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Updated compilation of information on the mitigation benefits of actions, initiatives and options to enhance mitigation ambition

Technical paper

Addendum

Technical examination process to unlock mitigation potential for raising pre-2020 ambition through land-use actions with climate benefits

Summary

This updated technical paper compiles information on the mitigation and sustainable development benefits of actions, initiatives and options to enhance mitigation ambition, with a focus on the thematic areas of land use, urban environments, carbon dioxide capture, use and storage, and non-carbon dioxide greenhouse gas emissions. Information for the update was provided in literature, submissions from Parties and observer organizations, and at the technical expert meetings held during the sessions of the Ad Hoc Working Group on the Durban Platform for Enhanced Action held in June and October 2014 in Bonn, Germany. The technical paper builds upon the previous version of the technical paper, contained in document FCCC/TP/2014/3 and its addendum FCCC/TP/2014/3/Add.1.

This technical paper consists of the main document and four addenda. The addenda are focused on mitigation action in the thematic areas of land use, urban environments, carbon dioxide capture, use and storage, and non-carbon dioxide greenhouse gas emissions. The addenda elaborate on mitigation potential, progress, benefits, costs and barriers, as well as on good practice policies, key opportunities and options for catalysing action in these four thematic areas.

Contents

I. Introduction

1. This update of the technical paper on mitigation benefits of actions, initiatives and options to enhance mitigation ambition was requested by the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) at the third part of its second session.[1] The first and second versions of this technical paper were published on 28 May and 30 October 2013, respectively, and are contained in documents FCCC/TP/2013/4 and FCCC/TP/2013/8 and Add.1 and 2.

2. This update of the technical paper comprises five parts: the main text, contained in document FCCC/TP/2014/13, and four addenda, contained in documents FCCC/TP/2014/13/Add.1–4. The main text contains a summary of the main findings, substantiated by the more detailed information provided in the addenda, which capture the content of the discussions that took place at the technical expert meetings (TEMs) on land use, urban environments, carbon dioxide capture, use and storage (CCUS) and non-carbon dioxide (non-CO_2) greenhouse gas (GHG) emissions, held in June and October 2014 in Bonn, Germany, during the fifth and sixth parts of the second session of the ADP.[2]

3. This addendum covers the discussions on land use and consists of two parts, focusing on mitigation potential, progress, benefits, costs and barriers; and practices, policies and actions to unlock mitigation potential in relation to land use.

II. Technical summary on land use

A. Mitigation potential, progress, benefits, costs and barriers

4. Emissions from the agriculture, forestry and other land use sector amounted to nearly 25 per cent of global GHG emissions (10–12 Gt CO_2 eq/year) in 2010, including direct emissions from agriculture alone that contributed 10–12 per cent of global GHG emissions (5.4–5.8 Gt CO_2 eq) and emissions from forestry and other land use contributing around 12 per cent of global GHG emissions (Tubiello et al., 2013; IPCC, 2014). However, while there exists a broad range of current emission estimates for forestry and other land use, most research agrees that in recent years there has been a decline in emissions from this sector (IPCC, 2014). Most assessments demonstrate that during the period 2000–2009 land as a whole has been a net carbon sink.

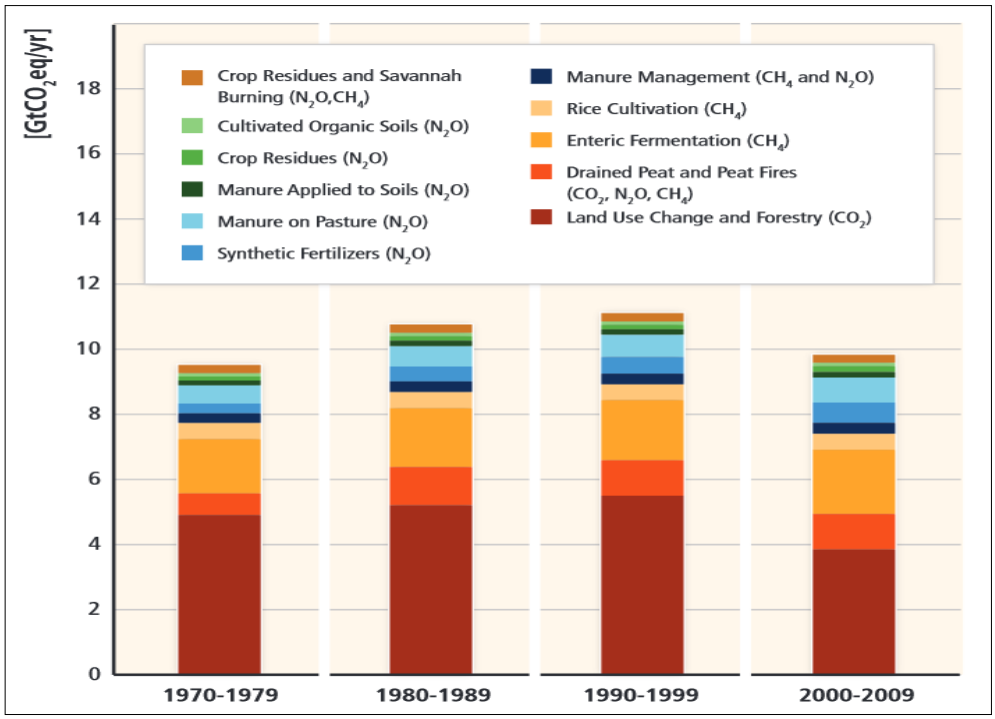
5. In 2010, the agriculture, forestry and other land use sector was the second largest emitter after the energy sector (IPCC, 2014). Figure 1 below illustrates the emissions from agriculture, forestry and other land use by activity over the last four decades. Figure 2 below illustrates the global historical trends in the area of land use and the amount of nitrogen fertilizer use by region, which are major drivers of emissions.

[1] FCCC/ADP/2013/3, paragraph 30(c)(ii).

