A boost in biodiversity through BDAs on the Swiss Plateau

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Introduction and Approach Artificial beaver dams, known as “beaver dam analogs (BDA)” were built for the first time in Switzerland in a large project along the Schlossbach stream (Fig. 1). With these simple measures, streams can be revitalized cost-effectively and efficiently by significantly enhancing aquatic areas and strongly promoting habitats with alternating moisture levels. This benefits a wide range of species such as fish, insects, macrophytes, amphibians, reptiles, birds, and bats. Consisting of rows of stakes and wickerwork, which is slightly sealed with stream substrate, the structures bring the stream water into the overbank area. Like their natural counterparts, they delay water runoff, increase infiltration, mitigate heavy rainfall, and make streams more resilient to climate change. BDAs can stop erosion in incised stream beds (***Fig. 3B***).

Material and Methods We have erected six BDA structures over a distance of 220 m. We collected the same data before and two years after the measurements. For the biogenetic approach, we focused on macrophytes (semi-quantitative), amphibians (quantitative for grass frogs), and fish (quantitative). In addition, we used a simple but effective method (Frech Fisch Microhabitat Index) to investigate the proportion of attractive substrates in the improved water space along the Schlossbach stream throughout the study area.

Results The construction of the BDA increased the water surface area by **600%** (***Fig. 2A***). Attractive substrates increased (up to **25%**), while less attractive substrates for fish decreased (up to **30%**; ***Fig 2A***). Across all measurement points, depth variability increased significantly, while flow variability decreased slightly (***Fig. 2B***). The number of fish increased by a **factor of 17** (***Fig. 2C*** and ***3A***), the number of macrophytes increased by **9 species** (Fig. ***3A/B***), and grass frog spawn could be counted for the **first time** (***Fig. 3A/B***).

Conclusion & Take Home Message Like natural beaver dams, BDAs also increase species diversity and abundance. The water surface area increases to the same extent, which enhances the sponge effect (***Fig. 1***). In times of climate adaptation, this is particularly important in agricultural areas. The revitalization method using BDAs is an effective and cost-efficient way to curb the decline of aquatic species in small and medium-sized streams. The sponge effect slows down the drying out of areas near the banks and raises the groundwater level.

