

Chapter 11: Countermeasures against Climate Change in Africa

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1. Introduction

Climate change is already a reality; various phenomena such as rises in global average temperature, floods and drought due to changes in precipitation, an increasing number of large-scale typhoons, hurricanes and cyclones and other extreme weather events have been observed, and, in the long run, rises in sea level caused by the melting of glaciers and ice sheets in the Antarctic, and many other serious phenomena could be realized. IPCC (2007) predicts that greenhouse gases (GHGs) will continue to increase, leading to serious climate change unless appropriate actions are taken promptly. The effects of climate change could threaten human lives, damage the social capital and the fruits of development that both advanced and developing countries have accumulated over the decades and centuries.

Developing countries are particularly vulnerable to climate change, since in addition to being adversely affected by the consequences of climate change such as torrential downpours, drought, the submerging of low-altitude areas due to a rise in sea level and so on, their physical and social capital is not sufficiently developed to adapt to climate change. African continent and other least developed countries (LDCs) and small island developing states (SIDS) are countries of particular concern for their vulnerability to climate change, as many of their inhabitants depend on the natural environment for their livelihoods, and those are already vulnerable even under the current climate conditions. Thus, climate change will introduce new risks to the Continent, in addition to current environmental and socioeconomic stressors.

On the other hand, Africa contributes the least to ongoing global warming, while advanced countries, as well as China, India, and other

emerging countries, have attained economic growth while emitting large amounts of the GHGs that accompany industrialization.

A number of studies on the impact of climate change, mitigation and adaptation and other climate -related activities have been implemented in developing countries. Many developing countries have analyzed the risks caused by climate change and have formulated mitigation and adaptation policies, which have been submitted as National Communications to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC 2012).

Climate change issues are also a critical development agenda, and development partners have worked to mainstream climate change issues into their development cooperation policies and strategies. The OECD has developed policy guidance to integrate climate change adaptation into development cooperation (OECD 2009). The World Bank featured climate change issues in its *2010 World Development Report* (World Bank 2010), noting that although climate change is one of many issues that developing countries face, “Left unmanaged, climate change will reverse development progress and compromise the well-being of current and future generations.”(World Bank 2010: 37)

Japan has been an active player in the international community in its effort to combat climate change. In 1997, the Japanese government announced a new initiative named the “Kyoto Initiatives,” advocating proactive assistance to developing countries for countermeasures against climate change. Of particular note for Africa, the Yokohama Action Plan, compiled at TICAD IV in 2008, discusses “Addressing Environmental Issues and Climate Change,” along with the need to promote measures for mitigating or adapting to climate change, water resources conservation, hygiene, and education for sustainable development (ESD).

JICA has worked to support countermeasures against climate change in Africa based on the Yokohama Action Plan, at the same time revising the “Direction of Low Carbon and Resilient Development Cooperation by JICA” (JICA 2012). JICA is offering assistance to developing countries in their countermeasures against climate change while advocating three basic policies: (1) climate compatible sustainable development; (2) comprehensive assistance utilizing an array of schemes; and (3)

collaboration with development and climate partners.

Against this backdrop, this chapter discusses the challenges and the ways to address climate change in Africa. Section 2 gives an overview of the general discussion on the importance of such countermeasures; Section 3 summarizes the effects of climate change in Africa and the situation regarding GHG emissions; Sections 4 through 6 will discuss challenges and opportunities regarding climate change, respectively focusing on mitigation measures (Section 4), adaptation measures (Section 5); and on funding, technologies and market mechanisms related to countermeasures against climate change (Section 6). Finally, Section 7 proposes five recommendations for the direction of international cooperation to be pursued at TICAD V and beyond.

2. Dealing with Climate Change

2.1 Impacts of climate change

Developing countries are highly vulnerable to natural disasters; according to a report by the Intergovernmental Panel on Climate Change (IPCC) published in 2012, over 95% of the people killed in natural disasters between 1970 and 2008 lived in developing countries. They suffer not only in terms of human casualties; the economic losses in developing countries caused by natural disasters between 2001 and 2006 were smaller than losses in developed countries in absolute terms, but were higher in low-income countries as a percentage of GDP (about 0.3%) than they were in advanced countries (below 0.1%) (IPCC 2012). As shown in Section 1, various phenomena caused by climate change will affect to the developing countries severely. Therefore, countermeasures against climate change need to include adaptation alongside with measures to mitigate exposure to the effects of climate change (mitigation). Here, “adaptation” refers to strengthening capacity (adaptive capacity) to reduce the vulnerability of people and natural systems to risks related to climate change.

2.2 Mitigation and adaptation

Mitigation includes introducing renewable energy, promoting energy conservation, reducing the methane gas generated from livestock waste, and increasing CO₂ sequestration by afforestation, reforestation and forest conservation, and so on. However, these measures must be promoted in such a way that they do not impair the benefits of

development. Therefore, governments need to formulate appropriate plans and strategies to balance both development policies and mitigation policies at the national and sectoral level. In addition, governments also need to establish socioeconomic systems where resources are utilized efficiently and effectively, and to promote development and deployment of low-carbon technologies that allow these plans and strategies to be realized.

Measures to deal with the effects of climate change (adaptation) include strengthening adaptive capacity against the increasing number of meteorological disasters, and infrastructure development to deal with the medium- to long-term impact of climate change. However, the impacts of climate change are influenced by such diverse factors and cannot be fully foreseen. Thus, such adaptation measures need to be considered based on the features of the regions, sectors, and communities concerned, along with nationwide measures. In order to steadily pursue adaptive measures in developing countries, the governments need to formulate National Adaptation Plans (NAPs) and other appropriate strategies and plans at the national and sector level. When formulating these plans, it is desirable to take into consideration the results of scientific analyses, such as impact assessments, backed up by scientific data. However, due to the uncertainty of the impacts of climate change, formulating policies based on a precautionary approach and a “no regrets policy” will be required, in a way that suits the development needs of developing countries.

