INTEGRATING CLIMATE CHANGE ADAPTATION INTO SECURE LIVELIHOODS

POVERTY

TOOLKIT 1: Framework and approach

christian aid

CONTENTS

Abbreviations

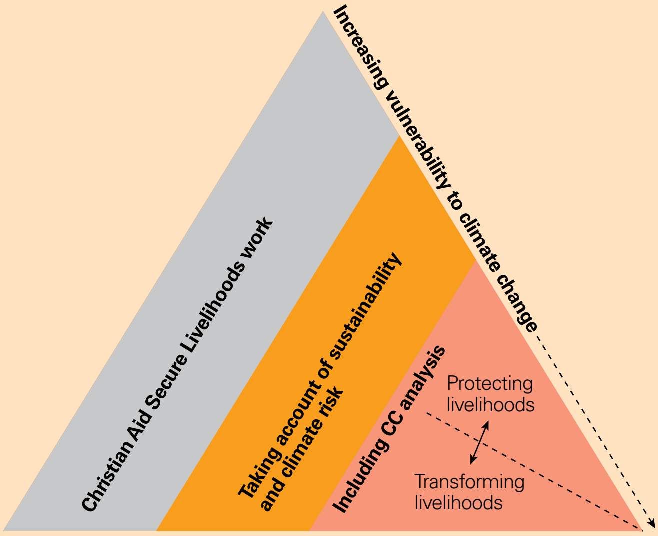
AGW Anthropogenic global warming
CBA Community-based adaptation
CC Climate change
CPSP Country Programme Strategy Paper
DRR Disaster risk reduction
ENSO El Niño Southern Oscillation
EWS Early warning systems
FAO Food and Agriculture Organisation
GCM Global circulation model
GEF Global Environment Fund
GHG Greenhouse gases
IPCC Intergovernmental Panel on Climate Change
NOAA National Oceanographic and Atmospheric Administration
PRECIS Providing Regional Climates for Impacts Studies
PVCA Participatory vulnerability and capacity assessment
RCM Regional Climate Model
SME Small and medium enterprises
UNFCCC United Nations Framework Convention on Climate Change
UNISDR United Nations International Strategy for Disaster Reduction

Cover: Terracing farmland in Rwanda to reduce soil erosion

Credit: Christian Aid/Richard Ewbank

1. CLIMATE CHANGE AND LIVELIHOODS – THE BASIC FRAMEWORK

Fig 1. Christian Aid's climate change adaptation framework[1]



The triangle represents the totality of Christian Aid's current secure livelihoods work. The smallest (red) triangle includes work that aims to protect and/or transform the livelihoods of the poor, based on an explicit climate change analysis. Only work in the red triangle will be described as climate change adaptation. The more vulnerable people are to climate change impacts, the greater the need to move Christian Aid's livelihoods work into this red triangle.

The middle (grey) triangle shows livelihoods work that explicitly addresses sustainability, including climate risk and vulnerability, but that has not (so far) included a more detailed climate change analysis. Over time, all our livelihoods work should build in an analysis of sustainability and move to either the grey or red triangles.[2]

Adaptation is about empowering people to cope with the impacts of climate change. This includes both severe shocks due to short-term climate variability, where our entry point will typically be through disaster risk reduction work; and ongoing degradation of livelihoods as a result of longer-term more gradual climate change, where our entry point will typically be through livelihoods development programmes. Climate change adaptation therefore learns from and draws on the complementary strengths of both disaster risk reduction and livelihoods programming.[1]

Climate change related to man-made greenhouse gas emissions (or anthropogenic global warming, AGW) is just one manifestation of mankind's inability to manage the ecosystem on which all life depends. Just as unsustainable exploitation of oceanic natural resources has led to a collapse of 30 per cent of the world's fisheries and over-exploitation of terrestrial natural resources has destroyed half the world's forests, so treating the atmosphere as an unlimited sink for the products of fossil fuel burning is having profound impacts on the global climate system. The changing climate system's ability to exert direct impact on human lives and livelihoods has led to climate change being described as 'the greatest market failure the world has seen'.[3]

Both existing poverty and the likelihood of the most severe effects of climate change falling on developing countries highlight the critical importance of adaptation to its impacts.

Without substantial intervention to improve the adaptive capacity of the poorest and most marginalised, the likelihood of reaching both global and specific national poverty reduction objectives will be severely compromised or even reversed.

Given the already-observed impact of increased weather variation, increasingly attributed to AGW, there are limits to adaptation beyond which strategies such as migration become inevitable. This is already happening as a result of conflict, economic deprivation and other factors – climate change has already and will in future add to these.

The purpose of this toolkit is to provide guidance on the adaptation of livelihoods where they currently exist, before the more extreme coping mechanisms such as migration start to happen. However, in situations where migrants have transferred their livelihood from a rural to an urban setting, the basic tools described can still apply.

2. FOCUS OF THE TOOLKIT

For the purposes of this toolkit series, the focus is on livelihood adaptation (although the overlap with mitigation is acknowledged when it arises).

In restricting the scope to livelihoods, it does not address issues such as adaptation of health and other services, although these will clearly impact on livelihoods (for example, malaria spreading to highland areas previously malaria-free).

The toolkit series focuses on providing resources on planning for adaptation.[4]

The focus of Toolkits 1 and 2 within planning is on developing an analysis of future climate change that can then be integrated into mainstream livelihoods work. This includes both:

(a) A project-specific analysis of climate change and how this fits into the options available for livelihoods development (see Toolkit 2).

(b) The development of a specific national-level climate change document, think-piece or strategy that may be developed as a Country Programme Strategy Paper or a resource for partner strategy development (see Toolkit 3).

The toolkits are primarily aimed at Country Programme and partner staff focusing on disaster risk reduction and livelihood adaptation to climate change.

These toolkits are not intended to be step-by-step manuals on the A-to-Z of adaptation. There are many existing tools that are already extensively used and understood and can be applied where appropriate. Where tools are limited, more detailed guidance is given (as in Toolkit 2), but the general approach is to provide basic advice and links to various tools and approaches so that adaptation can be planned, in partnership with those most affected, to develop responses that are locally relevant, owned and managed.

