Plugging the leaky sink

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The media has been full of stories recently related to climate change. Against a backdrop of climate disasters and doom and gloom scenarios, there are reports that the international community is taking the issue seriously and increasing their efforts to reduce greenhouse gas emissions. Meanwhile in New Zealand the carbon tax has been abandoned, and other aspects of the climate policy package are under review. Now is the opportunity to revisit the objectives and develop appropriate responses. Given their key roles in the New Zealand economy and the New Zealand greenhouse gas inventory, it is vital that the primary-based sectors participate effectively in this process.

Background

The United Nations Framework Convention on Climate Change (UNFCCC) established the objective and principles of protecting the climate systems for the benefit of present and future generations. Inside this overarching framework – but with some important differences – is the Kyoto Protocol (KP). Finally there are national strategies, developed in response to climate change, which can be entirely consistent with or totally different from the international approach.

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to stabilise atmospheric greenhouse gas (GHG) concentrations in the atmosphere to avoid dangerous interference with the climate system. Parties to the Convention – most of the countries in the world – have agreed to monitor and report GHGs they produce, and develop their own climate change strategies. Guidelines were developed by the Intergovernmental Panel on Climate Change (IPCC) to help Parties prepare consistent and transparent national inventories of emissions by sources and removals by sinks (Fig 1).

The Kyoto Protocol introduced legally binding targets for emissions reductions, but only for the more industrialised/developed countries. Each of these - except USA and Australia - made a commitment to reduce their average annual GHG emissions over the period 2008-12 to a percentage of their 1990 emission level. The international framework is more or less fixed for the first commitment period 2008-12: emissions targets have been established, the reporting guidelines have been accepted and the accounting system principles and rules have been agreed.

There are two key activities currently underway. Firstly, each Party is now working to "achieve its emission limitation commitments, in order to promote sustainable development, by implementing policies and measures in accordance with national circumstances". Secondly, the international community is working collaboratively to develop an international climate agreement beyond 2012, and identify appropriate responses to climate change that will include Kyoto outsiders such as the United States and developing countries. There is therefore an opportunity to consider not only suitable domestic policies, but also how these might be incorporated in a future international agreement.

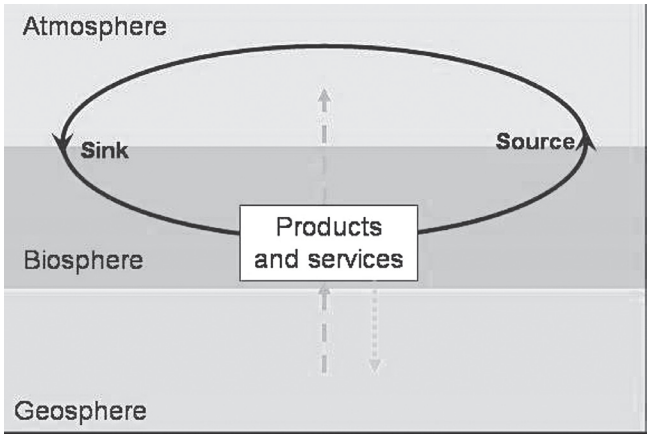

Fig 1: Removals by sinks and emissions by sources are defined in the UNFCCC as exchanges to and from the atmosphere. Biomass growth is a sink because it removes carbon from the atmosphere, and the combustion of biomass or fossil fuels are examples of source processes. Reservoirs are places where carbon is stored (retained) and could include fossil deposits as well as biomass and biomaterials. There is often a choice whether products (e.g. building materials) and services (e.g. energy) are derived from renewable or non-renewable resources. The former includes carbon in the current carbon cycle whereas the latter tend to be one-off flows of carbon from the geosphere. There is currently limited capture and deep sequestration of CO2 in geological formations.

New Zealand situation

The New Zealand target under the Kyoto Protocol is to stabilise average annual emissions during 2008-12 at 100% of 1990 levels or to take responsibility for any emissions above this level; e.g. by using forest sink credits. Projections for the first commitment period suggest New Zealand will show a negative carbon balance, i.e. emissions are anticipated to exceed removals by around 36 $MtCO_2$-equivalent. In December 2005 the government reported that the climate policy package alone was insufficient to achieve either the Kyoto target, or the domestic target of setting a permanent downward path for emissions by 2012. (Emissions in 2003 were reported to be 22% higher than in 1990.) The policy review noted the inequity of some policy mechanisms which might have contributed to perverse incentives for activities such as deforestation.

