

# Blue Carbon and Sea Country

## Opportunities Report



Blue Carbon Lab





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**Wadawurrung**  
Traditional Owners  
Aboriginal Corporation



The Blue Carbon Lab proudly acknowledges and pay our respects to the traditional owners and elders past, present and emerging throughout Australia and recognises their continuing connection to land, waters, and culture.



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# Summary

## Opportunities for Traditional Owner-led adaptation and planning to protect and restore cultural values through BCE protection and restoration

The increasing recognition of blue carbon as a natural climate solution presents valuable opportunities for Traditional Owner (TO) groups to engage in blue carbon (BC) projects on their Country. In this report, we undertake a first pass exploration of a range of opportunities for TO leadership and engagement in blue carbon projects.

The first opportunity is knowledge sharing and capacity building initiatives to empower TOs in various aspects of blue carbon projects, fostering skills in project planning, restoration activities, ecosystem monitoring, carbon accounting, and community engagement.

As Australia holds a substantial portion of blue carbon ecosystems (BCEs), mapping blue carbon opportunities on Country will help TO groups understand the potential for conservation and restoration efforts. Site-level scoping assessments can help evaluate the feasibility of a blue carbon project, considering both biophysical characteristics and cultural heritage. With many potential blue carbon opportunities occurring across private land, a framework for landholders should be developed outlining ways they can respectfully engage TO groups on blue carbon projects.

TO Natural Resource Management (NRM) teams can play an important role as service providers, undertaking on-ground restoration activities for blue carbon projects. Additionally, TO groups can establish seed banks or nurseries, which not only contribute to ecological restoration efforts but also offer avenues for economic empowerment. These initiatives collectively empower Indigenous communities to take a leading role in environmental conservation and sustainable land and sea management, fostering economic benefits and cultural preservation.

Following the completion of restoration work, continuous monitoring becomes crucial to evaluate the effectiveness of the restoration efforts and ensure desired outcomes are met.

TO groups can play a pivotal role in leading or supporting these monitoring activities by combining Western scientific approaches with their invaluable traditional knowledge. Additionally, by engaging in Environmental Economic Accounting (EEA), the value of cultural ecosystem services can be recognised and integrated into decision-making processes. This approach ensures that the cultural significance of coastal wetland restoration is given proper consideration alongside other environmental and economic considerations.

TO leadership of blue carbon projects presents a significant opportunity to achieve economic empowerment, while aligning with aspirations for caring for Country. Currently, through the Emissions Reduction Fund (ERF), project proponents can earn blue carbon credits by reinstating tidal flow to restore BCEs. As there is only one blue carbon method under the ERF, there is an opportunity to co-design new methods that better align with traditional management practices of BCEs. Additionally, the emerging Nature Repair Market (biodiversity credits) offers additional opportunities for TOs to actively participate in biodiversity conservation efforts, further aligning with their cultural responsibilities and aspirations for Country. Stewardship payments provide financial incentives to TOs for responsible land and sea management, fostering collaboration and sustainable practices for the preservation of these vital ecosystems.

The combination of these initiatives contributes to a holistic approach that respects Indigenous rights, enhances ecological outcomes, and empowers TOs to lead blue carbon projects for the benefit of Country and their communities.

# Introduction

## Blue Carbon & Sea Country

### Blue Carbon

The term "blue carbon" was coined just over a decade ago to describe the role of mangroves, seagrasses, and tidal marshes in sequestering carbon in coastal areas and oceans (Duarte de Paula Costa & Macreadie, 2022). These blue carbon ecosystems (BCEs) play a crucial role in mitigating climate change by capturing and storing carbon at rates often exceeding those of terrestrial forests (Macreadie et al., 2021).

Unfortunately, they are one of the most threatened ecosystems on Earth and continue to face threats from urban and agricultural development, coastal squeeze, sea level rise, pollution, and inappropriate recreation (Lovelock & Reef, 2020; Pendleton et al., 2012). The restoration of these ecosystems serves as a nature-based solution (NbS) by harnessing the inherent resilience and ecological functions of BCEs to mitigate climate change impacts, enhance biodiversity, provide coastal hazard adaptation, and support sustainable development. With the increasing recognition of BCEs restoration as a NbS, there is a growing trend towards increased efforts and investments in restoration projects.

### Sea Country

Indigenous peoples, as custodians of the land and stewards of Country, have a deep connection to these coastal environments. They have been maintaining a healthy Country through their traditional ecological knowledge, accumulated over generations, which offers unique insights into sustainable practices, ecosystem dynamics, and the interdependencies between humans and the natural environment.

In recent years, there has been an increase in the recognition of the value embedded within this knowledge and the rights held by Traditional Owners (TOs) in land and sea management. This knowledge is now being acknowledged as a valuable complement to scientific approaches, emphasising the importance of incorporating Indigenous perspectives in environmental decision-making processes. Furthermore, recognising and upholding the rights of TOs in land and sea management is essential for fostering meaningful partnerships, promoting cultural preservation, and ensuring the effective stewardship of natural resources.



# Opportunities

In recent years, there has been a growing interest and enthusiasm among TOs to actively participate in blue carbon opportunities, driven by their desire to protect and restore cultural values through the conservation and restoration of BCEs. This report delves into the emerging landscape of TO-led adaptation and planning, aiming to explore the opportunities for their meaningful leadership and involvement in blue carbon projects.

By identifying and examining potential roles and contributions of TOs in this domain, we seek to foster sustainable partnerships and equitable engagement among TOs, governments, investors, researchers, and other stakeholders. Additionally, this report highlights existing initiatives involving TOs and address the challenges and opportunities that may lie ahead.

However, it is crucial to acknowledge that this report offers a preliminary assessment, providing an initial overview of various opportunities and initiatives around Australia, including Victoria. Future research is warranted to delve deeper into the multifaceted aspects of Indigenous engagement in blue carbon conservation and restoration, recognising the importance of this evolving field and its potential for transformative environmental and social impact.



## Opportunities Explored:



### Education and training

Knowledge sharing workshops to support TO capacity building in the blue carbon space.



### Mapping BC opportunities

Lead carbon and biodiversity monitoring (e.g. drones program) of project outcomes for reporting



### Site level assessments

Detailed assessments involving on-Country visits and data collection to assess project feasibility.



### Framework for private land

A framework that outlines proper engagement with TO groups for blue carbon projects that occur on private land.



### Natural Resource Management

TO NRM teams can lead on-ground restoration activities.



### Nurseries

Collect seeds or grow coastal wetland tubestock to support revegetation projects.



### Monitoring restoration

Lead carbon and biodiversity monitoring of restoration outcomes.



### EEA project level accounting

Account for Indigenous cultural values and uses within a EEA framework.



### Economic Empowerment

Lead new method development aligned with traditional management practices of BCEs for carbon, biodiversity and water quality markets.

# Blue Carbon Capacity building and knowledge transfer

Blue carbon is a relatively new concept (Duarte de Paula Costa & Macreadie, 2022), but its popularity is increasing rapidly due to its potential as a natural climate solution. There is a growing interest from TO groups to know more about blue carbon and the opportunities for projects on Country that these groups can lead or support. Knowledge sharing and capacity building initiatives for TOs provide opportunities to empower and engage TO groups in all aspects of blue carbon projects.

These programs can help TOs develop skills in areas such as project planning and development, on-ground restoration activities, ecosystem monitoring, carbon accounting, project management, and community engagement. Capacity building and knowledge sharing may also involve developing networks and relationships across university, government, industry, and communities involved in blue carbon projects. Building capacity will empower TO groups to actively participate in and lead blue carbon projects, contributing to the ongoing protection and management of healthy land and sea Country.





