The Case of Ethiopia

Reducing the Impacts of Environmental Emergencies through Early Warning and Preparedness: The Case of the 1997-98 El Niño

by

Tsegay Wolde-Georgis
(Team Leader)[1]

Team Members
Demlew Aweke (NMSA)
Yibrah Hagos (DPPC)

July 10, 2000

---

[1] I would like to state that Dr. Berhane Asfaw and Mr. Adane Kebedde have participated as consultant and research assistant respectively for the research project.

Executive Summary

The Setting

Ethiopia is a developing country that has been vulnerable to climate-related disasters during the last three decades. More than 88 percent of Ethiopia's 60 million people are engaged in agricultural and pastoral activities for their livelihood. With little access to irrigation, these predominantly smallholding farmers depend on rainfall to cultivate their crops. Poverty, lack of access to technology, subsistence agriculture, deforestation, soil erosion and over-population are some of the problems that increase the vulnerability of the people to climate-related disasters. Constant wars and political instability also contributed to the severity of the impact of disasters.

Ethiopia is located in the tropics. Its climate, however, is modified by altitude, which has led to the existence of diverse microclimates. Ethiopia has four climatic zones, which are classified according to the patterns of rainfall. These climate zones are those (1) with a distinct wet and a distinct dry season, (2) with two wet and two dry seasons, (3) with two wet seasons and one dry season in between, and (4) with an undefined rainy season. Altitude leads to the creation of microclimates such as the *quola*, *weinadega* and *dega*, which are hot, temperate and cool, respectively. One of the major causes of rainfall variation in Ethiopia is the north-south movement of the Inter-Tropical Convergence Zone (ITCZ, following the seasons. The three-season pattern known as *Kiremt* (big rains from June-September), *Bega* (dry from October-January) and the *belg* (small rains from February-May) characterize the crop-producing areas of the country.

Drought is the dominant climate-related disaster in Ethiopia. Droughts in Ethiopia have killed many people and animals in 1957-58, 1964-65, 1972-73 and 1983-84. Though not as pronounced as drought in their impact and publicity, floods and fires have increasingly caused disasters in Ethiopia. In response to these disasters, Ethiopian governments decided to create the Relief and Rehabilitation Commission (RRC) in 1976 (which was renamed in 1995 the Disaster Prevention and Preparedness Commission (DPPC)).

In the 1990s, the government of Ethiopia had created four important documents to guide its early warning system and food security. These are (1) National Food Security Policy; (2) The National Policy for Disaster Prevention and Preparedness Management (NDPPM); (3) General Guidelines for the Implementation of the National Policies on Disaster Prevention and Preparedness Management; and (4) The Five-Year Disaster Prevention Plan 1998-2002 (DPPC).

The National Disaster Prevention and Preparedness Committee (NDPPC) is chaired by the Prime Minister. The Regional Disaster Prevention and Preparedness Committees are presided over by the regional presidents. Its important members are the National Meteorological Services Agency (NMSA) and the Ministry of Agriculture and the DPPC, which is the secretary. It also has other important ministries as its members. The objective of the NDPPC is to implement the National Disaster Prevention and Preparedness Policy. There are early warning committees at all levels of the government down to the lowest level, the *wereda*. The committees gather the information, evaluate their work and report to the higher-level committees. They are composed of various government agencies.

There were major developments in the area of preparedness for climate-related hazards in Ethiopia in the 1990s. To this end, rural communities were involved in water and soil conservation activities such as terracing the hills and the construction of micro-dams. Ethiopia established the National Disaster Prevention and Preparedness Fund (NDPPF), seed reserves, and strengthened the Emergency Food Security Reserve Administration (EFSRA) by raising its stock from 33, 000 metric tons (MT) to 307, 000 MT. These activities were conducted to strengthen Ethiopia's disaster prevention and preparedness capacity.

Ethiopia began to use El Niño information to forecast drought after the 1983-84 drought, which was believed to have been influenced by El Niño. According to the manager of the NMSA, interest and preliminary research on El Niño was motivated by the desire to make long-range forecasts for the country (Kassahun, 2000). Because of the severity of the drought in 1983-84, the NMSA was compelled to prepare and issue a seasonal forecast of the *Belg* and *Kiremt* rains for 1987, well in advance.

The NMSA uses statistical and analogy methods in constructing its El Niño impact forecast. For example, the 1997-98 El Niño's analogue event was the 1972 El Niño. The NMSA scientists identify the current El Niño and compare it with known El Niños of the past with similar characteristics. Then, the forecast would follow the pattern of the past El Niño. The NMSA scientists also realized that the sea surface temperatures (SSTs) in the Indian and Atlantic oceans also affect Ethiopian weather. El Niño is a relatively new concept in Ethiopia with no known scientific research on it outside the NMSA.

The 1997-98 Event

The NMSA was the first Ethiopian agency to hear about the 1997-98 El Niño in March 1997. Other agencies learned about it during the presentation of the weather assessment outlook by the NMSA when presenting its seasonal forecast. The El Niño information had been received from the Climate Prediction Center of NOAA through its *Climate Diagnostics Bulletin*. The NMSA did not have an e-mail connection at that time. When NMSA heard in May 1997that the 1997 El Niño would be strong, it issued the el Niño-related seasonal forecast on May 29.

The first media report on El Niño appeared on August 5, 1997, when experts from the NMSA gave an interview on Ethiopian TV to explain the role of the El Niño phenomenon in Ethiopian droughts. There was no report in the Ethiopian media about the evolution of the 1997 El Niño[2]. The media reported the NMSA forecast issued by NMSA at the end of May, but there was no follow-up report on the issue.

Media interest in El Niño began to pick up when the impact was felt at the end of August, and when the Prime Minister's Office instructed federal and regional authorities to monitor the situation of El Niño and its impact on Ethiopia. The Ethiopian News Agency, The Ethiopian

[2] The only exception to this was *Addis Tribune*, which briefly warned of the evolution of El Niño in its March 6, 1997 issue.

Herald and *Addis Zemen* wrote that El Niño causes drought in Ethiopia. The media also wrote about the impacts of the drought and floods of 1997 for which they blamed El Niño. One of the shortcomings of the Ethiopian media was their inability to clearly inform the public without confusion. There was no expert analysis or editorial specifically focused on El Niño and its climate-related impact in Ethiopia, which might have contributed to an understanding of the phenomenon by Ethiopians.

Teleconnections

According to Kassahun,[3] research at NMSA concluded that El Niño affects the weather in Ethiopia. In 1987, El Niño effects on the Ethiopian seasonal forecast were first considered by the NMSA.[4] El Niño years are characterized by below normal rainfall in Ethiopia. Neville Nicholls believes that the 1888 Great Ethiopian Drought was caused by El Niño. Empirical observations also show a connection between El Niño and droughts in Ethiopia. For example, the major droughts in Ethiopia in 1957, 1965, 1973, 1983-84, 1987, 1993-94 occurred following El Niño events. The teleconnection between El Niño and Ethiopian seasons has been established by NMSA. El Niño decreases and disrupts the *kiremt* rainfall (main season) in Ethiopia and boosts the *belg* rainfall (small rainfall season). However, it should be noted that weather in some areas might not be correlated with El Niño events because of the country's diverse microclimates.

Total rainfall in Ethiopia between June and September 1997 at 20 weather stations was 20% less than 1996. According to the NMSA, almost all parts of Ethiopia had dry spells in the *Kiremt* months of July and August 1997. Out of the 33 zones in Ethiopia, 18 zones received late rainfall, affecting land preparation and sowing. The 15 zones that had a good start in rainfall were affected by dry spells in August and September 1997, which adversely affected the maturation stage of the crops.

The unseasonable rainfall in October and November 1997 led to fungal attack, slowed the rate of desiccation of the seeds, and led to the germination of the seeds before the harvest.[5] Erratic rainfall affected the size of cultivable land by 9% from that of 1996, because of oxen with low energy levels due to less access to fodder. Poor farmers could not rent or borrow oxen at the right time because the owner gave priority to his own plot. The re-planting of the land several times following the coming and retreating of rainfall depleted the seed reserves of farmers. Yields were low because of reduced land preparation, and poor and early cessation of rainfall. Heavy rainfall that flooded farms along with pest infestation also reduced output. Lack of fodder reduced the price of cattle and some animals died, especially in the Raya region of northern Ethiopia. Coffee, the main cash crop of the country, was reduced in production because "coffee berries ready to be

[3] Kassahun, Bokretsion, 1999: Ye'ayer Mezabat'na tinbi'ya k'Itiopia Antsar (Climate Change and Forecast in Ethiopia, in Amharic). Paper presented at a meeting organized by DPPC on Nehase 1991 (Ethiopian calendar), titled Ye'ayer Mezabat, Dirk'na ye'adega mekalakel 'Itiopia in August 1999. Addis Ababa: DPPC.

[4] Haile, T., 1987: A case study of seasonal forecast in Ethiopia. WMO Regional Association I: Africa. Seminar on Modern Weather Forecasting, Part II, 30 November-4 December 1987 in Geneva, Switzerland. Geneva: WMO, 53-65.

[5] UN Food and Agriculture Organization, 19 December 1997.

picked from the trees have been falling on the ground due to heavy rains."[6] Food production declined after two years of good harvest in 1995-96 and 1996-97. Total output in the *meher*[7] season in 1997-98 was reduced by 24 % from the 1996-97 output. Prices of agricultural commodities also increased by 13%-53% from those of 1996.

It was reported that there was an abnormal number of rainfall-related deaths: more than 237 persons and 16,887 animals. Many houses were washed away because of floods and thousands of people were displaced. Some commercial plantations in the Awash Valley were flooded, which was a loss of millions of birr.[8] Water shortfalls in hydroelectric dams led to the rationing of electric power.

The abnormal weather was the cause of these disasters. The only other factor that might have decreased 1997-98 food output was the reduction in the subsidy of fertilizer prices. However, farmers interviewed did not cite that as a cause of decline in food production. There was access to credit from the government and NGOs to buy fertilizers, but farmers were not sure of the reliability of rainfall. Besides, the use of fertilizer is effective with the use of selected seeds and adequate rainfall. In 1997-98, the use of fertilizer would not have increased output because farmers were re-planting their land with fast-maturing and drought-resistant crops.

Responses

The first response of the Ethiopian government to the El Niño was to issue a forecast on May 29, 1997. It warned that the *Kiremt* rainfall would be erratic and begin late. The DPPC wrote its early warning report about the possible impacts of the abnormal weather. Immediately, the NDPPC came up with a response plan to avert the disaster. The two-pronged response was designed in the area of agricultural policies and mobilization of resources. Meetings were organized in the regions, zones and *wereda*s to brief every Disaster Prevention and Preparedness Committee member on responses specific to the area. They decided to study the strengths and weaknesses of the most vulnerable *wereda*s.

At the national level, the NDPPC asked the Ministry of Agriculture, which is a member of the committee, to come up with possible responses. The Ministry estimated that food production would be down by 40%, based on the weather forecast issued by the NMSA for the *Kiremt* season. It recommended the planting of drought-resistant crops, such as chickpea, and the replanting of failed crops with fast-maturing ones, such as teff and lentils. It also recommended the provision of seeds to farmers until the end of August and the protection of crops through the free distribution of pesticides. In addition, it advised the use of all newly constructed micro-dams and ponds by farmers, as well as the building of irrigation canals. Farmers were also advised to plant potatoes and convert lost crops to feed the animals. The mass media was to be used to educate the people on the response actions.

---

[6] Reuters, 9 December 1997.

[7] *Meher* is the main harvest that comes because of the main *Kiremt* rainfall (June-September).

[8] The birr is the currency of Ethiopia.

A major response came from the office of the Prime Minister when the issue of El Niño was raised during a meeting of the Prime Minister with high-level national officials and the Regional Presidents on August 25, 1997. They addressed their concern about the impact of El Niño and all responsible officials and departments were given instructions to respond to the crisis.

The regions also issued evaluation reports on the impact of the erratic rainy season on agriculture. The DPPC issued a special report in October about the impact of El Niño on Ethiopian weather.

As the season progressed, the Ministry of Agriculture advised farmers to replant their crops especially when the rains returned to some areas in August. The zone officers provided the seeds on credit in order to take advantage of the rains. The October-November 1997 floods disrupted the normal harvest of crops, and local governments organized popular campaigns to help farmers gather their crops. One of the most important roles of the NMSA during the 1997 abnormal weather was to update the unpredictable weather by providing information, such as about the continuation of the rains beyond the normal end of the season. For example, on Nov. 12, 1997, the NMSA urged farmers to "gather their harvest before an untimely rain expected over the various parts of the country." The Ministry of Agriculture also advised farmers to harvest their matured crops before it was too late. Farmers were also advised to construct drainage in areas where crops had not yet matured.
The Ethiopian government was so concerned about the crisis that it asked the UN FAO/WFP crop production and food needs assessment team to arrive earlier than usual. The DPPC was also mobilizing resources internally and from the donors. The DPPC continued to appeal for aid to donors who were initially reluctant in their generosity. On November 29, 1997, Ethiopia appealed for 572, 835 MT of food aid to be distributed to over 4 million people. The major component of the 1997-98 appeal was emergency relief. Food supply was critical as early as December 1997 in the central highlands. Resource constraints and the lack of carry-over stock from 1997 contributed to the problem. Donors finally pledged for 352, 249 MT and eventually delivered 303, 987 MT.

The timely response to the crisis by the government avoided the death of people due to famine.[9] The Ministry of Agriculture continued to advise farmers for the 1998 *Belg* season. In December 1997 and January 1998 one could see unseasonable crops, such as chickpeas, in the field in many parts of northern Ethiopia.

One of the characteristics of the 1997-98 crisis was the way information was flowing between the various DPP Committees in the center and in the regions. Despite various constraints, the Disaster Prevention and Preparedness Committees at all levels met every two weeks to exchange information, experience and evaluate the effectiveness of various responses. Local functionaries were also working despite the disadvantage of having unreliable local weather information about their *weredas* or villages. Ethiopia has designed a five-year development plan to deal with future disasters.

---

[9] *Addis Tribune*, 13 March 1998: "Prime Minister Meles Presents Six-Month Report to Parliament."

As a final note, at the end of the El Niño in the middle of 1998, a war started between Ethiopia and Eritrea. The war began on May 12, at a time when Ethiopians were coping with the adverse impacts of El Niño. The conflict was an added constraint on the El Niño-related responses by the government and the people. About 450,000 Ethiopians who live in the border areas occupied by Eritrea were displaced and became dependent on food aid. They lost their animals, seeds, and harvests. Other farmers in the border areas could not plant, because of the lack of security and occasional shelling. Thousands of Ethiopian farmers were mobilized to defend against the Eritrean threat, and the farms of those who joined the army were cultivated with the help of those who remained in the villages. In July 1998, Eritrea confiscated 45,000 tons of U.S. grain that was in an Eritrean port en route to Ethiopia. It is believed that Eritrea confiscated more than US$300 million worth of goods when the conflict erupted. Ethiopia was forced to import food and other items through Djibouti in order to avoid the Eritrean ports because of the conflict.

There has been research interest on the climate-related impacts and responses in Ethiopia. Some of the major works have been done institutionally in the NMSA and the DPPC, on Ethiopian climate and disaster management, respectively: on the chronology of drought, on El Niño, on seasonal forecasting, on the impact of Pacific SSTs on Ethiopian weather and Kassahun, and on climate change and Ethiopian weather. These are some of the reports that have come out of the NMSA. There is very little research interest outside the NMSA on El Niño impacts in Ethiopia. Most of the research in Ethiopia has been in the area of drought and its impact on society. One of the notable researchers in the field includes Rahmato[10] on the coping mechanisms of peasants to drought and famine. International research on Ethiopian drought includes the social history of famine in Wollo, and on the Ethiopian early warning system.

Forecasting by Analogy

Lack of timely and credible weather forecasting is one of the constraints on the Ethiopian seasonal forecast. Theoretically, if there had been credible and perfect information as early as October 1996, there would have been adequate time to disseminate the information, and the response could have taken the form of a non-emergency. In the case of 1997, for example, the NMSA was informed about the El Niño as early as March 1997, but it had to wait until the end of May to declare a forecast for fear that a weak El Niño might not have a pronounced impact. The NMSA did not want to panic the users by giving out unreliable information. However, a May forecast (as was done on May 29, 1997) coincided with the beginning of planting in Ethiopia and was of little use for those who planned to plant long-maturing crops, such as maize and sorghum, at the end of April and May. There was very little early warning time to prepare any counter measures against the impact of the event.

Research shows that it took more than five weeks for the digested information and the various alternative recommended responses to reach the lowest *wereda* early warning committee. For example, in the case of the Tigray regional state, the NMSA gave its forecast on May 29, 1997 (*Ginbot* 19 in the Ethiopian calendar) and the Zone Disaster Prevention and Preparedness Committee members met with the regional DPPC at the beginning of July 1997 (*Sene* 28 in the

[10] Rahmato, D., 1991: *Famine and Survival Strategies: A Case Study from Northeast Ethiopia*. Uppsala: Scandinavian Institute of African Studies.

Ethiopian calendar). It was after finishing this meeting in the capital, Mekelle, that they returned to their zones and gathered the *wereda* early warning committee members in the middle of July. It took this amount of time because, those involved at the different levels of government had to receive the information, study and discuss it and come up with the relevant responses to their specific problems.

With perfect and earlier information, the emergency nature of the activity could have been changed into a routine development work. Perfect information could have helped in Ethiopia's preparedness for the disaster. Time is a very important factor in disaster response. There would have been enough time to mobilize domestic and international resources to reduce the impact of the El Niño. A perfect forecast with a longer lead-time could also have helped farmers and the government to have the time to budget their resources effectively both at a macro (national) and household level. For example, the Ethiopia government could have managed its import and export of cereals by taking the impacts of drought and flood into consideration. Rural households could have reduced their expenditures for festivities, such as weddings and *teskar*s (memorials feasts for the dead), and saved their food for the impending food shortages.

Lack of trained staff, especially at the regional, zone and *wereda* levels, is one of the major constraints even in the face of perfect information. For example, one of the recommendations might be to construct dams and canals to harvest and distribute all the rainwater, but this would have been a very difficult task to accomplish in the short period of nine months. The amount to be done, even during normal weather conditions, is so huge that it might be difficult to solve all the problems. Weather is only one factor: there are also many existing social problems in the country. In other words, responding to abnormal weather alone is not enough since there is widespread poverty in the country. There is also the perennial problem of the lack of meteorological information at the local level. Many of the diverse microclimates in Ethiopia outside the cities do not have meteorological stations. Thus, El Niño information is relevant at the national level but very difficult to forecast for the local microclimates.

El Niño's impact on Ethiopia is real. Therefore, El Niño considerations should be added explicitly to the country's national disaster plans. These would help the national policy makers and the average person realize the impact of an El Niño and prepare for the event. Such inclusion into the Ethiopian disaster preparation plans would also help in the understanding of the phenomenon by a wider audience in Ethiopia. It should be noted that very few people outside the NMSA and the DPPC understand the impacts of El Niño.

There are strengths and weaknesses of the Ethiopian government's response to El Niño-related climate impacts. The recurrence of drought in Ethiopia has led to the accumulation of experience in disaster response. The need to understand droughts in Ethiopia led the NMSA to discover the role of El Niño in 1986-87. Despite the lack of capacity, such as trained manpower, the NMSA has developed an effective methodology of forecasting by analogy, which is being used up to now. The response side has also led to the creation of a strong institution such as the DPPC with a department of early warning that works very closely with the Ministry of Agriculture and the NMSA. The DPPC has accumulated experiences to provide early warning and effective response to disasters. The Ethiopian government has created an enabling political environment for disaster response. Finally, one of the strengths of the country's response to El Niño is the existence of goodwill and support by the international donors for the activities of the government in disaster response.

Until recently, Ethiopia's forecast and response to El Niño have been biased toward droughts, which left other disasters such as floods, fires and fast-onset disasters as secondary. In the last three years floods and fires have become more frequent in many parts of Ethiopia. Another weakness is the low level of research activity on El Niño. No models adequately relate Ethiopian weather to El Niño for use in forecasting. There is a lack of trained personnel and scarcity of resources, particularly in the regions for an effective response. Solutions to some of these problems could make Ethiopia's use of El Niño as a tool in the forecasting of climate-related disasters more effective than has been the case until now.

Conclusion

Ethiopia is a developing country faced with many socio-economic problems, such as limited access to education, water supply and food. High population growth, environmental degradation, and climate variability compound the intensity of the problem. Lack of access to irrigation and the dependence of Ethiopian agriculture on rainfall have made food security in Ethiopia vulnerable to the variability of weather and climate.

The recurrence of drought and famine has led to the creation of an excellent early warning and response mechanism in Ethiopia. The DPPC is the central institution of the Ethiopian National Disaster Prevention and Preparedness Committee. The NMSA is a member of the NDPPC that provides weather forecasts to the users. The existence of such an institution has helped the country in the prevention of disaster in the 1990s.

The NMSA used the analogue method to identify characteristics of the 1997 El Niño. It reached the conclusion that the 1997-98 El Niño was analogous to that of 1972 in the amount and distribution of rainfall. The drought of 1973-74 had killed 200,000 people in the northern part of Ethiopia. The 1997-98 rainfall was variable during the Kiremt season and anomalous excessive rainfall during the Bega or harvest season. It destroyed the crops during the growing, flowering and harvesting season. Total production was 25 percent lower than the previous year.

Donors were initially reluctant to meet the demand for food aid. One of the reasons for the reluctance of donors to meet the Ethiopian demand probably was the existence of a record harvest in the previous year and the success of the Emergency Food Security reserves. The widespread news in 1996-97 that Ethiopia had begun exporting food must have hurt the demand for food aid when crops failed in 1997-98.

One of the major problems that hinders long-term effective weather forecasting in Ethiopia is the absence of meteorological information in various parts of the country that have been accumulated over a long period of time. At present, there are only 600 meteorological stations in Ethiopia. Most of those stations are located in the urban areas. If the researchers were expected to forecast accurate El Niño-based forecasts for the diverse climate zones of Ethiopia, they would require meteorological information such as rainfall, temperature, pressure, etc. for those localities. One of the forecast and response constraints in Ethiopia was a lack of trained personnel to interpret the information, especially in the regional states. In addition, those who work in the regions do not have access to resources such as transportation, communication, and office equipment.

At the national level, Ethiopia has to increase the number of its researchers in meteorology in general and in climate forecasting in particular. At present there is no single Department of Meteorology in any of Ethiopia's five universities. Mechanisms have also to be made so those social and physical scientists outside the DPPC and the NMSA could develop an interest in conducting research on the relationship between El Niño and climate-related impacts in Ethiopia. In general, there is a need for the training of meteorologists, especially for the regions. There is a need for the supply of basic office materials, computers and access to the Internet.

