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# INTRODUCTION

The issue of “sinks” rose to increased public prominence in November 2000, at the sixth international climate summit at The Hague, known as CoP6.<sup>1</sup> The media reported that “sinks” were at the heart of an impasse in the negotiations. On the one hand, Canada, the United States, Japan, and Australia wanted to get credits for the carbon dioxide (CO<sub>2</sub>) removed from the atmosphere by their forests and agricultural soils towards their commitment to reduce greenhouse gas emissions. On the other hand, the European Union wanted to limit credits for carbon removed by forests and soils. Both camps claimed that science and environmental integrity were on their side. By the end of two weeks of talks, the parties remained far apart. The world had entered negotiations at The Hague with the objective of securing a deal that would turn the emission reduction commitments of the Kyoto Protocol into reality, but was able to agree to little more than another round of talks in 2001.

Those talks are now slated for the last two weeks of July 2001 in Bonn, Germany. With increased scientific understanding of both the threat of climate change and the role sinks could play, negotiating parties need to intensify their efforts if they are to find solutions that protect the environment.

The next section reviews the negotiations over sinks that have taken place to date. The subsequent sections examine why some parties argue for crediting sinks whereas others strenuously oppose and/or limit their inclusion in the 1997 Kyoto Protocol.

This paper is a background paper for the joint West Coast Environmental Law and David Suzuki Foundation publication, *Taking Credit: Canada and the Role of Sinks in International Climate Negotiations*. That report is available on the internet at <http://www.davidsuzuki.org/sinks.asp>

## SINKS, SOURCES, RESERVOIRS, AND THE UNFCCC

In 1988, Canada hosted the World Conference on the Changing Atmosphere, which was held in Toronto. This seminal gathering of experts from 46 countries called for an international convention on climate change. The negotiations concluded in 1992 with the signing of the United Nations Framework Convention on Climate Change (UNFCCC) at the Earth Summit in Rio de Janeiro. The nations signing the convention promised to “promote and cooperate in the conservation and enhancement ... of sinks and reservoirs of all greenhouse gases ... including biomass, forests and oceans.”

In this context, *reservoirs* mean stores of carbon that might otherwise be released to the atmosphere. Soil organic matter and forests are carbon reservoirs. *Sinks* are processes that remove greenhouse gases from the atmosphere. For example, growing forests remove CO<sub>2</sub> from the air during photosynthesis. Forests and soils can also be a *source* of greenhouse gases when they emit more greenhouse gases than they remove from the atmosphere. (Chapter 4 discusses the carbon cycle, including sinks and sources, in greater detail.)

The UNFCCC also committed the industrialized nations of the world to adopt policies and measures aimed at returning emissions to their 1990 levels by 2000. Such measures were to include all sources of emissions as well as reservoirs and sinks. Despite this commitment, emissions from industrialized countries — especially Australia (15% increase from 1990 to 1998), Canada (13% increase), the US (11% increase), and Japan (10% increase) — continued to grow through the 1990s.<sup>2</sup>

# SECTION 1

## SINKS AND INTERNATIONAL CLIMATE NEGOTIATIONS

In 1995, the Intergovernmental Panel on Climate Change (IPCC), charged by the World Meteorological Organization and the United Nations Environmental Program with examining the state of scientific research on global climate change, released its Second Assessment Report. The report concluded that “the balance of evidence suggests that there is a discernible human influence on the global climate.”

The international community quickly recognized that stronger commitments were necessary to protect the world’s climate. In 1995 the 160 nations that had ratified the UNFCCC — known as “Parties” to the UNFCCC — agreed to negotiate stronger commitments by 1997. This process culminated in the Third Convention of Parties (CoP3) in 1997. The meeting was held in Kyoto, Japan, and negotiated the first international agreement with unambiguous commitments to reduce emissions — the Kyoto Protocol.

If the Protocol is ratified by a sufficient number of nations,<sup>3</sup> these commitments will be binding in international law, but only on the nations that ratify the Protocol. This need for consensus gives considerable negotiating power to nations opposed to strong action on climate change, as in the case of the recent US announcement that it would withdraw from the Kyoto Protocol. Under the terms of the UNFCCC, nations will be required to take action only if they agree to take action.

The Kyoto Protocol is one of the most complicated agreements ever negotiated by the international community. The formula for determining different commitments by industrialized countries gives some sense of its complexity:

- Article 3 of the Protocol establishes a commitment period between 2008 and 2012 (the “First Commitment Period”) during which the industrialized nations listed in Annex B (the “Annex B Parties”<sup>4</sup>) must limit their emissions of six greenhouse gases.
- Parties are given a quota of allowable emissions (the “assigned amount”) based on a certain percentage of emissions in a base year.
- For most purposes, the base year is 1990. Canada’s assigned amount is 94% of 1990 emissions times 5 (to reflect the five years in the First Commitment Period). The US assigned amount is 93% of 1990 emissions times 5; the European Union’s is 92% times 5.

The Kyoto Protocol does not set targets beyond 2012, but is based on the assumptions that parties will negotiate subsequent commitment periods that will start in 2013 and that developing nations will also accept specific “assigned amounts” following concrete action by developed nations.

The Kyoto Protocol also includes several “flexibility mechanisms” — joint implementation, the Clean Development Mechanism (CDM), and international emissions trading — intended to reduce the costs of achieving reduction targets defined by international law. While their design can potentially introduce loopholes that allow overall emissions to increase,<sup>5</sup> the cost savings and flexibility offered by the mechanisms were key to achieving broad partial



agreement on the Kyoto Protocol in 1997. Except for CDM and sinks, these mechanisms are not discussed at any length in this report.

### **Box 1.1: The Negotiators**

The CoP6 negotiations are dominated by several key parties and groups of nations:

- **Jan Pronk.** Dutch Environment Minister Jan Pronk is chair of CoP6, which began at The Hague and is scheduled to continue in Bonn in July 2001. As chair, he has tried to facilitate a deal by developing several compromise proposals.
- **The Umbrella Group.** Canada, the US, Japan, Russia, Ukraine, Australia, Norway, New Zealand, and Iceland all belong to the Umbrella Group. This group has been the leading proponent of “flexibility mechanisms” in the negotiations and has been criticized as favouring flexibility over environmental integrity. The Umbrella Group is divided over sinks: Canada, the US, Australia, and Japan favour broad crediting for a variety of activities that enhance sinks; Norway has argued against credit for “business as usual sinks”;<sup>6</sup> and New Zealand does not support increased credit for sinks.
- **The European Union.** The European Union (EU) is generally seen as a greater champion of environmental integrity than the Umbrella Group. It has opposed expanding the types of sink activities that can be credited during the First Commitment Period, and has opposed credit for sink enhancement or reservoir protection in developing countries.
- **G-77/China.** The G-77/China is the third main negotiating bloc. It represents the diverse countries of the developing world, from the Alliance of Small Island States (AOSIS) to the Organization of Petroleum Exporting Countries (OPEC). It opposes, or wants very tight limits on, the crediting of sink activities in the industrialized world. The G-77 is divided on whether developing countries should be able to generate valuable credits for enhancing sinks or protecting reservoirs through the CDM. Latin American countries generally support it; Asian countries generally oppose it.
- **AOSIS.** The Alliance of Small Island States has members whose survival is endangered by rising sea levels caused by climate change, and has taken strong environmental stands on many issues. Until scientific, policy, and methodological issues are resolved, AOSIS opposes expanding credit for sinks in both the industrialized world and developing countries.
- **Environmental Integrity Group.** Consisting of Switzerland, Mexico, and Korea, this group has generally promoted environmentally defensible positions while recognizing the need for flexibility. It has favoured inclusion of sinks but opposed credit for business as usual sinks. It supports discounts on any sink-related credits to reflect uncertainty.

## SINKS AND THE KYOTO PROTOCOL

The Kyoto Protocol provides Annex B or Industrialized Parties with “flexibility” by allowing them to emit more greenhouse gases from fossil fuels if they take certain actions to protect reservoirs or enhance sinks.<sup>7</sup> These countries can then get “credit” for certain increases in the carbon sequestered in forests and soils levels and use it to meet their targets for the First



Commitment Period.<sup>8</sup> Credit for sequestration comes in the form of an addition to the countries' assigned amount, which permits an increase in emissions from combustion of fossil fuels or other human processes. Conversely, certain losses in carbon sequestration levels lead to carbon debits that reduce a country's allowable emissions.

## Definitions

At Kyoto, Parties (all nations that had ratified the UNFCCC) agreed to include only a limited number of sinks activities in the system of credits and debits. Article 3.3 of the Protocol states that Annex B Parties<sup>9</sup> will be credited (or debited) with verifiable changes in carbon stocks due to afforestation, reforestation, and deforestation.<sup>10</sup>

Negotiations continued at the next climate session, CoP4 in Buenos Aires in 1998. All Parties clarified the intent of Article 3.3, saying that Annex B Parties would be credited (or debited) with any increase (or decrease) in sequestered carbon in the period 2008-12 due to afforestation, reforestation, or deforestation if those activities took place since 1990.<sup>11</sup> By CoP6 at The Hague in 2000, all Parties had generally agreed that afforestation and reforestation in the context of Article 3.3 meant converting non-forest land to forest. This excluded regeneration of forests after logging,<sup>12</sup> closing a significant loophole.

## Additional Activities

While there is general agreement regarding the treatment of reforestation, afforestation, and deforestation, the inclusion of additional activities such as agricultural soils remains unresolved. Article 3.4 states that Parties will decide on how, and which, activities related to forestry, agriculture, and land use change in Annex B countries will be included in the second and subsequent commitment periods. These activities are often referred to as "additional activities," meaning additional to Article 3.3.

## Sinks in the Clean Development Mechanism

The Protocol is silent on whether activities that sequester carbon or protect reservoirs in developing countries can be credited. At present, certified emission reductions, or CERs, can be generated under the so-called Clean Development Mechanism (CDM).<sup>13</sup> The CDM is supposed to be both a process for giving industrialized countries access to low-cost reductions in the developing world and a process for supporting the South with sustainable development practices. Annex B countries and their businesses can develop project in developing countries that reduce emissions to levels below what would otherwise occur. These reductions generate CERs, which can be added to the allowable emissions quota of the industrialized Annex B Parties, enabling the latter to increase their domestic emissions.

Because the CDM does not specifically refer to credit being given for protection or enhancement of reservoirs or sinks in developing countries, the EU and others have argued for the exclusion of sinks from the CDM. Canada, Japan, Australia, the US, and some developing countries have taken the opposite view in the hope of maintaining maximum flexibility.



### **Box 1.2: Windfall or Part of the Kyoto Deal?**

Credit for “business as usual” sequestration of carbon by forests and soils has been criticized as a windfall for countries with the potential for large carbon sinks; other countries justify credit for non-additional sinks as “part of the Kyoto deal.” Several facts suggest that credit for all sequestration on managed forest lands was not part of the Kyoto deal:

- *Article 3.4 rules out credit from pre-1990 activities.* The Kyoto Protocol states that additional sequestration activities counted in the First Commitment Period under Article 3.4 must have taken place since 1990. This runs counter to comprehensive crediting for sequestration on managed forest lands. The current uptake of carbon by managed forests in most industrialized countries is the result of regrowth after harvesting, often initiated decades ago in the case of Canada and the US. In many cases there has been no effort to increase carbon sequestration since 1990. Canada, the US, and Japan have tried to claim that such sequestration qualifies because it is the result of current forest management activities.
- *Article 3.4 refers to additional “human-induced activities.”* Much of the sequestration that would be credited under Canadian, US, and Japanese proposals is the result of purely natural factors. In some cases, the only human activity is allowing natural processes to occur.
- *Such credit would run counter to the overall reduction target and the purpose of the Kyoto Protocol.* Article 3.1 states that overall reductions of industrialized nations should be at least 5% *below* 1990 levels in the First Commitment Period. As discussed in Chapter 2,<sup>14</sup> proposals for crediting all sequestration occurring in managed forests and on agricultural lands would allow an *increase* in both direct industrial emissions (fossil fuel emissions and all other emissions not associated with the Land Use, Land Use Change, and Forestry sector) and net emissions (direct industrial emissions minus removals and emissions from the Land Use, Land Use Change, and Forestry sector). Under a proposal made by Canada in August 2000, the amount of credit generated could potentially be sufficient to eliminate any need for additional action by industrialized nations.
- *Negotiators were not in a position to rely on sequestration.* In Canada’s case, negotiators of the 1997 Kyoto deal could not have been relying on credit from non-additional sinks because at that time it was uncertain whether Canada’s managed forests and soils were a source or a sink for greenhouse gases.
- *The US defended the deal without credit for business as usual forest management.* After Kyoto, the State Department defended the American Kyoto target as achievable. Their defence was based on the assumption that forest management would not be credited.<sup>15</sup> Subsequently the US argued for rules that generated large amounts of credit from business as usual sequestration.

Credit for sequestration in agricultural soils was not agreed to at Kyoto, raising important issues. Yet sequestration on agricultural lands in the 2008-12 period would often be due to changes in agricultural practices since 1990. The relatively small scale of credit for business as usual sequestration on agricultural soils is far less than business as usual sequestration in managed forests.

## THE SINKS STANDOFF AT COP6

The unresolved issues described above lie at the heart of the current impasse over the implementation of the Kyoto Protocol. At the CoP4 meeting in Buenos Aires, it was clear that the details of the Kyoto mechanisms, the treatment of sinks, and other matters would be contentious. The participants did, however, agree to the “Buenos Aires Plan of Action” – a schedule that set CoP6 as the deadline for resolving key issues.

### The Debate

Before CoP6, little progress was made in resolving any of the issues, and negotiations at CoP6 started out slowly. By the end of the first week the negotiating texts — essentially draft legal decisions — contained thousands of brackets, each set of brackets indicating the unwillingness of one or more participants to accept the bracketed text. Because decisions under the UNFCCC are made by consensus, it is essential to remove all brackets for final agreement.

### The Countries’ Positions

Although the issue of sinks is complex, the negotiating dynamic is relatively simple. Canada and Japan entered the debate from one extreme. Canada advocated “a comprehensive land based approach” under Articles 3.3 and 3.4:

- Parties would receive credit (debit) for all verifiable increases (decreases) in the carbon stock on agricultural or managed forest lands during the first and subsequent commitment periods.
- All carbon pools (for example, wood products, above- or below-ground biomass, forest litter, soil carbon) must be counted unless there is evidence that they are not sources of greenhouse gases.
- Any future emissions from these carbon stocks would be accounted for in future commitment periods. Thus if a country took credit from growing forests, for example, it could not subsequently ignore emissions from forest fires or other processes within these forests or farmlands.

Leaving aside its implications for the overall effectiveness of the Kyoto Protocol (which are discussed in Chapter 2), the Canadian position has the advantage of being relatively simple and comprehensive. Japan took a position similar to Canada’s.

The United States took a slightly different stance. It suggested that during the First Commitment Period credit from forests should be discounted,<sup>16</sup> or Parties should be only allowed to claim credit for carbon sequestration that exceeded an undefined threshold (for example, 50% of 1990 levels).

At The Hague, Canada, the US, and Japan reconciled the differences in their positions and presented a united position on sinks. An initial proposal by the three provided for comprehensive, undiscounted inclusion of forests and agricultural soils for most countries combined with a discount (i.e. a reduction in the amount of credit below measured levels of



sequestration) on forest sinks for countries with extremely large sinks (likely only the US and Russia).

Canadian, Japanese, and American officials have argued that comprehensive crediting is scientifically appropriate and provides incentives for sustainable forestry. The three nations' position, however, may be driven more by perceived political expediency. As noted earlier, the three nations are all large emitters and have each had substantial increases in greenhouse gases since 1990. Because forests and agricultural soils in the US and Japan are expected to be major net sinks in 2010, comprehensive crediting offers large amounts of credit without the need to take additional action to reduce greenhouse gas emissions. Canadian government officials have generally assumed that our forests and soils will also be large net sinks and thus contribute to meeting the Kyoto target. Together with flexible rules under the other flexibility mechanisms, the three countries clearly see credit for sinks as making the Kyoto Protocol easier to implement and easier to ratify.

Canada, the US, and Japan have also strongly supported including all forms of forest and agricultural soil sequestration projects in the Clean Development Mechanism. Other negotiating allies have not supported their position. Australia, for instance, has accepted the exclusion of deforestation prevention projects from the CDM in the First Commitment Period.

Most climate protection non-governmental organizations (NGOs), the EU, the Environmental Integrity Group, the Association of Small Island States, and a number of other developing countries have stated that adding activities under Article 3.4 during the First Commitment Period could reduce the overall integrity of the Kyoto Protocol. Concerns raised include fears that:

- The accounting rules would allow global emissions to increase
- Storing carbon in trees and soils can transfer risks and responsibilities to future generations because of the impermanence of sinks
- The difficulty of measuring carbon removed by trees, soils, and other sinks could make commitments harder to enforce
- Rules would create perverse incentives to cut native forests

AOSIS nations took the strongest stance, advocating the complete exclusion of additional activities during the First Commitment Period. The EU's position was that no additional activities should be used under Article 3.4 during the First Commitment Period unless key issues are dealt with. If additional activities were considered under Article 3.4, the EU proposed a number of strict accounting rules that would have significantly limited the amount of credit available. Both AOSIS and the EU also sought to exclude sequestration projects from the Clean Development Mechanism.

Several other countries suggested compromise positions. Norway — normally an ally of the US, Canada, and Japan — took the position that for the First Commitment Period, countries should be credited only for the direct effect of new activities since 1990 that went beyond business as usual. It stated that the intention of Article 3.4 was to focus on the second and

subsequent commitment periods. Switzerland and environmental NGOs in favour of credit for sinks supported similar proposals.

## The Result

Faced with a standoff over sinks — and similar standoffs over other issues — CoP6 president Jan Pronk proposed a series of high-level decisions on key issues (the “November 23 Pronk Paper”<sup>17</sup>). Both the EU and the US, Canada, and Japan trio responded to the Pronk Paper with their own proposals. Their differences could not be reconciled in time and The Hague meeting adjourned without a decision.

## Who was Responsible for the Impasse at CoP6?

During and after The Hague meeting, Canada pointed to European intransigence as the reason for the breakdown in talks, and criticized the two Pronk papers as being biased in favour of the EU. Europe, on the other hand, blamed Canada and other members of the Umbrella Group. Who was to blame?

While a standoff can occur only when both sides refuse to compromise sufficiently, an examination of changes in the parties’ positions indicates that the EU made significant shifts in position to accommodate Canada. Before The Hague, the EU position was that no additional activities should be added under Article 3.4. At The Hague the EU agreed that all net sequestration by managed forests should be counted up to the level of any debits under Article 3.3. This eliminated the debits Canada incurred because of high deforestation rates (according to its own calculation, Canada annually deforests an area 30 times greater than it afforests).<sup>18</sup> The Europeans have also agreed to include forest management and agricultural soils (albeit subject to very large discounts for both).

During CoP6, Canada corrected aspects of its initial position that would have eliminated much of the environmental benefit of the Kyoto Protocol (see Chapter 2). It has, however, made few concessions that affect the amount of credit it expects to receive. The shifts in Canada’s position mainly involved applying discounts to the amount of carbon sequestered by Russian and American forests. In other words, while Canada, Japan, and most other countries would be able to claim credit for every tonne of carbon sequestered by their forests, the US and the Russian Federation (the two countries with the largest forest carbon sinks) would be able to claim credit for only a fraction of their sequestration.

Table 1.1 shows what various Canadian and EU positions represent for Canada. It indicates significant changes in the EU position that benefit Canada. The table is based on the projections of carbon sequestration on managed forest lands and agricultural lands that Canada submitted to the climate negotiations in August 2000. (It thus assumes that Canada would receive credits from adding forest management, an assumption that has been called into question by other analyses.)

Based on the August 2000 submission, Canada’s most recent position would still generate at least 97% of the credits Canada would have received under its original comprehensive carbon accounting position. Table 1.1 also shows that the April 2001 Pronk proposal represents a compromise between the EU and the Canadian positions.