## Blue Carbon

# Capacity building and knowledge transfer

### CASE STUDY 1

## Torres Strait Coastal Wetland Training Program

### Development of ranger-led coastal wetland monitoring and management

A collaborative research partnership was established between the Land and Sea Rangers (LSR) of the Boigu and Saibai Islands and James Cook University to develop a ranger-led coastal wetland monitoring and management (Waltham et al., 2018). The goal was for LSRs to develop skills and confidence in scientifically rigorous monitoring to measure and report ecological changes in their local wetland project sites. Over the course of three workshops, LSRs were trained in water quality and biodiversity monitoring. Outcomes of the training program included the identification of 40 wetland species that had their languages names also recorded. The workshops also identified concerns for their wetlands that included connections to culture, climate change and invasive species. A management strategy was developed and included installing protective fencing to control feral animals from accessing water wells. School educational programs were identified as a way to transfer wetland ecological and cultural knowledge. Overall, the result of this partnership was a framework for wetland training programs throughout the Torres Straits, which contributed to wetland restoration and protection efforts and provided a space to address challenges that threaten lifestyles and livelihoods in the region.

### CASE STUDY 2

## Blue Carbon Workshops in Victoria

### Knowledge sharing on blue carbon topics and demonstrate blue carbon sampling techniques

Training workshops are an effective way to share knowledge on blue carbon topics. Deakin University's Blue Carbon Lab hosted a [blue carbon and restoration workshop](#) with Bunurong Land Council Aboriginal Corporation in 2023 (Blue Carbon Lab, 2023). This workshop included an educational talk involving topics such as what blue carbon is and why it is important, threats to BCEs, and the range of restoration activities being used in Australia. Blue carbon crediting and financial schemes were also discussed, as was potential barriers that TO groups may face to progress blue carbon projects. In the afternoon, an On Country visit provided a chance to discuss opportunities and to demonstrate blue carbon sampling or restoration monitoring techniques.

## Blue Carbon

# Capacity building and knowledge transfer

### CASE STUDY 3

## Mangrove Assessment within Kujukum

### Collaborative research partnership to conduct a mangrove blue carbon assessment

Deakin's Blue Carbon Lab, Cairns Airport and the Yirrganydji Indigenous Land and Sea Rangers from Dawul Wuru Aboriginal Corporation developed a collaborative research partnership to conduct a mangrove blue carbon assessment within Kujukum ('Kujukum' is the traditional name for the land area to the east of the Cairns Airport). The partnership was initiated by Cairns Airport who has a long-term relationship with the Yirrganydji Indigenous Land and Sea Rangers from Dawul Wuru Aboriginal Corporation. This collaboration provided the rangers step-by-step guidance on the standards methods and equipment needed to obtain high-quality mangrove plant and soil carbon data. During four days of fieldwork, BCL researchers worked alongside Yirrganydji Indigenous Land and Sea Rangers collecting data for mangrove tree characteristics (i.e., tree height, DBH, density) and soil carbon samples to estimate soil and plant carbon stocks in mangroves. This project delivered the first site-specific data on carbon stocks and sequestration potential for mangrove ecosystems within Kujukum and is a great example of on-ground training on blue carbon sampling techniques. This capacity building is key for Cairns Airport and the Yirrganydji Peoples to continue monitoring blue carbon within their land.





## Spatial Analysis

# Mapping blue carbon opportunities on Country

Australia ranks among the countries with the largest expanse of BCEs, encompassing 9-32% of BCEs worldwide, thereby boasting substantial blue carbon storage capacity, estimated at 5-11% of global blue carbon soil stocks and 2-7% of annual soil carbon sequestration (Serrano et al., 2019). Mapping the distribution of these ecosystems is crucial as it provides a foundational understanding that underpins further consideration and investment in blue carbon conservation and restoration. To explore blue carbon opportunities on Country, it is essential to begin by understanding the historic and existing distribution of BCEs, such as mangroves, saltmarsh, and seagrass, and use this information combined with land use data to identify potential areas for restoration.

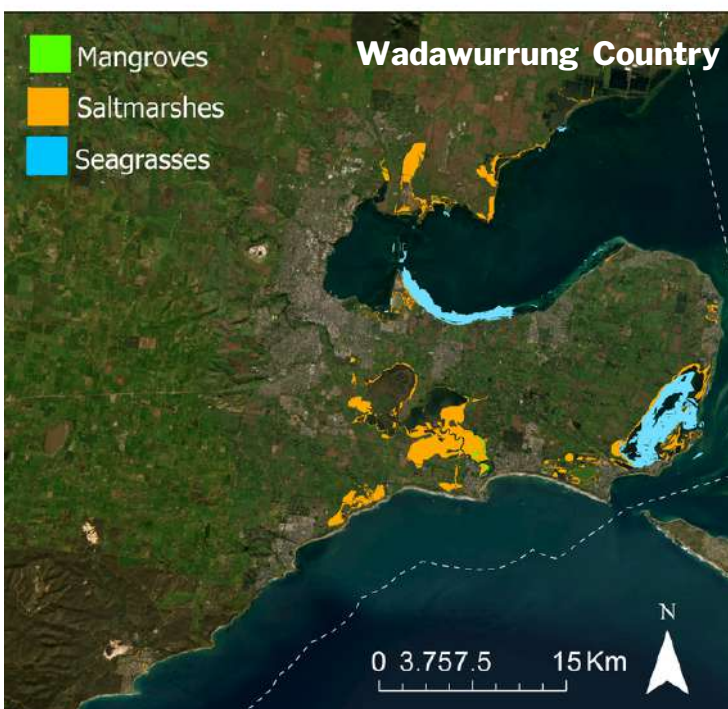
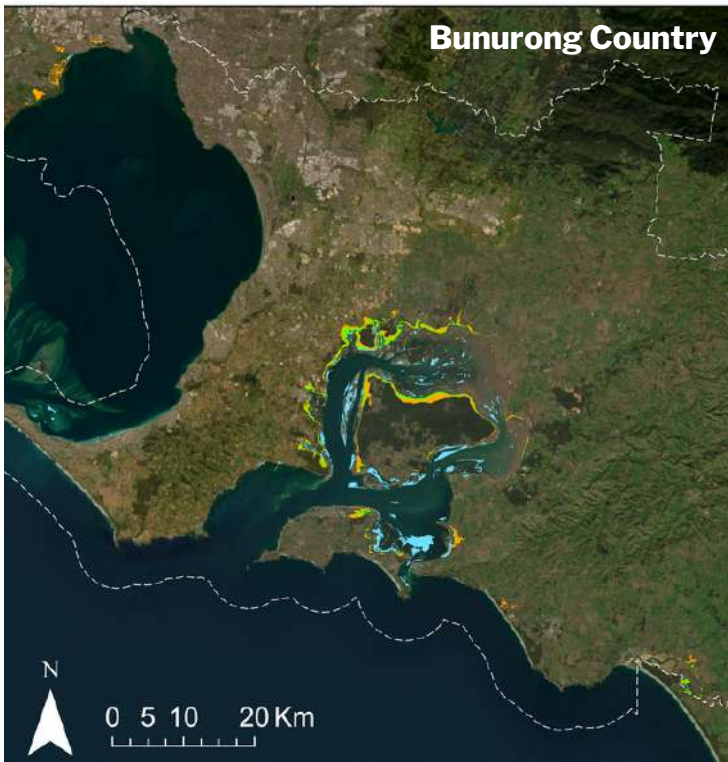
Conducting a spatial assessment requires accessing existing data layers on biophysical variables, including ecosystem mapping, land use cover, and future sea level inundation extent. These data combined with field data (e.g., carbon stocks, sequestration rates) provide insights into the blue carbon assets and restoration opportunities, highlighting sites suitable for restoration under different management actions (e.g., exclusion of non-native animals, tidal reinstatement, managed retreat) and their associated ecosystem services (e.g., carbon and nitrogen sequestration, coastal hazard mitigation, fisheries and biodiversity support and enhancement). Various management scenarios, such as baseline trends, fencing, managed retreat, and levee removal, can be considered to determine the most effective restoration approach.



