THE INITIATIVE FOR THE ADAPTATION OF AFRICAN AGRICULTURE TO CLIMATE CHANGE (AAA)

Addressing the Challenges of Climate Change and Food Insecurity

White Paper

INITIATIVE AAA
ADAPTATION OF AFRICAN AGRICULTURE

Introduction

COP21, which was held in Paris in December 2015, has marked a historic step in the fight against climate change. The goal of containing the average temperature rise under 2°C has been officially inscribed in the Paris Agreement. Developed countries have committed to provide at least US$100bn annually starting in 2020 to support mitigation and adaptation projects in developing countries.

This is good news for Africa and African agriculture, which are very vulnerable to climate change but are also great reservoirs of solutions.

While the continent is responsible for only 4% of global greenhouse-gas emissions, it is particularly affected by climate change. Six out of the 10 most affected countries in the world are in Africa, 65% of the African population are affected, not to mention that there are already 10mn climate refugees in Africa.

According to a report by the European Commission (2014), the negative effects of climate change are reducing Africa's GDP by 1.4% and inducing adaptation costs that can reach up to 3% of GDP, each year, until 2030. This GDP value loss is largely attributed to the degradation of the agricultural sector under the effects of climate change (temperature rise, droughts, floods, etc.).

Agriculture is a vital sector in Africa, concentrating between 25% and 35% of direct jobs depending on the country, and is a source of revenue for about 70% of the African population. Yet the sector is extremely vulnerable to the effects of climate change. Two thirds of Africa's arable lands could be lost by 2025 because of climate change, which deepens the effects of human practices that can be inappropriate at times (over-exploitation of lands, use of outdated techniques, insufficient irrigation, etc.), leading to desertification. The direct consequence of land degradation is loss of the soil's productive capacity. The slump in agricultural yields could reach 20% in 2050, even if we manage to contain the average temperature rise under 2°C.

If the international community does not take the measures necessary to reduce greenhouse gas emissions, an environmental, economic, and human catastrophe is bound to befall the African continent.

The challenge to which Africa must respond is grave, especially since its population is expected to double by 2050. The continent will have to triple its agricultural productivity by then, while reducing the impacts of climate change on natural resources, namely soil, water, and biodiversity.

According to experts, Africa and African agriculture are part of the solution to ensure food security to Africans a well as to the wider world. With sufficient means, African agriculture is capable of not only adapting to climate change, but also responding to the challenges of productivity and sustainable development.

Africa's production potential is immense. In fact, 60% of the planet's unexploited arable lands are in Africa. The continent constitutes a possible field of application for development approaches and innovative technologies. The continent is still tied to a traditional agriculture, but it is in a position to modernise rapidly with the use of digital tools, new technologies, and renewable energies. Africa can skip a whole stage of development and position itself as a pioneer of tomorrow's solutions. By doing so, it would provide itself with an immense source of jobs.

It is estimated that with smart, climate-sensitive agricultural practices, African annual agricultural production could increase from US$280bn to US$880bn by 2030.

Africa is in a position to show that, through its agriculture, it is fully capable of adapting to climate change and evolving with more resilience to meet the challenges of productivity and sustainable development and to ensure food security.

What Is the Initiative for the Adaptation of African Agriculture to Climate Change (AAA)?

If COP21 is known in the international community as a historic step for the many decisions it has brought about – notably with regard to reducing greenhouse gas emissions, committing to provide US$100bn a year to vulnerable countries, and ensuring the even-handed allocation of financial resources between mitigation and adaptation – COP22, for its part, will be the most opportune time to show that state parties are standing together to implement the Paris decisions. COP22 will be the COP of action in favour of the adaptation of African agriculture to climate change.

It is also the first time nations have expressed their needs to fight climate change through their nationally determined contributions (NDCs). Analysis of these NDCs showed that African countries are not only committed to contribute financially, but also to prioritise programmes of adaptation, agriculture, and food security.

The initiative for the Adaptation of African Agriculture to Climate Change (AAA) responds to the needs expressed by African countries.

It is built around two major pillars:

- Advocacy to secure financing for projects of agricultural adaptation in African countries;
- Promotion of innovative solutions to respond to Africa's top priority needs.

AAA promotes and encourages the implementation of concrete projects to improve soil management, agricultural-water control, climate-risk management, and financial-capacity building.

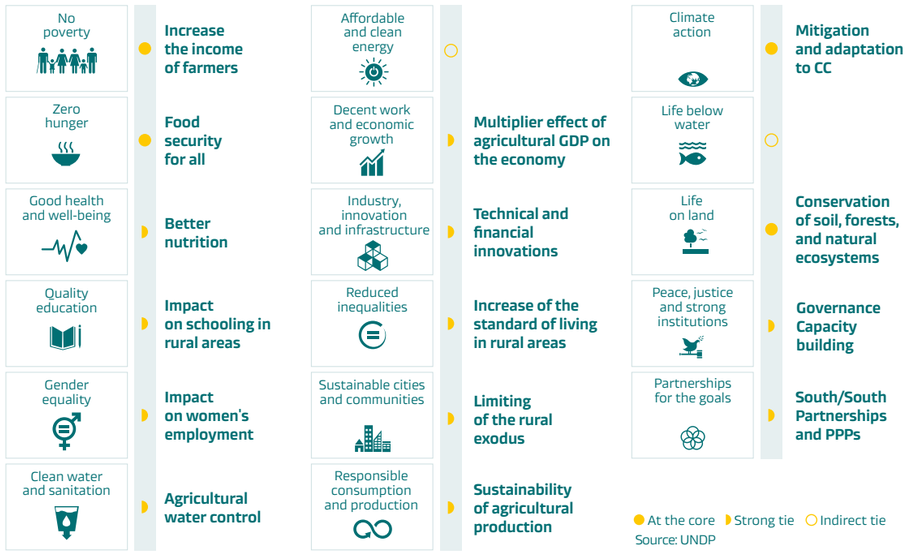
It highlights technical solutions as well as good practices and accompanying measures, notably technical and managerial capacity building. It is based on tools recommended by the UNFCCC: technology transfer, preparation of adapted agricultural policies and strategies, development of bankable projects that meet the criteria of development partners and donors, and promoting South-South cooperation.

AAA champions an integrated, participatory, and responsible approach, with three slogans: unite to succeed, provide a framework for action, rely on existing initiatives.

As a key answer to climate change and food insecurity, the initiative for the Adaptation of African Agriculture to Climate Change also contributes to meeting the most globally-spread developmental challenges.

In fact, it will contribute to the achievement of many Sustainable Development Goals.

