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Objective: To assess how Aid for Trade and finance for mitigation and adaptation to climate change could, and should, work together to address the related challenges of agriculture productivity, climate change, food security and trade capacity.

Draft Report

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Executive Summary

Agricultural trade flows are part dependent on the interaction between inherent comparative advantage, which will be subject to the changes in climate, as well as trade policy.¹ Poor countries with a large rural economy depend on agricultural exports for their fiscal and socio-political stability (Christoplos, 2009); climate change could potentially jeopardise agricultural export earnings unless alternatives can be sought or climate proof investments are made. But not only is the agricultural sector highly vulnerable to climate change, it is also one of the most distorted and heavily influenced by a wide range of local, regional, national and international trade policies. The increased stress to the system brought about by climate change makes reform in global agricultural policies even more important.

Even if the most ambitious climate change mitigation measures are adopted, global temperatures are likely to increase by at least 2⁰c since pre-industrial levels by the end of this century, if not sooner; the intensity and frequency of extreme climatic conditions is expected to increase and the predictability of normal rainy seasons, decrease.² Country specific studies on the climate change impacts expected for the agricultural sector in most low income countries are scarce, in part due to a lack of data availability. Where country specific studies do exist, there is typically limited crop coverage - cereals feature most prominently. Although such crops are important in terms of global agricultural trade, reductions in agricultural output and productivity because of climate change will affect more than just cereals.

Some of the most dependent agricultural economies face an estimated loss of more than fifty percent of their total agricultural output by 2080, even when including carbon fertilisation effects (where an increased concentration of carbon dioxide in the atmosphere acts as a stimulus to crop productivity). Countries such as Malawi may need to adapt to a 20% reduction in agricultural export earnings because of reduced agricultural output.

Beyond 'climate proofing' existing modes of production and investment, for which global 'top down' estimates exist, but 'bottom up' estimates are largely limited, other adaptation options may include those that relate to the transition to a low carbon global economy. New products and services are being demanded as part of the transition towards a low carbon global economy. Out of the total Greenhouse Gas (GHG) abatement opportunities and mitigation measures identified by McKinsey (2009), that need to be undertaken and adopted in order to avoid dangerous climate change, 70% in total are located in the developing world, and 90% of all 'terrestrial carbon' opportunities (which account for 30% of total GHG abatement opportunities).

It is highly likely that avoided deforestation (Reduced Emissions from Deforestation and Forest Degradation, abbreviated to REDD) will be included in the next commitment period of the Clean Development Mechanism (CDM). But recognition of *all* types of terrestrial carbon, could offer

1 See Nelson (2009) who also notes that uncertainties in where climate changes will take place mean lack of clarity about the effects on agricultural production. These uncertainties combine with the complexity of the agricultural policy environment to make simulations fraught with peril.

2 See Christoplos (2009): http://www.acp-eu-trade.org/library/files/Christoplos_EN_040509_GRM-GDR_Aid-for-pro-poor-agricultural-trade-in-a-context-of-climate-change.pdf

primarily agriculturally based societies, such as low income countries, potential new market opportunities in carbon trade.

Though the international architecture for climate change finance for mitigation and adaptation is new and growing, there is a considerable gap between what funds are needed and what are currently pledged. There is also considerable variation in terms of the focus of funds. Nevertheless, mitigation finance available through the Clean Development Mechanism (CDM) has been the largest source of mitigation finance to developing countries to date. Efforts should be made to increase access to the mechanism by low income countries; this may include in relation to its scope as well as scale.

That low carbon products must be certified as such is likely to be a growing trend in the transition to a low carbon global economy. If undertaken using the more objective, but inevitably more costly, methodology – lifecycle analysis – some developing country agricultural exporters may benefit from the relocation of agricultural production from high to low emitting locations. However, without a well designed and approved carbon labelling and or ‘sustainability’ methodology, there is a risk that some low carbon products are not recognised, and as a result some developing country producers, lose out. This suggests a need for intervention.

Technical assistance for trade aims to help developing countries to design and implement trade policy effectively and producers within them to be competitive, given the policies, markets, products, and conditions which face them, now and in the future. Climate change and the conventions in response to this will affect what is produced, what is traded, trading rules, the standards traded goods must meet, and the regulations which they must follow.

Ensuring that a development programme should use trade efficiently and be consistent with limiting climate change and achieving a sustainable pattern of production should be part of any aid programme. In practice it is already difficult to separate funding for adaptation or mitigation for climate change from normal adaptation to new trading problems or opportunities, and this will become increasingly difficult as taking account of climate change becomes a more standard part of project analysis. That targeted assistance should be additional to normal ODA does not mean that it should be separate from it at the level of programmes or projects. But any new purpose for Aid for Trade would require additional funding to avoid diversion from existing needs.

There is much scope for climate change finance and existing trade facilitation, such as Aid for Trade to work together to address the challenges of climate change: many of the donors that have provided mitigation and adaptation finance are also involved in trade-related assistance. However, given that there are not yet checks to ensure compatibility suggests that coordination between institutions and programs needs to be improved; this may, at the same time serve to reduce potential conflicts between competing demands (and agendas).

The Aid for Trade initiative, similar to climate change mitigation and adaptation finance, are in part, about delivery of global public goods - in these cases funding has to be additional and must not be diverted from other sources. In the current environment of donor resource constraint the need to establish and delineate, financing mechanisms that can stand alone if necessary, becomes arguably even more important.

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Abbreviations

AF	Adaptation Fund
AR4	Fourth Assessment Report
CDM	Clean Development Mechanism
CRS	Creditor Reporting System
EC	European Commission
ETF-IW	Environmental Transformation Fund-International Window.
GCM	General Circulation Model
GEF	Global Environmental Fund
GHG	Greenhouse Gas
GWP	Global Warming Potential
IATAL	International Air Travel Adaptation Levy
ICAO	International Civil Aviation Organization
IDA	International Development Association
IMERS	International Maritime Emission Reduction Scheme
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunications Union
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LUCF	Land Use Changes and Forestry
MEA	Multilateral Environmental Agreement
MDG	Millennium Development Goal
NAPA	National Adaptation Plans of Action
ODA	Official Development Assistance
OECD-DAC	Organisation for Economic Cooperation and Development- Development Assistance Committee
REDD	Reduced Emissions From Deforestation
SCCF	Special Climate Change Fund
SPA	Special Priority on Adaptation
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WTO	World Trade Organization

Introduction

Agricultural trade flows are part dependent on the interaction between inherent comparative advantage, which will be subject to the changes in climate, as well as trade policy.³ Poor countries with a large rural economy depend on agricultural exports for their fiscal and socio-political stability (Christoplos, 2009); climate change could potentially jeopardise agricultural export earnings unless alternatives can be sought or climate proof investments are made. But not only is the agricultural sector highly vulnerable to climate change, it is also one of the most distorted and heavily influenced by a wide range of local, regional, national and international trade policies. The increased stress to the system brought about by climate change makes reform in global agricultural policies even more important. Even if the most ambitious climate change mitigation measures are adopted, global temperatures are likely to increase by at least 2^oc since pre-industrial levels by the end of this century, if not sooner; the intensity and frequency of extreme climatic conditions is expected to increase and the predictability of normal rainy seasons, decrease.⁴

But what are the alternative sources of export earnings? Given the potential impact of climate change on agricultural production, this document sets out to assess how producers might adapt; this includes in relation to new markets for agricultural products and services related to climate change mitigation efforts. The first section, 'Scoping and Diagnostics', reviews some of the most notable climate change scenarios at the aggregate, as well as the country and product specific level (where this is possible). It then sets out to quantify the potential static revenue losses that might result from climate change on agricultural trade flows, and resultant impact on employment and GDP, for some of the most vulnerable and poorest countries in the world.

The second section reviews adaptation and mitigation options related to the agricultural sector, in three parts: first, climate change proofing current modes of production; second, diversifying into new products; and third, diversifying into new services. It relates the second and third options to global climate change mitigation efforts. The third section proceeds to review existing mitigation and adaptation finance mechanisms and their subsequent components; it assesses the extent to which available instruments and mechanisms are being leveraged to meet the challenges of climate change for the agricultural sector in vulnerable economies.

The fourth section reviews other sources of finance designed to facilitate trade and access to markets, such as Aid for Trade. It assesses the extent to which existing financial resources might adapt to accentuated development challenges given the impact of climate change on the agricultural sector in poor countries, and therefore increased demands. The final section concludes with a summary of overall findings and an assessment as how 'new' sources of climate change finance and existing mechanisms and tools could, and should, work together to address the challenges of climate change in the agricultural sector for vulnerable producers and exporters.

3 See Nelson (2009) who also notes that uncertainties in where climate changes will take place mean lack of clarity about the effects on agricultural production. These uncertainties combine with the complexity of the agricultural policy environment to make simulations fraught with peril.

4 See Christoplos (2009): http://www.acp-eu-trade.org/library/files/Christoplos_EN_040509_GRM-GDR_Aid-for-poor-agricultural-trade-in-a-context-of-climate-change.pdf

1. Scoping and Diagnostics

Although there are uncertainties in relation to the impact of climate change on agricultural production, there are a number of areas where general agreement exists:⁵

- the only certainties about the impact of climate change on agriculture are increasing uncertainty, variability and frequency and severity of extreme events (storms, hurricanes, droughts, etc.);
- there are opportunities for some countries under all but the most extreme scenarios (e.g. North America, Russia, China), which lead to an expansion of potential agricultural crop land;
- all scenarios show declining yields in Africa in the long run, but the level and rate of this decline differs amongst scenarios; and
- most scenarios show relatively similar impacts on agriculture in the next 1-2 decades and predict impacts to be moderate during this period at global and regional scales. Impacts at smaller scales (intra-regional and within countries) may be much more severe but are much harder to predict.

The studies reviewed which lead us to the aforementioned generalised statements are complex, a result of assumptions, data availability and modelling technique. Although a range of General Circulation Models (GCMs) are frequently used, few studies are based on the same model.⁶ Most of the scenarios reviewed have either formed part of the Fourth Assessment Report (AR4) of the IPCC (2007) or have drawn on the IPCC Special Report on Emission Scenarios (2000).⁷ According to the results of these studies, all regions will experience an increase in temperatures towards the end of the current century; this is accompanied by changes in precipitation, though to a much larger degree. In terms of the aggregate impact on agricultural production, it is clear a greater divergence between regions in terms of output is likely. That is, for the most part, developing countries are expected to lose in terms of agricultural production, whilst developed countries based in the North are likely to gain.

1.1 Predicted changes for agricultural production systems across regions

Most agricultural producers located in low income and less developed countries are typically operating well below their productive capacity. As noted by the FAO (2007) the developing world already contends with chronic food problems. Estimates suggest that this situation could worsen: around 11 percent of arable land in developing countries could be affected by climate change; including a reduction of cereal production in up to 65 countries, and loss of up to 16 percent of GDP in some cases.⁸ Tables 1.1-1.2 overleaf summarises some of the generalisable

⁵ See Ludi et al. (2007): <http://www.odi.org.uk/resources/download/1261.pdf>

⁶ GCMs are mathematical representations of the general circulation of a planetary atmosphere or ocean and have been developed by various research centres. Typically, they differ in terms of projected temperature change and climate sensitivity.

⁷ The most recent assessment report of the IPCC draws on climate change impact, adaptation and vulnerability (CCIAV) assessments. Most CCIAV's provide scenarios of the future emissions trajectories based on assumption in relation to socio-economic and technological development.

