maize yields in tons per ha for the investigated case-studies.

Country	2015-2050	2055-2095
Cambodia		
RCP2.6	-0.63	0.13
RCP4.5	-0.76	-0.34
RCP6.0	-0.95	-0.88
RCP8.5	-1.07	-1.46
Ethiopia		
RCP2.6	0.28	-0.18
RCP4.5	-0.93	1.17
RCP6.0	-0.86	-0.06
RCP8.5	-0.46	-0.93
India		
RCP2.6	0.17	0.15
RCP4.5	-0.10	-0.13
RCP6.0	0.12	-0.79
RCP8.5	-0.41	-0.14
Brazil		
RCP2.6	0.16	0.07
RCP4.5	0.25	0.04
RCP6.0	0.25	0.30
RCP8.5	0.59	0.37
Pakistan		

Country	2015-2050	2055-2095
RCP2.6	0.13	0.10
RCP4.5	0.21	0.25
RCP6.0	0.11	0.13
RCP8.5	0.14	0.12
South Africa		
RCP2.6	0.68	0.13
RCP4.5	-1.11	-0.50
RCP6.0	-1.19	-2.06
RCP8.5	-2.66	-2.23
Nicaragua		
RCP2.6	-0.08	-0.06
RCP4.5	-0.22	-0.07
RCP6.0	-0.28	-0.24
RCP8.5	-0.26	-0.53
Indonesia		
RCP2.6	-0.03	0.01
RCP4.5	-0.12	0.01
RCP6.0	-0.12	-0.10
RCP8.5	-0.11	-0.27
Kenya		
RCP2.6	-0.03	-0.03
RCP4.5	-0.12	-0.09
RCP6.0	-0.38	-0.15
RCP8.5	-0.25	-0.22

Table 33: Average yearly losses/gains of wheat yields in tons per ha for the investigated case-studies.

Country	2015-2050	2055-2095
Ethiopia		
RCP2.6	1.17	0.52
RCP4.5	0.97	0.38
RCP6.0	0.68	0.89
RCP8.5	0.88	1.08
India		
RCP2.6	-0.15	0.05
RCP4.5	-0.24	-0.04
RCP6.0	-0.10	-0.13

Country	2015-2050	2055-2095
RCP8.5	-0.31	-0.43
Brazil		
RCP2.6	0.01	0.14
RCP4.5	-1.03	-0.34
RCP6.0	-0.86	-1.88
RCP8.5	-2.09	-2.57
Pakistan		
RCP2.6	-0.14	0.08
RCP4.5	-0.13	-0.06
RCP6.0	-0.17	-0.11
RCP8.5	-0.19	-0.21
South Africa		
RCP2.6	-0.30	-0.41
RCP4.5	-0.50	-0.12
RCP6.0	-0.58	-0.46
RCP8.5	-1.27	-0.69
Kenya		
RCP2.6	0.25	0.29
RCP4.5	0.16	0.70
RCP6.0	0.13	0.44
RCP8.5	0.26	0.12

Figure 29: Projected average yearly losses/gains of total yield (rice, maize and wheat) in tons per ha for Brazil, Cambodia and Ethiopia.

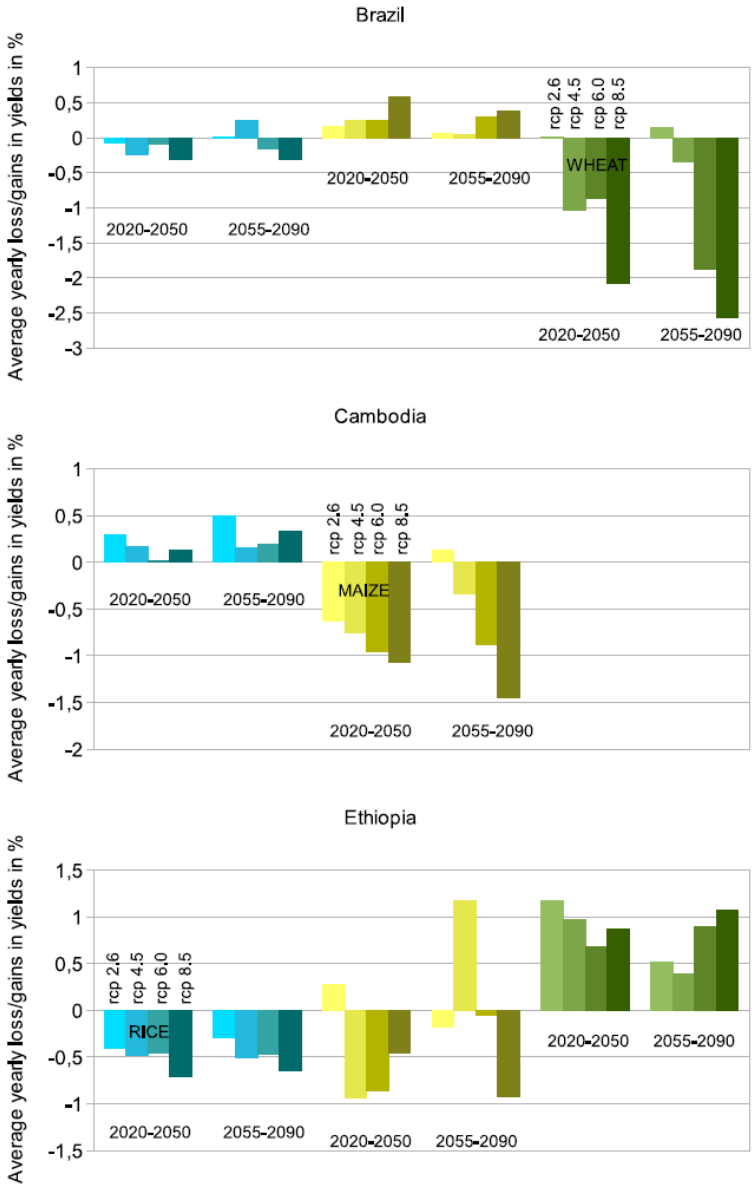


Figure 30: Projected average yearly losses/gains of total yield (rice, maize and wheat) in tons per ha for India, Indonesia and Kenya.

