Longitudinal connectivity part of ecological river reconstructions actions

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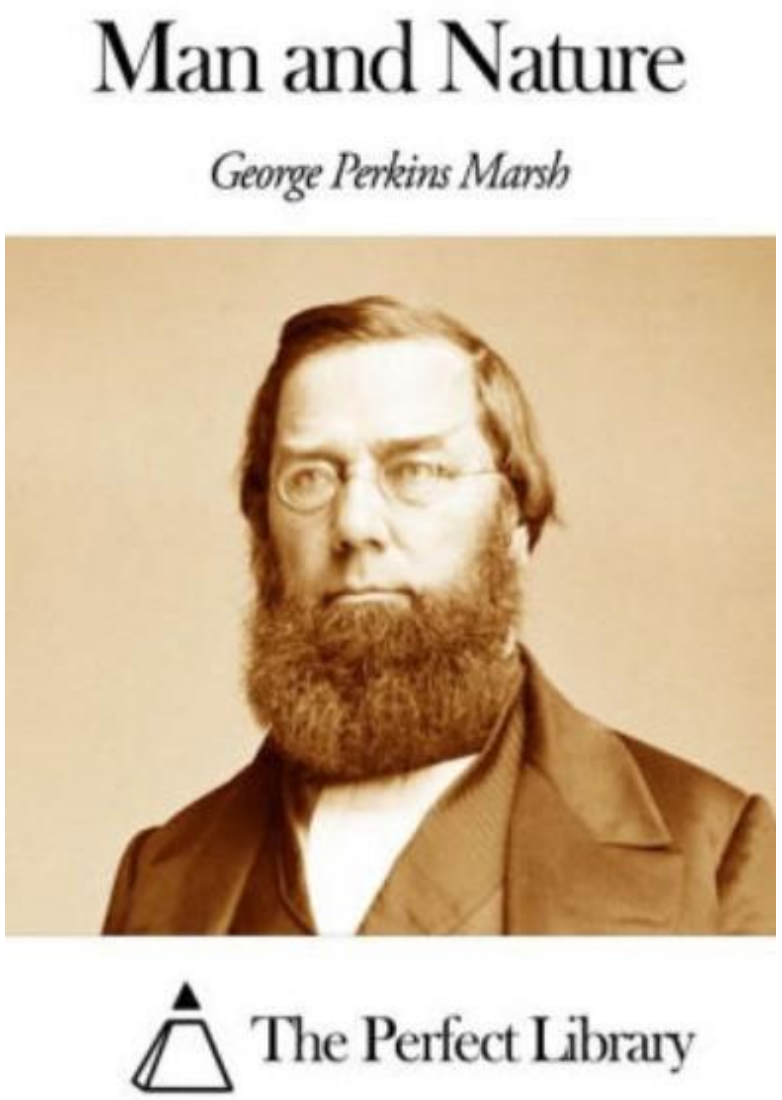
Connectivity and restoration

Connectivity describes the degree to which matter, energy and organisms can move between spatially defined units in a natural ecosystem (Turner and Gardner, 2015).

The circulation of matter and organisms is usually gradual, thus ensuring a flow with a certain continuity and intensity, which varies in time and space from completely connected to completely disconnected.

In the first edition of Man and Nature by George Marsh published in 1864, the concept of restoration was already considered. However, despite those early efforts, ecological restoration did not enter mainstream scientific thought until the 1980s.



Initially, the connectivity of rivers was approached from the perspective of ensuring the continuity of water flow (hydrological connectivity – continuity of water transfer, at the level of the water course, hydrographic basin, hyporheic zone and groundwater) and of alluvium (connectivity of the flow of alluvium – continuity of the transfer of alluvium between source areas for alluvium and those of accumulation within a watershed or along a watercourse, achieved by means of water - Fryirs, 2013) and very little from an ecological perspective (rivers are characterized by water-mediated connectivity, where the river in itself represents both habitat and migration corridor - Selinger and Zeiringer, 2018).