⁸ With reference to the FAO Committee on Food Security, Report of 31st Session 2005.

impacts of a range of climate change scenarios (and models) on agricultural production across regions.⁹

Table 1.1: Estimated Impact of Climate Change on Agricultural Production in the South

	Sub-Saharan Africa	Latin America	South Asia	South East Asia
Temperature	Temperatures to increase by 3-7°C by 2080-2099.	Temperatures to increase by 1-7.5°C by 2070-2099.	Temperatures to increase by 2.3-4.5°C by 2070-2099.	Temperatures to increase by 2-3.8 °C by 2070-2099.
Precipitation	Precipitation to decrease by up to 30-40% in most parts of southern Africa, but to increase by 7% in tropical and eastern regions by 2080-2099.	Precipitation to change by up to -40% to +12% by 2080.	Precipitation to increase by 10-17% by 2070-2099.	Precipitation to increase by 3-8% by 2070-2099.
Agriculture	Rain-fed cereal (wheat, maize, rice) production to decrease by 12% (net loss) by 2080, with great regional variations.	Overall grain yields to change by between -30% to +5% by 2080 e.g. rain-fed wheat production is to decrease by 12-27% by 2080.	Net cereal production to decrease by at least 4-10% e.g. rain-fed wheat production is to decrease by 20-75% by 2080.	Overall cereal production to increase by up to 30%, but rain-fed wheat production is to decrease by 10-95% by 2080.
<p>Note: The wide range of temperature and precipitation reflect the scenarios on which the estimates are based across regions. Sources: Christensen et al. (2007); IPCC (2007); Ruosteenoja et al. (2003).</p>				

Table 1.2: Estimated Impact of Climate Change on Agricultural Production in the North

	Europe	North America
Temperature	Temperatures to increase by 1-5.5 °C by 2070-2099.	Temperatures to increase by 2-5 °C by 2080.
Precipitation	Precipitation to change by -30% to +30% by 2071-2100.	Precipitation to change by -20% to +20% by 2080-2099.
Agriculture	Cereal yields to increase in Northern Europe, e.g. rain-fed wheat production by 10-30%, and to decrease in Southern Europe by 2080. However, there will be a net gain overall.	Yields to increase by 5-20% across the whole continent, though with some regional differences across products such as: corn, rice, sorghum, soybean, wheat, common forages, cotton and some fruits.
<p>Note: The wide range of temperature and precipitation reflect the scenarios on which the estimates are based across regions. Sources: Christensen et al. (2007); Giorgi et al. (2004); IPCC (2007).</p>		

⁹ Although these estimates are based on a range of scenarios, clearly even in the most optimistic that have been reviewed an increase in temperatures across regions is predicted.

1.2 What are the likely economic impacts of climate change on the agricultural sector?

Country specific studies on the climate change impacts expected for the agricultural sector in most low income countries are scarce, in part due to a lack of data availability. Where country specific studies do exist, there is typically limited crop coverage - cereals feature most prominently. Although such crops are important in terms of global agricultural trade, reductions in agricultural output and productivity because of climate change will affect more than just cereals. A summary of the ways in which climate change may impact agricultural production is presented in Box 1.1 below.

Box 1.1: Impact of Climate Change on the Agricultural Sector

Climate change can influence agricultural production in a number of ways. One can roughly group the drivers into six categories:

- **Temperature** as it affects plants, animals, pests, and water supplies. For example, temperature alterations directly affect crop growth rates, livestock performance and appetite, pest incidence and water supplies in soil and reservoirs among other influences.
- **Precipitation** as it alters the water directly available to crops, the drought stress crops are placed under, the supply of forage for animals, animal production conditions, irrigation water supplies, aquaculture production conditions, and river flows supporting barge transport among other items.
- **Changes in atmospheric CO₂** as it influences the growth of plants by altering the basic fuel for photosynthesis as well as the water that plants need as they grow along with the growth rates of weeds.
- **Extreme events** as they influence production conditions, destroy trees or crops, drown livestock, alter water supplies; influence waterborne transport and ports.
- **Sea level rise** as it influences the suitability of ports, waterborne transport, inundates producing lands and may alter aquaculture production conditions.
- **Climate change motivated greenhouse gas net emissions reduction efforts** as they would influence the desirability of production processes and the costs of inputs plus add new opportunities.

Source: Adapted from McCarl (2007).

As noted by Wheeler and Tiffin (2009:35), within the economic literature on climate change, there are two approaches that can be interpreted as reflecting the net costs of adaptation. These are referred to as the 'Ricardian' and 'crop growth model' methods. The Ricardian model includes the value of land and is modelled under assumptions that reflect the future profitability of land; in the crop growth model, the impacts of climate change are simulated and the value of the resultant change in output taken as a measure of the economic impact of climate change. Cline (2007) provides the results of both approaches across regions and a total of seventy countries.¹⁰

As the recent study by Cline (2007) provides the most comprehensive estimates of aggregate changes in output, it has been used and supplemented by the contribution of the agricultural sector to GDP and employment for the low income and less developed countries included; the results for which are summarised in Table 1.3. Cline's (2007) estimates are based on a consensus set of geographically detailed estimates for changes in temperature and precipitation by the 2080s which are applied to agricultural impact models.

¹⁰ These estimates are a mean value of the results of a Ricardian statistical model and a process-based agronomic crop model (Cline, 2007).

The results have been further supplemented by agricultural trade data for the most recent five years, as presented in Table 1.4. This is with a view to estimating the impact of climate change on agricultural trade flows, in a simple static sense. And therefore the brevity of potential export losses across countries in today's terms. The following sub-sections discuss the results.

1.2.1 Impact on Agricultural Output

Some of the most dependent agricultural economies face an estimated loss of more than fifty percent of their total agricultural output by 2080, even when including carbon fertilisation effects: where an increased concentration of carbon dioxide in the atmosphere acts as a stimulus to crop productivity.¹¹ Losses of agricultural output, without carbon fertilisation, range from -5.4% to -60.1%, as shown by Table 1.3 below. However, even with carbon fertilisation effects, only Kenya seems to gain: an increase of 8.8% in agricultural output is estimated by 2080, based on the crops produced and agricultural output as of 2003. For all other countries listed, losses of between -1.9% and -54.1% in agricultural output are expected by 2080.

Country	Dependence on Agricultural Sector		Vulnerability to Climate Change			
	Agriculture, value added (% of GDP) for nearest year	Employment in agriculture (% of total employment for nearest year)	Agricultural output for 2003		Estimates by the 2080's in % of agricultural output	
			per ha in 2003 USD	Millions of 2003 USD	Without carbon fertilization	With carbon fertilization
Liberia	66	-	419 (c)	1833 (c)	-32.7 (c)	-22.6 (c)
Somalia	66	-	-	-	-16.6 (b)	-4.1 (b)
Guinea-Bissau	62	-	419 (c)	1833 (c)	-32.7 (c)	-22.6 (c)
Central African Rep.	56	-	478 (a)	1429 (a)	-60.1 (a)	-54.1 (a)
Ethiopia	47	44.1	253	2,794	-31.3	-20.9
Congo, Dem. Rep.	46	-	422	3,289	-14.7	-1.9
Sierra Leone	46	-	419 (c)	1833 (c)	-32.7 (c)	-22.6 (c)
Tanzania	45	82.1	430	4,634	-24.2	-12.8
Niger	40	-	243	1,092	-34.1	-24.2
Mali	37	41.5	350	1,644	-35.6	-25.9
Afghanistan	36	-	313	2,448	-24.7	-13.4
Malawi	34	-	267	651	-31.3	-21.0
Nepal	34	81.9	728	2,399	-17.3	-4.8
Burkina Faso	33	-	190	1,296	-24.3	-13.0
Uganda	32	69.1	280	2,015	-16.8	-4.3
Cambodia	30	70.2	378	1,438	-27.1	-16.1
Madagascar	28	78	447	1,587	-26.2	-15.1
Mozambique	28	-	253	1,123	-21.7	-10.0
Kenya	27	19	446	2,300	-5.4	8.8
Zambia	22	-	189	997	-39.6	-31
Bangladesh	20	51.7	1,355	11,421	-21.7	-9.9
Vietnam	20	58.8	969	8,616	-15.1	-2
Zimbabwe	19	-	901	3,018	-37.9	-29
India	18	68.1	777	132,140	-38.1	-28.8
Senegal	16	-	441	1,104	-51.9	-44.7
Guinea	13	-	419 (c)	1833 (c)	-32.7 (c)	-22.6 (c)

Notes: (a) Values refer to Other Equatorial Africa (group of following countries: Republic of the Congo, Gabon, Equatorial Guinea, Central African Republic); (b) Values refer to Other Horn of Africa (group of following countries: Djibouti, Somalia); (c) Values refer to Other Equatorial Africa (group of following countries: Guinea, Guinea Bissau, Liberia, Sierra Leone).

Sources: Cline (2007); World Development Indicators for nearest year.

11 As noted by Cline (2007:24), carbon dioxide is an input to photosynthesis which uses solar energy to combine water and carbon dioxide to produce carbohydrates, with oxygen as a waste product. In addition, higher atmospheric concentrations of carbon dioxide reduce plants stomatal (pore) openings and hence the loss of water to respiration. Crops which are posited to benefit from the effects of carbon fertilisation include: rice, wheat, soybeans, fine grains, legumes and most trees; benefits for other crops such as maize, millet, sorghum and sugarcane are much more limited.

1.3: Predicted changes in agricultural production across countries within regions

Table 1.4: Contribution of agricultural exports to GDP

Country	Agricultural Exports US\$ million						GDP US \$ million (nearest year)	Value of agricultural exports as a % of GDP
	2003	2004	2005	2006	2007	2008		
Malawi	439	380	410	566	769	778	3,164	24.6
Zimbabwe		855	452	1,778	813		3,418	23.8
Kenya	1,284	1,316	1,555	1,841	2,155	2,623	22,779	11.5
Ethiopia (excludes Eritrea)	451	476	812	899	1,029	1,365	13,315	10.3
Vietnam	2,537	3,195	3,990	4,562	6,050		60,999	9.9
Uganda	280	337	386	454	649	798	9,419	8.5
Guinea-Bissau	59	54	23				304	7.5
Mali	403	423	328	345	300	340	5,866	5.8
Mozambique	120	172	215	314	231	367	6,833	5.4
Tanzania	360	422	558	497	634		12,784	5.0
Burkina Faso	286	368	303				6,173	4.9
Madagascar	330	224	129	168	220	199	5,499	3.6
Zambia	149	384	318	327	403	326	10,734	3.0
Senegal	185	182	199	133	298	252	9,186	2.7
Niger	82	84	71	80	83	81	3,663	2.2
India	6,617	7,208	9,270	11,524	14,652	19,701	911,813	2.2
Nepal	140						8,938	1.6
Guinea		14	23	79	32	23	3,317	0.7
Bangladesh	51	111	207	204	370		61,897	0.6
Afghanistan						27	8,399	0.3
Cambodia	9	20					7,258	0.3
Central African Republic	2	2	1				1,494	0.1

Note: GDP and exports for nearest year have been used. Agricultural exports are defined as those included under the WTO Agreement on Agriculture. Ethiopia excludes Eritrea.
Source: UNComtrade and World Development Indicators.

As shown by Table 1.4 some countries have experienced rapid growth in their agricultural exports in recent years. Agricultural exports also comprise a substantial proportion of GDP for some countries. Clearly some of the countries which are expected to experience substantial declines in agricultural output because of climate change are also highly dependent on agricultural export earnings. Table 1.5 estimates some of the static export revenue losses which may result from climate change.

Table 1.5: Estimated Export Revenue Losses by 2080

Country	Agricultural output in 2003, US\$ million	Agricultural exports in 2003, or nearest year, US\$ million	Agricultural exports as a % of total agricultural output (a)	Vulnerability to climate change: Estimates by the 2080's in % of agricultural exports (b)	
				Without carbon fertilization	With carbon fertilization
Malawi	651	439	67.5	-20.9	-14.2
Zimbabwe	3,018	855	28.3	-10.7	-8.1
Senegal	1,104	185	16.8	-8.7	-7.5
Mali	1,644	403	24.5	-8.7	-6.3
Burkina Faso	1,296	286	22.0	-5.4	-5.4
Zambia	997	149	15.0	-5.9	-4.6
Ethiopia	2,794	451	16.1	-5.0	-3.4
Guinea-Bissau	1,833	59	14.0	-4.6	-3.2
Madagascar	1,587	330	20.8	-5.4	-3.1
Niger	1,092	82	7.5	-2.6	-1.8
India	132,140	6,617	5.0	-1.9	-1.4
Mozambique	1,123	120	10.7	-2.3	-1.1
Tanzania	4,634	360	7.8	-1.9	-1.0
Vietnam	8,616	2,537	29.4	-4.4	-0.7
Uganda	2,015	280	13.9	-2.3	-0.6
Nepal	2,399	140	5.9	-1.0	-0.3
Guinea	1,833	14	0.8	-0.2	-0.2
Cambodia	1,438	9	0.6	-0.2	-0.2
Afghanistan	2,448	27	1.1	-0.3	-0.1
Bangladesh	11,421	51	0.4	-0.1	-0.1
Central African Republic	1,429	2	0.1	-0.1	-0.1
Kenya	2,300	1,284	55.8	-3.0	4.9

Note: (a) Calculated based on agricultural output and export values; (b) calculated based on agricultural output and export values as of 2003. Ethiopia excludes Eritrea.
Source: Cline (2007); UNComtrade.

