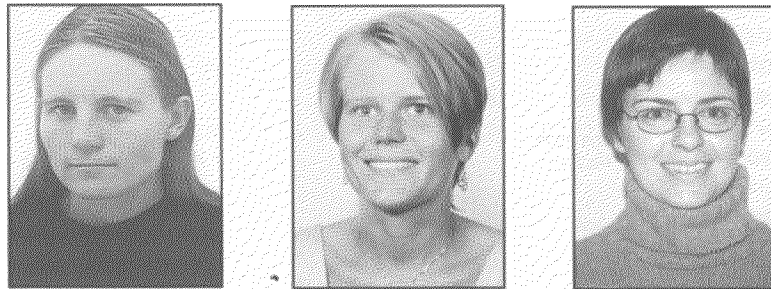


# Coping with climatic and economic change

**CLIMATE CHANGE** and economic vulnerability are global processes which have recently captured public attention. Both fundamentally impact production and consumption of goods and influence what is bought and sold. The two processes are intrinsically linked in shaping local level vulnerability, particularly in rural agricultural areas of developing countries.

Southern Africa exemplifies the need to study how climate variability and economic change interact within the development context.

Nations in southern Africa are experiencing dramatic economic reforms such as liberalization and privatization. At the same time, these areas rely heavily on agriculture, a sector greatly susceptible to climate change, for subsistence, employment and income. Despite this, climatic adaptation and economic change



*Siri Eriksen, Ane Schjolden and Julie Silva discuss the linkages between climate change and economic vulnerability in southern Africa.*

in developing countries have seldom been studied in conjunction.

This article explores the relationship between these two processes in southern Africa. It is based on ongoing research carried out at the Center for International Climate and Environmental Research - Oslo (CICERO) and collaborating organizations on liberalization

and climatic variability in southern Africa as well as the findings of doctoral research carried out in Kenya and Tanzania from 1997 to 1999.

For the purposes of this project, we define southern Africa as including eleven continental member countries of the Southern African Development Community (SADC): Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

## **Climate and economic change in rural Africa**

Approximately two-thirds of the African continent is comprised of drylands and is considered highly vulnerable to climate change and variability. As a predominately semi-arid tropical region, southern Africa is among the most drought-vulnerable regions in the world.

Climate variability and change can have considerable impacts on the hydrology of the region, and consequently on agricultural production. In semi-arid tropical regions, inter- and intra-annual variability of rainfall are considered key climatic elements that determine the success of agriculture. As a consequence of climatic variability, grain harvests in southern Africa are among the most unstable in the world.

In addition to the inherent variability in the African climate, the pattern of future climate is uncertain, in particular at the local scale. The possibilities for any large-scale adaptation programmes by developing country governments are few because of resource scarcity and immediate poverty and development problems that these countries already face. Efforts by those who feel the impacts of climatic changes, such as farmer households, are, therefore, crucial in ameliorating potential adverse impacts of climatic changes.

Responding to climate variability is of immediate concern to Africa given its variable climate and reliance on natural resources in economic activities. At the same time, global and national economic changes since the 1980s

are altering the context in which farmers throughout southern Africa are dealing with climatic variability. Southern Africa is currently experiencing dramatic economic changes, including globalization of economic activity through liberalization of trade and investment and regional trade integration.

In addition, countries throughout southern Africa are implementing national-level economic policy changes in the form of structural adjustment measures. Such measures are typically aimed at controlling inflation, eliminating current account deficits, alleviating balance of payments problems due to currency overvaluation, and so forth. Among the adjustment measures that are most relevant for the agricultural sector are efforts towards liberalization and privatization of agricultural markets, resulting in a reduction of agricultural subsidies and trade barriers as well as an opening up for private marketing of agricultural products.