Additionally, efforts should focus on including cultural value layers, which would provide a more comprehensive understanding of the cultural significance and priorities of Traditional Owners. Integrating cultural values into the assessment ensures a holistic and inclusive approach that respects cultural heritage, supports sustainable land management, and delivers positive social, economic, and environmental outcomes. Such assessments are crucial for promoting equitable and inclusive approaches to blue carbon projects that prioritise the preservation of cultural values while fostering environmental sustainability.

## Spatial Analysis

# Mapping blue carbon opportunities on Country



### CASE STUDY 4

## Blue Carbon and Sea Country Adaptation Project

### Assessing the current state of blue carbon ecosystem distribution and identify potential restoration opportunities

As part of 'Blue Carbon and Sea Country Adaptation Project', funded by DEECA, Blue Carbon Lab conducted a tailored and comprehensive blue carbon assessment to map blue carbon opportunities within BLCAC and WTOAC. The study utilised historical maps and data to assess the current state of BCE distribution in the region and identify potential restoration opportunities. Through this initial assessment, we have gained valuable insights into the shifting distribution of BCEs and the significant ecosystem services they provide. Furthermore, the analysis identified 35,000 ha and 14,000 ha of land amenable for restoration through various management activities within Bunurong and Wadawurrung Country, respectively. While this analysis is a significant step forward, there is further potential to enhance its effectiveness by incorporating cultural value layers. Therefore, providing an additional level of detail to prioritise the protection and restoration of cultural values in tandem with the ecological benefits.

## Blue Carbon

# Site-level feasibility assessments

After conducting a broad scale spatial analysis to identify blue carbon opportunities, it is essential to undertake site-level scoping assessments for blue carbon projects. These assessments help provide a detailed understanding of the biophysical characteristics and conditions of each site, allowing for a more accurate estimation of the potential carbon sequestration and restoration outcomes. Site-level scoping assessments enable project planners and stakeholders to identify any potential challenges or constraints (e.g., legal feasibility, community buy-in) that may impact the success of the project and develop tailored strategies to address them effectively. The site-level scoping assessment needs to comprehensively consider both the costs and benefits of restoration to ensure a well-informed evaluation of the feasibility and potential impacts of the project. Additionally, these assessments ensure that the blue carbon projects align with the unique ecological and cultural context of the area, fostering a holistic approach that considers both environmental benefits and the needs and aspirations of TOs and local communities.

Including TOs in the site-level scoping assessments is crucial as they hold deep knowledge about the land and sea, and their meaningful engagement is essential for the success and sustainability of blue carbon projects.

Respect for Indigenous rights, including the principle of Free, Prior, and Informed Consent (FPIC), is necessary for blue carbon projects (Clean Energy Regulator, 2018). Involving TOs in the scoping process ensures that their perspectives, cultural values, and aspirations are taken into account, and that any potential impacts or benefits of the project are thoroughly understood and addressed. FPIC allows TOs to make informed decisions about their lands and resources, fostering a collaborative and equitable partnership that respects their self-determination and traditional custodianship, while harnessing the potential of blue carbon projects as a natural climate solution.

In addition, TOs must also undertake cultural heritage assessments as part of the restoration process. These assessments are essential to identify and protect significant cultural sites and values within the restoration areas. By integrating cultural heritage considerations into the restoration planning, TOs ensure that the on-ground actions align with their cultural responsibilities and respect the sacredness of the land. Engaging in cultural heritage assessments enhances the holistic approach to restoration, recognising the intrinsic connection between cultural and ecological values and strengthening the integrity of the restoration outcomes.



## CASE STUDY 5

# Site-level assessment: Hydrological modelling from levee removal in the Avalon Coastal Reserve

Avalon Coastal Reserve holds a series of decommissioned salt ponds, that could be restored back to saltmarsh ecosystems through the removal of levees and the reinstatement of natural tides. However, before any management action can be implemented on-ground hydrological and environmental assessments are required at this site.

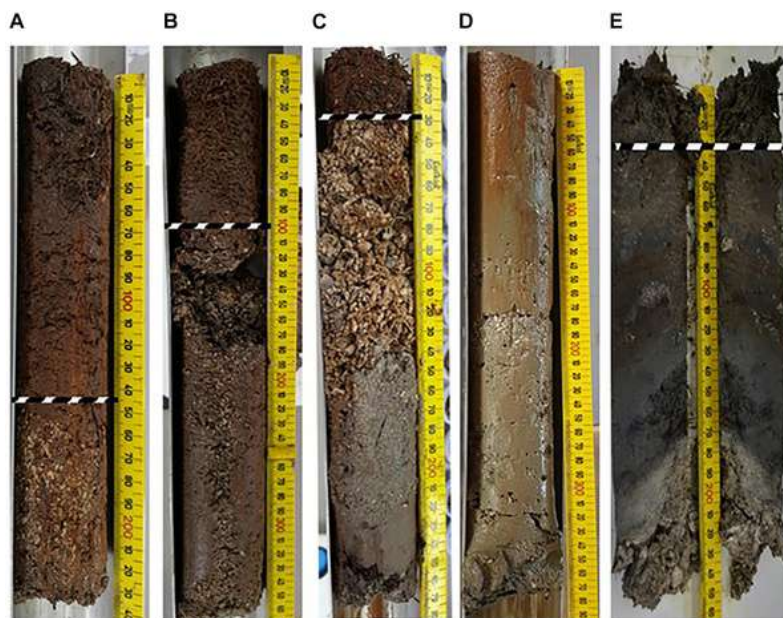
Avalon Coastal Reserve is located south of the Avalon Airport in Victoria, near Geelong. It was originally a low-lying coastal wetland; however, the land has been purchased and leased by Cheetham Saltworks for the construction of a salt field. Operations in the salt field lasted until 2002, with only limited operations maintained until 2017 when Parks Victoria assumed responsibility for the management of the site.

As part of the [Victorian Coastal Wetland Restoration Program](#), a carbon and hydrological assessment was undertaken at Avalon Coastal Reserve (Gulliver et al. 2020, Heimhuber et al. 2021). Carbon cores were collected across several salt ponds and saltmarsh habitats for carbon stock analysis and age-dating ( $^{210}\text{Pb}$ ). Given the complexity of the site and its location in an oceanic embayment, a detailed hydrodynamic model was also conducted to accurately predict the vegetation and inundation outcomes of different restoration options.

This project specifically aimed to optimise the restoration of the site for both shorebird habitat and blue carbon sequestration, while avoiding any conflicts with the cultural heritage and private properties. To find an optimal balance, the research team developed and tested a range of different restoration scenarios (i.e., no intervention, minimal modifications, substantial modifications, and fully engineered), which included the following steps:

- Development of a detailed and well-calibrated hydrodynamic model to simulate the inundation regime of each of these scenarios.
- Detailed RTK-GPS survey of relevant vegetation communities around the site to establish their elevation preferences.
- Tidewater levels survey to establish the corresponding hydroperiods and inundation regime.