Furthermore, the governments need to take into consideration the risk of “maladaptation” that exacerbates the vulnerability to climate change, when they design plans and projects. That is, without appropriate measures to avoid maladaptation, the adaptation plan and/or project may make the region (or other region) vulnerable further. Therefore, adaptive measures need to be examined with sufficient caution during implementation in order to prevent maladaptation, after discerning the vulnerability of the targeted strata and how they are affected by climate change.

3. Africa and Climate Change

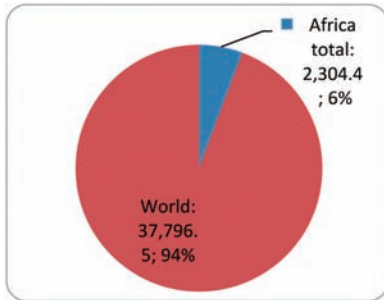
3.1 Greenhouse gas emissions in Africa

As a region, Africa has among the world’s lowest greenhouse gas

(GHGs) emissions and contributes the least to climate change. The percentage of global GHGs emissions emitted in Africa is lower than that of any other region. In 2005, the total GHG emissions from the African region were only 6% of the global total. Moreover, GHG emissions in the African region are 2.56 tons per capita, which is less than half the global average of 5.85 tons per capita (WRI-CAIT 2012).

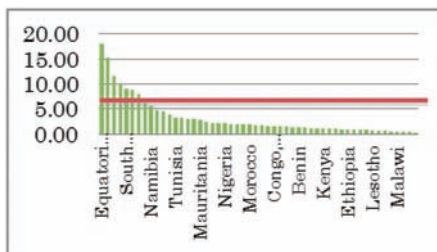
At individual country level, however, some countries have large emissions. For example, per capita emissions from Equatorial Guinea, the Central African Republic, Libya, Gabon, South Africa, Seychelles, Angola, and Botswana exceed the global average.

Figure 1. Africa's Percentage of Global GHG Emissions



WRI-CAIT (2012)

Figure 2. GHG Emissions per Capita in African Countries



WRI-CAIT (2012)

On the other hand, 585 million people (about three-quarters of the population in Sub-Saharan Africa) cannot access modern energy, and of these people, about 85% live in rural areas and use firewood and other biomass fuels for cooking and so on. Furthermore, about 30 countries suffer from a chronic shortage of electricity.

However, energy demands are expected to rise due to the rapid economic growth and population increase in recent years. It should be noted that if African countries choose to depend on fossil fuels to meet these energy demands, GHG emissions from Africa will increase significantly (World Bank 2012).

In addition, GHG emissions due to land-use and /or land use change are comparatively high in some countries. Those will be increased by further land-use change from forest to farms to address increasing food demand due to population increase.

3.2 Impact of climate change in Africa

Africa is one of the regions most impacted by climate change. Table 1 summarizes climate change trends in Africa and their future impact. In Africa, the temperature has risen by 0.5°C compared to 100 years ago, and impacts of El Niño and La Niña phenomena have been aggravated due to global warming. Also, the impact of climate change on incomes is estimated to reach 1.9–2.7% of GDP. In addition, about 75–250 million people will be threatened due to through increased water stress, and additional 80 million people be at risk of malaria.

Table 1.

<i>Trends</i>	<i>Impacts</i>
<p>-Africa is warming: Africa is 0.5°C warmer than it was 100 years ago. Tendency toward greater extremes: global warming will exacerbate El Niño and La Niña effects.</p> <p>-Vulnerability is rising: the income effects of climate change are approximately 1.9–2.7% of GDP in Africa.</p> <p>-Uncertainty remains: the precise effects of climate change on Africa are not well understood at the country level, due to the fact that very few countries have their own climate change scenarios and risk assessments.</p>	<p>-Increased water stress: 75-250 million more Africans will be at risk of water stress by 2025; arid and semi-arid lands are likely to increase by up to 8%; 25–40% of animal species in national parks in sub-Saharan Africa are likely to be become endangered.</p> <p>-Food insecurity: parts of the Sahara are expected to suffer agricultural losses of up to 7% of GDP.</p> <p>-Threats to health: an additional 80 million people will be at risk of malaria.</p> <p>-Sea level rises: coastal zones, especially in East Africa, will face increased flooding with the adaptation bill reaching 10% of GDP.</p>

Source: Adapted from World Economic Forum (2008).

Climate change seems to have already begun to take its toll in Africa. In the past several decades, the average rainfall in Sub-Saharan Africa has shown a decreasing trend. Compared to the monthly rainfall between 1951 and 1980, the average amount in the 2000s has decreased by as much as 7 mm. The reduction ratio is 2.5 times that of Asia and more than 10 times that of Latin American and the Caribbean countries. The instability and decrease in rainfall poses a food security threat to Africa, where over 90% of agriculture depends on rainfall (UNDP 2012).

Also, Africa is a region where abnormal temperatures, droughts, wildfires, and other climatic disasters take place at the second highest frequency in the world, after East Asian and the Pacific. Even though other natural disasters such as floods and violent storms occur less frequently here than in other areas, their number has increased at the second highest rate in the world and the affected population has tripled in the past decade (UNDP 2012).

Climate change is believed to aggravate the frequency and intensity of extreme weather phenomena. There are concerns that this in turn could have serious impacts not only on agriculture and water resources, but also on ecological systems and gene resources, as exemplified by the expansion of disease vector habitats and the extinction of plant and animal species (IPCC 2011).

4. Mitigation Measures in Africa

4.1 Challenges and opportunities regarding mitigation measures in Africa

As noted above, Africa contributes the least to ongoing global warming, while advanced countries, as well as China, India, and other emerging countries, have attained economic growth while emitting large amounts of the GHGs that accompany industrialization. In many African countries, where economic development and poverty reduction are the most urgent issues, expectations are high that economic development and poverty reduction will be realized by following the same path toward industrialization as these advanced and emerging countries, while effectively utilizing their own resources in the region. Moreover, there is an urgent need for improved access to energy in view of the fact that three-quarters of the population in the region have not had access to energy and have endured chronic electricity shortages, and also because

energy demands are expected to increase as the economy and population grow.

