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TITLE: Mapping the multi-decadal mangrove dynamics of the Australian coastline

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ABSTRACT:

Mangroves globally provide a diverse array of ecosystem services but these are impacted upon by both natural and anthropogenic drivers of change. In Australia, mangroves are protected by law and hence the natural drivers predominate. To determine annual national level changes in mangroves between 1987 and 2016, their extent (by canopy cover type) and dynamics were quantified using dense time-series (nominally every 16 days cloud permitting) of 25 m spatial resolution Landsat sensor data available within Digital Earth Australia (DEA). The potential area that mangroves occupied over this period was established as the union of mangrove maps generated for 1996, 2007?2010 and 2015/16 through the Global Mangrove Watch (GMW). Within this area, the green vegetation fractional cover (GVpc) was retrieved from each available cloud-masked Landsat scene through linear spectral unmixing. The 10th percentile (GVpc10) was then determined for each calendar year by comparing these data in a time-series. The percentage Planimetric Canopy Cover (PCC%) for each Landsat pixel was then estimated using a relationship between GVpc10 and LiDAR-derived PCC% (<1 m resolution and based on acquisitions from all states supporting mangroves, excluding Victoria). The resulting annual maps of mangrove extent and cover for Australia are the first to be generated at a continental scale and on an annual basis. These indicated that the total area of mangrove forest (canopy cover >20%; resolvable at the Landsat resolution) varied from a minima of 10,715 ± 36 km2 (95% confidence interval) in 1992 to a maxima of 11,388 km2 ± 38 km2 (95% CI) in 2010, declining to 11,142 ± 57 km2 (95% CI) in 2017. In 2010 (maximum extent), the forests were classified as closed canopy (38.8%), open canopy (49.0%) and woodland mangrove (12.2%). The majority of change occurred along the northern Australian coastline and was concentrated in the major gulfs and sounds. The 30 national maps of annual mangrove extent represent a reference dataset, which is publicly available through the Terrestrial Environment Research Network (TERN) landscapes portal. Future efforts are focusing on the routine production of annual mangrove maps beyond 2019 as part of Australia's efforts to monitor the coastal environment.

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