**Table 1.1: Who is showing flexibility?**<sup>19</sup>

<b>Proposed approach</b> <sup>20</sup>	<b>Estimated credit (debit) Canada receives, million tonnes carbon/year</b>	<b>Impact of position change on Canada, relative to original position of Party Mt carbon/year</b>
<b>Canada's position pre-Kyoto:</b> <sup>21</sup> Credit for all net sequestration on agricultural soils and forest land during 2008-12.	8.8	
<b>Canada's position pre-Hague:</b> Credit for all net sequestration on agricultural soils and forest land during 2008-12.	8.8	0
<b>Canada's 20 November 2000 position:</b> <sup>22</sup> Credit for all net sequestration on agricultural soils. Comprehensive inclusion of forest management, but subject to 66% discount if over 20 megatonnes but under unspecified threshold.	8.8	0
<b>Canada's 24 November 2000 position:</b> <sup>23</sup> Credit for all net sequestration on agricultural soils. Comprehensive inclusion of forest management, except for 5% discount and cap (4% of 1990 emissions) applied to sequestration over Article 3.3 debit but under unspecified threshold.		
<ul style="list-style-type: none"> <li>• Assumed threshold set at 80% of projected sequestration beyond first interval</li> <li>• Assumed threshold set at 100% of projected sequestration beyond first interval (yields minimum credit)</li> </ul>	8.65	0.19
	8.6	0.24
<b>Pronk proposal of April 2001 and June 2001:</b> <sup>24</sup> Agricultural soils included on net-net basis. 100% forest management counted up to level of Article 3.3 debit, and discounted thereafter. Boundary condition limits total credit from sinks (including credit purchased on international market).	5.0	Not applicable
<b>EU interpretation of Kyoto Protocol:</b> Article 3.3 only; no correction for asymmetry. <sup>25</sup>	(4.3)	
<b>EU proposal pre-Hague:</b> No forest management. Correction to Article 3.3 "asymmetry." <sup>26</sup>	(4.16)	0.14

<b>Proposed approach<sup>20</sup></b>	<b>Estimated credit (debit) Canada receives, million tonnes carbon/year</b>	<b>Impact of position change on Canada, relative to original position of Party Mt carbon/year</b>
<b>EU proposal of 25 November 2000:</b> Comprehensive inclusion of forest management up to level of Article 3.3 debit; 97% discount of forest management that exceeds Article 3.3 debit; 30% discounting of agricultural soils.	0.12	4.4

#### WHAT TO LOOK FOR REGARDING SINKS AT COP6.5

The June 2001 negotiating text prepared by CoP6 chair Pronk was simply the latest in a long series of proposals to find common ground on credits from non-additional sinks. Inevitably there will be more. The following are the different proposed accounting rules that are likely to be central to the negotiations. Suggestions regarding how Canada will behave are based on Canada's past positions.

- **First, second, and third tier.** Pronk's June 2001 negotiating text creates different rules for three tiers of sequestration under Article 3.4. The first tier is forest management up to the level of any deforestation debits under Article 3.3; most parties have supported crediting 100% of sequestration in this tier. The second tier is sequestration in managed forests beyond the level counted in the first tier; all parties have agreed to some discounting in this tier. The third tier is for agricultural soils. Pronk proposes accounting on a net-net basis for agricultural soils. Expect Canada to try to have forest management beyond a certain threshold moved into the third tier, where it will receive full credit.
- **Discount rates.** Pronk calls for a discount rate of 85% on the second tier. Expect the EU to call for a higher discount rate and Canada to call for a lower rate. A higher rate will decrease credit for non-additional activity, increasing actual emission reductions and the environmental effectiveness of the Protocol. On the other hand, a lower rate will decrease incentives to change forest practices.
- **Japanese exemption.** Special rules related to population density, energy intensity, and forest cover create a special exemption for Japan. Japan is exempted from the discounting that would normally apply to the second tier. Expect Canada to seek a similar exemption.
- **Boundary conditions.** Pronk's June 2001 negotiating text paper proposed boundary conditions that would limit the extent to which countries could utilize sinks. It limits both the amount of credit that can be obtained from forest management in Annex B countries and the credits from CDM projects. Canada, the US, and Japan have opposed any boundary condition, and will likely try to limit application of the boundary



condition to sequestration from forest management below a specified threshold. Expect Canada to try to increase the size of the boundary condition.

- **Net-net accounting.** Net-net accounting means that countries get credit only for increasing the rate of sequestration from 1990 levels. If applied to forest management, it could eliminate much of the credit for non-additional activities, but because of declining rates of sequestration it would make Kyoto targets more difficult to achieve. For this reason net-net accounting is unlikely to be applied to forest management in the First Commitment Period.
- **Pronk's June 2001 negotiating text** proposes net-net accounting for agricultural soil sequestration. This benefits Canada because its agricultural soils were a source in 1990. Expect Canada to agree to net-net accounting for agricultural soils.

## THE US WITHDRAWAL FROM THE KYOTO PROTOCOL

While the United States has been a vocal supporter of full inclusion of sequestration activities under the Kyoto Protocol, its March 2001 rejection of the Protocol was not the result of the failure to achieve a deal on sinks at The Hague. Announcing the US government's withdrawal from the Kyoto Protocol, President George W. Bush stated that the rejection was based on the fact that the Protocol does not set emission limits for developing countries, that the agreement would be too expensive to implement, and that the science on global warming was still not certain.

The US decision is likely to isolate Canada further at the climate talks. The sinks issue had already split Canada, the US, and Japan from other members of the Umbrella Group, which had supported more limited credit from sequestration. Within the US, there is growing demand from environmental and religious organizations, and from some elements within business communities and Congress, for the Bush administration to reverse its decision and support the Kyoto Protocol target and timeline. It remains to be seen what role the US will play at CoP6.5.

## SCIENCE, POLICY, AND POLITICS

While the recent proposals of Canada, the US, the EU, and Jan Pronk have significantly different impacts (see Chapter 2), they are united by one common feature: their design reflects politics, not science. The various crediting intervals and thresholds proposed have been attempts at political compromise.

Although crediting and debiting for changes in sequestration levels due to so-called "Land Use, Land Use Change, and Forestry" (LULUCF) activities under the Kyoto Protocol have been the subject of extensive policy analysis since Kyoto and the subject of a special report released in 2000 by the Intergovernmental Panel on Climate Change (IPCC), the negotiations have tended to focus on a "numbers game," with some countries trying to maximize potential credit and others trying to minimize it. Some of these proposals risk environmental integrity and atmospheric protection. Methodologies for crediting proposed by the IPCC may be a more fruitful source of compromise.

The following chapters discuss how the crediting and debiting systems for sequestration on agricultural and forest lands could create loopholes and reduce the effectiveness of the Kyoto



Protocol. Chapter 2 discusses competing concerns regarding the inclusion of forest and agricultural soil management under Article 3.4, and points to potential solutions. Chapter 3 discusses the inclusion of sinks under the Clean Development Mechanism.



## SECTION 2

### COUNTING CARBON IN THE INDUSTRIALIZED WORLD

As discussed in Chapter 1, the crediting of carbon sequestration from forest management and agricultural land management has been one of the most divisive issues in global climate negotiations. As negotiators put forth various proposals for discounts, thresholds, and boundary conditions, the underlying concerns often fade into the background. Ending the stalemate over sinks in a way that maintains the environmental integrity of the Kyoto Protocol will, however, require a basic understanding of the scientific and policy issues related to sinks. The first part of this section discusses competing arguments for and against adding activities under Article 3.4. The second part analyzes several issues associated with implementing Article 3.3.

#### ADDING ADDITIONAL ACTIVITIES UNDER ARTICLE 3.4

Those favouring the addition of new activities that qualify for credit under Article 3.4 argue that:

- A tonne is a tonne. Avoiding a tonne of emissions from deforestation or sequestering a tonne through changes to agricultural practices has the same impact on the atmosphere as avoiding a tonne of emissions from fossil fuels.
- Credit for sequestration can reduce the cost of achieving a given environmental target, thereby buying time for the development of low-emission technologies and possibly permitting deeper reduction targets.
- Credit for sequestration provides incentives for sustainable agriculture and forestry.

Those opposing the addition of forest management and agricultural land management under Article 3.4 during the First Commitment Period generally acknowledge the importance of protecting carbon reservoirs and recognize that credit for enhancing sequestration could reduce the short-term costs of compliance with the Kyoto Protocol. They argue, however, that:

- Credit for business as usual activities will reduce or eliminate the environmental impact of the Kyoto Protocol.
- Uncertainty in the measurement of sequestration could reduce the verifiability of Kyoto commitments and hide excess emissions.
- The impermanent nature of carbon sequestration shifts the risks of climate change and responsibility for reducing emissions onto future generations.
- Credit from Land Use, Land Use Change, and Forestry (LULUCF) activities could significantly diminish the need for reductions in fossil fuel emissions, allowing increased investment in energy sources and technologies that are not consistent with long-term climate protection goals.
- Credit for sequestration can encourage unsustainable forest practices.

This chapter examines these arguments, discusses the effectiveness of various proposals for dealing with the concerns expressed, and identifies potential solutions. It also looks at several relatively technical issues related specifically to Article 3.4: ensuring against perverse incentives to log natural forests and ensuring that definitions of key terms do not create loopholes.

A Tonne is a Tonne?

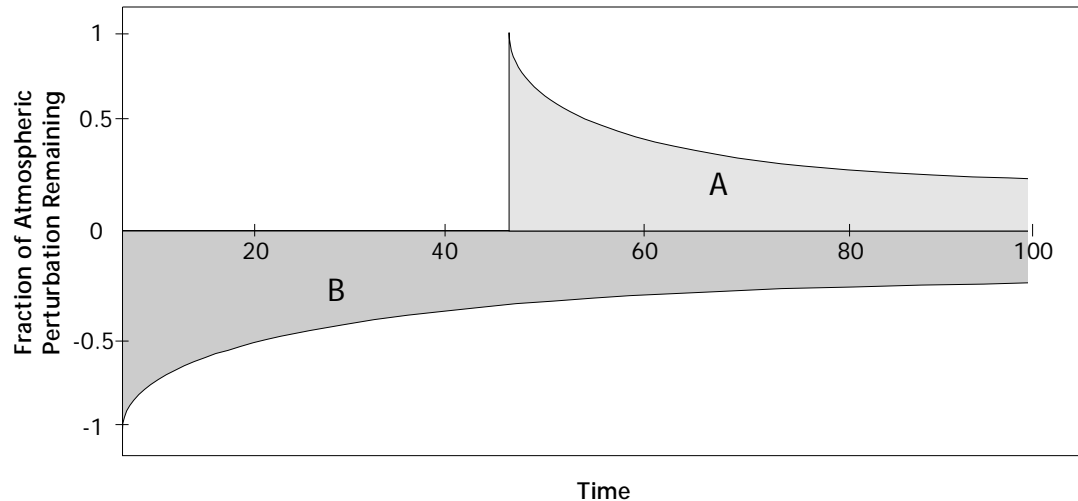
Proponents of receiving credit for increases in carbon sequestration argue that avoiding a tonne of emissions from deforestation or sequestering a tonne through changes to agricultural practices has the same impact on the atmosphere as avoiding a tonne of emissions from fossil fuels. Thus, they argue, each activity should be treated the same. Doing so would create an incentive to decrease Canada's high rate of deforestation (30 times higher than its rate of afforestation) and to rehabilitate soils and forests that have been degraded by human activity.

On one level this argument is correct. In terms of the atmospheric concentrations of greenhouse gases, the immediate impact of sequestering a tonne of carbon is the same as that of avoiding a tonne of carbon emissions. Without doubt, avoiding deforestation or rehabilitating degraded lands can help mitigate climate change.

The argument ignores several key points, however:

- Sequestering a tonne of carbon dioxide (CO<sub>2</sub>) will have the same impact on the atmosphere as reducing a tonne of emissions only if the carbon remains sequestered permanently. Avoiding a tonne of emissions from fossil fuels has a permanent impact on atmospheric concentrations, but the impact of sequestration is initially large and slowly declines over the course of centuries. This is indicated by Area B in Figure 2.1. The impact of sequestering a tonne is the same if sequestration is permanent. If carbon is subsequently released, however, the impact is equivalent to a reduction at the time of the sequestration (Area B) combined with an emission at the time of release (Area A). In the long term, atmospheric concentrations are higher where a short-lived sequestration is used as a substitute for emission reduction.
- To solve this problem, it has been suggested that countries be held responsible for future emissions from their land base. As discussed later, however (see "Impermanence of Carbon Sequestration" on page 23), this approach shifts responsibilities to future generations and adds to the risk of climate change.
- The incorporation of sequestration into the Kyoto Protocol can radically reduce the Protocol's effectiveness by permitting an immediate increase in net emissions (total emissions minus total sequestration) entering the atmosphere. This is discussed in greater detail later (beginning with the section "Credit for business as usual sequestration").





**Figure 2.1**

### Cost Savings and Buying Time for Low-Carbon Technologies

A key argument from proponents of crediting and debiting changes in carbon sequestration is that efforts to protect carbon reservoirs or increase carbon sequestration are often less expensive than reducing emissions from fossil fuels. Utilizing sequestration can therefore reduce the cost of achieving Kyoto targets. Economic modelling projects suggest that providing credit for changes in forest management and agricultural land management in Annex B countries could reduce the overall costs of compliance with the Kyoto Protocol by about one-third.<sup>27</sup>

In the longer term, however, potential cost savings may be limited. Management practices to increase sequestration will not have an indefinite impact. Although there is some evidence that biologically diverse ecosystems continually remove carbon from the atmosphere, the prevailing wisdom is that carbon reservoirs in forests and soils eventually reach a point where no more CO<sub>2</sub> is removed from the atmosphere. This suggests that sequestration can be used to offset emissions only for a limited time. Proponents of giving credit for sinks argue that this potential should be used, buying time and deferring emission reductions until low-cost alternatives to fossil fuels are developed.

Although the use of sinks will likely reduce the short-term costs of compliance for emitters, arguments along these lines have several weaknesses:

- They assume that low-cost emission reduction opportunities are not currently available. While cost estimates for reducing emissions vary, studies for Canada's National Climate Change Process project that overall Canadian compliance costs will be negligible.<sup>28</sup>
- Estimates of the costs of emission reduction often ignore its potential benefits, in terms of a more competitive economy or non-market benefits such as fewer premature deaths and lower health care costs due to air pollution.<sup>29</sup>
- Short-term cost savings through the use of sequestration may lead to long-term increases in compliance costs. The ability to invest in low-cost sequestration rather than in

emission reductions may encourage companies to continue investing in carbon-intensive industries such as tar sands extraction rather than in low-emission industries, renewable energy, and energy efficiency.

While it might be possible to offset the emissions from some of these investments with sequestration and still achieve the Kyoto targets, the investments are not compatible with longer-term climate goals. Global emission reductions of 60% or more are needed to stabilize the world's climate,<sup>30</sup> and Canada will need to make reductions that are far deeper than those required by the Kyoto Protocol. The costs will be greater if Canada has invested heavily in carbon-intensive industries instead of in new technologies and clean industries, and will include the cost of abandoning "stranded" investments in those carbon-intensive industries.

### Incentives for Sustainable Forestry and Agriculture?

Proponents of adding agricultural soils and managed forests to the Kyoto Protocol under Article 3.4 argue that doing so would encourage sustainable forest and agriculture practices. Opponents often argue the exact opposite.

To a limited extent, both arguments are correct. In the forest sector, practices such as protection of old growth and extension of rotation periods can maintain carbon reservoirs and enhance carbon sequestration, and are beneficial to the environment. On the other hand, credit for increased carbon sequestration can encourage:

- Monocultures of fast-growing species that can replace native grasslands or even native forests, and also deplete soil and ground water
- Forest fire suppression, possibly leading to loss of important grassland or fire-dependent ecosystems and to the build-up of fire-prone materials in forests
- Intensification of pest control, with a corresponding increase in pesticide use

The negative impacts of fire suppression and pest management are of particular concern in Canada and the United States, where, according to some estimates, these practices are expected to achieve the vast majority of increases in forest sequestration: over 80% in Canada and 70% in the US.<sup>31</sup>

In the agricultural sector, conservation tillage is generally seen as not only sequestering carbon but also reducing the costs of production and having positive impacts for water conservation and air, soil, and water quality. On the other hand, it also frequently leads to increased herbicide use, with attendant ecological impacts.

Ideally, the rules regarding credit for enhanced sequestration should ensure that such credit encourages only sustainable practices. A coalition of US-based environmental groups, such as the Natural Resources Defense Council (NRDC) and World Wildlife Fund (WWF), has been promoting a series of eligibility rules to help ensure that sequestration projects have positive environmental impacts. Such rules would, for example, prohibit the replacement of natural ecosystems with monocultures or prohibit interference with natural fire cycles. Both the European Union and environmental NGOs have also proposed a requirement that LULUCF activities under Articles 3.3 and 3.4 be consistent with treaties protecting biodiversity and wetlands.



Unfortunately, the prospects for international rules to ensure environmentally friendly activities under Articles 3.3 and 3.4 are uncertain. At Sixth Convention of Parties (CoP6) at The Hague, Canadian and American representatives supported the shifting of references to biodiversity and wetland treaties into the non-binding preamble of any decision. The June 2001 negotiating text of CoP6 chair Jan Pronk states that LULUCF activities under the Protocol “shall be implemented in such a way that they contribute to the conservation of biological diversity and the sustainable use of natural resources.” Specific rules will not be developed until at least 2003, however, and Canadian negotiators have criticized this and similar proposals as rewriting of the Protocol.

#### Climate Effectiveness Versus Encouraging Sustainable Forest Practices

Although European and, to a lesser degree, Pronk’s proposals for counting sinks attempt to maintain the principles of environmental effectiveness in the Kyoto Protocol, they reduce or eliminate incentives to carry out many of the additional activities that would benefit the climate and forest or agricultural ecosystems. The proposals call for simply multiplying most forest sequestration by discount factors to reduce credit from non-additional sequestration. They also call for caps or “boundary conditions” on the total amount of credit that can be generated through Article 3.4, to ensure that excessive credit is not generated from non-additional activities if sequestration rates are greater than currently estimated.

Unfortunately, caps and high discount rates remove the incentive to change forest or agricultural practices in ways that benefit the climate. For example, the June 2001 negotiating text calls for a boundary condition that would eliminate any incentive for Canada to decrease deforestation or to increase conservation tillage, rotation periods, or mature forest protection. A proposed EU discount of 97% eliminates almost all incentive for action.

#### Credit for Business as Usual Sequestration

Opposition to adding new activities for the First Commitment Period under Article 3.4 has been fuelled in part by fear that countries would get large amounts of credit for sequestration that is “non-additional” or “business as usual.” Non-additional sequestration is sequestration that would occur even without climate mitigation action, because of factors such as the changing age structure of forests or the impacts of nitrogen and greenhouse gas pollution that accelerate forest growth in the short term.<sup>32</sup>

Credit for non-additional sequestration would also mean an increase in atmospheric concentrations of greenhouse gases. Without such credit, the atmosphere benefits both from reductions in fossil fuel emissions and from carbon being sequestered by forests and agricultural soils. With such credit, emissions from fossil fuel would not go down, and net emissions to the atmosphere (emissions minus sequestration) increase. Credit from non-additional sequestration is sometimes referred to as *ineffective credit* or *credit for ineffective sinks*.

Prior to The Hague, Canada and Japan proposed credit for all verifiable sequestration on forest and agricultural lands and debits for any reductions in the carbon stocks of forests and agricultural soils. There would be no attempt to distinguish between sequestration due to natural factors or past history and sequestration due to new and additional activities. On the other hand, the EU, the Environmental Integrity Group, and Norway have tried to limit or eliminate credit for non-additional sequestration.

