Introduction:

In this submission I will show that a focus on annual emissions of various sectors, rather than their contribution to warming, leads us erroneously to work on short term methane reduction rather than targeting the long lived gases that need to be tackled now. Blindly following our Paris commitment to reduce annual emissions without consideration of warming effects will also lead to replacement of current vehicles with EVs, with a consequent relocation of the embedded manufacturing emissions off-shore, and without the necessary focus on reduction of total amount of travel. I propose an innovative regulatory approach to phase out private car ownership, which would be far more effective and would also be completely fair over all socio-economic groups. The publicity generated would instantly re-establish our global leadership and provide us with a brand our businesses would be able to project internationally. I will also show how incentives to promote forestry will have major negative effects on the sheep and beef industry leaving us with fewer options in the future. I offer an alternative to production forestry or mass carbon planting that would meet our need to sequester carbon, but not decimate our rural hill communities.

Long-lived versus short-lived greenhouse gases (GHGs)

The emissions trading scheme (ETS) means the NZ focus is on annual emissions and their quantification into tradable tonnes of carbon dioxide equivalents (CO₂ e). We should not lose sight of the purpose of the ETS which is to lower NZ’s contribution to warming. When looking at the contributions of each sector to warming, we should focus on the effect of their emissions in order to target sectors where our efforts can have the most impact. I will look at two sectors: sheep and beef farming, and liquid fuels.

I attach an analysis of historical data showing that the contribution to warming by the liquid fuels sector (the burning of petrol & diesel) is over double what it was in 1990; even if we manage to reduce usage to zero by 2050, the cumulative nature of CO₂ emissions means that warming would be over three times the 1990 level. Analysing the decay of methane shows that the contribution to warming by the sheep and beef sector in 2018 is slightly less than it was in 1990. Under a status quo situation, by 2050 it will be contributing a quarter less than in 1990. So in order to achieve the spirit of the Paris agreement we need to focus on long-lived GHGs. We need to focus on the liquid fuels sector as it is the biggest contributor of carbon dioxide emissions.

We need a bold initiative, to achieve significant reductions, but also to catch the attention of the world and let it know that we are taking real action to reduce warming, even if we may not be complying with the letter of the Paris agreement. I propose a ban on all new vehicle purchases by private individuals, combined with a total phase out of all privately owned vehicles. The embedded emissions of new electric vehicles (EVs) mean that although a swap of our entire fleet to EVs would greatly help to meet NZ’s Paris target, it would be irresponsible, as the total emissions shifted off-shore would be of the order of seven times our current total annual vehicle emissions. It is important that we do not scrap existing vehicles just to replace them with EVs. A policy to promote replacement of current vehicles with EVs would shift the embedded carbon off-shore in the short term. In the medium term, as the rest of the world tightens up on emissions, these vehicles will become very expensive, only the rich will be able to afford them. To carry on with 3.8M liquid fuel vehicles is also not responsible. The ETS will struggle to make any real dent in fuel usage; an increase in pump prices by 23cents/litre for each $100/T CO₂ e will just leave the wealthy to continue conspicuous consumption while the poor suffer.

We should use the transition to EVs as a pivot point for a change away from private ownership of vehicles. To really kick-start public transport, especially in a sparsely populated country such as NZ, we need mass uptake. Obviously all new public vehicles would be EVs. To achieve social justice, we all need to be in the same situation. It will not be good enough to offer welfare support, without a viable replacement for private transport to those who can no longer afford to fill up. Indeed, if the support were to be adequate then the poor would be able to afford to fill up as well as the rich, and all would just carry on as we do now. To subsidise the purchase of EVs would allow us to leave our current driving habits unchanged in the short term, but miss an opportunity to spend that money pursuing a sustainable goal of public transport for all. The degree of social change I am calling for is large. However I am sure it would result in a much healthier and happier society in NZ. We would all have a real reason to interact with our local community in order to coordinate and reduce our use of vehicles. Any reduction in time spent commuting must be of huge value to individuals and their families. There would be considerable employment opportunities in providing local goods and services, which would be of benefit in smaller provincial communities.
The negative effects of land use change under the ETS

It is well recognised that planting forestry to off-set emissions is a temporary measure\textsuperscript{x}. However while the respite from breaching NZ's obligations is temporary, the change of land use is permanent. Once committed to forestry this land can never be used for any other purpose; indeed the destruction of farming infrastructure (fences, yards, buildings etc.) over the life cycle of forestry, combined with the huge cost of re-developing the land into pasture, would mean that little, if any, hill country would ever be converted from plantation forestry to farming, even without the ETS. The result for rural NZ hill communities will be disastrous. Depopulation, loss of services (especially education and health services), and ageing resident populations, will all snowball to destroy local communities.

