

LAND UNITS OF THE
BEATRICE HILL
EXPERIMENT STATION

No. 9



*Animal Industry and Agriculture Branch,
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REPORT ON THE LAND UNITS OF THE BEATRICE HILL EXPERIMENTAL STATION 1972

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1.

INTRODUCTION

(A) LAND UNIT MAPS

Land unit mapping is undertaken to evaluate the use potential of the soils and other resources of a region.

Areas of land which exhibit an essentially uniform photo pattern on aerial photographs comprise a land unit. (Aldrick and Robinson, 1970). The uniformity of photo pattern reflects a uniformity in features such as land form, soil and vegetation, although minor variation in any of these is acceptable.

Land use potential is subjectively assessed for the units, taking into account limitations such as soil, depth, slope, drainage, rockiness or erodibility.

The land units of the Beatrice Hill station were delineated by studying 1 : 16,000 scale aerial photographs in conjunction with ground control surveying and sampling.

(B) BEATRICE HILL EXPERIMENTAL STATION

Beatrice Hill experimental station covers approximately 3,800 hectare (9,600 acres) beside the Mount Bunday Road, 75 kilometres (47 miles) by road south-east of Darwin. Property details and location are shown on the map included with this report.

Originally, a small area of the clay plain near Beatrice Hill was set aside by the Northern Territory Administration (N.T.A.) as experimental plots for rice and other crops. The present boundaries of the station were determined in early 1972 and include what was then considered to be a balance between the plains and the higher (upland) country for the purpose of raising cattle.

On the station, experimental animal husbandry and pasture management is carried out by officers of the Animal Industry and Agriculture Branch of the N.T.A. At the same time of writing this report, projects were under way on cattle breed comparisons, (including buffalo and banteng) management techniques, parasite studies, pasture comparisons and weed control problems.

(C) CLIMATE

The climate is wet monsoonal with an average annual rainfall (recorded at Beatrice Hill) of 1370 mm (54 ins.) occurring mainly between November and April. Rainfall intensities of up to 300 mm (12 ins.) per hour for five minutes have been recorded in the region while falls of 125 mm to 150 mm (5 ins. to 6 ins.) per hour for 30 minutes are quite common.

Maximum and minimum average temperatures measured at the Coastal Plains Research Station (C.P.R.S.) are 36°C (97°F) and 23°C (74°F) in October and 32°C (90°F) and 16°C (60°F) in July.

The monsoonal rainfall results in seasonal flooding of the clay plains. Flooding begins in late January and water persists in depressions on the plains well into July. Water to a depth of 1.5 meters (5 ft.) is common across the plain following heavy rain as a result of cyclonic disturbances over the Adelaide River catchment.

Potential evaporation is 2135 mm (84 ins.) annually, well in excess of precipitation. This, in conjunction with the heavy rainfall, strongly influences the vegetation and soil forming processes. The dry season acts as a strong selective force in favour of those plant species with drought avoiding mechanisms such as having a deciduous canopy or some other form of seasonal growth cycle. This selective force is reinforced by the almost yearly occurrence of fire. Van de Graaff (1965) noted that the excessive quantity of water which the soil must accommodate during the wet season leads to leaching of soluble material from the profile, while the alternate, complete drying that occurs in most of the soil families causes precipitation of dissolved materials. Under such conditions, the formation of mottles and subsequently of sesquioxide nodules is common. Weathering under the hot, seasonally wet conditions is likely to be rapid.

The run-off from high intensity rains at the onset of the wet season (when the cover given by native vegetation is most sparse and the soil is most susceptible to damage from run-off) results in the development of skeletal soils on slopes above 5%. (Van de Graaff, 1965).

2.

HYDROLOGY

Beatrice Hill is 90 km upstream from the mouth of the Adelaide River and the tidal influence persists. This influence becomes more pronounced as the fresh water flow decreases during the "dry" season (May to October) and the salt concentration in the river increases to a level dangerous to the growth of commercially useful plants.

TABLE 1

Salt concentration of Adelaide River water at Beatrice Hill (1959)

	Max. salt concentration (parts per million(p.p.m.))	Min. salt concentration (p.p.m.)
May 28	110	70
June 30	260	120
July 30	520	380
August 27	1100 *	800
Sept. 17	2300 *	1300 *

* These values are in excess of the accepted safe level of salt for normal plant growth.

Evaporation seasonally lowers the quality of water in storages in the area and irrigation is not practicable after August from the existing water supply.

Results from a bore-hole sunk in the Navy block, which should be representative for ground water from the high country on the station, show promise of a good supply of reasonably high quality water.

TABLE 2

Dissolved salts	p.p.m.
Calcium	24
Magnesium	15
Sodium	2
Carbonate	150
Sulphate	<2
Chloride	8

Recommended flow rate after pump testing : 2,000 G.P.H.

Source : Water Resources Branch, N.T.A., 1969.

This admits the possibility of more intensive agriculture on the deep Red Earths (Killuppa family, intergrading to Berrimah) less than one mile north of the bore-hole. For example, irrigated horticultural crops or forage and other cash crops. Further work on the suitability of the soils in the area for irrigation should be undertaken. Points for consideration could be :

- (i) Effect of removal of native vegetation on the soil moisture holding capacity.
- (ii) Method of application of water to give sufficiently even storage, with minimal erosion or compaction.
- (iii) Range of soil moisture content which will support adequate plant growth.
- (iv) Determination of the leaching requirement.

Permanent, though seasonally brackish water provided by Fogg Dam (close to the northern boundary of the station) attracts cattle which concentrate in the area as the dry season continues. Estimates of the pressure put on the area by cattle run to one thousand head in approximately ten square miles of readily accessible country around the dam. (J. Hayes, pers. comm.). This is well in excess of estimates of the carrying capacity of the country in this region, which, while controversial, vary around four to six beasts per square mile in the unimproved state (R. Story, 1969).

3.

