Vegetation comparison between the western and central areas of the Dhupuma Plateau in the Gove region of the Northern Territory, Australia.

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Executive Summary

The University of the Sunshine Coast (USC) was engaged by the Gumatj Corporation to conduct a vegetation comparison as part of a broader research initiative. Existing data obtained by a private consultant and new collected data was used to compare the vegetation between the central and western areas of the Dhupuma Plateau.

The assessed vegetation is classified as Plateau Woodland, dominated by Darwin Stringybark (*Eucalyptus tetrodonta*) and to a lesser extent Darwin Woollybutt (*E. miniata*). The study region is subject to frequent cyclones and wild fires, which influence the vegetation characteristics. We surveyed eight, 500m^2 transects spread across the western side of the study area, and sampled all plants over 1 m in height, and herbs in three 1 m quadrats. Previous data was collated and prepared for the comparative analysis.

We found that the structure and composition of vegetation between the western and central areas of the plateau are uniform. Due to the frequent cyclones and wild fires the vegetation on the plateau has a sparse large-tree layer with a thick layer of coppicing regrowth. We conclude that the habitat and conservation values for the two areas are comparable.

Introduction

The purpose of this report is to compare the vegetation diversity, composition and structure of the western side to that of the central area of the Dhupuma Plateau, to determine the level of similarity between the two areas. The vegetation within the central area was extensively surveyed in both the dry season in 2014 and during the wet season in 2015 by Mitchell (2014, 2015). The vegetation data from the central area survey has been used to compare with the current vegetation survey conducted at the adjacent western area. This vegetation survey was conducted during the wet season in April 2017. In addition to providing a vegetation comparison between the two areas, this study also aimed to provide local Gumatj forestry workers with ecological sampling experience, and for them to provide indigenous perspectives on local plant communities.

The Dhupuma Plateau is situated within the wet-dry tropics, with the dry session generally occurring from June to October and the wet season ranging from November to May. The forest within the region is characterized as Plateau Woodland, dominated by Darwin Stringybark (*Eucalyptus tetrodonta*) and to a lesser extent Darwin Woollybutt (*E. miniata*). Frequent fires (every 1-3 years) and cyclones play an important role within the disturbance regime, and influence the forest structure. Cyclone Nathan in 2015 occurred within the study region and resulted in significant damage including mature trees with broken and damaged crowns, large numbers of up-rooted trees, particularly in areas with shallow soil and fallen limbs.

Methods

Plot locations were predefined by desktop assessment of satellite imagery and mapping within the western area of the Dhupuma Plateau to cover the range of vegetation within this area (Figure 1). To compare the diversity, structure and composition of vegetation between the central and western areas on the Dhupuma Plateau, we sampled every plant in each transect above 1 m in height within an area of 50 m by 10 m. Large trees (those above 20 cm in diameter at breast height (DBH)) were identified and measured within a larger area outside of the transects, in an area of 50 m by 20 m. Herbs were sampled within a smaller area being 3, 1 m by 1 m quadrants located at the 10, 25 and 40 m interval along the central transect.

The vegetation sampling methods were chosen as to ensure consistency with the Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping (Brocklehurst et al. 2007), and match with the methods used in the previous surveys located within the central area of the plateau (Mitchell 2014, 2015). However due to the shape of the western part of the Dhupuma Plateau we considered a higher number of smaller plots would ensure capture of any variation within the area. This meant reducing the transect length to 50 m, which differed to Mitchell (2014, 2015) who used 100 m transect length. Consequently, the presented results have been scaled to represent this change in transect area, unless specified otherwise (e.g., species richness).

