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# **The new agro-biotechnologies**

**Challenges,  
trends and  
institutional  
considerations**

# El Niño and the Central American Agricultural Sector: Warning, Impact and Response

*The climate is part of the environment for agricultural entrepreneurs; it generates opportunities and threats, making it a factor to be considered for competitiveness.*

Manuel Jiménez Umaña<sup>1</sup>



**T**he Central American region is affected by recurring natural hazards related to climatic variability. Climatic disturbances, particularly extreme events, such as droughts and floods, have a significant impact on a

broad range of activities, with the agricultural sector and the rural milieu being particularly sensitive to these. The El Niño Southern Oscillation (ENSO) phenomenon is one of the main causes of climatic variations in the Central American Isthmus. This phenomenon consists of three phases known as El Niño, La Niña and the transition phase. Here we basically discuss the first phase.

**El Niño.** The National Oceanic and Atmospheric Administration of the United States (NOAA) recently

issued a set of operational definitions for El Niño, which were adopted by the meteorological services of the North American countries (National Weather Service of the United States, Meteorological Service of Canada and the National Meteorological Service of Mexico). According to these services, El Niño is a phenomenon in the equatorial Pacific Ocean characterized by a positive sea surface temperature (SST) departure from normal in the Niño 3.4 region greater than, or equal in magnitude to, 0.5 degrees C, averaged over three consecutive months. Based on this definition, NOAA announced the presence of a new El Niño event in September 2004.

The El Niño phenomenon, also known as the warm phase of ENSO, is a recurring event whose frequency varies between 2 and 7 years. Its average duration is estimated to be between 12 and 18 months, and the intensity, timing and effects differ from one event to another.

Typical manifestations of El Niño on the Central American Pacific coast include the warming of the ocean, irregular rainfall patterns and usually below normal levels, an increase in the air temperature during the dry season, a more intense and prolonged mid-year drought or hot spell (canícula) and changes in the winds. On the Caribbean coast, a tendency toward increased rainfall has been observed, particularly at the beginning of the second half of the year, along with less intense cyclonic activity. It is important to note that not all these manifestations occur during each event.

**On what do the effects of El Niño depend?** The effects depend on factors such as:

- The intensity, duration and development of the event.
- The influence of other factors that affect the weather in Central America, including the ratio between temperatures in the Caribbean Sea and the Pacific Ocean.

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## The Climate Scenario Forecast for Central America In the Presence of El Niño 2004-2005

According to the FCCA Report

- The timing of the different phases of the phenomenon.
- If El Niño begins in April or May it will probably affect the first phase of the rainy season and the mid-year drought. In the case of an El Niño event that begins later, such as the current episode, the repercussions could begin during the second phase of the rainy season, when the mid-year hot spell or “veranillo” has already passed.
- Weather patterns. A dry pattern lasting one or more years would tend to intensify the effects of scant or irregular rainfall, which are generally associated with the presence of El Niño in Central America.
- Planning is a determining factor in preventing or reducing losses, or taking advantage of an El Niño event.

### Early warning and monitoring

Information and communication are instruments of the utmost importance for risk management in response to threats associated with climatic variability. Early warning and monitoring of the phenomenon’s development and outlook are valuable allies in contingency and short-term planning, and also provide elements for strategic planning. The Regional Commission for Hydraulic Resources (CRRH), which operates within the context of the Central American Integration System, is the specialized hydrology and meteorology organization that coordinates the Central American Climate Forum (FCCA). This body issues quarterly bulletins that constitute one of the most crucial inputs for the prevention and mitigation actions undertaken by the Secretariat of the Central American Agricultural Council (CAC).

**Early warning systems and El Niño 2004-2005.** Since mid-2004, changes in the ocean and the atmosphere have indicated the development of a new episode of El Niño. NOAA confirmed this last September, after registering increases of more than 0.5° C in the sea surface temperature for three consecutive months. In October, the Central American Climate Forum (FCCA) issued a report summarizing its forecast for the climatic scenario expected under El Niño conditions in the Central American countries (see box).

