Biodiversity, Australia's National Ecosystem Accounts and the Global Biodiversity Framework

How biodiversity connects ecosystems, economics and society – and delivers a way forward

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Abstract

Biodiversity plays an essential role in supporting human wellbeing through maintaining functioning ecosystems that deliver essential services and economic benefits. There is an urgent need to integrate biodiversity information with broader ecosystem and economic information in ways that will be valuable for those involved in environmental restoration and protection, especially governments and land managers.

In February 2025, Australia's first National Ecosystem Accounts (NEA) were published in a collaboration between the Australian Bureau of Statistics (ABS), the Department of Climate Change, Energy, Environment and Water (DCCEEW) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The publication of these accounts not only provides an Australian perspective on how the System of Environmental-Economic Accounting (SEEA EA) can be used to guide national ecosystem accounts development, but in our paper we outline how these accounts can be used to support international commitments such as reporting for the 2022 Kunming-Montreal Global Biodiversity Framework (GBF) and Sustainable Development Goals (SDGs), as well as progress towards Australian government policy of the National Biodiversity Strategy and Action Plan (Strategy for Nature 2024-2030).

The SEEA EA provides the framework to spatially organise and aggregate biodiversity indicators such as the GBF, and we specifically address how the NEA engages with the GBF indicators A2 (extent of natural ecosystems) and B1 (services provided by ecosystems). The NEA includes ecosystem extent, ecosystem condition for select ecosystems and a set of ecosystem services; additionally, metrics on feral species and threatened species were included, with a spotlight on feral mammals providing an opportunity to delve into possibilities for future publications for biodiversity. Finally, we discuss the challenges and opportunities of applying a SEEA EA approach for national level monitoring of biodiversity within the GBF for Australia.

Introduction

Biodiversity plays an essential role in supporting human wellbeing through maintaining functioning ecosystems. These, in turn, deliver essential services that people rely on, such as food, water and the regulation of our climate, as well as other benefits such as the aesthetic enjoyment of natural landscapes, and economic growth, with over half of global GDP thought to be dependent on nature (UN, 2025). In Australia, biodiversity is especially important and valuable for Australia's agriculture and tourism industries.

Biodiversity, or biological diversity, is defined as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems according to the Convention on Biological Diversity (CBD, 2006).

However, biodiversity is in global decline across a range of taxonomic groups, occurring at genetic, species and ecosystem levels (IUCN 2025). For example, the IUCN Red List, an international list of assessed species and their status, currently has over 47,000 species 'threatened with extinction' (IUCN, 2025). The latest Living Planet Index showed the average decline in wildlife populations since 1970 was 73%, and explained that ecosystems and the benefits they provide to people can be negatively impacted when species become extinct or their populations fall to low levels (WWF, 2024). In addition, biodiversity experts believe that since 1500, 30% of species worldwide have become extinct or are threatened; they are also concerned that the impact of global biodiversity loss may be worse than first thought, and note this loss will most likely 'decrease ecosystem functioning and nature's contributions to people' (Isbell et al., 2023).

Australia is one of seventeen countries considered megadiverse, with many endemic and diverse species. Together these megadiverse countries contain around 70% of the world's biodiversity (WEF, 2024). For Australia, this means 93% of flowering plants, more than 80% of invertebrates, 87% of mammals, 93% of reptiles, 94% of frogs, 74% of freshwater fishes and more than half of temperate marine fishes are endemic to Australia and can be found nowhere else (Dielenberg et al, 2024). However, as with the global state of biodiversity, Australian fauna, flora and ecological communities are in decline (Cresswell et al., 2021), with habitat loss, climate change and invasive species the main drivers according to the latest Australia's Environment report (van Dijk et al., 2025). Mass mortality events are increasing, such as the 2019-2020 bushfires, which directly impacted 51% of new additions to threatened and uplisted species (van Dijk et al., 2025). Currently there are 100 species formally recognised as extinct in Australia, and it is thought that actual figures of biodiversity decline are more dire than what is reported (Dielenberg et al., 2024).

While these indicators, data summaries, reports and indices all uniformly highlight an ongoing and serious decline in biodiversity, these outputs alone have so far been insufficient to invoke a successful intervention to halt or reverse biodiversity decline. To achieve this requires the integration of biodiversity information with social and economic information, which we explore in the next section.

The System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) and biodiversity

Biodiversity measures and indicators provide a way to organise biodiversity information and integrate and align it with other accounts, developed in accordance with the UN System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) international framework (UNSD, 2024). Biodiversity is required to maintain ecosystem function, which underpins ecosystem services, that benefits people and supports economic activity, and provides ecosystem resilience (King et al, 2021). There is also a need to integrate biodiversity information with ecosystem and economic information to ascertain areas of potential trade-offs and priorities. Understanding changes and integration of such information can then lead to ways to better improve conservation of species and ecosystems for the benefit of future generations.

