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Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office:
Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Climate Policy

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tcpo20>

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Available online: 29 Sep 2011

To cite this article: Andrew Kerr Macintosh (2011): LULUCF in the post-2012 regime: fixing the problems of the past?, *Climate Policy*, DOI:10.1080/14693062.2011.605711

To link to this article: <http://dx.doi.org/10.1080/14693062.2011.605711>

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LULUCF in the post-2012 regime: fixing the problems of the past?

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One of the reasons why the Kyoto Protocol has been environmentally ineffective is the flaws in the land use, land-use change and forestry (LULUCF) accounting rules, including voluntary accounting for Article 3.4 activities, the adoption of a definition of forest management that allowed parties to preferentially include and exclude forest lands, and allowing parties with net emissions from LULUCF in 1990 to include deforestation emissions in their 1990 emissions base year. Three proposed amendments to the LULUCF rules for the post-2012 regime are discussed and analysed: (1) a force majeure rule, (2) a baseline-and-credit system for forest management and (3) an 'emissions-to-atmosphere' approach for harvested wood products. Although these proposals have the potential to significantly improve the accounting framework, there are still significant problems such as the failure to account for the biophysical effects of forest activities, uncertainties associated with the application of the forest management baseline-and-credit system and continuing optional coverage of Article 3.4 activities.

Keywords: abatement costs; Kyoto Protocol; land use, land-use change and forestry

Une des raisons pour lesquelles le protocole de Kyoto n'a pas été efficace sur le plan environnemental sont les divers compromis ayant été faits au sujet des règles de compatibilité liées à l'utilisation des terres, au changement d'affectation des terres et à la foresterie (LULUCF). Ces compromis incluent la comptabilité volontaire pour les activités de l'article 3.4, l'adoption d'une définition pour la gestion des forêts permettant aux parties d'inclure ou d'exclure à titre préférentiel les terres forestières, et permettant aux parties dont les émissions relatives à LULUCF étaient nettes en 1990 d'inclure les émissions liées à la déforestation dans leur année de référence 1990. Trois amendements aux règles de LULUCF pour le régime post-2012 sont discutés et analysés: (1) une règle de force majeure, (2) un système de référence et crédit pour la gestion forestière, et (3) une démarche « émissions à atmosphère » pour les produits de la récolte de bois. Alors que ces propositions ont leur valeur, il reste des problèmes considérables liés au cadre de compatibilité proposé pour LULUCF, tels que l'absence de compatibilité pour l'effet biophysique des activités forestières, les incertitudes associées à l'application d'un système de référence et crédit dans la gestion forestière, et le prolongement de l'inclusion facultative des activités de l'article 3.4.

Mots clés : coûts d'abattement; protocole de Kyoto; changement d'affectation des terres et foresterie; utilisation des terres

1. Introduction

Since the Kyoto Protocol was signed in 1997, critics have argued that it is doomed to fail (Cooper, 1998; Tol, 1998; Benedick, 2001; Victor, 2001; McKibbin and Wilcoxon, 2002; Aldy et al., 2003; Prins and Rayner, 2007; Rayner, 2010). For most, the greatest flaw in the agreement is its reliance on a 'targets and timetables' approach, which is seen as lacking the flexibility and durability required to achieve sustained reductions in emissions. The dominant response to this has been that, although the Protocol is not perfect, it is a 'first step' and was only ever intended to lay the foundations for a more comprehensive and cost-effective future regime (Eizenstat, 1998; Grubb et al., 1999; Grubb and Yamin, 2001; Depledge, 2002; Jotzo, 2005; Weiner et al., 2006; Eckersley, 2007). Some advocates of the Protocol

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have stressed that the deficiencies of the agreement were an unavoidable product of the political realities faced by negotiators and that any proposed alternative structure will face similar hurdles (Eizenstat, 1998; Schneider, 1998; Philibert, 2004). As Stuart Eizenstat, US Under Secretary of State for Economic, Business and Agricultural Affairs during the Clinton Administration, wrote in 1998, 'Kyoto is one of those ideas that can easily be criticised – until you consider the other options' (Eizenstat, 1998, p. 119).

Irrespective of the merits of the pro- and anti-Kyoto arguments, it is now clear (if it was ever in doubt) that the abatement generated by the agreement will be modest. The Annex B/non-Annex B country distinction, inflated quantified emission limitation and reduction obligations (QELROs) – in particular those granted to Russia and the Ukraine – and the withdrawal by the US from the agreement in 2001, have constrained the potential of the Protocol to reduce emissions.