The El Niño of 1997-98 exposed the fragility of food security in developing countries, even with a government that is focused on agricultural development. Ethiopia had excellent food production in 1995-96 and 1996-97, but the optimism was dashed with the onset of the first drought. In spite of the existence of a supportive political environment for those involved in disaster prevention in Ethiopia, the struggle was very difficult. At the end of 1997, the Emergency Food Security Reserve was depleted and there was nervousness in the country that famine might revisit the country. Only the mass intervention of the donors saved a "killer" famine. One of the lessons we learn from this experience is that even though food security reserves are an excellent way of responding to disasters, if they depend on donor generosity for refills, they can not be dependable. Donors can ignore pleas for food to fill the stocks, as happened in the case of Ethiopia in 1999 and 2000.

Long-lasting preparedness for climate-related impacts is necessary to improve the capacity of the country, especially in water preservation before the onset of the drought. Ethiopia is very rich in water resources, but a farmer's access to irrigation is very limited. We should also learn that one of the reasons for the containment of the 1997-98 disaster was because of a positive economic condition in the country, open-mindedness on the part of the government and donor support. In the final analysis, however, we should note that complete national preparedness to disaster could come only through socio-economic development in all sectors of the country.

Lessons Learned

- The existence of institutions in Ethiopia such as the disaster prevention and preparedness committees at all levels of government is important for the vertical flow of El Niño-related forecasts and impact information. However, the time it takes for the analyses of forecasts of El Niño to go from the highest levels of government to the lowest community levels must be shortened to allow for more lead time to prepare for the proposed impacts.

- Involvement of the Prime Minister's office gave an important impetus to the level of credibility and importance of the El Niño forecasts.

- Even countries such as Ethiopia, with little advance in scientific research, can select appropriate forecast methods, such as the use of historical analogues and can issue usable forecasts on El Niño impacts.

- The Ethiopian media did not take a keen interest in disseminating information about the 1997-98 El Niño’s development until the impacts were being felt. It usually followed the responses of the government instead of becoming a leader and educator of the public on awareness of El Niño’s potential impacts. The media must be encouraged to sustain their interest in the phenomenon, so that the population can better understand what it means to its food security and livelihood.

- There is a strong and compelling argument to enhance Ethiopia’s meteorological system and research activities at the national level. Such information has practical development application and is not just 'curiosity-driven' research. Research interest in El Niño and other climate-related impacts should also be encouraged outside the NMSA (National Meteorological Service Agency).

- Successful responses to climate-related impacts require coordination between the national government and donors, as happened in Ethiopia in 1997-98.

- There is a need for the issuance of forecast before the onset of the planting season. The late issuance of forecasts to improve the probability of success merges the risks associated with the timing of forecast and the response capability to proposed impacts.

- Governments need timely and credible El Niño forecasts that also include a forecast about its intensity, timing, and spatial distribution of its potential impacts.

- El Niño information, including forecasts, are useful for long-range development planning and not just for disaster early warning. Some of the recommended responses to reduce the adverse impacts of El Niño, such as the use of various types of dams, construction of canals, and the selling off of herds, are actions that should continue even after the El Niño event itself has ended.

- There is a tendency to refer to whole countries when referencing El Niño's impacts. But it is seldom that an entire country would be adversely affected in the same way by an El Niño event given the variability in topographic features, e.g., Ethiopia is known for its local, small-scale (micro) climate regimes. Ethiopia can suffer from droughts and floods during the same El Niño event. It is important for governments to identify in advance the regions and sectors that are vulnerable to the regional impacts of ENSO’s extremes.

- There should be an improved capacity of the regions in Ethiopia, in terms of skill improvement, access to information and resource capacity, to issue their own regional forecasts. This would make the forecasts more relevant to the local areas and would reduce the time spent in communications with the central government.

- Education and training programs at the local and regional levels related to El Niño would improve Ethiopia's overall ability to mitigate El Niño's adverse impacts.

- Countries such as Ethiopia that are frequented by climate-related hazards must not rush to export their cereals or deplete their food reserves before having assessed the status of the main harvest season, as happened in 1997-98 in Ethiopia.

- The national-to-local communication systems must be developed and maintained between El Niño events so that they will be available and functioning during El Niño's impacts.

The Setting

Socioeconomic Setting

Ethiopia is a developing African country located between 3?N and 15?N, and 33?E and 48?E[11]. Ethiopia is estimated to be about 1.2 million square kilometers, two thirds of which is mountainous, lying between 1700-3000 meters above sea level. The western and eastern highlands rise to 4000 meters with the Rift Valley dissecting them. More than 60 percent of Ethiopians live in these highlands. Drought, deforestation and soil erosion are the leading environmental problems in the region. At the turn of the 20th century, 40 percent of Ethiopia's land surface was covered with dense forests. This has been reduced to only 4 percent. Land degradation in Ethiopia is aggravated because of high population density and the traditional techniques of cultivation.

Ethiopia is called the water tower of Africa. It is home to many rivers such as the Blue Nile and Wabe Shebelle, making it potentially suitable for irrigated agriculture. The FAO estimates that Ethiopia has the potential to irrigate 3.5 million hectares of land (FAO/GIEWS, 12/19/1997).

At the end of the El Niño in the middle of 1998, a war started between Ethiopia and Eritrea. The war began on May 12, at a time when Ethiopians were coping with the adverse impacts of El Niño. The conflict was an added constraint on the El Niño-related responses by the government and the people. About 450,000 Ethiopians who live in the border areas occupied by Eritrea were displaced and became dependent on food aid. They lost their animals, seeds, and harvests. Other farmers in the border areas could not plant, because of the lack of security and occasional shelling. Thousands of Ethiopian farmers were mobilized to defend against the Eritrean threat, and the farms of those who joined the army were cultivated with the help of those who remained in the villages. In July 1998, Eritrea confiscated 45,000 tons of U.S. grain that was in an Eritrean port en route to Ethiopia. It is believed that Eritrea confiscated more than US$300 million worth of goods when the conflict erupted. Ethiopia was forced to import food and other items through Djibouti in order to avoid the Eritrean ports because of the conflict.

Ethiopia is home to more than 60 million people, making it the second most populous country in sub-Saharan Africa. Until the 1950s, Ethiopia was considered self-sufficient in food production. However, food production declined by 1.2 per-cent annually in the period between 1951-92, which led to food insecurity (DPPC 1998a, 5).

Drought, civil war, overpopulation and unwise government policies contributed to the decline of food security in Ethiopia. The socialist economic policies of the Military Government (1974-1991), such as land nationalization, forced collectivization and forced resettlement, undermined the productivity of Ethiopian agriculture. In the 1970s and 1980s, the subsistence agriculture was unable to produce a surplus for the market or to support itself, which caused food insecurity in Ethiopia.

---

[11] Ethiopia has a per capita income of $110; life expectancy is 48 years, and an adult literacy of 34.5 percent. It is estimated that 60 percent of the population live in absolute poverty. The UNDP has put Ethiopia in the 170th rank of the 175 countries in terms of its development index. (FAO 12/19/97).

The Ethiopian economy is highly dominated by agriculture, with a GDP composed of 50 percent agriculture, 40 percent services and 10 percent industry (FAO 12/19/1997). Agriculture contributes 88 percent of exports and 88 percent of employment. Coffee, for example, contributes 60 percent of foreign earnings. Ethiopian agriculture is dominated by (1) the subsistence peasant sector, which contributes 95 percent of the production of cereals, pulses and oil seeds; (2) the pastoral sector with a nomadic form of production; (3) agro-pastorals and small-scale modern commercial farming, which is in its nascent stage of development. Ethiopia produces the largest livestock population in Africa, and the FAO estimated that it ranked 9th in the world (FAO 12/19/1997). However, it is characterized by low productivity. The dominant and identified food supply systems in Ethiopia are "crop dependent, market dependent, and livestock dependent, with some groups of people depending on more than one of these systems" (Wolde Giorgis 1987, 519).

Ethiopia has a lot of potential for agricultural development. This potential could be realized with an increase in agricultural productivity through irrigation, use of fertilizers, improved seeds, and access to markets, infrastructure and improvement in agricultural techniques and skills. An increase in productivity would also require a solution to environmental problems, such as rainfall variability and the degradation and fragmentation of land. A long-term solution to the problem of food security in Ethiopia would require the transformation of the peasant mode of production with its increasingly diminishing and fragmenting farm plots, which is at the mercy of seasonal rainfall that is highly erratic and variable (Gonfa 1996).

Seasons and Climate Zones

Understanding the nature of the Ethiopian climate is important for any food security policy in Ethiopia. The Ethiopian National Meteorological Services Agency (NMSA) divides Ethiopia into four climatic zones based on the pattern of rainfall (NMSA 1996, 5). These are:

(1) The two-season type: this includes the western half of Ethiopia, which is divided into distinct wet and dry seasons.
(2) Bi-two season type: the south and southeast of Ethiopia is characterized by double wet seasons that occur between March-May and September-November with two dry seasons in between (Workineh, 1987 bibliog., Haile 1986 quoted by NMSA 1996).
(3) The undefined season mostly has sporadic rainfall between July and February without any defined season. It occurs in the dry northern part of the Ethiopian Rift Valley.
(4) The three-season type: these areas include central and southwestern Ethiopia. The average annual rainfall in the highlands of Ethiopia is above 1000 mm a year and it rises to 2000mm and 3000 mm in the wet southwestern parts of Ethiopia (NMSA 1996, Babu 1999a, 63).

The three seasons in Ethiopia are classified according to the amount and timing of rainfall. They are designated as *Kiremt*, (June-September), *Bega* (October-January), and *belg* (February-May) (NMSA 1989, 5). These seasons determine the seasonal agricultural activities, such as land preparation, planting, weeding and harvesting by farmers.

Kiremt (June-September)

Kiremt is the main rainy season in Ethiopia. There are various regional and global weather systems that affect the *Kiremt* season. These systems include the Inter Tropical Convergence Zone (ITCZ), the Maskaran High Pressure in the Southern Indian Ocean, the Helena High Pressure Zone in the Atlantic, the Congo air Boundary, the Monsoon depression and Monsoon trough, the Monsoon Clusters and the Tropical Easterly Jet (Kassahun 1999). The ITCZ moves north and south in the tropics following the change of seasons. The ITCZ reaches southern Ethiopia at the beginning of the *belg season* and moves northward bringing rainfall with it. At the end of August, the ITCZ begins to return southward ending the *Kiremt* precipitation that corresponds with the maturation of crops. Most Ethiopian rainfall, with the exception of the south and southeastern parts of the country, is caused by the ITCZ (Kassahun 1999).

The High Pressures created in the Makarin and St. Helena areas are important causes for the moisture-carrying winds to go to Ethiopia and drop their precipitation in the highlands. The weakening of these high pressures reduces the amount of rainfall in Ethiopia. The Congo Air Boundary in the Congo rain forest is a meeting place for the moisture-carrying winds from the Indian and Atlantic Oceans. This boundary pulls the low air pressure from the north and east into Ethiopia. It also pulls the winds originating from the low pressure in the South Atlantic and provides them with moisture to be dumped in southwestern Ethiopia (ibid.). Occasionally, the monsoon clusters also provide rainfall to the eastern part of Ethiopia (ibid.). Finally, the Tropical Easterly Jet, which moves 13 kilometers above sea level over Ethiopia, strengthens the ITCZ, which is the main system that creates rainfall over Ethiopia during the *Kiremt* season (June-September). The absence of this strong wind could negatively affect the amount and distribution of rainfall (ibid). The *MeherMeher* crops in the highlands of Ethiopia depend on the *Kiremt* rainfall.

The intensity and fluctuation of the rain-producing systems during the *Kiremt* season influence the amount and distribution of rainfall in Ethiopia (Babu 1999a, 65). The lack of definition of ITCZ, which is the main rain producing system, causes deficient rainfall over Ethiopia (ibid.). Following Jackson, Abate argues that not all rainfall in Ethiopia is caused by the movement of the ITCZ; other “dry” and “wet” periods in Ethiopia are influenced by the atmospheric disturbances that create rainfall away from the ITCZ (Jackson 1979 cited by Abate 1984, 18-19).

Kiremt rainfall is very important in Ethiopia. Most of the food is planted during this season. Drought during *Kiremt* may lead to food insecurity and starvation. With the exception of south and southeastern Ethiopia, most parts of the country receive 60 percent-90 percent of their rainfall during the *Kiremt* season (Babu 1999a, 65).

Bega (October-January)

The B*ega* season occurs between October-January. *Bega* is the dry, windy and sunny season in most highlands of Ethiopia. The causes of this dry season are the Sahara and Siberian High Pressures that send dry and cold winds to Ethiopia during the northern winter (Kassahun 1999). During the B*ega*, most of highland Ethiopia is sunny during the day and cold during the night and morning, which includes frost in December and January. Farmers harvest their *Meher* crops during this dry period. However, there are some areas of lowland Ethiopia, such as the Ogaden, that get some rainfall during this period.

A low pressure air that moves from Western to Eastern Europe, occasionally, passes over Ethiopia and interacts with warm and humid air from the tropics creating unseasonable rainfall in Ethiopia during the B*ega* (Kassahun 1999). Moreover, the tropical disturbances on the Arabian Sea might move to Ethiopia and drop some rainfall during the B*ega* season, especially in the pastoral areas of the country (ibid.). The pastoral areas of south and southeastern Ethiopia experience a bi-modal rainfall regime and receive their rainfall between October-January and February-May.

The precipitation during the B*ega* season (October –January) is generally very low in most of the grain-producing parts of Ethiopia. However, the regions in southern, southwestern and southeastern Ethiopia receive rainfall associated with the southward retreat of the ITCZ (Babu 1999a, 64). By the end of November, dry Arabian and Saharan anticyclones replace the southward shifting ITCZ and bring warm-dry weather to Ethiopia (ibid.). At times this new air circulation meets with tropical air masses and brings untimely and unwanted rainfall to Ethiopia. The wind direction also reverses from wet westerlies to dry easterlies that bring dry and cold wind to Ethiopia (ibid.). Rainfall in Ethiopia decreases from SW to NE.

***Belg* (February-May)**

The *belg season* is also known as the small rain period and occurs between February-May. The *belg rains* begin when the Saharan and Siberian High Pressures are weakened and various atmospheric activities occur around the Horn of Africa. Low-pressure air related to the Mediterranean Sea moves and interacts with the tropical moisture and may bring precipitation to the region. The high pressure in the Arabian Desert also pushes that low-pressure air from south Arabian Sea into mid- and southeast Ethiopia, which in turn, creates the *belg rains*. The beginning of the *belg rain* is also the period when the ITCZ begins to reach south and southwest Ethiopia in its south-north movement (Kassahun 1999). The *belg rains* fail when these diverse weather phenomena are not realized. For example, the creation of strong low pressure and cyclones in the southern Indian Ocean reduces the amount and distribution of rainfall in Ethiopia (ibid.).

Between 5 and 10 percent of crops in Ethiopia are produced during the *belg season*. In some areas, the *belg* rainfall may produce up-to fifty per-cent of local food. The small rains also contribute to increased pasture for domestic and wild animals. Normal *belg rainfall* adds moisture to the soil, easing land preparation for the *Kiremt* planting. During the dry season, the mass of dry air comes from the northeast. (Abate 1984, 13)

The *belg season* is influenced by the tropical surface air masses in the Indian and Arabian anti-cyclones and the Central African cyclones south of Ethiopia (Haile 1987). At the beginning of March, the ITCZ arrives in southwestern Ethiopia to move northward which brings rainfall (Babu 1999a, 65). *Belg rainfall* is brought by the penetration of extra-tropical troughs that replace the Arabian anticyclones (Babu 1999a, 65). The *belg* rains normally end in the middle of May and dry weather persists (for a month) until the middle of June when the *Kiremt* wet season begins. Babu (1999a) argues that the *belg* rains may sometimes merge with the *Kiremt* rainy season without the one-month break. He states, "Merging *belg* and *Kiremt* rains was observed in 1972, 1977, 1982, 1987 and 1993, which were all El Niño years. So the presence or absence of El-Nino could be used as a predictor to anticipate *belg* or *Kiremt* rainfall" (Babu 1999a, 65).

Microclimates in Ethiopia

In addition to the ITCZ, local factors also affect rainfall in Ethiopia. Spatial variations caused by altitude create rainfall variations in Ethiopia leading to the existence of various microclimates[12]. Altitude is an important factor in creating various climatic zones in Ethiopia. The four types of climate zones in Ethiopia are the *dega, weina-dega, kola* and *bereha*. The *dega* is cool and usually receives adequate rainfall. The *weina dega* is temperate and supports most Ethiopian crops. The *kola* is hot and includes the lowland areas. The *bereha* is the desert type area in the peripheral parts of the country in which nomadism is the main economic activity.

Evolution of the Early Warning System

The practice of delivering early warning for climate hazards did not exist in Ethiopia until the mid-1970s[3]. There was no early warning system in the 1973-74 drought, and the capacity and commitments of the government to disaster related impacts were absent. More than 200,000 people and animals died as a result of the drought (Wolde Giorgis 1987, 519). In 1976, the military government established the Relief and Rehabilitation Commission (RRC). The RRC was mandated to identify famine conditions and provide the information to the Ethiopian government and donors. The RRC was a pioneer in the area of famine early warning in Ethiopia. However, it was later discredited because the military government used it in making food a political weapon during the civil war. There was information and early warning about the drought and famine of 1984-85, but mistaken priorities of the government, the civil war and the politicization of relief led to the death of more than one million Ethiopians (Wolde Giorgis 1987, 519). The RRC was also a leading participant in the infamous resettlement program.

Since the overthrow of the military government in 1991, there have been deliberate sets of actions by the government to create institutions and capacities to adequately prevent climate-related hazards. The core foundations were institutional and material preparedness on the part of the government to adequately respond to disasters. Institutionally, the DPPC was strengthened with powers to strictly evaluate the various relief and development NGOs. The government introduced two important documents, *The National Policy for Disaster Prevention Management* (NPDPM) and *General Guidelines for the Implementation of the National Policies on Disaster Prevention and Management* (NPDMP) in 1993 and 1995, respectively (DPPC 1998a, 6, EG 1995a).

[12] Meteorological services in Ethiopia began in the 1950s in response to demands for civil aviation. When the NMSA was established in December 1980 modern and long-range weather forecasting was one of its objectives (Kassahun, 2000). Long-range weather forecasting is important for Ethiopia, which depends on rain-fed agriculture. The long-range forecast of the three seasons by NMSA became an important component of Ethiopia's early warning system. This long-range weather forecast is important for policy makers and planners. The beneficiaries of NMSA's long range forecast are those involved in farming, water development, construction, energy and the Disaster Prevention and Preparedness Commission (Kassahun 1999).

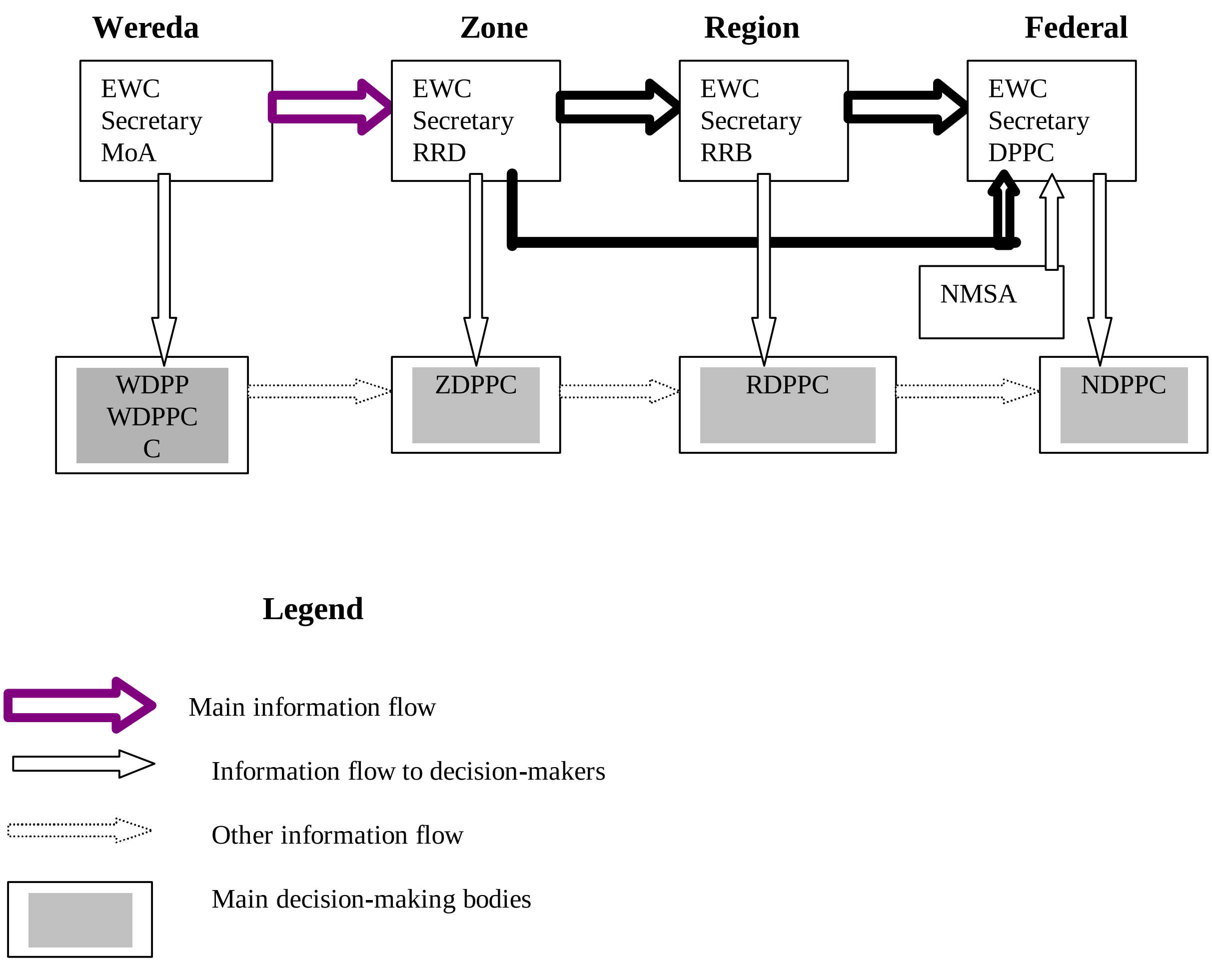
The National Policy for Disaster Prevention and Management stressed that early warning and preparedness were key elements to respond to climate-related hazards. An emergency food security reserve was put forward as an important component of preparedness. In 1995, the RRC was renamed the Disaster Prevention and Preparedness Commission (DPPC) to reflect the new philosophy (EG 1995b). The National Disaster Prevention and Preparedness Committee (NDPPC) was established under the Prime Minister's office to implement the National Disaster Policy (DPPC 1998a, 11). In 1995, a technical Task Force that included donors, UN agencies, NGOs, and government agencies was established to implement the National Policy.

