The role of forestry in helping New Zealand reduce carbon emissions to the atmosphere

Submission to the Productivity Commission, Dr David Evison and Professor Euan Mason, School of Forestry, University of Canterbury.

Introduction

The Productivity Commission has asked for submissions on the following questions (among others)

Q6. What are the main barriers to sequestering carbon in forests in New Zealand?

Q7. What policies, including adjustments to the New Zealand Emissions Trading Scheme, will encourage more sequestering of carbon in forests?

There are two ways for New Zealand to approaching climate change commitments:

- What are the ways to reduce New Zealand's greenhouse gas emissions? How do we contribute to reducing global greenhouse gases through a genuine reduction in New Zealand's emissions?

- What are the ways to meet New Zealand's international climate change commitments at least cost? This is a transactional approach – what is the cheapest way to acquire carbon emission permits that are acceptable to UNFCC to meet New Zealand's international undertakings?

This submission only considers the first approach- transactional solutions are not considered in this submission. In addition, any rules that relate to GHG reporting or accounting that modify the amount of GHGs sequestered by forests are not considered in this submission. Actual sequestration by new forests is matched against actual emissions by the emitting sectors in this submission.

This submission also only considers new emissions and removals – any emission at harvest from forests for which removals were reported or accounted prior to 2018 are not included. Additional forest could be planted to "counterbalance" emissions, however, and given the projected emissions profile of the post 1989 forests this could be easily modelled as an additional exercise.

Approach

In order to answer the questions posed by the Productivity Commission, it is first necessary to define what forestry is capable of and formulate a recommendation on forestry's contribution to New Zealand's greenhouse gas emission reduction goals. This will provide a necessary context to answer the questions of what the barriers to sequestration by forests are and what policy instruments should be used to encourage sequestration.

What can forests do and what it the best way to use them?

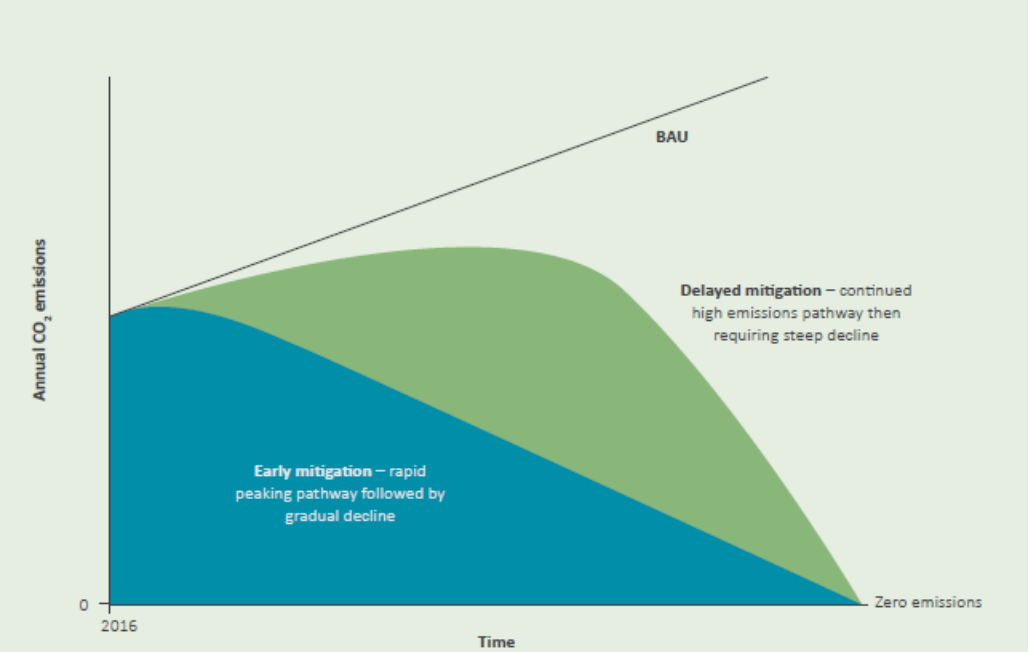
Forestry is the only known and tested technology which sequesters large quantities of carbon from the atmosphere (Evison 2016). It also seems unlikely that new technologies to capture and store carbon will be available before 2050 (Caldecott, B., Lomax, G., Workman M., 2015). Removal occurs as new forest grows, and once the forest reaches a biological steady state, no further significant new sequestration occurs. These two features have important implications for how planted forests should be used by New Zealand to reduce carbon emissions into the atmosphere.

The appropriate way to use new forests is to:

1. Develop national goals for reducing emissions by changing technologies, infrastructure and patterns of use (potential actions have been identified by RSNZ and Globe-NZ, among others), including:
    a. A target reduction with a date of achievement
    b. Specific actions that will lead to the target being reached
2. Use new planted forest to reach this target earlier that it can otherwise be achieved, and to further reduce emissions while new technologies (as yet not identified) are discovered and implemented
3. Because the carbon sequestration from forests is "one-off" it should not be squandered (Morgan Foundation, 2017) by using it to allow business as usual behaviours to continue (exactly what happened in commitment period 1 of Kyoto for New Zealand).

The benefits of early mitigation are large, because the total emissions are a lot lower (Royal Society 2016).

Figure 1: Benefit of early mitigation



Two possible emission pathways to reach zero annual CO^2 emissions at the same point of time in the future. The delayed mitigation pathway results in around double the total CO^2 emissions over the period, and hence greater warming, than the early mitigation pathway, even though they both end up with zero emissions at the same time.

Royal Society, (2016)

The approach outlined in this submission is consistent with the World Bank view which outlines three principles to guide countries' efforts to reduce emissions (two of which are relevant to this submission):

1. "…Planning ahead with an eye on the end goal. Implementing a mixture of cheap, quick fixes that are sector-specific as well as locking in costlier, long-term measures that support technology development and low carbon infrastructure
2. Supplementing carbon pricing with other policies: Recognising that carbon pricing alone will be insufficient, so creating a policy package that triggers changes in patterns of investment, technologies and behaviours…"

This submission is consistent with the World Bank's advice.

The role that forests can play in sequestering carbon is illustrated very well by the final returns from Kyoto CP1, (Table 1 below). Over this period, forests removed a quantity of atmospheric carbon that almost exactly equalled the amount by which gross emissions exceeded our agreed level of net emissions.

Table 1: New Zealand's CO2 equivalent emissions (Mt CO_2 eq.), by sector, 2008 to 2012

	Mt CO_2 eq.					
Sector	**2008**	**2009**	**2010**	**2011**	**2012**	**TOTAL**
Energy	34.582	31.741	31.624	31.222	32.121	161.290
Industrial processes	4.139	4.158	4.549	5.284	5.277	23.407
Solvent and other product use	0.031	0.028	0.031	0.028	0.034	0.152
Agriculture	33.156	33.368	33.560	34.213	35.020	169.317
Waste	3.857	3.806	3.727	3.646	3.596	18.632
SUM	75.764	73.101	73.491	74.393	76.048	372.798
Afforestation and reforestation	-17.364	-17.836	-18.193	-18.576	-18.965	-90.933
Deforestation	3.167	5.616	4.087	3.376	3.996	20.243
Total (Article 3.3)	-14.197	-12.220	-14.106	-15.200	-14.969	-70.691
NET EMISSIONS	61.567	60.881	59.385	59.194	61.079	302.107

Source: UNFCCC (2015)

The scenario of emissions reductions

The scenario from Globe-NZ that provides the largest reduction in gross emissions is "Innovative" which is estimated to provide New Zealand gross emissions in 2050 of 44.3 Mt. This is achieved through reductions by all of the emitting sectors as outline below in Table 2.

