Plant and soil indicators for detecting zones around water points in arid perennial chenopod shrublands of South Australia.

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Table of Contents

List Of Figures v
List Of Tables vi
Summary vii
Declaration ix
Acknowledgment x

Chapter 1 General Introduction 1
1.1 Introduction 1
1.2 Arid And Semi-Arid Australian Ecosystems 1
1.3 Australian Rangeland Ecosystems 2
1.4 Chenopod Shrubland Communities 3
1.5 Microbiotic Soil Crusts 4
1.6 Grazing Effects 5
1.7 The Concept Of Threshold 6
1.8 Patchiness Concept 7
1.9 The Piosphere Pattern As A Framework 8
1.10 Framework For This Research 10
1.11 The Objectives Of The Study 11

CHAPTER 2 LITERATURE REVIEW 12
2.1 The Ecological Theories Of Vegetation Dynamics 12
2.1.1 Introduction 12
2.2 Range Condition And Trend In Rangeland Ecology 12
2.3 Ecological Theories 12
2.3.1 Clementsian Succession Theory 12
2.3.1.1 Important Assumptions Of Climax Theory: 13
2.3.2 Range Science And Succession Theory 14
2.3.3 New Approaches To Rangeland Dynamics 15
2.4 The Ideas On Description Of Pattern In Chenopod Shrublands 18
2.5 Importance Of Indicators 19
2.6 Soil And Plant Features: Separately Or Together? 20

CHAPTER 3: STUDY AREA AND METHODOLOGY 24
3.1 Study Area 24
3.1.1 Location 24
3.1.2 Abiotic Variables 24
3.1.3 Biotic Features 26
3.1.4 Land Use 29
2.2 Methodology 31
3.2.1 Overview 31
3.2.2 Site Selection 32
3.2.3 Precision Of Data Collection 32
3.2.4 General Method 33
3.2.5 Data Analysis 35

CHAPTER 4 SPECIES COMPOSITION AND SIGNIFICANT PLANT SPECIES 38
4.1 Introduction 38
4.2 Aims And Objectives 39
4.3 Materials And Methods 40
4.3.1 Data Analysis 41
4.4 Results 42

4.4.1 Cluster Analysis 42
4.4.2 Group Description 43
4.4.3 Ordination 43
4.4.4 PCC Analysis 44
4.4.5 Vegetation Description 44
4.5 Discussion 45
CHAPTER 5: PANT-BASED VEGETATION FEATURES 49
5.1 Introduction 49
5.2 Aims And Objectives 50
5.3 Materials And Methods 50
5.3.1 Quadrat Configuration 51
5.4 Plant-Based Measurements 51
5.4.1 Significant Plant Species 51
5.4.1.1 Plant Attributes 54
5.4.2 Statistical Analyses 55
5.5 Results 55
5.5.1 Overland Paddock 55
5.5.1.1 Clustering Analysis 55
5.5.1.2 Non-Parametric Analysis 56
5.5.1.3 Ordination 56
5.5.1.4 PCC Analysis 57
5.5.1.5 Description Of Vegetation Types 58
5.5.2 Purpunda Paddock 59
5.5.2.1 Clustering Analysis 59
5.5.2.2 Non-Parametric Analysis 60
5.5.2.3 Ordination 61
5.5.2.4 PCC Analysis 61
5.5.2.5 Description Of Vegetation Types 62
5.5.3 Railway Paddock 63
5.5.3.1 Cluster Analysis 63
5.5.3.2 Non-Parametric Analysis 64
5.5.3.3 Ordination 64
5.5.3.4 PCC Analysis 65
5.5.3.5 Description Of Vegetation Types 66
5.5.4 Comparison Of Vegetation Form Of Three Paddocks 67
5.6 Discussion 68
5.6.1 Observed Spatial Pattern And Possible Causes 68
5.6.2 Distinguishable Zones 69
5.6.3 Vegetation Indicators 71
CHAPTER 6: VEGETATION ASSOCIATED EDAPHIC FEATURES 73
6.1 Introduction 73
6.2 Aims And Objectives 75
6.3 Materials And Methods 75
6.3.1 Soil Surface Condition 76
6.3.1.1 Field Assessment 76
6.3.1.2 Laboratory Assessments 79
6.3.2 Statistical Analysis 80
6.4 Results 82
6.4.1 General Features 82
6.4.1.1 Overland Paddock 83

