

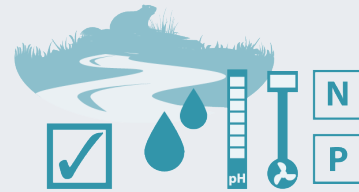


Water Quality

Objective: Improve chemical and physical water properties

Carpathian Mountains

status: no change observed



Problem: Unsustainable land use practices including logging in riparian areas have led to degraded riparian ecosystems. Beavers, a key ecosystem engineer, have also been absent from the landscape for two centuries. This has led to a reduction in [aquatic biodiversity](#) and a decline in the condition of aquatic ecosystems.

Action: Foundation Conservation Carpathia have reintroduced 62 beavers to the area. Beaver activity, including dam-building, is expected to improve habitat condition by retaining water in the landscape for longer and creating a greater range of heterogeneous aquatic and [riparian habitats](#). Pools created can trap sediment and pollutants, reduce bank erosion, and decrease flood risk.

Indicator: A improvement in physical and chemical measures of water quality following beaver reintroduction indicates the recovery of aquatic ecosystems in response to the ecosystem engineering activities of beavers.



A beaver being released. Photo: Calin Serban.

Methods

Within the area planned for beaver reintroduction, five river sections were selected for water quality sampling: Valea Vladului, Valea lui Coman, Valea Chilieii, Valea Bătrâna, and Valea Bălțatu. For all river sections except Valea Bălțatu, water quality parameters were sampled at two sites within the section, to cover the multiple sediment types present. Only one site was sampled at Valea Bălțatu, since sediment was relatively homogenous throughout the section. The same sections were used for [monitoring](#)

[macroinvertebrate communities.](#)

Samples were collected in June and November each year between November 2019 and June 2024. Sampling at one of the five river sections, Valea Bălțatu, started only in November 2021, while sampling at Bătrâna was paused between June 2021 and June 2023 due to the effects of flooding at the site. The baseline period, prior to beaver reintroduction, was between 2019 and 2021. Beaver reintroduction started in November 2021 and continued until April 2024, by which point 62 beavers had been successfully released: 19 individuals were released on the upper Dâmbovița Valley around Valea Vladului and Valea Bălțatu sampling sites; 21 individuals were released on the lower Dâmbovița Valley around Valea lui Coman and Valea Chilieș monitoring sites; 22 individuals were released on the upper Raul Targului Valley around Valea Bătrâna monitoring site. Reintroduced beavers showed very exploratory behaviour after release, making it difficult to predict where they would establish. Sites selected for baseline data collection were therefore not always the same sites where beavers subsequently established. Beaver activity was high around Valea Bătrâna and Valea Bălțatu, low around Valea Chilieș and Valea lui Coman, and absent around Valea Vladului (Fig. 1). However, monitoring at Valea Vladului was still informative as a comparative control for the sites where beavers did establish.