Table 2: Globe-NZ scenarios

			Globe-NZ scenarios (Mt CO2-e)		
			Off Track	**Innovative**	**Resourceful**
	1990	**2014**	**2050**	**2050**	**2050**
Energy	23.8	32.1	20.5	12.7	20.6
Industry	3.6	5.2	4.2	4.1	4.2
Agriculture	34.4	39.6	33.2	24.7	28.5
Waste	4.1	4.1	3.9	2.8	3.9
Gross	65.9	81	61.8	44.3	57.2
LULUCF	-28.9	-24.4	-11.5	-26.9	-36.4
Net	37	56.6	50.3	17.4	20.8

Note that New Zealand has made a heavily conditional undertaking under the Paris Accord

The Paris Accord undertaking which is 11% below 1990 (equivalent to 30% below 2005) by 2030

"…New Zealand commits to reduce GHG emissions to 30% below 2005 levels by 2030. New Zealand's INDC will remain provisional pending confirmation of the approaches to be taken in accounting for

the land sector, and confirmation of access to carbon markets. New Zealand will participate actively in discussions on the land sector with our negotiating partners, both in the lead -up to and after COP 21, and will confirm details of the accounting approach we will take prior to or upon ratification of the Paris agreement. In order to achieve domestic reductions and to do so at an affordable cost, we have identified a need for cost -effective mitigation technology, and in particular that our continuing investment in agricultural research delivers results that can be commercialised within the time period covered by this contribution. New Zealand will communicate its final NDC following agreement on the rules to apply in the above areas…" NZ Government

The scenario we are modelling in this submission is

1. Globe-NZ Innovative scenario to 2050 for the emitting sectors (gross emissions)
2. We further assume a New Zealand target of gross emissions declining to zero by 2080 (this uses technologies and changes in behaviour that are not as yet defined)

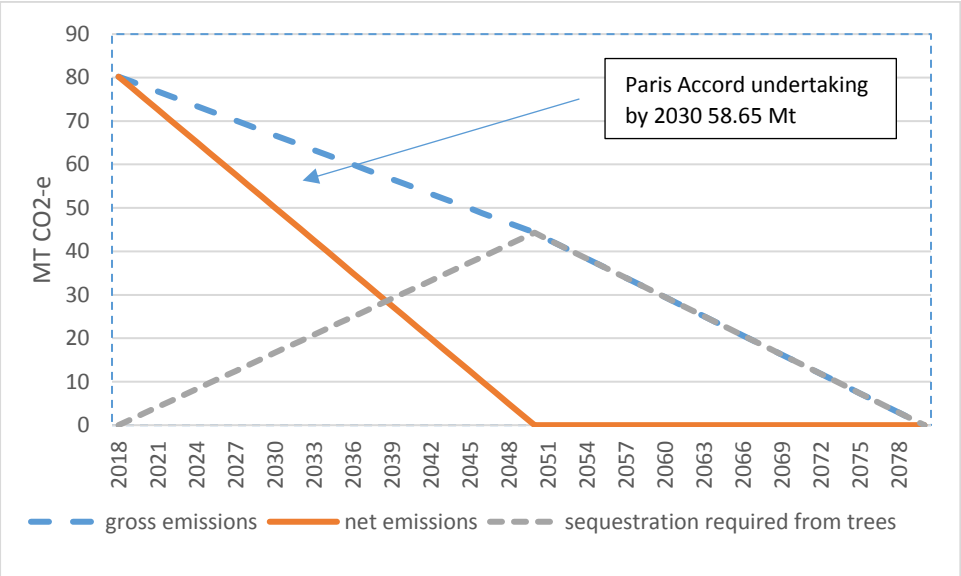
While this second part of the strategy has been solely described for illustrative purposes in this submission, Royal Society 2016) has identified that all sectors except agriculture can achieve zero emissions "in the long term". In addition Caldecott et al. (2015) suggest that new technologies for carbon capture and storage may be available for large-scale use beyond 2050.

If these were the two components of a New Zealand national strategy on climate change mitigation we contend that forestry can provide the means to achieve an even more ambitious strategy, as follows:

1. Net emissions to zero by 2050
2. Maintain net emissions at zero till 2080 (at which time gross emissions are assumed to be zero)

This scenario is shown below in Figure 2

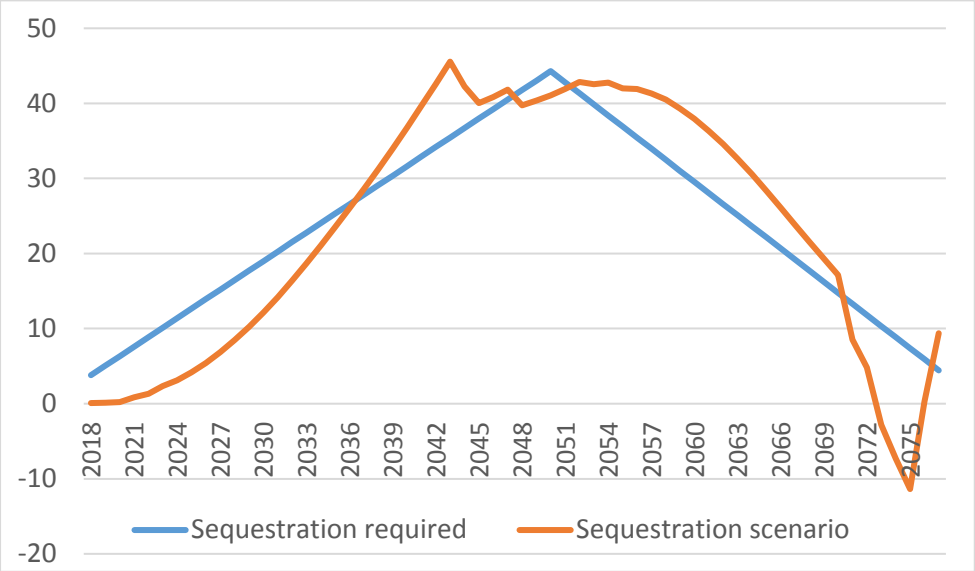
Figure 2: Scenario of gross and net emissions, and implied sequestration required



How can planted forests achieve the profile of net emissions shown in Figure 2? A new planting programme is modelled to provide the required sequestration (Fig 3 below).

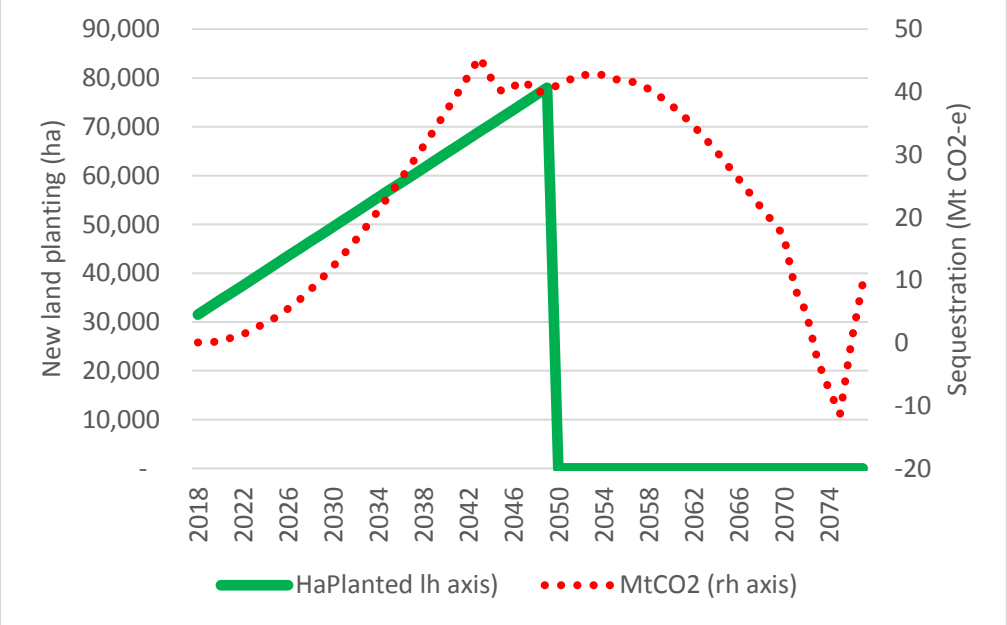
The goal of this planting programme is to provide the required sequestration which, combined with the assumed reductions in the emitting sectors to 2050 and 2080, will get New Zealand to zero emissions by 2050. The removals from the modelled planting programme are shown in Figure 3 below

Figure 3: Sequestration required to achieve net emissions scenario and modelled sequestration from new land planting



The planting programme is shown in Figure 4. This is not an arbitrary programme; it has been carefully designed through simulations to provide the required rates of sequestration while not delivering a future period of sustained net emissions from the planted area. All harvested forest is assumed to be replanted for the next rotation.

Figure 4: Proposed new planting and consequent carbon sequestration



- It is assumed that 1,314,000 ha of land would be planted for timber using a pruned regime (potentially a mix of private and public land)
- 438,000 ha would be planted as permanent carbon stores – potentially on Crown Land.
- If an unpruned regime was selected (perhaps a more likely scenario) sequestration would be higher and the area required would be lower.

Table 3: Area planted and assumed cost:

	Ha	Cost ($/ha)
Pruned, rotation 28 years	1,314,000	$1,300
Plant, no harvest	438,000	$3,000

- Under these assumptions planting the entire 1,752,000 ha would cost $3.022 billion

How would this planting programme be funded?

It is clear the cost is significant if it was required to be funded out of government revenue. However, at the costs assumed in Table 3, the entire planting programme could funded if projected gross emissions between 2018 and 2050 incurred a charge of $1.58 per tonne. Even if subsidy costs were considerably higher, the cost per tonne of total CO2-e emissions is relatively small, compared even to current NZU prices.

