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Cover photo: Township boys, South Africa

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The township of Amaoti outside Durban, South Africa

Photo: © James Waters

Ecosystems and adaptation

James Waters argues the importance of ecosystems and ecosystem services for poor urban communities likely to be affected by climate change

Over half of the world's population now lives in urban settlements. Severe climatic impacts are predicted for these areas and the need to address the threat of climatic impacts and find solutions is paramount. There has, however, been relatively little consideration of climate impacts on urban dwellers to date. Work on how communities may adapt to climate impacts has tended to focus on societal and engineering solutions. Meanwhile, in rural areas 'ecosystem-based adaptation' is a topical issue, both amongst practitioners and at the international climate negotiations. This approach refers to a range of strategies where communities work with ecosystems such that both ecosystems and society can adapt to climate change.

Here we ask the question of why ecosystems are being ignored in poor urban areas, and whether they have a role in adapting to climate change here. In addition to examining what ecosystem-based adaptation means in practice

and in policy contexts, observations from two townships on the outskirts of Durban, South Africa, highlight the ways in which ecosystems are of great use to poor urban communities.

Are ecosystem services important for the urban poor?

The work of the Millennium Ecosystem Assessment, amongst other studies, has shown

MAIN POINTS

- **The author details** the severity of climate change impacts on the urban poor.
- **He describes** the importance of ecosystem services, such as protection from natural hazards and disease, for poor urban residents.
- **He advocates** shifting debate on ecosystem-based adaptation from an 'ecosystems' to an 'ecosystem services' approach, acknowledging the importance of ecosystems – even if they are degraded – for urban adaptation.

that human societies are dependent on many aspects of ecosystems for their wellbeing. These aspects, whether used actively or passively, have been called 'ecosystem services'. In poor rural areas it is obvious that the provision of services, such as food via agriculture or wood from forests, is important in people's livelihoods. How relevant are they then in urban areas?

It is important to note that many settlements in 'urban' areas do not conform to western models of cities or traditional urban settlements. In sub-Saharan Africa, for example, 72 per cent of the urban population live in slums or informal settlements. At 78 per cent, this figure is even higher for the Least Developed Countries. These settlements are often found on the edge of burgeoning cities. They are not purely urban, nor are they rural, but rather contain a mix of the two. Such areas are described here as 'peri-urban'.

While much of the environment is polluted and there is little open green space, eco-

A TALE OF TWO TOWNSHIPS

Amaoti and Ntshongweni are both townships on the outskirts of Durban, South Africa. Amaoti consists of a mixture of informal settlements and more formal housing. Serious crime is high, most of the community are on benefits and many people have HIV/AIDS. Threats include the risk of infectious disease (although not presently an issue), exacerbated by poor sanitation in some areas, dwellings located very close

together and pressure on drainage systems. Ntshongweni on the other hand is much more rural, with lower crime rates and more social cohesion. The community is changing, however, and is becoming increasingly urbanized.

These two communities are unique and different. With little land available in Amaoti, people are heavily reliant on bought food, and heavy rain damages buildings (of-

ten in the floodplain) and causes loss of life. Ntshongweni is unusual in that the community has much land. This, however, brings dependence on locally-grown crops and the risk of damage from heavy rainfall. Many people are already changing the types or amounts of crops they grow. These two communities illustrate many of the challenges faced by poor settlements on the edge of African cities.

systems may still provide a range of benefits to local communities. These may be direct, such as food production on small patches of land, or indirect, such as providing protection against natural hazards. For townships such as Amaoti or Ntshongweni, these benefits do not constitute the entire source of income or food for residents, but complement other sources such as food bought from local stores with income earned from jobs in town. In dense urban settlements like Amaoti, rivers are often polluted, there is little land for each household and soil stability is poor. Individuals cannot, therefore, depend solely on local natural resources for their entire income, food or wood supplies. Nevertheless, the contribution that these direct ecosystem services make is crucial as they diversify the

sources of their goods - thereby spreading risk - and free up income for improving livelihoods. Ecosystem services can thus be of clear direct value to poor urban residents.

For the people of Amaoti, however, it is the more indirect services that arguably influence their lives most. In one informal settlement, residents choose to live in river floodplains and next to the river for various reasons, such as a preference for building shelter on land they do not have to rent. This puts them at high risk from flooding in times of storm surge or heavy rain. Such impacts are predicted to get worse with climate change. A vegetation buffer on the river's edge may help protect nearby houses and informal structures by absorbing some of the water's energy. In more rural locations, upland for-

ests sometimes provide protection against heavy rainfall events. This 'natural hazard protection' can also be vital in other habitats and locations, such as coastal areas and for protection against landslides.

Ecosystems can improve the health of peri-urban populations in complex ways. Humans gain significant psychological benefits from having access to natural areas and green space. Ntshongweni residents, for example, often ascribe their relatively positive wellbeing to having "plenty of space" and it being a "nice environment".

A more tangible threat is the risk of infectious disease. Ecosystems can regulate the spread of infectious disease in a number of ways, depending on the disease and ecosystem. Anthropogenic drivers such as urban sprawl, agricultural land use or the distribution of surface waters affect infectious disease risk, for example, by providing breeding sites for air-borne disease vectors or a reservoir of host species such as snails. Scientists are still struggling to fully understand the complex dynamics of such ecosystem services. Recently, however, national doctors from around the world called on politicians to be aware of the imminent threat of climate change on health. The letter was published simultaneously in two prominent medical journals, the *British Medical Journal* and *The Lancet*, and stated that climate change will be "the biggest global health threat of the 21st century."

For residents of poor peri-urban areas, outbreaks of water-borne disease will be

highly dependent on the state of water courses. Meanwhile, as forests act as potential reservoirs of disease, rapid urban sprawl into forested areas may result in the spread of vector-borne diseases such as dengue fever. The impacts of climate change on diseases such as malaria are still not entirely clear, but they should not be underestimated. As urbanization continues apace, ecosystem dynamics, and the benefits and problems that ecosystems provide for urban areas need considering in conjunction with climate change scenarios. For Amaoti, residents are largely unaware of the ecosystem services that are now in jeopardy, precisely

at the time when they may increasingly be needed.

Analysis of a survey and detailed information from semi-structured interviews revealed that the most utilized ecosystem services in Amaoti and Ntshongweni were protection against natural hazards, crop production and water regulation. Services utilized will differ from place to place but what is fundamental here is that poor urban areas cannot escape the influence of ecosystems, however degraded they may be. Unfortunately, natural environments tend to be seriously degraded in areas where there is urban sprawl. This, however, provides op-

portunities to support novel ways to adapt to future climate impacts under which ecosystems should not be ignored.

The services most at risk from climate change are often the least valued and understood

The ecosystem services of most concern to residents in the context of climate change will be those that are most utilized or most severely affected. Assessing the effects of climate change is not easy, but it was estimated using local climate predictions and expert knowledge of ecosystem functioning.

For Amaoti and Ntshongweni, a combination of climatic factors and future population pressure meant that the communities were particularly vulnerable to reduced protection from natural hazards, reduced protection against (and even a disservice by spreading) infectious disease, and potential crop failures. Worryingly, these services are the least understood and the least valued at the local level. The communities put little or no value on ecosystem protection against natural hazards, partly due to the long-term nature of the threat and partly because of the difficulty in managing such habitats collectively for communal gain. This acted only to further degrade this service. Understanding regarding the threat of infectious diseases was lacking in these settlements. This is unsurprising given the current state of knowledge amongst practitioners and scientists, and the novelty of potential climate impacts.



Settlements can erode natural buffer zones

Photo: © James Waters



A peri-urban township in South Africa: a mix of urban and rural

Photo: © James Waters

It is evident that in these peri-urban and urban townships climate change and ecosystems are crucially interlinked.

