CHAPTER 1

INTRODUCTION

Phytosociology and Conservation

Humans have transformed almost half of the world's ice-free land surface area into agricultural and urban systems (Chapin *et al.* 2000). These changes in species composition and ecosystem functioning alter the resistance and resilience of ecosystems to environmental change (Reyers 2003). Such alterations also impact on ecosystem services, such as water storage and purification, reduction of radiation and the control of green-house gasses, upon which humans depend for survival (Kunin & Lawton 1996; McCann 2000; Henns & Nath 2003; Barber 2003).

In the past, nature conservation was aimed at the preservation of single species in isolation from humans. Recently, there has been a paradigm shift in conservation towards the more holistic approach of ecosystem conservation (Fairbanks & Grant 2000; Reyers 2003). Holistic knowledge of ecosystem form and function is an indispensable prerequisite the effective conservation and management of the highly valued renewable environmental resources (Wright *et al.* 1998). Conservation efforts have begun to focus on higher levels of the biodiversity hierarchy, e.g. plant communities and vegetation classes (Margules and Pressey 2000; Pressey and Taffs 2001; Wessels *et al.* 2003). In order to conserve ecosystem patterns and processes, even if done only for the self-preservation of man, we need to understand the patterns and processes driving vegetation structure and function (Yeo *et al.* 1998; Turpie *et al.* 2003).

Vegetation is the most noticeable biological component of terrestrial ecosystems (Kent & Coker 1996). The structure and species composition of vegetation reflect the sum of all the abiotic environmental factors within a given environment, thereby acting as a living summary of the surrounding environmental factors (Corney *et al.* 2004). The entire biota of an ecosystem reacts either directly or indirectly to vegetation structure and composition. Vegetation is therefore that crucial link in understanding the interaction between the biotic and abiotic patterns and processes shaping ecosystems (Hudak *et al.* 2004). The physical properties and nature of vegetation renders it a very suitable yardstick by which ecosystems can be described, evaluated and monitored (Salisbury 1926; Cain 1944; Good 1953; Holdridge 1967; McArthur 1972; Box 1981; Stott 1981; Walter 1985; Ellenberg 1988, Mucina 1997; Guisan & Zimmermann 2000; Gillison & Liswanti 2004). The success of terrestrial ecosystem conservation, therefore, depends on understanding the form and function of the plant communities and their environmental drivers as the basic building blocks of the more complex ecosystems (Pienkowski *et al.* 1996).

This need for holistic and long-term approaches towards ecosystem conservation and land-use planning has sparked a renewed international interest in vegetation science phytosociology (Schaminée & Stortelder 1996; Snyman 1998; Wright *et al.* 2001). Tremendous efforts have been made during the last two decades at local, regional and international scale to promote vegetation classification and the standardization of phytosociological databases (Pignatti 1990; Dierscke 1992; Mucina *et al.* 1993; Rodwell *et al.* 1995; Schaminée 1995; Rodwell 1995; Schaminée & Stortelder 1996; Winterbach *et al.* 2000; Du Plessis 2001; Siebert *et al.* 2003). Recent phytosociological syntheses at regional scale include Korotkov *et al.* (1991) in the former Soviet Union, Oberdorfer (1992) and Pott (1992) in Germany, Julve (1993) in France, Grabherr & Mucina (1993) and Mucina *et al.* (1993a,b) in Austria, Rodwell (1990, 1991, 1992, 1995) in Great Britain, Valachovic (1995) in Slovakia, and Schaminée *et al.* (1995a, b) in The Netherlands.

The need for conservation and vegetation studies in the Soutpansberg and Blouberg area

The establishment of conservation areas and biosphere reserves are widely used in order to reduce anthropogenic threats to ecosystem form and function (Margules and Pressey 2000; Fairbanks *et al*. 2001). The Soutpansberg Conservancy (SC) and the Blouberg Nature Reserve (BNR) are examples of such conservation areas. Numerous scientists and conservationists have emphasized the biological importance of the Soutpansberg and Blouberg Mountain Ranges (Van Wyk & Smith 2001; Hahn 2002; Berger *et al*. 2003; Hahn 2006).

