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Cryptic genetic bottlenecks during restoration of an endangered tropical conifer

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ABSTRACT

Forest restoration programmes aim to use material for re-planting that is genetically diverse and not inbred. However, restricted seed sampling, high variance in reproductive output, and the production of inbred seeds that survive in the nursery but not in the wild can lead to forest restoration stock being genetically compromised. The aim of this study was to evaluate whether the reproductive biology of the New Caledonian endemic conifer *Araucaria nemorosa* makes it susceptible to these genetic problems and to assess whether there is evidence for genetic bottlenecks and elevated inbreeding in nursery stock compared to seedlings and adults from wild source populations. Reproductive output was low with high variance among trees (only 14% of adult trees surveyed produced mature cones, >50% of examined cones had <10 viable seeds). Evidence for an extreme genetic bottleneck was detected in a nursery population established from cones collected from adult trees. A second nursery population established with seed collected from the forest floor showed no evidence of a genetic bottleneck, but was inbred compared to its wild source population. In light of these results, we do not recommend collecting cones directly from *A. nemorosa* as an efficient means of establishing genetically diverse stock for restoration programmes. Collecting seed from the forest floor is likely to be more effective, but the planting stock may contain a high proportion of inbred individuals. Collecting established wild seedlings already subjected to natural selection is suggested as an alternative method of maximising the diversity captured, whilst minimising sampling effort and proportion of inbred individuals.

1. Introduction

Forest restoration is becoming increasingly important given the current wide-scale degradation and fragmentation of forest habitats. Over the short term forest restoration programmes are likely to be most successful if re-planting stock is of high immediate fitness, free from the deleterious effects of inbreeding (Charlesworth and Charlesworth, 1987) and locally adapted to the current conditions at the site of restoration (Hufford and Mazer, 2003; McKay et al., 2005; O'Brien et al., 2007). The long-term success of forest restoration programmes will be improved if the re-planting stock

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