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Number TM 87/1

PASTORAL LAND SURVEY OF THE HALE PLAIN
THE GARDEN STATION

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TABLE OF CONTENTS

SUMMARY ii
ACKNOWLEDGEMENTS iii
SECTION ONE - INTRODUCTION 1
SECTION TWO - DESCRIPTION OF THE PHYSICAL ENVIRONMENT 1
A. PREVIOUS SURVEYS
B. CLIMATE
C. GEOLOGY AND PHYSIOGRAPHY
D. SOILS
SECTION THREE - LAND UNITS OF THE HALE PLAIN 8
A. SURVEY METHODOLOGY
B. LAND UNITS
C. LAND UNIT DESCRIPTIONS
REFERENCES 37
APPENDICES 38
A. SPECIFICATION OF AERIAL PHOTOGRAPHY
B. SPECIFIC NAMES OF PLANTS MENTIONED IN THE TEXT.
SUMMARY.

The Hale Plain area of The Garden Station, occupying an area of approximately 120 sq.km, has been surveyed and mapped into 28 land units at a scale of 1:20,000. The aim of the survey has been to provide land resource information to assist with the interpretation of vegetation transect and stock distribution data collected as part of a three year study of feral horse ecology.

This report includes a general physical description of the Hale Plain, together with a detailed account of the landform, soil and vegetation attributes of each of the units. The management implications associated with pastoral use of the land are also indicated.

The landscape of the study area consists mainly of a complex mosaic of terrace landforms resulting from several episodes of colluvial deposition and erosion during the Cainozoic period. Consequently, the resultant pattern of soil and vegetation distribution is also complex.
ACKNOWLEDGEMENTS.

The co-operation and hospitality of Mr. Jim Turner of The Garden Station during the conduct of the field work for this survey is gratefully acknowledged. The assistance of Mr. David Berman of the University of New England is also gratefully appreciated.

Mr. Trevor Filmer and Miss Jill Sumner provided dedicated technical support during the field work and the compilation of the map and report. Mrs. Bobbie Roff completed the typing.
SECTION ONE - INTRODUCTION.

This land resource survey documents pastorally-different land types on the Hale Plain of the Garden Station, 70 kilometres north-east of Alice Springs. The plain occupies approximately 120 sq.km of gently undulating terrain along the upper Hale River, surrounded by mountainous topography.

The survey was requested by the University of New England, which has been commissioned by the Wildlife Research Section of the Conservation Commission to conduct a three year study of feral horse ecology in Central Australia in the period 1984-87. The Hale Plain has been selected as an area for intensive research into the behaviour of feral horses, with emphasis on determining their grazing habits and competitive interaction with cattle. The area supports a large number of easily-observable brumbies on a diversity of land types, and is readily accessible from Alice Springs.

The aim of the land resource survey is to provide a land unit map of the Hale Plain study area to assist in the interpretation of detailed vegetation and animal distribution data being collected as part of the project.

SECTION TWO - DESCRIPTION OF THE PHYSICAL ENVIRONMENT.

A. PREVIOUS SURVEYS.

The land resources of the Hale Plain area have been previously described at a reconnaissance level by Perry et al (1962), who identified three land systems, Sonder, Harts and Ambalindum, at a regional mapping scale of 1:1,000,000. A land system is a composite of related units, throughout which there is a recurring pattern of topography, soils and vegetation (Christian and Stewart, 1953).

Sonder land system consists of mountain ranges with strong relief formed by steeply dipping beds of resistant quartzite and sandstone and describes the backbone of the Georgina Range. It is subdivided into six unmapped units, the most significant of which are ridges and cuestas with shallow soils supporting sparse shrubs and low trees with spinifex.

Harts land system encompasses mountainous terrain of gneiss and granite, and also includes six units. The principal landforms include uplands with rounded crests, narrow mountain ridges, and granite domes and tors. Erosional footslopes and alluvial floors comprise minor units. Shallow stony soils predominate, supporting sparse witchetty bush or other low shrubs over spinifex or sparse grasses.

Ambalindum land system is comprised of nine unmapped units. These include low terraces and surfaces formed by their partial dissection, higher terrace remnants of an earlier, duricrusted valley fill, and recent alluvium. Texture-contrast soils are identified as the most common soil type, and eight vegetation associations are listed, including mitchell grass and mulga communities. The Hale Plain extending east to Ambalindum homestead...
was the "type area" for the description of this land system, which was mapped to have a very limited distribution elsewhere in Central Australia.

Jackson (1962) described the soils of the Hale Plain as part of a regional soil study in Central Australia. His survey is referred to later in this section.

B. CLIMATE.

Brief accounts of the climatic setting of Central Australia are to be found in Perry (1962) and Kalma and McAlpine (1983).

Low rainfall and rainfall variability have an overriding influence on the environment and its suitability for plant growth. Continuous meteorological elements such as temperature and humidity maintain a relatively stable and well-defined seasonal pattern, and have a lesser effect on plant growth, although the permanent components of native vegetation, including annual and perennial grasses, are sensitive to cold conditions. They remain virtually dormant during winter even when significant rainfalls are received.

Average and median monthly rainfall figures derived for The Garden Homestead, 4 km north-west of the study area, are presented in Table 1. These are based on Bureau of Meteorology records for the period 1954–85. Monthly rainfalls for the 1984/85 growing season prior to the survey are also indicated.

TABLE 1. RAINFALL FIGURES - THE GARDEN - 1954 – 85 (mm)

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<thead>
<tr>
<th>PERIOD</th>
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</table>

While the average figures provide a guide to rainfall patterns in the long term, exceptional recordings such as the "above average" rainfalls of the mid-1970's can easily distort the picture they present. Median rainfall figures, which indicate a middle value (i.e. 50% of recordings are above the median, 50% are below) provide a more reliable guide to the quantity and seasonal distribution of rainfall. The median values for The Garden Homestead indicate a marked summer dominance in the rainfall pattern, few falls occurring in the April-September period.

Rainfall decile values can give an indication of rainfall variability. A decile is a statistical figure derived from a cumulative frequency distribution indicating the relative occurrence of a particular value. For instance, the first decile is a rainfall figure that exceeds 10% of recordings, but is exceeded by 90% of recordings. The 5th decile is equivalent to the median, and is less than 50% of recordings, exceeded by 50%. The 9th decile is exceeded by only 10% of recordings, and exceeds 90%.
TABLE II - RAINFALL DECILES - THE GARDEN - 1954-85 (mm)

### ONE MONTH

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Decile ranges for one to twelve month periods are held by the Bureau of Meteorology.

The decile ranges for one month and three month periods, derived by the Bureau of Meteorology, are presented in Table II. The one month deciles give the probability of receiving an amount of rainfall in a month. Similarly, the three month deciles give the probability of receiving an amount of rainfall in the following three month period. For example, using the one month values, reference to the 6th decile indicates that there is an 80% chance of receiving less than 71 mm of rainfall in the month following the start of January, and a 20% chance of less than 22 mm.
C. GEOLOGY AND PHYSIOGRAPHY.

The geology of most of the study area has been described in detail by Shaw and Langworthy (1984).

