



TERN
AusPlots

Summary of Sites on Litchfield National Park May 2013- March 2014



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Acknowledgments

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Introduction

In June 2012, AusPlots, part of the Terrestrial Ecosystems Research Network (TERN), undertook surveys Litchfield National Park, Northern Territory. The surveys involved vegetation and soils work following the AusPlots Rangelands methodology, with 2 plots completed. The plots are part of over 580 plots completed nationally. Figure 1 shows the national AusPlots plot network, and Figure 2 shows the locations of the plots Litchfield National Park.

This report provides a snapshot of some of the data which was collected during the survey work. A more detailed description of the methods used can be found online in our *AusPlots Rangelands Survey Protocols Manual* (White *et al.* 2012), available from our website www.ausplots.org.

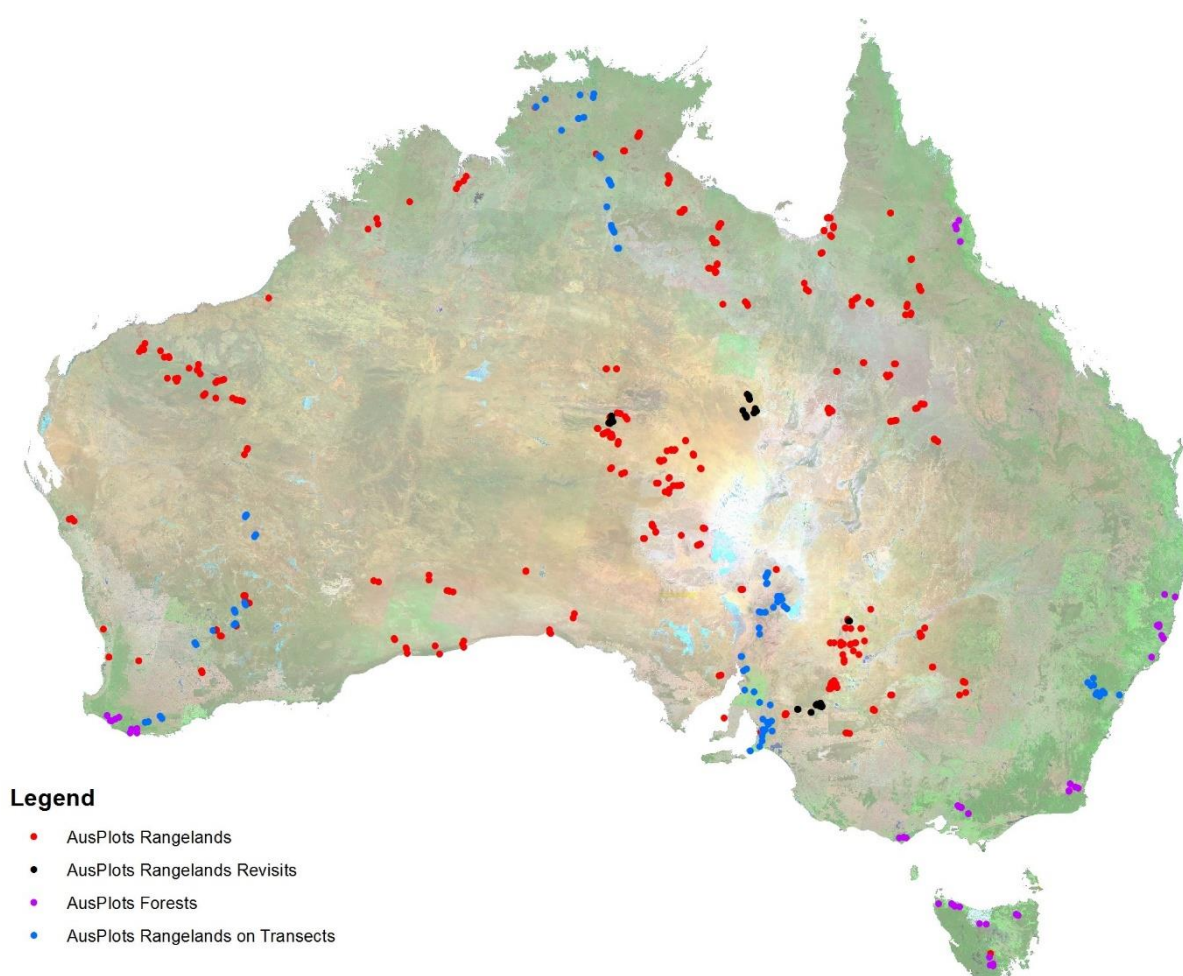


Figure 1. AusPlots plot network

LandSat Image used courtesy of the Commonwealth Department of the Environment

Topographic data copyright Geoscience Australia

Accessing the Data

All of the data the AusPlots collects is freely available online through the AEKOS data portal at www.aekos.org.au. It can also be viewed on the Soils to Satellites website which contains a range of useful visualisations sourced from the Atlas of Living Australia. At <http://www.soils2satellites.org.au/>.

Point intercept data

The point intercept method is a straightforward method that is readily repeatable and requires little instruction to produce reliable plot information. It provides accurate benchmark data at each plot including substrate type and cover; as well as species structural information such as growth form, height, cover and abundance and population vertical structure. The demographic information produced at each plot can be compared spatially to indicate plot differences, and temporally to indicate change over time. Additionally, the cover data collected at each plot can be used to validate cover data extrapolated through remote sensing techniques.