AAA contributes to the attainment of Sustainable Development Goals



Source: UNDP

(1) NDC: Nationally Determined Contrubutions.

(2) CCNUCC: Convention-cadre des Nations unies sur les changements climatiques.

White Paper: Genesis and Objectives

This White Paper is the fruit of a symposium that was held with the objective of laying the scientific and technical foundations of the initiative for the Adaptation of African Agriculture to Climate Change (AAA). It aims to offer a synthesis of data and solutions highlighted during the symposium, ahead of COP22 negotiations and beyond.

On July 14, 2016, a group of national scientists, supported by international experts, met in Skhirat, Morocco, within the framework of a symposium on the initiative for the Adaptation of African Agriculture to Climate Change.

During this day of exchange, around 60 experts worked on determining solutions for the Adaptation of African Agriculture, allowing to face the challenges of climate change and food security. This symposium, articulated around five working groups, was a platform for gathering scientific insights and highlighting AAA technical solutions and good practices with regard to durable soil and agricultural management, agricultural-water control, and climate-risk management.

Among participants in the discussions were representants of the IPCC, UNFCCC, FAO, the The National Institute of Agronomic Research (Morocco), the Forest Research Centre (Morocco), the OCP Group, the OCP Foundation, the International Centre for Development and Climate Change (Canada), the International Center for Agricultural Research in the Dry Areas (ICARDA), AfricaRice, the General Council of Agricultural Development (Morocco), and various Moroccan and African universities.

This meeting of experts has constituted an essential first step to federate the international scientific community around the initiative for the Adaptation of African Agriculture to Climate Change and to list existing solutions in regards to soil management, agricultural water control, climate risk management, and financial capacity building.

The White Paper aims intends to document the basic elements of the work resulting from this symposium around five core axes, with the aim of clarifying the scientific and technical challenges of AAA, ahead of COP22 and beyond:

I. Soil Management

a. Soil Fertility and Crop Fertilisation

b. Fruit Farming, Rangeland Management, and Agroforestry

c. Agro-Ecological Innovations and Carbon Sequestration

II. Agricultural-Water Control

III. Climate-Risk Management

For each of these axes, the White Paper reports on the current state of affairs, lists the solutions promoted and supported by AAA, and reviews existing initiatives.

List of the members of the AAA initiative scientific committee

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I – Soil Management

I
Soil Management

The effects of climate change on African soils, two thirds of which are located in arid or semi-arid zones, have exacerbated an already worrying situation. Human activities and inappropriate practices (over-exploitation, shifting cultivation, introduction of invasive species, etc.) have considerably degraded lands, driving them sometimes to desertification. The decrease of crop yields could reach 20% in 2050, even even if we manage to contain the average temperature rise under 2°C.

In parallel, demographic pressure is constantly increasing in Africa. Projections indicate that agriculture will have to feed 1.5 billion people in 2030 and 2 billion in 2050.

That is to say soil management constitutes a major challenge, especially since African soils offer an important potential of carbon sequestration, that could contribute to significantly mitigating the greenhouse gas emissions behind climate change. Remember that Africa is home to 60% of the planet's unexploited arable lands.

From soil fertility and crop fertilisation to fruit farming and rangeland management, from agroforestry and carbon sequestration in soils to agro-ecology, AAA promotes and supports concrete solutions to meet these concrete challenges. The goal is to enhance their development and support their implementation, notably through building the technical and managerial capacities of farmers, organising them around channels adapted to their ecological environment, and accompanying them financially.

In this regard, it is essential to commit to respond to the challenge of soil depletion in Africa, but also to sustainably capitalise on their resources and diversity. These soils, if used rationally according to their purpose, will produce more, contribute to the modernisation and development of the agricultural sector, to job creation and poverty reduction, and finally to better feed populations, thus creating an environmental, economic, and social virtuous circle.

A — SOIL FERTILITY AND CROP FERTILISATION

CURRENT SITUATION

African soils suffer from severe degradation, which is worsening due to climate change. Yet the continent is one of the world's lowest consumers of fertilisers. Integrated management of soil fertility is therefore required to support soil regeneration and improve productivity. Such management must be adapted to the high variation of local conditions.

500 million hectares of land are moderately or severely degraded in Africa, that is 27% of degraded soils worldwide.

The most obvious manifestations of land degradation are erosion: water erosion which is due to runoff water action, and wind erosion. There are also chemical degradation phenomena: nutrient loss, salinization and soil acidification. Finally, we have physical degradation phenomena such as soil compaction, waterlogging of irrigated areas, silting or subsidence that make soils unfit for cultivation.

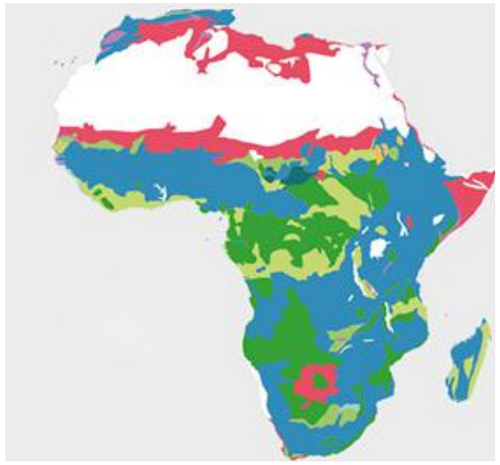
Africa is one of the world's lowest consumers of agricultural inputs: improved seeds, fertilisers and pesticides. For instance, the Sub-Saharan region consumes 20 times less fertilisers than Asia, and 15 times less than South America.

Many factors explain this lag: the sparse availability of fertilisers, both qualitatively and quantitatively, the insufficient efforts to raise the awareness of farmers about the advantages of fertilisers, and the financial hurdles.

This alarming situation requires that actions be taken to develop an integrated system of soil-fertility management based on a larger-scale, and more sensible, use of fertilisers.

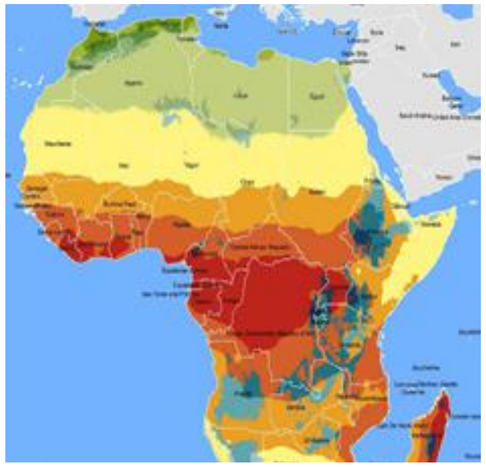
Responses must be adapted to each local situation.
Africa consists of four large ecological zones: arid, semi-arid, sub-humid, and tropical humid. This great variation affects soil types, cropping systems, organic-matter recycling, biogeochemical cycles, nutrients' bioavailability... which forbids any automatic and uniform use of fertilisers across the continent.

