Stakeholder Brief B: Understanding the true mitigation value of native forests

Background

In 2009 the first ANU Green carbon report concluded that Australia's south eastern native forests stored 25.5 Gt CO_2 and that allowing previously logged forests to grow old could sequester and store an extra 7.5Gt CO_2 over decades to centuries (about 136 Mt CO_2 yr).

The most recent assessment of the contribution ceasing logging could make to net reductions in emissions occurred as a result of Tasmania reaching a net -4% below its 2005 state wide emissions, was conducted by Mackey et al. in 2022. The State of Tasmania delivered negative emissions of about 22Mt CO_2-e per year over 2011/12-2018/19 due to reduced native forest logging. This figure reflects both an increase in sequestration from allowing forests to grow past their logging date and emissions reduction from ceasing logging over a large area.

None of these assessments of the carbon value of forests are revealed under current LULUCF accounting rules or reflected in methods for developing NF ACCU's: Land, forest and ecosystem ACCU methods are based solely on annual net changes in net fluxes of CO_2 into (i.e., "emissions") and out of (i.e., "removals") the atmosphere; and under current rules, the integrity, stability and longevity of forest ecosystem carbon stocks will be ignored in any new native forest ACCU method.

Carbon accounting and ACCU's

The capacity of forest ecosystems to accumulate and retain a stock of carbon is the most important factor determining their climate mitigation value. Yet, current forest carbon accounting rules fail to reflect the importance of a stock's longevity and how ecological integrity (i.e., ecosystem integrity) is important for its stability and resilience.

Failure to account for differences in carbon stock longevity based on differences in forest ecosystem integrity - such as the difference between an old growth forests, a young regrowth native forests, and a mono culture plantation) means we cannot see the true climate benefits from protecting native forests for the their superior ecosystem carbon stocks.

Gross emissions from logging are currently hidden by rules that allow annual emissions from the relatively small proportion of the forest estate logged each year to be netted out (offset) by sequestration (removals) in the whole forest estate. This net accounting is used to support the false narrative that logging is a "climate solution".

The accounting rules also allow these net forest accounts to be used to offset some of the fossil fuel emissions which erroneously treats fossil carbon as equivalent (fungible) to forest ecosystem carbon.

The science behind treating all carbon as equal is deeply flawed should not be treated as fungible (equivalent) because the main reservoirs are fundamentally different in their longevity, stability and whether they exchange CO_2 with the atmosphere (Mackey et al. 2013). From a scientific perspective, fossil fuel emissions should not be offset in net accounts by forest ecosystem removals. Consequently, that there is an international push to recognise that CO_2 removals from the atmosphere into ecosystems stocks (also called "bio carbon") and emissions from burning fossil fuels ("geo carbon") are not equivalent, and increasing calls for 'no land or forest based offsets' (see the Land Gap Report, Dooley et al, 2022). Science supports the establishment of separate goals, targets and accounts for the fossil fuel and land/forest sectors. This will help keep fossil fuels (geo-carbon) in the ground and protect and restore forests and other carbon dense ecosystems (bio- carbon).

Protecting and restoring forest ecosystem integrity requires a fundamental change to forest carbon accounting rules

Transformational change is needed in how we think about forest ecosystem carbon.

Ecosystem integrity plays a fundamentally important role in helping to sequester, accumulate and retain forest ecosystem carbon (Rogers et al 2022). Ecosystem integrity is underpinned by the functional role of biodiversity in ecological processes that results in a forest having a maximum degree of resilience and adaptive capacity compared to degraded forests and plantations (Thompson *et al*., 2009). If forests are degraded, species are lost and the functioning of the ecosystem, including its mitigation capacity, is diminished. Because biodiversity underpins ecosystem integrity it should be thought of as a building block of long-lived carbon sequestration , accumulation and retention.

Naturally evolved patterns of biodiversity comprise the most stable and resilient ecosystems and, within their system limits, provide natural resistance to threats that are increasing with climate change, such as pests, disease, drought and fire (Rogers et al. 2022). It follows that the carbon stored in ecosystems with higher levels of integrity are more stable and resilient. (Keith et al 2022b).

