

**CARBON SEQUESTRATION OPTIONS UNDER  
THE CLEAN DEVELOPMENT MECHANISM  
TO ADDRESS LAND DEGRADATION**

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**  
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## Preface

In continuation of a collaborative programme on the implementation of the Convention to Combat Desertification (CCD), FAO and IFAD agreed to implement a project to assist countries, initially in Latin America and the Caribbean, in the formulation of policy and technical options for sustaining production systems which can improve livelihood of poor farmers through land conservation, enhancement of agro-biodiversity and increased carbon sequestration.

The objective of this project is to address the urgent need to reverse land degradation due to deforestation and inadequate land use/management in the tropics and sub-tropics with focus on the Latin America and Caribbean region.

At a general level, the project deals with this issue through the promotion of improved land use systems and land management practices which provide economic gains and environmental benefits, greater agro-biodiversity, improved conservation and environmental management and increased carbon sequestration. The project will contribute to the development of regional and national programmes linking the Convention on Climate Change (CCC)-Kyoto Protocol, the Convention to Combat Desertification (CCD) and the Convention on Biodiversity (CBD), focusing on synergies among the three Conventions.

At a specific level, pilot studies are carried out in selected sites in Latin America to:

- assess the qualitative and quantitative assets of the major land use systems and land management practices in Latin America and the Caribbean in terms of soil fertility and land productivity, agro-biodiversity and carbon stock;
- evaluate the possibility and options of land use changes and land management practices which would prevent land degradation, conserve agro-biodiversity and enhance carbon sequestration; and
- prepare regional and national strategies and action plans linking together the specific legislative framework in place and its areas of operation.

This publication contains the result of a study on the origin and background of the carbon sequestration options and the Clean Development Mechanism (CDM). It documents the outcome of the various proceedings of the international meetings in which carbon sequestration and CDM have been discussed. The attitude and the position of the key countries and the Group 77 involved in international environmental treaties are examined using the available sources in the United States, including relevant NGOs and international organisations. The publication examines the various initiatives that have been taken in response to the above-mentioned ideas, including the recent initiative by the Global Environment Facility (GEF) and the World Bank to facilitate the funding of land degradation projects under GEF. This analysis includes the exploration of the legal base for such initiatives. It also includes a review of the ongoing programme of collaboration between IFAD and FAO on carbon sequestration and indicates how it would fit within the framework of the existing international environmental treaties, as well as the recent GEF and World Bank initiative.

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## Summary

The UN Framework Convention on Climate Change (FCCC) stated as its main objective: “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. It is interesting to note that the FCCC was also constructed with issues of desertification in the minds of the Parties’ negotiators: its Preamble recalls “the pertinent provisions of General Assembly Resolution of December 1989 on the implementation of the Plan to Action to Combat Desertification”.

The subsequent Convention to Combat Desertification (CCD) is concerned that extensive areas, which might otherwise be productive, have been rendered unsuitable for crop production to meet the needs of the population due to land degradation and reduction in soil carbon stocks. Thus, the CCD and FCCC with its Kyoto Protocol (KP) share a mutual goal, i.e., the proper management of carbon. Moreover, land use change, agriculture and forestry activities recognized by the KP are also closely linked to the CCD and Convention on Biodiversity (CBD), although the KP does not explicitly address its relation with those.

Restoration, to which all three Conventions refer, could only occur through improved land use and crop management, through practices leading to the proper placement of carbon in the geosphere at the same time as contributing to food security. Restituting carbon to those lands depleted of the capacity to be productive would also contribute to reducing carbon in the atmosphere.

Because industrialized countries are largely responsible for the excessive amounts of greenhouse gases in the atmosphere, and because they are better able to pay, the FCCC has assigned to those the leadership role in the reduction of greenhouse gas emissions. The KP, not yet entered into force, has set Quantified Emission Limitation and Reduction Commitments (QELRCs) to be met by the developed country Parties during the first commitment period, 2008-2012. Developing country Parties, due to the principle of common but differentiated responsibilities, presently have no such commitments though it is recognized that emissions from developing countries will grow.

The Clean Development Mechanism (CDM) is one of several mechanisms created in the KP that enables Parties to cooperate with each other to reduce emissions. It is the only mechanism directed specifically at developing countries, the Parties least able to adapt to adverse effects of climate change. The purposes of the CDM are to assist those Parties not having QELRCs in achieving sustainable development, and at the same time to assist developed country Parties in achieving their QELRCs.

One activity mentioned as meeting the objectives of the CDM, FCCC and CCD is carbon sequestration—retaining in the geosphere carbon that would otherwise escape into the atmosphere. Carbon sequestration can occur in several sites: biomass, forests, wetlands, geologic formations and soils, among others. Article 2.1 of the KP recognizes that carbon sequestration is an appropriate option for Parties to use in meeting their domestic obligations to reduce emissions. Additionally, Article 3.3 of the KP permits net accounting of direct human induced afforestation, deforestation and reforestation activities in assessing a developed country Party’s emissions.

Article 3.4 says that the Conference of Parties (COP) will decide “what additional human-induced activities related to changes in greenhouse gas emissions by sources and removals, by sinks in the agricultural soils and land-use categories shall be applicable”. This decision was reached because the uncertainties regarding measurement of carbon fluxes – particularly in soils – were then too great and had to be resolved.

Nevertheless, it has become well recognized that carbon sequestration is a viable option for capturing carbon under the Protocol. Forests as they mature can take up carbon and a grass cover will add to the forest’s effectiveness at taking up carbon. Lal (1997) estimates that the potential for soil carbon sequestration may be as high as 1.4 Pg C/yr or about 40 percent of the total amount of annual atmospheric increase in CO<sub>2</sub> concentration. The carbon fertilization and water use efficiency phenomena suggest that the appropriate choice of crops coupled with appropriate land management will lead to increased carbon retention. Carbon sequestration under the CDM is currently under review and will be decided at the upcoming COP.

The CCD has a funding mechanism, the Global Mechanism (GM), which facilitates, but does not itself provide, funding for efforts to prevent land degradation and desertification. Further, Parties to the CCD are urged to coordinate diverse project activities, activities that comprehend the various influences affecting land degradation, desertification and effective land use.

The FCCC’s funding mechanism is the Global Environment Facility (GEF) and, unlike the GM, the GEF is authorized to provide funds. The GEF has funded both projects that have had an effect on remedying land degradation and Activities Implemented Jointly (AIJ) that addressed carbon sequestration in forests. The GEF’s Scientific and Technical Advisory Panel (STAP) has endorsed an approach to sequestering carbon in an effort to rehabilitate degraded land and encouraging afforestation.

Within this context, the Food and Agriculture Organization (FAO) and the International Fund for Agricultural Development (IFAD), both carrying administrative responsibilities under the CCD, have jointly embarked on a programme to alleviate poverty and increase food security. The Central American Environment and Development Commission (CCAD) requested FAO assistance in preparing a Carbon Sequestration programme for the Central American region. At a consultation in 1999, FAO/IFAD proposed two options for reducing emissions through agricultural projects. First, increase the sequestration potential of forests and other land types in the soil and second, capture atmospheric carbon through increased vegetation cover and photosynthesis. Funding is needed to carry out these goals and the CDM presents an opportunity for obtaining necessary funds. However, the difficulty remains with measuring carbon exchange on a regionalized scale.

One method of addressing this difficulty is through the socio-economic component of sustainable development. There is a need to alleviate poverty not only for its own sake but because it contributes to environmental degradation and further exacerbates the effects of poverty. Nevertheless, there is an additionality requirement that must be met: a certified project under the CDM must achieve reductions in emissions that are additional to any that would occur without the project. For projects of this nature the GEF provides incremental funding, an approach that has been criticized. Still, the GM should have an opportunity to bring together private and public sector funding to address food security and land degradation if the COP approves use of soil carbon sequestration under the CDM. The GM will likely have to work through the CDM which “shall” help to arrange funding of certified project activities.

The United States, the country Party with the largest share of greenhouse gas emissions, is generally in favor of expanding its opportunities for cooperation with other country Parties in order to apply the resulting reductions to its own commitments. Developing country Parties are concerned that a certified emission reduction (CER) under the CDM will be interchangeable with emission reduction units (ERU), thus reducing the pool that might be available under the CDM. Also, developing country Parties are concerned with equity and that other sources of funding not be diminished as a consequence of CDM projects.

A second, though more limited fund, is the Prototype Carbon Fund (PCF) established through the World Bank. This fund will finance emission reduction projects; however, no more than 10 percent of the fund's assets may be invested in land use projects.

In conclusion, it is generally recognized that carbon sequestration is effective in reducing emissions of greenhouse gas to the atmosphere. The Kyoto Protocol encourages its increased overall use by developed country Parties in meeting their commitments. The KP limits its use in the forestry sector, although there is potential for reducing emissions to the atmosphere through improved land management and agricultural practices. Limitations under the CDM are large because of the problems with measuring carbon fluxes on a regionalized scale. On the other hand, the United States Senate unanimously passed a non-binding resolution conditioning its approval of the KP on developing country Parties committing to emission reductions. It is also expected that emissions from developing country Parties will grow. Yet many of them do not have the funds necessary to reduce land degradation, fertility decline and food insecurity; the CDM could be a win-win solution.



## I. INTRODUCTION

Efforts to effect the appropriate balance of greenhouse gases in the atmosphere involve the global commons, owned by no one, relied upon by all, but found by a balance of the evidence to have been abused to the detriment of many, thereby creating unnecessary insecurity for those least able to adapt. From the perspective of seeking remedies for land degradation, desertification and food insecurity this paper examines carbon sequestration options resulting potentially from the Kyoto Protocol and its Clean Development Mechanism. The unifying element is carbon, the unifying theme is management. There is general consensus that carbon sequestration in soils is a feasible option; its measurement on the local scale is the difficulty. It remains with the will of the Parties as to when carbon sequestration in soils will be applicable under the Clean Development Mechanism. The paper ends by examining funding options that currently are available or may become available as a result of a fully implemented Clean Development Mechanism.

## II. THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION AND ITS LINKAGE TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

At the United Nations Conference on Environment and Development (“UNCED”), the participants agreed to pursue negotiations toward a convention to combat desertification. Two years later the United Nations Convention to Combat Desertification (“CCD”) was adopted and on 17 February 2000 had 162 Parties.<sup>1</sup> Its objective is to:

combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach which is consistent with Agenda 21, with a view to achieving sustainable development in affected areas.

2. Achieving this objective will involve long-term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land, and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level.<sup>2</sup>

It is the integrational capacity of the CCD that is of importance, a capacity better understood through its definitions. The meaning of desertification in the CCD is “land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities[.]”<sup>3</sup>

“Combatting desertification” includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at: (i) prevention and/or reduction of land degradation; (ii) rehabilitation of partly degraded land; and (iii) reclamation of desertified land.<sup>4</sup>

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1 34 I.L.M. 1328 (1994); adopted 17 June 1994; entered into force 26 December 1996. See <http://www.unccd.ch/ratif/ratifications.htm>, accessed 1 April 2000. (Hereinafter all citations to the United Nations Convention to Combat Desertification (“CCD” or, when evident, “Convention”) will reference its specific articles and paragraphs.)

2 Article 2, CCD.

3 Article 1 (a), CCD.

4 Article 1 (b), CCD.

“‘Land’ means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system.”<sup>5</sup> Land degradation is defined in greater detail. It means:

reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation[.]<sup>6</sup>

Given this scope, it is not surprising that the Parties to the CCD are encouraged to coordinate diverse project activities, activities that comprehend the different influences affecting land degradation and desertification. Moreover, if they are Parties to other relevant Conventions — in particular the United Nations Framework Convention on Climate Change (“FCCC”)<sup>7</sup> and the Convention on Biological Diversity (“CBD”)<sup>8</sup> — CCD Parties are to coordinate joint programmes in conjunction with those Conventions. Joint programmes mentioned in the CCD include but are not limited to “fields of research, training, systematic observation and information collection and exchange, to the extent that such activities” help in the achievement of all relevant Conventions’ objectives.<sup>9</sup>

The financial mechanism of the CCD is the Global Mechanism (“GM”),<sup>10</sup> assigned for housing by the CCD’s first Conference of the Parties to the International Fund for Agricultural Development (“IFAD”).<sup>11</sup> The GM does not itself provide funds; instead it facilitates the finding of funds for national, sub-regional, regional and global groups by promoting multi-source funding approaches and arrangements.<sup>12</sup> The CCD is thus situated, as a result of the needs it addresses and the requirement that it work with other agencies, to coordinate funding based on linkages to the purposes of other multilateral environmental agreements.

The FCCC was itself constructed with issues of desertification in the minds of the Parties’ negotiators. The Preamble recalls “the pertinent provisions of General Assembly resolution 44/172 of 19 December 1989 on the implementation of the Plan of Action to Combat Desertification,”<sup>13</sup> a forerunner to the CCD. The Parties further recognized that “countries with . . . arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountain ecosystems are particularly vulnerable to the adverse effects of climate change”.<sup>14</sup> More significantly, under Articles 4.8 (c) and 4.8 (e), the Parties

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5 Article 1 (e), CCD.

6 Article 1 (f), CCD.

7 31 I.L.M. 849 (1992); signed 29 May 1992; entered into force 21 March 1994; as at 29 September 1999 180 Parties had ratified the Convention. (Hereinafter citations to the United Nations Framework Convention on Climate Change (“FCCC” or “Convention”) will reference its specific articles and paragraphs.)

8 31 I.L.M. 818 (1992).