The accounting rules devised for terrestrial carbon stocks and fluxes, known as 'land use, land-use change and forestry' (LULUCF) have been the other major contributing factor to the agreement's environmental ineffectiveness. These rules watered down the mitigation obligations of several countries, allowing them to claim credit for emission reductions and removals that were not a product of additional direct abatement actions. There is increasing concern that, in the post-2012 regime, the accounting rules for the LULUCF sector could once again serve to undermine the level of environmental ambition. Amendments have been proposed to facilitate greater access to LULUCF offsets and, although there is widespread acknowledgement of the theoretical benefits of LULUCF-related abatement, the past has not been forgotten. The manipulation of the accounting rules in the first commitment period has stained LULUCF's reputation and created scepticism regarding its capacity to make a meaningful contribution to the efforts to mitigate climate change in the post-2012 era (GFC, 2010; Greenglass et al., 2010; Reichert and Voßwinkel, 2010).

This article reviews the proposed changes to the LULUCF accounting rules and analyses whether the amendments can address the flaws in the existing regime. Section 2 provides an overview of LULUCF in the Kyoto Protocol, and explains the nature and origins of the existing deficiencies. In Section 3, the three main rule changes proposed for the post-2012 regime are reviewed, and in Section 4 the proposals are analysed critically. In Section 5 it is concluded that, although the proposed amendments may lead to the more accurate attribution of observed carbon stock changes, there remain significant problems with the accounting framework and safeguards are needed to protect the regime's environmental integrity.

2. LULUCF in the Kyoto Protocol

The Kyoto Protocol works with a 'targets and timetables' structure, whereby a limit is placed on the net emissions of Kyoto gases from Annex B countries over the commitment period. The way LULUCF is accounted for under this structure is distinct. Emissions can be recorded in all six of the reporting sectors (energy, industrial processes, solvent and other product use, non-CO₂ gases in agriculture, waste and LULUCF) but removals can only be recorded in LULUCF. Further, unlike the other reporting sectors, net emissions from LULUCF are generally not counted in the base year emissions estimate when calculating parties' assigned amounts – they are treated as offsets to the emissions recorded in the commitment period.

Ideally, to ensure consistency with the commitments in Article 4 of the United Nations Framework Convention on Climate Change (UNFCCC) and the structure of the Protocol, the emissions and removals recorded in the LULUCF sector would reflect only the direct anthropogenic influence. Emissions and removals caused by natural factors (e.g. major natural disturbances and inter-annual

variability) should be excluded because they are non-anthropogenic and the effects of CO₂ and nitrogen fertilization (indirect human-induced effects) should be excluded because they are not a product of direct actions taken by land managers (Höhne et al., 2007; Schlamadinger et al., 2007). The other issue associated with LULUCF is how to account for the impacts of pre-1990 management decisions (e.g. the age-class distribution of forests). There was concern in the Kyoto negotiations that the age-class distribution of forests could result in parties receiving 'windfall' credits and debits (i.e. credits and debits that are not a product of additional actions). Due to this, it was agreed that, for forest-related activities, the rules should seek to isolate the impact of post-1990 management changes as this would minimise undeserved credits and debits, while ensuring there is an incentive to reduce LULUCF emissions and enhance sinks.

The existing rules do not reflect the principles on which they are supposed to be based. This is a product of two main factors: the desire on behalf of the Parties to use simple methods to resolve the complexities associated with LULUCF accounting, and the use of LULUCF as a *de facto* safety valve to ensure the continued support of the Kyoto Protocol by recalcitrant Parties.

In the negotiations leading up to and at the Third Conference of the Parties (COP 3) to the UNFCCC in Kyoto in 1997, there was disagreement about which LULUCF activities should be accounted for in the first commitment period (Fry, 2002, 2007). Several countries, including the US, Canada, Japan, Russia and Australia, sought broad coverage of LULUCF activities with limited or no restrictions. Others partially or wholly opposed this position due to concerns about the permanency of the associated carbon sequestration, uncertainty regarding measurement and attribution to human activities, and the potential for windfall credits (Schlamadinger and Marland, 2000; Fry, 2002, 2007; Schlamadinger et al., 2007). The compromise reached required all Annex B countries to account for afforestation, reforestation and deforestation since 1990 (Article 3.3 activities), while accounting for additional Article 3.4 activities (cropland management, grazing land management, revegetation and forest management) was made optional. The non-compulsory nature of Article 3.4 coverage – the result of a last minute insertion by Japan – allowed countries to select which of the four activities they included, thereby ensuring they chose only those that suited their interests (Fry, 2002).