The basement material of the Hale Plain area is comprised of early Proterozoic metamorphic and igneous rocks of the Arunta Block, which are dated to 2070 million years old (m.y.o.). These outcrop as low hill and range topography in the southern part of the study area, as well as a pediment (plain of eroded bedrock) and uplands north of the Hale River. The foothills adjacent to the Georgina Range have been correlated with the Cadney Metamorphics unit, a complex of calc-silicate metamorphic rocks, biotite gneiss and sillimanite gneiss. North of the Hale River, outcrop has been classified as Ongeva Granulite, consisting mainly of mafic and felsic granulites and quartzofeldspathic gneiss. Granulite is a coarse-textured, granular metamorphic rock.

The backbone of the Georgina Range owes its high relief to several strike ridges of strongly-bedded Heavitree Quartzite. This quartzite, part of the Amadeus Basin sequence, was laid down as sediments in stable marine and lacustrine environments in the late Proterozoic (600-1100 m.y.a.) and subsequently infolded with Arunta Block rocks during the Alice Springs Orogeny in the late Devonian (350 m.y.a).

Terraces of white quartzose sandstone (the Hale Formation) occupy the valley floor between the foothills of the Georgina Range and the Hale River. The sandstone is derived from fluvial and lacustrine sediments deposited during a period of deep erosion and peneplanation during the early Tertiary period (approx. 60 m.y.a.), and overlies deeply-weathered basement rock. Subsequent tropical climate conditions were favourable for the formation of ferricrete, now exposed as ironstone outcrop, and the precipitation of groundwater produced layers of silcrete within the sandstone.

A further period of erosion and sedimentation associated with pluvial conditions in the mid Tertiary period (approx. 26 m.y.a.) was followed by mild calcareous silicification and the formation of a chalcedonic limestone overlying siltstone (the Waite Formation). Residuals of this formation are visible as limestone platforms in the eastern part of the study area.

During the late Tertiary or early Quaternary (1.5 - 1.8 m.y.a.), an uplift of the land surface renewed stream activity and erosion processes. Much of the Hale and Waite Formations were buried by deposits of colluvium, mainly rounded cobbles of Heavitree Quartzite, and the present drainage pattern may have been initiated at this time.

Present day floodplains along the Hale River and major tributaries, together with the alluvial fans adjacent to the ranges, probably date from a period of stream flow and erosion during the late Pleistocene or Holocene period (10,000 years ago).
D. SOILS.

The soils of the study area are essentially of a relict nature, with the exception of recent floodplain deposits, which are the product of weak, present day drainage under a semi-arid climate.

In describing the sedimentary history of soils in a similar landscape setting on Harry Creek, Yambah Station, Litchfield (1959) identified a sequence of five soil surfaces deposited subsequent to an earlier period of deep weathering, laterization and silicification. The magnitude of each deposit corresponds with apparent major fluctuations of the late Quaternary climate. Of successive cycles of erosion, each was only partially capable of dissecting or burying the soil mantle of the preceding accumulation.

Previous soil classification has been conducted at a reconnaissance level only.

In his broad scale study of the soils of Central Australia, Jackson (1962) made specific reference to the soils of the Ambalindum Valley. He related the soils of the western portion of the valley (the Hale Plain study area) to the Rodinga soil family, associated with pediment and mesa topography in the Rodinga - Maryvale area south of Alice Springs. A characteristic feature of this soil family is a surface "gibber" pavement of "grey billy" pebbles. The soils of the Hale Plain were noted to differ in that the surface pavement consists of "white quartz" stones rather than silcrete and that outwash deposits partially mantle the area. Highly calcareous soils were recorded in the eastern part of the valley.

In this report, the soils of the study area are described in terms of their Great Soil Group (Stace et al, 1968) and Principal Profile Form (Northcote, 1979) as well as general profile characteristics. The following descriptive groupings have been used:

i). UNIFORM TEXTURED SOILS - Principal Profile Forms Uc, Um, Ug.

a). Lithosols

Lithosols are shallow, stony or gravelly soils, lacking profile development and usually associated with the outcropping of parent rock and moderate to steep slopes, where natural erosion precludes soil development. In the study area, they constitute the principal soil cover on terrain with slopes exceeding about 3%.

They are best developed on the low hills of gneiss and schist, where they are medium-textured and comprise an extensive soil cover up to 0.3 m in depth. On the steep-sided ridges of resistant quartzite, however, lithosols development is confined to small pockets of soil amongst large expanses of bare rock, or a thin veneer of gravelly material on relatively level areas.


The alluvial soils consist mainly of coarse-textured sediments deposited as floodplains along the Hale River and its tributaries, or as floodouts adjacent to the hill country.
These soils show little horizon development other than a slight increase in clay content with depth. Profiles usually consist of non-calcareous dark reddish brown (5YR 3/4) sandy loams with a neutral reaction trend, sandy fabric and high permeability. However, contemporary flood channels or drainage tracts often have medium-textured deposits, occasionally with a distinct layering sequence of various textured sediments and gravels.

The surfaces of the coarse-textured soils lack cohesion and are susceptible to wind erosion if denuded. Soil loss does not expose a horizon of heavier texture, and eroded areas are likely to be readily revegetated by colonizer species after adequate rainfall. As the soils are permeable and on very low slopes, water erosion presents a minor hazard.

c). Red Calcareous Soils.

The red calcareous soils occur only on highly calcareous substrates and in the study area are limited to the terrace surfaces of the Waite Formation. Profiles are shallow, overlying calcrete at up to 0.4 m in depth, and consist of massive dark reddish brown (5YR 3/3) sandy clay loams, highly alkaline and with finely-divided carbonate throughout. They are pulverulent when disturbed. White marls - soft, friable earthy materials with high contents of carbonates - are often associated with weathered calcareous substrates.

d). Cracking Clays.

The cracking clays are pedal, self-mulching fine-textured soils with uniform profiles, featuring marked swelling and shrinkage on wetting and drying. They are usually associated with gilgai microrelief.

In the study area, the cracking clays have surface textures of light or medium clay, often with a slight increase in clay content with depth. Other properties, including soil colour, reaction trend and the presence of carbonates are variable. Generally there is no erosion hazard.

ii). GRADATIONAL SOILS - Principal Profile Form Gn.

a). Red Earths.

Red earths are widespread in the study area. The characteristic profile features of these soils include a gradation in texture from a loamy (usually sandy clay loam) A-horizon to a light clay at 0.5 m, a red, dark red or reddish brown colour (2.5YR 3/6 - 4/6, 5YR 4/4) tending redder with depth, an earthy fabric, and frequently the presence of ferruginous nodules. Soil reaction trend is usually neutral or slightly alkaline, and some profiles are calcareous at depth. They have developed on a range of parent materials including weathered crystalline rocks and colluvium.

These soils are permeable and occur on very gently sloping landforms draining by sheet flow. They have a slight to very moderate erosion hazard. Where the sheet flow of runoff is
channelled by a stock pad or grader cut, minor rilling may be initiated. High intensity rainfall on denuded surfaces may result in insidious sheet erosion visible only by the presence of fine lag gravel or grit deposits. Surface textures are generally too fine for these soils to be susceptible to wind erosion other than the local movement of sandy surface deposits.

iii). **DUPLEX SOILS** - Principal Profile Form Dr.

a). **Texture-Contrast Soils** (desert loams)

Leaching with the illuviation of clay is implicated as a major factor in the formation of these soils, and they are associated with drainage floors where the seasonal wetting necessary for this process takes place.