3. RATIONALE FOR ADAPTATION

Given that adaptation to changing weather patterns is as old as agriculture, why are specific activities and/or interventions needed to adapt to the challenges of climate change? There are a number of key factors that lead to the conclusion that the gradual adaptation that has been adequate so far will not be enough by itself to cope with future climate change:

a) **Magnitude of impact** – a degree of change in climate due to greenhouse gas emissions is now irreversible in the short to medium term. However, the overall magnitude of impacts on poor people and poor countries will depend on climate change adaptation and mitigation decisions taken now. Business as usual – ignoring climate change issues in addressing poverty reduction or leaving them as environmental add-ons in the development process – risks allowing the impacts of climate change to undermine or even reverse efforts to reduce poverty. Incremental interventions put in place now to ultimately mainstream climate concerns into poverty reduction and development will significantly reduce these impacts on poor people and poor countries in the years to come.

b) **Time scale** – much can be learned from traditional coping mechanisms and these should form the basis of enhanced adaptation, especially where spontaneous adaptation has already taken place. However, climate change is creating impacts beyond expected climate conditions. This reduces the effectiveness of both individual and community coping mechanisms and the development assistance designed to strengthen them in two ways:

- In the short-term, variation is now occurring outside normal or expected limits, increasing the likelihood of weather varying from very wet to very dry, extended dry spells within rainy seasons, increased intensity of rainfall episodes and so on.
- In the medium to long term, climate trends are changing so that the average situation will move towards higher temperatures and therefore lower (or in some cases higher) rainfall, increased frequency of more severe storm events and so on. Long-term change in climate trends may well change (and often increase) short-term climate variability.

c) **Geographic scale** – climate change, especially changing climate trends, will happen across a larger geographical scale than current climate variability. This will limit coping mechanisms that previously relied on a localised response, for example agricultural communities in an area affected by a poor season trading out of the short-term food insecurity episode through contact with nearby food surplus areas. As this larger-scale climate change occurs, so these coping mechanisms become less viable.

d) **Time scale and geographic scale combined** – the risk of generating maladaptation feedbacks (by which a rational short-term response to climate change vulnerability creates an accelerated vulnerability to long-term climate change) needs to be minimised. So for example, diversifying livelihoods into charcoal production as a result of drought-induced reductions in crop yield could reduce catchment protection of forest cover and increase vulnerability to both drought and flooding in the longer-term. Another example might be increasing the use of off-season irrigation in coastal farming areas to alleviate decreasing main-season rice yields, which reduces freshwater flushing of soils and increases the risk of saline intrusion from rising seas levels, thus reducing longer-term viability of agriculture generally. Adaptation must therefore respond to both short-term and long-term climate risks and consider upstream and downstream impacts.

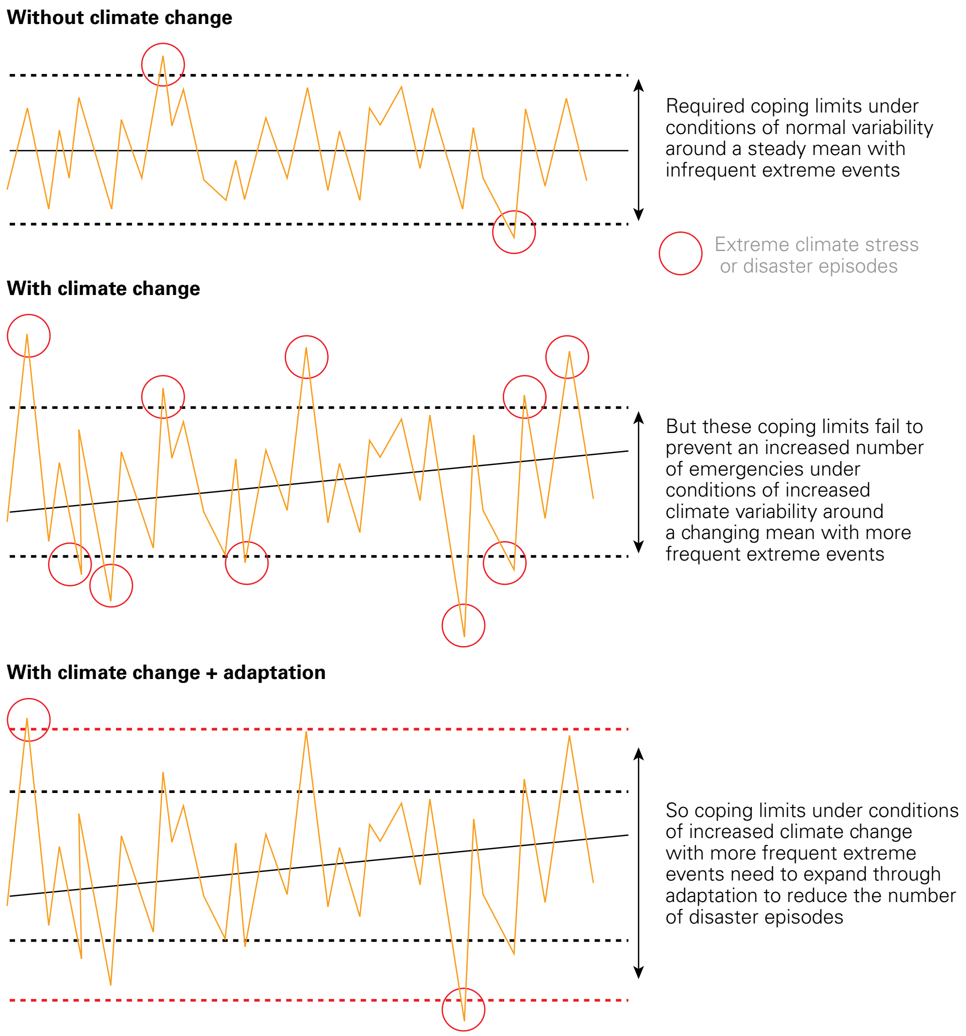
e) **Climate change, sustainability and poverty** – climate change is just one aspect, albeit the one with the greatest potential for global impact, of a development process that relies on over-exploitation of natural capital – land, forests, atmosphere and so on. The concepts of open access and common property resources and their over-exploitation are well known when applied to local assets such as forest reserves and fish stocks, but equally apply to the atmosphere. So the treatment of the atmosphere and oceans as an unlimited sink for greenhouse gases emphasises the need for climate change adaptation to form part of an approach which in turn reinforces sustainability and a development path which protects natural resources and reduces the vulnerability and lack of resource-use rights of the poorest and most marginalised.

Climate change adaptation and mitigation (the reduction of greenhouse gas emissions) are usually presented as separate issues requiring quite different approaches. In a development context, this division can be artificial. For example, agricultural adaptation may result in an increase in soil organic matter through increased use of manures or the adoption of more agroforestry-based techniques. This in turn increases the capacity of agriculture[5] to capture and store carbon from the atmosphere thereby reducing greenhouse gas concentrations. Other livelihood strategies may well show similar linkages between the two, especially where decentralised renewable energy can provide new or more reliable electricity supplies that in turn increase the resilience of small-scale productive enterprises (SMEs). Where these linkages and co-benefits occur, advantages should be maximised.

The degree to which mitigation is successful will influence the degree of adaptation required. The best adaptation is ultimately effective mitigation of greenhouse gases: the earlier progress is achieved in reducing emissions, the lower the scale of adaptation required now and in the future. However some climate change is inevitable. Communities across the world, and especially those in more climate-vulnerable areas and livelihoods, are already experiencing unprecedented changes. Even if emissions ceased immediately, there is still an estimated further increase of 0.5-1°C[6] in the global climate system – and both changing trends and increased variability will require those affected to increase their resilience by expanding their livelihood coping limits (see Figure 2 below).