Ecosystem-based approaches

Given the dependence of poor urban dwellers on certain ecosystem services, it makes sense to focus some adaptation activities around these systems. This would complement many existing development goals, such as providing piped water to every household, but could also lead to more resilient integrated approaches to development. Current literature, however, suggests that ‘ecosystem-based adaptation’ is only relevant in rural settings or pristine habitats.

Internationally, the term ‘ecosystem-based adaptation’ appeared in various United Nations Framework Convention on

Climate Change negotiating sessions in June and August during 2009. Despite this attention, it was evident that there was confusion regarding what the term actually meant and whether it should be included in the negotiating text. Examples given by proponents of ecosystem-based adaptation included habitats such as coastal mangroves and wetlands. Further discussion at a technical workshop in October 2009 highlighted specific ecosystems such as mountain, freshwater and dryland systems, rather than focusing on ecosystem services more widely. Once more, clarification of terminology was noted as a priority. The Ad Hoc Technical Expert Group on Biodiversity and Climate Change discussed similar issues at length, but focused on “rural or poor communities” rather than urban communities. Encouragingly, the

restoration and rehabilitation of degraded systems was mentioned along with maintenance of critical processes and functions.

The topic continues to gain attention in these international meetings and processes and in academic circles, but at this stage it is too early to expect national strategies to deal with ecosystem-based adaptation as is proposed here. Urban areas are also frequently poorly represented. For example, very few National Adaptation Programmes of Actions have identified urban-specific climate change impacts. Several non-government organizations are pushing for the development of ecosystem-based adaptation strategies and for ideas and guidance on this. Yet again we find the same pattern: across all programmes and briefing papers found on the topic, case studies and examples are based on extensive semi-natural ecosystems such as forests, grasslands, coasts and coral reefs. Urban or peri-urban ecosystems simply do not feature. One 2008 study of peri-urban areas highlighted the need to value ecosystem services in this context, but it seems this has not filtered up to wider climate change adaptation debates. The only exception where urban areas are included in ecosystem-based adaptation discussions concerns water provision through protection of the surrounding watershed.

Considering ecosystem services in debates about the role of ecosystem-based adaptation brings one to a different conclusion regarding the breadth and importance of ap-

proaches for climate change adaptation that use ecosystems. An ecosystem service lens incorporates all aspects of ecosystems that can be utilized, however degraded. Moreover, this approach is one that acknowledges the direct and indirect benefits for both urban and rural residents alike.

Ecosystem-based adaptation in an urban world?

The concept of ecosystem-based adaptation holds exciting promise for meeting the multiple goals of environmental protection, development and adaptation to climate change. Current thinking implies that the approach might only be applied to extensive ecosystems that are invariably in rural areas. The evidence from Amaoti, however, shows that many urban settlements, including poor peri-urban areas, use ecosystem services in a variety of ways that underpin their livelihoods. Whilst further ecosystem degradation may not destroy community livelihoods, it will certainly undermine community resilience.

Whilst ecosystem-based adaptation may not feature significantly in the portfolio of adaptation options in all circumstances, by examining the broader suite of ecosystem services that humans make use of, including indirect ones such as protection from natural hazards or disease regulation, the case for an approach that includes ecosystems becomes much stronger. Such an approach also includes urban areas and ecosystems

that are degraded. It is, therefore, important to shift from an ecosystems perspective to an ecosystem service perspective, and to at least acknowledge that ecosystems exist in urban environments too. Whether living next to an extensive mangrove system or a degraded city river, people will be influenced by the ecosystems that surround them. In order not to detract from the momentum that the ecosystem-based adaptation approach concept has gained, this shift should not detract from the current good work that is occurring in this field. Rather it encourages a widening of application, through a broader examination of the range of benefits that citizens derive from the natural world on which we all depend.

There are serious challenges to building on the ecosystem-based approach. These include understanding how degraded ecosystems function and provide adaptation benefits, how to value ecosystems in urban areas and halt their degradation and how to integrate this approach with other adaptation options. Urban planners and decision-makers have tended to ignore ecosystem goods and services for too long. Meanwhile, there is also the current risk that ecosystem-based adaptation will become the privilege of extensive, healthy ecosystems and surrounding rural populations. It is hoped that both will be reconciled, facilitating resilient development for rural and urban populations alike, as well as all those in between. ■

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FURTHER INFORMATION

● **In the Cyberlibrary:** The Tiempo Climate Cyberlibrary carries a listing of selected websites concerned with ecosystems and climate change at www.tiempocyberclimate.org/portal/ecosystems.htm.
● **On the Web:** The Nature & Poverty Knowledge and Learning Network at www.natureandpoverty.net provides a platform for practitioners working on ecosystem management and poverty alleviation. A call has recently been issued for sharing experiences and case studies relating to ecosystem-based adaptation. The World Bank publication *Convenient Solutions for an Inconvenient Truth: Ecosystem-based Approaches to Climate Change* is available at tinyurl.com/y5ponuj (2.5MB download).

Hanging vegetable gardens

Kazi Zaved Khalid Joy describes how hanging vegetable gardens provide an innovative adaptation strategy to cope with waterlogging in coastal Bangladesh

The southwest coastal areas of Bangladesh already suffer from land degradation, salt water intrusion and waterlogging as well as disasters such as cyclones, storm surges and floods. Climate change is likely to exacerbate these problems. People here also depend heavily on climate-sensitive sectors and natural resources such as agriculture, fishing, water, grazing and timber and non-timber forest products such as food, medicine, tools, fuel, fodder and construction materials.

Floods in Satkhira District have destroyed livelihoods and prevented farmers from planting aman paddy rice because by the time the water has receded it is too late to plant. Erratic rainfall patterns and temperature changes are hampering crop production. Permanent waterlogging has greatly reduced the agricultural potential of the land and there are no alternative sources of livelihood. Some homesteads remain submersed pre-

venting any sort of cultivation and stopping children from going to school. Stagnant water inhibits the disposal of human and other wastes causing pollution and proliferation of water-borne diseases. Over 1.2 million people have been adversely affected by waterlogging, which has forced people to migrate leading to problems elsewhere such as overcrowding in urban slums. The negative effects of increas-

ing salinity also have important implications for the natural environment, such as the functioning of the Sundarbans (mangrove forest) ecosystem.

Projects such as the Coastal Embankment Project and Khulna Jessore Drainage Rehabilitation Project have worsened the waterlogging problem and affected nearly 200,000

MAIN POINTS

- **The author explains** how south-west coastal parts of Bangladesh suffer from climate-related problems such as waterlogging.
- **With agricultural practices compromised**, people are migrating or looking for alternative livelihoods
- and their health is deteriorating.
- **Hanging vegetable gardens** help produce vegetables for family needs, allow people to sell excess vegetables for income, preserve local seed varieties and support local climate change adaptation.



Hanging vegetable gardens in Bangladesh

Photo: © Sumon Biswas



Hanging vegetable gardens provide food and income for families in waterlogged areas

Photo: © Sumon Biswas

families in the area over the past two decades. The problem is growing and suffering is gradually increasing. Cultivation of amon (a local variety of fine rice) has been abandoned in some areas due to waterlogging. Cultivation of borrow rice is left as the primary crop

but is also slowly being reduced, and the production of rabby crops (horticulture) is now at highly unsatisfactory levels.

In Satkhira District, many people have changed their occupation from farming to fishing (culturing shrimp) due to waterlog-

ging and salinity increases. In coastal areas like Sowndip, people have left for Dhaka and elsewhere in search of work due to sea-level rise. In the Bagerhat area, Cyclone Sidr forced farmers into day labour and to migrate to cities in search of work.

