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Agriculture and Climate Change Part II

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Overview

This report covers two topics related to agriculture and climate change in developing countries. The first section discusses the role of agricultural offsets in mitigating greenhouse gas emissions. Recent negotiations around a post-Kyoto Protocol agreement have included debate about whether agricultural carbon sequestration projects should be eligible under the Clean Development Mechanism (CDM). As examined in Section I, reasons for supporting or opposing this type of CDM reform relate to impacts on development goals and smallholder farmers, scientific uncertainty about carbon sequestration, and philosophical disagreement about the use of emission offsets.

The second section covers proposed agricultural adaptation activities in Africa and other developing countries. While the majority of developing countries have outlined immediate adaptation needs in National Adaptation Programmes of Action (NAPAs), few have made progress in implementing adaptation activities. Issues related to financial resources, scientific and technical information, and capacity building continue to challenge developing countries in preparing for the impacts of climate change.

Section I: Debating the Role of Agricultural Offsets in Mitigation

The Clean Development Mechanism (CDM) allows industrialized countries to meet their Kyoto Protocol emission reduction targets by purchasing carbon credits from emission reduction projects in developing countries. The mechanism is intended to provide industrialized countries flexibility in meeting their reduction commitments while also promoting sustainable development and emission reductions in developing countries.[i]

To date, agriculture has played a limited role in the CDM. According to the Kyoto Protocol, projects must produce "real, measurable, and long-term" mitigation benefits, and the CDM Executive Board has adopted measurement and monitoring methodologies for different project types to ensure this.[ii,iii] Due to scientific uncertainty about how to quantify and verify long-term soil carbon storage,

soil carbon sequestration activities – which represent 89% of agriculture's greenhouse gas mitigation potential – have been ineligible for inclusion in the CDM.[iv]

The CDM Board has approved a small number of methodologies for agricultural projects that reduce greenhouse gas emissions, such as manure management systems that mitigate methane emissions. Agriculture projects currently represent only 5% of registered CDM projects. Afforestation and reforestation activities are also eligible under the CDM, but account for less than 1% of registered projects.[v]

Arguments For and Against Increasing Agriculture's Role in the CDM

As UN Framework Convention on Climate Change (UNFCCC) parties negotiate a post-Kyoto agreement, several groups have proposed allowing a larger role for agriculture in the CDM, primarily by making carbon sequestration from agriculture an eligible project type. Agriculture emits about 13.5% of global greenhouse gases, and 74% of these emissions come from developing countries.[vi] Because carbon sequestration holds the most promise for reducing agricultural emissions, supporters of reform contend that including carbon sequestration in the CDM is essential for realizing agriculture's full mitigation potential.

Multilateral climate change funds will finance some agricultural mitigation in developing countries. However, organizations such as the FAO and International Food & Agricultural Trade Policy Council believe that maximizing mitigation potential requires using a full suite of financing mechanisms, including market-based tools like the CDM.[vii,viii] These groups see significant opportunities in mitigation to promote development alongside climate change goals. For example, farming practices that increase levels of soil carbon serve to reduce emissions, improve plant nutrient content, increase water retention capacity, and eventually produce higher yields.[ix] The CDM can provide a new source of funding to help capture such synergies.

Yet, even those who support giving carbon sequestration a place in the CDM caution against potential trade-offs between mitigation and development goals, such as food security. Restoring organic soils, for instance, increases carbon sequestration, but may require taking land out of food production. Some worry that marginalized groups will be displaced as commercial interests buy up areas for mitigation projects. Lands that government officials deem "unused" may actually be providing water and food resources for the poorest members of a community. Purchases of these lands for mitigation projects could displace and further impoverish vulnerable populations.[x]

Opponents of increasing agriculture's role in the CDM also argue that high transaction costs related to producing carbon credits would prohibit most smallholder farmers from participating. Some mitigation measures, such as tillage management, have low start-up costs. However, others require purchasing costly machinery or fertilizer inputs, such as special drills to implement no-till cropping. Labor costs and the time lag between establishing mitigation projects and receiving income from carbon credits are other potential adoption barriers to smallholders. The benefits of mitigation projects may flow disproportionately to large agribusinesses, who have greater access to credit and risk management tools than smallholders.