The modelling analysis has shown specifically how to achieve the goal, and how quickly it might be achieved. The scenario chosen was a gross emissions target of 43 MT at 2050, and a planting programme to show how much sooner that target could be achieved through new planting.

What additional value would derive to the New Zealand economy as a result of this resource size?

The scenario would create a new forest estate three quarters of which would be planted for timber and would make a significant economic contribution to the New Zealand economy, either:

- Exported as logs
- Processed into product

As a first estimate the size of this forest is very close to our current forest area. All would go to export so the export receipts should be at least as large as the current $5 billion per annum. Note the development of this new industry has some specific features:

It can replace other industries that are no longer viable under a low carbon economy when carbon emission incur a significant cost. So the second role of forests is to add to the new sustainable economy (wood processing has a low carbon footprint and a very low energy requirement, because of its use of waste wood for process heat and steam and cogeneration of electricity)

Response to Q6

Barriers to sequestration of more carbon by forests are the same as the barriers to new land planting of forests

- Economic
    - The current required rate of return on commercial forests is not attainable at the current price of suitable land.
    - For forests participating in the ETS, carbon price is uncertain and very volatile
    - ETS creates contingent liabilities which discourage forestry investment
- Regulation and policy
    - Land use planning rules and regulations
    - Lot of policy risk in ETS
- Knowledge and technical support for landowners
    - Not enough known by many land owners about forestry
- Attitudes and perceptions
    - The benefits of planted forests are not well understood by the public
    - Some land owners are opposed to planting trees
    - Perception that forestry is a sunset industry

An effective policy instrument would remove or mitigate enough of these barriers such that new land planting of fast growing tree species could occur again

Q7: What economic policy instruments are required to achieve this pattern of investment in forest planting?

It will be useful to briefly discuss the effectiveness of the NZ ETS since the government has identified it as being the main instrument to achieve New Zealand's climate change goals. A more detailed evaluation can be found in Evison (2016).

What has the ETS achieved so far?

- No reduction in greenhouse gas emissions by polluters.
- Significant deforestation
- Very little new land planting. From the passing of the Climate Change Response Act in 2002 till 2012 (end of Kyoto CP1), New Zealand had a net loss of 50,000 ha of planted forest.
- Effective curb on changing land use for pre-1990 forests, when carbon prices are high. Conversely, incentive to deforest when carbon prices are low…
- Acquisition of 122 million international credits by the NZ government (at no additional cost)

The current ETS is problematic because the inclusion of forestry makes it very difficult to implement an actual cap which can drive permanent emissions reductions (see Bertram and Terry, 2010). This is because new planting affects the number of credits issued and therefore affects the cap. This is essentially uncontrolled. Also, as pointed out by van Kooten (2015), when forestry is included in the ETS, new planting will have the effect of lowering the market price of NZUs as they are brought to market, which reduces the incentive for the emitting sectors to make long term changes to their emissions.

The policy instruments required need to:

- (for forestry) encourage a pre-determined planting rate of new forests, over 30 years. This is most likely to be achieved through a subsidy or through a greatly modified ETS
- (for emitting sectors) provide appropriate signals to encourage new investment in low or zero emissions technologies

It seems likely that separate policy instruments will be required to achieve these two separate but complementary goals.

What are the policy options?

- Modify the ETS to deliver on the strategy
- Combine an ETS for emitting sectors with a planting subsidy for forestry. The ETS could then be implemented with a cap, and if credits were auctioned by the government, part of the return from this auction could fund the planting programme.
- A carbon tax for emitters and a planting subsidy for forestry. Further details on issues with the ETS and the rationale for other policy instruments can be found in Evison (2016).

Planting subsidies

Planting subsidies have been effective in the past in New Zealand - they can be targeted at particular species and areas of land – the performance of the Afforestation Grant Scheme provides some insights into the effectiveness of this instrument. For example:

- Up to 2012 a planting subsidy (AGS) led to 12,000 ha of new planting. The effectiveness of the AGS was limited by the funding allocated by government.

A modified ETS

A possible fix for the ETS is outlined in Appendix I and 2. It outlines changes that would mean our ETS would no longer be a cap and trade scheme. Instead of controlling the supply of credits, which is problematic if forest owners can create them, the government opts to control the credit price and final outcome by setting targets for net emission reductions each year. Our ETS could be adapted to work in this way without substantially changing current ETS administrative structures.

The fix involves the following actions:

•Stop grandfathering credits
•Have no random gifting of NZUs from Government to industry
•Apply the ETS equally to all sectors
•Allow trading only between sequesterers and emitters
  –If you overpollute you pay someone else to clean up
•Buy back grandfathered NZUs that were replaced by fraudulent, hot air credits
•Manage our domestic credits as a currency rather than as a commodity
  –Set reduction targets each year that stabilise the NZU price and allow us to meet international commitments
  –Require surrenders only for “over target” greenhouse gas emissions
  –Plan to gradually reduce our NZU price as the world solves the climate change problem

Conclusions

This submission outlines the appropriate role for forestry as part of a strategy (as yet not articulated by the government) to reduce New Zealand's greenhouse gas emissions. It demonstrates both that forestry can play a significant role, and the other required actions for the long term value of that contribution to be maximised.

The questions asked by the Productivity Commission are answered within the context of that specified role. With the strategy in place, what would then be required from forests is a major planting programme that reduces net emissions to zero sooner than would otherwise be possible. At the same time investment in new technologies and changes in behaviour generate a decline in gross emissions. The implementation of strategic goals by the government and appropriate regulation, results in on-going reductions from the emitting sectors. We have assumed that gross emissions are reduced to zero by 2080.

The planting programme required to achieve net zero emissions by 2050 and maintain emission at net zero till 2080 is 1.7 million hectares, 75% of which is *P. radiata* grown on a timber regime and harvested at around age 30. The other 25% is assumed to be *P. radiata* planted but not harvested, that is providing a sink and then a permanent carbon reservoir. We assume this forest will be planted over 30 years. We assume different incentives and owners may be involved in planting the timber forest, and the non-timber forest. We answer the questions posed by the Productivity Commission within the context of this planting programme. The barriers to increased sequestration are thought to be in 3 main categories:

1. Economic – the price of suitable hill country land is too high for new land planting to take place with current expectations of required rates of return from new forestry investment
2. Regulatory and policy – which make it difficult to plant in a number of the more suitable areas for planting
3. Perceptions and lack of knowledge from land owners and the public.

If a planting programme of 1.7 million ha is recognised as a valuable contribution to New Zealand greenhouse gas undertakings, policies are required to overcome the barriers above. The economic barrier relates largely to land costs, and a policy instrument is required to overcome this barrier to new forest investment. The same type of regulation that allows the EPA to take a nationwide view on a particular economic or environmental opportunity would also be appropriate.

The authors of this submission offer two alternative views on the most appropriate policy instruments to achieve the scenario outlined above:

1. One alternative is that the ETS can be altered to achieve the goals outlined (Appendix 1 and 2 contain considerable detail). This may be the easiest pathway, given that the ETS already exists and has attracted considerable investment throughout the New Zealand community, but it may not be the most effective alternative.
2. The other alternative is to use the ETS to achieve desired outcomes from the emitting sectors, but altered it to behave as a cap and trade scheme, and remove forestry from the scheme. A planting subsidy would be used to achieve the required outcome from forestry. A carbon tax could also be implemented instead of the ETS, for emitting sectors.

References

Alessi M, Fujiwara N. 2011. Study on the Integrity of the Clean Development Mechanism.

Bertram, G. and Terry, S., 2010. The Carbon Challenge. New Zealand's Emissions Trading Scheme. Bridget Williams Books, Wellington.

Caldecott, B., Lomax, G., Workman M., 2015. Stranded carbon assets and negative emissions technologies. Working Paper, Smith School of Enterprise and the Environment, University of Oxford.

Environmental Protection Authority (2014). *The New Zealand Emissions Trading Scheme. NZETS 2013. Facts and Figures*. Info 695. NZ Government, Wellington

Evison (2016). The New Zealand forestry sector's experience in providing carbon sequestration services under the New Zealand Emissions Trading Scheme, 2008 to 2012. Forest Policy and Economics 75 (2017) 89–94

Fay, M., S. Hallegatte, A. Vogt-Schilb, J. Rosenberg, U. Narloch, T. Kerr (2015). Decarbonizing development: Three steps to a zero-carbon future. Climate Change and Development Series. World Bank, Washington D.C.

Manley B. 2016. Afforestation responses to carbon price changes and market uncertainties. MPI.

Mason EG. 2013. The New Zealand Emissions Trading Scheme: What has gone wrong and what might we achieve? New Zealand Journal of Forestry.58.

New Zealand Productivity Commission (2017). Low emissions economy. Issues Paper August 2017.