The NDPPC deals with climate-related impacts at the national level and is chaired by the Prime Minister. Its members include the Ministry of Agriculture, the Ministry of Health, the Ministry of Water Resources and Development, the Ministry of Economic Development and Cooperation, the Ministry of Trade and Industry, and the Disaster Prevention and Preparedness Commission (DPPC), the National Meteorological Services Agency (NMSA) and the Ethiopian Mapping Agency. The NDPPC assesses the status of weather, agricultural operations, and crop prospects and subsequently recommends possible responses. It appraises the likely onset of climate-related impacts and issues directives to minimize the threat. The DPPC is the secretariat of the NDPPC.

The *General Guidelines for the Implementation of the National Policies on Disaster Prevention and Management* (1995) provides guidelines for reducing the impacts of drought. In addition to the provision of relief in times of acute food shortages, the *Guidelines* contain various interventions to avert disasters. These interventions include improvements to the productivity of the drought vulnerable lands and improving resilience of farmers to drought (Guidelines 1995, 49). These interventions are related to crop systems and varieties, soil and moisture conservation, contingency agricultural plans, provision of seeds, and policies for livestock preservation. The Guideline recommends the preservation of drought resistant seed varieties and emphasis is put on low-cost, non-cash crop production, strengthening the agricultural extension system and establishment of a favorable cropping system (Guidelines 1995, 49). It recommends the conservation and retention of soil moisture and the establishment of small-scale irrigation, construction of wells, training farmers to reduce run-off and exploit ground water and encourage forestation (Guidelines 1995, 49). The *Guidelines* recommended contingency agricultural plans to reduce the impacts of drought on food production. These plans include the use of irrigation, water preservation, (?) exploitation of ground water and drought resistant agronomic practices, such as cultivation of alternative drought resistant crops and the preservation of farm moisture. It recommends the re-planting of crops during drought, the distribution of seeds, and the use of agronomic practices to reduce evapo-transpiration, such as weeding, reducing foliage and skipping inter-cropping. Fodder production, pasture development, water supply, veterinary services, fodder and water distribution, controlled grazing, organized migration, mobile abattoirs, fodder production and cattle camps are recommended to reduce the impact of drought in the pastoral areas (Guidelines 1995, 53).

The DPPC has established a crisis management group consisting of nodal officers of government ministries to assist in disaster management (DPPC 1998a, 10). Relevant Ministries and agencies have a designated technical person as a member of the National Committee for Early Warning (NCEW) under the Federal DPPC.

Figure 1: Reporting System of the Ethiopian EWS



There are "Early warning committees" at various levels of government i.e. the Federal DPPC, Regional Disaster Prevention and Preparedness Bureaus (RDPPBs), Zonal Disaster Prevention and Preparedness Departments (ZDPPDs) and the *Wereda* Early Warning Committee. The NCEW depends on these committees to collect and analyze information and data pertaining to weather, crop, food, market trends, commodity prices, livestock conditions, water and pasture, and food and nutritional conditions.

Since the change of government in 1991, there has been a genuine attempt by the central government to decentralize and improve community participation in disaster response. The 1995

Proclamation has made the regional DPPBs autonomous because of the federal system of government (EG, 95). For example, the *Wereda* Early Warning Committees play important roles in the dissemination and collection of early warning information. The DPPC's baseline socio-economic data is collected at this level (Hadera 2000). They also report any climate-related impacts to the government.

Various government actions were taken to strengthen the national preparedness for disaster. In 1992, the Ethiopian Transitional Government established the Emergency Food Security Reserve Administration (EFSRA) to improve its capacity of disaster response (DPPC 1998a 6-15). The government constructed food stock silos at various strategic locations so that food could reach the market or the needy people on a short notice. Ethiopia's food reserve capacity was raised from 33,000 MT in 1991 to 307,000MT in 1997 (*ibid*.). The government also established the National Disaster Prevention and Preparedness Fund (NDPPF) to cover the financial costs that may arise when climate-related disasters strike. Donors, the UN, NGOs, and Regional Presidents are the board members of the NDPPF. Shortage of inputs, such as seeds and oxen are important impediments for farmers' responses during drought. Access to oxen and seeds determine the decision of farmers to replant when variability of rainfall destroys crops. These inputs are also important for post-drought rehabilitation by farmers. Agricultural extension services were used to provide inputs.

The Ministry of Agriculture, which is mandated to oversee the seed banks, plays an important role in the distribution of inputs to farmers. The sector ministries and the regional states implement relief-based development projects, such as "food for work "or" employment generating schemes. The Livestock Preservation Program was also created to encourage farmers to focus on fodder production and controlled grazing.

Thus, in the 1990s, the Ethiopian government has been successful in drafting and in implementing food security policies. In 1996-97, the various policies of the Ethiopian government achieved their goal. There was a bumper harvest of about 11 million MT for the first time in Ethiopian history. However, the 1997-98 El Niño induced erratic rainfall, which reversed the trend on increasing food production.

Climate-related and other hazards in Ethiopia

There are many hazards, climate-related and otherwise, in Ethiopia. The most common disasters are droughts, floods, fires[13], epidemics, pests and earthquakes. Drought is the leading climate-related hazard in the country that particularly affects the food security of the people. Creeping environmental problems, such as soil erosion and deforestation, are widespread and increase the impact of climate-related hazards (*Addis Zemen Sene* 17, 1989 E.C). There is the problem of land mines due to the civil war and the current conflict with Eritrea that erupted on May 12, 1998.

Level of scientific research related to El Niño

[13] IRIN (Integrated Regional Information Network, United Nations Office for the Coordination of Humanitarian Affairs). Ethiopia: Raging fires wiping out wildlife, property. March 8, 2000.

Preliminary research is carried out at the National Meteorological Services Agency (NMSA) about the relationship between Ethiopian weather and El Niño. An understanding of El Niño as a cause of climate-related hazards in Ethiopia before the 1997-98 event was limited to the NMSA and the DPPC. The NMSA began to develop an interest in the long-range weather forecast and El Niño after the 1983-84 drought that killed about one million people (Kassahun 2000). El Niño forecasts have been an important aspect of Ethiopia's response to climate-related hazards since 1987 (Glantz 1996). According to Kassahun, NMSA's serious scientists conducted a discussion regarding the possibility of El Niño's effect on Ethiopian weather after reading the work of Marc Cane about the 1982-83 El Niño.

In 1987, a NMSA report stated that ENSO events negatively affect the rain-producing components of the Ethiopian weather. The report also stated that the impact of ENSO on Ethiopian weather is indisputable (NMSA 1987). After the severity of the 1983-84 drought, the NMSA was "compelled to prepare and issue a seasonal forecast of *belg* (small rain period) and *Kiremt* (big rain period) rains of 1987, well in advance" (Haile 1987a, 54). According to Haile, there is no theoretically sound methodology for the NMSA to carry out its long-range weather forecast. The NMSA used the analogue method to forecast the anomalous seasonal rainfall. Forecasting by analogy is used in an attempt to know the future in situations where the "cases are analogous to ways that societies might respond to environmental change" (Jamiesson 1988, 79). The government adequately responded to avert the 1987-88 famine and was awarded the Sasakawa-UNDRO award (Bekele 1997, 112).

The National Meteorological Services Agency has been using the technique of forecasting by analogy in its use of El Niño as a drought early warning. The NMSA agency identifies the current ENSO event and compares it with similar past ENSO events for which the impact on Ethiopia is known. The idea is to forecast that the impact on Ethiopia of the coming ENSO event would not be different from the past event. For example, the 1997-98 El Niño was compared by NMSA with past *El Niño*s, and it was decided that it resembled the 1972-73 El Niño. NMSA then concluded that the impact of the El Niño on the amount and distribution of rainfall in 1997 would be similar to that of 1972-73. Similarly, the impact of the current La Niña on the rainfall amount and distribution of rainfall in the *Kiremt* 2000 is similar to the analogue year of the 1980 La Niña. The use of forecasting by analogy to reduce the impact of the anomalous weather has been very important in Ethiopia's drought early warning. NMSA forecasters also take the SST of the Indian and Atlantic oceans into account. Then NMSA forecasts precipitation by classifying rainfall into normal (75 percent-125 percent of long term mean rainfall), below normal (less than 75 percent of long-term mean rainfall) and above normal (more than 125 percent of long term mean rainfall) (Babu 1999b, 68).

Historical interest in El Niño before the 1997-98 Impact

There was no mention of El Niño at the popular or media level before the 1997-98 period, with one exception. Following the 1982-83 El Niño that led to the 1984 drought in Ethiopia, the NMSA initiated the application of El Niño information as an early warning for the 1987 drought. According to Kassahun, NMSA experts for the first time explained the concept of El Niño to the public on TV on August 5, 1987. Information from the DPPC also reveals that ENSO information was being incorporated into the early warning system since then (Teshome 1997).

The 1997-98 Event

<u>Trace the flow of information on the 1997-98 El Niño</u>

a. When did the various Ethiopian agencies first hear about this developing El Niño?

The NMSA first heard about the 1997 El Niño in March 1997. Other agencies heard about it during the presentation of the weather assessment and outlook by the NMSA during the process of preparation for the seasonal forecast on May 29 1997. The forecast was issued on May 29, 1997.

b. Where did the information come from?

There are many sources of El Niño information for Ethiopia. Ethiopia receives meteorological information for its weather forecast from the following sources: (1) European Center for Medium-range Weather Forecast (ECMWF); (2) National Climate Prediction Center, (NOAA; (3) African Center of Meteorological Application for Development (ACMAD); (4) Drought Monitoring Center (DMC), and the Australian Weather Bureau (Kassahun 1999).

The El Niño information for the 1997-98 period was received from the National Climate Prediction Center of NOAA, which produces the Climate Diagnostic Bulletin and from the Weekly Climate Bulletin of the Australian Weather Bureau (Kassahun 2000). The information was received through the postal service because it did not have an e-mail connection at that time.

The following publications are regularly received by the NMSA:

1. The seasonal and monthly Climate Monitoring Bulletin for the Southern Hemisphere; Bureau of Meteorology, Melbourne, Australia;
2. The Monthly Bulletin of Drought Monitoring Center; Nairobi, Kenya;
3. The Seasonal and Monthly Bulletin of the South African Weather Bureau;
4. Rain watch and prediction for Africa, from the African Center of Meteorological Application for Development (ACMAD);
5. The Hadley Center for Climate Prediction and Research in the UK.

c. **When did they first hear it would be a strong event? From whom?**

They heard that it would be a strong El Niño in May 1997, when the Pacific SST temperature reached +4 degrees. The information came from the National Climate Prediction Center, USA and the Australian Weather Bureau.

d. **Which agencies first received the information?**

As a leading agency for monitoring Ethiopia's weather, the NMSA was the first to have access to the El Niño information of 1997-98.

e. **Were these the appropriate agencies to first receive the information?**

The NMSA was the appropriate Agency to receive the information first. The NMSA provides meteorological forecasts by gathering information both locally and from outside sources. It has established about 600 meteorological stations in various parts of the country. Through the WMO, which coordinates the exchange of information between its members, the NMSA receives information needed for weather forecast from diverse sources mentioned earlier.

NMSA scientists also gathered more information from the websites of the NCPC, the WMO and other agencies dealing with climate.

f. **How was the information obtained?**

The information was retrieved from the bulletin sent by the Climate Prediction Center and the Australian Weather Bureau. The El Niño information contained in the hard copy of the bulletin sent by the Climate Prediction Center was transmitted by regular mail because the NMSA did not have an e-mail connection at that time.

Through the DPPC, the early warning was distributed to the various ministries and to the regions. The various ministries, such as Agriculture, Water Resources and the DPPC, were to redesign their plans to respond to the expected seasonal variability. The regions got the information mainly through the early warning department of the DPPC and also through the regional government. The regional governments were expected to strengthen their early warning units at the regional, zonal and *Wereda* levels so that they could reach the farmers and herders in a timely manner.

g. How was the information transmitted?

The information was transmitted through the postal service. NMSA did not have an e-mail connection in 1997.

h. How did the media first report the developing El Niño?

NMSA provides weather forecasts to the media, but does not encourage them to distribute the forecast to the public for fear that it may create panic. It prefers the relevant Ministries, such as the Ministry of Agriculture and the DPPC, to advise the end users, such as farmers about the forecast and response. The 1997-98 El Niño event was first mentioned in the Ethiopian media on the March 6, 1997 issue of the private weekly newspaper, *Addis Tribune*. It briefly predicted that the 1997 *Kiremt* might be a drought season because of the so-called El Niño that was emerging in the world scene. With this exception, the Ethiopian media did not cover the initial El Niño reports of the development of El Niño (with the exception of NMSA or DPPC early warnings) and its possible impact on Ethiopia. Extensive coverage by the media came in the latter part of August when the impact of the El Niño was being felt by the Ethiopian government.

i. How did the media cover the event over time? (Quote headlines names of radio stations, programs, etc., with dates.)

Even though the Ethiopian media did not cover the evolution of the 1997-98 El Niño, it covered its impact in the second half of 1997. The NMSA forecasters were discussing the evolution of the El Niño and releasing its possible impact to members of the early warning committee before the May 29, 1997 forecast. The government-owned daily, *The Ethiopian Herald*, and *Addis Zemen* printed the May 1997 El Niño forecast, but they did not dwell much about its causes or implications. During June, July and the first three weeks of August 1997, the Ethiopian media did not cover the evolving El Niño and its implications for Ethiopia.

Over time, the media began to cover the impact of El Niño on Ethiopia. The brief burst in media coverage of the 1997-98 El Niño event and its impact on Ethiopia began at the end of August 1997, three months after the initial Ethiopia forecast on May 29, 1997.

The Ethiopian media boosted its coverage of the 1997-98 El Niño in response to the Prime Minister's Office's reaction to the impact of El Niño during the August 1997 joint quarterly meeting of the Federal and Regional government officials. There was a subsequent announcement, in which the Prime Minister's Office stated that appropriate measures would be taken to counter the impacts of El Niño. On its dispatch titled "Climate Change affects rainfall activity in Ethiopia," *The Ethiopian News Agency* (ENA) wrote that rainfall in Ethiopia was decreasing because of El Niño (ENA 8/29/1997). The Amharic daily, *Addis Zemen* (Nehasse 29 1989 EC or September 10, 1997) wrote an article titled, "Scientists declare that El Niño would bring drought: there is a need for a coordinated response." In this news item, *Addis Zemen* also included the announcement of the Prime Minister's Office about the advent of El Niño and its possible impacts on Ethiopia. The *Ethiopian Herald* (8/30 1997) wrote an article under the title, "Rainfall failure attached to El Niño phenomenon." It quoted the NMSA, which declared "the El Niño phenomenon in Ethiopia has resulted in the scarcity of rainfall in various parts of the country during the big rainy season, particularly in July." Two days later, the paper again wrote an article titled, "El Niño affects rainfall activity" (*Ethiopian Herald* 9/2/1997). This late extensive media coverage was influenced by the statement released from the Prime Minister's Office on the impact of El Niño on Ethiopia. The media did not disseminate the May NMSA drought forecast to the public through editorials or discussions. It only reported the forecast. In the latter part of the season the media was only following the government in its dissemination of the El Niño impact.

Another aspect of the media coverage was the impact of weather variability on Ethiopia. One of the characteristics of the 1997 El Niño was abnormal rainfall during the dry months between October and December 1997. The media covered the impact of the 1997 *bega* rains and floods on people, animals and property that it attributed to the El Niño phenomenon. The *Addis Tribune*, for example, wrote, "57 Die in Worst Flooding in Decades" (*Addis Tribune* 10/7/1997). There was some interest on the impact of El Niño on coffee, the leading export crop of Ethiopia. One article read: "World Coffee crop seen at the mercy of El Niño" (*Ethiopian Herald* 9/21/1997). Another headline was, "El Niño Cut Ethiopian Coffee Production" (*Addis Tribune* 12/12/1997). During this period, people were uncharacteristically talking about weather in Ethiopia. This was shown when the *Addis Tribune* featured two young weathermen from the NMSA on one of its issues. The feature was titled, "Talking of People…Weathering clouds that Fog the Bright Future" (*Addis Tribune* 9/5/1997). Though the interview was not particularly about El Niño, it was motivated by the impact of El Niño on Ethiopia by creating anomalous weather.

Sometimes the media did not put the statement of the NMSA with in the context of the seasonal forecast. The media presented it as if contradictory messages were coming out of NMSA. For example, *Addis Zemen* reported that the heavy rainfall in July in Addis Ababa was untimely and was caused by climate change (*Hamle* 11, 1989 E. C. July 21, 1997). However, July is normally a month of heavy rainfall. On July 27, 1997 (*Hamle* 17, 1989 E.C.), the same paper wrote optimistically about the *Kiremt* rainfall stating that it "will increase in quality and quantity" (*Addis Zemen, Hamle* 17, 1989, i.e. July 27, 1997). The newspaper also quoted NMSA as stating that the rainfall would continue for the next 8 days and that farmers who earlier missed planting because of the drought at the beginning of the season should take advantage of the new situation. Until the end of August, the media did not relate the rainfall variability to the El Niño phenomenon of 1997.

There was good media coverage of a conference titled "Flood Vulnerability in Ethiopia." It was organized in June 1997 to learn from the disastrous floods in 1996 that affected many low-lying areas of Ethiopia, including commercial plantations. Referring to this conference, *Addis Zemen* wrote an editorial titled "Will this year's *Kiremt* be like last year?" (*yezendrom Kiremt inde amna …Sene* 21, 1989 E.C. or July 11 1997). It echoed the fear of the DPPC, which forecast that 450,000 people might be vulnerable to flood in the 1997 *Kiremt*. It stated that the DPPC was prepared to handle the situation in terms of material acquisition, such as, food, clothing and shelter in order to support any population that might be affected. The daily also stressed the importance of forecasting instead of being reactive to the disaster. It stated that the Ministry of Water Resources had already built dikes and other anti-flood measures on the Awash River so that it did not repeat the 1996 disaster. Again, the paper failed to adequately compare the causes of the 1996 and 1997 floods.

The media continued to cover Ethiopian weather and stated that August would have an improved rainfall distribution (*Addis Zemen, Hamle* 23 1989 E.C., i.e. August 2 1997). The paper quoted an expert from the NMSA, Mr. Berhanu Getachew, who stated that the erratic rainfall of June and July would change for the better in August. He also predicted floods in many parts of the country. He explained that the reason for the change in weather was due to the decrease in the Sea Surface Temperature (SST) in the Pacific Ocean. The decrease in the SST on the Pacific would lead to the increase in the rainfall coming from the Atlantic Ocean. He also stated that Pacific Ocean SSTs affect rainfall distribution in Ethiopia.

The *Ethiopian Herald* also continued its interest in El Niño. It stated, " Effects of El Niño have already been felt in some parts of eastern Africa, including Eritrea, Ethiopia, Tanzania, Uganda and Sudan" (*Ethiopian Herald* 12/2/1997). It also referred to the fear of experts that drought and flood could lead to epidemics among people and cattle. It quoted Mr. Prosper Mutiwanyuka, who is the COMESA Secretariat in Lusaka, who advised farmers to slaughter their animals and retain the younger and healthier ones to avoid unnecessary losses.

j. Was the 1997-98 El Niño compared with any previous events?

It was compared with the 1972 El Niño. The 1997-98 El Niño was stronger than any previous El Niño. According to the NMSA, the 1997-98 El Niño, despite its strength, resembled that of the 1972 El Niño (NMSA 199a, 1997b, 1). The pattern of rainfall distribution during the *Kiremt* and other climatic factors made it analogous to that of the 1972-73 El Niño. The NMSA chose the 1972 El Niño as an analogue year for the 1997-98 El Niño. The NMSA expected rainfall distribution in 1997-98 to be similar to 1972 in terms of temporal and spatial distribution. There was also a better and more effective domestic and international response to the 1997-98 impact than to that of the 1972-73 El Niño. More than 200,000 people died in 1973-74 due to drought in Ethiopia. The impact of the 1972-73 El Niño, when thousands of people perished, was different because of differences in early warning and preparedness.

Before the mention of the 1997-98 El Niño, when was the previous mention of El Niño in the media?

The first mention of El Niño before 1997 was on August 25, 1987, when experts from the NMSA and the Minister of Agriculture gave a televised press conference and explained the 1987 drought and its relation to El Niño. It should be noted that Ethiopia, for the first time, used El Niño as an early warning in 1987 (Kassahun 2000).

Teleconnections (i.e., expected effects of El Niño)

What are the scientific views about the existence and the strength of El Niño teleconnections to the Ethiopian region?

Interest in El Niño in Ethiopia began following the devastating 1983-84 drought. In the 1980s, the research capacity at the NMSA on medium and long-range weather forecasting was improving (Kassahun 1999). Forecasters at NMSA were trying to come up with physical explanations for the recurrence of drought in Ethiopia (Kassahun 2000). ENSO was found to be one of the main factors that lead to drought in Ethiopia. Research at the NMSA began to focus on the links between the distribution of rainfall, Sea Surface Temperatures (SST) (including the Pacific, Indian and Atlantic Oceans), and Ethiopian weather (Kassahun 1999).
The NMSA has concluded that increases or decreases in the Sea Surface Temperature (SST) on the Pacific Ocean impact the amount and distribution of rainfall in Ethiopia (Kassahun 1999). Normal *Kiremt* rainfall is disrupted because El Niño weakens the atmospheric systems that strengthen rainfall and its distribution during the *Kiremt* season (Kassahun 1999).

The first application of El Niño to seasonal forecasting in Ethiopia was in 1987. In its 1987 seasonal forecast, NMSA incorporated ENSO effects on Ethiopia for the *belg* and *Kiremt* seasons (Haile 1987a, 54). Haile stated that the "occurrences of El Niño/Southern Oscillation (ENSO) phenomena and SST anomalies have a strong impact on the weather and climate variability" of Ethiopia. He said that the impacts of El Niño events on Ethiopian rainfall are real (Haile 1988). There is also an empirical pattern of association between El Niño and droughts in Ethiopia (Wolde-Georgis 1997, 5).

According to Ininda and el. al. (1987, 134), "… the years of strong El Niño, which are also years of negative SO anomaly, are generally characterized by below normal rainfall in Ethiopia." Nicholls (1993, 1) believes that El Niño caused the great Ethiopian drought of 1888. About one third of the population and 90 percent of the cattle died because of the 1888 drought (Webb and Braun 1994, 20). bibliography.