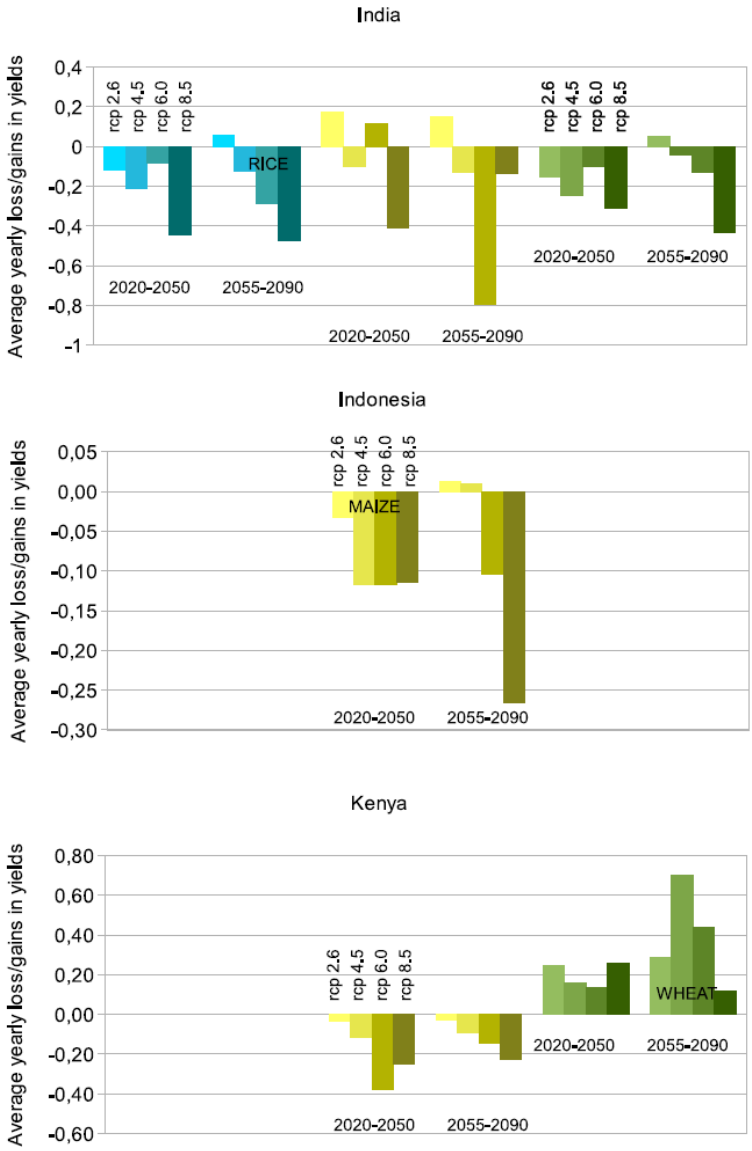


Figure 31: Projected average yearly losses/gains of total yield (rice, maize and wheat) in tons per ha for Nicaragua, Pakistan and The Philippines.

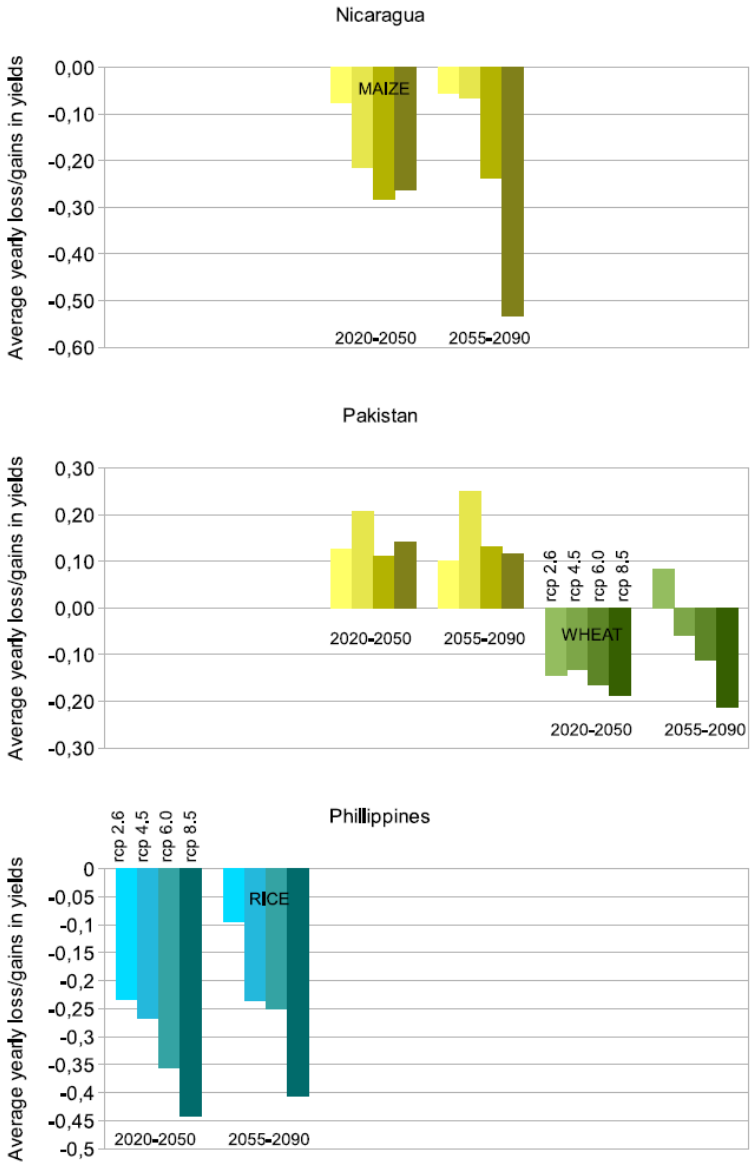
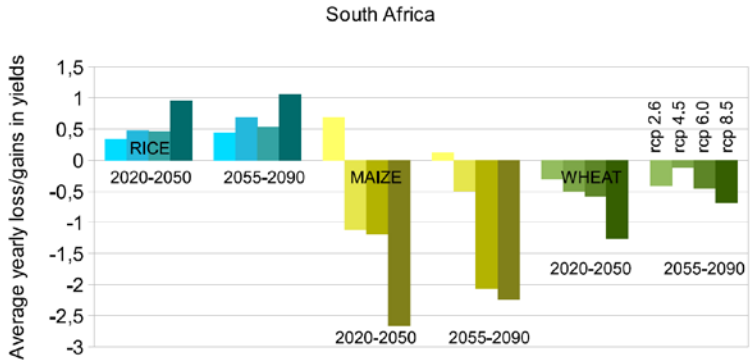


Figure 32: Projected average yearly losses/gains of total yield (rice, maize and wheat) in tons per ha for South Africa.



9.2 Coastal Systems

Figure 33: Logical adaptation process constructed for the case of adaptation in coastal and population systems. Histograms of implementation times and yearly costs taken CI:grasp database are provided in order to exemplify the heterogeneous distribution of these variables across adaptation project.

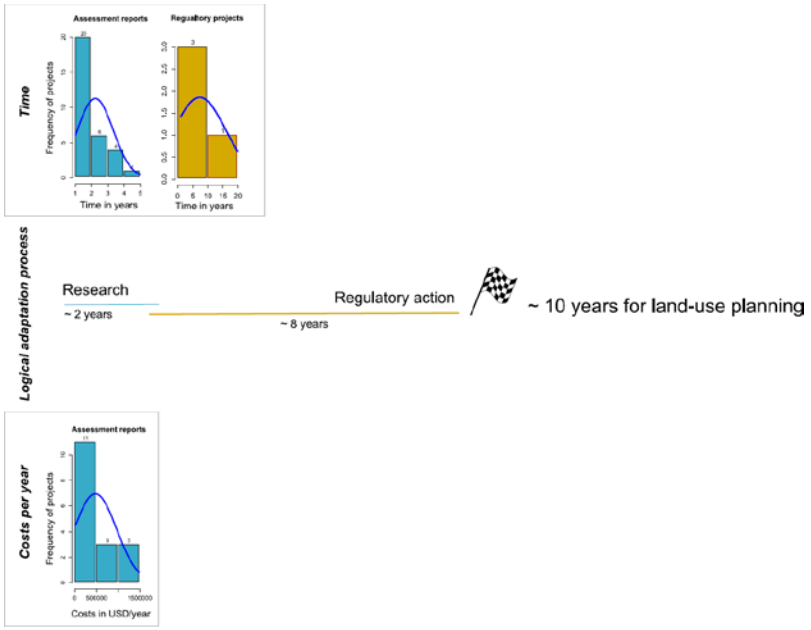


Figure 34: Cumulative urban area added below 1 (green) and 2 (blue meters elevation in km^2.

