Submission to the Senate Standing Committees on Environment and Communications on the Carbon Farming Initiative (CFI).

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Introduction

The sustainability of both the environment and the economy require nations to progressively abandon linear *extract-use-waste* developments (which expropriate and destroy natural systems) in favour of cyclical processes that use and reuse the same stock of resources endlessly as nature does.

The Carbon Farming Initiative offers a major step in this direction. It provides a direct incentive for farmers and other land managers to undertake abatement and sequestration activities by creating offsetting credits for the large greenhouse gas emitters. Australia, because of its size, can potentially become carbon neutral if sufficient offsetting credits can be created.

With Australia's relatively high emissions, small population and large land area, an offset mechanism is preferable to both a cap and trade system or a carbon tax which both depend on the capacity of future governments to either tighten the cap or increase the tax threshold while resisting cries for compensation from those most affected. Compensation results in a weakening of the incentive to lower emissions.

An offset mechanism such as CFI credits will enable the big emitters to purchase offsets at home, invest directly in abatement activities and avoid the uncertainties of dealing with unpredictable international carbon markets. A number of other countries are expressing a preference for an offset arrangement in preference to either a cap and trade system (preferred by economists) or carbon tax (preferred by environmentalists).

The crucial issue is whether the processes for creating carbon credits are workable in practice and whether enough carbon can be sequestered through the proposed abatement measures to offset most, and preferably, all Australia's emissions.

A nice feature of the proposed CFI is that it can deliver additional benefits such as increasing agricultural productivity, enhancing water supplies, improving biodiversity, building ecological and economic resilience, and through the management of local micro-climates, can address some of the more damaging prospects of climate change.

The remainder of this submission outlines the scientific basis for these claims. It uses a forensic type approach to collect fragments of evidence from the specialist scientific literature and, like a jigsaw, puts them together in a new and creative way. In the process some of the scientific uncertainties will be addressed along with some suggestions for streamlining the operation of the legislation.

The basis of the argument

From a greenhouse point of view, a stable ecosystem is carbon neutral. Emissions from the breakdown of biological material through natural senescence, digestion and fire are balanced by the sequestration of atmospheric carbon through photosynthesis by plants, algae and phytoplankton. Globally, photosynthesis sequesters around 100 Gt of atmospheric carbon per year.

To put this in perspective, globally, the living biomass (ie all plants, animals, insects etc alive today) contains around 600 Gt of carbon. The atmosphere contains 770 Gt mainly as carbon dioxide and soil contains 2,300 Gt of carbon in the form of large organic molecules that are highly resistant to further breakdown such as humates, glomalins, charcoal (organic carbon) and in some areas carbonates (mineralised carbon such as limestone).

Human activities through the burning of fossil fuels (the products of past photosynthesis), excessive land clearing and soil disturbance have upset this balance, releasing about 22 billion metric tonne of CO_2e per year.

There is no simple way to restore this balance. Simply stopping or reducing emissions and reducing destructive land management practices will slow the process, but do nothing to either address the imbalance or soak up the excessive emissions from the past.

Soil offers the only sink that is large enough and subject to human control. The oceans are bigger by far, and contain much more carbon (around 38,000 Gt), but are less well understood. Suggestions for using the oceans as a carbon sink are highly risky and problematic at this time. Managing terrestrial vegetation on the other hand is what farmers, horticulturalists, foresters, park managers and home gardeners do every day. Helping these folk do a better job not only to reduce emissions but also to sequester carbon is a key strength underpinning the CFI.

Soil Carbon

Traditionally soil organic matter (SOM) was thought to consist of decomposing plant and animal residues and the micro-organisms associated with the decomposition process. It specifically excluded fresh and uncomposted plant materials like leaf litter and the roots of living plants.

The chemical makeup of SOM includes stable, carbon rich polymers like cellulose, waxes, lignin, terpenoids and fats that are relatively resistant to decomposition and form a colloidal substance known as *humus.* Humus has long been recognised as a quality indicator for a healthy soil and can remain stable for decades and under some circumstances, centuries. Changes in humus levels are relatively easy to measure.

What is increasingly being recognised is that there are also highly stable soil processes associated with boosting plant growth that have been excluded by this traditional focus on humus. These include the mycorrhizal fungal symbionts that deliver water and nutrients to plants (in exchange for sugars exuded by the plant roots) and the bacteria that fix nitrogen. There are also photosynthesising bacteria in soils that use a different wavelength to green plants. These bacteria oxidise inorganic materials to derive energy and fix carbon. By breaking down inorganic compounds, they also release essential nutrients and make them available to plants and emit water as a by-product.