The Food and Agriculture Organization has identified several ways to promote smallholder participation in market-based mechanisms and minimize trade-offs between mitigation and development. These strategies include:[xi]

- Promoting individuals' and local communities' rights to land and resources;
- Ensuring that individuals and local communities have a voice in decision making at international and national levels;
- Integrating mitigation actions into long-term development plans;
- Taking advantage of existing institutional arrangements, such as group credit schemes and farmer field schools, to aggregate mitigation actions across a larger number of smallholders;
- Expanding access to risk management tools for smallholders, such as weather insurance.

Beyond possible negative effects on smallholders and development goals, opponents of CDM reform contend that scientific uncertainty about the measurability and permanence of soil carbon sequestration is too high.[xii] Supporters of reform acknowledge this concern, but suggest that making carbon sequestration eligible will trigger whatever research is necessary to improve measurement methodologies.[xiii]

A final argument used against increasing agriculture's role in the CDM is based on opposition to emission offsets of all types. Some environmental groups take the stance that carbon markets allow developed countries to evade an obligation to reduce their own emissions. Expanding the carbon market to include offsets from agriculture is only a distraction from the root problem of pollution in industrialized countries.[xiv]

In summary, major arguments for opposing an increased role for agriculture in the CDM are related to concerns about negative unintended consequences for vulnerable populations and development goals and scientific uncertainty about carbon sequestration. Some groups also oppose the use of offsets of any kind to combat climate change. They object to making carbon sequestration eligible under CDM because such a change would only increase opportunities for industrialized countries to purchase offsets rather than reduce their own pollution. Supporters of reform contend that the CDM represents an opportunity for new investment in both environmental and development goals. They do acknowledge a need to implement changes to the CDM carefully in order to avoid negative impacts on smallholder farmers.

Conclusion: What Happened in Copenhagen

Many groups hoped that negotiations in Copenhagen in December 2009 would clarify agriculture's role in mitigation and the CDM. This did not happen. An agriculture working group drafted a document directing the UNFCCC Subsidiary Body for Scientific and Technical Advice to develop recommendations for how countries can reduce emissions from agriculture and adapt agricultural systems to the negative impacts of climate change. However, the document was not finalized or approved before the end of the conference. Negotiators may revisit the document as early as this spring.[xv]

Section II: Current Adaptation Activities and Challenges

Climate change adaptation involves designing and implementing appropriate coping measures to deal with the negative impacts of climate change. In recent years, scientists have made progress in learning about what these likely impacts will be in Africa. Climate change is expected to increase the incidence and severity of floods, droughts, tropical cyclones, and other extreme weather events. Temperatures are very likely to rise throughout the continent, with drier subtropical regions warming more than moister tropics. Northern and southern Africa are expected to become drier, while East Africa will likely experience an increase in rainfall.

Scientists predict with certainty that climate change will impact agriculture in Africa, though the severity of the impact is still unclear. Higher temperatures and increased occurrence of drought will likely decrease the area of land suitable for cultivation, the length of growing seasons, and overall agricultural yield. These trends will be particularly apparent along the margins of semi-arid and arid areas.[xvi]

Given the high levels of poverty, lack of infrastructure, and widespread dependence on the natural environment for livelihood support, Africa is especially vulnerable to the impacts of climate change.[xvii] In response, African countries and development agencies have begun to design and implement adaptation measures that proactively address future climate risks across a range of sectors, including agriculture. The most prominent examples of strategies to adapt to climate change are developing countries' National Adaptation Programmes of Action (NAPAs).

National Adaptation Programmes of Action (NAPAs)

Recognizing that developing countries are among the most vulnerable and least able to deal with the adverse impacts of climate change, the seventh Conference of the Parties (COP 7) to the UNFCCC in 2001 established financing mechanisms and a process to build adaptation capacity in Least Developed Countries (LDCs). The COP 7 agreement created the Least Developed Countries Fund to finance the preparation of National Adaptation Programmes of Action (NAPAs). An LCD Expert Group was formed to advise LDCs on the creation of NAPAs.