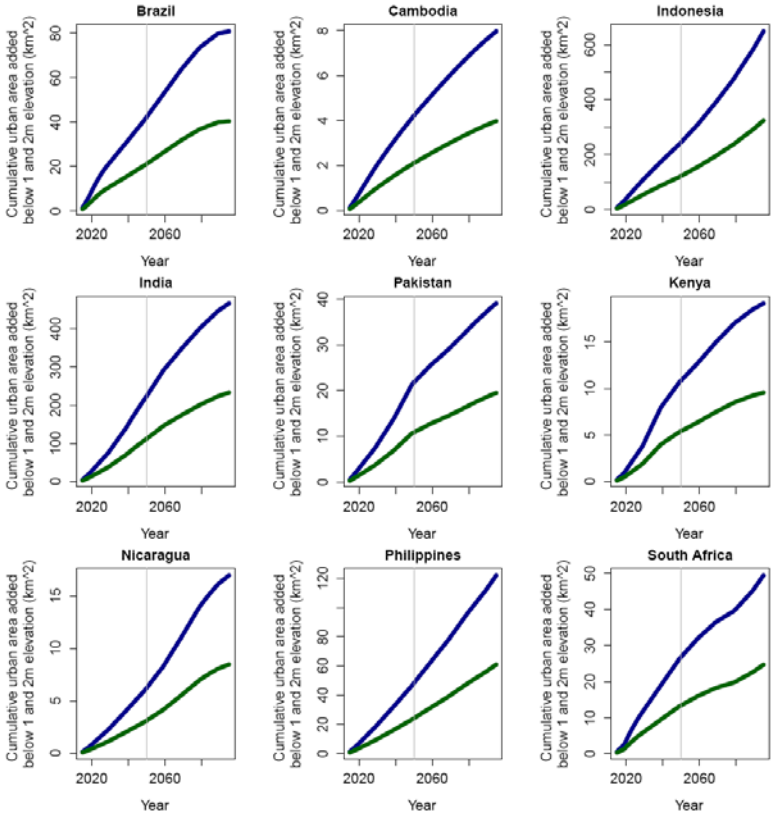
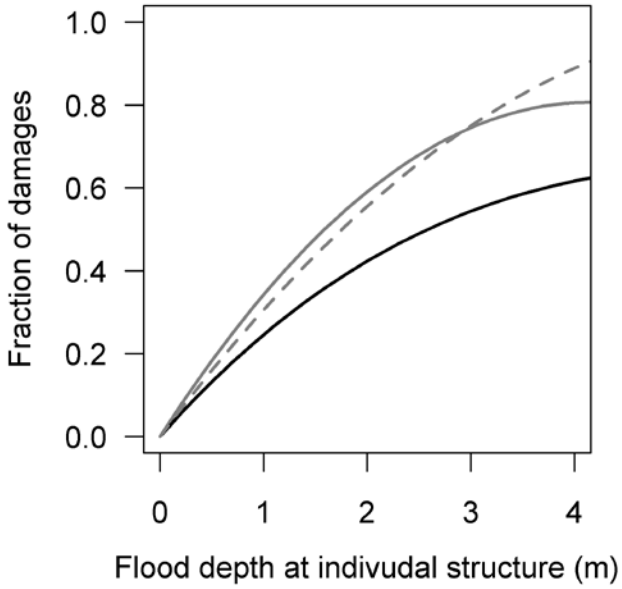


Figure 35: Empirical damage functions at building level investigated in this study. Black line Dutta et al. (2003), grey solid van Eck et al. (2003) and grey dashed USACE (2000).



9.3 Urban population

Table 34: Thresholds and slope of heat-mortality curves used additional to the ones presented in the main text. All thresholds expressed in daily mean temperature.

Author	City	Time	Threshold	Slope
Nastos and Matzarakis (2011)	Athens	1992-2001	33	5.8
Iñiguez et al. (2010)	Vigo	1990-1996	13.9	1.93
	Gijón	1990-1996	2,1	2,88
	Madrid	1990-1996	3	0,93
	Bilbao	1990-1996	3,28	1,59
	Zaragoza	1990-1996	3,3	1,39
	Barcelona	1990-1996	4,72	2,52
	Castellón	1990-1996	2,9	2,6
	Valencia	1990-1996	2,2	1,44
	Sevilla	1990-1996	3,95	2
Gouveia (2003)	São Paulo	1991-994	20	1.02
Curriero et al. (2002)	Boston	1973-1994	20,9	2,93
	Chicago	1973-1994	18,4	1,28
	New York	1973-1994	19,1	2,61
	Baltimore	1973-1994	21,4	2,57
	Washington	1973-1994	21,4	1,37

Author	City	Time	Threshold	Slope
	Atlanta	1973-1994	24,6	2,98
	Jacksonville	1973-1994	24,9	1,91
	Tampa	1973-1994	27,1	1,55
	Miami	1973-1994	27,2	2,31
Williams et al. (2012)	Adelaide	1993-2009	30	1.0

Table 35: Mean temperature anomalies for 8 climate models in respect to the baseline 1961-1990 for the investigated countries.

Country	2015-2050	2055-2095
Ethiopia		
RCP2.6	1.3	1.7
RCP4.5	1.5	2.5
RCP6.0	1.4	2.6
RCP8.5	1.7	3.9
India		
RCP2.6	1.2	1.6
RCP4.5	1.3	2.4
RCP6.0	1.3	2.5
RCP8.5	1.5	3.8
Pakistan		
RCP2.6	1.7	2.0
RCP4.5	1.8	3.0
RCP6.0	1.7	3.1
RCP8.5	2.0	4.8
South Africa		
RCP2.6	1.4	1.7
RCP4.5	1.6	2.5
RCP6.0	1.5	2.8
RCP8.5	1.8	4.1
Kenya		
RCP2.6	1.3	1.5
RCP4.5	1.4	2.2
RCP6.0	1.4	2.4
RCP8.5	1.6	3.5
Indonesia		

Country	2015-2050	2055-2095
RCP2.6	1.1	1.3
RCP4.5	1.3	2.0
RCP6.0	1.2	2.1
RCP8.5	1.4	3.2
Brasil		
RCP2.6	1.5	1.8
RCP4.5	1.6	2.7
RCP6.0	1.5	2.8
RCP8.5	1.8	4.2
The Philippines		
RCP2.6	1.0	1.3
RCP4.5	1.0	1.9
RCP6.0	1.0	1.9
RCP8.5	1.3	2.9
Cambodia		
RCP2.6	1.3	1.8
RCP4.5	1.3	2.2
RCP6.0	1.2	2.2
RCP8.5	1.5	3.4
Nicaragua		
RCP2.6	1.3	1.4
RCP4.5	1.3	2.1
RCP6.0	1.2	2.1
RCP8.5	1.5	3.3

Figure 36: Annual temperature anomalies for all case-study countries according to RCPs 2.6, 4.5, 6.0 and 8.5. Note that the lines for each RCP represent the mean of 8 climate models.