The area was not rated by Reyers (2003) as an urgent priority for conservation efforts in South Africa. The relatively few anthropogenic activities seriously threatening the remaining natural systems of the Limpopo Province are given as the main reason for the low urgency listing. However, based on the high levels of biological richness and diversity harboured by this area, it is regarded as a very high long-term priority for conservation (Van Wyk & Smith 2001).

The topographical diversity of the Soutpansberg and Blouberg Mountain Ranges has created suitable conditions for a wide variety of vegetation types, including swamp forests, mistbelt mountain forests, high altitude grasslands, high altitude peatlands and arid savanna bushveld. This phytosociological and topographical complexity has led to an unusually high diversity of ecosystems contained within a geographically relatively small area (Weisser *et al.* 2003). Although the Soutpansberg and Blouberg contain numerous of its own endemic species, they share many near-endemic species with the surrounding centres of endemism (Van Wyk & Smith 2001; Hahn 2002). The mountain range acts as an east-west corridor for the migration of mesic species along the southern slopes and for xeric species along the northern slopes and plains. It also acts as a north-south barrier for the migration of numerous less xeric species (Hahn 2002).

The Soutpansberg–Blouberg region has been recognized as a Centre of Endemism by Van Wyk and Smith (2001). However, little ecological knowledge of the area exists (Anderson 2001; Berger *et al.* 2003). Some floristic surveys conducted by Hahn (1994; 1996; 1997; 1999; 2002), Stirton (1982), Obermeyer *et al.* (1937) and Van Wyk (1984; 1996) indicated that the Soutpansberg Centre of Endemism is exceptionally diverse and species rich for its size (Van Wyk & Smith 2001). The conservation value of this centre lies in its unique ability to house a wide variety of floristic elements from the surrounding floristic regions (Hahn 2002). The region is an outstanding centre of plant diversity, with approximately 2 500–3 000 recorded vascular plant taxa (Hahn 1997). The region boasts with 41% of all plant genera and 68% of all known plant families of the flora of southern Africa. Altogether 595 specific and infra–specific trees and shrubs are known from the Soutpansberg, amounting to one third of all the known tree species in the entire southern Africa region (Hahn 1994; 1997; 2003). This constitutes one of the highest tree counts for a single region in southern Africa (Hahn 1997). The Kruger National Park, which covers an area of two million hectares, contains approximately 380 tree species (Van Wyk 1994), whereas 321 tree species have been recoded by Hahn (2002) in an area of only 2 000 hectares within the SC. Trees and shrubs encompass approximately 24% of the vascular plants of the Soutpansberg and play an important role in the species composition, vegetation structure and relative dominance within the different plant communities.

More than 500 bird species have been recorded throughout the Soutpansberg mountain range, amounting to approximately 56% of the recorded species for the entire southern Africa (Harrison *et al.* 1997; Hockey *et al.* 2005). The Soutpansberg and its surroundings contain some unique reptile habitats, and house seven endemic species (Branch 1988). A total of 46 spider families, 110 genera and 130 species have been recorded in the SC on the single farm Lejuma (<50 km^2), which constitutes 70% of the families, 26% of the genera and 5% of the species recorded for South Africa (Foord *et al.* 2002; 2003). The high biological diversity of the Soutpansberg and Blouberg can possibly be attributed to the fact that the mountain range acts as a refuge in times of environmental flux (Hahn 2003).

In the light of the high diversity recorded for the Blouberg–Soutpansberg expanse, it is proposed that the region be given the status of the Soutpansberg Centre of Biological Diversity (SCBD) in addition to its recognised status as the Soutpansberg Centre of Plant Endemism. There are current efforts to create a biosphere reserve in this area, which will include the SC and BNR (Hahn *in prep.*).

