

SINKS AND THE CLIMATE CHANGE REGIME: THE STATE OF PLAY

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I. INTRODUCTION

The sequestration of carbon by ecosystems, particularly terrestrial environments, has been the subject of much discussion since 1990, when the method was first recognized as a way to combat climate change. Since that point, ferocious debate has surrounded the evolving proposals, eventually leading to the collapse of one of the Conference of the Parties (COP) to the Framework Convention on Climate Change (FCCC), and the United States walking out on the Kyoto regime. This article intends to show why this collapse occurred, discuss the bewildering array of concerns over carbon sinks, and reflect on the current state of play with regard to the sink question in the overall climate regime.

II. THE POSSIBILITIES OF SINKS

It is possible to sequester (suck up) carbon from the atmosphere and store it in “reservoirs.” A “reservoir” is a component of a climate system where a greenhouse gas or a precursor of a greenhouse gas may be stored.¹ The term “sink” is used to describe the process, activity or mechanism that removes a greenhouse gas, aerosol, or precursor of a greenhouse gas from the atmosphere.² Theoretically, sinks may either be oceanic or terrestrial in nature. The following sections describe these processes and explain their importance to the global climate change debate.

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1. United Nations Framework Convention on Climate Change, May 9, 1992, art. 1, def. 7, 31 I.L.M. 849, 853 available at <http://unfccc.int/resource/docs/convkp/conveng.pdf> [hereinafter U.N. FCCC]

2. U.N. FCCC, *supra* note 1, art. 1, def. 8.

A. *Sequestration in the Ocean*

It is hypothesized that huge growths of plankton formed in the oceans 55 million years ago shortly after massive volcanic eruptions flooded the atmosphere with carbon dioxide. Arguably, this plankton played a key role in removing carbon dioxide from the atmosphere and helping the Earth return to a more hospitable temperature. Moreover, contemporary studies suggest that the phytoplankton may currently be incorporating 45-50 billion metric tons of inorganic carbon into their cells every year.³ This possibility has caused a number of scientists to suggest that plankton populations should be increased.⁴ It has been shown that adding iron to the ocean can make plankton bloom temporarily.⁵ This bloom may accelerate the reduction of carbon dioxide buildup in the atmosphere; the microscopic organisms suck up dissolved carbon dioxide from the water, which in turn is replaced by carbon dioxide from the air.⁶ As plankton die and settle on the ocean floor, their cells decompose and carbon is locked up in the seabed, and is thereby removed from circulation.⁷ This cycle causes the ocean to act as a carbon sink. In theory, adding one ton of iron to the ocean could lead to a bloom of plankton that could absorb up to 10,000 tons of carbon from the atmosphere.⁸ Such possibilities also suggest that “seeding the ocean” could be a relatively cheap option for reducing carbon dioxide buildup as compared to other reduction strategies.⁹

Despite these possibilities, the limitations of this approach have become apparent. There was originally “considerable quantitative uncertainty” in this area, and it has now been shown that massive amounts of seeding would be required to make relatively small reductions in carbon dioxide build-up.¹⁰ Further, dumping extra iron into

3. Paul G. Falkowski, *The Ocean's Invisible Forest*, 287 SCI. AM. 54 (2002) (providing figures that were mathematical estimates based on satellite images of chlorophyll); Fred Pearce, *Cooling Off*, NEW SCI., Sept. 16, 2000, at 10.

4. See Nolan Fell, *Can Algae Cool The Planet?*, NEW SCI., Aug. 21, 1993, at 34, 34-37 (discussing the effect of algae on cloud formation and the resulting effect on climate).

5. *Id.*

6. *Id.*

7. *Id.*

8. William Brown, *Flipping Oceans Could Turn Up The Heat*, NEW SCI., Aug. 25, 1990, at 21.

9. It is estimated that this process would cost between \$5 to 15 per ton of carbon dioxide captures. Pearce, *supra* note 3, at 18.

10. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [hereinafter IPCC], CLIMATE CHANGE 1994: RADIATIVE FORCING OF CLIMATE CHANGE 17 (1995).

the oceans may also disrupt ecological cycles.¹¹ In fact, seeding the oceans may actually encourage bacteria that produce methane and nitrous oxide.¹² It may also disrupt the nutrient patterns near the surface of the ocean and detrimentally affect biological activity in areas such as with fisheries.¹³ Finally, rather than causing an explosion of algae that would sequester carbon in the long term, seeding may simply give planktonic animals that feed on algae a massive free lunch in the short term.¹⁴ Due to such limitations, sequestration in the ocean has received little attention within the formal climate change regimes. Moreover, the Kyoto Protocol has limited emissions by sources and removals by sinks to land-use change and forestry activities, specifically “afforestation, reforestation and deforestation.”¹⁵ By ignoring the ocean’s impact on carbon sequestering, the Kyoto Protocol has failed to apply full carbon accounting.¹⁶

B. *Sequestration On Land*

The terrestrial uptake of carbon dioxide is vast. By the early 1980s, it became apparent that this uptake could be enhanced and possibly used to combat global warming. This argument first appeared in 1983 when the United States Environmental Protection Agency suggested that one way to significantly reduce the build-up of carbon dioxide was to plant trees,¹⁷ which could absorb an average of

11. “[Researchers] from Princeton . . . developed a complex computer model to analyse how [various] factors . . . would affect the process if 160,000 square kilometers of ocean were seeded with iron for a month. They found that 100 years later only between 2 and 11 percent of the extra carbon that was originally taken up by plankton had actually been removed from the atmosphere.” Nicola Jones, *Don’t Rely on Plankton To Save the Planet*, NEW SCI., Feb. 16, 2002, at 16.

12. Nicola Jones, *A Risk Too Far*, NEW SCI., Oct. 20, 2001, at 7. Methane and nitrous oxide are gasses that contribute to the greenhouse effect. *Id.*

13. *Bubble Trouble*, NEW SCI., Aug. 31, 2002, at 6 (discussing the postulation of some researchers that dumping CO₂ deep into the ocean will reduce the build up of gas in the atmosphere); John Gribbin, *How Plankton Change the Climate: A Technological Fix That Does Not Work*, NEW SCI., Mar. 16, 1991, at 48, 51.

14. In field experiments, scientists discovered that “iron addition does lead to a population explosion of algae, but the extra algae were rapidly gobbled up by planktonic animals. Furthermore . . . [m]ost of the iron settled out of the surface waters within three days, so it gave no long-term benefit to the algae.” Bob Holmes, *No ‘Quick Fix’ For Climate*, NEW SCI., Feb. 26, 1994, at 13.

15. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Conference of the Parties, 3d Sess., Dec. 10, 1997, art. 3(3), U.N. Doc. FCCC/CP/1997/L.7/Add.1, 37 I.L.M. 22 [hereinafter *Kyoto Protocol*] (stating that the Kyoto Protocol focuses attention only on land areas subject to ‘direct human-induced’ activities since 1990).