9 Article 8.1, CCD.

10 Article 21, CCD.

11 See <http://www.ifad.org/gm.htm>.

12 Article 21, CCD.

13 Paragraph 12, Preamble, FCCC.

14 Paragraph 20, Preamble, FCCC.

to the FCCC are to “give full consideration to what actions are necessary . . . , including actions related to funding, insurance and the transfer of technology, to meet” the developing countries’ specific needs arising “from the adverse effects of climate change, . . . especially on: . . . (c) [c]ountries with arid and semi-arid areas . . . : [and] . . . (e) [c]ountries with areas liable to drought and desertification[.]”<sup>15</sup> A more broadly worded FCCC requirement, which could be interpreted to be effective in bringing together the more diverse activities contemplated under the CCD, is Article 4.1 (d) and (e). All Parties shall:

(d) Promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems; (e) Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods[.]<sup>16</sup>

The CCD and the FCCC are thus connected and this connection provides a conceptual basis for fulfilling compatible goals.

### III. OVERVIEW OF THE FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THE KYOTO PROTOCOL

The adoption and ratification of the FCCC and the subsequent adoption of the Kyoto Protocol<sup>17</sup> evolved because of concern “that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases” thereby “enhancing the natural greenhouse effect” resulting “in an additional warming of the Earth’s surface and atmosphere” which “may adversely affect natural ecosystems and humankind[.]”<sup>18</sup> The FCCC notes in its Preamble that the majority of greenhouse gas emissions originated in developed countries<sup>19</sup> and assigns to them, as designated in the Convention’s Annex I, the leadership role in addressing anthropogenic greenhouse gas emissions; at the same time it acknowledges that emissions from developing country Parties will grow.<sup>20</sup> The Convention’s objective is:

to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development in a sustainable manner.<sup>21</sup>

The FCCC recognizes and is guided by five principles the first being the principle of common but differentiated responsibilities which requires protection of the climate system for present

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15 Articles 4.8 (c) and 4.8 (e), FCCC.

16 Articles 4.1 (d) and 4.1 (e).

17 1/CP.3, FCCC/CP/1997/7/Add.1, 18 March 1998 (hereinafter citations will reference specific articles and paragraphs of the “KP”). See also FCCC/CP/1997/L.7/Add.1 at 37 I.L.M. 32 (1998), Subject to Technical Revision. The KP was adopted on 10 December 1997 and, as at 13 January 2000, 22 Parties had ratified it and 84 States had signed.

18 Paragraph 2, Preamble, FCCC.

19 Paragraph 3, Preamble, FCCC.

20 Paragraph 3, Preamble, and Articles 4.2 and 3.1, FCCC.

21 Article 2, FCCC.

and future generations on the basis of equity.<sup>22</sup> The second principle recognizes the developing country Parties' specific needs and special circumstances; in particular those country Parties that are highly susceptible to the adverse effects of climate change or would have to bear a disproportionate burden are to be given full consideration.<sup>23</sup> Given the scientific uncertainties that have infused negotiations involving crucial elements of the Convention, the third guiding principle, the precautionary principle, is quoted in full.

The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by interested Parties.<sup>24</sup>

The Intergovernmental Panel on Climate Change ("IPCC"), the body assigned under the Kyoto Protocol to develop "[m]ethodologies for estimating anthropogenic emissions by sources and removals by sinks"<sup>25</sup> and the body upon which the FCCC Secretariat relies for guidance, also defines the precautionary principle. It is: "[a]voiding a solution that is irreversible, because the assumptions on which the solution is based may prove incorrect, in favour of a seemingly inferior solution that can be reversed."<sup>26</sup>

The fourth guiding principle is that "[t]he Parties have a right to, and should, promote sustainable development."<sup>27</sup> The IPCC defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."<sup>28</sup> Finally, the Parties are to cooperate to promote a system that will lead to sustainable economic growth and development, particularly for developing country Parties, and the Parties are prevented from using measures to mitigate climate change as a means to discriminate against fair trade practices.<sup>29</sup>

The FCCC also defines terms important to this discussion. Greenhouse gases are "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation."<sup>30</sup> "Emissions" means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time."<sup>31</sup>

"Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and

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22 Paragraph 6, Preamble, and Article 3.1, FCCC.

23 Article 3.2, FCCC.

24 Article 3.3, FCCC.

25 Article 5.2, KP.

26 Glossary, <http://www.ipcc/>, at p. 29.

27 Article 3.4, FCCC.

28 *Supra*, note 26, at p. 37.

29 Article 3.5, FCCC.

30 Article 1.5, FCCC.

31 Article 1.4, FCCC.

which is in addition to natural climate variability observed over comparable time periods.<sup>32</sup>

“Adverse effects of climate change” means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.<sup>33</sup>

“‘Source’ means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.”<sup>34</sup> “‘Reservoir’ means a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored.”<sup>35</sup> “‘Climate system’ means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.”<sup>36</sup> “‘Sink’ means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.”<sup>37</sup> Thus carbon sources can be said to give up carbon to another reservoir, and carbon sinks can be said to take up carbon from the atmospheric reservoir.<sup>38</sup> As to sinks and reservoirs, the FCCC’s Preamble recognizes their importance “in terrestrial and marine ecosystems”.<sup>39</sup>

Because of their emissions levels and based on their leadership role, developed country Parties and other Parties in Annex I were to aim to return to their “1990 levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol.”<sup>40</sup> In order to achieve that aim, Annex I Parties are to “adopt national policies and take corresponding measures on the mitigation of climate change, by limiting [their] anthropogenic emissions of greenhouse gases and protecting and enhancing [their] greenhouse sinks and reservoirs.”<sup>41</sup> Annex I Parties were permitted to “implement these policies and measures jointly with other Parties,” a practice referred to in the context of the FCCC as joint implementation.<sup>42</sup> However, based on a decision that the language of Article 4.2 (a) and (b) was inadequate,<sup>43</sup> in effect that the provisions did not give sufficient direction regarding means to achieve the aim, the Parties adopted the Kyoto Protocol (“KP”).

The KP established legally binding quantified emission limitation and reduction commitments (“QELRCs”) for Annex I Parties. The QELRCs are based on assigned amounts (“AAs”) and are to be met during the first commitment period, 2008-2012, with later AAs and commitment periods to be named.<sup>44</sup> The AA is the quantity of greenhouse gas emissions that an Annex I

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32 Article 1.2, FCCC.

33 Article 1.1, FCCC. *See also* Article 3.3, FCCC, *supra*, note 24 and accompanying text.

34 Article 1.9, FCCC.

35 Article 1.7, FCCC.

36 Article 1.3, FCCC.

37 Article 1.8, FCCC.

38 Anne Hambleton, “An Annotated Glossary of Commonly Used Climate Change Terms, The Clean Development Mechanism Draft Working Paper,” CSDA Reports and Publication, *citing* A World Bank Policy Paper: The Forest Sector, The World Bank, Washington, D.C. 1991, at <http://www.csdanet.org/glossary.html>, accessed 7 November 1999, at p. 12.

39 Paragraph 4, Preamble, FCCC.

40 Article 4.2 (b), FCCC.

41 Articles 4.2 (a) and (b) and 12.2, FCCC (generally referred to as policies and measures).

42 Article 4.2 (b).

43 Pursuant to 4.2 (d), FCCC.

44 Articles 3.1 and 3.7 and Annex B, KP.

Party may release, or the quantified national emission limit; it is equal to the percentage assigned to a Party listed in Annex B and is based on 1990 or, if applicable, another year's aggregate carbon dioxide equivalent greenhouse gas emissions. The QELRCs were set with a view to reducing overall anthropogenic emissions of greenhouse gases to at least 5 percent below 1990 levels in the first commitment period.<sup>45</sup>

The KP identified six greenhouse gases, four of which are carbon compounds: carbon dioxide, methane, hydrofluorocarbons and perfluorocarbons, as well as nitrous oxide and sulphur hexafluoride.<sup>46</sup> Carbon compounds, in particular carbon dioxide, constitute the greatest component of greenhouse gases. In addition the KP identified in Annex A several sectors/source categories including Energy, Industrial Processes, Solvent and other product use, Agriculture and Waste.<sup>47</sup>

The KP also created cooperative mechanisms to be employed jointly by eligible Parties, mechanisms other than domestic policies and measures to be employed to reduce greenhouse gas emissions. Article 4, written to accommodate the EU (a regional economic integration organization) and labeled the "bubble," permits two or more Parties in Annex I, which includes country Parties with economies in transition and does not include developing country Parties, to agree to fulfil jointly their commitments through aggregation of their AAs and subsequent redistribution of new amounts among the group.<sup>48</sup> Article 6 permits Annex I Parties to transfer to or acquire from each other "emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks in any sector of the economy,"<sup>49</sup> a process also referred to by some Parties as Joint Implementation.<sup>50</sup> Article 12, the Clean Development Mechanism ("CDM"), creates an opportunity for Parties not included in Annex I to work with Annex I Parties on projects which will lead to certified emission reductions that will benefit Annex I Parties' commitments.<sup>51</sup> Article 17 permits Parties in Annex B to participate in emissions trading to supplement their domestic actions.<sup>52</sup> Finally, Article 3.13 permits Annex I Parties to bank emission reductions from one commitment period to the next.<sup>53</sup> Two of these mechanisms, Article 12's CDM and Article 17's emissions trading, while their reach is currently not settled, may offer potential opportunities for use on carbon sequestration projects in achieving certified emission reductions under the CDM and emission reduction units under Article 17.

The FCCC and KP outline the roles of developed and developing country Parties, including those most vulnerable and those least developed, recognizing that special circumstances apply to developing countries and to countries with economies in transition. But for purposes of negotiating both instruments and issues yet to be resolved, various countries representing similar interests joined together in blocs to submit documents on behalf of those shared interests. Given its role as the Party with the largest share of emissions, the United States, with 36.1 percent of

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45 Article 3.1, KP.

46 Annex A, KP.

47 Annex A, KP.

48 Article 4, KP.

49 Article 6, KP.

50 See FCCC/SB/1999/8, "Synthesis of proposals by Parties on principles, modalities, rules and guidelines," 28 September 1999, comments by Parties on Mechanisms Pursuant to Articles 6, 12 and 17 of the Kyoto Protocol, at p. 7.

51 Article 12, KP.

52 Article 17, KP.

53 Article 3.13, KP.

the total greenhouse gases emitted by the Annex I Parties,<sup>54</sup> possesses the strongest voice. It shared similar interests, and grouped with Japan, Switzerland, Canada, Australia, Norway and New Zealand (“JUSSCANZ”), industrialized country Parties outside the EU, and permitted Iceland, the Republic of Korea and Mexico to attend.<sup>55</sup> As negotiations for the KP were being completed, Switzerland dropped out of JUSSCANZ and Russia and the Ukraine joined forming what became known as the Umbrella Group.<sup>56</sup> Also among the developed nations, the European Union, a Party to the FCCC, participates and though it could vote as a regional economic integration organization, it does not have a separate vote from its members.

The developing country Parties are generally represented by the Group of 77 and China (“G77 plus China”), a grouping of approximately 130 nations from diverse settings including Asia, Central and South America, the Small Island States and Africa. The G77 plus China thus includes the newly industrialized nations of Asia, the most vulnerable Parties to the FCCC, and the least developed countries. However, sub-groups, some of which are blocs of developing countries, emerged to represent more specialized and regionalized interests, those groups being the Alliance of Small Island States (“AOSIS”), representing the most vulnerable Parties; regional groups, to wit, the African Group, the Asian Group, the Latin American and Caribbean Group (“GRULAC”), the Central and Eastern Europe Group (“CEE”), and the Western Europe and Others Group (“WEOG”).<sup>57</sup> Another developing country group having impact on negotiations was OPEC which represents the oil producing country Parties. Both AOSIS and OPEC are often willing to depart from positions taken by the G77 plus China.<sup>58</sup> Other groupings of country Parties that commented at COP 5 were the Central American Group, CARICOM and VISEGRAD (representing the Czech Republic, Hungary, Poland and Slovakia).<sup>59</sup>

The Protocol will enter into force on the ninetieth day after which no fewer than 55 Parties to the FCCC, including Annex I Parties that account for at least 55 percent of the total 1990 carbon dioxide emissions, deposit instruments indicating acceptance of Party status.<sup>60</sup>

#### IV. CARBON SEQUESTRATION

##### The meaning of carbon sequestration in current literature

Carbon sequestration occurs within – is a part of – the carbon cycle. The IPCC says “carbon cycle” is “[t]he term used to describe the exchange of carbon (in various forms, e.g., as carbon dioxide) between the atmosphere, ocean, terrestrial biosphere and geological deposits,”<sup>61</sup> in

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54 FCCC/CP/1997/7/Add.1, at p. 60.

55 Glossary: Glossary of climate change acronyms and jargon, at <http://www.unfccc.de/siteinfo/glossary.html>, at p. 3.

56 MICHAEL GRUBB with Christiaan Vrolijk and Duncan Brack, *THE KYOTO PROTOCOL: A Guide and Assessment* (The Royal Institute of International Affairs Energy and Environment Programme, 1999), at p. 35 (hereinafter “Grubb”). For another list of the players see SEBASTIAN OBERTHUR and HERMANN OTT, *THE KYOTO PROTOCOL: International Climate Change Policy for the 21st Century* (Springer, 1999), at pp. 13 – 32 (hereinafter “Oberthur and Ott”).

