ABSTRACT

The introduction of alien invasive plants can have fundamental impacts on ecosystem functioning, such as the cycling of limiting nutrients between plant and soil pools. Such impacts are primarily mediated through differences in physiological traits between the invasive and native species. In South Africa, invasions by Australian acacias (Fabaceae) are causing widespread ecosystem-level disturbances, including changes to N cycling through increased bioavailable N inputs. To assess potential alterations to nutrient dynamics, I compared aboveground biomass and N and P standing stocks of a native (*Acacia ataxacantha*) and an invasive Australian acacia (*A. dealbata*) which is displacing *A. ataxacantha* in a riparian woodland in eastern South Africa. This entailed the development of species-component specific allometric models for biomass prediction, determination of novel N contributions through symbiotic N_2-fixation, investigation of seasonal N and P allocation in aboveground components and the evaluation of nutrient conservation strategies in these species. Stem diameter was a good predictor of aboveground biomass in both acacias (accounting for 90-98% of the variation in biomass across species) which differed primarily in terms of higher leaf biomass allocation in the invasive acacia. N isotope analyses showed that *A. dealbata* trees derived more than 70% of their leaf N through N_2-fixation, while *A. ataxacantha* (a non-nodulating acacia) did not fix N. Seasonal N and P concentrations, analysed in aboveground components over a nine months period, were generally higher with more pronounced seasonal fluctuations in the deciduous *A. ataxacantha* than in the evergreen *A.dealbata*. Mature leaf N concentrations were considerably higher than the global averages, while green leaf P concentrations were low. Inefficient N-resorption was found in both acacias, most notably in the invasive (mean = 27% N resorbed), however P was tightly conserved (74 – 88% of leaf P resorbed). Weak N conservation in the invasive acacia was attributed to both a high N_2-fixing capacity and a long leaf lifespan, both of which have been hypothesised to carry evolutionary trade-offs in nutrient conservation and allocation. Theoretical considerations and the data available suggest that phosphorus is the limiting nutrient in this system. Standing stock models suggested that N input rates via litterfall were >4-fold higher in *A. dealbata* relative to *A. ataxacantha*, and that novel N in inputs by *A. dealbata* are higher than total N inputs by *A. ataxacantha*. Overall, this study has provided considerable evidence that invasions by the alien invasion *A. dealbata* will increase N cycling rates and inputs considerably, and to a lesser extent, increase rates of P cycling. Invasive

Australian acacias successfully compete for resources in non-native environments, allowing them to proliferate at remarkable rates under variety resource limitations.