During the rapid historical expansion of forestry on the East Coast and in Wairoa in the 1990s, reports commissioned by Scion such as those by Fairweather, Mayell and Swaffield (2000) and Butcher(1995) indicated optimistic forecasts for future employment when farmland was converted to forestry. However emerging trends identified then by these authors have continued, with the result that today forestry is an industry that generates fewer jobs than farming in rural communities and service towns.

“[W]e can examine employment per unit area. Looking at total (full time equivalents) FTEs/1,000 hectares, Table 5 shows that forestry employs more people than agriculture for each 1,000 hectares in production but that this declined rapidly by nearly 50 per cent, from 30 in 1986 to 16 in 1996. In contrast, employment per unit area in agriculture has increased slightly (+14 per cent) to ten FTEs/1,000 hectares in 1996. Further, most of the forestry FTEs/1,000 hectares is in processing employment, while for agriculture, most of the FTEs/1,000 hectares are in on-land employment”\textsuperscript{xii}.

They also point out that further processing is carried out in regional centres, not rural communities. Moreover Butcher notes that “At the time of the study much of the forestry-related employment (up to 75 per cent) was being carried out by contracted workers from outside the district.”\textsuperscript{xiii} Butcher has re-worked these calculations today in the light of this fact, and also the reality that virtually none of these logs are now processed locally. As a result, Butcher’s prediction of a large increase in Wairoa employment, becomes a 30% decrease: 3.2 FTE’s/1000ha for forestry as opposed to 4.55 FTE’s/1000ha for farming\textsuperscript{xiv}.

Since these reports were written we have also seen an explosion of whole log exports. In 1990 NZ exported 17% of the total harvest, in 2016 it was 54%\textsuperscript{v}. So today, not only do rural communities and their service towns miss out on employment, the country as a whole does.

If we create another explosion of planting we can guarantee that nearly 100% of the increase of wood in 28years time will be processed off-shore, just as the additional “wall of wood” that is coming on stream now from the plantings of the 1990s will also all be whole log exports. Lack of local investment and overseas protectionism leaves no benefit to NZ employment. Furthermore it leaves reduced communities paying larger amounts for road wear and tear from logging trucks which they already can ill afford.

It is not only the total numbers employed that determine the health of a community, it is the length of their stay and their commitment to a district that counts. Forestry workers are made up of local residents, workers who move to the district, and those who commute from another centre. Those who move to the district tend to be transient. Wall and Cocklin noted that “When asked about their plans following the completion of the ECPP (East Coast Forestry Project), two-thirds of those who migrated to the region stated that they intended to move again”\textsuperscript{xv}. In addition, workers that commute from a regional centre contribute little to the local community while adding to emissions from the transport sector.

It might be hoped that economics will mean that it is the marginal land which will be planted with forestry, leaving a smaller, but more viable farming community to farm the more productive and less environmentally fragile hills. A closer analysis and a look at previous waves of afforestation will show that this result is highly unlikely.

Despite positive long-term economic and social performance by farming there are times in the economic cycle when plantation forestry out-performs less efficient sheep and beef farms. Beef and Lamb Economic Service survey reports show that in general the return on capital decreases as the class of land improves (ie becomes less steep)\textsuperscript{xvi} and that low performance is strongly tied to management, rather than to the land class. When forestry is doing well, it ends up purchasing all these lower-performing farms as they come on the market, along with those being sold by older farmers wishing to retire.