[2] Detailed information on the TEMs held in June and October 2014, including the initial summaries of the discussions at the meetings, is available at <http://unfccc.int/bodies/awg/items/8171.php>, <http://unfccc.int/bodies/awg/items/8170.php>, <http://unfccc.int/bodies/awg/items/8421.php> and <http://unfccc.int/bodies/awg/items/8420.php>.

Figure 1

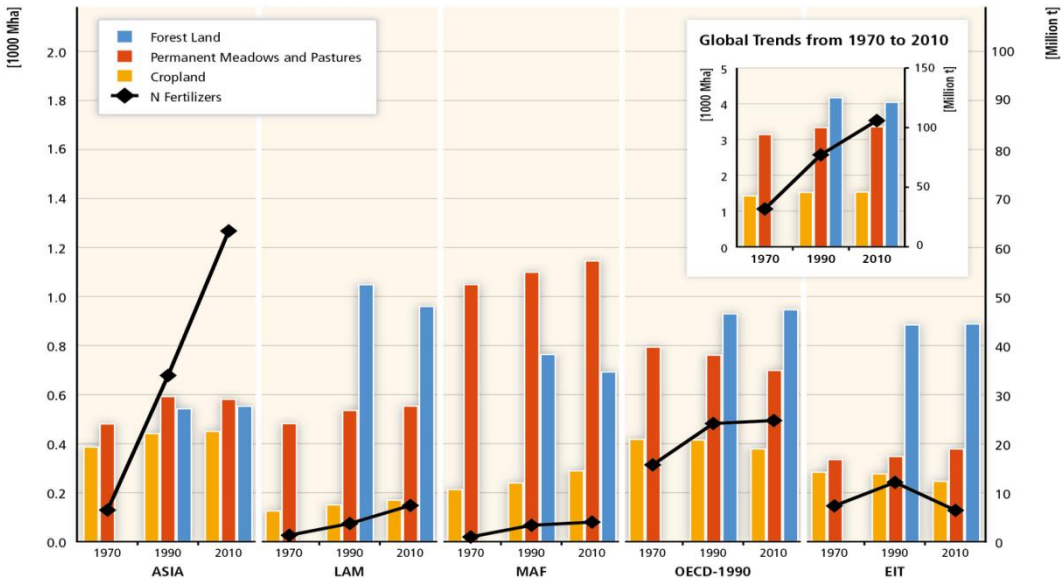
Agriculture, forestry and other land use emissions by source over the last four decades



Source: Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Figure 2

Global trends from 1970 to 2010 in the area of land use and the amount of nitrogen fertilizer use



Source: Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

Abbreviations: EIT = economies in transition, LAM = Latin America, MAF = Middle East and Africa, OECD = Organisation for Economic Co-operation and Development.

6. The role of agriculture as one of the major sources of emissions has been growing. During the period 1990–2010, non-carbon dioxide emissions from agriculture grew by 0.9 per cent per year and since the mid-2000s these emissions have become a larger source of GHG emissions than deforestation. Looking to the future, emissions from agriculture are expected to be an increasingly important source of emissions in the coming decades (Kissinger et al., 2012).

7. The projection of global population trends indicates that food production will need to increase by 70 per cent between 2007 and 2050 (FAO, 2009), while some experts predict that it is expected to double by 2050 (United Nations General Assembly, 2009). The largest growth in population is expected in developing countries, many of which already struggle with food insecurity and low productivity of agricultural systems.

8. The land use sector plays a central role in food security and sustainable development.[3] Achieving food security will require increases in production, alongside key efforts to adapt to climate change.

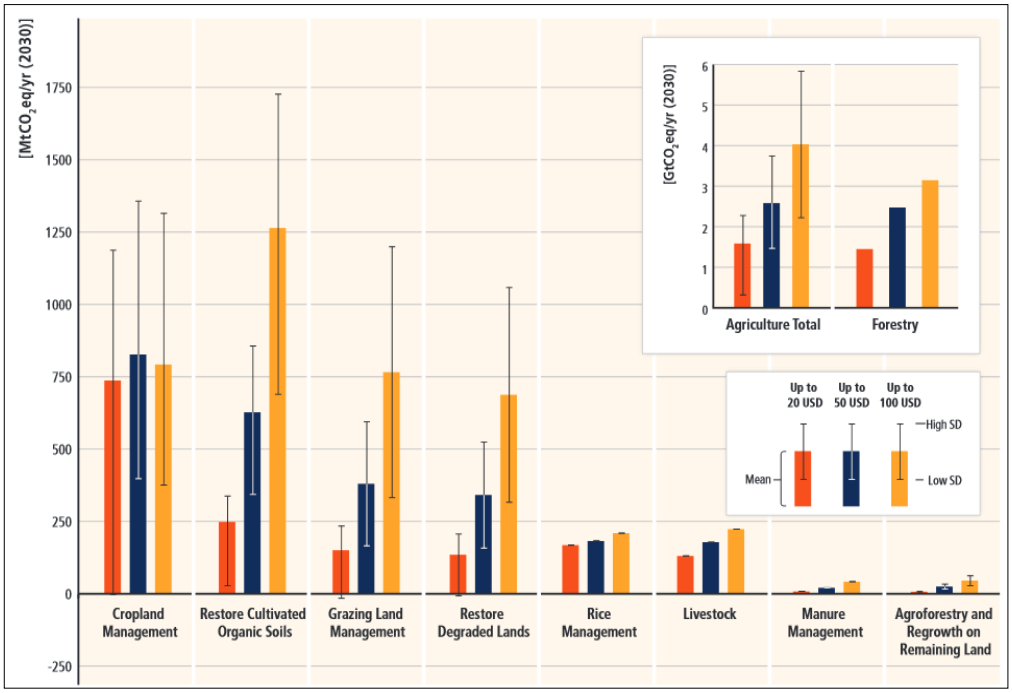
9. At the national level, a dominant share of emissions in developing countries comes from agriculture, forestry and other land use activities. This is especially true in low-income countries where agriculture is often the principal economic activity, resulting in shares of emissions from agriculture, forestry and other land use that are frequently above 50 per cent of the total national GHG emissions (UNEP, 2013).