Thus, although the lack of economic infrastructure development is an important challenge for Africa, this situation may be an opportunity for Africa to move toward greener and more sustainable development, in a manner unlike that adopted by the advanced and emerging countries.

Africa has a potential to develop renewable clean energy. For example, Africa holds 15% of the global hydroelectric power generation potential, but only about 10% of this has been developed (World Bank 2012). Besides hydroelectric power generation, there is also high potential for photovoltaic power, solar thermal power, wind power, geothermal power, and biomass energy. By utilizing these resources effectively, the risks accompanying fluctuations in the international price of crude oil and other fossil fuels may be reduced. In addition, there is a potential for Africa to improve efficiency of energy/resource use by leapfrogging to more efficient technologies and infrastructure.

Africa also has great potential for carbon sequestration and storage. The tropical forests in Africa's Congo Basin constitute the second largest such area in the world. However, these forests have been continuing to shrink and deteriorate due to farmland conversion, excessive logging, forest fires, and other factors. According to the FAO, the global forest area shrank by about 13 million hectares a year on average between 2000 and 2010, which is equivalent to one-third of Japan's national land area. Of this, Africa accounts for 3.4 million hectares (FAO 2010). The need to conserve forests, where these natural resources and carbon are stocked, has increased. The Congo Basin is an effective carbon sequestration and storage resource, and is also high in biodiversity. Congo Basin may be benefitted by Introducing Payment for Ecosystem Services (PES), such as Reducing Emissions from Deforestation and Forest Degradation plus conservation, the sustainable management of forests and enhancement of forest carbon stocks (REDD+), since PES could add new economic value to natural resources which has not yet been appropriately valued.

The sections that follow present a sector-by-sector discussion of the challenges and opportunities related to mitigation measures.

4.2 Energy sector

Improving access to energy is important in view of making progress in industrialization, the poverty reduction accompanied by industrial development, and expanding opportunities to access education and medical services. In order to address increasing in energy demands, the governments need to consider stable energy supply while also attending to preventing pollution and conserving the natural environment.

Africa also has abundant potential for renewable energy, as exemplified by the photovoltaic power and solar thermal power that could be obtained from the ample sunlight in the Sahara Desert and surrounding areas, the geothermal energy found mainly in the Great Rift Valley, the copious source of hydroelectric energy found mainly along large international rivers, and the wind power capacity found mainly along the coastal areas. Crude oil and other fossil fuels have also been found in the region. Those resources could help the government to establish a low carbon society, if the government promotes proactive use of renewable energy and the cleaner use of limited fossil fuel resources appropriate to the economic and technology level of each country.

In addition, GHG emissions could be reduced if a more efficient and stable power supply were made possible by developing of efficient power transmission networks and regional power interchange systems based on power pooling. In remote regions, access to energy could be improved by utilizing small-scale power generation by hydroelectric power, solar power, wind power, and biomass power, as well as independent small-scale grids. However, the use of low-carbon energy requires efforts on the user side such as energy conservation in addition to those on the supplier side. Energy users in rural areas need to convert the traditional types of fuel and methods to modern and more thermally efficient methods.

To support African countries' efforts toward increasing their energy efficiency, JICA has assisted in renewable energy projects including wind power generation in Egypt and geothermal power generation in Kenya, research to utilize solar energy in the Sahara Desert, and the development of efficient power transmission and distribution networks in Tanzania and Cameroon, and so on.

4.3 Transportation and urban sectors

Developing the transportation infrastructure is also important to promote economic growth. On the other hand, economic growth could lead to increasing fuel demands and GHG emissions as road transportation demands increase. If the development of high-traffic arterial roads is insufficient, the increased traveling time caused by traffic jams could hinder economic growth and lead to excessive fuel consumption. Also, if the transportation infrastructure is vulnerable to the foreseeable natural disasters due to climate change, the transport of necessary goods could be impaired in times of disaster, and economic activities could be impeded until recovery is achieved. Therefore, the introduction of low-carbon transportation systems that have sufficient resilience to withstand disasters need to be considered when examining transportation system development.

JICA has assisted African countries in transport infrastructure in various ways: one typical example is the development of arterial roads such as the Nacala Corridor of Mozambique; another is logistics improvement by developing one stop border posts to reduce congestion at borders.

Urbanization has progressed rapidly in major urban areas. Urban plans should be revised by reallocating urban functions more efficiently, according to the development stage of the city, and in the medium- to long-term, disasters-resilient low-carbon urban development should be attempted. As such medium- to long-term projects, the introduction of railroads and Bus Rapid Transit (BRT) systems may be possible options mainly in large- and medium-scale cities.

4.4 Forest management

As discussed above, Africa has an abundance of diverse forest resources, as exemplified by the Congo basin, which is the world's second largest area of tropical forests. Forest conservation is important for increasing the water-retention capacity of the soil and mitigating the scale and frequency of natural disasters, in addition to retaining a resource for absorbing GHGs. In other words, forest conservation is expected to have both mitigating and adaptive effects. On the other hand, Africa has one of the highest percentages of forest reduction in the world. The percentage of forest coverage in the Sub-Saharan region fell from 31.2% in 1990 to 28.1% by 2010. This reduction is attributed to the excessive exploitation of forest resources caused by population growth, the

accompanying fulfillment of basic needs, and economic development, as well as the conversion of forests to other uses (AUC et al. 2012).

Mitigation measures with the aim of reducing GHGs by curbing forest reduction in developing countries were on the agenda for the first time at the 11th meeting of member countries to the United Nations Framework Convention on Climate Change (UNFCCC) (COP11). Subsequently, Reduced Emissions from Deforestation and forest Degradation (REDD) was officially adopted as one of the topics for consideration under the Bali Action Plan at COP13, and it was decided in the Copenhagen accord at COP15 to pursue the development of a REDD+ framework.