Then, all these data were combined and the linkages between hydroperiod and vegetation were then used to infer the vegetation outcomes of each restoration option from the hydrodynamic model results. Overall, this local information could also be used to estimate potential carbon abatement and co-benefits provided by the restoration project. Further information is available on the [Program website](#) or an interactive [StoryMap](#).



Sediment cores collected during the carbon assessment. Dashed white line is horizon between an upper organic layer developed after saltmarsh return and the deeper levels of shell and gravel.



# Guidance for Traditional Owner engagement in BC projects occurring on private land

In Victoria, there is significant blue carbon opportunities that will occur on private land, with approximately 50% of private lands being amenable for blue carbon restoration through different land management actions (Costa et al., 2022). Currently, there is a notable absence of resources available for private landholders to effectively engage TO groups in blue carbon projects occurring across private land. Engaging TOs in blue carbon restoration on private land requires thoughtful strategies that foster consultation, collaboration, and co-management.

The development of a private land dedicated framework would provide a structured approach to facilitate collaboration, respect cultural protocols, and recognise Indigenous rights and interests. It would enable TOs to actively participate in decision-making processes, contribute their traditional ecological knowledge, and strengthen their stewardship over ancestral lands. Moreover, a private land framework promotes partnerships between TOs, landholders, and relevant stakeholders, fostering mutual understanding and shared responsibility for blue carbon projects.

By embracing TO engagement on private land, a framework could support the integration of Indigenous perspectives, enhances the ecological outcomes of blue carbon projects, and promotes reconciliation and cultural empowerment.



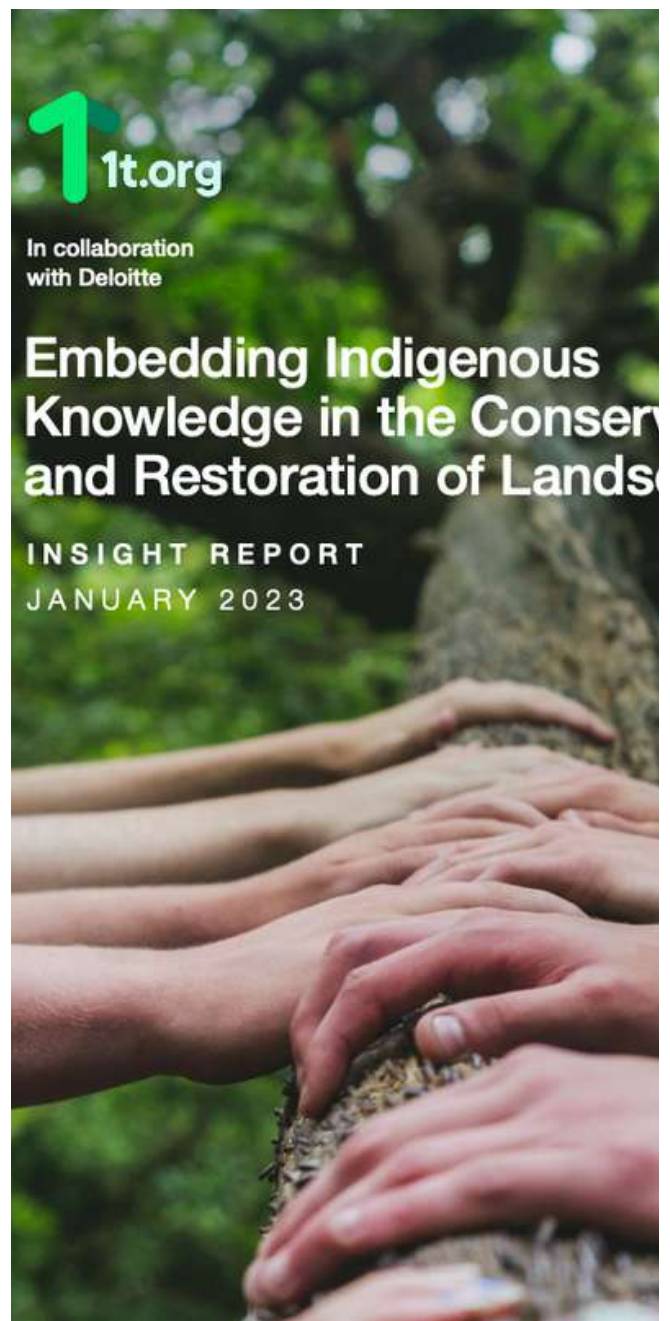
# Guidance for Traditional Owner engagement in BC projects occurring on private land

## CASE STUDY 6

### Embedding Indigenous knowledge in the conservation and restoration of landscapes

#### Exploring the relationship between investors and Indigenous people.

A [report](#) published by the World Economic Forum explores the relationship between investors and Indigenous people in the context of conservation and restoration of landscapes (World Economic Forum, 2023). Designed specifically for the investors, the report highlights a range of complexities (e.g., cultural load, gender roles, trust building, etc.) faced by Indigenous peoples arising from historical impacts, which investors must understand prior to engagement. While investors will be faced with complexities when working with different cultures and Knowledge systems, embedding Indigenous Knowledge and concepts into landscape conservation and restoration projects can lead to more effective and sustainable solutions. This report identifies and explores solutions to help investors manage these complexities delivered as a framework for action known as 'ALIVE' comprised of principles and practices.





## Blue Carbon

# Natural Resource Management

TOs can harness the skills and capabilities of their Natural Resource Management (NRM) teams to implement on-ground restoration and protection activities within BCEs, leading to employment opportunities for Indigenous communities. In addition, NRM teams, with their deep understanding of local ecosystems and traditional land management practices, play a crucial role in implementing restoration projects that align with TOs' Sea Country plans and cultural responsibilities. These teams can facilitate the coordination of restoration efforts, providing technical guidance, and ensuring that the restoration activities are conducted in a manner that respects traditional practices and ecological values. There is also opportunity to upskill and capacity with new and innovative approaches for ecosystem restoration (see AirSeed case study). By empowering their NRM teams, TO groups can strengthen their capacity to engage in meaningful stewardship and conservation, fostering a more sustainable and holistic approach to land and sea management, as well as employment opportunities for their team to work on Country.

## Blue Carbon

# Natural Resource Management

### CASE STUDY 7

## AirSeed Technologies

### Global-scale reforestation through drone technology

AirSeed is an innovative environmental restoration company created to increase carbon sequestration through global-scale reforestation through drone technology. Harnessing this technology, AirSeed is able to revegetate faster and cheaper than traditional manual planting practices. Their services include mapping and ground truthing the project site, manufacturing seed pods, planning and planting, and post-planting monitoring. AirSeed are able to use seed pods instead of seedlings, because their proprietary seed pod biotechnology contains soil, nutrients and minerals to support early stage seedling growth. Their drones have the capacity to plant up to 40,000 seed pods per day, and are able to work across remote, hazardous and inaccessible areas. AirSeed is partnering with Telstra to reforest 240 ha of land at Yarrowyck, NSW, planting around 158,000 trees and shrubs.



# Coastal Vegetation & TO Owned Nurseries

The establishment of seed banks is crucial for scaling up blue carbon projects and presents a unique opportunity for Aboriginal ownership. Seed banks serve as repositories for storing and preserving the seeds of native coastal vegetation species essential for ecosystem restoration. By collecting and storing a diverse range of seeds, seed banks ensure a reliable and sustainable supply of plant material for large-scale restoration efforts. Given the cultural significance and deep connection that Aboriginal communities have with the land, there is a natural alignment for Aboriginal ownership and management of seed banks. Aboriginal-owned nurseries can take on this role, combining their expertise in plant propagation with their cultural knowledge and custodial responsibilities. This ownership model not only strengthens the involvement of TOs in blue carbon projects but also facilitates the integration of traditional ecological knowledge and practices in seed collection, propagation, and restoration activities. Furthermore, Aboriginal ownership of seed banks fosters economic opportunities, capacity building, and cultural empowerment within Indigenous communities, reinforcing the importance of Indigenous-led conservation and restoration efforts in BCEs.



