



Australia's National
Science Agency

Blue Carbon in Australian and the Indo-Pacific

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Context

Despite their relatively small global extent (between 0.5 and 1×10^6 km², equivalent to 0.2% of the ocean surface), vegetated coastal ecosystems (VCE), tidal marshes, mangroves and seagrasses, contribute ~50% of C sequestered in marine sediments (i.e., blue carbon), with their organic carbon (C) sequestration rates exceeding those of terrestrial forests, per unit area, by 1–2 orders of magnitude.

The greatest extent of extent of these ecosystems occurs across the Indo-Pacific region notably in Indonesia, Malaysia, Papua New Guinea and Australia.

Australia holds to 5–11% of blue carbon soil stocks worldwide, despite losses amounting to 47–78% of tidal marsh and mangrove extents, and 20–26% of seagrass extent since European arrival. While rate of loss is much less than historically continued coastal development results in a net decline in VCE extent, of at least 0.03% year⁻¹ for Australian mangroves (100–315 ha year⁻¹) the loss for saltmarsh and seagrass are unquantified but likely to be of at least a similar order.

Australia stands to benefit from developing blue carbon-focussed climate change mitigation schemes. Restoration of historic losses of VCE together with enhanced conservation of threatened VCE could constitute a mechanism to mitigate Australian CO₂ emissions while enhancing ecosystem services and climate adaptation. In 2017 Australia included mangroves in its national emission reporting for 2015.

Understanding Australia's blue carbon potential

The CSIRO Carbon cluster (2012-2015) which engaged seven universities and CSIRO was the largest initiative undertaken in Australia to quantify the significance of blue carbon across Australian climate regions and understand factors affecting storage and sequestration. In summary, it demonstrated that:

1. Australia contributes 5-11% of the C stored in VCE globally (70-185 Tg C in aboveground biomass, and 1,055-1,540 Tg C in the upper 1m of soils).
2. Potential CO₂ emissions from current VCE losses are estimated at 2.1-3.1 Tg CO₂-e yr⁻¹, increasing annual CO₂ emissions from land use change in Australia by 12-21%.
3. This assessment, the most comprehensive for any nation to-date, demonstrate the potential of conservation and restoration of VCE to underpin national policy development for reducing greenhouse gas emissions. assessment of Australian national blue carbon storage, accounting for the various climate regions and administrative jurisdictions, provides a basis to estimate potential CO₂ abatement through restoration and conservation of VCE.
4. Key references include:
 - [Assessing the risk carbon dioxide emissions from blue carbon ecosystems](#)
 - [Tidmarshes in Australia](#)
 - [Glove mangrove stocks](#)
 - [Australian vegetated coastal ecosystems as global hotspots for climate change mitigation](#)

Informing the development of Australian domestic policy

Under the Emissions Reduction Fund (ERF) the Australian Government (AG) seeks to recognise activities that contribute to CO₂ and GHG abatement and to have these included in national emissions inventories and their reporting.

In considering the potential inclusion of blue carbon the AG engaged CSIRO in 2017 to investigate blue carbon management actions that would meet the offsets integrity standards of the Australian Emissions Reduction Fund. In total, twelve actions were assessed for their greenhouse gas abatement potential and the ability to measure abatement reliably, using a combination of available data and qualitative and quantitative methods, including expert knowledge. Five most relevant and promising activities, encompassing the protection, restoration and creation of mangroves, tidal marshes and seagrasses we evaluated. On a per area basis, mean abatement intensity of organic carbon was highest for the (re)introduction of tidal flow resulting in establishment of mangrove (13 – 15 Mg C ha⁻¹ yr⁻¹) and tidal marsh (6 – 8 Mg C ha⁻¹ yr⁻¹), followed by land use planning for sea-level rise for the creation of new mangrove habitat (8 Mg C ha⁻¹ yr⁻¹).

This was followed in 2019 by a commission to undertake a comprehensive technical assessment of the potential for an ERF method to use, or be based on, components of the Verified Carbon Standard (VCS) “VM0033 – Methodology for Tidal Wetland and Seagrass Restoration” developed in the USA. The specific focus of the ERF method was for the introduction/re-introduction of tidal flow to coastal environments capable of supporting mangrove and tidal marsh vegetation. This has resulted in a decision to prioritise this activity for method development.

