CHAPTER 1

INTRODUCTION

1.1 Background

The environmental heterogeneity of southern African savannas is expressed in diverse ecosystems, each comprising a complex combination of specific organisms, objects, structures and processes. Maintenance of this notable biological wealth depends on the understanding of the ecosystems that underlie this rich biodiversity. Vegetation is a complex phenomenon, which largely reflects ecological processes and therefore, for various practical and academic reasons, deserves to be described and classified (Mucina 1997). Plant communities as a result of vegetation classification, provide baseline information on all ecological processes and consequently provide knowledge on variability, distribution and dynamics of vegetation. Hence, plant communities are generally treated as environmental management units. There is a growing concern in applying phytosociological knowledge in nature conservation and natural resource management. Although such studies are generally of local interest, they provide essential knowledge to holistic focus in vegetation classification.

Why the need for holistic focus on vegetation classification?

Vegetation is more of a continuum than a set of distinct units. Holistic knowledge on vegetation heterogeneity, distribution patterns and dynamics is therefore an indispensable prerequisite for identifying and understanding ecological processes and hence, providing subsequent insight for managing ecological systems and the highly valued renewable resources. It is, for instance, often difficult to explain ecosystem functioning within a small study area in the savannas of southern Africa. When the emphasis is however put on complete integration of vegetation knowledge of southern African savannas, complexity is dispersed, resulting in a simplified view of the same ecosystem.

In southern African savannas little has been done to present plant communities on a scale larger than regional. Mapping and description of large vegetation types are however abundant (e.g. Boughey 1961; Rattray 1962; Wild & Barbosa 1967; Fanshawe 1969; Barbosa 1970; Weare &

Yalala 1971; White 1983; Acocks 1988; Timberlake & Mapaure 1992; Timberlake *et al.* 1993; Giess 1998). Although such descriptions contribute to a better knowledge of southern African savannas, attempts should be made to analyse plant communities documented by recent and historical vegetation relevés (=phytosociological synthesis) to constitute a proper basis for evaluating the consequences of environmental changes, both on regional as well as on international scale (Schaminée & Stortelder 1996).

Why are such studies being avoided in southern Africa?

1) Vegetation sampling in southern Africa is still in its growing stage due to limitations in vegetation knowledge on the regional scale. It is, however also true that botanists eluded vegetation sampling for classification purposes in parts of southern Africa, leaving gaps in sound vegetation knowledge.

2) Considering the high plant species diversity in southern Africa (Cowling & Hilton-Taylor 1994; Davis *et al.* 1994), vegetation studies on a local scale are complex themselves, which consequently suppress interests in large-scale studies.

3) The Zürich-Montpellier or Braun-Blanquet approach for the study of vegetation has proved to be efficient and reliable method for vegetation surveying and classification in most countries (Whittaker 1962; Werger 1974). Since 1969 this approach became popular in southern Africa, however, criticisms on the method (e.g. Egler 1954; Poore 1956; Kent & Coker 1995) evoked uncertainties. Since then, several alternative multivariate methods for vegetation classification evolved (Whittaker 1980; Gaugh 1982), resulting in growing knowledge on vegetation in southern Africa, but lacking consistency between authors.

4) Many vegetation data sets, which are of valuable contribution to vegetation knowledge, were never analysed and described, which consequently hampers phytosociological syntheses.

5) Local/regional vegetation surveying often constitutes biased conclusions due to ignorance of system functioning on a larger scale.

6) A major constraint in phytosociological syntheses is inadequate and inconsistent methods to treat large vegetation data sets containing high species diversity, as in the case of southern African vegetation studies.

1.2 Motivation

Vegetation classification in the Savanna Biome of South Africa has received attention in recent years (e.g. Van der Meulen 1979; Van Rooyen *et al.* 1981a; Van Rooyen *et al.* 1981b; Van Rooyen *et al.* 1981c; Westfall *et al.* 1985; Bredenkamp & Theron 1990; Bredenkamp & Theron 1991; Bredenkamp *et al.* 1993; Coetzee 1983; Nel *et al.* 1993; Schmidt *et al.* 1993; Bredenkamp & Deutschländer 1994; Bredenkamp & Deutschländer 1995; Brown *et al.* 1995a; Brown *et al.* 1995b; Brown *et al.* 1996; Dekker & Van Rooyen 1995; Bezuidenhout 1996; Visser *et al.* 1996). These studies definitely contributed to the knowledge of variability, distribution and dynamics of vegetation, resulting in better natural resource management. It is however evident that little is known at the level beyond the superior vegetation unit.

The study of Winterbach (1998) was one of the first attempts to synthesise knowledge on South African savanna vegetation. This synthesis revealed four major groups of communities, interpreted as zonal vegetation classes, of which the Commiphoro mollis – Colophospermetea mopani evoked further interest. This proposed vegetation class represents Mopaneveld (=Mopani Veld) of the Central Savanna Biome in South Africa, although it is known to cover large areas of savanna vegetation in southern Africa (Mapaure 1994).

The savannas of southern Africa are comprised of various vegetation types of which some, e.g. the Mopaneveld, traverse environmental extremes. Although variability within Mopaneveld vegetation is recognised, no attempt has ever been made to synthesise existing vegetation knowledge. This need can be ascribed to (a) scarcity in adequate methods for synthesising large data sets as well as (b) the priority given to local/regional vegetation studies since the Mopaneveld crosses the borders of several countries.

1.3 Objectives

The **primary goals** of this study include significant contributions to the knowledge on Mopaneveld vegetation in southern Africa by means of classification procedures as well as literature studies. Furthermore the study aims to present a better understanding of the ecological processes within Mopaneveld. The **secondary goal** is to identify the viability of a proposed new

method for treating large vegetation data sets by analysing the outcome: e.g. do results reflect speculations on large vegetation types within Mopaneveld?

1.4 Rationale

In order to accomplish the above goals, an investigation was initialised with the following rationale:

- **Problem identification:**
  - (i) The understanding of Mopaneveld vegetation needs assessment.
  - (ii) Scientists strive towards holistic approaches in vegetation studies, but are limited in adequate methods to treat large data sets in regions of high species diversity, e.g. the Mopaneveld.
- **Attempts to solve problem:**
  - (i) A phytosociological synthesis of Mopaneveld.
  - (ii) The proposal of a new method for treating adequate phytosociological data from several studies undertaken in the Mopaneveld of southern Africa.
- **Hypotheses:**
  - (i) Mopaneveld comprises different major vegetation types, which vary along environmental gradients.
  - (ii) Ecological processes within Mopaneveld are reflected by vegetation patterns.
  - (iii) Large data sets can be synthesised by basic phytosociological procedures.
- **Key question:**

  If results could not support the above hypotheses, could it be explained by limitations in the methodology used, or by variance in vegetation that eluded Botanists in previous studies?

This dissertation should be seen as a first attempt to synthesise the vegetation of Mopaneveld over its entire distribution range in southern Africa. The proposed method was developed in coincidence with many constraints encountered in data analysis.