Plant collections

Each species that is found within the plot has a herbarium grade sample taken. These have all been formally identified by the NT herbarium. Much of the material is then lodged at the NT herbarium or at the Ausplots facility in Adelaide.

Leaf tissue samples

All of the above samples also have leaf tissue samples taken. This involves placing leaf samples from each species into a cloth bag and drying them on silica desiccant. All of the dominant species have an extra 4 samples collected. These samples are available for use on application to Ausplots facility in Adelaide. They are able to be used for genetic analysis, Isotopic composition and range of other uses.

Site description information

Contextual information is also collected at each site. This includes measures of slope an aspect, surface strew and lithology, and information on the grazing and fire history of the site. The sites location is also recorded with a differential GPS and the plot corners and centres (with landholder permission) marked with a star picket.

Structural summary

Detailed structural summary information is also collected at each site. When combined with the height and cover information from the point intercept data it enables the creation of structural description compatible with and NVIS level 5 description.

Leaf Area Index

In plots where a mid and/or upper canopy is present a measure of Leaf Area is recorded. The tool used is an LAI-2200 and it captures LAI measurements in a range of canopies using one or two sensors attached to a single data logger (LI-COR 1990). The LAI data has a range of potential application such as studies of canopy growth, canopy productivity, woodland vigour, canopy fuel load, air pollution deposition, modelling insect defoliation, remote sensing, and the global carbon cycle.

Basal area

Basal area measurements are collected across plots where woody biomass is taller than 2m. Basal area measurements provide information useful for calculating biomass and carbon levels and for structural studies. The wedge aperture, the length of string – 50 cm (and hence the distance from the eye and subsequent angle from the eye to the edges of the wedge aperture) and species count are all important in calculations. Algorithms developed for use with the basal wedge include the above data to calculate plant basal area on a per hectare basis even though species are counted outside the one hectare plot area. The method is plotless but used because it is based on the

concept of circles (trunks/basal area) within circles (circular plots) – the area of one varies proportionally to the change in the area of the other. Use of the basal wedge may be superseded by further improvement of the 3D photo point method and development of algorithms to provide information on vegetation community structure.

Soil classification

Soils descriptions i.e. information recorded, number of recordings and coverage of locations, are generally poor across the rangelands region of Australia. The plot descriptions and soil characterisations collected will substantially alleviate this paucity of information. The data collected can also be used to increase the reliability of the rangelands component of the Soil and Landscape Grid of Australia, produced by the TERN facility consistent with the Global Soil Map specifications. Analyses of the collected samples will greatly enhance the level of knowledge (e.g. nutrient and carbon levels) and hence understanding of rangelands soils and how they will respond to climate change and management options. It is hoped to eventually be able to analyse all 9 of the soil pits from within the plot using a number of different methods e.g. wet chemistry, MIR or NIR (mid infrared spectrometry or near infrared spectroscopy) either individually to provide a measure of variation of the parameter being measured across a plot or bulked together and a sub-sample extracted and analysed to provide a mean value for that parameter across a plot.

Soil meta barcoding samples

Metagenomics is the study of genetic material recovered directly from environmental samples. Soil metagenomics provides the opportunity to understand what organisms are present at survey plots and provides an indication on their abundance. The collection techniques result in a bias towards higher order organisms. All of the Ausplots Litchfield National Park have soil meta barcoding samples collected.

Soil bulk density

The soil bulk density (BD), also known as dry bulk density, is the weight of dry soil divided by the total soil volume. The total soil volume is the combined volume of solids and pores which may contain air or water, or both. The average values of air, water and solid in soil are easily measured and are a useful indication of a soils physical condition. Soil test results are most often presented either as a percentage of soil (e.g. % organic carbon) or as a weight per unit of soil (e.g. nitrogen, mg/kg). As bulk density is a measure of soil weight in a given volume, it provides a useful conversion from these units to an area basis unit (e.g. t/ha). The resulting number gives an easily understandable idea of the carbon storage or nutritional status of the soil on an area basis.

3D Photo Panorama

AusPlots uses a three-dimensional method for photographing the site. This involves taking three 360 degree panoramas in a triangular pattern. This allows the creation of a 3D model of the vegetation within the site which can be used to monitor change over time, track plot condition as well as providing a unique, fast measurement of basal area and biomass. A subset of these photo panoramas is shown below.