Investing and financing blue carbon initiatives in Australia to achieve carbon neutrality

Another objective is to develop the conditions enabling investment in blue carbon and the creation of livelihood opportunities and requires building partnerships with a range of sectors.

With DFAT, CSIRO convened in 2017 a workshop on blue carbon finance that generated a report and a [peer-reviewed publication](#) which provided a set of recommendations for sustainable and equitable investment in blue carbon.

This work was expanded on through a partnership with the FRDC, and engagement with representatives of the Australian seafood industry. This resulted in a [report](#) setting out advice for seafood industry operators who want to use blue carbon offsets, and advice to the FRDC on how they can support the industry to achieve this aspiration.

Australia’s role in blue carbon in the Indo-Pacific and internationally

The Australian Government established the [International Partnership for Blue Carbon](#) after the Conference of the Parties to the United Nations Framework on Climate Change conference in Paris 2016.

The Australian Government has also sought to support other countries across the Indo-Pacific region with assistance to help them incorporate blue carbon into their national inventories, including the announcement of a AUD\$6m *Pacific Blue Carbon Initiative* (PCBI) in Paris 2016 fund, as well as prioritisation of blue carbon in bilateral programs such as the *Indonesia-Australia Maritime Capacity Building Initiative* (MCBI).

Subsequently, CSIRO has worked with DFAT and DOEE in delivering science and technical capacity across a number of countries in the Indo-Pacific region, to develop the underpinning science and capability for implementing effective emission reporting of, and livelihood opportunities from, blue carbon ecosystems. This has included:

1. In 2017 CSIRO hosted 11 early career professionals from Madagascar, Mauritius and Seychelles for a three-week program of training in blue carbon, supported by the Australia Awards Fellowship program. The training included all aspects of blue carbon science and policy. Several of the fellows have subsequently been promoted to positions of responsibility, and two have subsequently started PhD research into the field.
2. In 2018 a blue carbon training week was conducted on Perth for more than 60 representatives from 15 countries.
3. In August 2020 Foreign Minister Payne [announced](#) the [IORA Indian Ocean Blue Carbon Hub](#), to be hosted and staffed by CSIRO. The hub will seek to support IORA nations — which collectively hold much of the world’s mangrove and seagrass carbon — in blue carbon science and policy. The Hub currently has an open call for early career professional to visit the CSIRO offices at the IOMRC for a research project and is planning a think-tank on blue carbon finance in February 2020.
4. Under the MCBI a project is currently underway to support the Government of Indonesia to understand and manage its coastal blue carbon ecosystem assets for climate action, maritime security and to support sustainable livelihoods that foster a prosperous blue economy. This included recently training for 9 early career professionals from 7 Indonesian government ministries and agencies in Australia. program of research co-designed with Indonesia includes mapping, and research into carbon dynamics and livelihoods. DOEE provide aspects of policy implementation
5. Similarly, under the PCBI, assistance to Fiji and Papua New Guinea is being provided also covering capacity building, mapping of VCE, collection of carbon samples for development of a Tier II inventory and case studies to develop livelihood opportunities

6. With Sri Lanka In October we will host a workshop in Colombo with 30 Sri Lankan scientists and practitioners to co-design a subsequent package of research, and in March 2020 we will host early career professionals in Australia for a three-week training program. The work with Sri Lanka is designed to support their role as Champion of *the Commonwealth* Mangrove Ecosystems and Livelihoods Action group.

Future directions

While blue carbon has been very successful in galvanising action on VCE it is our view that the narrative need to shift to a broader a recognition of the ecosystems Services from Vegetated Coastal ecosystems (coastal protection, food and filtering) and the livelihood opportunities they provide. Secondly blue carbon needs to framed as a component within the Blue Economy and Ecosystem Accounting frameworks.

Developing livelihood opportunities from blue carbon ecosystems, particularly for indigenous peoples, is also an emerging priority within the broader blue economy dialogue.



Mangrove regrowth in the Seychelles