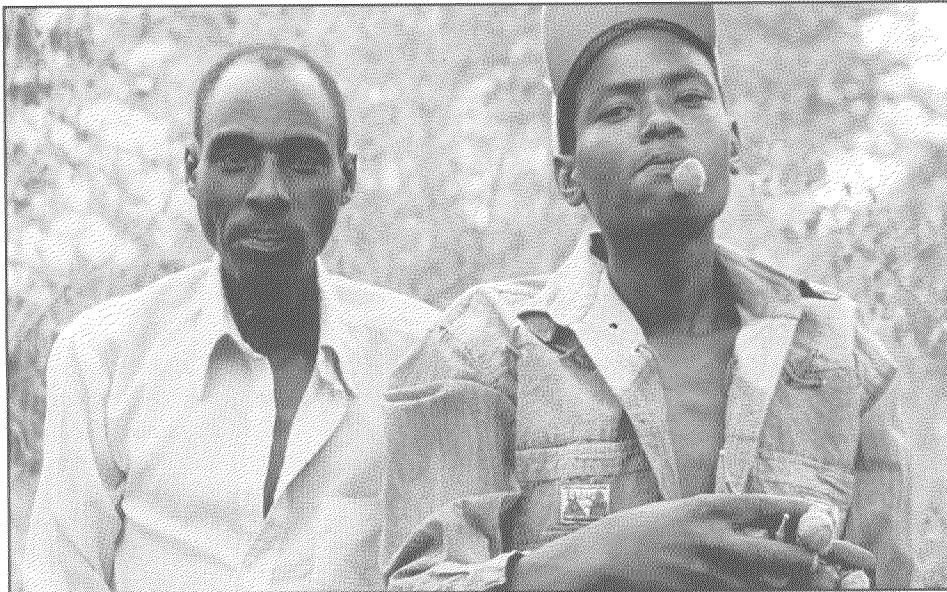
Economic globalization and liberalization have differential effects on vulnerability at several levels: within southern Africa; within a country; and between households in a village. To secure sustained economic growth and poverty alleviation in the face of climatic uncertainty, there is a need to put measures in

place for adaptation within the context of economic change.

African farmer responses to climatic events have been seen as belonging to a different sphere from economic reform, involving diversification in informal sector activities rather than the specialization and economies of scale in the formal sector. As demonstrated by research in Kenya and Tanzania, a key feature in household responses to climatic events is increasing reliance on multiple income-generating activities.

Information regarding household activities during drought and non-drought periods was collected in two sites, in Mbitini Location, Kitui District, in Kenya and in Saweni sub-village, Same District, in Tanzania. Data from focus group interviews as well as 50 household interviews in each site suggest that households seek access to a source of income that can provide reliable and (relatively) substantial income to assume the role of the main activity when agricultural production fails.

These favoured strategies are mainly paid formal or informal employment locally or remittances from a family member or relative from such employment in urban areas. A minority of the households have access to such



favoured activities and many households, therefore, resort to a multitude of activities that complement each other in securing food or income for the household. Most of these activities are informal and include the sale of forest products, collection of wild foods, local handicrafts, charcoal production, casual labour and assistance from relatives.

While many of the households' responses to climate change (in terms of economic activities) operate in the informal sphere, they are shaped by the character of the formal economy and trade.

The need for cash, particularly to pay medical bills and school fees, as well as to buy food and other basic necessities, strongly

influences the choice of small-scale activities undertaken by the household. Very few farmers can afford agricultural inputs such as fertilizer or improved seeds. Those who can afford such inputs as well as hiring labour to satisfy high labour inputs required for relatively higher agricultural production, or invest in local business activity, are normally better off than those who cannot. Thus, the need for cash shapes both coping strategies and local social and economic stratification.

Charcoal production represents an example of how national and international trade affects local climate responses. Charcoal is almost exclusively exported out of the producer area. The production increases dramatically with drought or crop failure. At times of drought, sacks of charcoal appear along roads which are plied by traders with trucks. The amount of traders, from nearby towns or the capital, can to a great extent influence the price that the farmer gets for this charcoal and thus his or her income.

Similarly, the recovery phase after a drought is also influenced by national and international trade. As farmers harvest, they sell part of their crop to repay debts incurred during the drought. The price of the crops varies with the amount of traders plying the area -- which depends partly

on the arrival of ships in the nearest port buying up maize for export.

Just how economic liberalization interacts with climatic variability to shape local vulnerability among farmers in southern Africa is the topic of a World Bank-sponsored investigation being undertaken at CICERO in collaboration with Rutgers University in the United States as well as collaborating institutions in Kenya, Tanzania, Mozambique and Namibia.

The project, a follow-up to a study of user responses to seasonal climate forecasts in southern Africa, is assessing how global and national economic changes have influenced the vulnerability of farmers in southern Africa to climatic variability. It is also exploring the ways in which these changes are influencing user responses to seasonal forecasts. From an operational perspective, the following question emerges: *Are economic changes constraining or enhancing strategies for coping with climate variability?*

In order to assess how climatic and economic changes affect farmers' vulnerability in southern Africa, analyses are being carried out at three levels: 1) regional (southern Africa); 2) national level in selected countries; and 3)

village level case studies. The coping strategies that farmers use in responding to climatic variability are being assessed through national and local case studies in Namibia, Tanzania and Mozambique, all pursuing distinct pathways within a globalizing world economy.