The essential feature of these soils is a distinct soil texture difference between a shallow sandy or loamy A-horizon and a structural clay B-horizon. The A-horizon usually consists of a non-calcareous sandy loam, yellowish red (5YR 4/6) or occasionally brown (7.5YR 5/4) in colour, with a loose or weakly crusted surface and up to 0.2 m in depth. This overlies a slightlyredder (2.5YR 3/4) pedal sandy clay or light clay B-horizon. Soil reaction trend is neutral or slightly alkaline, and the B-horizon may be slightly calcareous at depth or saline.

In general these soils have a severe erosion hazard, and most profiles are extensively altered by scalding and gully filling. The sandy A-horizon is susceptible to both wind and water erosion if denuded and disturbed, and when stripped the scalded surface of the clayey B-horizon is exposed. This in turn may be susceptible to rilling, minor gullying and salination. Where the A-horizon is medium textured, the erosion hazard is only slight.
SECTION THREE - LAND UNITS OF THE HALE PLAIN.

A. SURVEY METHODOLOGY.

A large scale land unit map with homogenous vegetation units likely to reflect grazing preferences was required for the purposes of the feral horse study.

Colour aerial photographs at a scale of 1:20,000 (see Appendix A) provided an adequate coverage of the study area. Tentative land units were mapped onto these during a detailed stereoscopic examination prior to the conduct of the field survey. Suitable sites for field examination were selected according to this preliminary classification of land units within the constraints of time and accessibility.

Field work of five days duration was conducted during early March, 1985, and consisted of vehicle and foot traverses between recording sites. Access to rugged terrain was achieved at a later date on horseback. Landform soil and vegetation attributes were recorded at 50 sites, and vegetation alone at a further 50 locations.

At the time of the field survey, the Garden Station was entering a period of drought. 120 mm of rainfall had been received during the preceding summer growing season (October - March), but falls lacked follow-up rain and pasture growth had been burnt off by hot winds. Consequently, the most palatable pasture species, especially annual grasses, were heavily utilized in many areas and herbaceous plants had disintegrated through the action of termites or the elements. This factor somewhat restricted the detailed recording of pasture characteristics at inspection sites.

Final amendments to land unit boundaries were made during a comprehensive re-examination of the aerial photography. Land unit boundaries and landscape features were then transferred to a base map with a scale of 1:20,000.

B. LAND UNITS.

Each land unit described in this report delineates areas with relatively uniform landform, soil and vegetation attributes. Slight variability may occur within each unit consistent with the degree of resolution possible at a mapping scale of 1:20,000. The units have been grouped into categories according to the main landform features.

The description of each unit is structured according to the following headings:

GENERAL DESCRIPTION - a brief outline of the main landscape features.

GEOLOGY - an indication of surface geology.

LANDFORM - a description of the particular landform element in terms of relief, slope and drainage pattern.
SOILS - includes Great Soil Group, Principal Profile Form and a brief profile description incorporating field textures, Munsell colour names, soil reaction trend (change in acidity or alkalinity down the profile) and the presence or absence of carbonates.

VEGETATION - a listing of the main species comprising the vegetation association. Where the original association has been degraded, both the existing and former components are indicated.

LAND MANAGEMENT IMPLICATIONS - A comment on the potential land management hazards likely to be encountered with pastoral use of the land unit, including susceptibility to erosion and pasture degradation.

C. LAND UNIT DESCRIPTIONS.

1. RANGE AND HILL COUNTRY

Map Unit - 1.1.

GENERAL DESCRIPTION - RUGGED MOUNTAIN RIDGES: pockets of lithosol with scattered low shrubs over spinifex.

GEOLOGY - Steeply-dipping Proterozoic quartzites (Heavitree Quartzite).

LANDFORM - Mountain ridges with bold relief, very steep slopes and conspicuous bedding, drained by narrow, widely-spaced channels. Also includes some areas of lower relief without prominent bedding northwest of Georgina Gap.

SOILS - Mainly absent, with pockets of shallow lithosol amongst rock outcrop.

VEGETATION - A sparse hummock grassland of hard spinifex with scattered low shrubs including acacias and holly grevillea. Blue mallee occurs on areas with moderate slopes.

LAND MANAGEMENT IMPLICATIONS - This landscape is largely inaccessible and may provide an effective barrier to the movement of livestock.

Map Unit - 1.2.

GENERAL DESCRIPTION - STEEP HILLS: lithosols with indigo, sparse mulga and witchetty bush over mainly annual grasses.

GEOLOGY - Early Proterozoic metamorphic rocks, mainly gneiss (Cadney Metamorphics).

LANDFORM - Rocky, steep-sided hills with narrow-crested ridges, drained by widely-spaced deep and narrow valleys.

SOILS - Shallow lithosols, with some areas of rock outcrop.

VEGETATION - Scattered shrubs, mainly mulga and witchetty bush, with an open low shrub cover of silver indigo. Groundcover consists of annual grasses, mainly woollyoat grass, together with kangaroo grass and mountain wanderrie.

LAND MANAGEMENT IMPLICATIONS - Steep rocky slopes hinder access by livestock and consequently this landscape has limited grazing value.
Map Unit 1.3.

GENERAL DESCRIPTION - LOW ROLLING HILLS: lithosols with open mulga over annual grasses.

GEOLOGY - Early Proterozoic metamorphic rocks, mainly granulites (Ongeva Granulite).

LANDFORM - Hills with low relief, moderate slopes and rounded crests, drained by a close network of narrow drainage lines.

SOILS - Shallow lithosols amongst rock outcrop.

VEGETATION - An open shrubland of mulga and witchetty bush over annual grasses, including woollyoat, oat and mulga grasses, with cotton panic, native panic, curly windmill and umbrella grasses beneath the shrub canopy. Kangaroo grass and occasionally a corridor of dense mulga occurs along drainage lines.

LAND MANAGEMENT IMPLICATIONS - Storm runoff from steep slopes is likely to scour graded tracks and well-worn stock pads.

Map Unit 1.4.

GENERAL DESCRIPTION - GENTLY-UNDULATING LOW HILLS: lithosols with sparse mulga and ironwood over annual grasses.

GEOLOGY - Early Proterozoic metamorphic rocks, mainly gneiss (Cadney Metamorphics).

LANDFORM - Stony hills with low relief and gentle slopes (less than 10%), drained by a widely-spaced network of depressions tributary to the main creek channels. Prominent quartz reef outcrop occasionally present.

SOILS - Lithosols (Um 5.51) predominate. These are gravelly, medium-textured soils, dark reddish brown and usually slightly alkaline and calcareous. Coarse-textured brown alluvial soils (Uc 1.23) are present along drainage depressions.

VEGETATION - Scattered ironwood, mulga and witchetty bush, with occasional bloodwood, long-leaved corkwood and ghost gum, in association with annual grasses, mainly woollyoat, oat and mulga grasses. Herbage species including common sida, lambs tails and potato bush occasionally present. Dense stands of curly windmill grass, desert bluegrass and kangaroo grass occur on the alluvial soils.

