

Project brief



# The economics of adaptation to climate change in least-developed countries



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The world's least-developed countries (LDCs) will be disproportionately affected by the adverse consequences of global climate change – even though they are the least responsible for it. Their exposed geographical locations and current low adaptive capacity makes them extremely vulnerable to the physical consequences of climate change, which includes drought, flooding, rising sea levels and more intense and frequent tropical storms. These impacts will continue to evolve over the next few decades, even if the developed world makes immediate and massive reductions to its greenhouse gas emissions. Therefore, the physical consequences of climate change not only pose a severe threat to LDCs today, but could constitute an even greater threat in the future if adaptation is not properly thought through. Further delays in mitigation will increase the effort required to adapt to climate change (and thus the cost of adaptation), and reduce the effectiveness of early efforts to mitigate its impacts.

From an economic development perspective, adaptation is crucial in order to maintain or restore the pace of development in LDCs. Their economies, and the livelihoods of their poor, are particularly vulnerable to the impacts of climate change because of their dependence on climate-sensitive sectors such as agriculture. In order to determine the adaptation priorities of LDCs, analysis of the economic dimensions of adaptation to climate change requires a solid understanding of the development needs, economic issues and impacts associated with climate change in these countries. Preliminary studies by economists from several LDCs have identified the key issues that will shape the focus of subsequent work on the economics of adaptation in LDCs.

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## 1. Key economic impacts

The consequences of changing climate patterns are already having an adverse effect on the economies of LDCs, signalling how it could further hamper economic growth in the coming decades. Climatic events have had severe economic impacts at the local, national and regional levels, especially in countries in sub-Saharan Africa and South Asia. In many cases, they have resulted in further uneven distribution of income, with the poorest groups bearing a disproportionate part of the costs of economic decline.

### Sudan

Livestock accounts for 21% of Sudan's GDP, mostly based on natural rangelands, but climatic events, such as drought, are reducing the capacity of these areas to support livestock. The state of Kordofan lost 80% of its livestock during the drought of 1989, and the value of animal exports fell by 19.5% between 1998 and 2002.

Overall, agriculture, water and health are the sectors most vulnerable to climate change, and which suffer most from its economic impacts. Agriculture is of paramount importance, as it supports a significant proportion of the population and most other sectors or activities depend on it, either processing agricultural products or servicing the sector. LDC economies are heavily dependent on natural resources, including water, which is crucial for agriculture. Too much or too little water can destroy the livelihoods of huge numbers of people. In Sudan, the plant sector (crops and natural resources) accounts for 51 per cent of the entire contribution from the agricultural sector, which has been particularly hard hit by dwindling pastures and falling range capacity. Its contributions fell from 26.6 per cent in 2004 to 13.4 per cent in 2005, largely as a result of a decline in the country's natural resources. Approximately 80 per cent of all the livestock in the state of northern Kordofan died during the drought of 1989 and the value of animal exports fell by 19.5 per cent between 1998 and 2002 and continues to decrease. Thus, Sudan is particularly vulnerable to climate change due to limited water resources across much of the country, low soil fertility, frequent droughts and high dependency on climate-sensitive resources.



## Bangladesh

It is estimated that 40% of Overseas Development Assistance to Bangladesh may be at risk from the consequences of climate change.

Another country severely threatened by climate change is Bangladesh. Its coastal zones are blighted by increasing salinity, waterlogging, cyclones and rising sea levels; its northern, eastern and central flood plains are at risk from more frequent and prolonged flooding, while the northwest is affected by low rainfall, rising temperatures and deforestation. These physical consequences of climate change also have severe economic impacts: damaging agriculture, fisheries, livestock and infrastructures, causing water pollution, increasing health hazards and disrupting human settlements. These adverse impacts hamper economic growth and also have the potential to undermine poverty reduction efforts. The Organisation for Economic Co-operation and Development (OECD) and the World Bank estimates suggest that some 40 per cent of Overseas Development Assistance to Bangladesh may be at risk due to climate sensitivity.