## Coastal Vegetation & TO Owned

# Nurseries

### CASE STUDY 8

## Mangrove nurseries in Queensland

**TOs leading the propagation and planting of mangrove seedlings to help stabilise eroding shorelines and enhance fish habitat**

For more than 10 years, the Bunya Bunya Country Aboriginal Corporation (BBCAC) have led the propagation and planting of mangrove seedlings to help stabilise eroding shorelines and enhance fish habitat. They have developed and refined knowledge on mangrove husbandry and active restoration methods, including mangrove species selection, soil characteristics and best practices. Of their many projects, their work at Golden Beach was highlighted at the [2021 Pumicestone Catchment workshop](#). Here, over 900 mangrove seedlings were planted over 5 years. The establishment and success of the seedlings was assisted by soil stabilisation, including the biodegradable structures that are also used by Blue Carbon Lab's [Regenerating Our Coasts Program](#). BBCAC's work has been supported by local council and catchment groups and state grants, as well as a partnership with researchers from James Cook University.



### CASE STUDY 9

## Victorian Terrestrial Nurseries

While there are currently no coastal plant nurseries led by TO groups in Victoria, there are several TO-led nurseries that specialise in native terrestrial and freshwater wetland plants. These nurseries may provide examples of the economic opportunity, partnerships, and community engagement for such an enterprise for nurseries that specialise in coastal plant propagation. For example, the [Willum Warrain Aboriginal Bush Nursery](#) run by the Willum Warrain Aboriginal Association (Bunurong Country, Mornington Peninsula) provides retail and wholesale nursery services. They also have a walking trail and billabong area on-site to view the plants in-situ. In Western Victoria, the [Dalki Garringa Native Nursery](#) in Wail managed by the Barengi Gadjin Land Council provide a range of services, including project-specific propagation and plantings for council, government, commercial and NGO groups. Warnambool-based [Worn Gundidj Nursery](#) centre their business around keeping sustainable values, providing expert advice, and enhancing community enterprise through social engagement programs.

There are non-TO managed nurseries in the Naarm-Melbourne area that have experience with coastal plant husbandry. [Advance College Native Nursery](#) on Mornington Peninsula has extensive experience with seagrass (*Zostera muelleri*) and mangrove (*Avicennia marina*, grey mangrove) husbandry, and supplies propagules for restoration trials in Western Port and Port Phillip Bay. Some Landcare groups (e.g., [Bellarine Landcare](#)) have experience in saltmarsh husbandry, including Saltbush (*Atriplex* spp.), Austral Seablite (*Suaeda australis*) and Beaded Samphire (*Sarcocornia/ Salicornia quinqueflora*).

# Blue Carbon

## Monitoring Restoration

Monitoring restoration outcomes in blue carbon projects is crucial to assess the effectiveness of the implemented activities to ensure they deliver the desired environmental benefits. Long-term monitoring allows for the evaluation of carbon sequestration and storage, as well as the overall health and resilience of coastal wetland ecosystems. In restoration monitoring, combining the insights of modern ecological science (Cadier et al., 2020) together with traditional cultural knowledge (Berkes et al., 2000) has great potential in its application, allowing for a more comprehensive assessment of blue carbon project outcomes, combining quantitative data with TOs' qualitative insights, ensuring a holistic approach that respects and values the contributions of both knowledge traditions, and providing a deeper understanding of ecosystem dynamics. TOs can play a central role in developing and implementing monitoring programs, ensuring that the restoration aligns with their Sea Country plans and reflects their long-term stewardship goals for the land and sea. Their active involvement fosters effective collaboration to establish culturally appropriate monitoring and evaluation methods that includes both ecological and cultural indicators.

TOs can use their deep understanding of ecosystem dynamics, seasonal changes, and local indicators to develop their own monitoring programs, incorporating traditional ecological knowledge and cultural practices (e.g., storytelling). Through narratives and anecdotes, TOs can pass down information about changes in BCEs and environmental conditions from generation to generation. Recording and documenting these stories can contribute to long-term monitoring efforts and provide valuable insights into historical ecosystem trends. This approach recognises the unique insights that TOs possess about their lands and waters and contributes to a more holistic and culturally appropriate monitoring framework.



For Indigenous-led carbon projects, the Aboriginal Carbon Foundation (AbCF) has developed a core benefits framework, that creates an opportunity for Indigenous peoples to become experts in the verification process. It aims to highlight the multiple benefits these projects bring, including not only carbon sequestration but also social, cultural, and economic advantages for Indigenous communities and the environment. The framework ensures that the full value and impact of these projects are recognised and appreciated by stakeholders, investors, and the wider public. In its guiding principles the framework is built upon indigenous to indigenous verification, aboriginal ownership, strength-based approach, capacity building, data triangulation and cost effectiveness (Aboriginal Carbon Foundation, 2019).

In addition to traditional monitoring approaches, TOs can embrace and incorporate Western monitoring approaches, such as remote sensing and drones, to effectively monitor and track restoration outcomes in their land and sea management efforts. Integrating these technologies with their traditional ecological knowledge allows for a more comprehensive and data-driven assessment of ecosystem changes over time. Remote sensing, which involves using satellites or aircraft to capture high-resolution images, can provide valuable information on vegetation cover, land use, and other environmental indicators (Malerba et al., 2023). Drones, on the other hand, offer a flexible and cost-effective way to conduct on-the-ground assessments, capturing real-time data on vegetation health and habitat conditions (Lanceman et al., 2022). Both remote sensing and drones will be valuable tools for reporting on blue carbon projects under the Emissions Reduction Fund, with carbon abatement determined by the extent of BCE vegetation within the project boundaries. By harnessing additional monitoring tools, TOs can strengthen their stewardship of Country, enhance ecological understanding, and bolster their active engagement in blue carbon and conservation initiatives.





## Blue Carbon

# Monitoring Restoration

### CASE STUDY 10

## Seagrass and dugong monitoring program

### TO-lead seagrass and dugong monitoring program using drones

The Giringun Traditional Owners are taking the lead in a [high-tech seagrass and dugong monitoring program around Hinchinbrook Island](#), North Queensland. With the support of TropWATER scientists, Indigenous rangers are equipped with small drones for dugong surveys, while helicopter and boat-based surveys generate digital maps of seagrass habitats. The program, funded by the Great Barrier Reef Foundation's Healing Country Grant, empowers Indigenous-led Sea Country management and enriches scientific knowledge, bridging western science and Indigenous wisdom to protect and manage these crucial habitats. Through this initiative, Indigenous rangers and TOs are actively contributing to building scientific data for dugong and seagrass management, fostering employment opportunities and cultural connections with Country. The program also explores emerging technologies like drones, AI, genetics, and animal-borne tracking tags, providing unique insights and enabling fast collection of data. The success of this initiative sets an encouraging precedent for future Indigenous-led monitoring programs, fostering a vision of self-sufficiency for Indigenous People in Sea Country monitoring.



