Adaptation measures and assessment of agricultural practices and technologies to enhance productivity in a sustainable manner

Coordination SUD submission to the UNFCCC's SBSTA (Subsidiary Body on Scientific and Technological Advice) Work Programme on Agriculture, March 2016

The forty fourth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) invited Parties and admitted observer organizations to submit to the secretariat their views on:

- *Identification of adaptation measures, taking into account the diversity of the agricultural systems, indigenous knowledge systems and the differences in scale as well as possible co-benefits and sharing experiences in research and development and on the ground activities, including socioeconomic, environmental and gender aspects;*
- *Identification and assessment of agricultural practices and technologies to enhance productivity in a sustainable manner, food security and resilience, considering the differences in agro-ecological zones and farming systems, such as different grassland and cropland practices and systems.*

The Climate and Development Commission (Commission Climat et Développement, CCD) and the Agriculture and Food Commission (Commission agriculture et alimentation, C2A) of Coordination SUD believe that the broad objective of this work program is to enhance the support to smallholders farmers who are already largely suffering from hunger and who are and will be among the most affected by climate change.

Summary of main recommendations highlighted in this submission:

- **Allow for direct and indirect involvement of civil society organizations, in particular those of smallholder farmers;**
- **Fully include smallholder farmers organizations and civil society in the SBSTA's agriculture work program;**
- **Strengthen synergies between the various fora of governance of food security and climate change;**
- **Support and promote the agroecological transition;**
- **Accompany sustainable adaptation of smallholder farmers;**
- **Make adaptation by smallholder farmers a funding priority;**
- **Build agronomic research on partnerships with farmers organizations, including smallholder farmers' organizations;**
- **Include women in each and every of the above mentioned steps**.

1. Lessons learnt from the two agricultural workshops held in 2015

The 2015's workshops failed to address the key role smallholders should play in the UNFCCC processes. Indeed, in June 2014, the SBSTA launched a work program focusing on four themes in order to exchange views about issues and real solutions relating to agriculture. The two first SBSTA workshops on issues related to agriculture focused on early warning systems and contingency plans to deal with extreme events and took place in June 2015. However, the discussions do not sufficiently reflect the needs of smallholder farmers in developing countries yet. Regarding the second workshop (risk analysis and the vulnerabilities of agricultural systems to various climate change scenarios), few mentions were made on the need for analyses of weaknesses or of participatory and differentiated capabilities, especially as regards to gender equality. No analysis was presented on the various vulnerabilities arising from different agricultural systems, in spite of the importance of this issue. Such analysis, however, could have helped make progress in the debate on the type of agricultural models that the UNFCCC should endorse to reduce emissions and promote adaptation.

In summary, the workshops contained valuable presentations, provided a useful space for exchanges and allowed participants to share concrete adaptation measures for agriculture. However, they fell short of a robust discussion about the pros and cons of each approach, what were the approaches that really respond to the need of vulnerable populations and smallholder farmers especially women farmers and did not permit to make concrete recommends as regards the type of approach that the UNFCCC should support.

Finally, neither civil society, nor smallholder organizations were invited to take part to the debate despite different decisions of the SBI that have highlighted in the past that the existing means of engagement of observer organizations could be further enhanced, in the spirit of fostering openness, transparency and inclusiveness (FCCC/SBI/2011/7 - SBI-34 conclusions 178). This is very unfortunate, as we know how farmer's participation is an asset for the dissemination of best practices as underlined by the Special Rapporteur on the Right to Food in his 2010's report on Agroecology (§32-34).

Smallholder farmers are the backbone of many developing countries' economies. They already experience the impacts of climate change in their fields and in their lives. They require much more support to enhance their capacity to undertake adaptation actions.

2. SBSTA workshops in 2016 should build on feedbacks from the smallholder farmers

Future workshops would benefit from smallholder farmers organizations reporting on the impacts of policies and actions taken to adapt to climate change.
For the SBSTA to really support the work of the COP and the CMP through the provision of timely information and relevant advisory on issues relating to agriculture, we suggest the following guiding intentions:

- Sharing of information, best practices, and advice on scientific programs related to climate change and agriculture. There is an opportunity to learn from organizations usually not well represented in the UNFCCC processes, such as farmers' organizations and civil society organizations involved in agriculture and to identify research gaps and information needs as the SBSTA work on agriculture progresses;
- Debating on intersessional discussion from Parties, Civil Society, farmers organizations and marginalized stakeholders, including women, smallholder farmers, pastoralists and indigenous people;
- Recommendations made by Parties and Civil Society during these workshops could be summarized, analyzed and pointing to concrete opportunities for collaborative action.

