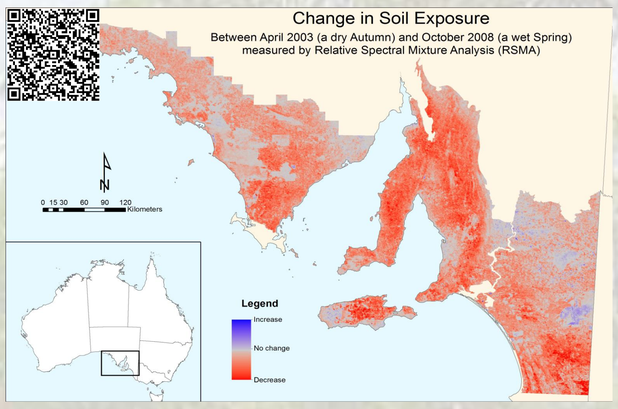
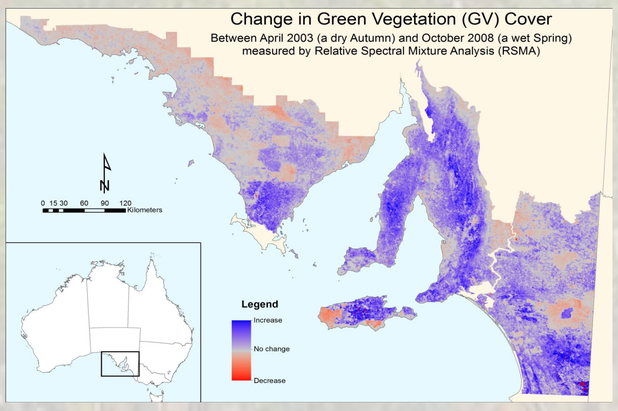
Changing covers? How TERN has fostered greater research collaboration for land management

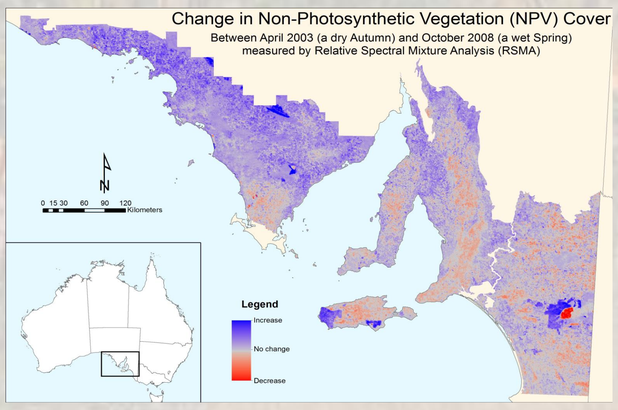
Peter Scarth, Juan Pablo Guerschman, Ken Clarke, Matthew Purss, Rebecca Trevithick, Leo Lymburner, Michael Schmidt

Background

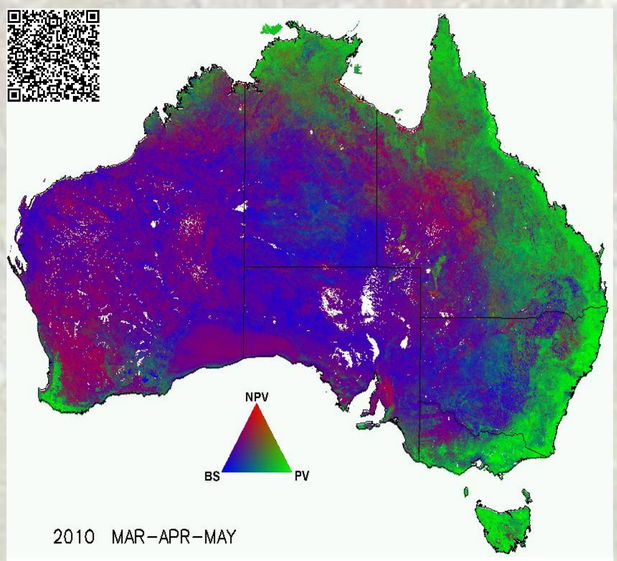
Accurate and timely information on ground cover condition is a key data input for achieving land management practices which can minimise the risk of soil erosion while maximising the goods and services obtained from the land. TERN, through the AusCover facility, has played a pivotal role in holding such data and making it accessible to a wide range of users. Major challenges however are still associated with mapping condition, and therefore monitoring land condition . These include: system efficiencies to conduct monitoring over vast areas, separating management from natural seasonal effects, and deriving universal condition classes. Complicating this process has been the parallel development of multiple ground cover products by several research groups. TERN provides a collaborative research framework to share calibration and validation data, to host datasets and to cooperate between research groups. This has brought together remote sensing scientists developing techniques for ground cover mapping, scientists from operational agencies making those data available to the users and government agencies working to link the science to the natural resources managers. This facilitation is enabling more efficient and effective research with better linkages to land management needs. Three products are presented which separate ground cover into 3 fractions—green vegetation (PV), non-green vegetation (NPV) and bare soil (BS). These fractional cover products can be used in a wide array of climate and ecological research including regional and global carbon modelling, ecological assessment, and agricultural monitoring. A remote sensing and land management TERN ACEAS workshop is to be held to better understand these land cover products and facilitate their adoption by land managers and policy makers.