Based on the estimates of Cline (2007) of the impact of climate change on agricultural output, Table 1.5 estimates the impact on agricultural trade. Countries that have a high dependence on agricultural output as a proportion of GDP, and for which agricultural exports account for a high proportion of total agricultural output, are clearly the most vulnerable to climate change. Countries such as Malawi may need to adapt to a 20% reduction in agricultural export earnings because of reduced agricultural output (an estimated 31% reduction) as a result of climate change (excluding carbon fertilisation effects); countries such as Mali and Senegal may need to adapt to a reduction of around 10% in their agricultural export earnings. Although rudimentary, such estimates may be grossly underestimated given population growth, which may also result in a further reduction of agricultural output (surplus) sold onto international markets.

2. What are the adaption and mitigation options?

The previous section made reference to specific low income exporters and the potential impact of climate change on agricultural production and trade. This section discusses adaptation and mitigation options that relate to the agricultural sector in much broader terms. The objective is to contrast the opportunity costs of inaction, which are largely underestimated, with available adaptation and mitigation options, within three broad categories:¹²

- ‘climate change proofing’ existing products and methods of production;
- diversifying into new products and methods of production; and
- diversifying into new tradable services.

The ensuing section links the adaption and mitigation options identified to specific financial tools and mechanisms included in the (growing) international architecture of climate change finance.

2.1 Climate change proofing existing products and methods of production and logistics

According to Wheeler and Tiffin (2009:38), the estimate of McCarl (2007) is the *only* global estimate of the costs of adaptation for the agricultural sector. The results of Cline (2007) correspond to those made by McCarl (2007) only so far in that the former study covers crop production, whilst the latter includes crop production plus forestry and fisheries. Table 2.1.1 below summarises the UNFCCC’s estimates, which are based on McCarl (2007), of the costs of adaptation across sectors, including agriculture.¹³

Table 2.1.1 UNFCCC estimates of global investment costs for adaptation

Sector	Global cost (\$bn per annum)	Of which developed countries	Of which developing countries	Residual damage
Agriculture	14	7	7	-
Water	11	2	9	-
Human health	5	0	5	-
Coastal zones	11	7	4	1.5
Infrastructure	8-130	6-88	2-41	-
Total	49-171	22-105	27-66	1.5

Source: UNFCCC (2007a) as presented by Wheeler and Tiffin (2009).

The costs of adaptation in the agricultural sector referred to by the UNFCCC (2007a) and McCarl (2007) relate to climate change proofing investments, including:

- 10% increase in research and extension funding; and
- 2% increase in capital investment costs.

¹² These categories correspond to those identified by Ludi et al. (2007), who identify the following scenarios: 1. Export agricultural declines; 2. Capital intensive agricultural exports increase; and 3. Labour intensive export increase.

¹³ Table 1 Annex presents the current range of global estimates of adaptation costs.

The estimates refer to three distinct cost items: better extension services at the farm level; the cost of additional global research (e.g. on new cultivars); and extra capital investment at the farm level (Wheeler and Tiffin, 2009). They are ‘top down’ estimates; that is they are based on the increments that should be made to existing expenditure.¹⁴

An increase in capital investment costs could relate to an increase in irrigation demands. An increase in research and extension expenditure could relate to the development of new crop varieties and plant breeding; and/or the provision of inputs such as fertiliser as well as technical assistance related to crop management techniques. Some of the major classes of adaptation in the agricultural sector are summarised in Box 2.1 below.

Box 2.1: Adaptation Measures in the Agricultural sector

Long term adaptation measures may include: changes in land-use to maximise yield under new conditions; application of new technologies; new land management techniques; and water-use efficiency techniques. Reilly and Schummelpfenning (1999) define the following ‘major classes’ of adaptation, which include adapting to: seasonal changes and sowing dates; and different varieties or species. Actions required may include those related to:

- water supply and irrigation systems;
- other inputs (fertiliser, tillage methods, grain drying and other field operations);
- new crop varieties;
- forest fire management and/or other natural disasters.

Source: UNFCCC (2007b).

Given the diversity of possible management responses to the challenges posed by climate change, some authors question the ability to summarise and cost in headline figures. However, despite the criticisms levied at the basis of UNFCCC’s estimates, given their limited and mostly speculative basis, they do provide for a starting point to focus debate.¹⁵ Further to a critical review undertaken by Wheeler and Tiffin (2009), overall it is concluded that the UNFCCC estimates provide a sufficient first approximation, in part because of the limited availability of ‘bottom-up’ case studies that could better indicate the magnitude of costs; it is noted that as more specific studies and adaptation options become available, cost estimates are likely to increase. Box 2.2 discusses some of the challenges of adapting to increased vulnerability because of climate change in Mali.

14 For example, Wheeler and Tiffin (2009:11) note that the estimated costs of climate change proofing capital investments are made on the assumption that 2% of current investment is climate sensitive.

15 One of the major shortfalls is that applying a ‘climate mark-up’ is not appropriate when current investment flows are well below what they should be; this may result in what some authors have termed, ‘adaptation deficit’ – which is largely a ‘development deficit’ (*Ibid*:11).

Box 2.2: Adapting to Climate Change in Mali

Mali is a country in Sahelian Africa where 80% of the population lives on agriculture and pastoral activities. The major crops produced for domestic consumption include: millet, sorghum, rice, maize and legumes. Cotton, vegetables and tubers are produced as cash crops. Exported agricultural goods include cotton, livestock, mangoes and fish. Livestock and fisheries are traded, but also serve as a source of wealth. Agricultural activities are likely to be severely affected by climate change which occurs through increased temperature and likelihood of drought; as a result of reduced rainfall and a shrinking rainfall season. The effect of these changes affects agricultural and livestock productivity, food security and food prices, and renders agriculture a daily struggle.

Climate change will limit the quantities and qualities of these tradable goods by reducing cultivated and grazing areas and their productivity, enhancing pest attacks and limiting access to water. The combination of climate effects is likely to increase the costs of imported goods and limit the market for exported crops.

Limited farming and grazing lands may enhance the potential for conflicts between farmers and pastoralists and result in additional pressure on natural resources. Although the population has a long history of adapting to climate variability through changes in livelihood strategies (cropping patterns, consumption habits as well as migration), the adaptation options that farmers can afford – such as new seed varieties, changes in production methods – still depend, to some extent, on rainfall distribution. Farmers are not equipped to adapt to the potential of global climate change, adaptation options are limited because all production systems are climate dependant and inter-dependent.

To cope with climatic changes some farmers have adopted early maturing and drought resistant varieties, as well as soil water conservation techniques, fertilizer application and chemical spraying. But some of these strategies may further limit access to foreign markets because farmers cannot afford 'best agricultural practices' and therefore escape trade barriers. Traceability of exported products requires knowing safety and grading procedures; this is lacking to most of African farmers.

The main objective of agricultural production is self-sufficiency, which is, in practice, rarely achieved by producers in the country. Most public investment in agriculture (around 14.2% of the National Budget) targets irrigation development, cereal stocks, and the facilitation of access to credit. A few parts are devoted to research and extension of improved strategies to cope with climate change. The country has a National Action Plan of Adaptation which has been drafted and submitted to UNFCCC.

Source: Alpha Kergna, Agricultural Economist, Institut D'Economie Rural (IER), Mali

2.2 Diversifying into new products, methods of production

Beyond ‘climate proofing’ existing modes of production and investment, other adaption options may include those related to the transition to a low carbon global economy. New products and services are being demanded as part of the transition towards a low carbon global economy. This sub-section reviews some of the products that are being increasingly demanded.

2.2.1 Trade in Carbon

Out of the total Greenhouse Gas (GHG) abatement opportunities and mitigation measures identified by McKinsey (2009), that need to be undertaken and adopted in order to avoid dangerous climate change,¹⁶ 70% are located in the developing world (non-Annex 1 countries).¹⁷ The carbon abatement opportunities identified by McKinsey (2009) fall within (and across) the following categories: energy efficiency, terrestrial carbon, and low carbon energy supply.

Around 30% of the total GHG abatement opportunities identified fall within the ‘terrestrial carbon’ category. This relates to both forestry and the agricultural sector and includes: halting deforestation, reforesting marginal areas of land and sequestering more ‘carbon’ (or ‘carbon equivalent’: CO₂e) in soils through changing agricultural practices. Of the total amount of terrestrial carbon abatement opportunities by McKinsey, 90% are located in the developing world.

Table 2.2 provides a summary of the terrestrial carbon abatement opportunities identified by McKinsey (2009) related to the agricultural sector; these are in turn related to the potential for trade in certified emissions reductions.

Table 2.2: Terrestrial Carbon Abatement Opportunities in the Agricultural Sector

Sub-categories Identified in Terrestrial Carbon
Crop nutrient management
Rice management
Reduced slash and burn agriculture
Reduced pastureland conversion
Reduced intensive agriculture conversion
Pastureland afforestation
Grassland management
Organic soil restoration

Source: Adapted from McKinsey (2009)

Since most low income countries are already ‘low carbon’, any international agreement is likely to exclude them from binding emissions reductions targets, but include the opportunity for them to sell their certified emissions reductions. The Clean Development Mechanism (CDM) is one of the key tools established as part of the Kyoto protocol designed to encourage trade in certified emissions

16 To avoid an increase in temperature of not more than 2°C since pre-industrial levels.

17 See Table 1 Annex.

reductions between the North and the South; that is between those countries that have legally binding emissions reductions targets and those that don't.

There is a 1% cap on the share of carbon credits that can be generated through Land Use Changes and Forestry (LUCF) within the current commitment period of Kyoto (2008-2012); some have argued that if the CDM included all terrestrial carbon opportunities it could lead to a collapse in the price of carbon (UNDP 2008). However, it is highly likely that avoided deforestation (Reduced Emissions from Deforestation and Forest Degradation, abbreviated to REDD) will be included in the next commitment period.

There is much more uncertainty about other types of terrestrial carbon. But recognition of *all* terrestrial carbon including those with relevance to the agricultural sector could offer primarily agriculturally based societies, such as low income countries, potential new market opportunities in carbon trade. The IPCC (2007a) notes that the mitigation potential in the agricultural sector could be significant; in addition that expanding the scope of carbon markets to include agricultural soil carbon would allow carbon finance to play more of a role in sound land management practices. This view is echoed by the UNDP (2008) as summarised in Box 2.2.1 below.

Box 2.2.1: GHG Mitigation through Carbon Sequestration in Soils

Abatement opportunities in agriculture arise from improved crop land nutrient management, reduced slash and burn agriculture, less intensive agricultural production (i.e. less use of chemicals, fertilisers, and pesticides produced from energy intensive processes), pasture land afforestation, and degraded land restoration; in addition to improved livestock management (as methane released from livestock is also a GHG).

The environmental degradation of soils is both a cause and effect of poverty; tapping into carbon markets for these purposes could unlock multiple benefits. These include an increased flow of finance into environmental sustainability, support for more resilient livelihood systems in the face of climate change, and benefits for climate change mitigation. However, if the CDM were to include soil regeneration and grassland restoration, the volume of carbon credits that could be supplied to the carbon market could lead to a collapse in the price of carbon due to oversupply.

