

Accounting for the Critically Endangered box-gum grassy woodlands

In brief

The monitoring of biodiversity can be hampered by a lack of systematic information. One approach to overcoming this is to use a standardised environmental accounting framework. This study examined changes in the extent and condition of Critically Endangered White Box-Yellow Box-Blakely's Red Gum Grassy woodland since it was listed, using the System of Environmental-Economic Accounting. The compilation of environmental-economic accounts was able to reconcile and integrate a range of data

sources, with 288 accounts produced. These accounts indicate that the listing of box-gum grassy woodlands has had minimal impact on the conservation of this ecosystem.

The total extent of box-gum grassy woodlands in 2017 was 3.536 million ha, with around 11% of this total in protected areas. Most woodland was in small patches on agricultural land. Since 2001, the extent of grassy woodland has declined in New South Wales but seen some gains in Victoria. Our study highlights deficiencies in the data available

for environmental-economic accounting, including the ability of remotely sensed information to identify changes in the extent and condition of ecosystems. The natural resource management regions which had the greatest declines in woodland extent are where maintenance and restoration could be targeted. These environmental-economic accounts can be used to monitor and conserve box-gum grassy woodlands and provide a platform for further work, and in particular for accounting for ecosystem services.



Box-gum grassy woodland near Young in NSW.
Image: E. Lindsay



Background

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (or box-gum grassy woodlands for short) was listed as a Critically Endangered ecosystem under the national *Environmental Protection and Biodiversity Conservation Act 1999* in 2006. In 2010, the extent of box-gum grassy woodlands was estimated to be less than 10% of its pre-European settlement distribution. The box-gum grassy woodlands occurred mostly within the Murray-Darling Basin and its loss is mainly due to agricultural activities – the fertile soils of this region, in addition to its reasonable rainfall and relative flatness, made it desirable for agriculture.

Despite box-gum grassy woodlands being listed as a Critically Endangered and the preparation of a National Recovery Plan, it is unknown whether this community's status has improved or declined. The ecosystem was estimated to have occurred across a large part of south-eastern Australia

(nearly 50 million ha) but now it mostly occurs on private land, making a systematic assessment of its status across its entire range difficult.

The System of Environmental-Economic Accounting (SEEA) is a statistical standard combining environmental and economic information into integrated accounts using common definitions and classifications to link to the System of National Accounts (SNA). The most familiar output of the SNA is Gross Domestic Product (GDP). SNA is representative of the human pressures on biodiversity. Unstructured information on biodiversity has been identified as a key problem for biodiversity management.

The SEEA has been promoted as a way of organising information for improving decision-making and accounts have been produced in Australia and internationally. To date, no study has attempted to link accounting to the laws designed to conserve biodiversity.

What we did

We identified and assessed a range of data for this project. Table 1 presents the data sources on land use, ecosystem type, protected areas and predicted likelihood of occurrence of box-gum grassy woodland that were cross-classified with land cover data to obtain estimates of the likely occurrence of box-gum grassy woodland between 2001 and 2017. The data were divided into the 27 natural resource management regions that were predicted to have box-gum grassy woodland, according to the mapping in the Ecological Communities of National Environmental Significance data set, and compiled into SEEA-aligned land accounts. We did not use state and territory classifications owing to differences between the definitions of ecosystems between them.

A workshop to discuss data sources, methods, preliminary results and possible applications of accounts was held in November 2019 with key stakeholders, including Australian Government agencies the Australian Bureau of Statistics, GeoScience Australia and the Department of Agriculture, Water and the Environment.

We were unable to undertake planned field measurements of box-gum grassy woodlands in 2020 due to COVID-19 restrictions. Instead, we investigated existing field data from more than 100 long-term Australian National University monitoring sites. This data was not used for the landscape level study as it was unclear from the data available whether the sites would be considered box-gum grassy woodland as defined in the

Main aims of the research

Our first aim was to collate and evaluate data available on land use, land cover and ecosystem extent for measuring the current status of box-gum grassy woodlands over its former range. Second, we aimed to create a suite of accounts for box-gum grassy woodlands using the SEEA. Third, we aimed to use these accounts to evaluate whether listing box-gum grassy woodlands had a positive impact and to determine

how the accounts could be used to better manage the recovery of box-gum grassy woodlands. It was originally planned to use the ecosystem extent accounts as the basis for estimating ecosystem condition and ecosystem services, but the available data and resources, and the advent of COVID-19 which meant field work was not possible, did not permit this.