57 See, generally, *supra*, note 55.

58 Oberthur and Ott, *supra* note 56, at p. 24.

59 See [http://193.159.251.11/cop5/pages/hls\\_video.phtml?id=](http://193.159.251.11/cop5/pages/hls_video.phtml?id=).

60 Article 25.1, KP.

61 Glossary, at <http://www.ipcc/>, at p. 5. See also IPCC Technical Paper III, “Stabilization of Atmospheric Greenhouse Gases: Physical, Biological and Socio-Economic Implications,” 1997, at p. 45.

short the exchanges between reservoirs. Another definition says “carbon cycle” connotes “the movement of carbon through the surface, interior and atmosphere of the Earth.”<sup>62</sup> Then further:

Carbon exists in atmospheric gases, in dissolved ions in the hydrosphere, and in solids as a major component of organic matter and sedimentary rocks, and is widely distributed. Inorganic exchange is mainly between the atmosphere and hydrosphere. The major movement of carbon results from photosynthesis and respiration, with exchange between the biosphere, atmosphere and hydrosphere.<sup>63</sup>

However, neither the FCCC nor the KP define carbon sequestration. Still, the potential scope of carbon sequestration can be captured in the efforts by various organizations to define it. The United States Environmental Protection Agency (“EPA”), e.g., defines carbon sequestration as “[t]he uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned.”<sup>64</sup> The Center for Sustainable Development in the Americas defines carbon sequestration as “[t]he conversion by plants, through photosynthesis, of atmospheric carbon dioxide into organic carbon compounds. Also called carbon fixation.”<sup>65</sup> The United States Department of Energy (“DOE”) answers the question, “What is Carbon Sequestration?”

Carbon sequestration can be defined as the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere. The idea is (1) to keep carbon emissions produced by human activities from reaching the atmosphere by capturing and diverting them to secure storage, or (2) to remove carbon from the atmosphere by various means and store it.<sup>66</sup>

Resources for the Future (“RFF”), referencing sinks, defines carbon sequestration as “generally refer[ring] to capturing carbon – in a carbon sink, such as the oceans, or a terrestrial sink such as forests or soils – so as to keep the carbon out of the atmosphere.”<sup>67</sup> The RFF definition of “carbon sink” relies fully, in turn, through reference, on its definition of carbon sequestration.<sup>68</sup> Further and more specifically as to soils, the United States Department of Agriculture (“USDA”) answers the question, “What is soil carbon sequestration?”

Atmospheric concentrations of carbon dioxide can be lowered either by reducing emissions or by taking carbon dioxide out of the atmosphere and storing in (sic) it (sic) terrestrial, oceanic, or freshwater aquatic ecosystems. A sink is defined as a

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62 Michael Allaby, *THE CONCISE OXFORD DICTIONARY OF ECOLOGY* (New York: Oxford University Press, 1994), p. 68.

63 *Id.*

64 EPA Global Warming Site, Glossary of Climate Change Terms, at <http://www.epa.gov/oapeoee1/globalwarming/glossary.html>, accessed 10 November 1999, at p.3.

65 *Supra*, note 38, at pp. 12-13.

66 “Carbon Sequestration: State of the Science: A Working Paper for *roadmapping* future carbon sequestration R&D,” U.S. Department of Energy Offices of Science and Fossil Energy, 1999, at p. 1-3.

67 “Glossary,” Weathervane, at <http://www.weathervane.rff.org/glossary/>, at pp. 2-3, accessed 8 November 1999. *See also* Carbon Sequestration: A Better Alternative for Climate Change?, Maryland School of Public Affairs, University of Maryland, July, 1999, at p. ix, at <http://www.puaf.umd.edu/papers/nelson/carbseq.htm> (describing a third method of reducing the total amounts of carbon dioxide as “carbon can be prevented from entering or can be removed from the earth’s atmosphere by a ‘carbon sequestration’ or ‘carbon sink’ strategy.”).

68 Glossary, *supra*, note 67.

process or an activity that removes greenhouse gas from the atmosphere. The long-term conversion of grassland and forestland to cropland (and grazing lands) has resulted in historic losses of soil carbon worldwide but there is a major potential for increasing soil carbon through restoration of degraded soils and widespread adoption of soil conservation practices.<sup>69</sup>

For the USDA, “[p]rincipal conservation strategies which sequester carbon include converting marginal lands to compatible land use systems, restoring degraded soils, and adopting best management practices.”<sup>70</sup> Soil carbon sequestration thus consists of “[s]oil conservation practices [that] not only reduce soil erosion but also increase the organic matter content of soils.”<sup>71</sup> The indications are that the United States sees soil carbon sequestration as an attractive means of reducing carbon emissions.

Besides the several spaces and areas mentioned above, i.e., trees, plants, biomass, oceans, forests, soils and fossil fuels deposits—the most stable in that it is not closely tied to photosynthesis—within which carbon sequestration occurs, others being studied include wetlands,<sup>72</sup> geologic formations<sup>73</sup> and, more broadly, terrestrial ecosystems.<sup>74</sup> Each of them presents an option for carbon sequestration. But, with the exception of fossil fuel deposits, reliable measurement of the long term storage and retention capacity of carbon proves difficult.

The agricultural soils and forestry sectors, in particular, have received much recent attention because of their potential to store and retain carbon and thus reduce or limit emissions to the atmosphere. These sectors also offer the potential for sustainable management of ecosystems; both sectors present an opportunity to prevent land degradation and desertification or to rehabilitate degraded and desertified land.<sup>75</sup> An ambitious study and summation of the science, as well as of the problems of measurement, of carbon sequestration in soils is the report from the proceedings of the St. Michaels Workshop.<sup>76</sup> The basis for convening the Workshop is summarized.

Carbon in the form of carbon dioxide (CO<sub>2</sub>) is currently accumulating in the atmosphere at the rate of about 3.4 Pg/yr (1 Pg=1 billion tonnes) as the result of fossil fuel combustion and land use change. The [IPCC] in its Second Assessment Report estimated that it may be possible, over the course of the next 50 to 100

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<sup>69</sup> “Soil Carbon Sequestration: Frequently Asked Questions,” USDA Global Change Fact Sheet, at <http://www.usda.gov/oce/gcpc/sequeste.htm>, at p.1, accessed 15 December 1999.

<sup>70</sup> *Id.*

<sup>71</sup> *Id.*

<sup>72</sup> David Wylynko, Ed., “Prairie wetlands and carbon sequestration: Assessing sinks under the Kyoto Protocol,” International Institute for Sustainable Development, September, 1999. *See also* Wetlands International – Americas, “Wetlands and Climate Change: Phase I; Feasibility Investigation on the Potential for Crediting Wetland Conservation as Carbon Sinks,” 31 March 1999.

<sup>73</sup> Rita Bajura, Director, Federal Energy Technology Center, and George Rudins, Deputy Assistant Secretary for Coal and Power Systems, “A Message to Our Stakeholders, Carbon Sequestration R&D Program Plan: FY 1999 – FY 2000,” at p. 6. *See also* Robert Socolow, Ed., “Fuels Decarbonization and Carbon Sequestration: Report of a Workshop,” at <http://www.princeton.edu/~ceesdoe/>, at p. iii.

<sup>74</sup> *Id.* at p. 8.

<sup>75</sup> *See, e.g.*, R. Lal, J. M. Kimble, R. F. Follett and C. V. Cole, *THE POTENTIAL OF U.S. CROPLAND TO SEQUESTER CARBON AND MITIGATE THE GREENHOUSE EFFECT*, CRC Press (1999) and Norman Rosenberg, *et al.*, Eds., *CARBON SEQUESTRATION IN SOILS: SCIENCE, MONITORING, AND BEYOND*, Proceeding of the St. Michaels Workshop, December 1998, Battelle Press (1999) (hereinafter “St. Michaels Workshop”).

<sup>76</sup> *Id.*

years, to remove between 40 and 80 Pg of the carbon by sequestering it in cropland soils (Cole *et al.*, 1995). Thus soil carbon sequestration on agricultural land alone might offset the effects of fossil fuel emissions and land use change for one or two decades or even longer. Additional carbon sequestration is possible in managed forest and grassland soils. Article 3.3 of the [KP] recognizes land use change and forestry (limited to afforestation, reforestation and deforestation since 1990) as valid source/sink activities that parties could use to meet greenhouse gas reduction commitments when reported in a verifiable and transparent manner. Yet managing soils for carbon sequestration was not included as a valid activity because of perceived uncertainties regarding verification of changes in carbon stocks.<sup>77</sup>

The Workshop concluded that “about 17% of the Earth’s surface has been degraded by human activity” causing the loss of approximately 20-30 Pg of soil organic carbon, an amount of carbon equal to approximately 10 years of the present rate of increase of carbon in the atmosphere.<sup>78</sup>

While the Workshop report focuses on the potential for carbon sequestration in soils, the lessons it teaches can be extrapolated to other carbon sequestration options. One of the chapter critiques mentions, however, that the Workshop’s sponsorship lacked any development-oriented organizations<sup>79</sup> and discussion of varying socioeconomic settings is limited. Yet the IPCC, when evaluating country Party communications accepts, in keeping with the principle of sustainable development, an “integrated assessment” which the IPCC defines.

A method of analysis that combines results and models from the physical, biological, economic and social sciences, and the interactions between these components, in a consistent framework, to project the consequences of climate change and the policy responses to it.<sup>80</sup>

In the Workshop report, actions meeting the FCCC’s objective are broadly identified as a simultaneous reduction of carbon dioxide release to the atmosphere and enhancement of removal from the atmosphere through different sequestration mechanisms. The actions “include enhanced CO<sub>2</sub> uptake by, and control of emissions from terrestrial ecosystems” with the two basic processes relevant to carbon sequestration being “(1) CO<sub>2</sub> input through photosynthesis, and (2) longevity of assimilated C.”<sup>81</sup>

However, the ultimate potential for terrestrial sequestration is not known because of a lack of fundamental understanding of (1) the biogeochemical mechanisms responsible for [carbon] fluxes and storage potential on the molecular, landscape,

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<sup>77</sup> *d.* at p. vii.

<sup>78</sup> William Pennell, “Working Group 3: Desertification,” in *id.*, at p. 187.

<sup>79</sup> While the St. Michaels Workshop was attended by over 100 people, it was sponsored by the Pacific Northwest National Laboratory, the Oak Ridge National Laboratory and the Council for Agricultural Science and Technology, and support was provided by the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Department of Energy, the Monsanto Company, and the National Aeronautics and Space Administration. *Id.* at p. v. Douglas Johnson, V. Haarman, Y. Li, N. Manspeizer and A. Marzouk, in their critique of, Metting, et al., *infra* note 65, at p. 74, point out the lack of development oriented organization sponsorship.

<sup>80</sup> Glossary, <http://www.ipcc/>, at p. 21.

<sup>81</sup> F. Blaine Metting, Jeffrey L. Smith and Jeffrey S. Amthor, “Science Needs and New Technology for Soil Carbon Sequestration,” St. Michaels Workshop, *supra* note 75, at p.1.

regional, and global scales, and (2) the complex genetic and physiological processes controlling key biological and ecological phenomena. Specifically, the structure and dynamics of the belowground soil component, which accounts for two-thirds of global terrestrial organic [carbon] stocks, is poorly understood.<sup>82</sup>

Norman Rosenberg further comments: “. . . lacking knowledge, . . . of the geographical distribution of any impending climate change makes it impossible to forecast specifically where, when and how much C sequestration will be affected.”<sup>83</sup> William Schlesinger more pessimistically comments:

Reacting to the potential to sequester carbon in soils, especially during the next few decades, those with greatest relevance to the Kyoto Protocol, I am perhaps less optimistic than most. Human population will increase dramatically, requiring more land to be devoted to food production and more intensive food production than we have witnessed on earth. Meanwhile, we are likely to lower the overall net primary productivity of the planet and channel an increasing fraction of the remaining productivity to our own needs, leaving less to enter the soil ecosystem for storage.<sup>84</sup>

As mentioned, a recurring concern throughout the literature on the potential for carbon sequestration in terrestrial ecosystems is the ability to monitor and verify effectively carbon sequestration. The issue of identifying a relatively precise placement of carbon in Earth's system and the verification of measurements of carbon, given the fact that the amount of carbon can fluctuate in a given area, can be said to be of high importance at this stage of the negotiations. The task involves estimates of Annex I country Parties' measurements of base year (typically 1990) stocks, of the baselines (the emissions level if there were no project) upon which project impacts will be judged, and of fluxes from and to both sinks and reservoirs. When coupled with the need to do self-monitoring, the ability to assure compliance becomes questionable.

The scope of the problem as to soils is that “[t]he level of carbon sequestration . . . eventually needs to be known at different scales of resolution: field, region, national, and global.”<sup>85</sup> But “no official internationally agreed-upon method exists to verify or monitor changes in these stocks.”<sup>86</sup> Moreover, “accurate estimates [are lacking] about the land areas involved and the rate of soil organic matter changes that might be occurring under that management.”<sup>87</sup> One critique points out, *inter alia*, that there is a need to rely on regionalized data rather than extrapolating from data obtained in the US and that the large scale of research necessary to develop regionalized models will not sufficiently be funded from traded carbon credits.<sup>88</sup>

The St. Michaels Workshop papers contain an important effort to address desertification by Lal, Hassan and Dumanski.<sup>89</sup> The Lal, *et al.*, paper concludes that there are numerous uncertainties and gaps in the knowledge base.<sup>90</sup> Still, the authors believe the potential for

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82 *Id.*

83 Norman Rosenberg, in response to the Metting, et al., in *id.*, at p. 38.

84 William Schlesinger, in response to the Metting, et al., *id.*

85 Wilfred M. Post, R. Cesar Izaurralde, Linda K. Mann and Norman Bliss, “Monitoring and Verifying Soil Organic Carbon Sequestration,” St. Michaels Workshop, in *id.*, at p. 41.