The introduction of Payments for Ecosystem Services, such as carbon sequestration and storage by forest resources (REDD+), is expected to provide an incentive for forest conservation in the Congo basin and other places where forest destruction is underway.¹

In forest conservation, it is important for the policy makers and project developers to consider residents who depend on forest resources for their livelihoods. It is also important for the government to steadily promote the sustainable use of forest resources in a way that contributes to sustainable forest management, poverty reduction, and regional development. Communities that depend on forests for their subsistence have sometimes used appropriate forest conservation techniques as part of their regional traditions. These indigenous technologies could also be used for effective forest conservation. Also, for reviving deteriorated forests, sustainable forest management needs to be promoted by trading sustainably produced lumber, along with planting and replanting trees in Africa and other areas.

5. Adaptation Plans in Africa

5.1 Challenges and opportunities for adaptation plans in Africa

There is growing concern for Africa about extreme weather, such as the historical drought in the Horn of Africa in 2011, and on food security. Even if a significant reduction in CO₂ is realized globally, it will still take a long time for GHG concentrations in the atmosphere and the climate system to stabilize, and the adverse effects from future climate change

1. JICA has assisted in forest conservation programs in the Congo Basin, Gabon, Ghana, Malawi, and other countries.

could expand. Especially in Africa, where many of the poor live in rural areas and depend on natural resources for their livelihoods, including rain-fed farming, the impact of climate change is a huge threat to achieving inclusive development, since poor people will mainly be affected by the impact of climate change. Water resources are not just used for drinking water and cultivating food for subsistence, but also for many other uses, including for power generation and as industrial water. In addition, in urban areas, due to rapid urbanization and population increases, improvements in urban infrastructure such as water supply, sewerage and drainage systems have been delayed, and measures to combat floods are also urgently required. From this viewpoint, it is necessary for the governments to consider appropriate water resource management including management of forest as source of water, improvements in food productivity, improvements in water supply and sewerage systems, and the appropriate reuse of water resources as cross-sectoral theme.

Another threat to development posed by climate change is loss of developmental dividend due to the increase in natural disasters. The higher frequency of natural disasters and their increased intensity may lead to a loss in the human, social, and natural capital that has been amassed thus far, and could wipe out all the efforts to reduce poverty that have been made to date. This makes efforts to prevent disasters and reduce their impacts essential to securing the benefits of development..

Furthermore, responses to future climate must be considered with regard to existing infrastructure as well as in the creation of new infrastructure. For example, an irrigation facility would require the installation of water-saving equipment so as to withstand the adverse effects of changes in precipitation brought by climate change. For developing countries to create a society and economy capable of withstanding the effects of medium- to long-term climate change, the establishment of climate-proof infrastructure will be required.

In many cases, water resource management and disaster prevention will require a cross-border response. Especially in Africa, with its many international rivers, cooperation among watershed nations is important. Since this is an area where benefits are maximized through cooperation as opposed to through settlement by disputes, a policy dialogue among countries and the formation of cooperative groups involving various

stakeholders, such as private enterprises, citizen organizations, and communities, could maximize benefits, as well as accelerate regional unification, which in turn could lead to expanding markets and new business opportunities (AfDB 2012).

To tackle those challenges and to take an advantage of opportunities, African countries need to improve climate information for informed decision making, tailored solutions including development of early warning system, seasonal forecasts and regional level climate change projections.

The sections that follow will discuss, sector-wise, the challenges and opportunities concerning response measures.

5.2 Agricultural sector

Being dependent on rainwater and lacking adequate distribution systems, Africa has traditionally been very vulnerable to shocks such as droughts and floods. For example, between 2010 and 2011, the Horn of Africa region suffered a severe drought, and more than 10 million people faced a serious food crisis. While the region has periodically suffered severe damage in the past, in recent years the rainwater cycle has become more irregular, and the amount of actual precipitation is falling.

Agriculture is a source of wealth and poverty reduction in Africa, as discussed in Chapter 2. Indeed, the share of employment in agriculture is 65% in the region, and still constitutes a large 32% share of GDP, one-third of the economic development factor (World Bank 2008). In the past, Africa increased production by expanding its cultivated acreage; however, cultivated acreage per capita has been declining due to demographic pressure, and, coupled with stagnant land productivity, this has resulted in a drop in grain production per capita.

Economic growth and strong demographic pressure have caused food consumption needs to expand rapidly, worsening the domestic supply and demand balance and increasing its dependency on food imports. In other words, Africa is highly vulnerable to external conditions such as a sharp increase in international food prices and bad weather accompanied by climate changes.

Although improvements in agricultural productivity are urgently

required in Africa, improving productivity alone will not necessarily make the region less vulnerable or more resilient. Further measures should be considered for the government and farmers; for example, agricultural infrastructure development such as irrigation facilities to help farmers adapt to climate change, development of crop and cultivation methods, and the introduction of agricultural techniques adaptive to climate change. JICA is helping to improve the cultivation system to respond to the droughts and floods caused by climate change.

The private sector will play an important role in assisting local farmers to improve their productivity and enhancing the commercial values of the products through their investment and technology transfer, making their agricultural product competitive in the market. Particularly, foreign agricultural investments are needed in strengthening the production capacity of developing countries, and it is important for the governments to continue promoting this.² On the other hand, if plans are poorly structured and implemented, international agricultural investment could have unintended negative effects on the political stability of the recipient nation, as well as on its social cohesion, human security, sustainable food production, food safety on a household level, and environmental protection. It may also lead to local residents losing access to resources they depend on. Furthermore, land transactions are a very sensitive issue. In Africa, where laws and regulations concerning land use are not well established and where communal land use is a traditional norm, international land transactions can trigger a serious, emotionally charged backlash. At the L'Aquila Summit in 2009, the G8 nations highlighted the Promotion of Responsible Agricultural Investment, a comprehensive approach to promoting global agricultural development through increased investment while mitigating the negative effects of international agricultural investment. In September 2009, the "Principles of Responsible Agricultural Investment that Respects Rights, Livelihoods, and Resources,"³ consisting of seven principles, were announced.⁴ The expectation is that through agricultural investments conducted in line with these principles, agricultural infrastructure will be developed and technology to improve agricultural productivity by sustainable methods will be introduced

2. See Chapter 4 of this volume for more detailed discussion on investments in agriculture.

3. http://www.mofa.go.jp/mofaj/gaiko/food_security/pdfs/besshi3.pdf

4. Refer to the Knowledge Exchange Platform for Responsible Agricultural Investment (RAI), <https://www.responsibleagroinvestment.org/rai/>.