- More time should be given to discuss and search a consensus. Therefore, the secretariat should work on compiling the elements of convergence and divergence between the Parties submissions and statements in order to address these points in the discussion in which would be included civil society with all its constituencies and particularly the farmers.

3. A pathway to resilience in agriculture based on human rights and focused on smallholder farmers adaptation

By 2080, 600 million additional people may be undernourished due to climate change[1] in addition to the 795 million ones already suffering from hunger[2]. Climate change affects farm yields and livestock, the nutritional quality of food and the quality of water, as well as the quality of the soil which, in many cases, is already severely depleted. This situation has major consequences on food security and people's health. The last World Bank report on climate change (November 2015) states that "impacts on agricultural production and prices—triggered by either gradual changes in long-term climate trends or more frequent and severe natural disasters—will affect poor people through food production impacts, higher consumption prices, and changes in rural incomes" and that "that climate change could result in global crop yield losses as large as 5 percent in 2030 and 30 percent in 2080."[3] According to *The Lancet*, 529 000 more adults would die from hunger in 2050 worldwide due to changes in diets and bodyweight from reduced crop productivity[4] while average global food availability per person will be reduced by 3.2%. The most vulnerable groups, especially smallholder farmers in tropical and equatorial regions, are the first to be affected by the negative effects of climate change. However, we should not forget that underlying causes of vulnerability such as access to and control over resources: land, water, credit, information and knowledge limit the capacities of smallholder farmers to adapt. Therefore, given the fact that 70% of the world's food is produced by smallholder farmers, discussions on adaptation in the agricultural sector cannot be limited to a technical approach and it is fundamental to consider social, environmental and economic aspects.

3.1. A rights-based approach of adaptation in agriculture, for an enhanced food security

Most Parties are aware of the need to make their agricultural practices evolve: *"out of the 113 Parties that include adaptation in their INDCs, almost all (102) include agriculture among their adaptation priorities."*[5] But, and even if several studies demonstrate the link between the impacts of climate change, poverty and food insecurity, *"social equality, human rights and food security are not receiving high levels of attention in climate change policy either at national or global level. As they stand, the INDCs do not go far enough to meaningfully address climate-change induced stresses on society and social inclusion, while limited attention to gender equality in climate change actions risks substantially increasing the global gender gap."*[6] In the INDCs compiled in December 2015, only 25 Parties out of 160 were recognizing the needs of vulnerable and marginalized communities[7].

[1] *UNDP, 2007. Human Development Report. Fighting climate change. UNDP, New York, p. 90*
[2] *The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. Rome, FAO http://www.fao.org/3/a-i4646e.pdf*
[3] Hallegatte, Stephane, Mook Bangalore, Laura Bonzanigo,Marianne Fay, Tamaro Kane, Ulf Narloch, Julie Rozenberg, David Treguer, and Adrien Vogt-Schilb. 2016. Shock Waves: Managing the Impacts of Climate Change on Poverty. Climate Change and Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0673-5. License: Creative Commons Attribution CC BY 3.0 IGO. p.4
[4] Springmann et al, 2016. Global and regional health effects of future food production under climate change: a modelling study. Published online. The Lancet. March 2016
[5] Richards M., B. Bruun T., …, Vasileiou I., *How countries plan to address agricultural adaptation and mitigation.* Info Note. CCAFS. December 2015. p.1
[6] Richards M., B. Bruun T., …, Vasileiou I., *How countries plan to address agricultural adaptation and mitigation.* Info Note. CCAFS. December 2015. p.7
[7] Richards M., B. Bruun T., …, Vasileiou I., *How countries plan to address agricultural adaptation and mitigation.* Info Note. CCAFS. December 2015. p.6

Including social, environmental and economic aspects has also to do with the model of agriculture promoted. To maintain an agriculture model wrapped in a climate-smart label will not rightly address the entire picture of agriculture. A truly rights-based approach that ensures social and environmental safeguards and promotes traditional knowledge and a gender approach is key for the adaptation of smallholder farmers.