River connectivity can be described in four dimensions:

- Longitudinal – linear connectivity (upstream and downstream);
- Lateral – connectivity with the flood zone;vertical – connectivity with the hyporheic zone (under the river bed) and with the atmosphere;
- Temporal – seasonal,
- Perennial - intergenerational.

There are three levels of landscape connectivity:

(i) *integral connection*, when there is free movement between landscape units;

(ii) *partial connection*, when a discontinuity between units results in the obstruction of movement of water, sediment, dissolved substances or living organisms;

(iii) *a lack of connection*, when dikes (obstruct lateral connectivity), barriers (affect longitudinal connectivity) or bed elevations or dips - bottom thresholds - (influence vertical connectivity) (Fryirs et al., 2007).

These concepts present very interesting theoretical approaches, but present significant limitations when they end up being put into practice.

- the reluctance of the owners of such constructions (lack of the necessary technical information, the level of staff training in this field, the funds necessary for the implementation and maintenance of the passageways),

- the technical characteristics of the dam and the relief within the location (large upstream/downstream differences, mountainous areas with steep slopes, etc.)

- identification of the owners, their legal situation, the method of transfer of property (insolvent companies, etc.);- insufficient technical

-scientific foundations (lack of design staff in this field, insufficient scientific studies, adoption of project-type models, etc.).