Current carbon and other climate rules are blind to the functional importance of biodiversity and ecosystem integrity for the longevity and stability of the carbon sequestered and stored in ecosystems. Forest carbon accounting rules fail to recognise the importance of protecting and restoring carbon stocks in natural ecosystems - notably old growth and other natural forests (Keith et al. 2021, 2022a) including that:

- The total forest ecosystem carbon stock comprises the carbon stored in living trees, dead biomass including coarse woody debris on the forest floor, and in forest soils.
- Old growth forests store on average 50% more carbon than natural forests managed for wood production (Keith et al. 2021)
- 1 – 4% of large old trees account for 40 – 60% of above ground forest carbon (Clark and Clark 1996, Keith et al. 2010, Lutz et al. 2018, Mildrexler et al. 2020).
- Most of the above ground carbon stored in big old trees is irrecoverable in human lifetimes (Keith et al. 2010, Lutze et al., 2018).
- The natural floristics composition and structure of forests play an important role in the longevity of carbon storage and reducing the risk of CO_2 emissions to the atmosphere.
- Despite global temperature rise and associated increased risks from drought and fire, long unlogged forests are still resistant to and resilient in the face of risks that are increasing with climate change (Mackey et al 2020; Rogers et al 2022).
- The mitigation value of forests and other carbon-dense ecosystems resides in their ongoing capacity to sequester, accumulate and retain carbon.
- When subject to only natural processes, It is not just the rate at which forests sequester carbon that matters, but also the rate at which carbon is emitted to the atmosphere from respiration/decomposition and combustion, as well as life history traits of the dominant tree species (wood density, tree lifespan, resilience to fire and drought, modes of regeneration), which combined determines the accumulated carbon stock.
- It is the size and longevity of the accumulated stock of carbon that matters most for climate mitigation.
- Biodiversity provides natural resistance, resilience and adaptive capacity to ecosystems and enables larger and longer-lived ecosystem carbon stocks. (Mackey *et al.* 2020, Rogers et al. 2022).

Current carbon accounting fails to differentiate between carbon stored in high, medium and low integrity forest ecosystems at corresponding low, medium and high risk of loss. All forest carbon stocks are in effect assumed to have the same stability, longevity and resilience, and therefore that they are fungible (Ajani *et al.*, 2013). Carbon lost from old growth forest is assumed to be offset by planting new trees. Assuming the loss of long unlogged forests can be offset through new plantings, ignores the nature and scale of the carbon debt - reducing the carbon stored in the landscape and increasing the stock in the atmosphere, at least until planted trees reach the same size after decades, centuries or millennia. Moreover, new plantings have lower ecological integrity and thus a higher risk of loss.

Accounting rules need to be changed or supplemented to ensure that the mitigation outcomes of different land use and forest management strategies are revealed and reported transparently, and ensure decision makers can understand which policies and actions should be prioritised in order to be confident of achieving the desired mitigation outcomes while supporting the full range of ecosystem services, including carbon retention.

A transformational approach to carbon accounting offered by the UNSEEA-EA

It is important to have an ecosystem accounting/information system capable of:

- registering the risk of carbon stock loss and how these risks differ with the level of ecosystem integrity;
- reflecting the linkages between the biodiversity and climate crises; and
- revealing the benefits of synergistic biodiversity and climate action.

The new UN System of Environmental Economic Accounting - Ecosystem Accounting (UNSEEA-EA) adopted in 2021 (UN et al. 2021) has become the new global standard for accounting ecosystem assets and services in government economic accounts.

This new accounting and information system enables governments to appropriately reflect the economic value of a country's ecosystem assets by encouraging and enabling them to progressively bring into the balance sheet of their Economic Accounts, the value of every ecosystem asset and all ecosystem services, based on their level of integrity. It fills critical information gaps on the integrity of ecosystems and the climate and biodiversity value of retaining and restoring high integrity, carbon-dense natural ecosystems.

The UNSEEA-EA can provide this information because it has adopted a reference level of 'ecosystem integrity', which is defined as:

"…the system's capacity to maintain composition, structure and function over time using processes and elements characteristic for its ecoregion and within a natural range of variability. The system has the capacity for self organisation, regeneration and adaptation by maintaining a diversity of organisms and their interrelationships to allow evolutionary processes for the ecosystem to persist over time at the landscape level. Ecosystem integrity encompasses the continuity and full character of a complex system"

The UNSEEA-EA helps reveal that high integrity ecosystems provide higher quality, more reliable, more stable and lower risk of loss ecosystem services, including the crucially important ecosystem service of carbon retention. It facilitates considering climate and biodiversity synergistically and acting holistically on climate mitigation, adaptation and climate resilient sustainable development.

Utilising the UNSEEA=EA eference level helps track ecosystem condition over time and reveals the carbon carrying capacity of ecosystems in their natural state (including under natural disturbance regimes such as bushfires) (Keith et al. 2020). Changes from this reference level can be assessed to reveal the true loss of carbon due to human activities and the potential gain through restoration and can incorporate long time horizons that reflect the full extent of carbon dynamics at landscape scales (Keith et al. 2019).

The additional information provided by the UNSEEA-EA includes 'comprehensiveness' in terms of all pools, ecosystem types and land areas, another missing element in current GHG accounts. The UNSEEA-EA can encompass all ecosystems without necessarily incurring a penalty or bonus in a country's GHG accounts, and still reveal the mitigation benefits of and provide an incentive for improved conservation management.

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