LAND MANAGEMENT IMPLICATIONS - This unit has a moderate water erosion hazard. Storm runoff is likely to scour graded tracks and well-worn stock pads, and alluvial soils are subject to gullying. Rough wire grass is reputed to increase in response to prolonged grazing pressure.
Map Unit 1.4. The low stony hill country comprising this unit supports an annual pasture of woollyoat, oat and mulga grasses, together with potato bush and sida (foreground). Note also the steeper terrain of Unit 1.2 (background right) and the prominent quartzite ridge of Unit 1.1 (background left).

2. PEDIMENT

Map Unit - 2.1:

GENERAL DESCRIPTION - PLAINS: shallow red earths with sparse mulga over annual grasses.

GEOLOGY - Weathered early-Proterozoic metamorphic rocks, mainly granites and gneisses.

LANDFORM - Very gently-sloping pediment surfaces, with some small areas of bare rock or ironstone gravel. These plains drain by sheet flow into Unit 2.2.

SOILS - Red earths (Gn 2.13), consisting of gritty, dark reddish brown sandy clay loams at the surface, graduating to slightly calcareous, red light clays at about 0.5m. They are slightly alkaline throughout the profile, and nodules of carbonate occur at depth, overlying rotten granite.
VEGETATION - Scattered mulga or fork-leaved corkwood in association with an annual grassland of woollyoat, oat and mulga grasses. Wiregrass and herbage species including common sida, munyeroo and potato bush are sometimes present.

LAND MANAGEMENT IMPLICATIONS - This landscape has a slight water erosion hazard. Storm runoff is likely to initiate rilling where surface flows are concentrated along tracks or stock pads. Prolonged overgrazing is likely to result in an increase in the proportion of mulga grass and herbage species in the pasture. Rabbits favour the calcareous soils of this unit.

Map Unit 2.1. This type of country grows palatable annual grasses which are fully utilized early in times of drought. Note the gravelly nature of the soil surface.

Map Unit - 2.2.

GENERAL DESCRIPTION - TRIBUTARY DRAINAGE FLOORS: scalded soils with pockets of perennial and annual grasses.

GEOLOGY: - Weathered, early-Proterozoic metamorphic rocks, mainly granites and gneisses, and some Quaternary calcrete.

LANDFORM: - Broad tributary drainage floors with little surface relief, featuring shallow watercourse channels on their lower reaches. Surfaces are extensively scalded and often saline.
SOILS - Sandy texture-contrast soils (Dr 4.53) are present throughout the unit. Most areas have been severely scalded and gullied, removing what was probably once a sandy loam surface horizon. Erosion has exposed a red saline light clay or sandy clay, usually alkaline and slightly calcareous at depth. Gilgai relief occurs along the margins of the unit.

VEGETATION - In its present eroded and saline condition, most of this land type is bare, supporting winged chloris, sparse copper-burrs, and annual grasses on the remaining islands of topsoil, with wire grass colonizing sandy deposits along watercourses.

Prior to erosion, this unit probably supported an open stand of cottonbush in association with annual and perennial grasses.

LAND MANAGEMENT IMPLICATIONS - Sandy texture-contrast soils are extremely vulnerable to scalding and minor gullying. As a result, erosion damage on this type of country is generally extensive and long-standing, although minor rilling may continue to expand the area of bare ground. Pasture growth is scarce, but it is highly favoured by stock.

Map Unit 2.2 Extensive scalding and salination is a feature of this unit, and no soils in the study area were found to be intact.
Map Unit - 2.3.

GENERAL DESCRIPTION - SWAMPY AREAS: deep saline soils with dense old man saltbush.

GEOLOGY - Weathered early-Proterozoic metamorphic rocks, mainly granites and gneisses, with Quaternary alluvium and calcrete.

LANDFORM - Terminal drainage floors (downslope of Unit 2.2) with very low relief and slopes of less than 1%, drained by narrow, well-defined creek channels. The high salinity characteristic of this landscape is probably due to a relatively shallow groundwater table.

SOILS - Saline and moderately alkaline texture-contrast soils, (Dr 4.13) dark reddish brown in colour. The profile consists of a sandy clay loam surface horizon 0.2 m thick overlying a pedal silty clay or light clay. Unlike the soils of Unit 2.2, these are not subject to scalding.

VEGETATION - A shrubland of old man saltbush occurs throughout. Annual grasses, mainly woollyoat grass, grow on the open ground amongst the saltbush and perennial species such as curly windmill grass often establish under the shrub canopy.

LAND MANAGEMENT IMPLICATIONS - This landscape has a negligible erosion hazard. Where rabbits are present on adjacent country, the survival of old man saltbush may be jeopardized by heavy browsing pressure and the destruction of seedling growth.

Map Unit 2.3. The dense shrub cover of old man saltbush is a distinguishing feature of this unit. The Hale River, the major drainage feature of the study area, lies to the left of the scene.
3. SANDSTONE TERRACES

Map Unit - 3.1.

GENERAL DESCRIPTION - TERRACE SURFACES (MESAS AND PLAINS): stony red earths with open mulga over fuschia bush and wire grass.

GEOLOGY - Early Tertiary quartzose sandstone, with some silcrete (Hale Formation).

LANDFORM - Terrace surfaces with low relief and very gentle slopes (1% or less), featuring an open network of narrow tributary drainage depressions (Unit 3.6). Occasional sandstone outcrop. This unit embraces the remnants of a previous land surface of Tertiary age, now dissected and partially buried. It includes mesa tops-areas of the terrace surface now isolated by geologic erosion, as well as plains where the surface merges with surrounding landscapes.

SOILS - Red earths (Gn 2.13), with textures graduating from a sandy clay loam at the surface to a light clay at about 0.5m. Profiles are neutral or slightly acid throughout. Quartzite or sandstone cobbles and gravel occur on the soil surface and throughout the profile, and ironstone or quartz gravel is occasionally present. Soil colour is typically dark red or reddish brown.

VEGETATION - An open shrubland of mulga and occasionally witchetty bush with fuschia bush, spiny saltbush and blue-leaf cassia, over mainly wire grass. Woollyoat grass together with tussocks of brush wire grass, umbrella grass and native panic is often present beneath the shrub canopy.

In several areas the mulga cover is sparse and degenerate, possibly as a result of past wildfire damage and poor seedling recruitment. Thozet's box is present on this unit near the upper reaches of Delaney Creek.

LAND MANAGEMENT IMPLICATIONS - This unit has a minor water erosion hazard. Storm runoff may initiate minor rilling when groundcover is poor. Pastures are unattractive to stock and only lightly grazed.
Map Unit 3.1  This unit includes the surfaces of mesa formations as well as plains that merge into the surrounding landscape (above). The mulga-wire-grass association is avoided by grazing livestock.

Map Unit - 3.2.

GENERAL DESCRIPTION - BREAKAWAY SLOPES AND RESIDUALS: lithosols with Thozet's box or red mallee over buck spinifex.

GEOLOGY - Early tertiary quartzose sandstone (Hale Formation).

LANDFORM - Scarp faces along the margins of Unit 3.1, particularly in association with mesa topography, characterized by very steep slopes and relief up to about 70m. Also includes mesa residuals with variable relief, where the terrace surface has completely broken down.