New Zealand Government. New Zealand's Intended Nationally Determined Contribution, 7 July 2015 http://www4.unfccc.int/submissions/INDC/Published%20Documents/New%20Zealand/1/New%20Zealand%20INDC%202015.pdf

Royal Society of New Zealand (2016). Transition to a low carbon economy for New Zealand. Royal Society of New Zealand Te Aparangi, Wellington

UNFCCC, 2015. Report on the individual review of the annual submission of New Zealand. submitted in 2014. FCCC/ARR/2014/NZL. http://unfccc.int/resource/docs/2016/arr/nzl.pdf

Valatin G. 2012. Additionality & climate change mitigation by the UK forest sector. Forestry.85:445-46

Van Kooten, G.C., 2015. The Economics of Forest Carbon Sequestration Revisited: A Challenge for Emissions Offset Trading. Working Paper 2015-04. Resource Economics and Policy Analysis Research Group, Department of Economics, University of Victoria.

Vivid Economics (2017). Net zero in New Zealand. Scenarios to achieve domestic emissions neutrality in the second half of the century. Summary Report prepared for Globe-NZ. March 2017. London.

World Bank. (2015). Decarbonizing development: Three steps to a zero-carbon future. Washington D.C.: World Bank Group.

Young P. (2017). Towards a 2050 Pathway for New Zealand. A discussion paper for GLOBE-NZ

Young, P. and G Simmons (2016). Cook the Books. Climate Cheats III: when the going gets tough, change the rules. The Morgan Foundation, November 2016. www.morganfoundation.org.nz/new-report-climate-cheats-iii-cook-books/

Appendix 1 – fixing our ETS (Euan Mason)

One option for implementing this plan is to fix the ETS, which has so far failed to prevent deforestation and promote tree planting. Much effort has gone into designing the scheme, and participants have a stake in it, and so if it can be made to work then this might be the easiest pathway to meeting our national objectives for climate change mitigation.

The ETS has failed because policies have ensured that the price of New Zealand Carbon Units (NZUs) is too low, and because sectors are treated unequally in the ETS. Figure 1 shows the spot price of NZUs between 2009 and 2016. In addition, a cap and trade scheme cannot be properly regulated while some participants can create carbon credits by sequestering carbon. Nevertheless, we wish to provide a strong incentive for carbon sequestration, and modified scheme can do this.

Bogus "Hot air" credits

The price of domestic carbon credits, NZUs, dropped substantially late in 2011 when New Zealand began to import cheap "hot air" credits (ERUs) from eastern Europe (Mason 2013) that represented no real environmental gain (Figures 2 and 3) (Alessi and Fujiwara 2011). The price of these bogus, imported credits was as low as $0.17, and many New Zealand greenhouse gas (GHG) emitters bought and surrendered them instead of NZUs in order to meet their obligations. Clearly such prices provide no incentive to reduce GHG emissions or to plant trees in order to sequester CO_2. Manley (2016) has modelled likely responses of the forestry sector to varying NZU prices, and even current NZU prices close to $10 would lead to minimal new planting.

Last year the New Zealand government outlawed the surrendering of imported credits, and this has led to a modest increase in the price of NZUs (Figure 1). However, that was not the only flaw in ETS policy.

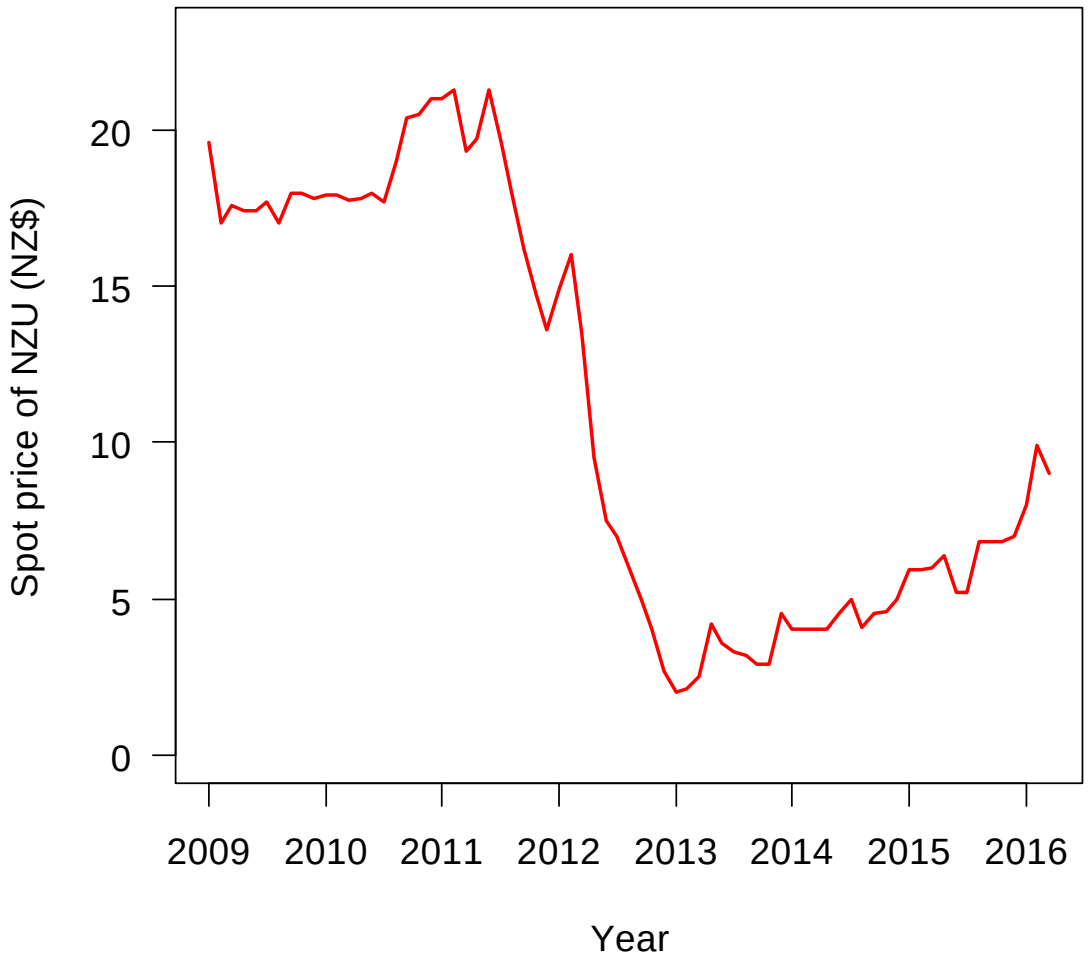


Figure 1 – Spot prices for New Zealand Units (Source: CommTrade)

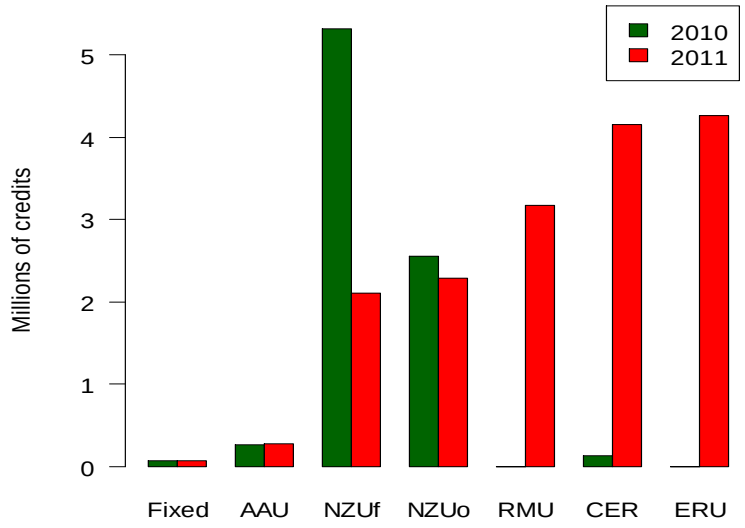


Figure 2 – Transition in types of carbon credits surrendered under ETS regulations from 2010 to 2011. Fixed=fixed price offer, AAU=international Kyoto assigned amount units, NZUf=NZUs generated by forest sequestration, NZUo=other sources of NZUs (usually grandfathered to emitters), RMU=removal units, CER=certified emission reduction units from developing countries, ERU="Emission reduction" units (hot air from Eastern Europe) (Source: Ministry for the Environment)

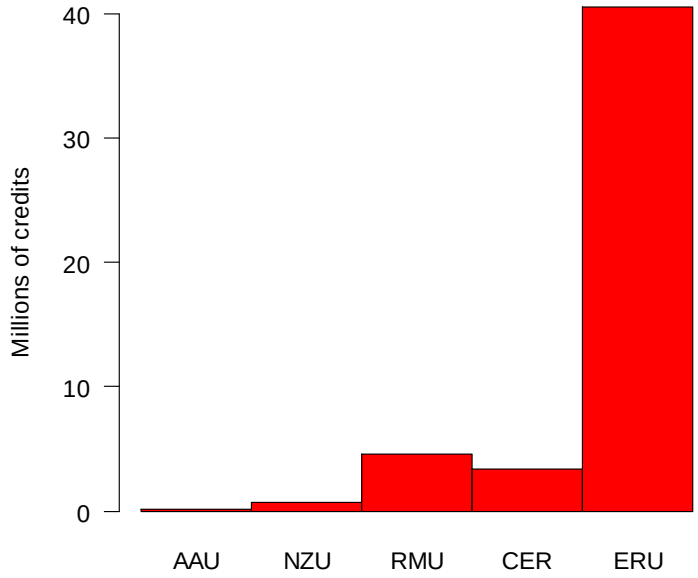


Figure 3 – Volumes of different types of carbon credit surrenders from emitters under ETS regulations in 2013 (Source: Ministry for the Environment). ERUs were almost all hot air from

Eastern Europe. Note also the lack of NZU surrenders, which led to a giant hoard of thin air NZUs in our registry that had been gifted to companies for "allowed emissions" of GHGs.