NTADAC0001



NTTDAC0001

Regional Context

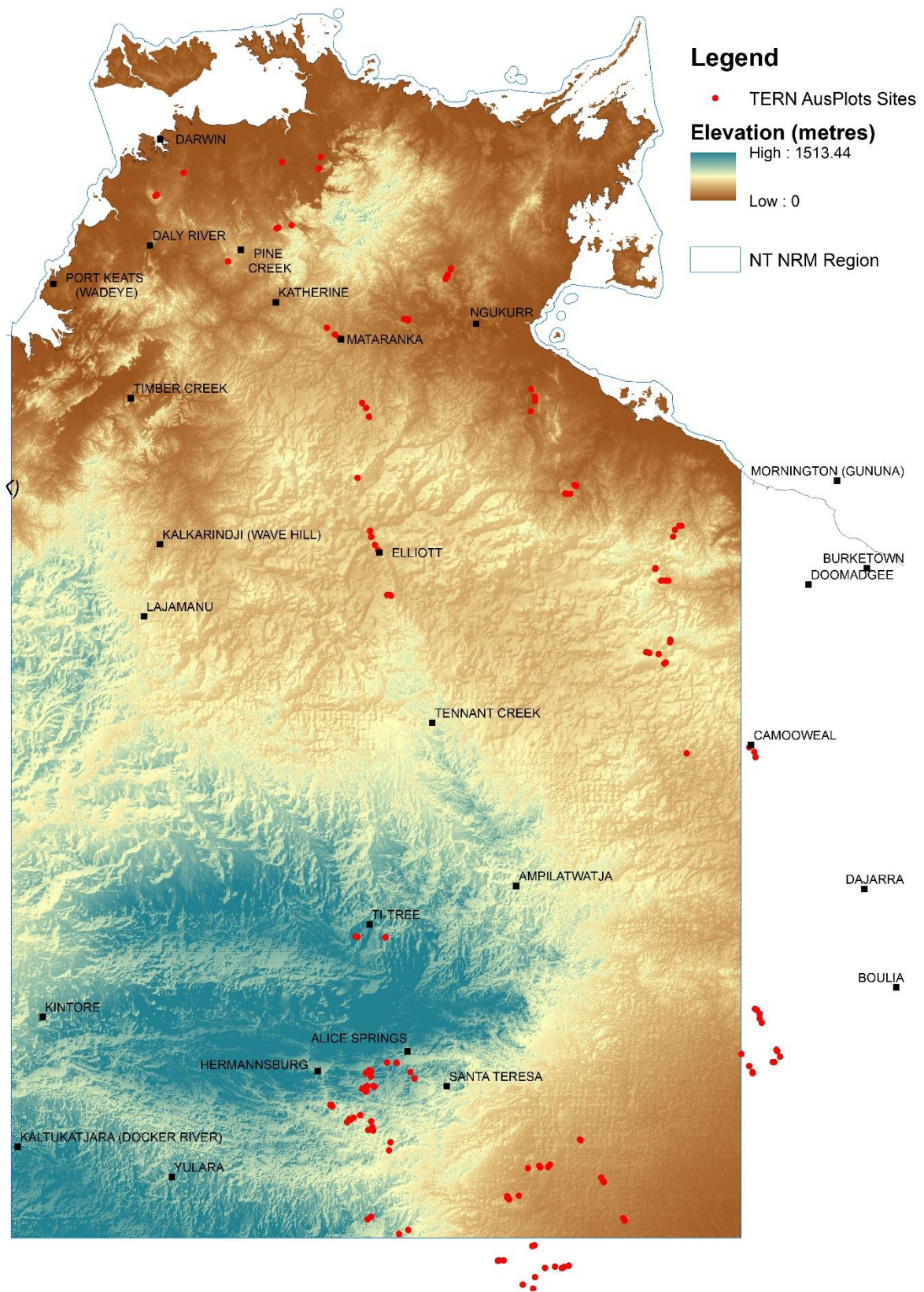


Figure 3. Modelled 9s elevation

Data from: Xu and Hutchinson, 2011. ANUCLIM Version 6.1. Fenner School of Environment and Society, Australian National University, Australia.