NAPAs are plans that identify each LDC's most urgent adaptation needs and activities to address those needs. According to UNFCCC guidelines, NAPAs should: [xviii]

- Focus on immediate needs for which delay could increase vulnerability or lead to greater costs in the future;
- Use existing information instead of requiring new comprehensive assessments or research;
- Be action-oriented, country-driven, flexible, and specific to national circumstances; and
- Be presented in a format that is understandable to both policymakers and the public.

As of November 2009, 43 of 48 LDCs had developed and submitted NAPAs, including 30 African countries.[xix] The remaining five LDCs are in the final stages of preparing NAPAs and are expected to submit them in 2010.[xx] In 2009, the UNFCCC LDC Expert Group analyzed 42 submitted

NAPAs and found that countries had proposed 433 adaptation projects with a total estimated implementation cost of $1.66 billion. The projects cover a range of sectors, including agriculture and food security, water resources, terrestrial and marine ecosystems, energy, health, education, early warning and disaster management, and capacity building and public awareness.

Projects related to agriculture and food security represent the largest number, with 123 projects requiring $352 million for implementation. Water resources account for the second highest number of projects, 69, but require the largest amount, $837 million, for implementation. NAPAs proposed relatively few projects related to education, capacity building, and public awareness.[xxi]

The NAPA agricultural projects involve direct investment in actions to demonstrate or test adaptive strategies, such as breeding drought and salt resilient crops. The projects cover a range of scales, including countrywide efforts (promoting crop diversification throughout Malawi), initiatives specific to regions (supporting irrigation of cereal crops in two provinces in Burkina Faso), and community-based activities (encouraging breeding of drought-tolerant livestock in six villages in Eritrea).[xxii]

Many projects promote diversification of income-generating activities to reduce people's reliance on livelihoods that will be affected by climate change. A project in Niger, for example, will help women and youth who are forced to migrate to urban areas due to droughts to develop skills in market gardening and intensive livestock farming. Across all NAPAs, agricultural project costs range from $100,000 to $45 million.[xxiii] See Appendix I for a full list of agricultural adaptation projects proposed in African countries' NAPAs.

Once NAPAs are submitted to the UNFCCC secretariat, the LDCs become eligible to apply for funding for implementation of NAPA projects through the LDC Fund. As of September 2009, the Fund had committed $100 million to support implementation of 75 of the 433 NAPA projects. Forty-one percent of the funded projects are related to agriculture and food security.[xxiv]

Remaining Adaptation Challenges

To avoid the adverse impacts of climate change, African countries need to take steps beyond completing NAPAs. While the LDC Expert Group and external analysts see value in the participatory, country-driven processes used to identify NAPA projects, they contend that serious challenges remain in implementing all NAPA projects and preparing for long-term adaptation to climate change.[xxv] As discussed below, challenges related to financial resources, scientific and technical information, and capacity building threaten to diminish the momentum of NAPAs and stall preparation for long-term exposure to climate risks.

Financial Resources

The main concern stressed by LDCs and development groups such as the International Institute for Environment and Development is the lack of access to adequate funding for implementation of NAPA projects. The primary financing source for NAPA projects is the LDC Fund. In an assessment of the NAPA process conducted by the LDC Expert Group in 2009, NAPA preparation

teams highlighted the difficulty of transforming NAPA project concepts into detailed funding applications to the LDC Fund.[xxvi] The initial funding for NAPA design did not include resources for expanding the two- to three-page NAPA project summaries into complete implementation plans. As a result, implementation of NAPA projects has been slow.[xxvii]

In interviews with African NAPA preparation teams in 2007, all responded that available funding opportunities were insufficient.[xxviii] The LDC Fund relies on voluntary contributions from Annex I parties (industrialized countries) and has received commitments of $177 million to date. The Fund pays a maximum of $5 million per NAPA project (increased from $3.5 million in June 2009), meaning that LDCs must seek out other sources of funding or implement projects only partially.[xxix]

