How land use and land cover data informs the restoration of Australia's coasts

Coastal wetlands include tidal marshes, mangroves, and seagrass meadows which are being lost at twice the rate of tropical forests each year, from a variety of causes including land clearing and extreme weather events. These ecosystems, which are often called 'blue' carbon ecosystems as they are located in coastal and marine ecosystems, store disproportionately high amounts of carbon. They provide numerous benefits, such as carbon sequestration; habitat for multiple species of fish, birds, and other wildlife; and protection against waves and storm surges. The loss or degradation of these ecosystems can severely diminish their ability to provide these benefits.

Land use history

By understanding the history of land use in areas where blue carbon ecosystems once existed, we can identify locations to focus restoration efforts. Similarly, knowing the land use of places where blue carbon ecosystems might exist in the future, as the atmosphere warms and sea level rises, can help us plan ahead.

Credit: Joe Waranont, unsplash

What is land use and land cover data?

Land cover change can include the removal of vegetation or the creation of impermeable surfaces like roads and buildings. Land use and land cover change such as land clearing, agriculture, and urbanisation, can cause the loss of blue carbon ecosystems, and also prevent their ablity to migrate in response to climate change.

Land use change -	Is the shift in functional use of land e.g. change from crop production to carbon farming.
Land cover change -	The alteration of the natural or built earth's surface e.g. vegetation clearing.

To gain insights into the interactions between national-scale land use and land cover processes and the potential locations of blue carbon restoration projects, we use the Land Use of Australia 2010-11 to 2015-16 dataset (250 m resolution). This dataset provides a comprehensive national-level map of how Australian land is used. The map shows agricultural and non-agricultural land using seven thematic layers from information provided by state and territory governments and external agencies. These layers include information about protected areas, topographic features, land tenure, forest cover, catchment-scale land use, urban boundaries, and stock routes.

Agricultural land uses were mapped using the 2010-11 and 2015-16 agricultural census data from the Australian Bureau of Statistics, satellite imagery, and information about the location of some crops, horticulture, and irrigation zones. This data is converted to land use categories relevant for coastal restoration and coupled with models of tidal height to identify areas which might overlap showing the current and potential distribution of blue carbon ecosystems (which mainly occupy intertidal areas).

How are we using land use and land cover data?

Land use and land cover information is critical for estimating greenhouse gas emissions from different land uses (e.g from livestock or soils), emissions that might occur during transition to a different ecosystem (e.g. greenhouse gases released as old vegetation dies), and the sequestration of organic carbon that occurs in soils and vegetation.

Land use and land cover information is used to identify existing vegetation, land management practices and tenure in areas that could be used for tidal restoration of blue carbon ecosystems. We also use the land use data to estimate the potential loss of agricultural production if land were to be restored back to blue carbon ecosystems (Figure 1), and to mask out areas where blue carbon projects are unfeasible (such as places where houses exist).

Figure 1. A schematic illustration showing the difference between an area with tides excluded to allow for agricultural uses (left hand panel) and a restored area with blue carbon ecosystems (right hand panel).

For further information

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