SOILS - Shallow, stony lithosols, with some areas of sandstone outcrop.

VEGETATION - Sparse Thozet's box or red mallee over an open stand of buck spinifex.

LAND MANAGEMENT IMPLICATIONS - These stony slopes have a negligible erosion hazard and no grazing value.
MAP UNIT 3.3.

GENERAL DESCRIPTION - DISSECTED BREAKAWAYS AND WASH AREAS:
texture-contrast soils with occasional Thozet's box over bladder
saltbush.

GEOLOGY - Early Tertiary sandstones (Hale Formation) and Quaternary
alluvium.

LANDFORM - Dissected scarp faces with variable slopes and relief up
to 30 m, draining into narrow channels that feed small alluvial
tracts usually about 500 m in length.

SOILS - The scarp faces are comprised of bare, white sandstone out­
crop, with only small pockets of soils. Texture-contrast soils
(Dr 4.53) occur along the alluvium tracts, and consist of a brown
sandy loam surface horizon 0.1 m deep overlying a reddish brown
sandy clay. Soil reaction trend is neutral or slightly alkaline.
These soils are often badly scalded and gullied.

VEGETATION - Isolated specimens of Thozet's box are often present
on the scarp faces. The alluvial tracts support sparse bladder
saltbush in association with a groundcover that includes woollyoat
and eight-day grasses, winged chloris, katoora, fairy grass,
various copperburrs and scattered tussocks of curly windmill grass.
Thozet's box is occasionally present on these areas.

LAND MANAGEMENT IMPLICATIONS - The texture-contrast soils of the
alluvial tracts have a severe erosion hazard and are subject to
extensive scalding, gullying and minor desalination. The bladder
saltbush community is usually degenerate, supporting only scattered
saltbush and ephemeral or unpalatable grasses.
Map·Unit 3.3  The soils of the wash areas are usually scalded and gullied, supporting only sparse bladder saltbush (foreground). Thozet’s Box (background) has a very limited distribution in Central Australia.
Map Unit - 3.4.

GENERAL DESCRIPTION - IRONSTONE RESIDUALS: stony soils, bare or with sparse mulga.

GEOLOGY - Ferricrete associated with early Tertiary sandstone.

LANDFORM - Terrace residuals, including gently sloping terrace surfaces fringed by steep scarps, and low rises with smooth rounded crests.

SOILS - Virtually absent. Surfaces are comprised of ironstone gravel and cobbles.

VEGETATION - Absent, otherwise a sparse cover of annual grasses. Mulga (often dead), Thozet's box and fuschia bush are associated with small outcrops of sandstone (see Unit 3.1) and southern bluebush is present in conjunction with colluvial deposits (see Unit 5.3).

LAND MANAGEMENT IMPLICATIONS - This unit has a negligible erosion hazard and very little grazing potential.

Map Unit 3.4. This landscape supports a sparse vegetative cover. Fuschia bush (foreground and distance) is associated with small areas of sandstone outcrop. Many of the ironstone residuals support old dead mulga.
Map Unit - 3.5.

GENERAL DESCRIPTION - VALLEY FLOORS: stone-mantled marl with open Thozet's box over bladder saltbush.

GEOLOGY - Early Tertiary quartzose sandstone (Hale Formation).

LANDFORM - Broad valley floors with gentle slopes and low relief, with a closely-spaced drainage network of deep, narrow watercourses.

SOILS - A pavement of quartzite or sandstone cobbles overlying a white kaolinitic saprolite.

VEGETATION - Scattered Thozet's box in association with an open low shrub cover of bladder saltbush and sparse fuschia bush. Ground-cover is dominated by oat grass and copperburrs. Watercourses support a corridor of Thozet's box and tussock grasses such as curly windmill grass, and main creeklines (i.e. Delaney Ck) are fringed by tea-tree and rarely northern myall.

LAND MANAGEMENT IMPLICATIONS - A slight water erosion hazard. Storm runoff is likely to strip topsoil deposits, exposing a stony pavement. Although pasture growth is sparse, stock are likely to be attracted by the palatable feed available on this unit.

Map Unit - 3.6.

GENERAL DESCRIPTION - DRAINAGE FLOORS: sandy alluvial soils with mulga over kerosene and annual grasses.

GEOLOGY - Quaternary alluvium derived from Tertiary sandstone.

LANDFORM - Narrow, flat-floored drainage tracts, comprising an open tributary drainage network on Unit 3.1. Watercourse channels are generally absent.

SOILS - Coarse-textured yellowish red alluvial soils (Uc 5.21). Textures grade from sandy loam at the surface to sand clay loam at 0.5 m. Soil reaction trend is neutral.

VEGETATION - Mulga woodland, occasionally with scattered ironwoods, over mainly woollyoat and kerosene grasses. Tussocks of curly windmill grass, kangaroo grass and desert bluegrass are present in minor depressions, while umbrella grass and cotton panic occur beneath the canopy cover.

LAND MANAGEMENT IMPLICATIONS - These depressions have a moderate water erosion hazard and are subject to rilling and gullying. They have a moderate grazing potential, but prolonged grazing pressure is likely to result in an increase in the proportion of kerosene grass and promote the growth of herbage species.
4. LIMESTONE TERRACES

MAP UNIT - 4.1.

GENERAL DESCRIPTION - TERRACE SURFACES: shallow calcareous soils with open witchetty bush over annual grasses.

GEOLOGY - Mid-Tertiary chalcedonic limestone and siltstone (Waite Formation).

LANDFORM - Residual terrace surfaces, either as low platforms merging with adjacent landforms, or mesa tops where isolated by geologic erosion. These surfaces are almost level, with very low relief, and only sometimes exhibit a poorly defined drainage pattern. The surfaces are relicts of an ancient landscape.

SOILS - Shallow calcareous earths (Um 5.61). Profiles consist of a dark reddish brown horizon, sandy clay loam in texture and highly alkaline, overlying calcrete. Surfaces are strewn with large cobbles of quartzite and calcrete, together with calcrete and some laterite gravel.

VEGETATION - An open shrubland of witchetty bush with an occasional solitary bloodwood or beefwood, over oat grass, limestone oat grass and sparse herbage.

LAND MANAGEMENT IMPLICATIONS - This landscape has a negligible erosion hazard, but is a habitat highly favoured by rabbits. Consequently the witchetty bush and other perennial vegetation is in a degenerate condition, grazing rabbits precluding regeneration.

Map Unit 4.1. Note the degenerate condition of the witchetty bush and lack of regeneration. This damage can be attributed to rabbits, and old warrens are common throughout this unit.
Map Unit - 4.2.

GENERAL DESCRIPTION - BREAKAWAY SLOPES AND RESIDUALS: stony marl with occasional red mallee and sparse grasses.

GEOLOGY - Mid Tertiary chalcedonic limestone and siltstone (Waite Formation).

LANDFORM - Scarp faces fringing platform or mesa surfaces (Unit 4.1) with moderate slopes and relief up to 15 m.

SOILS - White calcareous marl, usually with stony surfaces.

VEGETATION - Isolated clumps of red mallee, with scattered dead finish and sandalwood over sparse grasses, mainly oat grass.