These processes have been well studied and documented in specialist scientific literature, but, like jigsaw pieces, have yet to be put together in a meaningful way and be adopted into mainstream agricultural science and farming, forestry and horticultural practice. They have the potential to massively increase the total living biomass by restoring degraded landscapes and building soil carbon.

Unfortunately many current practices destroy theses processes and this accounts for the relatively high emissions currently attributed to agriculture. Biological farming techniques will reverse this trend completely and bring land management practices back into ecological balance.

In addition, as we build up vegetation levels, historic emissions will also be progressively reduced, until a new equilibrium is reached. We do this simply by managing the microbial processes of soils so that they increase above-ground photosynthesis and thereby sequester far more atmospheric carbon than previously thought possible.

At present the abatement measures identified under the CFI are all steps in the right direction. Once adopted by the Parliament they can be progressively enhanced by the new biological techniques for inoculating soils that boost microbial activity, stimulate appropriate symbionts and build organic soil carbon.

It is important to recognise that industrial agriculture and 'factory farming' are based on old paradigm, chemical thinking and are unsustainable because they depend on limited resources such as fossil fuels. They are also increasingly expensive and release greenhouse gases in their manufacture, distribution and application. Worse, they kill off the very microbial agents needed to restore the balance. Biological approaches mimic nature and avoid all these associated costs and difficulties. They are sustainable.

The potential for building soil carbon in Australia is huge. A healthy soil typically has 2-3% carbon. Loamy soils have around 5% and wetlands and peat bogs, which are highly productive, have around 50%. Contrast this with agricultural soils in Australia which typically hold around 1% or less and are continuing to decline in soil carbon.

Answering critics

Critics of biological approaches to agriculture broadly fall into two groups:

1. Those committed to industrialised approaches who argue that organic agriculture is inefficient and will never feed growing world populations, and
2. Those trained in traditional agricultural science who do not understanding the potential of these biological farming techniques referred to here.

Taking each in turn.

Industrialised Vs biological agriculture

While global populations are continuing to increase, global agricultural production, using current farming methods, appears to have reached a plateau over the last 4-5 years. The number of people on the planet is expected to reach 7 billion later this year of whom about 2 billion are already undernourished and around 2 billion overweight. In short industrialised agriculture has proven itself unable to deliver what is needed: adequate food for all. Indeed there is growing evidence that it is part of the problem.

Worse, industrialised agriculture forces people off the land into already over-crowded cities making more and more people totally dependent on imported food at a time when oil has peaked and transport (another major source of greenhouse gases) is becoming prohibitively expensive.

Biological farming will enable rural communities to thrive while increasing both the quantity and quality of food. Farmers markets, seasonal foods, 'food miles' and 'slow food' initiatives are all moving in the right direction.

Just as the tobacco industry, the mining industry and now the gambling industry, are vociferous in the defence of their sector and generate well resourced misinformation, industrialised agriculture and factory farming will no doubt put up a similar fight.

Increased vegetation reduces run-off.

This is true, but hardly a reason for not planting trees, deep rooted perennial grasses and other much needed vegetation. All life depends on photosynthesis and needs water. Urbanisation, soil compaction, extensive road networks and other impervious surfaces have already massively increased runoff in Australia resulting in deeply excised gullies, heavily eroded soils and silted up rivers and streams. What was once a resilient chain of ponds hydrology with raised river courses and extensive wetlands has been reduced to compacted and desiccated subsoils.

Currently about 12% of Australia's annual rainfall results in runoff into rivers and streams often in the form of serious flood events. Pre-development Australia's soils were deep and spongy, holding water for longer and percolating slowly to replenish aquifers and rivers and streams. Our river systems evolved under these conditions. Increasing surface runoff will worsen, not improve river health. What is needed is improved soil structure to hold water, reduce desiccation and replenish aquifers and rivers with clean, percolated water throughout the year: not in single runoff events.

It is sometimes argued that extra runoff is needed fill dams to meet urban and irrigation needs. Currently about 2% of Australia's rainfall is captured in dams and weirs (this includes all small farm dams). Many of the larger dams already have undisturbed catchments and rely on the purification effects of the undisturbed soils and vegetation. Where catchments are disturbed they would benefit from revegetation, resulting in less sedimentation and cleaner water.

