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Restoration demography: a 10-year demographic comparison between introduced and natural populations of endemic *Centaurea corymbosa* (Asteraceae)

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Summary

1. In a context of increasing human impact on ecosystems and species distributions, population restoration (introductions, reintroductions, reinforcements) is an essential management tool, especially for plant species with limited colonization ability. However, detailed demographic surveys following restoration and comparisons of demographic rates between restored and natural populations, although essential for identifying the key factors of restoration success, are lacking.

2. We compared the demography over 10 years of six natural and two experimentally introduced populations of the narrowly endemic, cliff-dwelling, self-incompatible plant species *Centaurea corymbosa*. We analysed the fate of two cohorts of individuals that emerged simultaneously from seed introduction and natural germination. We then built a matrix model of population dynamics (using 6 years of data) and compared the demographic rates and asymptotic growth rate between the natural and introduced populations.

3. Overall, survival rates were higher in the introduced than in the natural populations, either due to better habitat conditions at the cliff scale or to better conditions in microsites selected for seed introduction compared to those reached by chance following natural seed dispersal.

4. In contrast, introduced populations exhibited lower fecundity than natural populations, probably due to the introduction protocol which led, in combination with self-incompatibility, to severely reduced mate availability.

5. Despite clear differences in population dynamics between introduced and natural populations, no significant difference in the asymptotic growth rates could be detected, because the higher survival compensated for the lower fecundity in introduced populations.

6. *Synthesis and applications.* Creating new populations of *C. corymbosa* in suitable unoccupied sites seems straightforward, provided that the introduction protocol allows sufficiently high fecundity. This key parameter for restoration success can be optimized by sowing seeds from several sources at high density and in several consecutive years, which should increase mate availability for self-incompatible flowering individuals. We suggest that population introduction might be successful for many (endemic) plant species whose geographical range is mainly limited by low colonization ability, especially in Mediterranean landscapes. We show that the simultaneous monitoring of restored and natural populations enables identification of the key parameters to be targeted for management optimization of restored populations.

Key-words: species introduction, population dynamics, matrix population model, population restoration, long-term monitoring, species management strategies, vital rates, plant survival, plant fecundity, cliff-dwelling species

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