



## Brussels Policy Briefing no.29

### Climate change, agriculture and food security: proven approaches and new investments

Brussels, 27 September 2012, European Commission, Charlemagne Building

<http://brusselsbriefings.net>

#### 1. Background

Agriculture provides the nutritional foundation of humanity and the economic foundation of states. In Sub-Saharan African (SSA) countries, agriculture employs about 60 percent of the workforce and contributes an average 30 percent of gross domestic product.<sup>1</sup> For the poorest people, GDP growth originating in agriculture is about four times more effective in raising incomes than the one originating outside the sector.<sup>2</sup> Various projections suggest that food production must increase globally by 70–100 percent by 2050 to meet the demands of a world with 9 billion people and changing diets.<sup>3</sup> In many developing countries this will require considerable investments in agricultural sector - research, institutional support and infrastructural development, above all.<sup>4</sup>

Climate change - both natural and anthropogenic - will lead to significant changes at global and local scales. Its impact will be both short-term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns. People who are already vulnerable and food insecure – more than 600 millions<sup>5</sup> - are likely to be the first affected. Climate change will affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It will have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows.<sup>6</sup>

It is not possible to predict precise future climate conditions, but the scientific consensus is that global land and sea temperatures are warming under the influence of greenhouse gases (GHGs), and will continue to warm regardless of human intervention for at least the next two decades.<sup>7</sup> Further increase in emissions of GHGs resulting from human activities will exacerbate the impact of climate change on food production in the near future.

#### 2. Agriculture and climate change

Food systems contribute up to 29 percent of global anthropogenic greenhouse gas (GHG) emissions, releasing 9800-16900 megatonnes of carbon dioxide equivalent (MtCO<sub>2</sub>e) per year. Agricultural activities are the component of the food system most heavily associated with anthropogenic climate change, responsible for 15 to 25 percent of human-generated GHG emissions.<sup>8</sup> Farming practices directly release 5100–6100 MtCO<sub>2</sub>e a year - roughly the same as the world's transport sector - and contribute a

<sup>1</sup> Pye-Smith C. 2011. Farming's climate smart future: placing agriculture at the heart of climate-change policy. [http://ccafs.cgiar.org/sites/default/files/assets/docs/farmings\\_climate-smart\\_future.pdf](http://ccafs.cgiar.org/sites/default/files/assets/docs/farmings_climate-smart_future.pdf)

<sup>2</sup> World Bank. 2008. World Development Report 2008: Agriculture for Development. <http://siteresources.worldbank.org/INTWDR2008/Resources/2795087-1192111580172/WDR0ver2008-ENG.pdf>

<sup>3</sup> Godfray H.C.J. et al. 2010. Food Security: The Challenge of Feeding 9 Billion People. <http://www.sciencemag.org/content/327/5967/812.full>

<sup>4</sup> Rosegrant M.W. et al. 2009. Looking into the future for agriculture and AKST. [http://www.agassessment-watch.org/docs/reports/Global\\_C5\\_text\\_250208.pdf](http://www.agassessment-watch.org/docs/reports/Global_C5_text_250208.pdf)

<sup>5</sup> FAO. 2011. The State of Food Insecurity in the World. <http://www.fao.org/docrep/014/i2330e/i2330e.pdf>

<sup>6</sup> FAO. 2008. Climate Change and Food Security: A Framework Document. <http://www.fao.org/forestry/15538-079b31d45081fe9c3dbc6ff34de4807e4.pdf>

<sup>7</sup> Ziervogel G. et al. 2008. Climate Change and Adaptation in African culture. [http://www.environmentportal.in/files/5\\_22.pdf](http://www.environmentportal.in/files/5_22.pdf)

<sup>8</sup> Vermeulen S.J. et al. 2012. Climate change and food systems.

disproportionate amount of two high-impact gases - nitrous oxide (N<sub>2</sub>O) and methane (CH<sub>4</sub>). Agriculture is responsible for approximately 47 percent of human-generated CH<sub>4</sub> emissions and 58 percent of N<sub>2</sub>O emissions. In addition to its direct contributions of GHGs from crop, livestock and fisheries production and management of soils, agriculture also contributes to GHG emissions through land use change. About 80 percent of new land for agriculture comes from clearing of natural vegetation, particularly in the tropics, and historically 75 percent of deforestation has been associated with agricultural expansion. Land use change contributes 6-18 percent of total global GHG emissions.

