

# A Boost in Biodiversity through Dam-Building Activity of Beavers on the Swiss Plateau

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**Introduction and approach** This study aims to examine the role of beavers as ecosystem engineers in the context of Swiss waterways (specifically in the biogeographical region of the Swiss Plateau) with their thriving beaver population. The main objective is to gain insights into how beavers can be used in future to strengthen the ecological infrastructure in typical Swiss Plateau water bodies, especially small and medium-sized brooks. The approach aims to determine the effect in and possible legitimacy of the recurring “positive ecological disturbances” caused by dam-building activity introduced by beavers in a watercourse.

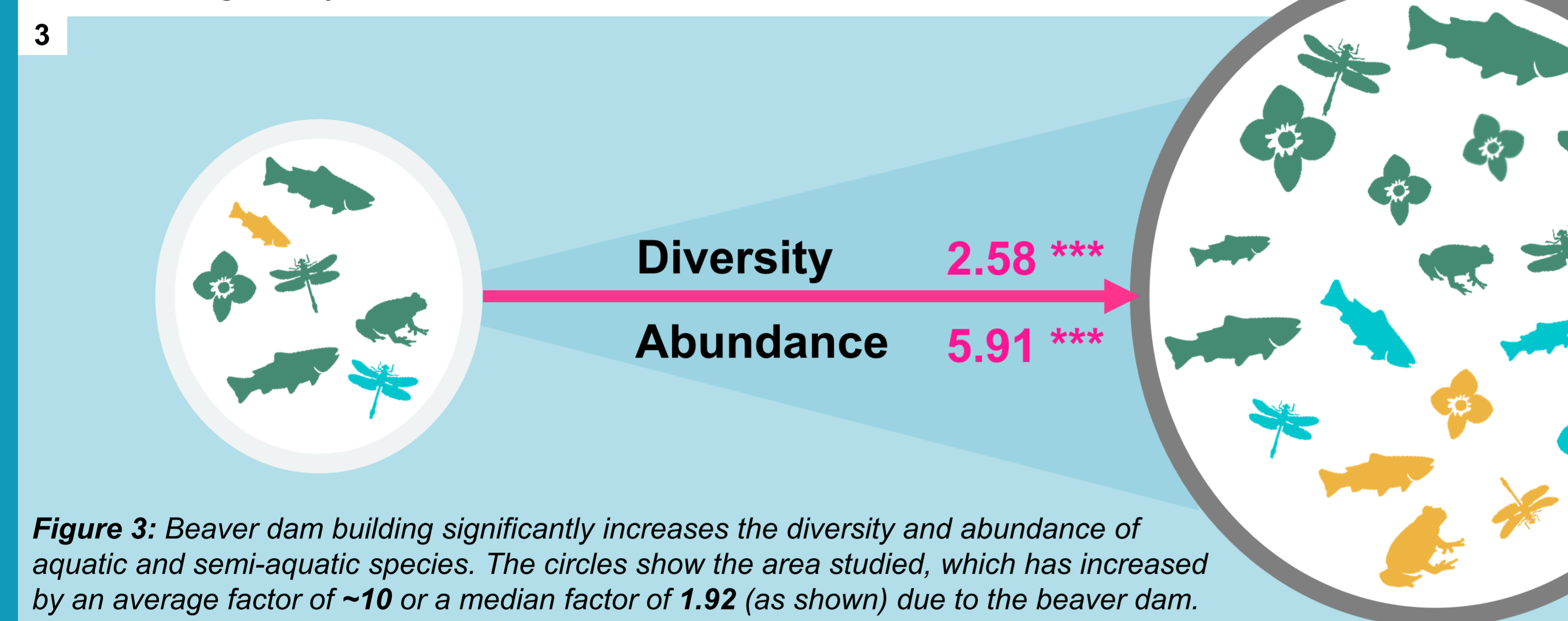
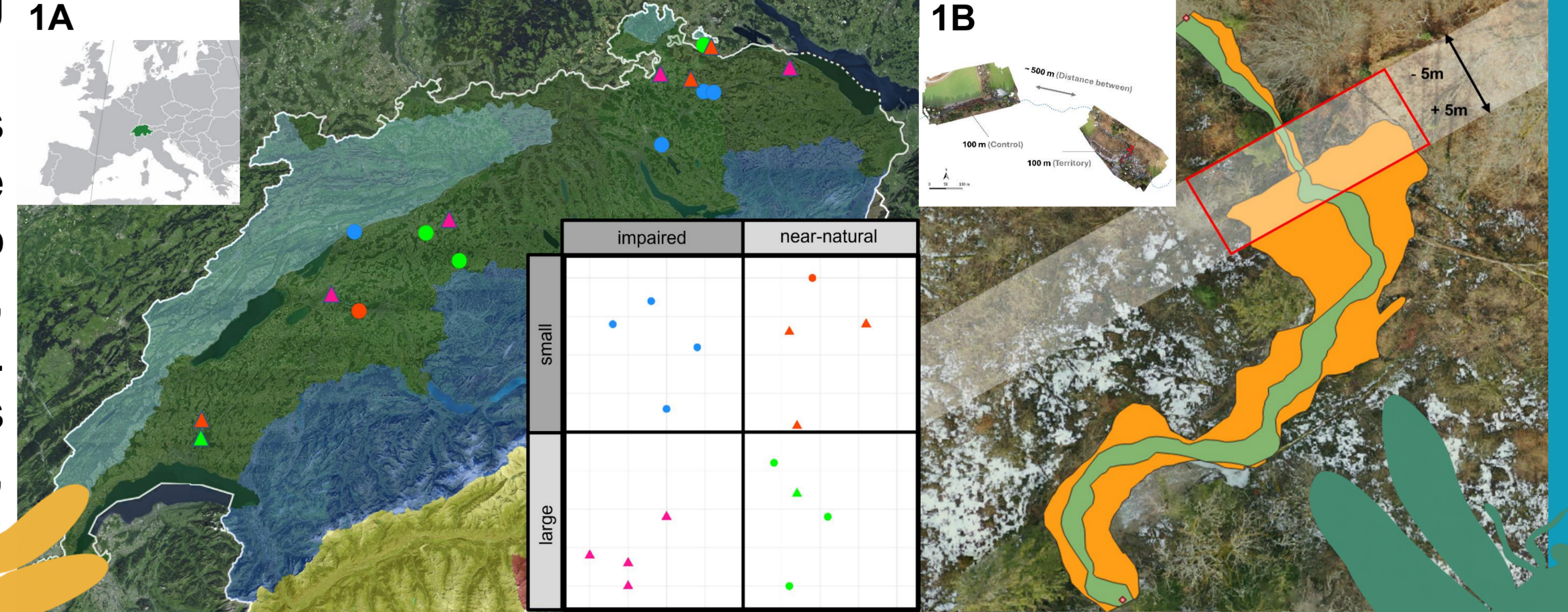
**Methods** The increase in diversity and abundance of aquatic and semi-aquatic species was investigated at 16 sites (with 32 sections) on the Swiss Plateau (Fig. 1A/B). The **SDPE-matrix** (Stream-Dam-Pool-Ecosystem, as a 4x4 potential-matrix) was used to classify different sites according to the parameters of beaver pond size (small vs. large), brook impairment (impaired vs. near-natural) and landscape (forest vs. open land; Fig. 1A). The biotic survey, conducted in 2021/22, was carried out by several specialists collecting data on macrophytes (semi-quantitative), dragonflies (quantitative), amphibians (quantitative, focusing on grass frogs) and fish (both quantitative and qualitative). In a subsequent meta-analysis, these species groups were analysed together. For the main analysis, we applied a generalised linear regression model (*glm.nb*) with a negative binomial distribution. No overdispersion was detected. The most suitable approach to analyse the data was an additional model that included perimeter (WITH vs. WITHOUT beaver dam activity), landscape and brook impairment as predictors. In addition, we examined how diversity and abundance changed where there was an active beaver dam (11 sites with dams vs. 5 sites without). We also analysed the extent of these changes in interaction with the **SDPE** potential matrix (4x4).