16. IPCC, *LAND USE, LAND USE CHANGE, AND FORESTRY 5* (2000).

17. *Id.*

750 tons of carbon annually for each square kilometer planted.¹⁸ Thus, to offset 50 years of carbon dioxide emissions from fossil fuels at the then current rate of 5 million gigatons per year, approximately 6.7 million square kilometers of sycamores would have to be planted and maintained—an area roughly equal in size to Europe.¹⁹ Calculations reporting similar figures appeared during the 1980s and 1990s.²⁰

In 1995, the Intergovernmental Panel on Climate Change (IPCC) suggested that a global reforestation program of 350 million hectares—an area slightly larger than the European Union (EU)—could sequester up to 35 billion tons of carbon in 50 years (about 6 percent of all emissions between 1998 and 2050).²¹ Later IPCC estimates suggested that improved management within a land-use and land-use change activities had the greatest potential for net carbon change in carbon stocks by 2010.²² The IPCC estimated the following changes in carbon stocks achievable through improved management in the top three areas of land use: 240 Gigatons of Carbon (Gt C) for grazing land management, 170 Gt C for forest management, and 125 Gt C for cropland management. In terms of land-use change, agro-forestry could introduce a net change of 390 Gt C. It is important to note that the vast majority of these savings will come from inclusion of developing countries.²³

The attraction of terrestrial sequestration by forests is enhanced by the financial savings this option presents—especially when pursued in developing countries. The land required for forest planting is typi-

18. *Id.*

19. Lee Torrey, *Raised Temperatures Over Greenhouse Effect*, NEW SCI., Oct. 27, 1983, at 247 (describing that by the 1990's, the Earth's atmosphere would warm up as carbon dioxide levels rise and offering the option for Greenhouse effect minimization involving sycamore trees, which grow well in temperate climates).

20. Roger Sedjo, *Forests: A Tool To Moderate Global Warming?*, ENV'T, Jan.-Feb. 1989, at 14, 16 (1989) (discussing that 465 hectares of new plantations would be needed to sequester the estimated annual increment of 2.9 million tons of free carbon). Fred Pearce, *Planting Trees for a Cooler World*, NEW SCI., Oct. 15, 1988, at 21 (citing a U.S. Dep't of Energy report estimating that "new forests covering 7 million square kilometers could absorb all the releases of carbon dioxide from the burning of fossil fuels"). Richard A. Houghton & George M. Woodwell, *Global Climate Change*, SCI. AM., Apr. 1989, at 36, 44 (arguing the reforestation of one to two million km² will result in annual storage of one billion tons of carbon). See generally Edward P. Glenn, et al., *Growing Halophytes to Remove Carbon From the Atmosphere*, ENV'T, Apr. 1992, at 40.

21. Fred Pearce, *Growing Pains*, NEW SCI., Oct. 24, 1998, at 20.

22. *Id.*

23. IPCC, *supra* note 16, at 14 (displaying in a table IPCC estimates of the potential in 2010 for net change in carbon stocks through changed land-use activities in developing countries and globally).

cally much cheaper in developing countries, and the forest crops tend to grow much quicker in the tropics.²⁴ To date, cost estimates reported for forestry mitigation options vary significantly ranging from US\$0.1 per metric ton of Carbon (t/C) to about US\$20/tC in non-tropical countries.²⁵ Thus, according to the IPCC: "Forestry options, in some circumstances, offer large potential, modest costs, low risks, and other benefits."²⁶

Once developed countries realized the clear benefits in this area that were linked to developing countries, a number of joint bilateral projects were undertaken. The first sequestration project between countries was in 1988, when an American power plant agreed to sow 52 million trees in Guatemala on farmland and other areas already deforested.²⁷ The theory was that the trees would absorb the amount of carbon dioxide that would be generated by a new power station the plant was building in the United States.²⁸ Later deals with American utilities were also brokered in Costa Rica; by 1998, Costa Rica had already sold credits for more than 200,000 tons of carbon dioxide.²⁹ In 1990, the Netherlands began considering a similar plan to offset emissions from its power stations by replanting previously harvested rainforests in South America.³⁰ In 1994, the U.S. and Russia began a joint carbon sequestration project.³¹ In 1997, Japan expressed an interest in planting forests in other countries to offset its own emissions.³² Soon after, one of Japan's largest power companies made a deal in Austra-

24. Sedjo, *supra* note 20, at 17 (estimating a cost of \$400 per hectare in Indonesia compared to an average of \$800 per hectare in the United States). Fred Pearce, *The High Cost of Carbon Dioxide*, NEW SCI., July 17, 1993, at 26.

25. IPCC, CLIMATE CHANGE 2001: MITIGATION 8 (2001) (stating cost estimates of biological mitigation in subtropical and non-tropical countries and describing the limitations of the method of financial analysis). See also IPCC, LAND USE, *supra* note 16, at 15.

26. IPCC, CLIMATE CHANGE 1995: ECONOMIC AND SOCIAL DIMENSIONS 11 (1996).

27. Pearce, *supra* note 20, at 21.

28. *Id.*

29. Pearce, *supra* note 21, at 20.

30. Peter Spinks, *Replanted Rainforest Could Offset Dutch Coal-Fired Power Stations*, NEW SCI., Apr 21, 1990, at 6.

31. 5 Y.B. INT'L ENVTL. L. 205 (1994) (Russia and the US co-directed a carbon-offset forestry project. The directors maintain that many companies should find carbon/forestation projects economically attractive).

32. Peter Hadfield, *Japan Fiddles While the World Warms*, NEW SCI., May 31, 1997, at 10 (stating "The goal will be to plant 5 million hectares of forest around the world by 2020, to absorb some of the CO₂ that Japan produces every year" and noting also that the plan would not have much of a global effect as 5 million hectares of forest are destroyed worldwide every four months).

lia to plant 40,500 hectares of trees.³³ Finally, in 1999, Norwegian forestry companies were considering planting fast growing pine and eucalyptus trees on some grassy plains in Tanzania.³⁴

III. SINKS WITHIN THE FCCC AND KYOTO PROTOCOL

Originally, as the United Nations Conference on Environment and Development (UNCED) process got underway, it was uncertain how the convention would deal with forestry issues, both with regard to tropical deforestation and its role in climate change. Initial possibilities included placing all forestry considerations relating to climate change within a separate convention³⁵ or within a specific protocol to the forthcoming climate treaty.³⁶ In addition, it was originally believed that carbon sequestration was only a 'stop-gap'/short-term measure to slow the carbon build-up while more comprehensive responses were worked out.³⁷ In the end, none of these ideas eventuated, and sinks became entrenched within the broader FCCC ambit. This provision followed G7 suggestions that the Convention should "consider all sources and sinks."³⁸ The next year the G7 reiterated the importance of sinks by again looking at "all sources and sinks for greenhouse gases" as possible solutions to carbon.³⁹ The inclusion of sinks in the FCCC was also supported by the Organization for Economic Cooperation and Development (OECD)⁴⁰ and a number of multinational corporations⁴¹ and was actively pursued by a number of key countries.

33. *Tree Trade*, NEW SCI., June 17, 2000, at 19 (Australian foresters planted trees under an agreement with a Japanese power company that hopes the agreement will allow the company to burn fossil fuels and win "carbon credits" under the Kyoto Protocol); C. Zinn, *Japan Makes Ecology Deal With Australia*, GUARDIAN WKLY., Feb 24, 2000, at 2.