Agriculture is also among the sectors most severely impacted by climate change, through the sensitivity of yields, food quality and diseases to higher temperatures, unpredictable rainfall patterns and water availability, and extreme climate events such as heat waves, floods and droughts. Such changes will in time affect the vegetation cover and species distributions over the world. Water withdrawals for irrigation already represent 66 percent of the total withdrawals - up to 90 percent in arid regions<sup>9</sup> - and are expected to increase 19 percent by 2050.<sup>10</sup> Changes in precipitation patterns will also increase the likelihood of short-run crop failures and long-run production declines. Although there will be gains in some crops in some regions of the world, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security.<sup>11</sup>

Agricultural adaptation can occur in many ways, from the individual field - where a crop is grown, varieties are selected and management decisions such as tillage, fertilization, and pesticide application are made - through the farm level - where managers choose among crops, livestock, and other activities and capital investment decisions are made - to the landscape level, where decisions are made about management of water resources, biodiversity, forests and energy. Beyond the farm gate, many other decisions, in markets, governments and civil society, critically affect the economic environment in which farms operate. Many of the most important agricultural adaptations will be made in the domain of policy and planning, including climate-proof infrastructure investments, research and development for future agricultural environments, and incentives for adopting new practices.<sup>12</sup>

### 3. Effects of climate change on ACP countries

Agriculture-based livelihood systems that are already vulnerable to food insecurity face immediate risk of increased crop failure, new patterns of pests and diseases, lack of appropriate seeds and planting material, and loss of livestock. Several groups of countries require significant and urgent assistance to adapt to climate change, especially small islands, countries with low-lying coastal areas, and those with areas prone to natural disasters.<sup>13</sup> Within countries and regions there are particular hotspots of vulnerability of agricultural livelihoods to climate change, where climate change impacts are large, food production systems highly sensitive to these changes, and local populations lacking access to the capital and services that can increase resilience.<sup>14</sup>

In many parts of Africa warmer climates and changes in precipitation will destabilize agricultural production, for example forcing a shift out of mixed crop-livestock systems to pure livestock systems across large areas, and this is expected to undermine the systems that provide food security.<sup>15</sup> Significant economic losses are projected for African agriculture under climate change. For example net farm

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<sup>9</sup> World Water Council. 2010. Water Crisis.

<http://www.worldwatercouncil.org/index.php?id=25>

<sup>10</sup> Paulson L.D. 2 April 2012. UN study: Agricultural water use to increase 19 percent by 2050.

<http://www.rwlwater.com/agricultural-water-use-to-increase/>

<sup>11</sup> Nelson G.C. et al. 2009. Climate change :Impact on Agriculture and cost of Adaptation.

<http://www.ifpri.org/publication/climate-change-impact-agriculture-and-costs-adaptation>

<sup>12</sup> Antle J.M. 2009. Agriculture and the Food System. Adaptation to Climate Change.

<http://www.rff.org/rff/documents/rff-rpt-adaptation-antle.pdf>

<sup>13</sup> Simpson M. et al. 2011. Climate Change's Impacts on the Caribbean's Ability to sustain Tourism, Natural Assets and Livelihoods. <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35769833>

<sup>14</sup> Ericksen P. et al. 2011. Mapping Hotspots of Climate Change and Food Insecurity in the Global Tropics.