In August, the Secretariat of the Central American Agricultural Council (CAC) issued a preliminary warning that a new episode of El Niño might be developing, in a communiqué directed to CAC’s member Ministers. Subsequently, other communiqués were issued confirming the presence of the phenomenon, describing the most likely climatic scenario, the probable evolution of condi-

- The event (refers to the warm phase of ENSO or the El Niño phenomenon) will reach its mature phase between November 2004 and January 2005.
- It will be an event of weak to moderate intensity and of short duration, with a return to near-normal temperatures in the May-July quarter of 2005.
- Early rains are expected in some parts of the region; this may be significant, particularly in those areas of the Pacific slope that are experiencing an accumulated rainfall deficit during this season.
- Greater incidence of cold fronts during the months of December, January and February, with effects on minimum temperatures, particularly in the northern part of the region; episodes of persistent rain in the Caribbean basin areas and/or strong winds.
- Prolongation of the mature phase could slightly delay the start of the 2005 rainy season.

*Source: Based on the Special Report of the Central American Climate Forum, under CRRH coordination, issued on October 4, 2004*

tions in the ocean and potential impacts on the agricultural sector. The communiqué also included an offer of technical assistance. In this process support was provided by the CRRH, the meteorological services and the Regional Oceanographic Information Service (SERIO).

Early warning of an El Niño event allows governments time to review or prepare contingency plans to respond to threats, such as droughts, floods, landslides and forest fires. For example, a timely warning of the presence of El Niño issued in August for the current episode, provided an opportunity to deal with some of its potential effects several months in advance. After issuing the early warning and the offer of technical cooperation, the CAC/IICA Secretariat supported the organization of more than 20 seminars attended by farmers, cattlemen, fishermen, agricultural entrepreneurs, technicians of agricultural sector institutions, civil and military authorities and representatives of non-governmental organizations, among others.

Early warnings associated with the El Niño phenomenon are useful to the agricultural sector for several reasons:

- 1) Scientific knowledge helps to detect, monitor and forecast an evolving El Niño event,
- 2) Identifies the phenomenon’s main effects on the climate and the sea, and its implications for Central American agriculture,

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3) Allows a response time or period between notification of the risk and the effects of the changes in the climate and the ocean, which may be used for decision-making to reduce or prevent losses and even take advantage of these changes,

4) The recent announcement of operational definitions for El Niño encourages early warning and monitoring of the phenomenon.

**Lessons learned.** The participation of the CAC Secretariat in issuing warnings and alerts to the agricultural sector has taught it a number of lessons, such as: 1) international assessment of the phenomenon does not necessarily reflect the intensity of its effects in Central America, 2) the predicted intensity and duration of the phenomenon may be reconsidered as the episode develops, and 3) forecasts by international centers are important but are not sufficient, and therefore it is important to obtain regional inputs on likely climatic scenarios and conditions in the ocean.

### *Economic impact*

Disasters associated with climatic variations in general, and with El Niño and La Niña in particular, significantly affect the Central American agricultural sector and rural milieu.

The most recent episodes of El Niño and La Niña have confirmed the impact of climatic variations on the agricultural sector. The El Niño phenomenon of 1997-1998 caused US\$ 475 million dollars in losses in Central America, according to ECLAC estimates; all countries reported significant impacts on the agricultural sector. In the case of Costa Rica, where economic losses were broken down by components, around 58% of losses occurred in the agricultural sector, and these might have been even greater if prevention and mitigation actions had not been taken.

For its part, Hurricane Mitch's passage through this region, during a year of La Niña, caused economic losses of more than US\$ 6 billion dollars, approximately half of these in the agricultural sector. Other effects of such disasters that are of particular concern to these countries are the number of human deaths, the impact on human health and the psychological sequels that also affect rural communities and campesino families.

The huge economic losses and damage reported in the agrifood sector also have repercussions on the

rest of the economy. Initially, these phenomena affect the quantity and quality of production in agriculture, livestock, fisheries and forestry, although not always in a negative sense. Banks, insurers and government institutions invest extraordinary efforts and resources to deal with the crisis. In some cases, the rehabilitation processes are slow and onerous (including basic infrastructure for trade). Living conditions in rural communities are affected by the disintegration of families, rationing or suspension of basic services (electricity and drinking water), unemployment, forced migration, a greater vulnerability to diseases, food insecurity, conflicts over use of water, etc.

