**How influential is herbivory, both native and exotic, in shaping Australian vegetation patterns?**

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Prior to European settlement fire was the main driver structuring Australian vegetation patterns and our dominant herbivores were termites. Since then the livestock industries and associated land management activities have greatly degraded many Australian vegetative communities, a legacy that will be long-lasting if not permanent in many, particularly low fertility ecosystems. Land clearing, water-point provision and the introduction of 100's of exotic adapted pastoral plants, while driving up achievable stocking densities, also provided opportunities for many feral vertebrate herbivore species to prosper and contribute to the further degradation of Australian plant communities.

Vertebrate herbivory has caused changes in species dominance, plant traits, vegetation structure and assisted exotic species invasions. In some communities grasslands have been turned to woody weed thickets, shrub communities to grasslands and perennial grasslands to annual grasslands. Irreversible abiotic degradation of soil and ecosystem processes like nutrient capture and fire regimes have threatened the regeneration, resilience and viability of longstanding vegetation types. Many plant species have gone extinct or become threatened both directly from grazing and through the unchecked spread of the exotic invasive grazing "increaser" species. Not all is doom and gloom, however, as in some productive communities degradation appears reversible and moderate grazing has a complex but beneficial role to play in biodiversity management.

Most influences of climate change on herbivory will operate indirectly via direct effects on vegetation dynamics. Few studies have explored how species interactions will change under predicted future climate scenarios and quantifying such indirect impacts are likely to be both complex and context dependent. Generally increased $CO_2$, and resulting temperature rises and predicted changes in rainfall patterns should interact to increase plant

growth and water use efficiency, but also increase the plant tissue C:N ratio in Australia's nutrient poor ecosystems. Herbivores will be exposed to increased plant growth, but of lower nutritional quality. Generalist feeders may compensate by consuming more, but specialist and endophagous herbivores may be cornered. An outcome might be changes in herbivore community structure in favour of generalists with resulting herbivore-mediated changes in plant community dynamics.

This simple model will be hard to test. Already vertebrate herbivores will physiologically adapt easily to climate changes and the dominant invertebrate herbivores in Australian ecosystems, termites, grasshoppers, grass moths and Christmas beetles, are generalists. Specialists nonetheless make up half the insect herbivore species richness and are the building blocks of our biodiversity rich foodwebs. Climate change and all that entails may directly disrupt the complex ecologically synchronous distributions and phenologies specialists share with their host plants. The butterflies predicted as most threatened from climate change are those with most specific feeding habits and most complex life cycles.

The suites of perennial pasture grasses and shrubby legumes established in Australia for the benefit of the grazing industries are perhaps the greatest grazing-linked threat to Australia's native plant communities under climate change. Revised grazing practises and land use along with southerly spread under warmer conditions offer whole new opportunities to both existing and sleeper weeds that can, in turn, further modify fire regimes and continue to dominate and degrade Australia's grazed "native" communities .

In the presentation I will try to help prioritise research questions that can assist in understanding and adapting to the interactions between herbivory and climate change that may further threaten the dynamics of Australian vegetative communities beyond the damage already done.