Many villagers are suffering from malnutrition and ill-health. This is because of increases in the salinity of water used for domestic purposes - good drinking water is increasingly scarce - but also because of a reduction in food sources that used to meet a large proportion of people's nutritional needs. Lower job availability, unemployment, rising poverty levels and damaged livelihoods have also dramatically reduced food intake. Waterlogging and the expansion of shrimp farming have reduced the availability of fodder and grazing land. This in turn has reduced livestock numbers and thus deprived people of animal protein. Poor women, children and people in the margins of society suffer most.

Adaptation strategies

Climate change-related disasters and increasing climate variability are forcing people to adapt. Farmers in Bangladesh are growing salt-resistant crops and also adapting high-yielding varieties of rice to cope with waterlogged areas. In areas where increases in salinity and waterlogging have meant that vegetable production has become scarce, hanging vegetable gardens have been introduced.



Women grow vegetables near their homesteads

Photo: © Sumon Biswas

Hanging vegetable gardens

The introduction of hanging vegetable gardens involves placing large clay pots (nada) on bamboo stands outside people's homesteads. One such project has been implemented in four villages (Bagdanga, Manahar nagar, Pathorghata Monoharnagar and Sarutia) of Panjia Union of Keshabpur Upazila of Jessore District in Bangladesh. This project aims to produce enough vegetables for family needs and to allow people to sell the excess to generate income. It aims to preserve local seed varieties, encourage replica-

tion of these practices in other communities and help families cope with climate change.

Big earthen clay pots were secured on strongly supported bamboo platforms. Pots were then filled with soil and organic fertilizer to provide a highly fertile substrate for cultivation. Gardeners were then supported – primarily the women – in terms of the provision of local seed varieties and instructions on how to store seeds for future use. Vegetables cultivated include bottle-gourd, cucumber, pumpkin, green chilly, creeper vegetable, cucurbitaceous plants and beans.

Local knowledge and participation in planning was used throughout. Locals wanted seeds to germinate elsewhere before planting in the clay pots. Farmers also knew that vegetables such as creepers, kitchen vegetables and cucurbitaceous plants should not be grown in the same pot as gourds or sweet gourds as they would not survive.

Establishing a hanging vegetable garden costs 350 to 400 taka per clay pot and bam-

ANIMA SARKER'S STORY

Anima Sarker is a housewife in the Bagdanga village in Jessore District in Bangladesh. Her family has 84 decimals of land but has been unable to grow any crops on this land for the past four years due to waterlogging resulting from the unplanned water management projects implemented in the area. She has had to change her profession to support her family and now relies on fishing. Before waterlogging, her family earned 24,000 taka per year but when the cultivable land, including her homestead and yard, went under water for eight to nine months every year, she could not grow anything in her fields, including any vegetables to meet her families nutritional needs. She was, therefore, very interested in hanging vegetable gardens. In comparison with natural cultivation, production was less, but the gardens proved cost effective. They have allowed her to provide for her family's daily nutritional needs and she earns additional income from selling surplus vegetables at the local market.



Vegetables are grown in large clay pots known as nada

Photo: © Sumon Biswas

boo stand. Changing the soil allows farmers to cultivate seasonal vegetables three times each year earning them 600 to 700 taka from selling excess vegetables at the market once their families' nutritional needs have been met. Cultivation in this way provides more production and far less expenditure than traditional agriculture.

It is primarily the women – especially widows, disabled women and comparatively poor women – who are engaged with hanging vegetable gardens. Women's indigenous

knowledge on food production and sustainable agriculture has been promoted and their rights regarding seed and food sovereignty have been enhanced.

Upscaling and replication

Hanging vegetable gardens in these four villages were enormously popular and have been taken up by other organizations in similar waterlogged areas. Their potential is considerable as waterlogging increases. They provide an effective coping mechanism for small farmers and, in addition to floating vegetable gardens (which involve cultivating vegetables on floating beds of water hyacinth - a weed that grows prolifically on ponds and rivers), they could provide an alternative livelihood for fisher folk. The government fisheries department bans fishermen from catching fish for three or four months in the rainy season and fisher folk could use this time to grow vegetables as there are few other livelihood options available to them.

Initiative for Right View, with support from Action Aid, is conducting participatory action research on hanging vegetable gardens in water-imprisoned communities in the southwest coastal region of Bangladesh. The techniques have yet to be adapted to the specific conditions of different areas but show considerable potential and have been very popular in the beneficiary area to date. ■

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FURTHER INFORMATION

● **On the Web:** You can learn more about the implementation of hanging vegetable gardens in an account published by Coastal Development Partnership at tinyurl.com/y47or4s.

Informing adaptation

Gina Ziervogel and Fernanda Zermoglio discuss the integration of climate change science in adaptation responses in the agricultural sector in Africa

Climate change is expected to place considerable additional stress on the biophysical, economic, political and social systems that determine livelihood security in Africa. Accordingly, there is a growing need for 'anticipatory adaptation' or proactive rather than reactive management of climate change risk. Successful anticipatory adaptation requires the best available information concerning the nature of future climate risks. This article assesses the extent to which climate change scenarios for the future are currently used in developing adaptation strategies within the agricultural development sector with a focus on Africa. By focusing on what is working and what is not working, it provides suggestions for future research and support aimed at supporting adaptation to climate change.

The evidence in this article comes from a study undertaken by the Stockholm Environ-

ment Institute for the Rockefeller Foundation. Forty semi-structured interviews with practitioners and donors working in Africa were conducted in person and on the telephone between 2007 and 2008. The interview

MAIN POINTS

- **The authors consider** the challenge of how to make effective use of climate change science in adaptation responses in the agricultural sector in Africa.
- **Their analysis suggests** that downscaled climate change scenarios for local areas are rarely used at present in determining the nature of support for and

implementation of agricultural development responses.

- **If the existing barriers** to accessing and integrating climate change scenarios are addressed in practice and policy, this information could play an important role in supporting adaptation actions aimed at addressing climate change.

questions aimed to evaluate the organizations' current and planned climate change strategies, strengths and adaptation pathways. A second objective was to understand how organizations currently access and use climate model outputs in order to identify opportunities for improved delivery of information for adaptation in Africa.

It was found that, although there is growing awareness of and references to climate change, much of this is based on media messages or else highly aggregated model output from the Intergovernmental Panel on Climate Change (IPCC) data distribution centre and from global climate model output. The link between climate change information and adaptation practitioners on the ground remains largely non-existent and many adaptation practitioners in the agricultural sector still rely on generalized assumptions about how the climate will change or derive very general information about climate change



Mulching young trees, Machakos, Kenya

Photo: © Shortie66/flickr

and its impacts from the IPCC reports. This is mostly the result of a lack of awareness as to where to access more detailed data and how to interpret it or a general feeling that responding to current climate variability is sufficient.

Those who do apply model output in their work have tended to rely on only one model, creating the risk of drawing incorrect conclusions. Decisions are more often than not based not on that model's suitability to the

research problem or adaptation challenge, but its ease of access and use, with the extreme, but still plausible adoption by simple word of mouth. Only rarely do researchers provide a science-based rationale for choosing one model over another. It is clear that there is a long way to go before climate change scenarios are used effectively in developing adaptation strategies.

Agricultural decision makers require information on a range of matters in order to

manage their businesses and programmes. Making the link between the type of data that are reported by climate change models (typically, projections from 2046 up to 2100) and the type of data that decision makers perceive as being important to their activities (market demands, price, cost of inputs, labour availability, short-term weather) is not always possible or, in some instances, is not considered a priority. Indeed, it presents a great challenge that is difficult to overcome. Although some respondents viewed climate change data as useful, other respondents suggested that there is a lack of perceived relevance of climate model data for agricultural stakeholders, which is why these data are not used more widely.