Dam Paltinu, River Doftana

Water catchment, River Vâlsan

Anti-Erosion Bridge DJ102E Border, River Teleajen

Failed connectivity actions

Fish stairway Pietroșița

MHC Capra

MHC Viștea

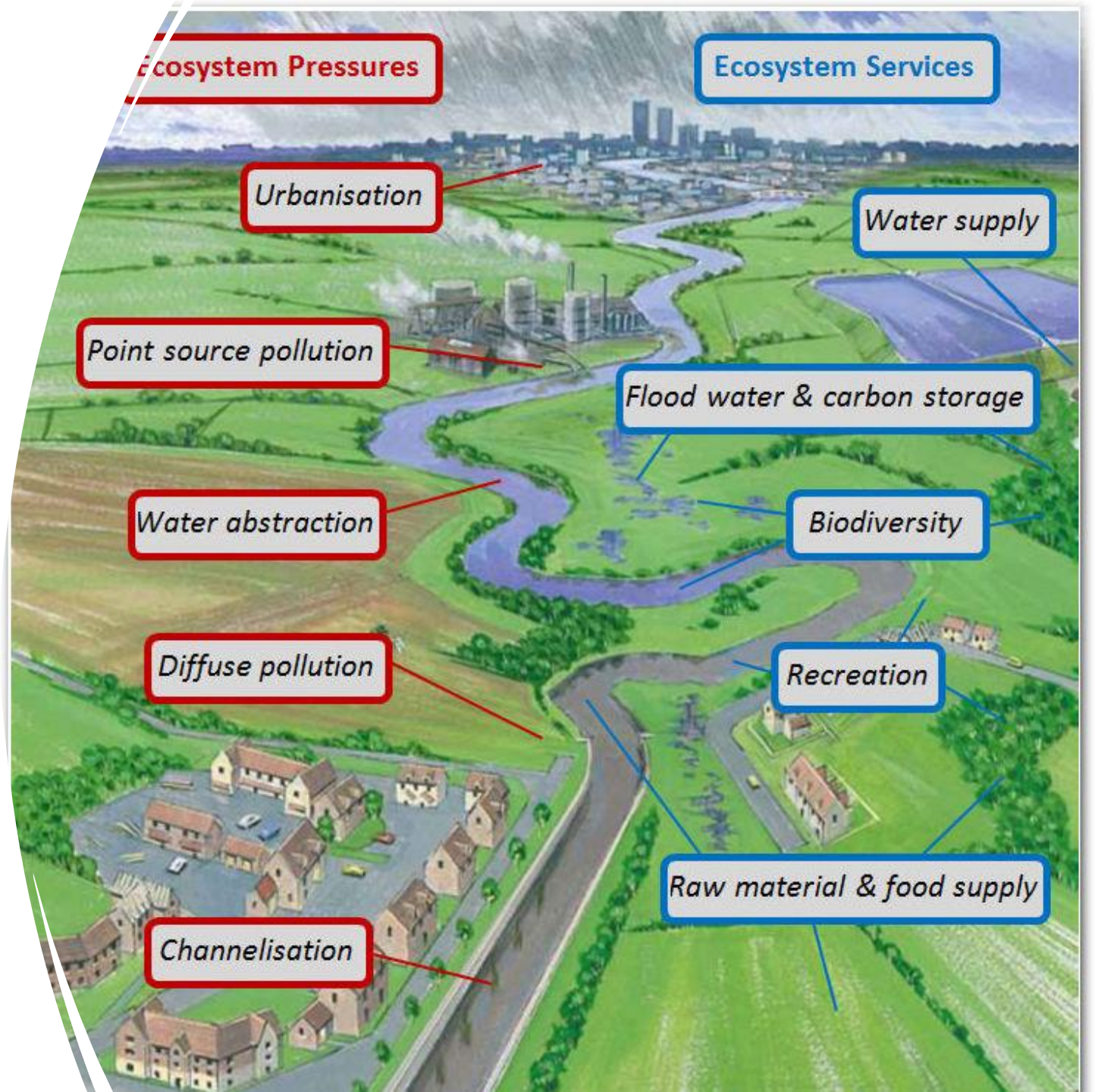
Cuntu

Correction of torrents in the watershed #Măieruș”, județul #Bacău, care are un buget de 3,38 milioane de lei, din care 2,78 milioane de lei din #PNRR.

