Monitoring floodplain succession on the created lower reaches of the New Traisen

Gregory Egger[1, 2, 3], *Isabell Becker*[1]

[1] *Department of Wetland Ecology, Karlsruhe Institute of Technology (KIT), Rastatt, Germany, email: gregory.egger@naturraumplanung.at*

[2] *Institute of Hydrobiology and Water Management, University of Natural Resources and Life Sciences, Vienna (BOKU), Austria*

[3] *Naturraumplanung Egger, Klagenfurt, Austria*

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Abstract

In the context of a LIFE+-project 'Habitat in the estuary section of the river Traisen', the artificial channel in the lower course of the river Traisen (Lower Austria) was replaced by a newly created, near-natural riverbed within a broad, lowered floodplain corridor. In the course of vegetation ecology monitoring, succession, and in particular, the development of woody plants and the impact of alien plants are documented. The created connectivity between the river and its floodplains and the successful regeneration of the native woody species, the restoration goal of creating a near-natural floodplain ecosystem can be considered successful.

Introduction

The Traisen has its origin in the northern Limestone Alps and flows into the Danube on the right bank at Traismauer, approx. 50 km west of Vienna. During the construction of the Altenwörth Danube hydropower plant in 1973, the lowest section of the Traisen was channelled into a 7.5 km long artificial canal past the impounded Danube and its mouth was relocated downstream of the hydropower plant. The area is part of the Natura 2000 site 'Tullnerfelder Donauauen European Nature Reserve'.

The restoration concept intended to replace the canal-like Traisen section with a new meandering river course ('New Traisen') within a lowered floodplain corridor up to 300 m width (*fig. 1 and 2*). The project was implemented between 2014 and 2017. It is one of the largest river restoration projects in Austria and was co-financed by the LIFE+-project 'Habitat in the estuary section of the river Traisen' (Egger et al. 2018). The LIFE+-project's objectives were the creation of near-natural water and floodplain biocoenoses and an increase in biodiversity as well as the establishment of softwood riparian forest (FFH habitat type 91E0*). In the context of an accompanying monitoring program, the development of the vegetation was documented regularly, starting with the completion of the first construction phase in 2014 until 2021 (Egger et al. 2022).

Figure 1. The sinuous course of the New Traisen within the newly lowered floodplain corridor. On the right is the straight former Traisen canal. In the background is the Danube with its surrounding floodplain forests (© Pock/VERBUND).

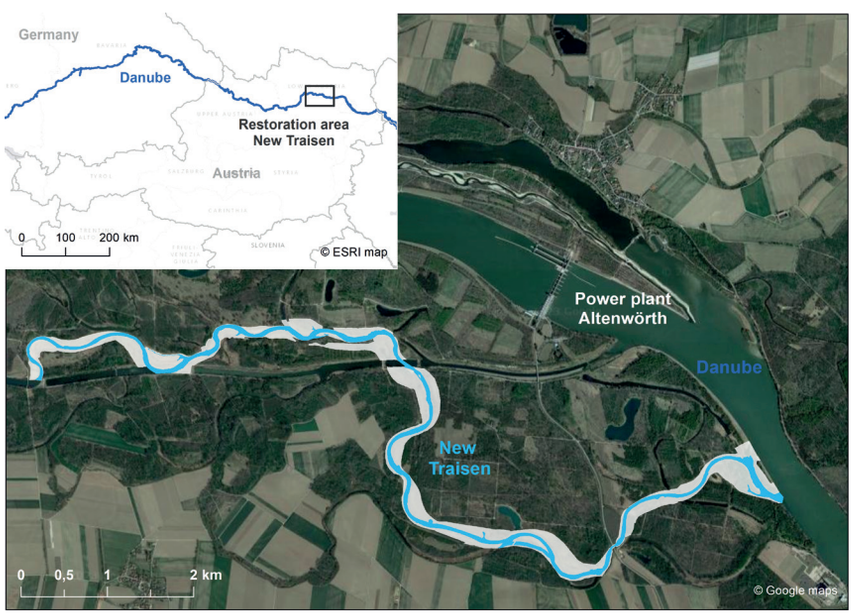

Figure 2. The newly created floodplain corridor (grey) and created river course (blue) in the LIFE+-project area in the lower section of the New Traisen.