- **Land and water rights**

Because land is crucial to all farming activities, and especially for smallholder farmers, it is often a subject of intense implicit or explicit conflict between local communities, state and firms. Therefore, the application of voluntary guidelines on the responsible governance of tenure of land, fisheries and forests (VGGT, 2012) should be an unquestionable prerequisite. In relation to climate change, the voluntary guidelines highlight the importance for State to "ensure *that the legitimate tenure rights to land, fisheries and forests of all individuals, communities or peoples likely to be affected, with an emphasis on smallholder farmers, and vulnerable and marginalized people, are respected and protected by laws, policies, strategies and actions" (art. 23.1).* Beyond those general obligations, a specific focus is made on the importance of the principles of consultation and participation in the negotiations and implementation of adaptation programs (art. 23.3). Last but not least, when people may be displaced due to climate change, a particular attention must be paid to include affected communities in the decision on further actions and policies (art. 23.2). Linking adaptation measures in the agricultural sector to the respect of land rights cannot be bypassed. The Importance of rights in climate change mitigation has been proved[8]; similarly, the progress of land rights and a better adaptation for smallholder farmers are often the two faces of the same coin[9].

- **Indigenous knowledge**

The very identity of indigenous people is defined by their relation to their lands. As raised by the fourth IPCC assessment report (2007), their *"knowledge is an invaluable basis for developing adaptation and natural resource management strategies in response to environmental and other forms of change"*.[10] Indigenous people have developed years of experiences and a great knowledge of natural systems (land use, agriculture, water resources, animal and plant health, etc.) which is intrinsically complementary to scientific research on climate change. A bottom-up approach taking into account traditional indigenous knowledge is highly valuable in the identification of adaptation measures. It is for instance an unquestionable asset for implementation of those measures that allows participation, appropriation and dissemination at local level. Unfortunately, indigenous people are too often excluded of global processes of decision, including UN climate negotiations. In the INDCs, it is regrettable to note that *"only 27 Parties refer to indigenous knowledge, practices or peoples"*[11] although their capacity to cope with climate change has been largely proven. Furthermore, not considering traditional knowledge endangers indigenous livelihoods and the stability of their societies. It is then fundamental to ensure, among others, customary rights and the right to free, prior and informed consent.

"Integrated agricultural systems based on indigenous knowledge and traditional practices provide many examples of sustainable and adaptive systems with potential to survive and mitigate major

[8] Helen Markelova and Ruth Meinzen-Dick, Agriculture and Climate Change : An Agenda for Negotiation in Copenhagen For Food, Agriculture, and the Environment. The Importance of Property Rights in Climate Change Mitigation, IFPRI, Brief 10, May 2009 ; REYTAR Katie, SPRINGER Jenny, STEVENS Caleb, WINTERBOTTOM Robert, Securing rights, combating climate change. How strengthening community forest rights mitigates climate change, World Resources Institute, 2014, 56 p.

[9] http://www.wri.org/blog/2014/10/3-maps-show-importance-local-communities-forest-conservation?utm_campaign=wridigest&utm_source=wridigest-2014-10-27&utm_medium=email&utm_content=title

[10] M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds), *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 2007, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[11] Richards M., B. Bruun T., …, Vasileiou I., *How countries plan to address agricultural adaptation and mitigation.* Info Note. CCAFS. December 2015. p.6

climatic change. Agricultural adaptation strategies employed by Indigenous Peoples include adjusting crop varieties and planting dates (such as mixed cropping in Burkina Faso or rotational cropping in the Indian Himalayas); relocating crops (Indigenous Peoples in Guyana are moving from their savanna homes to forest areas during droughts and have started planting cassava, their main staple crop, on moist floodplains which are normally too wet for other crops); change of hunting and gathering periods to adapt to changing animal migration patterns; and improvement of agricultural techniques (with many instances reported across Africa and Latin America). [...] Indigenous communities have remarkable adaptive capacities to survive in inhospitable environments and difficult circumstances. Indigenous adaptive strategies in the agriculture sector typically take advantage of traditional knowledge held by the community to reintroduce indigenous agricultural techniques that may have fallen out of favour, and promote sustainable natural resources management practices. Many indigenous populations also possess a unique knowledge of plant genetic diversity that may be needed to fight plant and animal diseases: they breed animal and plant varieties that cope with stressed environments, and possess the ability to interpret natural phenomena to forecast weather shifts and respond appropriately."[12]