1. Mitigation potential and practices

10. There are low-cost opportunities in the agriculture, forestry and other land use sector that link food security, environmental sustainability, climate adaptation needs and socioeconomic development into a coherent package. The United Nations Environment Programme (UNEP) (2013a) estimates that at marginal costs of less than USD 50–100/t CO_2 eq, the direct emission reduction potential of agriculture lies in the range of 1.1–4.3 Gt CO_2 eq/year and of forestry in the range of 1.3–4.2 Gt CO_2 eq/year in 2020. The Intergovernmental Panel on Climate Change (IPCC) estimates the economic mitigation potential of supply-side measures (i.e. measures aimed at reducing GHG emissions per unit of land/animal, or per unit of product) below 'business as usual' levels at between 7.18 and 10.6 Gt CO_2 eq in both agriculture and forestry by 2030 at a cost up to USD 100/t CO_2 eq (IPCC, 2014). The mitigation potential of actions in the agriculture, forestry and other land use sector by subsector by 2030 is demonstrated in figure 3 below.

[3] ADP TEM on land use; presentation by the Food and Agriculture Organization of the United Nations (FAO), June 2014.

Figure 3
Mitigation potential of actions in the agriculture, forestry and other land use sector by subsector by 2030



Source: Intergovernmental Panel on Climate Change. 2014. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*.

11. According to the IPCC Fifth Assessment Report, the main options in agriculture, forestry and other land use involve one or more of the following three strategies:

(a) Prevention of emissions to the atmosphere by conserving existing carbon pools in soils or vegetation or by reducing emissions of methane (CH_4) and nitrous oxide (N_2O);

(b) Sequestration: increasing the size of existing carbon pools, thereby extracting CO_2 from the atmosphere;

(c) Substitution: substituting biological products for fossil fuels or energy-intensive products, thereby reducing CO_2 emissions.

12. Demand-side measures (e.g. measures aimed at reducing loss and waste of food or changes in wood consumption) may also play a role. These opportunities, including both supply-side and demand-side options, can be pursued through improvements in institutional arrangements and legal and regulatory frameworks, as well as through the design and implementation of specific climate actions, as discussed in chapter II.B below.

13. As a result of the growing demand for increased agricultural output combined with climate risks and the mounting economic losses in the agriculture sector due to climate change, adaptation to climate change has become a high priority in vulnerable countries.[4] Governments are making efforts to mainstream adaptation-related considerations in land-use policies. Policies governing agricultural practices and forest conservation and

[4] ADP TEM on land use; presentation by FAO, June 2014.

management are more effective when both mitigation and adaptation and addressed together.

14. Therefore, effective implementation of land-use actions with climate benefits requires the consideration of multiple objectives to maximize the positive linkages with sustainable development and climate adaptation needs. Mitigation actions that are bundled with sustainable development and adaptation goals can help to fulfil important national development objectives beyond GHG mitigation targets. Such actions and policies generate additional co-benefits for rural and local communities because they, in turn, are informed by research, knowledge management and the sharing of experiences. For example, bundled climate actions in agriculture, forestry and other land use can increase agricultural productivity, promote eco-tourism, abate air pollution, reduce associated adverse health effects and lower costs of heating (UNEP, 2013). Such climate actions as a whole should be planned and weighted very carefully for their potential impact on natural resources, ecosystem services and populations.

2. Barriers to mitigation action in relation to land use

15. Designing and implementing effective land-use actions with climate benefits requires consideration of the inherent complexities associated with land use, for example:

(a) Many land-use actions with climate benefits are contextual and cannot readily be replicated or scaled up across different ecosystems, governance structures or cultures; however, it is widely recognized that targeted demonstration activities could build capacity for implementation at larger scales;

(b) Land-use actions with climate benefits can take considerable time to implement as they depend on interacting biological systems. Thus, longer time frames are needed to achieve results (e.g. a slow rate of accumulation of carbon in soils and natural forests). To address this challenge, long-term policies with clear mandates, political determination and commitment, and financial backing are required;

(c) Building readiness capacity for the implementation of actions also takes time and requires extensive planning and upfront funding. Experiences from activities such as REDD-plus[5] show that capacity-building can take longer than anticipated;

(d) A number of emergent stressors place additional pressure on land-use actions with climate benefits, such as depleted/degraded resources, uncertain tenure arrangements, exceeded carrying capacities, and land grabbing/squatting. Also, limited land resources in some regions can create aggressive competition for resources such as space and water. The tendency to over-regulate land-use actions to achieve climate benefits must be avoided, so that flexibility and adaptive management can improve and refine actions over time;

(e) Subnational integration and multilevel governance is also a challenge. Bridging the gap between national development objectives and the priorities of local communities often presents very complex social and political challenges.

16. Barriers to the replication and scaling up of land-use mitigation actions are discussed in more detail in table 1 below.

[5] In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities: reducing emissions from deforestation and forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks.

Table 1
Barriers to the replication and scaling up of land-use mitigation actions

Categories	*Details drawn from the technical expert meeting presentations, submissions from Parties and relevant literature*
Socioeconomic barriers	• Lack of sufficient upfront financing to cover transaction and monitoring costs • Need for long-term financial planning (for one or several decades) that renders the resource allocation and scaling up of financing for coordinated land use and that is challenging for donors and implementing countries • Multiple objectives of land use leading to competition between different economic sectors and also between policymakers • Lengthy time required for information dissemination and overcoming social resistance and risk aversion • Engagement of indigenous peoples and overcoming historic conflicts, mistrust and diverse value systems • Urgent demand for increased food production outweighing mid- to long-term mitigation benefits
Environmental barriers	• Diversity of environmental conditions and ecosystem-specific circumstances • Depletion and degradation of land resources that reduces the availability of productive land • Impact of natural disasters and increase of related climate-induced risks such as forest fires, droughts, cold snaps/heatwaves, floods, pests, invasive species and diseases • Loss of ecosystem services (e.g. loss of pollinators) that affects land use and requires more labour-intensive land management
Institutional barriers	• Lack of capacity, such as technical skills, information management, institutional memory or inter-institutional communication • Issues related to designing and implementing effective cross-sectoral long-term policies • Need for effective coordination at the national level of different approaches adopted at the local level and the need for subnational integration • Diversification of delivery modalities and increased complexity of implementation of land-use actions at different stages of implementation
Technological barriers	• Need for harmonized, scientifically supported methodologies and protocols for measuring and monitoring of carbon stocks and fluxes • Complexity of data collection and lack of data reliability hindering informed decision-making • Additional risks associated with implementation of land-use actions in arid and semi-arid areas