[http://ccafs.cgiar.org/resources/climate\\_hotspots](http://ccafs.cgiar.org/resources/climate_hotspots)

<sup>15</sup> Thornton P. et al. 2011. Agriculture and food systems in sub-Saharan Africa in a 4°C+ world.

<http://rsta.royalsocietypublishing.org/content/369/1934/117>

revenue is anticipated to fall 25 percent between 2008 and 2020 under a scenario in which temperatures rise 1.6 percent.<sup>16</sup> There will be considerable variation, however, among different regions and farming systems. While farmers in some areas may benefit from higher precipitation and longer growing seasons, the general consequences for Africa are expected to be adverse, particularly for poor smallholder farmers and consumers who do not have the means to withstand shocks and changes.

Caribbean and Pacific island countries contribute less than 1 percent to global GHG emissions, yet these countries are expected to be among the earliest and most impacted by climate change in the coming decades, because they are the least able to adapt to climate change impacts.<sup>17</sup> The Caribbean and Pacific countries are facing increasingly variable rainfall, cyclones / hurricanes, accelerating storm water runoff, floods, droughts, decreasing water quality and increasing demand for water which threaten the economic development, the health and livelihood of their people.<sup>18</sup> Climate change is projected to reduce the availability of freshwater resources in many parts of the Caribbean. In some areas, this will happen to a point where these resources become insufficient to meet demand by local populations and tourists, at least in periods with low rainfall. Since many islands rely on groundwater sources and rainwater harvesting for their water supply, any changes in the amount, frequency, and intensity of rainfall will affect the amount of water available for extraction.

#### **4. Bringing together food security, adaptation and mitigation for increased resilience**

Actions towards adaptation include both longer-term preparatory adaptation to progressive climate change over decadal time scales (i.e. integrated packages of technology, agronomy and policy options for farmers and food systems) and immediate improvements in management of agricultural risks associated with increasing climate variability and extreme events (e.g. improved climate information services and safety nets). Actions towards mitigation need to link higher resource-use efficiency in agriculture with governance at the level of landscapes and food systems to manage any displacements of emissions to other places or parts of the food chain.<sup>19</sup>

Fortunately there are multiple technical and institutional options in agriculture that can achieve benefits to food security through long-term adaptation, near-term risk management and mitigation of GHG emissions simultaneously. One portmanteau term for these options is “climate-smart agriculture”. FAO defines climate-smart agriculture (CSA) as “an agriculture that sustainably increases productivity resilience (adaptation), reduces/removes greenhouse gases (mitigation) while enhancing the achievement of national food security and development goals”. Climate-smart agriculture is about strengthening farmers’ resilience to climate change, and reducing agriculture’s climate imprint by curbing greenhouse gas emissions and increasing carbon storage, including in the soil. Climate-smart agriculture offers some unique opportunities to tackle food security, adaptation and mitigation objectives. African countries will particularly benefit from climate-smart agriculture given the central role of agriculture as a means to poverty alleviation and the major negative impacts that climate change is likely to have on the African continent.

Climate-smart agriculture includes proven practical techniques - such as mulching, intercropping, conservation agriculture, crop rotation, integrated crop-livestock management, agro-forestry, improved grazing, and improved water management - but also innovative practices such as early warning systems

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<sup>16</sup> Hassan R.M. 2010. Implications of climate change for agricultural sector performance in Africa: policy challenges and research agenda.

[http://jae.oxfordjournals.org/content/19/suppl\\_2/ii77.full.pdf+html](http://jae.oxfordjournals.org/content/19/suppl_2/ii77.full.pdf+html)

<sup>17</sup> Simpson M.C. 2009. An overview of modelling climate change: Impacts in the Caribbean Region with contribution from the Pacific islands.

<http://www.caribsavve.org/assets/files/UNDP%20Final%20Report.pdf>

<sup>18</sup> Overmars M. and Gottfried M. 2009. Adapting to climate change in water resources and water services in Caribbean and Pacific small island countries.

