relatively high values for an endemic species and that yellow-flowered subspecies is the more genetically diverse. Observations of pollinator differences between the two subspecies reveal that both are visited by hopline monkey beetles (*Eriesthes vulpine*), while honey bees (*Apis mellifera*) are restricted to the yellow subspecies. This divergence of vectors impacts heavily on the reproductive success of the respective subspecies. These data need to be incorporated in conservation management of the species.

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A re-evaluation of floral nectar properties in bird-pollinated plants

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Considerable attention has been paid to a supposed dichotomy in floral nectar traits between hummingbird and passerine bird pollination systems. Here we argue that a more useful distinction at the global scale is between specialized and generalized bird pollination systems. In Africa, where all flower-feeding birds are passerines, flowers adapted for sunbirds which are specialized nectarivores have nectar which is very similar to that of hummingbird flowers in terms of nectar volume, concentration and sucrose content. By contrast, in Africa and elsewhere, flowers adapted for pollination by occasional nectarivores are characterized by large volumes of extremely dilute nectar with very low sucrose content. Thus the evolution of nectar volume, sugar concentration and sugar composition may depend less on whether bird pollinators are hummingbirds or passerines, and more on whether they are specialized or occasional nectarivores. We present several hypotheses for the association between nectar properties and specificity in bird pollination systems.

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Down-regulation of neutral invertase activity in sugarcane cell suspension cultures leads to increased sucrose accumulation

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Suspension cultures were used as a model system to investigate sucrose metabolism in four sugarcane (*Saccharum* spp. interspecific hybrids) cell lines transformed with antisense neutral invertase (NI) constructs. Throughout the 14 day growth cycle two cell lines in which the antisense sequence was under the control of a tandem CaMV-35S: maize ubiquitin promoter showed a strong reduction in NI activity, as well as reduced hexose and increased sucrose concentrations in comparison to the control line. In lines where the antisense NI sequence was under the control of the weaker CaMV-35S promoter alone, changes in enzyme activity and sugar concentrations were intermediate to those of the more strongly inhibited lines and the control. In comparison to the control line, a higher sucrose to hexose ratio, i.e. increased purity, was obtained in all the lines with reduced NI activity. These lines also showed a decrease in the in vivo rate of sucrose hydrolysis, suggesting that flux through the 'futile cycle' of sucrose breakdown and re-synthesis was minimised in transgenic tissues. Differences between the transgenic cultures and the control were most pronounced during the early stages of the growth cycle and tapered off as the cultures matured. The transgenic cultures displayed severely impaired growth characteristics suggesting that although decreased NI activity may increase sucrose content, the growth rate of the cells was retarded due to a reduced availability of hexoses for respiration.

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Road verges: Corridors for plant invasions — A spatial hierarchical approach

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Inhabited areas are often sources from which invasive species disperse. Road verges have been suggested as corridors facilitating this dispersal, as disturbed habitats are swiftly colonised by problem species. We therefore hypothesized that (i) houses and urban areas are sources from which problem plants disperse, and that (ii) verges act as corridors for the dispersal of problem plant species. To test these hypotheses a spatial hierarchical approach was used as ecological processes vary across spatial scales. We sampled presence and cover of problem plants in 20 plots per road at 5 km intervals for four roads, nested within three city-centred localities ($n=240$ plots). Roads started off from Beaufort West, Prieska, and Middelburg; South African transit cities with no other major urban areas within a radius of 200 km. We also mapped permanent structures (e.g., houses and train

stations; $n=3349$) in a 5-km radius around plots from topographical maps. Environmental processes as predictors of problem plants differed across spatial scales. At the regional scale, Canonical Correspondence Analysis showed that annual precipitation, elevation, bare soil and indigenous plant cover were the strongest predictors of problem species composition. At the locality scale, environmental variables predicting problem species composition differed strongly between localities. At the road scale, correlation analysis of problem species richness with housing showed that richness was significantly positively correlated with housing density, particularly within 1500 m from plots. Environmental variables as predictors of problem species composition differed across spatial levels, confirming the need for a spatial hierarchical approach in such studies. Distance of plots from urban areas was never a significant predictor for problem species richness or cover at any of the spatial levels. Density and proximity of structures predicted problem species richness but never cover, suggesting that propagule pressure affects successful colonisation while local variables affect population growth.

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How is carbon allocation of African Savanna trees affected by atmospheric CO_2 change?

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The allocation of carbon strongly differentiates between woody and herbaceous plants, with trees especially vulnerable to the impacts of low CO_2 typical of Pleistocene glacial conditions, due to their required investment in costly trunks and branches. This suggests that trees might allocate carbon away from certain key functions, such as defence structures and compounds, in low CO_2. The anticipated doubling of atmospheric CO_2 concentration due to anthropogenic activity has prompted thousands of studies on its impacts on plants, but very few on macro-allocation. Comparison of studies on elevated CO_2 impacts has revealed responses that include enhanced photosynthesis and growth of different functional types especially in woody shrubs and trees. Carbon allocation was allocated proportionally to growth in height, stem diameter, number of leaves and leaf area index. A large proportion of carbon was allocated to branches (in the form of increased number of branches) and dry matter production. This paper presents evidence that African savanna tree photosynthetic physiology was suppressed by the low levels of atmospheric CO_2 during the last glacial maximum. This reduction in photosynthesis translated to reduced growth in above ground plant height, stem diameter and below ground growth. Equally importantly, there less carbon was invested towards defence against herbivory in the form of condensed tannins and thorns. These responses were reversed under elevated CO_2 conditions with trees exhibiting enhanced photosynthesis, growth and carbon investment towards defence was also increased. The adjustment of carbon allocation may be a critical factor in projecting the direct impacts of varying atmospheric CO_2 levels on woody plants, and their ecological implications.

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Effects of competition and resource availability on *Terminalia sericea* seedlings establishment and growth

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Competition for resources between established grass species and transplanted seedlings is high. We studied the establishment and growth of *Terminalia sericea* seedlings in a mesic savanna in Pretoriuskop under different levels of resource availability. To examine the effects of water and nutrients on *T. sericea* growth, competition for resources between *T. sericea* and grass species and effects of grass on *T. sericea* seedling growth we conducted an experiment under field conditions with manipulation of water and addition of nitrogen and phosphorous. We tested hypothesis (i) *T. sericea* growth will be highly influenced by the addition of water and nutrients in the absence of grasses, (ii) grass will compete for resources with *T. sericea* seedlings, and (iii) high belowground biomass of grasses will reduce seedling growth rate by limiting available resources. The grass biomass was higher after the addition of water and nutrients. *T. sericea* seedlings did not show effect to the addition of water and nutrients in the presence and absence of grass layer. Results suggest that the initial height (May) was more important to determine the September seedling height, followed by the addition of nutrients; and the initial stem diameter was also important to determine the September stem diameter followed by grass layer. Although there was not treatment effect on seedling growth, we therefore conclude that seedlings do not grow during the dry season but use the little resources available to maintain their daily photosynthetic activities.

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