B. Practices, policies and actions to unlock mitigation potential in relation to land use

17. Participants in the TEM and Parties' submissions identified a number of good practice land-use actions with climate benefits that integrate land-use planning across different sectors and governance levels, demonstrate co-benefits related to both mitigation and adaptation, and generate co-benefits for rural and local communities. These policy options are presented in table 2 below.

18. While many countries have specified mitigation actions in forestry as part of their emission reduction pledges, few countries have specified mitigation actions in agriculture for this purpose (UNEP, 2013). The fact that approximately 45 per cent of national adaptation programme of action (NAPA) projects are related to land use demonstrates the high priority that many countries accord to increasing resilience when implementing land-use climate actions.[6]

19. The potential for successful land-use actions with climate benefits depends on high-level commitment, clear mandates, cross-cutting facilitation, the broad participation of all stakeholders, and policies and measures beyond the forestry and agriculture sectors. An example of such action is described in spotlight box 1 below. Identifying linkages between climate actions, conservation and development objectives is of critical importance to the successful implementation of policies. Support is most effective when tailored to meet contextual needs within particular national and local circumstances.

Spotlight box 1
Alliance for 1 Million in Panama

Despite having the highest percentage of protected areas in Central America, Panama lost an estimated 541,000 ha (14.3 per cent) of its forest cover between 1990 and 2010. To reverse this trend, a unique partnership has been created to reforest 1 million ha over the next 20 years. In support of the National Forestry Plan, the Alliance for 1 Million initiative will reforest over 13 per cent of the country land area and help to meet cross-sectoral sustainable development goals, support the nation's mitigation commitments and protect the rich biodiversity and delivery of critical ecosystem services. The effort is an innovative public–private alliance between the Government of Panama, the Chamber of Commerce, Industry and Agriculture, civil society, non-governmental organizations, the Association for the Conservation of Nature and the Panama Association for Reforestation.

Source: Autoridad Nacional del Ambiente, Panama. 2014. Press release. Available at <http://anam.gob.pa/index.php/homepage/ultimas-noticias/otras-noticias/700-gobierno-nacional-y-sociedad-civil-sembraran-un-millon-de-hectareas-y-sustentan-compromiso-con-la-agenda-ambiental>.

20. **Strengthening institutional arrangements and legal and regulatory frameworks**: Good governance across multiple levels is central to reducing barriers for land-use actions with climate benefits and ensuring that multiple benefits for rural development are achieved. It is important to create effective consultation mechanisms with all land users and support informed policy design.

21. The use of consultation mechanisms helps to generate collective actions, thereby scaling up successful outcomes and changing practices across the rural landscape. Local landowner consultations also create an opportunity for policymakers to witness impressive

[6] ADP TEM on land use; presentation by the Least Developed Countries Expert Group, June 2014.

changes first-hand. This engagement with landowners can ultimately facilitate access to funding (New Climate Economy Report, 2014). Consultations also help to create trust and allow for local problems of significant concern, such as upstream water pollution by smallholders, to be resolved.

22. Institutional arrangements and legal and regulatory frameworks can be further strengthened by a cross-sectoral approach that recognizes the critical role of land use in food security and the provision of ecosystem services, and takes multiple objectives into consideration in order to maximize the positive linkages between sustainable development and adaptation needs.

23. This approach requires collaboration across different disciplines, various government authorities, scientific organizations, local communities and landowners. Linkages and trade-offs between adaptation, mitigation and other objectives need to be carefully analysed, as they are contextual and depend on the scale, scope and pace of implementation. In the agriculture sector in particular, options need to be identified that consider productivity, mitigation and adaptation benefits as a whole. Increased productivity becomes especially important for rural populations in the light of rapidly expanding urban areas and the mitigation benefits from limiting agricultural expansion into forested and other carbon-rich areas.

24. When designing and implementing land-use actions with climate benefits, the consideration of relevant safeguards in frameworks could avoid negative impacts on food security, pollution and biodiversity, as well as other impacts. Involving all stakeholders early in the process and building long-term partnerships with local communities are important attributes for successful outcomes. Furthermore, it must be stressed that opportunities for GHG mitigation and rural development through land-use actions with climate benefits are available and should be pursued now, in view of the fact that further climate change in the coming decades will further stress implementation.

25. International cooperation and partnerships can play a key role in fostering technical readiness and political will towards climate action. Public–private sector partnerships could also scale up the impact of land-use actions with climate benefits by providing access to additional resources, spurring the development of new models for sustainable land use, and identifying innovative mechanisms to ensure sustainability. One of the innovative examples is presented in spotlight box 2 below.

Spotlight box 2

Woodland Carbon Code in the United Kingdom of Great Britain and Northern Ireland

The Woodland Carbon Code in the United Kingdom was developed between 2007 and 2011 to address the lack of confidence, lack of standards and disrepute prevailing in the United Kingdom forest carbon markets at that time. The design of the Code addressed the lack of opportunities to invest in domestic carbon reduction projects. The standards developed under the Code address mitigation through the enhancement of woodland carbon stocks, but also require an assessment of resilience to climate change. The programme gained strong support from the United Kingdom Government and the national forestry sector and made woodland creation more attractive to landowners. In total, 202 projects were registered under the Woodland Carbon Code, encompassing 15,401 ha and with a potential of 5.7 Mt CO_2 eq lifetime sequestration. The United Kingdom is currently considering the development of a peatland code.