## Nepal

Poor rains in the early 2005-06 monsoon in Eastern Terai prompted a 12.5% fall in national crop production. Late monsoons in 2009 could halve rice production in a year that has already seen a 14% drop in wheat and a 17% fall in barley production due to an earlier drought.

As in most LDCs, agriculture in Nepal is highly dependent on rainfall, and is therefore extremely sensitive to climatic variations. National crop production fell by 12.5 per cent following poor rains in the early 2005-06 monsoon in Eastern Terai, and nearly 10 per cent of agricultural land was left fallow due to rain deficit in Western Terai; while heavy rainfall and flooding in mid-Western Terai reduced production by 30 per cent that year. This agricultural decline is potentially catastrophic for Nepal, where subsistence agriculture provides employment for around 65 per cent of the population and accounts for about 38 per cent of gross domestic product (GDP). Food insecurity in Nepal has doubled in the last two years due to a combination of high food prices and

drought, while a rapid reduction in winter snowfalls, retreating glaciers and snowlines, and sudden shifts in weather patterns look set to trigger a severe water crisis at both local and regional levels.

## Malawi, Uganda and Senegal

Some 70-90% of the economically-active population of these countries are classified as rural. Therefore, most people are heavily dependent on agriculture and natural resources for their livelihoods. Rainfall in these countries has declined by about 35%, while the incidence of flooding and risk of dangerous rises in sea levels has increased.

The economies of Malawi, Uganda and Senegal are even more dependent on rainfall; some 70-90 per cent of their economically-active populations are classified as rural, and therefore rely heavily on agriculture and natural resources for their livelihoods. Malawi is most reliant, with a rural population of 89 per cent and with almost 80 per cent of its export earnings generated by agriculture. Their dependence on rain-fed crops makes these countries vulnerable to variations in weather and commodity price shocks, and the situation is exacerbated by their narrow economic base and high dependence on biomass for household energy. As a result, their economies are deeply affected by drought, which impacts on the growth of GDP, agricultural productivity and the industrial sector. Rainfall in Senegal has declined by about 35 per cent, its forest resources have little regenerative capacity and its soils are becoming increasingly degraded due to desertification, salinisation and lack of vegetal cover that exposes them to wind and water erosion. The country's coastal zones are now seen as particularly vulnerable, with an estimated area of between 1350km<sup>2</sup> and 7450km<sup>2</sup>, and about 3.7 million people likely to be affected by rising sea levels by 2020. The risks from flooding are also causing growing concern – particularly in Uganda. Its drained wetlands were unable to absorb the heavy rains that fell between July and October 2007, causing flooding in northern and eastern Uganda, and landslides and waterlogging in 22 districts. Some 65 per cent of the population lost 90 per cent of their crops, triggering widespread food insecurity, and in addition to this the rise in average

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temperatures could see the area under coffee – the country's top export earner – fall by as much as 90 per cent.

## Zambia

Floods in the summer of 2008 displaced a total of 82,662 households (495,972 people), 87% of them from rural areas and 13% from urban areas.

Zambia experiences a wide range of climatic hazards, from occasional dry spells and heat waves, high temperatures in valleys and seasonal droughts to intense rainfall, floods, altered growing seasons and shortened growing periods. A total of 444,624 people (74,104 households) in 21 of the 39 assessed districts were found to be in need of food assistance following floods in the summer of 2008, requiring 33,333 m<sup>3</sup> of maize which could cost about US\$90 million over a nine-month period from July 2008. These floods displaced some 82,662 households (495,972 people), 87 per cent of them from rural areas and 13 per cent from urban areas.

Overall, the impacts of such events tend to be most keenly felt by poor, vulnerable communities. This is likely to constrain economic growth, hinder the attainment of millennium development goals (MDGs), exacerbate the high levels of poverty already endemic in these countries, and widen the gap between the rich and the poor. It will also require greater government expenditure on disaster management and relief, further locking LDCs in a poverty trap.

