Australia's Dynamic Habitat Template for 2003

THE AUSTRALIAN NATIONAL UNIVERSITY

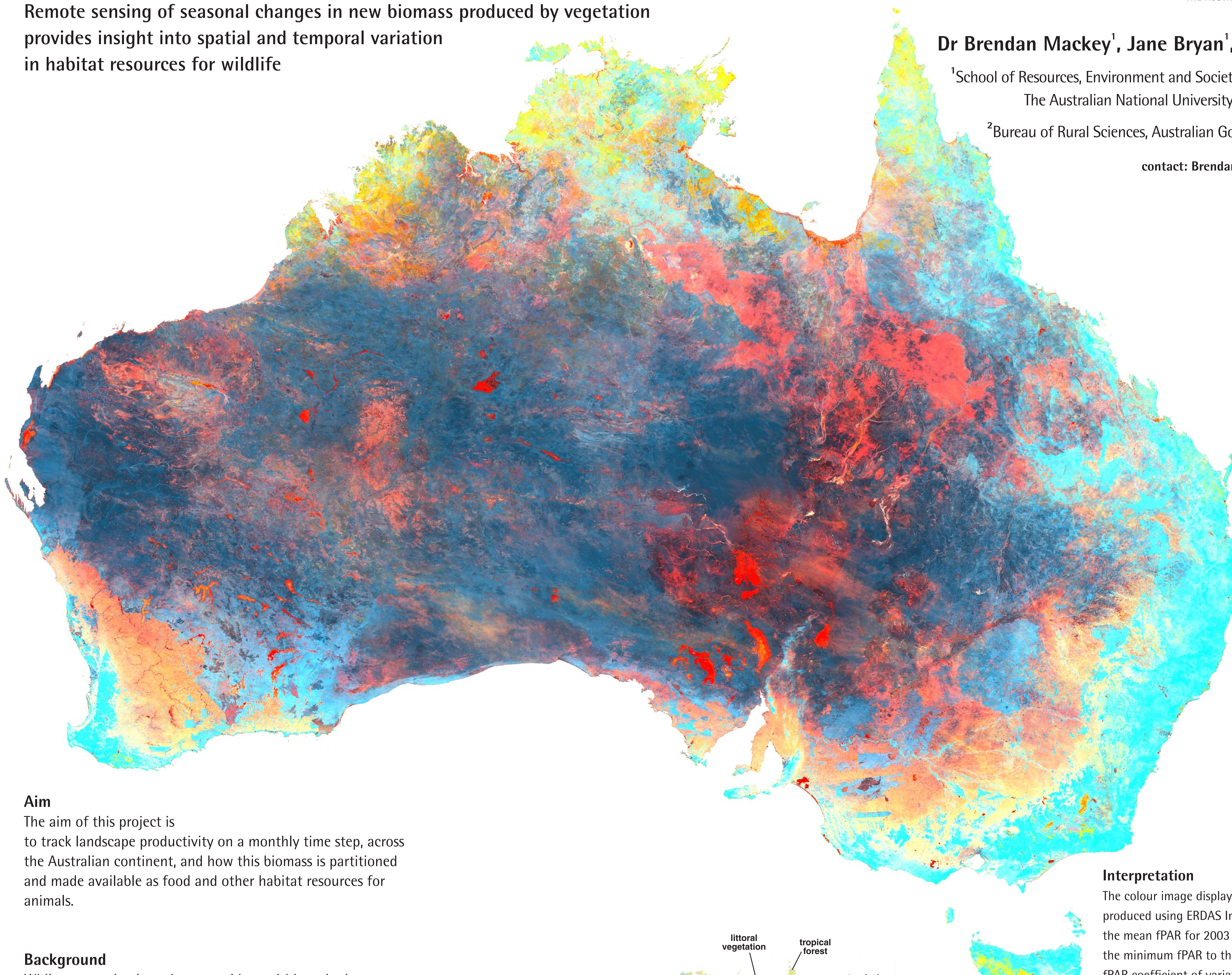
Remote sensing of seasonal changes in new biomass produced by vegetation provides insight into spatial and temporal variation in habitat resources for wildlife

Dr Brendan Mackey[1], Jane Bryan[1], Lucy Randall[2]

[1]School of Resources, Environment and Society, Faculty of Science
The Australian National University, Canberra ACT 0200