Agriculture and a fragmented, sector by sector approach

New Zealand has taken a fragmented approach to emissions trading that has greatly reduced the ETS's effectiveness. In particular, agriculture, which contributes almost half our national GHG emissions has no surrender requirement and therefore no incentive to undertake any mitigation activities. The excuse used for this exception is that "agriculture has no mitigation options" (Hon. Tim Groser, on several occasions), but that statement is false.

At least two very effective mitigation options are available to the agricultural sector. Nitrous oxide emissions comprise a large minority of agricultural GHGs, and these can be significantly reduced by more efficient use of fertiliser. In addition, plenty of erosion prone land currently under grass could be planted in trees without significant reductions in livestock numbers on our farms. With an effective ETS, many farmers would then earn money from their mitigation activities. They currently have no incentive to undertake either of these mitigation options.

Grandfathering of credits

We can make rapid progress at mitigating climate change by adopting the simple principle that those who emit GHGs should either sequester them or pay other people to sequester them. This principle has been undermined by ETS policies.

The government has engaged in a practice labelled "grandfathering", where polluters are given credits for "allowed emissions" up to a portion of their actual emissions and then they have to surrender credits for 100% of their emissions. Grandfathered credits represent no cleaning of the atmosphere and flood the credit market with credits that are at least 50% as bogus as "hot air" credits from Eastern Europe (Mason 2013). They also impose awkward administrative difficulties, requiring people to assess "additionality" of climate change responses, and such judgements can at time appear rather arbitrary and costly (Valatin 2012).

The Kyoto process also adopted grandfathering and it has encouraged people to think irrationally about what it means to be "GHG neutral". For instance, "Greencarbon", a company devoted to measuring and brokering carbon credits, runs a New Zealand website (http://www.greencarbon.co.nz/certification-overview/step-3--purchase-carbon-credits, accessed on November 29th 2012). A quote from that website is as follows:

> "A wind farm provides electricity from wind, a plentiful renewable source. Carbon Credits are awarded for the carbon emissions that have been avoided as compared with electricity generation by burning fossil fuels.
>
> The *Te Apiti Wind Farm* by *Meridian Energy* is located in the lower North Island of New Zealand. It is a 90MW wind farm made up of 55 Vestas 1.65MW wind turbines. The wind speeds at the site are on average 9.3 m/s giving an annual output of over 325 GWh. The wind farm reduces GHG emissions by approximately 203,125 tCO2e/year....
>
> .... In order to be able to promote your business as 'Carbon Neutral', and earn the label of *'Green Carbon: Carbon Neutral Certified'*, you must first Measure your carbon footprint,

Reduce your emissions where possible, and then purchase and retire the correct amount of carbon credits."

These quotes are typical of those engaging in carbon trading. The idea is that we can claim "GHG neutrality" or "carbon neutrality" by purchasing carbon credits to offset our emissions, but purchase of credits derived from lowering pollution below the level of a free allocation (essentially a kind of domestic emission reduction unit) does not confer GHG neutrality. This can easily be seen by using the example above. Suppose an energy company generated enough domestic ERUs through wind power generation to reduce its GHG emissions to exactly half of its free allocation of credits (In the NZ ETS, some companies get an allocation of free NZUs that means they are allowed to pollute without penalty up to a certain level). It could then use the credits it generated to account for its remaining emissions and claim to be GHG neutral even though it was still emitting 50% of its original allowed GHG pollution. This kind of irrationality arises from the Kyoto concept that we need only reduce emissions down to our level of gifted credits, and below that level we can sell credits that have been "grandfathered" to us as "allowed" emissions. The energy company could be said to have reached some kind of target if it reduced its GHG emissions to 50% of its allowed pollution, but it is irrational to reward it with sellable credits that people can use to claim "GHG neutrality". For an alternative way of looking at how this is irrational, please see appendix 2. Unfortunately this irrationality has contributed to the undermining of New Zealand's emissions trading scheme. Only credits derived from sequestering GHGs in sinks can be sensibly used to confer GHG neutrality on purchasers' activities, and these credits are an important key to changing the way we live and solving the problem of climate change.

Grandfathering of credits for allowed emissions also contributes to inflation of our carbon credit currency. Credits created from thin air and grandfathered for allowed emissions increase the number of bogus credits in circulation, and although they theoretically should be surrendered to government, effects of any slop in emission/sequestration measurement, or any schemes such as arbitrage with imported credits are amplified by these excessive numbers of credits.

Credits as a commodity

Carbon credits are a currency that should be used to secure the least-cost way of meeting our climate change mitigation targets. If it is cheaper or more expensive to pollute and then clean the atmosphere by sequestration than to reduce pollution, then credit prices will reflect this. Unfortunately much carbon trading has been speculative and some people have seen carbon trading as a means to make money by doing nothing of value. They simply clip the ticket and extract value as credits pass through their hands. This means that relative values of sequestration versus pollution reduction are improperly valued by the currency, leading to poor market outcomes. At an extreme, an individual could amass a large proportion of credits and effectively control marginal prices by selling only a few at a time. This would result in volatility which is a disincentive for long-term sequestration activities such as forestry because it increases people's perceptions of risk. Speculators profit from price volatility, whereas a stable credit price will promote long-term investments in sequestration.

Random gifting

From time to time the government has randomly gifted "thin air" credits, that represent no environmental gain, to entities or people whom they wish to encourage or mollify. These credits represent no cleaning of the atmosphere and are of no greater value than Eastern European "hot air

credits". Such gifts are very tempting for a government because they enable a "reward" to be delivered without any immediate impact on government accounts. Gifts include allocations of credits to a power company for building a wind farm (the reward for a wind farm is power generation that requires no credit surrenders, hence these credits were a double payment), or an allocation of many millions of credits to pre-1990 forest owners to partially account for losses in land value (suffered when they were forbidden to generate sequestration credits but were required to surrender credits for emission of carbon stored in trees when land use changed). In this latter case any compensation should have been in cash, but a more rational approach would have been to treat all forest equally irrespective of the date of forest establishment. Gifting thin air credits floods the ETS with credits that represent no environmental gain and so contributes to credit currency inflation.

Managing the price of New Zealand Units

Currently the most effective sequestration activity is new forest establishment, a long term investment which requires a stable credit price. Perceptions of risks of future credit price increases dissuade people from establishing carbon forests. This is because, quite rightly, when trees are harvested carbon foresters need to surrender credits to account for losses of carbon storage. Policies that stabilise credit prices will greatly improve the ETS as a tool for meeting our international obligations because sequestration investments will be seen as less risky.

We should arrange for independent management of the value of our NZU currency just as our independent Reserve Bank carefully manages the integrity of our dollar currency, except that instead of using the official cash rate, an independent agency would foster the integrity of NZUs by managing percentages of emissions for which credit surrenders would be required. An annual five per cent decline in our net emissions, for instance, would see New Zealand GHG neutral within 20 years. The agency's job would be to meet such a target by manipulating percentages of emissions for which credits are required across all sectors on an annual basis. Just like the Reserve Bank, the agency would have to use clear and open processes to ensure minimal surprises. Moreover, oversight by such an agency would reduce the likelihood of *ad hoc* political interference in the ETS. Credit price stability would vastly improve the effectiveness of the ETS.