- **Gender equality**

Women represent 43% of the farming labour force in developing countries[13] although they own less than 1% of the land. They are involved in both crop and livestock production at subsistence and commercial levels. They produce food and cash crops and manage mixed agricultural operations often involving crops, livestock and fish farming. Recognizing their work is matter of right and is fundamental to ensuring global food security. Gender inequalities limit the capacity of women to adapt and also agricultural productivity and efficiency and in doing so, undermine development agendas. Failing in recognizing the different roles of men and women results in misguided projects and programs, forgone agricultural output and incomes, and food and nutrition insecurity. It is time to take into account the role of women in agricultural production and systems and to increase concerted efforts to enable women to move beyond production for subsistence[14]. According to the study led by CGIAR on 133 INDCs, *"Gender receives substantial attention (57 Parties), but gender references are confined mostly to impacts of climate change with less emphasis on supporting women to actively address and participate in adaptation and mitigation actions. Only 10 Parties refer to the role of women in agriculture. [...] The lack of substantive references and commitments in the INDCs to gender equality and women reflects the limited approach to gender within the UNFCCC."*[15]

CARE project "Where the rain falls" illustrates this in Bangladesh, Kurigram district, where more than 65 per cent agricultural activities are being done by women although they are not being recognized as farmer. After several workshops and discussions with Sub Assistant Agriculture Officers (SAAO), a local union and communities to recognize women as farmer from the beginning of the project, the situation is changing slowly. People are realizing women's contribution in agriculture and recognizing them as farmers. As a consequence of that initiative, 43 women have got farmers ID card and are now receiving technical assistance from the authorities.

[12] Galloway McLean K., *Advance Guard. Climate change impacts, adaptation, mitigation and indigenous peoples*, United Nations University, Institute of Advanced Studies, Traditional Knowledge Initiative, p.15
[13] *The role of women in Agriculture* - FAO SOFA team - March 2011 http://www.fao.org/docrep/013/am307e/am307e00.pdf
[14] http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf
[15] Richards M., B. Bruun T., …, Vasileiou I., *How countries plan to address agricultural adaptation and mitigation.* Info Note. CCAFS. December 2015. p.6-7

3.2. A smallholder farmers-based transition to agroecology

Facing climate change adverse impacts on agriculture cannot be limited to a question of productivity and profitability. Climate change will not only affect production through the decrease of yields but also the other pillars of food security and other stages of the food value chain causing reductions in both food quantity and quality. Impacts range from issues related to food security**,** such as increased prevalence of pathogens and toxins, to impacts on infrastructure such as damage to storage facilities or roads have to be considered from the outset.
Furthermore, project and policy preparation needs to be based on a better understanding of interconnections between smallholder farming and wider landscapes.

Consequently, it requires a more holistic approach, where we consider environment in which food is produced and the people who are producing it. These are the basics of sustainable development: being at the crossroad between economic, social and environmental criteria.
However, many agricultural practices and systems are now labelled as "climate smart" (based on 3 pillars : sustainably increase agricultural productivity and incomes, adapt and build resilience to climate change, and reduce and/or remove greenhouse gas emissions) but many are being used to greenwash unsustainable practices because of a lack of straightforward criteria to define "climate-smart". Consequently, considering the diversity of solutions and f interests among stakeholders, one can wonder which agricultural models should be promoted to tackle climate change.
Many practices and cultural systems can enhance productivity in a sustainable manner, promote food security and build resilience of local populations. These practices are based on indigenous knowledge and know-how and are adapted to each agro-ecological zone and farming system. These practices are gathered under the term "agroecology". Very diverse and knowledge intensive, these practices represent tremendous opportunities for applied research partnerships with farmers organizations.

3.2.1. Supporting the agroecological transition

Agroecology is an efficient, resilient and sustainable model of production that meets the challenges of both adaptation and mitigation. The many benefits of this knowledge-intensive approach have been proven on the ground. Practiced on smallholder farms, agroecology helps make best use of the potential of ecosystems and of natural biomass cycles, as well as of land management, broken down into its different environmental, social and economic components.
Evolving from a technical set of field-level practices that better mimic nature and avoid negative environmental impacts, agroecology as a movement has increased the call to minimize negative socio-economic impacts, to value and promote the engagement and knowledge of small-scale food producers, and to empower farmers to have more control over resources. And the agroecology movement strongly emphasizes issues of equity, autonomy of local populations and the preservation of natural resources.

A definition of Agroecology

According to Gliesmann (1998) and Altieri (1995) agroecology is the fusion of agronomy and ecology. It is a science and a set of practices as well:

- As a science, agroecology is the application of ecological science to the study, the conception and the management of sustainable agroecosystems;
- As a set of agricultural practices, agroecology strives to improve agricultural systems by mimicking natural processes and creating beneficial interactions and synergies between the components of the agroecosystem. This leads to provide the most favorable conditions for plants growth, particularly by managing organic matter and increasing the soil biotic activity.