34. Fred Pearce, *That Sinking Feeling*, NEW SCI., Oct. 23, 1990, at 20, 20-21.

35. 1 Y.B. INT'L ENVTL. L. 103 (1990) (At the Houston Economic Summit, the reference to convention or agreement left open the possibility of a free standing convention or a protocol to the climate change convention).

36. *Britain Seeks Global Action to Halt Global Warming*, NEW SCI., May 20, 1989, at 22 (wherein the U.S. hosted a conference on global warming to provide a strong impetus for an international convention on limiting the emissions of gases that contribute to the greenhouse effect).

37. Houghton & Woodwell, *supra* note 20, at 44 (arguing that reforestation will help to stabilize the composition of the atmosphere). See generally Sedjo, *supra* note 20.

38. G7 Summit: Houston, July 9-11, 1990: Environment, available at <http://www.library.utoronto.ca/g7/summit/1990houston/communique/environment.html> (July 11, 1990).

39. G7 Summit: London, July 15-17, 1991: Environment available at <http://www.library.utoronto.ca/g7/summit/1991london/communique/environment.html> (July 17, 1991)

40. 2 Y.B. INT'L ENVTL. L. 114 (1991) (The OECD acknowledged the world's important responsibilities in promoting sustainable development in limiting greenhouse gas emissions.)

41. Fred Pearce, *Draft Treaty Fails to Put Limits on Emissions*, NEW SCI. May 16, 1992, at

The United States in particular wanted a broad convention that did not just cover carbon dioxide emissions, but also sinks that absorb greenhouse gases.⁴² This view was initially objected to by other states arguing for a Convention that focused only on emissions, not sinks.⁴³ These states raised fears about inadequate baseline data and the specter of “replacing forests with tree farms.”⁴⁴

Despite such opposition, the FCCC included sinks within its ambit. Accordingly, the FCCC adopted a “comprehensive” policy requiring that any precautionary measure address “all relevant sources, sinks and reservoirs of greenhouse gases and adaptation”⁴⁵ As such, the FCCC was “aware of the role and importance in terrestrial and marine ecosystems of sinks and reservoirs of greenhouse gases.”⁴⁶ With this background, the FCCC requires all signatories to: “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.”⁴⁷

With specific regard to developed countries, they are obliged to commit themselves to “mitigation of climate change, by limiting their anthropogenic emissions of greenhouse gases and protecting and enhancing their greenhouse gas sinks and reservoirs.”⁴⁸ These FCCC obligations were supported by Agenda 21, which called upon to countries to “promote terrestrial and marine resource utilization and appropriate land-use practices that contribute to . . . the conservation, sustainable management and enhancement, where appropriate, of all sinks for greenhouse gases.”⁴⁹

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42. Debora MacKenzie, *Storms Cloud Gather Over Climate Talks*, NEW SCI., Sept. 21, 1991, at 5 (stating “[T]he US want[ed] to ask countries to adopt measure aimed at reducing their output of greenhouse gases and increasing the size of ‘sinks’ that absorb the gases; then seeing what happens”).

43. Debora MacKenzie, *America Creates Cold Climate For Greenhouse Talks*, NEW SCI., June 22, 1991, at 16 (noting the talks looked to end in deadlock as the US continued to reject the notion of targets for the reduction of greenhouse emissions).

44. 2 Y.B. INT’L ENVTL. L. 113 (1991).

45. U.N. FCCC, *supra* note 1, art. 3, para. 3 (discussing principles that should guide national policy in the area of climate change).

46. *Id.* pre., para. 4.

47. *Id.* art. 4, para. 1(d).

48. *Id.* art. 4, para. 2(a).

49. Agenda 21, 9.20.a.ii, available at gopher://gopher.un.org/00/conf/unced/English/a21_09.txt.

Despite this wording, the question of how far sinks could be utilized within the FCCC context remained. Developing flexibility mechanisms⁵⁰ and overall scientific uncertainties with regard to terrestrial sinks increased uncertainty.⁵¹ Nevertheless, it was agreed that the forthcoming Protocol should cover all greenhouse gases, their emissions by sources, *and* removals by sinks.⁵² Indeed, the Berlin Mandate, which set objectives for the Kyoto Protocol including specific reduction targets stated that the targets should cover “anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.”⁵³ The Kyoto Protocol further entrenched the role of sinks in the United Nations’ framework for responding to climatic change. Accordingly, parties obliged to make reductions in their greenhouse emissions faced certain requirements:

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. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.⁵⁴

In addition, these parties were to elaborate on their policies, and include the: [p]rotection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation.⁵⁵ An exception was added for countries whose land use change and forestry practices lead to disadvanta-

50. 4 Y.B. INT’L ENVTL. L. 143 (1993); Fred Pearce, *All Gas and Guesswork*, NEW SCI., July 30, 1994, at 14.

51. 8 Y.B. INT’L ENVTL. L. 177 (1997).

52. See also 6 Y.B. INT’L ENVTL. L. 229 (1995); *Report of the Ad Hoc Group On the Berlin Mandate On the Work of Its Second Session*, United Nations Framework Convention on Climate Change, Ad Hoc Group on the Berlin Mandate, 2nd Sess., Para. 51, U.N. Doc. FCCC/AAGBM/1995/7/ (1995).

53. *Report of the Conference of the Parties On Its First Session*, United Nations Framework Convention on Climate Change, Conference of the Parties, 1st Sess., pt. 2, Decision 1/CP.1, at 4, U.N. Doc. FCCC/CP/1995/7/Add.1 (1995).

54. Kyoto Protocol, *supra* note 15, art. 3(3) (referring to Annex B of the Kyoto Protocol, which delineates the quantified greenhouse gas emissions limitation ascribed to each Annex I country).

55. *Id.* art. 2 (a) (ii).

geous high point for emissions in 1990. Thus:

Those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount.⁵⁶

Each party was required to provide data establishing its level of carbon stocks in 1990 to enable an estimate to be made of future changes in its carbon stocks.⁵⁷ With regard to questions of scientific uncertainty in this area, it was stipulated that the parties were obliged to “research on, and promot[e], . . . carbon dioxide sequestration technologies.”⁵⁸

Finally, it was acknowledged that much remained to be done. Accordingly, it was agreed that in the future,

[m]odalities, 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 the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, [and] the methodological work of [the various scientific bodies].⁵⁹

IV. SINKS FOLLOWING THE COLLAPSE OF THE 6TH COP

Although the Kyoto Protocol gave a clear nod to the utilization of sinks, it was apparent that much work remained to be done in this area, and difficult, substantive decisions on the necessary modalities were deferred.⁶⁰ These decisions were not really settled until the 7th COP in 2001 following the most volatile period in the life of the climate change regime.

The conflict began with a slow build up. Indeed, although states broadly agreed to deal with sinks during the first commitment period at the 4th COP in 1998,⁶¹ the issue was largely postponed until the

56. *Id.* art. 3 (7).

57. *Id.* art. 3(4).

58. *Id.* art. 2(1)(a)(iv).

59. *Id.* art. 3(4).

60. 8 Y.B. INT'L ENVTL. L. 178 (1997); Fred Pearce, *It's a Deal, But Can it Work?*, NEW SCI., Dec. 13, 1997, at 6.

