Contributions to the ecology of Maputaland, southern Africa, with emphasis on Sand Forest

by

Wayne Sidney Matthews

Submitted in partial fulfilment of the requirements for the degree

Philosophiae Doctor

In the Faculty of Natural and Agricultural Sciences

Department of Botany

University of Pretoria

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Promoter: Prof. Dr. A.E. van Wyk
Co-promoter: Dr. N. van Rooyen

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"No man crosses the same river twice. It is impossible for two reasons. The second time it is not the same river, and the second time it is not the same man. In the interval of time between the first and second crossing, no matter how short, both the river and man have changed."

Heraclitus of Ephesus, 540–486BC

Dedicated to my family and friends. . .
Specifically to those friends who stopped me from throwing this thesis into the dustbin

ABSTRACT

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Keywords

Braun-Blanquet classification, endemism, Maputaland, Sand Forest, Woody Grassland, allelopathy, elephant, forage preference indices, evolution, vegetation dynamics

The principal hypothesis of this thesis was that the Maputaland Centre of Plant Endemism [MC] is characterised by plant communities that match a particular set of environmental variables, and their rich biodiversity with endemic and rare taxa reflecting the geomorphological history of the region. Data assembled supports the hypothesis. Vegetation studies highlighted two plant communities, endemic to the MC as being an important component of the region's biodiversity, namely Sand Forest and Woody Grassland.

A broad approach to the floristic classification of vegetation was adopted for information on the floristics patterns and diversity of the endemic/rare plants and plant communities of the MC. A hierarchical classification, description and ecological interpretation of the plant communities of the Tembe Elephant Park, Sileza Nature Reserve and surrounding areas are presented. Much of the vegetation distribution can be ascribed to the level of the water table, vegetation dynamics and historic evolution of the geomorphology of the region.

The hypothesis is presented that Sand Forest may have allelopathic effects on its environment. Data of exploratory germination trials are presented to test this hypothesis. Sand Forest soil inhibits the emergence of seedlings, the inhibiting effect decreasing progressively from Sand Forest through grassland to woodland.

Sand Forest was defined as a community, and its possible dynamics are described. Ideas were formulated (albeit largely hypothetical) on the likely origin of this vegetation type. It is proposed that ancient Dune Forest is the precursor of Sand Forest, but that Sand Forest has subsequently become a separate functioning plant community on its own. Sand Forest appears to be a relictual vegetation type of which the historical factors responsible for it's original establishment and expansion are currently no longer present in the region.

The use of woody species by elephant in different vegetation types in Tembe Elephant Park was investigated. A classification of species into utilization categories was produced which enabled assessment of the importance of different species to elephants, and also of the potential impact of elephants on different tree species. Management implications are highlighted.

CONTENTS

SUMMARY

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This study focused on aspects of the vegetation of Maputaland, an area with a rich biodiversity located in the extreme northeast of KwaZulu-Natal, South Africa, and adjacent parts of southern Mozambique. The principal hypothesis of this thesis was that the Maputaland Centre of Plant Endemism [MC] is characterised by plant communities that match a particular set of environmental variables, with a rich biodiversity including endemic and rare taxa reflecting the geomorphological history of the region. Data assembled supports the hypothesis. Vegetation studies highlighted two plant communities, both endemic to the MC, as being important components of the region's biodiversity, namely Sand Forest and Woody Grassland. Knowledge of the vegetation and flora of the MC and the role that large herbivores (specifically elephant) and fire may play in the dynamics of the different vegetation communities can help facilitate the formulation of management strategies. Notable for their richness in MC endemic/near-endemic taxa, the conservation of Sand Forest and Woody Grassland, should be a high priority.

A broad approach to the floristic classification of vegetation was adopted to address the need for information on the distribution patterns and diversity of the endemic/rare plants and plant communities of the MC. A hierarchical classification, description and ecological interpretation of the plant communities of the Tembe Elephant Park, Sileza Nature Reserve and surrounding areas are presented. The classifications resulted in mainly Sand Forest, woodland and grassland communities. Much of the vegetation distribution can be ascribed to the level of the water table, vegetation dynamics and historic evolution of the geomorphology of the region, either directly or indirectly, through its role in soil formation on the geologically young sandy substrate. Fire is an essential factor, particularly in maintaining the Woody Grassland. Geoxylic suffrutices abound in

the Woody Grassland, raising questions about whether this vegetation type is best considered as grassland or extremely stunted savanna.

The hypothesis is presented that Sand Forest may have allelopathic effects on its environment, hence the characteristic zonation of the surrounding vegetation. Data of exploratory germination trials, as well as inorganic and organic soil analyses, are presented to test this hypothesis. Sand Forest soil inhibits the emergence of seedlings, the inhibiting effect decreasing progressively from Sand Forest through grassland to woodland.

Sand Forest was defined as a community, and its possible dynamics are described. Many biophysical factors were considered to formulate ideas (albeit largely hypothetical) on the likely origin of this vegetation type. It is proposed that ancient Dune Forest is the precursor of Sand Forest, but that Sand Forest has subsequently become a separate functioning plant community on its own. Sand forest appears to be a relictual vegetation type of which the historical factors responsible for it's original establishment and expansion are currently no longer present in the region.

The use of woody species by elephant in different vegetation types in Tembe Elephant Park was investigated using a modified Point-centred Quarter sampling design. A classification of species into utilization categories was produced which enabled assessment of the importance of different species to elephants, and also of the potential impact of elephants on different tree species. Ninety of the 137 plant species encountered in the study were utilized. Thirteen species were selected for, 32 were used at random, 35 were avoided and at least nine were rejected. Management implications are highlighted.

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CURRICULUM VITAE

Wayne Sidney Matthews was born in 1961 and grew up in Springs, South Africa. He received his school education there, and completed his tertiary education at the University of Pretoria. In 1988 he did his National Service, followed by an MSc, which he received with distinction. His thesis dealt with the phytosociology of the North-eastern Mountain Sourveld. In 1992 he joined the then KwaZulu Bureau of Natural Resources as a Regional Ecologist for Maputaland. This post he still holds today in the Ezemvelo KwaZulu-Natal Wildlife where he is based in Tembe Elephant Park, Maputaland. Wayne has worked as a natural history tour guide for Trialblazers and Lapalala Wilderness Trails. He has travelled widely on advisory trips (compiling plant species lists, wildlife carrying capacities, biodiversity, ecological methodologies) and is familiar with the flora and fauna of many areas, such as Transkei/Pondoland, Southern Namibia/Richtersveld, Botswana/Okavango and Kalahari, Zimbabwe highlands, Western Zambia (Kafue area) and Maputaland (northern KwaZulu-Natal/southern Mozambique). He is an avid photographer and has had many of his photographs published. A list of his publications follows:

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