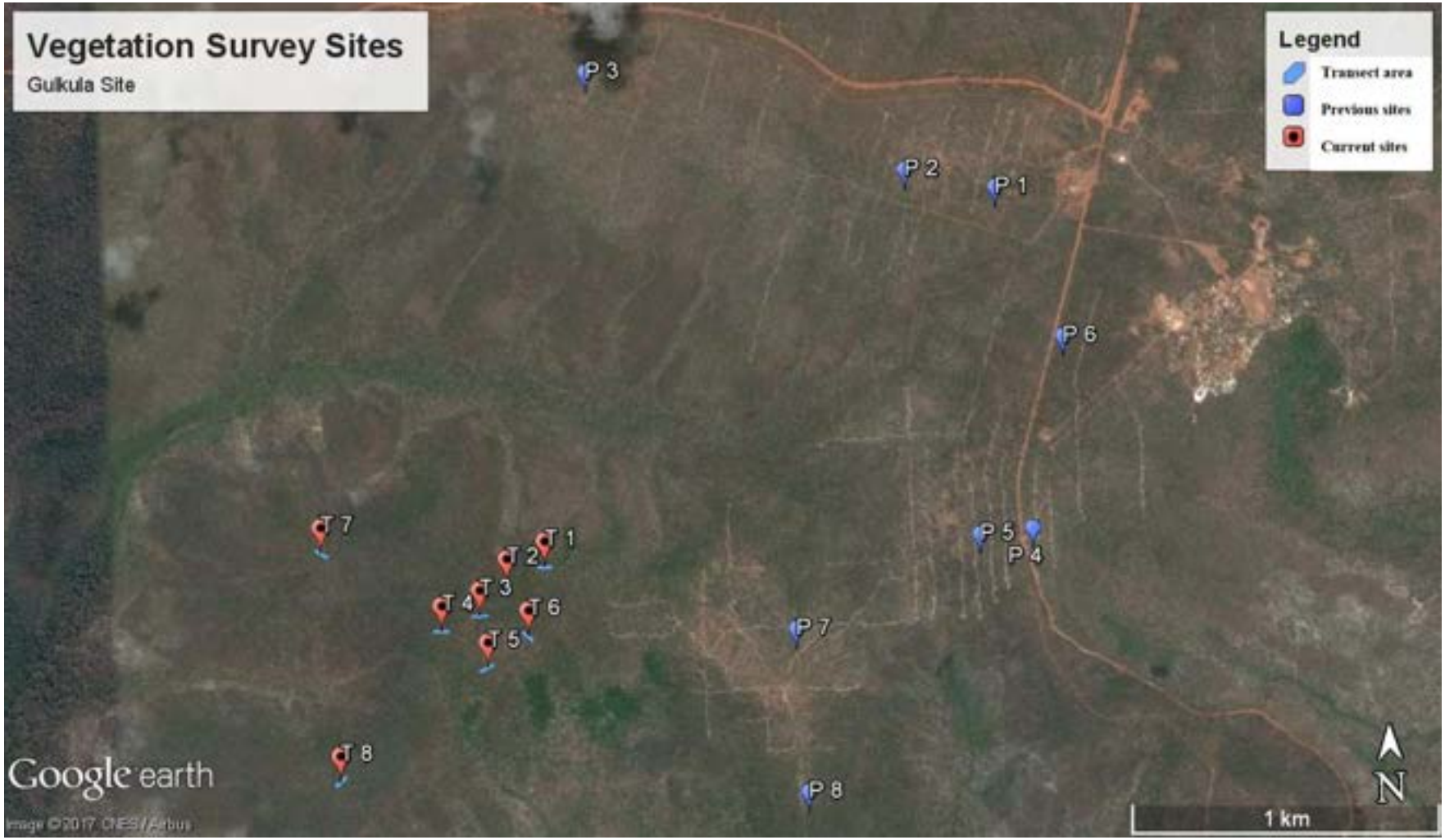

Figure 1. Map of study area, showing the sampled transects (T 1-8) and the previous sites (P 1-8).

Analysis

To compare the vegetation composition between the central and western areas of Dhupuma Plateau we assessed composition using non-metric multidimensional scaling (nMDS), based on Bray-Curtis Dissimilarity. Species richness was used to assess differences in diversity. Structure was compared using the number and average size of large trees (>20cm), stem density and Basal Area (BA). All analysis was conducted within Excel or in R statistical computing version 3.1.1.