(refer to Chapter 3).

Since the agricultural sector is the most vulnerable to climate change, another idea would be to establish a structure to cover losses from climate aberrations, such as a climate index insurance policy.

5.3 Disaster prevention and reduction

In recent years, many African countries have been hit by large-scale natural disasters, such as floods, droughts, coastal erosion, and mudslides. With the increasing frequency of natural disasters, the risks they pose and their influence on social and economic development are also rising. However, their effects are varied, and a case-by-case response is required. At the UN World Conference on Disaster Prevention in 2005, the Hyogo Framework for Action was adopted as an international framework for disaster prevention. In accordance with the Hyogo Framework for Action, it is important for the governments to establish disaster prevention plans in line with the priority that each country places on them.

To respond to large-scale disasters accompanying future climate change, meteorological and climate observation capabilities must be improved, and an early warning and evacuation system structure constructed on the bases of an accurate meteorological and climate change forecasting system. In addition, there is a need to improve climate change risk management capabilities in infrastructure development at a sector level, such as agricultural development, water resources management, and traffic, to mainstream disaster prevention and the rapid recovery from disasters.

In addition to conducting disaster prevention training in African countries, JICA is cooperating in programs to enhance response capabilities in countries including Benin, Cape Verde, Cote d'Ivoire, and Lesotho, helping to increase their resistance to natural disasters.

Hosono (2012) points out that there are three kinds of gaps between the capabilities required for disaster prevention and the actual levels of such capabilities, which are (1) the level required for addressing expected impact of disaster (a disaster scenario), (2) the level required for a level exceeding a disaster scenario, and (3) the level required to respond to long-term changes. To close these gaps, there are cases in which the

traditional techniques handed down in the community or the technologies used in other developing countries are more favorable than the latest technology. In such cases, cooperation through South-South cooperation or triangular cooperation may be effective.

To respond to a temporary shortage of funds in case a massive disaster occurs, systems such as standby-type loans and insurance could be utilized as safety nets.

5.4 Water resources management

Water resources are an important component in almost all development sectors. Among others, water demand is expected to increase due to the expansion of agricultural and industrial production and the energy sector as well as increasing demand of safe water supply for human lives, while the changes in precipitation accompanying climate change, and the decreased water retention capability due to the reduction of forest resources are all likely to cause an unstable water supplies. Africa has not been able to fully develop the potential of its rich renewable water resources (UNECA et al. 2011). Therefore, developing these potential renewable water resources and appropriately managing water resources are important issues for Africa.

Africa has a number of international rivers like the Nile and the Congo, and approximately three-quarters of its surface water resources, estimated at 4.6 trillion cubic meters annually, are concentrated in eight major international rivers (World Bank 2009). This makes it essential to conduct cross-border water resource management and to establish master plans and enhance governance to conduct optimal Integrated Water Resource Management (IWRM) for each watershed, which would include the appropriate development of surface and ground water and the purification and recycling of industrial and living discharge water. Africa has established an Africa Water Vision for 2025, which aims to provide an environment in which all people will have equal access to water resources, be able to use these for power generation and agriculture, create an enabling environment for IWRM, and integrate regions based on watersheds (UNECA et al. 2011).

Reservoirs can be an effective response to an unstable water supply (World Bank 2009). However, a safe water supply will have a different meaning for urban and rural areas. In urban areas, improvements in the

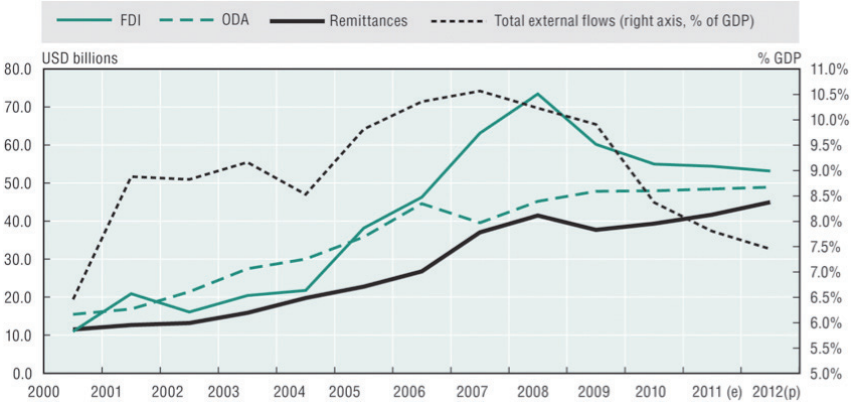
water supply system will be required to deal with the increase in population caused by the inflow of people into the areas. On the other hand, since many people lack access to safe water in rural areas, one urgent issue for the governments is to establish in these communities a system and infrastructure for a stable supply of safe water. JICA is currently assisting rural water supply projects in Djibouti and Ethiopia.