The importance of the forest sector cannot be overemphasised. New Zealand forests remove carbon from the atmosphere, currently reported as a significant sink of 23 $MtCO_2$-equivalent (offsetting 30% of national emissions). There are global benefits of maintaining forest carbon stocks and providing biomass-based materials and fuels for fossil fuel substitution. If new planting rates could be maintained at levels enjoyed in the 1990s, this would contribute a massive and enduring sink both in terms of the Kyoto accounting system, and also in terms of what the atmosphere sees. Sadly new planting rates have plummeted meaning anticipated sinks will not materialise, and deforestation leads to both a loss of carbon stock and further emissions from the subsequent pastoral land use. This has consequences well beyond the climate debate.

Table 1: Potential GHG impacts of different types of forestry. The forest and its products need to be considered together as options for land use, and the production of renewable materials and fuels.

Forest type	Forest characteristics		Avoided emissions		Lifecycle
	On site stocks	Sequestration rate	Fuel substitution	Product substitution	
Protection forest	Highest	Low/none	None	None	Long/Indefinite
Sustained yield - sawlog	High	Moderate	Yes	High	Long
Sustained yield - pulp	Medium	Fast	Yes	Moderate	Short
Energy forestry	Lowest	Fast	Yes	None	Shortest

Forestry

The carbon cycle includes carbon sequestration by plants and its return to the atmosphere through processes such as combustion and decay. The UNFCCC refers to these processes as sinks and sources respectively, defined in terms of their relationship with the atmosphere. Carbon reservoirs are places where carbon is stored (retained) including living biomass or associated ecosystems (e.g. woody debris, soils) and products (e.g. food, materials, fuels).

The IPCC Guidelines explain that the sink that exists in forests is equal to the stock change in the forest and associated products. For a variety of reasons, the focus has been on the forest stocks alone based on a default assumption that the carbon in harvested biomass is emitted when and where it leaves the forest (or farm). In other words, responsibility for emissions is allocated to the producer who sequesters the carbon, rather than the consumer that releases it.

The instant oxidation assumption can create the impression that in order to mitigate climate change the objective is to maximise carbon stocks in the forest, rather than the combined total of carbon stocks inside the forest and in wood-based products. This can lead to policies to reduce or stop harvesting trees to avoid carbon release. Although 'harvesting' is carefully distinguished from 'deforestation' in other parts of the Guidelines, in terms of the way the carbon is assumed to be released immediately no distinction is made. Avoiding deforestation will prevent the loss of a large carbon reservoir and increased emissions from the subsequent land use. While non-harvest (protection) forestry may be totally appropriate for some objectives, it fails to capture additional benefits for emissions reduction through material and energy substitution.

The type of forest will affect the potential downstream uses and hence the overall GHG benefits of the forestry sector (see Table 1). Protection forests offer little if any net sequestration and no off-site carbon benefits. Sustained yield forests may have lower stocks but higher turnover rates and the biomass harvest offers off-site benefits. Very short rotation energy forestry plantations may have the highest sequestration rate, but lower carbon stocks and a rapid cycle without great opportunities for product substitution.

Forest products

Extracting biomass from the forest for products is equivalent to extending the lifetime of the carbon in the biosphere before it is returned to the atmosphere. Every unit of carbon in the biosphere, e.g. in forests and wood products, is not in the atmosphere. Therefore the objective is to maintain and enhance these stocks, which means removals must be equal to or more than emissions.

The direct and indirect fossil fuel substitution opportunities offered by wood products are widely recognised. Direct benefits arise from using biomass as a fuel, but indirect benefits can also be gained by substituting wood for more energy- or emissions-intensive materials, e.g. steel, concrete. The atmospheric outcome is maximised if these benefits are additive rather than competitive. For example this could include the manufacture of durable products and extensive reuse and recycling, so that each product replaces a non-renewable material. The carbon is not released to the atmosphere until the biomass is used for energy when there are no available opportunities for reuse and recycling.

Measurement and reporting

The IPCC Guidelines to help Parties report their emissions and removals in their National GHG inventory includes general principles, definitions, calculation procedures, and emissions factors. It is based on preparing an inventory divided into different sectors: energy; industrial processes; agriculture; land use, land use change and forestry (LULUCF); and waste. There are rules on what is reported under each of them, for example:

1. All carbon removed from a forest is reported as an emission of CO_2 in the LULUCF Sector.
2. CO_2 released from biomass (e.g. firewood, bark) burnt for energy is not included in the Energy sector totals (CO_2 from biofuels is noted as a memo item).
3. CH_4 released from biomass burnt for energy is included in the Energy sector .
4. CO_2 released from waste biomass (e.g. wood/paper in landfill) is not included in the Waste Sector.
5. CH_4 emissions from waste biomass are included in the Waste Sector.

