



# Global Re-introduction Perspectives: 2011

More case studies from around the globe  
Edited by Pritpal S. Soorae



IUCN/SSC Re-introduction Specialist Group (RSG)





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## Re-introduction of Spanish moon trefoil in Illa Grossa, Columbretes Islands, Spain

Emilio Laguna

CIEF (Centro para la Investigación y Experimentación Forestal) – Generalitat Valenciana, Avinguda Comarques del País Valencià 114, E-46930 Quart de Poblet (Valencia), Spain [laguna\\_emi@gva.es](mailto:laguna_emi@gva.es)

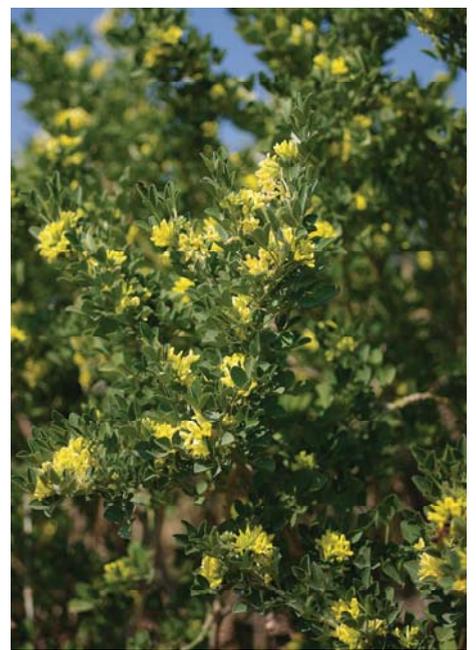
### Introduction

Spanish Moon Trefoil (*Medicago citrina*) is a shrub endemic of small islands of the Mediterranean Spanish coasts. Its population, less than 2,000 specimens, is scattered through 10 islets of 4 archipelagos: Columbretes Islands and Illot de la Mona (Valencian Community region) and Ibiza and Cabrera Islands (Balearic Islands). It is listed as Critically Endangered of the Top 50 Mediterranean Island Plants (Crespo *et al.*, 2005), and strictly protected in the Spanish List of Endangered Species. Formerly covering most part of the Columbretes archipelago (18 ha, Valencian Community), *M. citrina* went extinct in the main island (Illa Grossa, 14 ha) by the 1960s, there are only two remaining small populations in the close islets Foradada (1 ha) and Ferrera (1 ha).

The extinction was caused by overgrazing (introduced pigs, goats and rabbits) and the overexploitation for fuel, made during the building works of the lighthouse of Illa Grossa (1856 - 1860), and the maintenance of its keepers between 1860 and 1975. The strong climatic conditions such as rainfall (200 mm/year) with a 8 - 9 month drought period with sandy volcanic soil, which cannot maintain the rainfall water, added serious troubles for the natural re-colonization of the native population (Fabregat & Laguna, in press).

### Goals

- Goal 1: Eradication of introduced rabbits, to ensure the recovery of native vegetation in Illa Grossa.
- Goal 2: Partial eradication of invasive plant competitors (introduced prickly-pear *Opuntia ficus-indica*).
- Goal 3: Production of new plants from the two close populations (Ferrera and Foradada) of *M. citrina*.



*Medicago citrina* in Illa Grossa

- Goal 4: Plantation of *M. citrina* in selected sites of the island Illa Grossa.
- Goal 5: Maintenance of the re-introduced population against the effect of new pests (biological control of *Icerya purchasii*, Hemiptera).

## Success Indicators

- Indicator 1: Number of planted specimens.
- Indicator 2: Number of adult plants remaining in the long term after plantation.
- Indicator 3: Effective recruitment of new plants in the re-introduced population.
- Indicator 4: Number of damaged/resistant individuals of *M. citrina* after attacks of *Icerya purchasi*.

## Project Summary

**Feasibility:** In 1986 the Columbretes Islands archipelago, formerly used as a military area, was transferred to the regional government of Valencia (Generalitat Valenciana) to ensure its protection and nature conservation tasks. Columbretes is 56 km off the Valencian coast. The archipelago is formed by 4 main islands (Illa Grossa, Foradada, Ferrera and Carallot), but the 3 last are less than 1 ha. Only 2 of them (Foradada and Ferrera) still contain remainders of the native vegetation, a dense Mediterranean, cushion-shape shrubland partially dominated by the Spanish endemic shrub *Medicago citrina*. The vegetation of the main island (Illa Grossa, 14 ha) was extensively destroyed during the 19<sup>th</sup> and 20<sup>th</sup> century, used by their ancient lighthousekeepers as fuel or as a food for introduced species; in addition the island suffered the invasion of the prickly pear (*Opuntia ficus-indica*).

By mid 1980s, *M. citrina* was fully extinct in Illa Grossa, and the 2 other islands held 600 adult individuals, as a remnant of the native population. A time the archipelago was abandoned by the lighthousekeepers and the Spanish Navy, the Service of Biodiversity of the Generalitat Valenciana (SBGV) drafted a long-term program to recover the ancient vegetation of the main island, including the re-introduction of *M. citrina* from the close minor islands of the same archipelago (Ferrera and Foradada), placed 1 - 2 km from Illa Grossa (Laguna & Jimenez, 1995). In 1987 the whole archipelago was protected as Natural Park, reclassified in 1992 as Nature Reserve. In 1998, Ferrera and Foradada islands were also protected as Plant Micro-Reserves (Laguna, 2001).

