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UNU Monitor is a quarterly review of the United Nations University's (UNU) current research activities, publications and forthcoming projects in the area of environment and sustainable development. This issue features an article by Dr. Zafar Adeel (Academic Programme Officer, UNU) and Dr. Michael H. Glantz (Senior Scientist, National Center for Atmospheric Research, USA). This paper reflects the findings of a multi-agency, international project to review the 1997–98 El Niño and highlights the challenges and opportunities identified in the study. This study was funded primarily by the UN Foundation; the funding for six of the country case-studies was provided through various sources. A more detailed summary of the study findings is available from the project website: <http://www.esig.ucar.edu/un/index.html>. For further information, please contact Dr. Adeel, UNU Environment and Sustainable Development Programme © 2001 Elsevier Science Ltd. All rights reserved.

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El Niño of the century: once burnt, twice shy?

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1. The 1997–98 El Niño

El Niño has become a household word in many parts of the world since 1997 (see Box 1 for the definition of El Niño). The 1997–98 event was the first time that highly visible forecasts of El Niño and its impacts were made, and major media groups focused their attention on them. The worldwide destruction caused by this event was massive: loss of life, destruction of infrastructure, depletion of food and water reserves, displacement of communities and outbreaks of disease all occurred as manifestations of climate-related natural disasters concurrent with the 1997–98 El Niño event (see Box 2 for a chronology of this El Niño). Estimates of global losses range from US\$ 32 billion (Sponberg, 1999) to US\$ 96 billion (Swiss Re, 1999). This greater visibility, combined with the unusual strength of that El Niño phenomenon, earned it the dubious title “El Niño of the Century” (WMO, 1999).

Box 1

El Niño

El Niño is defined as a phenomenon in which warm sea surface temperatures anomalously appear in the central and eastern equatorial Pacific Ocean. The El Niño phenomenon is typically followed by a cold event, La Niña, during which the some region of Pacific Ocean is colder than “normal.” Together, these two events form a seesaw-like pressure pattern in the western part of the tropical Pacific, commonly referred to as ENSO (El Niño-Southern Oscillation). Scientific research during the past two decades has confirmed that El Niño episodes, recurring every $4\frac{1}{2}$ years on the average, do indeed trigger unusual weather patterns the world over. The impacts can include droughts, fires, floods, blizzards, frosts and outbreaks of infectious diseases.

In its aftermath, policymakers, politicians and scientists the world over took notice of the impacts of this event and realized the need for a rational strategy to cope with its adverse aspects. The UN General Assembly took expedited action and passed resolutions

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to develop an Inter Agency Task Force on El Niño. This task force, created in December 1997, provided a forum for sharing scientific information and for combining efforts to improve general understanding of the El Niño phenomenon. At the same time, a number of research groups, government agencies, international organizations and societies at large began looking for answers to some key questions:

- how far in advance can we tell that an El Niño is coming?
- how strong will the El Niño event be?
- where will the worst damage occur?
- how can we prepare ourselves for its impacts?
- what can be done differently to mitigate or avoid future problems?

The answers to these seemingly straightforward questions are often complex and convoluted. The complexity is partly driven by various uncertainties: scientific, social, political and economic. A main underlying concern is whether we have learned from the lessons and made ourselves better-prepared for the next event; this issue lies behind the notion of “once burnt, twice shy?” Responding to this concern is central to finding answers to the key questions such as those listed above. The study described in this paper provides guidelines to finding these answers through a retrospective review of the 1997–98 El Niño episode.

Box 2

The 1997–98 El Niño — a chronology

This event started in mid-1997 and rapidly developed into a strong phenomenon. Rain-producing cloud systems in the western Pacific Ocean shifted eastward, causing heavy rains at many locations in the western coastal regions of Central and South America. This also triggered drought conditions over the western Pacific and Southeast Asian region. Similar adverse climatic impacts occurred worldwide during the same time, although their relationship to El Niño is still not fully understood. The El Niño event ended in June 1998, as unexpectedly and as rapidly as it had developed a year earlier. Sea surface temperatures in the tropical Pacific rapidly returned to normal. Then, months later, a La Niña event developed that lasted well into the year 2000.

