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FOOD SYSTEMS AT RISK

NEW TRENDS AND CHALLENGES

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CHAPTER 5.1

LIMITED FOOD AVAILABILITY

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SUMMARY

While food security is a major worldwide issue, it is a much more serious problem in Low-Income (LI) and Lower Middle-Income (LMI) countries. Currently, sub-Saharan Africa is the sub-continent with the highest proportion of undernourished people, the largest gap between current and potential yields, and between cereal consumption and production. Looking to the future, population growth and climate change may worsen the situation, particularly in Africa. African countries are still facing rapid population growth with uncertain prospects about the ability of their agriculture to meet growing food demand. In addition, without sufficient adaptation measures, climate change will negatively impact food production in most African regions.

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Increase in food demand

Although global food production has been increasing dramatically, the world still faces a persistent food security challenge. Currently, many consider that we are producing enough food to meet the dietary needs of today's global population. However, food security is one of the major issues worldwide and is a much more serious problem in LI and LMI countries, where 821 million people still suffered from undernourishment in 2017 (FAO, 2018). Most people who are not able to afford enough food live in Asia (515 million people were estimated to be undernourished in 2017) and in sub-Saharan Africa (256 million). The proportion of undernourished people remains highest in Africa, where 21 percent of people are suffering from hunger (FAO, 2018).

Looking to the future, population growth and climate change may exacerbate the situation, especially in Africa. Analysis of recent data confirms that the world's population is likely to continue growing for the rest of the century. World population, now standing at 7.7 billion people, would reach 10 billion in 2050 according to the UN's medium variant, compared to 9 billion in the lowest scenario and up to 11 billion in the high variant. It would increase to between 9.6 billion and 12.3 billion in 2100 (Gerland *et al.*, 2014). This projection hides important differences between continents. The Asian population is likely to peak around the middle of the century and then begin to fall.

The main reason for the increase in the projection of the world's population is the growth in the population forecast for Africa, with at least a 3.5-fold increase. In these conditions, how can the world be fed in 2050? First, we have to consider that global food needs will necessarily increase to satisfy the growing population. Looking at different scenarios in the literature, Le Mouël and Forslund (2017) suggest the range of expectations for future food needs will be an increase of between 29 and 91 percent over the 2010-2050 period, depending on the assumptions for population growth, economic growth and dietary changes. Hence, global food demand is expected to increase by 60 percent by 2050 compared with 2005/2007 (FAO, 2017), with the rise being much greater in sub-Saharan Africa.

The challenge of meeting the needs

Feeding the world in 2050 will be a challenge as we must consider that we shall face limits and barriers to increasing agricultural supply in order to meet these needs. Indeed, in addition to land degradation and the limits of land availability, scarcity of resources such as water and phosphorus (*cf.* Chapter 3.1) and climate change will also determine the future conditions and constraints in food production (*cf.* Section 2). Despite technological progress, maize, rice, wheat and soybean yields are stagnating or have even fallen in several world regions (Ray *et al.*, 2012). The causes are various and complex. In some cases they are linked to socio-economic and institutional constraints, whether these concern input availability in Africa or the intensification of rotations in the USA to increase incomes. It may also be explained by reasons doomed to persist in the long term, such as reaching physical limits in Bangladesh and parts of India and Europe, or the limitation on nitrogen inputs due to environmental concerns in Europe. Without sufficient adaptation measures, climate change will negatively impact food production in many areas (Lobell *et al.*, 2009). In addition, most of the large negative impacts are projected to be in very vulnerable areas that are highly dependent on agriculture in LI and LMI countries. This means climate change is a serious threat to crop productivity in regions that are already food insecure. Furthermore, it is projected that the impacts of climate change on food security are significant, with millions of additional people at risk of hunger by 2050.

Food availability in sub-Saharan Africa

Despite the importance of sub-Saharan Africa's domestic market (Bricas, Tchamda and Mouton, 2016), it is one of the sub-continents with the largest gap between current and potential yields (cf. Figure 21 and Box 14) and between cereal consumption and production, with current levels of cereal consumption already dependent on substantial imports. As climate change will exacerbate yield variability, with extreme weather events causing production shortfalls, the risks to food security associated with this productivity gap and market instability will continue to grow. Van Ittersum *et al.* (2016) have shown that nearly complete closure of the gap between current yields and yield potential will be needed to maintain the current level of cereal self-sufficiency (approximately 80 percent) by 2050, which is an extreme and improbable objective. As a result, massive cropland expansion with attendant biodiversity losses and greenhouse gas emissions and/or vast import dependency can be expected.

