

Summary:

Modelling population dynamics of *Leysera gnaphalodes* in Namaqualand, South Africa

by

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Namaqualand is world renowned for its mass displays of annual wildflowers occurring in highly disturbed areas. *Leysera gnaphalodes* is a short-lived perennial shrub that encroaches into this wildflower display, lessening the aesthetic appeal. For this reason populations of *L. gnaphalodes* need to be kept as small as possible. This is usually achieved by tilling the area regularly, but a less disruptive method would be preferable. Alternatives to this approach are explored.

The effect of many interacting factors needed to be examined over long periods of time so that alternative management strategies could be evaluated. Ecological modelling was used as it is ideally suited to this purpose. A review of modelling and its application in ecology is given, which includes a description of the modelling process and a discussion of different types of models and their applications.

It was hypothesised that grazing and low rainfall, in addition to tilling, could control the population size of *L. gnaphalodes*. Data was used from an eight-year study conducted to determine the effects of tilling, grazing and environmental factors on the seedbank and population size of *L. gnaphalodes*.

A rule-based mechanistic mathematical model based on the logistic growth curve was constructed to describe the population dynamics of this species. The model-fit was evaluated using Pearson's correlation coefficients and graphs, and it proved to be a good model. Tilling and low rainfall were both

found to be effective in reducing populations of *L. gnaphalodes* but grazing had no reducing effect. Simulations based on the model were run to test three different basic management strategies under stochastic rainfall conditions. The management strategy, which most effectively controlled the population was to till the lands whenever the population of *L. gnaphalodes* reaches or exceeds a relative frequency of 45%.

Multivariate statistical models were constructed to determine the effects of all of these factors on the population of *L. gnaphalodes*. Tilling was confirmed to be effective in reducing the population, but grazing was found to have no effect. Low rainfall was also effective in controlling the population but has the disadvantages of being out of management control and also affecting the desirable wildflowers.

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