The macro-level analysis of southern Africa uses crop data, hydrological and soils data and gridded rainfall data, as well as basic socio-economic indicators at the national level, to assess vulnerability. Macro-level mapping analysis is used to identify broad economic and social trends in the context of liberalization and structural adjustment. National level indicators are selected to measure general economic performance, importance of the agricultural sector, existing infrastructure, educational attainment and health, and climate trends.

The goal of this geographic information systems analysis is to identify areas that exhibit a high concentration of disadvantages which make them more vulnerable to the negative consequences of climate variability, and the implications this has on their food security.

The three national-level case studies include a more detailed national analysis, using the most recent physical, social and economic data available at the province/district level.

Indicators of economic globalization will be refined according to the individual countries' policy responses to liberalization. Attention will also be paid to the differential effects of the spread of HIV/AIDS on vulnerability within a country. The main aim of this analysis is to identify how vulnerability may vary in space and over time in a country. Certain areas and groups may benefit from economic restructuring while other groups may become more vulnerable from this development.

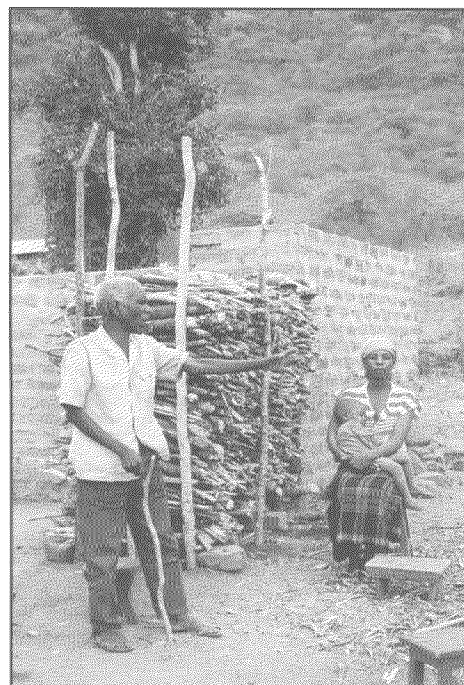
For the micro-level case studies, one or two case studies are being conducted in each of the three countries to focus on key issues in the interaction between economic change and vulnerability to climate variability. The objective of the micro-level analysis component of the study is to gather basic information on how farmer responses to climatic variability are affected by economic changes. Local-level analyses attempt to capture data on informal institutions and networks and whether they mitigate vulnerability. These village-level studies involve surveys and interviews with farmers and agricultural institutions, focusing on economic factors that may facilitate or constrain actions in response to climate forecasts. Issues such as marketing networks,

### Differential effects of economic changes in southern Africa

The economic changes brought by liberalization of trade and national economic policy reforms have differential effects throughout southern Africa as a region and within the countries of the region.

On the one hand, liberalization of trade may make certain countries and regions less vulnerable to climatic variability because they are able to make advanced preparation for the purchase of imported grain during years of predicted drought. On the other hand, liberalization may make some farmers *more* vulnerable by subjecting them to a volatile international market. Existing studies of the impacts of climatic variability on agricultural producers in the developing world typically do not take into account ongoing economic changes at a variety of scales.

Increased trade may contribute to reducing vulnerability in two ways. First, trade renders cash and increases the availability of a variety of crops. This may enhance robustness in time of climatic stress. In addition, a more efficient market could make it easier to acquire the inputs and seeds necessary to respond to seasonal forecasts.



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credit availability, commodity prices, storage facilities, draft power, and input procurements are emphasized, and the results analytically linked to the economic changes occurring at the macro scale.

One must, however, take into account the differing extent to which areas are reached by trade, and people's differing ability to take advantage of increased trade. Rural areas that are physically isolated cannot get products to markets easily. Rural infrastructure in terms of roads and transport is poor in many areas. While government structures previously provided markets for agricultural produce as well as distribution of agricultural inputs, in most countries, farmers now have to find their own markets. This means that the full transportation cost is covered by farmers in terms of lower prices on agricultural produce and higher prices on inputs because few private traders are willing to ply inaccessible routes.

Liberalization measures are often selected based on the doctrine of comparative advantage, hence export-led growth is increasingly regarded as a feasible strategy for growth and development of countries throughout the African continent.

Because agriculture is the key industry in southern Africa, effects of liberalization measures will be felt profoundly within this sector. Potential impacts of liberalization for agriculture in southern Africa include shifts in cultivation patterns toward cash-crop exports,

improved access to advanced technologies including drought-resistant seeds, and better access to credit for farmers.