86 *Id.*

87 *Id.*

88 Johnson, et al., in *id.*, at pp. 74-75.

89 R. Lal, H. M. Hassan and J. Dumanski, “Desertification Control to Sequester C and Mitigate the Greenhouse Effect,” St. Michaels Workshop, in *id.*, at p. 83.

90 *Id.* at p. 119.

carbon sequestration may be as much as 1.4 Pg C/yr or about 40 percent “of the total amount of annual atmospheric increase in CO<sub>2</sub> concentration.”<sup>91</sup> Yet the estimates are tentative because of:

(a) scarcity of reliable data on soil properties and processes, (b) scaling up data without using the soil or pedon<sup>(92)</sup> as the basis of extrapolation, (c) difficulties of avoiding double accounting, and (d) lack of analyses to assess the economic feasibility of carbon sequestration.<sup>93</sup>

Moreover, even with improved sustainable land management there is uncertainty about the amount of carbon that can be stored in agricultural soils.<sup>94</sup>

But the positive strategy is to marry two goals: “(1) arrest land degradation, and (2) enhance food security through alleviation of drought stress.”<sup>95</sup> Means for achieving simultaneously these two goals are: “(1) enhancing water use efficiency, (2) controlling erosion and restoring degraded soils, (3) managing and enhancing soil fertility, and (4) increasing production of biofuels and fodder.”<sup>96</sup> An important contribution can be made toward these ends through the selection of appropriate plant species for drylands.

From an agricultural perspective, plants and grasses possess C3, C4 or CAM (crassulacean acid metabolism) pathways, i.e. different photosynthetic pathways that can provide advantage in given circumstances.<sup>97</sup> CO<sub>2</sub> is required for plant growth and pursuant to the CO<sub>2</sub> fertilization effect, higher concentrations of CO<sub>2</sub> in the air – enrichment of the atmosphere – enhance plant growth.<sup>98</sup> In accord with the CO<sub>2</sub> fertilization effect, C3 plants (which include cotton, soybeans, sunflowers, oats, barley, wheat, rice, sugarbeets and groundnuts) respond more to increased CO<sub>2</sub>.<sup>99</sup> Therefore increased CO<sub>2</sub> can aid in the production and increased yields of these species while contributing to carbon sequestration. Corn (*Zea mays*), sugarcane (*Saccharum officinalis*), sorghum (*Sorghum bicolor*) and sudan grass (*Sorghum sudanense*) are C4 plants that respond comparatively better than C3 plants to hotter environments; they demonstrate a higher water use efficiency (“WUE”) and use nutrients more efficiently, particularly in soils deficient in nitrogen, while at the same time fixating or sequestering carbon.<sup>100</sup> Further, plants with CAM pathways, e.g. pineapples, agave, opuntia, onions, castor, various cacti, and yucca plants, are still more adaptable to desert environments than C4 plants.<sup>101</sup> Lal, et al., report that CAM plants “lose 50

91 *Id.* at p. 117.

92 *See* Allaby, *supra* note 62 (“**pedon** A three-dimensional sampling unit of soil, with depth to the parent material and lateral dimensions great enough to allow the study of all horizon shapes and intergrades below the surface.”), at p. 294.

93 *Supra*, note 75, at p. 117.

94 *Id.*

95 *Id.* at p. 93.

96 *Id.*

97 *Id.* and Wim G. Sombroek and Rene Gommès, “The Climate Change – Agriculture Conundrum,” in Fakhri Bazzaz and Wim Sombroek, eds., *GLOBAL CLIMATE CHANGE and AGRICULTURAL PRODUCTION* (Food and Agricultural Organization and John Wiley & Sons, London: 1996), at p. 8.

98 Global Change Glossary From A Through C, Global Change Electronic Edition, at <http://globalchange.org/glossal/glossa-c.htm>, at p. 7, accessed 17 November 1999.

99 L. Hartwell Allen, Jr., and Jeff. T. Baker and Ken J. Boote, “The CO<sub>2</sub> Fertilization Effect: Higher Carbohydrate Production and Retention as Biomass and Seed Yield,” in *supra*, note 97, at p. 65 and ff., and Lal, et al., *supra* note 75, at p. 93.

100 *Id.* at 93-94.

101 *Id.*

to 100 g of water for every g of CO<sub>2</sub> gained compared to 250 to 300 g for C4 plants and 400 to 500 for C3 plants”<sup>102</sup> suggesting that for these plants an increase in CO<sub>2</sub> could increase carbon sequestration as well as crop production and yields in hot environments.

Switching to other crops could also enhance WUE.

Rather than growing common cereals (wheat, barley, sorghum) and legumes (chickpea, clovers), there are a wide range of grain crops and legumes which are adapted to drylands [citation deleted]. Some promising ones are grain amaranth, quinoa and triticale among cereals, and bambara groundnut, marama bean, tepary bean and narrow leaf lupin among legumes [citation deleted]. These plants, in addition to being efficient in water use, can improve farm income through sale of industrial material (e.g. resins, rubber, oil and fodder.)<sup>103</sup>

WUE, biomass production and income may also improve through use of “stone bunds, micro-catchment, appropriate tillage methods, improved crop rotations, and adoption of new species, applications of organic amendments, judicious use of fertilizers and especially that of [phosphorus].”<sup>104</sup> Site specific demands will govern selection of the most effective and suitable methods.<sup>105</sup>

Another strategy mentioned includes improving irrigation in order to improve biomass production.<sup>106</sup> Poor irrigation technique can “lead to waterlogging and salinization” while irrigation can be improved using the “proposed HELPFUL ... system (high frequency, efficient, low-volume, partial area, farm unit, low cost.”<sup>107</sup> Flood irrigation is criticized as “wasteful and most inefficient ... lead[ing] to severe problems of land degradation.”<sup>108</sup> In selected areas, expansion of irrigation is an option.<sup>109</sup> In any case, “the emphasis needs to be on small-scale irrigation projects involving a small farm unit.”<sup>110</sup> “Appropriate smallscale irrigation schemes may involve use of ground water, runoff storage, water harvesting techniques, micro-catchment farming, and other cost-effective and simple watershed management techniques.”<sup>111</sup> Using crops adapted to brackish water and water harvesting are also mentioned as potential opportunities to increase carbon sequestration.<sup>112</sup>

Additionally, erosion control, better soil fertility management, crop rotations, fallowing, utilizing residue mulch, and controlling soil salinity are all mentioned as contributors to increased carbon sequestration.<sup>113</sup> Given that harvesting crops limits the retention time of carbon in the plants themselves, it is important that these measures be performed in tandem with proper crop selection. The report generally concluded that “large scale application of tried-and-true land management practices such as reduced tillage; increased use of rotational crops such as alfalfa, clover and

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102 *Id.*

103 *Id.* at 95-97.

104 *Id.* at 95.

105 *Id.*

106 *Id.* at 99.

107 *Id.*

108 *Id.*

109 *Id.*

110 *Id.*

111 *Id.*

112 *Id.*

113 *Id.* at pp. 101-106.

soybeans; and ... an efficient return of animal wastes to the soil” would lead to reductions in carbon in the atmosphere.<sup>114</sup>

From a forestry perspective, the relative utility of forests as sinks increases while the forests are growing, but when forests mature they are generally unable to increase their carbon uptake. Deforestation, generally for fuel wood, increases the risks of desertification and development of drylands.<sup>115</sup> Therefore afforestation using selected species with associated grass cover is a helpful strategy in protecting and restoring soils while increasing carbon sequestration.<sup>116</sup>

Importantly, the chapter by Lal *et al.*, attaches an appendix that recognizes the need to integrate policies under UN conventions so as to better manage global carbon stocks and flows.<sup>117</sup> The conventions mentioned having direct impact on carbon stocks and flows are the FCCC, the CBD and the CCD.<sup>118</sup>

### **The meaning of carbon sequestration as it has developed under the FCCC**

The applicability of carbon sequestration within the contours and under the direction of the FCCC and KP has more slowly developed its potential, and its reach under those legal instruments is to be more fully elaborated by the IPCC in the summer of 2000. Carbon sequestration as a tool to limit greenhouse gas emissions is encountered in 1995 in the national communications submitted by 27 Annex I Parties wherein were enumerated more than 1000 suggested policies and measures that could be initiated to help meet the objective of the FCCC; the Ad Hoc Group on the Berlin Mandate (“AGBM”)<sup>119</sup> then synthesized the submissions and organized them within one document.<sup>120</sup> Within two sectors carbon sequestration is mentioned. “Enhance[ment of] carbon dioxide sequestration and retention in agricultural soils” is included in the AGBM list as a subcategory within the Agriculture sector.<sup>121</sup> Within the Land Use Change and Forestry (“LUCF”) sector, carbon sequestration is identified as an option under both subcategories, “[p]reserving biomass”<sup>122</sup> and “[a]fforestation and reforestation.”<sup>123</sup> And in September 1997, the FCCC’s Subsidiary Body for Implementation issued a report saying a carbon sink, under

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114 *Id.* at p. v.

115 *Id.* at pp. 106-107.

116 *Id.*

117 *Id.* at Appendix II, p. 132.

118 *Id.* at pp. 132-133.

119 The AGBM was assigned the duty of negotiating the terms of the Kyoto Protocol and dissolved with the Protocol’s adoption.

120 FCCC/AGBM/1995/6, 23 October 1995, “Strengthening the Commitments in Article 4.2(a) and (b): Policies and Measures. Synthesized list of policies and measures identified by Annex I Parties in their national communications: Note by the secretariat,” at <http://www.unfccc.de/resource/docs/1995/agbm/06.htm>, accessed 14 November 1999. *See also* Article 12.2, FCCC.

121 AGBM, *supra*, note 120, at p.18 (referring to: regulations to require improved tillage practices and soil management and other regulations requiring reduced fallow frequency; financial incentives (*e.g.*, subsidies and subsidy removal) to practice less intensive agriculture, financial support for soil management initiatives, and financial incentives to reduce fallow frequency; voluntary agreements to improve soil management; education on improved soil management practices; and research on improved soil management practices and the link between soils and greenhouse gas emissions).

122 *Id.* at p. 19 (under the heading “Information, education and training,” referring to promotion of carbon sequestration through greater use of wood products; (under “Research, development and demonstration” mention is made of research on carbon storage in wood products)).

123 *Id.* at pp. 19-20 (under “Research, development and demonstration: referring to research on methods to maximize carbon sequestration through afforestation).

what was then called the Land Use Change and Forestry sector, was meant as a site for carbon sequestration.<sup>124</sup>

However, for the purpose of reporting national inventories, the IPCC developed a restrictive definition of sequestered carbon. Article 4.1 of the FCCC requires all Parties to develop and publish, “in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of” greenhouse gases.<sup>125</sup> In 1996, the IPCC, in its *Revised Guidelines*<sup>126</sup> for the reporting of National Greenhouse Gas inventories, defined “[s]equestered carbon” as “[s]tored carbon” which means: “Carbon retained for long periods of time within non-fuel products manufactured from fuels.”<sup>127</sup> The Revised Guidelines’ Workbook explained the scope for reporting inventories of stored carbon.

Not all fuel supplied to an economy is burned for heat energy. Some is used as a raw material (or feedstock) for manufacture of products such as plastics or in a non-energy use (e.g. bitumen for road construction), without oxidation (emissions) of the carbon. This is called stored carbon, and is deducted from the carbon emissions calculation. Estimation of the stored carbon requires data for fuel use by activities using the fuel as raw material.<sup>128</sup>

As to the KP, it uses the term carbon sequestration in Article 2.1, the only place in both the FCCC and KP where the term is specifically mentioned, as follows:

Each Party included in Annex I in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:

- (a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:
  - .....
  - (ii) Protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation;
  - (iii) Promotion of sustainable forms of agriculture in light of climate change considerations;
  - (iv) Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon sequestration technologies and of advanced and innovative environmentally sound technologies[.]<sup>129</sup>

In the context of removals by sinks, the Protocol in Articles 3.3 and 3.4 addresses the potential for Annex I Parties to rely on carbon sequestration. Article 3.3 states:

124 FCCC/SBI/1997/19, 30 September 1997, at p. 20.

125 Article 4.1, FCCC.

126 Preface, 1996 IPCC *Revised Guidelines*, at p. 1 (The 1996 *Revised Guidelines* are intended to assist all FCCC Parties in implementing two objectives: development, periodic updating, publication and availability to the COP of “their national inventories of anthropogenic emissions by sources and removals by sinks, of all GHG not controlled by the Montreal Protocol”; and “to use comparable methodologies for inventories of GHG emissions and removals, to be agreed upon by the COP.”).

127 Glossary, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions*, p. 16.

128 *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*, p. 1.3.

129 Article 2.1 (a) (ii)-(iv), KP.

The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I.<sup>130</sup>

The term carbon stock is not defined in the KP though one effort suggests its scope. “Carbon stocks include carbon stored in vegetation (above and below ground), decomposing matter, soils, wood products, and carbon substituted by burning wood for energy instead of fossil fuels.”<sup>131</sup> At COP 4, the Parties adopted the following interpretation of Article 3.3.