Sources: Gliesmann S., 1998. *Agroecology : ecological Processes in Sustainable Agriculture*, MI : Ann Arbor Press and Altieri M.A., 1995. *Agroecology : The science of Sustainable Agriculture* (2nd ed.), Westview press.

3.2.2. Accompanying sustainable adaptation of smallholder farmers

In addition to financial support, smallholder farmers must be supported in their efforts to adapt to the effects of climate change, starting with those in least developed countries. This should be done **a) via the widespread distribution of adaptation practices, b) by taking better account of nutritional issues, c) by sharing knowledge and good practices, and d) via structured policy responses.**

a) Improvement of sustainable farming practices and agroecology are essential to allowing smallholder farmers to adapt. This includes the development of agroforestry; efficient and fair practices of management and resource conservation, in particular of water and land; an integrated management of crop with livestock farming, etc. No lasting adaptation measure is possible without reducing inequalities, particularly those of gender, especially in terms of access to and control of resources. Local government's extension services have a key role in the spreading of adaptation practices[16].

b) The quality of agricultural output is affected by climate change. Indeed, growing wheat, rice or barley in a high-CO 2 environment can reduce the protein content of those grains by 10 to 14%, as well as their zinc and iron content[17]. This also concerns all the factors contributing to undernutrition (health care, access to water, hygiene and sanitation, gender, food security). The forecasts are alarming: if nothing is done to tackle the challenge of climate change, by 2050 the fall in available calories will cause child malnutrition to rise by 20%. Agricultural strategies must from the outset take into account their impact on nutrition and target those who are most vulnerable[18]. Agricultural diversification strategies that encourage resilience[19] of the most vulnerable and that ensure the promotion of the best crops from a nutritional point of view must receive support.

c) Sharing concrete knowledge and experiences, including research results and smallholder farmers knowledge and skills, is essential. This is based on a dialogue between smallholder farmers (for example, as part of the "farmer field schools") and their organisations, civil society, research bodies, and agricultural development organisations. Strengthening links between scientific research and smallholder farmers could, for example, be done by involving them in agricultural innovation platforms at national and regional level[2021]. These could aim at strengthening and promoting the main agroecological principles of soil, water and landscape management, etc.

d) Adaptation to climate change and climate-related risks by smallholder farmers in Southern countries requires links between agricultural and territorial policies, as well as ensuring they are consistent at different levels, from the national to the local. National adaptation plans have been defined in many countries, but too few of them have led to concrete action plans and implementation, notably due to a lack of financial resources and institutional support. These policies must take into account the difficulties that the smallholder farmers themselves have raised, by drawing up local adaptation plans (taking into account land-related problems) which are based on locally developed knowledge. These local action plans should be fed by proposals from the agricultural innovation platforms mentioned above.

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[16] HLPE, 2012. Food security and climate change. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2012 (p.56).

[17] http://www.nature.com/nature/journal/v510/n7503/full/nature13179.html

[18] International Food Policy Research Institute. 2015. Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development. Washington, DC. (chap 6)

[19] Lin B.B., 2011. Resilience in agriculture through crop diversification: Adaptive management for environmental change. BioScience, 61 (3) , pp. 183-193.

[20] http://www.avsf.org/public/posts/1424/fiche_innovation_avsf_equateur_partage_eau_2013.pdf
http://www.camaren.org/foro-de-los-recursos-hidricos/

[21] http://www.jolisaa.net/

3.2.3. Making adaptation by smallholder farmers a funding priority

Smallholder farmers have a strong potential to adapt to constraints imposed by climate change. They are also a source of innovation, both in terms of production methods as well as at social and institutional level. It is therefore necessary to make additional public funding available that is dedicated specifically to smallholder farmers. It is also necessary to redirect farming subsidies to smallholder farmers involved in the transition towards agroecology instead of polluting industrial agricultural models which are incompatible with the necessary changes.
This funding must serve to identify and replicate local knowledge and innovations (technical, social and institutional) in the field of adaptation. It must help improve climate forecasts, as well as help better evaluate vulnerabilities, in particular the factors of and evolutions in malnutrition. The Green Fund must include adaptation of smallholder farmers as one of its priorities[22].