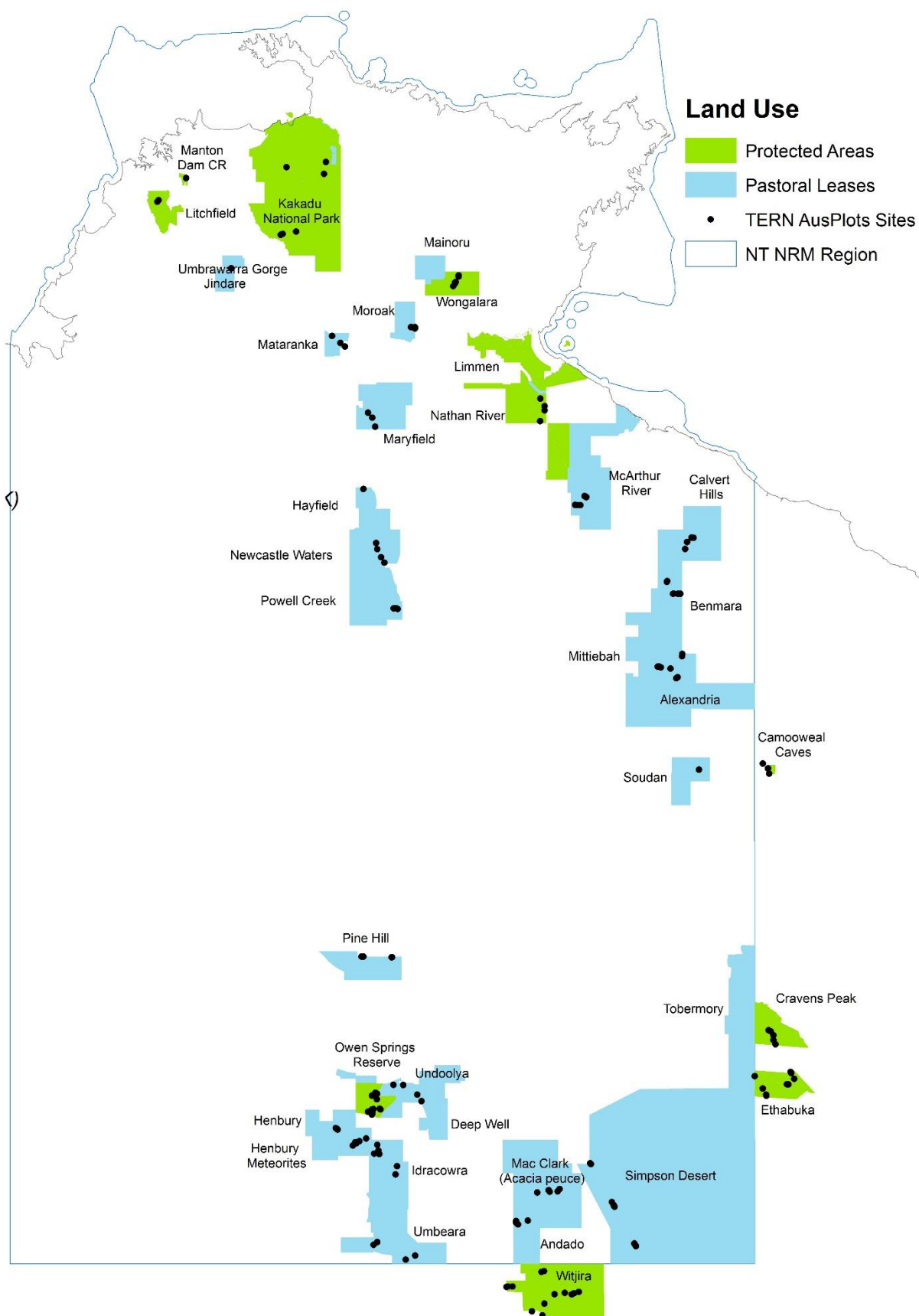


Figure 4. Conservation and pastoral land use

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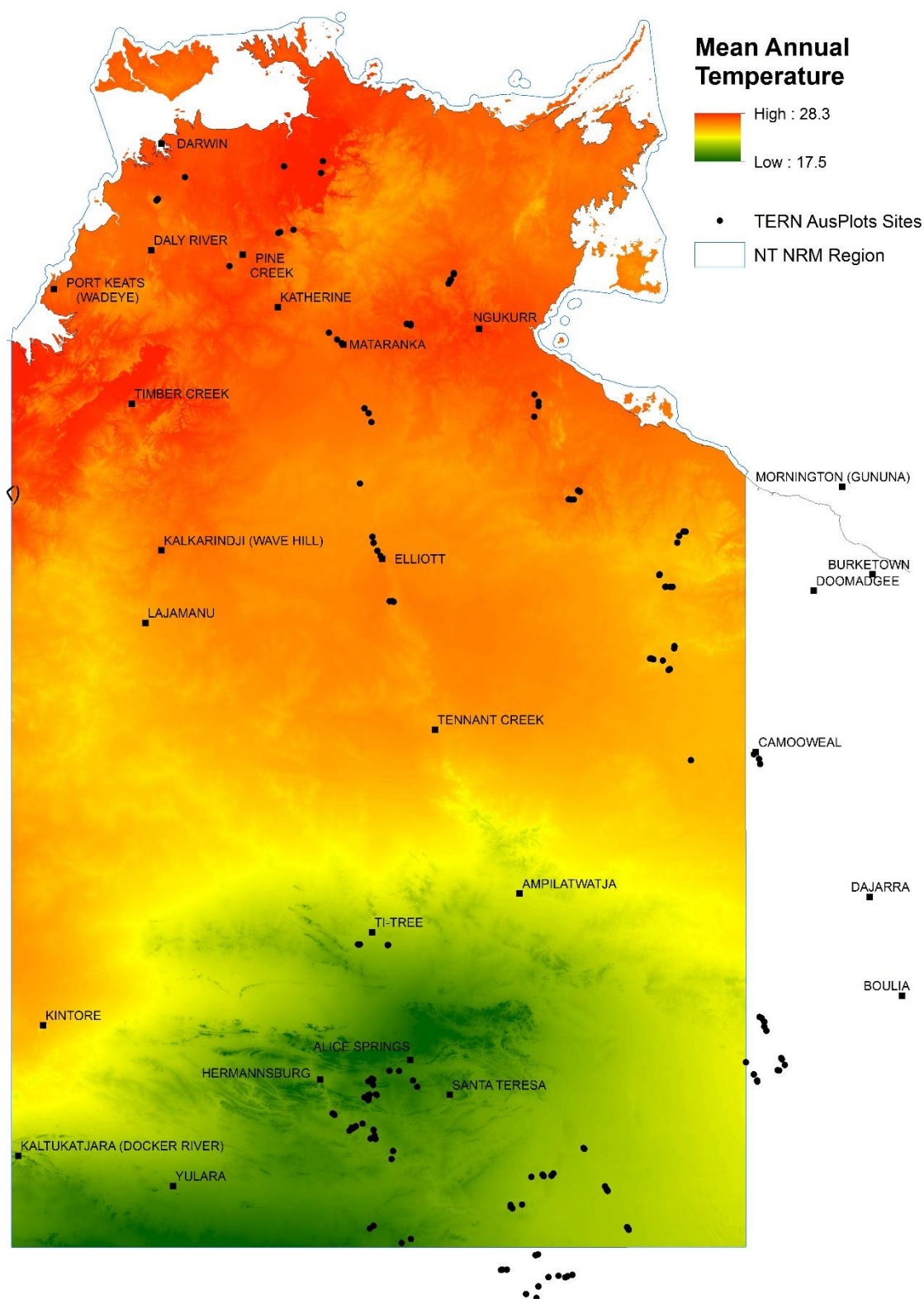


Figure 5. Mean annual temperature

Data from: Xu and Hutchinson, 2011. ANUCLIM Version 6.1. Fenner School of Environment and Society, Australian National University, Australia.