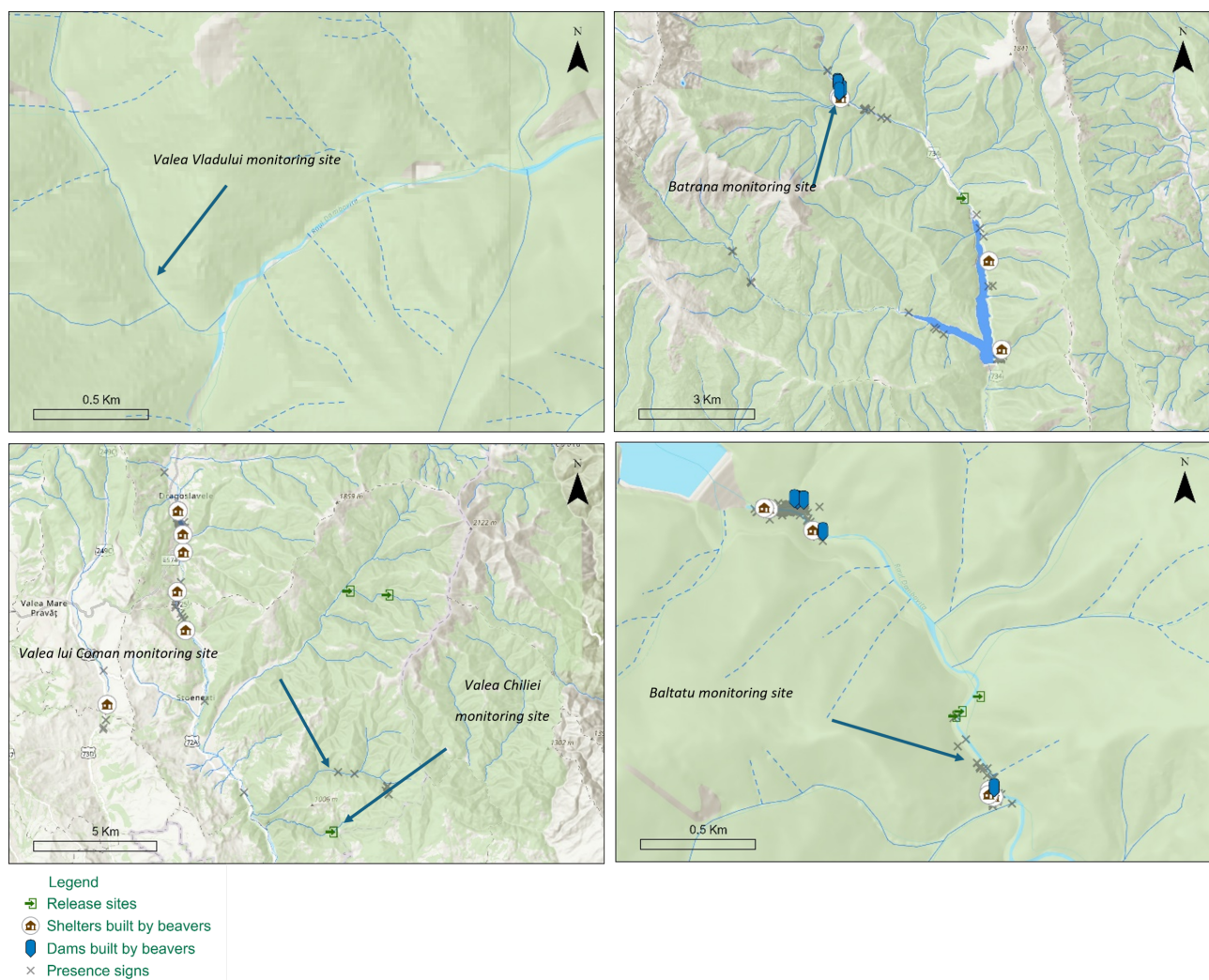


Figure 1: Location of monitoring sites relative to sites where beaver activity was recorded.

Two samples were taken at each sampling site: a water sample and a sediment sample. A multi-parameter probe was used to take in situ measurements of pH, temperature, conductivity and dissolved

oxygen. Both water and sediment samples were analysed in the lab at the Faculty of Biology, University of Bucharest for bio-available forms of nitrogen and phosphorus. Sediment samples were additionally analysed for % water content, pH, and organic matter content, while water samples were additionally analysed for suspended solids, total carbon, organic carbon and total organic carbon. Parameters for water sampling were chosen to align with the EU Water Framework Directive, so that sampling could contribute to classifying the status of waterbodies following the criteria set out by this Directive.

Due to the small number of sampling sites and the large variations in environmental conditions during the period, including record flooding in 2021 that reshaped much of the river morphology, the dataset was not analysed statistically. It can instead be considered as a baseline against which to compare future monitoring data to assess long-term change.



Different macrohabitat types in the Valea Bătrâna river. Photo: Foundation Conservation Carpathia.



Different macrohabitat types in the Valea Bătrâna river. Photo: Foundation Conservation Carpathia.

Results

Ammonium levels were very low across sites, and remained low from year to year (Fig. 1). With a single exception measured at Bălțatu in November 2023, all measurements were below 0.1 mg/L, significantly below the 0.4 mg/L threshold for 'very good' ecological status, the highest quality status under the Water Framework Directive.

