Reintroduction of threatened animal and plant species

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1 Reintroduction

Human induced habitat loss and degradation are primary causes of the ongoing decline of habitats and associated species. Conservation efforts focusing on the preservation and restoration of areas of high natural value through appropriate habitat management are fundamental, but sometimes insufficient. For some species, measures have come too late, while others are unable to cross fragmented landscapes, resulting in isolated subpopulations. In cases where natural recolonization of suitable habitats is unlikely, reintroduction is a tool to re-establish, stabilize and increase populations of vanishing species and often the only way to prevent regional extinction.

Our reintroduction project has re-established the European tree frog (*Hyla arborea*) in the SICONA area. Further projects to re-establish and/or strengthen other amphibian species are ongoing. Finally, the reintroduction of more than 30 plant species (24,000 individuals to over 250 sites to date) helps to stabilize rare plant populations and restore intact habitats.

The objectives

- Re-establish, increase or stabilize species
- Restore intact ecosystems
- Ensure the efficient provision of ecosystem services

2 Amphibians – How and when?

Starting in 2012, the European tree frog was the first animal species to be reintroduced by SICONA. It was followed by the yellow-bellied toad (*Bombina variegata*, from 2016) and the great crested newt (*Triturus cristatus*, from 2021). While exact procedures regarding sourcing, captive-rearing and release of animals vary between species, long-term procurement of suitable habitats and post-release monitoring are essential requirements. Between 2012 and 2024 more than 7,000 tree frogs were released in five sites (Fig. 1).

Fig. 1. European tree frogs were collected as spawn and released as tadpole or juvenile in five locations in several steps (2012–2014, 2019–2020, 2022, 2024).

3 Plant species – How and when?

Reintroductions of plant species are being carried out by SICONA since 2013. Plants issued from autochthonous seed material are grown in nurseries and planted out in groups of ±100 per plot (Fig. 2). The position of each individual is measured using a High Precision GPS, and monitoring, designed to determine survival rate (and in some cases also establishment rate as the increase in the population compared to the number of initially planted individuals) is carried out in the first, second, fifth and tenth year after planting.

Fig. 2. Seeds from at least three collection sites per species are grown in nurseries and planted as seedlings in autumn at predetermined sites (mostly meadows).

4 Tree frog – Success

Following the near extinction of tree frogs in Luxembourg, our reintroduction project led to the (re-)colonization of 80 sites in an area covering ca. 135 km². Over the years there has been a continuous spread of the species from the release sites (Fig. 3). Both the number of calling males and populated sites have increased steadily (Fig. 4), with the current maximum of ca. 830 calling males at 61 sites in 2024, twelve years after the first reintroduction.

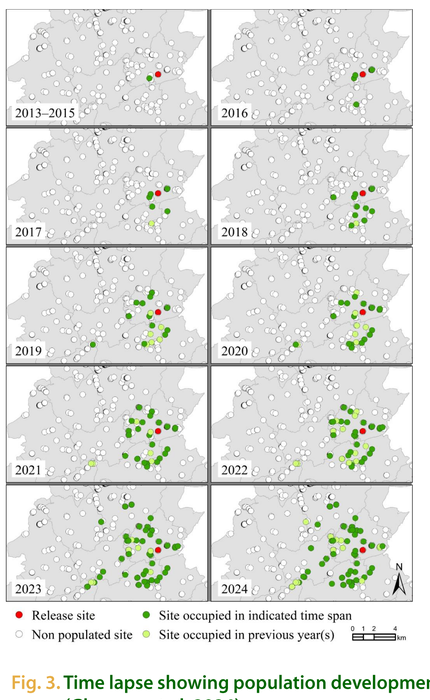

Fig. 3. Time lapse showing population development (Glesener et al. 2024).