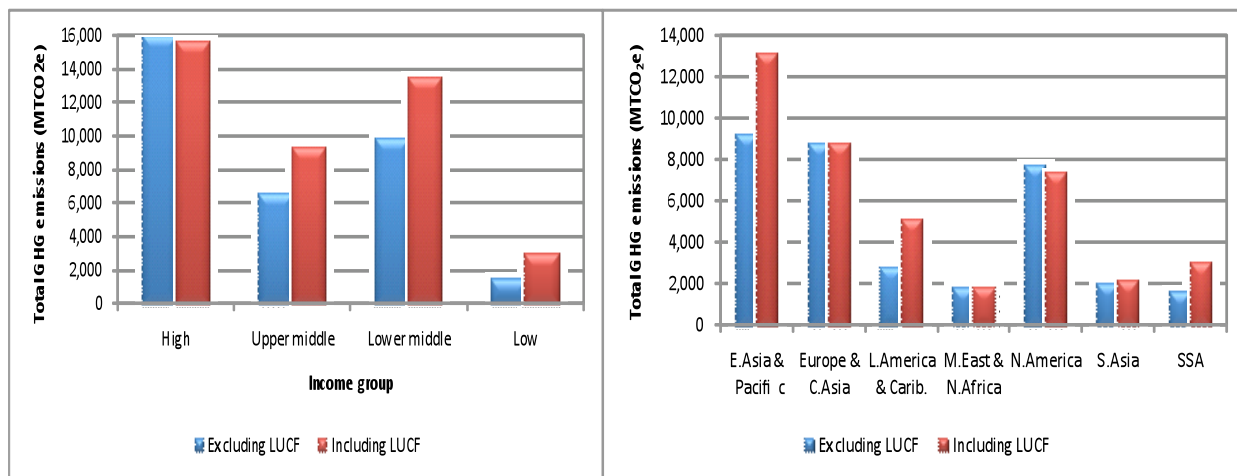
Source: Adapted from UNDP (2008).

The importance of terrestrial carbon has recently been recognised by the US. The Waxman-Markley Act was passed by the House Energy and Commerce Committee on the 21 May 2009 and the House of Representatives on 28 June 2009; it is currently awaiting Senate approval before presidential decree. It includes binding emissions reductions targets from major US sources of 17% by 2020 and 80% by 2050 compared to 2005 levels; mandates energy saving standards for buildings, appliances and industry; and requires that 20% of electricity demand be met through renewable energy sources and energy efficiency by 2020. It also includes agricultural credits based on the sequestration of carbon in soils.¹⁸ And perhaps more controversially, it provides for the application of Border Tax Adjustments (BTAs) on those countries that don't adhere to emissions reductions targets.

18 See <http://www.ft.com/cms/s/0/2f99b984-61e9-11de-9e03-00144feabdc0.html>; and for a brief summary of the Act: http://energycommerce.house.gov/index.php?option=com_content&view=article&id=1697:house-passes-historic-waxman-markey-clean-energy-bill&catid=155:statements&Itemid=55

The EC has also recognised the role the agricultural sector has to play in the mitigation of climate change; it has proposed to review key sectoral policies by 2012 to determine the potential impacts and costs of climate change for different economic sectors; according to a recent announcement, European farmers must slash agricultural greenhouse gases by at least 20% by 2020 primarily by producing biomass and storing carbon in soil.¹⁹ Despite fears of a collapse in the price of carbon in international carbon markets should the agricultural sector be included in carbon trading schemes, this does not seem to have prevented other National schemes from recognising the importance the sector must play in mitigating climate change, if we are to avoid dangerous temperature increases. Figures 2.1.2 and 2.1.3 present the contribution of Land Use Change and Forestry (LUCF) to emissions across countries and regions. Almost half of sub-Saharan Africa's emissions are from LUCF.

Figure 2.1.2 and 2.1.3: Total CO₂e emissions by income group and region (2000^a), including and excluding Land Use Change and Forestry (LUCF)



(a) 2000 is the latest year for which LUCF data are available. Includes data from international bunkers (where available).
Source: Derived from data obtained from World Bank (2009b) and CAIT 2009. World Bank income groups as at July 2009. Taiwan (not included in the World Bank listing) has been assumed to be high income. 2000 is the latest year for which LUCF data are available.
Note: Table X Annex presents those countries which have been excluded from analysis because of a lack of data.

The second commitment period of the Kyoto protocol and the CDM (2012-2016) is unlikely to include *all* terrestrial carbon opportunities. However, other regional, national or voluntary carbon markets may be more accommodating in the future (see Text Box 2.2.2 and Figure 2 Annex).

Box 2.2.2: Carbon trading regimes

Until developing countries are ready - authors such as Stern (2008) put this date at around 2020 - a 'one sided' trading regime is proposed, which rewards developing countries for reducing emissions, but does not punish them for failing to do so. During this period, developing countries should commit to strong sectoral reductions supported by international financial institutions and carbon markets; this means moving CDM from being project-based to operating at a more sectoral level (See ODI 2008c). The EC (2009) proposes that for advanced developing countries and highly competitive economic sectors, the CDM should be phased out, with a move to a 'cap and trade' system, possibly via a sectoral carbon market mechanism.

The increasing proliferation of cap and trade schemes across countries and possibly regions may result in increasing opportunities for some types of terrestrial carbon mitigation opportunities to feature. Although the institutional and legal framework of global carbon market – of which the CDM plays a crucial role – is set out by the UNFCCC, individual companies may prefer to use voluntary carbon markets and standards, some of which include the agricultural sector.

19 As announced by the European Agriculture Commissioner, see EurActiv (2009).

The limited participation of sub-Saharan Africa in the first commitment period of the CDM is to some extent to be expected: large developing country emitters, such as China, have benefited the most from the CDM to date because they emit more and therefore have emissions ready to be offset.²⁰ But the recognition of avoided emissions in both the forestry *and* agricultural sector, may, in the future, increase the level of participation towards primarily agricultural societies.²¹

Should some of the issues of monitoring and verifying the increased storage and permanence of carbon sequestration be resolved, investing in the agricultural sector in non-Annex 1 countries' and offsetting emissions produced elsewhere could become increasingly attractive. As noted by the World Bank (2009, Chapter 3:42): a soil compliance carbon market holds great potential for achieving the necessary balance between intensifying productivity, protecting natural resources, and simultaneously helping rural development in some of the worlds poorest communities. Though, it is acknowledged that such a market is not yet ready: technical issues regarding verification, scale and time frame remain to be resolved.

2.2.2 Low carbon products

There is no approved CDM methodology for verifying GHG emissions offset by biofuels, since land may have been cleared to produce the biofuel crop, ODI (2008a). However, the EC has proposed legislation that includes mandatory requirements for measuring the carbon footprint of biofuels. This is to ensure that only certified biofuels which meet environmental sustainability criteria are used to fulfill national renewable energy targets, which may be imported. The sustainability criteria require that the GHG emission saving from the use of biofuels and other bioliquids must be at least 35%, applicable from 1 April 2013 (EC 2008).²² That low carbon products must be certified as such is likely to be a growing trend in the transition to a low carbon global economy.

If undertaken using the more objective, but inevitably more costly, methodology – lifecycle analysis – some developing country agricultural exporters may benefit from the relocation of agricultural production from high to low emitting locations. This may also be the case for other types of sectors and industry, such as manufacturing. That production may relocate because of stringent emissions reductions targets to countries without such regulation, or that are simply lower carbon production sites, is known as 'carbon leakage'. Border Tax Adjustments are designed to reduce the likelihood that production relocates as a result of stringent emissions reduction targets or additional regulation. The implementation of such measures requires an understanding of the carbon content of products.

20 As of August 2008, over half of all registered projects were based in either India (30%) or China (22%) with only 2% located in sub-Saharan Africa (ODI 2008a). This bias towards middle income countries has also been highlighted in the recently published World Development Report 2010.

21 A recent policy brief produced by the FAO (2009) also makes this point, it states that: inclusion of agriculture in developing country NAMAs may also help to balance the exclusion of most forms of agricultural mitigation from the Clean Development Mechanism of the Kyoto Protocol.

22 The Commission will report on the requirements of a 'sustainability scheme' for biomass energy uses by 31 December 2010 (ODI 2008a).

Box 2.2.2: Approaches to Carbon Labelling

- **Lifecycle approach:** This includes adding up all carbon emissions throughout a products life from the production of inputs to final consumption and disposal of waste. As noted by Brenton et al. (2008) the methodological difficulties of turning this intuitively appealing idea into practice are immense and the lack of standardised methods heavily influences the usefulness and comparability of existing studies. However, it is the scientifically preferred measure.
- **Carbon footprint estimates (carbon disclosure):** This methodology includes estimating GHG emissions related to production and final consumption, but exclude the additional carbon emissions related to inputs. The approach therefore traces the value chain, from farming to pack-house, transportation and sale (including storage and packing).
- **Transportation approach, ‘food miles’:** This methodology estimates the carbon footprint of a product based only on the emissions that result from transportation.

Brenton et al. (2008) note that the effective inclusion of low income countries in labelling schemes may offer important opportunities for carbon emissions reductions through incentivising increased trade - due to the favourable climatic conditions of developing countries and their use of low energy intensive production techniques. As Table 2.2.2 shows Kenya is a considerably more carbon efficient production location than the Netherlands even including the emissions associated with air freight.²³

Table 2.2.2: GHG Emissions Comparison – Cut Flowers from Kenya and the Netherlands

Supply chain section	Country	
	Kenya	Netherlands
Production	300	36,900
Packaging	110	160
Transport to airport	18	0
Transport to RDC (air)	5,600	0
Transport to RDC from airport	5.9	50
Total	6,034	37,110

Source: Edwards-Jones at al. (2008)

Note: Emissions are shown as Global Warming Potential (GWP) expressed in kg of CO₂ equivalents using the IPCC (2001) conversion factors. GWP and CO₂ emissions from Kenya include the IPCC altitude factor.

A well designed scheme - which does not penalise developing country exporters unable to cover costs of compliance - could incentivise increased production of low carbon, clean energy products such as first generation biofuels in countries that are more carbon efficient (and with the capacity to do so without compromising food security). Despite the public perception of biofuels production as competing with food crops, developing country households typically grow both food and biofuels, and biofuel production could provide a stimulus to agricultural productivity.²⁴

²³ The transportation of horticultural products is usually not undertaken as a solo journey, but with chartered tourist flights; the marginal additional carbon emissions that result from the air freight of horticultural produce has therefore not been accounted for in this analysis.

²⁴ More biofuel means less use of fossil fuels. This reduces some countries reliance on oil imports, and may therefore benefit other developing countries that cannot grow biofuel feedstock but which would could benefit from lower oil prices as a result. The findings of the Gallagher Review (2008) concede that there is a role for a sustainable biofuels industry but that feedstock production must avoid agricultural land that would otherwise be used for food production, see ODI (2008a and 2008b).

However, without a well designed and approved carbon labelling and or 'sustainability' methodology, there is a risk that some low carbon products, including some types of first generation biofuel, are not recognised. This may have negative implications for some producers in developing countries. For example, should carbon labelling proceed along less objective lines, such as calculation of emissions from method of transportation only;²⁵ or should producers be unable to prove compliance even though they meet low carbon criteria.

2.3 Diversifying into new tradable services

New tradable services are likely to be needed in the transition towards a low carbon global economy, such as the verification of carbon emissions. There is a need for new types of services and institutional infrastructure to support trade in carbon, and/or low carbon products. The development of such 'new' services could be developed in parallel with those that already exist such as tourism, air freight and shipping. Though how such new financial sources might be operationalised in the future is not yet known, clearly opportunities for new types of tradable services should be capitalised upon. Although the constraints to doing so are likely to be similar to those that limit growth in other more traditional tradable services, in most cases development of 'new' services is best achieved by those that complement already existing sectors.