There is a negative teleconnection between the floods of the Nile and Atbara rivers that originate in Ethiopia and ENSO Events (Attia and Abulhoda 1992). Etahir (1996) also concluded that ENSO affects the flow of the Nile River that gets 85 percent of its water from highland Ethiopia; i.e. low flows of the Nile indicate drought in Ethiopia. Etahir recommended that knowledge of such information could help in the predictability of the annual flow of the Nile River.

The 1997 *Kiremt* droughts and the 1996 *Kiremt* floods also occurred during El Niño and La Niña years, respectively. According to Haile (1987a, 58), "the ENSO events have significant impacts on the rain-producing components over Ethiopia and its vicinity. The normalized rainfall analyses in northern Ethiopia clearly indicate that the drought years 1957-58, 1965, 1972-73, and 1984 strongly correspond to the recurrence of the ENSO events."

According to Haile (1987b, 118), "The occurrence of the ENSO events as represented by the Southern Oscillation Index (SOI) … strongly corresponds to the drought incidence (in mid-1960s, early 1970s and early 1980s)." The teleconnection is a result of a complicated feedback mechanism with speculated sequences that cause drought incidences in Ethiopia. These sequences are:

> Positive SST anomalies? ENSO events? generation of high frequency of typhoons? displacement and weakening of Tibetan high? the weakening of TEJ, vertical shear and easterly disturbance? drought" (Haile 1987b, 118).

Drought occurs in Ethiopia during ENSO years because the thermal gradient is weakened as a result of the SST anomalies over the Gulf of Guinea (Haile 1987b, 118). This weakening, in turn, reduces the warm-moist cross equatorial flow. Thus, the ENSO events (and the SST anomalies) … seem to strongly correspond to the reoccurrence of drought in Ethiopia" (Haile 1987b, 118). In addition to the influence of tropical weather systems, "the interaction between the above tropical systems and the extra tropical weather system makes the major active weather component of the country" (Kassahun 1987, 53). Rainfall patterns in Ethiopia are disturbed when El Niño weakens the high-pressure air mass on the South Indian and South Pacific Oceans that cause rainfall in Ethiopia (Kassahun 1999).

Impact of El Niño on the *Kiremt* Rainfall

El Niño affects the *Kiremt* seasonal weather in Ethiopia by weakening the rain-producing systems in the region and by distorting the amount and distribution of rainfall in Ethiopia (Kassahun 1999). La Niña has the opposite effect on the *Kiremt* rainfall, as was seen in 1970, 1971, 1988 and 1996, when there was above-normal *Kiremt* rainfall in Ethiopia (Kassahun 1999). Regions that are usually affected by El Niño are northern, northeastern and eastern parts of Ethiopia.

There is no single model of correlation between ENSO and the whole country; some areas are more correlated with ENSO than others. However, "All Ethiopian *Kiremt* rainfall is significantly correlated with May SOI" (Southern Oscillation Index) (Yebeshaw 1996, 5). bibliography. Comparisons of seasonal *Kiremt* rainfall totals with the corresponding seasonal mean of Southern Oscillation Index (SOI) appears to be deficient during ENSO events (Babu 1999b, 68). Droughts in Ethiopia outside El Niño years are the result of other physical factors that control rainfall.

Babu states the following on the relationship between ENSO and *Kiremt* rainfall:
Since SOI is closely related to ENSO or La Nina episodes, the *Kiremt* rainfall anomalies (1970-1988) were correlated with the June, July, August and September (JJAS) seasonal mean of SOI. It is found that the correlation is very high (0.8) and indicating a possible link between SOI and *Kiremt* rainfall. For the southern and northeastern regions the correlation was weak (0.3). It is worth to mention that southern regions do not experience rains during *Kiremt* seasons. Thus, low negative SOI links to below normal while high positive SOI corresponds to normal to above normal rainfall (Babu 1999b, 68).

Table 1. Correlation coefficient between rainfall and SOI for Ethiopia for different zones

MONTHS	RAINFALL REGIMES					
	Country	A	a_1	B		C
				b_1	b_2	
JJAS	0.8	0.8	0.3	0.6	0.7	0.3
AM	0.7	0.6	-0.3	0.6	0.5	0.1
MA	0.6	0.4	0.1	0.5	0.3	0.0
MAM	0.5	0.2	-0.1	0.5	0.4	0.1
FMAM	0.4	0.3	-0.1	0.4	0.3	-0.1
FMA	0.2	0.2	-0.1	0.3	0.2	-0.2

Source: Amare Babu 1999b, 69.

As Table 1 shows, a fairly high value of 0.7, the SOI has a predictive value because of the correlation between *Kiremt* rains and the pre-seasonal months of SOI (Babu 1999b, 68). The correlation (-0.2) between *Kiremt* rainfall and SOI decreases as one moves to the southeastern and northeastern parts of Ethiopia. Thus, "pre-seasonal April and May (AM), March and April (MA) and March, April and May (MAM) months mean could be used to issue seasonal weather outlooks for the *Kiremt* seasons as one of the predictors" (*ibid*.). ENSO disturbs the *Kiremt* rain producing system in the tropics and sub-tropics, while "during La Niña episodes, the major features are well defined, strong and well organized, and a good amount of rainfall is experienced" (ibid.).

Impact of ENSO on the *belg* rains

The *belg* rainfall is generally considered variable in quantity and distribution. However, southwestern Ethiopia and some areas in the central highlands receive between 500-700 mm of rainfall during this season. The rest of the country gets a low amount of rainfall. The relation between Pacific SST and *belg* rainfall show a negative association with SOI (Babu 1990). The *belg* rainfall between 1970 and 1988 and its comparison with February to May SOI show that normal to above normal *belg* rainfall exists during negative SOI (*ibid*.). During ENSO years (e.g. 1982, 1987, 1992), the *belg* rains were above normal, while during La Niña years, the *belg producing* regions of Ethiopia received below normal rainfall, as shown in 1991, 1974, 1999 and 2000 (Kassahun 1999, 2000.). The relationship is created because "high negative or positive index" makes the weather system deviate from the norm by pushing or bringing that precipitation.

The NMSA has classified ENSO types by their timing, and the timing of the significant increase in SST. Zang and Wang (1990) state that, "In the first group, the anomaly increases considerably in the period from January to June, in the second during July to December." The NMSA has used this classification to correlate the relationship between El Niño events and 223 rainfall stations for the 1969-1987 period. Based on this analysis, NMSA has reached the following conclusion on the impact of El Niño on Ethiopia (Bekele 1997, 106, Babu 1999b, 70):

- ENSO events are associated with anomalous synoptic patterns during *Kiremt* and *belg* seasons.
- La Niña (negative SSTA) is strongly associated with deficient *belg* rainfall
- El Niño (positive SSTA) is associated with normal or above normal *belg* rainfall
- If the increase in the SST occurs between January-June (i.e. group A), it is always associated with severe Ethiopian drought in *Kiremt*: e.g. the 1972 and 1987 El Niños
- If the increase in SST occurs between July-December (group B), it seems the El Niño has limited effect on the *Kiremt* rainfall: e.g. the 1982-83 El Niño.
- El Niño is not the only cause of drought in Ethiopia.

The NMSA scientists state, "So far basic statistical research indicates that ENSO events influence the rainfall variability over Ethiopia. It seems that there is a possibility to predict seasonal rainfall in Ethiopia if the SST and ENSO events could be forecast in good time. In order to carry out these objectives, however, it is essential to acquire improved ENSO forecasts well in advance" (Babu 1999b, 70).

In response to the FEWS report in early October 1997, the Early Warning department of the DPPC issued a special report on El Niño to show the relevance of El Niño events to Ethiopian rainfall. The report was extracted from the NOAA and other Internet sites. It affirmed that there is a historical association between El Niño and drought in Ethiopia.

El Niño episodes seem to be associated with drought occurrences in Ethiopia. The National Meteorological Services Agency (NMSA) has recognized the association for several years now and El Niño information is included in making seasonal forecasts. As a result, the quality of the forecasts has greatly improved. (DPPC, October 1997)

There is a teleconnection between El Niño events and climate-related hazards in Ethiopia as manifested by the droughts of 1888, 1957, 1965, 1973, 1983-84, 1987, 1993-94. There is a clear association when periods of El Niño from Quinn and Neal (1987) were compared with droughts in Ethiopia, as Table 2 illustrates (Wolde-Georgis 1997).

Table 2. Chronology of El Niño and Climate-Related Disasters in Ethiopia

*El Niño*s	Disaster Years	Types	Affected	Killed	Regions
1953	1953	Drought	NA	NA	Tigray, Wollo
1957-58	1957-58	Drought	NA	NA	Tigray, Wollo
	1965	Drought	150,000	2000	
	1968	Flood	10,000	1	
	1969	Drought	170,000	Unknown	
1972-73	1973-74	Drought	300,000	100,000	Tigray, Wollo
	1976	Flood	50,000	Unknown	
	1978-79	Drought	250,000	157	
1982-83	1983-85	Drought	7,750,000	300,000	Ethiopia
1986-87	1987-88	Drought	330,000	367	Ethiopia
	1989-90	Drought	2,300,000	Unknown	N. Eth., Harer
	1990	Flood	350,000		N. Eth., Harer
1991-92	1991-92	Drought	6,160,000		
1993	1993-94	Drought	6,700,000		Tigray, Wollo
1996	1996	Flood			East Ethiopia
1997	1997-98	Drought Flood			N & E Ethiopia East Ethiopia

Complete models on the impact of El Niño on Ethiopian climate variability are not yet available. The existences of many microclimates due to the mountainous terrain, the lack of meteorological data and trained staff in Ethiopia are most likely some of the reasons for this lag in scientific studies. The NMSA has to develop its studies of the effect of the El Niño event on Ethiopia both by different regions and ecological zones as well as on different scenarios of the emergence of the El Niño event and its monthly effect on various parts of Ethiopia.

<u>Climate Related Anomalies Associated with the 1982-83 El Niño</u>.

There were many climate-related anomalies associated with the 1982-83 El Niño in Ethiopia. In addition to the misguided policy of the military government, it was the El Niño of 1982-83 that led to the devastating Ethiopian drought/famine of 1984-85. Some argue that the Ethiopian drought of 1983-84 was not as intense as the strength of the El Niño (the record SST at that time) (Ward and Yeshannew 1990). The 1984-85 *Kiremt* rains in Ethiopia failed because, "In 1984, a warm event of unusual amplitude affected the eastern tropical Atlantic during the relaxation phrase of the 1982-83 Pacific El Niño" (Bekele 1997, 109). Following the 1984 drought, thousands of people and animals died in Ethiopia due to hunger. Many families were displaced due to voluntary and forced migration, especially from Tigray, which was the center of military confrontation against the military government. One notable example was the mass migration of about 200,000 people from northern Ethiopia to the Sudan who were in search of food, at least until the weather improved (Hailu, et. al. 1994).

Climate-Related Social and Physical Impacts in 1997-98:

The development of El Niño in the Western Pacific and its impact on Ethiopia were clear in mid-1997. The NMSA gave its first forecast on May 29, 1997, and assessed the impact in August. In August 1997, the NMSA announced that El Niño had disrupted rainfall distribution in various parts of Ethiopia during the *Kiremt*. It stated that rainfall was below normal in many parts of the country, including southern Tigray, Northern Shewa and the SPNNS by 60, 30 and 40-50 percent respectively. The cause was El Niño (*Ethiopian Herald* 8/30/1997).

The El Niño led to climate anomalies on the *Kiremt*, *Bega*, and *belg* seasons of 1997-98 in Ethiopia. The 1997-98 Ethiopian rainfall was characterized as deficient and erratic (Babu 1999b, 69). This led to a decline in food production, the outbreak of disease, such as cholera and cerebral malaria, which killed hundreds of people, and displacement of people due to flooding (Babu 1999b, 70).
It was also reported that the temperature was abnormally high in July and August 1997. It was reported that 18 people were bitten by snakes--8 of the individuals fatally. This happened when the snakes were taking refuge in residential areas due to the scorching sun (*Xinua* 9/20/1997).

The 1997 Erratic *Kiremt* (June-September)

The *Kiremt* rains usually begin in the middle of June. In 1997, the rains arrived on time; but as the season progressed, precipitation was "generally low and distribution were uneven," especially in the low altitude areas of the country (DPPC 1997b, 3). The 1997 *Kiremt* was characterized by variability of rainfall in amount and distribution. This was particularly severe in the eastern part of the country (NMSA 1997b). In the first ten days of July, there was a normal commencement of rainfall in the northern and northeastern parts of the country; however, rainfall was reduced in July and August in quantity and distribution (NMSA 1997b, 2). In many other areas, the rains were late by 10 to 15 days, which deviated from the normal and expected pattern.[14] In line with the forecasts of NMSA, the 1997 *Kiremt* rainfall in Ethiopia was "somehow erratic with some areas

[14] The rainy month of July that is very important for the sowing of short maturing crops and for the growth of long maturing crops. Based on 37 years of data, November is the driest month in the Ethiopian central plateau with an average of 1.9 mm. (Arrlee, 1965; Quoted by Abate 1984, 21).

of the country receiving poor rains while others – mainly the western highlands – have received relatively good rainfall during the growing season" (UNDP – 9/1997). There were interruptions of rainfall in July and August, undermining the growth and development of crops during these crucial months. There was also "the early withdrawal of the *Meher* rains, when most crops were at critical stages in their development" (NMSA 1997c, DPPC 1997b, 3).

According to the NMSA almost all parts of Ethiopia had dry spells in the *Kiremt* months of July and August 1997 (NMSA November 1997). Of Ethiopia's 33 zones, 18 reported that the *Kiremt* rains were unusually late, which caused further delay in planting and reduced the number of seed options. Land preparation was affected because "farmers sacrificed the quality of plowing for timeliness of sowing" (FAO/WFP 12/19/1997). In addition, the 15 zones that had a good start of the *Kiremt* rainfall in 1997 were not saved from the anomaly. As the season progressed, rainfall was becoming increasingly erratic "with variable dry spells recorded in August and/or September in most zones" (FAO/WFP 12/19/1997). Although the lowland parts of Ethiopia were more affected by the variability of rainfall than others, even the *dega* and *weina dega* agro-climatic zones were not spared from the impact of the low rainfall record.[15] This led to the premature desiccation of crops (FAO/WFP 12/19/1997). The FAO team that visited Ethiopia in 1997-98 reported that total precipitation from the first decade of January 1997 to the last decade day of September 1997 was 15-50 percent below 1996 rainfall[16] (FAO/WFP 12/19/1997).

The late arrival of the rains and their interruption during the 1997 *Kiremt* led to the late planting or replanting of crops, particularly affecting the planting of long maturing crops (UNDP 9/1997). At the end of September 1997, it was obvious that the normal development of crops would need an unseasonable extension of the rains by 2-4 weeks to save a fall in production (UNDP 9/1997). The wish of many farmers for the unseasonable extension of the rains was realized when the rains were extended until late November, which became too much for the crops to bear normal production.

The heavy rainfall slowed the rate of desiccation of the crops. Furthermore, there was germination of wheat and sorghum and an increase in the rate of spoilage of the crops that were harvested. The possibility of fungal attack on standing and stored cereals also increased (FAO/WFP 12/19/1997). The area planted in the 1997 *Kiremt* season was estimated to have decreased by 9 percent from that of 1996. Shortage of inputs, such as oxen power and seeds, reduced the size of cultivated land in 1997. Farmers without oxen normally rent from others who have finished planting their plots. Farmers without oxen usually miss ideal planting days. Replanting of plots several times following the arrival of rainfall also depleted the seed reserve of farmers. The 1997-98 FAO/WFP Mission noted that there was a noticeable seed shortage and seed price hikes in the northern zones in October and November 1997. Farmers were opportunistically attempting to

---

[15] Those areas that received much below normal rainfall include "most of Tigray and Afar, Western, Northern and Southern and Northeastern Amhara, western and central parts of Benishangul Gumuz, Eastern, Southern and localized areas of Oromiya, the eastern lowlands of Somali and southwestern and central SNNPR and southern Gambela regional states" (NMSA November 1997).

[16] In 1997, the FAO stated that there was 20-50 percent less rainfall than in 1996 at 28 weather stations, and a 15% decline compared to long-term average rainfall at 18 stations. The stations were selected throughout the country

cultivate fast maturing crops, such as barley, *teff* and chickpeas, in order to take advantage of the 1997 unseasonable rains (FAO/WFP 12/19/1997). Chickpeas are usually planted at the end of the rainy season and need less precipitation to mature. Chickpea prices were up by 25-300 percent because of the high demand for seeds (ibid.).

Yields and output in 1997 were disappointing because of drought during the *Kemt* and heavy rainfall during the harvest. Crop output was reduced because of "delayed and reduced cultivation practices, poor rainfall at flowering, seed and grain fill, and early rain stop" that were reported in all regions of Ethiopia (FAO/WFP 12/19/1997). The 1997 heavy rainfall during the harvest season reduced crop yields. There was "physical damage, increased seed drop, vulnerability to fungal attacks, pre-harvest sprouting, delayed harvesting with associated increases in pest attacks, discoloration of grains, increased vulnerability to spoilage in on-field stacks and untimely threshing and storing of moist grains" (FAO/WFP 12/19/1997). In 1997, it was reported that yield-reducing factors other than rainfall were very few.

One of the impacts of rainfall variability is pest infestation. The alternation between dry and wet conditions is conducive for the reproduction of pests and worms that attack crops. In 1997, there were reports of localized pest infestation, such as armyworms, stalk borer and grasshoppers, that attacked sorghum and maize in the lowland areas of Northern Gondar and Western Harerghe.

The 1997 drought had threatened livestock production in the pastoral areas. It is believed that about 10,000 domestic animals might have died in two districts of the Raya in Southern Tigray alone due to drought (UNDP 9/1997). Other localities affected included the lowland *Weredas* of southern Gondar and the vicinity of the Tekeze Valley. In Oromiya there was stress in the lowlands areas in July and August due to erratic rainfall (UNDP 9/1997). The price of cattle fell by 60-70 percent. There were premature migrations and an increase in morbidity and mortality (FAO/WFP 12/1997). Fortunately, abnormal late rains reversed the situation for the animals.

The 1997 unseasonable *bega* floods:

Unseasonable heavy rainfall started in most parts of Ethiopia in October 1997 and continued until the end of November (FAO/WFP 12/19/1997). These months are normally dry, and Ethiopian farmers harvest their crops during this time of year. The areas most affected by flood were normally marginal in terms of rainfall. The floods of 1997 were the worst in 40 years (Reuters, 12/5/1997).

The abnormally heavy rainfall of 1997 during the harvest season destroyed property and killed many people in Ethiopia. The heavy rains of September 1997 in Tigray caused floods and damaged 1,400 hectares of crops owned by 1,971 peasants (*Addis Tribune*, 9/5/1997). In Dollo Odo in eastern Ethiopia, 935 families were homeless and 5,700 cattle were lost to flood. In Melka Suftu, on the border of Kenya, floods displaced 2,500 people (*Addis Tribune* 11/7/1997). Heavy rainfall raised and flooded the banks of the Wabe Shebele and Genale Rivers in the Somali Regional State. The flood killed 38 people, over 9,000 head of livestock, destroyed. In addition, it destroyed 300 houses, displaced 1,300 people homeless and washed out roads (IPS 11/3/1997, UN-DHA, 11/5/1997, ENA 11/13/1997). Somali refugees in eastern Ethiopia were the groups most severely affected by the flood. The flood situation was bad in most countries of the Horn of Africa, including Kenya and Somalia. Table 3 is a conservative summary of the impact of abnormal weather in 1997.

Table 3. Summary of the Consequences of Abnormal Weather in 1997

	Killed	Injured	Damaged Property	Damaged Crop
Flood	171 people 5620 animals	16 persons	512 houses & residential units	805 hectares
Lightning	26 persons 9 oxen	6 persons		
Torrential rain	18 persons 3258 animals	21 persons	151 houses & residential units	131,915 hectare
Land slide	22 persons	24 persons		
Rain failure	800 animals			
Total	237 persons 16,887 animals	67 persons	663 houses & residential units	132,732 hectare

Source: NMSA, Early Warning System Report, November 1997 (unpublished)

In October 1997, Ethiopia introduced nation-wide power rationing to offset water shortages in dams with hydroelectric stations (Reuters, 10/3/1997).

The Ethiopian Electric and Power Corporation (ELPA) stated that the effect of El Niño on Ethiopian weather had reduced the volume of water in the reservoirs at the hydroelectric plants. It announced at the end of August 1997, which is the time the reservoirs usually reach their full supply volume, that water volume at Koka was reduced by 40 percent and at Melka-Wakena by 25 percent of their full capacity. The ELPA announced, in a statement that it had divided the nine Federal States into 11 zones. Each would be without power between 7.00 a.m. and 8.00 p.m. on a rotating basis every 14 days (IPS 8/26/1997).

The 1997-98 El Niño affected the production of coffee, Ethiopia's leading export. During normal weather conditions, Ethiopia's annual coffee production ranges between 200,000 to 250,000 tons. In the 1997-98 season, however, Ethiopia produced only 128,000 tons (Reuters 10/1/ 1997). This made 1997 production 20 percent less than 1996. In September 1997, Mr. Tsegaye Berhanu, manager of Ethiopia's Coffee and Tea Authority said that there would be some damage to Ethiopia's coffee production, but it was too early to assess the damage (Reuters 9/1/1997). He also added "the freak rains were somewhat light over the coffee growing region during October and September." His earlier optimism was dashed when, two months later, he lamented that "Coffee berries ready to be picked from trees have been falling on the ground due to heavy rains accompanied by gale (force) winds prevailing in the area" (Reuters 12/9/1997).

At the beginning of 1998, there were hopes that the abnormally excessive precipitation in the *bega* season would continue to the *belg* season. However, the 1998 *belg* rains were very poor and below average in amount, throughout the southeastern, eastern, central and northern parts of Ethiopia in amount, distribution and duration (DPPC 1998d, 1).

Increase in the Price of Commodities

At the beginning of September 1997, the price of all the major crops was substantially above that of 1996. The price hike ranged from 13 percent for *teff* to 53 percent for maize (FAO/WFP 12/1997). The anomalous weather in 1997-98 impacted the prices of commodities. Average prices of cereals between August-October 1997 were markedly higher than during the similar months in 1996. There were also regional differences in the prices of cereals. *Teff* prices ranged from 173 Birr per quintal in Hossana to 273 in Mekelle; the price of wheat ranged between 149 in Bale Robi to 263 in Mekelle; the price of maize ranged from 112 Birr in Chagni to 173 Birr in Alaba; and the price of sorghum ranged from 103 Birr in Chagni to 225 Birr in Mekelle (Grain Marketing Research Project [GMRP] November 1997).