**Results** Across all sites, beaver dam construction boosted species diversity by a factor of **2.58** ( $p > 0.001^{***}$ ) and abundance by a factor of **5.91** ( $p > 0.001^{***}$ ) (Fig. 3). This effect increased when only sites WITH beaver dams were analysed, in which case species diversity rose by a factor of **3.11** ( $p > 0.001^{***}$ ) and abundance by **13.74** ( $p > 0.001^{***}$ ) (Fig. 4A). WITHOUT beaver dams, diversity remained significant ( $p < 0.05^*$ ), while abundance hardly changed ( $p = ns.$ ). The largest gains in species diversity occurred in impaired streams in open land and forest. In both, there was a major increase in diversity, especially in forested sites (by a factor of **6.48**) with large beaver ponds (pink group) (Fig. 4B).

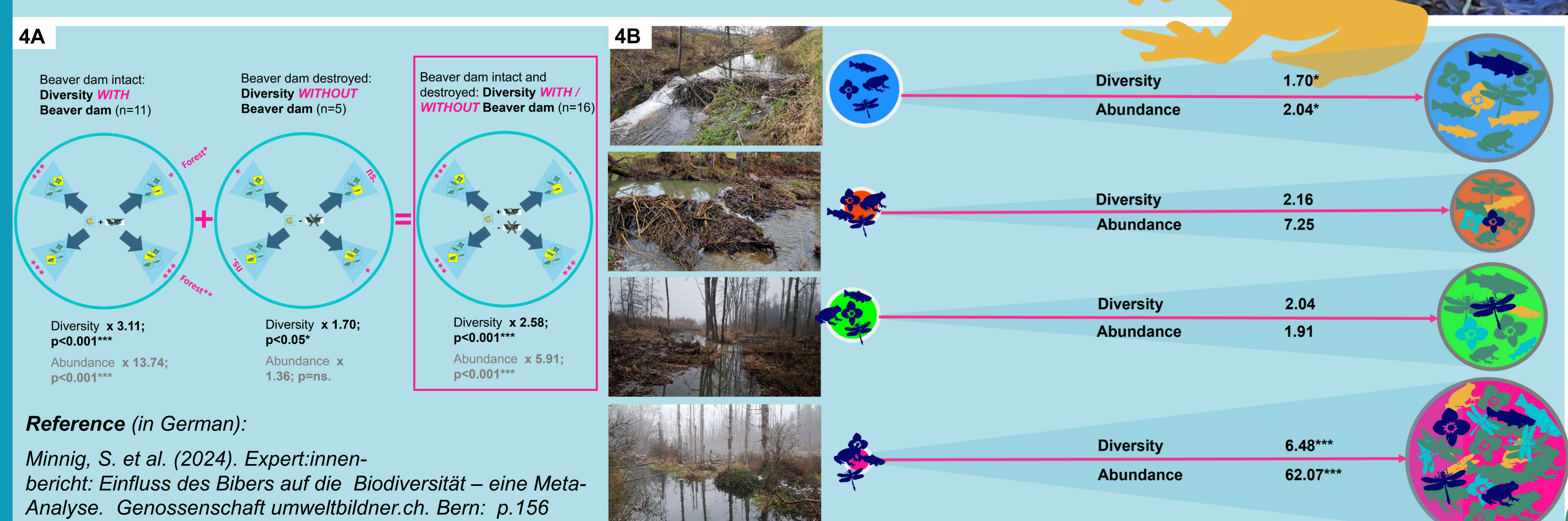
**Conclusion and take aways** Beaver dam construction activity in small to medium-sized streams on the Swiss Plateau plays a key role in expanding and supporting ecological infrastructure. Each dam studied helps increase species and habitat diversity and heterogeneity. It's time to work with beavers to revitalise our streams.

**Figure 1 A/B:** **A)** Four study sites were found for each of the four groups in the potential matrix (SDPE). Matrix groups A and D include sites in impaired sites while those in matrix groups B and C are in near-natural sections. **B)** Study perimeters per site, always 100 m WITH or WITHOUT beaver dam. The illustration focusses on the boundary between lotic and lentic. Circle = open land; triangle = forest; blue = matrix group A, orange = matrix group B, light green = matrix group C, pink = matrix group D; orange = Beaver pond WITH a functional dam; green = Beaver pond WITHOUT a functional dam

**Figure 2:** A beaver dam forms a boundary zone between flowing water (lotic) in a narrow stream bed and standing water (lentic) in a dammed beaver pond. Beaver ponds can be particularly large in flat terrain.



**Figure 3:** Beaver dam building significantly increases the diversity and abundance of aquatic and semi-aquatic species. The circles show the area studied, which has increased by an average factor of ~10 or a median factor of 1.92 (as shown) due to the beaver dam. **Figure 4 A/B:** **A)** Comparing the sites WITH and WITHOUT beaver dams, species diversity remains significantly higher in the sites with dams. In terms of species abundance, a slight increase was recorded in the group WITHOUT beaver dams, as the sampled area without beaver dams had become comparable to the control area. **B)** Analysis of the dataset in interaction with the matrix shows that diversity and abundance benefit most from beaver activity in the blue group (open land + impaired brooks) and the pink group (forest + impaired brooks).



**Reference (in German):**  
Minnig, S. et al. (2024). Expert:innenbericht: Einfluss des Bibers auf die Biodiversität – eine Meta-Analyse. Genossenschaft umweltbildner.ch. Bern: p.156