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PEGNet Policy Brief

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Achieving Food Security in the Face of Climate Change

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The year 2015 is important for sustainable development: the Millennium Development Goals (MDGs) have expired and have been replaced by the Sustainable Development Goals (SDGs) in September, and from November 30th to December 11th, the 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21/CMP11) will be held. The COP21/CMP11 aims to reach a universal, legally binding agreement to combat climate change and boost the transition towards resilient, low-carbon societies and economies. Reducing greenhouse gas emissions to limit global warming (mitigation) and helping societies adapt to existing climate change are seen as measures the agreement should equally focus on.

The group that is likely to suffer most from climate change is poor rural households in developing countries who mainly rely on small-scale agriculture for their livelihood. In large parts of Sub-Saharan Africa and South Asia, the two regions with the highest incidence of undernutrition, the MDG of cutting hunger by half has not been met (United Nations 2014). Reaching the still more ambitious SDG 2 (end hunger until 2030, achieve food security and improved nutrition, and promote sustainable agriculture) appears to be a daunting task even in the absence of climate change. By lowering agricultural yields in some regions, climate change adds to the challenge.

This policy brief therefore argues for a particular focus on agricultural production and food security in the current COP21 to help the largest possible number of people satisfy the most basic need of being well nourished.

Key Points

- Climate change will lead to falling yields in already food insecure Sub-Saharan African and South Asian countries
- Small scale farmers in these regions will have to respond to these changes by adapting their modes of production
- The international community should assist the farmers e.g. through the newly established Green Climate Fund
- The COP21 in Paris provides an opportunity to place food security on the agenda

Climate Impacts on Agriculture: Falling Yields in Food-Insecure Regions

In 2012-2014, about 805 million people in the world, or one in nine, were suffering from chronic undernourishment (FAO, IFAD and WFP 2014). To meet the future demand of a growing world population with rapidly changing consumption patterns, it is estimated that agricultural production needs to be increased by 70-110 percent until 2050 (Bruinsma 2011; Tilman et al. 2011). Some of this will be achieved through the expansion of croplands, but in order to save ecologically fragile and valuable regions such as tropical forests most will have to come from productivity gains on existing cropland (Mauser et al. 2015). Land productivity has indeed improved considerably over the last six decades, although increased food production doubled agricultural land use by only 10 percent (Ray et al. 2013).

Progress has been very uneven, and in several regions agricultural yields and production stability are now additionally threatened by a changing climate. Data on regional variation in agricultural production potentials shows a large gap between current yields and maximum attainable yields for developing countries, most notably Sub-Saharan Africa, whereas industrialised regions are already close to realising their maximum potential yield (Mauser et al. 2015).

As illustrated in **Figure 1**, the highest absolute net decline in areas suitable for agricultural production is found in Sub-Saharan Africa, even though some areas close to the equator benefit from a changing climate (see green coloured pixels), as do regions in the northern hemisphere such as Canada and Russia. Climate change not only alters the suitability of land for agricultural production; agricultural yields are also affected by larger variations in temperature and precipitation. Overall, Sub-Saharan Africa and South Asia are expected to be seriously hit by climate change. Knox et al. (2011) find that mean yields of all crops will decline by 8 percent by 2050 in both regions. Major food crops produced in Sub-Saharan Africa and South Asia bear the brunt of the yield losses, which points to severe consequences of climate change for the region's food security.

Responses to a Changing Climate

The scenarios above show that there is a pressing need to not only design responses that place an emphasis on cutting and curbing emissions as has been the norm but to also place a greater focus on strategies that aim to reduce the vulnerability of groups that are most susceptible to changes in the agricultural suitability of land.

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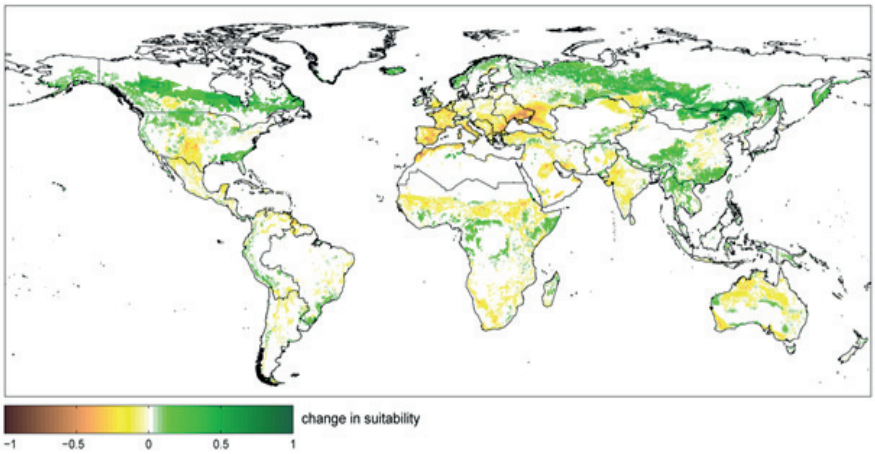
In this section, we highlight several adaptation responses to climate change that can enhance global food security levels.