3.2.4. Building agronomic research on partnerships with producers organizations

There is a lack of active involvement of farmers in the research process. Partnership Action Research (PAR) could aim to address this deficiency. Because they are close to the farmers' concerns and can be very active innovation platforms and vectors, as they allow people to share experiences and practices from different places, farmers' organizations could be chosen intermediary between academic research and smallholder farmers. A properly designed partnership between research centers and farmers organizations could generate highly practical bottom-up knowledge and set up experience sharing and technology transfers hubs to benefit the most vulnerable. This could participate to building the field-based knowledge needed to develop productive agroecological systems adapted to different zones and conditions with practices affordable for smallholder farmers.
Furthermore, mechanisms need to be created to support collaboration and exchange of knowledge between stakeholders, especially at the regional but also at the interregional levels. Such partnerships can support responses in relation to transboundary issues such as the sustainable management of natural resources or the prevention and control of pests and diseases. In addition, collaboration can allow countries encountering new challenges and climate and weather patterns to receive advice from countries who are accustomed to such conditions. These mechanisms have to include different forms of knowledge as well as people's diverse aspiration in order to act as a catalyst to achieve the above objectives. However, it's important to define clear contractual frameworks to support these partnerships.

3.3. Examples of agroecological practices and studies

3.3.1. Academic studies showing the interests of Agroecological practices

Agroecological practices improving crop yield
A study conducted in 2011[23] examined 40 initiatives employing agroecological production methods in 20 countries, involving 10.4 million farmers. These included agroecological approaches to aquaculture, livestock and agroforestry, conservation agriculture, and crop variety improvements with locally appropriate cultivars and cropping systems. Analysis of project outcomes demonstrated not only an average crop yield increase of 113%, but also numerous environmental benefits, including carbon sequestration and reductions in pesticide use and soil erosion.

[22] HLPE, 2012. Food security and climate change. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2012 (p.58).
[23] Jules Pretty , Camilla Toulmin & Stella Williams (2011) Sustainable intensification in African agriculture, International Journal of Agricultural Sustainability, 9:1,5-24

According to Pretty, Toulmin and Williams (2011), a sustainable production system would exhibit most or all of the following attributes:

- utilizing crop varieties and livestock breeds with a high ratio of productivity to use of externally and internally derived inputs;
- avoiding the unnecessary use of external inputs;
- harnessing agro-ecological processes such as nutrient cycling, biological nitrogen fixation, allelopathy, predation and parasitism;
- minimizing the use of technologies or practices that have adverse impacts on the environment and human health;
- making productive use of human capital in the form of knowledge and capacity to adapt and innovate and social capital to resolve common landscape- scale problems;
- quantifying and minimizing the impacts of system management on externalities such as greenhouse gas emissions, clean water availability, carbon sequestration, biodiversity and dispersal of pests, pathogens and weeds.

Agroecological practices improving food security

A study conducted in 2009[24] show impact of applying agroecological practices on household food security, nutrition, crops diversity and health: 88% of organic farmers found their food security better or much better than in 2000 compared to only 44% of conventional farmers; organic farmers eat 68% more vegetables, 56% more fruit, 55% more protein rich staples and 40% more meat than in 2000 (2 to 3.7 times higher than for conventional farmers); organic farmers on average grow 50% more crop types than conventional farmers; in the full organic group 85% rate their health today better or much better than in 2000. In the reference group, only 32% rate it positively, while 56% see no change and 13% report worse health.

Agroecological practices improving resilience

According to the Special Rapporteur on the Right to Food [25], Farms run on agroecological principles can be more resilient in response to natural disasters such as hurricanes. For instance, farms in Nicaragua, Honduras and Guatemala that relied on sustainable agricultural methods suffered considerably less damage than conventional farms following Hurricane Mitch in 1998, with sustainable farms retaining up to 40 per cent more topsoil and suffering less economic loss than neighboring conventional farms.[26] Similar studies conducted in Mexico following Hurricane Stan and in Cuba following Hurricane Ike had similar findings.[27] Agroecological farms were also able to recover faster after the hurricane.[28]„

3.3.2. Practices to be promoted for a sustainable increase of productivity and resilience of smallholder farmers

In its 2012 report on food security and climate change, the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security proposed the following list of concrete practices. All of them are related to building richer agro-ecosystems and applying agroecological practices.

