3.2.6 LEAP

Introduction

Scope of prototype

LEAP is an integrated food security early warning system, owned by the Government of Ethiopia's Disaster Risk Management and Food Security Sector (DRMFSS) and supported by the United Nations World Food Programme (WFP). LEAP uses precipitation monitoring data to estimate the number of people in need of food assistance due to drought. By providing early and objective estimates of the expected magnitude of needs, LEAP helps increase both the speed and transparency with which a humanitarian response can be triggered. Currently, LEAP uses monitoring data to calculate needs at the end of the season. The aim of the prototype is to integrate seasonal precipitation forecasts into the calculations, which will enable the model to provide earlier and more accurate projections of beneficiary numbers.

Scope of vulnerability analysis

The vulnerability assessment will be focusing on the physical dimension of food security which is the climate impact on crop yield. Other factors (e.g. political, social, and economic) are as much relevant as seasonal crop yield and may be influenced by climate as well but won't be considered in this analysis.

System of concern

The Ethiopian Government's Productive Safety Net Program (PSNP) was launched in 2005 and represented a pivotal departure from the cycle of annual emergency food aid appeals in Ethiopia. Following the drought of 2002/2003, the Government of Ethiopia formed the New Coalition for Food Security to identify key actions to break the cycle of emergency appeals—which saved lives but did little to protect household assets—and comprehensively address food insecurity in Ethiopia. This process resulted in the creation of the Food Security Program (FSP). Launched in 2003, the FSP was funded by the Government of Ethiopia (GoE) and Development Partners and implemented, mostly through government structures, in Amhara, Oromiya, Tigray and Southern Nations, Nationalities and Peoples Region (SNNP), with Harari and Dire Dawa added in 2005.

The PSNP is one component of the FSP and provides food and/or cash transfers to food insecure households in chronically food insecure woredas (districts) in exchange for labor-intensive public works, while households which are not able to contribute in labour (due to old age/health reasons) receive unconditional "direct support" transfers. The public works component, which covers approximately 80% of program participants, focuses on the implementation of soil and water conservation measures and the development of community assets such as roads, water infrastructure, schools, and clinics. The PSNP has gone through 3 different phases and in 2015 the PSNP 4 has been launched. This phase will cover all regions in the country except Gambella and Benishangul Gumuz.

Critical situation

Within the last 10 years Ethiopia has achieved a substantial decrease in poverty and food insecurity levels. Nonetheless, poverty and food insecurity remain a big concern. Almost a third of the population is considered to be below the poverty line and unable to afford the minimum caloric intake to sustain healthy living conditions. Chronic malnutrition affects children disproportionally: 44% of all those under 5 years of age are stunted and 10% are affected by acute malnutrition (ECSA WFP).

Food security is highly sensitive to climate conditions in Ethiopia, since the agricultural system is predominantly rain-fed –only 1% of agricultural land is irrigated (Zekaria, Yigezu et al. 2014). Climate events in the years 2008/2009 and 2011 highlighted the impact of extreme weather events, especially droughts, on food security, affecting food production, access to markets and livelihoods. Reduced food production due to dry years has impact on food access: less food available forces households to consume more of their own food instead of selling it to the market; and prices going up force households to spend more of their income on food. Besides, climate-related hazards such as floods, limit physical access to markets. This has further impact on the livelihoods especially for the poorest that have to reduce quantity and quality of meals and have to rely on selling livestock or labour migration (WFP 2014).

Food insecurity in Ethiopia is highly seasonal and is directly linked to rainfall patterns. All rural livelihood systems like crop cultivation (89% of population), pastoralism (6%) and agro-pastoralism (5%) are vulnerable to climate variability and associated hazards. All types of livelihoods are closely linked to seasonal cycles of rainfall: the dominant rain seasons are Belg (February-May) and Meher (June-October). In general low rainfall events in 2000-2002, 2008, 2009 and 2011 can be associated with less land being cultivated. The rainy seasons have different relevance for different regions and cultivation type. Crop-cycles are regionally adapted and span across one or both rainy seasons. The most critical period in terms of hunger is represented by the pre-harvest months, at the end of the rainy season, and immediately after that, in case of a bad harvest (WFP 2014).

Hazard: The link between rainfall trends and crop production during different seasons is significant in Ehtiopia for both Belg-rains and Meher-rains. The correlation is strongly crop dependent: teff and wheat are very sensitive and maize and sorghum are more drought-tolerant (WFP 2014). However, the link between crop production and changes in food security is less obvious. A threshold of crop production (crop yield) to cause a shock event regarding food security (i.e. equivalent number of households requiring food assistance) is difficult to determine. This is probably also because the ‘normal situation’ in Ethiopia is already ‘shocking’: 28% of the Ethiopian households live permanently below the food poverty line and 40% of the households have food energy deficiency resulting in a number of around 8.3 million people require chronic food assistance. This comes along with the per capita production of grain which is just above the minimum consumption threshold level of 0.218 mt/person/annum required to cover the basic food requirements of 2100 kilocalories/day (Zekaria, Yigezu et al. 2014).