These situations also compromise future production for several reasons. Farmers lose their creditworthiness because they are unable to honor their financial commitments. Loss of seeds, seedlings and nurseries, a reduction in breeding stocks, soil erosion and the death of fry, negatively impact the production of subsequent periods after the disaster.

However, the consequences are not limited to what happens within national borders, nor are they negative for all the actors of the agricultural sector. The El Niño phenomenon causes climate changes in different parts of the world that affect agricultural commodity markets. In general, there are risks of food shortages and subsequent price increases which, depending on the direction of trade of the affected product, may imply more expensive imports or better-remunerated export products. Market intelligence therefore becomes a crucial ally, particularly in the presence of global events such as El Niño that cause extreme events in different parts of the world.

The effects of these disasters on the agricultural sector are transmitted through forward and backward linkages of the production chains. Agricultural input providers find that demand for their products decreases. Employment is reduced as is demand for services such as agricultural mechanization. The supply of commodities and raw materials is affected and demand for marketing services is reduced. People's saving capacity is affected, and with it investment. Income earned from exports is reduced and spending on imported goods and services increases, affecting the balance of trade and international reserves. The financial sector suffers the consequences of loan default, and insurers are forced to make exceptional expenditures to indemnify those affected.



***Possible response actions broadly respond to two large thematic areas: risk management and competitiveness, recognizing a significant interrelation between both.***

Depending on the severity of the effects, there may be other major consequences, such as increased inflation and exceptional public spending requirements to deal with the emergency, etc.

Clearly, the effects of droughts, floods and fires are not exclusively borne by a particular sector. In recent disasters, there has been a growing awareness of the multisectoral nature of their impact, as well as of the need to coordinate efforts to confront these threats.

## **Response**

Possible response actions vary in nature, in terms of their thematic area, time frame and the actors involved. In general, the actions broadly respond to two large thematic areas: risk management and competitiveness, recognizing a significant interrelation between both. With regard to time frames, these range from short-term actions, usually of a contingency nature, to long-term efforts of strategic character, advocated as lasting solutions. Responsibility for execution involves a number of actors, including the government, the academic sector, the primary production sector, the processing sector and the agricultural services sector.

**Illustrative actions.** Early warning and the preparation of easily understood forecasts for the interested parties, together with impact assessment, as mentioned earlier, form part of a package of measures. Information and training on possible threats and plans to deal with these, and the inclusion of climatic variability, or in a broader sense, risk management in sectoral policies, programs and plans, are actions of a general cross-cutting nature. In more specific terms, these actions include: organization (committees and preparedness plans), technical recommendations by productive activity (crops, livestock, fishing, etc.) depending on the type of threat, and by area (information and communication management, market intelligence, funding and insurance, etc.). As part of the response effort, the network of monitoring stations that record variables such as rainfall, wind, temperature, river flows etc. should be strengthened; in addition, events should be documented and actions assessed to provide feedback for prevention and mitigation of future events.

Recommendations by productive activity must include short- and long-term actions. Some examples of these recommendations are:

- Adapt the seasonal agricultural calendar,
- Suspend crop planting in areas where critical conditions have been anticipated,
- Substitute crops affected during their early stages of development with others more resistant to adverse conditions,
- Clean and maintain drainage systems in areas affected by excessive rainfall,
- Carry out pest and disease surveillance and monitoring actions,
- Keep reserves of supplementary cattle feed,
- Provisionally transport cattle to low-risk areas,
- Monitor the existing stock of supplies and the use of basic products,
- Strengthen fire brigades.

In the longer term, the pivotal role of technology must be acknowledged, particularly in terms of identifying and adapting successful experiences, developing environmentally friendly production techniques that are less vulnerable to adverse climate conditions, and incorporating risk management in agricultural planning. It is also essential to promote a culture of prevention and mitigation that avoids the same types of risks whenever a threat appears.

## **Final thoughts**

It is important to reaffirm and complement some of the above-mentioned elements with some final thoughts:

*1. The agricultural sector has an obligation to concern itself with El Niño in particular, and with climatic variability in general. This conclusion stems from the following considerations:*

- El Niño is a phenomenon that recurs at short intervals, with variable frequency.