Having said that, the prescribed structural adjustment measures of reducing government expenditures and devaluation of currency rates to reduce inflation have negatively influenced many farmers' terms of trade, access to credit and employment opportunities. In particular, national-level price reforms eliminating price controls on agricultural commodities have allowed some farmers to earn higher profits, but, at the same time, have left many farmers vulnerable to both price instability and drought.

Liberalization has also been observed to increase people's need for cash. This may be affecting vulnerability because people are increasingly dependent on accessing sources of cash compared to the past. A solution that has been promoted in African countries is to diversify local activities into increasingly commercial activities. This activity in itself sometimes contributes to increasing vulnerability, however, because they may increase cash and investment needs. Furthermore, these income sources, such as cash crops, may be more dependent on water inputs or high labour inputs, as well as being

exposed to economic fluctuations and changes in market prices.

The challenge is, therefore, to find modes of diversification that do not increase vulnerability. We argue that diversification may have to look beyond the traditional sectoral approach, and incorporate and enhance local income-generating activities that may be both agricultural and non-agricultural.

It is also important to pay attention to the fact that most of the economic reforms target the formal sphere of the economy. At the same time, most households more easily access informal rather than formal activities, and their coping is often characterized by a lack of access to cash and sources of investment.

The Mbitini/Saweni study revealed that rural households face several problems in diversifying to cash crops or accessing seeds and other inputs required to prepare for and respond to drought. Women often do not have access to the capital, inputs, labour time and training necessary to joining a formal sector activity or engaging in improved seeds or cash cropping activity. Hence, the economic reforms will have a differential effect on vulnerability depending on how people are integrated into the formal economy.

### **Vulnerability and double exposure**

The exposure of agriculture to both climatic variability and economic change has important policy repercussions within and beyond southern Africa.

Poverty alleviation programmes could be targeted towards the countries and sub-regions that are "double-exposed" to the negative impacts of both economic changes and climate variability. If it can be secured, a stronger and more resilient agricultural sector would free up some much-needed resources to address other problems, such as the AIDS epidemic that is spreading unchecked throughout many countries of southern Africa.

In conclusion, without a better understanding of vulnerability within the agricultural sector, prospects for feeding Africa's growing population will continue to be a challenge for national and international communities.

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## A weather eye on.....

**Having rejected the Kyoto Protocol, in February 2002, President George Bush announced a unilateral, voluntary plan to curb global warming.**

The Bush plan for the United States differs from the strategy laid out in the Kyoto Protocol in two critical ways. First of all, the emissions reduction goals are stated not in terms of greenhouse gas emissions *per se*, but in terms of greenhouse gas intensity. Greenhouse gas intensity is the ratio of emissions to economic output. Coupling emissions reductions to economic growth rates in this way, should, the Bush administration believes, reduce adverse impacts on jobs and the overall economy. The White House has claimed in the past that the Kyoto target for the United States would cost almost five million jobs.

Bush proposes a reduction in emissions intensity of 18 per cent in the United States over the next ten years. The Kyoto Protocol target for the United States would have resulted in a 33

per cent drop in intensity over this period. In terms of actual emissions reductions, the Bush goal represents a 4.5 per cent reduction below the 1990 baseline as opposed to the Kyoto target for the United States of 7 per cent.

The second major difference between the Bush plan and the Kyoto agreement lies in the entirely voluntary nature of the Bush programme. Businesses can decide whether or not to opt in to the programme. Tax incentives will be provided to those who invest in clean technology, alongside an emissions trading programme. At the national level, the Kyoto Protocol targets are mandatory limits.

The aim is to “get people to put their creativity behind finding the solutions which they do far more rapidly if it is voluntary,” said Christie Whitman, the administrator of the Environmental Protection Agency. “You can always put in mandatory in the future if that’s what you think you have to have.”

International reaction to the plan was mixed. Japanese Environment Minister Hiroshi Oki said that he appreciated Mr Bush’s efforts but

that more was needed. German Environment Minister Juergen Trittin observed that “because of its non-binding character, one can hardly expect the programme to significantly lower the already high US emissions.”

Apart from the fear of adverse effects on jobs and the corporate sector, the Bush administration has argued that the Kyoto Protocol, in exempting developing nations, skewed the international playing field. Responding to the Bush plan, the Chinese foreign ministry stated that “developed countries have the duty to take the lead in taking action to reduce greenhouse gas emission, because historically and at present, they are the main emitters of greenhouse gas.”

Meanwhile, nations are lining up to ratify the Kyoto Protocol, with Japan, the United Kingdom and the European Union due to ratify during the first half of 2002.