In the 1990’s wave of afforestation in Wairoa this is exactly what happened: family farms on easier hill country, closer to the main roads, were bought up by forestry interests as they came on the market. This excluded a new generation of young farmers, who historically were able to afford these run down farms, which have huge potential for increased production\textsuperscript{xvii}. This means plantation forestry not only depopulates the district, it also disrupts the natural cycle of young people coming to re-vitalize the community.
A new factor in this process is the introduction of National Environmental Standards. From 1 May 2018 forestry has come under more stringent controls on earthworks and set-backs from water ways. Today there is also an awareness of an increasing liability risk to forestry from post-harvest slash damaging downstream infrastructure. These factors will mean that, given incentives, forestry will only buy the better hill land. This is the land that is most suitable for sustainable sheep and beef farming. Any carbon price above $50/Tonne will result in all hill farmland that comes on the market being converted to forestry, an irreversible and irresponsible path in a world that may suffer increased food insecurity due to climate change. Even the anticipation of future carbon price increases has resulted in such a sale in the last weeks. Farm land will go into forestry, but not vice versa, even if the economics should reverse in the future.

Any wide spread and sudden expansion of forestry has two dangers for the country as a whole over and above the adverse effects for rural communities. Firstly, a sudden wave of planting removes a relatively steady export income from sheep and beef causing a 28 year hole in the nation’s cash flow. Secondly, any permanent carbon-sink forest produces no export income and after a certain time, when the forest has reached its peak biomass, it produces no more carbon credit income either. The owner is left with the cost of maintaining this forest (fire protection, pest management, rates, etc.) but no income. Will the owners of this land then abandon it leaving the taxpayer to foot the bill?

Forestry for harvest is incapable of targeting the worst erosion areas for several reasons. Steep land requires more earth movement for roading and skid sites, while higher rainfall and soft rock leads to high maintenance costs of forestry infrastructure. Any forestry venture needs to harvest a large continuous area of forest to pay for and maintain this infrastructure. Thus, rather than just the marginal land, we will see whole farms go into forestry losing the more versatile classes of land also.

Proposals to produce carbon credits without destroying hill farming:

Clearly, incentivising plantation forestry is incompatible with the long term sustainability of hill country communities. However it is possible to promote trees that are able to be integrated into a production system that sustains our local population. Shelter belts, and individual erosion control trees on pasture land, and targeted small areas of non-production plantings are all able to be successfully integrated with farming. A really valuable initiative would be to promote carbon accounting such trees. We have the technology to count trees from satellite imagery. These trees could then be registered for carbon credits. The promotion of individual trees in pasture land would also promote biodiversity when compared with plantation forestry monoculture.

Satellite imagery could also be used to promote the registration of other farm plantings that would already qualify. Many farmers have not registered these plantings because they have been put off by red tape. A government group to identify these areas, register for farmers and share the credits could yield a considerable number of credits. Other research could result in a measure for increased carbon sequestration in native forests that could be obtained by control of pests such as possums & deer.

The sum of these three initiatives would be in excess of 30M Tonnes CO₂ e per year for the next 20 years (see notes xxii to xxvi). This is the equivalent of 1.2M ha of radiata or 60% of a billion trees.

Grass fed meat production is a sustainable, largely carbon neutral, system of food production. The loss of this production from NZ hill pastures, if converted to forestry, would mean the destruction of rain forest in Argentina and Brazil in order to produce soy protein. Obviously any reduction that we can make in methane emissions from sheep and cows will be beneficial and research into this area should continue, but it should certainly not be our priority. Scientists such as Allen (2013) stress that tackling the emission of short lived gasses first leads to a significant delay in reducing warming. It is only beneficial to reduce short term GHGs if we already have measures to curb long term GHGs.

Summary:

Firstly, I have shown that we need to consider the effects of different GHGs, that is, their differing contribution to global warming. It is clear that we need to prioritise tackling emissions of carbon dioxide by the liquid fuels sector. I have proposed actions which could enhance our global brand while maintaining an equitable society.

Secondly, I have shown that incentivising afforestation, whether permanent or plantation, will have detrimental effects on rural and provincial communities and our balance of payments. I have shown how hill farming could help mitigate warming caused by other sectors by other kinds of planting rather than forestry monoculture.

It is incumbent on us to tackle our use of liquid fuels as the major and longer lasting source of global warming. We should not “export” our emissions by moving them off-shore through mass change to EVs. We should combine a change to EVs with a policy to reduce unnecessary road trips.