Under the SEEA EA, biodiversity is expressed as a thematic, which means it is a standalone part of the ecosystem accounts that organises data around a specific policy-relevant environmental theme. It is important to note however that the work around biodiversity measures and indicators is less developed than other areas of the SEEA EA, and while SEEA EA offers guidance on the conceptual approach and the construction of these, it remains flexible about interpretation of these guidelines.

There are a growing number of countries producing measures of biodiversity (either as stand-alone or embedded with ecosystem or other accounts), such as the EU, the Netherlands, Mexico, USA, South Africa and Australia. While the theory around this has advanced, relatively few biodiversity thematics have been produced compared to output from the other areas of the SEEA EA, and so the next section of this report is concerned with what has been done in this space and identifies the relevant policy drivers for biodiversity.

A current limitation on the potential of measuring biodiversity is how to value biodiversity; this paper and the biodiversity accounts included in the NEA only address the physical side of biodiversity, as the monetary side is underdeveloped. However, within the NEA accounts more broadly the valuation of selected services has been included.

The Australian perspective: Australia's National Ecosystem Accounts (NEA)

In February 2025, Australia's first NEA were published in a collaboration between the Australian Bureau of Statistics (ABS), the Department of Climate Change, Energy, Environment and Water (DCCEEW) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (ABS, 2025).

The publication of these accounts shows how SEEA EA can be used to guide national ecosystem accounts and how the data can be used to support reporting requirements for the 2022 Kunming-Montreal Global Biodiversity Framework (GBF) (CBD, 2022). The NEA can also guide progress towards Australian government policy and international commitments such as the National Biodiversity Strategy and Action Plan (Australia's Strategy for Nature 2024-2030) (DCCEEW, 2024).

The GBF replaces and updates the Aichi Targets of the Strategic Plan for Biodiversity (2011 - 2020) (CBD 2020), which provided the initial impetus for measuring biodiversity while the SEEA EA was under development. The GBF outlines a vision where "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people". It also highlights the need for urgent action to be taken against the loss of biodiversity so that nature can be used sustainably for the benefit of all (CBD, 2024).

We specifically address how the accounts engage with the GBF indicators A2 (extent of natural ecosystems) and B1 (services provided by ecosystems). The NEA address ecosystem extent, condition and a selection of ecosystem services, with metrics on feral species and threatened species included; there was also a spotlight feature on feral mammals providing an opportunity to delve into possibilities for future publications for biodiversity.

In the NEA, estimates were produced not only for extent and condition, but also selected ecosystem services and valuation of those services, covering terrestrial, coastal, marine and freshwater ecosystems. This was an experimental account, using available data sources and methods.

For the terrestrial realm, all dryland ecosystems as well as transitional ecosystems (i.e. those between terrestrial and marine or freshwater, such as estuaries) were in scope, and included both natural and anthropogenic ecosystems. The years reported on were 2010-11, 2015-16 and 2020-21, and covered ecosystem biomes and ecosystem functional groups. Desert ecosystems comprised half of Australia's ecosystems while intensive land-use accounted for 15%. Condition measures for terrestrial ecosystems included bare ground cover (Bare Soil Index BSI), vegetation productivity (kernel Normal Difference Vegetation Index kNDVI), burnt area ratio (Normalised Burn Ratio NBR), canopy moisture (Normalised Difference Moisture Index NDMI) and surface water availability (Normalised Difference Water Index). Ecosystem services included grazed biomass provisioning, wild fish provisioning, water supply and global climate regulation.

For the coastal realm, mangrove and saltmarsh ecosystems which form wetlands that are regularly inundated with tidal seawater were in scope. Mangroves covered 1.1 million hectares of Australia, and saltmarsh covered 493.7 thousand hectares; both were predominantly in Queensland, the Northern Territory and Western Australia. Mangrove canopy cover was used as a measure of condition to determine the overall health and productivity of mangrove forests, as monitoring changes to canopy cover can detect if mangroves are responding to ecosystem disturbance. Coastal ecosystem services were measured as coastal protection for dwellings protected by mangroves and saltmarsh, as these ecosystems reduce damage to dwellings during storms and tidal surges.