Without climate change, variation would generate occasional emergencies but would be mostly within existing coping limits. The 'with climate change' situation shows how existing coping limits cannot prevent an increase in emergencies. If coping limits are not expanded (as per the second diagram), the number of disaster episodes will multiply and make operating a sustainable livelihood increasingly difficult. This will result in increased poverty and ultimately stress migration and so coping limits need to be considerably expanded (to the red dashed lines in the third figure) to maintain the same resilience to both changing average conditions/trends and increased variability and limit the number of extreme climate stress episodes to much the same as the 'without climate change' situation.

Fig 2. Potential impact of climate change on livelihood coping limits



4. THE NATURE OF CLIMATE RISK

4.1 Speed of onset

For livelihoods and adaptation, the speed of onset of a particular climate-related event or trend is a critical factor:

- Fast-onset factors are those whose duration or predictability can be measured in terms of days or weeks. They are therefore more amenable to short-term weather forecasting (1- to 14-day forecasts).
- Medium-onset changes occur over a timescale of weeks or months and are therefore more amenable to seasonal forecasting (typically 3 to 12 months).
- Slow-onset factors develop typically over a number of years and tend to be measured using multi-seasonal, or decadal[7], forecasting and climate change models (or global circulation models). Regional climate models are being developed under the PRECIS programme to provide more resolution and detail at region/country levels (see Toolkit 2, Box 1).

Fig 3. Categorisation of climate events according to speed of onset

Fast onset (days/weeks)	Medium onset (weeks/months)	Slow onset (years)
• Intense cyclones/tropical storms and associated storm surges. • Localised high winds/tornados. • Sudden river and flash flooding/ mudflows. • Erratic and intense rainfall, hailstorms and lightning strike. • Landslides resulting from intense rainfall events.* • Extreme temperature episodes. • Snow storms, instability of snowfields and avalanches. **Key: (related to)** Red: Wind and water Orange: Water Light red: Snow/ice Grey: Temperature Light orange: Ocean acidification and temperature Light grey: Ecosystem	• Changes in seasonal wind patterns. • Increasingly erratic onset and reliability of rainfall increasing drought and flood risks. • Increased drought risk and moisture stress in rain-fed crop and rangelands. • Increased intensity of rainfall during the monsoon/rainy season together with increased erosion risks. • Increased seasonal river and streamflow variability. • Water table fluctuation changing groundwater availability. • Increased temperatures and evapotranspiration. • Increased melt season temperatures increasing meltwater streamflow. • Increased variation in snowfall increasing meltwater streamflow variation.	• Average windspeed and cyclone frequency and strength. • Sea-level rise and coastal erosion. • Saline intrusion into soils and aquifers. • Changing rainfall patterns and seasonality. • Declining average water availability and increased water stress. • Declining rangeland water resources, leading to reduced livestock productivity, increased mortality and erosion around water sources. • Higher temperatures and increased aridity. • Rising average temperatures, particularly at high altitude and in regional 'hotspots'. • Retreat and disappearance of mountain glaciers and glacier-based water resources. • Coral bleaching and loss of fishery resources. • Desertification. • Changes to ocean currents and current upwelling affecting marine ecosystems and fishery resources. • Latitudinal and altitudinal shifts in climate and agro-ecological zones. • Changing ecology and hydrology affecting ecosystems. • Declining resilience of forest resources and consequent loss of biodiversity and carbon sinks.

In addition, it is possible to relate speed of onset to the standard categories of climate change hazard:[8]

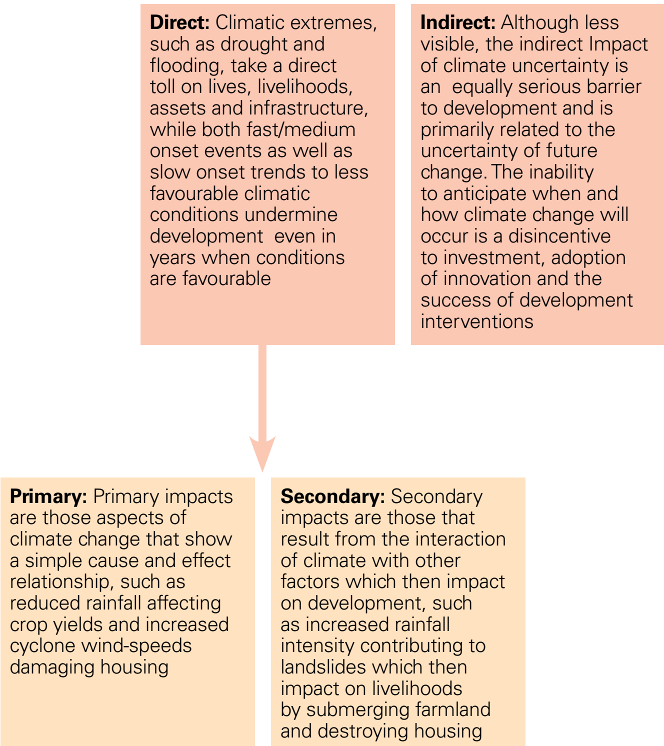
- Category 1: Discrete recurrent hazards, as in the case of transient phenomena such as storms, droughts and extreme rainfall events.
- Category 2: Continuous hazards, for example increases in mean temperatures or decreases in mean rainfall occurring over many years or decades.
- Category 3: Discrete singular hazards, for example shifts in climatic regimes associated with changes in ocean circulation.

Fast- and medium-onset risks are therefore Category 1, while slow onset risks are Category 2. Category 3 refers to major irreversible climate shifts (also referred to as 'tipping points') that are currently predicted on a decadal or millennial time scale – these will become increasingly important if the 2°C global average temperature increase is breached. Other relevant climate features include magnitude, area affected, frequency and duration (see Toolkit 2, page 10).

4.2 Direct and indirect impacts

The impacts of climate change on development are felt in both direct and indirect ways. Direct factors can be further sub-divided into primary and secondary as shown in Figure 4 below. Impacts vary from region to region and depending on the level of temperature increase (see Annex 2).

Fig 4. Direct/indirect, primary/secondary impacts



Climate directly impacts food production, shelter and other livelihoods. Both severe climate shocks and incremental climate change can push vulnerable households into a persistent poverty trap, particularly when their individual coping responses involve selling off productive assets such as livestock, equipment or land. In terms of indirect impact, the inability to accurately predict future climate risks will result in short-term planning and conservative risk management that buffers against climate variability, but often at the expense of efficient resource use and productivity. It can even accelerate resource degradation, resulting in maladaptation. This indirect impact of climate change highlights the need to reduce uncertainty by improving the development of climate science and the community's ability to integrate it into their decision-making processes.

Primary impacts show a simple cause-effect relationship, whereas secondary impacts demonstrate the complexity created as climate interacts with other risk factors. Both primary and secondary climate impacts are unlikely to be the sole factor affecting a particular livelihood or aspect of development. Climate is one risk factor among others affecting livelihoods, such as insecurity and conflict, earthquakes/tsunamis, disease factors and so on.