The other notable last minute LULUCF insertion at COP 3 came from Australia, who threatened not to sign the Kyoto Protocol unless it was allowed to include deforestation emissions in its own base year estimate (Hamilton and Vellen, 1999; Hamilton, 2001; Pearse, 2007; Macintosh, 2010). Australia insisted on this provision because its deforestation emissions in 1990 had been high and had since fallen due to climatic and market conditions (Macintosh, 2010). If it could include these emissions in its base year, it would receive credit for the subsequent decline, which could then be used to offset emission increases in other sectors. Desperate to reach an agreement and unaware of the magnitude of the offset (~90 MtCO₂e/year during the first commitment period; ADCCEE, 2011a, 2011b), the international community agreed to Australia's demands. The resulting concession, found in Article 3.7(2), allows countries with net emissions from LULUCF in 1990 to include deforestation emissions in their 1990 emissions base year (Hamilton and Vellen, 1999; Höhne et al., 2007; Macintosh, 2010).

The problems associated with the 'buffet approach' to accounting for Article 3.4 activities were exacerbated by the definitions and rules that were adopted for these activities at the Sixth and Seventh Conference of the Parties (COP 6 and COP 7, respectively). The outcome of these conferences can only be understood in the context in which they were negotiated. The collapse of the initial COP 6 negotiations at the Hague in December 2000 cast a shadow over the future of the Protocol (Grubb and Yamin, 2001; Fry, 2002). When the US announced in March 2001 that it was withdrawing from the agreement, the Protocol was teetering on the edge of oblivion.

Facing a complete collapse, countries with concerns about LULUCF were forced to concede ground at the COP 6 *Bis* in Bonn in July 2001 (Höhne et al., 2007). Broad definitions were adopted for forest management, grazing land management and cropland management, increasing the risk of windfall credits. Proposals to impose limits on the use of credits from cropland and grazing land management were abandoned. A cap was placed on the use of forest management to limit windfall credits, which was supposed to be equal to the lesser of 15% of projected removals or 3% of base year emissions. However, exceptions were negotiated with Russia, Japan and Canada to ensure their continued support for the Protocol (Canadell et al., 2007; Höhne et al., 2007). The political compromise that emerged from the COP 6 *Bis* was explicitly designed to water down the mitigation obligations of several Parties by allowing access to windfall credits (Babiker et al., 2002; Fry, 2002; Löschel and Zhang, 2002; McKibbin and Wilcoxon, 2002; Höhne et al., 2007).

The other contributing factor to the sub-optimal accounting framework that emerged from the negotiations was the desire for simplicity. For grazing land management, cropland management and revegetation, 'net-net' accounting was adopted (whereby net emissions in the base year are subtracted from net emissions in the commitment period) as it provided an easy way of factoring out natural and indirect human-induced impacts. However, the accuracy of this method is dependent on whether, and to what extent, these factors are present in the base year and commitment period, and whether the same land area is accounted for in the base year and commitment period (Canadell et al., 2007; Schlamadinger et al., 2007). Parties are also left exposed to the impacts of inter-annual variability and major natural disturbance events (droughts, fires, pest attacks, etc.), which can lead to the recording of large debits that are not directly related to human activities (Canadell et al., 2007).

Net-net accounting was deemed inappropriate for forest activities because of age-class effects. As a result of this, 'gross-net' accounting (whereby credits and debits are determined on the basis of carbon stock change during the commitment period) was adopted for afforestation, reforestation and deforestation under Article 3.3, and forest management under Article 3.4. Although this approach protected Parties from being unjustly penalized for age-class effects, it increased the risk of windfall credits. The solution that emerged to limit the extent of such credits was to require afforestation and reforestation to have been undertaken 'since 1990' and to impose the cap on forest management credits – a strategy that was later undermined by the negotiated exemptions to the cap principles.

Two additional quirks in the rules were inserted to deal with the implications of the carbon fluxes associated with forest activities, which are generally characterized by extended periods of gradual sequestration punctuated by rapid emissions over short periods. Some Parties raised concerns about the nature of these fluxes and the potential for those undertaking afforestation/reforestation to be penalized if the resulting forests reached harvesting age during the commitment period (Höhne et al., 2007). In response, the 'harvest sub-rule' was agreed, which prevents land units subject to afforestation/reforestation recording net debits over the commitment period. Similarly, there was apprehension that the rules and nature of forest fluxes might disadvantage countries simultaneously undertaking deforestation and afforestation/reforestation. To overcome this claimed 'accounting imbalance', Parties with net emissions from Article 3.3 activities were allowed to offset them with removals from forest management up to a limit of 9 MtC before applying the general forest management caps (Schlamadinger et al., 2007, p. 275).