6. The Funding, Technology, and Market Mechanisms Associated with Climate Change Measures

The demand for funds to implement these measures is huge. As discussed in Chapter 7, there is a high demand for funds for infrastructure improvement in Africa. AFD-WB 2009 calculated the infrastructure funding needs for 2006–2015 to be US\$93.3 billion, and the financial gap between this amount and that already expended to be US\$48.0 billion. Of this, the funding gap, excluding the efficiency gap (US\$17.0 billion), was calculated at US\$31.0 billion (AFD-WB 2009). According to an estimate by the AfDB 2011, the funding needs accompanying climate change measures will be around US\$9–12 billion annually, if Africa is to take the low-carbon development route, and the incremental cost if appropriate measures are not taken now is estimated to be around US\$13–19 billion (AfDB 2011).

At COP16, the Cancun Agreement was established (UNFCCC 2010), which clearly stated that in the three years between 2010 and 2012, developed countries would provide funding aid of almost US\$30 billion to developing countries in the area of climate change (“fast-start” finance). It also agreed to establish a Green Climate Fund that would make US\$100 billion in funds available annually by 2020 (long-term funds).

Figure 3. Flow of Funds to Africa



Source: UNCTAD, OECD/DAC, and World Bank. IMF’s GDP forecast for 2012. Extracted from Africa Economic Outlook (2012)

As indicated in Figure 3, the flow of funds is on the increase. This fund flow includes not only ODA, but also contains a large amount of foreign direct investment from the private sector. As private fund is also one of major finance sources, government need to consider to mobilise private funds, not just public funds, so as to finance in climate change measures. For further mobilisation of funds for climate change measures, African countries need to strengthen the absorptive capacity for climate funding and improve enabling environment for private sectors.

Particularly, the governments need to engage diverse actors comprehensively in planning and establishing; climate change policies, such as Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Plans (NAPs), as part of their development policies; information sharing and dissemination with related parties in transparent manner; and implementation of measures based on an appropriate budget. The climate change program loans now being implemented in Indonesia and Vietnam are donor support schemes for these activities. In these schemes, the donor and the government of the developing country engage in dialogues on the provision of financial support, through which they monitor and evaluate the implementation status of a climate change policy scheme matrix. These schemes provide an efficient way for governments to implement climate change policies such as NAMAs and NAPs as part of their development policies, work toward transparently sharing and disseminating information with

related parties, and implement measures based on an appropriate budget (Sudo et al. 2008, Katsurai and Murakami 2012). On the other hand, Furukawa et al. (2013) have surveyed the effects of general budget support in the health sector and concluded that although there have been certain improvements in budget allocations in this sector, these have had a limited effect on improving health indicators. They comment that general funding support and the complementary effects of the projects and programs require attention. The complementary effects between policy, budget, and project, as pointed out before, should be considered carefully, when policy planner consider to introduce a climate change program loan.

There is also a strong need in Africa for appropriate low-carbon technologies for enhancing development that is resistant to the effects of climate change. The Cancun Agreements also included an agreement to establish a Climate Technology Center and Networks, in order to expand and promote the development and transfer of technology to assist in mitigation and adaptation, and to understand and support technical needs in developing countries. To promote the use of appropriate technology, various activities, such as formulating systematic capabilities and data-gathering capabilities, and establishing systems to share knowledge, will be required in addition to training human resources.

These technical and investment needs could also create an attractive market for private companies. Establishing an attractive market environment for private companies to introduce technology and investments could help promote climate change measures in the private sector.

The Clean Development Mechanism (CDM), one of the market mechanisms introduced under the Kyoto Protocol, was expected to promote the active participation of the private sector in the mitigation business, and over 5,500 projects have been registered to date. However, as of the end of December 2012, only 104 projects, a mere 1.9%, were in Africa (UNFCCC 2012). It has been pointed out that the current CDMs have not been able to fulfill the functions intended at the Kyoto Protocol due to the complexity of the applications and fundraising for low-profit projects (Yamada and Fujimori 2012). The use of market mechanisms, such as a simplified CDM or a bilateral offset credit system mechanism,

could act as an incentive for private companies to provide investments and technical transfers, and efforts to improve the system and develop the ability to effectively utilize these mechanisms are important.

7. Toward the Effective Promotion of Climate Change Measures in Africa

As mentioned above, climate change is a cross-cutting issue and a problem that has possible global effects. This means that instead of individual actors such as countries, sectors, or communities responding in an ad-hoc manner, it requires a comprehensive approach spanning various strata from the individual and community level to the governmental and regional level, and there is a need to resolve the “apparent disconnect” generated between a policy-based top-down approach and a community-based bottom-up approach (Bharwani and Taylor 2011). In addition, the activities of each actor must be considered from the viewpoint of externalities that influences the actions of others. For example, an adaptive policy taken by one community might trigger a maladaptation that could exacerbate the disaster damage in another community. Therefore, to effectively implement climate change measures, information sharing among a wide range of actors is important, from the international level down to the community level.

Although Africa has the world’s lowest amount of GHG emissions, it is affected the most by climate change. For Africa to maximize its natural resource potential in a sustainable, low-carbon way, and be resilient to external shocks such as the effects of climate change, it must engage in sustainable development in which everyone can receive the benefits of growth. In other words, Africa is in a position to target sustainable development through inclusive and resilient green growth. Africa’s climate change measures are themselves the start of a new development process.

Regarding its support for climate change measures in developing countries, the Japanese government announced the Kyoto Initiative in 1999, the Environmental Conservation Initiative for Sustainable Development (EcoISD) in 2002, the Cool Earth Partnership in 2008, and the Hatoyama Initiative in 2009. Climate change was incorporated into the Yokohama action plan, at TICAD IV, and as part of the Cool Earth

Partnership, US\$92.1 million in funding was declared in the action plan to support climate change measures in African countries. In the three years from 2010 through 2012, a total of approximately US\$1.3 billion was provided, as support for climate change measures in Africa, covering both mitigation measures and adaptation measures. Japan and JICA have more than fifteen years of experience in the area of climate change measures, and as the largest donor in this field, JICA supports many projects and programs. It has extensive knowledge on the establishment and implementation of promotion methods and the planning and implementation of specific policies related to climate change measures (such as energy, traffic, and agricultural policies), as well as in the measurement, reporting, and verification of GHG reduction effects using Climate-FIT, in vulnerability assessments, and in the methods used to assess project effects through post-project evaluations. This knowledge should be used effectively to support climate change measure policies in Africa. Based on the discussions above, we offer the following recommendations for the effective promotion of future climate change measures in Africa.