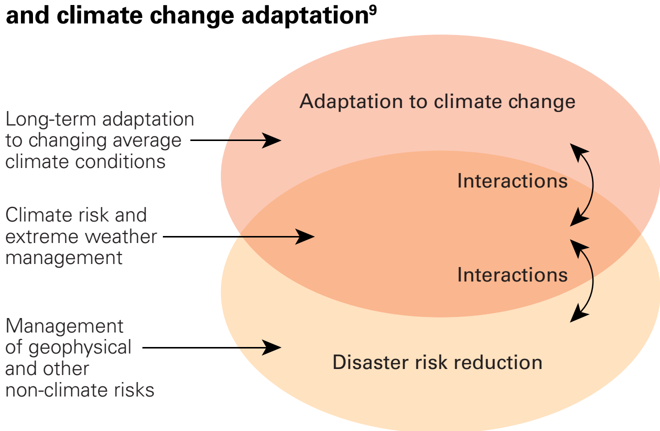
Climate risks interact both:

a) with these other livelihood risks; and

b) with each other – slow-onset climate factors will exert a gradual impact on livelihoods so that when fast- or extremely fast-onset factors occur, communities fall into a humanitarian crisis more quickly and then need extended recovery periods after the crisis has passed.

However, the key feature that marks out climate change from other disaster risks is the nature of slow-onset climate factors and the need to understand their likely impact at least 10-15 years into the future. The rather arbitrary distinctions made between emergency response, disaster risk reduction and longer-term adaptive development are rarely recognised at community level, so a community-based approach to climate change must reflect this and seek to integrate longer-term livelihoods development with disaster risk reduction and humanitarian support (see Figure 5 below).

Fig 5. The overlap between disaster risk reduction and climate change adaptation[9]



5. CLIMATE CHANGE ANALYSIS IN THE PROGRAMME CONTEXT

5.1 Four stages to adaptation

Adaptation is often described as either scenario-led or vulnerability-led. In reality, it is both – adaptation needs to be informed by likely climate scenarios as well as the vulnerability that will result.

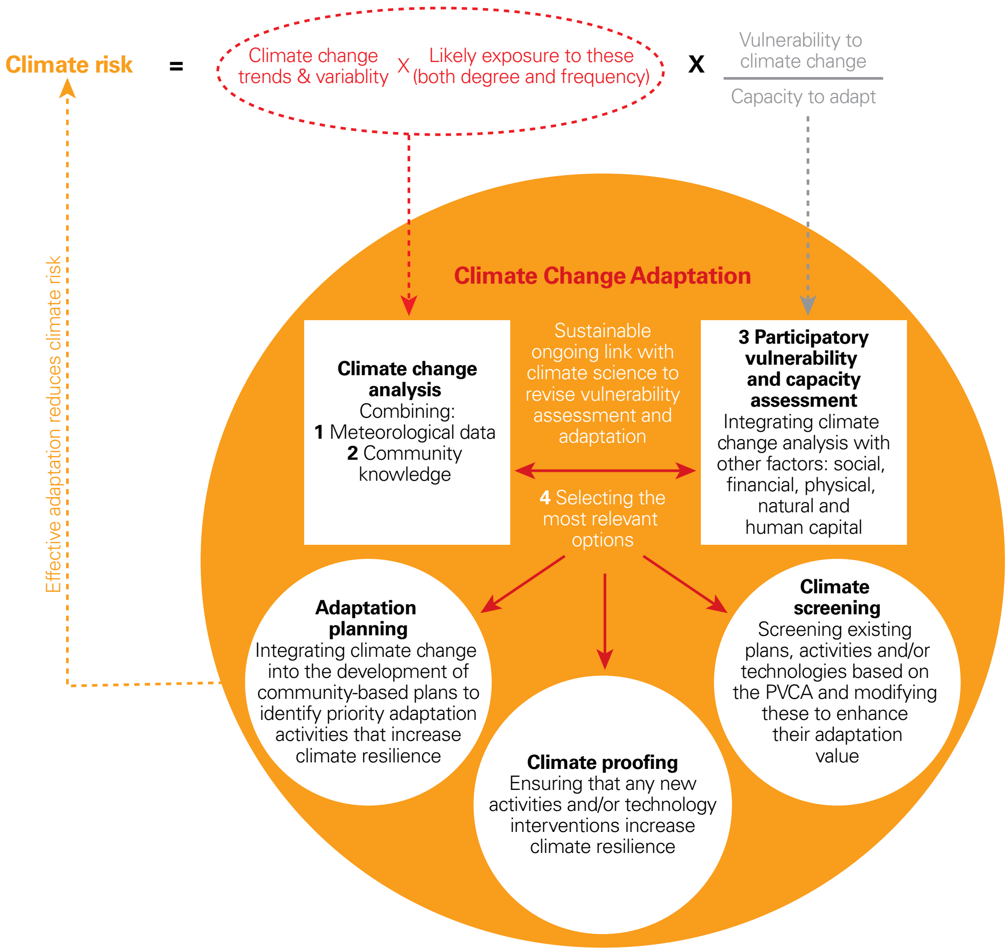
In the classic risk-reduction equation (see Figure 6 below), climate risk is a function of changing climate and likely exposure to this change, and the degree of vulnerability to this exposure divided by the capacity to adapt. As both climate change trends and variability and likely exposure (in red) are largely beyond the influence of any particular livelihood choice other than migration, increasing the capacity to adapt is therefore the primary response in reducing the climate risk that a livelihood is subjected to.

Using this to determine the essential stages needed to climate screen existing projects, or plan climate-resilient interventions, leads to four basic stages for integrating climate change adaptation into secure livelihoods.

Stages 1 and 2 consist of developing a climate change analysis that combines available knowledge, firstly in terms of short- and longer-term climate science, and secondly, the local or indigenous knowledge of those communities and individuals most directly affected.

Stage 3 uses the information gained to inform the participatory vulnerability and capacity assessment (PVCA). This may focus on several priority factors increasing vulnerability, including climate change. Given the rapidly improving ability of meteorology departments and other climate science institutions to provide increasingly accurate predictions about both short- and long-term climate change at the local level, it is important to maintain links with these sources so that the climate change analysis and the PVCA can be regularly updated with the latest information.

Fig 6. Adaptation at project level – an overview



Following the PVCA, stage 4 consists of selecting the most appropriate options across a range[10] – from screening existing projects to ensure that they are not increasing climate change vulnerability, to climate-proofing new activities to increase climate change resilience, to more in-depth community adaptation planning processes in which village or community development plans are enhanced to strengthen climate resilience across all sectors and areas. These will include both short-term responses to fast- and medium-onset climate factors as well as longer-term planning to adapt to slow-onset climate factors. Collectively this approach is often referred to as 'community-based adaptation'.

5.2 Community-based adaptation

Community-based adaptation (CBA)[11] builds on a number of development practices that have been in widespread use for some time, including participatory development, sustainable livelihoods and community development planning approaches (such as village development planning and participatory land use planning). It should therefore be seen as consistent with these existing and ongoing practices and tools, rather than as a new methodology requiring a radical transformation. As such, adaptation responds to climate risks assessed in a developmental framework, rather than just to 'dangerous' anthropogenic climate change as defined by the United Nations Framework Convention on Climate Change (UNFCCC), and so responds to, and plans for, both the low-level gradual impacts of climate change (which can be addressed in the 'normal' stage of the climate risk cycle, see 5.3 below) as well as higher-level disaster-related impacts (addressed in the 'emergency' and 'recovery' stages of the climate risk cycle).