Other UN-sponsored financing mechanisms for adaptation include the Special Climate Change Fund, also reliant on voluntary contributions, and the Adaptation Fund, which is financed through a share of proceeds from clean development mechanism (CDM) project activities.[xxx] As of 2009, pledges to the Special Climate Change Fund totaled $90 million, and deposits in the Adaptation Fund totaled $28 million.[xxxi,xxxii] The estimated budget for all NAPA projects is $1.66 billion, representing a significant funding gap.[1]

The funding gap grows even larger considering that NAPAs represent urgent priorities, not full adaptation costs over the long-term. Global estimates of adaptation costs range widely, reflecting uncertainty about the full impacts of climate change and effectiveness of adaptation measures. A 2009 estimate by the World Bank put global adaptation costs at $75 to $100 billion annually from now until 2050, with $17 to $18 billion needed annually in Sub-Saharan Africa.[xxxiii] The International Food Policy Research Institute calculates that about $7 billion per year is needed in global agricultural productivity investments to offset the negative impacts of climate change.[xxxiv]

Collection and Communication of Scientific Information

Limited scientific and technical resources in Africa and other developing countries are obstacles to planning and implementing adaptation activities. Despite advancements in climate science, considerable uncertainty remains about how climate change will impact individual countries, or even sub-regions, in Africa. Climate scientists are unsure, for example, whether the Sahel will become wetter or drier due to climate change. This high degree of uncertainty is the result of a growing, but still poor, understanding of the drivers of the African climate and how they interact with each other.

In addition, local weather data is severely lacking throughout the continent, with Sub-Saharan Africa having the world's lowest density of meteorological stations.[xxxv,xxxvi] The relatively poor state of knowledge makes it challenging to assess climate risks and respond with appropriate adaptation measures. In reviewing the process of creating NAPAs, the LDC Expert Group found that many NAPA preparation teams struggled to find relevant information about expected climate change impacts.[xxxvii]

[1] The Copenhagen Accord, signed in December 2009, pledged an additional $30 billion per year for 2010-2012 and $100 billion per year by 2020 to address adaptation and mitigation needs in developing countries. The Accord is not legally binding, however.

The Stockholm Environment Institute (SEI) in 2008 reported that initial efforts were underway to produce climate information at finer scales in Africa, but that awareness and use of these data are still limited. Among farmers and agricultural policymakers, the report found that decisions were being made based on year-to-year climate variability rather than available information on climate change. The authors identified three problems that impede wider use of climate change data by the agricultural sector in Africa:[xxxviii]

- Climate change data are still largely unavailable at the small-scale resolution needed to make farming decisions. When farmers cannot reconcile their own observations of weather patterns with climate projections, they lose confidence in the projections.
- The timeframes of climate change projections do not resonate with farmers, who tend to focus on immediate rather than long-term issues. Many climate change predictions report what is likely to happen by 2050.
- Africa has very few scientists with the necessary training to interpret climate change data and apply it to the agricultural sector.

The report found that when decision makers did use available data, they often relied on only one model's predictions, running a risk of drawing inaccurate inferences and promoting misdirected adaptation strategies. To help overcome data collection and communication challenges, the report highlighted the need to expand climate change modeling efforts within Africa while consulting closely with users of the information on how to interpret and apply modeling results.[xxxix]

Capacity Building

Widespread lack of capacity to plan, manage, implement, and account for results of adaptation projects is a third major obstacle for developing countries in preparing for climate change. LDCs cited numerous capacity constraints that made the NAPA preparation process difficult, such as: lack of technical experts who understand climate change and the local context; lack of skill and experience with documenting and integrating indigenous knowledge into adaptation plans; and inability to develop project proposals that integrate multiple sectors.[xl] These and similar constraints are likely to hinder implementation of NAPAs and long-term adaptation projects.