Building resilience of small scale farmers

With the impending threat of climate change, many agricultural producers will be confronted with a twofold challenge of finding new ways to close yield gaps while at the same time strengthening the resilience of their productive systems. Famers in regions that experience reduced agricultural suitability due to prolonged droughts or increased rainfall variability are likely to benefit strongly from efficient water management strategies that include rain water harvesting, drip irrigation and increasing soil organic matter to heighten the water retention capacity of soils.

Figure 1: Change in suitability for agricultural production under climate change (SRES A1B emission scenario) in 2071-2100 compared to 1981-2010



Sources: Zabel et al. (2014)

Conservation agriculture and other practices that promote ecosystem management and bio-diversity such as sustainable weed and pest control, the use of compost and manure as well as crop rotation and the cultivation of legumes are equally fundamental in strengthening the resilience of small scale agricultural producers (Thornton and Lipper, 2014).

Furthermore, increasing resilience should not end at the production phase but should extend to harvesting and storage as food loss is highest during these phases.

Diversification to other crops and income strategies

Increased weather uncertainty and variability caused by climate change strengthens the case for agricultural diversification. Agricultural diversification takes different forms that include the introduction of different genetic species within monocultures, crop rotations, cultivating non-crop vegetation as well as agro-forestry practices. Small scale farmers that adopt intercropping systems by planting crops with different maturation dates, agroforestry or mixed crop-livestock systems are more likely to recover from crop failure than farmers that practise mono-cropping. A case study in the Ekwendeni region of Northern Malawi shows how crop diversification options in variable climatic conditions influence the food security levels of small scale farmers (Snapp et al., 2013). In this region, farmers opted to grow food legumes such as pigeon pea in rotation with maize. The results from this study show that under varying climatic conditions, intercropping maize and pigeon pea is likely to produce sufficient calories and protein for smallholder farm households. By contrast, it is found that when mono-cropped, maize is only able to meet calorie needs half of the time.

Economic diversification through, for instance, the engagement in off farm activities will also prove to be a viable means of consumption smoothing during periods of weather uncertainty. Diversification of non-agricultural income is particularly effective if the economic activities selected do not tend to be correlated with the same weather shocks as agricultural production.

Risk management

Farmers in developing regions are vulnerable to a series of risks that range from price volatility to pest diseases and weather variability that continuously place them in a precarious situation (Thornton and Lipper, 2014). Managing these risks, including those caused by climate change, is essential in ensuring that they have adequate food security levels. One promising risk management strategy that has now been applied in several pilot projects but has not yet been implemented on a large scale is index based insurance that provides pay-outs based on an objectively measured index that is correlated with farmer's anticipated losses rather than actual losses. This form of insurance buffers farmers against the effects of climatic shocks at least to some extent and may enable them to invest in productive activities that raise their food security levels. To raise uptake, which has been shown to be limited in most pilot projects, the roll out of index insurance should be combined with careful information campaigns (see the section on strengthening local policies and institutions below).

Sustainably intensifying agricultural production systems

Although increasing agricultural production leads to raising food security levels it is also one of the leading causes of climate change and could thus perpetuate rather than reduce the problem. To avoid a self-reinforcing cycle of vulnerability and food insecurity, it is imperative that a climate smart approach to agriculture is adopted. Climate smart agriculture is a three-pronged strategy

Box 1: Audio conferring for extension service delivery in Ghana

Farmers are usually not involved in the development of the extension content and therefore find the extension services not adequately tailored to address their farming challenges in order to enable them to take up agriculture as a business and a sustainable livelihood. The Savannah Young Farmers Network (SYFN), a youth-led nongovernmental organization in Ghana, is running the Audio Conferencing for Extension project in the north of Ghana, offering innovative extension services. SYFN organizes the audio conferences for extension service twice a week with farmer groups consisting of a minimum of 10 and a maximum of 15 farmers. During the audio conferences, farmers are put in touch with agricultural officers from SYFN and other agricultural extension experts, agronomists, information and communications technology professionals, and agricultural researchers. A cell phone with an audio conferencing system is used and attached to a portable loudspeaker to enable all farmers present at the conference to interact with the advisers. Community agricultural information officers are present with the farmers to ensure that the capacity-building sessions are well planned and moderated and that the desired impact is achieved.

Source: Thornton and Lipper, 2014

introduced by the FAO that aims at: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change as well as reducing and/or removing greenhouse gases emissions, where possible.

In Uganda, for instance, research showed that intercropping two of the country's most important cash crops, coffee and banana, can earn farmers more income than growing either crop alone (CGIAR, 2013). The farmers' resilience to climate change was strengthened through reduced soil erosion and degradation provided by the roots and canopy of the banana trees. In addition, the shade from the taller banana trees helped cool the coffee plants. Moreover, banana captures atmospheric carbon dioxide, enriching soil carbon stocks while mitigating climate change.