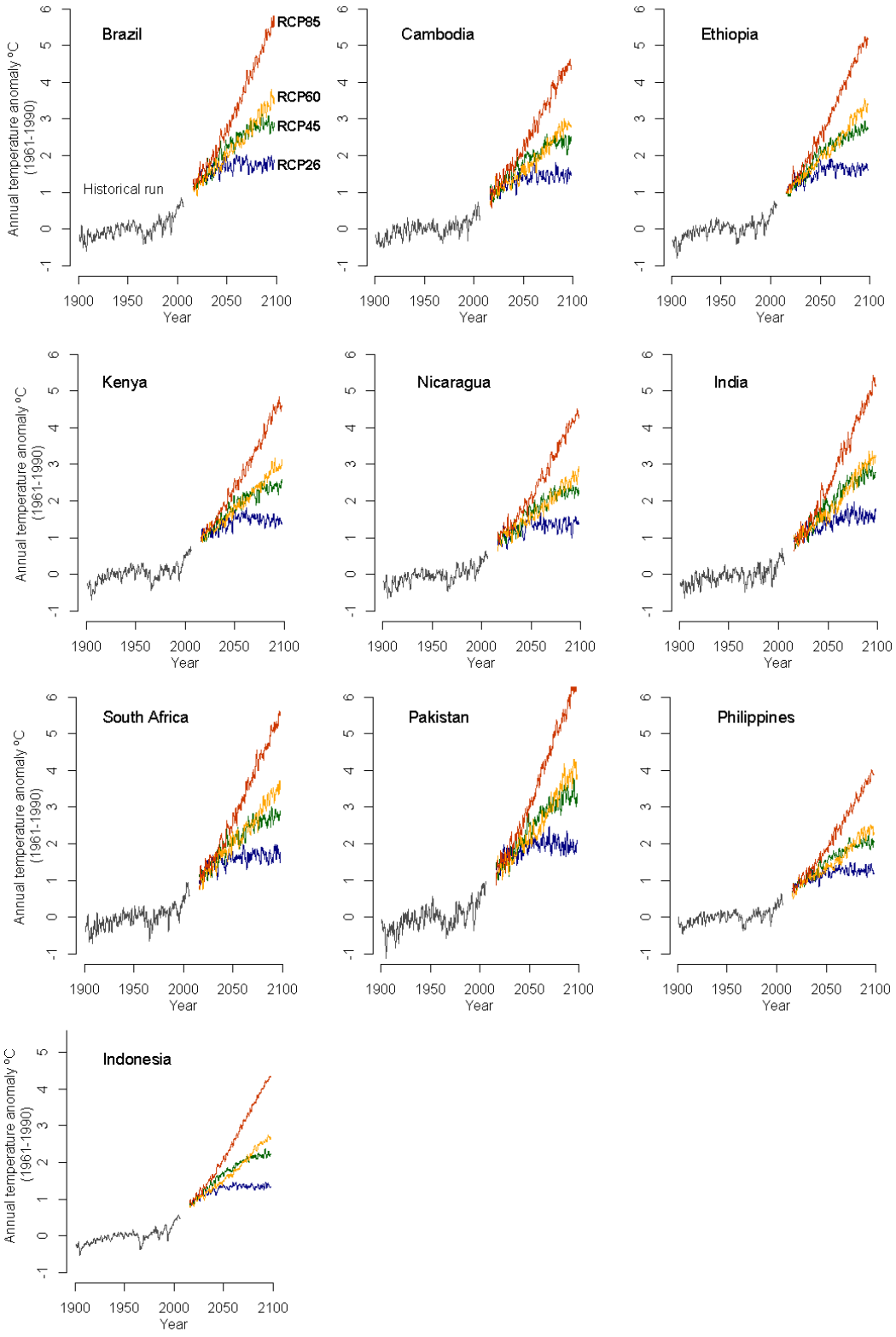
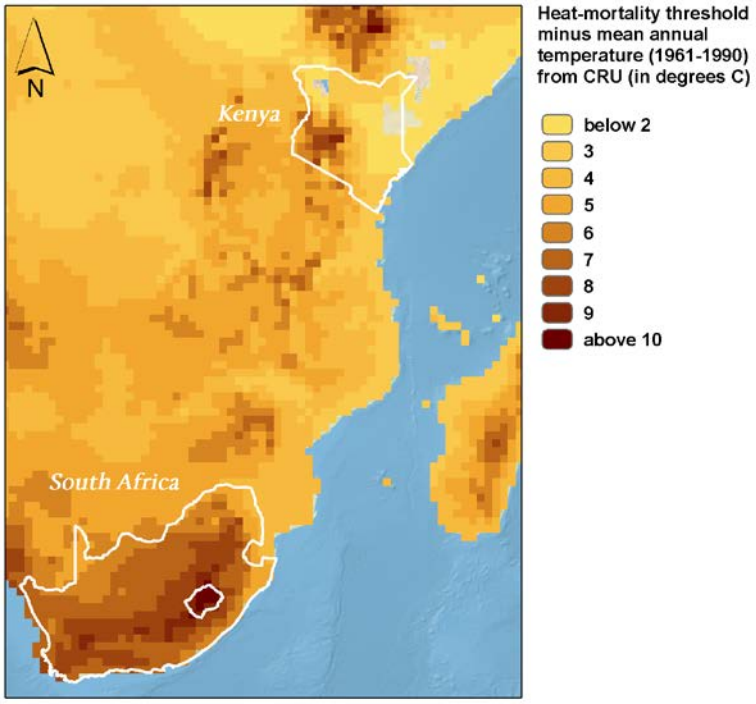


Figure 37: Spatial distribution of the heat-mortality threshold minus mean annual temperature for South-East Africa and the case study countries of South Africa and Kenya.



9.4 Adaptation finance allocations: Funding per recipient country

Table 36: Adaptation finance allocations: Funding per recipient country. GDP = gross domestic product. Population number and GDP refer to 2011 values. For references regarding the numbers in this cf. to the list at the end of this table.

Receiving Country	Total funding (USD, mn)	Rank	per capita	Rank	per unit GDP in %	Rank	Population (mn)	GDP (US$ billion)
Afghanistan	8.36	74	0.27	100	0.05	69	31.08	18.32
Albania	6.93	81	2.15	54	0.05	69	3.23	12.97
Angola	12.15	65	0.62	85	0.01	89	19.63	104.29
Armenia	3.03	100	0.91	78	0.03	77	3.33	10.25
Azerbaijan	2.70	102	0.30	98	0.00	101	9.12	64.82
Bangladesh	216.98	2	1.46	62	0.19	51	148.46	113.86
Barbados	2.30	105	8.30	32	0.05	69	0.28	4.31
Belarus	4.38	94	0.46	93	0.01	89	9.43	55.14
Belize	3.94	96	11.62	25	0.27	45	0.34	1.45