The study focused on 16 developing countries: Bangladesh, China, Costa Rica, Cuba, Ecuador, Ethiopia, Fiji, Indonesia, Kenya, Mozambique, Panama, Papua New Guinea, Paraguay, Peru, the Philippines, and Viet Nam. This study was enhanced by the diversity of the international partner agencies involved: the US-based National Center for Atmospheric Research

(NCAR), the United Nations Environment Programme (UNEP), the United Nations University (UNU), the World Meteorological Organization (WMO) and the International Strategy for Disaster Reduction (ISDR).

2. Enhancing preparedness for future events

2.1. Disaster management institutions and infrastructure development

Studies from the 16 countries clearly indicated that there is a strong need for developing focused disaster management institutions, and that the national governments have a key role to play in this respect. Existing institutions must review their operations during the 1997–98 El Niño event to identify strengths, weaknesses, jurisdictional constraints and conflicting interests in institutional responses to the forecasts and to the impacts of El Niño.

The studies also suggest the need for the formation of an inter-ministerial task force to deal with various aspects of El Niño-related problems. This is particularly important because a number of government ministries are typically involved in El Niño-related preparedness, including those related to disaster management and climate-sensitive sectors such as agriculture, water, energy, public safety and health, as well as those concerned with economic development. Such national coordinating institutions can help reduce the inter-ministerial rivalries and conflicting interests. The involvement of civil society, particularly NGOs, should be emphasized to achieve effective preparedness for El Niño events.

The retrospective review of impacts in the 16 countries (Glantz, 2001) indicates that the influence was greater in regions and areas where the basic infrastructure — such as roads, railroads, canal systems, dikes, dams, grain/food storage services and medical facilities — were in a dilapidated condition to begin with. Therefore, preparedness for El Niño-related disasters can be effectively undertaken by building up national infrastructure in advance of the next El Niño.

2.2. Raising public awareness

Studies in the 16 countries point to a wide gulf between public perceptions about the impacts of El Niño and the reality. This lack of awareness often manifests itself in the form of inappropriate action or activities or, more frequently, no response at all. An indirect result of such ignorance is an absence of pressure on politicians and policymakers to take urgently needed action. It is, therefore, imperative to undertake multidisciplinary climate-related educational efforts that enable government personnel, the public and

representatives of various sectors to become more aware of El Niño-related issues.

A first step towards educating people about the ENSO cycle involves “educating the educators,” who would in turn educate the public. On the positive side, increased media attention and worldwide publicity have heightened the public awareness of issues and problems. Now, the more challenging task is to develop educational programmes that are tailored to the different needs of specific users and their local conditions. Fostering media interest in El Niño *between* extreme events can help build public understanding of the phenomenon. Scientists and national meteorological services must strive to convince the media of the importance to society of El Niño information and encourage them to run stories about the ENSO cycle between its extreme events.

2.3. *The importance of timely and accurate forecasts*

It is obvious that one needs sufficient warning time to prepare for extreme climate events. The warning comes in the form of early forecasts and predictions of adverse impacts. A study of the forecasts that were available during the 1997–98 El Niño has revealed several problems with accuracy and precision of forecasts as well as their specificity in describing local anomalies. This problem was worse in developing countries, which often did not possess sufficient technical or human resources to develop their own predictions. In the aftermath of the 1997–98 El Niño, it is important that the scientific and forecast communities undertake research and awareness-raising activities to reduce the level of public skepticism about the reliability of these forecasts.

In some cases, the situation was exacerbated by conflicting forecasts provided by various groups, or by regional forecasts that predicted the opposite of the actual impacts. For example, in Costa Rica thousands of cattle were moved away from the Pacific coast to the north-central region to escape a predicted drought during 1997 — only to perish because of an unexpected El Niño-related drought in the resettlement area. It should also be emphasized that rarely is an entire country affected by the same climate hazard spawned by El Niño. Therefore, forecasts must be tailored to local conditions and needs, and in a “user-friendly” format.

2.4. *Sharing and disseminating the information*

Collection, evaluation and dissemination of information were found to be critical components of an integrated response to El Niño-triggered climatic extremes. This information comes in many forms and shapes: scientific knowledge and forecasts about impacts, resource avail-

ability for coping with disasters, logistical arrangements undertaken by governments and international agencies, and the status of adverse impacts at regional and local levels. It is important that this information is correct and is provided to relevant parties in a timely fashion. Coordination between governmental ministries and agencies was found to increase the effectiveness of information dissemination and its ultimate utilization.

The study also indicates that transparency in El Niño-related information dissemination can increase trust among government agencies, scientists, forecasters and the public. This requires that forecasters and researchers present an honest appraisal to governments and the media about the state of the science of El Niño forecasting. Transparency between governments and donors is also essential, so that the needs and the expectations about disaster assistance of both are well understood.