Using climate information in context

In order to monitor progress on how climate change information is used, there needs to be a comprehensive baseline that characterizes and contextualizes the current adoption of climate change information in Africa's agricultural sector. According to our analysis, such contextualization is hampered in three ways.

First, there appears to be a general tendency to isolate climate change impacts from the broader context in which developments are taking place. There are several examples where climate change is assumed to be causing negative trends without considering the possible importance of other drivers. For instance, a respondent from International

Crops Research Institute for the Semi-Arid Tropics gave an example from the Machakos district in Kenya, where pastoralists blamed climate change and decreasing rainfall for decreasing crop yields yet downplayed the detrimental effects of overgrazing on pasture resources. The meteorological records, however, indicated that rainfall had been on the increase rather than decreasing. This illustrates the importance of putting climate change in a broader context, taking into consideration other possible (and often more directly probable) causes and explanations. Lack of understanding of these other drivers of change might unintentionally lead to misdirected projects and, in the long run, to 'maladaptation'.

Second, the vulnerability context is often not fully understood. Many organizations seem to adopt the adaptation mandate without first clearly understanding the very important role that the vulnerability context can play in implementing adaptation options. Certain climate impacts and vulnerabilities are taken for granted without exploring which climate parameters and conditions are actually responsible for specific vulnerabilities to climate change and how these parameters and conditions might change under future scenarios. This may again lead to misdirected adaptation and development measures.

Third, climate change adaptation efforts often fail to contextualize climate change risks within the set of other climate information



Orchard, South Africa

Photo: © Mallix/flickr

used in decision making, including historical data, real-time data and indigenous knowledge, all of which are currently used and available to support decision-making processes. In fact, there seems to be an apparent tension between people working on future climate change and those focusing on current climate variability. Some climate change professionals argue that, although focusing on current climate variability might equip agricultural decision makers in the short-term, they might then be caught off-guard by climate change, particularly where the changes brought about

by climate change are significant and can be abrupt. In contrast, those who focus on climate variability claim that, unless farmers in Africa can be helped to cope better with current climate variability, the challenge of adapting to future climate change will be daunting for most and impossible for many.

We argue that approaches focused on short-term variability and long-term trends are complementary, rather than mutually exclusive, and they must, eventually, be integrated. A small-scale farmer, for instance, will be interested in seasonal climate fore-

casts that highlight the expected rainfall in the coming season in order to make a decision on what crops to grow. It should come as no surprise that these farmers do not prioritize climate change projections in their decision making. A crop breeder, on the other hand, might benefit more from an understanding of climate change patterns in the next 20 to 30 years because of the time delay between the development of new crops and their actual distribution and use. In this case, an understanding of climate change scenarios would be beneficial. Similarly, a donor agency looking to promote sustainable rural development would be interested in climate change-induced shifts in agro-ecological zones over a ten to 20 year period, so that their current initiatives are not undermined by future change.

Why is the uptake of climate information limited?

One of the main barriers to producing climate change information remains the lack of reliable meteorological data. This is especially true for complex environments where higher concentrations of station data are needed to capture the heterogeneity of the terrain. While many African countries established extensive monitoring networks during much of the 20th century to support daily weather forecasting, economic difficulties in the region, coupled with civil unrest and often wars, have led to the deterioration of these networks in recent years. Ultimately,

the lack of sufficient and clean historical data renders the task of developing robust scenarios relevant to the local area difficult.

Another reason for the limited uptake of climate change information is the lack of capacity, both in terms of human resources and computational facilities, to expand the available databases. Running regional models requires considerable computational capacity. A handful of organizations in Africa have some basic infrastructure and human resources in place. More needs to be done to support these organizations in their evolution into fully-fledged climate modelling centers.

Despite these barriers and shortcomings, the state of climate science and modelling has reached a point where it may indeed be able to adequately inform decision making. The critical focus, however, should be placed on the development of sector-specific methods and examples of how climate model outputs could be utilized to support robust adaptation responses. The modelling community needs to focus on expanding modelling efforts within Africa while working closely and interactively with the users of model information in the interpretation and understanding of climate model output.

For farmers and other agricultural decision makers, there are costs and risks involved when modifying their age-old activities and practices in order to adapt to what models indicate will happen. Some farm-

ers and programme operators noted that it makes more sense to react to observed (or historical) changes in weather than to alter their activities based on a predicted climate risk. It is further, true that many decision makers are unable to contextualize the uncertainty that is inherent in climate projections and, therefore, stick to what they know. The reality is, however, that model disagreement is most significant at annual time scales, while for longer time periods and for specific regions many models concur on the direction of change in the near-term. If used with the correct caveats, these models can provide a sound, scientifically-grounded basis for decision making. For example, if apples are grown in an area where temperatures are expected to rise, whether they rise one or two degrees might not matter if there will not be sufficient cold units for the development of the apple's growth. The challenge comes in the timing of the adaptation response. It is unlikely that the models can provide enough information on when critical thresholds will be exceeded and this will require farmers to decide on timing for themselves.

Bridging the gap between scientists and farmers

Improving information uptake from climate models is going to require bridging the gap between what scientists produce and what end-users require. A farmer, for example, may be less interested in mean annual rainfall or temperature trends but would be very

interested in knowing how many years in an orchard life time of, say, 25 years sub-optimal rainfall or extreme temperatures might be expected and how the probability of extreme events might change over time. This information might be impossible to infer from a reported annual trend, especially where the relationship between extremes and averages is not established.

Bridging the gap between climatologists and end-users will require growth in the people and organizations able to interpret and communicate this information effectively. The translation skills of so-called knowledge brokers are necessary in order to engage a wide range of stakeholders with specific needs. The limited number of climate scientists in Africa cannot be expected to develop their science at the same time as meeting the growing need for interpretation and communication of model output.

At the same, there needs to be input from African scientists to drive the climate change agenda. Currently, the growth in climate adaptation and agricultural development activity in Africa has been mobilized from outside of Africa, rather than from within. Many projects have emerged in response to foreign funding and so are 'supply-driven'. More focus on 'demand-driven' approaches is needed that address locally-identified needs. It does not have to be one or the other, but rather there should be space to enable demand-driven approaches to emerge

alongside supply-driven approaches and in doing so promote buy-in from a wider local community.

To conclude, there has been a lack of work conducted at the nexus between climate science and those concerned with making decisions. This is, however, starting to change. As adaptation rises in prominence on the international agenda, so does the need to increase and, in many cases, develop the competences on the use and interpretation of climate change scenarios to support informed decisions. A particular challenge for those tasked with the design and implementation of adaptation projects is to leverage the best available data and synthesize tools to understand how the expected climatic changes will exacerbate or induce vulnerability of different activities under a changing climate. We suggest that, by focusing on the barriers to and opportunities for strengthening the understanding, packaging, delivery and communication of climate change science among providers of climate data and users, adaptation responses can be made more robust and actionable suggestions can be provided to reduce the negative consequences of climate change, particularly for Africa's most vulnerable groups. ■

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● This article is based on the 2008 report *Climate Change and Adaptation in African Agriculture*, prepared for the Rockefeller Foundation on behalf of the Stockholm Environment Institute. The contribution of the co-authors of the 2008 report is gratefully acknowledged. The report is available at tinyurl.com/y24x987.

MEKONG DROUGHT

The flow of the Mekong River in South-east Asia is at its lowest for 20 years, according to the Mekong River Commission.

The Save the Mekong Coalition believes that the low level is the result of upstream dams in China. However, Chen Dehai of the Chinese embassy in Bangkok blamed low rainfall over the catchments of the rivers that feed into the Mekong in Thailand and in neighbouring areas.