Benin	23.22	40	2.55	50	0.32	37	9.10	7.30
Bhutan	22.87	43	30.99	17	1.51	15	0.74	1.52
Bolivia	94.62	11	8.90	30	0.39	33	10.63	24.06
Botswana	0.00	127	0.00	125	0.00	101	1.85	17.68
Brazil	17.10	53	0.09	109	0.00	101	194.93	2492.91
Burkina Faso	20.47	46	1.21	69	0.20	49	16.97	10.20
Burundi	3.34	98	0.39	94	0.14	58	8.57	2.36
Cambodia	137.77	7	9.12	28	1.07	20	15.10	12.89
Cape Verde	35.09	27	67.48	10	1.84	13	0.52	1.90
Central African Republic	4.94	92	1.04	73	0.23	47	4.74	2.20
Chad	0.20	123	0.02	120	0.00	101	10.48	9.35
Chile	2.17	106	0.13	106	0.00	101	17.25	248.43
China	147.06	5	0.11	108	0.00	101	1347.35	7298.15
Colombia	22.04	44	0.48	92	0.01	89	46.05	327.63
Comoros	12.59	63	18.51	18	2.05	10	0.68	0.61
Cook Islands	8.22	77	441.98	3	4.49	3	0.02	0.18
Costa Rica	4.85	93	1.05	72	0.01	89	4.61	40.95
Cote d'Ivoire	3.35	97	0.15	103	0.01	89	22.69	24.10
Cuba	0.89	116	0.08	110	0.00	101	11.24	57.49
Democratic Republic of the Congo	5.79	89	0.08	110	0.04	74	72.57	15.71
Djibouti	11.11	68	13.15	23	0.90	22	0.85	1.24
Dominica	0.30	121	4.23	39	0.06	67	0.07	0.48
Dominican Republic	5.21	91	0.52	90	0.01	89	10.06	55.75
East Timor	6.79	83	6.21	35	0.15	57	1.09	4.54
Ecuador	16.81	54	1.12	71	0.03	77	15.01	66.47
Egypt	10.90	69	0.14	104	0.00	101	80.40	235.72
El Salvador	17.35	52	2.94	47	0.08	63	5.90	22.76
Eritrea	7.56	79	1.38	65	0.29	41	5.49	2.61
Ethiopia	117.85	9	1.36	66	0.37	34	86.83	31.72
Fiji	1.89	107	2.11	55	0.05	69	0.89	3.80
Gambia	19.40	47	10.78	26	1.99	11	1.80	0.98
Georgia	10.67	70	2.39	51	0.07	64	4.47	14.35
Ghana	11.88	67	0.49	91	0.03	77	24.30	38.39
Grenada	36.68	25	352.69	4	4.48	4	0.10	0.82
Guatemala	14.17	55	0.96	75	0.03	77	14.74	46.90
Guinea-Bissau	6.32	85	3.76	44	0.65	24	10.59	5.17
Guinea	6.89	82	0.65	84	0.13	60	1.68	0.97
Guyana	11.97	66	15.49	21	0.46	29	0.77	2.58
Haiti	12.82	62	1.28	67	0.17	53	10.01	7.39
Honduras	32.21	30	4.01	41	0.19	51	8.03	17.37
Hungary	0.79	117	0.08	110	0.00	101	9.99	140.30
India	45.84	22	0.04	116	0.00	101	1206.92	1826.81
Indonesia	34.71	29	0.14	104	0.00	101	241.03	846.45

Iran	4.18	95	0.06	114	0.00	101	75.15	482.43
Iraq	25.62	37	0.78	82	0.02	84	32.85	114.23
Jamaica	35.24	26	12.81	24	0.24	46	2.75	14.49
Jordan	6.00	87	0.96	75	0.02	84	6.25	28.88
Kenya	110.54	10	2.70	49	0.32	37	40.91	34.06
Kiribati	7.26	80	69.12	9	4.35	5	0.11	0.17
Kyrgyzstan	1.69	111	0.31	97	0.03	77	5.53	5.92
Laos	18.63	48	2.96	46	0.22	48	6.29	8.30
Lebanon	146.05	6	36.90	14	0.37	34	3.96	39.04
Lesotho	13.12	59	6.76	34	0.53	27	1.94	2.49
Liberia	13.21	58	3.41	45	0.86	23	3.88	1.55
Macedonia	2.46	103	1.19	70	0.02	84	2.06	10.64
Madagascar	12.99	61	0.59	86	0.13	60	21.85	9.90
Malawi	65.04	18	4.02	40	1.16	17	16.17	5.61
Maldives	27.63	36	85.02	8	1.44	16	0.33	1.92
Mali	36.72	24	2.32	52	0.35	36	15.85	10.61
Mauritania	17.94	50	5.06	37	0.43	30	3.54	4.20
Mauritius	66.46	17	51.56	12	0.59	26	1.29	11.27
Mexico	14.07	56	0.12	107	0.00	101	113.74	1153.96
Moldova	6.27	86	1.76	59	0.09	62	3.56	7.00
Mongolia	13.85	57	4.97	38	0.16	55	2.79	8.71
Montenegro	0.56	119	0.90	79	0.01	89	0.62	4.54
Morroco	25.23	38	0.78	82	0.03	77	32.19	99.28
Mozambique	204.78	3	9.30	27	1.63	14	22.02	12.57
Myanmar	1.85	108	0.03	118	0.00	101	62.42	51.44
Namibia	35.07	28	16.40	20	0.28	44	2.14	12.53
Nepal	179.76	4	5.90	36	0.95	21	30.49	18.98
Nicaragua	23.33	39	3.96	42	0.32	37	5.89	7.30
Niger	227.32	1	15.07	22	3.77	7	15.09	6.02
Nigeria	90.38	12	0.56	87	0.04	74	160.34	244.05
Oman	0.22	122	0.07	113	0.00	101	3.08	72.68
Pakistan	48.34	21	0.28	99	0.02	84	175.31	210.22
Palestine territories	23.04	42	N/A	N/A	N/A	N/A	N/A	N/A
Panama	0.04	125	0.01	123	0.00	101	3.59	30.57
Papua New Guinea	8.24	76	1.24	68	0.07	64	6.66	12.66
Peru	41.66	23	1.39	64	0.02	84	30.01	177.19
Philippines	31.90	31	0.33	95	0.01	89	95.86	224.77
Russia	6.00	87	0.04	116	0.00	101	142.41	1850.40
Rwanda	18.29	49	1.79	58	0.29	41	10.21	6.33
Samoa	56.36	19	308.00	5	8.89	2	0.18	0.63
Sao Tome and	9.44	72	55.86	11	3.81	6	0.17	0.25

Principe								
Senegal	28.56	34	2.24	53	0.20	49	12.77	14.46
Serbia	2.44	104	0.32	96	0.01	89	7.57	43.32
Seychelles	3.26	99	35.82	15	0.32	37	0.09	1.02
Sierra Leone	12.39	64	2.07	56	0.43	30	6.00	2.92
Singapore	0.02	126	0.00	125	0.00	101	5.18	259.85
Solomon Islands	27.77	35	50.40	13	3.20	8	0.55	0.87
Somalia	10.02	71	0.99	74	N/A	N/A	10.09	N/A
South Africa	8.69	73	0.17	102	0.00	101	50.59	408.69
Sri Lanka	5.64	90	0.27	100	0.01	89	20.54	59.15
St. Kitts and Nevis	0.09	124	1.61	61	0.01	89	0.06	0.72
St. Lucia	23.07	41	138.14	7	1.88	12	0.17	1.23
St. Vincent and the Grenadines	22.00	45	200.04	6	3.20	8	0.11	0.69
Sudan	30.89	32	0.95	77	0.05	69	32.66	64.00
Swaziland	1.67	112	1.42	63	0.04	74	1.18	3.98
Syria	0.67	118	0.03	118	0.00	101	22.53	59.96
Tajikistan	70.71	15	9.06	29	1.08	19	7.80	6.52
Tanzania	69.13	16	1.64	60	0.29	41	42.18	23.85
Thailand	0.97	115	0.02	120	0.00	101	64.08	345.67
Togo	17.82	51	2.89	48	0.48	28	6.17	3.70
Tokelau	1.70	110	1204.30	1	N/A	N/A	0.00	N/A
Tonga	1.79	109	17.21	19	0.41	32	0.10	0.44
Tunisia	73.95	14	6.94	33	0.16	55	10.66	45.99
Turkey	1.35	114	0.02	120	0.00	101	74.72	774.34
Turkmenistan	2.93	101	0.53	88	0.01	89	5.53	28.06
Philippines	31.90	31	0.33	95	0.01	89	95.86	224.77
Russia	6.00	87	0.04	116	0.00	101	142.41	1850.40
Rwanda	18.29	49	1.79	58	0.29	41	10.21	6.33
Samoa	56.36	19	308.00	5	8.89	2	0.18	0.63
Sao Tome and Principe	9.44	72	55.86	11	3.81	6	0.17	0.25
Senegal	28.56	34	2.24	53	0.20	49	12.77	14.46
Serbia	2.44	104	0.32	96	0.01	89	7.57	43.32
Seychelles	3.26	99	35.82	15	0.32	37	0.09	1.02
Sierra Leone	12.39	64	2.07	56	0.43	30	6.00	2.92
Singapore	0.02	126	0.00	125	0.00	101	5.18	259.85
Solomon Islands	27.77	35	50.40	13	3.20	8	0.55	0.87
Somalia	10.02	71	0.99	74	N/A	N/A	10.09	N/A
South Africa	8.69	73	0.17	102	0.00	101	50.59	408.69
Sri Lanka	5.64	90	0.27	100	0.01	89	20.54	59.15
St. Kitts and Nevis	0.09	124	1.61	61	0.01	89	0.06	0.72
St. Lucia	23.07	41	138.14	7	1.88	12	0.17	1.23
St. Vincent and G.	22.00	45	200.04	6	3.20	8	0.11	0.69
Sudan	30.89	32	0.95	77	0.05	69	32.66	64.00
Swaziland	1.67	112	1.42	63	0.04	74	1.18	3.98