Table 4. National Average Cereal Prices August-October 1996 and 1997
(In Birr/Quintal)

	1996			1997			% Change
Cereals	Aug	Sept.	Oct.	Aug.	Sept.	Oct.	Oct. 97 / Oct. 96
Mixed *teff*	177.90	174.79	187.81	186.58	187.84	189.18	+13
White barley	118.55	122.42	120.23	155.90	161.21	189.18	+57
White wheat	143.62	147.97	152.52	181.12	183.57	183.01	+20
White sorghum	129.54	133.99	137.64	159.15	161.74	166.91	+21
White maize	78.19	76.81	79.69	123.30	124.17	111.89	+40

Source: Grain Marketing Research Project (GMRP) New Market Information System (MIS) database, November 1997(Quoted by FAO/WFP 12/19/1997).

Impact on Food Production

The El Niño of 1997 damaged food production in Ethiopia by a combination of drought during the *Kiremt* and unseasonably excessive rainfall during the harvest season. As previously stated, total land cultivated, yield amount and total output in 1997 were lower than in 1996.

The total area of land cultivated in 1997-98 was estimated to be about 6.8 million hectares. For example, only 29 percent of farmland in the Oromiya zone of region 3 was planted due to drought (*Addis Zemen Nehase* 1, 1989 E.C[17] or August 10 1997). An aggregated investigation of the damage indicates that *teff* was the most damaged crop in 1997-98 (CSA 1998, 22). The Central Statistical Authority (CSA) data indicates that 49 percent of the land for *teff* was damaged due to too much rain; while 12 percent was damaged due to too little rain. Only 21 percent was reported to be undamaged (ibid.). The yield for this important crop was also reduced by 46 percent due to a shortened period of rain and by 25 percent due to too much rainfall (ibid.). Wheat and barley, which are very important crops on the Ethiopian plateau, were also affected by the unusual weather. Too much rain affected 29 percent and 36 percent of wheat and barley, respectively. This lowered yields by 4 percent for wheat and 1 percent for barley. The undamaged areas for

[17] E.C., Ethiopian Calendar

wheat and barley were 44 percent and 39 percent respectively (ibid. 23). The undamaged area had yields higher than 1996/97 by as much as 15 percent for wheat and 13 percent for barley (ibid. 23-24). Maize and sorghum are important crops in the lowland areas of Ethiopia. The CSA data indicates that 18 percent of maize areas and 21 percent of sorghum areas were damaged due to drought, while 22 percent of maize and 12 percent of sorghum were damaged due to too much rainfall (CSA 1998, 25). Too much rain also damaged 30 percent of other crops (ibid.).

Table 5. Damage Assessment for the 1997-98 Season[18]

CAUSE OF DAMAGE	AREA	%	PRODUCTION '000 QT	%	YIELD	% CHANGE FROM NO DAMAGE
NO DAMAGE	2335.4	34.1	28954.12	39.33	12.40	-
INSECT AND PESTS	237.15	3.46	2179.21	2.19	9.19	-25.88
SHRTAGE OF RAIN	891.32	13.01	8087.49	10.98	9.07	-26.81
TOO MUCH RAIN	2256.56	32.94	22744.84	30.98	10.08	-18.70
OTHER	1129.07	16.48	1166.05	15.84	10.33	-16.70
TOTAL	6849.50	100.0	73626.71	100.0	10.75	-

SOURCE: Central Statistical Authority, 1998, page 22.

The FAO estimated that Ethiopia's grain production in 1997-98 from the main season had declined by 26 percent from the previous year (FAO/GIEWS 12/1997)[19]. The FAO said the main reasons for the food production in 1997 were the erratic rainfall during the main season (i.e. June-September), torrential rains during the harvest season, and reduced fertilizer use by farmers (FAO/WFP 12/1997).

The 1997-98 climate anomaly had a significant impact on the Ethiopian economy, by reducing Ethiopia's GDP growth from 5 percent in 1996/97 to 3 percent in 1997-98 (Thompson el. al., 98). As Table 6 indicates, the output and yield of crops were reduced due to drought and excessive rainfall. Total area for cereals was reduced by 16.25 percent while output was down by more than 24 percent due to erratic weather. Yields were also down by about 10 percent, as Table 6 indicates. The yields of most pulses and other crops also declined due to the 1997-98 El Niño events.

.Table 6. Estimates of 1996/97 and 1997-98 Area, Production and Yield of Major Crops for Private Peasants' Holdings in Ethiopia (Meher Season)

CROP	Total area in (000 HA)	Total Output (000 QT.)	Yield (QT/HA)

[18] The twenty major crops included on the table do not include cash crops, such as coffee and chat fruits, vegetables, enset and other root crops. (CSA 1998, 22).

[19] There was a reduction in fertilizer use due to the removal of subsidies by the government. However, there are those who argue that fertilizer use during erratic rainfall may in fact make the situation worst. Fertilizer is very responsive to adequate and controlled water supply. It can be argued that the non use of fertilizers by some Ethiopian farmers in 1997 may be a blessing in disguise.

	96/97	97/98	% Change	96/97	97/98	% Change	96/97	97/98	% Change
Cereal	6,688.56	5,601.88	-16.25	8,6293.32	6,4987.83	-24.69	12.90	11.60	-10.07
Teff	2,167.77	1,747.19	-19.40	20,019.93	13,073.48	-34.69	9.23	7.48	-18.93
Barley	697.67	681.95	-2.25	7,423.85	7,863.95	5.93	10.64	11.53	8.38
Wheat	772.23	787.72	2.01	10.015.90	11,067.85	10.50	12.97	14.05	8.33
Maize	1,316.87	1,100.61	-16.42	25,320.03	19,288.51	-23.82	19.23	17.53	-8.86
Sorghum	1,399.95	954.74	-31.80	20,073.46	10,697.40	-46.71	14.34	11.20	-21.87
Millet	290.66	289.74	-0.32	2,961.65	2,587.05	-12.65	10.19	8.93	-12.38
Oats									
Pulses	905.35	837.61	-7.48	8026.28	6801.92	-15.25	8.86	8.12	-8.35
Horse Beans	329.31	266.30	-19.13	3,206.76	2,596.67	-19.03	9.74	9.75	0.11
Field Peas	158.11	119.88	-24.18	1,063.03	927.25	-12.77	6.72	7.73	15.10
Haricotbeans	112.81	92.19	-18.28	947.64	548.46	-42.12	8.40	5.95	-29.18
Chick Peas	147.90	169.97	14.92	1,264.61	1,371.33	8.44	8.55	8.07	-5.64
Lentils	52.81	47.09	-10.83	344.87	310.79	-9.88	6.43	6.60	2.64
Vetch	104.41	142.17	36.17	1,199.36	1,047.44	-12.67	11.49	7.37	-35.88
Others	478.45	410.01	-14.30	2132.79	1836.96	-13.87	4.46	4.48	0.45
Neug	250.52	195.22	-22.07	834.54	735.79	-11.83	3.33	3.77	13.18
Linseed	148.17	134.64	-9.13-	676.23	633.46	-6.32	4.56	4.79	3.18
Rapeseed	21.40	15.67	26.78	125.28	86.94	**	**	5.55	**
Groundnuts	17.43	11.02	-36.78	**	77.76	-37.93	7.19	7.06	-1.86
Sunflower	5.17	3.33	-35.59	**	12.57	**	**	3.77	**
Sesame	18.50	23.62	27.68	72.76	98.25	35.02	3.93	4.16	5.84
Fenugreek	17.26	29.71	72.13	100.31	162.19	61.69	5.80	5.46	-5.88
ALL CROPS	8072.36	6849.50	-15.15	96452.39	73,626.71	-23.67	11.95	10.75	-10.05

Source: CSA, 1998

Impact of the 1998 *belg* season:

At the beginning of 1998, the prospects for the *belg* season were expected to be good. The good precipitation at the end of 1997 left some moisture in the soil that led to the early commencement of agricultural activities in some *belg*-producing areas (DPPC, May/June 1998). There was some rainfall at the beginning of the *belg* season. However, the rains abruptly stopped in March and the first half of April 1997 (ibid.) A 1998 report by the NMSA stated that the *belg* rains of 1998 were deficient in the eastern and southeastern parts of Ethiopia. This led to the shortage of fodder and water for the pastoralists who predominantly live in these areas. The rainfall resumed in April and May 1998, but good rainfall that came after April "did not lead to significant improvements in crop conditions in most areas" (DPPC May/June 1998). The dry spells in March and the first week of April 1998 had destroyed the *belg* crops. The good rains across all the *belg* growing areas from the second half of April until May were good for the maturation of those grains already "approaching flowering or grain filling stages" (ibid.). The irregularity of the *belg* rainfall in 1998 "substantially reduced the area planted to the relatively high-yielding but long-cycle crops," such as maize and sorghum for the for the 1998 *Kiremt* season (DPPC 1998d, 1).

Table 7 below is a comparison between 1996-97 and 1997-98 grain production in various regions of Ethiopia. The FAO Mission put the total grain deficit for Ethiopia in 1998 at 530,000 tons with an affected population of over 5 million (Ibid.)

Table 7. Crop Production in Metric Tons by Region for 1996/97 and 1997-98

	1997-98	1996/97
Tigray	522,881	751,036
Amhara	2,828,827	3,635,923
Oromiya	4,113,637	5,835,035
SNNPS	1,179,860	1,440,661
Benishangul	113,830	96,899
Gambella	9,008	11,130
Somali	17,822	27,300
Harar	12,573	16,627
Diredawa	800	6,153
Addis Ababa	6.055	10,245
Total	8,806,283	11,831,009

Source: *Addis Tribune*

At the end of August 1997, Ethiopia estimated that 154,107 Metric Tons (MT) of food was needed to feed an estimated 3.4-5 million people (*Addis Tribune*, 8/10/97 and 8/28/97). The main cause of this food deficit was rainfall variability. The reason given for the intensity of the food shortage was a combined failure of the *belg* and the *Kiremt* rainfall. A joint USAID and EC report also estimated that in the marginal areas of Ethiopia,[20] which are usually drought prone, not more than 50 percent of the normal output would be produced in the 1997-98 harvest (*Addis Tribune*, 10/10/1997).

What is the reliability of those attributions?

Evaluations of the impact of the El Niño at the end of the 1997-98 season confirmed that the climate anomaly that caused the disasters was real. The NMSA compared the rainfall of the 1997 *Kiremt* with 1972, which was the analogue year selected during the forecast. It confirmed that the amount of rainfall was similar with some exceptions, as some areas received less rainfall than the 1972 *Kiremt*. The attributes that can be taken for reduced output are the supply of inputs. The zone governments were providing farmers with seed credits to take advantage of any precipitation. Inputs, such as oxen and seeds, were in short supply because of the abnormal weather that necessitated numerous replanting of the fields because of 1997's erratic rainfall. There was an absence of subsidized fertilizers, but farmers stated that fertilizers are not useful with unpredictable rainfall.

Responses

Were any government reports or statements issued before the impact of the 1997-98 El Niño appeared?

The NMSA regularly collects meteorological information and prepares advisory reports/outlooks regularly at the beginning of each season and produces dekedal flash, monthly and mid-season assessments and outlooks for decision-makers and users (Babu 1999b, 68). NMSA forecasters

[20] The areas that are usually considered marginal agricultural areas are East and West Harerghe, lowlands of Bale, North Wello, Wag Harma and South East Tigray Zones and the Northern highlands of the Somali Region (*Addis Tribune* 10/10/1997).

discuss the developing weather before the information is released to the users. After the discussion within the organization, the NMSA invites the major users of the weather information, such as the Ministry of Agriculture and the DPPC, to add their input before a forecast is issued[21].

The NMSA was following the development of the seas surface temperature in the Pacific Ocean since it heard about the evolving El Niño in March 1997. Monthly reports about the evolution of the El Niño were discussed, evaluated and written in the NMSA's monthly *Climate Bulletin*. The NMSA did not rush to issue its forecast based on initial El Niño reports until the SST on the Pacific Ocean reached a record temperature of +4 in May 1997. On May 29, 1997 (*Ginbot* 19, 1989 E.C), NMSA issued a forecast in the *Climate Bulletin and Seasonal Outlook*, which stated, "the 1997 *Kiremt* rainfall would deviate from the normal in its quantity and quality of distribution because of the El Niño phenomenon" (NMSA 1997b, in *Amharic*). It warned of the negative impacts of the 1997 El Niño on the *Kiremt* rainfall. The DPPC Early Warning Department echoed the NMSA forecast to the various users saying, "The current *Meher* season will be influenced by the El Niño phenomenon, which may result in irregular and deficient *Meher* rains in several areas" (DPPC, June 1997, page 2). It also added the following:

> *"The National Meteorological Services Agency (NMSA) has issued a seasonal forecast for the coming Meher season. The forecast indicates that the current Meher season will be influenced by the El Niño phenomenon, which could result in irregular and deficient rains. The El Niño influence is expected to be strongly felt over Eastern and Southern Tigray, North and South Wello, and North Shewa in Amhara; Central and eastern Oromiya including parts of Arsi and Bale; Harari; Dire Dawa; and border Somali regions"* (DPPC, June 1997, 3).

The early warning later received unprecedented national attention on August 27, 1997. The threat was acknowledged by the Prime Minister's Office by announcing that "rainfall activity in Ethiopia is decreasing under the effect of El Niño" (ENA 8/29/1997; *Addis Zemen*, *Nehase* 23 1989 (EC)*; Ethiopia Herald* 9/2/1997). In their regular quarterly meeting at the end of August 1997, high level officials from the Federal Government and Regional States discussed the possible negative impact of El Niño. During the meeting, the officials discussed the late start of the *Kiremt* rainfall in many parts of Ethiopia and warned that if the rains stopped before the crops matured, it might lead to a food shortage. They also discussed the strengthening of responses at the federal and regional levels, and prepared for emergency responses with the participation of the regional officials in the quarterly meeting. The problem was transmitted to the regions very quickly. Responses to the 1997 El Niño were to be implemented by the various ministries and agencies, including the National Meteorological Services Agency (NMSA), the Ministry of Agriculture (MoA) and the Disaster Prevention and Preparedness Commission (DPPC).

The government agency responsible for the response and evaluation of the threat at the national level was the National Disaster Prevention and Preparedness Committee (NDPPC), which was under the Prime Minister's Office. Following the May 1997 forecast, the NDPPC advised the regional Disaster Prevention and Preparedness Bureaus to design a strategy of response. At the

---

[21] The Office of the Prime Minister, Regional governments, the Ministry of Agriculture, the mass media, the Ministry of Water Resources, the DPPC, UN agencies, NGOs and donors regularly receive the information.

national level, the Ministry of Agriculture, the Ministry of Water Resources, the DPPC and other agencies designed their plans to respond to the erratic weather. The Regional States, which chair the DPPBs, gave direction to the zones and *Wereda*s in their region on reducing the impact of the abnormal weather.

As a member of the NDPPC, the Ministry of Agriculture came up with a strategy to reduce the impact of the 1997-98 El Niño (MoA 1997, handwritten, unpublished). It predicted that there would be a reduction of approximately 40 percent in food production due to the expected early cessation of rainfall during the 1997 *Kiremt*. At the end of June 1997, there was no precipitation to plant the Meher crops. The 1997 *Kiremt* was characterized by the reduced planting of the long maturing crops, such as maize and sorghum, the creation of a conducive environment for pests and worms, and the reduction in the use of fertilizers (MoA 1997).

The 1997 reduction in the use of fertilizers was due to the elimination of subsidy by the government. Farmers were also faced with the limited capacity of replanting their crops due to a shortage of oxen and seeds. The Ministry of Agriculture, in order to reduce the impact, recommended the following actions:

1. The provision of late planting crops, such as chickpeas to farmers (MoA, 1997).
2. Replanting of destroyed crops with other fast maturing crops, such as chickpeas, *teff*, lentils and *guay*.
3. The provision of farmers with seeds until the end of August.
4. Observing the spread of pests and worms and the protection of crops from pests by distributing free anti-pest chemicals to farmers.

It also recommended the irrigation of land by the newly completed micro-dams. As part of the water and soil conservation program, farmers were building various micro-dams before the onset of the drought. The Ministry of Agriculture advised on the construction of canals so that water could flow to the farms. Farmers were to be advised to plant potatoes and sweet potatoes. It also recommended the provision of extension support with a new focus on the environmental emergency. The major focus was to provide drought resilient crops (MoA 1997). The Ministry of Agriculture also introduced a plan to save livestock by converting failed crops into fodder. It recommended the orderly migration of animals from the drought affected areas into areas with better seasonal rainfall, and the purchase of livestock by the government and the provision of fodder. It also planned to strengthen existing ponds and create new ones for human and animal consumption. Finally, it recommended a quick study and the implementation of disaster prevention techniques through the coordination of regional, zonal and district Ministry of Agriculture representatives and other relevant offices.

The various recommendations were to be implemented by the regional states because of the decentralization introduced by the federal form of government. A case study for the implementation of the NDPPC response can be seen by the experience of the Tigray Regional State, the *Mugulat Tabia*, included in this study.

Farmers in Tigray who were interviewed for this research clearly remember the abnormal rainfall of October and November, and how it spoiled their harvest. They said that it was very good for the animals because of the rainfall. They said that they did not get any special advice on the severity of the harvest rain. If they had known that it would rain that much, they would have constructed a platform for their harvested crops, saving them from germination because of the water that seeped through the ground. They were able to save some un-germinated grains for seeds by the separating the top from the bottom during processing. Farmers believe that the Ministry of Agriculture's Development Agents (Das) are usually wrong about their predictions, and some farmers do not take them seriously.

Were any reports issued after the impacts appeared?

The National Meteorological Services Agency reported an evaluation of the 1997-98 *Kiremt* and the Synoptic Forecast for the 1997-98 *bega* season (NMSA 1997b). The report compared the May forecast with the actual course of events and forecast that heavy rainfall would continue in the *bega* season. It also evaluated the various impacts of the weather to agriculture. In the report, it referred to El Niño as the main factor for the anomalous weather of the period.

There were reports from the Regional States about the initial impact of t1997's abnormal weather. In its evaluation of the 1997 *Kiremt* rainfall, the Tigray Regional Early Warning Committee wrote the following that reflects the situation in the various villages:
" Except for the first week of May, there was good rainfall that lasted until the end of July. The last week of July and the first week of August showed a tendency for reduced rainfall. This was in contradiction to the seasonal forecast given to us by NMSA which stated that there would be dry spells in June and July." (*Kunetat Kiramat: Kab Sene-Hamle* 25/89, in Tigrigna, unpaged and unpublished)

The DPPC issued a Special Report on El Niño in October 1997 (DPPC October 1997). The DPPC argued that the 1997-98 abnormal weather conditions were the result of El Niño. It also stated drought in Ethiopia is associated with El Niño events.

The major report after the impact of El Niño was the food aid appeal to donors by the DPPC in August 1997. The appeal did not get the expected response from the donor community. On April 9, 1998, the FAO appealed to the international community to make relief contributions to Ethiopia (Reuters 4/9/ 1998). The DPPC also showed that the 1998 *belg* production was also down following the erratic rainfall and appealed to the international community to help the affected population (DPPC 8/1998).

The concern on the part of donors was most likely because of the euphoria in Ethiopia in response to the bumper harvest of 995-96 and the talks of exporting for the first time in the previous year. During this time, the DPPC had under-estimated the number of beneficiaries in Ethiopia by more than 50 percent. It had revised the 1997 needy people from 1.6 million to 3.4 million people. The DPPC was forced to make three appeals for food aid in 1997. It was an uphill battle to convince donors to provide food aid.

What were the major responses to the event?

There were many responses to the 1997-98 climate-related disasters, such as weather forecasts, agronomy-based agricultural responses, and the mobilization of resources to fill the food gap created by the event.

The NMSA, the Ministry of Agriculture and Regional States responded to the erratic *Kiremt* season by advising farmers on alternative responses as the seasons progressed. As stated earlier, the May 29 1997 forecast was issued to all the regions and relevant ministries. The main advice to farmers was to replant their crops. The problem of seed shortage for replanting when the rains arrived in August 1997 forced many zonal offices to provide farmers with credits to buy fast maturing seeds from the local market (FAO/WFP 12/19, 1997). When the 1997 *Kiremt* season was over, the floods of October and November disrupted the harvest.

The NMSA disseminated information about the weather to users, such as farmers, the government and NGOs. Ethiopian regional states initiated programs to inform farmers about El Niño and its impact (MoA 1997). The government educated the farmers both through the radio and the extension system. The government stated, "that heavy rainfall was to be expected much later than normal in the *Kiremt* season, in spite of the fact that in some areas the rain appeared to have stopped" (Thompson 1998, 98). Farmers were advised to harvest the long maturing crops that were planted during the *belg* season. They were also advised to plant fast maturing crops and to take advantage of the rains.

One of the tasks of the government was to provide short-term weather information to farmers. On November 12, 1997, NMSA urged farmers "to gather their harvest before an untimely rain expected over the various parts of the country" (Xinua 11/12/1997). The forecast stated that an unexpected rain was to hit many parts of the country. With the increase in rainfall during the harvest season, the Ministry of Agriculture advised farmers to harvest the matured grains. It also "appealed to farmers to dig drainage ditches in fields where crops were not yet ripe." It appealed to regional officials to help store any salvaged crops. The government said "unless ripe crop is collected and sheltered, the country's expected grain harvest in 1997, which is expected to be much less than the previous years, could even be much worse" (Reuters 10/24/1997). Popular campaigns were launched to help farmers harvest crops, such as *teff*, wheat and barley (FAO/WFP 12/19/1997).

One of the responses of the Ethiopian government to the expected disaster was to appeal to the international community for relief aid. In August 1997, the DPPC appealed for food aid, but did not receive any prompt response by donors (DPPC August 21, 1997, 2). The Ethiopian government also requested the "early deployment of the Annual FAO/WFP Crop Production and Food Needs Assessment Mission" to Ethiopia in order to respond to the disaster as early as possible (UNDP 9/1997). One of the characteristics of the 1997-98 response was that the donors and the Ethiopian government agreed to create a joint crop assessment team to avoid contradictory reports. It was also aimed at raising the confidence of donors concerning the reports and food aid appeals.

The DPPC and the FAO sent assessors to the grain producing areas to assess the state of food production in the wake of drought and flood in 1997-98. When the floods continued unabated into October and November the government instructed the team members that were assembled from the various ministries to stay in the field for two more weeks so that they might provide accurate information on the impact of the abnormal rains. In the southern part of the country, peasants and mechanized farmers delayed the harvest and waited for the right dry weather.