[http://www.worldwatercouncil.org/fileadmin/www/Library/Publications\\_and\\_reports/Climate\\_Change/PersPap\\_03\\_Small\\_Island\\_Countries.pdf](http://www.worldwatercouncil.org/fileadmin/www/Library/Publications_and_reports/Climate_Change/PersPap_03_Small_Island_Countries.pdf)

<sup>19</sup> Vermeulen S.J. et al. 2011. Options for support to agriculture and food security under climate change.

<http://www.sciencedirect.com/science/article/pii/S1462901111001456>

and risk insurance.<sup>20</sup> One very practical example is the current effort in many African countries to increase the accuracy and communication of seasonal forecasts to farmers.<sup>21</sup>

More productive and resilient agriculture will need better management of natural resources. Agriculture can contribute to mitigation by avoiding further deforestation and conversion of grasslands and wetlands; increasing the storage of carbon in vegetation and soil; reducing current, and avoiding future, increases in emissions from N<sub>2</sub>O and CH<sub>4</sub>.<sup>22</sup> Attention must be given to landscape approaches, for example, integrated planning of land, agriculture, forests, fisheries and water to ensure synergies are captured. Such approaches are essential if emissions from land cover change and deforestation are to be reduced, and are also indispensable given greater land and water scarcity and the need to balance food, energy and climate considerations.<sup>23</sup> Climate-smart agriculture fully incorporates attention to climate risk management. Developing new varieties and innovative practices matters, but equally important are ways of increasing farmers' adoption of new technologies and institutions. CSA also involves changes in policy that will help farmers adapt and succeed.<sup>24</sup>

## 5. Financing agriculture and climate change

The cost of achieving the Millennium Development Goal One, on reducing hunger, was estimated by the World Bank at US\$40–60 billion per year. Without this, the estimated levels of investment needed for adaptation within the agriculture sector would be insufficient to avoid serious damage. Annual incremental investments and financial flows needed for adaptation of agriculture in developing countries are estimated to require US\$7 billion a year in 2030, and this was acknowledged as estimate “on the low side of adaptation costs of the sector”.<sup>25</sup> These types of top-down cost estimates have a high level of uncertainty because of uncertainty on the pace and geographic variability of climate change, the rate of innovation and, perhaps most important of all, the capacity for adoption of new practices and institutions among farmers.<sup>26</sup>

Farmers' main impediment to adopting climate-smart agricultural practices is likely to be lack of financial capital to make upfront investments. The shortage of financial capital is likely to be progressively exacerbated by climate change itself, as shocks to agricultural yields and hence incomes are caused more frequently by extreme climate events such as droughts and floods. At a higher institutional level, the scale and speed of climate change requires considerable investment in institutions and services, in capacity enhancement, in climate-proofed infrastructure, in facilitation of trade (including, again, infrastructure) and in research to develop technologies, decision tools and support systems.<sup>27</sup>

Finance for climate change mitigation can be delivered through public sector-backed grants, loans, guarantees or other instruments. International finance sources available to large-scale programmes under the UNFCCC mechanisms include funds managed under the Global Environment Facility (GEF) and the Kyoto Protocol. “Fast-start funds” are available for rapid action in agriculture. Alternatively, finance can come from private sources, either through carbon markets or via climate-motivated capital investments. A

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<sup>20</sup> FAO. 2010. Climate-Smart Agriculture. Policies, Practices and Financing for Food Security, Adaptation and Mitigation. [http://www.fao.org/fileadmin/user\\_upload/newsroom/docs/the-hague-conference-fao-paper.pdf](http://www.fao.org/fileadmin/user_upload/newsroom/docs/the-hague-conference-fao-paper.pdf)

<sup>21</sup> Hansen J. et al. 2011. Review of seasonal weather forecasting for agriculture in sub-Saharan Africa. <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8235654>