## Significant Potential Loophole

Estimates of non-additional sequestration that could be credited if forest management is added to the Protocol under Article 3.4 are huge. For example, the amount of credit generated throughout Annex B countries under Canada's initial comprehensive accounting approach to forests and agricultural soils could equal the "Kyoto Gap" — the gap between projected business as usual emissions and what would be required for Annex B Parties to comply with the Kyoto Protocol. Estimates of the amount of carbon absorbed by forest management activities in Annex B countries vary between 445 million tonnes and 727 million tonnes per year, equivalent to between 9.5% and 15% of Annex B emissions in 1990.<sup>33</sup> In comparison, the US Department of Energy estimates the Kyoto Gap for Annex B countries at about 14% of 1990 emissions.<sup>34</sup>

The potential credit may be even larger. The uptake of carbon by forests and soils is estimated at roughly 2,300 megatonnes of carbon per year globally.<sup>35</sup> Most of this uptake — 2,100 megatonnes, according to recent estimates — occurs in the Annex B countries of the Northern Hemisphere.<sup>36</sup> Crediting this amount of carbon uptake would allow overall Annex B emissions to increase by over one-third. While most of this amount is currently uncreditable, either because it cannot be verified through on-the-ground measurements or because it lies in unmanaged forests, the amount indicates the potential for huge increases in credit from non-additional sequestration in managed forests.

Uncertainty in current and projected sequestration levels makes limiting credit for business as usual sequestration extremely difficult. If there were an accurate way to predict business as usual sequestration in 2008-12, one could simply say that countries would receive credit for all sequestration beyond business as usual. Current estimates of sequestration are, however, simply too uncertain to provide an accurate estimate of future sequestration.

One solution may be to give credit only for increases in sequestration from 1990 levels, using the same methodology to calculate both 1990 sequestration and sequestration in the commitment period. While estimates of sequestration in the commitment period may be too high, systematic measurement errors will be balanced out by overestimates of 1990 sequestration. This approach is known as "net-net accounting" because it compares net emissions in 1990 with net emissions in the commitment period. Unfortunately, net-net accounting is unlikely to be accepted for forest management in the First Commitment Period because it would increase the Kyoto targets of many countries. For example, Sweden would receive a debit equivalent to 18% of its 1990 emissions.<sup>37</sup> Net-net accounting may be a solution for future commitment periods.

For agricultural soils, either using net-net accounting or crediting of all sequestration in the commitment period is likely to generate credit from business as usual activities. However, the amount of credit would probably be much smaller than for forest management.<sup>38</sup>



### **Box 2.1: Business as Usual Credit: What Does Canada Get?**

If sequestration in managed forests of Annex B countries were fully credited, it is generally accepted that Russia, the US, and the countries of the EU would receive significant amounts of credit. The same may not be true for Canada.

The Canadian government has estimated that its managed forests are a small net sink of carbon,<sup>39</sup> and has projected that its forests will continue to be a sink in 2008-12. These conclusions are uncertain, however. According to Canada's most recent greenhouse gas inventory:

Methodologies for estimating emissions and removals from land use change and forestry are more complex than those used in other IPCC categories; involving more steps, and requiring more data, factors and assumptions. Results should be treated as first estimates that reflect the direction (i.e., source or sink) and magnitude of emissions or removals. They are characterized by a high degree of uncertainty (over 100% in every case).<sup>40</sup>

Other work indicates that Canada's forests as a whole are currently a net source of greenhouse gas emissions.<sup>41</sup> More recent unpublished analysis suggests that managed forests could be a source of emissions depending on variables such as fire, weather, and definitions of managed forest.<sup>42</sup>

Thus, based on business as usual practices, adding forest management under Article 3.4 could give Canada either a small debit or a small credit. Compared with the 10 megatonnes of credit per year that Canada would receive under optimistic business as usual scenarios, the US would receive an estimated 288 megatonnes of credit per year if all forest management sequestration were credited (as initially proposed by Canada).<sup>43</sup>

The intent of the various formulas, discounts, and boundary conditions proposed by the Parties and CoP6 chair Pronk (see Chapter 1) has been to reduce credit from non-additional sequestration. The formulas succeed to varying degrees. Table 2.1 shows how different proposals for adding forest and agricultural soil management under Article 3.4 would *increase* net emissions (that is, direct industrial emissions minus sequestration by sinks) from Annex B countries. Only increases in emissions due to credit for non-additional sequestration are shown. Not included are:

- Increases in fossil fuel emissions that may be offset by additional forest or soil sequestration due to elevated CO<sub>2</sub> concentrations
- Sequestration that is used to offset Article 3.3 debits for deforestation

The increases are shown in tonnes and as a percentage of the projected gap between Annex B business as usual emissions in the First Commitment Period and allowable emissions under the Kyoto Protocol. The "percentage of projected Annex B gap" is an indication of how much business as usual sequestration would reduce the effectiveness of the Kyoto Protocol.



**Table 2.1 Increase in net global emissions due to addition of forest management and agricultural soil sequestration under Article 3.4.<sup>44</sup>**

Proposal <sup>48</sup>	Estimated credit from non-additional sequestration <sup>45</sup>					
	Based on FAO data <sup>46</sup>			Based on national submissions <sup>47</sup>		
	Mt carbon/yr	% of allowable emissions	% projected Annex B gap <sup>49</sup>	Mt carbon/yr	% of allowable emissions	% projected Annex B gap
Canada's position pre-Hague	755	16	116	581	12	89
Canada's 20 November 2000 position	385	8.1	59	310	6.6	47
Canada's 24 November 2000 position – 80% threshold	339	7.2	52	295	6.2	45
Canada's 24 November 2000 position – 100% threshold	205	4.3	31	195	4.1	30
Pronk paper, 9 April 2001	68.9	1.5	11	105	2.2	16
June 2001 negotiating text	76.9	1.6	12	106	2.2	16
EU, 25 November 2000	16.8	0.4	2.6	16.4	0.3	2.5

For purposes of comparison, projections of credit are based on different estimates of current or future sequestration in forests.<sup>50</sup> The November 2000 proposals by Canada, the US, and Japan were silent on a key variable — the threshold over which they wanted 100% of forest management sequestration to be credited. Table 2.1 shows estimates for two possible thresholds, one of which provides the lowest possible estimate of non-additional sequestration.<sup>51</sup>



Table 2.1 shows that Canada's most recent proposal would reduce the global environmental effectiveness of the Kyoto Protocol by at least 30% and possibly 50%. European proposals would have only a marginal effect, while Pronk's June 2001 proposal could reduce effectiveness by an estimated 12-16%.

### Uncertainty Related to Sinks

Critics argue that without special rules to deal with uncertainty related to sinks, a number of issues would arise. Uncertainty in this context refers to the accuracy of sequestration or emissions estimates that are used to determine compliance with the Kyoto Protocol. The uncertainty would:

- Reduce the transparency of countries' commitments
- Decrease the extent to which compliance with emission limits can be verified
- Increase the possibility that countries would exaggerate the amount of sequestration in order to increase emissions or sell excess emission quotas

According to the EU, the Alliance of Small Island States (AOSIS), the Environmental Integrity Group, and others, credit for sequestration should be discounted and/or caps should be placed on the total amount of credit that can be gained from forest management. Other nations agree that uncertainty can be an issue, but argue that it can be reduced to a point where it is no worse than uncertainty from other elements of nations' emissions inventories.

In weighing these arguments the following factors should be kept in mind:

- *Although uncertainty in some other classes is equal to that from the LULUCF sector as a percentage, the absolute uncertainty is greater for sinks.* Within Annex B the only class of emissions with uncertainty similar to that of the LULUCF sector is nitrous oxides. Nitrous oxides, however, amount to only 6% of Annex B emissions, whereas the LULUCF sector sequesters 9.5-15% of emissions.<sup>52</sup> Within Canada, the only class of emissions whose level of uncertainty equals the LULUCF sector's  $\pm 100\%$  uncertainty is nitrous oxide from anesthetics, but this accounts for only 0.05% of Canada's emissions compared with the LULUCF sector, which is estimated to offset 5% of emissions.<sup>53</sup> The differences in absolute quantities are therefore significant.
- *For the above reasons, uncertainty could mask overall non-compliance.* If additional Article 3.4 activities were to offset 11% of Annex B emissions and uncertainty could be limited to  $\pm 50\%$ , it might be impossible to know whether countries had actually reduced emissions below 1990 levels.<sup>54</sup>
- *Another potential solution — discounting for uncertainty — is also unlikely for the First Commitment Period.* Special accounting rules for sinks could encourage improvements in measurement techniques while ensuring that sequestration is not overcredited. Both the EU and the Environmental Integrity Group have supported discounting sequestration credits by an amount that reflects uncertainty in measurement. For example, if the US estimate of forest management sequestration (289 megatonnes of carbon per year<sup>55</sup>) were accurate to within 50%, the US would be able to get credit for only 144 megatonnes. This approach has been rejected by Canada, the US, and Japan. Parties are currently

discussing only across-the-board discounts that do not reflect differing levels of uncertainty.

### Impermanence of Carbon Sequestration

As discussed earlier, sequestering a tonne of CO<sub>2</sub> is not equivalent to reducing greenhouse gas emissions by a tonne. Carbon in forests and in the upper layer of soils can be quickly re-released to the atmosphere as a result of forest fires, logging, the cessation of practices such as conservation tillage, and climate change itself. If carbon is sequestered in soils or forest for only a decade, the overall impact on the atmosphere is negligible. Atmospheric concentrations are lower during the decade but rebound subsequently. In contrast, a one-year reduction in fossil fuel emissions will lead to a centuries-long reduction in concentrations of CO<sub>2</sub> in the atmosphere.

Parties to international climate negotiations have recognized this fundamental difference by stating that once land credit is given for sequestration on an area of land under Article 3.3 or 3.4, subsequent human-induced emissions from that area must be accounted for. This helps ensure that countries cannot get credit for enhancing carbon reservoirs and then ignoring future releases from the same reservoirs, but it fails to solve the problem of the impermanence of carbon sequestration for several reasons:

- *Countries have not accepted responsibility for emissions resulting from forest fires, drought, insect infestations, or other causes that are not clearly human-induced.* Canadian officials have said that countries should accept responsibility for these emissions, but this negotiating position/proposal is linked to credit for natural sequestration — that is, credit for non-additional sinks.
- *There is a risk of increasing long-term atmospheric concentrations of CO<sub>2</sub>.* If countries are permitted greater emissions because they have sequestered carbon in trees or soils, more carbon will be released into the active carbon pool, which consists of the atmosphere and the biosphere. The carbon stored in trees and soils is available to the atmosphere (unlike carbon stored in oil, coal, or gas deposits), and climate change simulations suggest that large amounts of carbon currently sequestered in soils and forests may be released over the next century, accelerating future climate change.<sup>56</sup> Carbon stored in the biosphere as a result of human sequestration activities may be a small fraction of all carbon in the biosphere but it is particularly susceptible to fire, disease, and other catastrophes. For example, fire suppression may enhance sequestration in the short term but can also create tinderbox conditions that increase the risk of fire and subsequent release of large amounts of CO<sub>2</sub> into the atmosphere.
- *It transfers responsibility to future generations.* If countries are debited for future releases of sequestered carbon, they may simply take stronger action and offset those releases by making deeper cuts in the amount of carbon released in the future. In essence, this transfers an additional risk and responsibility to future generations, who would have to make the tough decisions to cut emissions.
- *It transfers risk to government and to society at large.* If countries are given credit for carbon sequestration under the Kyoto Protocol, their governments are likely to give corporations credit for projects that sequester carbon. Corporations could use the credit to increase



their own emissions, but if they restructure or go out of business, government would be left responsible for the carbon debit.

- *Future generations may be unable to offset biotic carbon releases.* They may be overwhelmed by the need to reduce their direct emissions — by 50% or more globally in the long term — while offsetting emissions due to sequestration reversals. Faced with these pressures, countries are more likely to fall short of their emission reduction commitments and to shun deeper cuts.
- *Future carbon releases are likely to accelerate the rate of climate change.* Storing carbon in trees or soil reservoirs for several decades may help delay climate change, but if releases from these reservoirs are not matched by deeper emission reductions, climate change could be faster and more damaging in the future.<sup>57</sup>
- *“Credit now, debit later” overvalues sequestration relative to reduction.* Both the United Nations Framework Convention on Climate Change and the Kyoto Protocol recognize that climate change is a long-term problem. Different greenhouse gases are rated based on their cumulative effect on the climate over a 100-year timeframe. The credit now, debit later approach is inconsistent with such a long-term view. If a tonne of carbon is sequestered for only 46 years, the cumulative impact on warming over 100 years is only 37% of the impact of an actual emission reduction.<sup>58</sup> An investor comparing sequestration and reduction, however, would discount the future debit and treat the two as similar.

It should be noted that permanence issues are not the same for all types of sequestration projects. Protecting existing old growth does not increase the risks to future generations the same way as suppressing forest fires or planting monocultures of fast-growing species. Other sink enhancement projects, such as changes in tillage practices, are also less susceptible to natural disturbances, albeit more susceptible to changes in management practices.

#### Over-Reliance on Sinks

Like estimates of business as usual sequestration from forest management and agricultural soil management, estimates of the potential for additional sequestration are uncertain. The potential credit from forest management, wood products management, and agricultural soil management activities would allow most of the 20 Annex B countries studied to achieve their reduction commitments through sequestration. Relying on additional sequestration alone, the US could potentially increase emissions by 4-12% from 1990 levels, instead of having to meet its -7 % Kyoto target. EU countries would be able to increase emissions by 8-11% instead of meeting the -8% target agreed to in Kyoto.<sup>59</sup> This study estimates that 600 megatonnes of carbon per year will be sequestered through additional activities by Annex B countries in the First Commitment Period, compared with the US Energy Information Agency’s estimated gap of 653 megatonnes between business as usual emissions and the Kyoto targets in 2010.<sup>60</sup>

Other estimates are lower. The Intergovernmental Panel on Climate Change estimates the realistic potential for revegetation and cropland, grazing land, and forest management in Annex B Parties to be 269 million tonnes of carbon per year,<sup>61</sup> which would achieve over one-third of the reductions needed to comply with the Kyoto Protocol. Others suggest that, given the likely value for sequestration credits, additional activities under Article 3.4 in Annex B will

achieve only about 20% of the projected gap between Annex B business as usual emissions and the Kyoto targets.<sup>62</sup>

Despite this range of estimates, it is clear that if agricultural soils and forest management are added under Article 3.4, there will be significant sink credits that could potentially overwhelm direct industrial emission reduction efforts.

#### APPLYING ARTICLE 3.3: OUTSTANDING ISSUES ON AFFORESTATION, REFORESTATION AND DEFORESTATION

Article 3.3 says that a nation will be credited (or debited) with any increase (or decrease) in sequestered carbon in the period 2008 to 2012 due to afforestation, reforestation, or deforestation, if those activities happened since 1990. Unlike Article 3.4 — which is simply an agreement to further negotiations on issues that were unresolved at Kyoto — Article 3.3 represents a substantive agreement, with rules established as to what activities will be counted and how they will be counted. Nonetheless, several key issues need to be resolved to ensure that treatment of afforestation, reforestation and deforestation is effective for climate protection and equitable.

#### The Meaning of Afforestation, Reforestation and Deforestation

The IPCC — the international climate change scientific advisory panel — defines afforestation as “planting of new forests on lands which, historically, have not contained forests” and reforestation as “planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use.”<sup>63</sup> Deforestation is referred to as conversion of forest to other land uses. Based on these definitions, Article 3.3 is about changes in land use: debits for shifting from forest to pasture or pavement; credits for reforesting land that had been cleared for agriculture.

Although the Kyoto Protocol adopted the IPCC definitions,<sup>64</sup> prior to the Hague Canada had argued that “reforestation” in Article 3.3 meant planting trees after harvest, but that “deforestation” in Article 3.3 did not include harvesting trees. Crediting post harvest regeneration while not debiting harvesting — the other side the harvest-regeneration cycle — was widely criticized as being asymmetric — the equivalent of only counting the credit column in an accounting ledger. (Canada proposed balancing this asymmetry by adding counting harvesting and forest growth under Art. 3.4). Canada backed away from this position at The Hague, accepting that Article 3.3 is meant to benefit countries that expand their forest land base.

#### The Asymmetry of Article 3.3

Defining reforestation as conversion of non-forest land into forest did not, however, eliminate the asymmetry of Article 3.3. The reference to “since 1990” in Article 3.3 creates a discrepancy between the actual and creditable stock changes caused by conversion of land to or from forest use. A nation might have a balance between carbon stock changes due to conversion of land from forest to agriculture and conversion of land from agriculture to forest. However, a country with long rotation periods like Canada would still receive a net debit because the sudden emission from deforestation is not cancelled out by growth on the fraction of land converted to forest since 1990.



To remedy the discrepancy caused by Article 3.3, the EU proposed debiting countries only to the extent their annual rate of deforestation exceeded their annual rate of afforestation and reforestation. For instance, if a country deforested 100 hectares a year and re-established forests on 80 hectares, they would only count emissions from 20 hectares. The EU proposal would have decreased Canada's deforestation debit slightly, but, because we deforest roughly thirty times as much land per year as we afforest, we would have had a net reduction in our assigned amount of about 2.8%.<sup>65</sup>

Canada rejected the European proposal, and President Pronk subsequently proposed that countries could offset any debit under article 3.3 by counting 100% of carbon sequestration by managed forests since 1990 up to the level of the 3.3 debit. Canada, along with its Umbrella Group partners has supported the proposal, and the EU has essentially accepted it.<sup>66</sup>

### The Meaning of Forest

A key issue in article 3.3 is the meaning of forest. The amount of credit or debits that would be generated under different definitions of forest varies greatly.

Both the EU and Umbrella Group countries have supported a definition that gives countries considerable flexibility in how they define a forest. Forest is land with tree crown cover of over ten to thirty percent (Parties to choose threshold) that has a minimum height and covers a minimum area.<sup>67</sup> Forests can either be open forests that have continuous vegetation cover or that closed forests that have trees or undergrowth covering a high proportion of ground. Clear cuts that have not yet been restocked, young natural stands and plantations that have not yet reached the minimum parameters are also considered forests.<sup>68</sup>

This approach to defining forest recognizes the difficulties of a single definition that works for everything from dense temperate rain forests to open, low chaparral; however, it also allows parties to choose definitions that avoid permanent forest clearing being treated as deforestation. Parties are likely to choose definitions that maximize their credit rather than being most appropriate for their forests. Despite the fact that most forests in Canada are fairly dense, Canada could choose a minimum forest cover of 10%. Based on that threshold, the clearing of dense forest to allow agriculture or a golf course would not be considered deforestation so long as every hectare has 10% tree cover and the remainder has some form of vegetation cover (including grass).<sup>69</sup>

To avoid this problem both AOSIS and environmental groups have called for definitions that are similar to the definition above, but tailored for each biome type. Canada has been open to the biome approach in future commitment periods, but has insisted on a "flexible" approach for the First Commitment Period.

### Perverse Incentives

Critics have also suggested that Article 3.3 can reward countries for deforestation. Potentially, areas deforested since 1990 or since negotiation of the Kyoto Protocol could be deforested and subsequently reforested for credit during the commitment period. To ensure against any incentive to deforest and subsequently reforest, several countries and environmental groups have recommended not counting reforestation on land deforested after either 1990 or 1997.

## Afforestation and the Albedo Effect

While negotiators have focused on the above issues, they have ignored at least one crucial issue. Afforestation — especially afforestation in Canada's north — can accelerate climate change.

Climate change is expected to shift Canada's boreal forest treeline northward. Boreal forests will replace tundra. While this will mean that carbon is removed from the atmosphere as trees grow, it may not benefit the climate. One of the determinants of climate change is how much sunlight is reflected back into space (the albedo effect) and how much warms the earth's surface. Dark green forests absorb more sunlight than tundra or farmland, adding to climate change. This is particularly true if large unforested areas covered in highly reflective snow are compared to forests that shed their snow much faster than the underlying surface. Climate modellers predict that shifting of the tree line north in Canada would actually accelerate climate change. In Siberia, the positive atmospheric impact of carbon absorbed by establishing new forests is likely to be diminished by a reduced albedo effect.<sup>70</sup>

Under Article 3.3, there is a risk that northern countries will seek credit for planting or seeding forests in areas where new forests will have a limited and possibly negative impact on climate change. No Parties have proposed methods to eliminate or restrict such credits.