Source: Presentation by the United Kingdom at the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use in June 2014.

26. **Design and implementation of effective policy portfolios: Improved agricultural practices nested in geographic and social scales** can unlock large mitigation potential, while at the same time contributing to addressing adaptation needs and promoting rural development. Some examples of such practices include conservation agriculture, improved livestock and manure management, more carbon-efficient and profitable livestock production systems, reduced fertilizer use, agroforestry and pest control. Other examples of agricultural practices with mitigation impacts, include:

(a) No-tillage practices that eliminate ploughing and maintain crop residues as ground-cover seeding directly under the mulch layer of the previous season's crops. This reduces GHG emissions from soil disturbance and farm machinery operating on fossil fuels, and can also increase profitability from savings in labour and energy, conserve soil and increase tolerance to drought. In Latin America, zero tillage is practised on an estimated 43 per cent of the arable land (more than 40 million ha) (World Bank, 2008). One of the examples of the national actions is presented in spotlight box 3 below;

(b) Improved nutrient and water management in rice production. The utilization of innovative practices such as alternate wetting and drying, and urea deep placement reduces CH_4 and N_2O emissions;

(c) Agroforestry, including woody perennials on farms and fields, increases the uptake and storage of CO_2 from the atmosphere into biomass and soils;

(d) Introducing legumes into farming systems can provide multiple benefits, most importantly fixing nitrogen, thereby reducing the need for synthetic fertilizers. In fact, much of the yield gain in Australian cereal production over the past 60 years has been the result of a rotation system that includes legumes (World Bank, 2008).

Spotlight box 3
Low-carbon agriculture plan in Brazil

As an important food producer, Brazil faces challenges in balancing agricultural production with environmental protection. A large area of the country is occupied with agricultural activities. Through extensive research and positive policies, Brazil has been promoting sustainable practices for agricultural production systems. The Low-Carbon Agriculture Plan (ABC Plan) has been developed in this context, as an additional tool to give farmers – both large-scale and small-scale – the necessary knowledge and incentives to adopt suitable technologies, in synergy with other agricultural and environmental policies in place in the country.

The objective of the plan is to stimulate specific activities such as: no-tillage agriculture; recuperation of degraded land; integration of crops, livestock and forest; planting of commercial forests; biological nitrogen fixation; and treatment of animal residues. This is not an easy task, as farmers tend to be conservative in adopting new techniques. However, there is a concrete perception by farmers that the promoted practices are also more profitable and allow for production systems that are less vulnerable to risks, especially changes in climate patterns.

Through the provision of tailored credit lines under the ABC Plan, around 24,000 properties received financing of approximately USD 3 billion between 2010 and 2014. Between 2005 and 2013, national crop production increased by 64 per cent, while the area used for agriculture increased by only 9 per cent. However, these achievements could be at risk depending on future climate change impacts.

Source: Presentation by Brazil at the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use in June 2014.

27. **Effective cropland and grazing land measures**: in the agriculture sector, effective options for cropland and grazing land measures are varied and can include actions to improve resource management on productive lands, as well as long-term retirement of environmentally sensitive cropland. Measures on productive lands that have proven to be cost-effective include: nutrient management actions to protect water quality; soil-conserving strategies to minimize run-off and soil loss; water conservation and drainage control; livestock grazing regimes that help to sustain grassland and riparian systems; wildlife enhancements that improve habitat and forage conditions; and the preservation of farmland and open spaces in urban fringe areas. Other examples of cost-effective land retirement from cropland include: cropland with very erodible soils where erosion costs exceed the crop value; restoration of wetlands, cropland subject to risk from severe flooding, farmland and forest land that provide critical habitats for species recovery; forest regeneration on sensitive cropland; and irrigated production areas with acute water issues (e.g. declining aquifers) (United States Department of Agriculture, 2006).

28. **Research and development and application of efficient land-use management and effective planning**: national land-use planning and enhanced knowledge of land use and land cover have become increasingly important, not only in the context of climate mitigation and adaptation, but also to overcome broader issues of uncontrolled development, loss of prime agricultural land and natural resource management (see spotlight box 4 below).

Spotlight box 4
Climate benefits of agriculture development in New Zealand

About 90 per cent of the agricultural production of New Zealand is exported, generating nearly 56 per cent of the country's export earnings. This makes both mitigation and adaptation to climate change a very high priority. The focus of mitigation efforts is on increasing the productivity of the agriculture sector while at the same time reducing the emissions per unit of produce (emissions intensity).

While absolute emissions from agriculture have increased by 15 per cent since 1990, the emissions intensity has decreased by 20 per cent. This represents a reduction in the global food footprint and has led to important economic benefits at the local level as well as for the national economy. New Zealand seeks to share the skills and expertise gained through the implementation of policies focused on emissions reduction, domestic action, scientific research and innovation, and development programmes. The country actively engages in national and international research and collaboration to scale up the reduction of emissions intensity.

Source: Presentation by New Zealand at the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use in June 2014.

29. An example of such a policy is the Consultative Group on International Agricultural Research (CGIAR), a global partnership of 15 research centres that catalyses high-level scientific support, funding and institutional memory for the development of agriculture and natural resource management. CGIAR's International Rice Research Institute developed a variety of "scuba rice" that can withstand water submersion in flood-prone regions. After 10 years of development, the scuba rice was introduced in India in 2008 and today more than 5 million farmers have adopted varieties of "scuba rice" (New Climate Economy Report, 2014).

30. **Improved land-use productivity and resilience** can be effective in protecting carbon-rich areas such as forests if they are based on context-specific, holistic approaches to food security, adaptation and mitigation with evidence-based practices, strategies, policies, planning and investment. Responses to climate variability and change and other

drivers of climate change may require shifts in management practices that have beneficial effects on the climate system if they are considered from the outset.