Figure 3. Ruderal flora and young woody plants of black poplar and white willows in the lowered floodplain corridor one year after the restoration measure (© G. Egger).

Within just a few weeks, patchy pioneer vegetation and closed tall forbs, some with young willows (*Salix alba*) and poplars (*Populus nigra, P. canescens*), were able to establish on the freshly dredged areas. Floods were important for the rapid development, which led to sedimentation of silt and sand in the lowered corridor, creating optimal growth conditions with regard to water and nutrient balance. On the lowest bank areas in the wet to partially flooded areas, reed canary grass and rushes established while in the higher areas in the early years mainly tall herbaceous plants and sometimes ruderal vegetation as well as goldenrod stands prevail. The latter were able to spread increasingly over the years. In addition

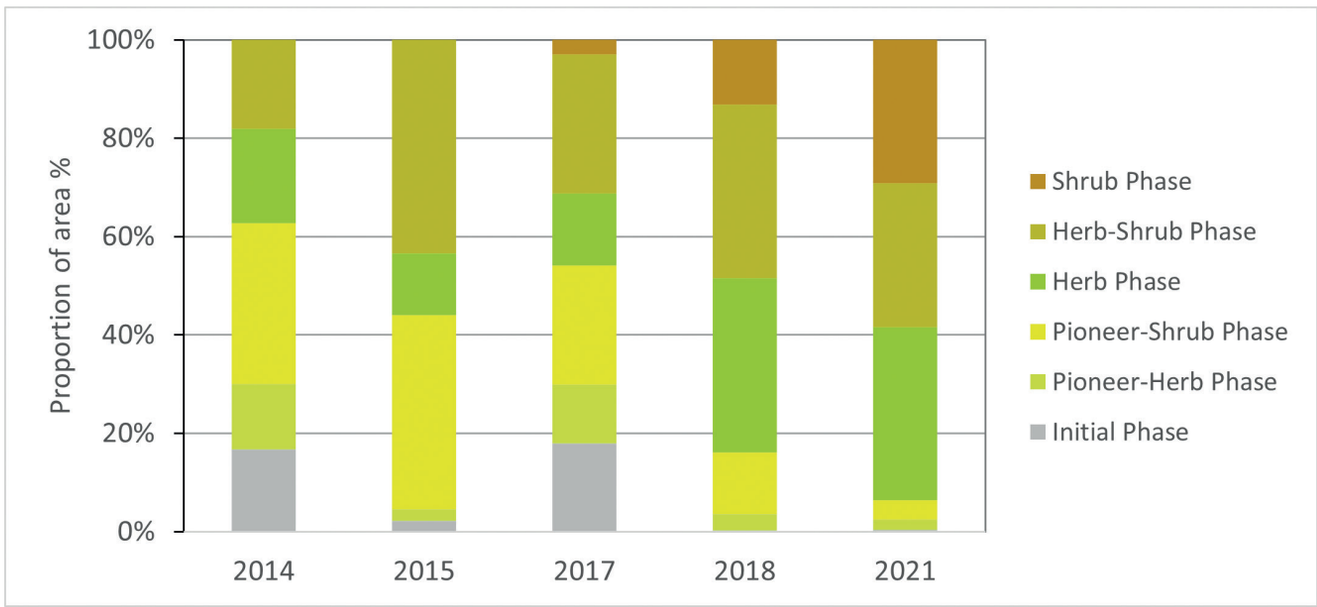

Figure 4. Area proportion of the succession phases in 2014, 2015, 2017, 2018, and 2021.

to herbaceous species, typical woody plants of softwood floodplains were also present from the outset. A closed shrub layer already formed on about 30 % by 2021. Mosaic stands of herbaceous plants and shrubs were able to establish on another 30 % (*fig. 4*).