Figure 1. **Main phenomena causing soil degradation in Africa**



Source: Soil Atlas of Africa. JRC 2015.

Figure 2. **Agro-ecological zones in Africa**



Source: Peel, M. C., B. L. Finlayson, and T. A. McMahon, 2007. Updated world map of the Köppen-Geiger climate classification, In. Hydrol. Earth Syst. Sci., 11, 1633 1644.

SOLUTIONS

The Initiative for the Adaptation of African Agriculture to Climate Change promotes two complementary and interdependent types of solutions in terms of fertilisation: diagnosis approaches and technical responses. In parallel, it promotes teaching and support measures for the farmers.

Diagnosis approaches enable to establish the current state of soils fertility. These approaches require developing soil-fertility information systems:
- Information systems for each country, while adopting new technologies of soil mapping and digital compilation;
- Information systems for the agricultural use of land at the regional level;
- Soil-fertility and crop-fertilisation Observatories.

These measures of analysis allow the control of technical responses such as:
– "Systems" management
  - Improve the biological fixation of atmospheric nitrogen provide better nitrogen availability in soils by adopting rotations based on food and forage legumes;
  - Specific recommendations on fertilisers for protected crops and crops subject to localised irrigation: use of fertigation (injection of fertilisers in irrigation water) and implement hydroponics (soil-less crops in neutral substrates);
  - Adapt soil-fertility and crops-fertilising management to specific production systems: agriculture/agro-ecology vs agroforestry;
  - Develop organic agriculture;
  - Direct application of phosphate rocks without transformation into fertiliser on acid soils;
  - Improve acid and saline/sodic soils;
  - Rehabilitate the land.

– Diversification of nutrient sources:
  - Recover organic waste for agricultural use and manage crops residues;
  - Treat and reuse waste water (solid-waste source) and agricultural by-products to produce compost;
  - Develop a fertilisers market due to the improvement of procurement and distribution systems; develop blending units for the production of fertilisers suited to local conditions.

In order to see these solutions through, farmers must be assisted:
– Expert systems with tools to help in the decision-making regarding recommendations for fertilising crops adapted to farmers' knowledge and practices.
– Agricultural counsel for the simplification and dissemination of good practices of integrated soil-fertility management with participatory approach (basic education, awareness, demonstrations, field schools, innovation platforms, etc.)
– Provision of fertiliser equipment via farmers' organisations;
– Facilitated access to loans, use of smaller packaging requiring a smaller investment for farmers,
– Development of incentive systems aiming to promote the use of fertilisers ("smart subsidies")
– Implementation of policies to encourage and reinforce research and development and support production price, etc.

EXISTING INITIATIVES

AAA is in line with already existing initiatives. Among the most important initiatives on soil fertility and crop fertilisation, we can mention the following: Soil Fertility Initiative (SFI), the Green Revolution in Africa, the African Soil Health Consortium (ASHC), AfricaFertilizer.org and FertiMap.

1. Soil Fertility Initiative (SFI)

SFI, which is led jointly by the World Bank and the FAO and gathers 20 African countries, aims to develop and disseminate appropriate technologies for restoring and maintaining soil fertility, improve institutional and market contexts, and develop incentive programs and mechanisms among farmers and communities.

2. The "Green Revolution in Africa"

The purpose of this initiative, which is led by the Alliance for a Green Revolution in Africa (AGRA, established in 2006 in response to Kofi Annan's call) and mostly consists of sub-Saharan African countries, is to double the yields and revenues of 30 million farmers and households by 2020. It also focuses on the integrated management of soil fertility and the rational use of fertilizers, the improvement of policies and institutional and financial environment, and capacity building.

3. The African Soil Health Consortium

The Program, which is supported by the Bill and Melinda Gates Foundation and brings together several African countries, promotes the access to information and to the supervision related to the integrated soil fertility management.

4. AfricaFertilizer.org

Carried out by the Africa Fertilizer Agribusiness Partnership (AFAP), the International Fertilizer Industry Association (IFA), the FAO, and the African Union Commission, this initiative supports the dissemination of information on fertilizer sector for the public and private sector, including fertilizer industry, distributors and farmers.

5. FertiMap

FertiMap is concerned with the fertility of cultivated soils in Morocco. It is an ongoing partnership project between the Moroccan Ministry of Agriculture and the OCP Group since 2010. The works are carried out by a consortium of Moroccan research and agricultural education institutions, led by the National Institute of Agricultural Research (INRA Maroc). Its main objective is to conduct a digital mapping of the fertility of 8.7 million ha of Morocco's agricultural soils. Based on soil analyses, including the levels of organic matter, available phosphorus, exchangeable potassium and pH, an expert system developed on the web allows for making recommendations related to fertilisers for the main adapted crops. Regional fertiliser formulas adapted to the quality of soils, their fertility status, and the nutrient elements requirements for the dominant crops are recommended.

The technology developed is used by scientists and agricultural advisers for the reinforcement of the capacities of farmers and technicians in the agricultural sector in Morocco. The impact is already measurable: +30% of productivity in the lands concerned.

The system is in use in several African countries as part of the South-South cooperation.

B — FRUIT FARMING, RANGELAND MANAGEMENT, AND AGROFORESTRY

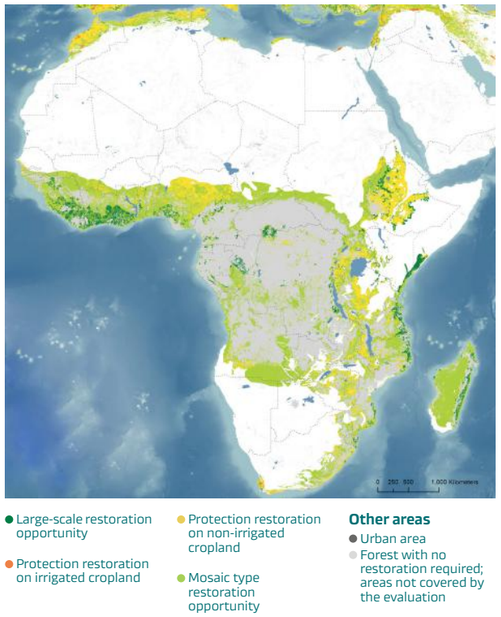
CURRENT SITUATION

Today in Africa, more than 715 million hectares of deforested and degraded lands are eligible for restoration. The establishment of synergies between agricultural crops, trees and livestock is a proven approach in terms of land restoration and improvement of soil productivity and regeneration over time.