## 2. Prioritised adaptation strategies

These examples show how the impacts of climate change are endangering the livelihoods of a large proportion of the population in LDCs, and threatening to reverse current patterns of economic growth. Climate change multiplies and intensifies the environmental, economic, social and institutional challenges facing vulnerable societies, further compromising their already fragile ability to attain the MDGs.

The LDCs concerned need to adopt several adaptation strategies to prevent climate change from triggering economic decline.

By implementing short-, mid- and long-term strategies at the local, national and sometimes even regional levels, they can

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use preventive and reactive adaptation measures to counteract the increased vulnerability and threats to economic growth caused by climate change. While it may not be possible to neutralise the physical effects of climate change, every effort should be made to minimise their impacts.

LDCs and poor households with limited resources need to prioritise their adaptation efforts and target particular sectors. As their immediate goal is likely to be to improve welfare, they will need to adapt to the climate risks that threaten their welfare and invest in adaptation actions that contribute to their current goals and needs; setting short-, medium- and long-term adaptation priorities in order to maximise the benefits from limited or scarce resources.

### Short-term targets

Mass awareness and advocacy are crucial first steps in climate-proofing vulnerable and exposed states. It is important to build widespread public awareness in order to include communities at the grassroots level



and prevent an inefficient, top-down approach to adaptation. However, it is not enough to inform people about the threats presented by climate change; people need to know how to deal with it too. Therefore, training on climate change issues at every level of society is a key factor to creating social resilience; provided this training is supported by advocacy on several levels to create the space for research and greater public awareness.

Certain short-term technical measures, such as tree planting and afforestation, are also needed to create physical resilience. Sahelian countries have been particularly badly affected by extended droughts and deprivation, which lead to unsustainable levels of deforestation that further degrade the environment and local living conditions. This vicious circle can be counteracted by targeted reforestation to protect crops and help secure sustainable livelihoods.

A change in development policies is also necessary, with climate change issues mainstreamed into sectoral development programmes. This should be feasible, as many activities already overlap and reinforce each other; however, existing policies and programmes will need to be implemented effectively for such mainstreaming to succeed. Finally, global networks on adaptation to climate change would constitute another positive step by facilitating knowledge sharing and better coordination between organisations, civil society and the media. Short-term adaptation actions also target areas already affected by climatic trends like drought and flooding. Most National Adaptation Programmes of Action (NAPAs) identify specific parts of the country requiring the most urgent (immediate) adaptations, which would often benefit from development interventions unrelated to climate change.

### Medium-term targets

Certain short-term measures will need to extend into the mid- and long-term phases of adaptation. Thus, awareness building, advocacy and afforestation initiatives should continue while new technologies such as renewable energy are introduced to lessen the strain on scarce resources, and simpler approaches

like crop diversification and irrigation systems are promoted to secure the livelihoods of local communities that are reliant on agriculture.

Improving water resource management is another key priority, since water is implicated in most climatic hazards. In places such as Nepal, Bangladesh and countries crossed by the River Niger, this will often require trans-border water management programmes, as different countries intersected by a single river are all variously affected by flooding and drought, and downstream communities are highly sensitive to the decisions and activities of upstream communities.

In-depth research is also required to remedy the current lack of research and detailed data on the specific consequences of climate change, and to help develop more focused national adaptation efforts – which should receive international support.

### Long-term targets

Research should naturally continue in the long-term so that decision-makers and policy-makers have access to constantly updated information, while being kept informed of new developments in project implementation. In addition to crop diversification, it would be useful to develop tailored crop varieties suited to the countries most affected by climate change. These will need to be resistant to higher temperatures and prolonged periods of drought, or more extreme rainfall, storms and floods. Infrastructure developments to make the population less vulnerable to local hazards in general will also be required in source countries. Above and beyond these technical solutions, training on climate change issues should be further institutionalised and incorporated into educational curriculums at every level, from primary schools through to vocational training courses. Finally, each country's NAPA should be regularly reviewed and updated to increase their long-term effectiveness.

