

Recent innovation and improvements in the Habitat Condition Assessment System

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The Habitat Condition Assessment System (HCAS) is an innovative framework designed to provide reliable, robust, consistent and repeatable assessments of terrestrial habitat condition at a national scale. Since 2015, CSIRO has been developing HCAS in collaboration with the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW). HCAS is a remote sensing-based monitoring approach to condition assessment that provides site-level estimates of habitat condition benchmarked against high ecosystem integrity reference sites. The HCAS data collection follows FAIR (Findable-Accessible-Interoperable-Reusable) principles, and includes a time series of short-term epochs derived from three years of remote sensing data for each year from 1990 to 2024, the National Connectivity Index which uses HCAS as an input, as well as input data used in developing HCAS and supplementary data to support use.

The 2025 release of HCAS (v3: <https://data.csiro.au/collection/csiro:63571>) incorporates substantial advancements to enhance accuracy and utility for a range of applications. This includes a finer spatial resolution (90m) and longer time series (1988-2022), achieved by replacing MODIS with Landsat data, incorporating products generated by Geoscience Australia, new environmental data developed by TERN, and a revised approach to delimiting locations of 'reference' sites.

Technical innovations in software development and workflow management using high performance computing have substantially reduced run times, and minimised manual intervention in processing, enabling bootstrapping to provide 95% confidence intervals from model-based uncertainty quantification.

We describe technical details and advancements of the method, briefly point to current applications, and outline where future improvements are needed to address known limitations.

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