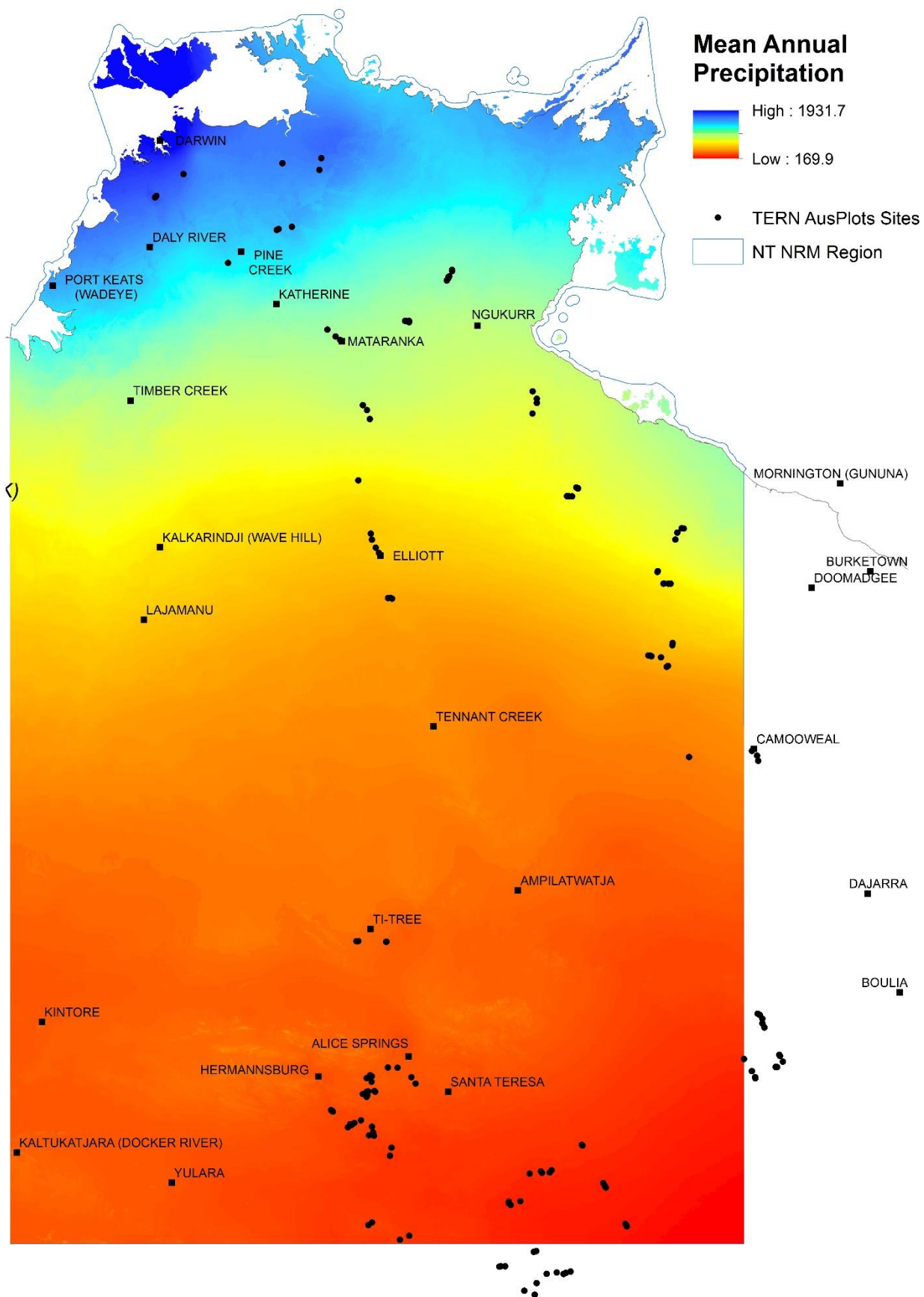


Figure 6. Mean annual Precipitation

Climate Data from: Xu and Hutchinson, 2011. ANUCLIM Version 6.1. Fenner School of Environment and Society, Australian National University, Australia.

Uses of AusPlots Data from Litchfield National Park

The AusPlots survey method was developed out of a dire need for consistent, national scale ecological data and surveillance monitoring. To date, we have completed over 530 survey plots across the continent. The data and samples collected from these surveys are being used in a range of ways to allow comparisons across the state and the continent. Some of the projects that have made use of the data and samples from Litchfield National Park sites are listed below.

Opportunities for Integrated Ecological Analysis across Inland Australia with Standardised Data from Ausplots Rangelands (*Greg Guerin*)

How species abundance distributions (SADs) vary over climatic gradients is a key question for the influence of environmental change on ecosystem processes. Greg Guerin is a researcher based at the University of Adelaide. Greg has undertaken analysis on the entire plot network (Including Litchfield) He has found linear relationships between SAD shape and rainfall within grassland and shrubland communities, indicating more uneven abundance in deserts and suggesting relative abundance may shift as a consequence of climate change, resulting in altered diversity and ecosystem function.

Floristic and structural assessment of Australian rangeland vegetation with standardized plot based surveys (*Zdravko Baruch*)

Vegetation classification at a continental scale has been lacking over the rangelands in Australia due to a lack of consistent data beyond state and regional levels. Zdravko undertook an integrated and comparative environmental, floristic and structural description of rangeland vegetation based on the AusPlots Surveys. His results offer a tentative classification scheme that is novel, ecologically sound and coherent in terms of floristic composition and structural attributes.