Australia's water problems have more to do with the past harvesting and management decisions than the availability of water. Our main problem as a nation is with desiccation; strategic tree planting (as shelter belts for example) will do much to create the microclimates that will reduce desiccation. In time the additional microclimates and re-hydrolated landscapes will improve Australia's overall bio-productivity and potentially trigger increased rainfall.

Increased vegetation locks up nutrients

True, but only while the vegetation is alive. Once vegetation is broken down by decomposition, digestion or fire, the nutrients are released. In farming systems the issue is what happens to the essential nutrients. If they are exported around the world and consumed by people most of these nutrients are lost in the ocean outlets of urban sewage systems. But if they find their way back into the soil in the form of compost or soil amendments they are reused and can potentially be cycled forever. There are also huge losses of nutrients for food wastes that find their way into landfill.

Fossil fuels contain nutrients locked up millions of years ago. Burning these and feeding the resultant emissions to algae under controlled conditions will enable these nutrients (along with the emitted greenhouse gases) to be captured. The fats from the algae can then be turned into a bio-fuel and the residues put back into the soil as a soil supplement.

Biological farming releases higher levels of NOx: an even more virulent greenhouse gas than CO_2.

True, but only under current farm management practices. If land managers and farmers change to biological methods, the nitrogen cycle, like the carbon cycle will return to being in balance: nitrogen in will equal nitrogen out. There will be no need to add costly nitrogenous fertilisers as nitrogen fixing bacterial can readily meet the need plants have for nitrogen.

Nitrogenous fertilisers depend on natural gas for their manufacture (through the Haber process). As natural gas supplies begin to dwindle, they will become increasingly expensive and we will be forced to rely on natural nitrogen fixing processes.

Livestock for managing vegetation releases methane, also more virulent than CO2

True, enteric emissions from livestock predominantly comprise methane. But the herbage used to feed the livestock has sequestered the equivalent amount of carbon before it is eaten and digested. Well managed and grass fed livestock are carbon neutral.

But why single out livestock? Plants have co-evolved with herbivores and depend on them to cycle nutrients. Termites, leaf eating insects, and larger plant eaters (including humans) all release methane as a result of their digestive processes. In the past they all returned the nutrients to the soil through their frass, dung etc as part of nature’s cycles. Only modern humans, who dispose of their wastes in landfill and ocean outlets, are net emitters of methane.

Additional benefits

The CFI abatement and sequestration activities have additional benefits over and above their potential for reducing greenhouse gas emissions. These include improved water holding capacity and nutrient cycling, landscape restoration and reducing the decline in biodiversity, and most importantly, improving the quality and nutrient density of food.

The provisions for aggregation will enable smaller participants to join the scheme and make a meaningful contribution to be made by large numbers of people.

Possible improvement to the CFI

All the planned abatement activities result in reduced emissions but if managed well they can also sequester large amounts of carbon. As they stand the draft methodologies are heavily weighted in favour of abatement rather than sequestration measures. They are also so complex and intrusive that many land managers will be unable or unwilling to participate.

There are only two types of sequestration each of which can be measured by remote sensing and verified locally through independent sampling. These are:

1. Net increases in the living vegetative biomass in the form of forests, woodlands, pastures etc. These remain a net carbon sink until maturity when they become carbon neutral unless harvested, and
2. Net increases in stable soil carbon.

All abatement and sequestration activities can be accounted for in terms of the tonnages of carbon not released or sequestered.

The proposed requirement to develop elaborate plans to be verified by bureaucratic process should be replaced with credits based on actual amounts of reduced or sequestered carbon. Just as independent financial audits are adequate to satisfy stakeholders of the accuracy of financial accounts; independent carbon audits are all that will be needed to satisfy the purchasers of carbon credits of their validity.

Commercial enterprises are not expected to submit their operational budget to a government appointed bureaucracy for approval. In the same way, land managers that have carbon sequestration as their goal should be judged on actual results, not their planned intentions. The method used for growing a ton of soil carbon, like growing a ton of wheat, is a matter for the individual land manager.

As the ultimate goal is to offset all Australia's emissions, all impediments to innovative ways of sequestering carbon should be avoided. The proposed requirement to submit plans to an external bureaucracy involving large numbers of State and Commonwealth officials will ensure that Australia will not achieve this goal.