[T]he meaning of Article 3.3 of the [KP] is as follows: the adjustment to a Party’s assigned amount shall be equal to verifiable changes in carbon stocks during the period 2008 to 2012 resulting from direct human-induced activities of afforestation, reforestation and deforestation since 1 January 1990. Where the result of this calculation is a net sink, this value shall be added to the Party’s assigned amount. Where the result of this calculation is a net emission, this value shall be subtracted from the Party’s assigned amount.<sup>132</sup>

For the second commitment period, the Conference of the Parties serving as the Meeting of the Parties (“COP/MOP”) “shall, . . . , decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and land-use change and forestry categories shall be added to, or subtracted from” the Annex I Parties’ AAs.<sup>133</sup> Thus for the second commitment period there is a broader opportunity to rely on human-induced activities in the agricultural soils sector as well as the forestry sector. The meaning of Articles 3.3 and 3.4 of the KP is currently under study by the IPCC with its final “Special Report on Land Use, Land Use Changes, and Forestry” due for plenary approval in the first week of May, 2000.<sup>134</sup>

At Buenos Aires in 1998, on recommendation of the Subsidiary Body for Scientific and Technological Advice (“SBSTA”), COP 4 clarified the scope of the LUCF category and changed its name to Land Use, Land Use Change and Forestry (“LULUCF”).<sup>135</sup> Still, in September of 1999, the SBSTA issued a draft decision on Annex I Party reporting guidelines for annual inventories in national communications mandating use of the IPCC’s 1996 *Revised Guidelines* “to estimate and report on anthropogenic emissions by sources and removals by sinks of greenhouse gases.”<sup>136</sup> This draft decision later became 3/CP.5.<sup>137</sup> Pursuant to the KP’s Article 5, paragraphs 2 and 3,<sup>138</sup> and COP direction the IPCC is presently preparing updated guidelines and definitions for use in national communications, the report to be available by the summer of 2000 for action at COP 6.

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130 Article 3.3, KP.

131 *Supra*, note 38, at p. 13, *citing* Parks et. al. An economic approach to planting trees for carbon storage. In *Economics of Carbon Sequestration in Forestry*, Roger A. Sedjo, R. Neil Sampson, and Joe Wisniewski editors. CRC Press LLC, New York, 1997.

132 9/CP.4, FCCC/CP/1998/16/Add.1, at p. 40.

133 Article 3.4, KP.

134 See <http://www.ipcc.ch/activity/master-sch.html>.

135 9/CP.4, FCCC/CP/1998/16/Add.1, 20 January 1999.

136 FCCC/SBSTA/1999/6/Add.1, at p. 5 *ff.*

137 3/CP.5, FCCC/CP/1999/6/Add.1, 17 January 2000, *citing* FCCC/CP/1999/7.

138 Article 5, paragraphs 2 and 3, KP.

Consequently, under the KP, carbon sequestration is available for use by Annex I Parties in meeting their QELRCs. The use of sinks for all Parties appears limited, in the first commitment period, to direct human-induced afforestation, reforestation and deforestation activities in meeting QELRCs. Subject to direction from the COP, additional (i.e., not limited to direct) human induced activities are to be available for application under the agricultural soils sector and for LULUCF activities for purposes of meeting the targets assigned for the second commitment period. Definitions of direct human induced, human induced, afforestation, deforestation and reforestation are yet to be elaborated.

Finally, the United States House of Representatives has introduced a non-binding Concurrent Resolution favoring carbon sequestration as a means of reducing carbon dioxide in the atmosphere demonstrating its importance in fulfilling the goals of the Kyoto Protocol.<sup>139</sup> The resolution recognizes that carbon dioxide can be removed from the atmosphere by trees through photosynthesis and stored in wood.<sup>140</sup> The resolution thus proposes that the United States “should manage its public domain national forests to maximize reduction of carbon dioxide in the atmosphere and recognize the scientific validity of carbon sequestration and sinks of trees and wood products.”<sup>141</sup>

## **Carbon sequestration and the CCD**

### ***Emerging principles under the CCD***

Both IFAD and FAO have a strong interest in and have studied the synergies between the FCCC, CBD and CCD. The CCD Secretariat in November of 1998 noted that the conventions have overlapping and linked concerns<sup>142</sup> which bring together climate change, biodiversity and desertification, a comprehensive approach recognizing that carbon infuses and informs<sup>143</sup> virtually all of nature’s structures. Desertification reduces global carbon reservoirs and sinks and thereby contributes to global warming.<sup>144</sup> The note also recognized that vegetation acts as a carbon sink because plants convert carbon dioxide into solid organic material; but when the natural biosphere reservoir is damaged, there is a greater release of carbon dioxide and potentially an impairment of sink functions.<sup>145</sup> However, the interrelationships are often complex and an action can be counter productive. For that reason, in part, the note concluded by urging a precautionary approach to conserve the entire biodiversity of an ecosystem to preserve the sink capacity of dryland vegetation.<sup>146</sup>

In September of 1999 the CCD Secretariat produced another note elaborating on the potential for collaboration and synergies among the Rio conventions.<sup>147</sup> The note explored ecological

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139 Congressional Record, 10 September 1997, at p. E1716.

140 *Id.*

141 *Id.*

142 ICCD/COP (2)/7, 17 November 1998, Note by the Secretariat, Promoting and Strengthening of Relationships with Other Relevant Conventions: Collaboration and synergies among Rio conventions for the implementation of the UNCCD.

143 *Id.* at p. 5.

144 *Id.*

145 *Id.*

146 *Id.*

147 ICCD/COP (3)/9, 28 September 1999, Note by the Secretariat, Review of Activities for the Promotion and Strengthening of Relationships with Other Relevant Conventions and Relevant International Organizations and Agencies: Collaboration and synergies among Rio conventions for the implementation of the UNCCD.

linkages and proposed a mode for implementing activities that would lead to conserving and promoting sustainable use of biodiversity, forests and wetlands, and to the mitigation of climate change through efforts to combat desertification.<sup>148</sup> It said further:

Desertification caused and expressed by loss of vegetation, deforestation and loss of topsoil and the resulting loss of soil organic carbon, exacerbates climate change. Reduction in the global carbon reservoirs and sinks is both a cause and an effect of regional and local desertification. Forests are instrumental in forestalling desertification, both directly through their effect on soil and water, and indirectly through their role in mitigating climate change and supporting biodiversity.<sup>149</sup>

The note recommended that measures should be taken to sequester carbon and conserve biodiversity, measures which, at the same time, combat desertification.<sup>150</sup> Such measures should also account for transboundary reaches, such as watersheds (which are in turn linked to airsheds), so that ecosystems, including forests, can be modified as necessary in a unitary manner. This unified approach provides a coherent framework from which to develop remedies, including increased income and production, for the benefit of developing countries.

#### ***The FAO/IFAD Collaborative Programme***

In a more practical vein, FAO and IFAD have joined together in an effort to address poverty alleviation and food security.<sup>151</sup> Through FAO's Land and Water Development Division, the programme is to implement the CCD and assist countries in tropical and subtropical regions in developing National Action Programmes on land development beginning with Latin American and Caribbean countries.<sup>152</sup> In 1994, Latin American governments adopted the Central American Alliance for Sustainable Development which in turn established the Central American Environment and Development Commission ("CCAD") to handle environmental and development issues at a sub-regional level.<sup>153</sup> CCAD subsequently requested FAO assistance in the preparation of a Carbon Sink Programme for the Central American region, the Programme to include a component to address land degradation, carbon sequestration enhancement and conservation of biodiversity through land use change and sustainable land management.<sup>154</sup> The result is a plan "to promote improved land use systems and land management practices which are expected to provide economic gains and environmental benefits to poor farmers in the Latin American and Caribbean Region."<sup>155</sup>

At its consultation in April 1999, FAO/IFAD proposed two options for reducing emissions by changing land use (IFAD/FAO, 1999).

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148 *Id.* at p. 4.

149 *Id.*

150 *Id.*

151 WORLD SOIL RESOURCES REPORTS 86, "Prevention of Land Degradation, Enhancement of Carbon Sequestration and Conservation of Biodiversity Through Land Use Change and Sustainable Management with a Focus on Latin America and the Caribbean," Proceedings of an IFAD/FAO Expert Consultation, IFAD, Rome, Italy, 15 April 1999 (Food and Agriculture Organization of the United Nations, Rome, 1999), at p. 1.

152 *Id.*

153 *Id.*

154 *Id.* at pp. 1-2.

155 *Id.* at p. 2.

The first option is to increase the sequestration potential of forests and land use mainly to compensate for the increased emission in industrialized countries from fossil energy use. The second option is to capture atmospheric carbon through photosynthesis and through calcification. By so doing both organic and inorganic carbon in the form of calcium carbonate are returned to the soil..... [T]he potential of the second option through sequestration in soil and the vegetation can be as much as the amount of carbon returned to the atmosphere every year, and estimated 3 thousand million tons but for a limited period of time (20 to 25 years).<sup>156</sup>

The objective is to develop local projects to be funded through the CDM but the challenge is implementation.<sup>157</sup> The “CDM has the potential of generating large amounts of funds into restoring soil productivity and, therefore addressing the poverty problem.”<sup>158</sup> The consultation mentions the Global Emission Management Consortium (“GEMCO”), ten US power companies willing to give credit to farmers who commit long term – twenty years – to carbon sequestration.<sup>159</sup> Since farmers would be changing their practices to internalize a global externality caused by others, they should be paid for their efforts in accord with the benefit.<sup>160</sup> However, individual efforts are likely to be too small to measure thus larger administrative units, such as watersheds, will need to be designated as the operational units.<sup>161</sup> And farmers will have to realize benefits—higher yields, more income—from the proposed changes.<sup>162</sup> Maintaining the incentive for farmers will also be a challenge and the link to administering the projects will likely need to be local governments<sup>163</sup> or the community.<sup>164</sup> One possible approach for addressing all the concerns raised by land degradation for purposes of funding under the CDM is Integrated Ecosystem Management, a holistic approach used in the context of a watershed which involves key local governments.<sup>165</sup>

Toward that end, one paper presented at the consultation suggested a methodology for assessing carbon stock and carbon sequestration potential.<sup>166</sup> Four areas of concern should be addressed: enhancement of carbon sequestration, conservation of biodiversity, prevention of land degradation, and food security and poverty alleviation.<sup>167</sup> The strategy is to treat each area as independent modules of a system later to integrate them.<sup>168</sup> Thus, first assess carbon stock and carbon sequestration potentials. Second, assess the status of biodiversity and its potential changes implicit in a land use change. Third, assess the current status of land degradation and formulate needed land management practices for the suggested land utilization type that would reverse the

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156 *Id.* at p. 4.

157 *Id.* at pp. 5, 8 and 9.

158 *Id.* at p. 5.

159 *Id.* at p. 6.

160 *Id.* at p. 9.

161 *Id.* at p. 10.

162 *Id.* at p. 11.

163 Stefano Pagiola, “The global environmental benefits of land degradation control on agricultural land,” in *id.* at pp. 74-78.

164 *Id.* at p. 10.

165 *Id.*

166 Raul Ponce-Hernandez, “Assessing the carbon stock and carbon sequestration potential of current and potential land use systems and the economic rationality of land use conversions,” in *id.* at pp. 79-94.

167 *Id.* at p. 80.

168 *Id.* at pp. 80-81.

land degradation. Fourth, simultaneously optimize the objectives including constraints for food security and minimum income through models.<sup>169</sup> After the optimization, the economic rationale can be established.<sup>170</sup>

This approach contains the elements for meeting the needs of farmers on a regional level and provides IFAD and FAO a methodology for addressing land degradation in the context of the KP. Moreover, it affords an opportunity for seeking funding through the CDM.

## V. EMISSIONS TRADING AND THE CLEAN DEVELOPMENT MECHANISM (CDM)

All of the various “flexibility” mechanisms for redistributing among all of the Parties the QELRCs that are to be met by Annex I Parties under the KP<sup>171</sup> might generally be referred to, as a whole, as joint implementation.<sup>172</sup> (This joint implementation, however, should not be confused with the joint implementation contemplated in Article 4.2 (a) of the FCCC though the KP mechanisms are an outgrowth of that FCCC provision; and it is broader than the same term used by some Parties for the Article 6 mechanism in the KP.)<sup>173</sup> The developing country Parties, as represented by the G77 plus China, have typically resisted efforts to include in both the FCCC and KP any form of joint implementation, choosing instead to focus on the need of Annex I Parties to employ domestic policies and measures to reduce their emissions and on technology transfer from the Annex I Parties to aid the developing country Parties in minimizing the expected increase in their emissions.<sup>174</sup> This attitude is captured by the comments of Ms. Allison Drayton on behalf of Guyana and the G77 plus China at COP 5: “I do not have to repeat that the challenge before developing countries is to catalyze sustainable development, while the Annex I Countries have to reign (sic) in the enormous amount of greenhouse gas emissions of the past few decades.”<sup>175</sup> AOSIS, representing those country Parties highly susceptible to the effects of rising sea levels and therefore very vulnerable, has strongly supported that G77 plus China position.<sup>176</sup> A Central American country Party, Costa Rica, on the other hand, has been participating for several years with the United States in a form of joint implementation.<sup>177</sup>

The African Group’s concerns were expressed at COP 5 by Mr. Lawrence Kesimbira-Miyingo, who urged Annex I country Parties to meet their greenhouse gas reductions primarily through domestic means and emphasized that those issues concerning Africa were capacity building, adaptation to the adverse effects of climate change, access to and support for development and transfer of clean technologies, and access to financing through the CDM and AIJ.<sup>178</sup>

At COP 5 the European Union urged that caps or a ceiling on the use of Kyoto mechanisms be implemented and further urged that the industrialized country Parties should fulfil their commitments through domestic action while at the same time recognizing the need to partner

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169 *Id.* at p. 81.

170 *Id.* at p. 93.

171 *Supra*, notes 36-40 and accompanying text.

172 *See* Grubb, *supra* note 56, at p. 88, n. 22.

173 *Id.* and accompanying text; and *supra*, note 50 and accompanying text.

174 *Id.* at p. 100, and Oberthur and Ott, *supra* note 56, at pp. 27-28.

175 [http://193.159.11/cop5/pages/hls.his\\_video.html?id=37](http://193.159.11/cop5/pages/hls.his_video.html?id=37), at p. 1, accessed 15 November 1999.