Priority Areas for Action

Responding to climate change by strengthening the adaptation capacities of small scale farmers will go a long way towards countering the negative impacts of climate change. However, the potential to adapt to climate change is unlikely to be fully exploited without strong support by the international community. We identify three major areas in which the international community might provide assistance.

Develop agricultural technologies

Research that specifically targets the linkages between food security and climate change is limited. The international community has a key role to play in encouraging the development of agricultural technologies that support adaptation strategies of smallholders to climate change.

Agricultural research for development should encourage the development of localized solutions to climate change. Areas that face reduced agricultural suitability due to reduced rainfall would be well advised to invest in agricultural research that promotes new technologies such as the breeding of drought resistant crop varieties as well as improved irrigation techniques. In contrast, technologies that promote the development of crop varieties with higher moisture tolerance as well as flood control mechanisms can be introduced in areas that experience increased rainfall and floods. Technologies that improve weather forecasting and early warning systems also need to be developed to enable farmers to better adapt to the variations in weather.

Regional efforts such as the Comprehensive Africa Agricultural Development Programme (CAADP) that pledges to increase agricultural GDP has a huge role to play in prioritising agricultural research and development. The fourth CAADP pillar specifically targets improving agricultural research, technology dissemination and adoption.

Strengthen local policies and institutions

Agricultural extension offices have long been the local institutions responsible for the dissemination of agricultural information to small scale farmers. In view of the impending effects of climate change on agriculture and food security these local institutions will have a special role to play in relaying information on climate change to farmers within their networks. With the support of the international community more emphasis should be placed on capacity building and training of staff at these local institutions.

Innovative approaches that disseminate agricultural information by local institutions need to be encouraged as well. In Kenya, a reality TV show on farm makeovers that has over 3 million viewers uses innovative solutions in science to scale up gender sensitive climate-smart practices (CGIAR, 2013). Local institutions can take advantage of rapidly growing mobile phone networks that allow for the dissemination of information on climate change adaptation strategies to small scale farmers via SMS texts. **Box 1** provides an example of an intervention that has empowered young Ghanaian farmers to access agricultural information via audio conferring tools.

Local governments and the international community can work in a variety of ways to assist smallholders in managing risk. As noted earlier, the provision of timely weather information can help rural communities manage the risks associated with high rainfall variability. By reducing income risks, social safety net programs such as cash transfers could potentially also have a significant effect on risk management in agricultural production systems.

Moreover, already existing informal institutions such as village committees, rural

producer organisations, savings and loans groups as well as agricultural cooperatives will play an important role in ensuring that adaptation strategies are well coordinated and that small scale farmers cooperate in community projects aimed at strengthening resilience.

Access to financing

Traditionally climate finance has taken centre stage in international climate change discussion rounds, with a much lesser emphasis placed on financing agriculture and ensuring food security. The UNFCC's Adaptation Fund (AF) that has been financed by the proceeds from the sales of certified emission reduction credits under the Kyoto Protocol has been one of the principal sources of agriculture related climate funding. Since 2010, the AF has financed close to 20 projects that aim at promoting climate resilient agriculture and ensuring food security. Despite its relative success, the future of the AF is uncertain as revenue from carbon credits has been negligible. The operationalisation of the Green Climate Fund (GCF) is also expected to divert funds from the AF.

The GCF was formally set up at the COP16/CMP6 in Cancún and is now being regarded as a possible game changer that might shift the balance between mitigation and adaptation funding. It aims to mobilise 100 billion USD by 2020, to be equally shared between mitigation and adaptation. The first eight GCF investment projects – four of them in the area of adaptation – were approved at the recent GCF Board Meeting that convened in Livingstone at the beginning of November 2015. These projects constitute a promising first step towards taking adaptation more seriously in international climate policy. For example, one of the projects aims at scaling up the use of modernized climate information and early warning systems in Malawi, a country that is highly susceptible to droughts and weather variability due to climate change.

While these efforts, and in particular the first projects approved by the GCF, indicate that adaptation to climate change and food security needs have begun to feature more prominently on the international climate policy agenda, the COP21/CMP11 in Paris provides an opportunity to create further momentum for developed countries to commit to a new balance between mitigation and adaptation and steer additional funds towards projects in developing countries that promote climate resilient farming and support vulnerable communities. To be able to contribute to climate mitigation and adaptation, donor countries have to strengthen their commitments and fulfil their pledges to international climate funds. The COP21/CMP11 talks should also provide a platform to better coordinate the efforts of the GCF with the AF and the various existing bilateral programs, and over time to achieve a consolidation of activities where the GCF serves as the principal source of financing for adaptation to climate change.

Overall, with around 800 million people still suffering from undernutrition and the looming threat that climate change might worsen the situation through adverse effects on agricultural potentials in developing countries, there appears to be a moral obligation for a strong engagement of the international community.

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