SEI identified institutions and programs active in African agricultural adaptation and noted a lack of practitioners specifically focused on adaptation. The majority of institutions, donors, and practitioners were internationally based and had expertise in either climate science or agriculture. While these groups were found to be exploring climate change impacts, few had knowledge of both climate change and agricultural adaptation. To build local capacity, SEI recommended favoring processes that build technical and decision making skills over one-off pilot projects and interventions.[xli]

Conclusion

Countries have made progress in preparing for climate change by identifying immediate adaptation needs through the preparation of NAPAs. They have proposed a range of agricultural adaptation

activities, from developing drought resistant seeds to helping farmers diversify their crops. Implementation of NAPA projects has been slow, however, with countries finding it difficult to access sufficient adaptation funding. Building on the momentum of adaptation planning will require additional financial, scientific, and capacity building support.

Please direct comments or questions about this research to Leigh Anderson, at eparx@u.washington.edu.

Appendix I.

Country	Agricultural Adaptation Projects Proposed in NAPAs
Burkina Faso	Securing cereal production through the promotion of supplemental irrigation in the North and Central North regions Producing fodder and developing fodder stocks for livestock in the Sahelian region Implementing irrigated crops in Gourma, Namentenga, Tapoa and Sanmatnga regions Protecting pastoral-suited regions in the Sahelian and Eastern regions Securing agricultural production through the use of appropriate technological packages in the South East and East regions.
Burundi	Promoting short cycle and drought resistant food crops Promoting zero grazing techniques
Cape Verde	Modernizing and diversifying agricultural production to improve food security
Central African Rep.	Implementing climate change-resistant varieties in Central, North, Southeast areas of country
Comoros	Introducing varieties that are more adapted to drought Introducing fish concentration mechanisms Improving refrigeration infrastructure to reduce or avoid the deterioration of the fish post-harvest Increasing fodder production for poultry farming Increasing fodder production for goat breeding
Dem. Rep. of Congo	Strengthening of agricultural production capacities through improved corn, rice, and cassava seeds
Djibouti	Improving rangeland management to mitigate the risks associated with traditional extensive livestock
Eritrea	Introducing community based pilot rangeland improvement and management in selected agro-ecological areas in the eastern and northwestern lowlands rangelands Introducing community based pilot projects to intensify existing production models Increasing agricultural production through spate irrigation and range development
Ethiopia	Improving rangeland resource management practices in the pastoral areas of Ethiopia
Gambia	Diversifying and intensifying agricultural production, processing, and marketing

	Improving livestock and rangeland management for food security and environmental sustainability Increasing fish production through aquaculture and conservation of post-harvest fishery products
Guinea	Intensifying bulrush millet crops in the North region of Guinea Rehabilitating hydro-agricultural systems in plains and lowlands through implementation of irrigated rice cultivation in Moyenne and Haute Guinea Intensifying small ruminant breeding to promote income-generating activities Developing and promoting vegetable growing to promote income-generating activities Implementing a ranch for cane rats to prevent unsustainable hunting of wildlife and improve the livelihoods of rural populations
Guinea Bissau	Providing support to a short-cycle animals project Providing support to diversify food production and diet
Lesotho	Improving resilience of livestock production systems under extreme climatic conditions in various livelihood zones Promoting sustainable crop based livelihood systems in foothills, lowlands and Senqu River Valley Improving community food security through the promotion of food processing and preservation technologies
Liberia	Enhancing resilience to increasing rainfall variability through the diversification of crop cultivation and small ruminants rearing
Madagascar	Supporting intensification of crop and livestock production through material acquisition, input distribution, and development of income generating activities
Malawi	Improving community resilience to climate change through the development of sustainable rural livelihoods Improving agricultural production under erratic rains and changing climatic conditions
Mali	Providing extension services for improved food crop varieties adapted to climate change Providing extension services for animal and plant species with the highest adaptation potential to climate change Promoting income-generating activities Rehabilitating aquaculture sites Promoting cereal stocks Intensifying fodder crops Promoting fodder stock for livestock
Mauritania	Increasing treatment and use of unrefined fodder and manufacture and use of multi-nutritional blocks Developing fodder crops