SOIL GEOGRAPHY(A) LAND SYSTEMS

The station is within the area mapped by Story et al. in "Lands of the Adelaide-Alligator Area, N.T., 1969" and includes areas of the sub-coastal plain of the Adelaide River and of lateritic, gently undulating higher country. The plains (approximately half the total area) rise no more than eight metres (25 ft.) above sea level and consist of Cyperus Land System. The hills slope gently upwards to about 30 m (100 ft.) above sea level with a more or less level crust, and consist predominantly of Kosher Land System with some Krokane and some poorly defined Keating Land System. Beatrice Hill itself out-crops as Baker Land System from the floor of the old river basin through the clay plain in the southern corner of the station.

(B) SURFACE DRAINAGE

The road leading to the C.P.R.S. coincides with a crest running across the middle of the station (see map). The area south-east of this crest drains as surface flow and as seepage to Beatrice Lagoon, a remnant of an earlier river system on the plain, and eventually to the Adelaide River. The area north-east of the "crest" acts essentially as part of the catchment for Fogg Dam situated near the northern boundary of the station.

(C) SOIL DISTRIBUTION

The distribution of soils throughout the area can be related to soil drainage, past climatic influences, the distribution of various land form elements and to the underlying geological formations.

In general, weathering of the land forms (both local and those further up what is now the Adelaide River catchment) seems to account for the overall distribution of soils, while recently developed drainage patterns control superimposed local variation.

Most of the higher country seems to be formed on late Tertiary sediments which have been deeply weathered and extensively lateritised. Beneath lie planed-off, lower Proterozoic formations which occasionally out-crop in the region. Whitestone Ridge (parallel to and just outside the north-western boundary at the northern tip of the station) is probably one of these outcrops.

Samples taken from a bore-hole beside the C.P.R.S. road show that the soil is underlain by mudstone at about 10 metres, (30 ft.) then by shale, siltstone and limestone below 42 m (140 ft.). This is possibly the Golden Dyke formation with some carbonate lenses (G. Lau, pers. comm.) and would explain the relatively high concentration of carbonate ions in the ground water.

Extensive lateritisation is evident throughout the country above the margin of the sub-coastal plain, with lateritic gravel present in most profiles and laterite outcrops occurring frequently. Active lateritisation seemed apparent in about 20% of sites investigated although in some instances this may have been old laterite gravel undergoing decay. It is probable that both processes are occurring in the area. Subsequent erosion has concentrated ferruginous gravels in patches across the higher country.

Yellow soils on parts of the upland areas are possibly formed from what were once the mottled and pallid zones of a past lateritising era in the sediments. This is not certain since these areas also seemed to coincide with more poorly drained sites and the yellow colour could be due to concentration of iron oxides in mottles and concretions and to some hydration of the oxides.

Some of the material comprising the upper soil layers would have been transported onto the lower slopes and also into the clay plains system. The occurrence of buried soils around the lower drainage lines and the margins of the clay plains provides evidence of this lateral movement of soil material.

A catenary sequence is observed in the distribution of soils from the higher country down to the plains. On the crest, well to excessively drained soils with red, whole coloured B horizons are developed (Killuppa family). Further down the slope, soils with a mottled, less red B horizon occur (Woolner and Hotham families) and these frequently contain dense, gravelly pans which slow the rate of internal drainage. Lower on the slopes, where lateral drainage is impeded by rock or laterite outcrops, or where water is perched in the profile by dense, shallow gravel layers, soils with a predominantly yellow, mottled B horizons are located. (Koolpinyah family, with some Lateritic Podzolics).

Weathering of quartzite outcrops (such as Whitestone Ridge) gives rise to soils with a predominantly sandy texture and a minimum of profile development (Baroalba family). Another outcrop of quartzite occurs near the edge of the plain on the station but its sandy influence is effectively isolated by the proximity of the clay plain.

The parent alluvium of the soils on the clay plain appears to be of predominantly freshwater origin although strong alkaline reactions observed at depth in some profiles suggest an estuarine influence. It is most likely that alluvial deposition under freshwater conditions has occurred over the area following initial estuarine formation of the plain. A relative lowering of sea-level seems to have occurred allowing the change from a saline to a freshwater influence.

At best the genesis of the clay plain is complex. The aerial photographs show traces of many extinct river and stream channels, while in profiles of the soils on the plains a variety of deposits (gypsic, calcic, sandy lenses, occasional pebbles) were found. This suggests that the actual nature of the deposition of the material was very complicated.

4. DESCRIPTION OF SOIL FAMILIES

SUMMARY CLASSIFICATION :

GREAT SOIL GROUP: (Stace, et al., 1960)	FAMILY:	NORTHCOTE KEY:	NO. OF SERIES:
A. Alluvial Soils (Polygenetic)	Murrabibbi	Gn2.61, (Gn2.64; .81)	1
B. Siliceous Sands	Baroalba	Vc5.11, (Uc5.22; rare Gn2.81)	1
C. Yellow Earths (Lateritic)	Koolpinyah	Uc1.41; Gn2.21, (Gn2.24; .61; .64; .81)	2
D. Red Earths	Killuppa	Gn2.11, (Gn2.61)	2
E. Red Earths (Lateritic)	(1) Woolner	Gn2.41, (Gn2.44; .61; .64)	1
	(2) Hotham	Gn2.11, (Gn2.14)	1
F. Grey, Brown and Red Clays	(1) Carmor	Ug5.21	1
	(2) Wildman	Ug5.28	1
	(3) Cairncurry	Ug5.16, (Ug5.28)	1

A. Alluvial Soils (Polygenetic) :

Murrabibbi family; Northcote Key : Gn2.61; (Gn2.64; .81).

Considerable variation, typical of most polygenetic soils was seen within this family. The presence of weak A₂ horizons in some profiles provided evidence of podzolization.

Typical profile :

Soil Depth (cm)

0 - 5	Black (10YR 2/1) sandy loam; massive; earthy; pH 5.5.
5 - 35	Very dark brown (10YR 2/2) sandy loam; massive; earthy; pH 5.5.
35 - 80	Pale brown (10 YR 6/3) to light brownish grey (2.5Y 6/2) light sandy clay with gravel; common red and red-brown mottles; massive; earthy; pH 5.0.
80 - 150	Light grey (2.5Y 7/2) sandy clay with gravel; common red and yellowish brown mottles; massive; earthy; pH 4.5 to 5.0.

B. Siliceous Sands :

Baroalba family; Northcote Key : Uc5.11, (Uc5.22; rare Gn2.81).