Faced with weather extremes, African farmers develop survival mechanisms, often taking short-term measures, such as slash-and-burn agriculture or the cultivation of fragile and marginal lands, which degrade resources and affect productivity and regeneration over time.

In animal husbandry, too, Africa has come to face a momentous challenge. This sector contributes over 26% to Africa's agricultural GDP. 10% of the Sub-Saharan population mainly depends on this sector, while 58% of the population is partially dependent. And while livestock is abundant, it is marginally productive because it still relies on traditional production systems that are extremely vulnerable to climate changes.

Figure 3. **Forest and site restoration opportunities in Africa**



Source: Global Partnership on Forest and Landscape Restoration, 2011.

To improve its agro-pastoral resources and ensure the sustainable protection /management of its natural resources, Africa is called to develop agroforestry systems. As an essential bridge between forestry, agriculture and animal husbandry, agroforestry refers to a system of rational use of lands that increases the total yield by combining agricultural crops (food as well as annual crops), trees (perennial crops), and/or livestock farming in a synergic manner on the same plot. The combination can be spread over time, taking into consideration the ecological and socio-economic conditions of the local populations.

Agroforestry covers a wide range of useful trees that can be grown on farms and in rural landscapes. They include "fertiliser trees" for land regeneration, soil health and food security: fruit trees for human consumption, fodder trees that improve small farmers' livestock production, trees for timber and heating, medicinal trees for disease treatment, and trees that produce gums, resins or latex products. Most of these trees are multipurpose, providing farmers with many benefits in a sustainable manner.

SOLUTIONS

The initiative for the Adaptation of African Agriculture to Climate Change (AAA) encourages the integrated management of agroforestry and arboriculture cropping systems, pastoral systems, and forest systems, offering numerous benefits to farmers as well as to the environment. It also promotes political proactivity, regional cooperation, strengthening of legislations with relation to lands, forests and water, knowledge sharing and financial support to farmers and breeders.

The integrated management of agroforestry and arboriculture cropping systems requires the Improvement of technical coordination, the promotion of suburban agroforestry, the domestication of native species and the introduction of economic-interest species.

The integrated management of pastoral systems requires the development of rangelands and regulation of transhumance flows, the securing of pastoral zones as well as strategic pastoral areas, the elaboration/implementation of rangeland development/rehabilitation protocols, the establishment of water points for livestock watering, the diffusion of improved genotypes in regions with favourable intensification conditions, preservation of native species and nutrition improvement (use of by-products, improvement of feed production). The establishment of professional organisations for breeders is necessary to facilitate training, access to fertilisers and production commercialisation.

The integrated management of forest systems requires the improvement of the management of forest landscapes and gain-sharing, the introduction of large-scale afforestation/reforestation programmes, the establishment of national forest parks for carbon storage and safeguarding diversity. The launch of sustainable natural-forest developments and increase of reforestation/planting efforts, the domestication of native species and the introduction of economic-interest species, as well as the development and rational management of natural forests are major orientations of adaptation and resilience vis-à-vis climate change. The promotion of non-timber products in forest and pastoral spaces allows for the improvement of farmers' revenue. In this sense, the establishment and improvement of community business management paves the way to innovation, depending on local ecological and socioeconomic conditions.

Agroforestry offers many benefits to farmers as well as to the environment:

- Decrease in the amount of work and fertilisers;
- Resource diversification (food crops, cash crops, timber, medicine...);
- Systems less vulnerable to climate and economic changes;
- Many environmental services: maintenance of soil fertility and water resources, erosion control, carbon sequestration and biodiversity preservation;
- Decrease in greenhouse gas emissions by slowing the conversion of forests into agricultural land and storing carbon in the trees existing on the farms

All these opportunities can materialise at a large scale by way of implementing assertive national or regional policies, strengthening regulatory and institutional provisions: Legislations for the "greening" of the savannah, for equitable access to resources (land, water and forests) and for the implementation of REDD (Reducing Emissions from Deforestation and Forest Degradation).

The implementation of the aforementioned solutions also requires the engagement of the private sector, improving the agricultural-investment environment, and strengthening research and development capacities. Finally, it requires coordination, knowledge sharing, and facilitating access to climate-related financing.

I – Soil Management

EXISTING INITIATIVES

The initiative for the Adaptation of African Agriculture to Climate Change is in line with other existing initiatives.
Among the most emblematic initiatives in the field of agroforestry/arboriculture we have the "AFS4Food", the "Agroforestry and sustainable agriculture: the Fight Against Poverty, Malnutrition and Climate Change" initiative, and the initiative for "Increasing Food Security through the Practice of Agroforestry" (ASAPAM); and the "Great Green Wall for the Sahara and the Sahel Initiative"

1. **"AFS4Food"**
The project coordinated by CIRAD and funded by the African Union and EuropeAid promotes the improvement of food security and well-being of rural households in Africa through Agroforestry. In addition to providing a performance evaluation of agroforestry systems in three countries (Cameroon, Kenya and Madagascar), the project establishes a networks including all the partners via the following internet platform: http://afs4food.cirad.fr

2. **"Agroforestry and sustainable agriculture: the fight Against Poverty, Malnutrition and Climate Change".**
The initiative led by the International Solidarity Association, supported by ministries and NGOs in three countries: Nigeria, Ghana and Ivory Coast, aims to fight poverty and deforestation in rural areas.

3. **"Increasing Food Security through the Practice of Agroforestry" (ASAPAM).**
The initiative led by the Centre for International Studies and Cooperation (CECI) and funded by international universities and research centres supports agroforestry development in West African countries. It promotes the development and dissemination of fattening and diet improvement techniques. It also works on the identification of the appropriate plant species and the creation of agroforestry systems to allow for associating food crops to the sustainable production of timber and non-timber fodder.

4. **The "Great Green Wall for the Sahara and the Sahel Initiative"**
Launched in 2008 in the framework of the United Nations Convention to Combat Desertification (UNCCD), the "Great Green Wall for the Sahara and the Sahel Initiative" aims to plant an 8,000-kilometre-long tree strip, from Senegal to Djibouti, to increase food security, mitigate climate change, and stop the flux of immigrants to Europe, as well as promote land-degradation neutrality.