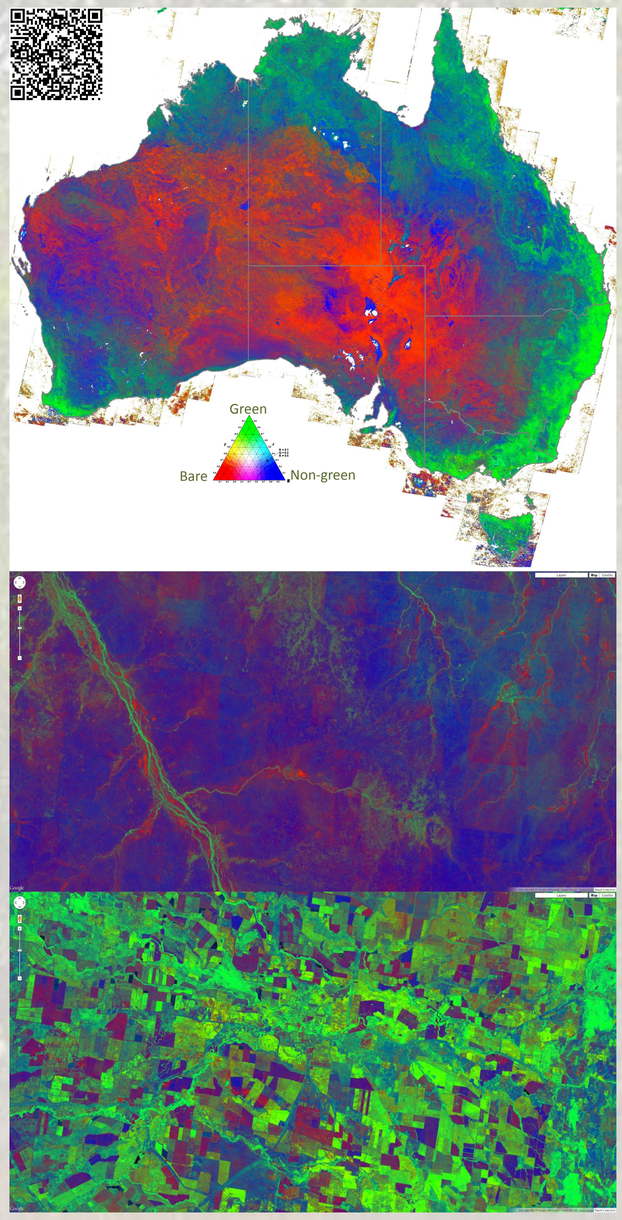




Different policy and research drivers



Land cover products based on multiple methods



RSMA Fractional Cover - University of Adelaide

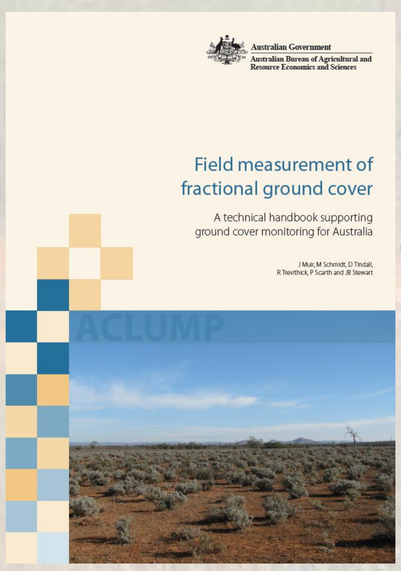
The University of Adelaide Relative Spectral Mixture Analysis (RSMA) algorithm measures change in fractional cover over time, relative to a baseline date. This index is produced from 500-m MODIS nadir BRDF-adjusted reflectance (NBAR) data (Okin *et al*. 2013). RSMA indices are useful indicators of the dynamics of fractional cover. The graphic above shows the seasonal dynamics in each of the fractional covers across South Australia.