[2]Bureau of Rural Sciences, Australian Government, Canberra

contact: Brendan.Mackey@anu.edu.au



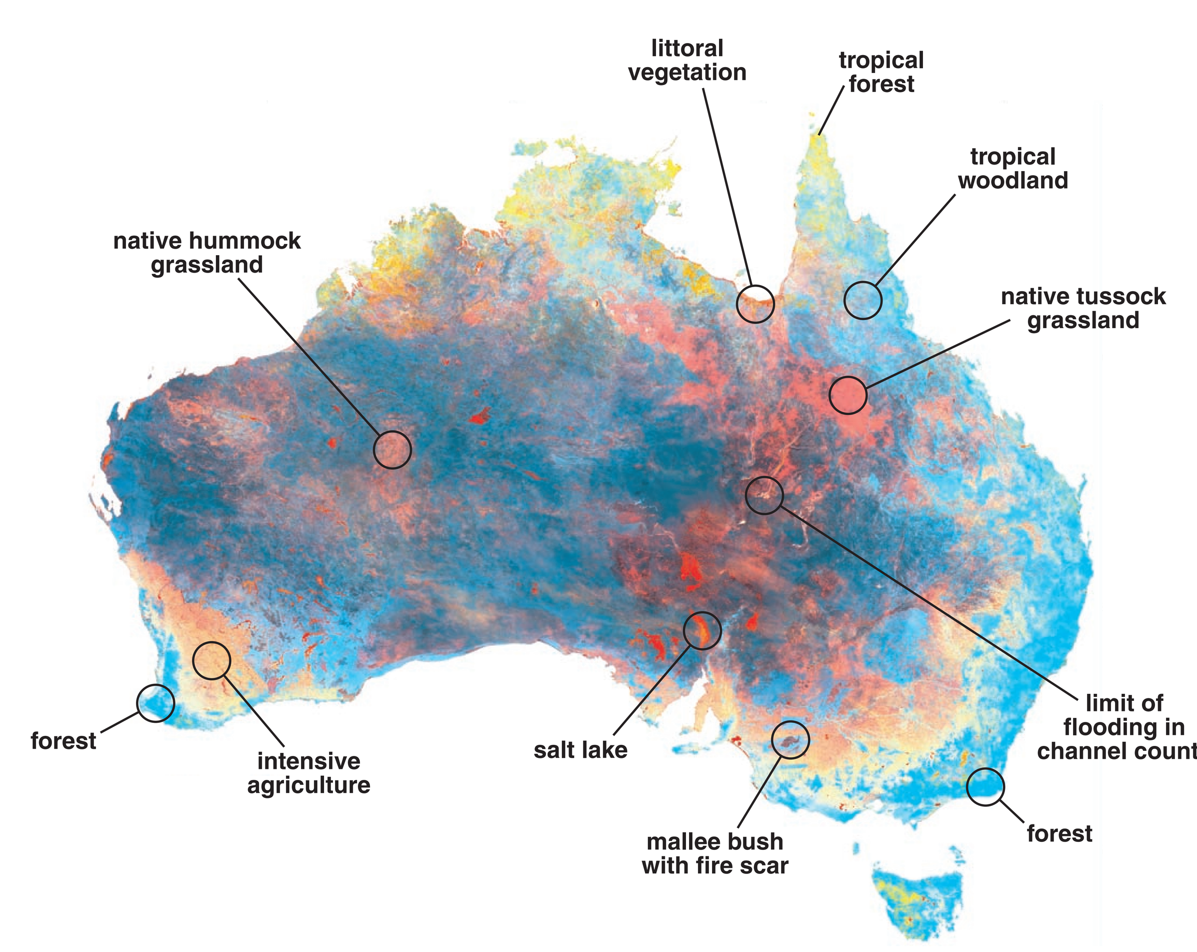
Aim

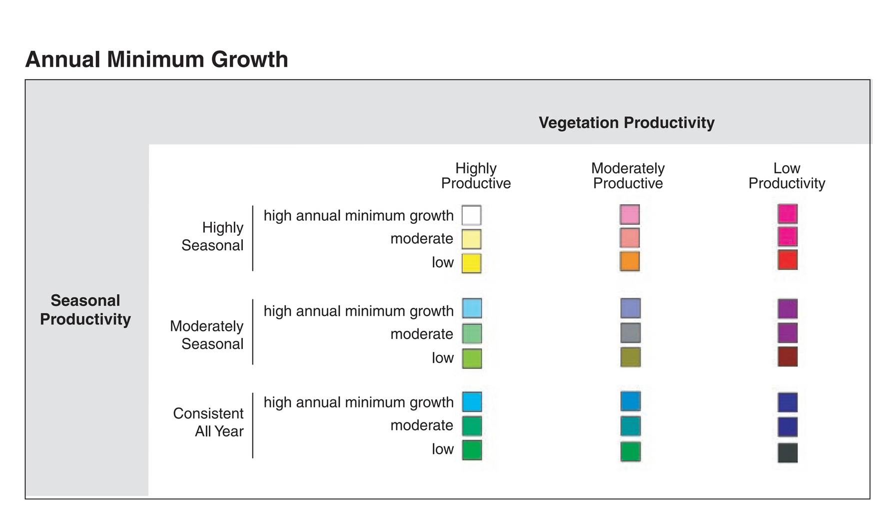
The aim of this project is
to track landscape productivity on a monthly time step, across the Australian continent, and how this biomass is partitioned and made available as food and other habitat resources for animals.