C — AGRO-ECOLOGICAL INNOVATIONS AND CARBON SEQUESTRATION

CURRENT SITUATION

African soils offer a tremendous potential for carbon sequestration. This potential is under-exploited, even though carbon storage enriches soils and is a limiting factor of greenhouse gas emissions. Developing an agro-ecology adapted to Africa would allow to unlock the potential of African soils and benefit from them.

African soils, namely unexploited lands (representing 60% of unexploited lands globally), harbour a huge potential for carbon storage.

Yet, at present, Africa only stores 175 gigatonnes of carbon, out of 1,500 gigatonnes stored globally, accounting for 12%. This is explained by anthropic factors (inadequate farming practices, burn-beating, overgrazing, deforestation, and non-incorporation of crop residues on soil), and natural factors (bad weather conditions, low precipitation, high temperatures, loss of vegetation cover, extreme rainfalls, and high mineralization) (figure 4).

The loss of the organic matter of agricultural soils is unanimously observed. This carbon release is largely seen in arid and semi-arid zones.

However, carbon storage is at the same time a solution to global warming (mitigation and compensation of GHG emissions) and to the rehabilitation of soil quality (water retention, aggregate stability, sodicity mitigation, biological activity, etc.)

As an ecologically sustainable alternative to a production-driven agriculture, agro-ecology allows for increased soils storage potential, while limiting their degradation. This model, known as "produce with less, or zero, inputs", is sometimes criticized, insofar as most of African agro-ecological zones are naturally characterized by soils with decreased levels of organic matter and nutrients; thus restricting their productivity and endangering food security.

It is therefore about developing an agro-ecology adaptable to the agro-pedo-climatic contexts of African countries and driven by the optimisation of the balance between "productivity and preservation".

According to this redefinition, agro-ecology is multidimensional and adaptable to each agro-ecological zone. It adopts specific practices for each of the three scales (plot, farm, and territory), as well as for the components of agro-ecosystems (soil, water, plants/crops, animals, and landscape).

SOLUTIONS

AAA puts forward a range of concrete and realistic agro-ecological and carbon sequestration solutions.

Among the key solutions:

- Implement a conservation-oriented agricultural model based on the minimal use of mechanised tillage (no plowing or direct seeding), the permanent coverage of soil by organic, carbon-rich mulch (straw and/or other crop residues), crop rotations and associations (including nitrogen-fixing legumes);
- Introduce intercropping (between tree rows);
- Develop composting, crop-residue incorporation, and convert organic waste into compost;
- Develop bio-intensive micro-agriculture;
- Undertake fallowing;
- Develop oases sustainably;
- Develop agro-pastoral zones sustainably.

The first step to implement these solutions is to share and disseminate good agricultural practices and knowledge by researchers and professionals.

EXISTING INITIATIVES

AAA is in line with already existing initiatives. Among the most important initiatives on agro-ecology and carbon sequestration, we can mention the following: "4 per 1,000", "The Promotion of Climate-Smart Agriculture: Transitioning Towards Agro-ecology in West Africa", "Integrated approaches of sustainable management of soil (SMS), water, forests, and actions related to risk prevention and adaptation to climate change", "Training for transformation" project, and "Soil Carbon Network for Sustainable Agriculture in Africa" (CaSA)

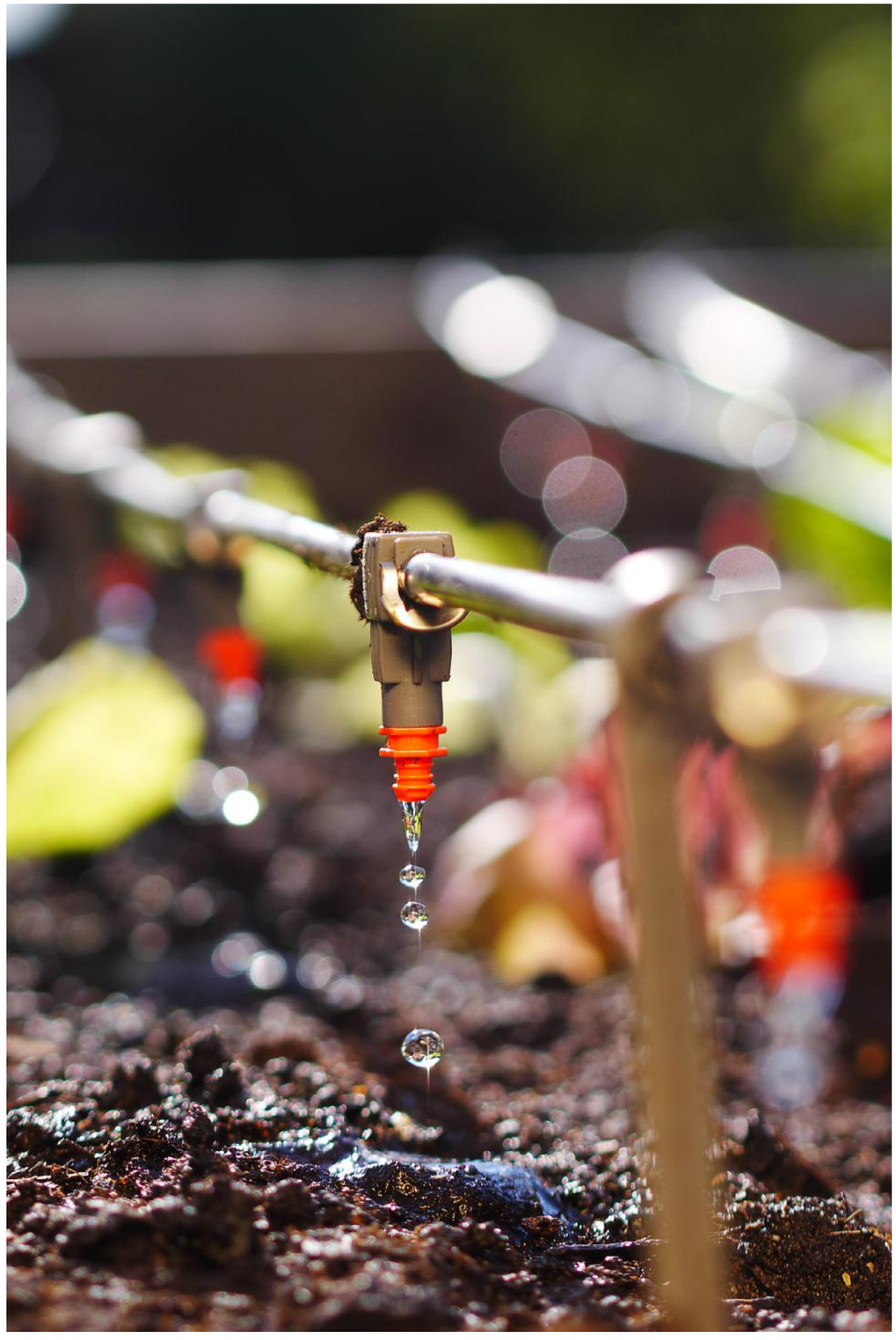
1. **The "4 per 1,000" Initiative**
   Launched by France during COP21, the initiative aims to increase soil carbon content by 0.4%, which would compensate for the increased amount of carbon dioxide in the atmosphere.

