Lessons

from the 16-Country UNEP Study

The UN Environment Programme (UNEP) was awarded a grant by the UN Foundation, and in cooperation with the National Center for Atmospheric Research (NCAR) (Boulder, Colorado, USA), carried out a study of the impacts of the 1997–98 El Niño event on sixteen countries in four major areas: Asia, Southeast Asia, Subsaharan Africa, and Latin America. The study was a partnership among United Nations agencies in addition to UNEP and NCAR's Environmental and Societal Impacts Group: the World Meteorological Organization's (WMO) World Climate Program, the International Decade for Natural Disaster Reduction (IDNDR, now the International Strategy for Disaster Reduction, ISDR) and the UN University's Environment and Sustainable Development Programme.

This assessment reviewed the forecasts and impacts of the 1997–98 El Niño, as well as the climate-related early warning and natural disaster preparedness systems in the selected countries in order to improve their ENSO coping mechanisms. Based on this assessment, the project identified research and policy needs and developed suggestions for regional and national disaster preparedness plans for ENSO warm and cold events and their impacts.

Teleconnections Drive the Severity of Impacts

Teleconnections:
Scientists refer to the process of associating a climate anomaly or its societal impact with the ENSO phenomenon, thousands of miles away from the central Pacific Ocean, as one of "attribution." The relationship is referred to as a "teleconnection." Teleconnections can be identified by observing physical processes or by statistical studies.

For some countries or regions within them, the teleconnections of climate-related anomalies with El Niño or La Niña events are very strong and are, therefore, considered reliable enough for use in decision making. For other countries such associations are likely to exist but may be less clear. Teleconnections can be further categorized by their timing of onset of the various phases that an El Niño goes through during its life cycle (onset, growth, peak, decay). ENSO's extreme warm (El Niño) and extreme cold (La Niña) events can disrupt regional and local climates around the globe to varying degrees and in a variety of ways, but especially in the tropics and, most directly, in countries that border the Pacific Ocean. Armed with details, individuals and groups as well as governments can develop appropriate seasonal response strategies that can mitigate the harmful impacts or enhance potential benefits. The fact is that any advanced warning of the onset of an ENSO extreme can provide usable information to those prepared to use it in decision making.

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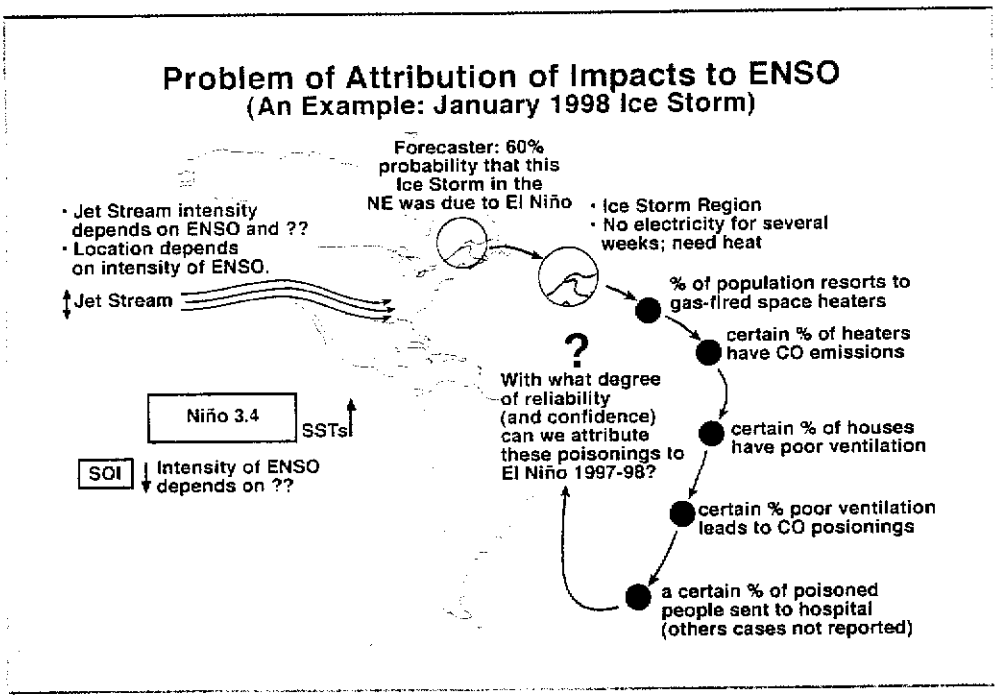
While the ENSO phenomenon and its extremes are not yet considered to be natural hazards, they clearly spawn hazards such as droughts, floods, fires, frosts, cyclones, and infectious disease outbreaks around the world. This means that ENSO-related forecasts can provide a society (or an individual or a corporation) with the ***earliest warning*** of potentially disruptive climate anomalies, even in locations where the teleconnections are not yet considered to be very robust.