176 [http://193.159.251.11/cop5/pages/his\\_video.phtml?id=80](http://193.159.251.11/cop5/pages/his_video.phtml?id=80), accessed 15 November 1999.

177 USJI,

178 [http://193.159.251.11/cop5/pages/hls\\_video.html?id=99](http://193.159.251.11/cop5/pages/hls_video.html?id=99), accessed 15 November 1999.

with developing country Parties.<sup>179</sup> The United States, on the other hand, has consistently sought the expansion of opportunities to obtain emission credits through investment in emission limitation or reduction projects in other country Parties, in particular through emissions trading, and successfully negotiated to achieve virtually all of the flexibility that it wanted.<sup>180</sup> But far more important, the United States Senate, the body given power to ratify the KP, has affected the negotiations by passing a non-binding resolution by a vote of 95 to 0 requiring that, for the purposes of US ratification of the KP, developing country Parties must commit to emission reductions much as the Annex I Parties have.<sup>181</sup> Thus it is very possible that developing countries will have to participate more actively in reducing emissions.

### **Emissions trading Under Article 17**

Article 17 permits Annex B Parties to participate in emissions trading for purposes of fulfilling their Article 3 commitments.<sup>182</sup> From an economic perspective it is argued by some, including the United States, that emissions trading provides the most efficient use of economic resources; it can be less expensive to get someone else to do something for you than to do it yourself. Annex B Parties are thus aided in meeting their QELRCs, but “[a]ny such trading [is to] be supplemental to domestic actions for the purpose of meeting [QELRCs] under [Article 3].”<sup>183</sup> (For most practical purposes, there is little difference between the FCCC’s Annex I Parties and the KP’s Annex B Parties.<sup>184</sup>)

The goal of emissions trading under KP’s Article 17 is to achieve emission reduction units (“ERUs”) which may be acquired or transferred<sup>185</sup> and thus added to or subtracted from, respectively, the AAs of the acquiring or transferring Party.<sup>186</sup> Article 17 is not lengthy and leaves to the Conference of the Parties the duty of “defin[ing] the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading.”<sup>187</sup> At COP 4, the Buenos Aires Plan of Action established a work programme on the KP’s Article 6, 12 and 17 mechanisms.<sup>188</sup> COP 5 invited further proposals addressing those mechanisms to be submitted by 31 January 2000, and requested the subsidiary bodies thereafter to consolidate a text, including recommendations to the COP/MOP, with a view that decisions and further recommendations would be made at COP 6.<sup>189</sup>

### **The clean development mechanism**

Among developing country Parties, the CDM has engendered a strong interest tempered by caution. Arguably, more than any other KP mechanism, the CDM best integrates the five guiding principles of the FCCC.<sup>190</sup> It attempts to marry equity and emissions reduction, taking into account the need to prevent future emissions through sustainable development. Though the

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179 [http://193.159.251.11/cop5/pages/hls\\_video.html?id=99](http://193.159.251.11/cop5/pages/hls_video.html?id=99), accessed 15 November 1999.

180 Grubb, *supra* note 56, at p. 112.

181 105th Congress, 1st Session (1997), S. Res. 98.

182 Article 17, KP.

183 Article 17, KP.

184 *Cf.* Annex I, FCCC, and Annex B, KP.

185 Articles 17, 3.10 and 3.11, KP.

186 Articles 3.10 and 3.11, KP.

187 Article 17, KP.

188 7/CP.4, FCCC/CP/1998/16/Add.1, 20 January 1999, at p. 22.

189 14/CP.5, FCCC/CP/1999/6/Add.1, 17 January 2000, at p. 38.

190 *Supra*, notes 23 – 28 and accompanying text.

dominant focus of the FCCC and the KP is to reduce the emissions of the developed countries, the CDM is the only Kyoto mechanism addressed directly to the developing countries. Article 12 of the KP “defines” the CDM and states its three purposes. They are: first, “to assist country Parties not included in Annex I in achieving sustainable development”;<sup>191</sup> second, to assist country Parties not included in Annex I “in contributing to the ultimate objective of the Convention”; and third, “to assist Parties included in Annex I in achieving compliance with their [QELRCs] under Article 3”.<sup>192</sup> “Parties not included in Annex I will benefit from project activities” that result in certified emission reductions (“CERs”) which Annex I Parties may use “to contribute to compliance with part of their [QELRCs].”<sup>193</sup> “Any [CERs] which a Party acquires from another Party in accordance with ... Article 12 shall be added to the AA for the acquiring Party.”<sup>194</sup> (The CDM being directed to developing country Parties, i.e., non-Annex I and non-Annex B Parties which have no AAs, there is presently no corresponding provision under the CDM to Article 3.11, the ability to transfer under Articles 6 and 17.<sup>195</sup>)

The bases for receiving certification for the project activities undertaken are:

- (a) Voluntary participation by each Party involved;
- (b) Real, measurable, and long-term benefits related to the mitigation of climate change; and
- (c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.<sup>196</sup>

There is thus an additionality requirement to be met under the CDM, a requirement raised as a concern in the IFAD/FAO consultation.<sup>197</sup> Under the CDM the private sector may be involved<sup>198</sup> and [CERs] “obtained during the period from the year 2000 up to the beginning of the first commitment period can be used [by the Annex B Parties] to assist in achieving compliance in the first commitment period.”<sup>199</sup>

However, the extent to which carbon sequestration projects are potentially applicable under the CDM is, as Ambassador Estrada-Oyuela, Chairman of the Committee of the Whole at COP 3, has written, up to the will of the Parties.<sup>200</sup> Comparing the language of Article 6 with Article 12, the first which includes both “reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks” while the second speaks only of reduction of emissions of greenhouse gases and not of removals by sinks, and relying on his knowledge as Committee of the Whole Chairman, Ambassador Estrada-Oyuela concluded that, as presently understood, carbon sequestration projects are not included as an option under the CDM.<sup>201</sup> Farhada Yamin suggests three options for sinks in the CDM. First, “[c]onstrue the ... text literally and exclude all sinks projects”; second, “[i]nterpret Article 12 in the light of Article 3, which allows” limited

191 *Supra*, note 26 and accompanying text.

192 Article 12.2, KP.

193 Article 12.3 (a) and (b), KP.

194 Article 3.12, KP.

195 *But see supra*, note 181 and accompanying text.

196 Article 12.5, KP.

197 *Supra*, note 151, at p. 10.

198 Article 12.9, KP.

199 Article 12.10, KP.

200 Raul A. Estrada-Oyuelo, “First Approaches and Unanswered Questions, in Jose Goldemberg, Ed., ISSUES AND OPTIONS: THE CLEAN DEVELOPMENT MECHANISM, United Nations Development Programme, 1998, at p. 27.

201 *Id.*

use by Annex I Parties for the purposes of meeting their QELRCs; and third, “[d]esign a new regime for sinks that is specific to the CDM.”<sup>202</sup>

In response to the need to elaborate principles, modalities, rules and guidelines for Articles 6, 12 and 17 so as to be acted on at COP6, Parties have submitted various proposals which have pursuant to Article 12.7.<sup>205</sup> The proposal from the Chair is that either an annex to the Protocol or a rule will define functioning of Articles 6, 12 and 17.<sup>206</sup> There have been intensive efforts by developing country Parties to shape the will of the Parties to make carbon sequestration projects available under the CDM. There have also been numerous recommendations from the Parties to influence the makeup of the proposed annex or rule, some of which are mentioned below.

The G77 plus China, AOSIS and India argue that an operationalized CDM should contain a strong commitment to the principle of equity and the G77 plus China has urged that equitable developmental rights and balanced regional activity should be the goal.<sup>207</sup> Australia, Canada, Iceland, Japan, New Zealand, Norway, the Russian Federation, Ukraine and the United States believe Article 6 and CDM projects should provide for enhancement of removals by sinks.<sup>208</sup> AOSIS urges that local and national needs and priorities should be taken into account when selecting projects.<sup>209</sup> The G77 plus China has argued that projects meant to enhance anthropogenic and non-anthropogenic removals by sinks should not be eligible for CDM funding until the outcome of the methodological work on Articles 3.3 and 3.4 is resolved.<sup>210</sup> Costa Rica and Switzerland are willing to wait until the COP/MOP decides on CDM project eligibility for removals.<sup>211</sup> More interesting was a proposal by Mexico.

CDM project activities may be embedded in broader projects which are undertaken for reasons other than climate change [citation deleted]. In such cases, emission reductions from the CDM component of the broader project shall be additional and subject to certification procedures [citation deleted].<sup>212</sup>

The major blocs all agree that the host Party should have the power to determine if a project has contributed to sustainable development, a requisite for project activity approval under the CDM.<sup>213</sup>

Two options were presented for determining project baselines. Costa Rica and the G77 plus China urge they should be set on a project-by-project basis.<sup>214</sup> Others – Sierra Leone and South Africa – argue that they should be established at national levels per national communications.<sup>215</sup> Farhada Yamin has suggested there is no right or wrong baseline, only the

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202 Farhada Yamin, “Operational and Institutional Challenges,” in *id.*, at p. 60.

203 *Supra*, note 50.

204 *Supra*, note 132.

205 Article 12.7, KP.

206 *Supra*, note 50, at p. 10.

207 *Id.* at p. 18 and FCCC/SB/2000/MISC.1, “Mechanisms Pursuant to Articles 6, 12 and 17 of the Kyoto Protocol,” 9 March 2000, at p. 43.

208 *Id.* at pp. 28 and 35.

209 *Id.* at p. 35.

210 *Id.* at pp. 35-36.

211 *Id.*

212 *Id.* at p. 36.

213 *Id.* at pp. 36-38.

214 *Id.* at p. 39.

215 *Id.*

need to agree on a common framework.<sup>216</sup> Subsequently, the group including the United States urged that project specific baselines be what would otherwise happen were the project not to go forward.<sup>217</sup> However, multi-project baselines should be performance oriented (based on emissions and/or removals) for a sector or source category for the specific geographical area and also based on what would otherwise happen were the project not to go forward.<sup>218</sup>

As to project funding, the G77 plus China urges that private and/or public entities from developed countries may be involved though India believes CDM funding should be additional to ODA, GEF and other financial commitments of developed countries.<sup>219</sup> The group including the United States suggests financing through a portfolio approach by means of a centralized market operated by the CDM executive Board.<sup>220</sup> In any event, Article 12.6 states that the CDM “shall assist in arranging funding of certified project activities as necessary.”<sup>221</sup>

It is worthy of some note that the OECD has proposed that the CERs to be received under the CDM and the ERUs to be received under Articles 6 and 17, would all become parts of assigned amounts (“PAAs”).<sup>222</sup> A study issued through UNCTAD has proposed that “verified actual reductions from CDM projects with developing countries could be incorporated into an international emissions trading scheme.”<sup>223</sup> However, China, India and Saudi Arabia strongly oppose linkage of the Articles, or fungibility, i.e., the ability to freely exchange or trade credits derived from participating under Articles 6, 12 and 17.<sup>224</sup>

It has been suggested that several types of agreements could be used to facilitate acquisition of CERs. Governments could agree among themselves either generally or for a specific project.<sup>225</sup> Concession contracts could be awarded to private sector entities.<sup>226</sup> Build, Operate and Transfer project contracts could be awarded to private sector entities.<sup>227</sup> A standardized CDM Joint Venture Agreement could be created to transfer technology and develop natural resources.<sup>228</sup> Finally, Risk Service Contracts could be employed by host countries in connection with a private sector entity.<sup>229</sup>

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216 *Supra*, note 205, at pp. 61-62.

217 FCCC/SB/2000/MISC.1, “Mechanisms Pursuant to Articles 6, 12 and 17 of the Kyoto Protocol,” 9 March 2000, at p. 13.

218 *Id.*

219 *Supra*, note 50, at p. 40.

220 *Id.*

221 Article 12.6, KP.

222 ENV/EPOC(99)18/FINAL, “International Emissions Trading Under the Kyoto Protocol,” OECD Information Paper, 27 May 1999, at p. 8.

223 Greenhouse Gas Emissions Trading: Defining the Principles, Modalities, Rules and Guidelines for Verification, Reporting & Accountability, United Nations Conference on Trade and Development, August, 1998, at p.11.

224 *Supra*, note 50, at pp. 14, 29 and 60.

225 UNU/GEIC/IAS – Global Climate Governance, “Global Climate Governance: Scenarios and Options on the Inter-Linkages between the Kyoto Protocol and other Multilateral Regimes,” at p. 31.

226 *Id.* at p. 32.

227 *Id.* at p. 33.

228 *Id.*

229 *Id.* at p. 35.