Syria	0.67	118	0.03	118	0.00	101	22.53	59.96
Tajikistan	70.71	15	9.06	29	1.08	19	7.80	6.52
Tanzania	69.13	16	1.64	60	0.29	41	42.18	23.85
Thailand	0.97	115	0.02	120	0.00	101	64.08	345.67
Togo	17.82	51	2.89	48	0.48	28	6.17	3.70
Tokelau	1.70	110	1204.30	1	N/A	N/A	0.00	N/A
Tonga	1.79	109	17.21	19	0.41	32	0.10	0.44
Tunisia	73.95	14	6.94	33	0.16	55	10.66	45.99
Turkey	1.35	114	0.02	120	0.00	101	74.72	774.34
Turkmenistan	2.93	101	0.53	88	0.01	89	5.53	28.06
Tuvalu	7.84	78	712.73	2	21.78	1	0.01	0.04
Uganda	29.91	33	0.87	80	0.17	53	34.51	17.43
Ukraine	0.50	120	0.01	123	0.00	101	45.60	165.25
Uruguay	13.03	60	3.87	43	0.03	77	3.37	46.71
Uzbekistan	1.50	113	0.05	115	0.00	101	29.10	45.35
Vanuatu	8.33	75	34.00	16	1.10	18	0.25	0.76
Vietnam	74.40	13	0.83	81	0.06	67	89.32	122.72
Yemen	48.79	20	1.94	57	0.14	58	25.13	33.76
Zambia	120.21	8	8.85	31	0.63	25	13.59	19.21
Zimbabwe	6.63	84	0.53	88	0.07	64	12.58	9.46

The content in Table 37 refers on the following documents:

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India, 2004: Initial National Communication to the UNFCCC. http://unfccc.int/essential ffbackground/library/items/3599.php?rec=j&priref=4870#beg

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Japan, 2011: Japan's Fast-Start Financing for Developing Countries up to 2012. (as of 31 March 2012). http://unfccc.int/files/cooperation ffand ffsupport/financial ffmechanism/financial ffmechanism ffgef/application/pdf/annex-japan fffsf(mar ff2011).pdf

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9.5 ANNEX II.1 (Annex V of LCA decision from Durban)

9.5.1 Indicative list of activities for the Adaptation Committee

- Considering relevant information and providing recommendations to the Conference of the Parties on ways to rationalize and strengthen coherence among adaptation bodies, programmes and activities under the Convention;
- Preparing an overview of the capacities of regional centres and networks working on aspects related to adaptation to the adverse effects of climate change, drawing on relevant information, and making recommendations to the Parties on ways to enhance the role of regional centres and networks in supporting adaptation at the regional and national levels;
- Identifying the process for and scope of overview and other periodic reports on adaptation issues relevant to the work of the Adaptation Committee;
- Preparing periodic overview reports synthesizing information and knowledge relating to, inter alia, implementation of adaptation actions and good adaptation practices, observed trends, lessons learned, gaps and needs, including in the provision of support, and areas requiring further attention, for consideration by the Conference of the Parties, drawing on information from Parties and on other relevant reports and documents, including those of other bodies under the Convention;
- Upon request, considering technical support and guidance to the Parties as they develop national adaptation plans;
- Upon request, considering work in support of the work programme on loss and damage;
- Exchanging information with relevant Convention bodies and others, including the Standing Committee and the Technology Executive Committee, on means to incentivize the implementation of adaptation actions, including finance, technology, and capacity-building, with a view to identifying opportunities and further actions for consideration by the Conference of the Parties;

- Upon the request of the Parties, providing advice on adaptation-related matters to relevant Convention bodies, including to the operating entities of the financial mechanism, as appropriate;
- Compiling a roster of experts on adaptation issues, building on the existing UNFCCC rosters.

9.6 ANNEX II.2 (COP17 decision on NAPs)

9.6.1 Draft initial guidelines for the formulation of national adaptation plans by least developed country Parties

Introduction

The elements described in § 2 - 6 below are indicative of the activities that can be undertaken in the development of national adaptation plans (NAPs). The planning of such activities will depend on national circumstances and should be determined by least developed country Parties.

Elements of national adaptation plans

1. Laying the groundwork and addressing gaps
2. Activities undertaken under this element would be planned with a view to identifying weaknesses and gaps in enabling environments, and addressing them as necessary, to support the formulation of comprehensive adaptation plans, programmes and policies, through, inter alia:
    a) Identification and assessment of institutional arrangements, programmes, policies and capacities for overall coordination and leadership on adaptation;
    b) Assessment of available information on climate change impacts, vulnerability and adaptation, measures taken to address climate change, and gaps and needs, at the national and regional levels;
    c) Comprehensive, iterative assessments of development needs and climate vulnerabilities.

Preparatory elements

3. In developing NAPs, consideration would be given to identifying specific needs, options and priorities on a country-driven basis, utilizing the services of national and, where appropriate, regional institutions, and to the effective and continued promotion of participatory and gender-sensitive approaches coordinated with sustainable development objectives, policies, plans and programmes. Activities may include:
    a. Design and development of plans, policies and programmes by considering decision 1/CP.16, § 14 (a), to address the gaps and needs referred to in § 2 above;
    b. Assessments of medium- and long-term adaptation needs, and, as appropriate, development needs and climate vulnerabilities;
    c. Activities aimed at integrating climate change adaptation into national and subnational development and sectoral planning;
    d. Participatory stakeholder consultations;

e. Communication, awareness-raising and education.

Implementation strategies

4. Activities carried out as part of the implementation strategies would take into consideration:
    a) Prioritizing work according to development needs and climate change vulnerability and risk;
    b) Strengthening institutional and regulatory frameworks to support adaptation;
    c) Training and coordination at the sectoral and subnational levels;
    d) Public dissemination of information on the national adaptation plan process, to be made available to the public and to the UNFCCC secretariat,
    e) Considering other relevant multilateral frameworks and international programmes and initiatives, with a view to building on and complementing existing adaptation planning.