Because several different kinds of hazards can occur in a country simultaneously, it can be difficult (but not impossible) to attribute with certainty a particular negative societal impact to a specific hazard. For example, the 1991–92 El Niño occurred at the same time as a major drought and the eruption of Mt. Pinatubo in the Philippines. To what extent was the drought influenced by El Niño, the eruption, or some combination of the two? Likewise, the 1982–83 El Niño and the eruption of El Chichon in Mexico occurred at the same time, making it difficult to determine El Niño's impacts worldwide from those of the volcano's emissions into the stratosphere. The volcanic events may have modified the effects of the El Niño events, but it is more likely, for example, that they simply masked our ability to observe from satellites the effect on such environmental conditions as sea surface temperature. The January 1998 ice storm in Canada is another example of the problem of attribution. It appears (from research) that the El Niño may have been a contributing factor to this damaging ice storm. However, it is not possible to draw a general conclusion about the influence of El Niño events on the formation of major ice storms over eastern Canada.

The 1997–98 "El Niño of the Century"

Governments must pay close attention to the subtle long-term influence of El Niño on sustainable development. The devastation caused by a drought lasting but a season can set in motion adverse ripples in the socio-economic system that can continue for several years. Agricultural losses during a drought can reduce export earnings that a developing country needs to meet its budgetary goals. Not only do the geographic impacts of El Niño need to be understood, but also its delayed impacts over time. Thus, a single El Niño-related drought (or any drought for that matter) could reduce a country's standard of living.

An appropriate analogy to a country's attempts at development that are periodically disrupted by El Niño (or La Niña) would be that of mythical Sisyphus pushing a boulder up a hill only to have it roll back to the ground before reaching the top. He must begin the process again and again.

Although many governments, corporations and individuals become alerted to El Niño once it has been forecast, their responses will depend on the level of confidence they have in the forecasts. While the climates of some countries have reliable teleconnections to El Niño, others do not. The same applies to El Niño's impacts on different economic sectors as well. For example, whereas teleconnections from the perspective of Chinese authorities may be perceived as weak, the authorities in Brazil or the Philippines consider their teleconnections to be strong. So, responses from different governments to the same El Niño forecast can vary by a wide margin. This underscores the need for regional and national studies.

El Niño-related teleconnection information can be used to create maps of "at risk" populations, regions and sectors of society. Such baseline information is useful for the development of El Niño-related responses by individuals, groups and governments. The preparation of at-risk maps requires international and national financial and moral support for national studies related to El Niño (and La Niña).

Need for attribution and understanding teleconnections

Scientists and the media often refer to El Niño's environmental impacts as if they had directly affected an entire country. Yet, seldom is a whole country typically one with diverse topographical features, affected by the same El Niño-related anomaly. For example, during El Niño the Pacific coast of Costa Rica tends to suffer from drought. However, its Atlantic coast usually remains wet. As another example, northern Peru during El Niño suffers from floods, while the southern part usually suffers from El Niño-related drought. Northeast Brazil suffers from severe drought during El Niño, while southeastern Brazil is plagued by heavy rains and flooding.

Users of El Niño information need to know the degree of reliability of the teleconnections attributed to ENSO's extremes as well as the location and type of their sub-national impacts. In this regard and for the sake of the forecast users, forecasters need to include "error bars" with their forecasts – what they estimate to be the forecast's degree of reliability. Armed with such information, governments can plan to mitigate expected impacts in at-risk areas that have previously been identified. Under conditions of reliable attributions, governments can establish El Niño-specific forecast and disaster-response institutions.

