Global Re-introduction Perspectives: 2013

Further case-studies from around the globe

Edited by Pritpal S. Soorae

IUCN/SSC Re-introduction Specialist Group (RSG)

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First steps for the conservation translocation of the betic alder buckthorn in Eastern Spain

Pablo Ferrer[1], Emilio Laguna[1], Inmaculada Ferrando[1], Ana Hurtado[1], Francisco Albert[1], Albert Navarro[1], Mari C. Escribá, Merche Piera[2], Federico Martínez[3] Juana M. Arregui[4], José Juárez[4] & Luis Navarro[4]

[1] - CIEF (Centro para la Investigación y Experimentación Forestal) - Servicio de Vida Silvestre, Generalitat Valenciana, Avinguda Comarques del País Valencià 114, E-46930, Quart de Poblet (Valencia), Spain laguna_emi@gva.es; flora.cief@gva.es
[2] - Tercera Demarcación Forestal de Valencia – Servicios Territoriales de la Conselleria de Infraestructuras, Territorio y Medio Ambiente, Generalitat Valenciana, c/Carretera de Albacete, 13. 46623 Jarafuel, Valencia, Spain piera_mer@gva.es
[3] - Parque Natural de Las Hoces del Cabriel, Generalitat Valenciana. c/Sindicato Agrícola s/n, 46310 Venta del Moro, Valencia, Spain hoces_cabriel@gva.es
[4] - IVIA (Instituto Valenciano de Investigaciones Agrarias), Generalitat Valenciana. Ctra. Moncada-Naquera, km 4,5. 46113 Moncada, Valencia, Spain arregui_jua@gva.es

Introduction

Frangula alnus subsp. *baetica* (E. Rev. & Willk.) Rivas Goday ex Devesa is a relict tree (Hampe & Arroyo, 2002) found in a few areas of Southern Spain, but having an isolated population more than 500 km far on the Eastern side of the Iberian peninsula, just sharing the borderline between the regions of Castilla-La Mancha (CLM) and Valencian Community (VC). There are some unchecked citations listing its presence in the Rif Mountains, NW Africa. It is listed as Vulnerable in the Spanish Red List of Vascular Plants (Moreno, 2008). The Eastern Spanish population is found along 20 km corridor in the deep gorges of the river Jucar. It is thought that most of the former continuous population, was severely destroyed by a big flood in 1982, which uprooted all the riverbanks destroying the ancient riverine forests. Nowadays the population are divided into two subpopulations which are 15 km from each other. These two populations are the western group (Casas de Ves, Albacete, CLM) which is estimated at over 40 specimens, and the Eastern group (Jalance, Valencia, VC), estimated at only 22

***Frangula alnus baetica* fruit**
© E. Laguna

subrupicolous individuals, mostly placed on water-oozing crevices on tall cliffs. The plants are too far away from each other and are unable to produce fertile fruit in the wild.

Goals

- Goal 1: Fine characterization of the Valencian (VC) subpopulation, where no reproductive success is seen in the wild; searching for appropriate sites to increase the population in the future
- Goal 2: *Ex situ* production of new individuals, after setting up a plant collection. New trees are obtained after cuttings from those accessible individuals on the Valencian gorges, which are able to produce fertile ('biodiverse') seed, from cross pollination amongst different individuals.
- Goal 3: Checking the site availability for restocking the Valencian sub-population in two phases: i) by using clonal plants (to reduce the effect of genetics on the site choice); and ii) by reinforcing the chosen good sites with new plants produced from seeds (obtained *in situ*), both for the river Jucar and several close tributaries (Cabriel River).
- Goal 4: Extending the above explained strategy to the Castilla-La Mancha's (CLM) subpopulation, checking also the intermediate sites between the two sub-populations.
- Goal 5: Long-term progressive enlargement of each sub-population, and establishment of a stepped-stones connection to re-create the ancient unique population.

Success Indicators

- Indicator 1: Number of *ex-situ* produced clones and individual plants (new parent plants, produced after cuttings from the available trees in wild).
- Indicator 2: Number of new 'biodiverse' (non-clonal) seeds and plantlets obtained, including the testing of germplasm quality (germination rates, seed longevity, viability, etc.).

Planting alders at a wild site

- Indicator 3: Number of planted individuals *in situ*, and survival rates, to be checked 2 - 4 years after plantation.
- Indicator 4: Number of established neo-populations with effective recruitment (4 - 8 years after each plantation in field).
- Indicator 5: Number of seeds produced in wild in the restored populations -

testing the germplasm quality- and effective recruitment (4 - 8 years after each plantation in field).

Planted *Frangula alnus baetica*
© Pablo Ferrer

Project Summary

Feasibility: *F. alnus* subsp. *baetica* is a riverine, termophile tree (Aguilella *et al.*, 2009); close relatives and other riverine trees use to show good results for vegetative propagation (both for *in vitro* and hormoned cuttings). There is good knowledge on the ecological requirements and reproductive biology for the Southern Spanish population, in Andalusia (Hampe & Arroyo, 2002). The Valencian native plants only produce a very small amount of seeds, often sterile, consequently forcing a interim step of *ex situ* seed production, obtaining the new parent plants after cuttings or buds taken from different individuals in filed. A test experience made by the IVIA (Valencian Institute of Agrarian Research) shown good results for *in vitro* clonal propagation after buds. All the Spanish rivers are of public property, co-managed by the national and regional administration.