For the freshwater realm, all permanent and temporary freshwater bodies, as well as saline waterbodies that are not directly connected to the ocean were in scope, however, the focus of the accounts was on the rivers and streams biome. For extent, non-perennial and perennial rivers were accounted for, with the length of non-perennial rivers equating to roughly half of that of perennial rivers. The condition of freshwater ecosystems, especially rivers, is strongly influenced by adjacent land use, as higher intensity land use is associated with the deterioration in the quality of river systems. Therefore land use intensity is used as a measure of inferred freshwater condition, and river length associated with natural land uses has decreased over time while more intensive uses have increased. Freshwater ecosystem services are mainly provided by rivers and streams as water supply for drinking, as a material or as an energy source. Surface water used as a material in production accounted for 86% of consumptive use and was valued at $1.18 billion in 2020-21; freshwater extracted for drinking was valued at $193 million.

For the marine realm, all ocean waters include benthic and open water ecosystems. For extent, the marine shelf and deep sea biomes were accounted for, with 70% of Australia's oceans being deep sea floor. Marine ecosystem services included wild fish provisioning, providing 56.3 million kilograms of wild fish to Commonwealth fisheries in 2020-21, worth $39.2 million.

Biodiversity in the National Ecosystem Accounts

How a biodiversity thematic is developed is important, as there are judgements to be made such as the need to consider the audience, scope, and appropriate data for inclusion, and these can then inform how to set up the biodiversity measurements and indicators correctly. There are different approaches for assessing biodiversity (for instance around an industry, such as Uganda's iconic tourism species (NEMA, 2021); the use of species indices, such as the TSX (TSX, 2025); the use of species accounts, such as the ACT's butterfly accounts (Bond and Vardon, 2023); or habitat-based accounts, such as the San Martin project in Peru (Conservation International, 2019)).

The NEA biodiversity assessments included species accounts with opening and closing stocks to show change over time, and an index. Information on feral animal and weed species, threatened species status and a threatened species index (TSX) were produced. The following tables were sourced from National Ecosystem Accounts, experimental estimates, 2020-21 financial year | Australian Bureau of Statistics. Many animals and plants have been introduced to Australia, and some of these developed into feral or weed populations. For instance, feral mammal (Table 1) and weed species (Table 2) have increased in number over time, with New South Wales and Victoria having the most feral mammals of all the states/territories, while New South Wales and Queensland had the most weed species by 2020. Feral animals and weeds can be a major problem for people and their environment, as well as industries such as agriculture.

Table 1: Number of feral mammal species recorded in ALA over time, by State/Territory

Region	2010 (no. species)	2015 (no. species)	2020 (no. species)
Australia	18	18	18
New South Wales	17	17	18
Victoria	16	17	17
Queensland	16	16	16
South Australia	14	16	16
Western Australia	11	11	11
Tasmania	10	10	10
Northern Territory	12	13	13
Australian Capital Territory	13	13	14

Table 2: Number of weed plant species observed over time, by State/Territory

Region	2010 (no. species)	2015 (no. species)	2020 (no. species)
Australia	82	83	83
New South Wales	62	64	67
Victoria	52	53	53
Queensland	50	53	56
South Australia	49	50	50
Western Australia	35	43	43
Tasmania	25	28	28
Northern Territory	22	22	24
Australian Capital Territory	35	35	36

The number of threatened species listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) in 2020 showed an increase in total numbers across all taxonomic groups (Table 3). For the TSX, an index compiled for threatened plants, birds, mammals and amphibians,

there was also a decline in threatened species populations across all groups (Table 4). Birds for example had an extra 10 species listed under the EPBC Act in 2020 (157 species) compared to 2015 (147 species), and mammals added an extra 5 species over the same period. For the TSX, nationally the index has declined between 2010 and 2020 across all taxonomic groups, with all populations lower than the reference year of 2000.

Table 3: Number of threatened animal species over time, by taxonomic group

Taxonomic group	2010 (no. species)	2015 (no. species)	2020 (no. species)
Birds	130	147	157
Mammals	123	130	135
Frogs	33	33	39
Fish	49	55	60
Reptiles	53	59	60
Other animals	42	55	67

Table 4: Threatened Species Index (TSX), relative to a reference year of 2000, by taxonomic group

Taxonomic group	2000	2010	2015	2020
Plants	1	0.57	0.4	0.31
Birds	1	0.66	0.52	0.46
Mammals	1	0.65	0.64	0.58
Amphibians	1	0.57	0.39	0.29
All	1	0.61	0.48	0.4

Trends in biodiversity can broadly indicate what the condition of ecosystems are over time. The data shows there is an ongoing decline in the 'quality' of our ecosystems as indicated by the decline in threatened species as well as the increase in introduced species. Because data underlying the feral animals and weed species accounts are spatially organized, this means they can be linked to other accounts which are related to these two measures, such as tourism, agriculture and land use.