The extent of forest in dryland biomes (*Jean-Francois Bastin*)

The vegetation cover data from Litchfield was also part of a recent mapping project undertaken by the Food and Agriculture arm of the UN. They were able to show that in 2015, 1327 million hectares of drylands had more than 10% tree-cover, and 1079 million hectares comprised forest globally. Their estimate is 40 to 47% higher than previous estimates, corresponding to 467 million hectares of forest that have never been reported before. This increases current estimates of global forest cover by at least 9%.

Herbarium Collections

The AusPlots program works very closely with state and national herbaria to help augment their collections to enable research and to better understand species distributions. Located in valuable areas of native vegetation, the plant collections made on Litchfield National Park have been eagerly accepted by the NT Herbarium and the National Herbarium in Canberra. These specimens are currently being professionally mounted and preserved and will form a permanent part of their collection, which is available to botanical researchers globally to support ongoing research.

Some other applications that may be undertaken in the future are listed below.

- Assessing vegetation change using the AusPlots methodology as both a baseline and a continued surveillance monitoring tool.
- Detecting the impact of invasive species based on soil and vegetation data.
- Ground-truthing satellite derived vegetation and soil data
- Soil carbon analysis using the soil bulk density samples
- Mapping soil phosphorus, nitrogen and other nutrients using soil pit and subsite samples
- Assessing fuel loading using the basal area and leaf area data.
- Use of the leaf tissue samples for genetic and isotopic analysis.

For more information

More information on the AusPlots facility can be found on our website www.AusPlots.org

For more information regarding the survey work on Litchfield National Park and assistance downloading and utilising the data from *AEKOS* and *Soils2Satellites* contact Emrys Leitch, AusPlots Field Survey Officer, emrys.leitch@adelaide.edu.au

For more information regarding the AusPlots facility, contact Ben Sparrow, AusPlots Director, ben.sparrow@adelaide.edu.au

Appendices

Appendix 1. Summary of AusPlots data and samples from Litchfield National Park

AusPlots Data and Samples	Count
<i>Total Collections</i>	91
<i>Total Leaf Tissue Samples</i>	138
<i>Total number of soil samples</i>	48
<i>Total weight of soil (kg)</i>	48
<i>Number of sites with Bulk Density data</i>	2
<i>Number of Sites with LAI</i>	2
<i>Number of Sites with Basal wedge</i>	2
<i>Total metagenomic samples</i>	18
<i>Total metagenomic weight (kg)</i>	9

Appendix 2. Plot locations

Plot Name	Date	Location	latitude	longitude
NTADAC0001	28-May-13	Litchfield national park. 30km south west of Bachelor. 77.5km south south west of Darwin. Along track to Lost City from Litchfield Road.	-13.1584	130.777911
NTTDAC0001	18-Mar-14	Litchfield National Park. 27 km south west of Bachelor	-13.1398	130.795687

Appendix 3. Co-location with existing plots

AusPlots works on a mix of both new plots (where this is little existing monitoring infrastructure) and co-location with existing plots. The two plots on Litchfield National Park are co-located with existing two existing TERN Facilities monitoring sites. The table below provides the name of the AusPlots site and the corresponding site

AusPlot name	ACRIS Plot name
NTADAC0001	TERN Litchfield Supersite
NTTDAC0001	TERN Australian Transect Network NATT Site

Appendix 4. Point intercept data

Plot name	Herbarium ID	Common name	Approx. % cover
NTAGFU0026	Schizachyrium fragile	Firegrass	15.4
NTTDAC0001	Sorghum plumosum	Plume Sorghum	28.42
NTTDAC0001	Eucalyptus tetrodonta	Darwin Stringybark	23.27
NTTDAC0001	Erythrophleum chlorostachys	Camel Poison	9.21
NTTDAC0001	Themeda avenacea	Kangaroo-grass	8.71
NTTDAC0001	Petalostigma pubescens	Bitter Bark	5.64
NTTDAC0001	Acacia difficilis		4.75
NTTDAC0001	Heteropogon triticeus	Giant Speargrass	4.16
NTTDAC0001	Croton arnhemicus		3.86
NTTDAC0001	Terminalia ferdinandiana	Green Plum	3.56
NTTDAC0001	Eucalyptus miniata	Bogong Gum	3.56
NTTDAC0001	Corymbia ptychocarpa subsp. ptychocarpa		2.38
NTTDAC0001	Spermacoce occultiseta		1.58
NTTDAC0001	Urochloa ramosa		1.58
NTTDAC0001	Grevillea pteridifolia	Darwin Silky Oak	1.39
NTTDAC0001	Desmodium pullenii		1.29
NTTDAC0001	Grevillea heliosperma	Rock Grevillea	1.19
NTADAC0001	Eucalyptus tetrodonta	Darwin Stringybark	20.10
NTADAC0001	Eucalyptus miniata	Bogong Gum	9.80
NTADAC0001	Petalostigma quadriloculare	Bitter Crab	5.15
NTADAC0001	Erythrophleum chlorostachys	Camel Poison	4.26
NTADAC0001	Pandanus spiralis	Common Screwpine	3.96
NTADAC0001	Grevillea pluricaulis		3.76
NTADAC0001	Galactica sp.		1.98
NTADAC0001	Livistona humilis	Sand Palm	1.19
NTADAC0001	Acacia sp.		1.19