Moreover, there is scope to increase revenues from mitigation policies aimed at existing services. The World Bank in its latest World Development Report 2010 estimates that Least Developed Countries could gain as much as \$4-10billion from a levy on international air travel (IATAL) and around \$4-15billion from levies on bunker fuels (IMERS).

3. What are the available resources to assist adaptation and mitigation related to the agricultural sector?

Though the international architecture for climate change finance for mitigation and adaptation is new and growing, there is a considerable gap between what funds are needed and what are currently pledged. There is also considerable variation in terms of the focus of funds. The following sections attempt to identify the proportion of international climate change finance destined for the agricultural sector in developing countries (loosely defined as those countries which are not currently required to adhere to binding emissions targets).

3.1 Finance for Mitigation

There are a variety of financial resources available to fund climate change mitigation efforts. These include: 1. Carbon markets and the Clean Development Mechanism; 2. Private Investment; 3. International Public Funds; 4. National Public Funds; 5. Private Philanthropy; and 6. Innovative

²⁵ See ODI 2008b for a review of a range of ethical standards for which compliance costs are typically high and scope of developing country exporters, low.

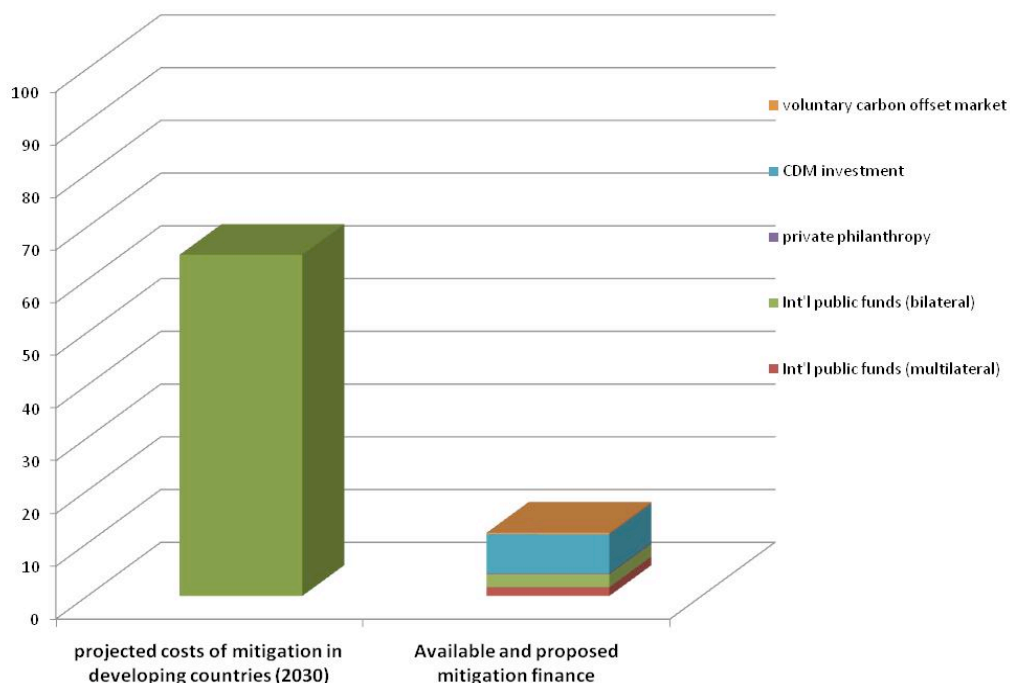
Financial Products. The resources allocated to each are based on various emissions reductions scenarios and mitigating actions, are summarised in Table 3.1.1 below.

Table 3.1.1: Pledged and proposed funds for mitigation in developing countries

	Amount per annum (US\$Bn)	Source
Projected costs of mitigation		
Projected costs of mitigation (between 2010-2020)	71-103	McKinsey (2009)
Pledged mitigation finance (2008-2012)		
International public funds (multilateral)	1.68	www.climatefundsupdate.org
International public funds (bilateral)	2.46	www.climatefundsupdate.org
Private philanthropy	0.2	Design to Win (2007)
CDM investment	7.4	Capoor & Ambrosi (2008)
Voluntary carbon offset market	0.27	Capoor & Ambrosi (2008)
Proposed future mitigation finance (2012 and beyond)		
Proposed innovative financing mechanisms	Ranges up to 201	Brown (2008)
Note: As of March 2009		

Despite the amounts of mitigation finance pledged, they remain considerably lower than the estimated costs as illustrated by Figure 3.1. Nevertheless, as can also be seen, mitigation finance available through the CDM is the most sizeable at present. As noted by the World Bank (Chapter 6, 7:2009) the financial revenues the CDM generates are modest relative to the amount of mitigation money that will have to be raised. But they constitute the largest source of mitigation finance to developing countries to date.

Figure 3.1: Mitigation finance required by developing countries per annum compared to that available



Sources: www.climatefundsupdate.org, World Bank, http://greengrants.org/pdf/design_to_win.pdf
 Note: McKinsey (2009) costs of mitigation have been used; estimates as of March 2009.

3.2 Finance for Adaptation

Currently, there are two dedicated adaptation funds under the UNFCCC, which are managed by the Global Environmental Facility (GEF): The Least Developed Countries Fund (LDCF); and The Special Climate Change Fund (SCCF). However, a third fund for adaptation has also recently been established under the organisation of the GEF; this is called the Special Priority on Adaptation (SPA) and is essentially a GEF trust fund.²⁶ The LDCF supports the preparation and implementation of National Adaptation Plans of Action (NAPAs).

NAPAs focus on enhancing adaptive capacity to climate variability and provide a process for LDCs to identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change. The SCCF focuses on climate change mitigation measures that are integrated into national poverty reduction strategies. The SPA finances adaptation activities that also generate global environmental benefits.

To date adaptation funds disbursed translate to only around \$250m a year to poor countries for climate change projects; nearly one-third of the \$760m distributed in the last three years, has gone to China, India and Brazil; less than \$100m of this has gone to projects in the world's 49 poorest countries. The Least-Developed Countries Fund (LCDF) has only financed 22 projects, together worth \$50m.²⁷

3.3 International funds for mitigation and adaptation targeted at the agricultural sector

Although there has been much criticism of both the amount of mitigation and adaptation funds disbursed to date as well as their recipient countries, Table 3.1.3 overleaf attempts to identify in broad terms, the proportion destined for the agricultural sector. This has been achieved by reviewing the projects currently in receipt of both types of funds. It can be seen that the projects currently funded in the agricultural sector do so in terms of either adaptation or mitigation. But funds targeted at adaptation in the agricultural sector appear to be more prevalent than those for mitigation efforts, such as diversifying into new low carbon products. Clearly the GEF Least Developed Countries Fund has been the most active fund in the agricultural sector to date in relation to both adaptation and mitigation.

26 An Adaptation Fund (AF) has also been set up under the Kyoto Protocol. The AF will finance concrete adaptation projects and programmes in developing countries that are particularly vulnerable to the impacts of climate change.

27 See <http://www.guardian.co.uk/environment/2009/feb/20/climate-funds-developing-nations>; and <http://www.climatefundsupdate.org/>

Table 3.1.3: International funds for mitigation and adaptation in the agricultural sector

Administered by	Name	Pledged (USD Millions)	Deposited (USD Millions)	Possible interventions related to agriculture (mitigation or adaptation).	Resources available for agricultural sector
Adaptation Fund	Adaptation Fund Boards	300 (est. Revenue from CERs)	300 (est. Revenue from CERs)	No specific information available yet as the Fund will start operating in 2009.	No specific information available.
World Bank	Clean Technology Fund	2,149	103	There are currently three investment plans available - for Turkey, Mexico, Egypt - but no projects specifically related to agriculture.	No specific information available.
Japan	Cool Earth Partnership	10,000	unknown	It provides assistance to developing countries that are already making efforts to reduce greenhouse gas emissions to enable them to achieve low-carbon economic growth, but no agriculture-related projects mentioned.	No specific information available.
United Kingdom	Environmental Transformation Fund – International Window	800	100	The ETF - IW will support the activities of the following World Bank-administered CIFs: Clean Technology Fund, Strategic Climate Fund and related sub-components.	No specific information available.
GEF	GEF Trust Fund – Climate Change focal area	3,130	2,389	<ul style="list-style-type: none"> • Efficient Utilization of Agricultural Wastes (China); • Biomass-based Power Generation and Co-generation in the Malaysian Palm Oil Industry (Malaysia); • Renewable Energy for Agriculture (Mexico); • Obtaining Biofuels and Non-wood Cellulose Fiber from Agricultural Residues/Waste (Peru); • Greening the Tea Industry in East Africa (Zambia, Mozambique, Burundi, Rwanda, Malawi, Tanzania, Uganda, Kenya). 	US\$23.5 million already disbursed for the projects listed.
European Commission	Global Climate Change Alliance	375	unknown	No specific information available.	Approximately US\$2.5 million to be disbursed. ²⁸
Germany	International Climate Initiative	157	157	No specific information available.	No specific information available.
GEF	Least Developed Countries Fund	172	131	<ul style="list-style-type: none"> • Integrated Adaptation Programme to Combat the Effects of Climate Change on Agricultural Production and Food Security in Benin (Benin); • Strengthening Adaptation Capacities and Reducing the Vulnerability to Climate Change in Burkina Faso (Burkina Faso); • Promoting Climate-Resilient Water Management and Agricultural Practices (Cambodia); • Building the Capacity of the Agriculture Sector in DR Congo to Plan for and Respond to the Additional Threats Posed by Climate Change on Food Production and Security (Congo DR); • Integrating Climate Change Risk into Community-Level Livestock and Water Management in the Northwestern Lowlands (Eritrea); • Strengthening Resilience and Adaptive Capacity to Climate Change in Guinea-Bissau's Agrarian and 	Total funds for the 13 projects listed: US\$35 million (the co-financing total amounts to US\$60 million).

28 See <http://register.consilium.europa.eu/pdf/en/08/st11/st11994.en08.pdf>

				<ul style="list-style-type: none"> Water Sectors (Guinea-Bissau); Integrating Climate Resilience into Agricultural Production for Food Security in Rural Areas (Mali); Support to the Adaptation of Vulnerable Agricultural Production Systems (Mauritania); Integrating Adaptation to Climate Change into Agricultural Production and Food Security in Sierra Leone (Sierra Leone); Integrating Climate Change Risks into the Agriculture and Health Sectors in Samoa (Samoa); Implementing NAPA Priority Interventions to Build Resilience and Adaptive Capacity of the Agriculture Sector to Climate Change (Niger); Implementing NAPA Priority Interventions to Build Resilience in the Agriculture and Water Sectors to the Adverse Impacts of Climate Change (Sudan); Adaptation to the effects of drought and climate change in Agro-ecological Zone 1 and 2 in Zambia (Zambia) 	
UNDP	MDG Achievement Fund – Environment and Climate Change thematic window	90	90	Enabling pastoral communities to adapt to climate change and restoring rangeland environments (Ethiopia).	US\$4 million.
World Bank	Pilot Program for Climate Resilience	208	0	No specific information available.	No specific information available.
World Bank	Scaling-up Renewable Energy Program for Low Income Countries	100	0	No specific information available.	No specific information available.
GEF	Special Climate Change Fund	107	94	<ul style="list-style-type: none"> Coping with Drought and Climate Change (Ethiopia); Adaptation to Climate Change in Arid Lands (KACCAL) (Kenya); Mongolia Livestock Sector Adaptation Project (Mongolia); Integrating Climate Change in Development Planning and Disaster Prevention to Increase Resilience of Agricultural and Water Sectors (Morocco); Coping with Drought and Climate Change (Mozambique); Rural Livelihoods Climate Change Adaptation Support Programme (Pakistan); Coping with Drought and Climate Change (Zimbabwe). 	Total funds for the 7 projects listed: US\$18 million (the co-financing total amounts to US\$166 million USD).
World Bank	Strategic Climate Fund	1,585	0	No specific information available.	No specific information available.
GEF	Strategic Priority on Adaptation	50	50	<ul style="list-style-type: none"> Adapting to Climate Change through the Improvement of Traditional Crops and Livestock Farming (Namibia); Sustaining Agricultural Biodiversity in the Face of Climate Change (Tajikistan); Adaptation to Climate Change Using Agro biodiversity Resources in the Rain Fed Highlands of Yemen 	Total funds of the three projects listed: US\$6.8 million.