### CASE STUDY 11

## Developing a Yawuru bilarra (wetland) monitoring program

### Knowledge sharing on blue carbon topics and demonstration of blue carbon sampling techniques

The Yawuru people, TOs of the lands and water in and around Rubibi, hold a unique position as they own and manage a pastoral lease that extends over their traditional Country and Native Title area, including the Yawuru Indigenous Protected Area (IPA). Balancing economic participation, custodial rights, and the preservation of their Country and important sites is a complex challenge. To address this, the Nyamba Buru Yawuru Ltd Environmental Services Unit and Country Managers conducted research on the condition of Roebuck Plains and its bilarra (wetlands). Yawuru's Cultural Management Plan and IPA Plan guide their monitoring and management activities. In collaboration with researchers from the University of Western Australia, Yawuru developed a scientifically sound bilarra monitoring program to facilitate adaptive management (Dobbs et al., 2022). The four-year project embraced a multiple evidence-based approach, combining Indigenous and university-based science to understand bilarra ecology better. Ongoing knowledge-sharing and collaboration between Yawuru staff and researchers ensured the monitoring protocol was adapted to meet information needs and Yawuru's ecological knowledge. Country Managers are now using the adapted protocol to record information at important bilarra sites, influencing management decisions and improving the health of the wetlands.

# Project Level Environmental Economic Accounting

Environmental Economic Accounting (EEA) is one way to order and record the benefits of BCEs to society. EEA is an organising framework for collecting and reporting data on physical and economic aspects of the environment. It is increasingly being used to record data on the natural value of marine and coastal environments, the services these ecosystems provide humans, and in turn the impact human activity can have on them. For example, in August 2022 the Australian Bureau of Statistics released the first phase of the National Ocean Ecosystem Accounts and at a project level for Geographe Bay in Western Australia (IDEAA Group, 2020).

At project level, the application of EEA to coastal BCEs is in its infancy, with few experimental case studies in existence. Some case studies have studied services and benefits of BCEs to people and nature; this includes research on services, such as wave attenuation (Losada et al., 2017) and fisheries (Jänes, Macreadie, Nicholson, et al., 2020). However, there have been fewer studies that have included coastal wetlands into an EEA framework (Carnell et al., 2019), and even fewer that have included first nations values.

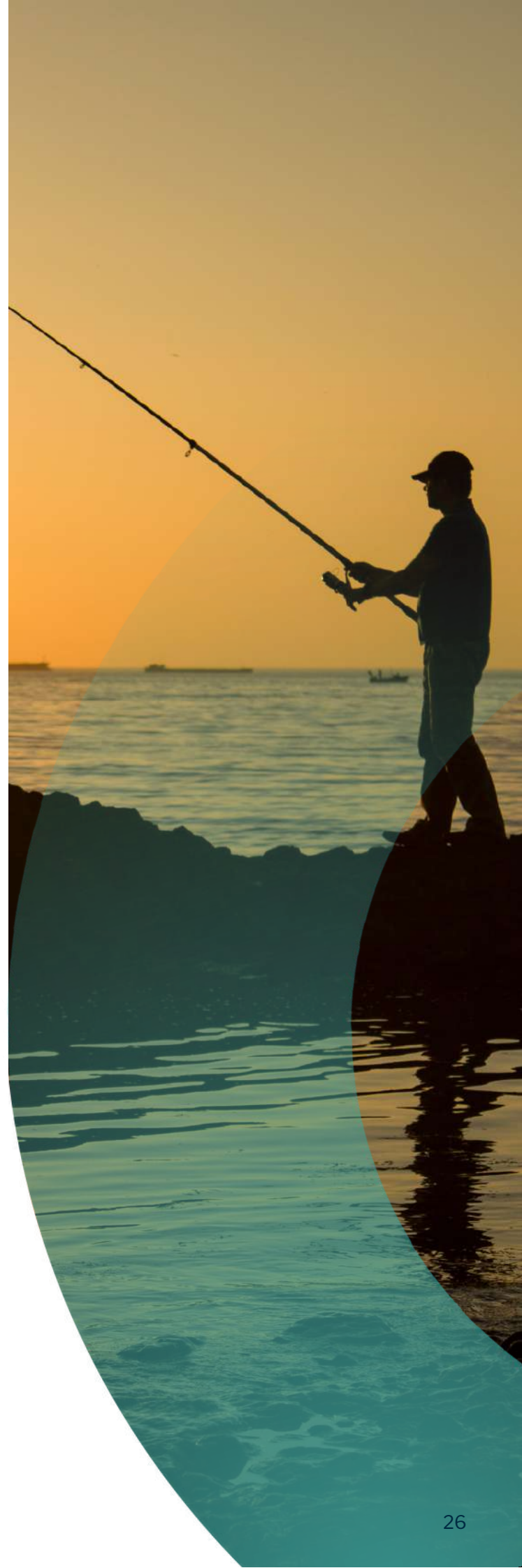
By incorporating cultural benefits into environmental economic accounting frameworks, the value of cultural ecosystem services can be recognised and integrated into decision-making processes. This approach ensures that the cultural significance of coastal wetland restoration is given proper consideration alongside other environmental and economic considerations. However, establishing a way to account for Indigenous cultural values and uses within EEA process brings unique challenges and opportunities (Larson et al., 2023). One challenge is that Indigenous worldviews are holistic thus their relationships with the environment are not reducible to a use or service per se, and their values are relational.



EEA processes use technical methods to study how nature and society interact and presume all components are identifiable, discrete, material and hence measurable (Manero et al., 2022). It is therefore problematic and possibly culturally unacceptable to separate – and quantitatively measure values from or traded off from each other – it is not possible to measure what is considered in Indigenous terms, the unmeasurable. There is also no substitute for sacred goods and services. Indigenous knowledge is specific and culturally held by certain people, so how it gets treated within an EEA process needs care. Assessments need also to respect and reflect recognition of various cultural losses that may have occurred in the area due to colonisation (Bostedt & Lundgren, 2010; Reid & Rout, 2018).

Despite this, the identification of Indigenous values in EEA process can have benefits. It can assist in Caring for Country for the relevant Indigenous group but also identify the impact /value of Indigenous cultural resource management (ICNRM) on and for the system (Normyle et al., 2022). Further, current EEA processes tend to focus on the flow of benefits from nature to people but do not recognise the reciprocal responsibilities of people to care for the environment, enacted by Australian Indigenous peoples via the process of Caring for Country. Cultural accounts can also help to document biocultural values in formats relevant to management. Acknowledgement of this circularity is integral to developing a cultural account within the EEA process.

In a soon-to-be-released report authored by the Blue Carbon Lab, in collaboration with scientists and Traditional Owners, the team documented the approach to account for the many ecosystem services and benefits provided by coastal wetlands, including First Nations values (See example Figure 1 below). This approach will allow First Nations values (for some examples see Table 1) to be included alongside Environmental Economic Accounts in future blue carbon restoration projects.



