THESES SUMMARIES

ASPECTS OF NUTRIENT CYCLING IN SEMI-ARID MALLEE AND MULGA COMMUNITIES.

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A study was made of nutrient distribution and fluxes in mallee and mulga ecosystems to obtain an appreciation of the manner in which the woody plants have adapted to their infertile semi arid habitats. Emphasis was placed on utilisation and fluxes of nitrogen and phosphorus within these ecosystems.

Pool sizes of total phosphorus, 'available' phosphorus and total nitrogen within the communities exhibited remarkable similarities despite wide differences in geographical location and plant assemblages supported. There was a pronounced concentration of organic carbon, total nitrogen and 'available' phosphorus in the soil surface horizons.

High resilience within mallee communities was demonstrated by comparison of a fifteen year old regrowth community with an adjacent mature (*c.* 55 year old) stand. There were only small differences between both communities in nitrogen and phosphorus pool sizes in the vegetation, and in lignotuber biomass, leaf area index and the amount of leaf litter present on the soil surface. The above ground net primary productivity of the regrowth community (5406 kg/ha/yr) was more than twice that of the mature mallee (2379 kg/ha/yr).

The mulga community had high concentrations of nitrogen in both its living and dead tissues compared with mallee. This suggested that the *Acacia/Rhizobium* symbiosis was effective but there was apparently no build-up of total nitrogen within the soil profile.

There were considerable fluctuations in the pulses of litter and nutrients onto the floors of these woodland ecosystems. However litterfall from *Eucalyptus* spp. exhibited a distinct summer maximum whereas litterfall in mulga appeared to be largely independent of season and rainfall. Withdrawal of nitrogen and phosphorus prior to leaf abscission indicated conservation in the use of these elements.

There were striking similarities in the breakdown and decomposition rates of mallee and mulga leaves, despite higher extant nitrogen concentratons in the latter. Similarly within a particular community there was little variation in the decomposition rates on different microsites. The patterns of mineralisation and immobilization of nitrogen and phosphorus in decaying leaves, branches and bark were in broad agreement with similar studies carried out elsewhere in a range of vegetation types.

It was demonstrated that the widely accepted decay constant is an unstable value which changes as decomposition progresses. Derivation of this value by the assumption of 'steady-state' in mature semi arid shrub and woodland communities appears to be equally tenuous.

The relatively poor ground flora and the large volume of surface roots suggest both mallee and mulga communities operate on a tight extrinsic rather than intrinsic cycling of nutrients, although taken together the efficiency of both cycles could be high. In fact the nitrogen and phosphorus cycle times in the semi arid shrub/woodland ecosystems studied were quite comparable with those from more mesic environments. Furthermore it was shown that mulga grassland is much less efficient in utilisation of phosphorus than endemic woodlands and could also require much larger amounts of nitrogen per unit of dry matter than competing woody plants.

It was concluded that grasses possess initial advantages in the establishment phase, in these infertile semi-arid ecosystems, through faster growth rates and mean phosphorus absorption rates. In time, however, competing woody plants develop a much larger root system which assists in drought survival and nutrient absorption. Concomitantly, the more efficient use of the limited available nutrients results in dominance by the woody plants.