Forecasting El Niño and Its Impacts

The more relevant the forecast to a potential user, the more likely it will be used. Also, the more reliable and the more detailed the forecast, the more widespread will be its use. Forecasts must be timely and provide lead time adequate for making plans to cope with the climate-related problems that El Niño spawns. Some people convincingly argue that forecasts about the potential societal impacts are needed more urgently than forecasts of El Niño's onset. Thus, ENSO-related forecasts should be of interest to all government ministries and not just those primarily concerned with disasters.

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There are other troublesome concerns for the users of forecasts, for example, which forecaster(s) should they believe? With the advent of widespread interest in El Niño and with the growing access to the Internet and the World Wide Web, users are bombarded with scores of interpretations and predictions about the future state of sea surface temperatures in the tropical Pacific. How are they to distinguish between the reliable groups and the numerous ad hoc groups that emerge for the purpose of making forecasts of the onset of an El Niño? For example, only one forecast group made a reasonable forecast of the onset of the 1997–98 El Niño. But, was it based on good science or just a lucky guess? Even if it was a correct forecast, one must ask how well that group did with previous forecasts. Why did the dozen or so forecast groups around the globe miss making a correct forecast of the biggest El Niño of the century in 1997–98? El Niño research and forecast communities must determine how best to remedy this situation, so that users can identify bona fide sources and rely on their forecasts.

This problem is made more difficult by the fact that the forecasters of El Niño have had a mixed record of success and failure. In the world of forecasting, such a mixed record of success and failure leads to a popular belief that forecasts of ENSO's extremes are not very reliable, despite the fact that there may be an occasional success. The record of success for forecasting El Niño's (and La Niña's) impacts, however, is considerably better for some locations than it is for forecasting the onset of the event itself.

Despite the current scientific uncertainties surrounding the forecasting of ENSO's extremes, researchers must work to show policy makers at all levels of government the value in their use of basic ENSO information. This knowledge can be used to guide pro-active decisions involving El Niño-related disaster responses and to guide long-term sustainable development programs. It is also imperative that the scientific and forecast communities identify ways to reduce the level of public skepticism about the utility and reliability of climate and weather forecasts.

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One factor that leads to skepticism about forecasts (and, therefore, to inaction following the release of an El Niño forecast) is related to contradictory signals. For example, it is difficult for most decision makers to believe forecasters that a drought will be coming, if the country is in the midst of a rainy period, or vice versa. As another example, in the midst of a good commercial fishing season, it would be difficult, if not impossible, to convince fishermen and fishmeal processing plant owners that fish catches will drop drastically some months in the future because an El Niño episode might be emerging. Making such projections in the absence of visible signs of change is as risky for the forecasters as it is for users to take such projections seriously enough to act on them. In many countries forecasters fear that they will have to bear considerable personal responsibility for incorrect actions that decision makers might take if the forecasts are off the mark and disaster ensues. From the perspective of a forecaster, it may be safer in many instances to avoid making assertive forecasts that might prove to be controversial later. This brings to mind the adage, "take a position, take a risk," and most forecasters try to avoid taking such risks with their jobs.

The public, policy makers and educators must be introduced to the many ways that climate variability influences human activities and ecological processes. They also need to know about the various ways that climate forecasts can be used in the sustainable development of society and economy.

Importance of forecasts at sub-national level

The lessons learned by each of the sixteen country-study teams for their countries centered around the following: There is a lack of belief in the reliability of El Niño-related forecasts for many regions around the globe. To date most forecasts are presented in terms of whole countries, e.g., Ethiopia, Mozambique, Indonesia being affected by drought or Peru and the USA being affected by floods, but, as noted earlier, rarely is an entire country affected by the same climate hazard at the same time. Thus, such geographically generalized forecasts are at risk of being seen as failures by different regions within a country.