Dealing with the hoard of credits in our registry

ETS policies allowed many emitters to receive grandfathered, thin air NZUs from the government to cover portions of their emissions (up to 90% in the case of "trade exposed" industries), and their natural reaction has been to hoard NZUs and surrender hot air credits instead (Figure 3). Hoarding has led to a giant mountain of more than 140 million NZUs in the registry that emitters can use to continue to emit GHGs, an amount equivalent to roughly four years of surrender obligations with current policies. This hoard threatens to undermine the ETS at least until early in the 2020s. There are a number of ways that we might deal with this problem:

1. The majority of credits in the hoard were grandfathered to companies for "allowed" emissions, and then those companies chose to buy and surrender hot air credits from the Ukraine or Russia because they were cheaper than NZUs. This violated the spirit of "grandfathering", and so one solution is to forcibly buy back the NZUs at a price that is only slightly larger than the purchase value of the hot air credits that replaced them (to allow for a reasonable return on purchase price). Each

credit has a pedigree and so it should be feasible to apply this solution fairly. That way the original intent of grandfathering will have been met.

2. The Reserve Bank or other ETS controlling agency could greatly increase the levels of emission reductions that are required in order to deplete the hoard more rapidly. This option runs the risk of price volatility because it will take some time for the agency to learn to stabilise the credit price. It also runs the risk of unfairly penalising those who did not engage in hot air credit substitution.

3. We could do nothing about the hoard, but this means that we'll further delay action just prior to a decade when our national net emissions are predicted to increase markedly due to harvesting of forests planted during the 1990s.

In summary, we have failed so far to respond fairly to climate change and we are rightly regarded as a pariah nation. Our emissions trading scheme can be made to work properly if we:

- Stop grandfathering credits
- Have no random gifting of NZUs from Government to industry
- Apply the ETS equally to all sectors
- Allow trading only between sequesterers and emitters
  - If you overpollute you pay someone else to clean up
- Buy back grandfathered NZUs that were replaced by hot air credits
- Manage our domestic credits as a currency rather than as a commodity
  - Set reduction targets each year that stabilise the NZU price and allow us to meet international commitments
  - Require surrenders only for "over target" greenhouse gas emissions
  - Plan to gradually reduce our NZU price as the world solves the climate change problem

Clearly this kind of structure is no longer a cap and trade scheme. Instead of controlling the supply of credits, which is problematic if forest owners can create them, the government opts to control the credit price and final outcome by setting targets for net emission reductions each year. Our ETS could be adapted to work in this way without substantially changing current ETS administrative structures.

Appendix 2 – Irrationality built into the framework of our current emissions trading scheme (Euan Mason)

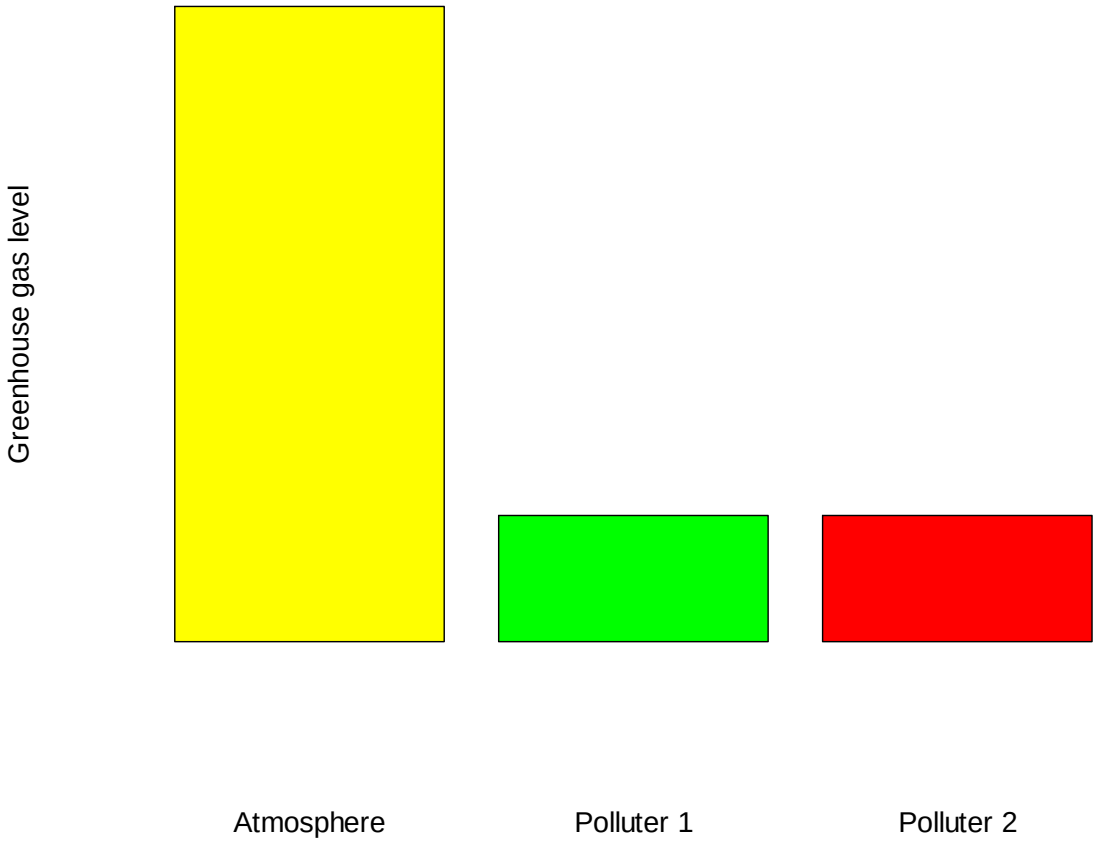
In a well-functioning emissions trading scheme, polluters would have to submit credits in order to be allowed to pollute, and they would purchase credits from those who cleaned up their pollution. So if the cost of cleaning was higher than the cost of reducing pollution in the first place then they'd choose to reduce emissions. Either way the atmosphere would not receive any more greenhouse gasses and purchasers of carbon credits could rightly call themselves "greenhouse gas neutral".

However, that's not what's happening in New Zealand's scheme (nor is it happening in the Kyoto scheme internationally). Many people assert that if a polluter reduces their pollution then they should receive credits for the extent of their pollution reduction. They also assert that purchasers of their credits can claim to be "greenhouse gas neutral". They are *wrong*.

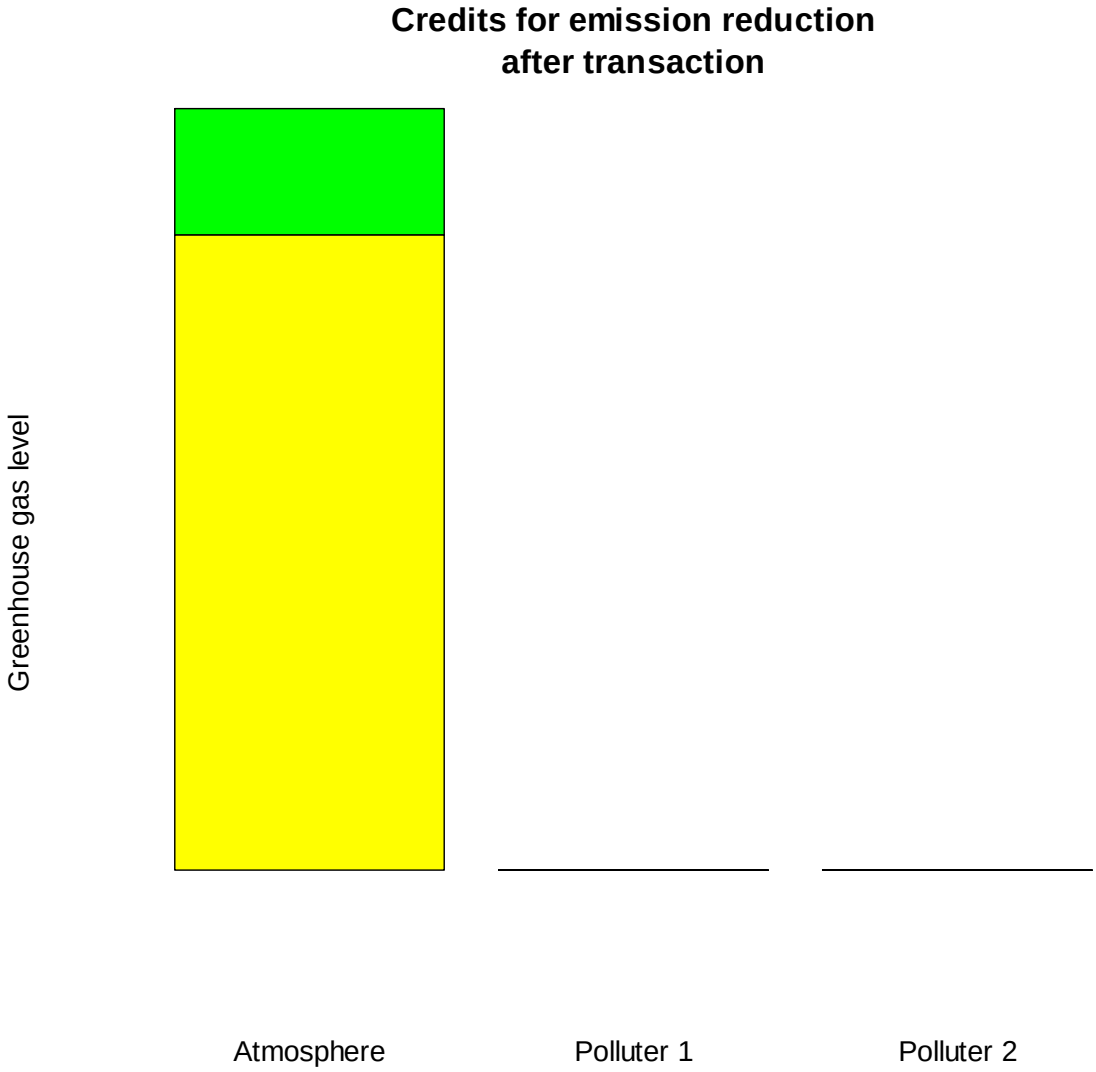
There are many ways to explain why they are wrong. You could use stories, mathematics, graphs or even children's blocks. Let's use the latter.