Frequently shallow; ground water laterite or quartzite rubble being encountered at 100 cm. Rarely intergrading with Koolpinyah series 2 soils.

Typical profile :

Soil Depth (cm)	
0 - 10	Dark greyish brown (10YR 3/2) loamy sand; single grained; sandy to earthy fabric; pH 6.0.
10 - 25	Dark greyish brown (10YR 4/2) loamy sand; single grained; sandy to earthy fabric; pH 6.0.
25 - 80	Yellowish brown (10YR 5/4) loamy sand to sandy loam; single grained; sandy to earthy fabric; pH 5.5.
80 - 100	Yellowish brown (10YR 5/4) sandy loam with gravel; single grained; sandy to earthy fabric; pH 5.5.

C. Yellow Earths (Lateritic) :

Koolpinyah family; Northcote Key : Uc1.41, Gn2.21, (Gn2.24; .61; .64; .81).

Two of the three Koolpinyah series described by Day (Soils Report - Woolner - Humpty-Doo survey, 1970) were sampled. The Koolpinyah series 3 was more frequently encountered and is shown below. The other series (Koolpinyah series 2) had a lighter texture, was frequently shallow (less than 75 cm) and had a more nearly uniform profile (loamy sand A horizon over a sandy loam B).

The Koolpinyah series 2 was observed on steeper slopes above drainage lines and could be the result of either (a) alluviation of the clay fractions from the profile, or (b) deposition of colluvial wash from higher ground.

Typical profile of a series 3 Koolpinyah soil is :

Soil Depth (cm)	
0 - 10	Dark grey (10YR 4/1) to very dark grey (10YR 3/1) loamy sand to light sandy loam with 5% ironstone gravels; massive; earthy; pH 5.8 to 6.0.
10 - 30	Dark brown (10YR 4/3) to yellowish-brown (10YR 5/4) sandy loam with 15% gravel; massive; earthy; pH 5.5.
30 - 100	Strong brown (7.5YR 5/6) to brownish-yellow (10YR 6/6); gravelly sandy clay loam; gravel to 40%; massive; earthy; pH 5.5.

D. Red Earths :

Killuppa family; Northcote Key : Gn2.11; .61.

Some of the profiles examined were intergrading to sandy Berrimah soils. Since no true Berrimah soils (which range from a dark brown sandy loam surface to a red, clay loam to light clay at 150 cm) were encountered, the Killuppa family was considered to adequately describe these soils.

The Killuppa series 2 soils were faintly mottled at depth in the profile. Lateritic gravels were found below the 150 cm sampling depth in two instances where deeper profiles were examined, and these could account for a fluctuating ground water level which is usually responsible for mottling.

The frequently heavier than usual texture and the presence of dense gravel layers deeper in the soil would limit the rate of internal drainage of these soils. They should be less droughty than the deep, sandy Killuppa soils commonly encountered in the Queue and Kay Land Systems.

Typical profile of a series 1 Killuppa is :

Soil Depth (cm)	
0 - 8	Dark brown (7.5YR 3/2) to dark reddish brown (5YR 3/2) sandy loam; massive; earthy; pH 5.5 to 6.0.
8 - 25	Dark reddish brown (5YR 3/4) sandy loam; to light sandy clay loam; massive; earthy; pH 5.5.
25 - 65	Dark red (2.5YR 3/6) sandy clay loam; massive; earthy; pH 5.5.
65 - 150	Red (2.5YR 4/8 to 1YR 4/8) heavy sandy clay loam; massive; earthy; pH 5.5.

E. Red Earths (Lateritic) :

(1) Woolner family; Northcote Key : Gn2.41, (Gn2.44; .61; .64).

While a few of the profiles examined could almost be described as gravelly Killuppa family soils, some were quite shallow and not distinctly different from Hotham soils.

A₂ horizons by Northcote's criteria were seen in many of the profiles but none were strongly developed.

Typical profile :

Soil Depth (cm)	
0 - 5	Very dark greyish brown (10YR 3/2) to dark greyish brown (10YR 4/2) loamy sand to sandy loam with 5% gravel; massive; earthy; pH 6.0.
5 - 40	Dark yellowish brown (10YR 4/4) to dark brown (7.5YR 4/4) sandy loam to light sandy clay loam with 20% gravel; massive; earthy; pH 5.7.
40 - 80	Strong brown (7.5YR 5/6) to yellowish red (5YR 5/6) sandy clay loam to light sandy clay with 30% gravel and cemented nodules; massive; earthy pH 5.5.
80 - 150	Yellowish red (5YR 5/6) to red (2.5YR 4/8) mottled sandy clay to light clay with sand and 20% gravel; massive; earthy; pH 5.5 to 5.0.

(2) Hotham family; Northcote Key; Gn2.11, (Gn2.14).

Typical profile :

Soil Depth (cm)

0 - 10	Very dark greyish brown (10YR 3/2) to dark brown (7.5YR 3/2) sandy loam to light sandy clay loam with 5% gravel; massive; earthy; pH 6.0 to 6.5).
10 - 35	Dark reddish brown (5YR 3/3 to 3/4) sandy clay loam with 30% gravel; massive; earthy; pH 6.5.
35 - 70	Dark red (2.5YR 3/6) to red (2.5YR 4/8) sandy clay loam to clay loam with sand; 30% gravel; massive; earthy; pH 5.0 to 6.0.
70 - 120	Red (2.5YR 4/8 to 1YR 4/8) sandy clay loam to light clay with sand; 60% gravel; massive; earthy; pH 5.0 to 5.5.
120+	Weathering laterite mottled zone.

F. Grey, Brown and Red Clays :

(1) Carnor family; Northcote Key : Ug5.21.

Weakly self-mulching, medium-heavy clay surface textures; deep cracking; with a "grey clay horizon" (value/chroma rating of 2 or 3); increasingly calcic with depth and hence strongly alkaline.