[24] Bachmann L, Cruzada E, Wright S (2009) Food security and farmer empowerment: a study of the impacts of farmer-led sustainable agriculture in the Philippines. Masipag-Misereor, Los Baños
[25] Elver H. 2015. Interim report of the special rapporteur on the right to food. A/70/287. August 2015. UNHR
[26] Eric Holt-Giménez, "Measuring farmers' agroecological resistance after hurricane Mitch in Nicaragua: a case study in participatory, sustainable land management impact monitoring", *Agriculture, Ecosystems and Environment*, vol. 93, Nos. 1-3 (December 2002)
[27] Stacy M. Philpott and others, "A multi-scale assessment of hurricane impacts on agricultural landscapes based on land use and topographic features", *Agriculture, Ecosystems and Environment*, vol. 128, Nos. 1-2 (October 2008)
[28] Peter Michael Rosset and others, "The *campesino*-to-*campesino* agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty", *Journal of Peasant Studies*, vol. 38, No. 1 (2011). ANAP stands for Asociación Nacional de Agricultores Pequeños (National Association of Small Farmers)

Options for adaptation to climate change

- Plant different varieties or species of crops, or rear different breeds or species of livestock (or fish in aquaculture). Varieties or breeds with different environmental optima may be required, or those with broader environmental tolerances. The use of currently neglected or rare crops and breeds should be considered.
- In the face of greater weather variability consider increased diversification of varieties or crops to hedge against risk of individual crop failure. Make use of integrated systems involving livestock and/or aquaculture to improve resilience.
- Sow crops (including feedstocks and forage) at different times of year; alter seasonal husbandry practices to adapt to different weather patterns.
- Change irrigation practices; in many areas the major challenge of climate change will be the reduced availability of water from various causes including lower precipitation, more rain occurring in extreme events which makes water harder to capture, changes in river flow as glaciers retreat and increased competition for water in a hotter environment. These challenges may be particularly critical in some of the major "bread basket" regions upon which the food security of large population concentrations rely. Food producers will need to adopt enhanced water conservation measures, use marginal resources and make more use of rainwater harvesting and capture. In some areas, increased precipitation may allow agriculture or non-irrigated agriculture in places where previously it was not possible.
- Alter agronomic practices; changes in rainfall may favour reduced tillage to lessen water loss, similarly the incorporation of manures and compost, and other land use techniques such as cover cropping increase soil organic matter and hence improve water retention. Animal diets and stocking rates will need to respond to changing environmental conditions.
- Prepare for increased frequencies of extreme events. General water conservation measures are particularly valuable at times of drought, while strategies such as improved soil organic matter help store water after storms. Increased storm frequencies will require improved drainage and farm design to avoid soil loss and gullying. Farms in coastal areas may need to adapt to increased frequency of saltwater intrusions and in dryer areas to more frequent wildfire events.
- Adapt pest, weed and disease management strategies; different crop and livestock antagonists will respond differently to climate change, not always to the disadvantage of food producers. However, to the extent that farmers have expertise in coping with existing pests and diseases, and that the natural regulation of potential pests by their natural enemies may be disrupted by a changing climate, food producers are on balance likely to face more rather than less challenges of this type. Similar considerations apply to the disruption of pollinator ecosystem services.
- Change post-harvest practices, for example the extent to which grain may require drying and how products are stored after harvest.
- Consider (where possible) increasing insurance cover against extreme events.
- Consider the effect of new weather patterns on the health and well-being of agricultural workers.
- Engage with other food producers to share best practice and experience so as to enhance community-based adaptation.

Source: HLPE, 2012. Food security and climate change. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2012 (p.55)

Member NGOs from Coordination SUD also recommend the following technical and organizational practices, field-tested through projects[29] in different climate zones.

[29] http://www.coordinationsud.org/wp-content/uploads/Innovations-agro--cologiques-Afrique-VEng-VDebray-2015.pdf

1. Innovative combination of agroecological practices in arid area: Mauritanian oases[30]

Adaptive measures:

- Managed irrigation : Californian irrigation systems or drip irrigation systems supplied with submersible solar pumps
- Better management of soil fertility through season cultivation and use of compost from date palm leaves as organic fertilizer
- Creation of the Association for Participatory Management of Oases which provides members with technical training and support and place to exchange.

Results:

This combination of practices allows peasants to face water scarcity and soil degradation and therefore limits migrations of rural populations to cities

2. Innovative combination of agroecological practices in sub-arid area: South Madagascar[31]

Adaptive measures:

- Selected adapted local seeds
- Associations of crops and optimal crop rotation to increase soil fertility
- Hedging plants to limit wind erosion
- Creation of the Association for Participatory Management of Oases which provides members with technical training and support and place to exchange.