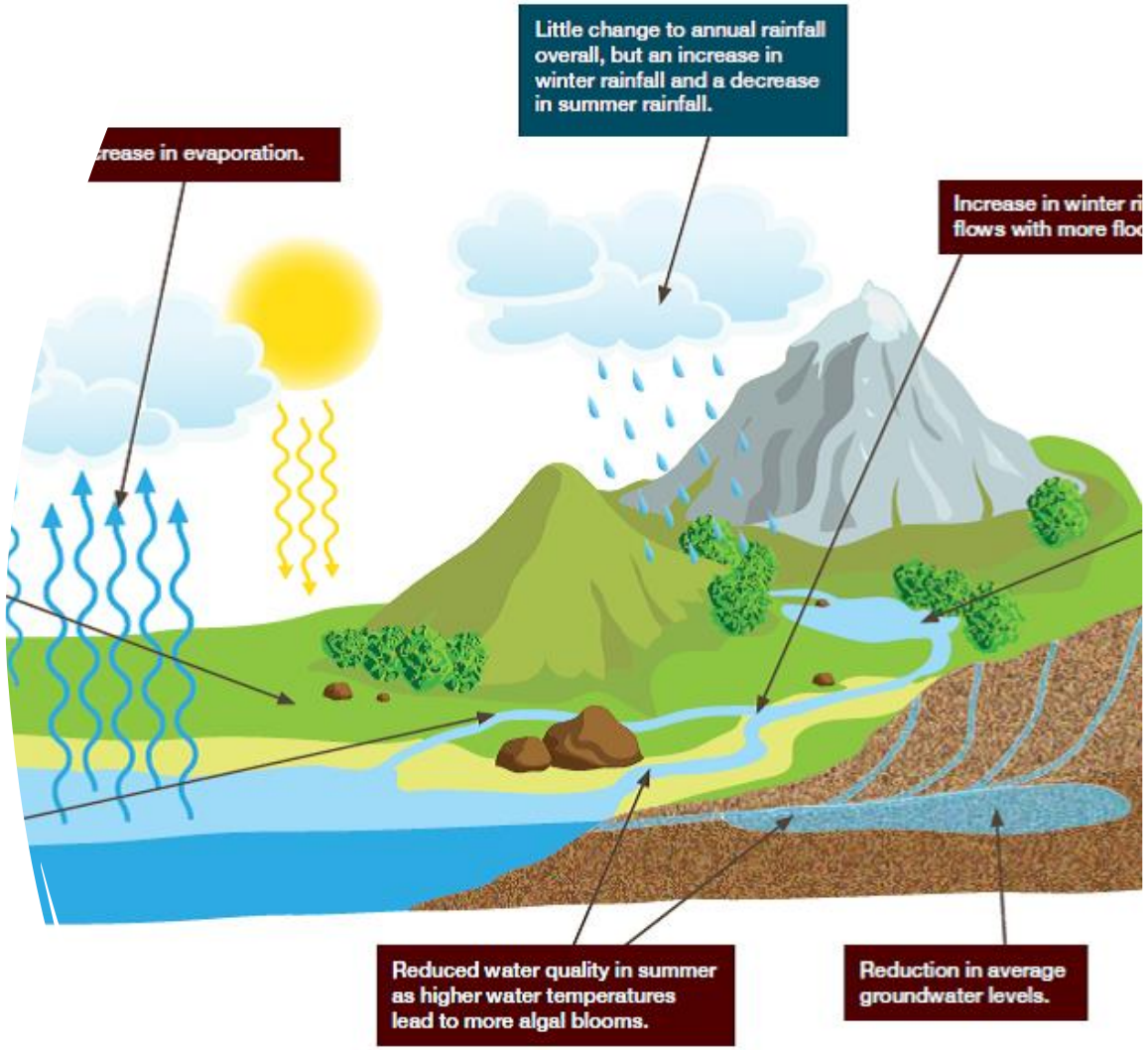
"The arrangement of torrential hydrographic basins is a very important action - reducing the risks generated by floods. The extreme phenomena of recent years have shown us that such investments are necessary, which are meant to protect people's lives and goods, economic objectives and even nature. The benefits of such investments are clear: stabilization of slopes and banks, mitigation of flood flows, retention and consolidation of alluvium, protection of downstream localities, defense of road and rail transport networks. At the same time, these works are carried out with care for nature, fish ladders will be installed at any threshold higher than 0.4 m in order not to prevent the migration of fish from the mountain waters", said Mircea Fechet

The investment provides for the consolidation of 910 m of torrential bed, the construction of 4 crossbars, 3 thresholds (1-1.5 m), 7 dams (3-4 m) and will retain a volume of 5597 m3.PIF 2023

The concept of river restoration has evolved rapidly and now encompasses not only classical ecological theory but also utilitarian concerns such as climate change preparedness and ecosystem service provision.



River restoration is an important measure to mitigate the effects of climate change. Heavily altered rivers are often less resilient and have lost their ability to retain water in both drought and flood.