I favour option 2: Net zero long lived GHG (including N₂O) and stable short lived GHG emissions by 2050.
Appendix

This is a summary of a larger excel document, with sources for data attributed. If you are unable to access this spreadsheet, contact me (Dave Read) at: bogaardread@outlook.com

Comparison of contribution to global warming caused by GHG emissions by two sectors in New Zealand.

<table>
<thead>
<tr>
<th>Comparison of warming potential of sectors using the pool of GHGs accumulated since 1930 by each sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>total pool of GHG (MT CO₂ equivalent)</td>
</tr>
<tr>
<td>% warming compared to 1990</td>
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</table>

Liquid fuels sector: flat consumption 2018-2050

<table>
<thead>
<tr>
<th>Liquid fuels sector assuming emissions reduce to zero by 2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>total pool of GHG (MT CO₂ equivalent)</td>
</tr>
<tr>
<td>% warming compared to 1990</td>
</tr>
<tr>
<td>NB: liquid fuel is only a proxy for transport as approx. A third of transport emissions come from manufacture of new cars, so line 11 would need to be increased</td>
</tr>
</tbody>
</table>

Explanation:

Global warming is caused by greenhouse gases [GHG]. The greater the amount of GHG the greater the warming. The contribution of any one sector to global warming is dependent on the sum of the tonnage of GHG that that sector has emitted over its history. This changes from year to year.

The burning of petrol and diesel (Liquid fuel sector) results mainly in carbon dioxide, which does not decay in the atmosphere. The degree of warming caused by the liquid fuel sector is the sum of all the emissions over the years. Sheep & Beef farming results primarily in the emission of methane; a potent GHG, but one that decays reasonably rapidly. The International Panel on Climate Change [IPCC] assigns an average global warming potential (GWP) for each gas over 20 & 100 year periods [GWP₂₀ & GWP₁₀₀]. Carbon dioxide [CO₂] remains in the atmosphere without any significant decay, so the IPCC assigns a value of GWP =1 for both the 20 and 100 year time spans.

Methane is a potent GHG, but decays rapidly into carbon dioxide. For methane, the IPCC assigns a value of GWP₂₀ =84 & GWP₁₀₀ =28

Compared to GWP, the Global Temperature change Potential (GTP) goes one step further down the cause-effect chain and is defined as the change in global mean surface temperature at a chosen point in time in response to an emission pulse — relative to that of carbon dioxide.

For Methane GTP₁ =117 GTP₂ =116…. GTP₂₀ =64……

This means that the amount of warming caused by 1kg of methane in the year of emission is 117 times that of 1kg of carbon dioxide emitted in the same year…. In the 21st year after emission it causes 64 times the warming of the 1kg of carbon dioxide

You can see a table of GTP₁ to GTP₁₀₀ in sheet 9) Note if you average the first 20 values you get 94, slightly more than the GWP₂₀ value. This is because GTP accounts for stored heat in the oceans being re-released into the atmosphere.

Since 1990 the annual emissions from the liquid fuels sector has increased by 62%. When we add all those years together the total pool of GHG for that sector has increased 2.3 times and thus the liquid fuels sector today is responsible for over double the warming that it produced in 1990.

Over the years since the removal of subsidies, the sheep and beef sector has reduced stock numbers and become more efficient in production, so the sector’s annual production of methane has decreased by about 70% from 1978 through to
2018. When taking into account the decay of methane over the years, the sheep and beef sector’s contribution to warming today is slightly less than it was in 1990. This is even when the sector’s other GHG emissions [mainly nitrous oxide], which don’t decay, are added in.

Notes

1 Myles Allen (2013).
2 Mike Berners-Lee (2010). The average car on British roads emits 50% as much carbon in its manufacture as is emitted by a lifetime of use. EVs involve considerably more emissions to construct than internal combustion models.