6.4.1.2 Purpunda Paddock 84
6.4.1.3 Railway Paddock 86
6.4.2 Edaphic Features And Vegetation Correlation In Three Paddocks 87
6.5 Discussion 90
6.5.1 Detected Soil Surface Changes 90
6.5.2 Soil Sensitive Indicators 91

CHAPTER 7 GENERAL DISCUSSION **96**
7.1 Introduction 96
7.2 Reliability Of Results 97
7.3 Vegetation Patterns 98
7.4 Definition Of Zones 99
7.5 Soil And Vegetation Of Defined Zones And Indicators 100
7.5.1 Soil and vegetation characteristics 100
7.5.1.1 Degraded zone 100
7.5.1.2 Outer Zone 103
7.5.1.3 Sensitive Zone 104
7.6 Piosphere Pattern 107
7.7 Threshold Level 108
7.8 Management Implications 109
7.9 State And Transition Model For Chenopod Shrublands 109

CHAPTER 8: CONCLUSIONS **114**
8.1 Aim 1. 114
8.2 Aim 2. 115
8.3 Aim 3. 116
8.4 Aim 4. 117
8.5 Implications For Range Management 118
8.6 Future Research 120

REFERENCES **121**

APPENDIX A **157**

ADDITIONAL PUBLICATIONS AND AWARD **169**

Summary

Overgrazing has reduced the carrying capacity of chenopod shrublands, reduced biodiversity and increased the susceptibility to degradation in fenced paddocks. The piosphere is part of this grazed ecosystem, and therefore within it there are many mutually interacting, dynamic processes.

This study investigates several questions relating to the impact of continuous sheep grazing on the form, structure and botanical composition of chenopod shrublands. Specifically, which species are more sensitive to grazing in which zones around water points; and which plant and soil features are important for identifying the point of incipient change (threshold). The latter is important so that it can be used as an indicator for detecting the changes in chenopod shrubland communities. The "piosphere effect" was used as a framework for examining the effect of domestic livestock on ecological variables in detail in three arid chenopod shrubland paddocks of South Australian rangelands.

This project consisted of three components. The first aimed to describe the pattern of chenopod shrubland in terms of the foliage cover of the perennial species, using multivariate analysis. From the classification and ordination of these data, it was found that the plant patterns were patchy, rather than random and that five species could be considered dominant in the vegetation : *Atriplex stipitata* Benth (bitter saltbush), *Atriplex vesicaria* Heward *ex* Benth (bladder saltbush), *Maireana georgei* (Diels) Paul G. Wilson (satiny bluebush), *Maireana pyramidata* (Benth.) Paul G. Wilson (black bluebush) and *Maireana sedifolia* (F. Muell.) Paul G. Wilson (pearl bluebush).

The second component of the project specifically examined vegetation patterns based on these five dominant species. Five features (the percentage of canopy cover, density, total dry matter, average height and average width) of the above plant species were measured at 336 sites in

three paddocks separately. Three zones were distinguished (disturbed, sensitive and outer zones). Large and frequent *A. vesicaria* is the indicator of "outer" zone and wide and tall *M. pyramidata* indicate disturbed zones. The disturbed zone also had more abundant *A. stipitata* and *M. pyramidata.* The most important zones of the paddocks are the sensitive zones. The presence of narrow and small plants of *M. georgei* and *A. vesicaria* might be distinguished as the indicators for these zones.

The final component of the project examined to what extent soil features correlated with the vegetation patterns. At the same sampling sites used for collection of plant data, 23 soil based features were examined. Data were correlated with the plant attributes for three paddocks to give a classification of site attributes. High cryptogam cover, particularly of the lichen *Heppia polyspora* and a moderately hard soil crust (i.e. needing a plastic or metal tool to break the surface) may be a useful indicator, for soil infiltration, nutrient cycle status and soil stability in the outer zone. In contrast, destroyed cryptogam cover and an easily broken (with finger pressure), brittle, non-coherent sub-crust could be considered as indicators of degraded zones. Also, cryptogam cover, slaking performance, infiltration capacity, rate of nutrient cycle and soil stability were useful soil indicators for detecting different management zones. In contrast, results show that organic carbon might be not useful as an indicator for detecting zones for rangeland managers.

From an ecological point of view we might conclude that any form of grazing use by domestic livestock is likely to cause a shift in botanical composition. The longer term benefits (and impacts) of grazing needs to be weighed against the diminution of ecological values, including biodiversity.