The Soutpansberg Conservancy and the Blouberg Nature Reserve reveal extremely rich diversities of plant communities relative to the sizes of these conservation areas (Van Wyk & Smith 2001). Although Van Rooyen & Bredenkamp (1996) recognised this diversity and unique composition of plant communities within the Soutpansberg–Blouberg complex, the lack of detailed research in the region forced them to lump the area's vegetation under the broad term of Soutpansberg Arid Mountain Bushveld. Acocks (1953) recognised four different Veld Types for the greater surrounding region and described them as Arid Sweet Bushveld, Mixed Bushveld, Sourish Mixed Bushveld and Sour Bushveld. Most of these Veld Types were described as heterogeneous (Acocks 1953), comprising of many sub-communities with different agricultural and production potentials. In addition to the savanna vegetation of the area, Geldenhuys & Murray (1993) and Lubke & McKenzie (1996) described and mapped the patches of Afromontane Forest associated with the region. Van Wyk & Smith (2001) only briefly mention the occurrence of "Fynbos-type" vegetation along the summit of the mountain. They also refer to dense, almost mono–specific stands of Lebombo ironwood (*Androstachys johnsonii*) on the arid northern slopes of the mountain. Due to major gaps in the available vegetation data, no attempt has yet been made to synthesize, classify and to describe the plant communities of this region.

The fast growing local human population, especially through immigration from countries north of South Africa, is placing the Soutpansberg and Blouberg areas under increasing pressure. The insatiable demand for more arable land within these agriculturally marginal and semi-arid areas is leading to severe degradation of the remaining natural resources (Hahn 2002). Ecotourism in the Soutpansberg-Blouberg region have become an important alternative socioeconomic stabiliser within this poverty stricken province. However, the lack of sound ecological information, which is essential for effective management strategies of natural resources, is inhibiting conservation within the Soutpansberg and Blouberg areas. A baseline inventory of ecological data became essential to supply authorities with the necessary information needed to designate areas for the most appropriate forms of land-uses, and to formulate management plans for protection and sustainable use of the region's vegetation as a valuable resource (Kent & Ballard 1988; Bedward *et al.* 1992; Rhoads & Thompson 1992). During a workshop on the environmental, biological and cultural assets of the Soutpansberg (Berger *et al*. 2003) gaps within the existing data and information were identified. The lack of scientifically sound ecological data on the vegetation of the Soutpansberg was identified a one of the key components in urgent need of research. Hence, the motivation for this phytosociological study stemmed from the urgent need to identify and understand the main ecological drivers of vegetation structure and composition within this Centre of Biological Diversity. Phytosociology was therefore used as a basis for the description and ecological interpretation of the observed vegetation patterns.

Aims of the study

The aim of ecological studies on ecosystems is to understand the complex interactions between the various components. In order to reduce the complexity of such a system, one often needs to start by understanding its individual components. However, it is paramount to remember that communities have collective properties, and that the nature of a community is more than just the sum of its constituent species (Begon *et al.* 1996). Oversimplification of the system components leads to overly simplified theoretical explanations with no practical value for projections and predictions within the complexity of ecosystems. The level of complexity at which the researcher studies a particular community is scale dependant.

This study is a first attempt at understanding the complex ecological patterns and processes observed within the vegetation of the SCBD. It is concerned with the phytosociology and synecology of the SC and BNR. Its aim is to identify the different plant communities and to investigate the interrelationships between plant communities and their physical and biological environments. In an attempt to create a holistic image and to explain the macro-ecology of the region, disciplines such as climatology, geology, pedology, physical geography, history and anthropology are drawn upon and integrated. This study provides a first approximation of the vegetation and proposes eight Major Vegetation Types for the study area. It aims to define and describe the characteristics of these Major Vegetation Types within the context of the SC and BNR. This will assist scientists, conservationists and land–use planners when future projects are conducted within the surrounding areas. These plant communities from the SC and BNR will serve as reference sites with which to compare proposed development sites from the surrounding unprotected areas. Sound environmental development is a state of mind (Siebert 2001) and something that can be achieved if basic information, such as this account, is actively drawn upon during conservation planning and the management of natural resources.