To summarize, the LULUCF accounting framework that was adopted for the first commitment period is deficient. Political pressures and the emphasis on convenience and simplicity resulted in the adoption of rules that deviate from the underlying accounting principles and facilitate access to windfall credits.

3. LULUCF in the post-2012 regime

A number of proposals have been put forward to improve the LULUCF rules for the post-2012 regime, the three most important being (i) the symmetrical exclusion of major natural disturbances (called the ‘force majeure’ rule), (ii) the adoption of a baseline-and-credit system for forest management, and (iii) the introduction of an emissions-to-atmosphere approach for harvested wood products.

3.1. Force majeure

One of the current problems with the LULUCF rules is that they expose countries to debits caused by major natural disturbances. To deal with this, it has been proposed that Parties be given the option of excluding emissions and removals from major natural disturbance events that affect Article 3.3 and Article 3.4 lands. Countries taking up this option could exclude the emissions associated with the disturbance but would also be required to exclude any subsequent CO₂ removals on the affected lands until the end of the second commitment period (or potentially until the same amount of CO₂ is sequestered as was released in the initial event).

At the time of writing, three restrictions were being negotiated on the application of this rule (AWG-KP, 2010). The first is that it only apply if the associated net emissions from the disturbance event exceed a prescribed threshold (X% of total national emissions in the base year) and that only emissions above the threshold could be excluded. Second, emissions from salvage logging after a disturbance event would have to be accounted for in the commitment period in which the logging occurs. Third, if land-use change occurs after the disturbance, the party would be unable to exercise the force majeure option, meaning all of the initial emissions and subsequent removals would be counted.

3.2. Baseline-and-credit system for forest management

Emissions and removals associated with forest management are currently accounted for on a gross–net basis. For the second and subsequent commitment periods, it has been proposed that this approach be replaced with a baseline-and-credit system on the assumption that it would enable better isolation of the impacts of additional management actions. Under this system, reference levels would be set for net forest management emissions for each relevant developed country. The credits and debits that are recorded during the commitment period would be calculated by subtracting the reference level from the reported net emissions. Parties whose emissions are higher than the reference level would incur debits and those whose emissions are below it would receive credits.

At the United Nations Climate Change Conference held in Cancun in December 2010 (COP 16/CMP 6), a framework was agreed to further develop the baseline-and-credit system, whereby developed country Parties were expected to submit information on the proposed reference levels for 2013–2020 for ‘technical assessment by a review team’.¹ Decision 2/CMP.6 (UNFCCC, 2011) makes reference to the fact that the proposed reference levels were prepared with regard to a wide variety of factors, including net emissions from forest management in GHG inventories, the age-class structure of forests, forest management activities already undertaken, and projected net emissions under a business-as-usual (BAU) scenario. It also includes guidelines for the preparation of the reference levels and their review, which require Parties to describe the policies in place in December 2009 and to exclude the impacts of policy changes post-December 2009 in constructing the reference level.

The Cancun decisions’ discussion of policies at December 2009 and consideration of a BAU scenario seem to imply that the reference levels should be a projection of expected net emissions over the period 2013–2020 assuming no policy change. Yet the wording is ambiguous and the reference level submissions made in early 2011 show a diversity of accounting approaches. The majority of Parties,

including Australia, Canada, New Zealand, Switzerland, and the Member States of the EU have prepared the reference levels on the basis of a 'no policy change' projection.² Other Parties have adopted alternative methods. Japan proposes using a gross-net method embodying a reference level of zero net emissions. The submissions made by Russia, Ukraine and Norway indicate that they intend to use standard net-net accounting with 1990 as the base year.

As of mid-2011, the Parties had not resolved how the divergent approaches to forest management accounting can be reconciled. There are also unresolved issues regarding the restrictions that might apply to forest management credits (AWG-KP, 2010). Caps on forest management credits are being discussed along the lines of those agreed for the first commitment period. To account for the uncertainties associated with reference levels and measurement, some Parties are calling for debits and credits to be recorded only if net emissions exceed a set percentage of the reference level. Proposals have also been made to enable *ex post* adjustments to the reference levels to account for improvements in data and methods.

