



Global Re-introduction Perspectives: 2016

Case-studies from around the globe

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IUCN/SSC Re-introduction Specialist Group (RSG)



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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
vi. Agile frog, Jersey @ States of Jersey Department of the Environment

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Re-introductions of an increasingly rare North American lily to prevent regional extinction

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Introduction

Combined tall grass prairie, mixed grass prairie and short grass prairies once stretched across 1.5 km² of the North American continent. Less than 2% of North American native prairies exist in their natural state today. The tall grass prairie has declined 99.9% over the last 200 years, a decline exceeding that of any other plant community. One native forb that has all but disappeared from the landscape is *Lilium canadense* subsp. *michiganense* (Farw.) Boivin & Cody. *L. canadense* subsp. *michiganense* gained appeal in Europe after its introduction there when the explorer Jacques Cartier brought the first plants back to the continent. It was widely planted in European botanic gardens and estates after his North American expedition in 1629 (Hermes, 1993). Thomas Jefferson appreciated the species and contacted John Bartram to provide lilies for his political acquaintances in France (Jefferson correspondence, 1786).

Over time, robust modern lily hybrids, with their vast array of forms and colors eclipsed interest in the wild species and *L. canadense* subsp. *michiganense* slipped into obscurity. The common name for it is Michigan lily, sometimes also referred to as Turk's cap lily, although there is some debate about which of the North American native lilies is the correct one for that title. It is one of the showiest of all the native plant species. The plant was historically used by Native American Indian tribes for several medicinal purposes and the bulbs were used as a foodstuff.



Lilium canadense subsp. *michiganense*

The lily is listed as an endangered species in New York State and threatened in the state of Tennessee. Several other states report it to be "extremely rare" but do not afford it formal protected status (USDA Forest Service). In all the states where *L. canadense* subsp. *michiganense* still exists, populations are

small and isolated, making genetic exchange sporadic at best among the widely scattered remnant prairies.

Goals

- Goal 1: Conserve native lily germplasm from a minimum of 5 tallgrass prairie sites.
- Goal 2: Propagate the species by cloning various lines *in-vitro*.
- Goal 3: Harden off the propagules and establish experimental populations on protected sites within its historic range.
- Goal 4: Establish self-sustaining populations by distributing propagules to numerous conservation organizations in order to increase prairie biodiversity.

Success Indicators

- Indicator 1: Successful multiplication of germplasm from 5 lily populations.
- Indicator 2: Acclimatization *ex-vitro* and subsequent survival of propagules when planted in experimental plots in the natural habitat.
- Indicator 3: Persistence and reproduction in the habitat for a minimum of 5 growing seasons.
- Indicator 4: Establish multiple colonization sites with re-introduced propagules.

Project Summary

Feasibility: Because of increased urbanization, conversion to cropland and in some cases competition from invasive species, native forb populations have dramatically decreased across the entire tallgrass prairie region. Few Americans are familiar with the Michigan lily or the position it occupies in the prairie plant community. Today the species is found occasionally on tiny remnants of the once vast tallgrass prairie. The Omaha Henry Doorly Zoo Laboratory for Endangered Plants, in collaboration with multiple conservation organizations are carrying out a long-term project to ensure that this beautiful native forb does not disappear from the Great Plains. The lily ranges in height from 1 - 2 m with 1 to 20 nodding flowers that open in July. The flowers are yellow shading upwards to orange-red with magenta-brown splotches inside the throat. The petals recurve sharply giving the flower its Turk's Cap appearance. No seeds were found for the species when this project began in 1992 so it was necessary to collect tissues for cloning from several plants at different locations. The species has been subsequently produced *in-vitro* at the zoo's lab continually since that time. The species appears to seldom produce viable seeds. Possible pollinators include *Speyeria cybele* (great spangled fritillary) and various swallowtail butterflies but it is exceedingly rare to find a fruit in the wild that results from natural pollination events or a fruit that also contains viable seeds.