Key CBA principles include:

- It is a community-led process – CBA operates at a community level. The focus is usually on vulnerable communities but can be applied in any community. CBA is about the community making choices, not having them imposed from outside, and should therefore enhance the ability of the community to have a wider range of choices in the future, establishing a community-owned vision of what their climate-resilient community should look like.
- Other change processes such as environmental degradation, weak governance and poor access to land and resources, often exacerbate risks faced by communities from climate-related causes.
- CBA complements both the development and disaster communities, and it adopts methods and tools from both. Likewise, as both development and disaster communities are trying to learn more about incorporating climate adaptation into their own activities, the different languages of the climate adaptation, development and disaster communities need to be translated and shared.
- The CBA plan is a living entity subject to revision as new climate science becomes available and new adaptation priorities and funding options emerge.

A key part of integrating climate change into community-based planning will be to build in a risk cycle management approach.

5.3 Climate risk cycle management

A climate risk cycle management approach[12] takes as a basic starting point the inevitability of variation and changing trends, and the consequent need for proactive planning for future change including inevitable emergencies (see Figure 7 right). So if longer-term development is more resilience-focused, both the immediate impact of an emergency event, and the recovery time from it, should be reduced.

An inherent assumption in earlier risk cycle management approaches was that risks associated with variation cycle around a constant mean. However, climate change results in a changing mean, as well as increased variability (as described in section 3 and Figure 2, page 4), so this must be built into a climate risk cycle approach. If a community moves through a complete cycle and returns to the 'normal' stage, climate change will mean that this is a slowly changing normality, and this needs to be integrated into any community-based planning and adaptation.

Some basic features of the climate risk cycle approach to adaptation planning include:

- Building in a climate risk cycle management approach to the implementation of adaptation plans: the community determines which part of the cycle it is in and therefore the mix of adaptation/livelihood activities that need to be implemented. This, therefore, requires a sustainable link between both short-term weather forecasting/early warning institutions and longer-term climate change prediction capacity to enable the determination by the community of specific indicators that trigger transition from one part of the cycle to the next. Indicators that are used to move from 'normal' to 'alert' to 'emergency' critically depend on effective early warning systems.
- It is more than likely that some adaptation will already have been implemented, so the extent to which spontaneous adaptation by the community has been successful should be regarded as valuable experience for further planning. During the 'normal' part of the cycle, links to sources of expertise, inputs and markets that will enable the building of increasingly resilient livelihoods is required.

- For planning in the proactive part of the cycle ('normal' and 'alert'), the community-based adaptation plan distinguishes between priorities to be implemented in both the short (1-2 years) and the longer term (2-10 years). This should differentiate between:

  Changes in structure: activities that address infrastructure (roads, flood defences, etc, with a particular emphasis on households that are in more vulnerable locations).

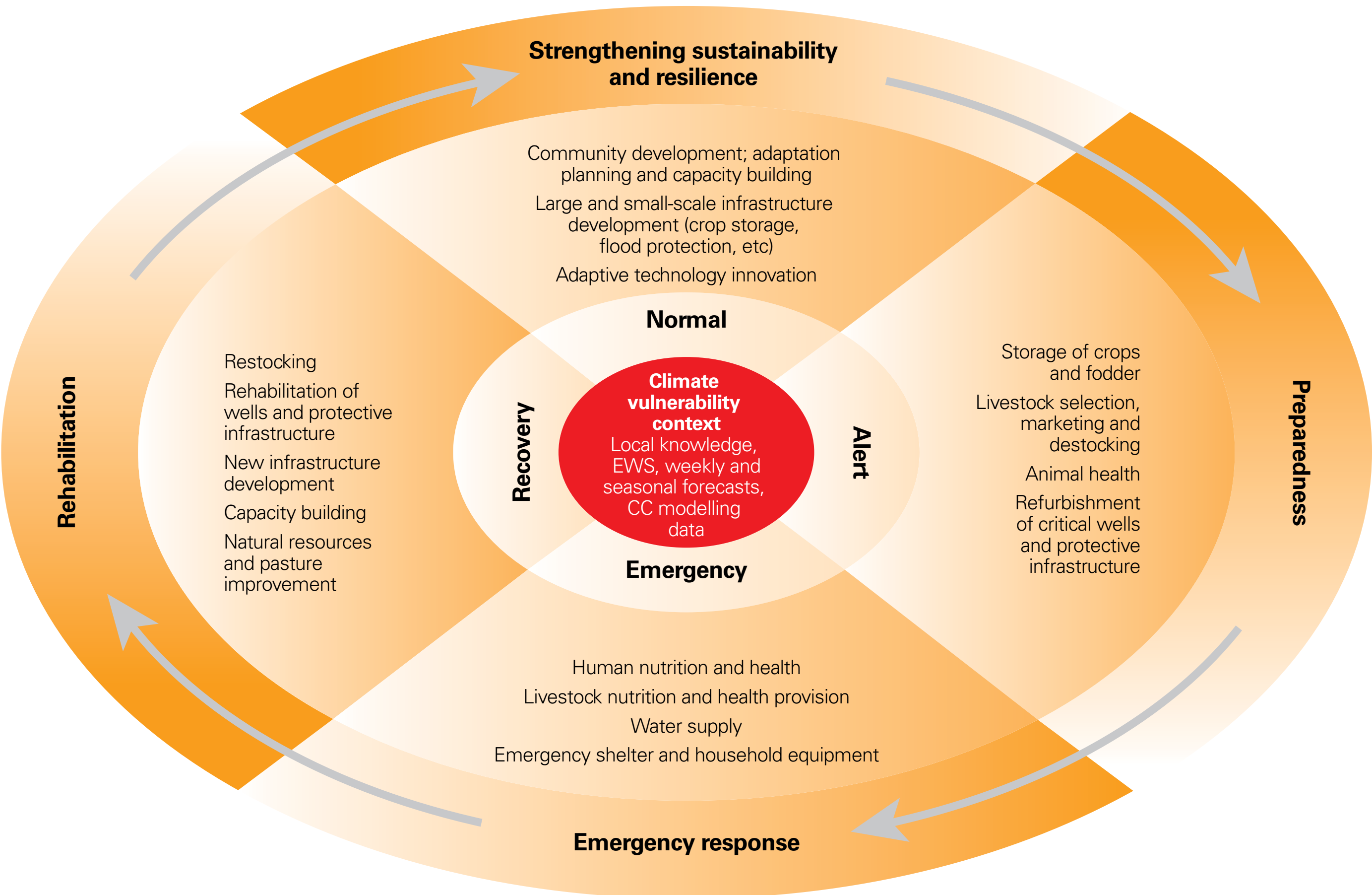
  Changes in livelihoods: activities that protect or transform livelihoods (such as identifying more drought- or flood-resistant crop varieties, diversifying into less directly climate-sensitive livelihoods, especially for the poorer and more vulnerable).