3.3. 'Emissions-to-atmosphere' approach for harvested wood products

Under the existing accounting rules, it is assumed that the carbon stored in wood products is released into the atmosphere in the year of harvest (instantaneous oxidation). The rationale behind this rule is that it is simple, avoids the difficulties associated with tracking the life cycle of wood products, and ensures consistency among all Parties. Although convenient, the rule is based on a fiction as carbon is stored in wood products for varying lengths of time depending on the nature of the product and wood type. As a result, countries are required to record forestry-related emissions under Articles 3.3, 3.4 (forest management, if it is elected), 6 (Joint Implementation forestry projects) and 12 (Clean Development Mechanism forestry projects), where none in fact occur. This results in false accounting and diminishes the incentive for countries to promote the production and use of long-lived wood products as a substitute for more carbon-intensive ones (Lim et al., 1999; Ford-Robertson, 2003; Green et al., 2006; Tonosaki, 2009).

To address this, it has been proposed that the instantaneous oxidation approach be replaced with an 'emissions-to-atmosphere' system for harvested wood products from Article 3 forests (AWG-KP, 2010). There are two basic elements of this proposal.

First, emissions would be accounted for when they occur using a method based on the estimated half-life of different wood products and byproducts. This is likely to involve the application of default decay functions or country-specific data if the products are domestically produced and consumed. Second, responsibility for wood product emissions would lie with the wood-producing country, meaning all emissions from a forest area would remain with the producing country, even if the wood products and byproducts were exported.

4. Pros and cons of the proposed new LULUCF rules

There is considerable theoretical merit in all three of the proposed rule changes. The force majeure rule would ensure that countries are not unfairly penalized for factors that are beyond their control and allow greater access to cheap sources of LULUCF abatement (a number of which are capable of producing important co-benefits, such as the biodiversity and hydrological benefits associated with native reforestation and reduced native forest harvesting). The baseline-and-credit and emissions-to-atmosphere proposals could improve forest accounting by providing more accurate estimates of the additional direct anthropogenic influence on forest-related carbon stocks and fluxes. In doing so, they could facilitate cost-effective abatement in forestry activities.

Although the proposed rule changes offer a number of potential benefits, they have received a mixed reception. Many believe they could exacerbate the problems associated with LULUCF accounting and open up new opportunities for countries to obtain windfall credits, thereby further undermining global mitigation efforts (GFC, 2010; Greenglass et al., 2010; Reichert and Voßwinkel, 2010). Some of this reaction is undoubtedly attributable to the stained history of LULUCF in the Kyoto Protocol. However, substantive issues remain that have the potential to threaten the efficacy of the international climate regime. These issues can be sorted into three broad categories: (i) accounting for the biophysical effects of forest activities, (ii) measurement and attribution uncertainty, and (iii) the potential for countries to generate low- and zero-cost LULUCF offsets and the implications for target setting.

4.1. Biophysical effects of forest activities

The climate benefits associated with reforestation, afforestation, revegetation and avoided deforestation projects undertaken in boreal and temperate regions are uncertain. These forest activities have a cooling effect on the Earth's climate by either sequestering carbon in biomass or preventing the release of GHGs through deforestation (called 'carbon-cycle effects'). However, there is evidence that these impacts may be offset by the warming caused by associated changes in surface albedo (called 'biophysical effects') (Betts, 2000; Pielke et al., 2002; Marland et al., 2003; Bala et al., 2006, 2007; Bonan, 2008; Thompson et al., 2009; Schwaiger and Bird, 2010; Anderson et al., 2011). For example, Bala et al. (2007, p. 6550) found that, although reforestation/afforestation in the tropics is likely to be effective in mitigating global warming, it 'would offer only little to no climate benefits when implemented in temperate regions and would be counterproductive, from a climate-perspective, at higher latitudes'.

The existing accounting rules focus exclusively on the carbon-cycle effects of forest activities and make no provision for their biophysical impacts. This issue has been discussed in the literature for over a decade, and numerous suggestions have been made on how the rules could be modified to better account for the full climate impacts of forest activities (Betts, 2000; Pielke et al., 2002; Marland et al., 2003; Thompson et al., 2009; Schwaiger and Bird, 2010; Anderson et al., 2011). Despite this, there appears to be no appetite to address this issue.