<sup>22</sup> Smith P. et al. 2008. Greenhouse gas mitigation in agriculture. <http://rstb.royalsocietypublishing.org/content/363/1492/789.abstract>

<sup>23</sup> Wollenberg E. et al. June 2011. Actions needed to halt deforestation and promote climate-smart agriculture. [http://ccafs.cgiar.org/sites/default/files/assets/docs/CCAFS\\_Brief04\\_web.pdf](http://ccafs.cgiar.org/sites/default/files/assets/docs/CCAFS_Brief04_web.pdf)

<sup>24</sup> The World Bank. 2011. Policy Brief: Opportunities and Challenges for Climate-Smart Agriculture in Africa. [http://climatechange.worldbank.org/sites/default/files/documents/CSA\\_Policy\\_Brief\\_web.pdf](http://climatechange.worldbank.org/sites/default/files/documents/CSA_Policy_Brief_web.pdf)

<sup>25</sup> FAO. 2010. Climate-Smart Agriculture. Policies, Practices and Financing for Food Security, Adaptation and Mitigation. [http://www.fao.org/fileadmin/user\\_upload/newsroom/docs/the-hague-conference-fao-paper.pdf](http://www.fao.org/fileadmin/user_upload/newsroom/docs/the-hague-conference-fao-paper.pdf)

<sup>26</sup> Streck C. et al. 2011. Addressing agriculture in climate change negotiations: a scoping report. [http://www.climate-agriculture.org/en/Scoping\\_Report.aspx](http://www.climate-agriculture.org/en/Scoping_Report.aspx)

<sup>27</sup> The World Bank. 2011. Policy Brief: Opportunities and Challenges for Climate-Smart Agriculture in Africa. [http://climatechange.worldbank.org/sites/default/files/documents/CSA\\_Policy\\_Brief\\_web.pdf](http://climatechange.worldbank.org/sites/default/files/documents/CSA_Policy_Brief_web.pdf)

key challenge in developing these funding mechanisms is to ensure equitable access by, and suitable incentives for, smallholder farmers.<sup>28</sup>

There are a number of proposals for innovative financing mechanisms at national and international levels, such as a percentage of GNP from developed countries, levies on international transport emissions or financial transactions, carbon taxes, payments for environmental services and an eventual global carbon market, all of which need to be carefully examined in the context of ACP countries and small-scale farmers

## **6. The way forward**

The Commission on Sustainable Agriculture and Climate Change has outlined a comprehensive vision of the progress needed to achieve food security in an uncertain and constrained future.<sup>29</sup> Action on multiple fronts – agriculture, rural development, trade, social welfare, land rights, gender equity, education and knowledge management – can come together to ensure that humanity operates in a “safe space” that provides sufficient food for all without compromising environmental limits. Effective agriculture and climate change policies can boost green growth, protect the environment and contribute to the eradication of poverty. Public support should focus on raising the resilience of the most vulnerable farmers and consumers, including through social protection and safety net, development of climate-smart institutions and technologies, investments in soil and water conservation, value chain development, and incentives to improve diets and reduce was.

The international community needs to demonstrate commitment to the multiple agendas of food security, adaptation and mitigation by stepping up investment support to climate-smart agriculture and scaling up of best practices and technologies. Considerable finance will be needed to rapidly implement proven programmes. Placing a greater emphasis on agriculture in negotiations on climate change, as in the development of national policies, will ensure that agriculture fully contributes to efforts to adapt and mitigate without undermining food production and the fight against poverty.<sup>30</sup>

### **Objectives of the Briefing**

To improve information sharing and promote networking, CTA, the DG DEVCO from the European Commission, the ACP Secretariat, Concord organize bimonthly briefings on key issues and challenges for rural development in the context of ACP-EU cooperation. The Briefing on 27 September 2012 will be organized in collaboration with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). It will address issues related agriculture and food security in a changing climate and how agriculture can increase resilience to climate change effects. In particular, it will: (i) raise awareness in ACP countries on the key challenges posed to agriculture by climate changes; (ii) increase exchange of information and expertise on strategies to develop climate-smart agriculture and proven successes; and (iii) facilitate networking among development partners.