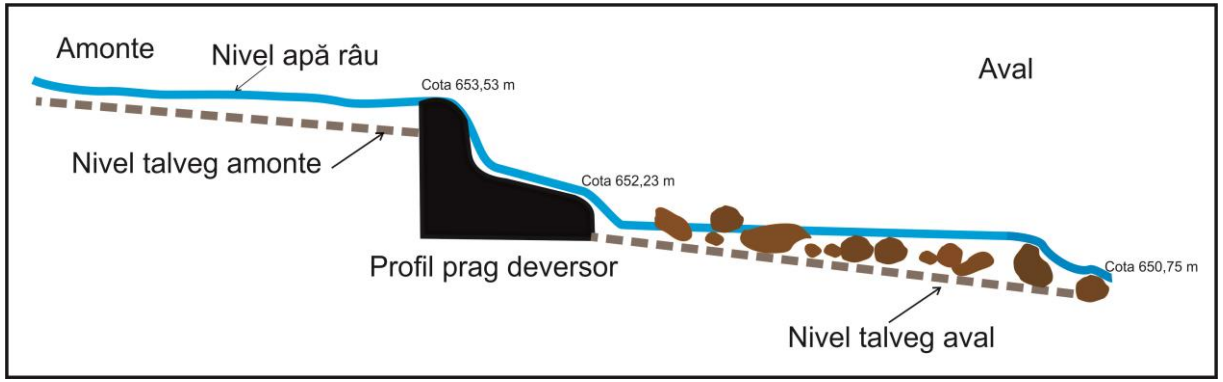
River restoration can be done at different scales and work with many different aspects (such as morphological, hydrological, biological, chemical and socio-economic). The improvement of the river environment initially began by addressing the problems of serious water pollution and the conservation of target species. But changing attitudes towards environmental management eventually led to more integrated river restoration schemes with multiple benefits. The most common measures within the restoration of rivers referred to:

- watershed management (elimination of point pollution, reduction of diffuse pollution);
- recreation of wetlands, storage of water from floods and subsequent feeding of the river in dry periods);
- abandoning the rectification of meanders, and insisting on restoring a morphological form of the bed and a more natural function in order to accelerate the restoration of the ecosystem;
- arranging heavily artificial riverbeds and sectors with areas to generate points of biodiversity (islands, green banks, etc.).

Restoring the Longitudinal Connectivity of the Vâlsan River, Brădetu Sector, by Total or Partial Removal of Four Concrete Thresholds Present in the Key Habitat of Romanichthys valsanicola – Asprete, the Rarest Freshwater Fish Species in Europe, Endemic and Critically Endangered

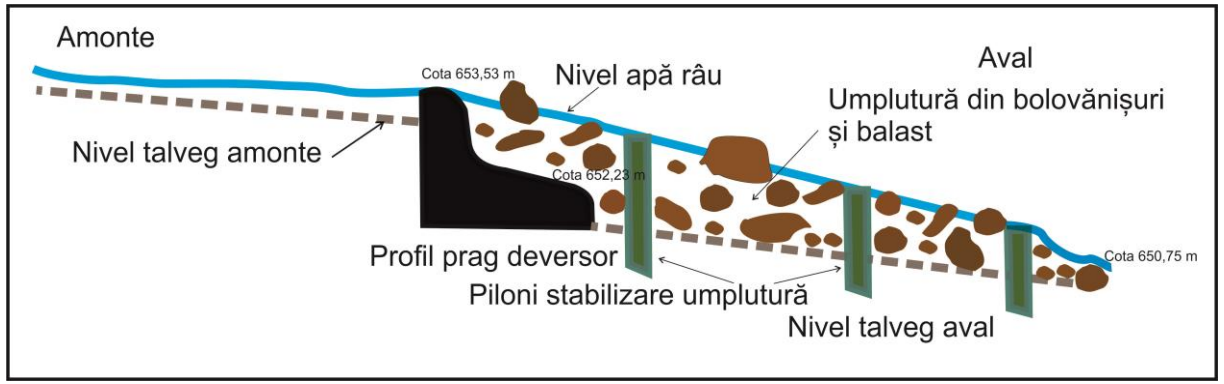
Projects in Implementation

Green Measures



Actual State

Proposed State



Conclusions

When restoring a river, it is important to address barriers to lateral connectivity, longitudinal connectivity, and vertical groundwater connectivity.

The focus of reconstruction efforts and the removal of barriers must be done initially on rivers with high renaturation potential.

The action of restoring rivers is a multidisciplinary task (ecologists, biologists, geomorphologists, hydrologists, hydrotechnicians but also from the field of social sciences).

Let's not forget that:

- Perfect fish scales do not exist!

- We do not have a perfect recipe for river restoration.

Thank you very much for your participation in such a debate!