61. *Report of the Conference of the Parties on Its Fourth Session*, United Nations Framework Convention on Climate Change, Conference of the Parties, 4th Sess., pt. 2, Decision 9/CP.4, at 40, U.N. Doc. FCCC/CP/1998/16/Add.1/CP.4 (1999) [hereinafter Conference of the

IPCC special report on land use, land-use change, and forestry (LULUCF) was ready.⁶² This holding pattern was repeated at the 5th COP.⁶³ Finally, when the issue was confronted at the 6th COP at the Hague in 2000, the COP collapsed (with the United States walking out) and had to be resumed months later. The conflict was largely caused by disagreement over the role that sinks were to play in the Protocol.⁶⁴ Those who wanted a very liberal regime that would broadly include sinks in carbon accounting (primarily the United States, Australia, Russia, Japan and Canada) could not come to terms with those who wanted a very conservative regime that would strictly curtail the use of sinks.⁶⁵ The following sections describe the meeting held subsequent to this collapse and the climate change regime dealing with LULUCF that resulted.

A. Commitment Periods

At the 7th COP in 2001, it was agreed that the IPCC's methodological accounting of anthropogenic greenhouse gas emissions (those

Parties 4] (stating that sinks will be included in calculations of net changes in carbon stocks resulting from direct human-induced activities of reforestation and deforestation during the first commitment period). *Climate Change: Plan of Action Adopted*, 29 ENVTL POL'Y & L. 3 (1999), available at <http://search.epnet.com/direct.asp?an=1985468&db=afh> (describing the proceedings of the Fourth Conference of the Parties to the UN Framework Convention on Climate Change, held from November 2-13, 1998).

62. Conference of the Parties 4, *supra* note 61, Decision 9/CP.4, ¶ 3, 4, & 5, at 40-41 (agreeing to recommend to the Parties to the Kyoto Protocol a draft decision for adoption on "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" but stating that the draft decision will not be presented until the completion of the IPCC LULUCF report).

63. *Report of the Conference of the Parties on Its Fifth Session*, United Nations Framework Convention on Climate Change, Conference of the Parties, 5th Sess., pt. 2, Decision 16/CP.5, at 40, U.N. Doc. FCCC/CP/1999/6/Add.1 (2000) [hereinafter Conference of the Parties 5] (further postponing introduction of the draft decision to enable incorporation of the still forthcoming IPCC report on LULUCF).

64. Fred Pearce, *NEW SCI.*, July 28, 2001, at 13 (explaining that the issue was how much a country could offset carbon dioxide emissions with "carbon sinks" of forests and farm soils).

65. David M. Reiner, *Climate Impasse: How The Hague Negotiations Failed*, ENV'T, Mar. 2001, at 36 ("The US delegate arrived claiming they had an 'understanding' from the Kyoto Protocol talks three years ago that they could have carbon credits for doing little more than watching trees grow . . . [the European] successors in The Hague were not interested"); *Time To Come Clean*, *NEW SCI.*, Dec. 2, 2000, at 3; Pearce, *supra* note 64, at 13; *Disappointment At Meagre Progress*, 30 ENVTL POL'Y & L. 264 (2000), available at <http://search.epnet.com/direct.asp?an=3988149&db=afh>; Michael McCarthy, *Kyoto Talks Stall In Dispute Over Carbon Sinks*, INDEP. (London), July 20, 2001, at 15 (arguing the potential use of trees as carbon sinks was emerging as the principal obstacle to the Kyoto Protocol); Sarah Simpson, *Debit or Credit?*, *SCI. AM.*, Feb. 2001, at 25.

resulting directly from human-induced degradation and de-vegetation activities) should be included only in the first commitment period.⁶⁶ This result frustrated the progress of other states that advocated applying the IPCC's work to future commitment periods so that they could act with certainty in this area.⁶⁷ Thus, the second commitment period is open to review and contemporary accounting for LULUCF does *not* imply a transfer of agreement to any future commitment period.⁶⁸ Nevertheless, to assure consistency, once land is accounted for as required under Article 3, paragraphs 3 and 4, all anthropogenic greenhouse gas emissions by sources and removals by sinks occurring on that terrestrial area must be accounted for in subsequent and contiguous commitment periods.⁶⁹

B. Overall Claim Potential

Prior to the collapse of the first part of COP 6, the United States calculated that sinks could provide as much as half of its annual reduction obligations by 2010 (312 million out of the necessary 600 million ton reduction).⁷⁰ Therefore, the United States was strongly opposed to any restriction on claims of potential carbon sinks.⁷¹ However, due to scientific uncertainty in calculation of carbon sequestration by sinks, the EU rejected the U.S. position and demanded limits on how much forest sequestration could be claimed toward meeting Kyoto obligations.⁷² Although the two factions neared agreement in this area (with the U.S. offering to reduce its sink claim from 312 to 20 million tons), an accord proved too elusive and the talks collapsed.⁷³

When the COP reconvened without the United States it was agreed that for the first commitment period a Party, included in An-

66. *Report of the Conference of the Parties on Its Seventh Session*, United Nations Framework Convention on Climate Change, Conference of the Parties, pt. 2, Annex, Decision 11/CP.7, at 59, U.N. Doc. FCCC/CP/2001/13/Add.1. 21 (2002) [hereinafter Conference of the Parties 7]. Definitions, modalities, rules and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol.

67. IPCC, *supra* note 16, at 4 (providing an overview of the global magnitude of carbon stocks in terrestrial systems).

68. Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 ¶ 1 at 54.

69. *Id.* Annex Decision 11/CP.7 at 61-62.

70. *Id.*

71. *Disappointment At Meagre Progress*, 30 ENVTL POL'Y & L. 217 (2000).

72. *Hotting Up In The Hague*, ECONOMIST, Nov. 18, 2000, at 97 (describing the gathering of 5,000 at the Hague to discuss implementing the United Nations Kyoto treaty on climate change drawn up in 1997).

73. Simpson, *supra* note 65, at 25; 11 Y.B. INT'L ENVTL. L. 170 (2000).

nex I that incurred a net source of emissions under the provisions of Article 3, paragraph 3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to the greater of net emissions under the provisions of 3.3 or 9.0 MtC times five. This provision applied only to parties whose total anthropogenic greenhouse gas emissions by sources and removals by sinks in managed forests since 1990 were equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.⁷⁴ Further, for the first commitment period, any additions to or subtractions from a Party's carbon reduction obligations under the Kyoto Protocol resulting from forest management activities, could not exceed values prescribed by the COP.⁷⁵ A Party could also request reconsideration of the value prescribed to it.⁷⁶

C. "Since 1990"

The Kyoto Protocol is explicit that LULUCF is "limited to afforestation, reforestation and deforestation *since 1990*."⁷⁷ However, many forests are sustainably managed; regeneration and harvesting are continual processes. The "since 1990" starting date set forth by the Protocol will account for only those stands harvested or regenerated since 1990. The benchmark chosen will result in either net credits or net debits being falsely created. For example, a state that deforested its land before 1990 at the beginning of the first commitment period, but then reforests in the following decade would obtain wind-fall credits toward carbon reduction without ever having taken into account the emissions associated with the earlier deforestation.

74. Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 art. 3, ¶ 4 at 60.