- El Niño is a global phenomenon, and therefore its positive or negative effects are not limited to what happens within a given country or region. Prices and markets are affected around the world, and, in the context of increasingly open economies these changes are transmitted more easily through international trade.
- The agricultural sector is vulnerable to climate disruptions caused by the presence of the phenomenon, among them: droughts, floods, decreased or increased flows in rivers, forest fires and the implications of anomalies in ocean temperatures, the environment in which fishing and sea hunting take place.
- The economic impact is significant and the proportion of the costs borne by the sector is high. The agricultural sector accounts for nearly 60% of all economic losses reported during droughts and El Niño events.
- The effects associated with El Niño are predictable, increasingly better understood and some tend to intensify everyday conditions.
- The interval between detecting the presence of the phenomenon and its effects allows us to take some steps. However, actions that offer lasting solutions require longer periods.
- Short-, medium-, and long-term solutions may help prevent losses and enable us to take advantage of opportunities during the phenomenon.

Similar considerations apply to the La Niña phenomenon and therefore this recommendation goes beyond a single phenomenon, in the sense of incorporating cli-

matic variables in day-to-day decision-making by those who participate in or support the agricultural production chains.

2. *Global forecasts are not enough. The ENOS phenomenon is an important source –but not the only cause - of climate variations in the Central American region.* The lesson learned is that information from international centers should be analyzed by local experts in meteorology, hydrology and oceanography, in order to prepare specific forecasts for the region. In this sense, we recognize the progress made by the Central American Climate Forum (FCCA), which produces forecasts for the whole of the Central American region. An interesting challenge for the Forum will be to issue forecasts and other products to respond to the specific needs of the different clients-users.

3. *This issue is about food security and competitiveness.* Climate change is usually associated with food security. The presence of extreme events affects production and therefore the availability of food. As a result, rural populations suffer a reduction in their incomes due to the decreased quantity or lower quality of their production and also due to fewer employment opportunities, which affects their access to food. Finally, these manifestations of the forces of Nature cause instability in the supply chain and in incomes.

At the same time, climate is part of the environment for agricultural entrepreneurs, creating opportunities and threats that must be taken into account for competitiveness. Climatic characteristics are regarded as basic factors in agricultural activities; nevertheless, they can also play an important role in creating competitive advantages. Technological responses (seeds with greater tolerance to extreme conditions, for example) to compensate for climatic conditions may result in increased competitiveness. Environment-friendly farming practices and low vulnerability to natural hazards may imply greater stability and sustainability of production over time, as well as improved access to markets.

Knowledge of the natural effects associated with climatic variations allows producers to better estimate the demand for inputs, thereby rationalizing production costs. In events of a global scale, market intelligence plays an important role in reducing import costs and increasing income from the sale of products. The development of auxiliary industries, such as farm insurance or other mechanisms for spreading risk, may prevent the recurring loss of capital investment in production units

*Usually climatic changes are associated with food security. The presence of extreme events affects production and therefore the availability of food.*

or farms and increase their competitiveness over the longer term.

Taking precautions with respect to climatic risks in the different types of agribusinesses is a good starting point to guarantee the success of investments (redundancy requirements in business agents, for example). Similarly, an appropriate use of information on oceanic conditions may help to rationalize the fishing effort and increase catches. In synthesis, management may become good business and not just a cost.

*Hurricane Mitch, which occurred during a La Niña year, caused economic losses of more than US\$ 6 billion dollars; half of these losses were in the agricultural sector.*

### *Sites of interest*

#### **Secretariat CAC/CORECA/IICA**

<http://www.coreca.org/vulsac/> (with links to the Central American meteorological services, CRRH, climate and markets, etc.)

#### **University of Washington**

<http://www.atmos.washington.edu/gcg/RTN/rtnt.html>

#### **NOAA**

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/)

#### **NASA**

<http://topex-www.jpl.nasa.gov/science/el-nino.html>

#### **IRI**

<http://iri.columbia.edu/climatete/ENSO/index.html>

#### **NCAR**

<http://www.isse.ucar.edu/signal/index.html>

*According to ECLAC estimates, the El Niño phenomenon of 97-98 caused losses of US\$ 475 million dollars in Central America; all countries reported major impacts in the agricultural sector.*