  Both of these can be supported by establishing a community-based adaptation fund to resource livelihood projects or receive funds for infrastructure development.

- Situations may well occur in which a community moves from 'alert' back to 'normal' which, as long as it does not result in so many false alarms that community confidence in the system is eroded, is not necessarily a bad thing. However, moving from 'recovery' back to 'emergency' (the reactive part of the cycle) risks a community being caught in a recovery trap, which – if repeated – results in a downward spiral of diminishing assets and income and increasing vulnerability and poverty. The more resilience that can be built into the 'normal' stage and the faster the recovery, the lower is the risk of this happening.

The aim of any risk cycle management approach is to maximise the time a community spends in the top right-hand half of the cycle (normal – alert) and minimise the time spent in the bottom left-hand half (emergency – recovery).

Fig 7. Climate risk cycle management



ANNEXES

Annex 1. Glossary

Adaptation – any adjustment, whether passive, reactive or anticipatory, that is proposed as a means for reducing the anticipated adverse consequences of, or taking advantage of any benefits associated with, climate change (based on Stakhiv 1993).

Adaptive capacity – the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damage, to take advantage of opportunities or to cope with the consequences (IPCC 2007).

Attribution – the process of determining whether a particular effect or impact is the result of a particular cause, or of some other factor.

Climate change – statistically significant variation in either the mean state of the climate or its variability, persisting for an extended period (typically decades or longer) and resulting from anthropogenic (man-made) greenhouse gas emissions (IPCC 2007).

Climate change mitigation – technological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emissions reduction, with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks (see also greenhouse gas) (IPCC 2007).

Climate hazard – potentially damaging physical manifestations of climatic variability or change, such as droughts, floods, storms, episodes of heavy rainfall, long-term changes in the mean values of climatic variables, potential future shifts in climatic regimes and so on (Brooks 2003).

Climate impacts – consequences of climate and climate change on natural and human systems.

Climate model – A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity (ie for any one component or combination of components a hierarchy of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical, or biological processes are explicitly represented, or the level at which empirical parameterisations are involved (IPCC 2007).

Climate trend – the general direction in which climate factors, such as average annual temperature or rainfall, tend to move over time

Climate variability – variations from the mean state (and other statistics, such as standard deviations, the occurrence of extremes, etc) of the climate on all temporal and spatial scales beyond that of individual weather events (IPCC 2007).

Coping capacity – the ability of people, organisations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters (UNISDR 2009).

Decadal climate cycles – variations in climate that oscillate on a multi-year or even multi-decade timescale, often as a result of ocean-atmosphere interactions (see also El Niño).

Disaster risk management – the systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster (UNISDR 2009).

Disaster risk reduction – the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UNISDR 2009).

Early warning system – the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss (UNISDR 2009).

El Niño – or El Niño Southern Oscillation (ENSO), is a complex interaction of the tropical Pacific ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts over many months, such as altered marine habitats, rainfall changes, floods, droughts and changes in storm patterns (UNISDR 2009). El Niño and La Niña are defined as sustained sea surface temperature anomalies of magnitude greater than 0.5°C across the central tropical Pacific ocean, El Niño being a warming and La Niña a cooling event. El Niño events are associated with wetter weather in Peru/Ecuador and East Africa and drier conditions in Southeast Asia, northern Australia and Southern Africa. La Niña events generally cause the opposite and are associated with increased Atlantic cyclones. Climate change may increase the strength and frequency of the oscillation.

Extreme weather event – an event that is rare within its statistical reference distribution at a particular place. Definitions of 'rare' vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile. By definition, the characteristics of what is called 'extreme weather' may vary from place to place. Extreme weather events may typically include floods and droughts (IPCC 2007).

Forecast – definite statement or statistical estimate of the likely occurrence of a future event or conditions for a specific area (UNISDR 2009)

Greenhouse gas – a gas that absorbs radiation at specific wavelengths within the spectrum of radiation (infrared radiation) emitted by the Earth's surface and by clouds. The gas in turn emits infrared radiation from a level where the temperature is colder than the surface. The net effect is a local trapping of part of the absorbed energy and a tendency to warm the planetary surface. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere (IPCC 2007).

Hazard impacts – impacts related to dangerous phenomena, substances, human activities or conditions that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR 2009).

Indigenous knowledge – also referred to as local knowledge, is the ancient, communal, holistic and spiritual knowledge that encompasses every aspect of human existence (Brascoupé and Mann 2001)

Livelihoods – a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation: and which contributes net benefits to other livelihoods at the local and global levels in the long and short term (Chambers and Conway 1992). A secure livelihood reduces poverty and marginalisation; equips and empowers an individual, household or community to protect and claim their rights to the resources and assets essential for their livelihood; strengthens them against the impact of disaster; and deepens their understanding of and ability to respond to climate change (derived from Christian Aid Secure Livelihoods Strategy 2007–11).

Maladaptation – actions that increase vulnerability to climate change. This includes making development or investment decisions while neglecting the actual or potential impacts of both climate variability and longer-term climate change (Burton et al 1998).

Maladaptation feedbacks – consequences of actions taken to reduce short-term vulnerability which then accelerate medium or long-term vulnerability to climate change.

Resilience – the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to, and recover from, the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UNISDR 2009).

Scenario – a plausible and often simplified description of how the future may develop, based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline (IPCC 2007).

Triangulation – the verification of information gained from one source or methodology with that gained from one or more other sources or methodologies.

Vulnerability – the extent to which a natural or social system is susceptible to sustaining damage from hazards caused by climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate. Hence, a highly vulnerable system is one that is highly sensitive to modest changes in climate and one for which the ability to adapt is severely constrained (IPCC 2007).