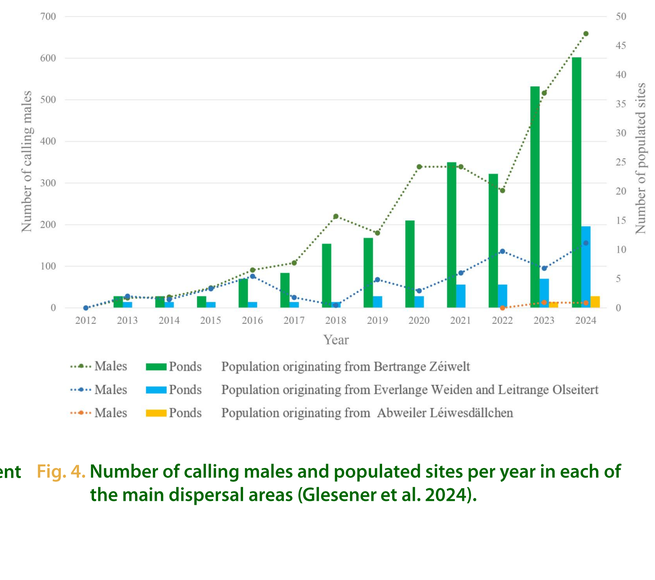

Fig. 4. Number of calling males and populated sites per year in each of the main dispersal areas (Glesener et al. 2024).

5 *Molinia* meadows – Success

A more specific evaluation based on vegetative and generative characteristics of five typical species of *Molinia* meadows (Fig. 5) showed that three of the target species (*Oenanthe peucedanifolia*, *Betonica officinalis* and *Succisa pratensis*) were reintroduced successfully. On average, 23.3–41.0 % of the translocated plants survived (Fig. 6a), and the establishment rate was up to 763 % (Fig. 6b). The other two target species (*Scorzonera humilis*, *Serratula tinctoria*) showed lower rates of survival and especially establishment.

Fig. 5. *Scorzonera humilis - Oenanthe peucedanifolia - Betonica officinalis - Succisa pratensis - Serratula tinctoria* (Breit et al. 2023).

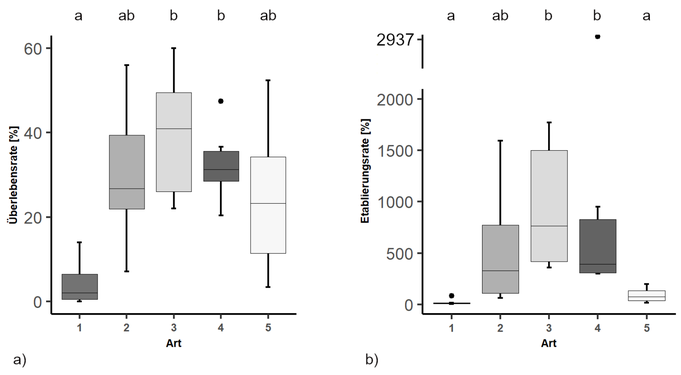

Fig. 6. a) Survival rate of individuals of F0 at the time of the study in 2022 and b) Establishment rate (surviving and newly produced plants), separated by species and averaged over the six reintroduction sites. Different letters indicate significant differences between species resulting from Kruskal-Wallis multiple comparison of means and pairwise Mann-Whitney-U-test. 1 = *Scorzonera humilis*, 2 = *Oenanthe peucedanifolia*, 3 = *Betonica officinalis*, 4 = *Succisa pratensis*, 5 = *Serratula tinctoria* (Breit et al. 2023).

6 Conclusion

Reintroduction is a suitable supplementary method for habitat restoration and helps to preserve rare species. The methods used have proven to be effective. Both amphibians and plant species have been successfully reintroduced. These successes depend on many factors (biotic and abiotic) and are not always guaranteed to the full extent. Furthermore, financial and legal requirements and the sheer scope of reintroduction projects should not be underestimated. Nevertheless, reintroduction, combined with standardized monitoring to evaluate the success and identify necessary improvements, is suitable to counteract species loss in the long term. Yet habitat conservation, restoration and appropriate management of habitats remains essential to counteract increasing fragmentation and other influencing factors.

Reintroduction benefits the species themselves and the right choice of target species supports entire communities which in turn helps provide valuable ecosystem services. The ongoing decline of biodiversity and the passing of the Nature Restoration Law should increase the need for further reintroduction measures in the future.

7 References

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