31. The primary concerns of farmers are food and nutritional security, followed by considerations about longer-term returns on investment and the long-term provisioning character of their land. For farmers to consider investing in practices that can be considered land-use actions with climate benefits, they require technical and financial support, an enabling environment and appropriate supply chains. This is necessary to ensure that food and nutritional security targets can contribute to the mitigation of climate change without negatively affecting development outcomes.

32. **Improved livestock productivity, including improvements in quality and digestibility of forage and fodder** not only reduce emissions of enteric methane, but also improve weight gain so that livestock can go to market sooner. Strategies with high mitigation potential include feed additives and physical treatment methods (e.g. processing, chopping and thermal treatment); forage management (e.g. rotational grazing); breeding of forage; and increased efficiency in the age structure of herds.

33. On the demand side, the reduction of food loss and waste can have an impact on GHG emissions from the food production life cycle. Between "the farm and the fork", 24 per cent of food intended for human consumption is wasted (Lipinski et al., 2013). There is a very high level of inefficiency throughout the supply chain that can be identified and corrected. Annually, it is estimated that USD 750 billion is lost (FAO, 2013a). This creates opportunities for improvement. For example, during the period 2007–2012, the United Kingdom of Great Britain and Northern Ireland was able to reduce household food waste by 21 per cent, while the number of households increased by 4 per cent in the same period. In 2012, this reduction is estimated to have avoided 4.4 Mt CO_2 eq in GHG emissions (New Climate Economy Report, 2014).

34. In the forestry sector, **REDD-plus** remains a mitigation option with a high level of interest among developed and developing countries, as exemplified by the actions undertaken by developing countries and the level of funding that has already been provided for REDD-plus since the first decision on REDD-plus was adopted by the Conference of the Parties (COP) at its thirteenth session in 2007. In 2013, the COP adopted a comprehensive set of decisions, also known as the Warsaw Framework for REDD-plus,[7] to provide clarity on results-based finance and related methodological guidance, including modalities and procedures for measuring, reporting and verifying REDD-plus results.

35. Today, bilateral and multilateral initiatives support more than 100 developing countries to implement REDD-plus activities, in particular in relation to the elements that are to be developed during the initial phase of implementation: a national strategy or action plan; a forest reference emission level and/or forest reference level; a national forest monitoring system; and a system for providing information on how the safeguards are being addressed and respected.[8] These activities should evolve into results-based actions that should be fully measured, reported and verified.[9] Spotlight box 5 below highlights three examples of good practice national approaches to implement REDD-plus activities.

[7] The Warsaw Framework for REDD-plus comprises decisions 9/CP.19 to 15/CP.19. For more information, see document FCCC/CP/2013/10, paragraph 44.

[8] Decision 1/CP.16, paragraph 71.

[9] Decision 1/CP.16, paragraph 73.

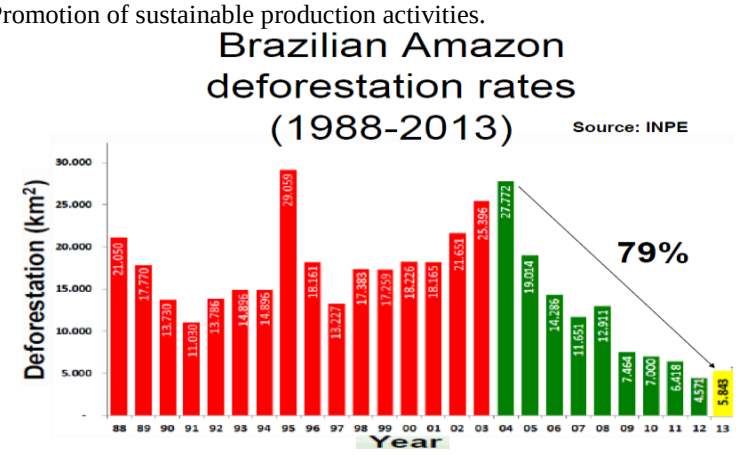
Spotlight box 5

Experience of implementation of land-use actions for reducing emissions from deforestation and forest degradation in Brazil, Ghana and Mexico

Emissions from land-use change and forestry were responsible for about 80 per cent of Brazil's emissions profile in 2000. In 2003, the federal government established a permanent interministerial working group to propose and coordinate actions aimed at reducing deforestation in the Amazonia biome.

The second highest increase in deforestation in the Amazonia biome was registered in 2004, reaching more than 27,800 km^2 (see the figure below). Also in 2004, the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon entered into force. The Action Plan focused on three main areas:

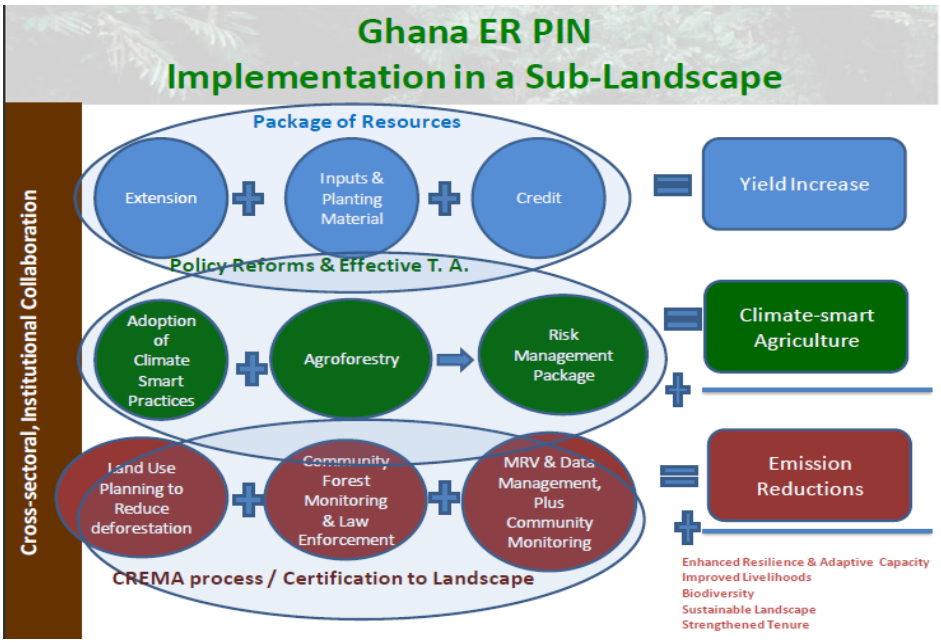
- Robust forest monitoring and law enforcement;
- Territorial planning;
- Promotion of sustainable production activities.