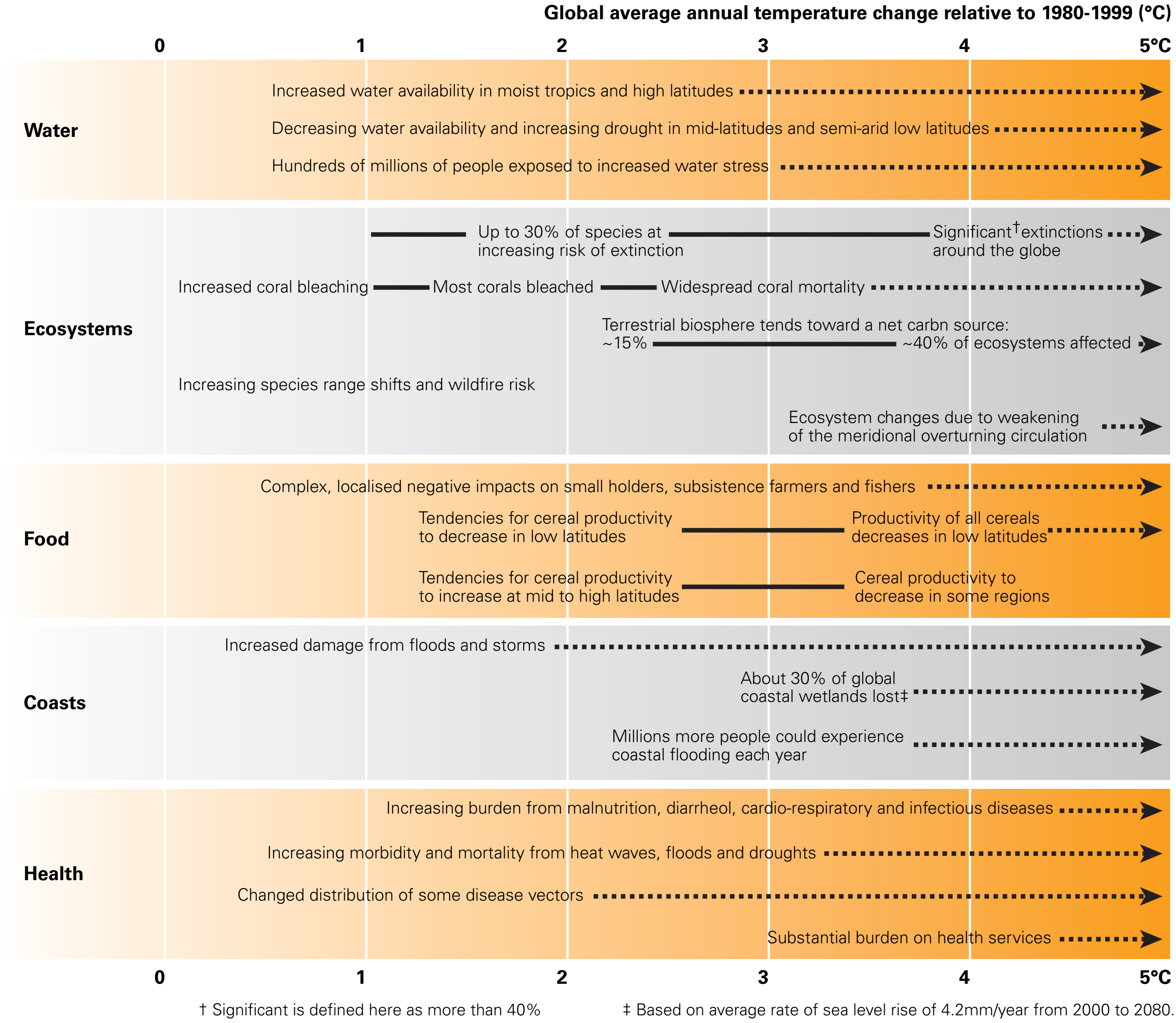
Annex 2. Climate change impact by region and temperature

(a) Regional impact and vulnerability

Region	Likely regional impacts of climate change	Vulnerability, adaptive capacity
Africa	• By 2020, between 75 million and 250 million people are projected to be exposed to increased water stress due to climate change. Coupled with increased demand, this will adversely affect livelihoods and exacerbate water-related problems. • Agricultural production, including access to food, in many African countries and regions is projected to be severely compromised by climate variability and change. The area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease. This would further adversely affect food security and exacerbate malnutrition in the continent. In some countries, yields from rain-fed agriculture could be reduced by up to 50 per cent by 2020. • Local food supplies are projected to be negatively affected by decreasing fisheries resources in large lakes due to rising water temperatures, which may be exacerbated by continued overfishing. • Towards the end of the 21st century, projected sea-level rise will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5-10 per cent of gross domestic product (GDP). Mangroves and coral reefs are projected to be further degraded, with additional consequences for fisheries and tourism.	• Most vulnerable due to multiple stresses and low adaptive capacity as a result of low GDP per capita, widespread poverty (the number of poor grew over the 1990s), inequitable land distribution and low education levels. There is also an absence of safety nets, particularly after harvest failures. • More than one quarter of the population lives within 100km of the coast. Most of Africa's largest cities are along coasts vulnerable to sea-level rise, coastal erosion, and extreme events. • Individual coping strategies for desertification are already strained, leading to deepening poverty. • Dependence on rain-fed agriculture is high. • Adaptive capacity is likely to be greatest in countries with civil order, political openness, and sound economic management. Some adaptation to current climate variability is taking place; however, this may be insufficient for future changes in climate.
Asia	• Glacier melt in the Himalayas is projected to increase flooding, rock avalanches from destabilised slopes, and to affect water resources within the next two to three decades. This will be followed by decreased river flows as glaciers recede. • Freshwater availability in central, south, east and south-east Asia, particularly in large river basins, is projected to decrease due to climate change that, along with population growth and increasing demand arising from higher standards of living, could adversely affect more than a billion people by the 2050s. • Coastal areas, especially heavily-populated megadelta regions in south, east and south-east Asia, will be at greatest risk due to increased flooding from the sea and, in some megadeltas, flooding from rivers. • Climate change is projected to impinge on the sustainable development of most developing countries of Asia, as it compounds the pressures on natural resources and the environment associated with rapid urbanisation, industrialisation, and economic development. • It is projected that crop yields could increase up to 20 per cent in east and south-east Asia while they could decrease up to 30 per cent in central and south Asia by the mid-21st century. Taken together, and considering the influence of rapid population growth and urbanisation, the risk of hunger is projected to remain very high in several developing countries. • Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in east, south and south-east Asia due to projected changes in the hydrological cycle associated with global warming. • Increases in coastal water temperature would exacerbate the abundance and/or toxicity of cholera in south Asia.	• Adaptive capacity varies between countries depending on social structure, culture, economic capacity and level of environmental degradation. • As a region, poverty in both rural and urban areas has decreased in Asia. • Capacity is increasing in some parts of Asia (for example, the success of early warning systems for extreme weather events in Bangladesh), but is still restrained due to poor resource bases, inequalities in income, weak institutions, and limited technology.