I have placed a summary and explanation in an appendix to this document. For anyone unable to access this excel file, it is accounting for methane as a short-term GHG. As is recognised by climate science the metric of GWP100 is not able to deal with gases such as methane in a manner that allows sound planning. Unlike the “two baskets” approach, my method allows different sectors to be compared in one metric. In this respect it has the same goal of a single metric as does Myles Allen’s GWP*. Although my metric is less elegant (it requires a large spreadsheet with annual emissions tracked back as far as possible, until their contributions today are negligible) it is much easier to understand than GWP*

Apart from electric scooters, say

Once public transport was at an acceptable level in a particular area low efficiency vehicles could be scrapped at, say 150,000km efficient ones would be sold to areas with less public transport. The dangers of an older vehicle fleet would be mitigated by safer roads due to less traffic.

The carbon dioxide produced by the manufacture of the average vehicle (its embedded carbon) is half of the total emissions coming out of its exhaust pipe over its life time. (Based on an input-output analysis). Mike Berners-Lee

Reducing our 3.8M light vehicles would not only reduce the carbon produced in the manufacture of their replacements (some of which will be in countries that have exited from the Paris accord, and admittedly not part of our Paris commitment, since it is off-shore) but also free up all future funds earmarked for road expansion for use in public transport. With fewer cars we would not need more road infrastructure.

Even a $700/T increase will result in an average pump price of $3.80/l or a 70% increase in price. A 50% increase in petrol prices in real terms (1990-2018) has resulted in a big increase in transport emissions, how will a 70% increase result in a reduction? In contrast a phase out scheme combined with a ban on new purchases would lead to people trying to “save” their vehicle for longer and thus driving fewer km.

There will of course be many challenges for us to overcome. We would need to allow the hire of an EV whenever a group of people could fill its seats (eg. a family holiday). The plight of rural people is tricky; a return to combined mail/freight/passenger runs of the past would not be enough. We would need public transport in a very wide sense. The kaumatua vans that many rural marae run is a model that could be widened: a rural road or district could run a similar scheme for whenever a group of people had a common purpose. Local hire EVs would be needed too.

See Productivity Commission web site e

“Comparison of the Employment Generated by Forestry and Agriculture in New Zealand” John Fairweather, Peter Mayell and Simon Swaffield, AERU, PO Box 84, Lincoln University, Canterbury, New Zealand. P23
If buying decisions are rational: Average gross income /ha over 4 years from farming $835/ha (beef & lamb NZ economic farm service top quintile on hard NI east coast model) c/f 763T/ha of CO2e by year 30 av, per year = 25T at $50= $1250/ha gross income (mpi look-up tables for radiata averaged over 9 regions for a 30 year rotation).

BakerAg Agletter 30 June 2018 “It's not just marginal farm land being affected, with the recent sale of a very good Wairarapa sheep & beef farm to forestry. The price paid for this farm was around $2,000/ha above the ‘current’ forestry market.”

We would like to think that many of the permanent sinks created will involve native vegetation, with a much longer time till final maturity. However with an average rate of sequestration of 25T/year compared with 9T/year (Radiata v native av. of first 30 years) this will not be so. Even native for honey production will require the bee keepers to weed out larger trees if they wish to maintain their UMF honey production, thus further depressing their carbon credit income.

Space planting of say 50sph (stems per ha) over 5M ha of hill pasture= 250M trees. At this level of planting pasture production would not be diminished and erosion control greatly enhanced. My HBRC rep estimates that erosion plantings in the country as a whole total about 2-3M trees, so that leaves a lot that we could plant. A mature poplar tree of 70cm dbh (diameter at breast height) has a canopy area of 137sq m (personal correspondence Ian McIvor ~Plant and Food), 250M trees give a total canopy cover of 3.4Mha then the look-up value for exotic soft wood gives 128T/ha at 20 years: so an average of 22Mt CO2e per year for next 20 years

Work on the calibration of carbon sequestrated has started on a Taumaranui case study farm (David Norton: personal correspondence)

Norton,D & Parnel,J (2018) identify 1.4M ha of woody native vegetation on Farms. Although the majority of this is pre-1990 we have the data available to date this vegetation & thus could quantify its current rate of sequestration.

Assume the 1.4M ha is av. age of 30 years today that would yield an av. of 4.6Mt CO2e per year for next 20 years (from Look-up tables)

Our mature native forests represent a permanent sink of 1700Mt CO2e a modest 5% total increase in biomass by the end of 20 years due to successful exclusion of pests would result in 0.25% increase in the carbon sink per year or 4.25Mt CO2e

Dave Read