Typical profile :

Soil Depth (cm)

0 - 30	Very dark greyish-brown (2.5Y 3/2) medium to heavy clay with common red-brown and grey mottles; coarse granular; rough ped to smooth ped; pH 7.0.
30 - 90	Olive grey (5Y 4/2) medium-heavy clay with common grey, red-brown and yellow brown mottles; blocky; smooth ped; pH 8.5; rare calcium carbonate nodules.
90 - 120	Olive (5Y 5/3) medium-heavy clay with common red-brown and grey mottles; massive to blocky; smooth ped; pH 8.0; 5% carbonate nodules.
120 - 150	Olive (5Y 5/3) to olive-grey (5Y 4/2) medium-heavy clay with common dark grey and red-brown mottles; massive to blocky; smooth ped; pH 8.0; calcium carbonate nodules.

(2) Wildman family; Northcote Key; Ug5.28.

Deeply cracking, dark grey clay with medium-heavy clay surface texture; pH neutral to moderately acid.

Typical profile :

Soil Depth (cm)

0 - 25	Very dark grey (5Y 3/1) to black (5Y 2/1) medium-heavy clay with common yellowish-brown and grey mottles and rusty rootline stains; coarse granular; rough ped; pH 6.5 to 7.0.
25 - 80	Very dark grey (5Y 3/1) medium to heavy clay; yellowish brown and grey mottles; strong blocky; smooth ped; pH 6.0.
80 - 100	Dark olive grey (5Y 3/2) medium to heavy clay; common dark grey mottles; strong blocky to massive; smooth ped; pH 6.0.
100 - 140	Olive brown (2.5Y 4/4) medium-heavy to heavy clay with common dark grey mottles; strong blocky to massive; smooth ped pH 7.0.
140 - 180	Grey (5Y 5/1) medium clay with common yellow and red-brown mottles; blocky to massive; smooth ped; pH 5.0.

(3) Cairncurry family; Northcote Key; Ug5.16; .28.

Deeply cracking grey clay with light to medium clay surface textures; gypsic and hence moderately to strongly acid with increasing depth. Possibly formed over ancient swamp sites, (Hooper 1970) or in back plain areas where seasonal inundation by tidal water does not occur.

Typical profile :

Soil Depth (cm)

0 - 20	Very dark grey (10YR 3/2) light to medium clay with common rusty mottles; coarse granular; rough ped; pH 6.0.
20 - 45	Grey (10YR 5/1) to dark olive (5Y 3/2) medium to heavy clay with common rusty and dark grey mottles; weak blocky; smooth ped; pH 6.0; rare gypsum crystals.
45 - 80	Dark grey (10YR 4/1) to greyish brown (2.5Y 5/2) medium to heavy clay; common red and brown mottles; blocky; smooth ped; pH 5.5; 5% gypsum crystals.
80 - 100	Olive brown (2.5Y 4/4) to olive grey (5Y 4/2) medium to heavy clay; common red-brown and pale brown mottles; blocky; smooth ped; pH 4.5; 5% gypsum crystals.
100 - 140	Olive brown (2.5Y 4/4) to olive grey (5Y 4/4) medium to heavy clay; many bright yellow mottles; pedality and fabric difficult to determine because of the "crumbly" consistence; pH 4.0; abundant gypsum crystals.
140 - 180	Very dark grey (2.5Y 3/0) medium clay; common brownish grey and red-brown mottles; blocky; smooth ped; pH 4.0.

5.

EROSION

Accelerated erosion has been caused by improper land use and has far outstripped the rate of natural, or geological erosion. Under natural conditions, the gentle slopes above the margins of the clay plains do not readily erode but a chronic condition of soil loss can arise where extensive clearing of natural vegetation has been carried out. Removal of vegetative cover allows runoff to increase, washing the surface soil from even very slight slopes. Loss of surface soil can be minimised on areas where clearing is worthwhile by leaving strips of native vegetation on the contour. This technique has been applied to some of the recently acquired land but greater success could have been achieved by reducing the width and increasing the number of cleared strips.

Shade trees for cattle have been wisely left standing, as they were in the early clearing of Brahman paddock.

Parts of the sloping areas are also prone to damage by wild pigs. In their search for edible plant roots and for places to wallow, pigs churn up considerable areas. If this exposes a weakly coherent B horizon, gullying may be initiated where the slope allows sufficiently rapid run-off. Buffalo wallows can give rise to a similar situation, but usually occur on fairly flat land.

Pigs and buffalo also spoil considerable areas of the clay plains. The wallows and pig roots set hard in the dry season and provide a hazard to the passage of vehicles and stock. The damage is greatest close to animal watering places where the mud is stirred up, lowering the quality of the water and often rendering it unfit for drinking. This can be critical late in the dry season when water is at a premium.

The possibility of excluding feral animals from the property by the use of electric fencing should be considered. Such a fence could prove very effective against pigs and might teach the buffalo some respect for fence lines. Cropping areas could similarly be protected from wallabies. An electric fence would also be cheaper to erect and maintain than a netting fence.

Gravel stripping for road surfacing material has created a problem in the western corner of the station. The run-off from these areas during rainstorms is now extremely rapid and gullying has begun where the water drains away. Gullying has made the north-western access track very difficult to traverse and a hazard in the wet season.

An attempt should be made before the start of the next wet season to reduce run-off from these man-made scald areas and to re-establish vegetative cover on them. Pitting, check-bank construction and seeding with suitable species should provide some measure of control.

A similar, though less acute problem of increasing run-off due to reduction of ground cover is probably arising from the excessive cattle population in the country around Fogg Dam.

The steep slopes of Beatrice Hill itself pose several problems. Road construction has interfered with the normal surface drainage, concentrating run-off which already has quite considerable erosive ability. The rate of "natural" erosion from slopes such as these is quite rapid and has been considerably accelerated by the roads and by grazing. While the roads seem to be a necessary evil, grazing should not be permitted on the steeper slopes. The exclusion of grazing animals in these situations will help to preserve the already sparse protective cover afforded by plants.

6.

VEGETATION

The vegetation falls into two broad, but clearly separate categories; the sedge and grass land of the plains and the upland areas dominated by tree species.

Medium to tall open forest predominates over the higher areas with some woodland and scrub. Eucalyptus miniata and Ironwood (Erythrophleum chlorostachys) dominate the upper storey while Planchonia careya and Buchanania obovata are representative of the lower storey. Annual sorghum is the dominant grass with some Eriachne sp. and Ainstida sp. The taller open forest was found in association with a variety of soils but was generally associated with the deeper sandy Red and Yellow Earths (families Killuppa, Woolner and Koolpinyah series 3).