Background

While some animal species are resident within a single landscape ecosystem, many vertebrate and invertebrate animal species are highly mobile and move large distances over the course of their life cycles. Animal movements may be (1) regular - being driven by seasonal changes, or (2) irregular (dispersive/nomadic) - reflecting less predictable changes. In both cases, spatial and temporal variation in food and other habitat resources – the dynamic habitat template - is one of the prime drivers of this animal behaviour.

Large-scale movement of animals presents special challenges for the conservation of biodiversity as these species are dependent on more than one landscape ecosystem, and the locations they occupy may change from year to year. The key to understanding and managing for the conservation of highly dispersive species is the capacity to track landscape productivity at continental scales through space and time. Gross Primary Productivity (GPP) – the rate at which new biomass is produced by photosynthesising plants and organisms – underpins the entire food chain. This biomass is differentially allocated to plant respiration and various plant parts, including: foliage; stems; roots; and reproductive organs. A proportion of this material is directly consumed by herbivores, while some fluxes directly to litter pools and the detritivore food chain. All animals are therefore either directly or indirectly dependent on this biomass production and partitioning for food and shelter.





Interpretation

The colour image displayed on this map was produced using ERDAS Imagine by assigning the mean fPAR for 2003 to the green band, the minimum fPAR to the blue band, and the fPAR coefficient of variation to the red band. Bright red areas have low annual mean fPAR, low annual minimum fPAR and high seasonal variability.

- Thus, bright red areas indicate locations where the small of amount of primary production that occurs was evident for only part of the year, e.g. salt lakes subject to occasional flooding.
- Bright yellow areas have high mean fPAR, a low annual minimum, and high variability. These landscapes support cereal crops such as wheat. Bright cyan areas have a high mean, a high minimum and low variability.
- Cyan therefore indicates locations with vegetation that was consistently productive throughout the year – these areas support forest ecosystems.
- Darker blue indicates landscapes with a low mean, a high minimum, and low variability. Thus, while these locations have relatively low biomass production, it is constant throughout the year.
- Orange areas indicate moderately productive vegetation that varied in productivity throughout the year, e.g. natural grasslands.

Methods

The map shows spatial variation in a surrogate measure of relative vegetation productivity for 2003. The analysis is based on three indices calculated from monthly estimates of the fraction of photosynthetically active radiation absorbed by vegetation (fPAR) for the year 2003. The three indices are: (1) annual mean fPAR, (2) annual minimum fPAR, and (3) coefficient of variation of fPAR. MODIS13 vegetation greenness index values (NDVI) were the source data used to estimate fPAR. These data were generated by the Terra satellite as part of the NASA Earth Orbiting System, and downloaded and analysed at The Australian National University. Twelve 16-day NDVI composites, one for each month in 2003, were extracted from the MODIS13 data. Using the NDVI values, fPAR for each 16-day composite was calculated according to the method outlined by Berry & Roderick (2002). The average of the 12 fPAR surfaces was taken to produce the annual mean fPAR for 2003. The lowest of the 12 fPAR surfaces was used as the annual minimum. The standard deviation of the 12 fPAR surfaces was calculated and then used to derive the coefficient of variation for 2003 (an index of seasonal variability).

Acknowledgements

These analyses were undertaken as part of the WildCountry Science Project; a collaboration between The Australian National University and The Wilderness Society Australia.

References

Berry, S.L. & Roderick, M.L. (2002). Estimating mixtures of leaf functional types using continental-scale satellite and climatic data. Global Ecology and Biogeography 11: 23-39.

Future Research

The next step is to use the remotely sensed estimates of fPAR as input to (1) a model of GPP and then (2) a carbon accounting model that simulates the stocks and fluxes of biomass through the terrestrial carbon cycle. The results of these analyses will then be coupled to field data that quantify the presence and abundance of selected dispersive fauna in order to identify, inter alia, critical habitat refugia.