75. *Id.* (referring to forest management activities described in Article 3 paragraph 4 of the Kyoto Protocol. The maximum addition to or subtraction from the Kyoto Protocol carbon reduction requirements could not exceed the following values times five, [values are in Mt C/yr, which may be found at FCCC/CP/2001/13/Add.1 on page 63]). Australia 0.00, Austria 0.63, Belgium 0.03, Bulgaria 0.37, Canada 12.00, Czech Republic 0.32, Denmark 0.05, Estonia 0.10, Finland 0.16, France 0.88, Germany 1.24, Greece 0.09, Hungary 0.29, Iceland 0.00, Ireland 0.05, Italy 0.18, Japan 13.00, Latvia 0.34, Liechtenstein 0.01, Lithuania 0.28, Luxembourg 0.01, Monaco 0.00, Netherlands 0.01, New Zealand 0.20, Norway 0.40, Poland 0.82, Portugal 0.22, Romania 1.10, Russian Federation 33.00 (changed from 17.65 by decision 12/CP.7), Slovakia 0.50, Slovenia 0.36, Spain 0.67, Sweden 0.58, Switzerland 0.50, Ukraine 1.11, United Kingdom 0.37. *Id.* Appendix at 63

76. Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 art. 3, ¶ 4 at 60.

77. Kyoto Protocol, *supra* note 15, art. 3(3) (emphasis added)(stating that net changes in greenhouse gas emissions by sources and removals by sinks that may be accounted for in meeting Protocol commitments must result from "direct human-induced LULUCF activities, limited to afforestation reforestation and deforestation since 1990").

Likewise, if land was reforested prior to 1990, but harvested before 2008, the state's emissions would appear to increase. This failure to account for a state's initial condition when calculating its net carbon emissions creates odd results.⁷⁸

This problem was dealt with at the 7th COP. It was agreed that carbon removals attributable to activities and practices before the reference year would be excluded.⁷⁹ In addition, debits resulting from harvesting during the first commitment period would not be greater than credits accounted for on that unit of land.⁸⁰

D. *Scientific Uncertainty*

The Kyoto Protocol was explicit that any utilization of LULUCF would require “verifiable changes in carbon stocks in each commitment period” and that associated “activities shall be reported in a transparent and verifiable manner,” reviewable in accordance with Articles 7 and 8 of the Protocol.⁸¹ Toward these goals, the Protocol stipulated that scientific bodies should develop and future COPs adopt “modalities, rules and guidelines taking into account uncertainties, transparency in reporting, verifiability, “and the work of various advisory scientific bodies.”⁸²

Despite strong scientific carbon accounting in this area, estimations of emissions and sequestration by terrestrial sinks have proven very problematic. As the IPCC noted in 1995 and reiterated in 2001⁸³ there is “considerable quantitative uncertainty” in this area.⁸⁴ Theoretically, a well-designed carbon accounting system would provide transparent, consistent, comparable, complete, accurate, verifiable,

78. IPCC, *supra* note 16, at 6-7 (describing the shortcomings of the limited inclusion of LULUCF activities in Article 3(3),(4) of the Kyoto Protocol).

79. Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 at 54.

80. *Id.* Annex Decision 11/CP.7 art. 3, ¶ 4 at 59-60.

81. Kyoto Protocol, *supra* note 15, art. 3(3).

82. *Id.* art. 4(4).

83. The degree to which terrestrial ecosystems continue to be net sinks for carbon is uncertain due to the complex interactions between the factors mentioned above (e.g., arctic terrestrial ecosystems and wetlands may act as both sources and sinks) (medium confidence). IPCC, *supra* note 25, at 11 (stating past research indicated terrestrial ecosystems appeared to be storing increasing amounts of carbon, but that the degree to which terrestrial ecosystems continue to be net sinks for carbon is uncertain because while carbon uptake by terrestrial ecosystems was thought to be due to heightened plant productivity due to elevated CO₂ concentration, increasing temperatures, and soil moisture changes, it now appears that productivity gains are smaller than what past research indicated and that terrestrial uptake may be due more to change in uses and management of land than to the direct effects of elevated CO₂ and climate).

84. IPCC, *supra* note 10, at 17.

and efficient recording and reporting of changes in carbon stocks and/or changes in greenhouse emissions from LULUCF. In fact, many of these goals can be achieved. Changes in carbon stocks and greenhouse emissions over time can be estimated using some combination of direct measurements, activity data, and models that are based on accepted principles of statistical analyses, forest inventories, remote sensing techniques, flux measurements, soil sampling and ecological surveys. However, these measures may vary in accuracy, precision, verifiability, cost and scale of application. Inconsistencies also arise due to the discontinuity in states' decisions concerning which carbon pools and sinks to count and their varied ability to distinguish between human-induced and natural changes in carbon flux.⁸⁵

The problems in this area arise from three sources. First, during the 1990s, there were no agreed criteria for accurate measurements. For example, with the Activities Implemented Jointly (AIJ) projects from the 1990s, there was no standard method for determining baselines or agreement over the level of precision that would be required when measuring and monitored.⁸⁶ Second, the capacities and abilities of even developed countries to fully measure all of their carbon stocks are limited. As of 2000, although most developed countries had the basic technical capacity to measure carbon stocks and net greenhouse emissions in terrestrial ecosystems, few if any performed all of these measurements routinely, particularly soil inventories.⁸⁷ Indeed, some developed countries may need to "significantly improve" their existing measurement systems in order to develop operational systems in this area.⁸⁸ Finally, distinguishing natural from anthropogenically caused changes in LULUCF can be very difficult. For example, much of the carbon stored in trees, related biomass and soils moves between the air and the ground both seasonally and as the result of anthropogenic sources such as forest fires or small changes in land use.⁸⁹ Difficulty in distinguishing between the two causes has implications for carbon accounting.⁹⁰ The scientific uncertainty in this

85. IPCC, *supra* note 16, at 7-9 (proposing two accounting systems that will solve several current problems in recording and reporting changes in carbon stocks to meet stated FCCC goals of transparency, consistency, comparability, completeness, accuracy, verifiability, and efficiency in reporting). *See also*, Fred Pearce, *Dead and Buried*, NEW SCI., May 12, 2001, at 19; Sedjo, *supra* note 20, at 19.

86. IPCC, *supra* note 16, at 16 (discussing generally Project-Based Activities).

87. *Id.*

88. IPCC, *supra* note 16, at 11.

89. Pearce, *supra* note 50, at 14-15.

90. Fred Pearce, *Smokescreen Exposed*, NEW SCI., Aug, 26, 2000, at 18, 18-19 (noting that,

area is so pronounced that in some cases it may be such, that in certain instances it may be “impossible, to distinguish with present scientific tools that proportion of the observed stock change that is directly human induced from that proportion that is caused by indirect and natural factors.”⁹¹

In 1998, a report suggested that the United States’ forests were sucking up 1.5 billion tons of carbon per year, just short of the country’s annual carbon emissions.⁹² However, critics of this study highlighted the many uncertainties in the sequestration assumptions (such as assumptions that all forests are operating at maximum capacity and failures to take into account the impacts of fires, pests, etc.).⁹³ These criticisms were borne out in a new study in 1999 that employed a different methodology and suggested that the forests were only sequestering about one-fifth of total U.S. emissions.⁹⁴ Similarly, in the EU as of the end of the 20th century, it was believed that carbon sequestration by forests absorbed between 120 and 280 million tons of carbon per year. This large range belies an uncertainty level in excess of 50 percent.⁹⁵

Another source of uncertainty is the potential for forests to actually produce carbon emissions. The use and promotion of forest sequestration could indirectly produce negative effects on climate change.⁹⁶ In addition to these indirect effects, there may also be direct

while forests may be “carbon sinks” today, they may “leak” carbon in the future); Pearce, *supra* note 21, at 20 (explaining that “it is inherently difficult to estimate how much CO₂ is produced or absorbed by biological activity” because of additional variables such as acid rain, different growth rates among trees, and climate); Pearce, *supra* note 50, at 14-15 (citing a variety of variables that make categorization of greenhouse gas emissions as natural or anthropogenic very difficult).