## SECTION 3

### COUNTING CARBON IN THE DEVELOPING WORLD

The Clean Development Mechanism (CDM) contained in the Kyoto Protocol enables industrialized nations to receive credits for investing in emission reduction projects, and potentially sequestration projects, in developing countries. It is also supposed to help developing countries achieve sustainable development.

Whether CDM projects involve sinks or more straightforward emission reductions, calculating credits is a difficult task. Credits generated by CDM projects are determined by comparing actual “with project” emissions with a hypothetical “without project” emission baseline. The “without project” baselines are counterfactual – best guesses of what would have occurred without a project. To fully offset the effects of increased emissions in industrialized countries, baselines must represent the level of emissions that would have occurred without the project, and the projects must be projects that would not have occurred in the host nation without the CDM.<sup>71</sup> The need for “additionality” and the need for accurate baselines make calculating CDM credits a challenge, with or without the inclusion of sinks.

#### SINKS AND THE CDM

The Kyoto Protocol is silent on whether credit can be generated from the establishment of sinks or the protection of carbon reservoirs in developing countries. This silence has generated a good deal of attention in the post-Kyoto negotiations to finalize interpretation of the Protocol.

Negotiations have distinguished between various types of CDM projects:

- *Afforestation and reforestation* — projects that plant trees either on grasslands, formerly forested areas, or agricultural land. They can include agroforestry (planting trees in conjunction with agriculture), establishing plantations to produce wood products and/or to sequester carbon, or restoration of native forests.
- *Prevention of deforestation* — projects that protect existing, generally natural forests.
- *Soil sequestration* — projects that either reduce the rate of soil loss due to agriculture or sequester carbon in agricultural soils.

The November 2000 and April 2001 iterations of the paper<sup>72</sup> by CoP6 chair Jan Pronk, as well as the June 2001 negotiating text, proposed limiting Land Use, Land Use Change, and Forestry (LULUCF) projects in the CDM to afforestation and reforestation during the First Commitment Period (2008-12). Canada, the United States, and Japan opposed restrictions on the types of projects that would be eligible for CDM credits, and opposed any limits on the amount of such credits that can be generated. Other members of the Umbrella Group<sup>73</sup> have been less hawkish. For example, Australia has accepted the exclusion of credit for avoided deforestation during the First Commitment Period.

The European Union has opposed the inclusion of any LULUCF projects in the CDM. Developing countries are divided on the issue. The G-77/China supports excluding the



prevention of deforestation and land degradation from the CDM for the First Commitment Period. This reflects a compromise on the part of traditional opponents of including sinks in the CDM (India, China, South Korea, the Philippines, and the AOSIS countries), but several Latin American countries continue advocating the inclusion of deforestation prevention projects in the first or second commitment periods.<sup>74</sup>

## OUTSTANDING ISSUES AND CONCERNS

### Environmental and Socio-Economic Impacts

LULUCF projects that might qualify for the CDM can have both positive and negative effects on local communities and the environment. For example, a number of projects have protected or could protect biodiversity and provide sustainable development:

- Swaths of rainforest that might otherwise be logged have been protected, and proponents of such projects have worked with local communities, trying to ensure that they have an economic interest in rainforest protection and trying to provide economic alternatives to forest-endangering, CO<sub>2</sub>-emitting practices.
- Some projects have involved providing legal protection for existing, traditional forest use by indigenous communities.
- Managing agricultural lands to store more carbon is also likely to reduce soil erosion, increase soil fertility, and enhance food security.
- Reforestation of denuded or degraded land with mixed native species can reduce erosion and restore biodiversity.

Other projects, however, have been criticized for their negative environmental and socio-economic impacts:

- Monocultures of pine and eucalyptus have been planted because they maximize short-term sequestration of carbon. Replacement of natural grasslands and forests with these plantations has led to significant loss of biodiversity in and around plantations.<sup>75</sup>
- Afforestation with these species can decrease the flow of water from catchments and cause water shortages during droughts, and all types of afforestation can affect groundwater and local river flows.
- Plantation projects can displace local communities. For example, the completion of one sequestration project in Uganda could lead to 8,000 farmers and fishermen being evicted from the plantation area.<sup>76</sup>

Since the CDM is intended to help developing countries achieve sustainable development, it would seem reasonable to develop rules to ensure that CDM projects are, indeed, sustainable. Canada and other Umbrella Group countries have resisted such rules, however, arguing that developing countries should have the sovereign right to define sustainable development in their own way. This approach would also encourage competition among developing countries: those that impose strict sustainable development criteria could lose investment to those with laxer standards.



Efforts to develop rules to ensure a minimum of environmental integrity in LULUCF projects have so far met with little success. Several US and Latin American environmental groups have suggested adopting rules that would disallow projects involving the conversion of natural ecosystems, or on land that has been deforested since the Kyoto Protocol was negotiated. The EU has also suggested that LULUCF projects in general be consistent with other international obligations. Members of the Umbrella Group, however, have opposed requiring LULUCF projects to be consistent with treaties protecting indigenous peoples, biodiversity, and wetlands, and see little need for additional rules to deal with such projects.

Pronk's proposal to include afforestation and reforestation in the CDM while excluding the prevention of deforestation has heightened fears that the CDM could promote projects with negative environmental and socio-economic impacts. Most of the LULUCF projects in developing countries that are considered the best in terms of their impacts on biodiversity and local communities tend to be forest protection projects, while those that have been most heavily criticized are afforestation and reforestation projects. (The reasons for excluding prevention of deforestation relate to the problems of leakage and scale associated with such projects.)

Pronk has also proposed that rules to deal with adverse socio-economic and environmental effects be negotiated in 2002, after agreement is reached on principles considered more immediate. Given past experience, it is uncertain whether effective rules could then be negotiated.

#### Perverse Incentives

A driving concern of those opposed to reforestation projects in the CDM is that credit for reforestation could actually encourage deforestation: developing countries would have incentive to log or burn natural forests and claim credit for forests planted to replace them, even if the original forest sequestered far more carbon. This same perverse incentive exists under Article 3.3 of the Kyoto Protocol before the First Commitment Period, and there have been cases of carbon-rich natural forests being replaced by carbon plantations in both developing and industrialized countries.

In industrialized countries both emissions from deforestation and CO<sub>2</sub> removal from the atmosphere due to reforestation will be counted after 2008, but no such protection exists in relation to the CDM. Several US environmental non-governmental organizations (NGOs) have proposed rules eliminating credit for reforestation on land deforested before 2000, but these proposals have not been promoted by any country.

#### Impermanence of Carbon Sequestration

Carbon in forests and soils can be quickly released into the atmosphere as a result of forest fires, logging, the cessation of practices such as conservation tillage or fire protection, and climate change itself (see Chapter 5 for a detailed discussion). To fully offset the atmospheric impacts of an additional tonne of CO<sub>2</sub> emissions, an equivalent amount of carbon must be sequestered permanently; to be consistent with the Kyoto Protocol's long-term approach, it must be sequestered for at least a century. As discussed in Chapter 2, the temporary sequestration of carbon can have some temporary value for the climate, but it can also shift risks onto future generations.

To date, most of the LULUCF projects in developing countries have been of limited duration, promising only to monitor carbon stocks and/or guaranteeing to keep carbon sequestered for 20, 40, or 60 years. Given projections of severe losses of biomass in tropical areas over the next century,<sup>77</sup> this raises concerns that sequestered carbon that is now credited under the CDM could be released in the future.

Although these risks can be reduced through the design of a project, they cannot be eliminated. For example:

- A discount can be applied to credit for carbon sequestered, but what if more carbon is released into the atmosphere than the amount of the discount?
- Projects can be designed so that the local community has a stake in protecting the forests, but what if forests burn as a result of factors beyond the community's control?
- Risks can be spread over several projects, and credits can be discounted to reflect risk (sometime referred to as "self-insurance"). But what if climate change or other factors result in forests and soils in entire regions becoming sources of emissions (as is projected for many tropical areas in the next century)?

To date, few concrete proposals have dealt with the impermanence risk. CoP6 chair Pronk has said that rules for dealing with this should be worked out by CoP8, in late 2002. Nations advocating broad inclusion of LULUCF projects in the CDM, such as Japan, Australia, Canada, and the US, have simply proposed that the issue be dealt with through a combination of project design and risk management. They have not been willing to accept developed-country responsibility for offsetting emissions should a sequestration project be reversed in the future. There has also been little support for requiring that sequestration projects be maintained and monitored for the minimum period — 100 years — consistent with the Kyoto Protocol's focus on long-term solutions.<sup>78</sup>

## Measurement

All CDM projects pose challenges because of the need to accurately determine additionality and set baselines that reflect what would have occurred without the project. The challenge is especially great in the context of afforestation, reforestation, and soil sequestration projects.

For a CDM energy project to fully offset emissions, it is necessary only for the baseline to reflect what would have occurred without the project in the 10 or 15 years during which the project generates credits. Emission reductions from the baseline due to the project will have a permanent impact on the atmosphere that offsets increased emissions in industrialized countries.

On the other hand, afforestation, reforestation, or soil sequestration projects will fully offset increased emissions only if the baseline is accurate far after the time at which sequestration occurs, and only if the sequestration is permanent. For example, sequestration of carbon by plantations will fully offset increased emissions only if the sequestration would never have occurred without the project. A project that simply brings a plantation into being 5 or 10 years earlier provides little benefit in offsetting "permanent" emissions such as those from fossil fuel use.



To date, there have been no serious proposals for dealing with this problem.

### Leakage

Emission reductions or sequestration of carbon by a project can be cancelled out if the project indirectly causes emissions or decreases sequestration elsewhere. For example:

- A project may successfully protect an area of forest from slash-and-burn agriculture, but farmers may simply move somewhere outside the project boundaries and continue the same level of slash-and-burn, resulting in no gain for the atmosphere.
- If trees are planted for carbon sequestration and then later made available for timber production, the expectation of lower timber prices could reduce investment in plantations that do not get credit.

This phenomenon of leakage is not unique to forest projects, and projects can be designed to avoid it (for example, by providing farmers with alternatives to slash-and-burn agriculture). Nonetheless, leakage remains a particular problem for forest protection projects and can be as high as 100% if such projects are poorly designed. Where new forests have been established to generate carbon credits and timber for the global commodities market, the estimated rate of leakage is 40%, compared with 5-20% in the energy sector.<sup>79</sup>

### Scale

Finally, there is concern that the amount of credit that could be generated by CDM projects might siphon off resources from emission-reducing activities in the energy, industrial, and transportation sectors that are essential for long-term climate protection. This is especially true if credit can be generated from projects to prevent deforestation.

Estimates of the cost of reducing carbon emissions by protecting forests in developing countries range from 10 cents per tonne to \$15 per tonne. Based on economists' best guess of \$1 per tonne for prevention of deforestation, CDM LULUCF projects could dominate the emission reduction efforts of Annex B countries. Economic models show that if they were eligible for credit, they would account for over 40% of the emission reductions required by the Kyoto Protocol. Less than 15% of reductions would occur through domestic action.<sup>80</sup>

# GLOSSARY

## ABBREVIATIONS AND ACRONYMS

AAU	Assigned amount unit
AOSIS	Alliance of Small Island States
C	Carbon
CDM	Clean Development Mechanism
CERs	certified emission reductions
CO <sub>2</sub>	Carbon dioxide
CoP	Conference of the Parties to the UNFCCC
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LULUCF	Land Use, Land Use Change, and Forestry
Mt	Million metric tonnes (10 <sup>12</sup> grams)
N <sub>2</sub> O	Nitrous oxide
OPEC	Organization of Petroleum Exporting Countries
SBSTA	Subsidiary Body for Scientific and Technological Advice
TAR	IPCC Third Assessment Report
UNFCCC	United Nations Framework Convention on Climate Change

## TERMS

**Additionality** — The requirement that greenhouse emission reductions or greenhouse gas emission reduction projects be “additional” to those that would have occurred without the CDM.

**Afforestation** — Planting of new forests on lands that historically have not contained forests.

**Annex B Parties** — Industrialized countries that have legally binding emission reduction commitments under the Kyoto Protocol. Annex B Parties include almost all the wealthy countries of the Organization for Economic Cooperation and Development and economies in transition to a market economy in Eastern Europe and the former Soviet Union.



**Annex I Parties** — Industrialized countries that are Parties to the UN Framework Convention on Climate Change. Generally the same as Annex B Parties.

**Assigned amount** — The quota of allowable emissions held by industrialized (Annex B) countries. Also see *Base year*.

**Baseline emission** — A hypothetical reference case, or “business as usual” projection, of emissions or sequestration in the absence of an emission reduction or sequestration project.

**Baseline scenarios** — Scenarios that include the combined effects of net sources and sinks from natural processes and indirect and direct human activities in a world without climate change mitigation policies.

**Base year** — The year used to determine assigned amount. The assigned amount of countries is equal to direct industrial emissions in the base year times a percentage listed in Annex B to the Kyoto Protocol, times 5 for each of the five years of the First Commitment Period. For most purposes the base year is 1990.

**“Business as usual”** — The emissions levels, activities, or carbon sequestration levels that would occur without climate change mitigation action.

**Carbon pool** — A reservoir or system that has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and the atmosphere.

**Carbon stock** — The absolute quantity of carbon held within a carbon pool at a specified time.

**Certified emission reductions (CERs)** — Emission reductions in developing countries that have been certified under the Clean Development Mechanism and are added to the allowable emissions quota (the “assigned amount”) of industrialized (Annex B) countries.

**Clean Development Mechanism (CDM)** — Mechanism established under Article 12 of the Kyoto Protocol, under which investments in emission reduction projects (such as clean energy technology) in developing countries generate certified emission reductions.

**Climate change mitigation action/initiatives** — Activities undertaken to reduce the risks of climate change.

**Conference of the Parties (CoP)** — The “supreme body” governing the UN Framework Convention on Climate Change, composed of all Parties to the agreement.

**Conservation tillage** — Methods of cultivating the soil that minimize the frequency of or avoid tillage, with the objective of retaining an erosion-controlling cover of crop residues on the soil surface. Sometimes referred to as *minimal tillage*, or as *zero-* or *no-tillage*, where the soil is disturbed only at planting, when seed and fertilizer are applied into narrow slits opened in the soil.

**Deforestation** — Long-term or permanent removal of forest cover and conversion to a non-forested land use.

**Direct industrial emissions** — Emissions from fossil fuel production, transportation, and combustion; industrial processes; waste management; and agricultural activities such as fertilization. Does not include carbon sequestration or emissions from agricultural carbon reservoirs.

**Discounting** — A reduction in credit from estimated levels of greenhouse gas sequestration or emission reduction.

**G-77/China** — Negotiating bloc composed of over 130 developing (or “non-Annex I”) countries.

**Greenhouse gas (GHG) emissions** — Emissions of gases such as nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>), and especially carbon dioxide (CO<sub>2</sub>) that accumulate and act to retain atmospheric heat, thus causing the warming of the earth.

**International emissions trading** — Mechanism established under Article 17 of the Kyoto Protocol, which provides for the transfer of assigned amounts between two Annex B Parties.

**Intergovernmental Panel on Climate Change (IPCC)** — Body established in 1988 by the World Meteorological Organization and the United Nations Environment Program. It conducts rigorous surveys of the worldwide technical and scientific literature and publishes assessment reports that are widely recognized as the most credible existing sources of information on climate change. The IPCC also works on methodologies and responds to specific requests from the UNFCCC’s subsidiary bodies.

**Joint Implementation (JI)** — Mechanism established under Article 6 of Kyoto Protocol, which provides for the transfer of emission reductions between two Annex I Parties through particular projects.

**Kyoto Gap** — The gap between projected business as usual emissions and what will be required for Annex B Parties to comply with the Kyoto Protocol.

**Managed forest** — Forest that is managed by humans for one or more purposes. A precise definition of the managed forest has not been agreed to. Some countries argue that it includes land in parks that is set aside for recreational or wilderness purposes. Others suggest that it includes all land within a defined distance from a road.

**Net-net** — An approach to counting carbon sequestration in which countries are given credit only for increases in the rate of sequestration from base year levels. Thus a country that sequestered 10 Mt per year in 1990 would need to increase the rate of sequestration to receive a credit in a future commitment period. A reduction in the rate of sequestration would create a debit.

**Party** — Any country that ratified the UN Framework Convention on Climate Change.

**Pool** — Any system component that has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, organic soils, fossil fuel deposits, and the atmosphere.

**Reforestation** — A conversion of deforested land back into forested land. The IPCC definition of reforestation used in this report does not include regeneration after harvesting.



**Reservoir** — A pool. Component or components of biosphere or physical climate system where carbon or, more generally, a greenhouse gas or precursor of a greenhouse gas is stored.

**Sequestration (“sinks”)** — The process of increasing the carbon content of a carbon pool other than the atmosphere. Under the Kyoto Protocol, developed countries can meet part of their emission reduction commitments by enhancing the storage of carbon in the biosphere through certain land use change and forestry activities.

**Sink** — A reservoir that is removing greenhouse gases from the atmosphere. A given reservoir is a sink for atmospheric carbon if, during a given time interval, (1) more carbon is flowing into it than is flowing out, and (2) the changes in the remainder of the connected system are such that there is a net withdrawal of carbon from the atmosphere.

**Source** — A source of greenhouse gas emissions. A carbon reservoir can be a source of carbon to the atmosphere if, during a given time interval, (1) less carbon is flowing into it than is flowing out, and (2) the changes in the remainder of the connected system are such that there is a net release of carbon to the atmosphere.

**Umbrella Group** — Negotiating bloc composed of Canada, the United States, Japan, Norway, Australia, New Zealand, Iceland, Russia, and the Ukraine.



# APPENDIX 1

The Following tables estimate the amount of credit or debits countries would receive under different accounting proposals for sinks.

## THE PROPOSALS

The proposals evaluated are as follows:

- Comprehensive Crediting (proposed by Canada, October 1997 and August 2000). All changes in carbon stocks between January 1, 2008 and December 31, 2012, on managed forest and agricultural lands are counted, with no thresholds, discounts, or other limitations.
- Canada/US/Japan proposal November 20, 2000. Same as above, but increases in carbon stock on managed forestland are subject to 66% discount if they exceed 20 mt C per annum. Discount not applied to increases that exceed unspecified threshold. For purposes of this report threshold assumed to be equal to 100% of projected business as usual levels (minimizes credit).
- Canada/US/Japan proposal November 24, 2000. Same as Comprehensive crediting, except forest management that exceeds amount of debit under Article 3.3. subject to 5% discount and is capped at a level equal to 4% of 1990 emissions. Discount and cap not applied to increases that exceed unspecified threshold. For purposes of this report, threshold is assumed to be equal to 100% of projected business as usual sequestration on managed forest lands (this minimizes credit) or 80% of the lower of either (a) projected business as usual sequestration on managed forest lands, or (b) projected business as usual sequestration on managed forest lands minus any debits under article 3.3 (this ensures a strong incentive for carbon management in forests).
- Pronk proposal (April 2001). All changes in carbon stocks between January 1, 2008 and December 31, 2012, on managed forest and agricultural lands are counted. No discounts sequestration on managed forest land up to level of Article 3.3 debit unless this exceeds cap. Cap equal to 8.2 mt per year. Sequestration on managed forest land in excess of 3.3. debit discounted by 85%. Boundary condition limits total credit from sinks (including credit purchased on international market). If a country's initial assigned amount is based on a reduction target of less than 100% (e.g. Canada's target is 94%), its boundary condition is equal to one half of base year emissions, times the difference between the country's reduction target and 100%. E.g. for Canada boundary condition is equal to 50% of 1990 emissions, multiplied by 6% (100% minus 94%). If a country's initial assigned amount is based on a target of 100% or greater, its boundary condition is equal to 2.5% of base year emissions.
- Pronk proposal (June 2001). Same as above, but countries meeting specified indicators (relating to population density, forest cover and energy intensity) are exempt from the discount. Specified indicators only met by Japan.



