CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

The character of the Kalahari ecosystem depends on spatial heterogeneity which increases biotic diversity. *Acacia erioloba* is considered a keystone species in the Kalahari and therefore create spatial heterogeneity, prevent single species dominance and supply a critically limiting resource or service (Milton & Dean 1995). The functions performed by a keystone species may be modified by its population structure, density and distribution.

Preliminary data on the size structure of the *Acacia erioloba* population in the northern Nossob Riverbed of the Kalahari Gemsbok National Park showed a poor survival of seedlings and an almost complete absence of juvenile plants (Van Rooyen *et al.* 1996). This recruitment failure is presently resulting in the decline in isolated mature trees, which may result in a change in the population structure of the species.

The generation of patchiness, a keystone function, can only be performed by large trees, and a change in the population structure of *Acacia erioloba* could therefore also alter its role in the ecosystem. From a management view point it is therefore important to recognize *Acacia erioloba* as a keystone species and to be aware of the functions it performs. It became essential to determine the accurate age-structure in order to have a more complete understanding of the population dynamics and the sustained management of *Acacia erioloba*.

Core sampling in indigenous hardwood species is not a common practice and the difficulties of both sampling and examining species has been discussed in numerous research reports. However, through this research a unique and effective non-destructive method of sampling was developed, whereby high quality cores suitable for carbon dating and dendrochronological studies can be obtained without permanently damaging trees.

In indigenous species it is often found that features which appear to delineate growth-rings are either discontinuous or rows of fibres laid down in response to stress. This necessitates the analysis of population structure and dynamics to be based on tree sizes.

The results of this investigation into the problem of determining the age of semi-arid trees suggest that the marginal parenchyma bands can indicate seasonal growth patterns in *Acacia erioloba*. The marginal parenchyma bands can usually be distinguished from the frequent intraseasonal banded parenchyma by their fineness and evenness in appearance in contrast to the more irregular, wavy, confluent bands.

Carbon dating of samples was done at the Quaternary Dating Research Unit of the Division Water, Environment and Forest Technology of the CSIR in Pretoria. Estimated carbon date age was determined by making use of calibration curves. Ring counts and carbon date ages were compared and exhibited a high correlation ($r^2 = 0.96$).

A correlation was also found between stem circumference/height and carbon date age ($r^2 = 0.66$). This was used successfully to estimate population structure from data that has already been collected. It is recommended that more samples be collected and analysed in order to improve the regression. Estimated age based on stem circumference overestimate age.

By identifying seasonal growth changes in the wood anatomy and correlating ring counts with carbon date age, age and subsequent growth rates for *Acacia erioloba* in the Kalahari Gemsbok National Park were determined. Mean annual radial growth rates were calculated at 2mm/year which indicated that the average growth rate was slower than that previously reported for *Acacia* spp. growing in arid and semi-arid conditions.

Although more sophisticated dendrochronological based research may provide more accurate ages for older trees, it has been the conclusion of this study that in fact many *Acacia* spp. are probably far younger than believed.

Further work in this field to cast light on the relationship between growth rate and meteorological data should include cambial marking techniques which do not require felling of trees. Periodic marks with pins or nails (Wolter 1968; Shiokura 1989) or with vertical knife cuts permit collection of wood samples without cutting down the tree. The time of the year when the marginal parenchyma bands are produced can then be identified precisely. This has potential for trees of any age or size, provided it is conducted over sufficient years to allow for variation in an area with highly erratic rainfall.

It is suggested that although the cessation of flood waters is seen as one of the major factors influencing the decline of juvenile plants a comprehensive study needs to be undertaken. This research should take into account possible:

- decrease in insect populations responsible for pollinating *Acacia erioloba*;
- increase in predatory insects and rodents;
- impact of increased grazing during drought periods; and
- diseases and fungal infections of mature trees.