Results

Composition and Diversity

Overall, we found that the number of species and their composition was comparable between the central and western areas of the plateau. The average number of plant species for the central area was 23 and for the western area was 20 per transect (Figure 2). However, species richness soon reaches a plateau and therefore the 100 m transect doesn't capture any more species then the 50 m transect. Due to this, we decided to not correct for this difference in sampling area for the presentation of figure 2- species richness results. However, for other presented results we corrected for this difference.

For both the western and central areas, species richness was highest for plants occurring within the herb vegetation layer and declined for the shrub and tree layers. The tree layer for all transects was dominated by *E. tetrodonta*, sometimes cooccurring with *E. miniate*. The shrub layers are dominated by either coppicing *E. tetrodonta* or *E. miniate* saplings, or with Cook Town ironwood (*Erythrophleum chlorostachys*), Emu Palm (*Livistona humilis*), cocky apple (*Planchonia careya*), wild mango (*Buchanania obovate*) or wattles (*Acacia sp.*). These vegetation patterns are very consistent between the two areas.

Species composition using the shrub and tree layers revealed little variation in species composition between the two areas, with 95% confidence intervals showing considerable overlap (Figure 3).

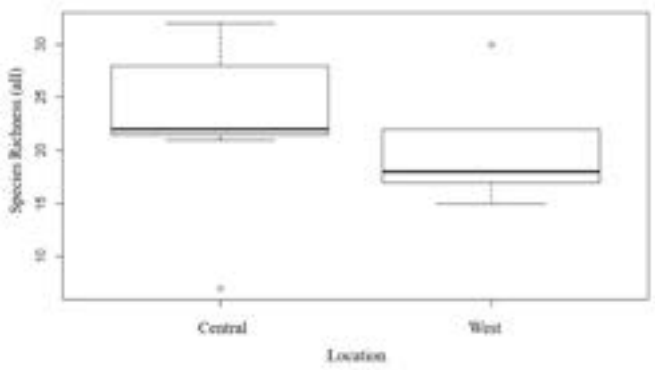

Figure 2. Species richness using all growth forms for the central and western areas. Note that the central area has not been corrected to compensate for the large transect length.

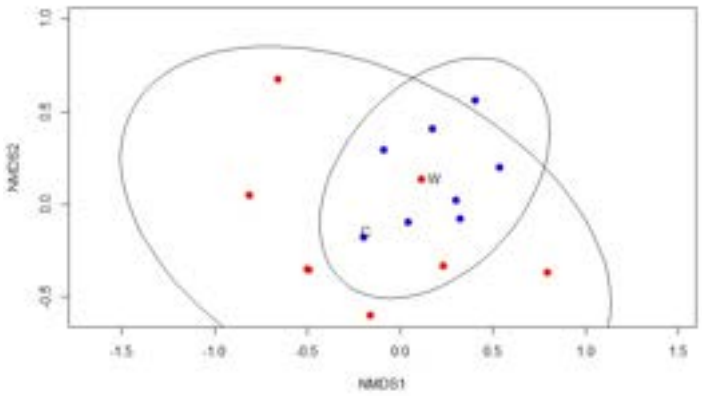

Figure 3. NMDS ordination using tree and shrub species presence/absence data for the central (C) and western (W) areas. Circles represent 95% confidence intervals.

Forest Structure

We found little difference in both the number of large trees (DBH >20cm) or the average size of large trees for each transect (Figure 4- left top and bottom). The average Basel Area's and stem densities for each transect showed marginally higher maximum and average values for the transects located within the central area. However, this difference is non-significant as demonstrated by the overlap in error bars (Figure 4- right top and bottom).