What we did (continued)

EPBC Act, nor whether the sites were a representative sample of the remaining box-gum grassy woodland.

We sought evidence of expenditure on the activities identified in the

National Recovery Plan in the annual reports or budget statements of the federal and state/territory governments. While some evidence of expenditure on activities related to conservation of box-gum grassy

woodland can be inferred from these sources, expenditure against actions identified in the plan was not systematically recorded, and hence accounts for environment protection expenditure could not be produced.

Type of data	Data set name	Source	URL	Notes
Land use	Catchment scale land use for Australia 2018 (CLUM)	ABARES	https://www.agriculture.gov.au/abares/aclump/land-use/catchment-scale-land-use-of-australia-update-december-2018	Classification used is Australian Land Use Management (ALUM) Date of mapping varies depending on state and region and ranges between 2003 and 2018
Ecosystem type	National Vegetation Information System (NVIS)	DAWE	https://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system	Classification used is Australian Vegetation Attribute Manual (NVIS Technical Working Group (2017) Six main versions released between 2001 and 2020. Date of mapping varies depending on state and region
Ecosystem type	Ecological Communities of National Environmental Significance	DAWE (2020)	http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B184A3793-2526-48F4-A268-5406A2BE85BC%7D	Map of possible and likely distribution of box-gum grassy woodland Date of reference year unknown.
Land cover	Digital Earth Australia (DEA - ANU)*	ANU and GeoScience Australia (Van Dijk and Liao 2018)	http://dapds00.nci.org.au/thredds/catalog/ub8/au/LandCover/DEA_ALC/catalog.html	Data transformed using the definition of box-gum grassy woodland from DECCW-NSW (2010) 2000 to 2018
Protected areas	Conservation and Protected Areas Database (CAPAD)	DAWE	https://www.environment.gov.au/land/nrs/science/capad	11 iterations: 1997, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018 (e.g. DAWE 2018)
Agricultural production	Agricultural commodities, Australia	ABS	https://www.abs.gov.au/statistics/industry/agriculture/agricultural-commodities-australia/2018-19	Data available in separate ABS publications of the same for each financial year 2011-12 to 2018-19* (e.g. ABS 2020)

*The ABS timeseries for agricultural production extends further back but not for the current definition of NRM regions.

Key findings

The available data enabled the production of nine accounts for each of the 27 natural resource management regions that historically featured box-gum grassy woodlands, as well as aggregate tables for the 27 regions as whole and each of the four jurisdictions (ACT, NSW, Qld and Vic.). In total we produced 288 environmental accounts.

Overall, the total area of box-gum grassy woodland increased by a small amount, from 3.536 million ha in 2001 to 3.590 in 2017 (Figure 1). Figure 2 shows the likely distribution of box-gum grassy woodland in 2001 and 2017, and the areas of change between 2001 and 2017. Most of the decline was in natural resource management regions of New South Wales, while the largest increases were in Victoria (Figure 3). While the overall net gain in area is positive, it was not possible to determine the condition of areas lost and gained with the available satellite information. It is possible that the areas lost were in good condition (i.e., having many mature trees, a regenerating understorey and native grasses) and the areas gained were in poor condition or in the early stages of regeneration. The multiple data sources and models used meant that an empirical measure of the confidence in extent was not possible to calculate. Field work planned for 2020 to validate the predictive model was not possible owing to COVID-19 movement restrictions. The field work would also have been used to provide data that could have been used to model ecosystem condition. Remotely sensed estimates of condition by land cover are strongly correlated with rainfall and because the relationship of land cover condition to ecosystem