Recommendation 1:

It is necessary to establish climate change policies in accordance with the conditions of each country as part of its development policies, share and disseminate this information with stakeholders in a transparent manner, and implement it with appropriate budget allocation.

The climate change policies established by governments, such as Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Plans (NAPs), are prepared as part of each country's development policy, and it is desirable for these climate change policies to generate co-benefits that will contribute to sustainable development (Fujikura and Toyota 2012). Many countries in Africa have already created NAMAs. In addition, LDCs have already prepared National Adaptation Programs of Action (NAPAs). These clear, foreseeable, and stable policies lend credibility to the activities of actors, including in private investment. In establishing these policies, the opinions of actors in the private sector and civil society organisations (CSOs), as well as those of women and the poor, should also be actively incorporated along

with those of the government. Furthermore, although the use of data based on scientific analysis is recommended wherever possible, such as the amount of GHG emissions and forecasts of the effects of climate change (Fujikura and Kawanishi, 2010), it is also necessary for the policy makers to respond to the needs of their respective countries based on precautionary principles and the concept of a “no regrets” policy, taking into consideration the capabilities of the subject sector, region, community, and others.

To support these activities, in addition to supporting projects or programmes, schemes such as climate change loans can be effective, but great care should be taken with regard to the mutually complementary nature of policy, budget, and project policy, as well as the leverage effects of general funding support.

Recommendation 2:

For effective Green Growth in Africa, support for access to information as well as innovation through R&D are important to identify opportunities for low-carbon and climate resilient growth and promote effective green growth.

Access to information is the most important factor in today’s society, not only for disseminating climate change policies, but also for providing disaster information or information concerning low-carbon technologies and funding access. It is also important for a country in determining how it can apply climate change measures implemented by other nations or communities, or what effect they could have. Making greater use of information and communication technology (ICT) is one way to improve access to this information. Sharing information and knowledge through policy dialogues is another effective method. In addition, the NAMAs established by each country require monitoring, reporting, and verification (MRV), and securing the transparency and accountability of information through MRV will enable the implementation of appropriate climate change policies in a plan-do-check-act (PDCA) cycle. Furthermore, access to technical information will promote a country’s introduction of technology that is internationally available and it can utilize, and could lead to the development of technology enabling leap-frogging. We must not forget that appropriate technical information includes not only cutting-edge technologies, but also information on

traditional technologies, which can be very useful at times. Technology transfers are expected to include not only transfers from developed countries, but also transfers between developing countries through South-South cooperation and triangular cooperation (Hosono 2012).

From the viewpoint of inclusivity using environmental education to enhance people's awareness of climate change is important, particular for the poor, who are vulnerable to the effects of climate change, and also for women, and future generations.

Recommendation 3:

It is necessary to establish an enabling environment where everyone, including the private sector, will participate in various climate change measures.

It is important for the public sector to establish a path toward the creation of a low-carbon economic society resilient to climate change through policies and system improvements. However, the public sector itself neither manufactures nor conducts business transactions on its own. Everyone, not just private companies and CSOs, but also poor and socially vulnerable people, is involved in certain economic and social activities. In view of the public and external nature of global-scale climate change, the participation of all is required for a low-carbon, socio-economic model that is resilient to climate change.

In particular, high expectations are placed on the private sector's participation in climate change measures, in terms of its broad influence, funds, technology, and ability to increase employment. As pointed out by JICA-RI (2012), in addition to support from the policy side, in order to promote the participation of the private sector, actions will be required including organizing an investment environment such as stable macroeconomic operations, establishing fair and transparent legal systems, promoting business models such as public-private partnerships (PPPs), and providing support and seed money for establishing projects.

Recommendation 4:

To promote climate change actions, it is necessary for African countries to use market mechanisms effectively along with the effective use of funds and promotion of capability development

The implementation of specific climate change measures requires funds and implementation capabilities. The Cancun Adaptation Framework requires annual funds of US\$100 billion to be made available by 2020, as well as the structuring of a system to enable effective technology transfers; there is also a strong need for funds for climate change measures and technology in African countries. The effective use of funds is required, as well as the development of ways to maximize the effects of development and climate change measures while minimizing additional costs. Funding for climate change was discussed at the 2011 High Level Forum on Aid Effectiveness, and the partnership document it adopted calls for the promotion of consistency, transparency, and predictability in effective climate change finance and a broad approach toward development aid (OECD 2011).

In addition to their effective use for supporting climate change measures, public funds are also expected to provide leverage in obtaining private funds,. Establishing a structure and environment to promote private investment can also contribute to an overall increase in private investment, beyond climate change measures. Moreover, by monitoring and evaluating the efforts of the donors involved, even more effective cooperation could be possible. Lamhauge et al. (2012) have conducted studies on monitoring and evaluation methods with regard to several donors' support for adaptation measures. Such monitoring and evaluation methods focusing on the role of donors should be examined in the future.

Market mechanisms like CDM and bilateral offset credit mechanisms, or innovative mechanisms like PES, including REDD+, can be easy for African countries to work with. As pointed out by JICA-RI (2012), in order for these mechanisms to be used effectively to benefit African countries, it is necessary to develop the capabilities of the African countries themselves, and to introduce these mechanisms into international society so they can become even easier to use.

Recommendation 5:

JICA needs to function as a Solution Provider by establishing partnerships with various stakeholders..