Read more:
tinyurl.com/y5j73j9

ENERGY SECURITY

The World Bank has approved a US\$3.75 billion loan to South Africa in support of the nation's energy security plans. Part of the loan concerns wind and solar power projects and low-carbon energy efficiency measures, including a railway to transport coal and reduce greenhouse gas emissions.

The bulk of the loan, US\$3.05 billion, however, covers the completion of the Medupi coal-fired power station and this has attracted strong criticism. Michael Stulman of Africa Action described the project as misguided, saying that it would do little to help poor South Africans.

Read more:
tinyurl.com/y4gxkmw

FOOD PRICES

Global warming could have a substantial effect on food prices, poverty and hunger over the next two decades, according to a new modelling study led by the Food Security and the Environment programme at Stanford University in the United States.

A rise in global temperature of 1.5 degrees Celsius by the year 2030 might result in a ten to 20 per cent drop in agricultural productivity, a ten to 60 per cent rise in the price of rice, wheat and maize and an overall rise in the poverty rate of three per cent in the 15 countries studied.

Read more:
tinyurl.com/y469ttht

EUROPEAN WIND

The European Union could exceed its target of generating 20 per cent of its energy from renewable sources by the year 2020, the European Wind Energy Association (EWEA) estimates.

"Europe has witnessed a sea-change since the 2009 Renewable Energy Directive was agreed, as in 2008 many countries were stating that their target would be difficult to meet. Now the majority are forecasting that they will meet or exceed their national target," commented Justin Wilkes from EWEA.

Read more:
tinyurl.com/y5jcj43

SAFE WATER

The world could exceed the 2015 safe drinking-water target set by the Millennium Development Goals (MDGs), according to the latest status report from the World Health Organization (WHO) and the United Nations Children's Fund.

"The question now lies in how to accelerate progress towards achieving the MDG targets and most importantly how to leap a step further to ultimately achieve the vision of universal access," said Maria Neira, director of the WHO Department of Public Health and Environment.

Read more:
tinyurl.com/y5xzkro

Stakeholder analysis in Pakistan

Javeria Afzal maps out key stakeholders in Pakistan in the context of climate change and recommends a number of important policy interventions

The adverse impacts of climate change on the lives and livelihoods of Pakistan's poor people will be enormous. Various studies show that significant changes to the climate and natural disaster patterns already pose serious threats to Pakistan's social, environmental and economic development. Receding glaciers, erratic rains, extreme climatic events (such as heatwaves and intense rains) and prolonged droughts are expected. These are likely to reduce Pakistan's water resources, affect the agricultural, livestock and poultry sectors, threaten mountain biodiversity and place further stress on human health and other economic sectors.

One point of concern is that Pakistan lacks an adaptation strategy to prepare for climate change, cope with its consequences and address the vulnerability of poor and at-risk communities, especially women who already suffer from the burden of poverty. Pakistan

has, however, begun some very basic elements of climate change policy development by developing a preliminary report *Pakistan's Climate Change Policies and Action*. The task force that led this initiative was formed by the Planning Commission of Pakistan.

Knowledge gaps

Little systematic research has been undertaken to understand the problem of climate

MAIN POINTS

- **Javeria Afzal argues** how Pakistan lacks a strong national climate change adaptation strategy.
- **She explains how** research conducted to date has been *ad hoc* rather than systematic, and she describes the various

institutions involved in climate change activities at the national level.

- **She concludes** by recommending a number of interventions to ensure Pakistan develops effective climate change policy measures.

change in Pakistan and devise appropriate actions. No particular effort has been made to look at the gender-differentiated impact of climate change, particularly on women who are most vulnerable. Research knowledge generated to date in Pakistan has been conducted by research organizations, international agencies or non-government organizations with donor funding, but only on an *ad hoc* basis.

Local and regional level understanding of the impact of climate change on livelihoods and socio-economic conditions (both on women and men) is necessary along with the development of gender-sensitive coping mechanisms to help communities adapt to changes. Understanding the indigenous knowledge and practices of both women and men for adaptation to climate change and extreme hazard events would help with devising appropriate climate change adaptation policies that meet community needs.



Fresh water sources are drying up in Khuzdar

Photo: © Sarfaraz Ahmad

Local public and civil society institutions and networks could best compile this knowledge at low cost. Such local networks can also be instrumental in developing climate change policies that are geared towards the needs and concerns of local communities.

Institutions involved

International dialogues (and some actions - though insufficient) are underway to mitigate global climate change by reducing atmospheric greenhouse gases to safe levels and to devise ways of reducing climate change impacts in affected countries. Pakistan is participating in these international policy

dialogues. The Ministry of Environment is the focal point for climate change issues, and amongst other activities it has established a Clean Development Mechanism cell.

The autonomous Global Change Impact Studies Centre is engaged in modelling-based research to assess the impacts of climate change, devise adaptation measures and provide feedback to policy makers for action. The Pakistan Meteorological Department focuses on monitoring climatic events and early warning systems to help prepare for floods, droughts and cyclones. A National Disaster Management Authority has been established, which acts as a focal point for

coordinating and facilitating the implementation of strategies and programmes on Disaster Risk Management in the country. Some international agencies and non-government organizations are undertaking climate change adaptation work, mainly at the grass-root community level. This work could be an important source of information in terms of developing evidence-based climate change policies and adaptation strategies. United Nations (UN) agencies have also devised cross-cutting plans as part of the 'One UN programme' under both environmental and disaster risk management themes.

As the focal ministry for climate change, it is the mandate of the Ministry of Environment to initiate the development and implementation of climate change policy decisions and action plans. Climate change is cross-sectoral, however, so this requires the various institutions involved to coordinate their work closely.

Recommended policy interventions

A number of interventions are needed to ensure Pakistan develops effective climate change policy measures. Pakistan should develop broad policy guidelines - both for mitigation and adaptation - covering the major sectors that are expected to be affected by climate change. Climate change should also be integrated into ongoing development and research programmes focusing on improving the livelihoods of rural and urban communities, including both women and men.



Land degradation near the sea due to climate change in Badin Photo: © Sarfaraz Ahmad

Comprehensive research covering all regions and sectors should be undertaken to assess climate change impacts and vulnerabilities and to devise adaptation strategies for specific regions, sectors and genders. These assessments and strategies should form the basis of a detailed national climate change action plan.

Proposed adaptation measures will need testing locally, and feedback on what practices and indigenous knowledge works best for adaptation should be used to develop gender-sensitive adaptation strategies and action plans based on the needs and priorities of grass-root communities, including both women and men. Results will need to be translated into simple messages and packages that can easily be adapted to local conditions. Local non-government organizations or community-based organizations are well placed to test the application of such

adaptation packages in the field at grass-root levels. These local organizations, however, need strengthening and they need links with national and international non-government organizations that can convey emerging knowledge to policy makers and planners for integration into development processes.

Climate change is expected to increase the number of extreme climatic events. To prepare for this, early warning systems under the Pakistan Meteorological Department and other organizations such as the National Institute of Oceanography, the Federal Flood Commission, the Drought Rehabilitation Authority and the National Disaster Management Authority need strengthening.

An awareness raising campaign should be initiated to inform policy makers, scientists, politicians, the business community, media and civil society about climate change. National and international non-government organizations can join hands to take on this role because they can be quite vocal and many have strong links to grass-root levels that could be tapped.

Finally, climate change adaptation requires large investments and resources. A multi-stakeholder forum should be formed, including donors, so that progress on the climate change interventions and research findings mentioned above, including emerging gaps and constraints, can be presented regularly at donor coordination meetings to solicit support where needed. ■

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CONFERENCES

9th World Wind Energy Conference & Renewable Energy Exhibition: WWEC2010

Istanbul, Turkey: 15-06-2010 to 17-06-2010

Conference is organized in cooperation with EUROSOLAR Turkey. Aimed at major players of wind energy technologies, industries and policies to share the latest technologies and information affecting strategic decisions. Special focus will be on how to integrate large capacities of wind power into existing grid infrastructure and how to adjust grid capacities.