A partial explanation for the indifference shown towards the biophysical effects of forest activities may be found in the customary international law that underlies the UNFCCC. The 'no harm principle' of international law provides that, while states have the sovereign right to exploit their own resources pursuant to their own environment and development policies, they also have 'a responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction' (Rio Declaration on Environment and Development (1992), Principle 2; see also Zaelke and Cameron, 1990; Birnie and Boyle, 1992). This principle is referred to in the preamble to the UNFCCC and arguably provides the fundamental rationale for it – because GHGs cause anthropogenic warming beyond territorial boundaries, States are thus obliged to respond proportionately so as to ensure that emitting activities within their jurisdiction do not cause significant injury to the environment of another state or of areas beyond their own national jurisdiction.

If the international climate regime is intended to reflect this principle, the accounting rules should arguably be concerned only with 'exported anthropogenic warming'. Warming that occurs within the boundaries of the country in which the activity is undertaken could be viewed as irrelevant. In the case of forest activities, the cooling associated with the carbon-cycle effects is 'manifested globally whereas biophysical effects are most strongly felt locally' (Bala et al., 2007, p. 6554); thus, to the extent that the biophysical warming is internal and not exported, it arguably should not be accounted for.

Although there is theoretical logic to this approach, the biophysical impacts of forest activities in temperate and boreal areas vary considerably depending on geographic and biological factors (species type etc.) and, in many cases, the associated warming is likely to extend beyond national boundaries would be (Betts, 2000). Moreover, in both the Copenhagen Accord and the Cancun Agreements, the object of the post-2012 international climate regime was defined as holding ‘the increase in global average temperature below 2°C above pre-industrial levels’ (UNFCCC, 2011, Decision 1/CP.16, clause 4; see also clauses 1 and 2, UNFCCC, 2010). If the long-term objective of the regime is based on a global average surface temperature target, the biophysical effects of forest activities should be taken into account and the resulting LULUCF credits should be discounted to ensure the net cooling effects are not overstated. Under the proposed rules, however, this will not occur and, by facilitating greater access to LULUCF abatement, the proposed changes could exacerbate the severity of any false accounting that arises from reliance on relevant forest-related offsets.

4.2. Measurement and attribution uncertainty

Measuring LULUCF emissions and removals is notoriously difficult and subject to a relatively high degree of uncertainty. Progress has been made in this field over recent years, but scientific and technological gaps remain (DeFries et al., 2007; Denman et al., 2007; Shvidenko et al., 2010). The measurement uncertainty gives rise to risks of inaccurate accounting, a problem that is then magnified by the attempts to separate additional direct human-induced impacts from natural, indirect human-induced and past management effects (Höhne et al., 2007; Schlamadinger et al., 2007). Although the proposed rule changes partially address some of the hazards associated with attribution, they will not ensure complete and accurate accounting. Outstanding issues include the following:

- Under Article 3.3, Parties are required to account for the emissions associated with deforestation: the direct human-induced conversion of land that was Kyoto-complying forest on 31 December 1989 to non-forest land (i.e. forest to a non-forest use). Once a land unit is deforested, they are also required to account for all subsequent carbon stock changes and non-CO₂ GHG emissions on the land unit, irrespective of the cause. These rules result in an accounting imbalance. Parties are not liable for deforestation emissions over the period 1990–2007, but they can generate offsets from reversing these emissions through regrowth on deforested land units after the first commitment period has commenced. The resulting offsets produce a net increase in emissions post-1990 and, because they can involve natural regrowth that is not directly human-induced, are inconsistent with the commitment in Article 4 of the UNFCCC to mitigate climate change by ‘addressing *anthropogenic* emissions by sources and removals by sinks’.
- Coverage of Article 3.4 activities is still optional, allowing Parties to preferentially include and exclude activities.
- Article 3.4 activities (other than forest management) continue to be accounted for using a net–net approach. The reliability of this method is dependent on: (i) the base year reflecting pre-1990 management effects and long-term natural and indirect human influences,³ (ii) the commitment period being of a sufficient length to factor out inter-annual variability⁴ (or the existence of rules allowing for the same); and (iii) the same land area being accounted for in the base year and commitment period. There is a risk that these conditions will not be satisfied, at least not for all Parties.
- The definition of ‘forest management’ is ambiguous, allowing Parties to choose between different interpretations of the phrase. As a result, Parties can preferentially exclude forest areas that are sources and include sink areas to maximize LULUCF offsets (IPCC, 2006; Höhne et al., 2007).

- The illegitimate offsets provided by Article 3.7(2) continue to be generated in the post-2012 era, allowing a small number of Parties (particularly Australia) to access zero- and low-cost credits by reducing their net deforestation emissions below those recorded in 1990.