LAND MANAGEMENT IMPLICATIONS - A slight erosion hazard. Storm runoff is liable to initiate minor rilling down these slopes, particularly where channelled by vehicle tracks or stock pads.

Map Unit - 4.3.

GENERAL DESCRIPTION - GILGAIED PLAINS: stony calcareous soils with mitchell and annual grasses.

GEOLOGY - Mid-Tertiary limestones and siltstone (Waite Formation), and some Quaternary colluvium.

LANDFORM - Pediplain surfaces (erosional surfaces formed by scarp retreat), partly mantled by Quaternary colluvium, comprising gently-sloping plains with low relief.

SOILS - Stony, highly calcareous and alkaline soils with crabhole and linear gilgai micro-relief. Brown gradational soils (Gc 1.22) occur between the gilgai depressions. Soil texture graduates from a sandy clay loam at the surface to a medium clay at 0.5 m. Yellowish red clay soils (Ug 5.3) light to medium clay in texture, occupy the gilgai depressions. Calcrete gravel is abundant on surfaces near areas of outcrop (Units 4.1 and 4.2), but diminishes with distance downslope, where the surface mantle consists mainly of quartzite gravel and cobbles.

VEGETATION - An annual grassland of oat and limestone oat grasses, with neverfail and curly mitchell grasses within the gilgai depressions. Sparse prickly wattle or needlewood is present on some downslope areas.

LAND MANAGEMENT IMPLICATIONS - This unit has a slight erosion hazard. Storm runoff may initiate rilling where surface flows are concentrated along graded tracks. Prolonged overgrazing is likely to result in an increase in the proportion of limestone oat grass.
Map Unit 4.3. North of White Dam. Linear gilgai depressions are outlined by tussocks of neverfail grass.

Map Unit - 4.4.

GENERAL DESCRIPTION - DRAINAGE FLOORS: calcareous cracking clays with neverfail and mitchell grass.

GEOLOGY - Quaternary alluvium derived from Tertiary limestones and siltstones (Waite Formation).

LANDFORM - Broad, flat-floored drainage tracts with very gentle fall (approx 1%). Narrow meandering watercourse channels have developed where the drainage floor is constricted by adjacent landforms.

SOILS - Slightly calcareous or non-calcareous cracking clays (Ug 5.3). Profiles consist of a dark brown light clay at the surface, graduating to a reddish brown medium clay at about 0.5 m. They are alkaline throughout. Gilgai relief is strongly-developed in poorly-drained areas, and quartzite gravel is occasionally present.

VEGETATION - A tussock grassland of curly mitchell grass with scattered barley mitchell grass and Queensland bluegrass. Neverfail is present on poorly-drained areas, together with sparse goat-
head burr and cannonball. The lower reaches of the drainage tracts also support sparse prickly wattle.

**LAND MANAGEMENT IMPLICATIONS**: This unit has a negligible erosion hazard, and produces a bulk of moderately palatable feed. Pasture composition is likely to remain relatively stable with prolonged grazing pressure.

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**Map Unit 4.4** Gilgaied soils supporting neverfail and sparse prickly wattle occur in poorly drained areas.

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**5. COLLUVIAL TERRACES**

**MAP UNIT - 5.1.**

**GENERAL DESCRIPTION** - GENTLY-SLOPING PLAINS: stony red earths, largely treeless with copperburrs and annual grasses.

**GEOLOGY** - Quaternary colluvium, mainly derived from late Proterozoic quartzites.
LANDFORM - Colluvial terrace surfaces, comprising plains with very gentle slopes (approx.1%) and low relief, drained by widely-spaced, narrow linear channels (tributary to Unit 5.5)

SOILS - Red earths (Gn 2.12) with very consistent properties throughout the study area. They are very stony, and quartzite gravel and cobbles dominate the surface and are present throughout the profile. The soils are red (2.5YR 4/6), non-calcareous and have a neutral soil reaction trend (pH 6.5 - 7.5). Soil texture graduates from a sandy clay loam at the surface to a light clay at about 0.6 m.

VEGETATION - A sparse groundcover of mainly copperburrs and annual grasses, including woollyoat, mulga and eight-day grasses. Samphire is present on slightly saline slopes, and scattered mulga occurs where shallow colluvium overlies sandstone (Unit 3.1.)

LAND MANAGEMENT IMPLICATIONS - This landscape has a low erosion hazard, the stone cover providing some protection to soil surfaces. Prolonged overgrazing will probably result in a decrease in the proportion of woollyoat grass in the pasture, and an increase in the proportion of copperburrs and ephemeral grasses.
MAP UNIT - 5.2.

GENERAL DESCRIPTION - GILGAIED PLAINS: stony red clays with Mitchell and annual grasses.

GEOLOGY - Quaternary colluvium, mainly derived from late Proterozoic quartzites.

LANDFORM - Colluvial fan deposits post-dating Unit 5.1 comprising gently-sloping plains (approx. 1% slope) with very low relief.

SOILS - These feature stony surfaces with crabhole gilgai relief. Between the crabhole depressions, profiles are dark red, and textures grade from a fine sandy clay loam or light clay at the surface to a medium clay at 0.6 m. Soil reaction trend is slightly alkaline (Gn 2.13). Surfaces are mantled with quartzite gravel, which occurs throughout the profile. Within the crabholes, soils are dark reddish grey medium clays (Ug 6.3) and slightly acid.

VEGETATION - The gilgai margins support isolated clumps of needlewood in association with a sparse groundcover of copperburrs and annual grasses, mainly woollyoat grass. Cottonbush is infrequently present. The crabholes support a dense growth of neverfail, curly Mitchell grass, barley Mitchell grass, Queensland bluegrass and occasionally goathead burr.

LAND MANAGEMENT IMPLICATIONS - These plains have a low erosion hazard. Prolonged overgrazing is likely to decrease the proportion of palatable annual grasses in the pasture and result in an increase in copperburrs and goathead burr.

Map Unit 5.2 The gilgai relief is clearly visible as a mosaic of stony surfaces with annual grasses or bare, interspersed by shallow depressions with Mitchell grass.
**MAP UNIT 5.3.**

**GENERAL DESCRIPTION - BREAKAWAY SLOPES AND RESIDUALS:** stony lithosols with southern bluebush and sparse annual grasses.

**GEOLOGY** - Quaternary colluvium derived from late Proterozoic quartzites.

**LANDFORM** - Breakaway areas and residuals where the terrace surface (Unit 5.1) has been dissected. These landforms feature low relief and gentle slopes (2-5%), and are drained by an open network of broad depressions.

**SOILS** - Bare stony surfaces with a mantle of white quartzite gravel predominate. Soil profiles consist of a calcareous brown light clay horizon graduating to a calcareous yellowish-brown medium clay or sandy clay at 0.5m. They have an alkaline reaction trend. Surfaces feature scattered pockets of topsoil overlying the stony mantle, consisting of a non-calcareous dark brown sandy clay loam with a neutral reaction.

The erosion status of these soils is unclear. The bare stony surfaces support a sparse perennial vegetation of southern bluebush without pedestalling, suggesting that these soils have not been subject to scalding. The patchy veneer of topsoil may consist of surface wash deposits slowly progressing downslope.