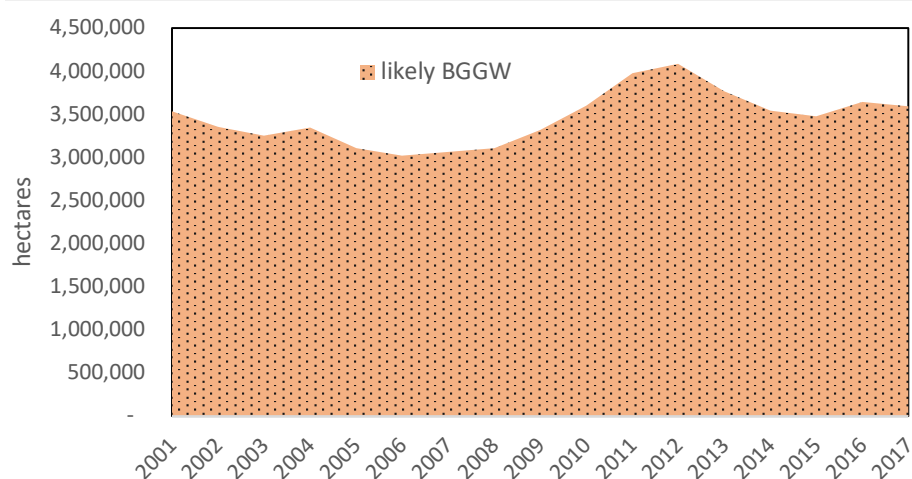


Figure 1. Area of likely box-gum grassy woodland extent in 2001 and 2017, and the change between 2001 to 2017.

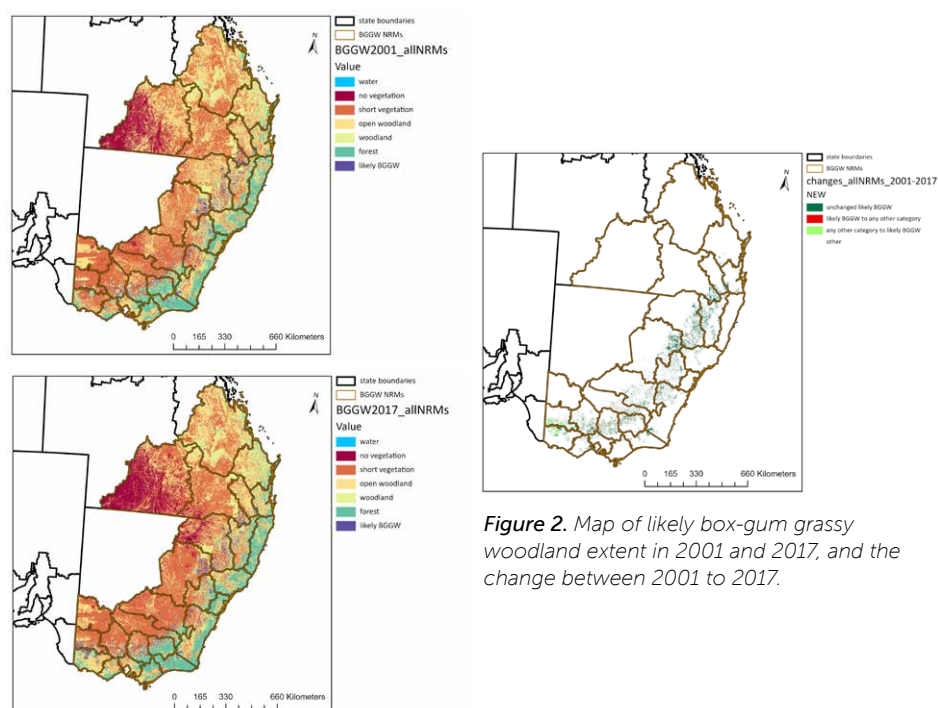


Figure 2. Map of likely box-gum grassy woodland extent in 2001 and 2017, and the change between 2001 to 2017.

condition needs to be assessed at site level no estimate of ecosystem condition was made.

The gross value of agricultural production was calculated for the 27 regions for the financial years 2012–13 to 2018–19. The gross value of agricultural production per hectare varied between the regions and overtime. The regions with lower values per hectare tended

to be associated with larger declines of box-gum grassy woodland in New South Wales (Figure 4). For example, in the Central West natural resource management region of New South Wales, where there was a likely decline of 45,000 ha of box-gum grassy woodland, the average gross value of agricultural production was only \$224 per ha.