91. IPCC, *supra* note 16, at 10.

92. Gabrielle Walker, *A Perfect Excuse*, NEW SCI., Oct. 24, 1998, at 5.

93. Walker, *supra* note 92, at 5; *Fuel’s Paradise*, NEW SCI., Oct. 24, 1998, at 3 (arguing the results of the study were “riddled with uncertainties”, including reliance on “models whose assumptions are largely untested.” The study also had a large margin of error). For the problems of fires and pests generally in this area see IPCC, *supra* note 16, at 7.

94. Robert Adler, *That Sinking Feeling*, NEW SCI., July 31, 1999, at 3 (using the “top-down” approach).

95. Fred Pearce, *The Heat is On*, NEW SCI., July 14, 2001, at 18; Pearce, *supra* note 21, at 20; Fred Pearce, *Soaking it Up*, NEW SCI., Oct. 3, 1998, at 20.

96. For example, in the UK peat bogs hold the equivalent of more than 100 years of UK carbon emissions. These bogs may be vulnerable to leakage, caused by such activities as planting forests on them. Forestry practices in peat bogs may then turn these former carbon sinks into carbon sources. Fred Pearce, *Peat Bogs Hold Bulk of Britain’s Carbon*, NEW SCI., Nov. 19, 1994, at 6. Another possible negative effect is that in the far north, although they may sequester carbon, during winter they may soak up solar energy that would otherwise have been reflected by the snow-covered tundra. *Reflect on It*, NEW SCI., May 13, 2000, at 19 (discussing how the

limitations on the long-term ability of forests to effectively sequester carbon. It may be that there is a threshold temperature, at which levels of carbon sequestration begin to decline or forests reach their saturation point.⁹⁷ In addition, a warmer climate would speed up the microbial breakdown of leaf litter, releasing even more carbon dioxide into the atmosphere. In some instances, the breakdown of leaf litter and subsequent carbon emission may actually equal the carbon uptake by the trees.⁹⁸ Moreover, if warm temperatures are sustained beyond a certain point, forests (some of which are more vulnerable than others) may fail to adapt and would begin to die off.⁹⁹ In the process of decay, carbon that was previously sequestered would break down and be re-released to the atmosphere. In these ways forests could introduce dangerous positive feedbacks to global warming.¹⁰⁰ In 1995, the IPCC warned that models were projecting that a sustained increase of one degree Celsius in global mean temperature would be sufficient to cause changes in regional climates, thereby affecting the growth and regenerative capacity of forests in these regions. This result could significantly alter the composition of forests. For example, under a doubling of carbon dioxide, the resultant changes in temperature and water availability would cause a substantial fraction of existing forests to undergo major changes.¹⁰¹ However, when consider-

Kyoto Protocol calls for reforestation to slow warming, but planting trees in the far north may actually increase global warming).

97. IPCC, *supra* note 16, at 4 (discussing that absorption by existing sources is sensitive to climate change as well as to atmospheric carbon dioxide concentrations. Rising temperatures may result in something called a “feedback loop” thus turning terrestrial ecosystems, which currently operate as a carbon sink, into a net carbon source). *See generally* Peter M. Cox, et al., *Acceleration of Global Warming Due to Carbon-Cycle Feedbacks in a Coupled Climate Model*, 408 NATURE 184 (2000).

98. James Randerson, *No Easy Answer*, NEW SCI., Apr. 13, 2002, at 16 (estimating that an atmospheric warming of 5°C would invigorate soil microbes that decompose fallen leaves and negate any benefit); Simpson, *supra* note 65, at 25; Pearce, *supra* note 34, at 20-21.

99. *Trees May Fare Badly As Britain Warms*, NEW SCI., Oct. 21, 1989, at 35 (indicating the deleterious ramifications of the Greenhouse Effect on the Sitka spruce, a staple of British climate that grows in cooler, moist regions).

100. IPCC, *supra* note 26, at 6. A. White, et al., *Climate Change Impacts on Ecosystems and the Terrestrial Carbon Sink*, 9 GLOBAL ENVTL. CHANGE S21 (1999) (explaining that combined biogeochemical, biophysical and biogeological ecosystem model predicts benefits from carbon sinks to end by the year 2050); Fred Pearce, *Only Ourselves to Blame*, NEW SCI., Nov. 20, 1999, at 24 (“The world’s forests could introduce a dangerous ‘positive feedback’ to global warming, as forests that are currently absorbing carbon dioxide from the atmosphere could release it again if they succumb to heat stress”).

101. IPCC, *supra* note 26, at 5-6 (discussing predicted changes in forest composition and function at various latitudes). Pearce, *supra* note 34, at 20-21 (noting that the thermal inertia of the oceans has created a 50-year time lag so that the “extra outpouring of CO₂” from forests is not yet apparent).

ing these possibilities, it is important to note that there are very large uncertainties with regard to estimates of physiological acclimation and climatic constraints that could result beyond a few decades into the future.¹⁰²

Subsequent to the Kyoto Protocol, COP attempts to deal with these uncertainties by stressing the strong scientific support and consistent methodologies found at the 6th¹⁰³ and 7th COPs.¹⁰⁴ Scientific bodies were given specific tasks with the goal of producing more certainty in some of the LULUCF areas.¹⁰⁵ The scientific bodies were also required to develop methodologies to factor out emissions by sources and removals by sinks due to indirect human-induced and natural effects from those that were produced as the result of past practices in forests (pre-reference year).¹⁰⁶ To achieve consistency in the accounting of carbon pools, it was agreed that each developed country would account for all changes in the following carbon pools: aboveground biomass, belowground biomass, litter, dead wood, and soil organic carbon. Parties could choose not to account for a given pool during a commitment period if transparent and verifiable information were provided to show that the pool was not a source of carbon.¹⁰⁷

E. *Forestation & Deforestation*

During the initial negotiations for the FCCC, one of the fears about including sinks was that doing so would lead to a process of “replacing forests with tree farms.”¹⁰⁸ This concern, which remained prominent through the 1990s, focused on the possibility that the Pro-

102. IPCC, *supra* note 16, at 4 (depicting estimated global carbon stocks in vegetation and soil carbon pools, but disclaiming that the numbers are considerably uncertain due to scientific limitation).