Blocks below represent levels of greenhouse gas in the atmosphere and levels planned to be emitted by two polluters.

Credits for emission reduction before transaction

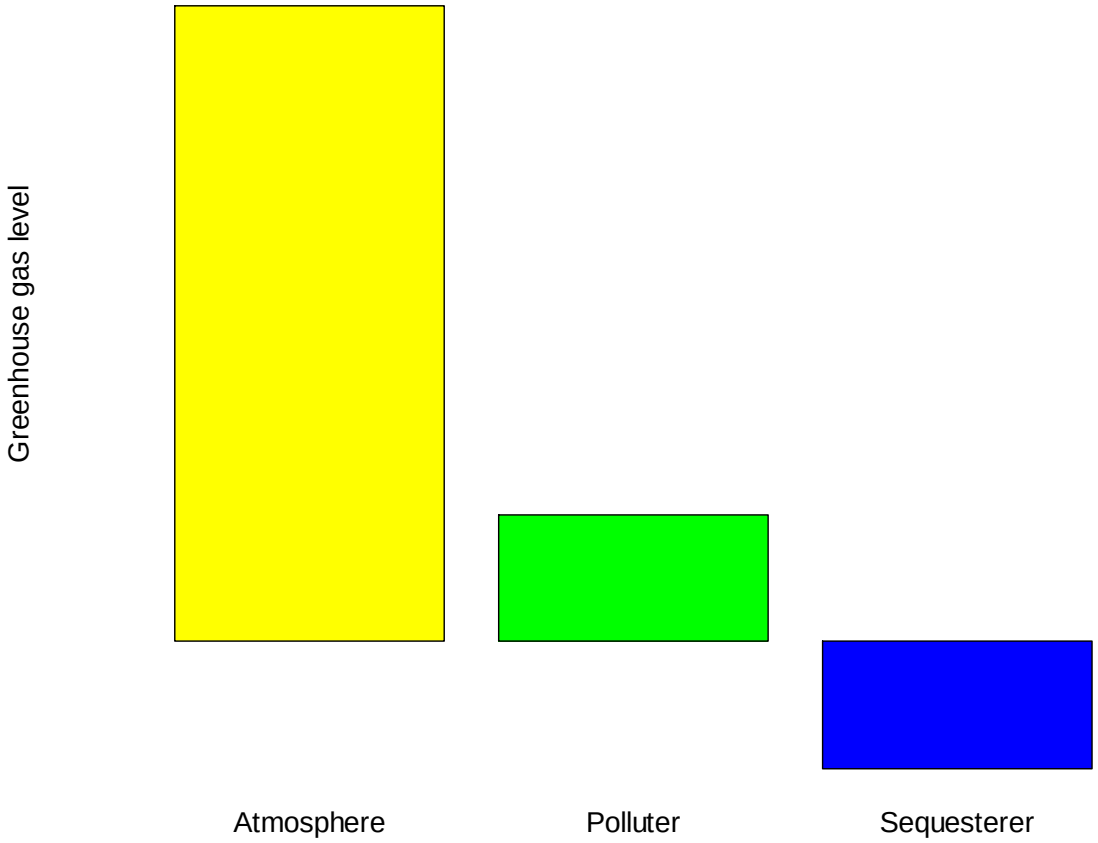


Then polluter 2 opts to no longer pollute and is awarded carbon credits. Polluter 1 purchases those credits and is allowed to pollute. The result is more greenhouse gas in the atmosphere, as shown below. Polluter 1 clearly *cannot claim to be "greenhouse gas neutral"*.



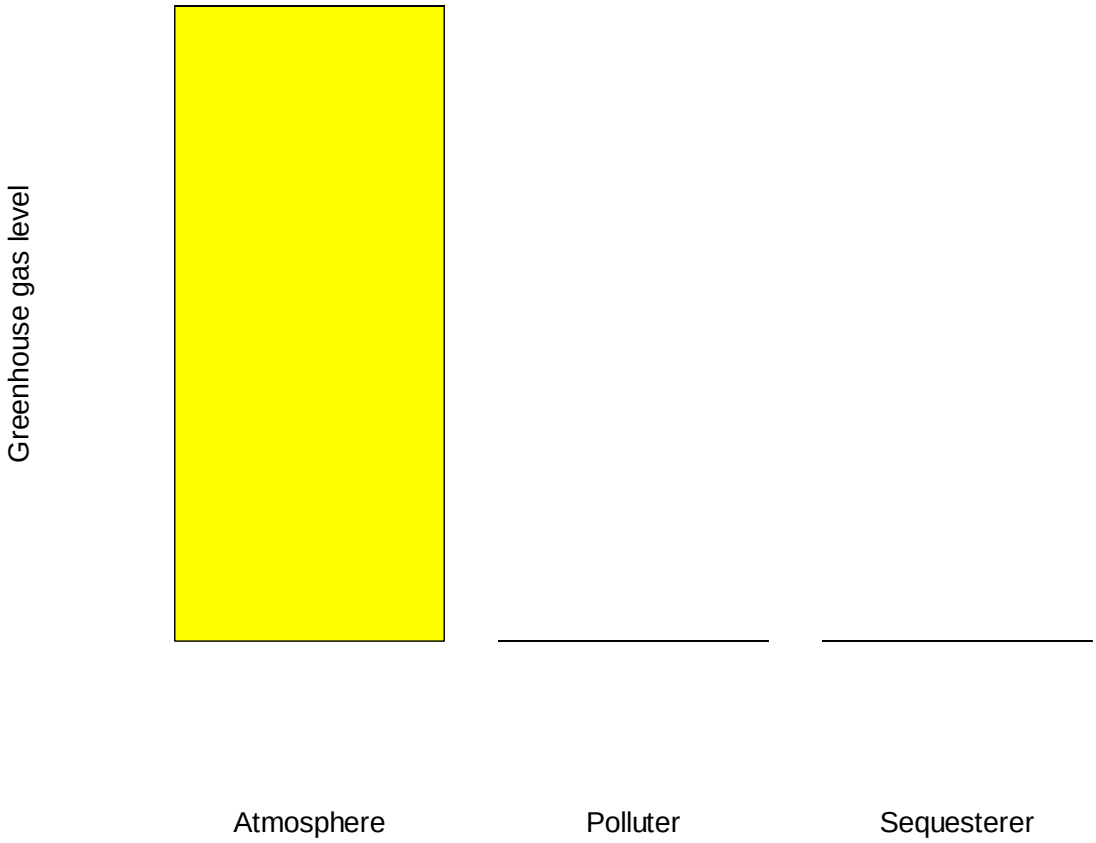
So, what kinds of credits can confer greenhouse gas neutrality on a purchaser? Let's reach for the blocks again. In this case, we have the atmosphere, a potential polluter and someone who will take greenhouse gas from the atmosphere (maybe using new trees, a scrubber, or perhaps by seeding the ocean with iron to promote plankton); a sequesterer.