	Promoting livestock mobility
	Promoting and developing domestic poultry farming
	Improving cultivation methods in pluvial zones
	Improving locale bovine breeds
	Introducing new fodder species along natural grazing routes
Niger	Introducing fodder crop species in pastoral areas
	Creating livestock food banks
	Restoring basins for crop irrigation
	Diversifying and intensifying crop irrigation
	Promoting peri-urban market gardening and livestock farming
	Promoting income-generating activities and developing mutual benefit societies
	Creating food banks
	Disseminating animal and crop species that are most adapted to climatic conditions
Sao Tome e Principe	Training and re-formulation of a project introducing new navigation technologies and fishing equipment for fishermen
	Constructing and installing a Device for Fish Concentration (DFC) on the costal zone
	Reinforcing and diversifying agricultural production
	Supporting a cow and sheep development project in the north part of S. Tomé island
Sierra Leone	Developing Inland Valley Swamps for rice production in the Moyamba District
	Developing irrigation and drainage systems for agricultural production in the Bombali District
	Establishing a Permanent Study Programme of mutli species fishering
	Improving quality of fisheries-related data and research
Sudan	Improving sustainable agricultural practices under increasing heat stress in the River Nile State
Tanzania	Improving food security in drought-prone areas by promoting drought-prone tolerant crops
Zambia	Promoting alternatives sources of livelihoods to reduce vulnerability to climate change
	Adaptating land use practices (crops, fish, and livestock) in light of climate change

Source: UNFCC. (2009). NAPA project patabase. Retrieved from: http://unfccc.int/cooperation_support/least_developed_countries_portal/napa_project_database/items/4583.php.

Endnotes

[i] United Nations. (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change, Article 12. New York: United Nations.

[ii] United Nations. (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change, Article 12. New York: United Nations.

[iii] Clean Development Mechanism. (2010). Baseline and monitoring methodologies. Retrieved from: http://cdm.unfccc.int/methodologies/index.html.

[iv] Food and Agriculture Organization. (2009). Food security and agricultural mitigation in developing countries: options for capturing synergies. Rome: Food and Agriculture Organization.

[v] Clean Development Mechanism. (2010). Distribution of registered project activities by scope. Retrieved from: http://cdm.unfccc.int/Statistics/Registration/RegisteredProjByScopePieChart.html.

[vi] Food and Agriculture Organization. (2009). Food security and agricultural mitigation in developing countries: options for capturing synergies. Rome: Food and Agriculture Organization.

[vii] Food and Agriculture Organization. (2009). Food security and agricultural mitigation in developing countries: options for capturing synergies. Rome: Food and Agriculture Organization.

[viii] International Centre for Trade and Sustainable Development & International Food & Agricultural Trade Policy Council. (2009). International climate change negotiations and agriculture. The ICTSD-IPC Platform on Climate Change, Agriculture and Trade: Promoting Policy Coherence.

[ix] Food and Agriculture Organization. (2009). Food security and agricultural mitigation in developing countries: options for capturing synergies. Rome: Food and Agriculture Organization.

[x] Ensor, J., Ernsting, A., Gura, S., & Paul, H. (2009). Agriculture and soils in carbon trading. Rugby, UK: Practical Action.

[xi] Food and Agriculture Organization. (2009). Food security and agricultural mitigation in developing countries: options for capturing synergies. Rome: Food and Agriculture Organization.

[xii] Paul, H., Ernsting, A., Semino, S., Gura, S., & Lorch, A. (2009). Agriculture and climate change: real problems, false solutions. Oxford, UK: EcoNexus.

[xiii] International Centre for Trade and Sustainable Development & International Food & Agricultural Trade Policy Council. (2009). International climate change negotiations and agriculture. The ICTSD-IPC Platform on Climate Change, Agriculture and Trade: Promoting Policy Coherence.

[xiv] Paul, H., Ernsting, A., Semino, S., Gura, S., & Lorch, A. (2009). Agriculture and climate change: real problems, false solutions. Oxford, UK: EcoNexus.

[xv] Institute for Agriculture and Trade Policy. (2009). Press release: weak climate deal leaves hard choices for next year. Minneapolis: Institute for Agriculture and Trade Policy.

[xvi] Conway, G. (2009). The science of climate change in Africa: impacts and adaptation. Graham Institute for Climate Change, Discussion paper No. 1. Imperial College London.