- EU Proposal August 2000. No additional activities under Article 3.4. Emissions from deforestation under Article 3.3 are to be adjusted by not counting deforestation on areas where an equivalent area has been converted to forestry.
- EU Proposal 25 November 2000. Same as Comprehensive crediting, except forest management that exceeds amount of debit under Article 3.3, subject to 97% discount and 30% discount applied to agricultural soils. Annual credit limited to 0.5% of base-year emissions.

## DATA SOURCES

Article 3.3 credits or debits are based on the August 2000 submissions of the Parties.<sup>81</sup>

For all proposals other than the April and June 2001, Pronk proposals, credits for agricultural soils are based on the August 2000 submissions of the Parties. Estimates for agricultural land include changes due to cropland management, grazing land management, cropland conversion to grazing land, and shelterbelts. For the April and June, 2001, Pronk proposals, estimated credit under net-net accounting is based on tables included with the April 2001, Pronk Proposal.

Two sets of data are used to estimate sequestration due to forest management. The first set (“National Submissions”) uses projections of sequestration on managed forest lands contained in Parties August 2000 submissions. Where this data is unavailable it uses data from countries’ national inventories. National inventories do not report changes in carbon stock due to forest management; however, inventory estimates of “changes in forest and woody biomass” are used as a proxy for forest management. No national estimates are available for Russia. Estimates for Russia are based on Kevin Gurney and Jason Neff, *Carbon Sequestration Potential in Canada and Russia, and the United States under Article 3.4 of the Kyoto*.

The second data (“FAO Forest Data) set uses estimates of sequestration from forest management based on United Nations Food and Agricultural Organization data. This data, as compiled by Chairman Pronk April paper is used to indicate the differences in projected sequestration from forest management. Agricultural soil data is based on the same sources as in the National Submissions data set.

National projections of sequestration contained in the Annex B Parties’ August 2000 projections of sequestration in 2008-12, as well as current rates reported in national inventories or estimated from FAO data are assumed to reflect business as usual. This is consistent with methodologies identified by different nations in their August 1 submissions. For example, US estimates are “based on recent trends,” “long-term baseline projections,” or “business as usual scenarios” (see US submission of August 2000). Canadian projections for forest management are equal to current estimates of carbon removals by managed forests.

## APPENDIX 2

Table 1: Comprehensive Crediting. Based on National Submissions.

	Base Year	AAU	Afforestation, Reforestation and Deforestation (Article 3.3)	Agricultural Soil Management (Art. 3.4)	Forest Management (Art. 3.4)	3.4 Credit	Comprehen sive Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		5.94	5.94	5.94
Austria	21.04	19.36	-0.20		1.88	1.88	1.68
Belgium	37.24	34.36				0.00	0.00
Bulgaria	42.84	39.38			1.71	1.71	1.71
Canada	166.17	153.64	-4.30	4.03	9.60	13.63	9.33
Czech Republic	51.74	47.61			1.17	1.17	1.17
Denmark	19.08	17.56			0.26	0.26	0.26
Estonia	11.10	10.20			1.23	1.23	1.23
Finland	20.51	18.87	2.20		3.94	3.94	6.14
France	148.96	138.91	2.59		22.95	22.95	25.54
Germany	330.28	304.12	8.60		9.13	9.13	17.73
Greece	29.28	27.00				0.00	0.00
Hungary	27.72	26.07			1.57	1.57	1.57
Iceland	0.70	0.76				0.00	0.00
Ireland	14.59	13.42			1.83	1.83	1.83
Italy	141.69	130.35			7.13	7.13	7.13
Japan	334.78	314.70	1.32		11.37	11.37	12.69
Latvia	9.73	8.94			3.57	3.57	3.57
Liechtenstein	0.07	0.07				0.00	0.00
Lithuania	14.06	12.93			2.35	2.35	2.35
Luxembourg	3.66	3.38				0.00	0.00

Table 1: Comprehensive Crediting. Based on National Submissions (cont'd).

	Base Year Mt C/yr	AAU Mt C/yr	Afforestation, Reforestation and Deforestation (Article 3.3) Mt C/yr	Agricultural Soil Management (Art. 3.4) Mt C/yr	Forest Management (Art. 3.4) Mt C/yr	3.4 Credit Mt C/yr	Comprehen sive Credit Mt C/yr
Monaco	0.03	0.03				0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.46	0.39	0.39
New Zealand	19.90	19.91	7.64		5.46	5.46	13.10
Norway	14.22	14.34	0.02		4.70	4.70	4.72
Poland	153.89	144.64			7.37	7.37	7.37
Portugal	17.12	16.03			0.74	0.74	0.74
Romania	72.24	66.43			1.54	1.54	1.54
Russian Federation	826.56	829.02			137.46	137.46	137.46
Slovakia	20.79	19.14			0.60	0.60	0.60
Slovenia	5.24	4.80			0.84	0.84	0.84
Spain	84.13	77.34			7.98	7.98	7.98
Sweden	19.25	17.73	-0.09		8.34	8.34	8.25
Switzerland	14.46	13.31	-0.02	0.01	1.65	1.66	1.64
Ukraine	250.70	250.67				0.00	0.00
United Kingdom	208.84	192.09	0.56		2.45	2.45	3.01
U.S.A.	1665.38	1539.35	-7.20	23.79	288.66	312.45	305.25
Total	4992.30	4725.64	11.12	27.76	553.88	581.64	592.76
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.11	0.12	0.12
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.12	0.12	0.13

Table 2: Comprehensive Crediting. Based on FAO Forest Data.

	Base Year	AAU	Afforestation, Reforestation and Deforestation (Article 3.3)	Agricultural Soil Management (Art. 3.4)	Forest Management (Art. 3.4)	3.4 Credit	Compre- hensive Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		40.49	40.49	40.49
Austria	21.04	19.36	-0.20		5.14	5.14	4.94
Belgium	37.24	34.36			0.22	0.22	0.22
Bulgaria	42.84	39.38			2.44	2.44	2.44
Canada	166.17	153.64	-4.30	4.03	49.43	53.46	49.16
Czech Republic	51.74	47.61			2.13	2.13	2.13
Denmark	19.08	17.56			0.31	0.31	0.31
Estonia	11.10	10.20			0.64	0.64	0.64
Finland	20.51	18.87	2.20		5.65	5.65	7.85
France	148.96	138.91	2.59		8.95	8.95	11.54
Germany	330.28	304.12	8.60		14.07	14.07	22.67
Greece	29.28	27.00			0.23	0.23	0.23
Hungary	27.72	26.07			1.92	1.92	1.92
Iceland	0.70	0.76			0.00	0.00	0.00
Ireland	14.59	13.42			0.32	0.32	0.32
Italy	141.69	130.35			0.71	0.71	0.71
Japan	334.78	314.70	1.32		13.58	13.58	14.90
Latvia	9.73	8.94			2.52	2.52	2.52
Liechtenstein	0.07	0.07				0.00	0.00
Lithuania	14.06	12.93			1.88	1.88	1.88
Luxembourg	3.66	3.38			0.01	0.01	0.01

Table 2: Comprehensive Crediting. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Afforestation, Reforestation and Deforestation (Article 3.3)	Agricultural Soil Management (Art. 3.4)	Forest Management (Art. 3.4)	3.4 Credit	Compre- hensive Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03				0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.40	0.33	0.33
New Zealand	19.90	19.91	7.64		3.67	3.67	11.31
Norway	14.22	14.34	0.02		3.53	3.53	3.55
Poland	153.89	144.64			5.45	5.45	5.45
Portugal	17.12	16.03			0.51	0.51	0.51
Romania	72.24	66.43			7.35	7.35	7.35
Russian Federation	826.56	829.02			425.54	425.54	425.54
Slovakia	20.79	19.14			3.36	3.36	3.36
Slovenia	5.24	4.80			1.78	1.78	1.78
Spain	84.13	77.34			3.00	3.00	3.00
Sweden	19.25	17.73	-0.09		10.89	10.89	10.80
Switzerland	14.46	13.31	-0.02	0.01	0.66	0.67	0.65
Ukraine	250.70	250.67			7.41	7.41	7.41
United Kingdom	208.84	192.09	0.56		1.67	1.67	2.23
U.S.A.	1665.38	1539.35	-7.20	23.79	101.18	124.97	117.77
Total	4992.30	4725.64	11.12	27.76	727.04	754.80	765.92
Percent of Baseyear Emissions			0.00	0.01	0.15	0.15	0.15
Percent of Initial AAU			0.00	0.01	0.15	0.16	0.16

Table 3: Canada/US/Japan proposal November 20, 2000. Based on National Submissions.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Manage- ment	First Tier (to 20 mt)	Second Tier (67% discount)	Credit from Forest Manage- ment	Credit from Art. 3.4	Credit from Article 3	Credit from 3.4 less 3.3 debits
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		5.94	5.94	0.00	5.94	5.94	5.94	5.94
Austria	21.04	19.36	-0.20		1.88	1.88	0.00	1.88	1.88	1.68	1.68
Belgium	37.24	34.36				0.00	0.00	0.00	0.00	0.00	0.00
Bulgaria	42.84	39.38			1.71	1.71	0.00	1.71	1.71	1.71	1.71
Canada	166.17	153.64	-4.30	4.03	9.60	9.60	0.00	9.60	13.63	9.33	9.33
Czech Republic	51.74	47.61			1.17	1.17	0.00	1.17	1.17	1.17	1.17
Denmark	19.08	17.56			0.26	0.26	0.00	0.26	0.26	0.26	0.26
Estonia	11.10	10.20			1.23	1.23	0.00	1.23	1.23	1.23	1.23
Finland	20.51	18.87	2.20		3.94	3.94	0.00	3.94	3.94	6.14	3.94
France	148.96	138.91	2.59		22.95	20.00	0.98	20.98	20.98	23.57	20.98
Germany	330.28	304.12	8.60		9.13	9.13	0.00	9.13	9.13	17.73	9.13
Greece	29.28	27.00				0.00	0.00	0.00	0.00	0.00	0.00
Hungary	27.72	26.07			1.57	1.57	0.00	1.57	1.57	1.57	1.57
Iceland	0.70	0.76				0.00	0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			1.83	1.83	0.00	1.83	1.83	1.83	1.83
Italy	141.69	130.35			7.13	7.13	0.00	7.13	7.13	7.13	7.13
Japan	334.78	314.70	1.32		11.37	11.37	0.00	11.37	11.37	12.69	11.37
Latvia	9.73	8.94			3.57	3.57	0.00	3.57	3.57	3.57	3.57
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			2.35	2.35	0.00	2.35	2.35	2.35	2.35
Luxembourg	3.66	3.38				0.00	0.00	0.00	0.00	0.00	0.00

Table 3: Canada/US/Japan proposal November 20, 2000. Based on National Submissions (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Manage- ment	First Tier (to 20 mt)	Second Tier (67% discount)	Credit from Forest Manage- ment	Credit from Art. 3.4	Credit from Article 3	Credit from 3.4 less 3.3 debits
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.46	0.46	0.00	0.46	0.39	0.39	0.39
New Zealand	19.90	19.91	7.64		5.46	5.46	0.00	5.46	5.46	13.10	5.46
Norway	14.22	14.34	0.02		4.70	4.70	0.00	4.70	4.70	4.72	4.70
Poland	153.89	144.64			7.37	7.37	0.00	7.37	7.37	7.37	7.37
Portugal	17.12	16.03			0.74	0.74	0.00	0.74	0.74	0.74	0.74
Romania	72.24	66.43			1.54	1.54	0.00	1.54	1.54	1.54	1.54
Russian Federation	826.56	829.02			137.46	20.00	39.11	59.11	59.11	59.11	59.11
Slovakia	20.79	19.14			0.60	0.60	0.00	0.60	0.60	0.60	0.60
Slovenia	5.24	4.80			0.84	0.84	0.00	0.84	0.84	0.84	0.84
Spain	84.13	77.34			7.98	7.98	0.00	7.98	7.98	7.98	7.98
Sweden	19.25	17.73	-0.09		8.34	8.34	0.00	8.34	8.34	8.25	8.25
Switzerland	14.46	13.31	-0.02	0.01	1.65	1.65	0.00	1.65	1.66	1.64	1.64
Ukraine	250.70	250.67				0.00	0.00	0.00	0.00	0.00	0.00
United Kingdom	208.84	192.09	0.56		2.45	2.45	0.00	2.45	2.45	3.01	2.45
U.S.A.	1665.38	1539.35	-7.20	23.79	288.66	20.00	89.46	109.46	133.25	126.05	126.05
Total	4992.30	4725.64	11.12	27.76	553.88			294.37	322.13	333.25	310.32
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.11	0.00		0.06	0.06	0.07	0.06
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.12	0.00		0.06	0.068	0.07	0.07



Table 4: Canada/US/Japan proposal November 20, 2000. Based on FAO Forest Data.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Manage- ment	First Tier (to 20 mt)	Second Tier (67% discount)	Credit from Forest Manage- ment	Credit from Art. 3.4	Credit from Article 3	Credit from 3.4 less 3.3 debits
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		40.49	20.00	6.82	26.82	26.82	26.82	26.82
Austria	21.04	19.36	-0.20		5.14	5.14	0.00	5.14	5.14	4.94	4.94
Belgium	37.24	34.36			0.22	0.22	0.00	0.22	0.22	0.22	0.22
Bulgaria	42.84	39.38			2.44	2.44	0.00	2.44	2.44	2.44	2.44
Canada	166.17	153.64	-4.30	4.03	49.43	20.00	9.80	29.80	33.83	29.53	29.53
Czech Republic	51.74	47.61			2.13	2.13	0.00	2.13	2.13	2.13	2.13
Denmark	19.08	17.56			0.31	0.31	0.00	0.31	0.31	0.31	0.31
Estonia	11.10	10.20			0.64	0.64	0.00	0.64	0.64	0.64	0.64
Finland	20.51	18.87	2.20		5.65	5.65	0.00	5.65	5.65	7.85	5.65
France	148.96	138.91	2.59		8.95	8.95	0.00	8.95	8.95	11.54	8.95
Germany	330.28	304.12	8.60		14.07	14.07	0.00	14.07	14.07	22.67	14.07
Greece	29.28	27.00			0.23	0.23	0.00	0.23	0.23	0.23	0.23
Hungary	27.72	26.07			1.92	1.92	0.00	1.92	1.92	1.92	1.92
Iceland	0.70	0.76			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			0.32	0.32	0.00	0.32	0.32	0.32	0.32
Italy	141.69	130.35			0.71	0.71	0.00	0.71	0.71	0.71	0.71
Japan	334.78	314.70	1.32		13.58	13.58	0.00	13.58	13.58	14.90	13.58
Latvia	9.73	8.94			2.52	2.52	0.00	2.52	2.52	2.52	2.52
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			1.88	1.88	0.00	1.88	1.88	1.88	1.88
Luxembourg	3.66	3.38			0.01	0.01	0.00	0.01	0.01	0.01	0.01

Table 4: Canada/US/Japan proposal November 20, 2000. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Manage- ment	First Tier (to 20 mt)	Second Tier (67% discount)	Credit from Forest Manage- ment	Credit from Art. 3.4	Credit from Article 3	Credit from 3.4 less 3.3 debits
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.40	0.40	0.00	0.40	0.33	0.33	0.33
New Zealand	19.90	19.91	7.64		3.67	3.67	0.00	3.67	3.67	11.31	3.67
Norway	14.22	14.34	0.02		3.53	3.53	0.00	3.53	3.53	3.55	3.53
Poland	153.89	144.64			5.45	5.45	0.00	5.45	5.45	5.45	5.45
Portugal	17.12	16.03			0.51	0.51	0.00	0.51	0.51	0.51	0.51
Romania	72.24	66.43			7.35	7.35	0.00	7.35	7.35	7.35	7.35
Russian Federation	826.56	829.02			425.54	20.00	135.04	155.04	155.04	155.04	155.04
Slovakia	20.79	19.14			3.36	3.36	0.00	3.36	3.36	3.36	3.36
Slovenia	5.24	4.80			1.78	1.78	0.00	1.78	1.78	1.78	1.78
Spain	84.13	77.34			3.00	3.00	0.00	3.00	3.00	3.00	3.00
Sweden	19.25	17.73	-0.09		10.89	10.89	0.00	10.89	10.89	10.80	10.80
Switzerland	14.46	13.31	-0.02	0.01	0.66	0.66	0.00	0.66	0.67	0.65	0.65
Ukraine	250.70	250.67			7.41	7.41	0.00	7.41	7.41	7.41	7.41
United Kingdom	208.84	192.09	0.56		1.67	1.67	0.00	1.67	1.67	2.23	1.67
U.S.A.	1665.38	1539.35	-7.20	23.79	101.18	20.00	27.03	47.03	70.82	63.62	63.62
<b>Total</b>	4992.30	4725.64	11.12	27.76	727.04			369.10	396.86	407.98	385.05
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.15	0.00		0.07	0.08	0.08	0.08
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.15	0.00		0.08	0.084	0.09	0.08

Table 5: Canada/US/Japan proposal November 24, 2000. Based on National Submissions.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (100% threshold) not capped	Second Tier (80% threshold) not capped	Second Tier (80% threshold) not capped	Cap on 2d Tier	Second Tier Credit with 80% threshold	Second Tier Credit with 100% threshold	Third Tier with 80% cap	Total Credit w. 80% threshold Tier + 3d tier + Ag soils	Total Credit w. 100% threshold tier + Ag soils	Total Art. 3 Credit w. 80% threshold tier + Ag soils +3.3	Total Art. 3 Credit w. 100% threshold tier + Ag soils +3.3	Credit under Comprehensive Crediting
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		5.94	5.64	4.75	4.51	5.38	4.51	5.3816	1.19	5.70	5.38	5.70	5.38	5.94
Austria	21.04	19.36	-0.20		1.88	1.60	1.34	1.28	0.84	0.84	0.8416	0.34	1.18	0.84	1.18	0.84	1.68
Belgium	37.24	34.36				0.00	0.00	0.00	1.49	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Bulgaria	42.84	39.38			1.71	1.62	1.37	1.30	1.71	1.30	1.6245	0.34	1.64	1.62	1.64	1.62	1.71
Canada	166.17	153.64	-4.30	4.03	9.60	5.04	4.24	4.03	6.65	4.03	5.035	1.06	9.12	9.07	9.12	9.07	9.33
Czech Republic	51.74	47.61			1.17	1.11	0.94	0.89	2.07	0.89	1.1115	0.23	1.12	1.11	1.12	1.11	1.17
Denmark	19.08	17.56			0.26	0.25	0.21	0.20	0.76	0.20	0.247	0.05	0.25	0.25	0.25	0.25	0.26
Estonia	11.10	10.20			1.23	1.17	0.98	0.93	0.44	0.44	0.444	0.25	0.69	0.44	0.69	0.44	1.23
Finland	20.51	18.87	2.20		3.94	3.74	3.15	2.99	0.82	0.82	0.8204	0.79	1.61	0.82	3.81	3.02	6.14
France	148.96	138.91	2.59		22.95	21.80	18.36	17.44	5.96	5.96	5.9584	4.59	10.55	5.96	13.14	8.55	25.54
Germany	330.28	304.12	8.60		9.13	8.67	7.30	6.94	13.21	6.94	8.6735	1.83	8.76	8.67	17.36	17.27	17.73
Greece	29.28	27.00				0.00	0.00	0.00	1.17	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Hungary	27.72	26.07			1.57	1.49	1.26	1.19	1.11	1.11	1.1088	0.31	1.42	1.11	1.42	1.11	1.57
Iceland	0.70	0.76				0.00	0.00	0.00	0.03	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			1.83	1.74	1.46	1.39	0.58	0.58	0.5836	0.37	0.95	0.58	0.95	0.58	1.83
Italy	141.69	130.35			7.13	6.77	5.70	5.42	5.67	5.42	5.6676	1.43	6.84	5.67	6.84	5.67	7.13
Japan	334.78	314.70	1.32		11.37	10.80	9.10	8.64	13.39	8.64	10.8015	2.27	10.92	10.80	12.24	12.12	12.69
Latvia	9.73	8.94			3.57	3.39	2.86	2.71	0.39	0.39	0.3892	0.71	1.10	0.39	1.10	0.39	3.57
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			2.35	2.23	1.88	1.79	0.56	0.56	0.5624	0.47	1.03	0.56	1.03	0.56	2.35