The National Ecosystem Accounts and Australia's reporting requirements

The NEA can support Australia's reporting requirements to the Kunming-Montreal GBF, but as the accounts undergo refining they have the potential to address other GBF indicators and targets in the future. NEA currently addresses indicators A2 and B1, which cover the following:

1. A2 Extent of natural ecosystems
    - Natural (and anthropogenic) ecosystems
    - Realms, Biomes, Ecosystem Function Groups
2. B1 Services provided by ecosystems
    - Terrestrial: grazed biomass provisioning and carbon retention services
    - Coastal: coastal protection services
    - Freshwater: water supply services
    - Marine: wild fish provisioning

The NEA can also support Australia's national biodiversity policies, international commitments and strategies, with Australia's Strategy for Nature policy and the EPBC Act (DCCEEW, 2025) the key government frameworks for biodiversity. For example, the Strategy for Nature plan's priority area of 'Protect and conserve 30% of Australia's land and 30% of Australia's oceans by 2030', which also aligns

with GBF target 3, requires a long-term time series of ecosystem extent of terrestrial and inland waters, marine and coastal areas which the NEA already account for. The EPBC Act on the other hand is the overarching act which aims to protect Australia's biodiversity. NEA's biodiversity assessments, with their focus on threatened species and feral animal and weed species, can help inform Australia's strategies on these two groups as they provide indications on the condition (or 'quality') of ecosystems over time. There is also potential for the NEA to support other policies and agreements in future iterations, such as the Ramsar convention and our bilateral migratory bird agreements.

Challenges and opportunities of applying a SEEA EA approach for national biodiversity within the GBF for Australia

There are several challenges of applying a SEEA EA approach for national level monitoring of biodiversity within the GBF in a country like Australia. These include:

- the ability to accurately and regularly account for large, often remote and difficult-to-access areas both spatially and temporally,
- the incomplete species occurrence and distribution knowledge that is part of being one of the most megadiverse nations on Earth,
- taxonomic issues such as the ability to account for all taxa when species are still being described and discovered, and
- consideration as to how to account for migratory species (between ecosystems or even between countries).

However, despite these challenges new technologies provide the possibility of infilling gaps, particularly with the development of ecoacoustics, environmental DNA sampling, and the use of camera traps. These technologies would help address some of the gaps in the biodiversity dataset, especially for remote areas and for incomplete species knowledge, but there is still much refining to do.

There is a need to ensure that applying a SEEA EA approach retains the ability of biodiversity measures and indicators to be able to support the reporting requirements of the Australian government, including international reporting requirements; to be able to maintain flexibility of these measures and indicators for both Australian needs while able to compare and contrast with those of other countries. The final but critical consideration is the necessity of being able to link the biodiversity measures and indicators with valuation metrics to ensure relevance to society and government and the potential integration with the SNA.

Conclusion

If society and the economy are to thrive, measures of biodiversity must be considered as a key part in achieving outcomes to conserve biodiversity. Measuring biodiversity through a SEEA EA lens can integrate biodiversity information with societal and economic information in a way that supports and enables an appropriate understanding for decision-makers by connecting everything together.

The publication of the NEA shows how the SEEA EA can be used to guide national ecosystem accounts development, and how the measurement of biodiversity can provide a framework to bring together indicators and measures of interest to policy-makers. By engaging with biodiversity indicators such as the GBF indicators A2 (extent of natural ecosystems) and B1 (services provided by ecosystems), the NEA showcases a way forward. Our approach is an evolving one, within the confines of knowledge development and data availability, whilst aiming to meet the intent of SEEA EA to ensure we can better assess and measure biodiversity.

References

Australian Bureau of Statistics (ABS) (2025). National Ecosystem Accounts, experimental estimates, 2020-21 financial year | Australian Bureau of Statistics.

Bond, S. and M. Vardon (2023) Biodiversity accounts for the butterflies of the Australian Capital Territory The Society for Conservation Biology

Conservation International (2019) 'Accounting for Biodiversity in San Martín, Peru', presentation by M. Honzak Module-3

Convention on Biological Diversity (CBD) (2006). Article 2. Use of Terms, Convention Text.

Convention on Biological Diversity (CBD) (2020) Aichi Biodiversity Targets.