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**Further information:** *The latest news of the climate negotiations can be found in the Tiempo Climate Cyberlibrary Newswatch: [www.cru.uea.ac.uk/tiempo/newswatch](http://www.cru.uea.ac.uk/tiempo/newswatch)*

# Waiting for El Niño

**Indicators in the Pacific Ocean suggest that an El Niño event may be on the way, though it is not clear yet whether any substantial development will occur later in 2002.**

In early March 2002, the United States National Atmospheric and Oceanographic Administration (NOAA) announced that sea surface temperatures had warmed by two degrees Celsius in the eastern equatorial Pacific close to the South American coast during the previous month. Other data confirm the assessment that an El Niño Southern Oscillation (ENSO) event may be in its early stages. Rainfall has increased over the region that has warmed and, off Peru, the cold-water anchovy has been replaced by tropical species.

Forecasters are cautious, though, about what happens next. The ocean may be warming but there is, as yet, no sign of any significant El Niño signal in the large-scale Pacific wind and pressure patterns.

According to an assessment published by the International Research Institute for Climate Prediction ([iri.columbia.edu/ENSO/](http://iri.columbia.edu/ENSO/)) in February, between one third and one half of the current forecast models predict El Niño conditions developing by mid-2002. Most of the remaining predictions indicate near-neutral conditions during the remainder of the year. Very few forecasts suggest a return to cold conditions.

These models are known to perform poorly in predicting El Niño development during the early months of the year and this may well account for the lack of any clear consensus.

The situation should become clearer over coming months. By June, the warming may or may not have reached the point where ocean-atmosphere interaction favours rapid development during the remainder of the year.

The possibility that an El Niño event might develop this year provided an appropriate backdrop for a recent workshop, *Forecasting El Niño and La Niña in Indochina*, held January 21st-25th 2002 in Hanoi, Vietnam.

The aim of the meeting was to strengthen regional climate forecasting capacity, building on existing institutional expertise and taking advantage of cooperation both within the region and further afield.

Vietnam, Laos and Cambodia are the main focus for this initiative, which is being organized by the Indochina Global Change Network with support from the Asia-Pacific Network for Global Change Research, NOAA in the United States and the Netherlands Foundation for Advancement of Tropical Research. Myanmar was also represented at the meeting. A team of international experts took part in the workshop, adding their specific skills and knowledge to the discussions and assessments.

Organized by the Indochina Global Change Network, the workshop was an important step forward in a series of collaborative activities aimed at dealing with climate impacts within this region. It was notable in bringing together forecast producers and forecast users to ensure that the science was "user-driven" as well as in



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its focus on the transfer and use of appropriate techniques that would build on existing strengths. To support this approach, a thorough review was undertaken of regional strengths. This highlighted the fact that, though weaknesses may exist in some nations, they can often be met by strengths in others.

Sharing experience proved an important aspect of the meeting. The promotion of ENSO science in Vietnam during the 1990s and the rapid development of public and political awareness of El Niño's significance during those years provided a sound model for other nations of the region. (World Meteorological Organization Publication UNUP-1063, *Once Burned, Twice Shy? Lessons learned from the 1997-98 El Niño*, reviews experience in Vietnam and other countries world-wide.)

Participants developed plans for a set of follow-up activities. These fell into three main categories:

- past and present: analysis of historical climate data to identify the ENSO signal in the region and monitoring current climate trends;
- medium-term future: use of statistical techniques based on persistence and continuity to predict local effects one to three months ahead; and,
- the longer-term: use of seasonal and longer-term forecasts based on dynamical models and other techniques issued internationally to provide warning of emerging trends.

The interpretation of ENSO predictions was a recurrent theme at the workshop, both in terms

of technical issues such as accuracy and skill and of the words commonly used when forecasts are issued, often with little thought of linguistic and cultural diversity.

The results of one exercise were enlightening, and rather disturbing. Participants were asked to assign a probability of occurrence to terms such as "probable," "possible," "likely" and "unlikely." In the case of "likely," the mean probability that emerged was close to 60 per cent. But this masked three distinct groups of responses. Some participants interpreted "likely" as meaning a probability of occurrence of 30-40 per cent; some around 60 per cent; and others as high as 75 per cent. The potential for serious, if not disastrous, confusion needs not be emphasized.

During the final plenary session, the workshop participants concluded that regional cooperation had an important role to play in ensuring that the nations of Indochina are better prepared when El Niño next comes to visit.

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*Further information: The Tiempo Climate Cyberlibrary lists web sites that contain regular updates of information regarding the development of ENSO events at: [www.cru.uea.ac.uk/tiempo/foar0/theme/theme.htm](http://www.cru.uea.ac.uk/tiempo/foar0/theme/theme.htm).*