Another important reason to increase food production in LI and LMI countries is to improve local economies in areas where numerous poor small farmers and landless workers depend on agriculture and often already suffer from malnutrition. Agriculture-led growth and agriculture-based solutions can make significant contributions to reducing undernutrition. According to the World Bank, agricultural productivity is fundamental for reducing poverty, sustaining the nutritional and health status of billions of people, ensuring food security and generating the resources required to access adequate care, health, water and sanitation services (World Bank, 2007). Because many poor and undernourished people are smallholder farmers, it is often assumed that diversifying production would improve dietary diversity within the household.

However, interactions between poverty, agricultural production and food security are complex. For example, a paradoxical situation has been identified in the Sikasso region in Mali where substantial agricultural production was concomitant with widespread child malnutrition (Dury and Bocoum, 2012). The authors have hypothesised that child malnutrition, reaching the highest level in this region, is linked to less diversified food consumption and probably to a lack of care, as a result of an overload of agricultural labour. Hence, the interactions between health, nutrition and agriculture are mutual: agriculture affects health and health affects agriculture, both positively and negatively. In the absence of conclusive links, both on-farm production and diversity, as well as access to markets, might matter for the diets of smallholder families (HLPE, 2017). Indeed, diversification of production at the farm scale can be both a sustainable pathway to increase productivity and incomes, but also a means to improving the food nutrition of poor smallholders.

So, in countries with a high prevalence of undernourishment it is very important to ensure the sustainable intensification of agricultural production in order to increase productivity and resilience to climate events that affect access to food. Moreover, increasing the incomes of poor populations, improving rural infrastructure and promoting local systems that ensure access to safe, affordable and varied foods are critically important for improving diets and reducing malnutrition.

Towards new solutions

By 2050, the world will face the challenge of producing enough food for a projected 9 to 11 billion people, while taking into consideration the impacts of climate change, the growing scarcity of water and land and a change in consumption patterns. Innovative systems are needed everywhere to increase productivity without compromising natural resources (FAO, 2018). Sub-Saharan Africa is expected to be the most vulnerable region since it has the highest prevalence of undernourished people in the world (FAO 2017), national economies are highly dependent on agriculture (and food imports) and most farmers are poor and have a limited capacity to adapt. There is an urgent obligation to find new pathways to guarantee harmonious agricultural development in rural areas, which is a necessary condition for ensuring food security. With regards to food security, and despite the fact conventional and biotechnological approaches still appear to produce higher yields (but with high impacts on natural resources), new agroecological pathways, including organic agriculture, could be more efficient in meeting this goal (Schoonbeek *et al.*, 2013; Andriamampianina *et al.*, 2018).