103. *Review of the Implementation of the Commitments and of Other Provisions of the Convention—Preparations for the First Session of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol*, United Nations Framework Convention on Climate Change, Conference of the Parties, 1st Sess., pt. 2, Decision 5/CP.6, VII(1)(a) & (b), at 10, U.N. Doc. FCCC/CP/2001/L.7 (2001) [*hereinafter* Conference of the Parties 6].

104. Conference of the Parties 7, *supra* note 66, at 54; Michael McCarthy, *Climate Deal Reached*, INDEP. (London), July 24, 2001, at 6 (asserting that sinks will “only be allowed on the basis of ‘sound science’”).

105. The IPCC were requested to develop both definitions for direct human-induced ‘degradation’ of forests and ‘de-vegetation’ of other vegetation types and methodological options for inventorying.

106. Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 ¶ (c) at 54.

107. *Id.* Decision 11/CP.7 at 61.

108. 2 Y.B. INT’L ENVTL. L. 113 (1991).

TOCOL actually promoted deforestation (fast growing plantations produced more credits than did standing old-growth forests), and its subsequent impact on biodiversity and indigenous communities. As such, it became imperative to create a regime that did not encourage deforestation of old-growth forests and their replacement with fast-growing plantations.¹⁰⁹ As the IPCC broadly recognized: “For activities within countries or projects between countries, if sustainable development criteria vary significantly across countries or regions, there may be incentives to locate activities and projects in areas with less stringent environmental or socio-economic criteria.”¹¹⁰

This problem was confronted with detailed rules and a commitment to act in conformity with the objectives of other multilateral environmental agreements, only utilizing LULUCF activities that contribute to the conservation of biodiversity and the sustainable use of natural resources.¹¹¹ The steps taken were in conformity with an IPCC recommendation.¹¹² Further, the Kyoto Protocol obliged developed countries, in fulfilling their obligations, to promote sustainable development in a manner that would take “into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation.”¹¹³

Forestation and deforestation practices were made somewhat more consistent when a number of definitions were agreed upon during the 6th COP and finalized at the 7th COP. Although the defining of terms may appear to be a simple issue, there are many possible definitions of “forest” and several meanings of the terms “afforestation, reforestation and deforestation.” The depth of this problem can be seen by the fact that, until 2000, the term “forest” had not been defined within the climate regime. The use of definitions in

109. See generally Alexander Gillespie, *Sinks, Biodiversity and Forests: Inter-Linkages With Other Environmental Multilateral Agreements and Instruments*, in GLOBAL CLIMATE GOVERNANCE: INTER-LINKAGES BETWEEN THE KYOTO PROTOCOL AND OTHER MULTILATERAL REGIMES 117 (B. Chambers ed. 1998); 8 Y.B. INT'L ENVTL. L. 303 (1997); 11 Y.B. INT'L ENVTL. L. 171 (2000); Pearce, *supra* note 21, at 20; *Hotting Up*, *supra* note 72, at 97.

110. IPCC, *supra* note 16, at 17 (noting that sequestration may create an incentive to cut down old-growth forests and plant “fast-growing carbon-guzzling” trees in their place).

111. *Report of the Conference of the Parties on First Part of Its Sixth Session*, United Nations Framework Convention on Climate Change, Conference of the Parties, 6th Sess., pt. 1, Note by President of the Conference, at 4-18, U.N. Doc. FCCC/CP/2000/5/Add.2 (2001) [*hereinafter* Conference of the Parties 6, President Note]; Conference of the Parties 7, *supra* note 66, Decision 11/CP.7 at 54.

112. IPCC, *supra* note 16, at 17.

113. Kyoto Protocol, *supra*, note 15, art. 2(1).

these agreements is critical as it determines the amount a country's reduction or limitation commitment that can be counted through land use change and forestry activities.¹¹⁴

Definitions of forests and other wooded lands may be produced using legal, administrative, or cultural requirements, by employing terms such as land use, canopy cover, or carbon density. Most definitions relate to percentages of canopy cover.¹¹⁵ The amount of canopy cover has a strong impact in the context of the Kyoto Protocol. For example, if a high threshold was set (e.g. 70 percent canopy cover) then many areas of sparse forest and woodland could be cleared or planted and the resultant carbon losses or gains would not be accounted in determining forest emissions/sequestration under the Protocol. If a low threshold was set (e.g. 10 percent canopy cover) then dense forest could be heavily degraded and significant amounts of carbon released, without the actions being registered as "deforestation." Similarly, a forest with low canopy cover (15 percent, for example), could be considerably enhanced without the actions actually qualifying as "reforestation" or "afforestation."¹¹⁶

At the 6th COP, it was agreed that for the first commitment period the standard FAO definition of 'forest' would be utilized.¹¹⁷ The FAO defines forests by considerations such as height and density, although a certain degree of flexibility is retained in the definition when considering national circumstances.¹¹⁸

For definitions of "afforestation," "reforestation," and "deforestation," the IPCC recommendations were largely followed. Accordingly, "afforestation" is the conversion of land that has not been forest for at least fifty years into forested land through direct human inducements, such as planting, seeding, and/or promotion of natural seed sources.¹¹⁹ "Reforestation" is also a directly human-induced conversion of non-forested land into forested land.¹²⁰ The key difference is that, under the Kyoto Protocol and consistent with standard practice,¹²¹ "reforestation" does not entail a fifty-year-period during which

114. 11 Y.B. INT'L ENVTL. L. 170 (2000); IPCC, *supra* note 16, at 5 (noting the problem and giving several examples of varying definitions of these terms developed for a variety of purposes).

115. IPCC, *supra* note 16, at 5-6.

116. *Id.* at 5 (providing a hypothetical example of the impact of this problem).

117. Conference of the Parties 6, President Note, *supra* note 111.

118. *Id.*

119. Conference of the Parties 7, *supra* note 66, at 59.

120. *Id.* at 59-60.

121. Afforestation is usually defined as the establishment of forest on land that has been

the land was not forested. Both lands were previously “deforested,” since they were converted to “non-forest” lands at some point. “Deforestation” is the direct human-induced conversion of forested land to non-forested land.¹²² For the first commitment period, “reforestation” activities will be limited to any reforestation occurring on lands that were not forested as of December 31, 1989.¹²³ The difference between deforestation and the reestablishment of forests following harvesting must be kept clear, and the distinction is subject to external review.¹²⁴

F. *Additional Activities*

No sooner had it become apparent that forests could sequester carbon, than it also became apparent that a number of other human activities could perform similar functions. For example, changing agricultural practices such as tillage approaches can significantly reduce the amount of carbon emitted from the soil.¹²⁵ The Kyoto Protocol expressly recognized that future COPs would consider “additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils” and whether the then standing LULUCF categories should be altered.¹²⁶

without forest for a period of time (e.g. 20-50 years) and was previously under a different land use. Some definitions of reforestation have no time period, between the harvesting of established forests, and their replanting. IPCC, *supra* note 16, at 6 (defining ‘afforestation’ as the establishment of forest on land that has been without forest for a period of at least 20-50 years and defining ‘reforestation’ as the activity of regenerating trees immediately after disturbance or harvesting where no land-use change occurs).

