Global Re-introduction Perspectives: 2016

Case-studies from around the globe

Edited by Pritpal S. Soorae

IUCN/SSC Re-introduction Specialist Group (RSG)

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Published by: IUCN/SSC Re-introduction Specialist Group & Environment Agency-ABU DHABI

Citation: Soorae, P. S. (ed.) (2016). *Global Re-introduction Perspectives: 2016. Case-studies from around the globe*. Gland, Switzerland: IUCN/SSC Re-introduction Specialist Group and Abu Dhabi, UAE: Environment Agency-Abu Dhabi. xiv + 276 pp.

ISBN: **978-2-8317-1761-6**

Cover photo: Clockwise starting from top-left:
i. Bolson's tortoise, USA @ Turner Endangered Species Fund
ii. Wetapunga, New Zealand @ Richard Gibson
iii. Morelos minnow, Mexico @ Topiltzin Contreras-MacBeath
iv. *Silene cambessedesii*, Spain @ Emilio Laguna
v. Tasmanian Devil, Maria Island, Tasmania @Simon DeSalis
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Cover design & layout by: Pritpal S. Soorae, IUCN/SSC Re-introduction Specialist Group

Produced by: IUCN/SSC Re-introduction Specialist Group & Environment Agency-ABU DHABI

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Successful translocation of *Narcissus cavanillesii* in Portugal

David Draper Munt[1], Isabel Marques[2,3] & José María Iriondo[4]

[1] - Centro de Ecologia, Evolução e Alterações Ambientais (CE3C - Centre for Ecology, Evolution and Environmental Changes), C2, Campo Grande, 1749-016 Lisboa, Portugal ddmunt@gmail.com
[2] - Departamento de Ciencias Agrarias y del Medio Natural, Escuela Politécnica Superior de Huesca, Universidad de Zaragoza, C/ Carretera de Cuarte Km 1, E-22071, Huesca, Spain.
[3] - UBC Botanical Garden & Centre for Plant Research, and Department of Botany, University of British Columbia, 3529-6270 University Blvd, Vancouver BC V6T 1Z4, Canada isabel.ic@gmail.com
[4] - Área de Biodiversidad y Conservación, Escuela Superior de Ciencias Experimentales y Tecnología, Universidad Rey Juan Carlos, C/Tulipán s/n, E-28933, Móstoles, Madrid, Spain jose.iriondo@urjc.es

Introduction

Narcissus cavanillesii A. Barra & G. López (Amaryllidaceae) is an autumnal geophyte listed in the Annexes II and IV (as *N. humilis*) of Habitats Directive (92/43/EEC). The first approximation to its threat status suggests that it should be classified as Critically Endangered in Portugal according to IUCN criteria (2001). This species occurs in the Iberian Peninsula and North Africa and the only two localities recorded in Portugal were affected by the construction of the Alqueva dam (Alentejo region). One of the localities would have been completely flooded if no conservation action had been taken and the other would have been affected by changes in habitat and in human activities. The population that was going to be flooded was discovered in 1999 during preliminary works of the construction of the dam (Rosselló-Graell *et al.*, 2003). This is key since because the floodgates would be closed during the summer of 2001 leaving just one flowering season to determine the situation of the population.

Flower of *Narcissus cavanillesii* © D. Draper

A conservation program was planned with the main goal focused on to avoid the extinction of the species in Portugal as well as guaranteeing the survival of its populations. The translocation action was followed by 11 years of monitoring activities and punctual interventions when needed.

Goals

- Goal 1: Get a clear picture of the situation of the population and the dynamic of the species (baseline information).
- Goal 2: Identify the best receptor site within the area of influence of the reservoir and validate *in-situ* the species suitability before translocation.
- Goal 3: Develop *ex-situ* conservation protocols to face the risks of the translocation.
- Goal 4: Perform the translocation while maintaining the original conditions as much as possible: translocate not only the individuals but also the organisms in the rhizosphere, keeping as much as possible the population structure and the spatial relative location of the various patches and individuals that conformed the population.
- Goal 5: Monitor the translocated population over the next 11 years and implement corrective measures when required.

Success Indicators

- Indicator 1: Percentage of individuals translocated relative to the census of 2000.
- Indicator 2: Number of patches translocated.
- Indicator 3: Percentage of reproductive plants annually relative to the census of 2000.
- Indicator 4: Long-term efficient *ex-situ* conservation of seeds and *in-vitro* micropropagation and preservation of 50 bulbs from the two Portuguese populations during at least 5 years (medium-term).