				(Yemen).	
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Source: www.climatefundsupdate.org

Note: Based on funds registered and/or disbursed as of 20 August 2009; Co-financing relates to grants provided in addition to loans and/or private finance.

3.4 National Adaptation Plans of Action (NAPAs)

Specific interventions related to adaptation measures planned for the agricultural sector for some of the most vulnerable countries to climate change (as identified in Section One) are summarised overleaf in Table 3.4. Essentially, these are country specific ‘bottom-up’ estimates of the likely costs of adaptation to climate change; in all cases they refer to the costs required to ‘climate change proof’ existing modes of agricultural production. However, the difficulties in distinguishing between funds for adaptation to climate change in the agricultural sector compared to ‘normal’ development practices are clear.

What Table 3.4 also identifies is the proportion of adaptation funds in the current NAPA that are destined for the agricultural sector. If we reflect back on the most vulnerable economies identified in Section One, in terms of proportion of GDP derived from agricultural output and exports, we can see that in some cases the proportion of total funds allocated to the agricultural sector appears to support the identified degree of vulnerability (i.e. Malawi). But in some cases, this does not appear to be the case, i.e. Senegal, though further analysis across NAPA categories may be necessary before drawing definitive conclusions.²⁹ In other cases, NAPAs are simply not currently available, this includes for some of the most vulnerable countries identified (i.e. Mali).

Notwithstanding country differences both in the proportion of NAPA funding destined for the agricultural sector as well as overall vulnerability to climate change, if the costs identified in all NAPAs were totalled, they should approximate to the estimates of the UNFCCC (2007) required to ‘climate change proof’ the agricultural sector globally. But the costs that wouldn’t be reflected are those related to adaptation to new sources income, goods and/or services.

It is highly likely that developing countries will need to make available country specific information on their carbon budgets, as well as options to reduce their emissions, in order to access some types of climate change finance for mitigation (though to a lesser extent adaptation). Although there are new market opportunities associated with low carbon growth and global mitigation efforts, there are also some major barriers. These include a lack of scientific capabilities to verify emissions reductions: tapping into carbon markets effectively requires a new type of institutional trade infrastructure. The following Section reviews other sources of finance designed to facilitate trade and access to markets, such as Aid for Trade.

²⁹ Since some intervention measures related to the agricultural sector may fall in other categories, such as ‘forestry’.

Table 3.4: Plans for the Agricultural Sector in NAPAs

Country	Adaptation Plan related to Agriculture (a) (b)	Indicative Project Cost in US\$ c)	Basis of assumptions	Country-specific source
Bangladesh	Promotion of research on drought, flood and saline tolerant varieties of crops.	5,050,000	A mean annual temperature increase of 2.4°C, a mean annual precipitation increase of 10% and a sea level rise of 88cm, all by 2100.	NAPA Bangladesh, http://unfccc.int/resource/docs/napa/ban01.pdf
	Promoting adaptation to coastal crop agriculture to combat increased salinity.	6,550,000		
	Adaptation in agricultural systems in areas prone to enhanced flash flooding–North East and Central Region.	6,550,000		
		18,150,000 (sum of all NAPA projects: 77,275,000)		
		23% of NAPA allocated to the Agricultural Sector.		
Cambodia	Promotion of Household Integrated Farming.	2,500,000	Not specified.	Cambodia project list http://unfccc.int/files/adaptation/napas/application/pdf/06_camb_pp.pdf NAPA Cambodia http://unfccc.int/resource/docs/napa/khm01.pdf
	Development and Improvement of Community Irrigation Systems.	45,000,000		
	Community Based Agricultural Soil Conservation in Srae Ambel District, Koh Kong Province.	2,000,000		
		49,500,000 (sum of all NAPA projects: 128,850,000)		
		38% of NAPA allocated to the Agricultural Sector		
Congo D.R.	The strengthening of agricultural production capacities: Multiplication of improved seeds of Corn, Rice and Cassava.	5,658,760	Not specified.	NAPA Congo D.R. http://unfccc.int/resource/docs/napa/cod01.pdf
		5,658,760 (sum of all NAPA projects: 16,475,654)		
		34% of NAPA allocated to the Agricultural Sector		
Guinea	Promoting adaptation-oriented technologies. 3. Dissemination of soil conservation practices 4. Intensification of bulrush millet crops in the North region of Guinea. 5. Implementation of a system of early warning climate forecasts to protect agricultural production	300,000;350,000;150000	Not specified.	NAPA Guinea project list: http://unfccc.int/files/adaptation/application/pdf/napa_index_country.pdf NAPA Guinea: http://unfccc.int/resource/docs/napa/gin01f.pdf
	Rehabilitation of hydro-agricultural system of plains and lowlands 1. Implementation of irrigated rice cultivation in Moyenne and Haute Guinea.	300,000		
	Promoting income-generating activities 1. Intensification of small ruminant breeding; 2. Development and promotion of vegetable growing. 3. Implementation of a ranch for cane rats to prevent unsustainable hunting of wildlife	325,000;250,000;300,000		

		1,975,000 (sum of all NAPA projects: 8,025,000)		
		25% of NAPA allocated to the Agricultural Sector		
Guinea-Bissau	Capacity Building In Prevention and protection of salt-water rice (mangrove) against high-tide invasion.	600,000	Temperature will rise 2%, rainfall will diminish by 11.7%, and the average seal level will rise 50cm (by 2100).	NAPA Guinea-Bissau http://unfccc.int/files/adaptation/napas/application/pdf/15_guineab_pp.pdf
	Promotion of Small-scale Irrigation in Geba and Corubal rivers Project.	800,000		
	Rehabilitation of Small Perimeters of Mangrove Soils for Rice Growing in Tombali, Quinara, Bafata and Oio Project.	500,000		
	Support to Production of Short-Cycle Animals Project.	400,000		
		2,300,000 (sum of all NAPA projects: 7,200,000)		
	32% of NAPA allocated to the Agricultural Sector			
Madagascar	Support to the intensification of crop and livestock production (through material acquisition, input distribution and development of income generating activities and sectors at regional level).	270,000	Not specified.	NAPA Madagascar http://unfccc.int/resource/docs/napa/mdg01f.pdf
		270,000 (sum of all NAPA projects: 2,130,330)		
		13% of NAPA allocated to the Agricultural Sector		
Malawi	Improving community resilience to climate change through the development of sustainable rural livelihoods.	4,500,000	Not specified.	NAPA Malawi http://unfccc.int/resource/docs/napa/mwi01.pdf
	Improving agricultural production under erratic rains and changing climatic conditions.	3,000,000		
		7,500,000 (sum of all NAPA projects: 22,930,000)		
		33% of NAPA allocated to the Agricultural Sector		
Senegal (d)	Implementation of agroforestry in North Region: 3 rd Activity : Fight Against the Soil Salinisation by planting Halophyte species	10,000;	Not specified.	NAPA Senegal http://unfccc.int/resource/docs/napa/sen01f.pdf
	Implementation of agroforestry in Bassin Arachidier Region : 2 nd Activity : Fight Against the Soil Salinisation: 1- Recovering of 'tannes' by planting Halophyte species 2- Reforestation by planting <i>Tamarix</i> 3- Restoration of Dikes	10,000;2,500,000; 1,000,000		
	Implementation of agroforestry in South Region: Tambacounda, Kolda, Ziguinchor : 2 nd Activity : Fight Against the Soil Salinisation: 1- Planting Halophyte species 2- Reforestation by planting <i>Tamarix</i> 3- Restoration of	10,000;2,500,000; 100,000		

	Dikes			
	Implementation of agroforestry in South Region: Tambacounda, Kolda, Ziguinchor : 3 rd Activity	54,000;90,000		
	Restoration of degraded Soils : 1- Restoration of Composted pits 2- Buy Carts			
	Sustainable use of water Promoting drip irrigation.	372,000		
		6,646,000 (sum of all NAPA projects: 43,182,000)		
		15% of NAPA allocated to the Agricultural Sector		
Tanzania	Improving food security in drought-prone areas by promoting drought-prone tolerant crops.	8,500,000	Mean annual temperature will rise by 20C – 40C, precipitation change -15% up to +45%.	NAPA Tanzania http://unfccc.int/files/adaptation/napas/application/pdf/34_tanz_pp.pdf
		8,500,000 (sum of all NAPA projects: 17,170,000)		
		50% of NAPA allocated to the Agricultural Sector		
Zambia	Adaptation to the Effects of Drought in the context of Climate Change in Agro-Ecological Region of Zambia.	3,000,000	Assumes temperature increase of 2°C in the period of 2010-2070.	NAPA Zambia http://unfccc.int/resource/docs/napa/zmb01.pdf , Zambia project list http://unfccc.int/files/adaptation/application/pdf/napa_index_country.pdf
	Adaptation of land use practices (crops, fish, and livestock) in light of climate change.	1,200,000		
		4,200,000 (sum of all NAPA projects: 14,650,000)		
		29% of NAPA allocated to the Agricultural Sector		
<p>(a) Agriculture refers to crop cultivation and livestock farming but excludes forestry and fishery. Even if projects concerning water management are considered agriculture-related in some NAPAs, this table only includes water issues if they refer to irrigation of cropland.</p> <p>(b) The affected sectors can be found as listed per project and country under the UNFCCC NAPA country list: http://unfccc.int/files/adaptation/application/pdf/napa_index_country.pdf</p> <p>(c) The figures were taken from the UNFCCC NAPA project database: http://unfccc.int/cooperation_support/least_developed_countries_portal/napa_project_database/items/4583.php</p> <p>(d) For Senegal, Agroforestry carry out activities for the agricultural and forestry sector. So, the figures mentioned in this sector is the one allocated to activities linked with the agricultural sector.</p>				

4. Linking Aid for Trade to climate change and agriculture

Technical assistance for trade aims to help developing countries to design and implement trade policy effectively and producers within them to be competitive, given the policies, markets, products, and conditions which face them, now and in the future. While good technical support programmes should prepare countries to meet any expected as well as the actual trading environment, some changes affecting international trade may be so large or so uncertain that trade assistance must allow for them explicitly. Climate change and the conventions in response to this will affect what is produced, what is traded, trading rules, the standards traded goods must meet, and the regulations which they must follow.

As discussed in Section One, this creates new costs and new opportunities, and therefore new needs for assistance, including in that related to trade. An additional reason for linking trade-related aid to climate change is that in some cases the new agreements are linked to financing for the costs of adaptation or mitigation. To the extent that these costs are related to trade, this financing must be coordinated with general assistance for trade. Changes in the climate, and in agreements about it, can thus affect the demand for and the supply of financing for trade capacity building.

This section will first look at how Aid for Trade has emerged as an agreed international initiative, because this offers possible lessons for aid for climate change. It will then examine the specific categories of it to indicate how they could be related to needs for assistance arising out of climate change. It will finally look at the problems of coordinating different types of assistance.

4.1 The History of Aid for Trade in the World Trade Organization

The costs of trading became an important issue in the Doha Round of WTO negotiations because developing countries were still facing costs from implementing the agreements of the previous, Uruguay Round, and they feared that the new Doha Round would impose additional costs. Both these have clear parallels with concerns about the impact of climate change through new rules and damage to production.

The extension of trade rules to new areas like intellectual property and the tightening of rules on existing areas had led to complaints that these had high costs of compliance for developing countries, often out of proportion to any benefit. While there had been general statements in previous agreements about potential technical assistance to help countries meet these costs, there had been no formal commitments, and countries did not consider that the aid had been sufficient. Therefore they would not accept new obligations without guaranteed assistance to meet the costs. The second concern was about serious costs to trade and production. Those countries which already had exceptionally favourable preferential access feared that multilateral liberalisation would reduce their export revenue. Starting in 2003, developing countries began suggesting special funding as a necessary part of any trade agreement.