Region	Likely regional impacts of climate change	Vulnerability, adaptive capacity
Latin America	• By mid-century, increases in temperature and associated decreases in soil water are projected to lead to gradual replacement of tropical forest by savannah in eastern Amazonia. Semi-arid vegetation will tend to be replaced by arid-land vegetation. There is a risk of significant biodiversity loss through species extinction in many areas of tropical Latin America. • In drier areas, climate change is expected to lead to salination and desertification of agricultural land. Productivity of some important crops is projected to decrease and livestock productivity to decline, with adverse consequences for food security. In temperate zones soya bean yields are projected to increase. • Sea-level rise is projected to cause increased risk of flooding in low-lying areas. Increases in sea surface temperature due to climate change are projected to have adverse effects on Mesoamerican coral reefs, and cause shifts in the location of south-east Pacific fish stocks. • Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation.	• Some social indicators have improved over the 1990s, including adult literacy, life expectancy, and access to safe water. • Other factors such as infant mortality, low secondary school enrolment, and high income inequality contribute to limiting adaptive capacity. • Some countries have made efforts to adapt, particularly through conservation of key ecosystems, early warning systems, risk management in agriculture, strategies for flood drought and coastal management, and disease surveillance systems. However, the effectiveness of these efforts is outweighed by: lack of basic information, observation and monitoring systems; lack of capacity building and appropriate political, institutional and technological frameworks; low income; and settlements in vulnerable areas, among others.
Small island states	• The projected sea level rise of 5mm per year for the next 100 years would cause enhanced soil erosion, loss of land, poverty, dislocation of people, increased risk from storm surges, reduced resilience of coastal ecosystems, saltwater intrusion into freshwater resources and high resource costs to respond to, and adapt to, changes. • Coral reefs would be negatively affected by bleaching and by reduced calcification rates due to higher carbon dioxide levels; mangrove, sea grass bed, and other coastal ecosystems and the associated biodiversity would be adversely affected by rising temperatures and accelerated sea level rise • Small islands, whether located in the tropics or higher latitudes, have characteristics that make them especially vulnerable to the effects of climate change, sea-level rise and extreme events. • Deterioration in coastal conditions, for example through erosion of beaches and coral bleaching, is expected to affect local resources, eg fisheries, and reduce the value of these destinations for tourism. • Sea-level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities. • Climate change is projected by mid-century to reduce water resources in many small islands, eg in the Caribbean and Pacific, to the point where they become insufficient to meet demand during low-rainfall periods. • With higher temperatures, increased invasion by non-native species is expected to occur, particularly on mid- and high-latitude islands.	• Adaptive capacity of human systems is generally low in small island states, and vulnerability high; small island states are likely to be among the countries most seriously impacted by climate change. • Decline in coastal ecosystems would negatively impact reef fish and threaten reef fisheries, those who earn their livelihoods from reef fisheries, and those who rely on the fisheries as a significant food source. • Limited arable land and extensive soil salination make agriculture on small islands, both for domestic food production and cash crop exports, highly vulnerable to climate change. • Tourism, an important source of income and foreign exchange for many islands, would face severe disruption from climate change and sea level rise.

(b) Impact as average global temperatures increase



Source: Derived from *IPCC 4th Assessment Report 2007*

Annex 3. Online sources of climate change and meteorological information

Intergovernmental Panel on Climate Change (IPCC)
www.ipcc.ch
The IPCC site has download links for the 4th IPCC Assessment Report (2007), a comprehensive assessment of the physical science basis (Working Group 1), impacts, adaptation and vulnerability (Working Group 2) and mitigation of climate change (Working Group 3).

UNDP Climate Change Country Profiles
http://ncsp.undp.org/news/undp-country-profiles
Fifty-two country-level climate data summaries intended to address the climate change information gap for developing countries by making use of existing climate data to generate a series of country-level studies of climate observations. Each report contains a set of maps and diagrams demonstrating the observed and projected climates of that country as country average time series as well as maps depicting changes on a 2.5° grid and summary tables of the data. A narrative summarises the data in the figures, and places it in the context of the country's general climate.

UK Met Office Climate Change
www.metoffice.gov.uk/climatechange
Useful information on climate science.

US National Oceanographic and Atmospheric Administration
www.climate.gov/#dataServices
www.nhc.noaa.gov
Climate Services and National Hurricane Centre websites.

Grantham Institute for Climate Change
www3.imperial.ac.uk/climatechange
Has a mission is to drive climate-related research and translate it into real-world impact, using research to shape policy and provide climate information to the wider public audience.

The Royal Society
http://royalsociety.org/climate-change
Guidance on climate science.

Realclimate
www.realclimate.org
A commentary site on climate science by climate scientists for the interested public and journalists. The 'Start Here' page aims to provide a one-stop link for various levels of interest and detail on climate change.

Up in smoke?
www.upinsmokecoalition.org
Reports produced by the Working Group on Climate Change and Development, a unique and diverse network of development and environment organisations. Its central message is that solving poverty and tackling climate change are intimately linked and equally vital, not either/or.

Potsdam Institute for Climate Impact Research
www.pik-potsdam.de
Based in Germany, addresses scientific questions on global change, climate impacts and sustainable impact. The Research page links through to reports and publications.
www.pik-potsdam.de

Pew Centre on Global Climate Change
www.pewclimate.org
In the US, has an approach based on sound science, straight talk, and a belief that we can work together to protect the climate while sustaining economic growth. The International page links to global issues.

Climate Funds Update
www.climatefundsupdate.org
An Overseas Development Institute-managed website providing up-to-date information on the status of climate finance and funding mechanisms.

And also visit…

Christian Aid Climate Change Resources
www.christianaid.org.uk/resources/policy/climate_change.aspx
For Christian Aid research and advocacy reports and climate change briefings.

REFERENCES AND NOTES

1 Source: Climate Change – A framework for Christian Aid programme responses, March 2008.

2 Burton refers to Type 1 adaptation – reactive adaptation to mainly climate variability – and type 2 adaptation – proactive adaptation to climate change, mainly changing trends. Whilst the green triangle conforms to the definition of type 1 adaptation, the yellow triangle requires a forward-looking analysis of both climate trends and variability so can be considered 'enhanced' type 2 adaptation.

3 See Nicolas Stern, *Stern Review on the Economics of Climate Change*, 2006.

4 See Christian Aid's Southern Campaigns Toolkit for further guidance on climate change advocacy, the Christian Aid/Practical Action Renewable Energy Toolkit for information on developing decentralised renewable energy projects and the Christian Aid PVCA Good Practice Guideline for information on participatory vulnerability and capacity assessment.

5 Globally agriculture produces 13 per cent of greenhouse gas emissions. An estimated 74 per cent of these emissions are generated by agriculture in developing countries and 90 per cent of the mitigation potential will be based on increasing the carbon sequestration capacity of soil (FAO, April 2009). A further 18 per cent of emissions are related to deforestation, mainly of tropical forests.

6 Average global temperature has increased by 0.8°C from pre-industrial times; with an additional 1°C already built into the system, the global economy has only 0.2°C worth of increased emissions before it breaches the critical 2°C limit.

7 Decadal forecasting/modelling is still relatively new but there is an emerging emphasis on being able to improve forecasting 5-10 years ahead. Information on decadal time scales is expected to become available in the next few years.

8 Nick Brooks, Tyndall Climate Centre, 2003.

9 Based on a figure in Tom Mitchell and Maarten van Aalst, *Convergence of Disaster Risk Reduction and Climate Change Adaptation*: *A Review for DFID*, 2008.

10 Shown as three options for simplicity

11 See also Saleemul Huq and Hannah Reid, *Community-based adaptation: A vital approach to the threat climate change poses to the poor*, IIED Briefing

12 This is based on earlier approaches, such as drought cycle management

13 Definitions and figures that are unattributed are generally based on original material, multiple information sources and/or adapted substantially to ensure they relate to the Christian Aid context (or a combination of these). See also reference list in Annex 2.

Poverty is an outrage against humanity. It robs people of dignity, freedom and hope, of power over their own lives.

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