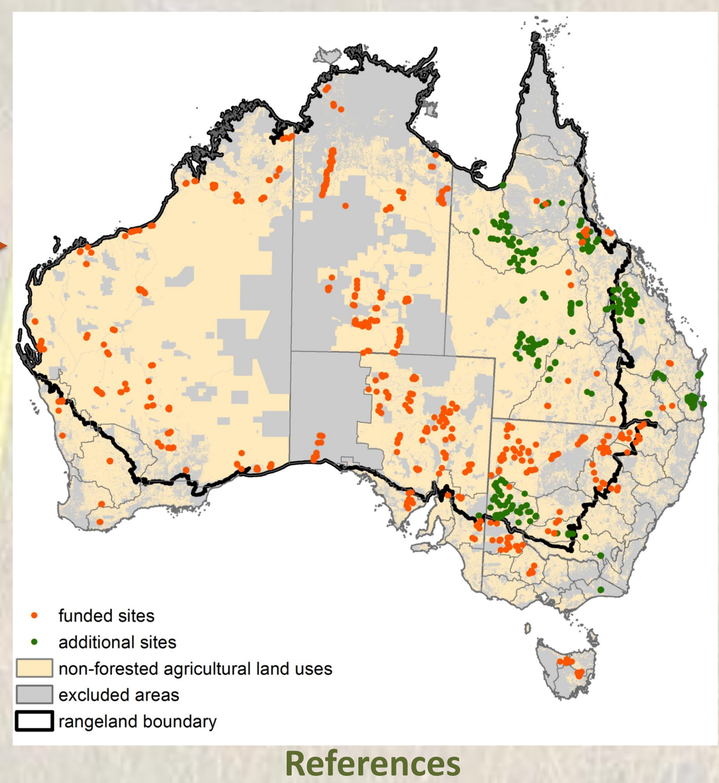
MODIS fractional cover - CSIRO Land and Water

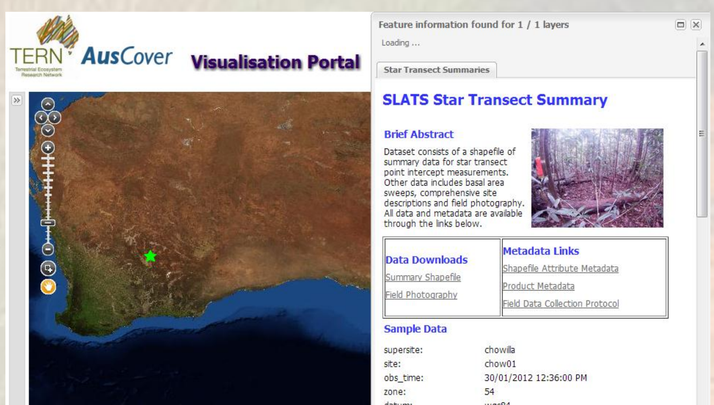
The CSIRO Land and Water fractional cover was derived using a linear unmixing methodology (Guerschman *et al*. 2009). The method uses the NDVI and the ratio of MODIS bands 7 and 6. The method was originally developed for the Australian tropical savannas but is being improved to better reflect agricultural conditions across Australia and in particular the rangelands. The graphic above shows a national composite and seasonal ground cover levels for agricultural areas (using version 2.2 and derived metrics) .

Landsat fractional cover - JRSRP

The Joint Remote Sensing Research Program (JRSRP) algorithm derives land cover fractions from USGS Landsat TM and ETM+ imagery, retrieved by inverting multiple linear regression estimates and using synthetic endmembers in a constrained non-negative least squares unmixing model (Scarth *et al*. 2010). The graphic above shows the algorithm applied to the Australian continent, the Mitchell Grass Downs and cropping lands around Moree, NSW.







ABARES coordination

The Department of Agriculture, Fisheries and Forestry through the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) has implemented with state and territory partners a nationally agreed basis for monitoring ground cover using satellite imagery. This is assisting the assessment of Australia's soil resources and agricultural productivity at national, state and regional scales. There is now a spatially comprehensive, well documented and accessible database of field measurements, shown on the map right.

TERN portal and knowledge capture

The fractional cover products, field data and metadata collection protocols are searchable and downloadable from the TERN portal. These data help calibrate and validate the products and inform questions of scale, such as analysing the differences between Landsat, field and MODIS spatial scales.

By making the products, algorithms, source and validation data available through the TERN portal, it is anticipated that botanists, ecologists, modellers and land managers will integrate these data into their work, provide feedback on the limitations, and collaborate on future iterations of the products.

References

Guerschman, J.P., Hill, M.J., Renzullo L.J., Barrett, D.J., Marks, A.S. and Botha, E.J. (2009). Estimating fractional cover of photosynthetic vegetation, nonphotosynthetic vegetation and bare soil in the Australian tropical savanna region upscaling the EO-1 Hyperion and MODIS sensors. *Remote Sensing of Environment*, 113, 928-945

Okin, G.S., Clarke, K., & Lewis, M. (2013). Comparison of methods for estimation of absolute vegetation and soil fractional cover using modis normalized brdf-adjusted reflectance data. *Remote Sensing of Environment, 130*, 266-279

Scarth, P., Röder, A., Schmidt, M., 2010. Tracking grazing pressure and climate interaction - the role of Landsat fractional cover in time series analysis. In: Proceedings of the 15th Australasian Remote Sensing and Photogrammetry Conference (ARSPC), 13-17 September, Alice Springs, Australia. Alice Springs, NT.

Tern is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and Super Science Initiative.