Consequently, the threshold between ‘normal’ and ‘exceptional’ with respect to food security cannot be determined due to ‘healthy conditions’ and ‘unhealthy conditions’ but due to the degree of capacity utilization of the food assistance system. This constitutes a very vulnerable situation with a high sensitivity to even low variabilities in crop production and thus precipitation variability amplified by subsequent impacts like food prices and market access.

Decision-making process: The implementation of the PSNP occurs almost entirely by national government systems, operating at the regional and local level of administration. The responsibility for the program management lies on the Ministry of Agriculture, with the DRMFSS being tasked with the overall program coordination. Within the DRMFSS, the Food Security Coordination Directorate (FSCD) organizes the day-to-day management and coordination of the PSNP using early warning information from the Early Warning Response Directorate (EWRD). These federal arrangements are replicated within the eight regions covered by PSNP, which comprise 319 woredas (World_Bank 2013). There are several processes and a number of actors involved to the current process of food assistance:

Need estimation: The multi-agency assessment team determines the needs every six months following the two main rain seasons *Belg/Gu/Sugume* and *Meher*. The findings of the team are then endorsed by the regional and federal government, and finally the annual Humanitarian Requirement Document (HRD) is developed.

After the need assessment it takes around six weeks in average to organize and execute the food distribution. The main steps, actors and time scales are noted:

Food allocation: Based on the HRD document, the *federal DRMFSS* prepare *monthly* food allocation for each woreda. Initially prioritization committee meeting conducted within the *first week of the month*. Food allocation conducted in the *second week* of the month based on the decision of the prioritization committee.

Food Dispatch: Dispatch of food to final distribution points/woredas is conducted in three ways. In all areas of the country except for Somali, the government and *NGOs/JEOP*[1] deliver the food to final distribution points found in government managed woredas and JEOP supported woredas respectively. In Somali region, food is transported to woredas/final distribution points by *WFP*. It takes on average *two weeks* to transport the food to final distribution point.

Food Distribution: Distribution of food from the final distribution point to clients is conducted by the *government institutions* at woreda level together with community representatives. It takes around a *week* to complete food distribution to clients.

The estimated maximum annual program caseload of the PSNP is 10 million clients, consisting of 8.3 million chronic food insecure clients and the capacity to support an additional 1.7 million transitory clients if need exists. The determination of absolute and especially transitory food assistance needs are currently supported by LEAP through meteorological real-time data (met-stations and satellite data) and agricultural data (observation of crop development; calculation of the Crop Water Requirement Satisfaction Index) to estimate the outcome of the current rainy season and the potential yield. Currently, real forecasts are only used on a temporal scale of 10 days with a focus on the agricultural sector and for the highlands. Furthermore, seasonal climate forecast are not routinely used yet and decision-making processes are therefore not yet aligned to the information potential of seasonal forecasts. Informational outputs of a seasonal forecast within the prevailing decision-making system of LEAP could help to identify bad rainy seasons with additional time to prepare food assistance activities. However, robust seasonal forecasts could also enable to initiate mitigating and preventive coping strategies (e.g. distribution/application of

[1]JEOP/Joint Emergency Operation Programme

drought resistance crops, destocking programs in pastoralist areas etc.) instead of or in addition to reactive and compensating measures. Thus, no lead-times for specific decision-making options can be determined at present. Minimum lead times are set to one month but in general the more time available the better (WFP 2014 pers. com. L. Bosi).

Critical situation:

Critical situations arise when there is a significantly reduced crop production which implies a need of food assistance for more than 8.3 million households. The situation becomes seriously critical when the number of indigent households impends to exceed 10 million.

Buffer system characteristics

Considering the physical system the climate signal is buffered by the terrestrial system. The topographical conditions and the interlinked soil system store water and determine water availability and its sensitivity to evapotranspiration and percolation. The better water holding capacity of clay soils for example helps to cope insufficient rainfall during flowering stage of maize compared to maize growing on sandy soils. The water storage characteristics of the ground can thus reduce sensitivity to dry spells (Barron, Rockström et al. 2003). The crop system accumulates water during the entire growth cycle. However, the storage function of the crop system is restricted by the need of a continuous input of water to assure photosynthesis and nutrient uptake (Porporato, Laio et al. 2001). Crops are especially sensitive to water availability at the stage of flowering and grain filling (Barron, Rockström et al. 2003, Arayaa, Keesstrab et al. 2010). In general, the movement of water within the plant-soil-atmosphere system is controlled by gradients of water potential. The water storage within the soil-plant system is very dynamic and mediates the local interaction of fluctuating water supply (rainfall) and demand (potential evapotranspiration) (Milly 1994, Porporato, Laio et al. 2001). The temporal scale for the storage factor of the soil, or the approximate period over which soil water storage can supply plants without experiencing significant stress, can be classified in the range of 20 to 60 days in dependence on the soil type and thus water holding capacity (Laio, Porporato et al. 2001, Porporato, Laio et al. 2001).