Results:

This combination of practices allows peasants to face soil fertility loss, because of heavy wind erosion and provides revenues diversification thanks to seed production commercialization and grain edible hedging plants.

3. Innovative combination of agroecological practices in sub-humid area: Togo[32]

Adaptive measures:

- Fallows, legumes to increase soil fertility
- Agroforestry systems

Results:

This combination of practices allows peasants to provide revenues diversification and enhancing soil fertility. Consequently, peasants contribute to food security of local populations and to the maintenance of fertile land in long term. Such plant associations may also contribute to improve their resistance to the spreading of weeds, pests and diseases.

4. Innovative combination of agroecological practices in humid area: Cameroun[33]

Adaptive measures:

- Association of fruit trees with 3-4 intermediate crops including legumes
- Soil cover and hedgerows to limit soil erosion

Results:

This combination of practices allows peasants to maintain soil humidity, limit soil erosion while enhancing its fertility. Furthermore, annual crops may be protected to a certain extent from extreme climatic events, such as heavy rains and cyclones, by surrounding trees. Also crop associations are supposed to have better management of pests and diseases than monoculture systems. However, such systems present a low productivity of work.

[30] Project implemented by Tenmiya association in Mauritania
[31] Project implemented by GRET in Madagascar
[32] Project implemented by AVSF in Togo
[33] Project implemented by AVSF in Cameroun

Organizational practices improving the farmers' adaptation and resilience to climate change:

1. Effective governance helps ensure that the people most impacted and most in need are part of the solution and that their priorities and needs are heard and addressed[34]

Participatory Scenario Planning model which brings together local communities, farmers, scientists, and officials to develop plans for multiple weather scenarios showed very good success. The process not only ensures inclusion of farmer and community voices but also connects them to local officials, builds all parties' capacity to collaborate, and disseminates important and relevant climate information back to community farmers. The process provides small-scale food producers with equitable access not only to information and resources but also to local government and planning processes.

2. Adaptation planning[35]

Planning is an essential element of Community-Based Adaptation because successful adaptation depends on ability to manage climate impacts, risks and uncertainty, which requires forward-looking and informed decision-making. The basic process of planning involves analyzing information, identifying actions and relevant actors, prioritizing and operationalizing. These are critical skills that underpin adaptive capacity, enabling people to learn and use their knowledge and experiences to manage the risks and uncertainty that are associated with a changing climate. With these skills, people are able to process climate information, analyze their situation and underlying causes of vulnerability, plan for the future and make good decisions for their livelihood options and risk reduction strategies. Local institutions also require these skills to ensure that their activities and plans are resilient to climate change and support adaptation by communities.

Smallholder farmers when associated to this process can adapt their approach, techniques to the current and future risk and uncertainty and increase their capacity to innovate and their resilience.

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Coordination SUD - Development Emergency Solidarity is the national platform of French international solidarity NGOs. Founded in 1994, it brings together more than 150 NGOs active in the fields of humanitarian aid, development assistance, environmental protection, the defense of disadvantaged people's human rights and international solidarity education and advocacy.

The **Climate and Development commission** (CCD) and the **Agriculture and Food commission (C2A)** are two commissions of Coordination SUD.

The CCD, created in 2007, aims at passing on good practices between its own members and influencing the development actors' strategies and international negotiations under the United Nations Framework Convention on Climate Change process.

The C2A is working to realize the right to food and increase support for smallholder farming in policies that impact world food security. The commission is mandated by Coordination SUD to formulate the positions taken by the group at major institutional appointments dealing with agriculture and food.

Together, these two commissions represent 34 organizations: 4D, Acting for Life, ACF, aGter, Agrisud International, Artisans du Monde, AVN, AVSF, ATD Quart-Monde, CARE-France, CARI, CCFD-Terre Solidaire, CFSI, CIDR, Crid, ESF, Fondation Energies pour le Monde, Fondation GoodPlanet, GERES, Gevalor, GRDR, Gret, ID, Inter Aide, Iram, Médecins du monde, Oxfam France, Peuples Solidaires-ActionAid France, Plate-Forme pour le Commerce Equitable, Réseau Foi et Justice Europe, Secours Catholique-Caritas France, Secours Islamique, Solidarité et Union Nationale des Maisons Familiales Rurales, WWF

[34] http://careclimatechange.org/wpcontent/uploads/2015/05/ALP_PSP_EN.pdf

[35] http://careclimatechange.org/wp-content/uploads/2014/08/CBA_Planning_Brief.pdf