## Project Level

# Environmental Economic Accounting

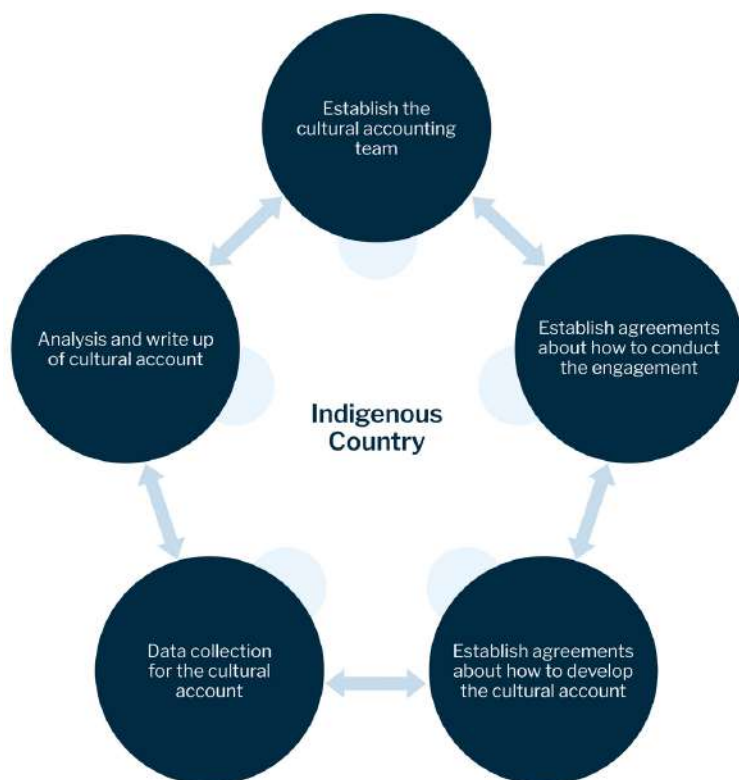


Figure 1: Five step pathway approach to implement engagement, partnership, and cultural account to be incorporated into Environmental Economic Accounting

Table 1: A summary of how values can be conceptualised, and which demonstrate material and non-material values. From Carnell et al. Unpublished.

Value Domain	Examples of values
Physical sites that support cultural activity	Cultural /dreaming sites, food sites, medicine sites, art/knowledge sites
Natural resources that support cultural activity	Water, air, soil, plants, animals
Accessibility to the system	Level of disruption, level of revitalisation, extent, scope of access to Country, native title recognition of Country
Knowledge about the system	Language, stories, TEK, Lore, Calendar
Wellbeing indicators	Residence/housing on Country, social/familiar relations, health indicators, security/work

## Project Level

# Environmental Economic Accounting

### CASE STUDY 12

## Accounting for benefits from coastal restoration: a case study from East Trinity Inlet

### Implementation of the draft guidance prepared in the 'Guide to Measuring and accounting for Impacts of Restoration projects in Coastal Blue Carbon Ecosystems', including a cultural account.

This case study reports on the assessment of the impacts of a restoration of a site in East Trinity, a region that is a mixture of wetland habitats (which include mangroves and saltmarshes), located directly to the east of the city of Cairns. This site has been impacted over the years by works that resulted in significant acid sulphate soil and in 2001, the Queensland Parks and Wildlife Service began remediation of the site. The restoration as resulted in ecological improvements and effective remediation across most of the site, including reduction of acid run off. This case study implements the draft guidance prepared in the EEA Guide (Carnell et al. In preparation), and includes a cultural account, which was co-developed with the Mandingalbay Yidinji people, on whose Country the site is located.

Analysis found a net increase in BCE extent of 110 hectares. Increase in saltmarsh extent was largely offset by decrease in mangrove extent. Other land covers decreased significantly, while water bodies increased. Intertidal seagrass and intertidal mudflats were not detected within the site. East Trinity provides a range of cultural services to the TOs.

These include services from harvesting, ceremony, knowledge generation, transmission, and governance. Emphasis is on the importance of the site for identity, recreation, wellbeing, family, and community.

The analysis also demonstrates the circular nature of ecosystem provision, as it includes both services derived from the ecosystem, but also other services, such as Caring for Country, which offer benefits to the ecosystem. Ecosystem service values included increases in recreational fishing (\$187,063 per year and \$474,500 welfare value) and bird watching activities (\$17,712 per year and \$31,446 welfare value), significant water quality improvements (7 tons of nitrogen, 1,220 tons of suspended sediments, and 1.1 ton of phosphorous per year), and carbon abatement changes (\$2,447,023 - \$15,640,268 over analysis period). In comparison, the restoration works to date have cost \$9,822,961 since 2001.



Photo taken by Celeste Hill

## **Blue Carbon**

# **Economic Empowerment Opportunities**

### **OPPORTUNITY 1**

## **Carbon Credits**

### **OPPORTUNITY 2**

## **Biodiversity- Nature Repair Market**

### **OPPORTUNITY 3**

## **Stewardship Payments**





## Blue Carbon

# Carbon Credits

Australia's Emissions Reduction Fund (ERF) is a government initiative, administered by the Clean Energy Regulator (CER), designed to reduce greenhouse gas emissions and promote carbon sequestration. Through a number of CER eligible activities, project proponents can earn Australian Carbon Credit Units (ACCUs)- representing one tonne of carbon dioxide sequestered, which can be sold or traded in the carbon market. These projects can include activities such as reforestation, savanna burning management, and restoration of BCEs. The fund aims to encourage emission reduction activities across various sectors while supporting Australia's climate change mitigation efforts.

Australia's new blue carbon method under the ERF focuses on restoring BCEs by reintroducing tidal flows through the removal or modification of barriers like sea walls or drains. The method allows for the earning of ACCUs by establishing BCEs and considers soil carbon, above and below-ground vegetation carbon, and emissions avoidance from reintroducing tidal flows. By introducing this method, it opens the door for Traditional Owners, landholders, and managers to actively participate in blue carbon projects, promoting sustainable practices for both land and sea management. However, due to the methods complexity and high cost for implementation, there is yet to be a registered project in Australia, despite the method being release in January 2022.

There is opportunity to develop additional blue carbon methods that restore or protect BCEs through various management activities. The CER, who is responsible for developing new ERF methods, is shifting to a collaborative co-design process with industry, end-users, scientists, and technical experts. There is a widespread recognition of the need to develop Indigenous-led methods aligned with traditional land management and cultural responsibilities, exemplified by the savanna fire management method.



There are several National Environmental Science Program (NESP) projects, such as [‘NESP 3.8 Carbon and biodiversity enhancement wetlands through controlling disturbances in wetlands from feral ungulates’](#), [‘NESP 3.9 Indigenous led management of large feral animals’](#), and [‘NESP 3.20 Indigenous land management prepared for environmental markets’](#), that are actively working towards the development of new methods related to wild herbivore management and traditional land management.

Participating in the Australian carbon industry presents a significant opportunity for Indigenous people to achieve economic empowerment while aligning with their aspirations for Caring for Country. However, there remains many challenges that currently limit the participation and benefits of Indigenous people in the carbon industry, including lack of access to expert advice, high capability requirements, land competition, and eligibility restrictions (Australian Government ILSC, 2022). Specifically, Indigenous rights, including free, prior, and informed consent, need to be respected, and Indigenous groups require access to unbiased information and support for assessing and managing carbon projects. Capability-building services are needed, particularly outside the savanna zone where Indigenous project ownership is limited. The development of Indigenous-led methods that align with traditional land management practices is crucial to overcome barriers and leverage cultural responsibilities. Innovative partnerships between Indigenous and non-Indigenous entities can help create opportunities in areas with limited Indigenous land tenure.

Another challenge in the carbon industry, which often excludes Indigenous-led landscape projects, is the concept of additionality. Currently, additionality requirements prioritise "new" practices, additional to what would have occurred in the absence of the project. This disregards the sustainable protection and stewardship of landscapes led by Indigenous peoples. Traditional practices should be considered "additional" when it amplifies efforts for holistic outcomes or serves as a necessary step towards healing the damage caused by past unsustainable practices (World Economic Forum, 2023). There are calls to redefine requirements for additionality in a way that recognises and encourages sustaining or scaling existing Indigenous practices. Addressing these challenges is essential for strengthening the participation, leadership, and power of Indigenous people and businesses in the carbon industry.