Considering the decision-making system the scale of decision-making also provides some buffering effect: since seasonal climate forecasts are supposed to help assessing the total number of people who are expected to require food assistance due to an ongoing bad rainy season, information on the individual needs and specific locations (woreda-level) is not yet required. This information is required as soon as distribution activities are going to be started and more detailed information on food assistance needs are being available. Thus, uncertainties with respect to local impacts can be tolerated at this stage.

Critical climate conditions and climate information

Critical climate conditions

With respect to the critical situations described above, the climate or weather conditions become critical when they are a significant factor for a decrease in crop yield or even crop failure so that food assistance is required. Rainfall totals of less than 400-500 mm during the rainy seasons (or 900 mm for long-cycle crops) in Ethiopia are assumed to be critical for viable farming and pastoral operations (Makurira, Savenije et al. 2010, Funk, Rowland et al. 2012). However, in many times the information from rainfall totals is limited since crop production in semi-arid areas of Africa is determined rather by rainfall distribution because dry spells strongly depress the yield (Barron, Rockström et al. 2003, Meze-Hausken 2004, Segele and Lamb 2005). The three major causes for crop failure in north-eastern Ethiopia are 'dry spells', 'short growing period' due to replanting or late onset ('false start') and/or early cessation of rain as well as 'total lack of rain' (Segele and Lamb 2005, Arayaa, Keesstrab et al. 2010). The most severe consequences on crop yield do have 'short growing periods' and 'total lack of rain' (Arayaa and Stroosnijderb 2011). Thus, the crop performance depends not only on the distribution but especially on the onset and cessation which often coincides with the critical stage of the crop growth (Barron, Rockström et al. 2003, Arayaa, Stroosnijderb et al. 2011). Depending on the local soil conditions, dry spells of 10-15 days have already significant impact on maize yields in semi-arid regions in east Africa (Barron, Rockström et al. 2003) and maize as well as sorghum are rather drought-tolerant compared to teff and wheat (WFP 2014). However, dry spells which occur at the late-season are more pronounced regarding their impact since they coincide with the flowering and yield formation stages (Barron, Rockström et al. 2003, Arayaa, Keesstrab et al. 2010).

Critical climate conditions are dry spells of around 10-14 days. The criticality increases with the spatial extend of such events and with the timing during stages of flowering and yield formation.

Climate information

Lower limit critical climate conditions for crop failure are dry spells of around two weeks which occur around April and especially September. Climate information with a temporal resolution of such events over a period which corresponds to the length of rainy season would be desired. Lead-times for information on potential crop failure are desired to be available as soon as possible. However, accuracy is required to integrate this information in decision-making.

Vulnerability attributes

Decision-making processes: the problem of food security is very sensitive, ethical, and political issues. Economic factors are important but will not take the dominant role. Success criteria are rather the reduction of hunger, associated fatalities and loss of livelihood capacities. Consequently, the risk to adjust food security provision to a forecasted "good rainy season" (i.e. reducing food security capacity) is much higher than the risk to adjust to a forecasted "bad rainy season" (i.e. increasing food security capacity). The first scenario would result in fatalities and probably in an increased demand for food security (and thus costs) in the coming seasons due potentially reduced livelihood assets. In contrast the second scenario would imply some financial losses which might be minimized by consecutive coping options. Furthermore, climate is only one of many factors influencing the decision to provide food assistance. Thus, decision-makers are rather risk-averse with respect to climate information even in the context of robust decision-making (low uncertainty required) (WFP 2014).

Usability of S2D climate forecast information: decision-making on the seasonal scale requires information on the expected total number households requiring food assistance with respect to the outcome of the prevalent rainy season. Thus, the exact location of the affected household and the exact timing of crop failure within this season are not (yet) required. This basically matches the informational content of seasonal forecasts which provide mean values of climate parameters (here precipitation) for the rainy season for a large region.

However, since critical climate conditions are dry spells of 1-2 weeks the distribution of rainfall is important information which is supposed to be desired by the climate service product. Also the timing of such dry spells is crucial especially when they occur during the flowering period. This could be a critical aspect of a climate information product for this purpose. Required lead times are rather flexible since no technical restrictions do determine these at which as long as possible lead times are desired. On the other hand is the tolerated uncertainty rather low since decision-makers are risk-averse and definitely would prefer a robust decision and consider rather more households than actually affected.