Abbreviation: INPE = Instituto Nacional de Pesquisas Espaciais.

By 2012, Brazil had achieved a reduction in the deforestation rate by approximately 79 per cent compared with 2004. This successful outcome was achieved by the use of additional measures, including economic incentives requiring proof of compliance with environmental regulations and the involvement of the private sector in sustainable development round tables. Brazil was the first developing country to submit a REDD-plus forest reference emission level for technical assessment in the context of results-based payments to the UNFCCC.

Ghana: Ghana anticipates that it will achieve emission reductions of 18.5 Mt CO_2 eq by 2020 through its REDD-plus efforts. In a subnational approach covering 25 per cent of the national land area, the programme focuses on increased productivity and resilience of agricultural production, in particular of cocoa, timber, palm oil and food crops. Combined with efforts to monitor and legally protect forests, these measures can reduce emissions from deforestation (reducing deforestation is included in REDD-plus, as mentioned above). At the same time, Ghana aims to conserve biodiversity in this global biodiversity hotspot and improve the livelihoods of the local population.



Abbreviations: CREMA = Community Resource Management Areas, ER PIN = Emission Reductions Programme Idea Note, MRV = measurement, reporting and verification, T.A. = technical assistance.

Mexico: In June 2010, the Governments of Norway and Mexico signed a memorandum of understanding (MoU) on cooperation in the field of the environment, forest and climate change. The MoU identified specific areas of cooperation relevant for the implementation of REDD-plus through an agreement entitled "Reinforcing REDD plus and South-South Cooperation". The three-year, USD 15 million programme had a key goal, which is to promote Mexico as a leader in South-South cooperation to exchange experiences on REDD-plus, in particular measurement, reporting and verification. Mexico's approach to REDD-plus implementation includes the use of special programmes, which constitute institutional efforts that seek to direct resources to specific areas with high rates of deforestation and forest degradation, and are prepared in accordance with actual local needs.

Currently, the National Forestry Commission is implementing three special programmes, which are being carried out in areas that correspond to the Early REDD-plus Actions: the Special Programme for the Lacandona Jungle; the Special Programme for the Jalisco Coastal Basins; and the Special Programme for the Yucatán Peninsula. All special programmes are adapted to local needs, promote local governance mechanisms, have the flexibility to change based on acquired knowledge and feed their experiences back to the national level. They also involve a public agent for territorial development, which allows for the integration of the programmes at the territorial level and the provision of support from other institutions. Measures to support these efforts include payments for ecosystem services, regeneration of jungles, diversified reforestation, sustainable forest management and community forest development.

Sources: Presentations by Brazil, Ghana and Mexico at the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use in June 2014.

36. One of the examples of international partnerships aimed at reducing deforestation is the Tropical Forest Alliance 2020 (TFA) that is a public–private partnership that seeks to

create ‘zero deforestation’ supply chain models in South-East Asia, Central and West Africa and regions of South America. The priority commodities of TFA include palm oil, soy, beef and paper pulp. TFA will use a range of market-based, policy and communications approaches to share best practices; provide expertise and knowledge to develop commodity markets that promote conservation of tropical forests and support activities such as improved forest planning and management, agricultural land use and tenure, and improved monitoring to measure progress.

37. The most cost-effective option to reduce emissions in the forestry sector is **improved forest management**. An increasing number of communities are also recognizing the value of forest capital for the provision of key services, including, inter alia: air quality improvement; flood mitigation; erosion control and landslide prevention; water filtration; and local/regional precipitation cycles.

38. Restoration and reforestation of degraded land is an activity with large mitigation potential and co-benefits, for example in arid and semi-arid lands or peatland. Peatland is considered an especially important area for restoration because of its high potential for carbon storage. Although peatland covers less than 3 per cent of the land surface, it is found in at least 175 countries from the tropics to the poles and contains 30 per cent of the world’s soil carbon (Joosten, 2012).

39. **Afforestation and reforestation** activities to enhance forest carbon stocks are also being implemented in many countries (see spotlight box 6 below). Possible benefits of these activities include mitigation and adaptation, ecosystem services, restoration of degraded land, biodiversity conservation or enhancement, and economic benefits in the form of timber and non-timber forest products.

Spotlight box 6
Forest carbon enhancement actions in China

In order to achieve the ambitious goal of increasing the net increment of forest area by 40 million ha by the end of 2020 compared with 2005, China combines a number of afforestation, forest protection and sustainable forest management policies and practices.

With regard to forest management, China emphasizes the importance of sustainable logging activities as well as fire monitoring and control of dangerous pests and diseases. Afforestation activities are integrated into China’s master plan of national social and economic development, the national plan for addressing climate change, and the forestry development plan. Activities largely take place on degraded agricultural land. Newly established forests provide a number of additional benefits, including offering an effective method of sandstorm source control. China uses different means to incentivize the participation of farmers, including financial support in the form of subsidies and tenure reform. The intention is to further increase the forest area and also integrate forest carbon into China’s national emissions trading system pilot programme.

Source: Presentation by China at the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use in June 2014.