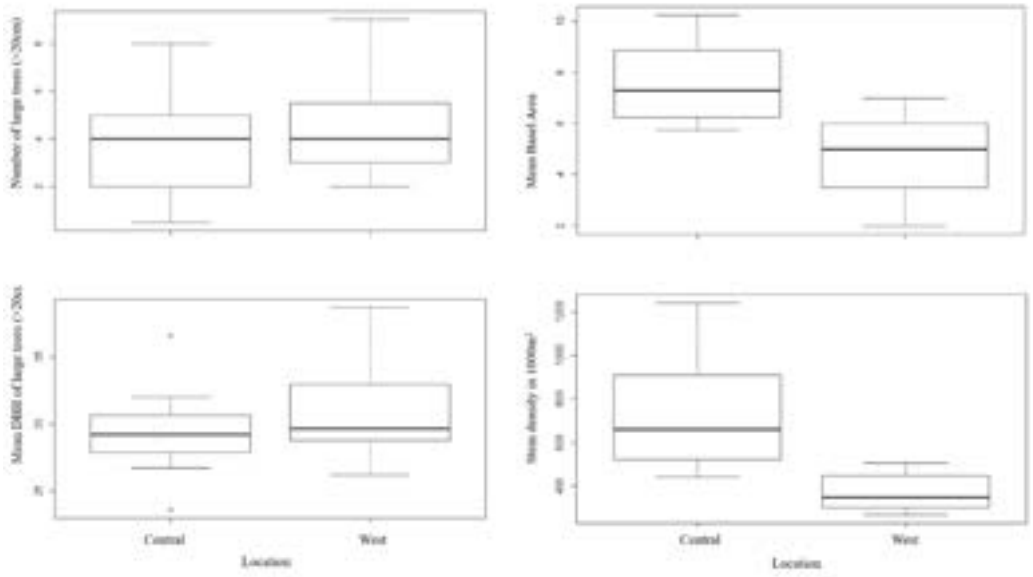

Figure 4. Number of large trees (left-top) and their average size (left-bottom), and the average Basel Areas (right-top) and stem densities (right-bottom) between the central and western areas.

Figure 5. Pictures from the 2017 and 2015 flora surveys for the central (right) and western (left) areas of the Dhupuma Plateau. Note the similarity in size class distributions and abundance of coppice regrowth and other damage due to cyclone Nathan.

Discussion and Conclusion

The vegetation on the Dhupuma Plateae is relatively uniform. Collectively, we found that the vegetation of the central Dhupuma Plateau is comparable to that of the western plateau, and is consistent within the broader forest type (Dhimurru Rangers 2012). Species richness and composition were similar between the two areas; indicating that most species were re-sampled within the western area survey. Structurally the forest in the central and western areas show a consisted pattern, typical of Plateau Woodland (Mitchell 2014, 2015). Due to both the areas being subject to similar disturbance regimes it is therefore not surprising that this occurs. Large and emergent trees are sparse in distribution across the plateau, with most of the vegetation occurring as a shrub layer of regrowth following the repeated disturbances. Due to the current survey being conducted two years after the 2015 survey, which occurred shortly after cyclone Nathan, the regrowth is now more developed (Figure 5), and will continue to develop until the next disturbance event. The data from the Mitchel (2014) vegetation survey is consistent with the 2017 assessment.

Key vegetation changes occur as the elevation drops of the plateau, primarily corresponding to changes in moisture availability. Given this, the vegetation on the Dhupuma Plateau is mostly uniform. Smaller-scale variation is mainly attributed to variation in disturbance intensity and frequency, and soil depth (Mitchel 2014, 2015).

There were no listed threatened species or vegetation types found in the 2014, 2015 or the current vegetation assessments, either on the plateau or immediately adjacent (per the Territory Parks and Wildlife Conservation Act (obtained from www.nt.gov.au/ipe/pwcnt) or Commonwealth Governments Protected Matters Search Tool).

In conclusion, the vegetation sampled on the western side of the Dhupuma Plateau is like that of the central area in terms of species diversity, composition and structure. This indicates the ecological processes shaping these communities are consistent and likely provide similar habitat for faunal communities and conservation values.

References

Brocklehurst, P., Lewis, D., Napier, D., Lynch, D. (2007) Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D. Department of Natural Resources, Environment and the Arts, Palmerston, Northern Territory.

Dhimurru Rangers (2012) Flora Survey of the Dhimurru Indigenous Protected Area (IPA). CSIRO/Dhimurru IPA

Mitchell, A. (2014) Flora and Vegetation Survey Report Proposed Gulkula Mine. Gulkula Mining Pty Ptd.

Mitchell, A. (2015) Flora and Vegetation Survey Report Proposed Gulkula Mine. Gulkula Mining Pty Ptd.