Table 5: Canada/US/Japan proposal November 24, 2000. Based on National Submissions (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (100% threshold) not capped	Second Tier (80% threshold) not capped	Second Tier (80% threshold) not capped	Cap on 2d Tier	Second Tier Credit with 80% threshold	Second Tier Credit with 100% threshold	Third Tier with 80% cap	Total Credit w. 80% threshold 2d Tier + 3d tier + Ag soils	Total Credit w. 100% threshold 2d tier + Ag soils	Total Art. 3 Credit w. 80% threshold 2d tier + Ag soils +3.3	Total Art. 3 Credit w. 100% threshold 2d tier + Ag soils +3.3	Credit under Comprehensive Crediting
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Luxembourg	3.66	3.38				0.00	0.00	0.00	0.15	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.46	0.44	0.37	0.35	2.39	0.35	0.437	0.09	0.37	0.37	0.37	0.37	0.39
New Zealand	19.90	19.91	7.64		5.46	5.19	4.37	4.15	0.80	0.80	0.796	1.09	1.89	0.80	9.53	8.44	13.10
Norway	14.22	14.34	0.02		4.70	4.47	3.76	3.57	0.57	0.57	0.5688	0.94	1.51	0.57	1.53	0.59	4.72
Poland	153.89	144.64			7.37	7.00	5.90	5.60	6.16	5.60	6.1556	1.47	7.08	6.16	7.08	6.16	7.37
Portugal	17.12	16.03			0.74	0.70	0.59	0.56	0.68	0.56	0.6848	0.15	0.71	0.68	0.71	0.68	0.74
Romania	72.24	66.43			1.54	1.46	1.23	1.17	2.89	1.17	1.463	0.31	1.48	1.46	1.48	1.46	1.54
Russian Federation	826.56	829.02			137.46	130.59	109.97	104.47	33.06	33.06	33.0624	27.49	60.55	33.06	60.55	33.06	137.46
Slovakia	20.79	19.14			0.60	0.57	0.48	0.46	0.83	0.46	0.57	0.12	0.58	0.57	0.58	0.57	0.60
Slovenia	5.24	4.80			0.84	0.80	0.67	0.64	0.21	0.21	0.2096	0.17	0.38	0.21	0.38	0.21	0.84
Spain	84.13	77.34			7.98	7.58	6.38	6.06	3.37	3.37	3.3652	1.60	4.96	3.37	4.96	3.37	7.98
Sweden	19.25	17.73	-0.09		8.34	7.84	6.60	6.27	0.77	0.77	0.77	1.65	2.42	0.77	2.42	0.77	8.25
Switzerland	14.46	13.31	-0.02	0.01	1.65	1.55	1.30	1.24	0.58	0.58	0.5784	0.33	0.91	0.59	0.91	0.59	1.64
Ukraine	250.70	250.67				0.00	0.00	0.00	10.03	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
United Kingdom	208.84	192.09	0.56		2.45	2.33	1.96	1.86	8.35	1.86	2.3275	0.49	2.35	2.33	2.91	2.89	3.01
U.S.A.	1665.38	1539.35	-7.20	23.79	288.66	267.39	225.17	213.91	66.62	66.62	66.6152	56.29	146.70	90.41	146.70	90.41	305.25
Total	4992.30	4725.64	11.12	27.76	553.88			411.97	199.69	158.60	166.85		294.78	194.61	317.71	217.54	592.76
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.11	0.00		0.08	0.04	0.03	0.03	0.00	0.059	0.039	0.064	0.044	0.12
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.12	0.00		0.09	0.04	0.03	0.04	0.00	0.062	0.041	0.067	0.046	0.13

Table 6: Canada/US/Japan proposal November 24, 2000. Based on FAO Forest Data.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (100% threshold) not capped	Second Tier (80% threshold) not capped	Second Tier (80% threshold) not capped	Cap on 2d Tier	Second Tier Credit with 80% threshold	Second Tier Credit with 100% threshold	Third Tier with 80% cap	Total Credit w. 80% threshold 2d Tier + Ag soils	Total Credit w. 100% threshold 2d tier + Ag soils	Total Art. 3 Credit w. 80% threshold +3.3	Total Art. 3 Credit w. 100% threshold +3.3	Credit under Comprehensive Crediting
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		40.49	38.47	32.39	30.77	5.38	5.38	5.3816	8.10	13.48	5.38	13.48	5.38	40.49
Austria	21.04	19.36	-0.20		5.14	4.69	3.95	3.75	0.84	0.84	0.8416	0.99	1.83	0.84	1.83	0.84	4.94
Belgium	37.24	34.36			0.22	0.21	0.18	0.17	1.49	0.17	0.209	0.04	0.21	0.21	0.21	0.21	0.22
Bulgaria	42.84	39.38			2.44	2.32	1.95	1.85	1.71	1.71	1.7136	0.49	2.20	1.71	2.20	1.71	2.44
Canada	166.17	153.64	-4.30	4.03	49.43	42.87	36.10	34.30	6.65	6.65	6.6468	9.03	19.70	10.68	19.70	10.68	49.16
Czech Republic	51.74	47.61			2.13	2.02	1.70	1.62	2.07	1.62	2.0235	0.43	2.04	2.02	2.04	2.02	2.13
Denmark	19.08	17.56			0.31	0.29	0.25	0.24	0.76	0.24	0.2945	0.06	0.30	0.29	0.30	0.29	0.31
Estonia	11.10	10.20			0.64	0.61	0.51	0.49	0.44	0.44	0.444	0.13	0.57	0.44	0.57	0.44	0.64
Finland	20.51	18.87	2.20		5.65	5.37	4.52	4.29	0.82	0.82	0.8204	1.13	1.95	0.82	4.15	3.02	7.85
France	148.96	138.91	2.59		8.95	8.50	7.16	6.80	5.96	5.96	5.9584	1.79	7.75	5.96	10.34	8.55	11.54
Germany	330.28	304.12	8.60		14.07	13.37	11.26	10.69	13.21	10.69	13.2112	2.81	13.51	13.21	22.11	21.81	22.67
Greece	29.28	27.00			0.23	0.22	0.18	0.17	1.17	0.17	0.2185	0.05	0.22	0.22	0.22	0.22	0.23
Hungary	27.72	26.07			1.92	1.82	1.54	1.46	1.11	1.11	1.1088	0.38	1.49	1.11	1.49	1.11	1.92
Iceland	0.70	0.76			0.00	0.00	0.00	0.00	0.03	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			0.32	0.30	0.26	0.24	0.58	0.24	0.304	0.06	0.31	0.30	0.31	0.30	0.32
Italy	141.69	130.35			0.71	0.67	0.57	0.54	5.67	0.54	0.6745	0.14	0.68	0.67	0.68	0.67	0.71
Japan	334.78	314.70	1.32		13.58	12.90	10.86	10.32	13.39	10.32	12.901	2.72	13.04	12.90	14.36	14.22	14.90
Latvia	9.73	8.94			2.52	2.39	2.02	1.92	0.39	0.39	0.3892	0.50	0.89	0.39	0.89	0.39	2.52
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			1.88	1.79	1.50	1.43	0.56	0.56	0.5624	0.38	0.94	0.56	0.94	0.56	1.88

Table 6: Canada/US/Japan proposal November 24, 2000. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (100% threshold) not capped	Second Tier (80% threshold) not capped	Second Tier (80% threshold) not capped	Cap on 2d Tier	Second Tier Credit with 80% cap and threshold	Second Tier Credit with 100% cap and threshold	Third Tier with 80% cap	Total Credit w. 80% threshold 2d Tier + Ag soils	Total Credit w. 100% threshold 2d Tier + Ag soils	Total Art. 3 Credit w. 80% threshold +3d tier + Ag soils	Total Art. 3 Credit w. 100% threshold +3d tier + Ag soils	Credit under Comprehensive Crediting
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Luxembourg	3.66	3.38			0.01	0.01	0.01	0.01	0.15	0.01	0.0095	0.00	0.01	0.01	0.01	0.01	0.01
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.40	0.38	0.32	0.30	2.39	0.30	0.38	0.08	0.31	0.31	0.31	0.31	0.33
New Zealand	19.90	19.91	7.64		3.67	3.49	2.94	2.79	0.80	0.80	0.796	0.73	1.53	0.80	9.17	8.44	11.31
Norway	14.22	14.34	0.02		3.53	3.35	2.82	2.68	0.57	0.57	0.5688	0.71	1.27	0.57	1.29	0.59	3.55
Poland	153.89	144.64			5.45	5.18	4.36	4.14	6.16	4.14	5.1775	1.09	5.23	5.18	5.23	5.18	5.45
Portugal	17.12	16.03			0.51	0.48	0.41	0.39	0.68	0.39	0.4845	0.10	0.49	0.48	0.49	0.48	0.51
Romania	72.24	66.43			7.35	6.98	5.88	5.59	2.89	2.89	2.8896	1.47	4.36	2.89	4.36	2.89	7.35
Russian Federation	826.56	829.02			425.54	404.26	340.43	323.41	33.06	33.06	33.0624	85.11	118.17	33.06	118.17	33.06	425.54
Slovakia	20.79	19.14			3.36	3.19	2.69	2.55	0.83	0.83	0.8316	0.67	1.50	0.83	1.50	0.83	3.36
Slovenia	5.24	4.80			1.78	1.69	1.42	1.35	0.21	0.21	0.2096	0.36	0.57	0.21	0.57	0.21	1.78
Spain	84.13	77.34			3.00	2.85	2.40	2.28	3.37	2.28	2.85	0.60	2.88	2.85	2.88	2.85	3.00
Sweden	19.25	17.73	-0.09		10.89	10.26	8.64	8.21	0.77	0.77	0.77	2.16	2.93	0.77	2.93	0.77	10.80
Switzerland	14.46	13.31	-0.02	0.01	0.66	0.61	0.51	0.49	0.58	0.49	0.5784	0.13	0.62	0.59	0.62	0.59	0.65
Ukraine	250.70	250.67			7.41	7.04	5.93	5.63	10.03	5.63	7.0395	1.48	7.11	7.04	7.11	7.04	7.41
United Kingdom	208.84	192.09	0.56		1.67	1.59	1.34	1.27	8.35	1.27	1.5865	0.33	1.60	1.59	2.16	2.15	2.23
U.S.A.	1665.38	1539.35	-7.20	23.79	101.18	89.28	75.18	71.42	66.62	66.62	66.6152	18.80	109.20	90.41	109.20	90.41	117.77
Total	4992.30	4725.64	11.12	27.76	727.04			543.57	199.69	168.11	177.55		338.92	205.31	361.85	228.24	765.92
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.15	0.00		0.11	0.04	0.03	0.04	0.00	0.068	0.041			0.15
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.15	0.00		0.12	0.04	0.04	0.04	0.00	0.072	0.043			0.16

Table 7: Pronk proposal April 2001. Based on National Submissions.

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Art 3.4 (AM) net net	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	108.00	0.00	2.18	5.94	0.00	0.00	0.89	3.07	3.36	3.07	3.07
Austria	21.04	19.36	92.00	-0.20		1.88	0.20	0.20	0.25	0.25	0.84	0.25	0.25
Belgium	37.24	34.36	92.00				0.00	0.00	0.00	0.00	1.49	0.00	0.00
Bulgaria	42.84	39.38	92.00			1.71	0.00	0.00	0.26	0.26	1.71	0.26	0.26
Canada	166.17	153.64	94.00	-4.30	5.00	9.60	4.30	4.30	0.80	5.80	4.99	4.99	4.99
Czech Republic	51.74	47.61	92.00			1.17	0.00	0.00	0.18	0.18	2.07	0.18	0.18
Denmark	19.08	17.56	92.00			0.26	0.00	0.00	0.04	0.04	0.76	0.04	0.04
Estonia	11.10	10.20	92.00			1.23	0.00	0.00	0.18	0.18	0.44	0.18	0.18
Finland	20.51	18.87	92.00	2.20		3.94	0.00	0.00	0.59	0.59	0.82	0.59	2.79
France	148.96	138.91	92.00	2.59		22.95	0.00	0.00	3.44	3.44	5.96	3.44	6.03
Germany	330.28	304.12	92.00	8.60		9.13	0.00	0.00	1.37	1.37	13.21	1.37	9.97
Greece	29.28	27.00	92.00				0.00	0.00	0.00	0.00	1.17	0.00	0.00
Hungary	27.72	26.07	94.00			1.57	0.00	0.00	0.24	0.24	0.83	0.24	0.24
Iceland	0.70	0.76	110.00		0.04		0.00	0.00	0.00	0.04	0.02	0.02	0.02
Ireland	14.59	13.42	92.00			1.83	0.00	0.00	0.27	0.27	0.58	0.27	0.27
Italy	141.69	130.35	92.00			7.13	0.00	0.00	1.07	1.07	5.67	1.07	1.07
Japan	334.78	314.70	94.00	1.32		11.37	0.00	0.00	1.71	1.71	10.04	1.71	3.03
Latvia	9.73	8.94	92.00			3.57	0.00	0.00	0.54	0.54	0.39	0.39	0.39
Liechtenstein	0.07	0.07	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93	92.00			2.35	0.00	0.00	0.35	0.35	0.56	0.35	0.35
Luxembourg	3.66	3.38	92.00				0.00	0.00	0.00	0.00	0.15	0.00	0.00

Table 7: Pronk proposal April 2001. Based on National Submissions (cont'd).

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Art 3.4 (AM) net net	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	92.00	0.00	0.20	0.46	0.00	0.00	0.07	0.27	2.39	0.27	0.27
New Zealand	19.90	19.91	100.00	7.64		5.46	0.00	0.00	0.82	0.82	0.50	0.50	8.14
Norway	14.22	14.34	101.00	0.02		4.70	0.00	0.00	0.71	0.71	0.36	0.36	0.38
Poland	153.89	144.64	94.00			7.37	0.00	0.00	1.11	1.11	4.62	1.11	1.11
Portugal	17.12	16.03	92.00			0.74	0.00	0.00	0.11	0.11	0.68	0.11	0.11
Romania	72.24	66.43	92.00			1.54	0.00	0.00	0.23	0.23	2.89	0.23	0.23
Russian Federation	826.56	829.02	100.00			137.46	0.00	0.00	20.62	20.62	20.66	20.62	20.62
Slovakia	20.79	19.14	92.00			0.60	0.00	0.00	0.09	0.09	0.83	0.09	0.09
Slovenia	5.24	4.80	92.00			0.84	0.00	0.00	0.13	0.13	0.21	0.13	0.13
Spain	84.13	77.34	92.00			7.98	0.00	0.00	1.20	1.20	3.37	1.20	1.20
Sweden	19.25	17.73	92.00	-0.09		8.34	0.09	0.09	1.24	1.24	0.77	0.77	0.77
Switzerland	14.46	13.31	92.00	-0.02	0.01	1.65	0.02	0.02	0.24	0.25	0.58	0.25	0.25
Ukraine	250.70	250.67	100.00				0.00	0.00	0.00	0.00	6.27	0.00	0.00
United Kingdom	208.84	192.09	92.00	0.56		2.45	0.00	0.00	0.37	0.37	8.35	0.37	0.93
U.S.A.	1665.38	1539.35	93.00	-7.20	10.20	288.66	7.20	7.20	42.22	52.42	58.29	52.42	52.42
Total	4992.30	4725.64			17.63	553.88		11.81		98.94		104.60	119.75
Percent of Baseyear Emissions	1.00	0.95		0.00	0.00	0.11	0.00	0.00	0.00	0.02			
Percent of Initial AAU	1.06	1.00		0.00	0.00	0.12	0.00	0.00	0.00	0.02			



Table 8: Pronk proposal April 2001. Based on FAO Forest Data.

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Agricultural Soil Management (net-net)	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	108.00	0.00	2.18	40.49	0.00	0.00	6.07	8.25	3.36	3.36	3.36
Austria	21.04	19.36	92.00	-0.20		5.14	0.20	0.20	0.74	0.74	0.84	0.74	0.74
Belgium	37.24	34.36	92.00			0.22	0.00	0.00	0.03	0.03	1.49	0.03	0.03
Bulgaria	42.84	39.38	92.00			2.44	0.00	0.00	0.37	0.37	1.71	0.37	0.37
Canada	166.17	153.64	94.00	-4.30	5.00	49.43	4.30	4.30	6.77	11.77	4.99	4.99	4.99
Czech Republic	51.74	47.61	92.00			2.13	0.00	0.00	0.32	0.32	2.07	0.32	0.32
Denmark	19.08	17.56	92.00			0.31	0.00	0.00	0.05	0.05	0.76	0.05	0.05
Estonia	11.10	10.20	92.00			0.64	0.00	0.00	0.10	0.10	0.44	0.10	0.10
Finland	20.51	18.87	92.00	2.20		5.65	0.00	0.00	0.85	0.85	0.82	0.82	3.02
France	148.96	138.91	92.00	2.59		8.95	0.00	0.00	1.34	1.34	5.96	1.34	3.93
Germany	330.28	304.12	92.00	8.60		14.07	0.00	0.00	2.11	2.11	13.21	2.11	10.71
Greece	29.28	27.00	92.00			0.23	0.00	0.00	0.03	0.03	1.17	0.03	0.03
Hungary	27.72	26.07	94.00			1.92	0.00	0.00	0.29	0.29	0.83	0.29	0.29
Iceland	0.70	0.76	110.00		0.04	0.00	0.00	0.00	0.00	0.04	0.02	0.02	0.02
Ireland	14.59	13.42	92.00			0.32	0.00	0.00	0.05	0.05	0.58	0.05	0.05
Italy	141.69	130.35	92.00			0.71	0.00	0.00	0.11	0.11	5.67	0.11	0.11
Japan	334.78	314.70	94.00	1.32		13.58	0.00	0.00	2.04	2.04	10.04	2.04	3.36
Latvia	9.73	8.94	92.00			2.52	0.00	0.00	0.38	0.38	0.39	0.38	0.38
Liechtenstein	0.07	0.07	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93	92.00			1.88	0.00	0.00	0.28	0.28	0.56	0.28	0.28
Luxembourg	3.66	3.38	92.00			0.01	0.00	0.00	0.00	0.00	0.15	0.00	0.00

Table 8: Pronk proposal April 2001. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Agricultural Soil Management (net-net)	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	92.00	0.00	0.20	0.40	0.00	0.00	0.06	0.26	2.39	0.26	0.26
New Zealand	19.90	19.91	100.00	7.64		3.67	0.00	0.00	0.55	0.55	0.50	0.50	8.14
Norway	14.22	14.34	101.00	0.02		3.53	0.00	0.00	0.53	0.53	0.36	0.36	0.38
Poland	153.89	144.64	94.00			5.45	0.00	0.00	0.82	0.82	4.62	0.82	0.82
Portugal	17.12	16.03	92.00			0.51	0.00	0.00	0.08	0.08	0.68	0.08	0.08
Romania	72.24	66.43	92.00			7.35	0.00	0.00	1.10	1.10	2.89	1.10	1.10
Russian Federation	826.56	829.02	100.00			425.54	0.00	0.00	63.83	63.83	20.66	20.66	20.66
Slovakia	20.79	19.14	92.00			3.36	0.00	0.00	0.50	0.50	0.83	0.50	0.50
Slovenia	5.24	4.80	92.00			1.78	0.00	0.00	0.27	0.27	0.21	0.21	0.21
Spain	84.13	77.34	92.00			3.00	0.00	0.00	0.45	0.45	3.37	0.45	0.45
Sweden	19.25	17.73	92.00	-0.09		10.89	0.09	0.09	1.62	1.62	0.77	0.77	0.77
Switzerland	14.46	13.31	92.00	-0.02	0.01	0.66	0.02	0.02	0.10	0.11	0.58	0.11	0.11
Ukraine	250.70	250.67	100.00			7.41	0.00	0.00	1.11	1.11	6.27	1.11	1.11
United Kingdom	208.84	192.09	92.00	0.56		1.67	0.00	0.00	0.25	0.25	8.35	0.25	0.81
U.S.A.	1665.38	1539.35	93.00	-7.20	10.20	101.18	7.20	7.20	14.10	24.30	58.29	24.30	24.30
Total	4992.30	4725.64			17.63	727.04		11.81		124.91		68.89	91.82
Percent of Baseyear Emissions	1.00	0.95		0.00	0.00	0.15	0.00	0.00	0.00	0.03		Percent of allowable emissions	0.01943
Percent of Initial AAU	1.06	1.00		0.00	0.00	0.15	0.00	0.00	0.00	0.03			

Table 9: Pronk proposal June 2001. Based on National Submissions.