Attribution or allocation

The examples above demonstrate incorrect attribution of emissions, i.e. the emissions are not associated with the correct sector let alone the activities that release them. Hence inventories do not accurately report sources and sinks, which can create a distorted picture of where policies need to be targeted to reduce net emissions.

Since all emissions of biomass carbon are allocated

to the grower/producer country, there is no identifiable benefit of extending the life of the carbon in the biosphere. Consumers/countries are not responsible for emissions from imported biomass and hence have no incentive to reduce consumption or encourage reuse and recycling. Under some proposals bioenergy is not only considered emission-free, but is also allocated a credit for avoided fossil fuel emissions.

This allocation system creates the worst possible emission profile for net producers and exporters of primary products. Fortunately for many industrialised countries, most of the biomass production can occur in developing countries, where there are currently no emissions commitments. Countries consuming imported biomaterials and biofuels need have no concern about any associated emissions liabilities. Unfortunately New Zealand relies heavily on exports of primary products and the 'emissions' calculated from stock changes are included in New Zealand national accounts. This also applies to developing countries, and is unlikely to encourage them to adopt emission reduction commitments.

Permanence and additionality

Activities fall into three categories in terms of the atmospheric impacts: those that emit GHGs into the atmosphere (sources), remove GHGs from the atmosphere (sinks), or have no net impact on the atmosphere (static reservoirs). It is the absolute quantity of emissions/removals that is more important to the atmosphere than emissions relative to a counterfactual baseline. However, there was a desire to differentiate between emissions from renewable and non-renewable resources (within current cycles or from geological sources), which resulted in concepts such as permanence and additionality.

Afforestation is considered in some international project mechanisms to be an inferior GHG mitigation activity than others because it is not permanent i.e. it is potentially reversible. The same mechanisms promote using biomass for energy because it is part of a renewable cycle, evaluating its benefit against other energy sources which often means bioenergy is considered as a permanent reduction in emissions from fossil fuels. These projects represent opposite absolute impacts on the atmosphere i.e. afforestation is a sink and combustion is a source. The project accounting system can consider both as 'emissions reductions' but only the bioenergy project would be counted as a permanent reduction in emissions. This could result in an increase in bioenergy use without associated biomass supplies.

Additionality is the concept that activities or projects are evaluated not on the basis of their atmospheric impact, but their impact relative to a counterfactual baseline. For example, a project involving use of gas rather than coal would be evaluated not on the emission from the gas, but on the emissions reduction relative to the baseline (higher emissions per unit of energy from coal).

Policy implications

The forest sector offers New Zealand the opportunity to increase domestic self-sufficiency and at the same time reduce reliance on non-renewable materials and fuels. Increasing the area of forestry (production and protection) and the efficiency of the forest industries would meet numerous economic, environmental and social objectives. Amongst these would be the reduction in net greenhouse gas emissions.

Creating a simple accounting system will be crucial to achieving atmospheric outcomes. Emission allocation rules in the KP increase the complexity of the accounting system because it no longer mirrors the carbon flows that run through the economy. The complexity has been identified as a reason for slow market uptake and poor industry engagement as well as creating perverse incentives. The inconsistent calculation and allocation rules have also created a system that is considered inequitable. New Zealand can adopt its own inventory and accounting system.

It might be useful to consider developing a national inventory of 'what the atmosphere sees' that would accurately capture forest sector roles. This could facilitate reporting under the UNFCCC and accounting under the KP, by applying the allocation rules or accounting procedures relevant to each agreement. The national carbon balance could be significantly more positive to the atmosphere than current estimates, since carbon sequestered in New Zealand, i.e. around two-thirds of the forest carbon harvested in New Zealand, is exported in various biomaterials.

Correct attribution of emissions would greatly facilitate the identification of real GHG impacts. Deriving actual emissions would be a relatively simple and transparent process for most companies, since it would reflect the material and energy flows that are known to resource users. It could even operate in a similar way to GST, and domestic trading could facilitate reducing net emissions.

In terms of atmospheric impact, the net sink in a forest is equal to the stock change of the forest plus any harvested carbon transferred to another user. In other words, each rotation is acknowledged to remove additional carbon from the atmosphere. A wood processor, bioenergy plant or waste facility would report the emissions that occur, e.g. from biomass combustion or decay (as well as from fossil fuel use), using IPCC guidelines to estimate emissions from these activities. This is likely to promote efficiency of biomass conversion and consumption, including recycling of carbon through multiple product uses as well as the 'useful' release of carbon through its use as a fuel.

Accurate identification of atmospheric exchanges would facilitate the development of appropriate policies and measures that will deliver net emission reductions. Companies in New Zealand might be more accepting of some form of targets if they are evaluated on the basis of their real impact on the atmospheric GHG balance, and given the opportunity to trade with other companies within New Zealand.