From the viewpoint of the public and external nature of climate change on a global scale, an approach to climate change must be taken with the participation of all people. Japan and JICA have more than fifteen years of cooperation experience in the field of climate change, and also constitute the top donor in this field. Particularly, Japan and JICA have comparative advantage in effective use of renewable resources, improvement of efficiency and productivity with optimal management, and so on. There is a need to proceed with cooperation to implement the optimal climate change measures, with Japan and JICA providing all the cooperation knowledge they have amassed to date for everyone to use. In recent years, other donors have also started to provide active support for climate change measures. Further knowledge is also being amassed in the academic and private sectors. In order to establish a low-carbon economic society with the ability to withstand climate change, all this knowledge needs to be utilized in an intercomplementary manner so that all people, including the poor, will be able to receive the benefits of development. Providing an optimal solutions by establishing networks with various actors while keeping in mind international negotiations, technology, and funding trends in the climate change field will be required. To do this, we recommend establishing a broad collaboration among international organizations, other aid organizations, CSOs, universities, autonomous bodies, private companies and others, as well as providing bridges for exchanges among various actors, such as mediating policy dialogues between communities and governments.

References

- AfDB. 2012. *Solutions for a changing climate: The African Development Bank's response to impacts in Africa*. Tunis, Tunisia: African Development Bank.
- African Development Bank (AfDB). 2011. *The cost of adaptation to climate change in Africa*. Tunis, Tunisia: African Development Bank.
- Bharwani, S., and A. Taylor. 2011. Understanding the dynamic nature of vulnerability to support climate adaptation and development: The case of Lesotho Highlands. In Fujikura and Kawanishi 2011, 153–172.
- FAO. 2010. *The global forest resources assessment 2010*. Rome: FAO.
- Fujikura, R., and M. Kawanishi, eds. 2011. *Climate change adaptation and international development: Making development cooperation more effective*. London: Earthscan.
- Fujikura, R., and T. Toyota, eds. 2012. *Climate change mitigation and international development cooperation*. London: Routledge.
- Furukawa, M., and J. Takahata. 2013. Is GBS still a preferable aid modality? Working Paper No. 50, JICA Research Institute.
- Government of Japan. 2012. Japan's fast-start finance for developing countries up to 2012. Submission to UNFCCC.
- Hosono, A. 2012. Climate change, disaster risk management. In *Scaling up South-South and triangular cooperation*, ed. H. Kato, 15–41. Conference Volume Prepared for the Global South-South Development Expo 2012. Tokyo: JICA Research Institute.
- IPCC. 2012. Summary for Policymakers. In *Managing the risks of extreme events and disasters to advance climate change adaptation: A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, ed. C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley, 1–19. Cambridge, UK: Cambridge University Press.
- Intergovernmental Panel on Climate Change (IPCC) [M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, eds.]. 2007. *Contribution of Working Group II to the Fourth Assessment Report of the IPCC*. Cambridge, UK and New York: Cambridge University Press.
- JICA Research Institute (JICA RI). 2012. Aiming for promotion of climate change mitigation policies in developing countries. Policy Brief No. 7, JICA Research Institute.

- Japan International Cooperation Agency (JICA). 2011. JICA Climate-FT: Climate finance impact tool for mitigation and adaptation, Version 1.0. Reference document.
- Katsurai, T., and Y. Murakami. 2012. Effectiveness of development policy lending in mainstreaming and financing climate change: Case studies from Indonesia and Vietnam. In Fujikura and Toyota 2012, 149–179.
- Lamhauge, N., E. Lanzi, and S. Agrawala. 2012. Monitoring and evaluation for adaptation: Lessons from development co-operation agencies. OECD Environment Working Papers No. 38, OECD, Paris.
- Matsumoto, M. 2012. REDD+: A new strategy for conserving tropical forests; Scientific background of REDD+ and international discussions. In Fujikura and Toyota 2012, 49–60.
- OECD. 2011. Busan partnership for effective development co-operation. Declaration, Fourth High Level Forum on Aid Effectiveness, Busan, Korea, November 29 to December 1.
- Organization for Economic Cooperation and Development (OECD). 2009. *Integrating climate change adaptation into development co-operation: Policy guidance*. Paris: OECD.
- Sudo, T., A. Sato, Y. Murakami, and M. Motohashi. 2009. Promotion of developing country's climate policy implementation: Applying development policy loan. Paper presented at the Asia-Pacific Forum on Low Carbon Economy, Beijing, China, June.
- Sudo, Tomonori. 2012. Climate change and development in Africa. Presentation at the fourth Annual Meeting of Low Carbon Society Research Network (LCS-RNet), Oxford, UK. http://lcs-rnet.org/meetings/2012/pdf/P3_3_Sudo.pdf (accessed January 8, 2013).
- Troell, J. J., and C. Odote Oloo. 2011. Climate change adaptation and water in Kenya: Governing for resilience. In Fujikura and Kawanishi 2011, 259–285.
- United Nations Development Program (UNDP). 2012. *Africa human development 2012: Towards a food secure future*. New York: UNDP, Regional Bureau for Africa.
- United Nations Economic Council for Africa (UNECA), African Union, and African Development Bank (AfDB). 2011. *The Africa water vision for 2025: Equitable and sustainable use of water for socioeconomic development*. Addis Ababa, Ethiopia: United Nations Economic Council for Africa.
- United Nations Framework Convention on Climate Change (UNFCCC).

2010. *Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010*. FCCC/CP/2010/7/Add.1.
- World Bank Corporate Scorecard. 2012. CO2 emissions. Indicator definition. <http://corporatescorecard.worldbank.org/images/pdfs/tier1/122.pdf> (accessed August 31, 2012).
- World Bank. 2009. *Making development climate resilient: A World Bank strategy for Sub-Saharan Africa*. Washington, DC: World Bank Sustainable Development Department.
- World Bank. 2012. *World development indicators 2012*. Washington, DC: World Bank.
- World Economic Forum. 2008. *Africa@Risk: A global risk network briefing*. Geneva: World Economic Forum.
- Yamada, Kazuhito, and Mariko Fujimori, 2012. "Current Status and Critical Issues of the CDM. In Fujikura and Toyota 2012, 37–48.