

A Habitat Condition Assessment System for Australia

Developing a new approach to mapping change in habitat for biodiversity continentally



Image credits: Top-left: Salmon gum woodland at Credo, WA (SM Prober); Top-right: Barron River floodplain, North Qld (D Metcalfe); Lower: Travelling Stock Route near Young, NSW (SM Prober)

Background

The Department of the Environment and the CSIRO are working together to develop an innovative approach for assessing habitat condition across Australia. The approach has been pioneered by ecologists and remote sensing specialists at CSIRO.

The three year project, to June 2017, will further develop and test a new Habitat Condition Assessment System – the HCAS. It is expected that this new system will significantly enhance our capacity to:

- identify natural and non-natural influences on habitat
- identify priority areas for management interventions
- provide context for reporting.

What is biodiversity habitat condition?

Conceptually, habitat condition relates to the capacity of an area of vegetation to provide the structures and functions necessary for the persistence of plant and animal species that would be expected to occur at that location if it were still in a natural state. The HCAS project will assess habitat condition with reference to ecosystem dynamics across space and time, and observable characteristics of ecosystem structure, function and composition.

Why do we need a HCAS?

The design and successful implementation of national biodiversity conservation policies and programmes requires reliable information at an ecosystem level.

Although there is a range of environmental information available to policy makers, a notable gap has been a cost-effective, repeatable, national system for biodiversity habitat condition assessment that reflects the natural fluctuations of the Australian landscape and distinguishes this from non-natural disturbances. This information gap has significantly constrained the capacity of policy makers to respond flexibly to environmental change, and deploy policy, regulatory and funding mechanisms strategically.

Recent advances in accessible satellite archives and plot-based habitat data are opening up new possibilities for a national view of the extent and condition of our ecosystems.

How the HCAS will work

The HCAS is based on the premise that natural vegetation occurring at places with similar abiotic environmental conditions (i.e., similar soil, landform, water availability, etc.) should look similar when viewed from space using satellite remote sensing, averaged across seasons and years. Where two such places have markedly different remotely-sensed spatial and temporal characteristics, this may indicate a difference in their condition for biodiversity.

The HCAS extends this idea in three key ways

Firstly, by using regular remote sensing observations over decades, it is possible to track how the characteristics of different places fluctuate over time and use that to further enrich our understanding of condition differences and their implications for biodiversity. When benchmarked against “reference sites”, time series data have the potential to help tease apart natural and non-natural characteristics.

The *second* key aspect of HCAS is its ability to use reference condition data from a range of sources. Ideally, the system would be referenced against systematic, repeated, ground-based observations of habitat condition. However, such data are sparse and will need to be supplemented by land use and management information gathered from a variety of sources. By integrating best available reference data with remote

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sensing data, the system can estimate relative condition across whole landscapes and the entire continent¹.

Thirdly, HCAS is designed to work with a range of long time-series, nationally consistent remote-sensed data and derivatives that represent attributes of habitat structure, function and composition, primarily using vegetation as a surrogate. At present, suitable data are available from MODIS, AVHRR and LANDSAT series. The length, resolution and variety of remote-sensed data will influence the operational application of HCAS, and how comprehensively biodiversity habitat condition can be depicted. For example, the 14 years of MODIS data allows HCAS estimates of habitat condition to potentially be represented in different time frames to show change over time.

Building on existing capabilities

Over the past several decades, government agencies, academic and research institutions across Australia have produced a range of key environmental information products, including data sets that have provided surrogate measures of biodiversity habitat condition, such as native vegetation cover, land use, aquatic ecosystem, greenness indices, land cover, wildlife population numbers and soil erosion mapping.

A range of cross-jurisdictional groups, such as the former Executive Steering Committee for Australian Vegetation Information and the taskforce responsible for developing the Native Vegetation Framework as well as the Terrestrial Ecosystem Research Network, have been pivotal in bringing relevant practitioners together to discuss nationally agreed approaches and directions on vegetation condition information. The Department, in collaboration with the HCAS project will continue to foster these collaborations, where it is practical to do so.

The HCAS approach builds on the conceptual foundations provided by prior work in environmental information development and condition monitoring, but seeks to overcome some of the challenges in delivering a nationally consistent view of biodiversity habitat condition, such as:

- inadequate and inconsistent information on vegetation dynamics including seasonal fluctuations and fire effects;
- variability in the scale and context of assessments; and
- costs associated with on-ground data capture.

Ultimately, the HCAS aims to build on the expertise and investments made by State and Territory governments, the scientific community and private sector organisations in the collection of site condition data. The HCAS intends to optimise the value of these data sets for national reporting purposes.

Outputs from the operational pilot

Output products will initially be delivered as 0.01 degree grids (~1km) with potential to move to a finer resolution in the future (i.e., 9 second: ~250m grids). Modelled output data layers and a User Guide will be made publicly available. Scientific publications, case studies, and a guide for policy makers will also be developed. The project further seeks to identify the operational requirements to routinely and regularly deliver HCAS products into the public domain. New technologies and infrastructure, such as Geoscience Australia's Landsat Data Cube and the National Computational Infrastructure will be critical to implementing HCAS at ever finer resolutions.

How the HCAS project will engage

The project team, comprising representatives from the Department of the Environment, CSIRO and the Arthur Rylah Institute, will seek to collaborate with organisations developing and maintaining ecological condition assessment site data, satellite remote sensing, environmental surfaces and climatic information.

The Department of the Environment will also seek to engage potential end users to understand how they currently use, or would seek to use, habitat condition information of the type outlined here in their decision making. The project team will hold annual public seminars to communicate about the project and its progress. If you're interested to know more, please contact us.

Background reading

Donohue RJ, Harwood TD, Williams KJ, Ferrier S, McVicar TR (2014) Estimating habitat condition using time series remote sensing and ecological survey data. CSIRO Earth Observation and Informatics Transformational Capability Platform, Canberra, Australia. <https://publications.csiro.au/rpr/pub?pid=csiro:EP1311716>.

Harwood TD, Donohue RJ, Williams KJ, Ferrier S, McVicar TR, Newell G and White M (2016) HCAS: A new way to assess the condition of natural habitats for terrestrial biodiversity across whole regions using remote sensing data. Submitted to MEE, 7: 1050–1059.

¹ It should be noted that the process of identifying, compiling and merging a range of reference data sources is a significant, separate

challenge that will not be resolved by the HCAS project. However, the HCAS project can inform and help focus aspects of this task.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION

CSIRO Land and Water
Kristen.Williams@csiro.au

Department of the Environment and Energy

Peter.Lyon@environment.gov.au
Fiona.Dickson@environment.gov.au