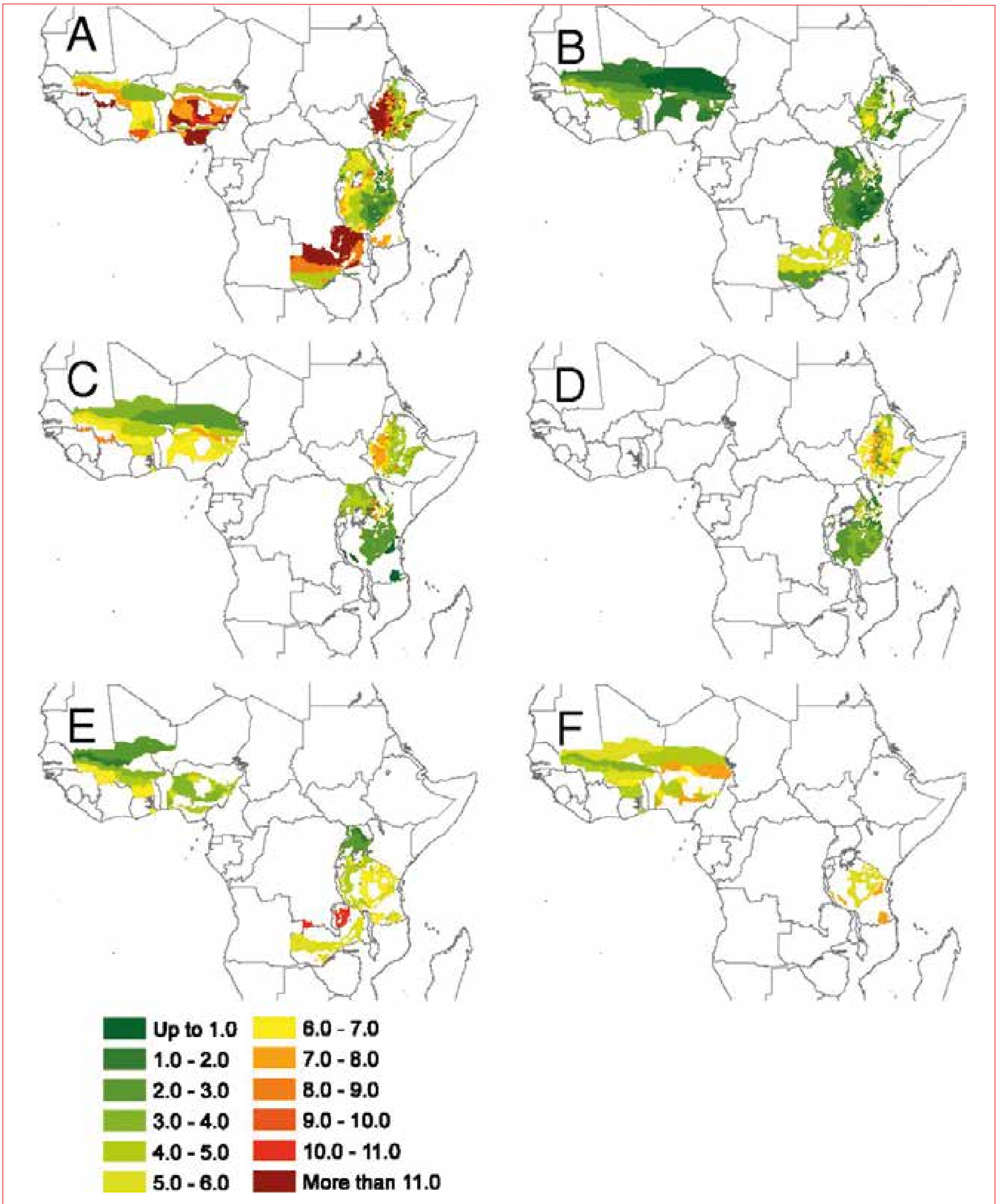

Figure 21: *Yield gaps (yield potential minus actual yields, t/ha harvested area) in sub-Saharan Africa. Source: van Ittersum* et al.*, 2016.*
Rainfed maize (A), rainfed millet (B), rainfed sorghum (C), rainfed wheat (D), rainfed rice (E), irrigated rice (F).

BOX 14

YIELD GAPS IN SUB-SAHARAN AFRICA

The yield gap (Yg) is the difference between potential yield (Yp, for irrigated crops) or water-limited yield (Yw, for rainfed crops) and actual yield (Ya), as found in farmers' fields. Yg is based on Yp or Yw that can be simulated with crop growth models using optimal agronomic management as inputs (i.e. cultivar maturity, sowing date and planting density).

A global yield gap analysis (Licker *et al.*, 2010) has shown that for many crops, especially maize and rice, yield gaps are at their largest in sub-Saharan Africa. For example, actual rainfed maize yields during the period 2003-2012 ranged from 1.2 to 2.2 t/ha, which represents 15 to 27 percent of the water-limited yield potential (van Ittersum *et al.*, 2016). For all rainfed crops, the largest gaps are found in the more favourable (higher rainfall) regions of the savannahs and cooler highlands of Ethiopia and the northern Zambia plain (*cf.* Figure 21**)**. Increasing maize yields from the approximately 20 percent of yield potential in 2010 to 50 percent by 2050 would require a doubling of annual crop yield increases compared with past decades. Although it is possible to achieve accelerated yield gains with improved cultivars coupled with good agronomy, increased fertiliser use and modern pest management practices, it is generally agreed that this will require greater investment in research and development in order to tackle the socio-economic constraints (for example, access to capital, infrastructure and markets) that have prevented smallholders in sub-Saharan Africa from achieving higher yields.

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