Some states have as few as 2 - 4 small populations that are found only where the prairie remnants have remained uncultivated. The zoo's lab began propagating and re-introducing the species in protected areas, a project that continues to the present day. Several regional conservation organizations have participated by planting the lilies that are produced in the zoo's tissue culture laboratory. By



Lily habitat - Nishnabotna prairie

creating sustainable populations land managers are taking pre-emptive actions to preserve the species before it reaches endangered status.

Implementation: Small tissue samples were collected from four different sites in Nebraska and one site in Iowa. No flowering plants were removed or translocated to initiate the project in order to

avoid any unintentional pollen transfer or hybridization. Cloning several lines was the next best option for propagation since no seeds were available. The tissues were sourced from several sites in order to save as much diversity as was practical from the region given the time commitment in the laboratory and funding limitations. Tissues continue to be cloned, hardened off and translocated to various sites in the same counties in Nebraska and Iowa which originally provided the source materials and to a number of other selected nearby sites with similar habitat.

The lilies are planted in protected prairies that are to remain uncultivated for the foreseeable future. Among the agencies that have participated in the re-introductions are the Audubon Society, the Nature Conservancy and the US Fish & Wildlife Service. Propagules have also been offered through Nebraska's Statewide Arboretum to the association's members who plant them at privately owned sites, increasing the overall number of individual lily specimens within its historic range. Private sites are monitored by the land owners themselves. The translocated populations are considered to be representative of the wild populations that were initially sampled for the project.

Post-release monitoring: Participating institutions monitor the re-introduced populations for survival, growth rates and flowering during each annual growth cycle. Visits are conducted by the zoo's plant scientists to observe overall survival rates. The numerous sites are scattered over a considerable distance and not all sites are visited each annual cycle by zoo personnel. All propagules are identified in the lab by their original collection sites and re-introduced to their respective areas to increase existing populations and in nearby prairies as well. The individuals are relatively small when first planted and flowering usually doesn't commence until after three annual growing seasons. Rodents occasionally dig up newly planted bulbs presenting a challenge in some instances. An underlying layer or top dressing of very coarse gravel has been found to be effective in

repelling most rodents. In cases where predation is a persistent problem land managers have built wire cages to protect newly emerging lilies.

Once the lily bulbs have established at a site the species is quick to colonize provided that the soil conditions and annual rainfall are adequate. Extensive flooding along the Missouri River destroyed one re-introduction site in 2012 but all other sites have survived. Underground stolons with small bulbs forming at the terminal ends begin developing within the first year or two when growing conditions are favorable. The species resents disturbance however, and may not reappear the following year when disturbed. Consequently, excavations are only done once at a planted site in order to verify their ability to reproduce vegetatively. The species generally grows vigorously once established and is capable of persisting for many years provided that growing conditions remain stable. The first site planted in 1993 still supports the lily after more than 20 years.

Major difficulties faced

- Development of a successful tissue culture protocol for a species with a scarcity of originating tissues.
- No publications were available regarding the species' propagation or reproductive cycle.
- Travel distances to population sites and the related costs.
- Weed control at introduction sites.
- Lack of funding.

Major lessons learned

- Lily tissue culture is a highly successful propagation method when using an appropriate media.
- Cloning produces a large number of available propagules in 6 - 12 months.
- The species readily establishes once soil, moisture and light requirements are met.
- Re-introduced lilies require protection from native animals and invasive plants.
- Monitoring multiple sites requires cooperation and commitment from land managers, particularly when funds are limited.

Success of project

| Highly Successful | Successful | Partially Successful | Failure |
|-------------------|------------|----------------------|---------|
| √ | | | |

Reason(s) for success/failure:

- The species survived at a high rate when cultural requirements were met.
- Site selections were made carefully to identify favorable growing conditions.
- Tissue culture multiplication of all five clones was highly successful.
- Plants at most sites are reproducing vegetatively and creating colonies.

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