Appendix 5. Substrate and growth form

Plot Name	Substrate	Approx. % Cover
NTADAC0001	Bare	2.47
NTADAC0001	Cryptogam	0.09
NTADAC0001	Coarse Woody Debris	1.19
NTADAC0001	Litter	95.33
NTADAC0001	Unknown	0.92

Plot Name	Substrate	Approx. % Cover
NTTDAC0001	Bare	11.27
NTTDAC0001	Cryptogam	1.32
NTTDAC0001	Gravel	2.87
NTTDAC0001	Litter	84.54

Plot Name	Growth form	Approx. % of Growth Forms
NTADAC0001	Tussock grass	46.60
NTADAC0001	Tree/Palm	28.89
NTADAC0001	Shrub	21.30
NTADAC0001	Vine	1.95
NTADAC0001	Forb	1.26

Plot Name	Growth form	Approx. % of Growth Forms
NTTDAC0001	Tussock grass	39.23
NTTDAC0001	Tree/Palm	36.55
NTTDAC0001	Shrub	18.59
NTTDAC0001	Forb	3.31
NTTDAC0001	Vine	2.32

Appendix 6. Structural summary

Plot name	Structural description
NTADAC0001	Eucalyptus tetradonta open forest with Eucalyptus miniata and Erythrophleum chlorostachys. A mid stratum dominated by Petalostigma quadriloculare and Pandanus spiralis. A ground stratum of Mixed tall tussock grasses.
NTTDAC0001	Eucalyptus tetradonta mid open forest with Erythrophleum chlorostachys, Eucalyptus miniata and Corymbia ptychocarpa subsp. ptychocarpa. A mid stratum dominated by Petalostigma pubescens and Acacia difficilis and a ground stratum dominated by Sorghum plumosum with Themeda avenacea and Heteropogon triticeus

Appendix 7. Soil Classification

Plot name	Upper depth	Lower depth	Horizon	Texture	Colour when wet	ph	effervescence
NTTDAC0001	0	0.1	A1	Sand	5YR36	5.9	Non-calcareous
NTTDAC0001	0.1	1	A3	Clayey sand	2.5YR46	5.5	Non-calcareous

Appendix 8. Bulk density

Plot name	Sample depth	Fine earth weight	Fine earth bulk density
NTADAC0001	0 to 10cms	275.16	1.31
NTADAC0001	10-20cms	271.27	1.3
NTADAC0001	20-30cms	262.66	1.25
NTTDAC0001	0 to 10cms	309.01	1.48
NTTDAC0001	10-20cms	286.23	1.37
NTTDAC0001	20-30cms	316.84	1.51

Appendix 9. Plant collection

Plot name	Herbarium determination	Common Name	NT Conservation Code
NTADAC0001	Acacia dimidiata		
NTADAC0001	Acacia lamprocarpa	Western Salwood	
NTADAC0001	Acacia oncinocarpa		
NTADAC0001	Acacia sp.	Wattle	
NTADAC0001	Acacia tolmerensis		
NTADAC0001	Alloternopsis semialata	Cockatoo grass	
NTADAC0001	Alphitonia excelsa	Coopers Wood	
NTADAC0001	Ampelocissus sp.		
NTADAC0001	Arthrostylis aphylla		
NTADAC0001	Bonamia sp.		
NTADAC0001	Brachychiton sp.	Flame Tree	
NTADAC0001	Buchanania obovata	Green Plum	
NTADAC0001	Buchnera linearis	Blackrod	
NTADAC0001	Carytia / Calamopina		
NTADAC0001	Chrysopogon fallax	Golden Beardgrass	
NTADAC0001	Clerodendrum tatei		
NTADAC0001	Corymbia polysciada		
NTADAC0001	Denhamia obscura	Weeping Denhamia	
NTADAC0001	Ehretia sp.		
NTADAC0001	Eriachne avenacea		
NTADAC0001	Eriosema sp.		
NTADAC0001	Erythrophleum chlorostachys	Camel Poison	
NTADAC0001	Eucalyptus miniata	Bogong Gum	
NTADAC0001	Eucalyptus tetradonta	Darwin Stringybark	
NTADAC0001	Euphorbiaceae sp.	Spurge	
NTADAC0001	Fabaceae sp.	Bean	
NTADAC0001	Flemingia parviflora		
NTADAC0001	Galactica sp.		
NTADAC0001	Goodenia armstrongiana		
NTADAC0001	Grevillea pluricaulis		
NTADAC0001	Grevillea pteridifolia	Darwin Silky Oak	
NTADAC0001	Grevillea sp.	Grevillea	
NTADAC0001	Haemodorum coccineum	Scarlet-flowered Blood-root	
NTADAC0001	Heteropogon triticeus	Giant Speargrass	
NTADAC0001	Hibbertia dilatata		
NTADAC0001	Hibbertia juncea		
NTADAC0001	Hibbertia lepidota		