The results of the harvest assessment of October and November 1997 by the DPPC, USAID, and EC confirmed earlier fears of harvest shortfalls in Ethiopia. On November 29, 1997, Ethiopia again appealed to the donor community for 572,835 MT of food aid for 1998 stating that 4,262,515 people were in need of immediate assistance (*Addis Tribune*, 12/5/1997). This was later adjusted in May1998 to 580,000 MT following the assessments of the pastoral areas and the 1998 *belg* crops, as well as the post-harvest assessment of the 1997 Meher output. The DPPC showed the gravity of the situation by stating that there is no carry-over stock from 1997, and that food had to be distributed in several areas as soon as December 1997 (ibid.). The reason for the high food deficit in Ethiopia in 1997-98 was due to the climate abnormalities.

The major component of the appeals in 1997-98 was for the emergency relief. The food shortage was critical, beginning as early as December 1997, in central and northern Ethiopia. Resource constraints of no carry-over stocks from 1997 and limited government resources compounded this. The 1998 pledge by donors for emergency relief was 352,249 MT, including the outstanding 1997 pledges of 39,000 MT, which was delivered in 1998. Therefore, the gap of required food against the updated requirement was 255,750 MT. The actual delivered amount by donors was 303,987 MT as shown in Table 8.

Table 8. 1998 Food Aid Status (MT)
(As of 10/27/98)

No	Donor	Pledge	Consignee		Delivery Status*		Remarks
			DPPC	NGOs	Delivered	% of total	
1	USA	141,156	125,156	16,000	121,109	86	
2	WFP	60,000	60,000	-	43,685	73	
3	EU	44,350	-	44,350	44,350	100	
	EU	-	-	22,620	22,620	-	1997 pledge
4	Sweden	31,000	31,000	-	31,000	100	
5	UK	18,792	-	18,792	17,892	95	
6	Netherlands	10,000	10,000	-	-	-	
7	Germany	3,718	-	3,718	3,718	100	
8	Norway	1,950	-	1,950	1,950	100	
9	Canada	-	16,380	-	16,380	-	1997 pledge
	Canada	1,000	-	1,000	-	-	
10	Denmark	740	-	740	740	100	
11	Various/Local	543	543		543	100	
Total		313,249	243,079	109,170	264,987 + 39,000	85	
					303,987		

* Delivery includes loans from the Ethiopian Food Security Reserve (EFSR).

Ethiopia succeeded in averting a disaster in the 1997-98 El Niño. The drought and floods of 1997 did not lead to starvation and death due to the timely response of the government. According to Prime Minister Meles Zenawi, the timely response to the crisis by the Ethiopian government avoided the death of people due to famine (*Addis Tribune* 3/13/98). Meles said that the good weather expected for 1998 would be exploited by sending timely inputs, such as seeds and fertilizer, to farmers (ibid.).

The public and official optimism of the 1996-97 record harvest was dashed because of the 1997-98 El Niño. The ability of the National Food Security Reserves Administration's capacity to respond to emergency was also tested to its limits. There was a slow response by the donors to the DPPC's appeals. The initial relaxation by donors might have been because of Ethiopia's 1996-97 success in food production. In March 1997, donors had transferred (borrowed) food from the Ethiopian reserves for their programs in Ethiopia and the neighboring countries. In hindsight, it would have been better for the food to stay in Ethiopia and for the neighboring countries get their food directly from the donors.

The response of the Ethiopian government and farmers saved some crops. Food production in 1997-98 was much lower than in 1996-97. However, it could have been worse considering the double danger of drought and flood in 1997. The Ministry of Agriculture advised farmers for the 1998 *belg* season. In 1997-98, its extension department introduced a package that encouraged farmers to make greater use of the *belg* rainfall. This package was designed to take advantage of the forecast that the *belg* season of the 1998 El Niño year might be above normal. However, the *belg* rainfall was brief and unpredictable, despite the forecast.

The government has also introduced policies that would strengthen the capacity of the vulnerable districts to future drought disasters. According to Mr. Ibrahim Mohammed (5/2000) of the Ministry of Agriculture, the areas that are worst affected by El Niño or La Niña are usually those that are considered drought prone. When there is a perturbation from the normal weather, the impact is felt in these areas very easily. According to a new policy introduced by the FDRE, he stated that the drought prone *Wereda*s are selected as "food security unit *Weredas*" in all regions of the country. The DPPC, the Ministry of Agriculture and others are involved in finding permanent ways of resolving the problem of food security in these areas (*Xinhua*, July 3, 2000). The Ministry of Agriculture is the coordinator, and there is a fund directed for these endeavors. The objective is to prepare these districts for a long-term effective response to droughts.

A Regional Example of Response to the 1997-98 El Niño

The research attempted to investigate the response to the 1997-98 El Niño in one region of Ethiopia[22]. Data collected from the Tigray Region and *Mugulat Tabia* (cluster of villages) indicate

[22] Extensive discussions were held with the Head of the Regional Early Warning Department, his assistant and Head of the Regional Disaster Prevention and Preparedness Bureau Planning and Programming head. Additional data was collected with the village leaders in *Mugulat*. The discussion with farmers focused on the value of

that the 1997-98 El Niño-based forecast about the deficiency of the *Kiremt* rainfall was first passed to them through the May 29 NMSA seasonal forecast (Hadera 2000). The regional Disaster Prevention and Preparedness structure was revived immediately to provide adequate response to the crisis. It is believed that during normal weather conditions, the regional early warning committees were weak, inactive and met irregularly. But when the strong early warning about the possibility of drought was announced by the NMSA, the regional Disaster Prevention and Preparedness Committee, which is headed by the State President, met on July 8 (*Sene* 28 E.C.), two weeks after receiving the NMSA early warning.

The first meeting of the Regional DPPC decided to meet regularly every two weeks to evaluate and follow up the impending disaster. Zonal and district level Disaster Prevention and Preparedness Departments (DPPD) were also instructed to do the same. Information coming from the NDPPC in the capital was to pass down smoothly, and ground level information was to go to the center immediately. The Regional DPPC met and decided to identify the *Wereda*s that were prone to disaster, the size of arable land, and the number of animals and population in the region.

The committee members discussed how to respond to the possible disaster. They decided to identify the rivers in the disaster prone areas and discussed how to use them. The objective of the Regional DPPC was to harvest every drop of water for food production. The "use of every drop of water" was to be realized through the re-direction of floods to the farms. Mr. Yohannes (2000) also stated that deliberate and controlled flooding of farms increased precipitation of the soil, but that this requires follow up to avoid water logging and washing of the top soil.

Preserving cattle, especially in the Raya districts, where most of the regional cattle are located, was one of the responsibilities of the Tigray Regional DPPB. Raya was provided with veterinary services and supported to organize the orderly migration of the cattle to better-endowed areas. The cattle migrated to the Tekeze Valley in the north and to the neighboring Region III (Amhara State) to graze with the consent of the latter. When the rain returned, the animals later returned to their homes. The price of animals declined, and 10,000 animals died in the district of Raya due to the 1997-98 drought.

After the end of the July 8, 1997 (*Sene* 28 E.C.) meeting of the Regional DPPC, including Zone DPPC representatives, who were members, the latter went back to their Zones to convene a meeting that included *Wereda* DPPC members. These members would later inform farmers about the emergency. When the second RDPPC meeting was held on July 25, 1997 (Hamle 15), the ZDPPC representatives came with their reports based on their prior meeting at the zone level. This second meeting evaluated the two-week activities of response to climate variability in the whole region of Tigray.

The RDPPC received all the information from the *Wereda* and Zone Disaster Prevention and Preparedness Committees. It discussed and identified the strengths and weaknesses of the responses. These exercises led to the identification of the most affected *Wereda*s in Tigray. They corrected those identified weaknesses related to water harvesting, such as flooding the farms.

---

information between the government and farmers. The basic question asked was do the agents of government involved in early warning really make any difference ton the agricultural activities of farmers during crisis.

These were corrected in favor of digging ponds around farms and directing the floods to fill them. Some of the waterlogging was later corrected. The region gained lasting experience in terms of drought management and rain harvesting from the response to the 1997-98 El Niño. Currently, water harvesting is part of the package of extension education given to farmers in Tigray.

A *Tabia* is a cluster of three or four villages that is administered by unsalaried elected local officials. At this level, the Ministry of Agriculture's Development Agent (DA) gives agricultural advice. The DAs advise farmers about the weather forecast and the use of fertilizer.

There were some problems in the relationship between the center and the regions that affected response to drought. It was found that NMSA forecasts usually arrive late to the early warning department office. This is still true today. There are no agro-meteorologists to interpret the meteorological data, making it difficult to understand. NMSA sends the weather forecast to the Regional Administration, which then sends the information to the RDPPC. For example, the ten-day flash reports faxed from the NMSA do not arrive at the office of the early warning immediately. The regional early warning department does not even have a fax machine (Hadera 2000). Monthly information from NMSA is sometimes compiled and sent to the Early Warning Department. When asked about this, the NMSA said the information is sent to the regional administration, which then distributes it to the relevant departments. However, the experiences in 1997 show that during real disaster forecasts, the regional administration mobilize its resources and responds immediately.

Reliability of national forecasts and realities in various locations is a problem. Forecasts are generally correct at the national level, but problems of accuracy appear in specific regions. Decadal updates of seasonal forecasts reach the users late.

The *Wereda* is the last tier of government and is very important in gathering information about agricultural activities and weather impacts. However, there are no DPPC and NMSA offices at the *Wereda* level. The chairman of the WDPPC is the head of the *Wereda* economic affairs section. And the secretary is the Ministry of Agriculture representative. The local agronomist, the veterinarian and the various associations, such as, youth, women and indigenous NGOs, are members of the WDPPC.

The representatives of the various line ministries at the *Wereda* level do not consider their activities as members of the early warning committee as important (DPPC, Hadera 2000). The problem lies with the absence of a DPPC branch office at the *Wereda* level. The Ministry of Agriculture is active in post–harvest crop assessment, including assessing and identifying the areas that would face food shortages. However, it usually puts non-farm socioeconomic activities that are important for climate-related disaster response into a secondary position.

A Village Example of the Response the 1997-98 El Niño

In an interview with farmers, we understand that farmers receive various types of advice from the Ministry of Agriculture[23]. The process calls for the DA to come to the *Tabia* and brief the farmers on government policies and programs. The DA also collects information and demands from the farmers, which is then transmitted to the *Wereda* administrator. The agenda of meetings between farmers and the DA usually deal with the supply of agricultural inputs. Meetings are also held to evaluate and program water and soil conservation measures, such as the construction of terraces, ponds, and the distribution of seedlings for afforestation. Village leaders are sometimes required to go to the *Wereda* administration to air their concerns and be briefed about government policies.

During meetings, the DA passes information about the seasonal weather forecast and its impact on farming (Baireu 2000). During the 1997 El Niño, no special meeting was held to advise farmers about the seasonal weather. In 1997, the DA advised the *Mugulat* farmers that the *Kiremt* rainfall would be dry, and that they should not hurry to plant their crops. This information was based on the forecast given by NMSA. None of the village leaders had heard of the word El Niño or its impact.

Thus, the reality of retailing weather information to specific villages can be problematic. During the 1997 El Niño, farmers in the village of *Atebes* ignored the advice of the DA and planted before it rained in accordance with their tradition. However, some villages in the lowlands followed the advice of the DA, which was that the rains would be late. Therefore, they did not plant (Baireu 2000). The rains came, and those who did not plant regretted accepting the advice of the DA on the weather. One of the problems in 1997 was that the DA did not return to the *Tabia* to update farmers on the changing weather situation. When the farmers questioned the DA about his misinformation in the next meeting, he did not have any satisfactory answer. This could undermine the credibility of the early warning system.

The contempt of farmers for the DA was stated by Mr. Hailu who said “the difference between us (farmers) and the DA is that they have finished the 12th grade education and know how to read and write, and we do not. As far as farming is concerned, they do not know anything better than we know. On the contrary, they do not know the type of local weather in the villages or when the rains normally start.” As far as weather information was concerned, he “trusts the national radio weather forecast rather than the information given to the village by the DA. The national radio does not give specific information about rains or clouds. It says it is going to rain in the northwestern or eastern part of the country, and it usually does.”

[23] An important part of the investigation was on the use of El Niño information as an early warning to see how the end users, i.e. the farmers receive and perceive it. The interview was conducted with the leaders of the *Mugulat Tabia* of 2000 households that includes the villages of *Atebes, Zomola, Dinkonia, Bieth-Hawya*, and *Mekodae*. Data was collected from the informants about their experiences of the early warning of the 1997-98 weather anomalies. Ato Hailu Waldegiorgis, the Atebes village administrator, and Aleqa Amare Baireu, Head of the Producers’ Cooperatives for the *Mugulat Tabia*, provided most of the information. Both were well informed about their environment and the relationship between the village and the state. They have also participated in many meetings with the *Wereda* administration. Both understand Amharic and Tigrigna and regularly listen to the radio. However, they do not have access to newspapers. The interviews were held separately.

The above statements show the problems of distributing weather information to local users in Ethiopia. Forecasts at the local level are often wrong, and one could lose credibility in the face of the farmers as happened in 1997 at *Mugulat Tabia*.

The Tigray Regional State worked hard to implement the anti-disaster responses in 1997-98. All early warning committees at the Region, Zone and *Wereda* levels were meeting every two weeks to evaluate the responses. In 1997-98, there was an acute shortage of food, but no one died because of lack of food (Hadera 2000). The unusual heavy rains and floods of October-November were good for the Raya district, which had lost its 1997-98 *belg*, and *Kiremt* harvests. The farmers in Raya opportunistically planted their land and collected some harvests. In January 1998, there were unseasonable crops (such as chickpeas) in various parts of Tigray. These crops were planted to take advantage of the unseasonable rains.

Ethiopia has a good institutional infrastructure conducive to the flow of information. The Early Warning Committees from the *Wereda* to the national level are re-activated and strengthened during disasters. One of the problems identified was the lack of competent personnel and materials at the regional level. For example, the Tigray Regional Early Warning Department has only three employees. They have no agro-meteorologists, no information processor, and no functioning photocopier, limited access to long distance telephones, no Internet connection, and no fax machine. The situation is worse at the Zone and *Wereda* levels where there are no disaster prevention and preparedness officers, as well as inadequate office equipment (Yohannes 2000). Despite all of these constraints, the Regional early warning system has been effective in dealing with disasters.

One of the major problems in the Ethiopian response to weather abnormalities is the absence of meteorological data. The data for the last four decades is small and limited to few urban areas. Although the government plans to put 1000 weather stations in various parts of the country, it has succeeded in setting up only 600. Ethiopia has diverse climatic zones, which makes it imperative to have many weather stations, especially with agricultural activities.

Identify (with citations if possible) the extent of national research (in the last 20 years).

Many climate-related disasters have affected Ethiopia in the last three decades. Diverse research activities were conducted on El Niño and disasters in Ethiopia. As stated in Part C, the NMSA was active in the area of El Niño's impact on Ethiopia. Haile (1987a, 1987b, 1988a, 1988b) [only 1 1988 reference in bibliography.], the former manager of the NMSA of Ethiopia has written extensively on the impact of El Niño on Ethiopian droughts. He believes that ENSO, as well as sea surface temperature anomalies in the Southern Atlantic and Indian Oceans, combined with anthropogenic activities, cause Ethiopian drought. Kassahun Bokretsion (1987, 1999), the current Manager of NMSA, and a long time weather expert, at the same organization has researched the weather systems, forecasts and climate changes in Ethiopia. His research also shows that El Niño events affect climate variability in Ethiopia. Amare Babu (1990, 1999a, 1999b,) [bibliog.] of the NMSA has correlated the Southern Oscillation Index for the different seasons of Ethiopia. He concluded that there is a correlation of .8 between *Kiremt* rainfall and the SOI. Ininda el. al. (1987) have written on the relationship between the characteristics of Ethiopian rainfall and ENSO. The NMSA issued a report on the impact of El Niño on Ethiopian weather. There are other publications by NMSA, such as evaluation reports and annual reports, which deal with the impact of El Niño on Ethiopian weather (NMSA 1990, 1997a, 1997b, 1997c, 1998).

There were also some research activities conducted about the impact of drought on Ethiopia. Wolde Mariam (1984) studied the famines that affected Ethiopia between 1958 and 1977. It is a detailed study of the whole country, and he concludes that the subsistence farmers are vulnerable to famine due to the lack technological change and lack of participation in the decision-making process. MacCan (1987) studied the social history of famine evolution in Northeastern Ethiopia. He argues that population pressures and lack of productivity led to the destitution and eventual famine of the peasantry. Rahmato (1991) researched the survival strategies of peasants and concluded that peasants mobilize their resources and knowledge to cope with climate-related disasters such as drought and famine. Dawit Wolde Giorgis (1987) has written about the problems of relief distribution during the 1985 famine in Ethiopia.

Research on the use of El Niño as an early warning is in its infancy in Ethiopia. Many studies conducted at the NMSA are not usually published in international journals. There have been unpublished research projects in the area of drought response in the DPPC. However, more needs to be done to address the acute nature of the problem.

Is there a national plan to respond to disaster in Ethiopia?

There is a five-year strategic National Disaster Prevention and Preparedness Plan for the 1998-2002 period. It was drafted by the DPPC with the participation of Regional Disaster Prevention and Preparedness Bureaus (DPPBs), who enriched the national plan through their regional plans (DPPC Five Year Plan, 1998). Although the national disaster planning process was developed by accommodating inputs from the draft regional plans, for a detailed and authoritative plan for the regions, reference has to be made to their respective plans (ibid.).

The five-year plan was developed because of the need to link relief and development through long-term planning and coordination of various agencies. Ethiopia's donor partners had also been asking for a multi-year plan. This plan was prepared with the transparent participation of many groups, including the donors, regions, multilateral agencies and NGOs. According to the DPPC, the plan would act as an inspiration and a common framework for all involved in Ethiopian disaster prevention.

This plan discusses the various types of disasters in Ethiopia, the hazards, and the state of vulnerability. It also highlights recent government activities in disaster prevention, preparedness and response. It also analyzes the political, economic and social environment, and the strengths and weaknesses of the various government agencies in implementing disaster prevention and preparedness in Ethiopia. It identifies the core programs, aims, resources, timing and responsible bodies for the implementation of the plan. Finally, it reviews the possible obstacles for the implementation of the core plan and highlights parts of the plan that need the support and cooperation of other agencies.

The Ethiopian government was faced with the climate-related impacts of “the El Niño of the century” in 1997-98. It used all available information to forecast the climate-related impact and raised resources from inside and outside the country. What could have been a millennium disaster was averted, and people did not die due to starvation.

Is El Niño explicitly considered to be a disaster in your country?

El Niño is not explicitly considered a disaster in Ethiopia. The NMSA has been using ENSO information in its seasonal forecasts since 1987. It has also stated that El Niño causes disasters in the country. However, the major disaster policies, such as the 1998 Five Year Plan of the DPPC, do not mention El Niño explicitly as a phenomenon that causes disasters in Ethiopia (DPPC 1998). Although it mentions drought as the major cause of disaster in the country, El Niño is not mentioned as a cause of drought in Ethiopia.

Identify (with citations if possible) any international research about the impacts of El Niño in Ethiopia.

The level of international scientific research and interest on the impact of ENSO on Ethiopia is very low; however, there is some growing international interest concerning the impact of ENSO on Ethiopia. A statistical analysis by Attia and Abulhoda (1992) shows that ENSO episodes are negatively correlated with Nile floods. They concluded that El Niño affects the rainfall in highland Ethiopia, which contributes 85 percent of the water to the Nile River.

Thompson el. al. (1998) wrote a paper titled “Information, Risk and Preparedness: Responses to the 1997 El Niño” and selected the Ethiopian government’s response to the 1997-98 El Niño event. Orlove and Tosteson (1999) selected Ethiopia as a case study in their research on the application of seasonal forecasts based on ENSO.

Forecasting by Analogy

If a perfect forecast had been available as early as October 1996 (knowing what is now known about the actual impact), what could have been done differently? (Do not take into consideration at this time any restrictions on possible actions.)

a. About information flow?

Societies have “the propensity to prepare for the last climate anomaly by which they are affected” (Glantz 1988, 4). Current Ethiopian policy makers have constantly engaged in forecasting by analogy in the area of climate-related impacts to avoid repeating the 1973-74, 1980, 1984-85, 1987 and 1993-94 experiences that reduce food in varying degrees. However, they do it with imperfect information.

One of the problems with weather forecasting in Ethiopia is the lack of timely and reliable information. As mentioned earlier, traditional meteorological information on the various Ethiopian climatic zones is not available. If there were perfect information available about the arrival of El Niño as early October 1996, there would have been more time between the dispatch of information to the users and the actual impact. In the case of Ethiopia, the season that was impacted was the Meher season when plantation of long maturing crops begins as early as April and May. With El Niño information that had about nine months of lead time, the Ethiopian Early Warning System could have had the time to spread the word to the regions and the villages.

The lack of perfect information forces the NMSA to delay its forecast. In 1997, for example, it heard about the El Niño in March, but issued the weather forecast at the end of May 1997. We can even argue that the May forecast does not have much utility for those farmers who plan to plant long maturing crops. Mr. Ibrahim Mohammed, Head of the Extension Department of the Ministry of Agriculture, stated that "the forecast usually comes at the beginning of the sowing season with no time gap to prepare any counter measures to counter the drought." The NMSA sends its forecast at the end of May after the drought has already affected the first or second stage of the planting process.[24] The late arrival of early warning information was also one of the main complaints of the Early Warning Officers in Tigray Region. Thus, there is very little time left for the National Early Warning System to meet, study how to respond, and reach the farmers and herders, who are the main users in Ethiopia.

If we examine the time frame between the 1997 El Niño-based forecast in Ethiopia and the flow of information based on our information from the Tigray Regional State, we find that more than a month had elapsed before the *Wereda* level functionaries held their first meeting. The NMSA forecast was released on May 29, 1997 and, they received the NMSA forecast at the end of June. On July 8 1997 they gathered the entire zone Disaster Prevention and Preparedness Department heads of the region for a briefing. The latter returned to their zones and briefed the *Wereda* Early Warning Committee members that have direct contact with farmers and herders. Thus, it took a minimum of approximately five weeks for the information to flow between the NMSA forecast and the briefing of the Zone Early Warning Committee by the Regions. In Tigray, the Regional Early Warning Committees and the Zone EWC met every two weeks to report about events and to evaluate the response until the impact of the drought was over. These activities were emergency in nature due to the late arrival of the forecast from the NMSA. Perfect information in October 1996 could have given much needed time to study the problem and choose the best alternative responses. The information could have reached the farmers long before the beginning of the planting season so that they could decide what alternate actions to take. Perfect information could have also have also created credibility between the users of information, such as the farmers and the distributors of information, such as the local development agent. The development agent meets with the farmers even when the information he delivers is wrong.

b. About preparing for the forecast impacts?

