



WHAT DON'T WE KNOW ABOUT *SCLEROCARYA BIRREA* SUBSP. *CAFFRA*?

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BACKGROUND

Sclerocarya birrea subsp. *caffra* (marula) is a widely studied woody species and a large body of literature on many aspects of its biology, ecology and uses has already been published. It is common knowledge that marula is a widely utilised species in terms of browsing by game in protected areas and utilisation by humans in communal areas for its fruit, wood and medicinal properties. It is a keystone species in many parts of its natural range and it is often a community dominant. Therefore the marula tree is an extremely important indigenous tree in terms of both economic and ecological value.

Increasing interest in marula as a commercial fruit tree has motivated most of the reviews of marula research. These reviews conclude that much is known about the fruit and its uses, as well as growing marulas under artificial conditions. However, the available information on natural marula populations is fragmentary mostly based on a collection of observations which have not been integrated. Thus a reliable interpretation of the population dynamics and life history strategy of this extremely important indigenous savanna tree cannot yet be made. In addition, little is known about the regeneration ecology of this species in its natural habitat and no monitoring of seed germination under natural conditions has been reported. We know almost nothing about the crown and stem dimensions of individuals of marula of known or estimated age, or their rates of growth. Allocation patterns to defense and storage have also not been studied in marula.

Concern has also been raised over the impact of heavy elephant utilisation of marula, especially adult trees, in areas such as the Kruger National Park and Associated Private Nature Reserves. The identification of the so-called 'missing size class', between 2 and 8 m in height, of certain populations has led to further concerns for the future population dynamics of marula. The adaptive recovery responses of marula to damage is not completely understood.

In order to address these concerns and the gaps in the current knowledge of the biology of marula, information regarding the identification of explanatory mechanisms for how marula populations are able to sustain themselves in environments where disturbance is a frequent and intense factor shaping community dynamics is required. In addition detailed experimental evidence which may lead to an understanding of the life history strategy and underlying physiology is also required. Such information will further provide a basis on which to explain the factors resulting in the 'missing size class'.

A PhD study has therefore been initiated at the University of the Witwatersrand in 2007 to study these factors.



Figure 1: Marula tree felled by elephant and hence susceptible to fire in the Kruger National Park

AIM

The aim of this study is to identify the key spatial and temporal factors affecting the growth and underlying allocation physiology of *S. birrea* subsp. *caffra* with special emphasis on the missing size class. The factors which may affect the growth of a savanna tree such as marula include its size; the disturbances to which it is exposed to such as fire, herbivory (elephant and small herbivores such as impala) and human utilisation; and site attributes such as the geology (hence soil type), mean annual rainfall and competition from neighbours. This study also aims to assess the adaptive responses and vulnerability of marula in its natural habitat as well as under artificial conditions, by monitoring its recovery from damage such as defoliation, branch breakage and bark removal. This information will then be used to make generalisations on the life history strategy of marula and to address the concerns for the future dynamics of certain marula populations in South Africa.



Figure 2: Measuring leaf area of 3 month old marulas grown in the greenhouse



Figure 3: A Marula tree being monitored for recovery from damage in the Kruger National Park

MATERIALS AND METHODS

A combination of field research, manipulation experiments, greenhouse experiments and laboratory analysis will be utilised to fulfill the aims and objectives of this study.

The field work phase consists of the marking and monitoring of a set number of trees from three different sites: Wits Rural Facility, the Roan Enclosure near Shingwedzi in the Kruger National Park and the Hlangwini Enclosure near Pretoriuskop in the Kruger National Park. These sites represent different soil conditions as well as rainfall regimes and were identified due to the presence of a large number of individuals within the "missing size class" between 2 and 8 m in height. In addition trees measured in 2001 for elephant damage in the Kruger National Park are being reassessed to obtain information on recovery and mortality rates of populations in the Kruger National Park.

Manipulation experiments are planned on trees identified within a communal site where the interactions of bark removal and fire as well as the recovery and growth of damaged trees will be assessed.

Greenhouse trials are being run at Wits University where the growth of marulas from germination is being monitored. Root growth is being monitored through the use of root chambers. Experiments on the effects of defoliation and fire on the growth and recovery of marula seedlings will also be assessed. The effect of soil type and rainfall regime on the growth of marula seedlings is also being investigated.

Analysis of defense in the form of total phenolics and condensed tannins is to be assessed in the foliage and bark of marula growing in their natural habitat as well as those growing in the greenhouse. The measurement of starch stored in the roots will only be assessed for greenhouse grown marulas. Through these measurements the effects of age and damage on the allocation patterns of marula will be analysed in detail.

Lastly all these factors will be integrated into a modelling framework to provide predictive capacity for the future dynamics of marula populations and by inference an understanding of other savanna trees in a similar environment and with similar life history strategies.



Figure 4: Combined effects of elephant and fire on marula in the Kruger National Park



Figure 5: Measuring seedling establishment and survival in the field



Figure 6: Measuring growth of the "missing size class" in the field

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