**VEGETATION** - The pockets of topsoil support sparse southern bluebush in association with annual grasses, mainly woollyoat grass. Other species present include eight-day and five-minute grasses, copper-burr, goathead burr, curly windmill grass and wire grass. The stony areas support very sparse southern bluebush.

**LAND MANAGEMENT IMPLICATIONS** - These areas have a very slight erosion hazard since most soil surfaces are protected by a mantle of stone. The remaining islands of topsoil are likely to be subject to rilling and slight windsheeting if denuded. The southern bluebush is heavily browsed by rabbits, and consequently regeneration is suppressed and mature plants are in a degenerate condition.
Map Unit 5.3  This unit features bare stony surfaces with scattered sandy deposits, possibly surface wash. Southern bluebush is specific to this land type.

MAP UNIT 5.4.

GENERAL DESCRIPTION - BREAKAWAY SLOPES: shallow sandy soils with sparse mulga over annual grasses.

GEOLOGY: - Quaternary colluvium and alluvium.

LANDFORM: - Breakaway areas and residuals where the terrace surface (Unit 5.1) has been dissected, featuring low relief and gentle slopes (2-5%). In contrast to Unit 5.3, this land type has a complete soil cover. Drainage is carried by broad, shallow depressions.

SOILS: Shallow, gravelly soils (Gn 2.12, Uc 5.21). Profiles consist of a reddish brown sandy loam horizon containing fine quartzite gravel, graduating to a yellowish-red sandy clay loam at about 0.4 m. Carbonate nodules are occasionally present at this depth. Soil reaction trend is neutral.
VEGETATION - An open woodland of mulga over annual grasses, mainly woollyoat grass. Dense mulga with curly windmill grass and desert bluegrass is present in drainage depressions.

LAND MANAGEMENT IMPLICATIONS - This land type has a moderate wind erosion hazard, and open areas may drift if denuded. Soils have high infiltration rates and the water erosion hazard is slight. Prolonged overgrazing is likely to result in a decrease in the proportion of woollyoat grass in favour of increased herbage growth.

MAP UNIT 5.5.

GENERAL DESCRIPTION - DRAINAGE FLOORS: extensively scalded texture contrast soils with sparse cottonbush and annual grasses.

GEOLOGY - Quaternary alluvium.

LANDFORM - Narrow tributary drainage floors 100 - 200 m wide on Unit 5.1 together with broad drainage floors 400 - 800 m wide along Georgina and Mulga Creeks, and north-east of Gidyea Bore. These landforms feature very low relief and slope and, in their uneroded state, are drained by narrow watercourse channels feeding small floodout deposits. All surfaces are extensively scalded and gullied.

SOILS - Texture-contrast soils (Dr 4.12) occur throughout. Where these remain intact, they are characterized by a dark reddish brown sandy loam surface horizon up to 0.2 m deep overlying a slightly redder sandy clay or light clay. Soil reaction trend is neutral and profiles are non-calcareous throughout. The surface horizon has a texture of sandy clay loam in some slightly eroded profiles.

VEGETATION - Uneroded areas support a sparse cover of cottonbush in association with mainly woollyoat grass and scattered tussocks of curly windmill and umbrella grasses. Herbage species including copperburrs, tarvine and common sida are usually present. Small floodouts support dense stands of curly windmill grass.

LAND MANAGEMENT IMPLICATIONS - This landscape has a severe erosion hazard and constitutes the most eroded landscape within the study area. Although the erosion damage is generally long-standing, most gully systems remain active and are encroaching on the remaining areas of topsoil. Pasture growth is scarce but highly palatable to stock.
Map Unit 5.5. Extensive scalding is a feature of this landscape (middle distance). Where surfaces remain intact, they support cottonbush and annual grasses (foreground).

MAP UNIT - 5.6.

GENERAL DESCRIPTION - DRAINAGE FLOORS: texture-contrast soils with cottonbush and perennial grasses.

GEOLOGY - Quaternary alluvium.

LANDFORM - Narrow, linear depressions less than 100 m in width, draining the terrace surface (Unit 5.1) in the eastern part of the study area. Watercourse channels are absent. This unit differs from Unit 5.5 in that scalding and gullyng are generally absent.

SOILS - Texture-contrast soils (Dr 4.12). Profiles consist of a dark red sandy clay loam horizon 0.1 m deep overlying a dark red sandy clay. They exhibit a neutral reaction trend and are non-calcareous.

VEGETATION - A sparse shrub cover of cottonbush in association with
mainly woollyoat grass and scattered tussocks of curly windmill grass, umbrella grass, desert bluegrass and Queensland bluegrass.

LAND MANAGEMENT HAZARDS - In contrast to Unit 5.5, this land type has only a slight erosion hazard. Poorly located tracks that channel the flow of runoff along the unit will be subject to rilling and gullying. Prolonged overgrazing will probably initiate a decline in the proportion of woollyoat and umbrella grasses in the pastures, and an increase in the abundance of goathead burr and eight-day grass.

6 ALLUVIAL SURFACES.

MAP UNIT 6.1.

GENERAL DESCRIPTION - FLOODPLAINS AND FLOODOUTS: sandy alluvial soils with sparse corkwood over kerosene grass.

GEOLOGY - Quaternary alluvium.

LANDFORM - Broad sandy floodplains and floodouts along the Hale River and its major tributaries, up to 800 m in width. Levee banks and other surface relief are generally absent.

SOILS - Dark reddish brown alluvial soils (Uc 1.23) exhibiting little profile development. They are usually sandy loam in texture to a depth of 0.4 m, often graduating to a coarse sandy clay loam beneath this depth. They are non-calcareous with a neutral reaction trend.

VEGETATION - Sparse fork-leaved corkwood and occasionally ironwood or prickly wattle over mainly kerosene grass. Woollyoat grass comprises only a minor component of pasture growth, together with tussock grasses including curly windmill grass and umbrella grass which are present beneath the tree canopy, and herbage species such as potato bush and munyeroo.

LAND MANAGEMENT IMPLICATIONS - This unit has a moderate wind erosion hazard and is subject to drift if denuded. The kerosene grass pastures are relatively resilient to grazing pressure. Prolonged overgrazing will probably result in a decline in the abundance of woollyoat and umbrella grasses, and an increase in the growth of wire grass and herbage. Rabbits were noted in localized areas on this landscape.
Map Unit 6.1. Scattered fork-leaved corkwoods and kerosene grass pastures are a feature of the floodplains along the Hale River. Although kerosene grass is only moderately palatable, stock make regular use of this type of country.

MAP UNIT - 6.2.

GENERAL DESCRIPTION - FLOODOUTS: Sandy alluvial soils with open ironwood over kerosene grass.

GEOLOGY - Quaternary alluvium.

LANDFORM - Broad floodout deposits up to 1 km in width, fed by shallow watercourse channels. No surface relief. Occurs mainly in the Gidyea Bore area.

SOILS - Gravelly dark reddish brown alluvial soils (Uc 1.23). Soil texture grades from a light sandy clay loam at the surface to a sandy clay loam at 0.5 m. Soils are non-calcareous with a neutral reaction trend. Quartzite and ironstone gravel is abundant throughout the profile.

