ARE ISLAND FORESTS VULNERABLE TO INVASIVE DEFOLIATORS?

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Abstract

It has become axiomatic to represent oceanic islands as simplistic, fragile ecosystems, which, because of their evolution in isolation from continental biota, are particularly susceptible to loss of endemic biodiversity. This largely untested premise is based on the equilibrium theory of island biogeography, which fuels the paranoia of New Zealand's border controls. It is patently obvious that simple stable ecosystems do exist (e.g. bogs, boreal forests and oceanic islands) and remain stable if left undisturbed by man. The high rate of endemism and co-evolution of island biota is proof of their long-term stability.

Recent risk assessments of the threat posed by invasive Lymantriids to the New Zealand flora, indicate that despite the accepted paradigms, New Zealand's flora is largely resistant to exotic invertebrate defoliators. As an explanation of this apparent anomaly, the Island Resource Allocation (IRA) hypothesis was developed which states that 'the palatability of plants to invertebrate herbivores is proportional to the geographic range of the plant'.

The basis for the IRA hypothesis is a redefinition of the fundamental ecological principle of the species: area relationship. Species diversity does increase with area, but the relationship is more pronounced at higher trophic levels. Higher trophic levels (natural enemies) are lost prematurely as ecosystem area shrinks. The redefined species: area relationship means that islands, or similarly geographically constrained ecosystems, which support lower biodiversity, have fewer trophic levels, and consequently have a lesser regulation of herbivores by natural enemies. The IRA hypothesis is an acceptable alternative to the argument that biodiversity maintains ecosystem stability, in that it argues that island ecosystem stability is achieved through bottom-up processes, such as plant defences, rather than top-down predation.

Ecosystem stability is the most rapidly growing theme in ecology as we grapple to understand the consequences of the loss biodiversity on the functioning of ecosystems. The most influential empirical research on biodiversity/ecosystem function relies upon the manipulation of grassland or microbial communities, and the measurement of productivity or nutrient fluxes. These studies have been the subject of persistent criticism because of the anthropogenic interference and the lack of trophic complexity involved. Like so many issues in ecology, the current debate on the causative relationships between the loss of diversity and possible effects on ecosystem stability is becoming polarised. This is at a time when locally, nationally and globally, species and genetic diversity is being lost at an alarming rate and there is an urgent need for criteria to help recognise the consequences of such loss. As well as resolving the problems associated with the manipulation of complex terrestrial ecosystems, a validation of the IRA hypothesis will provide an empirical anchor for biodiversity studies and allow predictors for forest ecosystem management and conservation programmes.