### **Target group**

Around 120 ACP-EU policy-makers and representatives of EU Member States, civil society groups, research networks and development practitioners, and international organizations based in Brussels.

### **Available material**

Input and comments before, during and after the meetings will be included in the Briefings blog: <http://brusselsbriefings.net>. A short report and a Reader in printed and electronic format will be produced shortly after the meeting.

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<sup>28</sup> Streck C. et al. 2012. Towards Policies for Climate Change Mitigation: Incentives and benefits for smallholder farmers. [http://www.climatefocus.com/documents/towards\\_policies\\_for\\_climate\\_change\\_mitigation](http://www.climatefocus.com/documents/towards_policies_for_climate_change_mitigation)

<sup>29</sup> Beddington J. et al. 2012. Achieving food security in the face of climate change. [http://ccafs.cgiar.org/sites/default/files/assets/docs/climate\\_food\\_commission-final-mar2012.pdf](http://ccafs.cgiar.org/sites/default/files/assets/docs/climate_food_commission-final-mar2012.pdf)

<sup>30</sup> Streck C. et al. 2011. Addressing agriculture in climate change negotiations: a scoping report. [http://www.climate-agriculture.org/en/Scoping\\_Report.aspx](http://www.climate-agriculture.org/en/Scoping_Report.aspx)



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#### Panel 1: Agriculture, food security and climate change: What's new?

This panel will present the key concepts, challenges and opportunities for agriculture and food security in relation to climate change. It will give an overview of the international negotiations on climate change and how they feature agriculture, especially in the context of ACP countries, and the farmers' perspective on how progress can best be achieved. It will include an overview of climate finance for agriculture that is relevant to ACP countries.

##### Panellists:

- Smallholder agriculture under climate change: challenges and outlook  
*Sonja Vermeulen, Head of Research, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)*
- The status of agriculture in negotiations on climate change: update and outlook  
*(George Wamukoya, Climate Change Advisor, COMESA), tbc*
- Planning for climate-smart landscapes  
*Tony Simons, Director General of the World Agroforestry Centre (ICRAF)*
- View from ACP farmers: successes to date and needs for the future  
*Ishmael Sunga, CEO, The Southern African Confederation of Agricultural Unions (SACAU)*
- Leveraging finance for climate-smart agriculture: overview of funding mechanisms relevant to ACP countries  
*Charlotte Streck, Director of Climate Focus and former Senior Counsel with the World Bank, USA*

#### Panel 2: Opportunities and innovations to bring climate-smart agriculture to scale

This panel will present a set of proven innovations to deliver climate-smart agriculture. It will present climate-smart interventions that work – socially, economically and environmentally – and could be scaled up in ACP agricultural and food systems.

##### Panellists:

- Scaling-up the implementation of climate-smart agriculture: innovations and successes  
*(Leslie Lipper, Senior environmental economist, Agriculture and Development Economics Division, FAO), tbc*
- Reaching scale through the private sector: the case of index-based weather insurance  
*Kolli N. Rao, CEO, Agricultural Insurance Company of India*
- Integrated national and regional approaches to climate-smart agriculture in: the Caribbean  
*Carlos Fuller, International and Regional Liaison Officer, Caribbean Community Climate Change Centre (CCCCC)*
- Successes in climate adaptation and mitigation in the Pacific region  
*Taito Nakalevu, Project Manager, Pacific Adaptation to Climate Change (PACC), Secretariat of the Pacific Regional Environment Programme (SPREP)*
- How farmers are linking food security, adaptation and mitigation in East Africa  
*Moses Tenywa, Director of Makerere University Agricultural Research Institute Kabanyolo (MUARIK), Uganda*

Conclusions

Networking Lunch