2.5. *The need for capacity building*

Many countries are in need of human and institutional capacity building in the area of climate impacts research and ENSO-related sustainable development and disaster planning. While the earliest of warnings can be made available to the public, education and training are required to properly interpret and use such warnings. Educators at all levels in a country’s educational system should encourage students to study climate-society-environment interactions. Building national capacity with regard to climate issues can reduce a country’s dependence on outside expertise for monitoring, forecasting and analyzing of “externally available” information.

Clearly, local capacity building geared toward interpreting global forecasts and analyzing them for local use is an important aspect of disaster reduction. Capacity building at the national level can create and foster multidisciplinary expertise while at the same time broadening existing disciplinary expertise. Both are needed for effective proactive participation in national as well as international activities related to climate issues (e.g., research programs, education and training activities, workshops, conferences and scientific visits).

The international partners for this study are joining hands to develop a comprehensive programme to “educating the educators” in developing countries. This effort will particularly address the science, impacts, policy and ethics related to climate change, variability and extremes. The UNU and NCAR, in partnership with the WMO and with support from the ISDR, are seeking donor support to fully develop such a programme.

Each of the 16 country-study teams called for improvement of weather and climate monitoring in

their respective regions. They recognized the value of a well-designed network of monitoring stations to collect meteorological data. Great value was seen in the establishment of a TAO Array-like monitoring network in the Indian Ocean, similar to the one completed in the Pacific in the mid-1990s, because changes in the Indian Ocean can influence (if not overshadow) the expected impacts in some regions such as eastern Africa. Improved monitoring and preparedness may be achieved through institutions that deal with El Niño and its impacts on a regional or sub-regional basis by pooling together their limited available resources.

2.6. *Links to sustainable development*

The lessons synthesized by the 16 country-study teams make it quite clear that by improving their preparedness for El Niño-related disasters, countries can reap considerable benefits for their overall development. Inter- and intra-governmental coordination and infrastructure development has significant economic and social advantages. Such actions can strengthen their economies and focus on achieving sustainable development. In time, such efforts should also address more fundamental social issues, such as poverty reduction or the enhancement of food security.

Governments must evaluate such benefits and synergies of El Niño preparedness at regional to local scales. To achieve this, they need to encourage the study of climate-society-environment interactions. To make El Niño earliest warnings more effective, many adjustments are likely to be required in the ways that societies operate. Such societal changes might include, for example, a change of bank credit policies; a strengthening of infrastructure for transportation, communication and health; and identifying the currently at-risk populations, regions and socioeconomic sectors. Environmental degradation also must be taken into account in such assessments, because existing degradation can magnify the adverse impacts of El Niño in different locations.

3. Key lessons to prepare for the next El Niño

El Niño and its impacts are inseparable from broader issues of climate variability and change, social and economic development, and environmental conservation. This underscores the importance of a concerted effort on the part of governments and non-governmental organizations to continue research into climate variability, to improve forecast skills, and to develop

appropriate policies for mitigating the impacts of climate extremes.

Some of the key lessons from this study are summarized here:

- Well-defined emergency management structures are needed in most of the developing countries. During an emergency, intervention at the highest level of government is needed to catalyze an appropriate level of response, as was the case in several countries' response to El Niño in 1997–98 (e.g., Peru, Ecuador, Viet Nam, the Philippines and Ethiopia). Additionally, well-defined emergency management structures are needed in most developing countries.
- To varying degrees, all the 16 countries studied lacked adequate human and financial resources for national monitoring and forecasting of extreme climate events spawned by El Niño.
- The top priorities for capacity building are training researchers to identify a country's "at-risk" populations and educating the at-risk public in preparedness for El Niño-related disasters.
- The reliability of El Niño-related forecasts at the local level needs improvement to the point where government agencies will take them much more seriously. In geographically diverse countries (like Indonesia), it is important that each sub-region should issue its own forecasts relevant to the local micro-climate.
- A network of floating meteorological data-recording stations monitored by satellite is needed in the Indian Ocean to help eastern and southern Africa and the Asia–Pacific region better forecast El Niño's influence on regional climate.
- El Niño can magnify existing problems. In countries with social and political unrest and/or poor infrastructure, the focus should be on developing and maintaining the necessary infrastructure, and identifying the populations most vulnerable to El Niño and its impacts.

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