Table 2
Policy options menu for land-use actions with climate benefits

Select policy options	*Select examples*
Strengthening of institutional arrangements and legal and regulatory frameworks	
Promotion of multilevel governance in land use	• Colombia – decentralized governance of the forestry and agriculture sectors[a] • Indonesia – decentralized management of natural resources to the district level[b] • Kenya – devolved governance in the 2010 Constitution, for example, the Council of Governors Secretariat and the Committee for Environmental and Natural Resources[c] • Mali – drought risk management at the local level[d] • Yemen – decentralized governance of water resources[e]
Facilitation of land-use planning and consultations with land users	• Austria – forest policy providing the legal basis for stakeholders to increase forest carbon stocks. Supporting replication in Georgia • Bolivia – indigenous property rights and titling of indigenous communally managed territories • Cameroon – satellite monitoring for forest protection[f] • Colombia – expansion of the Serranía de Chiribiquete National Park, and the Amazon Vision initiative[g] • Congo – participatory mapping of land and land uses [h] • Costa Rica – prohibition of conversion of mature forests to other land uses • Guatemala – community concessions in the Maya Biosphere Reserve • European Union – Common Agricultural Policy, enabling coordination between administrations, ministries and agencies • Jamaica – local forest management committees[i] • Rwanda – transition of poachers to rangers[j]
Promotion of interdisciplinary approach linking food security, ecosystem services and sustainable development	• Africa – Food, Agriculture and Natural Resources Policy Analysis Network[k] • China – "Grain for Green" payment for Ecosystem Services (PES)[l] • Costa Rica, Mexico and Viet Nam – PES
Introduction of relevant safeguards to avoid negative impacts	• India – landscape scores using set parameters to evaluate forests before permitting mining and other industrial uses • Uganda – UgoCert, organic certification for producers[m]
Promotion of international cooperation and partnerships, including	• Forest Carbon Partnership Facility • UN-REDD Programme • REDD-plus Partnership • BioCarbon Fund Initiative for Sustainable Forest Landscapes

Select policy options	*Select examples*
public–private partnerships	• World Bank – Community Development Carbon Fund (e.g. biogas project in Nepal; community-based hydropower project in Pakistan) • Namibia – private-sector participation in drafting the National Rangeland Management Policy and Strategy[n] • New Zealand – Primary Growth Partnership, which mobilizes finance for increased productivity/sustainability[o]
Agriculture	
Improved agricultural practices, nested in geographic and social scales, recognizing the context of local ecosystems and cultures	• Caribbean Agrometeorological Initiative – improved weather forecasting, and pest and disease information[p] • Niger – agroforestry techniques to 're-green' degraded farmland in the Sahel. Farmer-managed natural regeneration[q] • Rwanda – Land Husbandry Water Harvesting and Hillside Irrigation Project to increase the productivity of hillside agriculture[r] • Uganda – climate-smart agriculture practice on Mount Elgon coffee farms[s]
Effective cropland and grazing land management that maintains and improves habitats	• Kenya – linking pastoralism and conservation, Keekonyoki conservation meat enterprise • Namibia – Community-based Rangeland and Livestock Management Programme[t] • Zimbabwe – Africa Centre for Holistic Management[u]
Research, development and application to improve efficiencies and reduce costs	• Botswana – research and development and demonstration on more efficient beef production[v] • "C4 Rice" project of the International Rice Research Institute[w] • Eastern and Southern Africa – International Maize and Wheat Improvement Center for the development of drought-tolerant maize varieties and hybrids • India – Nutrition Masters programme for increased dairy production, development of computer software from the National Dairy Development Board[x] • Kenya – research and consultation • Philippines, Thailand and Viet Nam – genetic improvement of farmed tilapia programme[y]
Improved land-use productivity and resilience	• Africa – Lusaka Declaration on Mainstreaming Organic Agriculture[z] • China – Loess Plateau projects[aa] • Ethiopia – Koraro Village, Millennium Villages Project, improved water sources and micro dams[bb] • Ghana – strengthening the cocoa supply chain in the Juabeso-Bia landscape[cc] • Kenya – agricultural commodity exchange as a market price discovery mechanism[dd] • Madagascar – system of rice intensification, Conféderation Nationale Koloharena Sahavanona[ee] • Sri Lanka – research, irrigation and crop diversification measures

Select policy options	*Select examples*
Improved livestock productivity through improvements in quality and digestibility of forage and fodder	• Nigeria – cultivation of dual-purpose dry season cowpea[ff] • Latin America – vertical integration/contract farming of poultry and eggs • United States of America – 1977–2007 feed efficiency conversion gains
Reduction of food loss and waste	• Association of South-East Asian Nations – Save Food Asia and the Pacific Campaign[gg] • Mongolia – Think-Eat-Save: Reduce Your Food Print programme[hh]
Forestry	
REDD-plus	• Support for REDD-plus readiness, for example through the UN-REDD Programme and the Forest Carbon Partnership Facility • Center for International Forestry Research – Ten Principles for Landscape Approach[ii] • Germany – REDD Early Movers Programme • Norway – Forest and Climate Initiative
Improved forest management	• Brazil – Real Time System for Detection of Deforestation[ij] • Brazil (São Paulo), Colombia (Bogotá), Ecuador (Quito), United States of America (New York) – payments for wastershed services[kk] • Cambodia – research on reduced-impact logging with special silvicultural treatments[ll] • France, Hungary – new financial instruments to overcome the investment barrier of unknown return on investments[mm] • Republic of Korea – Forest Ecosystem Restoration Initiative to support Aichi Biodiversity targets[nn] • Sweden – voluntary forest management certification systems active on over 22 million ha • Suriname – management system for harvesting tropical rainforest developed at the Centre for Agricultural Research[oo]
Afforestation and reforestation	• China – sandstorm source control in the Beijing–Tianjin region. Fast-growing and high-yielding timber base development[pp]

Note: Many of the policy options and examples provided in this table are taken from the presentations made during the Ad Hoc Working Group on the Durban Platform for Enhanced Action technical expert meeting on land use, held in June 2014. Detailed information on this meeting is available at <http://unfccc.int/bodies/awg/items/8171.php>. Many examples reference ongoing activities at the local and regional levels. The list is not exhaustive and the examples are for informational purposes only.

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