2. **"The Promotion of Climate-Smart Agriculture: Transitioning Towards Agro-ecology in West Africa"**
   A regional initiative funded by the European Union, the World Bank, and the African Union's NEPAD, it concerns 15 West-African countries and aims to support the resilience of vulnerable populations. It intends to adopt practices by 25 million households by 2025, through creating a platform of sharing knowledge and of production, good practices promotion and dissemination (the use of types capable of capturing carbon, Stormwater management, etc.)

3. **"Integrated approaches of sustainable management of soil (SMS), water, forests, and actions related to risk prevention and adaptation to climate change".**
   Several producer organizations develop training devices, promotion and awareness-raising activities on agro-ecological practices. At the regional level, the World Bank and the Global Environment Fund pledged to allocate $1bn to this type of projects in 12 African countries.

4. **"Training for Transformation"**
   Carried out by "Terre et Humanisme" Association, "Training for Transformation" undertakes awareness-raising actions on agro-ecology and offers different types of trainings in 5 African countries (Morocco, Togo, Burkina Faso, Mali, and Senegal). They are directly conducted with farmers, in public institutions or during national and international events.

5. **"Soil Carbon Network for Sustainable Agriculture in Africa (CaSA)"**
   CaSA is the fruit of collaboration between African researchers that are convinced of the need to take into consideration soil carbon dynamics in sustainable production practices. Various research teams and professors have organized themselves in a network, with a view to encourage a kind of agriculture based on alternative production systems that are focused on an optimal management of organic matters, and thus of soil carbon. Among the main undertaken actions: a) Implement and harmonize a methodology of soil carbon characterization; b) Analyse and develop available data, and develop training and communication actions; and c) promote "TropiCFarmTool", a carbon balance or footprint calculation tool of a farm or an agricultural activity.



II – Agricultural-Water Control

II
Agricultural-Water Control

Africa is the continent that suffers the most from water scarcity, which can be explained by a precipitation deficit in more than two thirds of the continent and by the lack of conveyance, storage, and distribution infrastructures in regions endowed with water. An aggravating situation caused by climate change impacts: Aridification of Mediterranean zones, lake draining, decreased capacities of natural "water towers".

The agricultural calendar, crop yields, and animal production are heavily impacted by the fact that African agriculture is essentially rain-fed, which is compounded by water shortages and weather extremes.

The drop in yields from rain-fed agriculture could reach 50% by 2020 in some countries.

Water control is one of the key challenges of African agriculture. AAA considers it one of its key battles. It promotes and supports solutions which aim to improve sustainable crop irrigation in the continent.

AAA offers solutions that seek to achieve complementarity between water-conveyance installations, hydro-agricultural facilities, plot developments, institution building, and value addition off of irrigated lands.

CURRENT STATE OF AFFAIRS

African agriculture is particularly affected by insufficient rainfall, lacking water mobilisation capacities, and inadequate irrigation techniques. However, there is solid potential to irrigate the land: the current estimate is 2%, and it could reach 25%. Indeed, the Adaptation of African Agriculture inevitably requires an adequate and sustainable use of available water resources.

About 66% of African lands are located in arid or semi-arid areas, and suffer from water shortages. Besides, approximately 25% of the African population is subject to water stress (less than 1000m3 per capita/year), mainly in North Africa and the Sudano-Sahelian region.

In terms of geographic distribution, it should be noted that Central Africa and West Africa have the largest resources (51% and 23% respectively), as opposed to only 3% in North Africa.

Climate changes will increase the deficit in rainfall inputs or their concentrations in short periods, thus causing floods. Since African agriculture is predominantly rain-fed, extreme phenomena will significantly disrupt the agricultural calendar and affect crop yields and livestock production.

Even sufficiently-watered areas suffer from lack of mobilisation, storage, and distribution infrastructure, particularly for land irrigation.

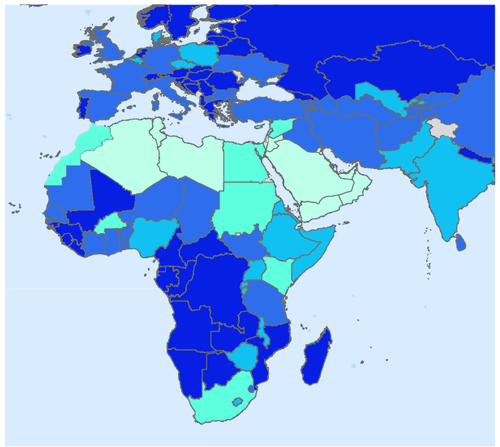
For example, Central Africa, which has 2,885 km3/year of total renewable water resources, has a storage capacity of 32,848 million m3, with only 90 dams, while North Africa, which has only 96 km3/year of total renewable water resources, has a storage capacity of 212,427 m3 million, with 340 dams (figures 5 et 6).

In Africa, only 2% of arable land is irrigated, against 42% in Asia.

However, the irrigable potential for the continent stands at 25%, considering both irrigable land and the available renewable resources.

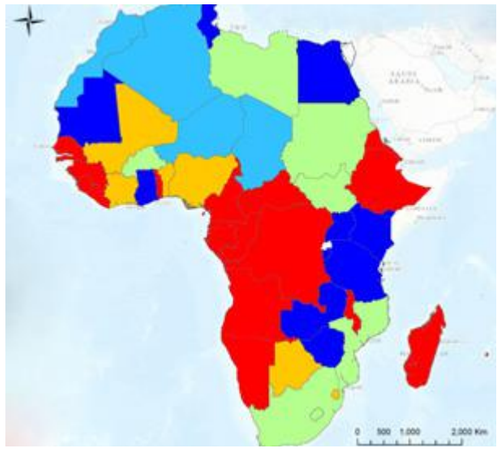
A global approach and a coordinated proactive action are required regarding the management of irrigation water.