Key findings (continued)

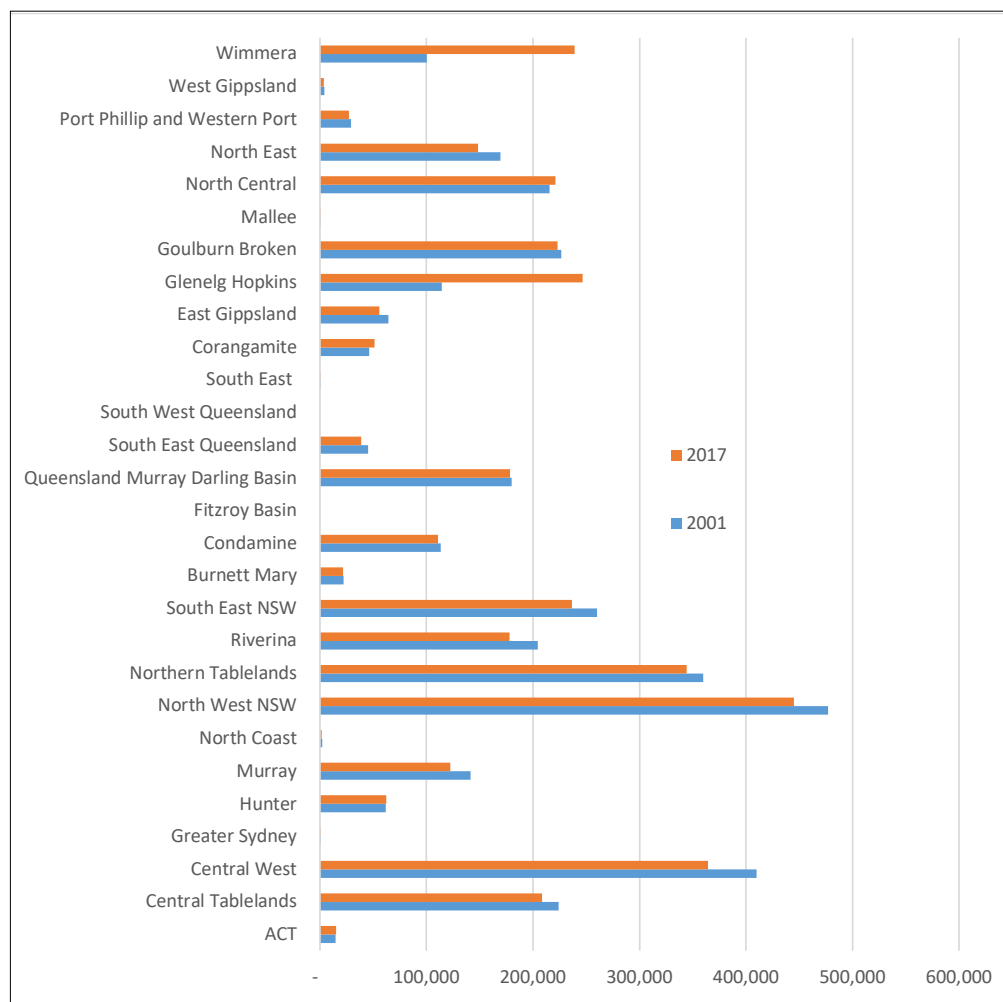


Figure 3. Changes in extent of likely box-gum grassy woodland extent by natural resource management region, 2001 to 2017, in hectares.

