

## Chapter 1

### INTRODUCTION

#### **South-eastern Lowland Native Grasslands are Australia's Most Threatened Ecosystems**

The arrival of European settlers to south-eastern Australia heralded the beginning of unprecedented and irrevocable landscape change. In search of flat and fertile regions amenable to agricultural systems which evolved in temperate Europe, the settlers immediately began to exploit the lowland plains. At the time, such areas supported vast expanses of grasslands and open grassy woodlands. In places, for instance in Victoria, such vegetation occupied about one third of the total area of the state (Woodgate and Black 1988; Lunt 1991; Department of Conservation and Environment 1992).

The introduction of domestic stock grazing, cropping and irrigation has resulted in vegetation clearance, species extinctions and weed invasion on a massive scale. Approximately 200 years of European occupation in south-eastern Australia has seen indigenous grassy ecosystems almost completely replaced by exotic vegetation (Benson 1991). So severe has the impact been that it is estimated "only 0.5% of the original area of lowland grasslands remains in even semi-natural condition" (Kirkpatrick *et al.* 1995), and in some areas, the original grassland vegetation is thought to be extinct (Lunt 1991; Kirkpatrick *et al.* 1995).

Remnant vegetation is only found in least disturbed refuges along roadsides (including stock routes), rail reserves, cemeteries, and parks (Stuwe 1986; Kirkpatrick *et al.* 1988; Scarlett and Parsons 1993; McDougall and Kirkpatrick 1994; Kirkpatrick *et al.* 1995). These areas are usually isolated and very small, and subject to a wide range of threats such as soil disturbance, weed invasion and over grazing: very few remnants are reserved and adequately managed for conservation (e.g. only 0.3% of their original extent in Victoria) (Frood and Calder 1987; Lunt 1991; Department of Conservation and Environment 1992). In some regions, important remnants can still be found on private property (Foreman 1993; Baker-Gabb 1993; Maher and Baker-Gabb 1993; Scarlett and Parsons 1993; Foreman and Westaway 1994). On the basis of these circumstances, lowland grasslands of south-eastern Australia are regarded

as the country's most threatened ecosystems (McDougall and Kirkpatrick 1994; Kirkpatrick *et al.* 1995). Grassy refugia have great conservation value, often supporting many rare or threatened species of flora and fauna, because they are the best remaining examples of plant communities that are now virtually extinct (Foreman 1995).

### **Poor Knowledge Base of Ecology of Grassy Ecosystems and Victoria's Northern Riverine Plain**

Only in relatively recent times have efforts been made to describe and understand the vegetation of the lowland plains of south-eastern Australia by sampling least modified refugia. However, these studies were initially biased towards the Victorian Volcanic Plain (Stuwe and Parsons 1977; Stuwe 1986; McDougall 1989; Lunt 1990; Conn 1993) and later the Midlands of Tasmania (Kirkpatrick *et al.* 1988; Fensham 1989; Kirkpatrick 1991). Relatively little work has been focused on other significant grassland regions (Lunt 1991; McDougall and Kirkpatrick 1994; Kirkpatrick *et al.* 1995). One such region occurs in the Riverine Plain of south-eastern Australia (Beadle 1948; Moore 1953a, 1953b; McDougall and Kirkpatrick 1994), the Victorian portion of which is referred to as the Victorian Riverina or Northern Plain (Conn 1993).

The Riverine Plain of south-eastern Australia once supported extensive areas of treeless plains or grasslands (Woodgate and Black 1988; Lunt 1991; Foreman 1993; McDougall and Kirkpatrick 1994). These grasslands have been described as "disclimax communities" developing after the destruction of the *Acacia pendula* - *Atriplex nummularia* shrubland alliance (Moore 1953a, 1953b). Whilst now there is a general understanding of broad vegetation patterns in the Northern Plain, little information is known of the area's grasslands as this extract from the recently published 'Flora of Victoria' (Conn 1993) demonstrates:

"Prior to European settlement, large areas of this region supported indigenous grasslands.... Only scattered remnants remain, and these have been greatly modified. It is assumed that these grasslands were dominated by species of *Danthonia* and *Stipa*."

In the Northern Plain, most previous survey and knowledge are based on the larger remnants of usually non-arable public land supporting atypical vegetation (Frankenberg 1971;

Beauglehole 1979, 1980, 1982, 1986, 1987, 1988; Froud and Calder 1987). While there have been a number of very recent studies (McDougall *et al.* 1991*a*, 1991*b*; Maher and Baker-Gabb 1993; Ingeme 1994; Foreman and Westaway 1994; McDougall and Kirkpatrick 1994), they have failed to adequately account for the complexity of the grassy vegetation in the Northern Plain.

## **Thesis Overview**

The objectives of this study are to:

- (a) Advance knowledge of the ecology of grassland remnants on Victoria's northern Riverine Plain,
- (b) Compare grassy vegetation of this region with similar ecosystems in other regions,
- (c) Establish a broad ecological framework for the conservation management of the region's threatened grasslands.

The study consisted of three phases:

- Study of the composition, structure and distribution of existing remnant grassland and grassy woodland remnants, and relationships with the environment and land management (Chapter 2).
- Historical review of the nature of treeless plains vegetation at the time of European settlement and discussion of post-settlement change (Chapter 3).
- Study of the impact of grazing, cultivation and burning on the composition and structure of a long-grazed species-rich grassland and its implications for conservation management (Chapter 4).

Results from all three sections are discussed and drawn together in the final chapter (Chapter 5) to demonstrate how the study objectives have been met. In addition, relevant directions for future research in grassy ecosystems in Victoria's northern Riverine Plain are highlighted.

## **Thesis Style**

Each of the three chapters in this thesis have been written as a paper suitable for publication in a refereed journal, although none have yet been submitted. For the purposes of consistency, formatting follows the style guide of the *Australian Journal of Botany*, with exceptions made only to maintain links between the various chapters (i.e. references to chapters rather than published papers). Also, duplication in the introduction and methods (study area location, geology, climate and soils) between Chapters 2 and 3 has been removed.

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