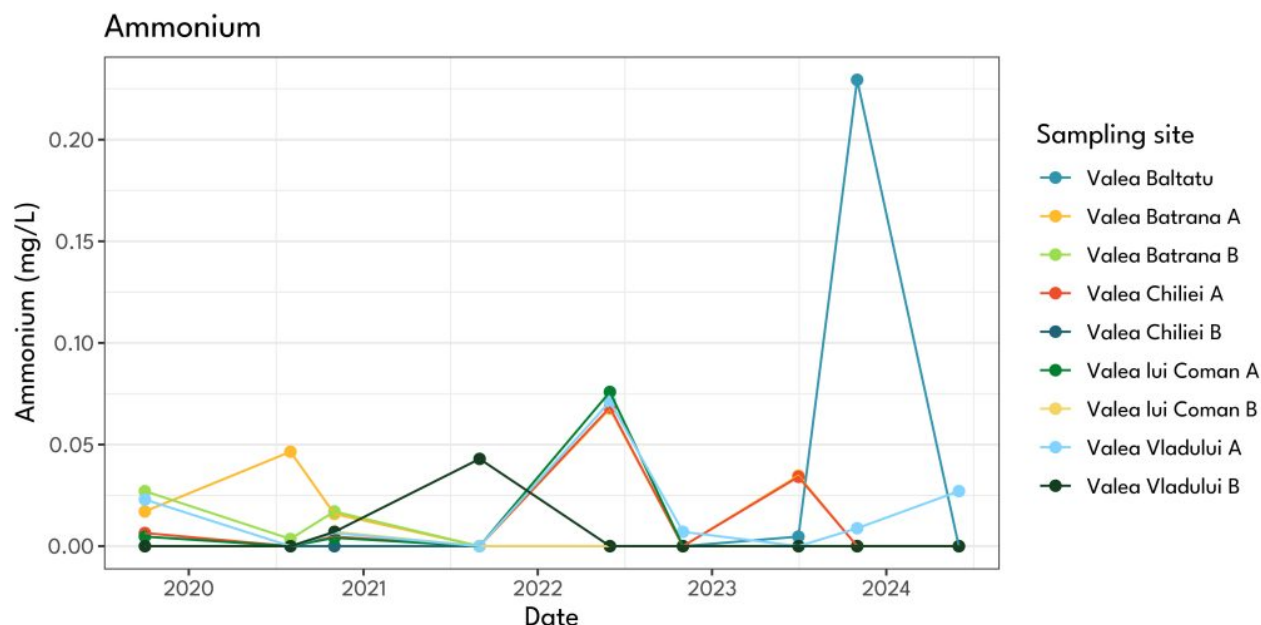


Figure 1: Concentration of ammonium (mg/L) at sampling sites between 2019 and 2024.

Similarly, values for nitrate were all below 1 mg/L, except for a single sample at Valea lui Coman in July 2023 (Fig. 2). 1 mg/L is the WFD ‘very good’ ecological status threshold for nitrate. Of the main three inorganic nitrogen species, nitrite was present in the lowest concentrations since it is an intermediate form between the previous two. Samples for this parameter were often below the detection limit of the method. Only one sample was above 0.4 mg/L – as for nitrate this was at Valea lui Coman in July 2023.

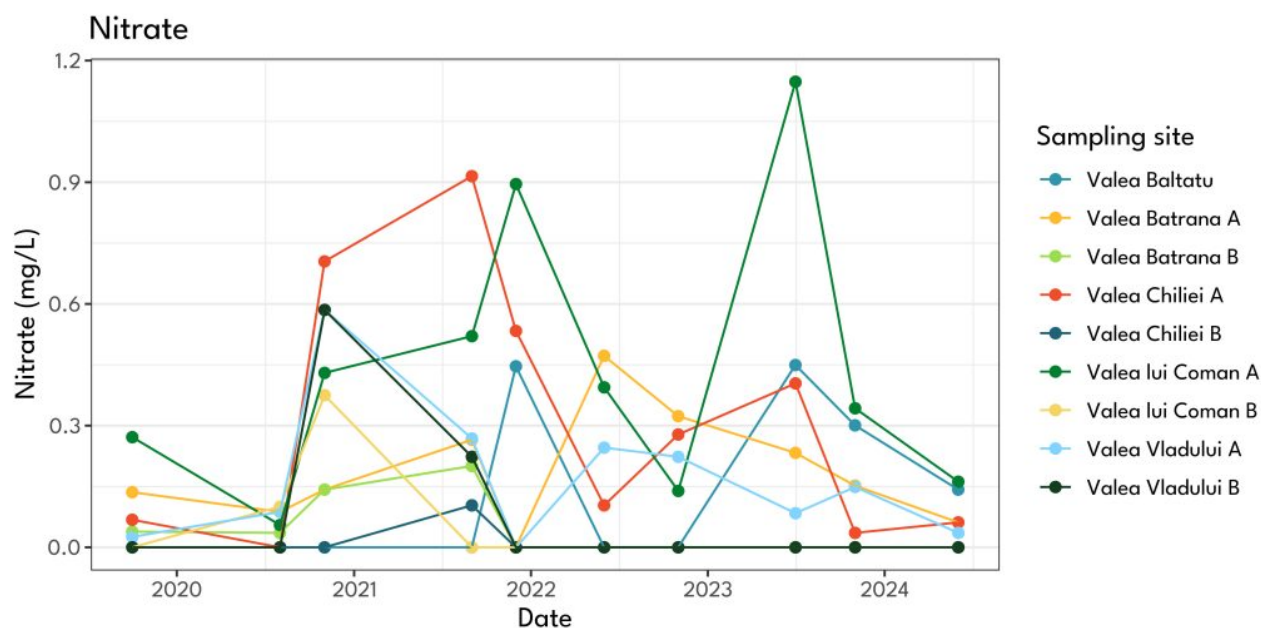


Figure 2: Concentration of nitrate (mg/L) at sampling sites between 2019 and 2024.