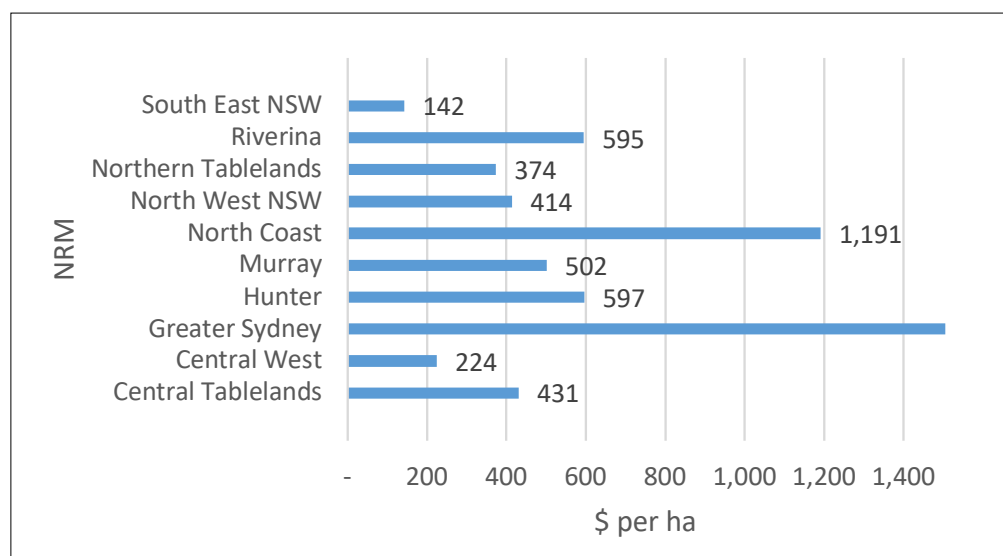


Figure 4. Gross value of production (\$ per hectare) on land used mainly for agricultural production in NSW natural resource management regions with box-gum grassy woodland, 2017–18.

Further Information

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Implications and recommendations

The environmental-economic accounts of the box-gum grassy woodlands show that listing as Critically Endangered has had little impact on the extent of this ecosystem. Only around 11% of the remnants are within the protected areas network, with around 77% on privately owned agricultural land.

The accounts indicate which natural resource regions have seen the greatest decline in likely extent. These regions in New South Wales should be where maintenance and restoration work is focused. It may also indicate where compliance with the EPBC Act has been lacking and hence be used to target enforcement activity by the Australian Government.

The lack of information on the expenditure on the activities specifically outlined in the National Recovery Plan is a significant data gap. It means that we are unable to examine whether the decline is because the plan is in some way deficient or whether it is due to a lack of resources for its implementation. It also means that we are unable to determine the efficiency of any spending. For example, we cannot

answer the question: are there areas which have been able to reduce the decline of woodlands with less money than in other areas? Going forward, such information would be useful to estimate the cost of restoring the ecosystem to a level where it was not threatened.

The accounts also show the value of agricultural production from each natural resource management region. Not all of the production will be from degraded box-gum grassy woodlands, but in some regions it will make up a significant proportion of value, particularly where livestock grazing dominates agricultural activities. If farmers are to be encouraged to restore box-gum grassy woodlands via financial incentives, then this information is useful for understanding the income they would forgo. This financial information also helps understand the value of alternative revenue streams (e.g., from selling biodiversity offsets or carbon credits) likely to be needed to change private landowner management practices. It may also influence other investor decisions, for example, investors buying and managing land for the production

of biodiversity offsets or carbon credits, as is being proposed by the Agricultural Stewardship Package.

The compilation of the accounts highlighted deficiencies in the data sources available to detect changes in the extent of ecosystems. Ecosystem mapping is irregularly undertaken, and the classifications of ecosystems changes between federal, state and territory governments. Compounding the problem for the administration of the EPBC Act is that the definition under the Act is not amenable to measurement via remote sensing alone. The definition is complex and requires on-ground field measurement to be certain of correct identification. The accounts can be used to design a sample survey for on-ground measurement of the box-gum grassy woodland which can then be used to improve the accuracy of predictive models and help determine ecosystem condition. Going forward, listings of ecosystems under the EPBC Act should give greater consideration to the definition of ecosystems listed under the Act so that they can be monitored in a cost-effective manner.

Cited material

Department of Environment, Climate Change and Water NSW, 2010. National Recovery Plan for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Department of Environment, Climate Change and Water NSW, Sydney. <http://www.environment.gov.au/biodiversity/threatened/recovery-plans/white-box-yellow-box-blakelys-red-gum-grassy-woodland-and-derived-native-grassland-national>

Department of Environment and Heritage, 2006. Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Van Dijk, A. and Liao, Z., 2018. Digital Earth Australia – Annual Land Cover (ANU-LC). Experimental product technical document.

Vardon, M. Chen, Y., van Dijk, A., Keith, H., Burnett, P., and Lindenmayer, D. (In review.) Accounting for the Critically Endangered Box-gum Grassy Woodlands.



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