## VI. THE GLOBAL ENVIRONMENT FACILITY (GEF)

The interaction of the CCD with the GEF provides the backdrop for this section. Under the CCD, developed country Parties, giving priority to African country Parties while not neglecting others, will undertake to:

(b) promote the mobilization of adequate, timely and predictable financial resources, including new and additional funding from the Global Environment Facility of the agreed incremental costs of those activities concerning desertification that relate to its four focal areas, in conformity with the relevant provisions of the Instrument establishing the Global Environment Facility[.]<sup>230</sup>

The GEF, after a pilot phase from 1991-1994, was restructured in 1994 to operate in collaboration and partnership with the United Nations Development Programme, the United Nations Environment Programme and the World Bank.<sup>231</sup> The World Bank was named Trustee of the GEF's Trust Fund.<sup>232</sup> The GEF Council, the main governing body, consists of 32 members, 16 members from developing countries (non-recipient constituencies), 14 from developed countries and 2 from countries with economies in transition (both recipient constituencies).<sup>233</sup> Voting rights, when consensus is not reached, are distributed based on a double majority system requiring a 60 percent majority of all member countries as well as approval by donors representing at least 60 percent of contributions to the Fund.<sup>234</sup> The 18 recipient constituencies are divided 6 to Africa, 6 to the Asia and Pacific, 4 to Latin America and the Caribbean, and 2 to Central, Eastern Europe and the Former Soviet Union.<sup>235</sup> The GEF, as part of its newly assigned duties, is to operate the financial mechanisms of both the FCCC and the CBD in accord with the direction of the each Convention's COPs, and under each it is able to provide funds only to developing countries.<sup>236</sup>

The effect of the restructuring was to authorize the GEF to provide "new and additional grant and concessional funding to meet the agreed incremental costs of measures to achieve global environmental benefits" in four focal areas: "(a) climate change, (b) biological diversity, (c) international waters, and (d) ozone layer depletion."<sup>237</sup> In addition, "[t]he agreed incremental costs of activities concerning land degradation, primarily desertification and deforestation, as they relate to the four focal areas shall be eligible for funding."<sup>238</sup> Depending on the project, funding from the GEF may be entire or in conjunction with public and/or private sector partners. For example, under Article 4.3 of the FCCC:

The developed country Parties and other developed Parties in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by the developing country Parties in complying with their obligations under Article 12, paragraph 1 [national communications of inventories and activities pursuant to

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230 Article 20.2 (b), CCD.

231 Instrument for the Establishment of the Restructured Global Environment Facility, 33 I.L.M. 1273, 1278 (1994).

232 *Id.* at 1286.

233 *Id.* at 1287 and 1307.

234 *Id.* at 1291.

235 *Id.* at 1307.

236 *Id.* at 1285.

237 *Id.*

238 *Id.*

Article 4.1]. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the full incremental costs of implementing measures that are covered by paragraph 1 of [Article 4] and that are agreed between a developing country Party and the [GEF], in accordance with that Article [11]. The implementation of these commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among the developed country Parties.<sup>239</sup>

Each developed country Party and each Party included in Annex I to the FCCC was to provide its initial national communication to the Secretariat within six months of entry into force of the convention for that Party; each developing country Party had three years from entry into force of the convention to make its initial submission or, in the alternative, the timing of its initial submission could be based on the availability of finances; and the least developed country Parties could submit at their own discretion.<sup>240</sup> Many developing country Parties have not yet complied. In 1997, the GEF published, in response to a request by COP 1 that the GEF “give priority to the support of national communications,” “Operational Guidelines for Expedited Financing of Initial Communication from Non-Annex I Parties.”<sup>241</sup>

Agreed incremental funding on the other hand is funding for a portion of the project which is in excess of the project cost if it did not include the element for which GEF may fund. It has been noted that GEF’s procedures for meeting compliance requisites to obtain incremental funding – “the skewed concept of incremental costs” – make it difficult for non-Annex I countries to access GEF resources.<sup>242</sup> Additionally, at COP 5 the G77 plus China “called for ... adequate financial resources, technical assistance and capacity building” for non-Annex I Parties in order to collect data.<sup>243</sup> But the EU responded that the GEF had provided funding to most non-Annex I Parties for national communications.<sup>244</sup>

In 1996, the GEF developed an Operational Strategy structured around the four focal areas incorporating within those focal areas issues of land degradation, primarily deforestation and desertification.<sup>245</sup> The Operational Strategy regarding biological diversity recognizes that “actions to sequester carbon and minimize land degradation may offer opportunities for biodiversity conservation” and “will develop operational programmes based on ecosystems.”<sup>246</sup> As to carbon sequestration, GEF points out that “[b]iodiversity concerns cut across the GEF focal areas and cross-sectoral issues: (a) Climate change examples include programmes that increase reforestation with indigenous plant species for carbon sequestration in ecologically important areas.”<sup>247</sup>

Under the Operational Strategy for the Climate Change focal area the GEF recognized and provided a scope for the term carbon sequestration saying it “includes carbon sink protection

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239 Article 4.3, FCCC.

240 Article 12.5, FCCC.

241 GEF/C.9/Inf.5 at <http://www.gefweb.org/meetings/council9/c9inf5.htm>, accessed 13 December 1999.

242 Activities Implemented Jointly, Preliminary Report of the Regional Workshop for Eastern and Southern Africa on Clean Development Mechanism (CDM) in the Context of the Kyoto Protocol, Climate Africa Network, 13–15 July 1998, Nairobi–Kenya, at <http://www.unfccc.de/program/aij/cnadrep.html>, at pp. 5-6, accessed 13 December 1999.

243 Earth Negotiations Bulletin, Vol. 12 No. 123, 8 November 1999, at p. 4.

244 *Id.*

245 Operational Strategy, Global Environment Facility, February 1996.

246 *Id.* at pp. 15-16.

247 *Id.* at p. 26.

and enhancement and restoration measures that improve carbon storage in biomass and soils.”<sup>248</sup> It further recognized that “[c]arbon sink protection, enhancement and restoration [to] improve storage in biomass and soils [would] help to prevent or control land degradation, especially desertification and deforestation.”<sup>249</sup> However, for the initial phase it included carbon sequestration only as a factor to be considered and that only in the context of short term response measures.<sup>250</sup>

Under the International Waters focal area, perhaps the most promising for funding facilitation by the GM, the GEF recognizes that “[b]iodiversity protection and carbon sequestration have potential linkages and important roles in restoring damaged transboundary basins.”<sup>251</sup>

In 1997, the GEF established ten Operational Programmes the first four designed to address issues related to the CBD, the next three the FCCC and the last three International Waters.<sup>252</sup> The four programmes under biological diversity target four different ecosystems – arid and semi-arid ecosystems; coastal, marine and freshwater ecosystems; forest ecosystems; and mountain ecosystems.<sup>253</sup> The climate change focal area’s three programmes revolve around removing barriers to energy efficiency and energy conservation, promoting adoption of renewable energy by removing barriers and reducing implementation costs, and reducing the long-term costs of low greenhouse gas-emitting energy technologies.<sup>254</sup> The International Waters focal area’s programmes are a waterbody-based operational programme, an integrated land and water multiple focal area programme, and a contaminant-based programme.<sup>255</sup> It is in the multiple focal area programme – the integration of land and water - where there is more promising opportunity to pursue carbon sequestration funding.

In 2000, along with a new programme addressing transport (#11), the GEF proposes to add Operational Programme #12, “Integrated Ecosystem and Natural Resource Management: A comprehensive approach to promote multiple benefits of sustainable ecosystem use,”<sup>256</sup> and Operational Programme #13, “Conservation and Sustainable Use of Biological Diversity Important to Agriculture.”<sup>257</sup> Operational Programme #12 is designed to promote holistic management and comprehensive projects—projects that will incorporate “conserving and protecting biodiversity, protecting international waters, and reducing the risk of climate change”—in order to facilitate investment decisions. Operational Programme #12 recognizes and relies on the reality that “ecosystems are intrinsically linked” and promotes integrated management of natural resources.<sup>258</sup> Programme #12 “implements Council decision 13/14 concerning elements for an Operational Programme on Carbon Sequestration”<sup>259</sup> and “should be utilized for the design of strategic interventions that provide significant and justifiable co-benefits in at least two” focal areas.<sup>260</sup> Some project opportunities that are suggested include:

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248 *Id.* at p. 46.

249 *Id.* at p. 32.

250 *Id.* at p. 45.

251 *Id.* at p. 50.

252 GEF Operational Programs, Global Environment Facility, June 1997.

253 *Id.* at pp. 1-1 – 4-11.

254 *Id.* at pp. 5-1 – 7-8.

255 *Id.* at pp. 8-1 – 10-8.

256 Draft Operational Program #12, Global Environment Facility, January 13, 2000.

257 Draft Operational Program #13, Global Environment Facility, GEF/C.15/Inf., May 9-11, 2000.

258 *Id.* at p. 1.

259 *Id.* at p. 2.

260 *Id.*

(a) Integrated approaches towards the rehabilitation of degraded ecosystems; particularly forests, wet and drylands, aiming to optimize ecosystem services including reducing net emissions and improving storage of greenhouse gases, enhancing water quality and storage capacity as well as restoring and improving biological diversity;

(b) Integrated “multiple use” forest management to protect watersheds[,] restore and enhance biodiversity, optimize carbon sequestration, and biomass and non-timber product outputs, and reduce the risk of forest fires;

(c) Integrated management of agrobiological diversity, land, water and energy resources in agricultural production systems, including agroforestry, pastures, and shifting cultivation (e.g. zero or low impact tillage, shifts to multiple cropping featuring legumes; shifts to land races, diverse perennial and rare indigenous crop species);

(d) Integrated management of multiple ecosystems in a river basin or coastal framework including soil conservation, wetland restoration, pollution reduction, coordinated land/water use planning and integrated management of forestry, agriculture, water resources, energy (biofuel) and integration of biodiversity objectives into river basin management.<sup>261</sup>

Subject to a list of potential constraints, incremental GEF contributions, including grants if the costs are not likely to be recovered by increased revenue, may finance information, advisory and capacity building services.<sup>262</sup> Funding may also be available for demonstrations and investments in ecosystem management.<sup>263</sup> These contributions will normally be available on a contingent basis, i.e., subject to reimbursement should the projects prove economically viable.<sup>264</sup> “GEF support for globally sustainable investments will complement, not substitute for, mainstream sources of financing” and would be “expected to leverage sources of mainstream capital.”<sup>265</sup>

Operational Programme #13, developed under GEF’s role as financial mechanism for the CBD which gives the GEF authorization to provide “new and additional grant and concessional funding to meet” agreed incremental costs, plans to “help integrate global environmental concerns into existing sustainable development efforts.”<sup>266</sup> As part of the GEF’s specific concerns regarding agrobiodiversity and recognizing the cross cutting nature of the issue, Operational Programme #13 acknowledges a link to land degradation and, more remotely, carbon emissions and climate change, as follows:

The intertemporal degradation of agricultural soil resources – that is, a decline in long term productive potential – is already seriously limiting production especially in the developing world, and the problem seems to be getting worse. Degradation is also associated with off site problems of sedimentation, carbon emissions affecting climate change, reduced watershed function and changes in natural habitats leading to a loss of genetic stock and biodiversity. In response to these concerns, GEF activities in agrobiodiversity will pay special attention to addressing issues related to land degradation including rehabilitation of degraded areas.<sup>267</sup>

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261 *Id.* at pp. 5-6.

262 *Id.* at p. 4.

263 *Id.* at p. 5.

264 *Id.*

265 *Id.*

266 *Supra*, note 257, at pp. 1-2.

267 *Id.* at p. 10.

The GEF thus proposes to expand on its efforts to fund measures to protect arid and semi-arid ecosystems, coastal, marine and freshwater ecosystems, forest ecosystems and mountain ecosystems.<sup>268</sup>

With respect to the GEF's role as financial mechanism for the FCCC, in 1996 the COP expressed concern that developing countries were having difficulties receiving necessary financial assistance due to the GEF's procedural arrangements, in particular for the preparation of national communications.<sup>269</sup> Until 1998 the financial mechanism was reviewed by each COP but, as part of the Buenos Aires Plan of Action adopted at COP 4, the Parties decided that the GEF "shall be an entity entrusted with the operation of the financial mechanism" and thereafter to review the financial mechanism every four years.<sup>270</sup>

As a result of decisions at the FCCC's COP 1, and based in part on the requirement to establish criteria for the joint implementation contemplated under the FCCC, the GEF also gained project funding experience as a result of being given responsibility, for what was intended to be a five year period, for funding a pilot phase known as Activities Implemented Jointly ("AIJ"). This funding was to be "additional to [both] the financial obligations of" Annex II Parties and the "current official development assistance flows[.]" and was available "among Annex I Parties and, on a voluntary basis, with non-Annex I Parties that so request".<sup>271</sup> Each COP thereafter reviewed the effectiveness of the AIJ pilot phase and affirmed its role in the Buenos Aires Plan of Action, recognizing that the AIJ continuation should provide the least developed and small island developing States opportunity to enhance capacity building.<sup>272</sup> In October 1999, the SBSTA and SBI issued a report analysing AIJ projects and identifying their location by region.<sup>273</sup> The report showed that of the 122 AIJ projects funded by GEF, the EITs received funding for 79, Latin American countries received funding for 29, Asian Pacific States 9, and Africa 5.<sup>274</sup> Of the five projects for which Africa received funding, 3 addressed energy efficiency and two addressed renewable energy<sup>275</sup> though none addressed any of the three categories—afforestation, agriculture, or forest preservation, reforestation or restoration—other activities for which funding was also available.

At COP 5, the Parties ended the AIJ review process and decided to continue it "beyond the end of the present decade" and also advised that "the issue of geographical imbalance, in particular the lack of projects in Africa and small island developing States, should be addressed[.]"<sup>276</sup>

The GEF has also directly addressed carbon sequestration. One of its AIJ pilot projects – the Rio Bravo Carbon Sequestration Project, a forestry project – is situated in Belize.<sup>277</sup> The purpose of the project is to combine "land acquisition and a sustainable forestry programme to achieve greenhouse gas (GHG) benefits from forest growth (i.e., carbon sequestration)"; in

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268 *Id.* at p. 12.

269 11/CP.2, FCCC/CP/15/Add.1, at p. 52.

270 3/CP.4, FCCC/CP/1998/16/Add.1, 20 January 1999, at p. 8.

271 9/CP.1, FCCC/CP/1995/7/Add.1, 6 June 1995, at p. 32, and 5/CP.1, FCCC/CP/1995/7/Add.1, 6 June 1995, at pp. 18-20.

