Department of Biodiversity, Conservation and Attractions
GOVERNMENT OF WESTERN AUSTRALIA
Biodiversity and Conservation Science

Information sheet 94 / 2019

August 2019

Fine-scale change in jarrah forest understorey vegetation assemblages over time is independent of fire regime

by Neil Burrows, Bruce Ward, Allan Wills, Matthew Williams and Ray Cranfield, Department of Biodiversity, Conservation and Attractions, neil.burrows@dbca.wa.gov.au

Background

Regular prescribed burning to reduce fuel hazard underpins bushfire risk mitigation measures in jarrah forests of south-west Western Australia. In 1986/87 we established sites in Yackelup forest on the eastern edge of the jarrah forest 40 km east of Manjimup ('dry forest') and McCorkhill forest 25 km west of Nannup ('moist forest') to assess the long-term effects of prescribed burning on the composition, richness and relative abundance of woody shrubs and perennial herbs. Annual herbs and grasses and geophytes were also recorded but they were not always detectable at sampling time, so were excluded from analysis.

Other fire treatments investigated included burning the forests as frequently as they would carry fire under mild summer/autumn conditions, and fire exclusion. Fire treatment plots were 4 hectares, with two plots randomly allocated to each of five treatments. Ten permanent sample quadrats each 10 m^2 were located in each plot (twenty per treatment) and assessed regularly over the period 1986/87 to 2015. This long-term study is one of a few in fire-prone forests globally.

Infrequently burnt plot Yackelup forest. Two fires in 40 years

Frequently burnt plot Yackelup forest. Eight fires in 40 years

Findings

- Plant species assemblages within all fire treatments, including fire exclusion, changed significantly over the elapsed time of the study (almost 30 years), but surprisingly, the changes were independent of fire treatment.
- The pattern of change in composition over elapsed time (ecological drift) of the different plant fire response types was different between the study sites. At the dry forest site, change in species assemblages was initially relatively large in the first decade or so of the study, but slowed thereafter. At the moist forest site, compositional change driven by obligate seeding shrubs occurred faster and more uniformly with elapsed time across all treatments.
- Changes can be attributed to species drifting in and out of the relatively small sample quadrats due to natural processes of mortality, recruitment and dispersal.

- While ecological drift was detected at this fine scale, because there was no net loss of species over time, such drift is unlikely to be detectable at landscape or regional scales, suggesting that over space and time, the understorey composition of these ecosystems is quite stable regardless of fire regime.
- Over elapsed time, species richness was also independent of fire treatment at both sites. Species richness in samples generally decreased with elapsed time on the moist site but increased with elapsed time on the dry site. The stronger effect of elapsed time on species richness at the wet site meant that the inverse effect of time since fire on species richness was not significant. However, there was a significant inverse relationship between time since fire and species richness in samples on the dry site.
- At both sites there were clear patterns of changing abundance based on plant life forms and fire response groups but this was not consistent between sites.

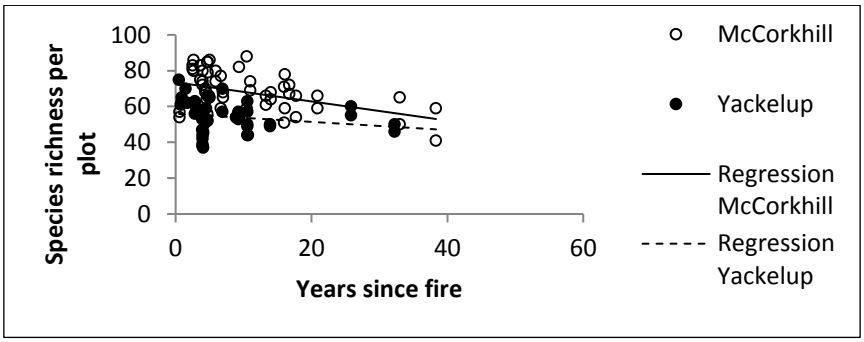

Figure 1. Species richness decreased with time since fire on Yackelup but species richness decreased on McCorkhill with elapsed time, coincident with and dominating decreases associated with time since fire on McCorkhill.

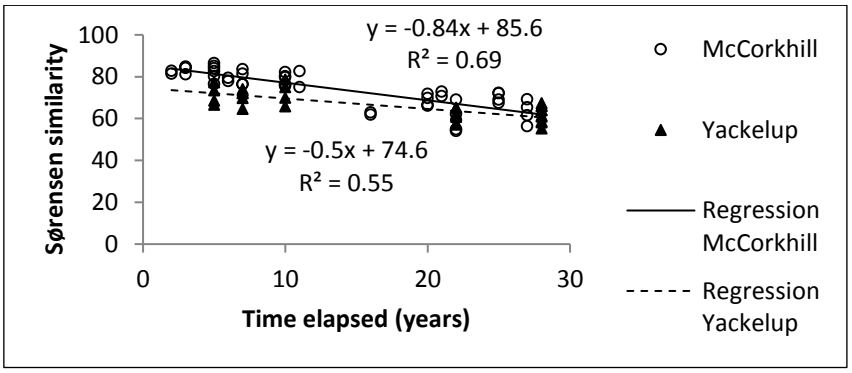

Figure 2. For each site, similarity to the initial plant assemblage decreased with elapsed time regardless of fire treatment.

Management implications

Over time, either elapsed time or time since fire, species assemblages across all fire treatments changed regardless of treatment. Changes were mostly associated with specific plant life forms and fire response traits, suggesting that the process is both deterministic and stochastic. While many species changed in abundance over time, no species were lost as a result of fire treatments. Within the fire frequency, season and intensity ranges investigated in this study, there is flexibility in the application of prescribed fire to achieve fire management objectives without loss of plant diversity.

Further information

Burrows, N., Ward, B., Wills, A., Williams, M., Cranfield, R. (2019). Fine-scale change in jarrah forest understorey vegetation assemblages over time is independent of fire regime. *Fire Ecology* 15:10 (http://doi.org/10.1186/s42408-019-0025-0).