Credits for sequestration before transaction



The sequesterer receives carbon credits for removing greenhouse gasses from the atmosphere. They are purchased by the polluter, who then goes ahead and pollutes, but the amount of pollution is exactly equal to the amount of sequestration and so the result is shown below:

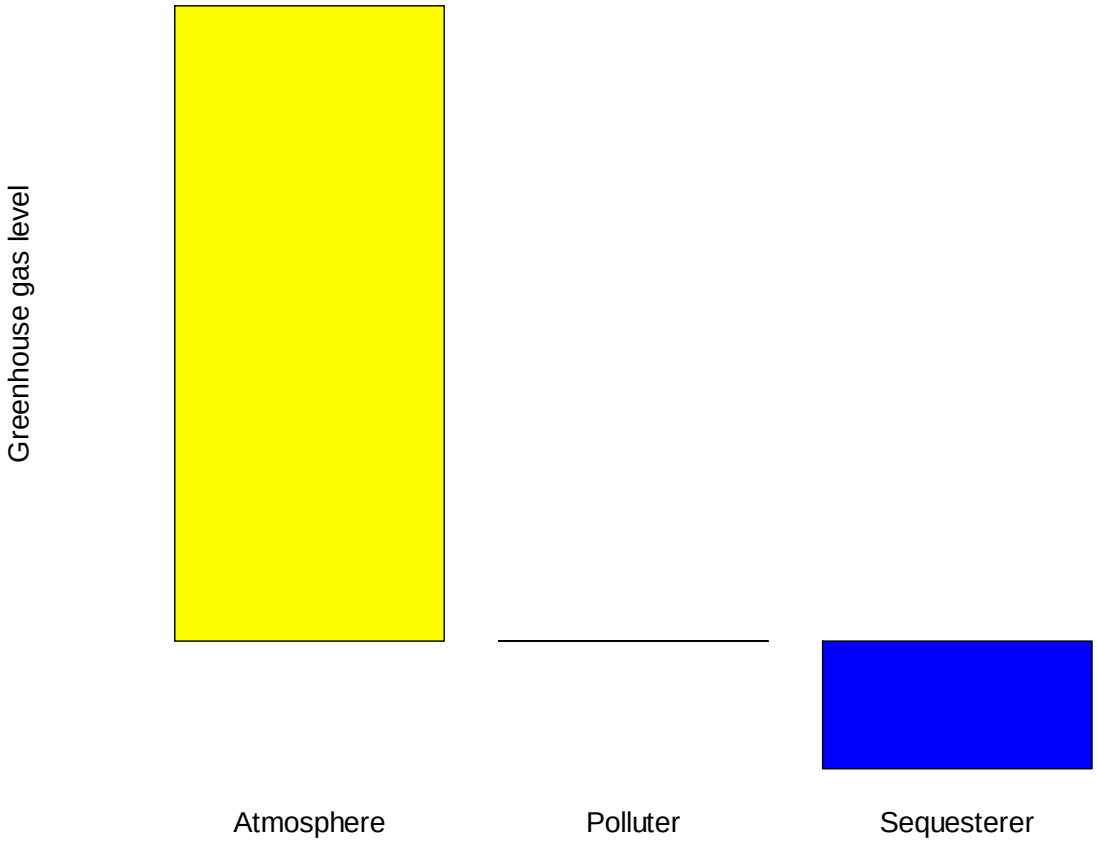
Credits for sequestration after transaction



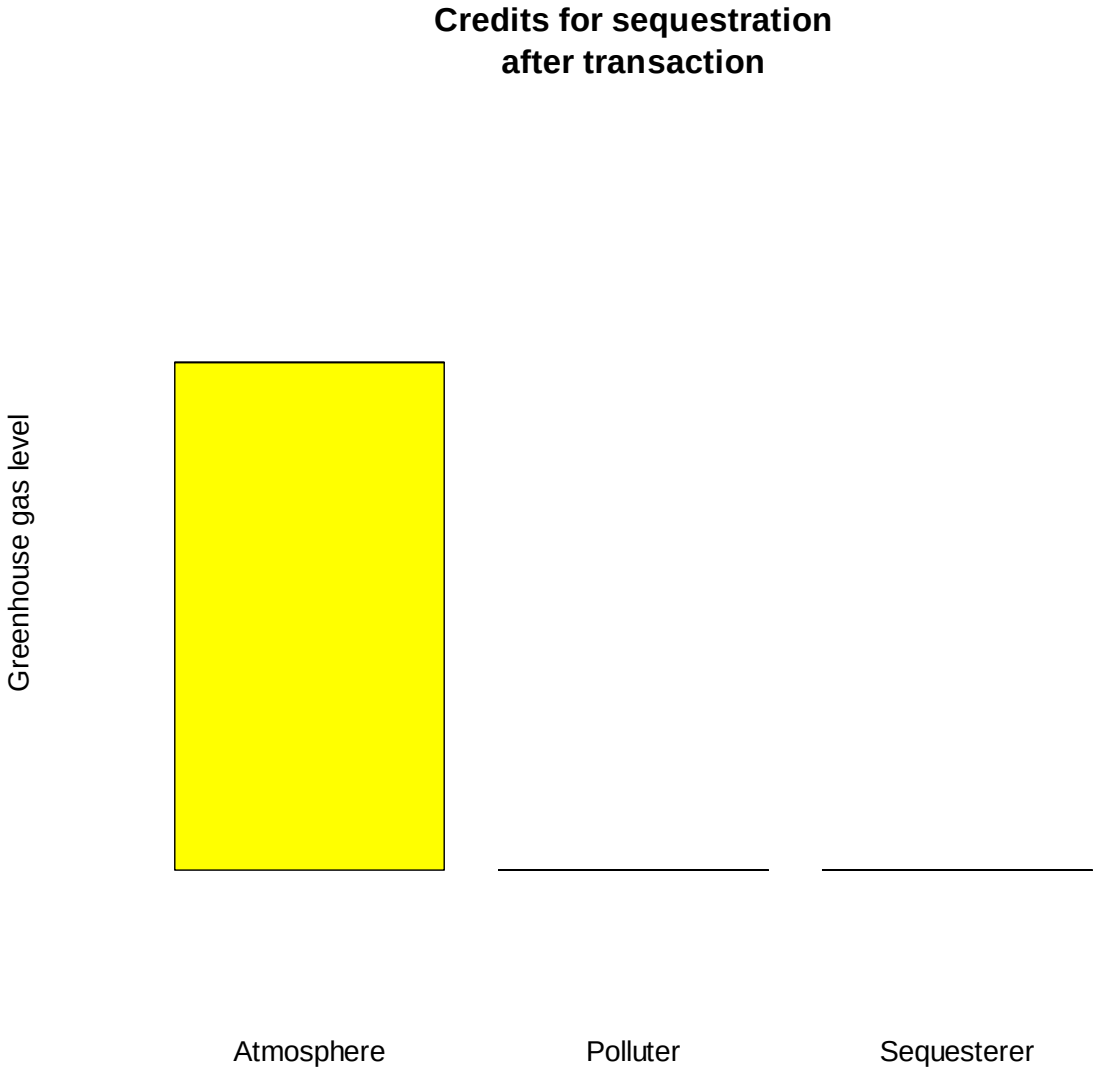
Clearly, the atmosphere gains no new greenhouse gas and the polluter can now claim to be greenhouse gas neutral.

But wait, there's more! Suppose there is no polluter, and a rich benefactor who cares about the environment or a government decides to purchase credits from the sequesterer and immediately destroy them. Before the transaction the blocks look like this:

Credits for sequestration before transaction



and after the transaction they look like this:



That's right, an ETS that awards credits for sale only to those who clean greenhouse gasses from the atmosphere encourages activity that can reduce atmospheric levels of greenhouse gas if credit purchasers choose not to pollute.

Here's the killer of cap and trade schemes: It is generally much cheaper to do nothing than to extract greenhouse gasses from the atmosphere. If we award people carbon credits for simply reducing outputs of greenhouse gas, we effectively pay them for nothing, and it takes much longer for emissions trading schemes to work because few will engage in activities that extract greenhouse gasses from the atmosphere.

So next time someone says that they are "greenhouse gas neutral" because they purchased credits from a power company that got credits for installing a wind farm, or from someone who opted not to clear a patch of rain forest, let them know that they are kidding themselves. We'll all benefit if you do because our emissions trading systems will be much more effective if they properly reward greenhouse gas neutrality.

Appendix 3:

Our national targets

The Government has to date set four unconditional national targets for reducing New Zealand's greenhouse gas emissions. These are:

- a target under the first Kyoto Protocol commitment period of reducing greenhouse gas emissions to 1990 levels between 2008 and 2012. New Zealand met this target in 2015 by submitting its "True-up Report" to the UNFCCC.
- a target of reaching 5 per cent below our 1990 greenhouse gas emissions levels by 2020. New Zealand reports progress towards this target in its 2020 Net Position Report.
- a target of reaching 30 per cent below our 2005 greenhouse gas emissions levels by 2030 (this target is equivalent to 11 per cent below 1990 levels by 2030)
- a long-term target of 50 per cent below our 1990 greenhouse gas emissions levels by 2050.

http://www.mfe.govt.nz/climate-change/reducing-greenhouse-gas-emissions/emissions-reduction-targets