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Reliable information about potential sub-national impacts is often absent. However, local users of these forecasts desperately need detailed information in the forecasts for effective planning. Such detail includes information about the probable onset of the event and its likely societal impacts, its magnitude, its duration, and so forth. Armed with such detailed forecasts, governments could identify the level of risk to its food-producing regions by determining if those regions might be at risk to drought or flood or some other climate-related hazard. If so, they could plan to adjust their exports and imports of food products accordingly. The Panama Canal provides another example: Canal operators need the earliest warning possible in order to be able to advise shipping companies about the increased likelihood for drought-related shipping restrictions in the Canal. This would

provide shippers with enough time to plan when and what to ship through the Canal or whether to ship around it.

Forecasts and the public

It is important to provide people in all parts of a country (rural as well as urban) with El Niño information, including forecasts and impacts. Urban populations are most frequently made aware of potential anomalies and impacts earlier than those in the rural areas. This disparity can be remedied by using the radio (as opposed to TV or the Internet) which people in the rural and poorer areas are more likely to have available. In the age of "high-tech," it is still very important to make full use of the radio as an important primary, as well as backup, channel of communication.

Often climate experts provide their forecasts in terms of probabilities, which many individuals do not readily understand. Therefore, the information provided to the public needs to be presented in plain language. To achieve this, different methods must be developed to convey timely climate information to the public and policy makers in a way that helps them to receive the intended climate message.

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Forecasting positive impacts

It is important for government agencies to identify the positive aspects of El Niño and not focus only on the negative. While some parts of their country or some sectors of their economy are negatively affected by an event, other parts might actually benefit. This does not mean that one balances out the other from the perspective of those directly affected – those who lose, lose; those who win, win. However, a system could be devised beforehand so that there is a sharing of the gains with those who are negatively affected. Identifying "winners and losers" of El Niño-related impacts deserves the attention of government leaders who are truly interested in identifying the real costs or benefits to their country of El Niño-related climate anomalies.

Forecast surprises

Each El Niño has some unique features that are not captured by the description of an average event and, as a result, there are likely to be surprises when a new El Niño event appears. For example, in response to the forecast in Costa Rica of the onset of the 1997–98 event, cattle were moved from the drought-prone northwestern part of the country along the Pacific coast to the country's wetter north central region. However, an unexpected drought occurred there as well, resulting in the death of thousands of the cattle that had been relocated there for protection.

Therefore, it must be remembered that other climatic processes continue to operate during an El Niño event. Often, these other processes may dominate locally and confound the normal or expected effects of El Niño. Ultimately, further research on the climate system will allow these other effects to be incorporated more effectively into forecast methodologies that are at present based predominantly on ENSO-related processes.

Information – Who Knows What and When

An old political adage suggests that "information is power." This adage is as relevant to El Niño forecasting as it is to politics. Whoever has a reliable El Niño forecast first is in a position to use it to his or her advantage, and sometimes to the detriment of others. Depending on how far in advance of an El Niño a forecast is received, the forecast can be used either for short-term (tactical) responses to climate anomalies or for responses that require longer (strategic) lead times. Furthermore, El Niño information (not just a forecast) can be valuable for long-range economic development planning for such sectors as agriculture, water, energy, manufacturing and public health.

Transparency of information to stakeholders

Transparency or openness, as it relates to El Niño, can increase trust among government agencies, scientists, forecasters and the public. At the very least, it can create awareness as well as educate, alert, and prepare people for the risks they may face from El Niño-related climate anomalies.

Transparency also requires forecasters and researchers to present an honest appraisal to governments and the media about the state of their capability for El Niño forecasting and an honest picture of their knowledge of the ENSO phenomenon. Transparency between governments and donors is also necessary, so that the needs and expectations of both about disaster assistance are well understood.

In many countries there are inter-ministerial rivalries and jurisdictional disputes. However, for the public good, such jurisdictional rivalries must be set aside, when it comes to dealing with El Niño-related hazards. Ministries need to establish close cooperative relationships to share their hazard-related information with other agencies in a timely way about potential impacts and about mitigative strategies and tactics that might be pursued.

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Raising public awareness about El Niño

Governments should support the educational needs of their citizens about El Niño specifically, and more generally about climate-society-environment interactions. It is, therefore, important to organize multidisciplinary climate-related educational efforts that enable government personnel, the public and representatives of various economic sectors to become more aware of these issues. For their part,