In addition to favourable growth conditions, the low level of natural disturbance was responsible for this fast vegetation development. Floods hardly led to any destruction of the vegetation. Lateral erosion only occurred on the steep slopes of the New Traisen, resulting in small-scale sedimentation of gravel, sand and silt banks on the point bars. However, these were mostly quickly covered by vegetation again, so that in 2021 only 0.4 % of the total area was covered by an initial phase.

Development of the native woody plants of the softwood floodplain

On the young sites, it was mainly black poplar and to a lesser amount white willow that germinated. After a few years, grey poplar was also able to establish and spread vegetatively by root suckers. Average tree densities were very high in the first few years (up to 17 trees/m²). After the woody plants reached growth heights of 2 m to 3 m after three to four years, the density was reduced to approx. 0.3 to 2 trees/m² due to competition for light.

Impact of browsing on the number of woody plants

The impact of browsing by deer was investigated using fenced monitoring areas. These enclosures showed that browsing has a statistically significant impact on all woody plants in the area. It causes both a reduction in the number of individuals and a reduction in growth height by about fifty percent. However, analyses of time series revealed that in all cases browsing delays the development of woody plants but does not cause total failure.

Impact of the alien giant goldenrod on the development potential of FFH habitat type softwood riparian forests

By far the most relevant alien plant species in the project area is the giant goldenrod (*Solidago gigantea*). In the first few years, it only covered a small area in the pioneer vegetation and young herbaceous vegetation. This highly competitive species established itself preferentially on higher and drier sites and continuously formed denser stands here year after year. Vegetation types dominated by giant goldenrod cover more than a third of the study area in 2021.

The dominance of goldenrod stands was also investigated regarding the development potential of softwood floodplain forests (FFH habitat type 91E0*). In general, typical woody plants of the softwood floodplain such as poplar, willow and alder are able to establish, grow and develop within goldenrod stands. Thus, up to a goldenrod cover of 80 %, there is a clearly positive development of woody plants. A reduction in the average growth height and a reduction of density in 15 to 30 % of the areas could only be observed when the goldenrod covers 80 % or more. Regarding the positive net balance of woody plant development on almost all subplots, however, the impact of the giant goldenrod on the development of the softwood riparian forest is generally low in relation to the whole restoration area. Besides, further development and growth of the woody plants will inevitably reduce goldenrod cover.

Summary and outlook

The monitoring results show that the areas within the lowered floodplain corridor will develop into a mosaic of patchy to close softwood riparian forests of FFH habitat type 91E0* in about 10 to 15 years. Individual wood-free islands will remain in small areas such as the wet and frequently flooded areas near the banks covered by reed canary grass. In small areas, individual goldenrod tall herbaceous meadows may still survive in slightly higher locations. Therefore, we expect that the overarching objectives of the LIFE+-project such as the creation of natural and near-natural water and floodplain biocoenoses and an increase in biodiversity as well as the establishment of a softwood riparian forest (FFH habitat type 91E0*) will be achieved.

Due to the low natural disturbance influence, new, open pioneer areas are only created locally in small areas. The main reason is that the former Traisen canal still exists and that the water is partially diverted into this channel during floods starting at HQ1. The formation of young pioneer sites, which need the input of bedload material, is a requirement for the long-term establishment and preservation of a living floodplain. To increase the proportion of young successional areas and to prevent over-aging in the long term, an increase in natural river dynamics would be essential. Hydrodynamics must improve by discharging the entire flood into the New Traisen.

References

Egger G, Tritschler A, Preinstorfer S (2022): Monitoring of vegetation 2021: Preservation of evidence in accordance with the LIFE proposal and adaptation measures for vegetation including consolidation of previous monitoring results. Unpublished project report on behalf of VERBUND Hydro-Power GmbH, Naturraumplanung Egger, Klagenfurt, 243 p.

Egger G, Mayer K, Kreuzberger M, Aigner S (2018): Vegetation development in revitalized river landscapes using the example of the LIFE+ Traisen project [in German; Vegetationsentwicklung in revitalisierten Flusslandschaften am Beispiel des LIFE+-Traisen-Projekts]. Österreichische Wasser- und Abfallwirtschaft 70, 291-304

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