Project Summary

Feasibility: The distribution range of *N. cavanillesii* extends from Algeria and Morocco to Portugal and Spain. In Portugal, *N. cavanillesii* is restricted to two localities, Ajuda and Montes Juntos, in the Alentejo region corresponding to the species' western range limit in the Iberian Peninsula. It can be found in forests clearings, scrublands, Mediterranean pastures, and riparian communities, and road edges in sub-humid Mediterranean climates from the sea level up to 1,000 m a.s.l. (Marques & Draper, 2012). *N. cavanillesii* is a small perennial geophyte less than 15 cm high. It has bright yellow flowers that bloom in early autumn and generally produce only one flower per individual. It has an open corolla exposing sexual structures with a virtual tube that improves cross-pollinations chance. The species is self-compatible although insects are needed to achieve a higher rate of fruit and seed set (Marques *et al.*, 2007). Major threats are habitat change and fragmentation of populations. Small populations are not attractive enough to pollinators (Marques *et al.*, 2007) and sexual reproduction often depends on the co-existence of congener species like *N. serotinus* and *N. miniatus*, although this also leads to hybridization in some cases (Marques *et al.*, 2012).

Implementation: After the discovery of the population of Monte Juntos in 1999 there was hardly time available to complete the phenological cycle and to know the dynamics and status of the population, because the closure of the floodgates was scheduled for August 2001. With this limitation, during that first year the

development of census of individuals (vegetative and reproductive) as well as a detailed log of the spatial distribution of individuals, phenological study, and characterization of predators, pollinators and dispersers was prioritized. A two-phase translocation was scheduled as the receptor site was not yet selected in 2001. A temporal translocation was made in 2001 (before blooming) taking the population above the flood level but as close as possible to the original population. The aim of this action was to keep the population in the same habitat but safe from water level rise caused by the closing of the gates.

Translocation was carried out cutting the rocks or soil patches in small blocks to be transported. This procedure had the advantage of moving the bulbs together with surrounding soil or rock and keeping the relative spatial structure. The translocated population had a total number of 1,200 mature individuals and it was structured in 11 small patches from 0.5 m^2 to 8 m^2. The final translocation site was determined by using predictive models integrating the niche and the characteristics of the original site (Draper *et al.*, 2006).

The model was stratified and validated by seed germination experiments in the field, so a relationship was established between the habitat suitability of the studied territory generated by the model and the germination rate. Several places were selected according to this workflow but the definitive receptor site should have the agreement of the land owner. A negotiation was carried out with the land owner to achieve the commitment to maintain the land use of the place over time. With the receptor site validated and selected and the commitment of the owner to maintain the land use, we proceeded to the final translocation. The receptor site was only 1.5 km north of the original site.

Post-plantation monitoring: Monitoring was performed during the following 11 years. This monitoring was divided into two phases: 1) The first 4 years had the financial support of EDIA S.A. and could implement corrective measures based on the observed results, 2) The second phase took place from year 5 to 11, where an annual census of reproductive plants and fruit set was performed. The second phase was performed with the logistical support of the Lisbon Botanical Gardens from the National Museum of Natural History and Science (Portugal).

Plants translocated with rock layer © I. Marques

Indicators showed a drop in percentage of reproductive plants during the first flowering season after translocation in all plots (average of 24%). To

reverse this trend, seed produced in each plot were planted in the plot for the next 4 years. The increase of cattle during the breeding season of 2004 forced to protect the plots with temporary exclusions which remained until 2010.

Overview of re-introduction site © I. Marques

After these corrective measures an increasing trend in the percentage of reproductive plants has been observed reaching the values before translocation. In 2010, about 5 m away from one of the translocation plots we found a reproductive individual. From this it follows that during all this time pollination, dispersal, germination and establishment processes effectively took place. *Narcissus cavanillesii* has managed to complete the life cycle in the new site. In the last census of 2011 the number of individuals was slightly above the reference value of 2000. Ten years after the translocation the number of breeding individuals was similar to that before the intervention.

Major difficulties faced

- Lack of knowledge of the species.
- Limited time to know the status of the original population.
- The scheduling of public works overrides biological processes and constrains our ability to act.

Major lessons learned

- The importance of a multidisciplinary team (botanists, entomologists, agronomists, geologists, etc.) is a first step to success.
- It is essential to understand as well as its relationships with the environment and other organisms.
- The process of identifying the receptor site must combine knowledge of the species with knowledge of space available for translocation.
- The *in-situ* germination can help validate the receptor sites.
- Dialogue between land-owners, researchers and decision makers must be continuous and fluid.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- We were able to identify the main factors governing population viability.
- The selection of the receptor site was made considering the ecology of the species and distance factors adding to the original population. Thus changes in soil, vegetation, wildlife or weather were minimized. The first ascertaining that in the receptor site the species would have a high germination rate reduced the risk that the new locality the species would be able to complete its life cycle.
- We translocated the community and not only the individuals. Cutting the soil blocks and rocky outcrops where individuals occurred and performing the translocation when the bulbs were dormant minimized the impact on the individuals.
- Having kept the spatial structure of individuals and plots helped ensure the genetic relationships between them. This is essential concerning future gene flow via both pollinators and dispersers.
- To summarize, we tried to maintain as much possible the original conditions.

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INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

WORLD HEADQUARTERS
Rue Mauverney 28
1196 Gland, Switzerland
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org