[24] The long maturing crops in Ethiopia are usually planted starting from April and May, depending on the type of crop and the availability of rainfall.

Lack of access by Ethiopians to water, infrastructure, markets, information and inputs are the most important constraints that are exacerbated during drought. With perfect forecast information many months ahead of time, the society could focus all of its energy and deal with the above problems. It could dig or construct dams in all parts of the country to prepare for the impact. Drought resistant seeds could be identified and collected for later distribution for farmers. There would also be time to pass the information on how to cope with the impact. Farmers would also get advice on where and when to plant their crops. This would reduce their lost energy and seeds that are used for planting and replanting. One of the pieces of advice from the Ministry of Agriculture to farmers in 1997 was to replant crops. This is hardly any support as farmers have been doing this all the time.

As stated earlier, the Ethiopian government advised farmers to adapt to the nature of the weather and reduce losses by planting drought-adaptive crops. It also mobilized and distributed resources. However, time is a very important factor for the successful implementation of both. A forecast with a lead time of more than six months would have given the farmer and the government ample time to communicate and implement their responses. The responses would not have the tone of an emergency. As stated by Mr. Ibrahim of the Ministry of Agriculture, Ethiopian forecasts usually come after the beginning of the planting season even for the fast maturing crops. Table 9 shows the planting and harvesting time of some of the crops in the Tigray region of Ethiopia at the beginning of the *Kiremt* season. Table 9 does not include the long maturing crops, such as maize, sorghum, *sigem hagai*, *taff Ginbot* (May *teff*) etc.

Table 9. Planting and Harvesting Dates

Crop variety	Plant	Harvest
Barley *Tsa'idaa sigem* *Sa-isa'a*	June 25-July 2 July 8-July 15	Sept 11-Oct 10 Sept 11-Oct 10
Wheat *Ashihaan* *Desaalegn* *Tselim sindaay* *Ayiqurtem*	June 8-June 15 July 8-July 22 July 22-Aug 6 Aug 7-Sept 6	Sept 11-Oct 10 Oct 11- Nov 9 Nov 10-Dec 9 Dec 2-Dec 9
Oats *'Ares*	Aug 7-Aug 15	Nov 10-Dec 9
Flax *Intati*	June 8-Aug 6	90 days later
Legumes *Inguayaa*	Sept 1-Sept 7	Nov 1-Nov 10
Chick pea *Shimbraa*	Sept 6-Sept 10	Nov 10-Dec 9

Source: Bauer (1976, 71).

Mr. Ibrahim stated that if "we were to get the El Niño or La Niña information a few months ahead of the beginning of the farming process for that season, we could cope and reduce the drought impact." He also added "anything you do to prepare for drought does not hurt." Some of the actions that can be taken to reduce the impact of drought are creating dams, saving seeds, and buying food. These are actions that are helpful to the society and the country even under normal weather conditions. The worst thing is "to sleep idle saying that there is no drought." Mr. Ibrahim stressed that Ethiopia needs to stop "working in the form of emergency or relief and deal with the drought problem in a planned manner."

Therefore, a longer time frame between forecast and action introduces the idea of planning. With time, people could be encouraged to introduce the diversification of crops. He wants to "shift from annual cereals to other crops, such as vegetables," which are dismally absent in Ethiopia. The opportunities created by the drought should be used to change the culture of the people in order introduce the gardening culture into their activities. Mr. Ibrahim cited the case of the bumper potato harvest in Debre-Berhan, which was not subsequently followed by the farmers because it is not a culture that is interested in eating potatoes.

The Ministry of Agriculture official stated that "access to perfect information with many months of lead time would help us to advise our nomads to convert their cattle into other forms of property, instead of waiting until the drought comes and forces them to sell their livestock cheaply." The extra lead-time could have given the herders time to sell their animals.

One of the problems of imperfect information is the tendency for trial and error. If there were perfect information, the Head of the Tigray Regional State Early Warning Department, Mr. Hadera said, "The region could have done more than what it did in 1997." The canals and water harvesting holes could have been built extensively, and drought resistant seeds could have been selected in advance. He said that it would have also been possible to sell animals before they starved to death.

A perfect forecast for the 1997-98 El Niño, as early as October 1996, could have been an incentive for the government and farmers to spend more resources on the post-harvest lose [losses] (?) of Ethiopian agriculture in 1996, which was a record production-year. In addition, Ethiopia would not have exported some of its 1996-97 surplus food production to the neighboring countries. It would have stockpiled it for the period of food deficit in 1997 and 1998. The 170,000 MT food exports were going on in March 1997, two months earlier than the NMSA forecast of May 29, 1997 (*Addis Zemen* July 4, 1997 or *Sene* 24, 1991 EC). In March 1997, there were two contradictory news items in *Addis Zemen*. One referred to food exports and the other to the possibility of food insecurity in the country. Additional *El Nino* information about the possibility of the failure of the *Kiremt* rainfall would have lent additional information to policy-makers that the food insecurity that might be witnessed would reach disaster proportions. Donors were also depleting the successful Ethiopian Emergency Food Security Reserve in Ethiopia because of loans, for their programs in the neighboring countries as well as Ethiopia, since the beginning of 1997. The Food Security Reserves should not have been opened until the impact of the 1997-98 El Niño was clear. When it was a necessity to get food later in 1997-98, it was depleted and there was very little reserve food for emergency. Donors could have been very careful before they borrowed grains from the Food Reserves. It could have also been possible to buy more food from the surplus producing areas and increase the capacity of the reserves. At this time, food was very cheap because of the record harvest in Ethiopia. Thus, if a perfect weather forecast was available ahead of time, the government could use the information to manage the import and export of food crops, as well as manage land use policies and advise farmers on what, when and where to farm. If there had been perfect information about El Niño and its impact on Ethiopia, the government would not have been in emergency mode to tackle the problem.

Credible and perfect forecasting could also lead farmers to re-organize their annual agricultural activities and household budgets. They could manage their resources by reducing non-mandatory expenditures, such as weddings and feasts in order to save for the expected reduction in food. With this information, farmers could have saved their drought resistant crops, such as chickpeas. The price of such crops rocketed by 300 percent in some areas in 1997. Others could have sold their animals before the prices were depressed and bought food when it was cheap. With accurate information on drought, many farmers would not waste their energy and seeds. Others reported that they could have looked for non-farm activities, such as petty trade or construction, to supplement the expected reduction in output.

What are the realistic obstacles that might have prevented these theoretical actions?

Effective response to drought is related to development. Ethiopia is frequently impacted by climate hazards because its crop and animal production are dependent on rainfall and natural resources. The contribution of irrigated agriculture in Ethiopia to the food system is insignificant. The Ethiopian market is not integrated, and cattle herders in Ethiopia have a mobile wealth that is destroyed by a single drought. Thus, even under normal weather conditions, the people are confronted with widespread poverty. What is absent under normal conditions is the mass famine and death as a result of starvation.

Therefore, the various actions that ought to have been taken to reduce the impact should be seen within the contours of the government’s capacity to finance and develop the various possible actions to counter the impact. Even under normal conditions, the Ethiopian government has been encouraging farmers to get involved in development activities relating to soil and water conservation. This is done through terracing and the construction of micro-dams. Even if financing were available from external sources, there might not be the capacity to implement it in between six and nine months.

An important constraint regarding the implementation of the ideal El Niño forecast is the fact that it will still be difficult to provide accurate information at the local level. Many farmers in Tigray were angry at the forecast that the rains would start late because, in some areas, the rains began as normal. However, some farmers did not use the opportunity because of the advice they received from the government. Thus, unless the relationship of El Niño with the local climate is definitely stated, it would be problematic to give specific warning to farmers about the timing of rains.

Ethiopian governments in the past did not have the institutional capacity or the desire to forecast droughts. In such cases, it is not useful to have perfect information about the future if you are neither interested nor willing to prevent it. In 1973-74, the Monarchy had the resources to respond to the hungry people in northern Ethiopia by providing relief. At this time, there were stocks of grain in the country. But the government did not consider that as its job. In fact, it considered drought and famine as an act of God that was going to happen once in a while. It is alleged that the government knew about the disaster but hid it in order not to tarnish the “image” of the Emperor of Ethiopia.

Government commitment, access to information, and the viability of its institutions, infrastructure and resources are important elements in the success of forecasting by analogy. The information required includes knowledge about previous disasters in the country and the lessons learnt in dealing with them. Availability of effective societal institutions, such as an effective and stable government, manpower, and infrastructure and material resources are some of the important components of effective response. It should be noted that planning for the future based on the unknown is a very difficult task for any government, especially when it requires spending scarce resources.

Current Ethiopian leaders have learned from past experience to cope with future droughts. In 1997, for example, the government at the highest level gave instructions and follow-up meetings to all concerned institutions in order to respond to the imminent disaster. This would minimize or prevent its impact. They learned from the past and avoided those strategies that were not effective. The response to the 1997 drought was effective because the government had been working to build institutions with the objective of preventing disasters. The sole objective of the Disaster Prevention and Preparedness Commission (DPPC) is to provide early warning and organize response to disasters. It has learnt from the disasters of 1972 and 1984-85. It also learned from the floods of 1996 and put in infrastructure to prevent the 1997 anomalous floods. It also learned to apply the various traditional and modern agronomic techniques of farming to reduce the impact of below-normal rainfall.

One of the beliefs of the current Ethiopian policy makers regarding disaster response is the use of local manpower and resources. The preventative responses should be done at the local level so that people can learn for the future. Food should be distributed at the village level to avoid distress at migration relief camps. The expansion of food security reserves is something that evolved from past experiences. The DPPC makes its appeals to the local and international community by telling them that unless they donate in time, the conditions of the past (i.e. 1973-74 and 1984-85) could return again.

Can El Niño considerations be added explicitly to national disaster plans?

The amount of information discovered on the relationship between El Niño and climate variability in Ethiopia needs to be explicitly included into the national disaster plan. As we saw previously, the National Meteorological Services Agency has been issuing weather forecasts based on El Niño information.

However, the extent of awareness on the part of the population about El Niño is very small. As we know, the various disaster management documents, such as the five-year Plan of the DPPC, do not even mention El Niño as a hazard. Such explicit inclusion would have made people aware of the dangers, and they could respond to future disasters accordingly. An explicit consideration can be useful because, when El Niño is on the scene, different organizations in the private and public sectors could plan their responses without waiting for the government. Importers and exporters, hydroelectric distributors and livestock traders could take mitigating actions on their own before the onset of El Niño.

Ethiopia has been a food deficit country even at the end of 1996-97, when there was a record harvest. The causes for this kind of food insecurity include over-population and lack of productivity of the agricultural sector. A timely and credible El Niño-based forecast is important for a government with perennial food insecurity because of the severity of climate-related disaster. It is believed that there was no indication that donors and NGOs were using El Niño information for program planning for the year 1998 (Thompson, et. al. 1998, 99). This probably was due to their continuous involvement in food aid, even outside El Niño years.

Identify the strengths and weaknesses in the way Ethiopia's government system responds to El Niño-related climate anomalies.

Ethiopia has a wide experience in disaster management. It has a network of institutions, such as the NMSA, the DPPC and various disaster prevention and preparedness committees at all levels of government, from the *Wereda* to the Office of the Prime Minister. The DPPC is an established agency that assesses the needs of people impacted by a disaster and mobilizes and distributes relief. The relationship between the government and non-governmental organizations involved in relief and development has been improving from time to time. There is a political will on the part of the government to mitigate drought and floods in the country. Ethiopia has also been able to establish good relations with donors after the replacement of the former Military Government in 1991.

The issuance of forecasts close to the plantation period is a visible weakness of the use of El Niño in Ethiopia. The Ministry of Agriculture, for example, complains that El Niño-based forecasts from the NMSA usually coincide with the period of the cultivation of crops, which makes early response to the impact of the climate anomaly on the crops quite difficult. For example, to those farmers who planned to plant long maturing crops, the early warning on May 29, 1997 was late by one month. As the example of the Tigray National State shows, although the NMSA forecast was released on May 29, the first meeting of the regional Disaster Prevention and Preparedness Committee was on July 8, 1997. We were informed that the Tigray Regional Early Warning Committee met two weeks after the information arrived in the region from the head office in Addis Ababa. In July, the rainy season had already started and the information was hardly a drought early warning (Hadera 2000). The Tigray region tried to do everything possible in spite of the contradictory information they were getting about the weather outlook.

Ethiopia also needs scientific models regarding the relationship between El Niño and Ethiopian weather for various local areas. Ethiopia has a diverse local climate, but it does not have accumulated meteorological information. There is also a lack of trained manpower, especially at the regional level.

The existence of a policy framework for inter-departmental collaboration of the committees is limited at the local level due to a lack of common understanding of the issues (DPPC 1998a, 6).

In its periodic evaluations, the NDPPC has reached the conclusion that some members of the early warning committee consider this task as secondary to their departmental work. This was despite the provision of a clear mandate by the government on the importance of inter-departmental cooperation on early warning and preparedness. The DPPC states that a lack of a skilled and experienced work force at the local level hinders the implementation of policies related to climate-related impacts. There is also lack of research interest outside the DPPC and NMSA. There is no ongoing research at the universities about El Niño. There is also little awareness of El Niño by the media or the public.

Ethiopia is vulnerable to the legacy of decades of civil conflict, land mines, over-population, and lack of agricultural productivity, which can change one season’s abnormal rainfall into a disaster. The number of people affected by drought disaster in Ethiopia is usually in the millions, which makes it difficult for the Ethiopian people and government to respond from its internal resources only.

Recent Events and the Problem of Food Security 1998-2000

Ethiopia has been struggling to reduce the impact of man-made and natural-disasters since the middle of 1998. The war with Eritrea, which started on May 12, 1998, and the continued failure of the *belg* rains since the onset of La Niña in the summer of 1998 had made Ethiopia vulnerable to man-made and natural disasters.

Drought created fodder, food and water shortages in the nomadic areas of the Somali Regional State and killed sheep, goats and camels. In March and April 2000, the situation reached a pre-famine state and the international community intervened again. The Ethiopian government had been requesting donors for relief since 1999 (?) but they were reluctant give new pledges or even repay their loans from the Ethiopian Food Reserve Administration (EFRA). Ethiopia released a report about the status of the food reserve which had fallen to its lowest. The report included a list of the donor countries that borrowed from the food Security Reserve Administration for their projects but failed to return. The donors undermined the original objective of having a strategic food reserve for an emergency response.

The war with Eritrea began on May 12, 1998, over a dispute as to the location of the international boundary between Ethiopia and Eritrea, when Eritrea occupied a few districts in northern Ethiopia that it claimed as its own. The conflict led to the internal displacement of over 350, 000 Ethiopians who became dependent on food aid.

The *belg* rains were absent for the years 1998-2000 inclusive, because of the persisting La Niña that began in July 1998. This reduced food output in the *belg* producing areas and reduced the plantation of long maturing crops for the Meher season. The impact of the absence of precipitation during the last three-*belg* seasons was mainly on the pastoral areas of Ethiopia. These pastoral lands receive their rainfall during the *belg* seasons. The herders in the Ogaden have lost their cattle, camel and goats due to the drought.

The war with Eritrea disrupted Ethiopia’s access to the ports of Massawa and Assab to import its relief and commercial goods. When the war erupted, Eritrea confiscated 70,000 MT of food aid destined for Ethiopia, of which 45, 000 MT was from the USAID (*Washington Times*). There was an increase in the number of needy people because of the displacement of more than 350,000 Ethiopians from the Eritrean occupied zones of Badme, Zalambessa and Burrie in Tigray and Afar regions.

In the last two years, food stocks in the EFRS (Ethiopian Food Security Reserves) were depleted because of the slowness of the donors to repay the grains they had borrowed. There are two possible reasons for the slowness of the donors to repay their loans. First, food production in 1996 and 1998 in Ethiopia was at a record high, creating the impression that Ethiopia did not need external aid. If this was true, Ethiopia’s success in its agricultural production worked against itself. Second, there is the theory that donors might have used food as a political weapon, to push Ethiopia to accept peace proposals that were unfair, in order to stop the war at any cost.

The impact of La Niña that replaced the 1997-98 El Niño in July 1998 has been visible. According to the NMSA, La Niña increases rainfall during the *Kiremt* and decreases the small rains during the *belg*. Thus, the persistent La Niña that started in 1998 had impacted negatively, particularly on the pastoral areas of Ethiopia.

The discussions in this report show that ENSO information has been useful to forecast the *Kiremt* and *belg* rainfalls in Ethiopia. Such forecasts are helpful for an early intervention on the part of the government and donors. The success of the proposed interventions in response to the disasters depends on the preparedness of the country for the impact. There can be an optimal preparedness and response to climate-related disasters if there is sustained economic growth, peace, stability and good governance in the country. The recent events also showed the vulnerability of the society to small social and climate-related perturbations.

Conclusion

Ethiopia is a developing country faced with many socio-economic problems, such as limited access to water supplies, food and education. Lack of access to irrigation and the dependence of Ethiopian agriculture on rainfall have made food security in Ethiopia vulnerable to the variability of the weather. This is despite its potential to irrigate 3.5 million hectares of land. The infrastructure for irrigated agriculture, such as reservoirs, irrigation canals, and the technology, is not available. Such a state of dependency on rainfall for food production has made Ethiopia vulnerable to drought. Moreover, high population growth, environmental degradation, unwise government policies, and lack of peace and stability have increased Ethiopia's vulnerability to disaster.

There have been many climate-related disasters, such as drought, that have often led to famine in Ethiopia. The experience has led to the evolution of an excellent early warning and response mechanism in Ethiopia. The National Meteorological Services Agency (NMSA) provides weather forecasts and the DPPC provides the famine early warning system and assesses the food supply in the country. The DPPC is the secretary of National Disaster Prevention and Preparedness Committee in the Office of the Prime Minister. As an agency that monitors Ethiopian weather, the NMSA is a member of the NDPPC. The coordinated warnings and responses of the NDPPC have helped the country in the prevention of famine disasters in the 1990s. The development of these institutions is also matched by the evolution of various policies, such as the *National Policy for Disaster Prevention and Management*, the *General Guidelines for the Implementation of the National Policies on Disaster Prevention and Management* and the *National Food Security Policy*. These policies were instrumental in setting the some of cornerstones for strengthening disaster preparedness in Ethiopia.

Drought early warning based on El Niño information has been practiced by the Ethiopian National Meteorological Services Agency since 1987. The NMSA received information about the development of El Niño in the Pacific Ocean in March 1997. It issued a forecast for Ethiopia on May 29, 1997 after being convinced that it was the strongest El Niño. It can be concluded that this was a late forecast because of its coincidence with the planting of the *Kiremt* crops. The forecast did not benefit the long maturing crops that are planted at the end of April and May. The Ethiopian early warning system transmitted the information to the Regional, Zone and *Wereda* levels early disaster prevention and preparedness committees with various recommendations.

The NMSA used the analogue method to assess the characteristics of the 1997 El Niño. It reached the conclusion that the 1997-98 El Niño was analogous to that of 1972 in the amount and distribution of rainfall. The drought of 1973-74 had killed 200,000 people in the northern part of Ethiopia. The characteristic of the 1997-98 rainfall was variable rainfall during the *Kiremt* season and anomalous excessive rainfall during the *bega* or harvest season. It destroyed the crops during the growing, flowering and harvesting season. Total production was 25 percent lower than the previous year.

There was a lot of mobilization in terms of replanting of short maturing crops and water harvesting. The DPPC mobilized local and foreign resources for the emergency. Donors were initially reluctant to respond to the DPPC appeal until the beginning of 1998. One of the reasons for the reluctance of donors was probably the existence of record harvest in the previous year and the success of the Emergency Food Security Reserves. The widespread news in 1996-97 that Ethiopia had begun exporting food must have hurt the demand for food aid when crops failed in 1997-98.

One of the problems in the use of the El Niño forecast in Ethiopia was the lack of awareness on the part of the general population about the phenomenon. For example, the role of the media in the dissemination of the El Niño information was not effective during the evolution of the El Niño in 1997-98. There was very little media coverage and analysis about El Niño other than printing news items coming from the various news wires and reports from the Ethiopian government. El Niño coverage began at the end of the season when the impact was being felt and because of heavy government involvement. In the 1997-98 El Niño we can conclude that the Ethiopian media was a follower rather than a leader or educator of the government or the public. The probable reason was lack of understanding of the event by the reporters. In 1997-98 some policy makers were stating that the mass media should be used to educate the farmers. However, many farmers do not have access to newspapers and radios. The radio is an effective medium to transmit information to farmers due to illiteracy, but most of them do not have a radio because of the cost.

Some of the recommendations given by the Ministry of Agriculture, such as the use of existing dams and the construction of canals appear to be good, but they should have been done before the onset of any disaster. In countries such as Ethiopia where farmers depend on unreliable rainfall for food production dams and canals should be constructed as part of the infrastructural development to improve productivity during normal rainfall seasons.

One of the major problems that hinders long term and effective weather forecasting in Ethiopia is the absence of meteorological information in various parts of the country that are accumulated for a long period of time. At present, there are only 600 meteorological stations in Ethiopia. Most of those stations are located in the urban areas. If the researchers were expected to provide accurate El Niño-based forecasts for the diverse climate zones of Ethiopia, they would require meteorological information, such as rainfall, temperature, air pressure etc. for those localities. One of the forecast and response constraints in Ethiopia was lack of trained manpower to interpret the information, especially, in the regional states. Those who work in the regions do not have access to resources, such as transportation, communication, the Internet, computers and office equipment. In general there is a need for the training of meteorologists, especially for the regions.

The various ecological zones of Ethiopia have given rise to the existence of rich species of cereals that require different growing periods based on location. Maize and sorghum are planted at the end of April or in May. There are many varieties of *teff*, which are sown in May, June or July. The same variety of crop might be sown at different dates because of the local climate. Such specific and local seeds and specific ecological zones would require both local knowledge and specific forecasts, which are not available for Ethiopia at this time. Providing weather forecasts to specific local areas might bring a lack of credibility to those involved in providing such information.

At the national level, Ethiopia has to raise the number of researchers in the field of meteorology in general and climate forecast in particular. At present there is no single department of meteorology in any of Ethiopia's five universities. Mechanisms also have to be constructed so that those social and physical scientists outside the DPPC and the NMSA could develop an interest to conduct research on the relationship between El Niño and climate-related impacts in Ethiopia.