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Art 3.4 (AM) net net	FM Green-peace	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	<b>144.21</b>	108.00	0.00	2.18	5.94	0.00	0.00	0.89	3.07	3.36	3.07	3.07
Austria	21.04	<b>19.36</b>	92.00	-0.20		1.88	0.20	0.20	0.25	0.25	0.84	0.25	0.25
Belgium	37.24	<b>34.36</b>	92.00				0.00	0.00	0.00	0.00	1.49	0.00	0.00
Bulgaria	42.84	<b>39.38</b>	92.00			1.71	0.00	0.00	0.26	0.26	1.71	0.26	0.26
Canada	166.17	<b>153.64</b>	94.00	-4.30	5.00	9.60	4.30	4.30	0.80	5.80	4.99	4.99	4.99
Czech Republic	51.74	<b>47.61</b>	92.00			1.17	0.00	0.00	0.18	0.18	2.07	0.18	0.18
Denmark	19.08	<b>17.56</b>	92.00			0.26	0.00	0.00	0.04	0.04	0.76	0.04	0.04
Estonia	11.10	<b>10.20</b>	92.00			1.23	0.00	0.00	0.18	0.18	0.44	0.18	0.18
Finland	20.51	<b>18.87</b>	92.00	2.20		3.94	0.00	0.00	0.59	0.59	0.82	0.59	2.79
France	148.96	<b>138.91</b>	92.00	2.59		22.95	0.00	0.00	3.44	3.44	5.96	3.44	6.03
Germany	330.28	<b>304.12</b>	92.00	8.60		9.13	0.00	0.00	1.37	1.37	13.21	1.37	9.97
Greece	29.28	<b>27.00</b>	92.00				0.00	0.00	0.00	0.00	1.17	0.00	0.00
Hungary	27.72	<b>26.07</b>	94.00			1.57	0.00	0.00	0.24	0.24	0.83	0.24	0.24
Iceland	0.70	<b>0.76</b>	110.00		0.04		0.00	0.00	0.00	0.04	0.02	0.02	0.02
Ireland	14.59	<b>13.42</b>	92.00			1.83	0.00	0.00	0.27	0.27	0.58	0.27	0.27
Italy	141.69	<b>130.35</b>	92.00			7.13	0.00	0.00	1.07	1.07	5.67	1.07	1.07
Japan	334.78	<b>314.70</b>	94.00	1.32		11.37	0.00	0.00	11.37	11.37	10.04	10.04	11.36
Latvia	9.73	<b>8.94</b>	92.00			3.57	0.00	0.00	0.54	0.54	0.39	0.39	0.39
Liechtenstein	0.07	<b>0.07</b>	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	<b>12.93</b>	92.00			2.35	0.00	0.00	0.35	0.35	0.56	0.35	0.35
Luxembourg	3.66	<b>3.38</b>	92.00				0.00	0.00	0.00	0.00	0.15	0.00	0.00

Table 9: Pronk proposal June 2001. Based on National Submissions (cont'd).

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Art 3.4 (AM) net net	FM Green-peace	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr		Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03	92.00					0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	92.00	0.00	0.20	0.46	0.00	0.00	0.07	0.27	2.39	0.27	0.27
New Zealand	19.90	19.91	100.00	7.64		5.46	0.00	0.00	0.82	0.82	0.50	0.50	8.14
Norway	14.22	14.34	101.00	0.02		4.70	0.00	0.00	0.71	0.71	0.36	0.36	0.38
Poland	153.89	144.64	94.00			7.37	0.00	0.00	1.11	1.11	4.62	1.11	1.11
Portugal	17.12	16.03	92.00			0.74	0.00	0.00	0.11	0.11	0.68	0.11	0.11
Romania	72.24	66.43	92.00			1.54	0.00	0.00	0.23	0.23	2.89	0.23	0.23
Russian Federation	826.56	829.02	100.00			137.46	0.00	0.00	20.62	20.62	20.66	20.62	20.62
Slovakia	20.79	19.14	92.00			0.60	0.00	0.00	0.09	0.09	0.83	0.09	0.09
Slovenia	5.24	4.80	92.00			0.84	0.00	0.00	0.13	0.13	0.21	0.13	0.13
Spain	84.13	77.34	92.00			7.98	0.00	0.00	1.20	1.20	3.37	1.20	1.20
Sweden	19.25	17.73	92.00	-0.09		8.34	0.09	0.09	1.24	1.24	0.77	0.77	0.77
Switzerland	14.46	13.31	92.00	-0.02	0.01	1.65	0.02	0.02	0.24	0.25	0.58	0.25	0.25
Ukraine	250.70	250.67	100.00				0.00	0.00	0.00	0.00	6.27	0.00	0.00
United Kingdom	208.84	192.09	92.00	0.56		2.45	0.00	0.00	0.37	0.37	8.35	0.37	0.93
U.S.A.	1665.38	1539.35	93.00	-7.20	10.20	288.66	7.20	7.20	42.22	52.42	58.29	52.42	52.42
Total	4992.30	4725.64			17.63	553.88		11.81		108.61		105.16	128.09
Percent of Baseyear Emissions	1.00	0.95		0.00	0.00	0.11	0.00	0.00	0.00	0.02	Percent of allowable emissions 0.022253		
Percent of Initial AAU	1.06	1.00		0.00	0.00	0.12	0.00	0.00	0.00	0.02			

Table 10: Pronk proposal June 2001. Based on FAO Forest Data.

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Agricultural Soil Management (net-net)	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	108.00	0.00	2.18	40.49	0.00	0.00	6.07	8.25	3.36	3.36	3.36
Austria	21.04	19.36	92.00	-0.20		5.14	0.20	0.20	0.74	0.74	0.84	0.74	0.74
Belgium	37.24	34.36	92.00			0.22	0.00	0.00	0.03	0.03	1.49	0.03	0.03
Bulgaria	42.84	39.38	92.00			2.44	0.00	0.00	0.37	0.37	1.71	0.37	0.37
Canada	166.17	153.64	94.00	-4.30	5.00	49.43	4.30	4.30	6.77	11.77	4.99	4.99	4.99
Czech Republic	51.74	47.61	92.00			2.13	0.00	0.00	0.32	0.32	2.07	0.32	0.32
Denmark	19.08	17.56	92.00			0.31	0.00	0.00	0.05	0.05	0.76	0.05	0.05
Estonia	11.10	10.20	92.00			0.64	0.00	0.00	0.10	0.10	0.44	0.10	0.10
Finland	20.51	18.87	92.00	2.20		5.65	0.00	0.00	0.85	0.85	0.82	0.82	3.02
France	148.96	138.91	92.00	2.59		8.95	0.00	0.00	1.34	1.34	5.96	1.34	3.93
Germany	330.28	304.12	92.00	8.60		14.07	0.00	0.00	2.11	2.11	13.21	2.11	10.71
Greece	29.28	27.00	92.00			0.23	0.00	0.00	0.03	0.03	1.17	0.03	0.03
Hungary	27.72	26.07	94.00			1.92	0.00	0.00	0.29	0.29	0.83	0.29	0.29
Iceland	0.70	0.76	110.00		0.04	0.00	0.00	0.00	0.00	0.04	0.02	0.02	0.02
Ireland	14.59	13.42	92.00			0.32	0.00	0.00	0.05	0.05	0.58	0.05	0.05
Italy	141.69	130.35	92.00			0.71	0.00	0.00	0.11	0.11	5.67	0.11	0.11
Japan	334.78	314.70	94.00	1.32		13.58	0.00	0.00	13.58	13.58	10.04	10.04	11.36
Latvia	9.73	8.94	92.00			2.52	0.00	0.00	0.38	0.38	0.39	0.38	0.38
Liechtenstein	0.07	0.07	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93	92.00			1.88	0.00	0.00	0.28	0.28	0.56	0.28	0.28
Luxembourg	3.66	3.38	92.00			0.01	0.00	0.00	0.00	0.00	0.15	0.00	0.00

Table 10: Pronk proposal June 2001. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Target under Annex B	Art 3.3 Credit	Agricultural Soil Management (net-net)	Forest Management	First Tier No Cap	First Tier	Second Tier	Total Second Tier and AM	Pronk Boundary Condition	Second and Third Tier Credit with boundary condition	Total LULUCF Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr			Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03	92.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	92.00	0.00	0.20	0.40	0.00	0.00	0.06	0.26	2.39	0.26	0.26
New Zealand	19.90	19.91	100.00	7.64		3.67	0.00	0.00	0.55	0.55	0.50	0.50	8.14
Norway	14.22	14.34	101.00	0.02		3.53	0.00	0.00	0.53	0.53	0.36	0.36	0.38
Poland	153.89	144.64	94.00			5.45	0.00	0.00	0.82	0.82	4.62	0.82	0.82
Portugal	17.12	16.03	92.00			0.51	0.00	0.00	0.08	0.08	0.68	0.08	0.08
Romania	72.24	66.43	92.00			7.35	0.00	0.00	1.10	1.10	2.89	1.10	1.10
Russian Federation	826.56	829.02	100.00			425.54	0.00	0.00	63.83	63.83	20.66	20.66	20.66
Slovakia	20.79	19.14	92.00			3.36	0.00	0.00	0.50	0.50	0.83	0.50	0.50
Slovenia	5.24	4.80	92.00			1.78	0.00	0.00	0.27	0.27	0.21	0.21	0.21
Spain	84.13	77.34	92.00			3.00	0.00	0.00	0.45	0.45	3.37	0.45	0.45
Sweden	19.25	17.73	92.00	-0.09		10.89	0.09	0.09	1.62	1.62	0.77	0.77	0.77
Switzerland	14.46	13.31	92.00	-0.02	0.01	0.66	0.02	0.02	0.10	0.11	0.58	0.11	0.11
Ukraine	250.70	250.67	100.00			7.41	0.00	0.00	1.11	1.11	6.27	1.11	1.11
United Kingdom	208.84	192.09	92.00	0.56		1.67	0.00	0.00	0.25	0.25	8.35	0.25	0.81
U.S.A.	1665.38	1539.35	93.00	-7.20	10.20	101.18	7.20	7.20	14.10	24.30	58.29	24.30	24.30
Total	4992.30	4725.64			17.63	727.04		11.81		136.46		76.90	99.83
Percent of Baseyear Emissions	1.00	0.95		0.00	0.00	0.15	0.00	0.00	0.00	0.03		0.02	Percent of allowable emissions 0.021124
Percent of Initial AAU	1.06	1.00		0.00	0.00	0.15	0.00	0.00	0.00	0.03		0.02	

Table 11: EU proposal November 2000. Based on National Submissions.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (3% Forest Manage- ment)	Second Tier (30% of Ag Soils)	Second Tier Total no Cap	Second Tier Total with Cap	Total Article 3 Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		5.94	0.18	0.00	0.18	0.18	0.18
Austria	21.04	19.36	-0.20		1.88	0.05	0.00	0.04	0.04	0.04
Belgium	37.24	34.36				0.00	0.00	0.00	0.00	0.00
Bulgaria	42.84	39.38			1.71	0.05	0.00	0.04	0.04	0.04
Canada	166.17	153.64	-4.30	4.03	9.60	0.16	1.21	0.12	0.12	0.12
Czech Republic	51.74	47.61			1.17	0.04	0.00	0.03	0.03	0.03
Denmark	19.08	17.56			0.26	0.01	0.00	0.01	0.01	0.01
Estonia	11.10	10.20			1.23	0.04	0.00	0.03	0.03	0.03
Finland	20.51	18.87	2.20		3.94	0.12	0.00	0.09	0.09	2.29
France	148.96	138.91	2.59		22.95	0.69	0.00	0.55	0.55	3.14
Germany	330.28	304.12	8.60		9.13	0.27	0.00	0.22	0.22	8.82
Greece	29.28	27.00				0.00	0.00	0.00	0.00	0.00
Hungary	27.72	26.07			1.57	0.05	0.00	0.04	0.04	0.04
Iceland	0.70	0.76				0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			1.83	0.05	0.00	0.04	0.04	0.04
Italy	141.69	130.35			7.13	0.21	0.00	0.17	0.17	0.17
Japan	334.78	314.70	1.32		11.37	0.34	0.00	0.27	0.27	1.59
Latvia	9.73	8.94			3.57	0.11	0.00	0.09	0.05	0.05
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			2.35	0.07	0.00	0.06	0.06	0.06
Luxembourg	3.66	3.38				0.00	0.00	0.00	0.00	0.00

Table 11: EU proposal November 2000. Based on National Submissions (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (3% Forest Manage- ment)	Second Tier (30% of Ag Soils)	Second Tier Total no Cap	Second Tier Total with Cap	Total Article 3 Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.46	0.01	-0.02	0.01	0.01	0.01
New Zealand	19.90	19.91	7.64		5.46	0.16	0.00	0.13	0.10	7.74
Norway	14.22	14.34	0.02		4.70	0.14	0.00	0.11	0.07	0.09
Poland	153.89	144.64			7.37	0.22	0.00	0.18	0.18	0.18
Portugal	17.12	16.03			0.74	0.02	0.00	0.02	0.02	0.02
Romania	72.24	66.43			1.54	0.05	0.00	0.04	0.04	0.04
Russian Federation	826.56	829.02			137.46	4.12	0.00	3.30	3.30	3.30
Slovakia	20.79	19.14			0.60	0.02	0.00	0.01	0.01	0.01
Slovenia	5.24	4.80			0.84	0.03	0.00	0.02	0.02	0.02
Spain	84.13	77.34			7.98	0.24	0.00	0.19	0.19	0.19
Sweden	19.25	17.73	-0.09		8.34	0.25	0.00	0.20	0.10	0.10
Switzerland	14.46	13.31	-0.02	0.01	1.65	0.05	0.00	0.04	0.04	0.04
Ukraine	250.70	250.67				0.00	0.00	0.00	0.00	0.00
United Kingdom	208.84	192.09	0.56		2.45	0.07	0.00	0.06	0.06	0.62
U.S.A.	1665.38	1539.35	-7.20	23.79	288.66	8.44	7.14	6.76	6.76	6.76
Total	4992.30	4725.64	11.12	27.76	553.88	16.26	8.33	13.04	12.83	35.76
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.11	0.00	0.00	0.00		
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.12	0.003	0.002	0.003	0.003	



Table 12: EU proposal November 2000. Based on FAO Forest Data.

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (3% Forest Management)	Second Tier (30% of Ag Soils)	Second Tier Total no Cap	Second Tier Total with Cap	Total Article 3 Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Australia	134.54	144.21	0.00		40.49	1.21	0.00	1.21	0.67	0.67
Austria	21.04	19.36	-0.20		5.14	0.15	0.00	0.12	0.11	0.11
Belgium	37.24	34.36			0.22	0.01	0.00	0.01	0.01	0.01
Bulgaria	42.84	39.38			2.44	0.07	0.00	0.06	0.06	0.06
Canada	166.17	153.64	-4.30	4.03	49.43	1.35	1.21	1.08	0.83	0.83
Czech Republic	51.74	47.61			2.13	0.06	0.00	0.05	0.05	0.05
Denmark	19.08	17.56			0.31	0.01	0.00	0.01	0.01	0.01
Estonia	11.10	10.20			0.64	0.02	0.00	0.02	0.02	0.02
Finland	20.51	18.87	2.20		5.65	0.17	0.00	0.14	0.10	2.30
France	148.96	138.91	2.59		8.95	0.27	0.00	0.21	0.21	2.80
Germany	330.28	304.12	8.60		14.07	0.42	0.00	0.34	0.34	8.94
Greece	29.28	27.00			0.23	0.01	0.00	0.01	0.01	0.01
Hungary	27.72	26.07			1.92	0.06	0.00	0.05	0.05	0.05
Iceland	0.70	0.76			0.00	0.00	0.00	0.00	0.00	0.00
Ireland	14.59	13.42			0.32	0.01	0.00	0.01	0.01	0.01
Italy	141.69	130.35			0.71	0.02	0.00	0.02	0.02	0.02
Japan	334.78	314.70	1.32		13.58	0.41	0.00	0.33	0.33	1.65
Latvia	9.73	8.94			2.52	0.08	0.00	0.06	0.05	0.05
Liechtenstein	0.07	0.07				0.00	0.00	0.00	0.00	0.00
Lithuania	14.06	12.93			1.88	0.06	0.00	0.05	0.05	0.05
Luxembourg	3.66	3.38			0.01	0.00	0.00	0.00	0.00	0.00

Table 12: EU proposal November 2000. Based on FAO Forest Data (cont'd).