Details: World Wind Energy Association, WWEA Head Office, Charles-de-Gaulle-Str 5, 53113 Bonn, Germany.

Fax: +49-228-3694084

Email: contact@wwec2010.com

Web: www.wwec2010.com

2010 International Energy Workshop

Stockholm, Sweden: 21-06-2010 to 23-06-2010

Organized in cooperation with the KTH Royal Institute of Technology in Stockholm. Intended for participants such as researchers and practitioners in developed and developing countries interested in the analysis of the inter-relationship between climate change and energy. Main themes are climate change - mitigation and adaptation, energy and transport modelling, and the economics of low carbon technologies.

Details: Massimo Tavoni, Fondazione

Eni Enrico Mattei, Corso Magenta 63, 20123 Milan, Italy.

Email: info@internationalenergyworkshop.org

Web: www.internationalenergyworkshop.org/Workshop_2010.html

Fourth World Congress of Environmental & Resource Economists

Montreal, Canada: 28-06-2010 to 02-07-2010

Papers will be presented in the three main areas of open sessions, special sessions and a poster session. Special session topics will include: economics of species and habitat conservation; demography and environment; climate impacts and policy in the Mediterranean region; impact of climate change on agriculture; new perspectives on water demands and valuation; and real options and renewable resources, amongst others.

Details: WCERE 2010 Secretariat, Bureau des Congres Universitaires, 162 Place Gatine, St-Jerome (Quebec) J7Y 5K2, Canada.

Fax: +1-514-3404440

Email: info@wcere2010.org

Web: www.wcere2010.org

2010 International Climate Change Adaptation Conference - Climate Adaptation Futures

Gold Coast, Australia: 29-06-2010 to 01-07-2010

Working theme of the conference is "Preparing for the unavoidable impacts of climate change". Co-hosted

by the Australian National Climate Change Research Facility and the CSIRO Climate Adaptation Flagship.

One of the first international forums to focus solely on climate impacts and adaptation, bringing together scientists and researchers from developed and developing nations.

Details: Conference Secretariat, YRD (Aust) Pty Ltd, PO Box 717, Indooroopilly, Qld 4068, Australia.

Fax: +61-7-33682433

Email: nccarf-conf2010@yrd.com.au

Web: www.nccarf.edu.au/conference2010

5th International Conference on Environmental Science & Technology

Houston, USA: 12-07-2010 to 16-07-2010

Sponsored by the American Academy of Sciences, the conference aims to provide a platform for environmental scientists, engineers, management professionals and government parties to discuss the latest developments in environmental research and applications. Session topics include: water pollution and water quality control; air pollution and air quality control; global change; wetlands; ecosystem assessment and restoration; and society and the environment.

Details: Environmental Conference Program, American Academy of Sciences, 9720 Town Park Drive, Ste 18, Houston, Texas 77036, USA.

Email: env-conference@aasci.org

Web: www.AASci.org/conference/env/2010

6th Australia-New Zealand Climate Change & Business Conference

Sydney, Australia: 10-08-2010 to 12-08-2010

The New South Wales government is the foundation sponsor and the conference is to be held at the Sydney Convention and Exhibition Centre. The conference will include discussion and debate on international developments, policy outlook and impacts, best practice responses and the challenges of adaptation and how they are all linked together. Sponsorship and exhibition opportunities are available and it is advised that interested parties contact the organizers as soon as possible.

Details: Conference Organizer, Climate Change & Business Centre, PO Box 375, Collaroy, NSW 2097, Australia

Email: secretariat@climateandbusiness.com

Web: www.climateandbusiness.com

ISEE 2010 Conference: Advancing Sustainability in a Time of Crisis

Oldenburg & Bremen, Germany: 22-08-2010 to 25-08-2010

The 11th biennial conference organized by the International Society for Ecological Economics will be held in the adjacent cities of Oldenburg and Bremen. Main subjects for presentations and discussion include: climate

EVENTS

change; energy; biodiversity and ecosystem services; sustainable development; land use; green business; environmental ethics and values; and ecology, amongst others.

Details: Bernd Siebenhüner, School of Computing Science, Business Administration, Economics and Law, Carl von Ossietzky University of Oldenburg, 26111 Oldenburg, Germany.

Fax: +49-441-7984379

Email: bernd.siebenhuner@uni-oldenburg.de

Web: www.isee2010.org

XXIII IUFO World Congress Seoul, Korea: 23-08-2010 to 28-08-2010

Working theme of the Congress is "Forests of the Future: Sustaining Society and the Environment". Will include plenary and sub-plenary sessions, technical sessions and poster sessions. The 126 technical sessions will feature latest advances in forest science covering projects and research conducted by leading forest scientists and experts in the various related fields. Congress will also have available specific tours and a trade exhibition.

Details: IUFO Secretariat, Hauptstrasse 7, A-1140 Vienna, Austria.

Fax: +43-1-877051.

Email: office@iufo.org

Web: www.iufo2010.com

2010 World Water Week: The Water Quality Challenge Stockholm, Sweden: 05-09-2010 to 11-09-2010

Programme will include celebrations and the Stockholm Water Prize as 2010 will be the 20th anniversary of World Water Week. The eight workshops will include themes such as: integrated pollution prevention and control; water quality for human health; improved water use efficiency through recycling and reuse; resilience, uncertainty and tipping points; and minimizing land use based pollution, amongst others.

Details: Stockholm International Water Institute, Drottninggatan 33, 111 51 Stockholm, Sweden.

Fax: +46-8-52213961.

Email: secretariat.www@siwi.org

Web: www.siwi.org

International Rivers Conference 2010

York, UK: 06-09-2010 to 09-09-2010

An international conference organized by the Nature Conservancy Council which aims to assess progress and lessons learnt since the 1990 conference "The Conservation and Management of Rivers". Some of the topics for discussion are: ecosystem integrity; philosophy of conservation; new methods and approaches; adaptive management; relevance of climate change; evidence-based management and monitoring; and public

involvement.

Details: Zena Bailey, Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough PE1 1JY, UK

Email: zena.bailey@jncc.gov.uk

Web: www.jncc.gov.uk/page-4902

Storm Surges Congress 2010: Risk & Management of Current & Future Storm Surges

Hamburg, Germany: 13-09-2010 to 17-09-2010

Two major questions will be discussed and debated regarding the frequency and affects of storm surges. First, how to deal with the present level of risk and, second, how to respond to changing future conditions. Will look at the interdisciplinary approaches and strategies in dealing with this issue.

Details: Conference Organizer, GKSS-Research Center, LOICZ International Project Office, Institute for Coastal Research, Max-Planck-Str 1, 21502 Geesthacht, Germany.

Fax: +49-4152-872040.

Email: loicz.ip@loicz.org

Web: www.loicz.org

International Conference: Deltas in Times of Climate Change

Rotterdam, The Netherlands: 29-09-2010 to 02-10-2010

Organized by the by the Climate Changes Spatial Planning and the Knowledge for Climate Research programmes together with the city of

Rotterdam and the C40 (a group of the world's largest cities committed to tackling climate change). Scientists, politicians, policy makers and practitioners are invited to share in debate and discussions on their knowledge and experiences of climate adaptation. Aim is also to strengthen cooperation between delta cities in adaptation.