Plot name	Herbarium determination	Common Name	NT Conservation Code
NTADAC0001	Livistona humilis	Sand Palm	
NTADAC0001	Lomandra tropica		
NTADAC0001	Microstachys chamaelea		
NTADAC0001	Murdannia graminea	Grass Lily	
NTADAC0001	No ID		
NTADAC0001	Pandanus spiralis	Common Screwpine	
NTADAC0001	Parinari nonda	Nonda	
NTADAC0001	Persoonia falcata	Booral	
NTADAC0001	Petalostigma quadriloculare	Bitter Crab	
NTADAC0001	Planchonia careya	Billygoat Plum	
NTADAC0001	Poaceae sp.	grasses	
NTADAC0001	Pseudopogonatherum irritans		
NTADAC0001	Sauropus sp.		
NTADAC0001	Scleria novae-hollandiae		
NTADAC0001	Sorghum intrans		
NTADAC0001	Sorghum plumosum	Plume Sorghum	
NTADAC0001	Spermacoce sp.	False Buttonweed	
NTADAC0001	Stemodia sp.	Twintip	
NTADAC0001	Stenocarpus acacioides		
NTADAC0001	Stenocarpus cunninghamii	Little Wheel Bush	
NTADAC0001	Syzygium suborbiculare	Apple	
NTADAC0001	Thaumastochloa major		
NTADAC0001	Thymelaeaceae sp.	Rice-flowers	
NTADAC0001	Uraria lagopodioides		
NTADAC0001	Zornia sp.		
NTTDAC0001	Acacia difficilis		
NTTDAC0001	Alphitonia excelsa	Coopers Wood	
NTTDAC0001	Arthrostylis aphylla		
NTTDAC0001	Bonamia brevifolia		
NTTDAC0001	Buchnera linearis	Blackrod	
NTTDAC0001	Capparis umbonata	Native Pomegranate	
NTTDAC0001	Cartonema spicatum		
NTTDAC0001	Cheilanthes nitida		
NTTDAC0001	Corymbia ptychocarpa subsp. ptychocarpa	Spring bloodwood	
NTTDAC0001	Crotalaria montana var. angustifolia		
NTTDAC0001	Croton arnhemicus		
NTTDAC0001	Denhamia obscura	Weeping Denhamia	
NTTDAC0001	Desmodium pullenii		
NTTDAC0001	Dodonaea hispidula		
NTTDAC0001	Dolichandrone filiformis		
NTTDAC0001	Drosera derbyensis		
NTTDAC0001	Eriachne avenacea		

Plot name	Herbarium determination	Common Name	NT Conservation Code
NTTDAC0001	Eriachne obtusa	Northern Wanderie Grass	
NTTDAC0001	Eriosema chinense		
NTTDAC0001	Erythrophleum chlorostachys	Camel Poison	
NTTDAC0001	Eucalyptus miniata	Bogong Gum	
NTTDAC0001	Eucalyptus tetradonta	Darwin Stringybark	
NTTDAC0001	Flemingia parviflora		
NTTDAC0001	Flemingia pauciflora		
NTTDAC0001	Fungi	Fungus	
NTTDAC0001	Gonocarpus leptothecus		
NTTDAC0001	Goodenia janamba		
NTTDAC0001	Grevillea dimidiata		
NTTDAC0001	Grevillea heliosperma	Rock Grevillea	
NTTDAC0001	Grevillea pteridifolia	Darwin Silky Oak	
NTTDAC0001	Grevillea sp.	Grevillea	
NTTDAC0001	Helicteres tenuipila		Near Threatened
NTTDAC0001	Heteropogon triticeus	Giant Speargrass	
NTTDAC0001	Hibbertia brevipedunculata		
NTTDAC0001	Hibbertia dilatata		
NTTDAC0001	Hibbertia tasmanica		
NTTDAC0001	Ipomoea graminea		
NTTDAC0001	Ipomoea tolmerana subsp. tolmerana		
NTTDAC0001	Livistona humilis	Sand Palm	
NTTDAC0001	Lomandra tropica subsp. tropica		
NTTDAC0001	Marsdenia trinervis		
NTTDAC0001	Microstachys chamaelea		
NTTDAC0001	Mitrasacme exserta		
NTTDAC0001	Murdannia graminea	Grass Lily	
NTTDAC0001	Owenia vernicosa	Emu Apple	
NTTDAC0001	Pandanus spiralis	Common Screwpine	
NTTDAC0001	Patersonia macrantha		
NTTDAC0001	Petalostigma pubescens	Bitter Bark	
NTTDAC0001	Polygala bifoliata		
NTTDAC0001	Polygala dependens		
NTTDAC0001	Poranthera coerulea		
NTTDAC0001	Sauropus stenocladus subsp. pinifolius		
NTTDAC0001	Setaria apiculata	Pigeon grass	
NTTDAC0001	Sorghum plumosum	Plume Sorghum	
NTTDAC0001	Spermacoce occultisetia		
NTTDAC0001	Stackhousia intermedia		
NTTDAC0001	Syzygium suborbiculare	Apple	
NTTDAC0001	Tacca leontopetaloides		
NTTDAC0001	Terminalia canescens	Pindan Walnut	

Plot name	Herbarium determination	Common Name	NT Conservation Code
NTTDAC0001	<i>Terminalia ferdinandiana</i>	Green Plum	
NTTDAC0001	<i>Thaumastochloa major</i>		
NTTDAC0001	<i>Themeda avenacea</i>	Kangaroo-grass	
NTTDAC0001	<i>Thysanotus banksii</i>		
NTTDAC0001	<i>Urochloa ramosa</i>		
NTTDAC0001	<i>Vigna lanceolata</i> var. <i>filiformis</i>	Maloga Bean	
NTTDAC0001	<i>Vigna vexillata</i> var. <i>angustifolia</i>	Wild Cow Pea	



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