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Modelling the effect of environmental factors on resource allocation in mixed plants systems

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In most cases, growth of plants is determined by competition against neighbours for the local resources light, water and nutrients and by defending against herbivores and pathogens. Consequently, it is important for a plant to grow fast without neglecting defence. However, plant internal substrates and energy required to support maintenance, growth and defence are limited and the total demand for these processes cannot be met in most cases. Therefore, allocation of carbohydrates to growth related primary metabolism or to defence related secondary metabolism can be seen as a trade-off between the demand of plants for being competitive against neighbours and for being more resistant against pathogens. A modelling approach is presented which can be used to simulate competition for light, water and nutrients between plant individuals in mixed canopies. The balance of resource allocation between growth processes and synthesis of secondary compounds is modelled by a concept originating from different plant defence hypothesis. The model is used to analyse the impact of environmental factors such as soil water and nitrogen availability, planting density and atmospheric concentration of CO2 on growth of plant individuals within mixed canopies and variations in concentration of carbon-based secondary metabolites in plant tissues.