Details: Conference Organizer, Programme Office Knowledge for Climate, PO Box 47, 6700 AA Wageningen, The Netherlands

Email: o.van.steenis@programmabu-reauklima.nl

Web: www.climatedeltaconference.org

4th International Conference - Transitions to Sustainability Auckland, New Zealand: 30-11-2010 to 03-12-2010

Organized by the New Zealand Society for Sustainability Engineering and Science, the conference is to be held at Auckland University. Main themes include: evolutions in technology; limits to growth; new economics of sustainability; resilient societies; beyond today's infrastructure; and embedding sustainability. Discussions will centre around potential transition pathways to a more sustainable future and what engineers and scientists can do.

Details: Vicky Adin, NZSSES, PO Box 305270, Triton Plaza, North Shore, Auckland 0757, New Zealand

Email: vicky@nzsses.org.nz

Web: www.nzsses.auckland.ac.nz

After Copenhagen

COP 15

Blame and recrimination dominated the aftermath of the Copenhagen climate summit. Sarah Granich and Mick Kelly report.

The European Union (EU), largely sidelined at the Copenhagen climate summit, blamed the United States and China for the “great failure” of the talks. “It was obvious that the United States and China didn’t want more than we achieved at Copenhagen,” commented Andreas Carlgren, the environment minister of Sweden, which currently holds the EU presidency. “We’ve been taught some lessons about the realities of the so-called multi-polar world,” said Carl Bildt, Swedish foreign minister. “These lessons will have to be taken into account when we go for a more comprehensive global agreement.” Carlgren did say, though, that the Copenhagen Accord means that United States negotiators “can now show the [United States] Senate that they have an agreement with [major developing nations such as] China, India, Brazil and South Africa”, removing a longstanding

obstacle. “Now the pressure is on the United States to really deliver,” he concluded.

The EU plans to make greater use of informal bodies such as the Major Economies Forum and the G20 in future discussions on climate change due to concern that the United Nations framework can readily be blocked by a small number of obstructionist states. “EU officials are pretty upset with the United Nations process and feel pretty frustrated,” commented Jason Anderson from WWF. “The trick is to find a way to avoid the blockages. If you could just get the major emitters to agree to things, that would take some major problems out of the process,” he added.

A meeting of EU environment ministers in Spain later re-affirmed the EU’s conditional goal of a 30 per cent reduction in carbon emissions below 1990 levels by 2020, despite disappointment over the outcome of the summit. The EU had hoped that the offer to deepen its commitment from 20 to 30 per cent would inspire other nations to adopt more ambitious targets. “We definitely think we should maintain the 30 per cent offer. We think it is very, very important. It has always been a conditional offer but it is a

very important signal that it is maintained,” British energy and climate change minister Ed Miliband said.

Ed Miliband had accused China of vetoing reference to specific emissions targets, such as the need for 50 per cent reductions in global emissions by 2050, in the Copenhagen Accord. “We cannot again allow negotiations on real points of substance to be hijacked in this way,” he said, calling for “major reform of the United Nations body overseeing the negotiations and of the way the negotiations are conducted.” In a swift response, Jiang Yu from the Chinese foreign affairs ministry referred to the statement as “plainly a political scheme,” intended to “shirk the obligations of developed countries to their developing counterparts and create discord among developing countries.” While intent on showing leadership in reducing its emissions growth, China is wary that it, along with other major developing nations such as India, may face demands to take on formal emissions targets at some future date. Yvo de Boer, head of the climate treaty secretariat, warned that “all this finger-pointing and recrimination”

could cloud negotiations next year. "We need to work together constructively," he said.

The claim by India's environment minister, Jairam Ramesh, that his country got a "good deal" out of the Copenhagen summit by avoiding emissions targets has been described as baseless. "India buckled under pressure in Copenhagen," said a statement from the Center for Science for Environment (CSE) in New Delhi. "The Copenhagen Accord that India plans to sign will erase both historical responsibility and the distinction between industrialized and non-industrialized countries from future climate change negotiations." Suparno Banerjee from CSE lamented the lack of legally-binding targets that the developed countries have to meet. "We have failed to agree at a sort of solution which will lead us to a viable action plan towards controlling climate change. And we believed that it is a disastrous summit and it is specially disastrous for India's poor and the vulnerable section because they are going to be most severely hit," he said.

There was also concern regarding the Accord's funding commitments. Grace Akumu, Kenya's technical adviser on climate change, criticized the funding allocated to developing nations in the Copenhagen Accord. "The money is very little," she said. "All of us were shocked when the continent's spokesperson, Ethiopian Prime Minister Meles Zenawi, backed this proposal." Kenya is seeking US\$3 billion annually to support its climate change

response strategy, but the global start-up fund only amounts to US\$10 billion a year. Bangladesh will seek 15 per cent of the global start-up fund but "this money is not enough to enhance our adaptation capability," said Hasan Mahmud, state minister for environment and forests. "We expect bilateral assistance too to finance our mitigation and adaptation plans," he said. The government plans to construct new embankments, repair 11,000 kilometres of coastal embankment and build more cyclone shelters.

While the Copenhagen Accord calls for the immediate establishment of a mechanism to unleash funds for forest protection, just what this means for the REDD (Reducing Emissions from Deforestation in Forest Degradation in Developing Countries) programme remains to be resolved. Funding has been the critical issue, with developing countries reluctant to take on targets for reducing deforestation without a clear financial commitment. Without targets, "REDD becomes toothless," according to Peg Putt of the Australian Wilderness Society. It has been estimated that at least US\$25 billion a year would be needed to launch the programme. To date, US\$3.5 billion has been committed to preparatory work over the coming three years. Nevertheless, the endorsement of REDD in the Copenhagen Accord has sent a clear signal to the forestry industry. "Once we implement REDD projects, we cannot anymore allow uncontrolled illegal logging. That kind of leakage

will not be acceptable to the global community," commented Indonesian environment minister Sarwono Kusumaatmadja.

The carbon market responded to the Copenhagen Accord with an immediate fall of ten per cent in the price of European Union emissions permits. Opinions on the agreement amongst analysts were, however, mixed. Trevor Sikorski of Barclays Capital saw the Accord as a "very disappointing outcome that is even below our modest expectations... I see nothing here that should drive investment in the carbon commodity and low carbon technology." David Metcalfe at Verdantix advised that "executives responsible for energy and climate change plans should avoid new investments in the Kyoto-based global carbon markets." Citing badly defined rules, insufficient United Nations staff and a depressed carbon price that conspire to make a very high risk market, he believes that "the Accord further postpones crucial reform of this dysfunctional market mechanism." Richard Gledhill of PricewaterhouseCoopers was more optimistic. "America is going to take action on climate now," he said. "If passed by Congress, United States climate legislation could create a market three times the size of the European Union scheme. That would be a massive boost to the global carbon market," he continued.

In the weeks after the meeting, the BASIC nations, Brazil, South Africa, India and China, confirmed that they will submit plans for voluntary mitigation actions by the end of



Yvo de Boer - Copenhagen, COP 15

Photo: © UN Climate Talks

the January deadline set by the Copenhagen Accord, but noted that the agreement has no legal basis and underlined their commitment to the ongoing negotiating process. "We support the Copenhagen Accord. But all of us were unanimously of the view that its value lies not as a stand-alone document but as an input into the two-track negotiation process [on the future of the Kyoto Protocol and on long-term cooperative action] under the United Nations Framework Convention on Climate Change (UNFCCC)," said India's minister for environment and forests Jairam Ramesh. The BASIC nations called for at least five negotiating sessions before the next annual UNFCCC summit in Mexico at the end of the year.