122. Conference of the Parties 7, *supra* note 66, at 60-61.

123. “For the purposes of determining the area of deforestation to come into the accounting system under Article 3, paragraph 3, each Party shall determine the forest area using the same spatial assessment unit as is used for the determination of afforestation and reforestation, but not larger than 1 hectare.” *Id.* at 59.

124. “Each Party included in Annex I shall report . . . on how harvesting or forest disturbance followed by the re-establishment of a forest is distinguished from deforestation. This information will be subject to review in accordance with Article 8.” *Id.*

125. For example, carbon levels in the soil are determined by the balance of inputs, as crop residues and organic amendments, and carbon losses through organic matter decomposition. Thus, management to increase soil organic carbon and to enhance the potential to sequester carbon requires increasing carbon inputs, decreasing decomposition, or both. Soil erosion can add to this process. Conservation tillage covers practices that range from reducing the number of trips over the field to raising crops without primary or secondary tillage. Leaving crop residues on the surface after planting, are also considerations. At all points, changing agricultural practice can reduce carbon dioxide emissions (and often improve soil quality at the same time). Noel D. Uri & Herby Bloodworth, *Global Climate Change and the Effect of Conservation Practices in US Agriculture*, 10 GLOBAL ENVTL. CHANGE 197 (2000).

126. Kyoto Protocol, *supra* note 15, art. 3 (4).

However, debate over how far to extend these categories was problematic for two reasons.¹²⁷ First, it is possible to interpret “activity” either broadly (e.g. cropland management) or narrowly (e.g. particular tillage method, fertilization technique or cover crop). If the term is broadly defined it may be difficult to separate human-induced changes from naturally occurring changes. A narrow definition based on specific activities such as reduced tillage or irrigation management could lend itself to activity-based accounting that would be related to each individual practice.¹²⁸ Second, it is unclear whether the additional activities considered should be limited to agricultural practices. For example, in 1999, the United States announced that they wanted to count landfills (which can also sequester carbon) as sinks.¹²⁹

A partial solution to this problem was arrived at during the split sessions of the 6th and 7th COPs¹³⁰ when it was decided that in addition to counting afforestation, reforestation, and deforestation in the first commitment period, re-vegetation,¹³¹ forest management,¹³² cropland management,¹³³ and grazing land management¹³⁴ could also be counted. A Party shall elect what it will count in the first commitment period and shall demonstrate that re-vegetation, forest management, cropland management, and grazing land management have

127. 11 Y.B. INT'L ENVTL. L. 170 (2000).

128. IPCC, *supra* note 16, at 4.

129. This was because by burying wastepaper and wood (of which 70 and 97 percent respectively never rots in a buried landfill remains locked in the ground), could permanently lock away their carbon which would otherwise escape into the atmosphere. The US calculated that this could lock up 28 million tons of carbon per year (about 2 percent of the annual US emissions from burning fossil fuels). Fred Pearce, *A Dirty Business*, NEW SCI., Jan. 23, 1999, at 22. *See also*, Observer, *How UN Climate Talks Fell Apart*, N.Z. HERALD, Nov 27, 2000, at B1; Brian Fallow & Reuters, *Outrage Over the Collapse of Climate Talks*, N.Z. HERALD, Nov 27, 2000, at A3; Gwynne Dyer, *Britain's Hague Concession to US Only Realistic Option*, N.Z. HERALD, Nov 28, 2000, at A15.

130. President Conference of the Parties 6 Note, *supra* note 111. *See also* Conference of the Parties 7, *supra* note 66, at 59-60.

131. Conference of the Parties 7, *supra* note 66, at 58. “‘Re-vegetation’ is the direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares but does not meet the definitions of afforestation and reforestation contained here.”

132. “‘Forest management’ is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.” *Id.*

133. “‘Cropland management’ is the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production.” *Id.*

134. “‘Grazing land management’ is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.” *Id.*

occurred since 1990, and are human-induced.¹³⁵ Specific modalities for this accounting were agreed to at the 6th COP.¹³⁶ For the first commitment period, anthropogenic greenhouse gas emissions by sources and removals by the additional sinks (such as cropland management, grazing land management and re-vegetation) shall be equal to anthropogenic greenhouse gas emissions by sources and removals by sinks in the commitment period, less five times the anthropogenic greenhouse gas emissions by sources and removals by the additional sinks in the Party's base year.¹³⁷ Double-counting through any of the additional sink activities must be avoided.¹³⁸

G. LULUCF & The Flexibility Mechanisms

At the 6th COP, it was agreed (but not finalized) that the extent of LULUCF inclusion within the CDM would be limited to afforestation and reforestation; the issues of non-permanence, social and environmental effects, leakage, additionality, and uncertainty still require methodological work.¹³⁹ Conversely, it was decided that the prevention of deforestation and land degradation would not be eligible to generate credits under the CDM.¹⁴⁰ Finally, for the first commitment period, the total additions to and subtractions from the Party's assigned amount (determined from eligible LULUCF activities under Article 12) was not to exceed one percent of the Party's base year

135. *Id.* at 59-60.

136. It was agreed that with regard to the first commitment period, the contribution of additional activities under article 3.4, towards meeting a Party's target in the first commitment period shall be limited to three percent of the Party's base year emissions. Moreover, accounting for additional activities shall take place through two distinguished intervals. The first interval was created due to the fact that some countries had an overall increase in their total forest carbon stock. However, this first interval shall not be more than 30 Mt carbon dioxide. With regard to the second interval, a discounted crediting was to apply due to non-human induced effects and remaining uncertainties in this area. In particular, in the second period parties were to exclude the effects of indirect nitrogen deposition, elevated carbon dioxide concentrations, other indirect effects and, (for forest ecosystems) the dynamic effects of age structure resulting from management activities before 1990. Therefore, Parties shall apply a reduction of thirty percent to the net carbon stock changes and net GHG emissions that result from additional cropland and grazing land management activities and of eighty-five percent to the net carbon stock changes and net GHG emissions that result from additional forest management.

137. Conference of the Parties 7, *supra* note 66, at 59-60.

138. *Id.*

139. Conference of the Parties 6, *supra* note 103, at 11-12; President Conference of the Parties 6 Note, *supra* note 111.

140. Note, however, it was believed that these activities were could qualify for funding under the Adaptation Fund in order to address drought, desertification and watershed protection, forest conservation, restoration of native forest ecosystems, restoration of salinized soils.

emissions times five.¹⁴¹ These measures were meant to limit the overall amount of carbon reduction that could be claimed through the CDM.¹⁴² These rules were largely reiterated at the 7th COP in 2001.¹⁴³

V. CONCLUSION

The inclusion of sinks within the climate regime has long been a source of contention. Despite earlier pleas not to include sinks in the mechanisms until a multitude of uncertainties were resolved, the international community allowed their entry into the Protocol. The largely unspecified nature of their inclusion, in addition to a large number of uncertainties surrounding them, was a primary of the United States' walkout in 2001. Following the U.S. walkout, the remaining members have attempted to resolve many of the difficulties and omitted modalities that continue to plague the issue of carbon sinks—from scientific uncertainties to linkages to deforestation. Whether these attempts will be successful is a matter of speculation.

141. Conference of the Parties 6, *supra* note 103, at 11-12.

142. *Id.*

143. Conference of the Parties 7, *supra* note 66 at 60-61.