The adaptation strategies in each phase need to strike a balance between education, technical solutions and innovation. Securing these measures will entail

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generating funds for long-term adaptation to climate change and disaster risk reduction. Adaptation is not an isolated, one-off activity, but a process requiring constant action – and thus continuous funding. While further economic research is required to determine the exact costs and benefits of adaptation, its benefits are likely to far exceed its costs.

Stakeholder consultations in the seven study countries identified the following priority areas for adaptation:

Country	Focus area for adaptation
Sudan	Rangeland rehabilitation and protection, restoration of biodiversity, water harvesting, sustainable agricultural practices
Bangladesh	Water management, disaster management in coastal zones and central flood plains, reforestation
Nepal	Water management, Inland disaster management, crop diversification, dams
Malawi	Inland disaster management, reforestation, livelihood diversification
Uganda	Inland disaster management, reforestation, livelihood diversification
Senegal	Reforestation, irrigation systems, crop diversification, agricultural development, disaster management in coastal zones
Zambia	Crop diversification, inland disaster management

These are not new activities. Most of them would be required to promote development anyway, and are therefore relevant for both development and adaptation to climate change.

## 3. Plans for economic research

The estimated future cost of the impacts of climate change on individual countries is now a major topic in international climate policy discussions and debates about the allocation of emission rights and criteria for compensation. Similarly, the costs and benefits of adaptation to climate change have become an important feature on the development aid agenda. Therefore, new economic research is needed to provide the basis for concrete national and community resilience planning, and for the ethical allocation of climatic rights and compensation among developed countries and LDCs.

It is important to treat adaptation as an integral element of national development planning, rather than a separate issue. National development strategies will need to take account of climate change as it is likely to restrict the options available to many countries, while capitalising on the fact that many development initiatives and climate change adaptation activities overlap and reinforce each other.

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Therefore, for LDCs, the economic dimension of adaptation to climate change extends beyond the current global focus on evaluating its costs and benefits. When costs are known, welfare and distributional effects become important as adaptation and development reinforce each other. The key economic aspects of climate change adaptation identified in country consultations include:

1. The costs of adaptation to support global climate change negotiations.
2. Investment choices: supporting decision-making in order to avoid technology failure and unintended negative impacts and ensuring that adaptation generates long-lasting outcomes.



3. The feasibility of approaches that respond to climate change while contributing to development (e.g. sustainable village concepts).
4. The costs and benefits of state-sponsored services, such as agricultural extension, meteorological services, early warning systems, etc.
5. Adaptation mechanisms: choosing between sustainable, low-input systems and revolutionary, high-tech and high-input approaches.
6. The rationale for incorporating climate change in national budgets.
7. Reducing government expenditure on food imports due to droughts and floods.
8. Up-scaling adaptation technologies that are currently being developed: the cost of developing and transferring technology on a wider scale.
9. Channelling and targeting adaptation resources where they are most needed.
10. Increasing the asset base of the poor.
11. Economic capacity building for climate planning (e.g. NAPAs).

### Framing the economic methodology

It may prove difficult to place a value on adaptation to climate change, as governments, firms and households do not consider climate change in isolation from other issues, and the decisions they make with a bearing on climate change may not necessarily be seen as explicit adaptations to climate change. Therefore, valuations need to take account of the non-climate related variables influencing stakeholder decisions, and to distinguish between autonomous and planned adaptation. Planned adaptation refers to the decisions made by government agencies, and autonomous adaptation to decisions made by private firms and households in order to adjust to the realities of climate change.

Cost-benefit analysis is the most useful framework for valuation when decisions need to be made about whether or not to adapt to climate change. This should use an uncertain baseline scenario where no adaptation measures are undertaken, in contrast to an evaluation of adaptation measures against the status quo, or even a counterfactual situation where no climate change is expected. Other approaches (such as cost-effectiveness analysis) are required if adaptation is the only option. These approaches may still value adaptation, but have different criteria for decision-making. Valuing the different approaches to delivering adaptation resources to vulnerable communities is also a critical aspect of economic analyses linked to cost-effectiveness, as the use of direct and indirect channels generates different responses and benefits in recipient communities.