Reporting, monitoring and review

5. These activities, including national adaptation plan documents, could be included in national strategies and plans, as appropriate.
6. Under this element, countries should undertake a regular review, at intervals to be determined by countries:
    a. To address inefficiencies, incorporating the results of new assessments and emerging science and reflect lessons learned from adaptation efforts;
    b. To monitor and review the efforts undertaken, and provide information in their national communications on the progress made and the effectiveness of the national adaptation plan process.

9.7 ANNEX II.3

9.7.1 Questions guiding the work programme to address loss and damage

IV. Thematic area 1: Assessing the risk of loss and damage associated with the adverse effects of climate change and the current knowledge on the same

1. What are the data and information requirements for assessing impacts and climate risk, at different levels and for a broad range of sectors and ecosystems? What data are available and where are the gaps?
2. What methods and tools are available for risk assessment, including their requirements, strengths and weaknesses, and can they address social and environmental impacts?
3. 18. What are the capacity needs for applying risk assessment methods on the ground, including for facilitating their application in developing countries?

4. How can the results of risk assessments be optimally formulated in order to support decision-making? What are the desired methods for presenting the results of risk assessment exercises so that they drive decision-making?

    a) Data and information requirements, and availability of data and information for assessing impacts and climate risk, at different levels and for a broad range of sectors and ecosystems

    b) Methods and tools available for risk assessment, including requirements, strengths and weaknesses, and whether they are able to also address social and environmental impacts

    c) Capacity needs for applying risk assessment methods on the ground, and what is needed to apply such methods in developing countries

    d) The communication of risk assessment results to inform and support decision-making

V. Thematic area 2: A range of approaches to address loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events, taking into consideration experience at all levels

5. What is the full range of approaches and tools that can be used to address the risk of loss and damage, at all levels and for a broad range of sectors and ecosystems, considering both extreme weather events and slow onset events? Such approaches and tools include, inter alia, conventional, non-conventional and innovative instruments to address specific types of loss and damage in the context of this thematic area, especially those driven by the multiplying, magnifying and intensifying effects of climate change at the national, subnational and local levels. What is known about the relative cost-effectiveness of these tools?
6. What are the foundational resource requirements (e.g. budget, infrastructure, and technical capacity for implementation) in order for different strategies and tools to be effectively applied?
7. What are the lessons learned from existing efforts within both the public and private sectors, considering elements of design, limitations, challenges and best practices?
8. What are the links and synergies between risk reduction and other instruments such as risk transfer? How can comprehensive risk management portfolios or toolkits be designed?

9.8 ANNEX III.1 (Annex V of LCA decision from Durban)

9.8.1 Indicative list of activities for the Adaptation Committee

1. Considering relevant information and providing recommendations to the Conference of the Parties on ways to rationalize and strengthen coherence among adaptation bodies, programmes and activities under the Convention;
2. Preparing an overview of the capacities of regional centres and networks working on aspects related to adaptation to the adverse effects of climate

change, drawing on relevant information, and making recommendations to the Parties on ways to enhance the role of regional centres and networks in supporting adaptation at the regional and national levels;

3. Identifying the process for and scope of overview and other periodic reports on adaptation issues relevant to the work of the Adaptation Committee;
4. Preparing periodic overview reports synthesizing information and knowledge relating to, inter alia, implementation of adaptation actions and good adaptation practices, observed trends, lessons learned, gaps and needs, including in the provision of support, and areas requiring further attention, for consideration by the Conference of the Parties, drawing on information from Parties and on other relevant reports and documents, including those of other bodies under the Convention;
5. Upon request, considering technical support and guidance to the Parties as they develop national adaptation plans;
6. Upon request, considering work in support of the work programme on loss and damage;
7. Exchanging information with relevant Convention bodies and others, including the Standing Committee and the Technology Executive Committee, on means to incentivize the implementation of adaptation actions, including finance, technology, and capacity-building, with a view to identifying opportunities and further actions for consideration by the Conference of the Parties;
8. Upon the request of the Parties, providing advice on adaptation-related matters to relevant Convention bodies, including to the operating entities of the financial mechanism, as appropriate;
9. Compiling a roster of experts on adaptation issues, building on the existing UNFCCC rosters.

9.9 ANNEX III.2: Draft decision on NAPs

9.9.1 Draft decision -/CP.18, National adaptation plans

- The Conference of the Parties,
- Recalling Article 4, § 1, 4 and 9, and Article 11, § 5, of the Convention,]
- Also recalling decisions 11/CP.1, 27/CP.7, 1/CP.16 and 5/CP.17,]
- Further recalling the initial guidelines for the formulation of national adaptation plans by the least developed country Parties adopted under decision 5/CP.17,
- Reaffirming that because of their development status, climate change risks magnify the development challenges for the least developed country Parties,
- Recalling that the national adaptation plans are a process to enable the least developed country Parties to formulate and implement national adaptation plans, building upon their experience in preparing and implementing national adaptation programmes of action, as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs; and

that other developing country Parties were invited to employ the modalities formulated to support the national adaptation plans in the elaboration of their planning effort[33].

- Underlining that planning for adaptation at the national level is a continuous, progressive and iterative process, the implementation of which should be based on nationally identified priorities, including those reflected in the relevant national documents, plans and strategies, and coordinated with national sustainable development objectives, plans, policies and programmes,
- Recalling the request to the Adaptation Committee, in accordance with its agreed functions, to consider, in its workplan, the relevant modalities for supporting interested developing countries that are not least developed country Parties to plan, prioritize and implement their national adaptation planning measures, including through the use of the modalities contained in decision 5/CP.17,
- Reaffirming the importance of the need to address adaptation planning in the broader context of sustainable development planning,
- Underlining that the national adaptation plan process should build on and complement existing adaptation planning, should not be prescriptive and should facilitate country-driven, gender-sensitive, participatory action taking into consideration vulnerable groups, communities and ecosystems,
- Recognizing the value of the experiences gained in preparing and implementing national adaptation programmes of action and stressing that support for the national adaptation plan process should not be at the expense of the national adaptation programmes of action,
- Appreciating the contributions made by developed country parties to the Least Developed Countries Fund to date,
- Recognizing that the Green Climate Fund will support developing countries in pursuing project-based and programmatic approaches in accordance with climate change strategies and plans, such as national adaptation programmes of action, national adaptation plans and other related activities,
- Also recognizing the important role of the Convention in catalysing support for the least developed country Parties to undertake the national adaptation plan process, noting the range of activities and programmes, both under and outside the Convention process, which could contribute to, and enhance, the national adaptation plan process,
- Recalling its request to the Subsidiary Body for Implementation to consider guidance on policies and programmes to enable support for the national adaptation plan process for the least developed country Parties, at its thirty-sixth session, for consideration by the Conference of the Parties at its eighteenth session,

Option 1:

Decides to adopt the following guidance for the Global Environment Facility, as the entity entrusted with the operation of the financial mechanism of the Convention for the operation of the Least Developed Countries Fund, to support activities by the least developed country Parties undertaken under the national adaptation plan process; while maintaining progress for the

[33] Decision 1/CP.16, § 15 and 16.

least developed countries work programme, which includes the national adaptation programmes of action, the operating entity is requested:

a) As a first step under the national adaptation plan process, to provide funding from the Least Developed Countries Fund, to meet the agreed full cost of activities to enable the formulation of national adaptation plans as described in the elements contained in § 2–6 of the initial guidelines for national adaptation plans in the annex to decision 5/CP.17;

b) To ensure separation of the funding for the national adaptation plan process from funds for the national adaptation programmes of action under the Least Developed Countries Fund, noting that there are linkages between the two;

c) To ensure complementarity of funding between the Least Developed Countries Fund and other funds with which the operating entity is entrusted, such as the Special Climate Change Fund;

d) To adopt simplified procedures and arrange for expedited access, including direct access to the Least Developed Countries Fund by the least developed country Parties for the national adaptation plan process, while ensuring sound financial management;

e) To ensure transparency in all steps relating to the funding of the development of the national adaptation plans;

f) To ensure a flexible, multiple-entry approach that enables the least developed country Parties to access funding for components of the national adaptation plan process as identified by the least developed countries Parties in response to national needs and circumstances;

g) To encourage the use of national and, where appropriate, regional experts;

h) To adopt streamlined procedures for the operation of the Least Developed Countries Fund in supporting the national adaptation plan process.