In addition to these issues, the proposed rule changes have their own inherent problems, typified by the baseline-and-credit system for forest management, which is dependent on either the reference level accurately incorporating natural, indirect human-induced and past management effects, or its capacity to be adjusted *ex post* to account for these factors. There is an understandable fear among some Parties and analysts that the reference levels could be set using inconsistent methods and in a manner that results in the generation of windfall credits (Greenglass et al., 2010). In its submission on reference levels, the Government of Tuvalu (2011) raised these concerns, stating that

the breadth of accounting methodologies that can be interpreted from paragraph 4 of FCCC/KP/AWG/2010/L.8/Add.2 and its respective footnote 1, will lead to inconsistent methodologies and inconsistent conclusions. The lack of clarity in defining precisely what a reference level is and how it should be applied, means that Parties are about to select their own methodology and set of assumptions.

The concerns about the robustness of the reference levels have been heightened by the diversity of approaches that have been adopted towards their preparation, particularly the refusal by several Parties to use a 'no policy change' projection method.

Inaccuracies could also arise in the operation of the force majeure and emissions-to-atmosphere rules, both as a result of impropriety and inadvertent errors. For example, errors could arise in the identification of lands subject to a major natural disturbance and the estimation of the associated emissions and subsequent removals. Similarly, there are uncertainties associated with the life cycle of wood products and emissions from harvested wood product pools. Although both the force majeure and emissions-to-atmosphere rules have the potential to improve the accounting framework, their success in providing incentives for positive behavioural change and reflecting 'what the atmosphere sees' will depend on the manner in which they are administered. The risks associated with the implementation of these proposed rules are exacerbated by the complexity of LULUCF measurement and accounting, which diminish transparency and scrutiny.

4.3. Cheap offsets and targets

The proposed changes to the LULUCF accounting rules will open up opportunities for countries to claim credit for emissions reductions and enhanced removals with little or no additional economic effort. Taken in isolation, cheap abatement is a positive. The problems associated with zero- and low-cost credits stem from the *ad hoc* way in which mitigation targets are set (Baumert and Kete, 2002). A number of different approaches have been advocated for comparing mitigation targets, but that of economic effort (typically measured either as a reduction in gross domestic or national product, or gross national expenditure or income, from a reference or BAU case) has been one of the most dominant (Meyer, 2000; Bode, 2004; Blok et al., 2005; Gupta et al., 2007; Baer et al., 2008; Garnaut, 2008; Australian Government, 2009; New Zealand Government, 2009). The reliance on economic effort means that, if the capacity to access zero- and low-cost LULUCF offsets is not taken into account, there is the potential for Parties to receive overly generous emission limits (or to 'get away with' unambitious mitigation pledges).

These risks often manifest themselves through economic modelling, in which the economic effort required to achieve specified mitigation obligations is evaluated. The potential for cheap LULUCF

abatement can be ignored or underestimated in the modelling, resulting in overestimation of the net economic cost of mitigation to the relevant Party or Parties. Despite the deficiencies in modelling, Parties may seek to use it as 'objective evidence' on which to judge relative economic effort and determine mitigation obligations. Australia's approach to the Kyoto Protocol negotiations provides a good example of this.

In the lead-up to COP 3 in Kyoto, there was fierce debate about the comparability of developed country mitigation commitments. The EU and the US, among others, had suggested that all developed countries should adopt flat-rate emission reduction targets in the first commitment period. Australia was one of a group of Parties that argued that this approach was inequitable because the costs of meeting these targets would not be uniform. To account for this, Australia sought differentiated targets, where mitigation obligations would be set having regard to the costs of fulfilling them.

Because of its dependence on coal-fired electricity generation and emissions-intensive industries, Australia claimed it would suffer relatively large economic losses in reducing its emissions and, therefore, its mitigation target should be less onerous than those of other Parties. As Alexander Downer, the Australian foreign minister at that time, explained:

an Australian should not have to shoulder more of the economic burden for greenhouse gas abatement than say a European, American or Japanese. We are talking about an 'equality of effort'. (Downer, 1997, p. 4)

Australia's claims for a more generous target were backed up by several studies published by a government agency, the Australian Bureau of Agricultural and Resource Economics (ABARE), which warned of the dangers of uniform commitments and the large economic costs Australia would incur in reducing its emissions (ABARE/DFAT, 1995; ABARE, 1997; Brown et al., 1997). In the absence of emissions trading, ABARE predicted that cutting Australia's emissions to 1990 levels by 2010 would reduce real gross national expenditure (GNE) by 2.6% in 2010, a figure significantly above the projected losses in most other developed countries (Brown et al., 1997). These results were used to support Australia's position and the final agreement reflected its concerns. The QELROs specified in Annex B to the Kyoto Protocol are differentiated, with Australia having the second-most generous emissions cap behind Iceland (108% of 1990 levels over the first commitment period).