E. tetradonta, a species which normally colonizes deep, sandy Red Earths and its common companion, E. miniata, are missing from the extensive area of Killuppa family soil. The large Ironwoods which now dominate this area may possibly be the remnants of some early clearing operation, although the absence of Eucalypt suckers suggests that some other factor may be operating. One possible explanation is that a cyclonic disturbance uprooted the large Eucalypts while the Ironwoods withstood the storm; several consecutive years of fire in that area may then have cleared the regrowth to give the present vegetation pattern.

Less well formed forest species together with an increased scrub layer are apparent where the soils were more gravelly. (Woolner, Hotham and Koolpinyah families). The scrub species were usually Quinine bush (Petalostigma quadriloculare), Acacia sp., and occasionally, Grevillea pteridifolia.

Quite dense stands of Tristania suaveolens, Eugenia suborbiculare and Xanthostemon sp. grow on the lower slopes above the clay plain margin. These areas receive a lot of water from the higher country both as surface and sub-surface flow and were very boggy at the end of the wet season. Small patches of rain forest also occur on the wettest of these seepage areas.

Pandanus sp. are scattered over most of the country above the plains margin but are most common where water is plentiful but slowly draining, as on the lower slopes.

E. alba var. australacica, E. polycarpa and low perennial grasses grow along and beside the drainage lines into Fogg Dam with patches of Melaleuca sp. and scattered clumps of Pandanus where the water persists longest.

Hyptis suaveolens has invaded most of the areas where tree cover exists and will provide adverse competition to most improved pasture species. One plant which appears to be able to compete successfully with Hyptis on suitable soils is Calopo (Calopogonium mucunoides) and further research into its value as a pasture plant could well be undertaken.

Paperbark (Melaleuca sp.) grows in dense pockets in swamps on the edge of the clay plain, which are inundated for from six to eight months of the year. Freshwater Mangrove (Barringtonia sp.) with scattered Melaleuca sp. and Cathormion sp. grows in several broad drainage depressions on the clay plain, notably in "Itchy bush" and "Flood" paddocks. Slatwater Mangroves grow along tidally influenced channels along the Adelaide River frontage.

7.

DESCRIPTION OF LAND UNITS

The land units listed in this report are on a more detailed scale than those described in the report by Day et al. on the Land Units of the Coastal Plains (Woolner, Mt. Brockman, Humpty Doo areas) N.T. 1968-72 (unpublished).

Because of this some of the units here are more or less components of those listed in that report. Where a unit closely approximates one listed by Day et al. a note in parentheses appears.

For the sake of simplicity, the units in this report have been numbered consecutively with no regard for the numbers adopted by Day et al.

LAND UNIT DESCRIPTIONSRUGGED TERRAIN

Land Unit	1a.
Land System	Baker.
Topography	Upper slopes of Beatrice Hill; erosional remnants; slopes of 15 to 40%.
Soils	Skeletal; rock outcrops.
Vegetation	Grassland with low shrubs to mixed Eucalypt and non-Eucalypt scrub.
Limitations	Shallow, rocky soils; non-arable; excessive run-off with high erosive ability.
Potential	Unsuitable for pastoral production.
Land Unit	1b.
Land System	Baker.
Topography	Lower slopes of Beatrice Hill and low erosional rises; slopes of 5 to 15%.
Soils	Skeletal; slightly better developed than those in unit 1a.
Vegetation	Grassland, low scrub as for 1a with scattered trees.
Limitations	As for unit 1a.
Potential	Limited rough grazing (under strict control).

GENTLY UNDULATING TO LEVEL TERRAIN

Land Unit	1c.
Land System	Kosher.
Topography	Low erosional rises (relics); quartzite and laterite outcrops; slopes up to 5%.
Soils	Skeletal soils and rock outcrop.
Vegetation	Annual grasses with scattered scrub; Eucalyptus bleeseri, Pandanus sp., Denhamia.
Limitations	As for unit 1a.
Potential	Limited rough grazing; buildings and cattle yards where the subsequent increased run-off can be adequately controlled.

Land Unit	2a 1
Land Systems	Kosher and Keating.
Topography	Level to slightly sloping surface; slopes no greater than 1.5%.
Soils	Killuppa family, (intergrading to sandy Berrimah soil); occasionally Woolner soil on the lower areas.
Vegetation	Tall open forest. Erythrophleum and Eucalyptus miniata, rare E. tetradonta. Erythrophleum with Myrtaceous scrub and scattered open patches on the predominantly Killuppa area.
Limitations	Excessive internal drainage of soil would introduce risk of water stress in any cropping programme. Surface washing occurs where vegetative cover is reduced; erodible.
Potential	Improved pasture; forestry plantations. If cheap irrigation water were available, horticulture.
Land Unit	2a 2 (Red Earth Component; Day et al. Land Unit 3d 1)
Land System	Kosher
Topography	Level to slightly sloping surface; slopes less than 1%.
Soils	Woolner soils, occasionally Hotham. Deep, relatively well drained Koolpinyah soils occur in the South of the high country in this unit.
Vegetation	Tall open forest, E. miniata, Erythrophleum dominant; rare E. tetradonta.
Limitations	High clearing costs as a result of forest. Surface washing occurs when vegetative cover is reduced. Moderate to high fertilizer requirements.
Potential	Timber source, forestry plantations; fodder or cash cropping on the deeper soils provided the contour is carefully followed. (This may be difficult to determine in the uncleared state). Improved pastures.
Land Unit	2a 3 (Day et al. : Land Unit 3d 1)
Land System	Keating, Kosher
Topography	Gently undulating, increased slope compared to unit 2a 2; slope to 2.5%.
Soils	Woolner and Hotham soils.
Vegetation	Tall open forest. E. miniata and Erythrophleum; annual sorghum.
Limitations	High clearing cost; increased risk of erosion because of slope.
Potential	Timber source, forestry plantations, grazing from improved pasture.

