

Keeping endangered species alive

Bank for Plants

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Prior to the mid-1980's, the term "bank" referred almost exclusively to financial institutions. The advent of the "biodiversity" concept, however, has led to the appearance of so-called "gene banks"

Biodiversity (biological diversity) is a concept that integrates ecology and genetics into a single nature conservation theory. The 1992 World Summit in Rio de Janeiro brought forth the Convention on Biological Diversity, as the fundamental law for nature conservation and sustainable development. As a result, "gene banks" have been set up worldwide to protect biodiversity

– the variability of all living beings on Earth. Indeed, it was the last call to do so.

In the second half of the 20th century, the threat faced by living specimens and ecosystems began to increase drastically. Of the approximately 250 thousand species of vascular plants (flowering plants and ferns) identified worldwide, at least 60 thousand are estimated to be threatened with extinction. Every day, one higher plant species is believed to be lost forever. The greatest threat is posed to plants of tropical communities, but those living in moderate climate zones are endangered as well. For example, 21% of Europe's vascular plant species are classified as being threatened with extinction. Among the 2,750 vascular species of Polish flora, 419 species were listed in the 1992 national "Red List" of threatened plants. This number could be even higher today, and has probably reached 500.

Pursuant to the Convention on Biological Diversity, the *Global Strategy for Plant Conservation* was adopted in



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Polish scurvy-grass (*Cochlearia polonica*) is extinct in its primary locality, but has been successfully preserved in the collection of the Botanical Garden of the Polish Academy of Sciences in Warsaw



Wiesław Gajnyś

The Franklin tree (*Franklinia alatamaha*) in full blossom in our gardens. This American plant was last seen in the wild at the end of the 18th century, but has survived in botanical gardens' collections

2002. According to this special document, 60% of threatened plant species worldwide should be conserved both in their natural habitat and in gene banks or botanical gardens by the year 2010. The first method of conservation (implemented in protected areas – national parks or nature reserves) is the most efficient one: it offers the opportunity to preserve whole ecosystems. Nonetheless, many habitats are threatened by environment degradation, climate changes or by various man-made and natural disasters. Therefore, the *ex situ* method has become a very important tool for preserving plant diversity.

Gardens and banks

At present there are about 2,000 institutions worldwide that can be considered botanical gardens. At the end of the 20th century, they began to play the main role as banks for the conservation of plants threatened with extinction. It is estimated that over 10 thousand species have been preserved thanks to botanical gardens' collections of living plants. In Poland such collections comprise 177 plant species protected by law, 192 species of threatened plants listed in the national Red List and 39 species of endemic or sub-endemic plants (occurring in limited areas, usually only in Poland). But preserving diversity by collecting living plants does have several limitations. Specimens may be affected by various hazardous factors like harsh weather, diseases or pests. Moreover, due to the limited space available in botanical gardens, plant populations are not sufficiently large to represent the primary genetic variation. This is why many botanical gardens have in recent years developed seed banks.

The first seed banks originated in the 1920s, and they were used for the long-term storage of crop seeds. Seed storage of wild plants was introduced at botanical gardens only in the 1980s. Due to the process of aging, seeds are normally only able to preserve their ability to germinate for several years. But it was found that seeds' life-span could be prolonged if they are kept in cold and dry conditions, which slow down their life processes. If the water content present in seeds does not exceed 10%

(preferably 5-7%) and the temperature is kept below 0°C (usually ca. -20°C), stored seeds might retain their full viability for 20-50 years.

Liquid nitrogen longevity

This storage period can be prolonged to more than 100 years if seeds are stored in cryogenic conditions, for example in liquid nitrogen (-196°C). In 1992, a cryogenic bank of this sort was organized for threatened species of Polish flora in the Botanical Garden of the Polish Academy of Sciences in Warsaw. Our goal is for the cryogenic seed bank to preserve all species of Polish vascular plants threatened with extinction and included on the Red List. Our seed bank has already participated in the successful restoration of several threatened plants. Thanks to our banked seeds, 3 rare and threatened plants from the West Tatra mountains were reintroduced into their primary localities by Professor Halina Piękoś-Mirkowa (Institute of Nature Protection of the Polish Academy of Sciences in Kraków). These lucky survivors are: the beetling flower milk vetch (*Astragalus penduliflorus*), the Slavic anemone (*Pulsatilla slavica*) and Villar's mountain fern (*Dryopteris villari*).

At present our botanical garden participates in the European Union project "ENSCONET – European Native Seed Conservation Network." The main goal of the project is to coordinate the activity of all seed banks in European countries that preserve native plants, so as to achieve the objectives set by the *Global Strategy for Plant Conservation* and the *European Plant Conservation Strategy*. ■

After passing germination and freezing tolerance tests, seeds collected from wild species are very slowly dried and placed in special cryogenic vials, in liquid nitrogen vapor at ca. -160 °C. Then they are stored at such temperature for long periods of time



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Further reading:

- Puchalski J. (2000). Genebanks in the conservation of rare and endangered plants (in Polish with English summary). *Bulletin of Botanic Gardens, Museums and Collections*, 9, 91-97.
- Łukasiewicz A., Puchalski J. (eds.). (2002). *Botanical Gardens in Poland* (in Polish with English summary). Warszawa: AR-W A. Grzegorzczak & Fundacja Homo et Planta.
- Frankel O. H., Brown A. H. D., Burdon J. J. (1995). *The Conservation of Plant Biodiversity*. Cambridge, New York & Melbourne: Cambridge University Press.