**Implementation:** During 1987 all the introduced rabbits were hunted using traps, bow and arrows, in order to not cause troubles to the endangered seabird colonies living there. A total of 213 rabbits (*Oryctolagus cuniculus*) were hunted, and the vegetation of lower stages, herbaceous and low-size perennials, quickly started recovering. More than 400 young individuals of *Opuntia ficus-indica* (Cactaceae) were removed, using their stems to make compost, further used to fertilize the holes made to plant *M. citrina*. Ancient, monumental trees of *Opuntia* were maintained to get fleshy fruits useful to feed migrant birds, as well as to ensure the life cycle of several insects acting as major local pollinators.

During the period 1988 - 1996 the SBGV produced *in situ* and planted more than 800 specimens of *M. citrina* on selected sites with deepest soils or partially shaded slopes; the seeds were collected in the two close islands Ferrera and

Foradada. For most specimens, additional irrigation was provided during their 2 - 3 first post-plantation years.

In 1996, a new pest affected the *Citrus* crops (orange and tangerine trees) covering most part of the agricultural landscape near the Valencian coast, and the landowners combated it using strong pesticides. The biocides produced the imbalance on the equilibrium between a former agricultural pest (*Icerya purchasi*, Hemiptera) and its predator (*Rhodolia cardinalis*, Coleoptera).



Re-introduced *Medicago citrina* (with yellow flowers) at Illa Grossa

During 1996 - 1997 a sudden increase of populations *I. purchasi* was noticed on the continent, and this species entered Columbretes, carried on the feathers of migrant birds. In two weeks, by mid-April 1997, *Icerya* had destroyed nearly 66% of the native population of *Medicago citrina*, as well as most part of the re-introduced plants in Illa Grossa. To combat the pest, the SBGV, assessed by the regional Department of Agriculture, quickly released the predator *Rh. cardinalis*, stopping the decline of *Medicago*. This practice is done every spring since 1997 as a preventive action.

**Post-planting monitoring:** The plantation has been continuously monitored and censused by the Nature Reserve keepers, including the re-plantation of low-success sites (i.e. sites where the specimens of *Medicago* died by *Icerya*). Regular censuses are conducted by SBGV's Plant Officers every 4 - 5 years since the mid-1990s.

By 1995 - 1996, the first re-introduced plants of *Medicago* flowered and started to produce fruits. Currently the new population consists of 220 adult plants and an active recruitment of new plants is noticed in open vegetation surrounding the older specimens. Each one of the older plants (more than 1.5 m high) of *Medicago* can produce over 3,000 seeds per year, but a strong recruitment only can be expected after very long periods of accumulation in the soil seedbank, due to seed dormancy. The germination capacity can be conserved for very long periods, and the dormancy also can be suddenly broken by the direct incidence of sunlight, i.e. after wildfires or clear cutting practices. Paradoxically, most part of the success in seed production depends on a pollinator diptera (Pérez-Bañón *et al.*, 2003) whose larvae host the fleshy fruits and stems in decomposition of the

invader *Opuntia ficus-indica*, maybe as an alternative food, instead of the fruits of native shrubs that have locally become extinct in the past.

## Major difficulties faced

- The resistance of young re-introduced plants to very long dry periods (summer). During the first 5 years, ~40% of specimens died because of the excessive drought period of 6 - 9 months without rainfall every year.
- Enhancement of pollinator populations. The extinction of several species bearing berries or fleshy fruits, reported from the islands by 1832, as *Olea sylvestris* and *Pistacia lentiscus* probably forced the main pollinators (*Syrphidae*, Diptera) of the Moon Trefoil to choose the invader cactus *Opuntia ficus-indica* as an alternative food for their larvae period (Pérez-Bañón *et al.*, 2003)
- Fight against the new pests as *Icerya purchasi*. Fortunately the biological control provided by *Rhodolia cardinalis ongoes*, but in a first stage *Icerya* destroyed a significant part of the specimens of the re-introduced population, just coinciding with the first successful episodes of seed production.

## Major lessons learned

- The re-introduction of the species was possible although the negative initial perspectives (i.e. lack of plant cover, excessive drought period, slow growth rate of *Medicago*, etc.). The success can be mainly attributed to the constant effort and continuous work of the Nature Reserve keepers.
- The needing of agreed decisions taken by animal and plant officers. The decision proposed by the animal officers of SBGV to maintain the *Opuntia* specimens even being an invader plant, was a key issue for the success of the re-introduction of *Medicago*. Due to the key position of the archipelago, at mid-distance between the continent and the Balearic Islands, it deals with a major site providing plant food for a lot of bird species in the Western Mediterranean migration routes. *Opuntia* pears are the only food that those birds can find in Columbretes. The optimal alternative solution (plantation of extinct, native berry species) could be undertaken but due to the extreme local drought they could need more than 30 years to get the adult stage and to provide fruits to feed the migrant birds.
- The projects for threatened plant re-introduction in small islands can face unforeseen serious problems, like herein indicated on pests or pollinators. Even having the most updated scientific knowledge on the biology of the plant species, the answer of managers after any stochastic negative event can be crucial.
- Special care of re-introduced plants can be maintained for years (for instance water supply) at least to ensure that they are reaching the adult age.

## Success of project

Highly Successful	Successful	Partially Successful	Failure
	√		

### Reason(s) for success/failure:

- The main reasons for the success has been the eradication of risk factors (invader plants and rabbits) and the continuous assessment and management of the re-introduced population, made by the keepers of the Nature Reserve of Columbretes Islands.
- Complementarily, the quick answer to the invasion of the new pest *Icerya purchasi* by means of biological control and release of its predator *Rhodolia cardinalis*, has ensured the conservation of adult plants.
- The water supply provided by the Columbretes' keepers during the long period of drought, maintained during the 4 - 5 first years of life of each re-introduced plant, has been a key point in ensuring their survival.

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