It is also essential that valuations take account of marginalised communities and consider the impacts of climate change on the informal economy, rather than solely focusing on its impacts on macro-economic indicators such as GDP. This is particularly important in LDCs where most agricultural and other forms of primary production (like fishing) are subsistence or near-subsistence activities undertaken at the household level, and are subject to numerous stresses and constraints. This type of production should be a major component of economic analyses, but is frequently ignored in economic statistics because it operates outside the formal economy.

Following the preliminary identification of the priorities for adaptation to climate change, the aim now is to focus on the specific projects listed overleaf, which are partly or wholly based on each country's NAPA.

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Country	Project name	Project content
Sudan	Increasing resilience of rural communities to poverty	The project is based in Kassala State in eastern Sudan, which is located in a fragile semi-arid area. Organised by the Practical Group, it aims to enhance access to water harvesting and improve sustainable agricultural practices.
Bangladesh	Coastal agriculture	Climate change reduces yields in coastal areas by 15-30%. This project aims to address the problem by promoting techniques that minimise or reverse losses from salinity caused by the coastal flooding.
Nepal	Rain-water harvesting and winter season crop diversification for adaptation in agriculture systems	Many community-based initiatives for adaptation in the field of agriculture and water management has been identified in Nepal. Farmers in many hilly and some Terai areas of Nepal are looking at options for harvesting rainwater to use in the drought season. Farmers in the flooded areas of Bardiya and Kailali districts have adopted new farming methods like riverbank farming to survive. The project will identify many others and look at opportunities to promote them more widely.
Malawi	Small-scale adaptation in Southern Malawi	Southern Malawi is prone to frequent droughts and flooding. Several projects in the region are promoting practices to reduce losses from these events, which will be exacerbated by climate change.
Uganda	Flood and drought mitigation and livelihoods	Oxfam is promoting tree planting, agro-forestry and soil conservation in the mountains, and bio-energy stoves in Kasese, Bundibujjo and Karamoja districts. It also promotes alternative livelihood strategies for pastoralists including growing cereal and constructing granaries and water reservoirs.
Senegal	Biological agriculture in Guede	Through their local farmers' association, certain communities in northern Senegal have launched the concept of clean and sustainable agriculture in partnership with Enda-Pronat. Activities include promoting organic fertilisers and introducing irrigation systems, alternative energy sources and crop varieties.
Zambia	Flood and drought mitigation in Southern Zambia	Climate-resilient water management and agricultural practices are a priority for the region. This project proposes to develop the adaptive capacity of subsistence farmers in rural areas.

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The Capacity Strengthening in the Least Developed Countries for Adaptation to Climate Change (CLACC) network works on adaptation to climate change in some of the world's most vulnerable nations. CLACC's aim is to strengthen the capacity of organisations in poor countries and to support their initiatives in sustainable development. [www.clacc.net](http://www.clacc.net)

#### Participating economists:

Malawi: George Matiya [georgematiya@yahoo.co.uk](mailto:georgematiya@yahoo.co.uk) Sudan: Khitma Mohammed [khitmamohammed@yahoo.com](mailto:khitmamohammed@yahoo.com)  
 Zambia: Maximillian Mainza [mainzamax@yahoo.co.uk](mailto:mainzamax@yahoo.co.uk) Uganda: Annuciate Nakiganda [aknakiganda@yahoo.co.uk](mailto:aknakiganda@yahoo.co.uk)  
 Nepal: Bikash Paudel [bikash\\_iaas@hotmail.com](mailto:bikash_iaas@hotmail.com) Bangladesh: Nazria Islam [nazria.islam@bcas.net](mailto:nazria.islam@bcas.net)  
 Senegal: Secou Sarr [secou@hotmail.com](mailto:secou@hotmail.com)

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This brief summarised the findings from an IIED preparatory project on the economics of adaptation in LDCs, carried out in partnership with economists from seven LDCs. In addition to raising the issues and areas of focus, the project also sought to build the capacity of LDC economists by involving them in policy research and encouraging interaction among LDC economists.