[xvii] Ziervogel, G., Cartwright, A., Tas, A., Adejuwon, J., Zermoglio, F., Shale, M., et al. (2008). Climate change and adaptation in African agriculture. Stockholm Environment Institute.

[xviii] UN Framework Convention on Climate Change. (2009). Least developed countries: national adaptation programmes of action: overview of preparation, design of implementation strategies and submission of revised project lists and profiles. Bonn, Germany.

[xix] UN Framework Convention on Climate Change. (2009). NAPAs received by the secretariat – Last update: 18 November 2009. Retrieved from: http://unfccc.int/cooperation_support/least_developed_countries_portal/submitted_napas/items/4585.php.

[xx] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.

[xxi] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.

[xxii] The UNFCCC NAPA Project Database (http://unfccc.int/cooperation_support/least_developed_countries_portal/napa_project_database/items/4583.php) contains a full list of projects by sector.
[xxiii] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.
[xxiv] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.
[xxv] See, for instance: 1) UN Framework Convention on Climate Change. (2009). Least developed countries: national adaptation programmes of action: overview of preparation, design of implementation strategies and submission of revised project lists and profiles. Bonn, Germany. 2) Abdullah, A., Jallow, B., Konate, M., Muyungi, R., & Reazuddin, M. (2009). National adaptation funding: ways forward for the poorest countries. London: International Institute for Environment and Development.
[xxvi] UN Framework Convention on Climate Change. (2009). Least developed countries: national adaptation programmes of action: overview of preparation, design of implementation strategies and submission of revised project lists and profiles.
[xxvii] Abdullah, A., Jallow, B., Konate, M., Muyungi, R., & Reazuddin, M. (2009). National adaptation funding: ways forward for the poorest countries. London: International Institute for Environment and Development.
[xxviii] Osman-Elasha, B., & Downing, T. E. (2007). Lessons learned in preparing national adaptation programmes of action in eastern and southern Africa. Oxford: European Capacity Building Initiative.
[xxix] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.
[xxx] UN Framework Convention on Climate Change. (2009). Least developed countries: support needed to fully implement national adaptation programmes of action (NAPAs). Bonn, Germany.
[xxxi] Global Environment Facility. Special Climate Change Fund. http://www.gefweb.org/interior.aspx?id=192
[xxxii] World Bank. (2009). Financial status of the Adaptation Fund Trust Fund (as of 30 November 2009).
[xxxiii] World Bank. (2009). The cost to developing countries of adapting to climate change. Washington, DC: The World Bank.
[xxxiv] Nelson, G. C., Rosegrant, M. W., Koo, J., Robertson, R., Sulser, T., Zhu, T., et al. (2009). Climate change: impact on agriculture and costs of adaptation. Washington, DC: International Food Policy Research Institute.
[xxxv] Conway, G. (2009). The science of climate change in Africa: impacts and adaptation. Graham Institute for Climate Change, Discussion paper No. 1. Imperial College London.
[xxxvi] United Nations Development Programme. (2008). Human development report 2007/2008. Fighting climate change: human solidarity in a divided world. New York: United Nations Development Programme.
[xxxvii] UN Framework Convention on Climate Change. (2009). Least developed countries: national adaptation programmes of action: overview of preparation, design of implementation strategies and submission of revised project lists and profiles. Bonn, Germany.
[xxxviii] Ziervogel, G., Cartwright, A., Tas, A., Adejuwon, J., Zermoglio, F., Shale, M., et al. (2008). Climate change and adaptation in African agriculture. Stockholm Environment Institute.
[xxxix] Ziervogel, G., Cartwright, A., Tas, A., Adejuwon, J., Zermoglio, F., Shale, M., et al. (2008). Climate change and adaptation in African agriculture. Stockholm Environment Institute.
[xl] UN Framework Convention on Climate Change. (2009). Least developed countries: national adaptation programmes of action: overview of preparation, design of implementation strategies and submission of revised project lists and profiles. Bonn, Germany.
[xli] Ziervogel, G., Cartwright, A., Tas, A., Adejuwon, J., Zermoglio, F., Shale, M., et al. (2008). Climate change and adaptation in African agriculture. Stockholm Environment Institute.