VEGETATION - Sparse ironwood and occasionally fork-leaved over kerosene grass and annual grasses. This unit was denuded at the time of the survey but it is expected that oat and woollyoat grasses comprise a significant proportion of pasture growth.

LAND MANAGEMENT IMPLICATIONS - The coarse-textured soils have a moderate wind erosion hazard, although surface gravel provides some protection against drift. The erosion hazard is compounded by intense rabbit activity on this land type, which maintains ground-cover in a poor state.
Map Unit 6.2. Near Gidyea Bore. This area is a focus of rabbit activity and was denuded at the time of the survey. Minor drift was occurring, but surfaces are partially protected by gravel (foreground).

MAP UNIT 6.3.

GENERAL DESCRIPTION - DRAINAGE FLOORS: alluvial soils with occasional red gum over dense curly windmill grass.

GEOLOGY - Quaternary alluvium.

LANDFORM - Shallow drainage tracts, including flood channels on floodplains (Unit 6.1), depressions adjacent to floodout areas (Unit 6.2) and tributary valley floors in low hill country (Units 1.3 and 1.4). Narrow watercourse channels are sometimes present.

SOILS - Medium-textured alluvial soils (Um 1.43). Typical profiles consist of a dark brown sandy clay loam horizon overlying a dark reddish brown light clay at 0.5 m. Soils are slightly alkaline at depth but non-calcareous.

VEGETATION - Scattered red gum, ghost gum or ironwood over a dense tussock grassland of curly windmill grass, silky browntop, kangaroo grass and Queensland bluegrass.

LAND MANAGEMENT IMPLICATIONS - Pastures grow rank and are generally ignored by stock except when new growth is available. Soil erosion is unlikely unless the drainage flow is channelled by earthworks or gullying on an adjacent landform.
Map Unit 6.3. This unit is characterized by a rank growth of curly windmill grass. Note Unit 1.4 in background.

MAP UNIT 6.4.

GENERAL DESCRIPTION - DRAINAGE FLOORS: alluvial soils with occasional red gum over dense curly windmill grass.

GEOLOGY - Quaternary alluvium.

LANDFORM - Terminal lobes of floodouts where flood deposition is presently active.

SOILS - Coarse-textured brown alluvial soils with bed load sand and gravels.

VEGETATION - A closed forest formation of red gum saplings. Ground-cover is generally absent, but perennial tussock grasses such as curly windmill grass may be present.
LAND MANAGEMENT IMPLICATIONS - Stock may use these areas as harbour during mustering operations. The unit is small in extent and presents no erosion problems. The density of red gum regeneration has increased spectacularly since the early 1970's (ref. 1971 1:80,000 black and white aerial photos) in response to favourable seasonal conditions.

Map Unit 6.4. The dense regeneration of red gum is specific to the floodout lobes of this unit. Soils consist of bed load sand and gravels (foreground).
MAP UNIT - 6.5

GENERAL DESCRIPTION - FANS: alluvial soils with sparse ironwood over annual grasses.

GEOLOGY - Quaternary alluvium.

LANDFORM - Alluvial fans up to 500 m long, fed by minor watercourse channels arising in adjacent low hilly country. These usually mantle pediment surfaces.

SOILS - Gravelly brown alluvial soils (Uc 5.2), usually sandy loam or light sandy clay loam in texture, slightly alkaline and non-calcareous.

VEGETATION - Sparse ironwood or fork-leaved corkwood over mainly woollyoat grass and some kerosene grass. Curly windmill grass, desert bluegrass, silky browntop and other tussock grasses occur where watercourse channels flood out.

LAND MANAGEMENT IMPLICATIONS - A slight erosion hazard. The margins of this unit may be subject to minor gullying following storm runoff. Prolonged overgrazing may result in a decline in the proportion of woollyoat grass in the pasture.
REFERENCES


APPENDICES.

APPENDIX A

SPECIFICATION OF AERIAL PHOTOGRAPHY.

Source: Australian Survey Office, Canberra.

Project: Ambalindum, N.T.

Photo Scale: 1:20,000

Film No: SOC 503

Run 2

Frame Nos. 7143-7155

3 7172-7184

4 7189-7197

5 7214-7219

Film Type: Colour

Date: 17/8/82
APPENDIX B.

SPECIFIC NAMES OF PLANTS MENTIONED IN TEXT.

GRASSES.

Wire grass (alluvial soils)  
Kerosene grass  
Mulga grass  
Wire grass (red earths)  
Brush wire grass  
Rough wire grass  
Curly mitchell grass  
Barley mitchell grass  
Desert bluegrass  
Winged chloris  
Queensland bluegrass  
Cotton panic  
Umbrella grass  
Curly windmill grass  
Oat grass  
Limestone oat grass  
Woollyoat grass  
Neverfail  
Mountain wanderrie  
Silky browntop  
Eight-day grass  
Native panic  
Katoora  
Fairly grass  
Kangaroo grass  
Hard spinifex  
Buck spinifex

Aristida biglandulosa  
" browniana  
" contorta  
" inaequidulmis  
" obscura  
" strigosa  
Astrebla lappacea  
" pectinata  
Bothriochloa eawartiana  
Chloris scariosa  
Vicanthisium sericeum  
Digitaria brownii  
" coenica  
Enteropogon acicularis  
Enneapogon avenceus  
" cylindricus  
" polyphyllus  
Eragrostis satifolia  
Eriachne mucronata  
Eulalia fulva  
Fimbriastylis dichotoma  
Panicum decompositum  
Sporobolus actinoclados  
" caroli  
Themeda australis  
Triodia basedowii  
" longiceps

FORBS

Tarvine  
Cannonball  
Munyaroo  
Lambs-tails  
Copperburr  
Goathead burr  
Common sida  
Potato bush

Boerhavia diffusa  
Dissocarpus paradoxa  
Portulaca oleracea  
Ptilotus obovatus  
Sclerolaena spp.  
" bicornis  
Sida rholena  
Solanum ellipticum

TREES AND SHRUBS

Mulga  
Northern myall  
Ironwood  
Acacia  
Witchetty bush  
Dead finish  
Prickly Wattle  
Old-man saltbush  
Bladder saltbush  
Blue-leaf cassia

Acacia aneura  
" calcicola  
" estrophilata  
" dictyophleba  
" kempeana  
" tetragonophylla  
" victoria  
Atriplex nummularia  
" vesicaria  
Cassia helmsii
TREES AND SHRUBS (Cont)

Fuschia bush  Eremophila freelingii
River red gum  Eucalyptus camaldulensis
Blue mallee  "  gamophylla
Ghost gum  "  papuana
Red mallee  "  socialis
Bloodwood  "  terminalis
Thozet's box  "  thozetiana
Beefwood  Grevillea striata
Holly grevillea  "  wickhamii
Fork-leaved corkwood  Hakea eyreana
Needlewood  "  leucoptera
Long-leaved corkwood  "  subera
Samphire  Halosarcia spp.
Silver indigo  Indigofera georgei
Cottonbush  Maineana aphylla
Southern bluebush  "  astrotricha
Three-winged bluebush  "  triptera
Tea-tree  Melaleuca glomerata
Spiny saltbush  Rhagodia spinescens
Sandalwood  Santalum lanceolatum