	Base Year	AAU	Art 3.3 Credit	Ag Soils	Forest Management	Second Tier (3% Forest Manage- ment)	Second Tier (30% of Ag Soils)	Second Tier Total no Cap	Second Tier Total with Cap	Total Article 3 Credit
	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr	Mt C/yr
Monaco	0.03	0.03				0.00	0.00	0.00	0.00	0.00
Netherlands	59.77	54.98	0.00	-0.07	0.40	0.01	-0.02	0.01	0.01	0.01
New Zealand	19.90	19.91	7.64		3.67	0.11	0.00	0.09	0.09	7.73
Norway	14.22	14.34	0.02		3.53	0.11	0.00	0.08	0.07	0.09
Poland	153.89	144.64			5.45	0.16	0.00	0.13	0.13	0.13
Portugal	17.12	16.03			0.51	0.02	0.00	0.01	0.01	0.01
Romania	72.24	66.43			7.35	0.22	0.00	0.18	0.18	0.18
Russian Federation	826.56	829.02			425.54	12.77	0.00	10.21	4.13	4.13
Slovakia	20.79	19.14			3.36	0.10	0.00	0.08	0.08	0.08
Slovenia	5.24	4.80			1.78	0.05	0.00	0.04	0.03	0.03
Spain	84.13	77.34			3.00	0.09	0.00	0.07	0.07	0.07
Sweden	19.25	17.73	-0.09		10.89	0.32	0.00	0.26	0.10	0.10
Switzerland	14.46	13.31	-0.02	0.01	0.66	0.02	0.00	0.02	0.02	0.02
Ukraine	250.70	250.67			7.41	0.22	0.00	0.18	0.18	0.18
United Kingdom	208.84	192.09	0.56		1.67	0.05	0.00	0.04	0.04	0.60
U.S.A.	1665.38	1539.35	-7.20	23.79	101.18	2.82	7.14	2.26	2.26	2.26
Total	4992.30	4725.64	11.12	27.76	727.04	21.46	8.33	17.41	10.28	33.21
Percent of Baseyear Emissions	1.00	0.95	0.00	0.01	0.15	0.00	0.00	0.00		
Percent of Initial AAU	1.06	1.00	0.00	0.01	0.15	0.005	0.002	0.004	0.002	

# ENDNOTES

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- <sup>1</sup> Sixth Convention of Parties to the United Nations Framework Convention on Climate Change.
- <sup>2</sup> A handful of European countries (Monaco, Ireland, Spain, Greece, and Portugal) showed steeper increases, but the increases were less significant because of low emissions in 1990: see UNFCCC/SBI/2000/INF.13.
- <sup>3</sup> The Protocol shall enter into force when not less than 55 Parties to the Convention, representing 55% of total greenhouse gas emissions in 1990 for Annex I countries, have ratified nationally.
- <sup>4</sup> The industrialized countries that have legally binding emission reduction commitments under the Kyoto Protocol.
- <sup>5</sup> Potential loopholes are discussed in Cathy Wilkinson, *Negotiating the Climate* (Vancouver: The David Suzuki Foundation, 2000), available at <[www.davidsuzuki.org](http://www.davidsuzuki.org)>, and Chris Rolfe, *Earth in Balance Briefing Note Series* (Vancouver: West Coast Environmental Law Research Foundation, 2000), available at <[www.wcel.org](http://www.wcel.org)>.
- <sup>6</sup> “Business as usual” refers to activities that would have occurred in the absence of efforts to mitigate climate change.
- <sup>7</sup> In this context, flexibility results from an ability to increase sequestered carbon rather than reduce emissions.
- <sup>8</sup> Sequestration is the process of increasing the carbon content of a non-atmospheric carbon reservoir, such as through certain land use changes and forestry activities.
- <sup>9</sup> Industrialized countries that have legally binding emission reduction commitments under the Kyoto Protocol.
- <sup>10</sup> For definitions of afforestation, deforestation, and reforestation, see the glossary.
- <sup>11</sup> CoP4 clarified the obtuse language of Article 3.3, agreeing that the article meant: “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” (Climate Secretariat document UNFCCC/CP/1998/L.5.C).
- <sup>12</sup> Until recently Canada asserted that reforestation includes post-harvest regeneration. However, “reforestation” is defined by the IPCC 1996 Guidelines as conversion of unforested land that once contained forests back to forested status. The Guidelines are adopted into the Kyoto Protocol by Article 5.2. At The Hague negotiations, brackets around the definition of reforestation were dropped, indicating a general consensus that reforestation did not include post-harvest regeneration.
- <sup>13</sup> The CDM is a mechanism established under Article 12 of the Kyoto Protocol under which investments in emission reduction projects in developing countries generate certified emission reduction credits.
- <sup>14</sup> See the section “Credit for ‘business as usual’ sequestration.”
- <sup>15</sup> Going into the Kyoto negotiations, the US had proposed a “net-net” approach to accounting (comparing net emissions in 1990 with net emissions in the First Commitment Period). This would have made any reduction target more difficult because of a projected decline in the US forest sink. A 15 January 1998 State Department fact sheet justified American agreement to a 7% emission reduction (after initially proposing only a stabilization target) because a change in accounting rules for sinks would make it 3% easier to achieve their target. The 3% figure is consistent with going from the net-net approach for all forests to counting only afforestation, reforestation, and deforestation. It is inconsistent with credit for non-additional sequestration due to forest management.
- <sup>16</sup> Discounting is the reduction in the level of credit claimed below the actual estimated level of reductions or sequestration.



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- <sup>17</sup> Jan Pronk, "Note by the President of CoP6," 23 November 2000, 7:04 PM.
- <sup>18</sup> This figure is based on Canada's August 2000 submissions to the climate negotiations, compiled in UNFCCC document UNFCCC/SBSTA/2000/MISC.6.
- <sup>19</sup> The numbers in this table are based on calculations detailed in Appendix 1. Concessions by Canada to the EU are in the form of reductions in credit from projected sequestration; concessions by the EU to Canada are in the form of increases in credit for non-additional sequestration (based on the sequestration projection in Canada's August 2000 submission to the climate negotiations).
- <sup>20</sup> Descriptions of approaches are summaries. For full details, see Appendix 1.
- <sup>21</sup> "Canada's Response to UNFCCC Questions on Sinks," 10 November 1997.
- <sup>22</sup> Unpublished proposal by Canada, the US, and Japan.
- <sup>23</sup> In UNFCCC document UNFCCC/CP/2001/MISC.1.
- <sup>24</sup> See Appendix 1 for explanation of Pronk proposal.
- <sup>25</sup> Article 3.3 is somewhat ambiguous, but the parties were able to agree, in most respects, on its meaning at the next session of negotiations after Kyoto. (See note 11 above).
- <sup>26</sup> The reference to "since 1990" in Article 3.3 creates a discrepancy between the actual and creditable stock changes caused by conversion of land to or from forest use. A nation might have a balance between carbon stock changes due to conversion of land from forest to agriculture and conversion of land from agriculture to forest. However, a country with long rotation periods, like Canada, would still receive a net debit because the sudden emission from deforestation is not cancelled out by growth on the fraction of land converted to forest since 1990. To remedy the discrepancy caused by Article 3.3, the EU proposed debiting countries only to the extent that their annual rate of deforestation exceeded their annual rate of afforestation and reforestation. For example, if a country deforested 100 hectares a year and re-established forests on 80 hectares, emissions from only 20 hectares would be counted. The EU proposal would have decreased Canada's deforestation debit slightly, but, because Canada deforests roughly 30 times as much land per year as it afforests, Canada would have had a net reduction in assigned amount of about 2.8%. (Canada's emissions from deforestation are estimated at 80,667 kilotonnes CO<sub>2</sub> during the First Commitment Period: UNFCCC Secretariat document, UNFCCC/SBSTA/2000/INF.7/Add.1. This is reduced by 3.2%, the percentage of lands projected to be converted into forests between 1990 and 2012 compared with the projection of area deforested in the same period: see UNFCCC/SBSTA/2000/MISC.6).
- <sup>27</sup> Figure 2 in Erik Haites and Fanny Missfeldt, "The Potential Contribution of Sinks to Meeting the Kyoto Protocol Commitments" (June 2001). Paper presented to the European Association of Environmental and Resource Economists.
- <sup>28</sup> Haloa Inc., "Integrated Analysis of Options for GHG Emission Reduction with MARKAL" (12 May 2000). Paper prepared for the Analysis and Modelling Group of the Canadian National Climate Change Implementation Process.
- <sup>29</sup> John Last, "Taking Our Breath Away: The Health Effects of Air Pollution and Climate Change" (Vancouver: The David Suzuki Foundation, October 1998), and Doug Russell, "Keeping Canada Competitive" (Vancouver: The David Suzuki Foundation, October 1997).
- <sup>30</sup> Intergovernmental Panel on Climate Change, First Assessment Report, 1990.
- <sup>31</sup> P. Kauppi et al., "Technical and Economic Potential of Options to Enhance, Maintain and Manage Biological Carbon Reservoirs and Geo-Engineering," Chapter 4 of Working Group III contribution to the IPCC Third Assessment Report, 2001.
- <sup>32</sup> Increased carbon dioxide concentrations in the air can speed up growth, but this effect may be short-lived and may be increasingly counteracted by increased respiration and pest and fire losses due to climate change (see Chapter 4). Deposition of nitrogen compounds due to pollution can also stimulate growth.

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- <sup>33</sup> The high figure is based on UN Food and Agriculture Organization data on areas of managed forests and current uptake rates compiled in the April 2001 Pronk paper. The lower figure is based on Annex B Parties' August 2000 projections for the First Commitment Period, with Russia's amount based on the work of the International Institute for Applied Systems Analysis, compiled in "New Proposals by the President of CoP6," 9 April 2001. Other estimates supplement the August 2000 projections by national greenhouse gases inventory data where no projections are made. See Chris Rolfe, *Sinking the Climate*, West Coast Environmental Law Association, September 2000 (which estimates credit from comprehensive crediting of agriculture and forest sinks at 591 megatonnes per year). See also Greenpeace, "In Depth Analysis of USA/Canada/Japan Proposal for Sinks under Art. 3.4" (22 November 2000). WCEL and Greenpeace calculations suggest that BAU credit for agricultural and forest sequestration would be equivalent to 11% or 12% of 1990 emissions.
- <sup>34</sup> The US Energy Information Agency projects an increase in Annex I Parties' emissions (the same as Annex B Parties, except that Annex I includes Belarus and Turkey) from 3,904 megatonnes in 1990 to 4,255 megatonnes in 2010 — an 8.9% rise above 1990 levels: US Energy Information Agency, "International Energy Outlook 2000" (2000). The Kyoto target for Annex B Parties is 3,710 megatonnes per year in 2010. The difference between this and projected levels is 14% of 1990 emissions.
- <sup>35</sup> Table 2 in R. Watson et. al., "Summary for Policy Makers," in IPCC Special Report *Land Use, Land Use Change and Forestry* (Cambridge: Cambridge University Press, 2000).
- <sup>36</sup> P. Ciais, P. Peylin, and P. Bousquet, "Regional biological carbon fluxes as inferred from atmospheric CO<sub>2</sub> measurements." *Ecological Applications* 10 (2000):1574-89. Ciais et al. estimates 500 megatonnes of annual carbon uptake in North America, 1,400 in Siberia, and 300 in Europe. See also S. Fan et al., "A large terrestrial carbon sink in North America implied by atmospheric and oceanic carbon dioxide data and models," *Science* 282 (16 October 1998):442, which suggests that North America is a larger sink.
- <sup>37</sup> Derived from United Nations Framework Convention on Climate Change, Conference of the Parties, *Second Compilation and Synthesis of Second National Communications* (7 October 1998) UNFCCC/CP/1998/11/Add.2. Tables C.2 and B.16 project sequestration levels for 2010 and baseline year.
- <sup>38</sup> Estimates are difficult because only 4 out of 37 Annex B countries projected sequestration by agricultural lands in the First Commitment Period, and only 7 countries have reported emissions or removals by agricultural soils in their inventories: UNFCCC/SBSTA/2000/3, 11 May 2000. Where estimates exist, they are typically far lower than estimates of forest sequestration.
- <sup>39</sup> The net removals from sequestration by forest and woody biomass stocks in timber-producing forests in Canada have been estimated at 37 megatonnes of carbon dioxide for 1996 (10 megatonnes of carbon): Art Jacques et al., *Canada's Greenhouse Gas Inventory, 1997* (Ottawa: Environment Canada, 1999). Projected sequestration for the period 2008-12 is 176 megatonnes of carbon dioxide (10 megatonnes of carbon for each of the five years): from Table 1, UNFCCC document UNFCCC/SBSTA/2000/INF.7/Add.1.
- <sup>40</sup> Jacques et al., *Canada's Greenhouse Gas Inventory, 1997*.
- <sup>41</sup> W.A. Kurz and Michael Apps. "A 70-year retrospective analysis of carbon fluxes in the Canadian Forest Sector," *Ecological Applications* 9 (1999):526-47.
- <sup>42</sup> The existence of various scenarios under which Canadian managed forests are either a small net source or a small net sink was confirmed to the author by the Canadian Forest Service. CFS officials were unwilling to release the analysis.
- <sup>43</sup> Based on national projections for the 2008-12 period compiled in the April 2001 Pronk paper.
- <sup>44</sup> See Appendix 1.
- <sup>45</sup> UN Food and Agriculture Organization (FAO) estimates are based on current business as usual. National projections of sequestration contained in the Annex B Parties' August 2000 projections of sequestration in 2008-12 are assumed to reflect business as usual. This is consistent with methodologies



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identified by different nations. For example, US estimates are “based on recent trends,” “long-term baseline projections,” or “business as usual scenarios” (see US submission of August 2000). Canadian projections for forest management are equal to current estimates of carbon removals by managed forests. Increases do not include credit used to offset debits under Article 3.3.

- <sup>46</sup> FAO data are available for forest management only. Data are taken from “New Proposals by the President of CoP6,” 9 April 2001, supplemented by national submissions for agricultural soils.
- <sup>47</sup> From August 2000 national submissions compiled in Climate Secretariat documents UNFCCC/SBSTA/2000/Misc.6 and UNFCCC/SBSTA/2000/Misc.6/Add.1, and national inventories where submissions are silent.
- <sup>48</sup> See Table 1.1 for descriptions of proposals.
- <sup>49</sup> Based on US Energy Information Agency, “International Energy Outlook 2000,” which estimates that Annex B business as usual emissions will be 13.9% higher than the Kyoto Protocol’s initial assigned amount. That estimate considered carbon only. It has been extrapolated to all greenhouse gas emissions, giving a projected gap of 653 megatonnes in 2010.
- <sup>50</sup> Two sources are used: (1) UN Food and Agriculture Organization data on current rates, and (2) the projections that countries submitted as part of the climate negotiations or, where projections were not given, the countries’ own inventories.
- <sup>51</sup> Two threshold scenarios are used. One assumes a threshold equal to 100% of projected emissions. No additional sequestration is counted beyond this threshold. The other assumes that 80% of all projected sequestration from forest management beyond that in the first tier (offsets of debits under Article 3.3) is included in the second tier (discounted and capped).
- <sup>52</sup> A quantitative estimate of uncertainty within Annex B is impossible. Reporting of uncertainties related to the LULUCF sector is sporadic. See *Synthesis Report on National Greenhouse Gas Information Reported by Annex I Parties for the Land-Use Change and Forestry Sector and Agricultural Soils Sector*, 11 May 2000 (UNFCCC/SBSTA/2000/3) and *Methodological Issues Identified while Processing Second National Communications: Greenhouse Gas Inventories*, 4 September 1998 (UNFCCC/SBSTA/1998/7).
- <sup>53</sup> Jacques et al., *Canada’s Greenhouse Gas Inventory, 1997*; Senes Consultants Ltd., “Study of Greenhouse Gas Emissions from Non-Fossil Fuel Sources” (1994).
- <sup>54</sup> See Michael Obersteiner et al., “The Political and Economic Costs of a Fully Verifiable Kyoto Protocol” (International Institute for Applied Systems Analysis, November 2000).
- <sup>55</sup> From Annex B Parties’ August 2000 submissions to UNFCCC, compiled in UNFCCC/SBSTA/2000/INF.7/Add.1.
- <sup>56</sup> Hadley Centre for Climate Prediction and Research, “An Update of Recent Research from the Hadley Centre” (November 2000).
- <sup>57</sup> Proponents of crediting sinks have noted that a tonne of carbon dioxide released in the future is likely to have less impact on climate change than a tonne released today. This is because the potency of a greenhouse gas is inversely related to its concentration in the atmosphere. Individual greenhouse gases absorb heat in specific wavelengths of radiation. As its atmospheric concentration grows, each molecule of a gas traps less radiation because more molecules are trapping that wavelength of radiation. Climate change is projected to accelerate over the next century, however, and future releases of sequestered carbon would speed it up even more. This may outweigh any benefit of delaying an emission, as the rate of climate change determines the ability of ecosystems to adapt to it. Limiting the rate of climate change is a key factor for a “safe landing” that avoids the worst impacts of climate change: Joseph Alcamo and Eric Kreileman, *The Global Climate System: Near Term Action of Long Term Protection* (Netherlands: National Institute of Public Health and the Environment, February 1996).
- <sup>58</sup> Ian Noble et al., “Implications of Different Definitions and Generic Issues,” in Robert Watson et al., *Land Use, Land Use Change and Forestry: A Special Report by the IPCC* (Cambridge: Intergovernmental Panel on Climate Change, 2000), pp. 87-89. See also Figure 2.1 in this report.

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- <sup>59</sup> G.J. Naaburs et. al., "Article 3.3 and 3.4 of the Kyoto Protocol: consequences for industrialized countries' commitment, the monitoring needs, and possible side effects," *Environmental Science and Policy* 3 (2000):123-34. See also Kevin Gurney and Jason Neff, *Carbon Sequestration Potential in Canada and Russia, and the United States under Article 3.4 of the Kyoto Protocol* (Department of Atmospheric Science, Colorado State University, 2000).
- <sup>60</sup> Based on US Energy Information Agency, "International Energy Outlook 2000," which estimates that Annex B business as usual emissions will be 13.9% higher than the Kyoto Protocol's initial assigned amount. That estimate considered carbon only. It has been extrapolated to all greenhouse gas emissions, giving a projected gap of 653 megatonnes in 2010.
- <sup>61</sup> The figure of 269 megatonnes per year is based on the Annex I (same as Annex B, except that Turkey and Belarus are included) figures for cropland management, grazing land management, forest land management, and conversion of cropland to grassland in Table 4-1, Sampson et al., "Additional Human Induced Activities — Article 3.4" in IPCC Special Report *Land Use, Land Use Change and Forestry* (Cambridge: Cambridge University Press, 2000).
- <sup>62</sup> Haites and Missfeldt, "The Potential Contribution of Sinks."
- <sup>63</sup> Intergovernmental Panel on Climate Change, Working Group I, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reporting Instructions Glossary* (Geneva: IPCC, 1996).
- <sup>64</sup> Article 5.2 of the *Kyoto Protocol* adopts the methodologies for estimating emissions and removals by sinks approved at CoP3. CoP3 approved the 1996 IPCC Guidelines, which include the narrow definition of reforestation.
- <sup>65</sup> Canada's emissions from deforestation are estimated at 80,667 kilotonnes CO<sub>2</sub> during the First Commitment Period: UNFCCC Secretariat document, FCCC/SBSTA/2000/INF.7/Add.1. This is reduced by the 3.2% (the ratio of lands projected to be converted into forests between 1990 and 2012 and the ratio of lands deforested in the same period: from FCCC/SBSTA/2000/MISC.6).
- <sup>66</sup> Although the EU seeks to limit the maximum offset to sequestration in the period 2008 to 2012 (rather than since 1990 as proposed by Pronk), the practical result is the same as all but three countries' project that sequestration from forest management will exceed emissions from deforestation.
- <sup>67</sup> The minimum area is 0.3 to 1.0 hectares. The minimum height is two to five metres.
- <sup>68</sup> See Secretariat document: FCCC/SBSTA/2000/CRP.11.
- <sup>69</sup> This is based on the definition of forest in FCCC/SBSTA/2000/CRP.11. The minimum resolution for determining areas deforested has not been set, but Parties have suggested a minimum resolution of either one or ten hectares.
- <sup>70</sup> Hadley Centre, above at footnote 56.
- <sup>71</sup> The environmental integrity of the CDM could be maintained if some non-additional projects are credited, but such credits must be balanced by underestimations of the emission reductions achieved by additional CDM projects.
- <sup>72</sup> See "The sinks standoff at CoP6" in Chapter 1.
- <sup>73</sup> For a description of the major players in international climate negotiations, see Chapter 1.
- <sup>74</sup> Colombia and Chile advocate their inclusion during the second commitment period, Costa Rica during the First Commitment Period.
- <sup>75</sup> David Allan et al., "The Impact of Commercial Afforestation on Bird Populations in Mpumalanga Province, South Africa," *Biological Conservation* 79 (1997):173-85.
- <sup>76</sup> Harald Eraker, "CO<sub>2</sub>lonialism — Norwegian Tree Plantations, Carbon Credits and Land Conflicts in Uganda," Norwatch 2000.
- <sup>77</sup> Hadley Centre for Climate Prediction and Research, "An Update of Recent Research from the Hadley Centre" (November 2000).



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- <sup>78</sup> The Protocol compares different greenhouse gases based on their global warming potential (GWP) over a 100-year timeframe. GWP is the measure of the cumulative impact of a gas on climate change over one year. Applying the same approach to sequestration implies that one tonne of sequestration should be fully credited only if sequestration is maintained for 100 years.
- <sup>79</sup> Pekka Kauppi et al., "Technical and Economic Potential of Options to Enhance, Maintain and Manage Biological Carbon Reservoirs and Geo-Engineering," Chapter 4 in IPCC Working Group III, Third Assessment Report.
- <sup>80</sup> Haites and Missfeldt, "The Potential Contribution of Sinks."
- <sup>81</sup> Compiled in FCCC/SBSTA/MISC.6 and FCCC/SBSTA/MISC.6/Add.1.