Figure 5. **Availability of renewable water resources per country in Africa (in m3 per capita/year)**



Source: elaborated by GT4 work group based on the FAO Aquastat Database

Figure 6. **Storage capacity/potential ratio**



Source: Aquastat Database and GT4 calculations and mapping

SOLUTIONS

AAA promotes and supports 5 types of solutions regarding water management. These solutions seek to achieve complementarity between water-conveyance installations, hydro-agricultural facilities, plot developments, institutional exploitation and reinforcement, and agricultural development. All irrigation opportunities, without exception, regardless of the scope of the areas to be developed for irrigation (large zones, collective or rustic zones, small-scale private irrigation, lowland development), must be seized.

Five priority action themes have been identified, addressing concerns reported by African countries in the field of water management through the INDCs:

- Reinforce water-potential mobilisation: rehabilitate existing structures to optimise their capacity and build new structural facilities;
- Proactively develop complementary irrigation between (a) large-scale irrigation based on the development of great plains, (b) lowland and flood-recession agriculture, (c) small-scale rural irrigation, and (d) individual irrigation;
- Continue to strengthen the Integrated Water Resources Management (IWRM) approach, particularly for cross-border water management;
- Modernise and promote more water-efficient and more productive irrigation and production systems;
- Proactively support irrigation development through capacity building.

AAA also calls for measures of support: strengthening regulatory and institutional provisions, training, R&D, and innovation.

The regulatory challenge is huge; it requires reforming institutions responsible for water resources in order to establish mechanisms of good governance and create a favourable environment for the sustainable management of national and cross-border river basins, and for regional cooperation on issues related to quantity and quality of water resources. It also requires reforming institutions responsible for irrigation management and agricultural development and strengthening R&D capacities.

EXISTING INITIATIVES

The initiative for the Adaptation of African Agriculture to Climate Change is in line with existing regional and national initiatives.
Among the initiatives regarding management of agricultural water, we can mention the Agricultural Water Partnership for Africa (AgWa), the Sahel Irrigation initiative (S2I), and the Water Scarcity Initiative (WSI).

1. The Agricultural Water Partnership for Africa (AgWa)

Launched by African states and coordinated by the FAO, the initiative aims at increasing investments in the field of agricultural water management in a way that is socially fair, cost-effective at the exploitation level, economically viable, environment friendly, and sustainable. AgWa supports the reinforcement of investments, and promotes analysis, knowledge sharing and dissemination, regional integration, coordination, partnerships, and the empowerment of national and regional stakeholders.

2. The Sahel Irrigation Initiative (S2I)

This joint initiative of six countries of the Sahel aims to significantly increase investments in agricultural water from 400,000 hectares irrigated today to 1 million hectares by 2020 to mitigate the effects of climate variability and change.

3. The Water Scarcity Initiative (WSI)

Launched by the FAO for the Near East and North Africa region, this initiative supports reinforcing efficacy and productivity of water usage, enhancing policies and governance related to agricultural water, strengthening regional collaboration and partnerships, and ensuring food security in the countries involved.

III
Climate-Risk Management

In its 4th report, the IPCC confirms that during the 21st century, the increase of the average temperature in Africa would be 1.5 times higher than the global level.

Africa, and mainly its agriculture, are therefore exposed to extreme phenomena caused by the climate change.

Africa is also the less prepared continent for these weather-related risks. Lack of reliable statistical data, obsolete equipment, insufficient transmission and sharing of data, lack of local adaptation to make each farmer a contributor and a beneficiary: forecasting and early warning systems are inadequate in Africa.

That is why the initiative of the Adaptation of African Agriculture to Climate Change intends to make climate risk management and agricultural insurance on top of its priorities.

It is about a better prediction for a better management of agricultural risks, in order to better act now. Also, to contribute to the security of crops and the development of the entire agricultural sector, and to address the food security challenge.

CURRENT SITUATION

If Africa is the most affected continent by phenomena related to climate change, it is also the less prepared for these weather-related risks, which endanger its agriculture, and consequently its food security. Therefore, the adaptation of agriculture requires the development of efficient systems for risk management and early warning.

Effects of climate change on Africa: Weather-related hazards, droughts, acute temperature variations, and extreme precipitation – all of these endanger agriculture and food security.

Africa is one of the less prepared regions for these weather-related risks: 2/3 of African countries have little or no capacity to manage these risks. For example, there are only 781 synoptic weather stations in Africa, while in Asia, there are 1,696, keeping in mind the size of the African continent and its vulnerability to weather and climate-related hazards.

In this context, agricultural adaptation must go through risk-management and early-warning systems.

The importance of these systems is well established, particularly as regards saving lives and reducing the economic impact of extreme events.

In fact, the INDC analysis presented by African countries shows that 50 out of 54 of them attach importance to these systems.

SOLUTIONS

The initiative for the Adaptation of African Agriculture to Climate Change promotes and supports three types of solutions with regard to climate risks management: the development and improvement of observation and forecasting systems, the development of the agricultural insurance and the development of training programs. A good climate risk management is indeed based on the quality and sharing of data as well as on technology transfer.

The development of observation and forecasting systems goes through the improvement of weather and climate observation network (modernization, densification and networking), the improvement of weather forecasting systems, the development of agro-meteorological systems for forecasting agricultural crops and fodder (weather, agricultural and satellite data processing and analysis) and the development of earth observation institutions (from Remote Sensing Space, mapping, GIS, GPS and other geomatics applications).

In the development of agricultural insurance, priority is given to the indexed agricultural insurance, an insurance product based on weather and satellite indices.

The implementation of these solutions requires the involvement of all stakeholders, namely scientists and engineers (meteorologists, agronomists, computer scientists, etc.), institutions (ministries, universities, agricultural research centers, insurance companies, etc.) and farmers who have to be advised and accompanied.

III – Climate-Risk Management

EXISTING INITIATIVES

The initiative for the Adaptation of African Agriculture to Climate Change is in line with existing initiatives.
Among the most emblematic in the climate risks management, we can cite the Sahara and Sahel Observatory (OSS), the Regional Centre for Mapping of Resources for Development (RCMRD), the AGRHYMET Centre, the Regional Center for Remote Sensing of North Africa states (CRTEAN), Climate Risk and Early Warning Systems (CREWS), the Initiative on Climate Risk Insurance, the Food Security Climate Resilience Facility, the Rural Resilience Initiative (R4), the Global Resilience Partnership, the "Anticipate, Absorb, Reshape" initiative (A2R), and the African Risk Capacity (ARC).

1. The Sahara and Sahel Observatory (OSS)

An international Organization operating in Africa, the OSS has a program dedicated to the environmental observation and monitoring as well as to follow-up and evaluation of environmental and developmental programs, and a program dedicated to shared water resources management in the Saharan region, particularly the large transboundary aquifers.