The sites for the new plantations in VC are unexploited wild areas placed 5 - 10 km far from the closest villages, and having difficult access for tourism related activities. The native plant sites, as well as proposed translocations sites belong to areas protected by the Natura 2000 network. Return period for the next big floods, like those causing the strong decline of the former population, is estimated at about every 500 years. The conservation of the Valencian subpopulation is made by the regional administration of the VC, having experience in germplasm conservation, seed germination and plant production with endangered plants in the CIEF (Centre for Forestry Research and Experimentation). For the Western subpopulation, the *in situ* work is done by the regional administration of CLM, having less experience and *ex situ* facilities for endangered species. A technical agreement is being established to develop the whole *ex situ* phase for both subpopulations in the CIEF nursery.

Implementation: Twenty two specimens, most of them inaccessible and scattered in 5 sub-populational groups, have been detected in the VC subpopulation, on rock crevices of the riverine tall cliffs protected from the biggest flood levels. The whole estimated extension of presence reaches about 3.6 km^2.

Picking cuttings © E. Laguna

Only a few Valencian plants produce seeds, which use to be sterile, apparently coming from self-pollination. CLM subpopulation, is still under study; the CLM trees grow on remainders of the optimal habitat, as low trees on riverbanks, forming a part of the low-tree layer of riverine forests dominated by tall willows (*Salix* spp.) and poplars (*Populus* spp.). First cuttings harvest made by climbers, and *in vitro* production using Valencian plants, both devoted to establish the *ex situ* clonal bank and to initiate the first phase of *in situ* plantations to check the sites feasibility started in 2007 - 2008. The *in vitro* production protocol was refined in 2008; and an additional successful protocol using hormoned cuttings in the nursery was also set up in 2010.

The current *ex situ* collection holds 40 individuals from five clonal lines, coming from two sub-populational groups; the genetic progressive enrichment with more lines from the remainder groups is expected after 2013. The first 'biodiverse' seed production obtained *ex situ* started in 2011, yielding more than 600 fruits and over 1,400 seeds and the production in 2012 bore over 2,500 fruits. Those first seeds show acceptable quality and they have been germinated in the laboratory in 2012. A fine germination protocol, complemented with several seed treatments and pre-treatments, is expected by 2013 - 2014. Since 2009, 320 individuals obtained from five clonal lines have been planted in the riverbanks of Jucar gorges and its close tributary Cabriel River, belonging to the Nature Park 'Hoces del Cabriel'. All the plantations can be considered as proximity reinforcements and neo-populations (see concepts in Laguna & Ferrer, 2012), close to the native sites; true reinforcements on the remainder sites on rock crevices cannot be implemented, due to their technical difficulties and the high risk of failure. Ninteen riverbank sites have been tested, the extension of presence for the whole sites reaches 766 km^2. The first enrichment of those neopopulations, from clonal plants, using plantlets produced *ex situ* from seeds has been done in the winter of 2012 - 2013. In 2012 a first cuttings harvest of some western specimens, CLM subpopulation, to initiate the parallel clonal production of new parent trees in the CIEF has also been done, and more complete campaigns are expected in the following years.

Post-planting monitoring: The plantation sites are visited every 3 - 4 months, and any incidence (phenology, predation, pests, etc.) is recorded. Eight of the 19

planted sites show good survival rates (over 80.6%); the main reasons for the unsuccessful plantations have been detected due to salinity, high fluctuation of water levels and ungulate foraging. A first blossom period of translocated plants has been observed in 2012, three years after the first translocations; however the first event of *in situ* seed production is expected in 2013.

Major difficulties faced

- Small amount of seeds, mostly unfertile and produced by self pollination, in the wild.
- Lack of knowledge of the optimal habitat requirements as former riverbanks were completely destroyed by a river flood.
- High rates of predation by Spanish ibex (*Capra hispanica*) living in the same area.
- Severe fluctuation of water level in some of the best pre-chosen sites which cannot be corrected.

Major lessons learned

- The lack of seed production is due to the long distance between wild individuals, even into each native sub-populational group. New specimens planted opposite each other show high fertility in *ex situ* conditions, and a similar behavior can be expected for the *in situ* translocated plants.
- A quick development of cultivated plants has been noticed, both after cuttings, *in vitro* explants and seeds. The new plants which are three years old can produce flowers, but the effective seed production is best made after the fourth year.
- The *ex situ* 'biodiverse' seeds (those obtained after cross pollination amongst individuals from different parents) show high rates of viability and germination.
- The translocated specimens species only grow on the first line of the local riverine vegetation (*Salix alba-Populus alba* forest, best than *Ulmus minor-Fraxinus angustifolia* community), on non-saline soils and avoiding sites showing strong fluctuations of water levels.
- The *ex situ* and *in situ* operations should follow a calendar protocol. The rooting of fresh cuttings (to initiate new lines of parent trees for *ex situ* production of new seeds) goes on best in spring, instead of autumn, using mid -diameter sizes (1.5 - 2 cm) instead of thin or thick ones. Translocations to wild habitats must be made in late autumn or early winter, instead of late winter or early spring.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
	√		

Reason(s) for success/failure:

- Definitive success will be considered a time the new plantlets obtained from seeds will be translocated. Provisory results are successful and allow to expect high success in a few years time.

- Failures are based on unexpected events like the recent progression of Spanish ibex population on the same sites, or unpredictable changes in water level due to dam content regulation. The translocated plants must be protected against the effect of ungulates (i.e. using metallic nets to protect them during the first years).
- The quick growth and early maturing age of the new specimens ensures the translocation success, for those sites having good conditions.
- To get native material (cuttings from rock crevices or other inaccessible sites), the *ex situ* phase is already protocoled for obtaining new seeds and plantlets in 3 - 4 years. The germination procedures are easy and quick, and the translocation sites can be well accessed.
- The species and the translocation sites are protected by Law, and the public property of the sites ensure the long-term conservation. However more fine protection measures through the designation of protected Plant Micro-Reserves (Laguna, 2001) could be required in the future.

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