The first result, in 2004, was a way of dealing with regulatory costs. For the proposed new rules on Trade Facilitation (how goods are treated at the border), it was agreed that countries which did not

receive the 'required support and assistance' would not be bound to implement the new rules. In order to deal with the much higher potential real costs from loss of exports, WTO members adopted a clause mandating Aid for Trade (Hong Kong Ministerial Declaration, paragraph 57, WTO 2005), 'to build the supply-side capacity and trade-related infrastructure that they [developing countries] need to assist them to implement and benefit from WTO Agreements and more broadly to expand their trade.' They set up a Task Force to report within six months, and the report was adopted in 2006.

The Task Force (WTO 2006) defined the scope of Aid for trade as:

- Trade policy and regulations, including: training of trade officials, analysis of proposals and positions and their impact, support for national stakeholders to articulate commercial interest and identify trade-offs, dispute issues, institutional and technical support to facilitate implementation of trade agreements and to adapt to and comply with rules and standards.
- Trade development, including: investment promotion, analysis and institutional support for trade in services, business support services and institutions, public-private sector networking, e-commerce, trade finance, trade promotion, market analysis and development.
- Trade-related infrastructure, including: Physical infrastructure
- Building productive capacity.
- Trade-related adjustment, including: Supporting developing countries to put in place accompanying measures that assist them to benefit from liberalized trade.
- Other trade-related needs.

The success (and speed) in securing agreement to special provisions to fund Aid for Trade, was in large part, due to the desire to secure a multilateral trade agreement which required the consent of all countries. It was consistent with the view that the developed countries which had created the system of preferences should help to meet the costs of unwinding it. But it also owed some of its acceptability to dissatisfaction with the treatment of aid in existing aid programmes. These had been increasingly focusing on poverty reduction goals, and this was often interpreted as requiring them to change allocations in favour of social programmes rather than support for the productive sectors. Aid to improve capacity to trade had fallen as a proportion of total aid. Tying demands for additional assistance to negotiating a multilateral agreement, to principles of restorative justice, and also to a real need to reform aid programmes could strengthen arguments for aid to help agriculture adjust to climate change.

The WTO has established a system of reviewing and monitoring progress, based on an annual Global Review. The WTO monitors data collected by the OECD-DAC's Creditor Reporting System for all aid. The CRS codes most closely related to the Task Force categories of Aid for Trade were identified and agreed with the WTO, and are used by the OECD to report to the WTO on donors' aggregate funding of Aid for Trade.

In addition to compiling data, the OECD and WTO jointly issued questionnaires in 2007 and 2008 to bilateral donors, recipient countries, and some international agencies asking for information on their Aid for Trade strategies and what they fund or receive. Some information going beyond flows of

funds data is thus now available at world and country level. The WTO also includes monitoring aid for trade in its Trade Policy Reviews of both donor and recipient countries. As these take place only every two years for the major donors and at most every six years for the poorest countries, this process will take time to cover all countries.

The data from the CRS, the Global Review by the General Council of the WTO, and the detailed monitoring of donors and recipients through the questionnaires and potentially in the Trade Policy Reviews give the WTO the information needed to monitor the level and distribution of funding and the opportunity to criticise and propose reforms. This links aid providers, reporting to the OECD-DAC, to the organisation responsible for trade, the WTO. But the reluctance of the WTO as an organisation to challenge the traditional aid agencies has made the reviews more fora for exchange of information than appraisal mechanisms. The agencies do not subject their decisions on projects to common criteria. After 2006, the stagnation of the Doha Round meant a lack of ongoing trade negotiations in which developing countries could demand changes to aid in return for trade concessions. Therefore, although there have been increased flows of funds for trade-related purposes, there is no way to ensure that these purposes will be influenced by the priorities of the international trading system.

In climate change funding, it has been accepted that there will be a variety of funds. These will also require monitoring to ensure that they are sufficient and appropriate. There may be lessons on structure, but warnings on the conditions for effectiveness from the experience of Aid for Trade.

4.2 Linking the Aid for Trade categories to climate change needs

4.2.1 Trade policy and regulations

The United Nations Environment Programme, UNEP (de Lombaerde, Puri 2009, pp. 94-5) has identified needs in environmental policy which closely parallel those in trade capacity building: 'A key issue...is the ability of developing countries and developing country experts to meaningfully participate in international standard-setting bodies. ...Equally important for developing countries are the issues related to domestic implementation capacities. The third element is related to both of the above and concerns the creation of policy space for meaningful participation by various stakeholders, including non-state actors.' Carbon labelling is an example of a potentially important advantage for developing countries if they can be assisted in participating more effectively in setting the rules and meeting them. For all these, the types of assistance given to build policy capacity in trade would be relevant to climate-related needs.

Trade policy may also be used as a tool in climate change initiatives. There are proposals to link national initiatives to tax or cap carbon usage to border taxes on countries not accepting similar taxes. Challenging such measures when they violate WTO rules and finding least cost ways of conforming to them when they do not will mean that countries may need additional training and assistance in analysing trade regulations in order to meet climate objectives.

4.2.2 Trade development

If carbon border taxes are imposed, countries may need assistance in adapting their production to minimise their impact. Some developing countries are likely to need assistance in order to take advantage of the CDM. Securing private finance for the investment needed for climate change adaptation and mitigation may include increasing foreign investment, so assistance in attracting and managing this will be relevant to climate objectives.

4.2.3 Trade-related infrastructure

Many of the types of infrastructure in the plans for the agricultural sector included in NAPAs (Table 3.4) could be related to support for trade. These include Guinea, rehabilitating hydro systems, Guinea-Bissau, plans to protect production from high tides, and Senegal, irrigation.

4.2.4 Building productive capacity

Trade capacity building will need to respond to climate change by assisting countries first (in the current conditions of uncertainty on the extent and timing of changes) to diversify to reduce their vulnerability to these risks and then to find new areas of specialisation and to meet the new regulatory requirements for traded products.

The data in tables 1.3, 1.4, and 1.5 show clearly that for some countries climate change effects will have a major impact on agricultural production and trade. The sizes of the effects are for some countries at least as large as those from preference erosion which triggered interest in Aid for Trade. In some cases, notably Malawi, the most seriously affected countries are the same, strengthening the case for providing coordinated assistance to adjust. Most of the projects in the NAPAs (table 3.4) to adapt supply could be related to trade, for example adapting crops to salinity and risks of flooding in Bangladesh, building capacity in DRC, adapting technologies in Guinea, improving crop and livestock production in Madagascar, and adapting agricultural production to erratic precipitation in Malawi.

4.2.5 Trade-related adjustment

The potential increase in the size and frequency of climate-related shocks will affect traded products: compensation schemes for shocks to supply or to prices of commodities are among the earliest forms of trade related assistance from the international financial institutions. They could cover climate related shocks.

4.2.6 Other trade-related needs

The Task Force did not want to exclude any measures which a country could show were intended to improve its trade. This category can therefore be used for any trade-related climate projects that do not fall under one of the designated categories.

4.3 Coordination and competition for funding

4.3.1 Trade and climate change

Some agencies involved in supporting trade have already recognised the need to include climate change issues. Most climate-related funds, including the growing number under the World Bank and those proposed by bilateral aid agencies (including EC, UK, Spain, Japan, Germany, Norway, Australia, and Germany) are targeted at adaptation to environmental change, including changes in trade, rather than at the regulatory requirements of the Conventions. Special funds include provisions for assistance on energy use and shifting to low carbon production. A more general aim is 'what the Bank calls "climate-proofing" development projects, which it estimates will require a few billion U.S dollars annually' (Porter et al 2008 p. 14). Some of these programmes are trade-related. For example, some technical assistance is targeted at increasing analytical capacity, which could have benefits for trade capacity as well, and the fund conditions often emphasise adoption of new technologies. There are obvious complementarities with productivity-increasing technical assistance for trade.

There appears to be no estimate of how much of the total estimated costs of adaptation to climate change may be for trade-related projects. 'A Bank paper on climate change has predicted that it would have to increase IDA funding by 6 percent to 21 percent annually just to maintain the same net level of benefits to recipient countries, compared to a scenario without climate change.' (Porter et al 2008 p. 14). This percentage might be taken as a rough initial estimate of the additional cost of 'climate-proofing' trade capacity building for other donors.

Only a few donors currently cover regulatory needs. UNEP has pointed to the need to link trade and environmental initiatives, supporting assessments of the environmental impact of trade policy changes in specific sectors, leading to a *Reference Manual for the Integrated Assessment of Trade-related Policies* and *Integrated Assessment Guidance for Mainstreaming Sustainability into Policy Making* (UNIDO 2009). It has promoted work on analysing the relationship between Multilateral Environmental Agreements (MEAs) and trade agreements, and published a joint report with the WTO (WTO-UNEP 2009).

Specialised agencies like the International Civil Aviation Organization, ICAO, and the International Telecommunications Union, ITU, are working to establish international technical standards to limit environmental effects, and could include these in their general support programmes. UNCTAD provides and supports analysis of the links of climate change to trade, investment and development, including building developing country capacity to adopt consistent trade and environmental policies. It also provides support specifically to help countries meet environmental standards. UNECLAC also provides support for analysis of the impact of climate change and new standards for trade (UNIDO 2009).

All the donors listed in Table 2.1.3 as providing funds for mitigation and adaptation in the agricultural sector, except the GEF, are also involved in funding trade-related assistance, so in

principle there should be mechanisms for harmonising objectives and coordinating finance. In practice, there are not yet regular checks to ensure compatibility.

4.3.2 Linking funding for specific purposes to official development assistance

Any targeted assistance, mandated by international agreement, causes problems in normal aid terms. Implementing WTO or climate agreements will benefit the world as a whole, and may benefit a country directly, but such changes are not necessarily priorities for a cash-constrained government, so under normal criteria many implementation costs will not qualify for assistance.

Assistance linked to climate change mitigation is for the benefit of the world as a whole, not simply for the country receiving assistance. As the World Bank (World Bank 2009) has suggested, the most efficient ways to reduce emissions and improve energy efficiency may be through investment in developing countries, but, as this is for the benefit of all, it argues that this should imply that such investment should be funded by those most able to do so, i.e. through transfers from developed countries. Assistance for adjustment is more directly related to a country's needs, but allocating aid according to the damage from climate change, like allocating it according to a country's costs from preference erosion, is not consistent with the normal criteria for aid, except perhaps for macroeconomic adjustment to exceptional external shocks. The public good and negotiation reasons that led to the acceptance of Aid for Trade, that developing countries must be persuaded to accept an international agreement which will impose costs on them, also apply to climate change-related assistance.

There has been discussion and concern about the difficulties of linking trade capacity building to poverty strategies in countries' aid programmes, as there is about linking environmental aid to poverty strategies (Prowse et al 2009, for example). Funds targeted at climate change also raise the same issues of inconsistency between targeted assistance and general budget support that are found in trade capacity building (e.g. Bird, Cabral 2009). In both cases there are clear general interests in ensuring that individual countries meet international standards, but the risk that countries may choose to give these lower priority than other national interests if country priorities are given precedence over global concerns.

Therefore, as both trade and climate change related programmes are, in part, for international objectives and for the benefit of countries other than the direct recipients of assistance, they should not be considered quantitatively part of official development assistance. They do not and should not follow the Paris Declaration principles of conforming to national priorities or the principles for allocation among countries according to poverty or other definition of need which bind some aid agencies and influence most of them.

That targeted assistance should be additional to normal ODA does not mean that it should be separate from it at the level of programmes or projects. Ensuring that a development programme should use trade efficiently and be consistent with limiting climate change and achieving a sustainable pattern of production should be part of any aid programme. This is consistent with the World Bank approach of considering how to 'climate proof' development projects and costing this.

For this, it is necessary to estimate the additional costs imposed by climate objectives, and increase total ODA by that amount (or, where there is sufficiently disaggregated information on costs, increase different types of ODA by appropriate factors). In practice it is already difficult to separate funding for adaptation or mitigation for climate change from normal adaptation to new trading problems or opportunities, and this will become increasingly difficult as taking account of climate change becomes a more standard part of project analysis.