Land Unit	2b
Land Systems	Kosher, Keating
Topography	Level to domed terrain, gravelly wash slopes and laterite outcrop. Slopes to 4%.
Soil	Woolner with occasional patches of Hotham in the western corner of the station. Koolpinyah soil occurs in this unit near the intersection of the C.P.R.S. road and Mt. Bunday road. Frequently shallow.
Vegetation	Open forest with some woodland species. <i>E. miniata</i> , <i>Erythrophleum</i> , annual sorghum.
Limitation	Shallow soils with very high gravel content. Excessive run-off and erosion when vegetative cover is disturbed.
Potential	Buildings and stock yards (if drainage water can be contained); in general non-arable, but capable of semi-improved pasture with careful management on the deeper soils.
Land Unit	2c 1 (Day et al. : Land Unit 3d 1)
Land System	Kosher
Topography	Level to gently sloping; slopes to 2%.
Soil	Predominantly Woolner soils with patches of Hotham.
Vegetation	Mixed woodland and scrub. <i>E. alba</i> , <i>Pandanus</i> sp., <i>Acacia</i> sp.
Limitation	Erodible; susceptible to damage (such as surface washing) as a result of uncontrolled grazing.
Potential	Forestry plantations; improved pasture (if established with minimal disturbance). Easier to clear than unit 2a 1 which it adjoins; distinction must be made between these two units.
Land Unit	2c 2.
Land System	Kosher.
Topography	Gently sloping; to 2%.
Soils	Relatively well drained Koolpinyah soils. Gravel occurs close to surface in patches.
Vegetation	Tall open forest. <i>E. miniata</i> , <i>Erythrophleum</i> , scattered patches of scrub with <i>Pandanus</i> sp.
Limitations	Erodible if surface exposed. Gravelly.
Potential	Improved pasture in the semi-cleared state but cultivation should be avoided.

Land Unit	2c 3
Land System	Kosher
Topography	Slopes below, and seepage areas of, units 2c 1 and 2c 2; slopes to 3% occur above the margin of the clay plain and above the southern edge of Fogg Dam.
Soils	Woolner and Koolpinyah, occasionally shallow; rare Murrabibbi; poorly drained.
Vegetation	Mixed woodland and Pandanus scrub. Rain forest species occur in the wetter soak patches.
Limitations	Gravelly soils, occasionally podzolized; seepage and run-on result in poor trafficability in the wet season. Prone to surface washing once grass cover is disturbed. Very susceptible to damage by pigs, buffalo and cattle.
Potential	Semi improved pasture, but would require careful management.
Land Unit	3a
Land System	Kosher
Topography	Level to undulating, slopes to 2%, with gravelly wash slopes and occasionally lateritic outcrops. Surface gravel common.
Soils	Koolpinyah; occasionally shallow Woolner soil.
Vegetation	Medium to tall open forest. <u>E. miniata</u> , Erythrophleum dominated with annual sorghum.
Limitation	Erodible once cleared; high gravel content.
Potential	Semi-improved pasture.
Land Unit	3b
Land System	Kosher
Topography	Lower wash slopes from units 3a and 2a and broad drainage flats; slopes to 1.5%.
Soils	Koolpinyah, frequently shallow.
Vegetation	Open forest, <u>E. miniata</u> , Erythrophleum with dense Myrtaceous scrub under storey.
Limitation	High gravel content; surface washing if disturbed (for example by tracks and cattle pads). Water stress likely in the dry season. Erodible.
Potential	Possibly semi-improved pasture but preferably left untouched.

Land Unit	3c (Topographically resembles Land Unit 5h 2 of Day et al.)
Land System	Kosher
Topography	Low sandy flats beside drainage tracts; slopes less than 1%.
Soils	Koolpinyah, rare Ramil. Depositional.
Vegetation	Scattered trees in open grassy areas to mixed woodland. <i>E. alba</i> , <i>E. polycarpa</i> , <i>Pandanus</i> sp.
Limitation	Water ponded at surface in patches during wet season. Possible water stress later in the dry season. High gravel content.
Potential	Possibly semi-improved pasture, but best left undisturbed as a watershed protection area.
Land Unit	3d (Day et al. : Land Unit 5k)
Land System	Kosher
Topography	Drainage path to Fogg Dam including lagoon margins; up to 200 m wide; not incised.
Soils	Depositional sandy soils; Murrabibbi family.
Vegetation	<i>Pandanus</i> , <i>E. alba</i> , <i>Melaleuca</i> , low perennial grasses and sedges.
Limitations	Very boggy when wet and hence limited seasonal access. Very erodible if ground cover is disturbed.
Potential	Watershed protection area; with fencing, could be used as grassed waterways for run-off disposal. Should not be disturbed.
Land Unit	4a (Day et al. : Land Unit 5b 1)
Land System	Krokane
Topography	Level to gently sloping land in Northern tip of the property. Slopes to 2%. Quartzite and laterite outcrop common.
Soils	Shallow Baroalba onto lateritic gravel and quartzite.
Vegetation	Stunted open woodland and annual grasses. <i>Planchonia</i> , <u><i>Terminalia ferdinandiana</i></u> , <u><i>E. foelscheana</i></u> , <i>Pandanus</i> and <i>Erythrophleum</i> .
Limitations	Waterlogged during the wet season; highly erodible once surface has been disturbed; water stress likely late in dry season. Very poor seasonal access.
Potential	Limited value for semi-improved pasture; would require very careful management. Best left alone for catchment protection because of the considerable risk of wash entering Fogg Dam.