In 1999, after COP 3, ABARE predicted that the Kyoto Protocol would reduce the Australian gross national product (GNP) by 0.5–0.7% in 2010, depending on whether emissions trading was permitted (Brown et al., 1999). Following COP 7 in 2002, where most of the operational rules for the Protocol were finalized, ABARE revised its estimated impact downwards to a reduction in GNP of 0.15% in 2010, rising to 0.24% by 2015 (ABARE, 2002). In a mirror report to the Australian Greenhouse Office in 2002, economist Warwick McKibbin projected the impact of the Protocol on the Australian economy would be roughly double the ABARE estimate: a 0.33% reduction in GNP in 2010 and a 0.47% reduction in 2015 (McKibbin, 2002).

All of the Australian Government studies published in relation to the Kyoto Protocol underestimated or ignored the potential for LULUCF offsets. This is a particularly important oversight by Australia because of the impact of Article 3.7(2), which effectively converted Australia's 108% target to the equivalent of a 142% increase on 1990 levels using the standard accounting practices that apply to most other countries (Macintosh, 2010). In the studies prepared in the lead-up to COP 3, LULUCF was completely excluded. Even ABARE's 1999 report on the impact of the Protocol did not model the impacts of Article 3.7(2). Although both ABARE (2002) and McKibbin (2002) included LULUCF offset projections based on Article 3.3 activities, they are likely to have underestimated the actual

outcomes by $\sim 50 \text{ MtCO}_2\text{e/yr}$, or almost 90% (ADCCEE, 2011a, 2011b). The failure to accurately forecast LULUCF abatement has therefore probably resulted in a significant overestimation of the impact of the Kyoto Protocol on the Australian economy.

5. Conclusions

Land use, land-use change and forestry (LULUCF) projects have the potential to make an important contribution to efforts to mitigate climate change. When designed well, they can also provide co-benefits related to biodiversity conservation, land degradation, water management and adaptation. However, reliance on LULUCF abatement carries risks that arise from uncertainties related to the biophysical impacts of forest projects, the difficulty in measuring terrestrial carbon stocks and fluxes, the need to attribute changes in sinks and removals to direct human-induced impacts, and the way LULUCF offsets interact with the process of setting mitigation targets. In the Kyoto Protocol, attempts to appropriately manage these risks gave way to the political imperative to appease recalcitrant parties. The result was a compromised accounting framework that undermined the environmental integrity of the agreement.

Proposals have been put forward for the post-2012 regime to address some of the weaknesses in the LULUCF rules. Although these amendments have the potential to lead to more accurate attribution of observed carbon stock changes, significant problems remain. There are risks associated with the design and implementation of the new rules, typified by the different approaches that have been taken to the development of the forest management reference levels. The Parties have also shown no desire to rectify a number of flaws in the current accounting framework, including the optional nature of Article 3.4 activities, the deficiencies associated with Article 3.7(2), and the absence of a mechanism to deal with the biophysical effects of forest activities. The weaknesses in the proposed rules and inherent uncertainties associated with LULUCF abatement create a significant risk of environmentally deficient accounting.

Given the magnitude of the problems, greater safeguards are warranted to protect the environmental integrity of the international regime. A number of options to achieve this are currently being debated within the LULUCF negotiations, including caps on offsets and trigger levels for the application of the force majeure rule (AWG-KP, 2010). Irrespective of how these measures are progressed, there should be a concerted effort to improve the auditing and transparency of LULUCF accounting. The complexity of the current LULUCF accounting rules shields the area from scrutiny, heightening the risk of illegitimate debiting and crediting. Ensuring greater disclosure of methods, models and data, and improved auditing processes, are both relatively simple ways of minimizing the risks inherent in LULUCF abatement.

Notes

1. See clause 5, Decision 2/CMP.6, UNFCCC (2011).
2. Copies of all forest management reference level submissions are available at http://unfccc.int/meetings/ad_hoc_working_groups/kp/items/5896.php [accessed 15 June 2011].
3. The IPCC Guidelines allow for alternative base years to be used if the single base year is abnormal (IPCC, 2006).
4. At the time of writing, there was discussion in the international negotiations of whether Parties should be able to 'remove the impacts of inter-annual variability' (AWG-KP, 2010, p. 34).

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