Option 2:

Requests/Invites the Global Environment Facility, as the entity entrusted with the operation of the financial mechanism of the Convention for the operation of the Least Developed Countries Fund, to provide support to activities in the least developed country Parties for the preparation of the national adaptation plan process, in laying the groundwork for, addressing gaps in, and undertaking preparatory elements, while maintaining progress for the least developed countries work programme, which includes the national adaptation programmes of action;

1. Also requests/Invites the Global Environment Facility to continue its efforts to improve access by the least developed country Parties to the Least Developed Countries Fund for the activities in support of the national adaptation plan process, inter alia by ensuring a flexible multi-entry approach that enables the least developed country Parties to access funding for components of the national adaptation plan process as identified by the least developed country Parties, in response to national needs and circumstances;
2. Requests the operating entity referred to in § 1 above to include in its report to the Conference of the Parties information on the steps it has undertaken to implement the provisions of this decision;

3. Invites developed country Parties to further contribute to the Least Developed Countries Fund to support the national adaptation plan process, and invites developed country Parties, and other Parties in a position to do so, to continue their efforts to support the least developed country Parties in the national adaptation plan process, through provision of finance, technology and capacity-building, as appropriate, in accordance with decision 1/CP.16, including § 18, and other relevant decisions of the Conference of the Parties;

4. Invites the operating entities of the financial mechanism of the Convention, bilateral and multilateral agencies and other relevant organizations, as appropriate, to take this decision into account when providing financial and technical support to developing country Parties in responding to decision 5/CP.17;

5. Invites the Green Climate Fund Board to take into account the national adaptation plan process when designing its modalities, including for direct access, in accordance with decision 3/CP.17, § 3;

6. [Requests the Standing Committee of the Green Climate Fund to develop recommendations for the predictability, accessibility, and adequacy of financial resources for the formulation and implementation of national adaptation plans;

7. Invites Parties and relevant organizations to continue to assist the least developed country Parties, in close collaboration with the Least Developed Countries Expert Group, in building national institutional arrangements and capacities, and to support scientific and technical capacity needs, as identified by the least developed country Parties, to undertake the national adaptation plan process;

8. Invites United Nations organizations, specialized agencies and other relevant organizations, as well as bilateral and multilateral agencies, to support the national adaptation plan process in the least developed country Parties and, where possible, to consider establishing or enhancing support programmes for the national adaptation plan process within their mandates, as appropriate, which could facilitate financial and technical support to the least developed country Parties, in close collaboration with the Least Developed Countries Expert Group, and to keep the Subsidiary Body for Implementation informed, through the secretariat, on how they have responded to this invitation;

9. Invites Parties and relevant organizations to share best practices and lessons learned in addressing adaptation, through the ongoing work of the Least Developed Countries Expert Group and work under the Nairobi work programme on impacts, vulnerability and adaptation to climate change, as well as through other efforts outside the Convention;

10. (Placeholder for consideration of recommendations on national adaptation plans for developing country Parties that are not least developed country Parties);

11. Decides to assess progress made in implementing this decision, and to consider the adoption of further guidance, as appropriate, at its twentieth session.

9.10 ANNEX III.3: Excerpts from the SB 36 conclusions on loss and damage

The SBI considered the progress made on the implementation of the work programme on loss and damage, in accordance with Decisions 1/CP.16, and decision 7/CP.17 and noted the remaining work to be undertaken under this work programme. The SBI further noted a number of points relevant to assessing the risk of loss and damage associated with the adverse effects of climate change and the current knowledge on the same, including the following[34]:

a) The assessment of climate-related risk is complex, involving the consideration of hazards, exposure and vulnerability, and takes into account underlying risk drivers;

b) A range of approaches, methods and tools are available to assess the risk of loss and damage associated with the adverse effects of climate change. The selection of appropriate approaches, methods and tools depends upon regional, national and local capacity, contexts and circumstances and involves the engagement of all relevant stakeholders;

c) Gaps in the assessment of the risk of loss and damage for vulnerable communities and populations, including women and children, can be addressed by involving these communities and populations in risk assessment processes;

d) The use of local and indigenous knowledge and observations helps to fill gaps in information about historic exposure and vulnerability;

e) Assessment of the risk of loss and damage is often constrained by the limited availability of data and knowledge, including, but not limited to, that on weather, climate, socioeconomic conditions and ecosystems. Risk management actions can still be taken in the absence of complete sets of data and knowledge, taking into account the national circumstances;

f) Access to, sharing and the use of information and data, such as hydro-meteorological data and metadata, on a voluntary basis is important to facilitate the assessment and management of climate-related risk;

g) Enhanced technical and institutional capacities supported by technical and financial assistance and other resources will help developing countries to continue to determine, prioritize and address their needs in assessing the risk of loss and damage associated with the adverse effects of climate change;

h) Involvement of, and dialogue with, decision makers at all levels can strengthen the design, dissemination and delivery of information on climate risk;

i) Numerical data are sometimes not sufficient in conveying a comprehensive range of the risks of loss and damage associated with the adverse effects of climate change since available estimates on losses typically lack numbers on non-economic losses.

The SBI recalled that the Conference of the Parties (COP), at its seventeenth session, requested the secretariat to organize four expert meetings, three at the regional level and one for small island developing States, to be held before the thirty-seventh session of the SBI[35], and the SBI

[34] FCCC/SBI/2012/L.12, § 3

[35] Ibid. § 5

requested the secretariat, in consultation with Parties and relevant stakeholders, in organizing the four expert to take into account, to the extent possible, the following[36]:

a) Inviting representatives from regional centres and networks, as well as experts from a wide range of relevant domains, disciplines and communities, including those involved in the development of the IPCC assessments and special reports, and experts in disaster risk reduction and in financial approaches to risk management, subject to the availability of financial resources, to attend the expert meetings;
b) Requesting presenters to make available the abstracts of the materials to be presented at the expert meetings in advance, in order to assist participants to better prepare for the discussions.

In accordance with decision of COP 17, the SBI again appreciated, the need to explore a range of approaches and potential mechanisms, including an international mechanism,

To address loss and damage associated with the adverse effects of climate change, with a view to making recommendations on loss and damage associated with the adverse effects of climate change to the COP for its consideration at its eighteenth session.37 Moreover, in order to facilitate the completion of its work, the SBI requested its Chair to convene an informal pre-sessional meeting of Parties, in conjunction with its thirty-seventh session, subject to the availability of resources and conflicts of timing, to exchange further views on the possible recommendations on loss and damage associated with the adverse effects of climate change.[38]

[36] Ibid. § 7

[37] Ibid. § 6

[38] Ibid. § 8

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10.1 Introduction

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