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LETTER TO THE EDITOR

On the value of temporary carbon: a comment on Kirschbaum

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Abstract A recent paper by Miko Kirschbaum (Mitigat Adapt Strategies Glob Change 11(5–6):1151–1164, 2006) argues that temporary carbon (C) storage has ''virtually no climate-change mitigation value.'' However, temporary carbon has value in delaying global warming that needs to be recognized in carbon accounting methodologies. The conclusions reached are very sensitive to any value that is attached to time. Basing analysis exclusively on the maximum temperature reached within a 100-year time frame ignores other important impacts of global warming that also need to be included when mitigation strategies are assessed. The relative weightings for long-term versus short-term impacts represent policy choices that result in a greater or a lesser value being attributed to temporary carbon, but that value should not be zero. Global warming is too formidable an enemy to allow us the luxury of discarding part of our arsenal in fighting against it. Both reducing fossil-fuel combustion and increasing biosphere carbon stocks are needed.

Keywords Global warming · Climate change · Greenhouse gas emissions · Carbon · Avoided deforestation · Tropical forests · Greenhouse effect · Mitigation

1 Introduction

Miko Kirschbaum (2006) brings useful information to the debate over the value of temporary carbon, especially the effect of changes in the timing of ocean sink strengths. However, consideration of the value of time would lead to a conclusion different from that of Kirschbaum.

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An important value not mentioned by Kirschbaum is the value of delaying climate change because of the cumulative nature of its impacts, especially loss of human life. Kirschbaum applies no discounting or other time-preference weighting over the 100-year span of his analysis. Restricting the analysis to 100 years is a good choice in order to avoid the distortions that enter when much longer time horizons are used without discounting (Fearnside 2002a). However, a strong argument exists for applying some sort of time-preference weighting over the course of the 100-year time horizon (Fearnside 2002b). Indifference to time is appropriate for random or ''one-time'' events, such as a volcanic eruption or a tsunami, but the impact of global warming is qualitatively different. When temperature increases by a given amount, the probabilities of various kinds of disasters, such as droughts and floods, are increased from that point in time forward. If this amount of warming is delayed for a given period, say 20 years, then all of the additional losses, especially additional human deaths, which would have occurred over that time period can be considered a permanent gain from having delayed global warming. This benefit needs to be reflected in carbon (C) accounting and crediting. Needless to say, permanent emission avoidance is better than temporary, but temporary sequestration also has value. Previous proposals for making conversions between the two types of mitigation measures, such as ton-year accounting (Fearnside et al. 2000; Noble et al. 2000), can be adapted to the concerns raised by Kirschbaum regarding oceanic uptake of carbon dioxide (CO_2) and the need for additional weight avoiding the highest predicted temperatures.

Kirschbaum's paper points out the decision of the Ninth Conference of the Parties (COP-9) of the United Nations Framework Convention on Climate Change (UN-FCCC) to allow certified emissions reductions (CERs) for afforestation and reforestation projects in the Clean Development Mechanism (CDM) [avoided deforestation was ruled out by COP-9 for the 2008–2012 First Commitment Period]. However, he makes no mention of the ''Colombian Proposal'' (Blanco and Forner 2000), which was later adopted in modified form as the means of accounting for CERs (UN-FCCC 2001). This means of applying a market mechanism removes the diplomatically intractable problem of negotiating a discount rate or alternative index. It also reduces the risk of C release from biomass loss from such events as fire or insect outbreaks, or from future changes in land-use decisions. The responsibility for renewing or replacing the CERs rests with the country buying the credit, not with those who own or manage the trees involved. The risk of the system breaking down and the carbon being released to the atmosphere is therefore lower than what Kirschbaum portrays, but it is not zero. In fact, to the extent that the diplomatic system does not break down such that commitments under the UN FCCC Kyoto Protocol cease to be honored, ''temporary'' CERs granted under the current system are not temporary carbon at all. The solution to the remaining risk, as with leakage and other disadvantages of forestry options as compared to avoiding fossil-fuel emissions, lies in adjusting the crediting to allow a margin of safety by granting less carbon credit than the number of physical tons of C present in the trees. This is especially attractive for avoided deforestation, which has the potential of avoiding very substantial quantities of emissions at modest cost (e.g., Brown et al. 1996; Niles et al. 2002; Fearnside 2006). Although, Kirschbaum does not mention avoided deforestation explicitly, this is the option for which the stakes are highest, not only in terms of C but also for biodiversity and the other environmental services to which Kirschbaum alludes. Here, as in most of the debate on ''permanence,'' examples and calculations focus on silvicultural plantations. It is important to explicitly maintain the distinction between silvicultural plantations and avoiding tropical deforestation, which is an option that has suffered tremendously from being lumped with plantations as a ''sink'' (Fearnside 2001).

Kirschbaum's Fig. 1 shows a much larger dip in atmospheric C (as represented by the area between the line representing atmospheric carbon and the line representing the 1900 baseline) than the area under the curve representing the rise in atmospheric carbon above the baseline after re-release of the sequestered C. Were impact at any given year given equal weight, temporary C would come out as advantageous. Kirschbaum reaches the opposite conclusion because his analysis gives exclusive priority to avoiding the greatest impacts within the 100-year timeframe. Although, it is true, for example, that one degree of temperature increase with respect to the 1900 temperature baseline has more impact if it is from 1°C to 2°C than if it is from 0°C to 1°C, it is also true that the considerations mentioned earlier (e.g. Fearnside 2002b) suggest that there should also be weighting in the opposite direction, giving an additional weight to the short term over the long term. The relative amounts of the two opposing weightings will therefore determine the outcome. Obviously, this is a policy choice rather than a purely 'scientific' question.

Kirschbaum's text evolves from presenting three distinct measures of climate change impacts (instantaneous effect, rate effect and cumulative effect) to repeatedly claiming that ''there is virtually no climate-change mitigation value in temporary carbon storage.'' While the paper begins considering lowering the expected temperature at the end of the 100-year period (i.e. the instantaneous effect) as only one of the three criteria to be considered, the paper ends considering this as the only criterion of any importance. The higher impacts expected towards the end of the century represent a legitimate reason to give additional weight to the emissions that drive this peak, but it does not mean that the climate-change impacts in the earlier part of the century are without value. In fact, as Kirschbaum himself notes, cumulative temperature increase (degree-years of temperature above the 1900 baseline) is the most relevant measure for several important climatic impacts, such as glacial melting and sea-level rise. Kirschbaum has a valid point in drawing attention to the importance of avoiding the highest temperature increases, but the appropriate step to be taken is to derive a weighting to scale the different kinds of impact, not to rule everything else out as unimportant.

Kirschbaum dismisses any value of temporary carbon in ''buying time'' during which technological advances might be made and the political will might be generated to apply both new and old options on a scale commensurate with the problem. This dismissal might be questioned given the severe impacts that unmitigated climate change has been predicted to imply before the period in time prioritized by Kirschbaum (the very end of the 21st Century). Among these is the demise of the Amazon forest (Cox et al. 2004).

The most fundamental problem is that global warming is too formidable an enemy to allow us the luxury of discarding part of our arsenal in fighting against it. Both reducing fossil-fuel combustion *and* increasing biosphere carbon stocks are needed.

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