

Food security and climate change in Mozambique: A farming-system approach to assess vulnerability

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Worldwide, population is projected to increase to 9 billion people by 2050 and, it is projected that 87% of that population will live in the developing world (Dobermann *et al*, 2013). By 2050 global food production will have to increase by 60% from 2005-2007 levels; However, producing this extra food will place additional stress on land, water and biodiversity, which are already scarce and showing worrying signs of degradation (FAO, 2014).

Developing countries are considered the most susceptible and vulnerable to the impacts of climate change, due to their high dependence of livelihoods on natural resources (land, water, forestry, etc.) and limited adaptive capacity to cope with the impacts (Ford *et al*, 2015).

Mozambique is located in the South Eastern coast of Africa, being extremely vulnerable to climate change. The agricultural sector is the largest contributor to GDP (about 23%), being a major source of employment (about 70% of the population), subsistence and income (Abbas, 2015). It is dominated by smallholders – family farms – which account for 99% of total farms (National Statistical Institute – INE, 2011); 98% of the farmers have rain-fed systems.

According to FAO (2014) family farms manage the majority of the world's agricultural land and are responsible for most of the world's food; therefore, are very important to ensure food security, to protect the environment and to end poverty. There is a consensus that the agricultural sector plays an important role on reducing poverty in developing countries (Abbas, 2015, 2016; Dixon *et al*, 2001; World Bank, 2010); and that farming systems play an important role in decreasing farmers vulnerability to climate change and also in increasing food security and alleviate poverty (Stephens, Jones & Parsons, 2018). It is, thus, important to identify and characterize the specific farming systems existing in Mozambique, in order to understand how they contribute to food security in the country and how vulnerable are they to climate change.

This is an ongoing research, as a result of my PhD thesis. The research is new and will bring a new and relevant contribute to Mozambique, since it will map the farming systems in Mozambique, and relate them with food security and poverty, as well as assess their vulnerability in order to improve resilience and food security in Mozambique under a changing climate.

In order to investigate the research problem, the mixed methods approach, i.e. the use of both qualitative and quantitative approaches, will be used. The research consists in a literature review focusing on the impact of climate change on the agricultural sector and food security, the farming system approach to poverty reduction and the climate vulnerability of farming systems. The research will also be based on secondary information in order to identify, describe and map the main type of farming systems (FS) in Mozambique, analyze the main (socioeconomic and biophysical) spatial correlates of these FS, and to assess their role in providing food security and their vulnerability to climate change. Farming systems will be defined as specific combination of a number of variables, such as: type of crops and livestock and their relative importance in the farm, intensity of fertilizer use, level of mechanization, labor use, etc. These variables will be collected and analyzed at the communal or municipal level. To identify the main farming systems in Mozambique as well as their spatial distribution, a database will be built using data from the agricultural censuses, which can be obtained from INE and Ministry for Agriculture and Food Security. FS types will be identified through factor analysis of these data followed by cluster analysis run on the main factors selected through the eigenvalue criterion. Data from climate and soils, as well as socio-economic variables (such as farm size, population density or employment by economic sector) will be used as spatial correlates of FS, to understand the spatial distribution of FS.

In general, climate-related disasters are among the main drivers of food insecurity in developing countries, being droughts the major driver. Studies have shown that many already-vulnerable regions in Mozambique are likely to be adversely affected by climate change; These include the mixed arid-semiarid systems in the south of Mozambique (Marques *et al*, 2009). It is also expected a decrease in yields in major crops in Mozambique (Brito & Holman, 2012; Warner *et al*, 2016; World Bank, 2010).

Brito & Holman (2012:33) refer that “besides the effect of changes in temperatures and rainfall, crop yields could decrease substantially across Mozambique due to increased frequency and intensity of natural disasters, in particular droughts affecting the semi-arid and arid regions of the country, floods affecting the rich valleys of the rivers where population density and economic activities are concentrated, and cyclones affecting the coastal zones of Mozambique where the majority of people live”.

Overall, projected future changes in climate will affect crop productivity and yields significantly, having a negative impact on food security and farming systems.

According to the literature there are five main farming systems in Mozambique: 1) Highland mixed; 2) Maize mixed; 3) Agro-pastoral; 4) Fish-based; and, 5) Perennial mixed; and, drought is considered the main source of vulnerability in most of these farming systems. Garrity, Dixon & Boffa (2012) considered the maize-mixed system the one with the greatest concentration of rural poverty and food insecurity in Africa. The maize-mixed farming system is the predominant system in Mozambique occurring along the whole country. Therefore, in order to improve food security, it is highlighted the need to consider sustainable farming systems and their supporting ecosystems, as well as local and traditional knowledge and foods.

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