"BASIC will take the lead in large-scale emission reduction and also stick to the policy of common but differentiated responsibil-

ities principle," said Buyelwa Sonjica, South African minister for water and environmental affairs. She emphasized that BASIC would not make any decision outside the Group of 77 (G-77) countries. "We see ourselves as adding value to the proposals of G-77," she added. The BASIC nations committed to developing a framework for permanent scientific cooperation and extending technological support to other developing nations, especially Least Developed Countries (LDCs), in areas such as forestry and adaptation. Resolving to help the most vulnerable nations was a "slap in the face of rich countries that are in a better position to do so," commented Carlos Minc, Brazil's environment minister. Minc estimated total support to LDCs would top the US\$10 billion pledged by the rich.

By the January 31st deadline, nations responsible for nearly 80 per cent of global greenhouse gas emissions had submitted emissions-reduction plans under the Copenhagen Accord. "This represents an important invigoration of the United Nations climate change talks," said Yvo de Boer, head of the climate treaty secretariat. "The commitment to confront climate change at the highest level is beyond doubt," he added. Welcoming endorsement of the Copenhagen Accord call to limit global warming to two degrees Celsius, Alden Meyer from the Union of Concerned Scientists, based in Washington DC, noted that "this is the first time that countries have ever committed to this goal." That's the good news, he continued, "the bad news, of

course, is that the pledges that have been put on the table to date don't put us on track to meet that goal, and would make it very difficult - both economically and politically - after 2020 to catch up."

As the January deadline passed, there was also concern that little progress had been made in arranging the financial support for developing nations covered by the Accord. "It remains far from clear where the funding will come from, if it is genuinely new and additional, and how it will be allocated," said Saleemul Huq at the International Institute for Environment and Development in London. "Looking at past experience of overseas development aid and climate funding, it may take several years to disburse even the 'fast-start' finance promised for 2010 to 2012," he warned. "All the mechanisms have yet to be invented," commented French Environment Minister Jean-Louis Borloo. "Simple bilateral aid is out of the question. We have to invent a new partnership and establish the fast-start modalities."

In his first public assessment of the Copenhagen climate summit, Yvo de Boer, head of the climate treaty secretariat, remained optimistic that the negotiating process would eventually result in a global treaty. While, he acknowledged, the Copenhagen summit may not have delivered enough, it did raise the climate issue to the highest level of government, the only level at which it can be resolved. A second positive outcome was the Copenhagen Accord, which reflects a

political consensus on the long-term, global response to climate change. Finally, he said, negotiations away from the cameras brought an almost full set of decisions to implement rapid climate action near to completion. "If countries follow Copenhagen's outcomes clearly with their eyes firmly fixed on the advantages of global action, then we can finish the job," he concluded.

The next major summit will be in Mexico at the end of the year. Flagging that the negotiating process could well continue unto 2011, de Boer said that his sense is that generally "people want to reach a conclusion on the [negotiating texts on the future of the Kyoto Protocol and on long-term cooperative action] in Mexico and then they will be in a position to decide on how they want to package that outcome in legal terms."

de Boer later announced that he was stepping down as executive secretary of the Secretariat of the UNFCCC on July 1st 2010. "Working with my colleagues at the UNFCCC Secretariat in support of the climate change negotiations has been a tremendous experience," de Boer said. "It was a difficult decision to make, but I believe the time is ripe for me to take on a new challenge, working on climate and sustainability with the private sector and academia," he continued. "It is quite bad news he is quitting at this point," commented climate change consultant Mark Lynas, "because the world is in desperate need for a reliable pair of hands to get through this dark period where climate change negotiations are under assault." de Boer has led

the UNFCCC Secretariat since September 2006.

The first negotiating session following the Copenhagen summit took place in Bonn, Germany, in early April. The main aim of the Bonn Climate Change Talks was to determine the organization and methods of work for the remainder of the year, including what documentation would be used as a basis for negotiations. In the event, the meeting overran as delegates argued over whether or not the Copenhagen Accord should be included in draft text that will act as a basis for the negotiations leading to the end-of-year climate summit in Cancún, Mexico. The United States and the European Union favoured its inclusion, but other countries were opposed, objecting to the Accord's voluntary emissions commitments and the manner in which it was brokered. It was eventually agreed that Margaret Mukahanana-Sangarwe, chair of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, would draft a negotiating text with implicit recognition that she would be able to draw on the Accord.

"The negotiations were very tense. There is a lot of mistrust," said French negotiator Paul Watkinson. Discussions also came close to deadlock over the issue of the relationship between the twin negotiating tracks of long-term cooperative action and the future of the Kyoto Protocol, with lengthy debate over the nature of cooperation between the chairs of the two working groups. The matter was resolved with agreement that the chairs should identify "information" regarding the

commitments of Annex I Parties rather than identifying "issues of common concern" regarding this topic. Rifts evident during the Copenhagen summit both within the G-77/China group and between the developed and developing nations remained.

It was agreed that there will be two additional negotiating sessions between the next scheduled talks in May and the Cancún summit. "The United Nations Climate Change Conference in Cancún must do what Copenhagen did not achieve: It must finalize a functioning architecture for implementation that launches global climate action, across the board, especially in developing nations," charged de Boer. Specific issues to be resolved concern mitigation targets and action, an adaptation package, a new technology mechanism, financial arrangements, ways to deal with deforestation and a capacity-building framework, he said. High-level political guidance will be sought when appropriate, de Boer noted.

● **Further information:** The Tiempo Climate Cyberlibrary provides weekly coverage of news at www.tiempocyberclimate.org/newswatch/. For detailed discussion of all climate negotiating meetings, visit Earth Negotiations Bulletin (ENB) at www.iisd.ca/process/climate_atm.htm. ENB has published daily reports and a summary of the deliberations at the Copenhagen climate summit at www.iisd.ca/climate/cop15/ and of the Bonn Climate Change Talks at www.iisd.ca/climate/ccwg9/.

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Solar power and the poor

In principle, solar energy is a near-perfect solution for the energy needs of developing countries. It is universally and freely available, particularly near the equator, where many developing countries are found. Solar energy is the ultimate renewable energy resource, at least within the timescale of human existence. Its use doesn't deplete reserves, or emit much carbon dioxide, making it the ideal response to the challenge of climate change.

Until recently, the major barrier to solar energy's uptake lay in the low efficiency - and relatively high cost - of converting it into a usable form. But scientific breakthroughs are rapidly eroding this barrier. Photovoltaic technologies, which use chemical reactions to turn sunlight into electricity, are advancing rapidly, as are the batteries used to store electricity until it is needed. As conversion and storage costs fall, solar technology's potential for serving poor communities will inevitably rise.

If the economic playing field were a level one, this combination of strong need/demand and falling costs would be sufficient to guarantee solar energy's rapid dissemination across the developing world. But, unfortunately, the playing field is not level. The capital costs of solar devices

remain considerable, particularly to the poor. And government subsidies for energy produced from non-renewable sources - intended ostensibly to keep prices affordable - have too often also distorted the market in the interests of conven-

tional energy suppliers.

One of the frequently-overlooked achievements of last December's climate conference in Copenhagen was the agreement on a Green Climate Fund. This is intended to raise and distribute about US\$30 billion a year for the next three years to help developing countries expand their use of renewable technologies and integrate these into development plans. The fund

reflects growing acceptance that developing renewable energy sources - particularly solar - is crucial to raising the world's poor out of poverty in a way that is environmentally sustainable.

But governments' failure to reach a global commitment to reduce carbon emissions underlines how energy policy is, and always has been, highly political. Powerful interests, including consumers, often have as much influence on policy as technological opportunities.

If solar energy is to contribute effectively to sustainable development, it must be an integral part of community-based innovation strategies. And these must simultaneously promote local needs and contest conflicting external forces.

THE FINAL WORD

David Dickson argues that economic and political challenges prevent the widespread adoption of solar energy by the poor



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