Land Unit	4b	(Day et al. : Land Unit 5c)
Land System	Krokane	
Topography	Drainage slopes below unit 4a; slope to 3%.	
Soils	Deeper Baroalba; depositional.	
Vegetation	Low open woodland with increased annual grass component. Pandanus, Melaleuca thickets, and Eriachne, Aristida, annual sorghum.	
Limitations	Erodible (as for unit 4a).	
Potential	This small area should be left alone to prevent silting of Fogg Dam. With fencing, may have some use as grassed waterways.	
Land Unit	4c	(Day et al. : Land Unit 5k)
Land System	Krokane	
Topography	Drainage lines with incised creeks within unit 4b. Generally level, with small remnant levees.	
Soils	Sandy depositional soils.	
Vegetation	As for unit 4b.	
Limitations	Impassable on the station during and just after the wet season. Creek surrounds highly erodible.	
Potential	Watershed protection area; should not be disturbed.	
Land Unit	5a	(Day et al. : Land Units 5h 1, 2 and 3)
Land System	Kosher - Cyperus transitional.	
Topography	Sandy wash slopes between lateritic uplands and the clay plains. Rare quartzite outcrops. Slopes generally less than 2%.	
Soils	Depositional soils; Murrabibbi family, occasionally degraded.	
Vegetation	Dense clumps of tall Melaleuca along the edge adjacent to clay plains thinning to Pandanus, Tristania and increased grass upslope; Eriachne, Aristida, sedges and Sesbania.	
Limitations	Erodible when disturbed; susceptible to pig and buffalo damage. Badly invaded by Hyptis. Poor accessibility in wet season.	
Potential	Improved pasture (water logging tolerant species) provided disturbance is minimal. Paperbark stands should be left for cattle shelter. Can be considered in conjunction with the higher clay plain units for grazing during the wet season.	

Land Unit	5b	(Day et al. : Land Unit 5h 1)
Land System	Kosher - Cyperus transitional	
Topography	Flatter than unit 5a, developed around the more extensive quartzite outcrops near the clay plains. Slopes level to 1.5%.	
Soils	Sandy depositional soils, with patches of clay and Humic Gleys. Murrabibbi soils.	
Vegetation	Open woodland to grass and sedge. Scattered Melaleuca, E. papuana, Barringtonia.	
Limitations	Seasonally inundated, soil frequently shallow and stony. Slight erosion risk on higher slopes. Poor seasonal accessibility.	
Potential	Improved perennial pasture, such as para grass. (Brachiaria mutica).	

CLAY PLAINS AREA

Land Unit	6a	(Day et al. : Land Unit 8a)
Land System	Cyperus	
Topography	Essentially level and moderately well drained alluvial clay plains.	
Soils	Black cracking clays; predominantly Carmor with minor Wildman.	
Vegetation	Predominantly grasses and sedges. Ischaemum, Cyperus with occasional Phyla, Sesbania and Malachra.	
Limitations	Flooding and inundation for several months each year. Local subsoil alkalinity and accompanying element availability problems. Moderately poor seasonal accessibility.	
Potential	Improved perennial pasture (Para grass). Rice cropping on those areas commandable by dry season water storage.	
Land Unit	6b 1	(Day et al. : Land Unit 8d)
Land System	Cyperus.	
Topography	Essentially level, but lower and less well drained than unit 6a, alluvial clay plain.	
Soils	Black cracking clays: predominantly Cairncurry with minor areas of Wildman.	
Vegetation	As for 6a. Scattered freshwater mangrove (Barringtonia sp.) on lower areas.	
Limitations	Water persists on this unit for considerably longer than on 6a.	
Potential	Improved perennial grasses for grazing when accessible.	

Land Unit	6b 2	(Day et al. : Land Unit 8d)
Land System	Cyperus	
Topography	Similar to unit 6b 1 with network of incised drainage channels to 50 metres wide.	
Soils	Similar to unit 6b 1, wetter for most of the year.	
Vegetation	Similar to unit 6b 1.	
Limitations	Very poor accessibility; reduced area for pasture and added hazard of bogging in channels.	
Potential	Limited scope for grazing.	
Land Unit	6c	(Day et al. : Land Unit 7a3 plus Barringtonia)
Land System	Cyperus.	
Topography	Freshwater drainage depressions on the clay plains.	
Soils	Black, cracking clay (Cairncurry) with some Humic Gleys (Dashwood).	
Vegetation	Dense clumps of freshwater mangrove with grass and sedge and scattered Melaleuca. Rare Cathormion.	
Limitations	Excessively wet for greater part of year. Very poor accessibility.	
Potential	Some scope for improved perennial grasses and seasonal grazing.	
Land Unit	7a	(Day et al. : Land Unit 9a).
Land System	Cyperus - Littoral	
Topography	Channelled, tidally affected areas adjacent to the river frontage.	
Soils	Predominantly Carpentaria.	
Vegetation	Mangrove swamps to scattered individual trees.	
Limitations	Mostly inaccessible, highly saline.	
Potential	Nil.	

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Plate 1

Surface wash has occurred on recently cleared land because of the sparse cover afforded by the establishing pasture.

This will probably worsen at the onset of the 1972-73 wet season.