The El Niño of 1997-98 showed us the fragility of food security in developing countries, even with a government that is focused on agricultural development. Ethiopia had excellent food production in 1995-96 and 1996-97, but the optimism was dashed with the onset of the first drought. In spite of the existence of a supportive political environment for those involved in disaster prevention in Ethiopia, the struggle was very difficult. At the end of 1997, the Emergency Food Security Reserve was depleted and there was nervousness in the country that famine might revisit the people. Only an intervention by the reluctant donors in early 1998 prevented a killer famine. One of the lessons we learn from this experience is that even though food security reserves are an excellent way of responding to disasters, if they depend on the donors' generosity for refills, they can not be relied upon. Donors can ignore pleas for food to fill the stocks as happened in the case of Ethiopia in 1999 and 2000. It should be noted that there had been a La Niña-inspired drought in the nomadic areas of Ethiopia because of the failure of the *belg* rains for three seasons since 1998. The DPPC had been appealing for relief for these regions for the last three years. However, donors had been reluctant until the last minute. Donors who borrowed grains based on pledges from the stocks failed to return the food until it was becoming too late. Some suspect that one of the reasons for the delay of food aid in 1999 and 2000 was to pressure the Ethiopian government for a peaceful resolution of its conflict with Eritrea. Eritrea had occupied some districts by force in 1998 until it was driven out by force in May 2000.

Long lasting preparedness for climate-related impacts is likely to improve the capacity of the society in food production. The international community should support Ethiopia's efforts to target agricultural development in drought affected areas (*Xinhua* 7/3/2000). The policies of soil and water conservation should be geared to the objective of raising food output by reducing the impact of drought. When you ask farmers what they want to have above everything, it would be access to water. Access to water could enable farmers to have multiple crops in a year. Ethiopia is very rich in water resources. However, farmers' access to irrigation is very limited.

The situation of the 1997-978 case teaches us that El Niño based forecasts are very important for Ethiopia. With credible El Niño information with a longer lead time, the national government can use it to manage the national food supply. It can advise farmers to produce more food instead of cash crops; it can discourage exports and import ahead of time. It can also advise farmers what and when to plant and help reduce losses of resources on seeds during the process of replanting when the rain returns.

We should learn that one of the reasons for the containment of the 1997-98 disaster was because of a positive economic condition in the country, open-mindedness on the part of the government and donor support. We should note that an El Niño-based forecast is important but it also needs a national preparedness for the impending disaster through socioeconomic development in all sectors of the economy, particularly in food production.

Bibliography

Abate, Kefialew, 1984. *Trends and variation of some climate elements at three stations in Addis Ababa*, MA thesis, Dept. of Geography, Addis Ababa University. June.

Attia, B.B., and A.B. Abulhoda, 1992: The ENSO Phenomenon and Its Impact on the Nile's Hydrology. In M.A. Abu-Zeid and A.K. Biswas (Eds.), *Climate Fluctuations and Water Management*. Butterworth Heinemann. 71-79.

Addis Tribune, 'The Little Rains are a Little Late', March 6, 1997.
Addis Tribune, November 7, 1997
Addis Tribune, December 12 1997.
Addis Tribune, October 7, 1997.
Addis Tribune, September 5, 1997.
Addis Tribune, August 15, 1997
Addis Tribune, August 28, 1997.
Addis Tribune, 'Weathering Clouds that Fog the Bright Future' September 5, 1997.
Addis Tribune, October 10, 1997.
Addis Tribune, September 5, 1997
Addis Tribune, December 5, 1997.
Addis Tribune, December 5, 1997.
Addis Tribune. 'Prime Minster Meles Presents six-month Report to Parliament.' March 13, 1998.
Addis Tribune. 'Current Relief Activities in Ethiopia.' August 28, 1998.

Addis Zemen, *Sene* 21, 1989 E.C. July 1?? 1997. Editorial, '*Yezendrom Kiremt ende amna*?' (Will this year's *Kiremt* rainfall be like last year?)

Addis Zemen, *Sene* 24, 1989 E.C. July 4?? 1997. '*Kekimicht 1.7 million quintal ehl lelegashoch bebdr tessettowachewal*' (Food Reserve Loans 170,000 MT of food to donors).

Addis Zemen, Hamle 11, 1989 E.C. July 22 1997. '*Yegorf adega derese, zenabu yiqetilal*' (There was report of flood disaster, rainfall will continue).

Addis Zemen, Hamle 17, 1989 E.C. July 27, 1997. '*Yekirmet'u znab metenegna srcht Yechemral*'. (Improvements in the quantity and distribution of the *Kiremt* rainfall will continue).

Addis Zemen, Hamle 23, 1989 E.C. August 23, 1997. '*Be'Nehasse yeteshale yizenba metenegna sircht yitebeqal*.' (Improved quantity and quality of rainfall is expected in Nehasse) (August/September 1997).

Addis Zemen, *Nehase* 1, 1989 E.C. (August 10, 1997).

Addis Zemen, 23, 1989 E.C.

All Africa Press Service, “ Africa Braces for Severe Drought”, September 29, 1997

Arrlee, Gizaw. 1965. *Weather and Climate at Addis Ababa, Dire Dawa and Jimma*, Addis Ababa.

Attia, B. B, and A. B Abulhoda, 1992: The ENSO Phenomenon and Its Impacts on the Nile’s Hydrology.

Babu, A (1999a), (NMSA). Lecture Notes: *The Main Synoptic Features Affecting Ethiopia During the Different Seasons.* National Meteorological Services. 1st DMC Nairobi Capacity Building Workshop, 11 January to 15 February 1999. Unpublished Lecture Notes.

Babu, A (1999b). (NMSA). Lecture Notes: *The Impact of Pacific Sea Surface Temperature on the Ethiopian Rainfall.* 1st DMC Nairobi Capacity Building Workshop, 11 January to 15 February 1999. Unpublished Lecture Notes.

Bahrens, S., 1971. *The Physical Environment and Its Significance for Economic Development with Special Reference to Ethiopia*. Lund: C.W.K.Gleerup Publishers.

Baireu, Aleka Amare, Head of Producers’ Cooperatives, *Mugulat Tabia*. Personal Interview, Atebes, *Mugulat Tabia,* Tigray Region, Ethiopia. April 29, 2000.

Bauer, Dan F. 1976. *Household and Society in Ethiopia: An Economic and Social Analysis of Tigray Social Principles and Household Organization*. East Lansing: African Studies Center, Michigan State University.

Bekele, Fekadu. 1997. ‘Ethiopian Use of ENSO Information in Its Seasonal Forecasts.’ In *Using Science Against Famine: Food Security, Famine Early Warning and El Niño*, Internet Journal of African Studies, Issue No. 2 – March 1997, Michael H. Glantz, special Volume Editor.

Central Statistical Authority (CSA), 1998. *Agricultural Sample Survey 1997/98* (1990 E. C.). ‘Report on Area and Production for Major Crops (Private Peasant Holdings, Meher Season).’ 189 Statistical Bulletin. Addis Ababa, June.

Degefu, Workineh. 1987. ‘Some aspects of meteorological drought in Ethiopia.’ In Michael H. Glantz (Ed), Drought and Hunger in Africa. Cambridge: Cambridge University Press.

DPPC. 1997. *Assistance Requirement to Address Emergency Food Needs in the* Belg *Producing Areas of The Country*. Addis Ababa, August 21, 1997.

DPPC. 1997. Early Warning Department *Monthly Report*, EW Department June 1997. (11 pages).

DPPC. 1997. Early Warning System Report, November

DPPC. 1997b. Early Warning System Report – Food Supply Prospect 1998, November
DPPC, Early Warning Department, *Special Report on El Niño*. October 1997
.
DPPC. 1998a. *Five Year Plan of the Federal Disaster Prevention & Preparedness Commission: 1998-2002*. DPPC, Addis Ababa.

DPPC Early Warning Department. *Monthly Report*, May/June 1998.

DPPC Early Warning Department. 1998. *Early Warning System Report: 1998 Belg Production and Food Prospects,* August.

DPPC. 1998d. Early Warning System Report: *Food Supply Prospect 1999*. December.
The Ethiopian News Agency, August 29 1997

EG (Ethiopian Government). General Guidelines for the Implementation of the National Policies on Disaster Prevention and Management (NPDMP). Addis Ababa, Ethiopia 1995a.

EG (Ethiopian Government). Proclamation to Establish the Disaster Prevention and Preparation Commission (DPPC. Proclamation No/95. Addis Ababa, Ethiopia 1995b.

The Ethiopian Herald, 'Rainfall failure attached to El-Nino phenomenon' August 30, 1997.

The Ethiopian Herald, September 2, 1997

The Ethiopian Herald, September 21 1997.

The Ethiopian Herald, 'Agriculture Experts give tips to counter El Niño.' December 2, 1977.

Ethiopian News Agency (ENA), November 6, 1997.

ENA, August 29, 1997.
ENA, November 13, 1997.

FAO/GIEWS Special Report on Ethiopia. *FAO/WFP Crop and Food Supply Assessment Mission to Ethiopia*. 19 December 1997.

Glantz, M.H.1996. *Currents of Change: El Niño's Impact on Climate and Society*. Cambridge: Cambridge University Press.

Glantz, Michael H., 1988l Introduction. In, Michael H. Glantz, ed. *Societal Responses to Regional Climate Change: Forecasting by Analogy*. Boulder: Westview Press, 1-7.

Glantz, Michael H. *Evaluation of USAID/Ethiopia Drought Assistance Program: Early Warning Component 1987-88*. Environmental and Societal Impacts Group, National Center for Atmospheric Research, Boulder, Colorado.

Gonfa, L., 1996: *Climate Classifications of Ethiopia*. Meteorological Research Reports Series, No.3, May. Addis Ababa, Ethiopia, National Meteorological Services Agency.

Grain Market Research Project (GMRP). *New Market Information System (MIS) database*, November 1997.

Hadera, Gebre-Sellassie. 2000. Head, Department of Early Warning, Disaster Prevention and Preparedness Bureau, Tigray Regional State. *Personal Interview*, Mekelle, Tigray, April 2000.

Haile, T., 1986. *Climate Variability and Surface Feedback Mechanism in Relation to the Sahelo-Ethiopian Droughts.* Dissertation submitted in partial fulfillment of M.S. degree in Meteorology, Department of Meteorology, University of Reading, Reading, UK.

Haile, T. 1987a. 'A Case Study of Seasonal Forecast in Ethiopia.' WMO Regional Association I (Africa). Seminar on Modern Weather Forecasting, Part II. Addis Ababa, Ethiopia. 30 November –4 December 1987, Geneva, Switzerland. Pages 53-65.

Haile, T. 1987b. 'Climate Variability in Ethiopia.' Proceedings of the First Technical Conference on Meteorological Conference on Meteorological Research in Eastern African and Southern Africa. Nairobi, Kenya. 6-9 January 1987, Technical Conference Number 1/87. Pages 117-120.

Haile, T. 1988. 'Causes and characteristics of drought in Ethiopia.' *Ethiopian Journal of Agricultural Science*, 10, 85-97.

Hailu, T, T. Wolde-Georgis Peter Van Arsdale. 1994. 'Resource Depletion, Famine and Refugees in Tigray', In Editors, Howard Adelman and John Sorenson. *African Refugees: Development Aid and Repatriation*. Boulder: Westview Press. Pages, 21-41.

Hailu, Waldegiorgis. Atebes Village Administrator. *Personal Interview,* Atebes, Mugulat Tabia, Tigray Region, Ethiopia. April 20, 2000.

Ininda, J. B. Desalegn and A. Befekadu, The Characteristics of Rainfall in Ethiopia and its relationship to El Niño-Southern Oscillation." *Proceedings of the First Technical Conference on Meteorological Research in Eastern and Southern Africa*, Nairobi, Kenya, January 1987. In Kenyan Meteorological Department, Number 1, 1987, Pages 133-135.

IPS (Inter Press Service). 'Ethiopia - Food: Famine Returns, three Million Need Aid', 26-Aug-97.

IPS, 'Africa - Food: Famine Belt Stretches from Sudan to Rwanda', October 1, 1997.

IPS, 'Environment: Chaos in Northeast Africa Following….', November 3, 1997. [The story was picked by the November 3, 1997 issue of *The Christian Science Monitor*].

IRIN (Integrated Regional Information Network, United Nations Office for the Coordination of Humanitarian Affairs. 'Ethiopia: Raging Fires wiping out wildlife, property.' March 8, 2000.

Jackson, I. J. 1979. *Climate, Water and Agriculture in the Tropics*. London and New York: Longman Groups Ltd.

Jamieson, Dale. 'Grappling for the Glimpse of the Future.' In, Michael H. Glantz, ed., *Societal Responses to Regional Climate Change: Forecasting by Analogy*. Boulder: Westview Press, 1988. Pages 73-93.

Kassahun, Bokretsion. 1987. Weather Systems Over Ethiopia. Proceedings of the First Technical Conference on Meteorological Research in Eastern and Southern Africa – Nairobi, Kenya. 6-9 January 1987. Pages 53-57.

Kassahun, Bokretsion. 1999. *Ye'ayer Mezabat'na tinbi'ya k'Itiopia Antsar* (Climate Change and Forecast in Ethiopia, in *Amharic*). Paper Presented at a Meeting organized by the DPPC on *Nehase* 1991 (Ethiopian Calendar), titled *Ye'ayer Mezabat, Dirk'na ye'adega mekelakel b'Itiopia.* A discussion organized by the DPPC on Climate Change, Drought and Disaster Prevention in Ethiopia, Addis Ababa, Ethiopia, August 1999.

Kassahun, Bokretsion, Manager, National Meteorological Services Agency. *Personal Interview.* National Meteorological Services Agency. Addis Ababa, Ethiopia, May 11, 2000.

MacCan.1987. *From Poverty to Famine in Northeast Ethiopia: A Rural History*, 1900-1935. Philadelphia: University of Philadelphia Press.

Ministry of Agriculture, 1997 (1989 E.C. Hand Written, in *Amharic*).'The Impact of Meher Rainfall until the first dekedal of August and its impact on Agricultural Activities' (*Y'1989 Amete Mi'hret Meher zi'nab aje'ma'mer'na eske Hamle 30 qen 1989 ye'neberew hidet be'ersha sira enqis'qasie la'y yasketelew tets'eno/likesetu yemias'chlu chigroch*.)

Mohammed, Ibrahim, 2000. Head, Department of Extension, Ministry of Agriculture, *Personal Interview*, in Addis Ababa, May 8, 2000.

NMSA. (National Meteorological Services Agency), 1987. *The Impact of El Niño on Ethiopian Weather*. Report. Addis Ababa: NMSA.

NMSA, 1989. *Beginbot* 9, *sleweqt yekremt azmamya yetesetew tinbit yezet* (in Amharit).

NMSA, 1996: *Climatic & Agroclimatic Resources of Ethiopia*. Meteorological Research Report Series, **1**:1, January. Addis Ababa, Ethiopia.

NMSA,1998. *Annual Climate Bulletin*. Addis Ababa, Ethiopia.

NMSA (Long-range Forecast Group), 1990. *Seasonal Weather Outlook of* Kiremt. NMSA mimeograph. Addis Ababa, Ethiopia: NMSA.

NMSA. 1997a. *Annual Climate Bulletin*. Addis Ababa, Ethiopia.

NMSA, 1997b. *Evaluation of the 1997 Kiremt rainfall and Synoptic Forecast of the 1997/98* bega *season climate outlook*. Unpublished, undated in Amharic, *ende auropawyan aqotater y'1997 ye'kiremt weqt ye'ayer huneta gimgemana ye'1997/98 ye'bega weqt ye'ayer huneta azmamya*. Addis Ababa, Ethiopia.

NMSA. 1997c. *The May 1997* Kiremt *Season Synoptic Forecast*. Unpublished Report in *Amharic*. Addis Ababa, Ethiopia.

The New York Times, 'Coffee Hits a 3-Month High And El Niño Gets the Blame', September 4, 1997.

Nicholls, N., 1993: 'What are the potential contributions of El Niño - Southern Oscillation Research to Early Warning of Potential Acute Food-deficit Situations?' in M. H. Glantz (Ed.), *Workshop on Usable Science: Food Security, Early Warning and El Niño*, 25-28 October, Budapest, Hungary, Boulder: National Center for Atmospheric Research, 169-177.

Orlove, Benjamin S and Joshua L. Tosteson. 1999. 'The Application of Seasonal To International Climate Forecasts Based on El Niño-Southern Oscillation (ENSO) Events: Lessons from Australia, Brazil, Ethiopia, Peru, and Zimbabwe.' Berkeley Workshop on Environmental Politics Working Papers. WP 99-3.

PANA (Pan African News Agency), Distributed Via Africa News Online, *www. Africanews.org*.

Quinn, W. H. and V. T. Neal, 1987: 'El Niño Occurrences Over the Past Four and Half Centuries.' *Journal of Physical Research*, **92**:C13, December 15, 14,449-14,461.

Rahmato, Desalegn. 1991. *Famine and Survival Strategies: A Case Study from Northeast Ethiopia.* Uppsala: Scandinavian Institute of African Studies.

Reuters, 'Ethiopia says coffee to be affected by El Niño.' October 1, 1997.

Reuters, 'Drought in Ethiopia introduces power rationing', October 3, 1997.

Reuters, ‘Ethiopia urges action to save crops from rains’, October 24, 1997.

Reuters, ‘Floods hit Somalia, Kenya and Ethiopia, WFP says’, November 4, 1997.

Thompson, A., Jenden, P., and Clay, E. 1998. ‘Information, Risk and Preparedness: Responses to the 1997 El Niño event’, Annex 4, Ethiopia. Research report: Department for International Development, ESCOR No. AG1215. London: SOS Sahel.

Teshome, E. Department of Early Warning, Disaster Preparedness and Prevention Commission (DPPC). 1997, 2000. Personal Interviews, Addis Ababa, Ethiopia, January 17 and May 10.

Tigray Regional State, Disaster Prevention and Preparedness Bureau, Department of Early Warning, August 1997. *Kiramat Kunetat: Kab Sene 1-Hamle 25, 19989* E.C. (The Situation of the *Kiremt*, June/July-July- August 1997.) Unpublished Report In Tigrigna.

Transitional Government of Ethiopia (TGE). 1993. *National Policy on Disaster Prevention and Management*. Addis Ababa, Ethiopia, October.

UN-DHA. Floods in Ethiopia. *Situation Report*, No. 1, 5 November 1997.

United Nations Development Program (UNDP). ‘Emergency Report for Ethiopia.’ *Monthly Situation Report for Ethiopia*: September 1997.

UN Integrated Regional Information Network (UN IRIN), November 25, 1997.

Ward, M., and A. Yeshannew. 1990. *Worldwide Sea surface temperature and* Kiremt *rains in Ethiopia*. NMSA unpublished mimeo, Addis Ababa, Ethiopia.

Washington Times, ‘Eritrean theft bars U.S. aid’, January 25, 2000.

Wolde Giorgis. Dawit. 1987. ‘Drought Crisis Management, the Case of Ethiopia.’ In, Donald A. Wilhite and William E. Easterling with Deborah A. Wood, editors, *Planning for Drough*t, Boulder, Westview Press. Pages 519-523.

Wolde Mariam, Mesfin, 1984. *Rural Vulnerability to Famine in Ethiopia, 1958-1977*. Delhi: Vikas Publishing House.

Wolde-Georgis, Tsegay. 1997. ‘El Niño and Drought Early Warning in Ethiopia.’ In *Using Science Against Famine: Food Security, Famine Early Warning and El Niño*, Internet Journal for African Studies, Issue No. 2 – April 1997, Michael H. Glantz, special Volume Editor. *(http://www.brad.ac.uk/research/ijas/ijasno2/ijasno2.html).*

Xinhua, ‘Eight People Died of Snakes Bites in Southern Ethiopia.’ September 20, 1997.

Xinhua, ‘Farmers urged to gather in harvest before untimely rains’, November 12, 1997.

Yohannes, Asfaw. 2000. Deputy Head, Early Warning System, Disaster Prevention and Preparedness Bureau, *Personal Interview*, Mekelle, Tigray Regional State, April 2000.

Zang Hengfan and Wang Sgaowu. 1990. ‘El Niño and anti-El Niño events in 1854-1987’. *Acta Oceanologica Sinica*, 9(3), 353-362.

Tables and Figures

Appendix II

Organizations that receive long and medium range forecasts from the NMSA

1. Office of the Prime Minister
2. Ministry of Water Resources
3. DPPC
4. PM Office in charge of Investment
5. Environmental Protection Agency
6. Ethiopian Press Agency
7. Radio Ethiopia
8. Ethiopian Television
9. Ethiopian News Agency
10. Walta Information Center
11. Ministry of Water Resources Engineering Department
12. Ministry of Agriculture
13. Ethiopian Air Force Headquarter
14. Office of the Prime Minister, Regional States Department
15. Addis Ababa City Administration
16. Oromiya Regional State Council
17. Amara National Regional State Council
18. SNNP National Regional State Council
19. Tigray National Regional State Council
20. Benishangul Gomuz Regional State Council
21. Hareri National Regional State Council
22. Dire Dawa Administration Council
23. Afar National Regional State Council
24. Somali National Regional State Council
25. Gambella National Regional State Council

Source: Bokretsion Kassahun, 1999

Acronyms

COMESA	Common Market for Eastern and Southern Africa
CSA	Central Statistical Authority
DA	Development Agent
DPPC	Disaster Prevention and Preparedness Commission
EC	Ethiopian Calendar
EWC	Early Warning Committee
EFRA	Emergency Food Security Administration
EG	Ethiopian Government
ELPA	Ethiopian Light and Power Authority
ENA	Ethiopian News Agency
ENSO	El Nino and Southern Oscillation
FAO	Food and Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
GDP	Gross Domestic Product
GMRP	Grain Marketing Research Project
ITCZ	Inter-Tropical Convergence Zone
MoA	Ministry of Agriculture
MT	Metric Tones
NCEW	National Committee for Early Warning
NCPC	National Climate Prediction Center
NDPPF	National Disaster Prevention and Preparedness Fund
NDPPC	National Disaster Prevention and Preparedness Committee
NMSA	National Meteorological Services Agency
NPDPM	National Policy for Disaster Prevention and Management
RDPPB	Regional Disaster Prevention and Preparedness Bureau
RDPPC	Regional Disaster Prevention and Preparedness Committee
RRC	Relief and Rehabilitation Commission
SOI	Southern Oscillation Index
SPNNS	Southern Peoples, Nations and Nationalities State
UN-DHA	United Nations Department of Humanitarian Affairs
UNDP	United Nations Development Program
WDPPC	Wereda Disaster Prevention and Preparedness Committee
WFP	World Food Program
WMO	World Meteorological Organization
ZDPPC	Zone Disaster Prevention and Preparedness Committee
ZDPPD	Zone Disaster Prevention and Preparedness Department