For phosphates, all but one values again fell below the WFD threshold of 1 mg/L for ‘very good’ ecological status (Fig. 3). The single value above this threshold was at Bălțatu in November 2023, but this had fallen to very low levels again by June 2024.

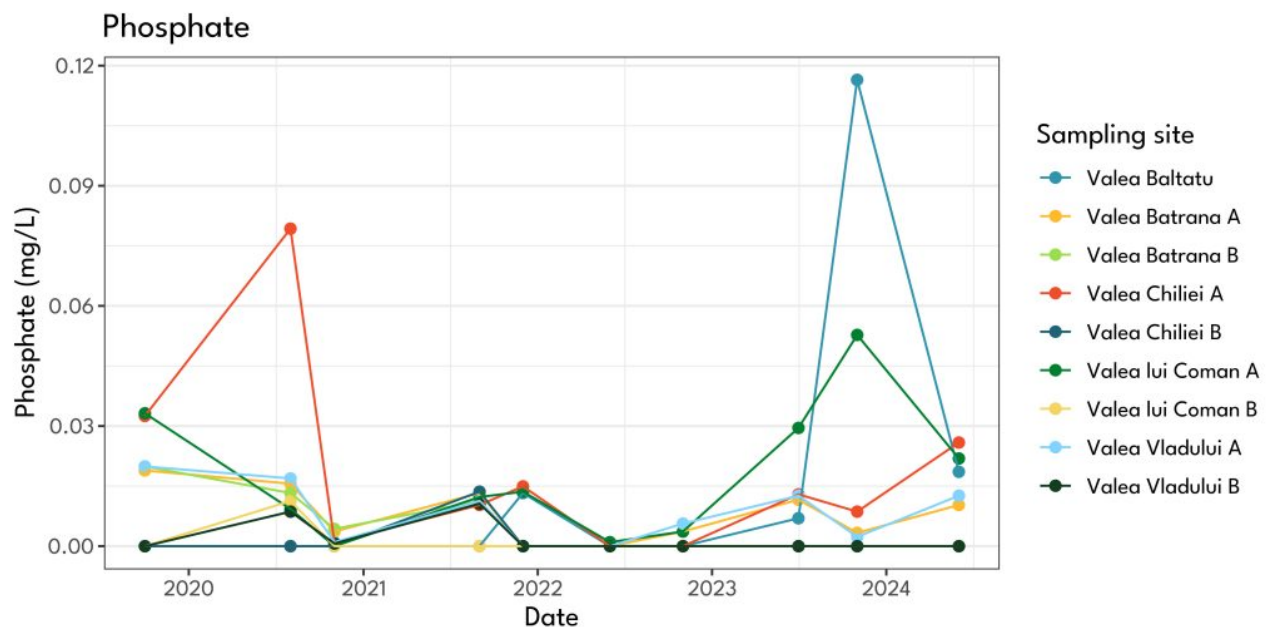


Figure 3: Concentration of phosphate (mg/L) at sampling sites between 2019 and 2024.

In sediment samples, there was some fluctuation in pH, but this was generally in the range between 5 and 6.5, slightly acidic, as expected in mountainous regions.

There was some fluctuation in organic matter content, particularly after periods of high runoff. However, organic matter content was relatively stable at a low level across sites and over time, rarely rising above 2%.

Interpretation

Water quality across sites and throughout the sampling period was generally very good, with the majority of sites meeting the criteria for 'very good' ecological status under the Water Framework Directive. The low values recorded for nitrogen species (ammonium and nitrate) and phosphates indicate that minimal organic pollution (from sources such as agriculture, fertilizers and wastewater discharge) was present. The higher values measured for nitrate compared to ammonium indicate that the oxygenation regime is good, which suggests good conditions for aquatic life. It is possible that the spike in nutrient levels (ammonium and phosphate) in Baltatu in November 2023 were caused by the arrival of beavers in this area, which occurred around the same time. However, this relationship could not be tested statistically. Further samples from June 2024 suggest that there was no long-term increase in nutrient levels and that overall water quality remained high.

Next steps

Monitoring will continue as the beavers establish. Beaver activity is already becoming more intense around Valea Bătrâna and Bălțatu. In future, monitoring is planned both upstream and downstream of

dams, to better understand the impacts of the dams on water quality.

Partners