# Blue Carbon

# Carbon Credits

## CASE STUDY 13

### 3.20 Blue Carbon and Environmental Repair markets: Supporting participation by Indigenous communities

**Empower Indigenous organisations through consultation, research, and co-design processes to ensure their active and confident participation in these markets.**

Project 3.20 focuses on addressing the challenges and opportunities presented by Australia's Blue Carbon and Environmental Repair markets for Indigenous communities. These markets offer significant funding prospects for Indigenous land and sea country management, but barriers such as navigating legislation, land tenures, and resource ownership must be overcome. The project aims to empower Indigenous organisations through consultation, research, and co-design processes to ensure their active and confident participation in these markets. By addressing knowledge gaps, considering protocols for informed consent, and synthesising Indigenous interests and rights, the project seeks to facilitate Indigenous involvement in the markets and support the sustainable management of their land and sea Country. The ultimate goal is to collaboratively create a new framework for decision-making, empowering Indigenous managers to play a significant role in the Blue Carbon and Environmental Repair markets.





## Blue Carbon

# Biodiversity- Nature Repair Market

Australia's Emissions Reduction Fund (ERF) is a government initiative, administered by the Clean Energy Regulator (CER), designed to reduce greenhouse gas emissions and promote carbon sequestration. Through a number of CER eligible activities, project proponents can earn Australian Carbon Credit Units (ACCUs)- representing one tonne of carbon dioxide sequestered that can be sold or traded in the carbon market. These projects can include activities such as reforestation, savanna burning management, and restoration of BCEs. The fund aims to encourage emission reduction activities across various sectors while supporting Australia's climate change mitigation efforts.

There is opportunity to develop additional blue carbon methods that restore or protect BCEs through various management activities. BCEs are widely recognised by the ecosystem services they provide to coastal communities, which include carbon sequestration (Macreadie et al., 2021), coastal hazard mitigation (Arkema et al., 2013; Temmerman et al., 2013), reduction of nutrients (Nelson & Zavaleta, 2012), biodiversity (Carugati et al., 2018) and fisheries enhancement (Jänes, et al., 2020a; Jänes et al., 2020b; Jinks et al., 2020). Globally, coastal wetlands are estimated to deliver \$20.4 trillion annually in ecosystem services (Davidson et al., 2019), while in Victoria, it has been estimated that coastal wetlands provide approximately \$121 billion annually in combined benefits, including coastal hazard mitigation, fisheries enhancement, nitrogen and carbon sequestration (Costa et al., 2022).



Despite their ecological significance, Australia's natural environment is currently experiencing a concerning state of decline, largely attributed to the impact of climate change and unsustainable resource use (Cresswell et al., 2021). While there is already an established carbon market, markets for water quality (Eco Markets Australia, 2021), and biodiversity preservation are emerging.

In response to this environmental deterioration, the Australian Government has developed the Nature Positive Plan (DCCEEW, 2022), with the primary objective of implementing more effective environmental protections and reforms. A key component of this plan involves the establishment of a nature repair market, which will serve as a transparent framework for issuing tradeable biodiversity certificates to landholders engaging in projects that protect, manage, and restore nature. The proposed bill aims to boost private sector investment in nature repair, while providing landholders with enhanced opportunities to safeguard and manage their land effectively. Aligned with the Australian government's commitment to protect 30% of the country's land and seas by 2030, as well as the global goals set by the United Nations Convention on Biological Diversity, this market will operate alongside carbon markets and will be regulated by the Clean Energy Regulator to ensure its integrity. All landholders, including First Nations peoples, conservation groups, and farmers, will be eligible to participate in the market by undertaking projects to improve or establish habitat.

## Blue Carbon

# Biodiversity- Nature Repair Market

### CASE STUDY 14

## Wilderlands Voluntary Biodiversity Credits

**Permanently protecting and actively managing land of high ecological value**

Wilderlands have developed one of the world's first voluntary biodiversity credits and launched a platform to make it easy for anyone to start protecting nature today. The Biological Diversity Unit (BDU) represents 1 m<sup>2</sup> of permanently-protected and actively managed land of high ecological value. Each BDU is geotagged to enable supporters to track their impact through their personal profile, receive regular reports from expert ecologists on the ground and watch as nature flourishes thanks to their support. BDUs are not designed as a direct offset for biodiversity or habitat loss, instead they support net biodiversity gain and contribute towards the COP15 goal of 30% Earth's land and ocean protected by 2030 target. Wilderlands currently support four projects across Australia including Coorong Lakes, Crowes Lookout, Alleena, and Budgerum.

### CASE STUDY 15

## Cassowary Credits

**Cassowary Credit represents a quantified amount of improvement in rainforest condition**

The Cassowary Credit Scheme is a new biodiversity market scheme that was developed by Terrain NRM to increase investment into the Wet Tropics region for habitat restoration. It is a mechanism that enables investors, such as governments, philanthropists or corporates, to pay landholders and land managers to undertake habitat restoration activities. A Cassowary Credit is a quantified amount of improvement in rainforest condition, achieved using an approved method that can be measured, verified and converted to credits. A cassowary credit is earned through rainforest reinstatement, repair, threat mitigation or enhanced protection. Landholder projects are monitored and payments are based on actual achievements.





## Blue Carbon

# Stewardship Payments

Stewardship payments are financial incentives provided to landholders or custodians for the responsible management and conservation of natural resources and ecosystems. In the context of TOs, stewardship payments can be a valuable tool to support them in managing and conserving coastal wetlands in alignment with their Healthy Country plans and ambitions. These payments recognise the critical role of TOs in maintaining the ecological health and cultural significance of these wetlands. By receiving financial support, TOs can invest in capacity building, undertake ecological restoration actions, and implement monitoring programs to ensure the long-term health and resilience of coastal wetlands. Stewardship payments also contribute to economic empowerment, creating opportunities for TOs to continue their custodial responsibilities while fostering sustainable land and sea management practices. This approach enhances collaboration between TOs, government agencies, and conservation organisations, encouraging the use of Indigenous knowledge and practices to safeguard these vital ecosystems for generations to come.

In Victoria, the State Government has the [BushBank First Peoples grant](#) that supports Traditional Owner participation in land restoration and carbon markets. The grant provides opportunities for First Peoples organisations to increase their ability to achieve self-determination and economic independence through internal capacity building or undertaking on-ground activities that align with their aspirations for Country. BLCAC was successful in receiving funds from this grant opportunity in 2022. BLCAC's project has been designed to empower the Bunurong team to better understand blue carbon ecosystems across Western Port, and to enable them to make decisions about restoration opportunities with Indigenous knowledge and perspectives.

# Blue Carbon

# Stewardship

# Payments

## CASE STUDY 16

### Traditional Owner Reef Protection

**Initiative aimed at achieving Indigenous rights and aspirations for ownership, access, and involvement in the formal governance and management of Sea Country**

The Traditional Owner Reef Protection component is an initiative aimed at achieving Indigenous rights and aspirations for ownership, access, and involvement in the formal governance and management of Sea Country. It seeks to create a stronger Indigenous-led approach to Reef management, respecting cultural values and diversity. Through a \$51.8-million investment from the Great Barrier Reef Foundation's Healing Country Grant, the program empowers TOs to lead and co-design Reef protection efforts, enabling the implementation of a Traditional Owner Future Fund and contributing to Reef bio-cultural health. The program includes activities such as crown-of-thorns starfish control, reef monitoring and reporting, reef restoration and adaptation, and promoting healthy waterways. It fosters collaboration, innovation, and leadership among TOs, integrating Indigenous knowledge with scientific data for a thriving and sustainable Reef.



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