By accepting helping countries to trade as an explicit objective, bilateral donor countries which are members of the WTO added an international obligation to their existing objectives for their aid programmes. The same would be true for aid related to climate change. For those donors which have mandates explicitly directed at poverty reduction, this requires some modification or reinterpretation, or clearly separated budget lines. The new focus on trade also brought a need for different types of expertise; in some cases this has been met by allocating more financing through multilateral or specialised agencies.

There will be temptations for those concerned with any special need, including trade and climate change, to try to divert funds from those for general development or from those for potentially related needs. This creates conflicts. As is shown by the calculations of the additional costs of 'climate-proofing' existing projects, any new purpose for Aid for Trade would require additional funding to avoid diversion from existing needs. How far should funding intended to help developing countries to build trade capacity be used for needs created by other policy interventions, such as climate change conventions? How far should environmental or trade funding based on the interests of the global community, displace assistance determined by the needs and priorities of each country?

5. Concluding remarks

There are going to be two types of affect of climate change on the agricultural sector. The first is from climate change itself: it will require changes in what is produced, what is traded, and how it is traded, because the new conditions will make some old types of production or trade impossible. Among the most important types of change likely to affect developing countries' current production patterns are changes in rainfall and other changes in the supply of water, altering the competitiveness of different areas in producing cereals (Tables 1.1 and 1.2). But temperature changes will also change the areas capable of producing tropical and sub-tropical crops, including major export revenue generators like coffee. Sub-Saharan Africa, Latin America, and South Asia are likely to have to produce new commodities, while South East Asia, like some developed areas, may be able to increase current production. Changes in sea level will reduce the supply of land in some areas.

Changes in the availability of and in regulations governing the use of different energy sources will affect use of energy, increasing costs by variable amounts which will affect the competitiveness of different products and producers, including agricultural products and producers. Increased risk of extreme climatic shocks may shift the balance of production towards locations that are more resilient to shocks, even at the cost of reduced productivity. On the demand side, climate change will

stimulate demand for low carbon or clean energy sources, this may include crops produced for biofuels.

There will also be changes as a result of new regulations, both multinational and national. These impose new product standards and new costs of meeting regulations and demonstrating compliance. The negotiation of new conventions also imposes new costs and the need for new skills. New regulations could include new requirements on standards and labelling (e.g. carbon labelling). There are risks that some developing countries will take unilateral action to restrict trade (e.g. border tax adjustments to complement national measures), which will require developing countries to respond or adapt.

Trade and the pattern of production which result from different trade regimes or capacity to trade, in turn affect the climate - assistance directed at trade needs to take these effects into account. If all inputs are priced to reflect both their scarcity and any external diseconomies, then shifting production to the most efficient producers should reduce the impact on climate as well as improving development prospects. To the extent that prices are wrong, assistance to trade should encourage better policy and avoid relying on distorted prices to identify trading opportunities.

Although the funds currently available for adaptation and mitigation efforts are low compared to what is estimated to be necessary, the climate change finance architecture is new and growing. There is scope for some developing countries to benefit significantly from the new sources of finance that may result from climate change mitigation efforts, including that from the CDM as well other voluntary, national or regional schemes in the future. Although it is inherently difficult to value all types of terrestrial carbon, such as that which is locked up in soils, that the most vulnerable countries to the effects of climate change have to date been bypassed by mitigation finance does give cause for concern. Steps taken now to build capacity and awareness of carbon assets and liabilities, as well as the available options to realise low carbon opportunities will be a key pillar of future growth and poverty reduction strategies, given the moves towards optimisation within a carbon constrained world.

How could and should new sources of climate change finance and existing trade facilitation measures work together to address the challenges of climate change in the agricultural sector? As discussed in the proceeding sections there is clearly much scope: many of the donors that have provided mitigation and adaptation finance are also involved in trade-related assistance. However, given that there are not yet checks to ensure compatibility suggests that coordination between institutions and programs needs to be improved; which may, at the same time serve to reduce potential conflicts between competing demands (and agendas).

The Aid for Trade initiative, similar to climate change mitigation and adaption finance, are in part, about delivery of global public goods - in these cases funding has to be additional and must not be diverted from other sources. In the current environment of donor resource constraint the need to establish and delineate, financing mechanisms that can standalone if necessary, becomes arguably even more important.

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National Adaptation Plans of Action (NAPAs) Reviewed

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Cambodia project list http://unfccc.int/files/adaptation/napas/application/pdf/06_camb_pp.pdf

NAPA Cambodia <http://unfccc.int/resource/docs/napa/khm01.pdf>

NAPA Congo D.R.: <http://unfccc.int/resource/docs/napa/cod01.pdf>

NAPA Guinea project list: http://unfccc.int/files/adaptation/application/pdf/napa_index_country.pdf

NAPA Guinea: <http://unfccc.int/resource/docs/napa/gin01f.pdf>

NAPA Guinea-Bissau: http://unfccc.int/files/adaptation/napas/application/pdf/15_guineab_pp.pdf

NAPA Madagascar: <http://unfccc.int/resource/docs/napa/mdg01f.pdf>

NAPA Malawi: <http://unfccc.int/resource/docs/napa/mwi01.pdf>

NAPA Senegal: <http://unfccc.int/resource/docs/napa/sen01f.pdf>

NAPA Tanzania: http://unfccc.int/files/adaptation/napas/application/pdf/34_tanz_pp.pdf

NAPA Zambia: <http://unfccc.int/resource/docs/napa/zmb01.pdf>, Zambia project list:
http://unfccc.int/files/adaptation/application/pdf/napa_index_country.pdf

7. Annex

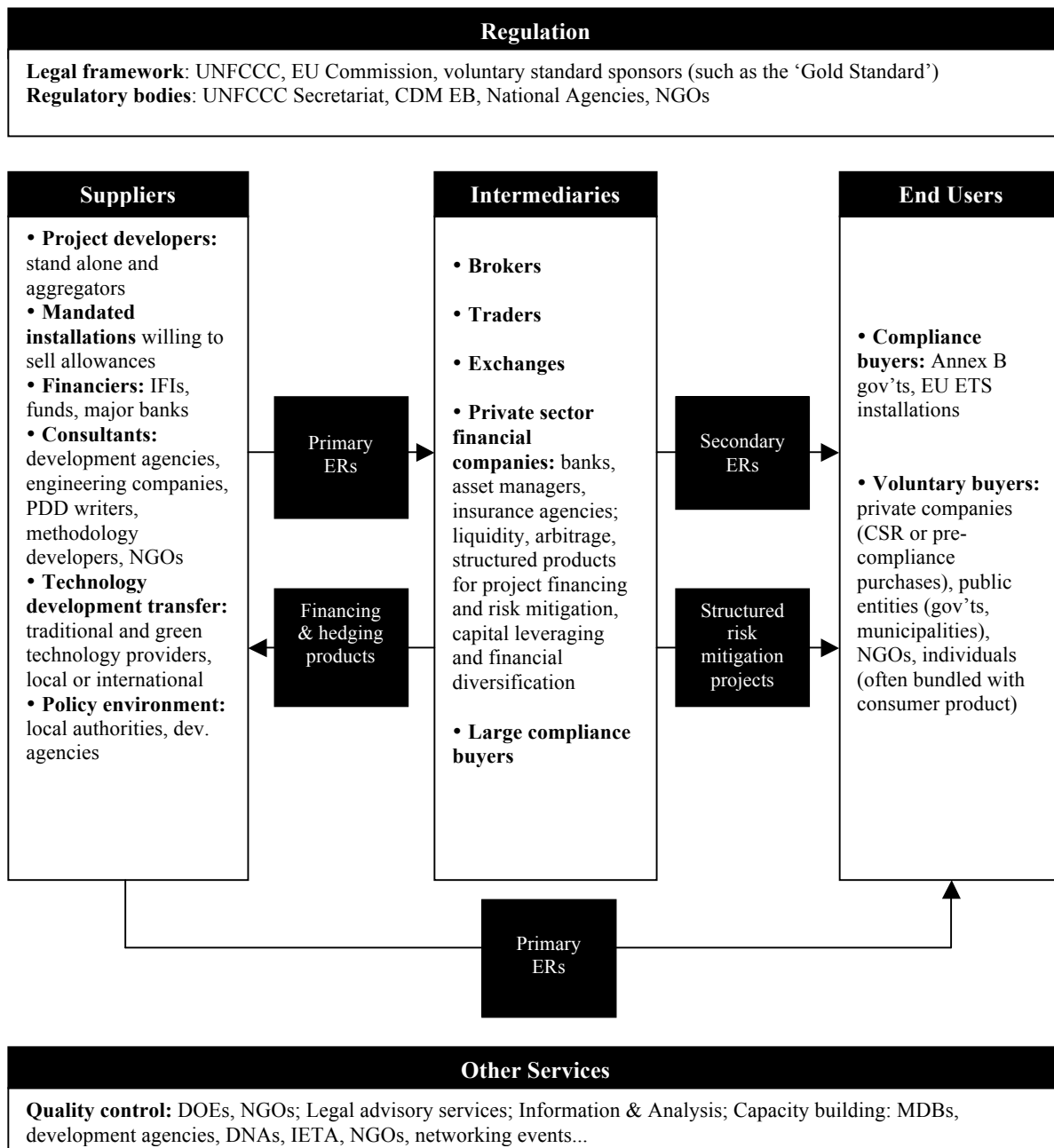
Table 1: Non-Annex 1 parties to the UNFCCC

Afghanistan	Djibouti	Malawi	San Marino
Albania	Dominica	Malaysia	Sao Tome and Principe
Algeria	Dominican Republic	Maldives	Saudi Arabia
Angola	Ecuador	Mali	Senegal
Antigua and Barbuda	Egypt	Malta	Serbia
Argentina	El Salvador	Marshall Islands	Seychelles
Armenia	Equatorial Guinea	Mauritania	Sierra Leone
Azerbaijan	Eritrea	Mauritius	Singapore
Bahamas	Ethiopia	Mexico	Solomon Islands
Bahrain	Fiji	Micronesia	South Africa
Bangladesh	Gabon	Mongolia	Sri Lanka
Barbados	Gambia	Montenegro	Sudan
Belize	Georgia	Morocco	Suriname
Benin	Ghana	Mozambique	Swaziland
Bhutan	Grenada	Myanmar	Syria
Bolivia	Guatemala	Namibia	Tajikistan
Bosnia and Herzegovnia	Guinea	Nauru	Thailand
Botswana	Guinea-Bissau	Nepal	Timor-Leste
Brazil	Guyana	Nicaragua	Togo
Burkina Faso	Haiti	Niger	Tongo
Burundi	Honduras	Nigeria	Trinidad and Tobago
Cambodia	India	Niue	Tunisia
Cameroon	Indonesia	Oman	Turkmenistan
Cape Verde	Iran	Pakistan	Tuvalu
Central African Republic	Israel	Palau	Uganda
Chad	Jamaica	Panama	United Arab Emirates
Chile	Jordan	Papua New Guinea	United Republic of Tanzania
China	Kazakhstan	Paraguay	Uruguay
Colombia	Kenya	Peru	Uzbekistan
Comoros	Kiribati	Philippines	Vanuatu
Congo	Kuwait	Qatar	Venezuela
	Kyrgyzstan	Republic of Korea	Vietnam
	Lao	Republic of Moldova	Yemen

Cook Islands Costa Rica Cuba Cyprus Cote d'Ivoire DPRK DRC	Lebanon Lesotho Liberia Libya Macedonia Madagascar	Rwanda Saint Kitts and Nevis Saint Lucia Saint Vincent and the Grenadines Samoa	Zambia Zimbabwe
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Source: http://unfccc.int/parties_and_observers/parties/non_annex_i/items/2833.php

Figure 1: Players and Institutions in the Carbon Market



Source: Adapted from Capoor and Ambrosi (2008:59)