2. The Regional Centre for Mapping of Resources for Development (RCMRD)

Created by the United Nations Economic Commission for Africa (ECA) and the African Union, the RCMRD is an intergovernmental organization which currently has 20 Member States and operates in the regions of Southern Africa, East Africa and the Indian Ocean. It aims to promote sustainable development in the Member States, through the production, application and dissemination of geographical information and technologies, as well as of information and communication products and services.

3. The ARGHYMET Centre

The AGHRYMET monitors the status of drought in West Africa (rainfall, vegetation conditions) in collaboration with international research organizations and based on soil observation via satellite.

4. The Regional Center for Remote Sensing of North Africa States (CRTEAN)

Established in 1990, the CRTEAN is based in Tunis and covers the five North African states today, along with Egypt and Sudan. It aims to enhance the capacities of Member States' executives through technology transfer and use of remote sensing techniques.

5. Climate Risk and Early Warning Systems (CREWS)

France, Norway, the World Bank, through the Global Facility for Disaster Reduction and Recovery, the World Meteorological Organization and the United Nations Office for Disaster Reduction, launched, in December 2015, the coalition of "Climate Risk and Early Warning Systems" (CREWS) for the least developed countries and small island developing States. They are aimed at improving their ability to generate and communicate early warnings on the basis of reliable information about dangerous hydrometeorological and climate risks.

6. The Initiative on Climate Risk Insurance

Adopted in June 2015 by the G7 and credited with a financing plan of US$42mn, the Initiative on Climate Risk Insurance intends to reinforce the following initiatives: the African Risk Capacity (ARC), the Caribbean Catastrophe Risk Insurance Facility (CCRIF), the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), the Climate Insurance Fund (CIF), CREWS and other bilateral schemes.

7. The Food Security Climate Resilience Facility

Launched by the World Food Program in partnership with the International Research Institute for Climate and Society (IRI) and funded by Norway and Luxembourg, the Food Security Climate Resilience Facility provides governments, through a flexible multi-year funding, with means to rapidly release funds to enhance food and nutrition responses in anticipation of or in response to climate disasters, with a view to strengthening communities' resilience.

8. The Rural Resilience Initiative (R4)

Launched in 2011 by the World Food Programme and Oxfam America with the support of the Swiss Re insurance company, it aims to increase food security and climate resilience of vulnerable rural households. Farmers can for example insure their assets through insurance schemes for assets and protect themselves against losses caused by severe drought.

9. The Global Resilience Partnership

Public-private initiative launched by the Rockefeller Foundation, the United States Agency for International Development (USAID), and the Swedish International Development Cooperation Agency (SIDA), this Partnership focuses on building resilience in the Sahel, the Horn of Africa, as well as in South and Southeast Asia.

10. The "Anticipate, Absorb, Reshape" initiative (A2R)

The "Anticipate, Absorb, Reshape" initiative (A2R), led by the UN, provides a platform for governments, international organizations, enterprises and civil society to work operationally for climate resilience, and coordinate and accelerate efforts in the most vulnerable countries by 2020.

11. The African Risk Capacity (ARC)

A specialized agency of the African Union, established in 2012 to help Member States to improve their capacities to better plan, prepare and respond to extreme weather events and natural disasters, thereby improving food security vulnerability of their populations. ARC has developed "Africa RiskView" an early warning system of drought based on rainfalls in sub-Saharan Africa. ARC is the only sovereign insurance program currently operating on the African continent.

CONCLUSION

**Africa and its agriculture are facing huge challenges;
however, they have the capacity to meet them. Solutions exist.
The initiative for the Adaptation of African Agriculture to Climate Change
is committed to supporting the development of these solutions and to facilitating their implementation.
Therefore, it has decided to act on two levels:**

1. The Negotiations Level

The AAA initiative aims to put the Adaptation of African Agriculture at the heart of the challenges of COP22 and obtain an equitable distribution of funds between climate adaptation and mitigation.

The issue of funding is crucial. A recent UNEP study (2010) indicates that the economic cost of climate change in Africa could account for 1.5 to 3% of GDP, every year, until 2030. Additionally, an ADB [1] study evaluated the adaptation costs in Africa at about 20 to US$30bn per year over the same period.

Current flows remain insufficient to meet the real needs of Africa, especially in agriculture and adaptation.

- Africa receives only 5% of climate funds while it has 16% of the population.
- Agriculture mobilizes only 4% of public climate funds, while it accounts for 40% of jobs in Africa.
- The Adaptation projects mobilize only 20% of climate public funds, while they need 50% for a balanced distribution.

The AAA initiative aims to restore balance and to ensure not only the accompaniment of AAA projects to enhance their access to climate funds (eligibility and accreditation criteria), but also the monitoring of climate funds allocation.

It will focus on strengthening the financing capacities of African farmers, via the micro-credit generalization to small farmers, meso-credit development to medium-sized farms and mobile banking solutions deployment.

2. The Solutions Level

The initiative for the Adaptation of African Agriculture to Climate Change is committed to promoting and supporting the solutions described in this White Paper for soil management, agricultural water control, climate risk management and financing capacity building.

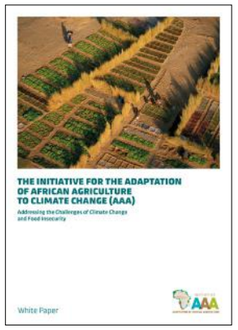
The AAA initiative is characterized by its pragmatic approach based on the design, implementation and monitoring of bankable projects with accountability for results and impacts on African countries populations. It will help link climate financing with food security through priority projects, which will allow for better appreciation of Africa's natural resources in a sustainable manner.

The AAA initiative calls for the mobilization of all stakeholders: governments, international institutions, private sector, NGOs, and scientific community.

The scientific community is already fully mobilized, as reflected by this White Paper.

- It knows the issues and needs of Africa.
- It knows that an environmental, economic and human disaster is likely to happen if nothing is done. But it also knows the resources and capacities of the continent.
- It knows that Africa and its agriculture are able to adapt to climate change and become more resilient, in order to meet the challenges of productivity, sustainable development and food security.
- It knows that solutions exist and are already afoot.

(1) ADB: African Development Bank



EDITORIAL CONTENT:
Source: Working group report of the scientific committee of the initiative for the Adaptation of African Agriculture to Climate Change.
Working Group 1: Soil fertility & crop fertilisation.
Working Group 2: Arboriculture & Agroforestry.
Working Group 3: Carbon sequestration in soils and agroecology.
Working Group 4: Agricultural-water control.
Working Group 5: Climate-risk management.

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