Convention on Biological Diversity (CBD) (2022) Kunming-Montreal Global Biodiversity Framework

Convention on Biological Diversity (CBD) (2024) 2050 Vision and 2030 Mission

Cresswell, I. D., Janke, T., and Johnston, E. L. (2021). Overview: Biodiversity. In: Australia State of the environment 2021, Australian Government Department of Agriculture, Water and the Environment, Canberra, https://soe.dcceew.gov.au/overview/environment/biodiversity, DOI: 10.26194/f1rh-7r05, ISBN: 978-0-646-86427-3; Biodiversity | Australia state of the environment 2021

Conservation International (2019) 'Accounting for Biodiversity in San Martín, Peru', presentation by Miroslav Honzak Module-3

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024) Australia's Strategy for Nature 2024–2030 - DCCEEW

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2025) Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) - DCCEEW

Dielenberg, J., Bekessy, S., Cumming, G. S., Dean, A. J., Fitzsimons, J. A., Garnett, S., Goolmeer, T., Hughes, L., Kingsford, R. T., Legge, S., Lindenayer, D. B., Lovelock, C. E., Lowry, R., Maron, M., Marsh, J., McDonald, J., Mitchell, N. J., Moggridge, B. J., Morgain, R., O'Connor, P. J., Pascoe, J., Pecl, G. T., Possingham, H. P., Ritchie, E. G., Smith, L. D. G., Spindler, R., Thompson, R. M., Trezise, J., Umbers, K., Woinarski, J. and B. A. Wintle. (2024). Australia's biodiversity crisis and the need for the Biodiversity Council - Dielenberg - 2023 - Ecological Management & Restoration - Wiley Online Library

International Union for Conservation of Nature (IUCN) Red List (2025). Background and history, IUCN Red List of Threatened Species

Isbell, F., Balvanera, P., Mori, A. S., He, J., Bullock, J. M., Regmi, G. R., Seabloom, E. W., Ferrier, S., Sala, O. E., Guerrero-Ramirez, N. R., Tavella, J., Larkin, D. J., Schmid, B., Outhwaite, C. L., Pramual, P., Borer, E., Loreau, M., Omotoriogun, T. C., Obura, D. O., Anderson, M., Portales-Reyes, C., Kirkman, K., Vergara, P. M., Clark, A. T., Komatsu, K. J., Petchey, O. L., Weiskopf, S. R., Williams, L. J., Collins, S. L., Eisenhauer, N., Trisos, C. H., Renard, D., Wright, A. J., Tripathi, P., Cowles, J., Byrnes, J. E. K., Reich, P. B., Purvis, A., Sharip, Z., O'Connor, M. I., Kazanski, C. E., Haddad, N. M., Soto, E. H., Dee, L. D., Diaz, S., Zirbel, C. R., Avolio, M. L., Wang, S., Ma, Z., Liang, J., Farah, H. C., Johnson, J. A., Miller, B. W., Hautier, Y., Smith, M. D., Knops, M. H., Myers, B. J. E., Harackova, Z. V., Cortes, J., Harfoot, M. B. J., Gonzalez, A., Newbold, T., Oehri, J., Mazon, M., Dobbs, and C., Palmer, M. S. (2023). 'Expert perspectives on global biodiversity loss and its drivers and impacts on people', Frontiers in Ecology and the Environment, March 2023, Vol 21, (Issue 3): 94-103. Expert perspectives on global biodiversity loss and its drivers and impacts on people - Isbell - 2023 - Frontiers in Ecology and the Environment - Wiley Online Library

King, S., Vardon, M., Grantham, H. S., Eigenraam, M., Ferrier, S., Juhn, D., Larsen, T., Brown, C. and K. Turner (2021). 'Linking biodiversity into national economic accounting', Environmental Science and Policy, Vol 116: 20-29. Linking biodiversity into national economic accounting - ScienceDirect

National Environment Management Authority, Uganda (NEMA) (2021) Biodiversity and Tourism Accounts for Uganda, Integrating Natural Capital into Sustainable Development Decision-making in Uganda, Biodiversity and Tourism Accounts for Uganda

Threatened Species Index, Australia (TSX) (2025). TSX – A threatened species index for Australia

United Nations (2025). Climate Action – Biodiversity: 'Biodiversity – our strongest natural defense against climate change'. Biodiversity - our strongest natural defense against climate change | United Nations

United Nations Statistical Division (UNSD) (2024). System of Environmental-Economic Accounting – Ecosystem Accounting. seea_ea_f124_web_12dec24.pdf

World Economic Forum (2024). 'World Environment Day 2024: 17 megadiverse countries'. World Environment Day 2024: 17 megadiverse countries | World Economic Forum

World Wildlife Fund (WWF). (2024) 'Nature in crisis: The current state of global nature loss'. Nature in crisis: The current state of global nature loss | WWF

Van Dijk, A., Rapley, S. and T. Lawrie (2025). Australia's Environment: 2024 report. 2024_Aus-Env-Report_FINAL-1.pdf

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