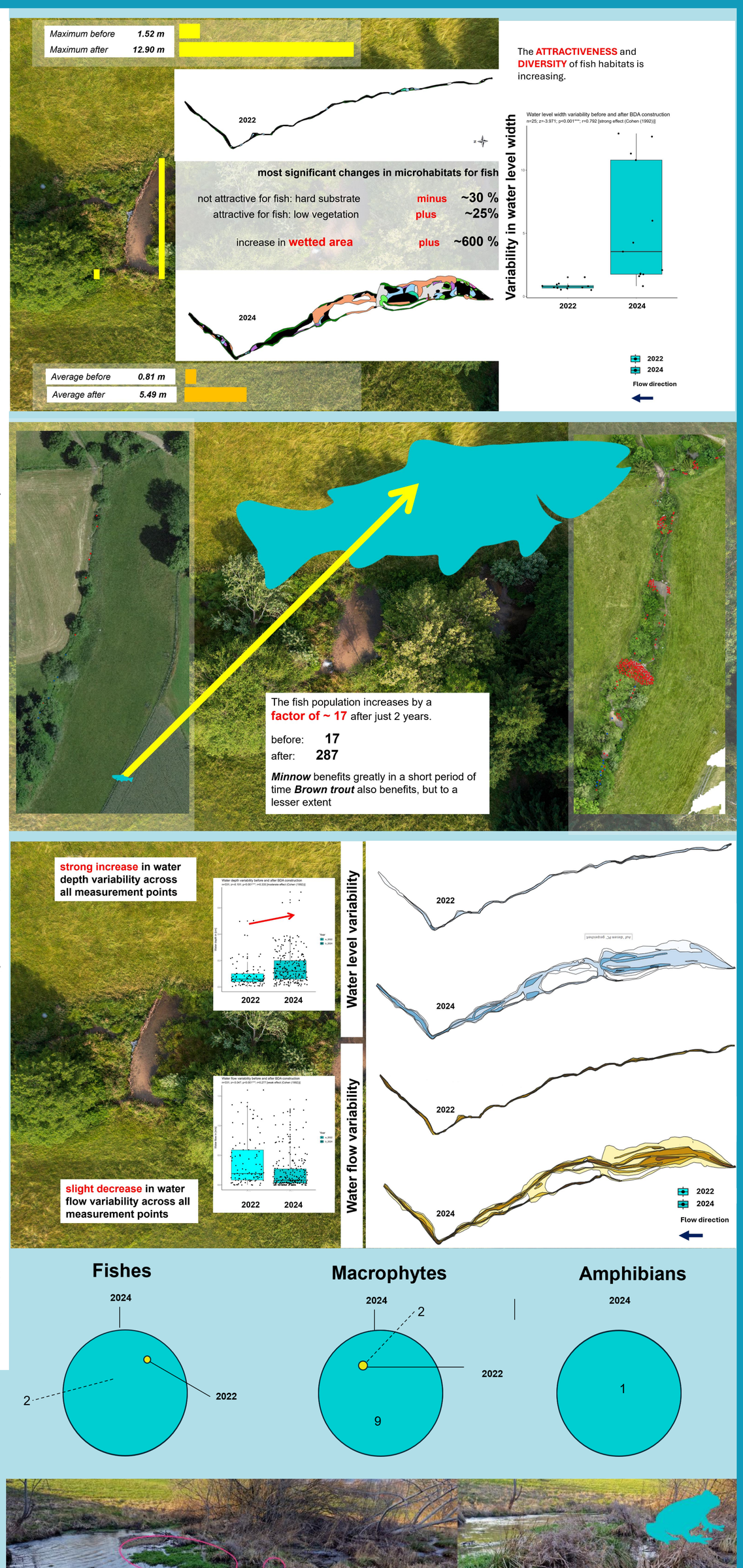

Figure 1: *Drone image of the BDA perimeter illustrates the sponge effect. The drone photo was taken in the summer of 2024, two years after the construction of the six BDA structures.*

Figure 2 A/B/C: A) *Maximum and average width of the stream before and after the construction of the BDAs. In addition, the attractiveness of the microhabitats for fish has increased enormously.* ***B)*** *The strong increase in depth and slight decrease in flow variability are shown here. Both factors further increase habitat heterogeneity and thus the niche space for many animal and plant species.* ***C)*** *Fish abundance increased by a factor of 17, from 17 fish (minnow and brown trout) before to 287 specimens after. The increase is particularly large in the new BDA ponds. ret points: minnow; blue points: brown trout*

Figure 3 A/B/C: A) *The BDAs had a strong effect on species diversity and abundance in all three species groups. In aquatic plants (an increase of 9 species from 2022 to 2024, from 2 to 11 species) and amphibians (only 1 species was found in the 2024 survey), diversity and abundance increased significantly, while in fish, abundance increased (with 2 species found in 2022 and 2024, namely minnow and brown trout). Blue = 2024 ONLY, green = AVERAGE for 2022 and 2024; circle size indicates abundance of species found, in relation to abundance in the recording year 2024.* ***B)*** *New macrophytes and Spawn from the grass frog in the created BDA-Pools.* ***C)*** *Siltation and various stages of succession BDA-6 2022 to 2024 (see **Fig. 1**).*

Reference: *Minnig, S.; Polli, T.; Werdenberg, N.; Egloff, N. & Vonlanthen, P. (2025). Expert:innenbericht: Beaver Dam Analogs (BDAs) – Monitoring Schlossbach 2022-2028 (Phase 1 2022 - 2024), Genossenschaft umweltbildner.ch, Bern, 39 S.*

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