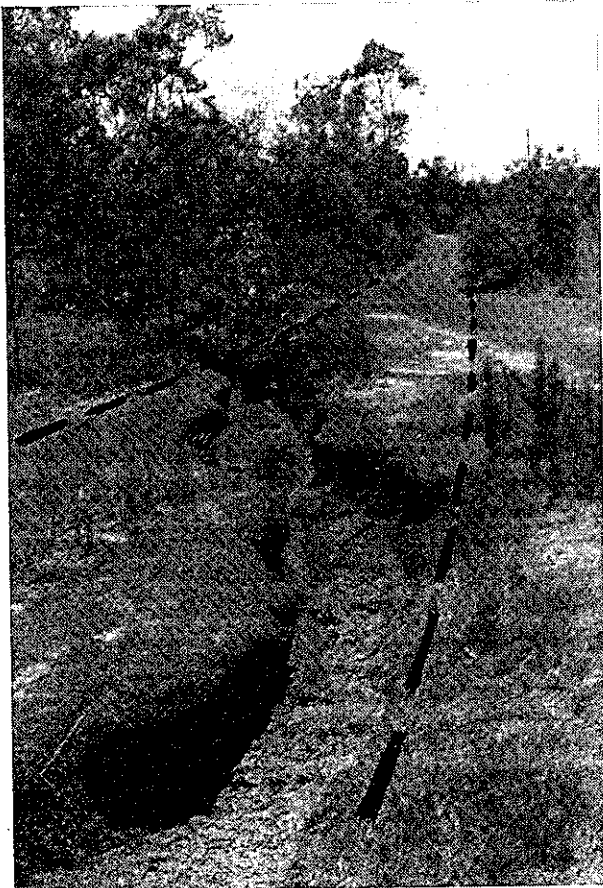
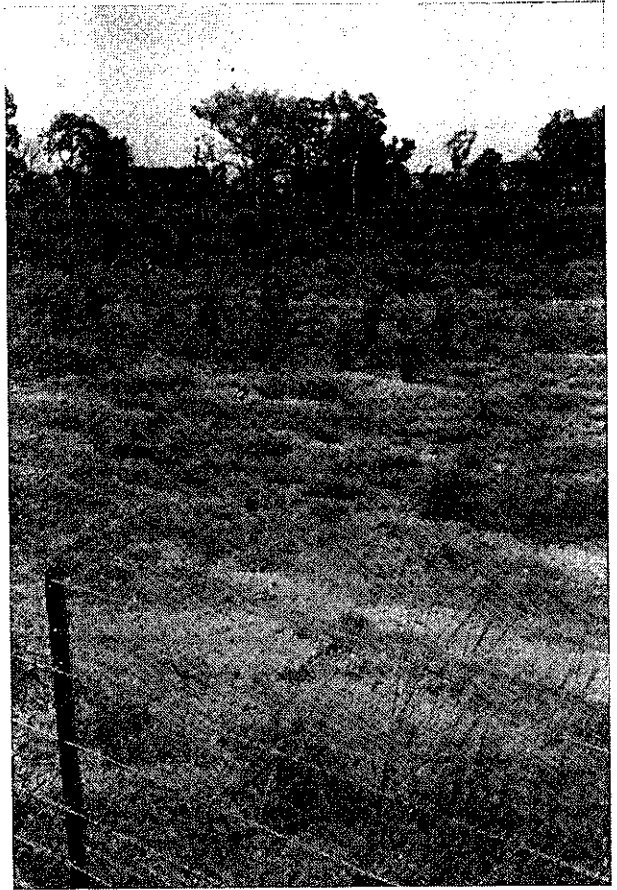


Plate 2

Gully erosion along a track.

This is the result of accelerated run-off from a gravel stripped area, (to right of photograph). Vehicles have detoured around the hazard; the new track will provide a site for further gullying.

(Note the hardened sub-soil laterite forming the gully floor. This limits the depth of the gully but increases the undercutting effect of flowing water).

Plate 3

Colluvial wash filling a gully which started as a wheel rut. This material will be carried away during the next rain storm and the gully will increase in size.

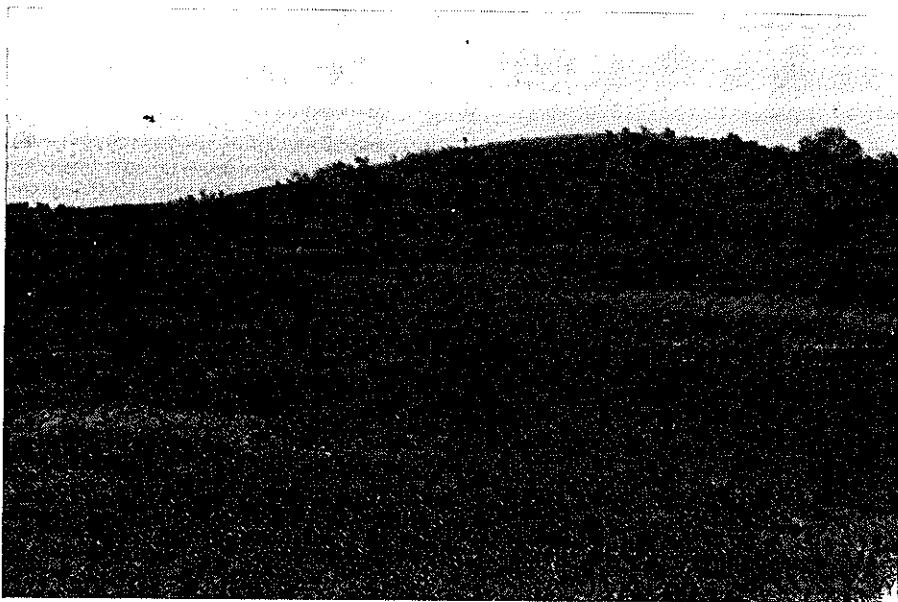
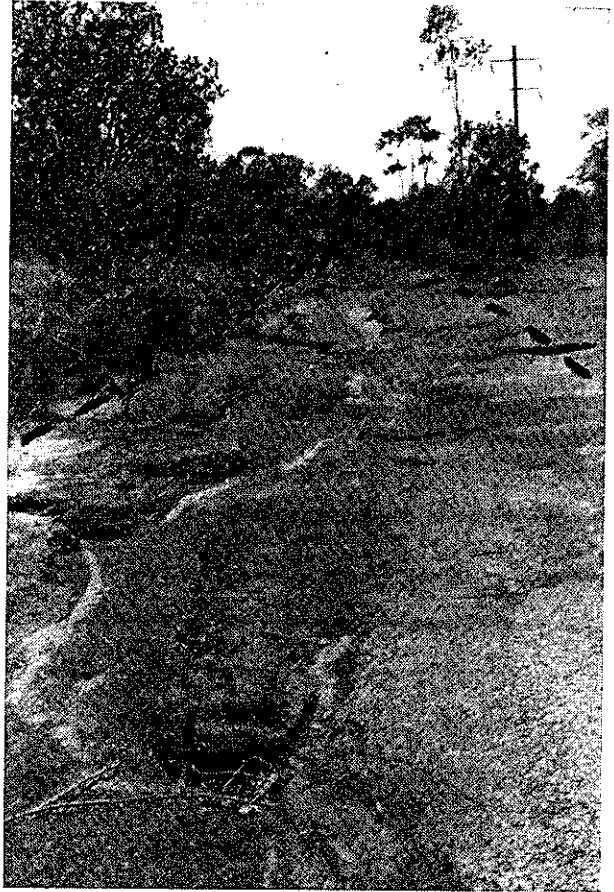


Plate 4

The result of grazing steep slopes is seen on the far side of the fence.

Plate 5

This fence has interfered with the gazing pattern of the cattle, concentrating their attention on foot slopes directly above a drainage line. Sheet erosion and gullying will be the most likely outcomes of the denudation of this slope.