272 6/CP.4, FCCC/CP/1998/16/Add.1, 20 January 1999, at p. 20.

273 FCCC/SB/1999/5/Add.1, 14 October 1999.

274 *Id.* at p. 8, Table 3.

275 *Id.*

276 13/CP.5, FCCC/CP/1999/6/Add.1, 17 January 2000, at p.36.

277 Rio Bravo Carbon Sequestration Pilot Project, <http://www.unfccc.de/program/aij/aijproj.htm>, accessed 3 April 2000.

accord with the GEF's approach to incremental funding it funds the aspect "that would not have occurred in absence of project activities."<sup>278</sup> The project seeks to show an "optimal balance between cost-effective carbon sequestration, economically sustainable forest yield, and environmental protection."<sup>279</sup> More broadly, the GEF issued a report on land degradation by its Scientific and Technical Advisory Panel ("STAP") in 1999 that specifically addresses issues of carbon sequestration in the context of climate change and biodiversity.<sup>280</sup> The report pointed out the weaknesses of the current generation of General Circulation Models ("GCMs") in relation to land degradation studies; the GCM is not designed to simulate accurately climate and in particular rainfall at fine or regional spatial scales.<sup>281</sup> Therefore, carbon sequestration in the context of land degradation will need proper baseline setting which should include relevant socioeconomic variables.<sup>282</sup>

In consideration of interventions aimed at sequestering CO<sub>2</sub>, initial emphasis is likely to be placed on dry and waste land rehabilitation and afforestation of suitable lands in a "grow-and-harvest" approach (in which trees are not harvested when they reach maturity). Emphasis should also be placed on the "growth-and-harvest" approach and/or the "perpetual-rotation approach where local populations grow trees and vegetation, harvest them for their use, as well as earn income from the sale of timber, pulpwoods and fuel woods to meet their livelihoods."<sup>283</sup>

The report also suggests that carbon sequestration to prevent desertification and restore degraded lands must be approached as a multi-faceted problem.<sup>284</sup> Thus, ameliorating agricultural practices will help enhance carbon sequestration, and "[s]oil improvement combined with water catchment and creation of small-scale reservoirs and irrigation systems will incur concomitant carbon storage in waters and their basins."<sup>285</sup> The report concludes in part that "[g]rowing biomass to sequester carbon (either a grow-and-store or a perpetual-rotation variant) would tend to be preferred over growing biomass for energy" in designated areas.<sup>286</sup> Thus, while incremental funding requires other sources of funding to team with GEF to obtain the GEF portion, the STAP report's approach, along with Operational Programme #12, is promising for acceptance of carbon sequestration projects that address land degradation, desertification and food security.

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278 *Id.*

279 *Id.*

280 Report of the STAP Expert Group Workshop on Land Degradation, Bologna, Italy, 14 – 16 June 1999, at GEF/C.14/Inf.15.

281 *Id.* at p. 15.

282 *Id.* at p. 17.

283 *Id.* at p. 18.

284 *Id.*

285 *Id.*

286 *Id.* at p. 22.

## VII. THE PROTOTYPE CARBON FUND

In 1999, the World Bank established and became the Trustee of a Trust Fund, the Prototype Carbon Fund (“PCF”), to provide participants an opportunity to finance projects in developing countries and in countries with economies in transition which could generate greenhouse gas emission reductions that could then be transferred to the participants thereby assisting them in meeting their obligations under the FCCC.<sup>287</sup> Both private and public sector entities are eligible to participate.<sup>288</sup> Participation agreements were not to be entered into prior to November 15, 1999 with initial or First Closing of the Fund to occur on February 1, 2000.<sup>289</sup> A Second Closing of the Fund may occur on February 1, 2001, or on a later date as determined by the Trustee.<sup>290</sup> The Fund may be terminated before December 31, 2012, the end of the Kyoto Protocol’s first commitment period, for several reasons including participation of contributions at USD 60 million or less as of the first closing or if the Trustee determines insufficient diversity among the participants.<sup>291</sup> The Fund is aiming for USD 100-200 million with each public sector participant contributing USD 10 million and each private sector participant contributing USD 5 million.<sup>292</sup> Each participant is entitled to one vote for each USD contributed.<sup>293</sup>

The Fund intends to finance high quality emission reductions projects, i.e., projects leading to reductions which in the Bank’s judgment are of sufficient quality that there is a strong likelihood that participants will be able to apply for and receive their shares of emission reductions under the FCCC.<sup>294</sup> Projects are to be selected which may meet the criteria of Articles 6 and 12 of the Kyoto Protocol.<sup>295</sup> Projects for emissions reduction are eligible under either Article and carbon sequestration enhancement projects are eligible under Article 6.<sup>296</sup> Article 12 carbon sequestration enhancement projects will qualify if the FCCC deems it appropriate.<sup>297</sup>

The Project Portfolio is initially to emphasize development of projects in developing countries with a major emphasis on renewable energy technology such as geothermal, wind, solar and hydro energy.<sup>298</sup> A project shall receive an investment of no more than 10 percent and no less than 2 percent of the Fund’s assets.<sup>299</sup> No more than 20 percent of the Fund’s assets are to be invested in projects in the same country; no more than approximately 25 percent of the Fund’s assets are to be invested in projects using the same technology; and, importantly, no more than 10 percent of the Fund’s assets are to be invested in land use sector projects.<sup>300</sup>

Project selection criteria include consistency with the FCCC and/or KP; consistency with relevant national criteria; consistency with the IBRD’s country assistance strategy; and,

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287 International Bank for Reconstruction and Development, Resolution No. 99-1, Authorizing Establishment of the Prototype Carbon Fund.

288 *Id.* at Annex I, p. 8.

289 *Id.* at Annex I, pp. 3 and 7.

290 *Id.* at Annex I, p. 6.

291 *Id.* at Annex I, p. 27.

292 *Id.* at Annex I, p. 8.

293 *Id.* at Annex I, p. 10.

294 *Id.* at Annex I, pp. 4 and 7.

295 *Id.* at Annex I, pp. 2 and 30.

296 *Id.* at p. 3.

297 *Id.*

298 *Id.* at Annex I, p. 31.

299 *Id.*

300 *Id.* at Annex I, pp. 31-32.

importantly, complementarity and not competition with the GEF with review of and assurance by GEF of each project before funding and implementation to assure that GEF will not fund the project.<sup>301</sup>

Thus, presently, the PCF is far more likely to fund renewable energy projects than land use projects and, because of the uncertainty regarding how Article 12 CDM projects will be certified, the PCF relies on the approval of the FCCC for such projects to qualify for CERs under the CDM.

## VIII. CONCLUSION

Carbon sequestration in forests is a viable option under the Kyoto Protocol; for soils it may not be available until the second commitment period. But virtually all studies agree that the ability to measure its effects remains uncertain. However, using suggested methodologies and relying on the principle of sustainable development, the inability to measure with desired precision need not deter its use.

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301 *Id.* at Annex I, pp. 30-31.

APPENDIX

LIST OF ACRONYMS AND SELECTIVE GLOSSARY

AA – The Assigned Amount is the quantity of greenhouse gas emissions that a developed country Party, listed in Annex I of the Framework Convention on Climate Change, may release. Developing country Parties do not have assigned amounts.

AGBM – The Ad Hoc Group on the Berlin Mandate served as the negotiating body for the Kyoto Protocol and dissolved in late November, 1997.

AIJ – Activities Implemented Jointly are activities overseen by the Global Environment Facility under the auspices of the Framework Convention on Climate Change Secretariat. Some of these activities have facets that affect carbon sequestration to one degree or another.

AOSIS – The Alliance of Small Island States is a bloc of country Parties that are considered most vulnerable to the effects of climate change because of its anticipated impact on raising sea levels.

C - carbon

C3 – is a photosynthetic pathway for plants such as cotton, soybeans, sunflowers, oats, barley, wheat, sugarbeets and peanuts that responds more to the carbon fertilization effect—when there are higher concentrations of CO<sub>2</sub> in the air, plant growth is enhanced.

C4 – is a photosynthetic pathway for plants such as corn, sugarcane, sorghum, and sudan grass that responds better than C3 plants to hotter environments demonstrating a higher water use efficiency (WUE).

CAM – is the crassulacean acid metabolism pathway for plants such as pineapples, agave, opuntia, onions, castor, various cacti and yucca plants which has higher water use efficiency than C4 plants.

CARICOM - the Caribbean Community

CBD – The Convention on Biological Diversity is a multilateral environmental agreement addressing the conservation of biological diversity,

CCAD – The Central American Environment and Development Commission requested FAO to develop a carbon sink programme.

CCD – The United Nations Convention to Combat Desertification is a multilateral environmental agreement that addresses land degradation and desertification in an effort to prevent them and restore the lands to productivity.

CDM – The Clean Development Mechanism is based on sustainable development and is the only flexibility mechanism in the Kyoto Protocol specifically directed to the needs of developing countries.

CEE – Central and Eastern European Group

CER – A Certified Emission Reduction will be earned by a developed country Party in Annex B to the Kyoto Protocol as a result of teaming with a developed country Party in a project activity that is certified under the Clean Development Mechanism.

CO<sub>2</sub> - carbon dioxide

COP – Conference of the Parties

COP/MOP – Conference of the Parties serving as the Meeting of the Parties

DOE – The United States Department of Energy is actively examining carbon sequestration in its many forms as an option for meeting the United States' reductions in greenhouse gas emissions.

EIT – Generally, a country newly independent of the former Soviet Union and with an Economy in Transition.

EPA – United States Environmental Protection Agency

ERU – An Emission Reduction Unit is created as a result of Parties participating in “joint implementation” and emissions trading under Articles 6 and 17, respectively, of the Kyoto Protocol.

EU – European Union

FAO – Food and Agriculture Organization of the United Nations

FCCC – United Nations Framework Convention on Climate Change

GCM – General Circulation Model

GEF – The Global Environment Facility is the financial mechanism for both the Framework Convention on Climate Change and the Convention on Biological Diversity. It provides full funding for some projects but for most projects it provides incremental funding, funding for the cost of the aspect of the project which is in excess of the project cost if it did not include the aspect for which the GEF may fund.

GEMCO – Global Emission Management Consortium

GHG – “Greenhouse Gases” is defined in the Framework Convention on Climate Change as “those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.” The Kyoto Protocol identifies six GHGs, four of which are carbon compounds: carbon dioxide, the most abundant; methane; hydrofluorocarbons; perfluorocarbons; nitrous oxide; and sulphur hexafluoride.

GM – The Global Mechanism is the Convention to Combat Desertification’s funding mechanism and is housed in the International Fund for Agricultural Development. It facilitates funding for projects that prevent land degradation and desertification and that restore degraded and desertified lands.

GRULAC – The Latin America and Caribbean Group is a bloc of countries that joined together to influence decisions of the Conference of the Parties.

G77 plus China – The Group of 77 plus China is a group of developing countries that speaks with one voice at meetings of the Framework Convention on Climate Change. However, there are other smaller groups of developing countries that represent regionalized and/or specialized interests.

IFAD – International Fund for Agricultural Development

IBRD – International Bank for Reconstruction and Development, the World Bank.

IPCC – Intergovernmental Panel on Climate Change

JUSSCANZ – A group of largely non-European industrialized countries that negotiated as a bloc leading up to the adoption of the Kyoto Protocol, including Japan, the United States, Switzerland, Canada, Australia, Norway and New Zealand, with Mexico, Iceland and the Republic of Korea permitted to attend. Thereafter Switzerland dropped out and the Russian Federation and the Ukraine joined creating the Umbrella Group.

KP – the Kyoto Protocol to the Framework Convention on Climate Change

LUCF – Land Use Change and Forestry is the term used in the Kyoto Protocol’s Article 3.3 which allows net accounting of emissions by sources and removals by sinks to direct, human-induced LUCF activities but limits them to afforestation, reforestation and deforestation.

LULUCF – Land Use, Land Use Change and Forestry is the term adopted in 1998 that replaces LUCF.

ODA - Official Development Assistance

OECD - Organization for Economic Cooperation and Development

OPEC – Organization of Petroleum Exporting Countries

PAA – The Organization for Economic Cooperation and Development has suggested that certified emission reductions and emission reduction units become Part of an Assigned Amount.

PCF – The World Bank’s Prototype Carbon Fund was established to finance emission reduction projects and it permits no more than ten percent of its total assets to be invested in land use projects.

QELRC – A Quantified Emission Limitation and Reduction Commitment is the commitment to be met by an Annex B Party assigned as a percentage of a base year, typically 1990.

RFF – Resources for the Future

SBI – The Framework Convention on Climate Change’s Subsidiary Body for Implementation

SBSTA – The Framework Convention on Climate Change’s Subsidiary Body for Scientific and Technical Advice

STAP – The Global Environment Facility’s Scientific and Technical Advisory Panel which has endorsed the use of carbon sequestration and suggests that dry and waste land rehabilitation and afforestation are likely suitable projects to initiate interventions aiming to sequester carbon.

Umbrella Group – A group of countries including Japan, the United States, Canada, Australia, Norway, New Zealand, the Russian Federation and Ukraine, that have joined together to negotiate and influence decisions made by the Conferences of the Parties. Iceland has joined with this group in making some submissions.

UNCED - United Nations Conference on Environment and Development

UNCTAD – United Nations Commission on Trade and Development

USDA – The United States Department of Agriculture has expressed a strong interest in soil carbon sequestration as a means of meeting the United States’ commitments under the Convention on Climate Change.

WISEGRAD – the Czech Republic, Hungary, Poland and Slovakia.

WEOG – Western Europe and Others Group

WUE – Water Use Efficiency. See C3, C4 and CAM.