Advantages and risks from recent beaver recolonization of the rivers in the Tatra Mountains foreland, southern Poland

Avantages et risques liés à la récente recolonisation par les castors des rivières de l'avant-pays des Tatras, dans le sud de la Pologne

Joanna Zawiejska, Dorota Chmielowska

Department of Physical Geography, Pedagogical University of Krakow
joanna.zawiejska@up.krakow.pl; dorota.chmielowska@up.krakow.pl

RÉSUMÉ

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Le castor (Castor fiber) est revenu dans les rivières des Carpates polonaises après la réintroduction de l'espèce dans les années 1980, mais les taux de recolonisation ont considérablement augmenté au cours de la dernière décennie. Cet article explore les modèles, les contrôles environnementaux et les effets de la récente recolonisation par le castor des cours d'eau morphologiquement variés du bassin d'Orawa-Nowy Targ, dans les Carpates polonaises. Ici, le succès de la recolonisation par le castor et l'ampleur des impacts dépendent largement du style de la rivière et de la présence ou de l'absence de conflits entre l'homme et le castor. Dans les grandes rivières, les effets sur la végétation riveraine sont prononcés alors que dans les petits cours d'eau, l'hydromorphologie et la végétation sont toutes deux affectées. Bien que la perception locale de la présence du castor soit tout au plus ambivalente, les effets à long terme de l'activité du castor semblent être bénéfiques pour l'état écologique des rivières de la région, tandis que l'activité non perturbée du castor peut en fait aider à la restauration des cours d'eau modifiés, ou contribuer à diminuer son coût global.

ABSTRACT

Beaver (Castor fiber) returned to the Polish Carpathian rivers after reintroduction of the species in 1980s, but rates of their recolonization significantly increased over the last decade. This paper explores the patterns, environmental controls and effects of recent beaver recolonization of the morphologically varied watercourses in the Orawa-Nowy Targ Basin, Polish Carpathians. Here, the success of beaver recolonization and the scale of the impacts largely depends on the river style and presence or lack of human-beaver conflicts. In large rivers, effects on riparian vegetation are pronounced while in smaller streams, both hydromorphology and vegetation are affected. Although local perception of beaver presence is at most ambivalent, the long-term effects of beaver activity seem to be beneficial for the ecological state of the rivers in the area while undisturbed beaver activity may in fact help restoration of modified watercourses, or contribute to decreasing its overall cost.

KEYWORDS

beaver impact, human-beaver conflict, mountain rivers, riparian forest, river restoration

1. INTRODUCTION

1.1.New kits on the block

After a few hundred years of absence, European beaver (Castor fiber) was reintroduced in Polish Carpathian Mountains in 1980s and have since started to systematically colonize Carpathian rivers. Since its start about 10-15 years ago, beaver recolonization of the Orawa-Nowy Targ Basin has progressed at unprecedented rates and the results of beaver activity are now pronounced across the basin. The basin seems particularly favourable for beaver as its unique combination of physiogeographic conditions (topography, geology and hydrology), diversity of river styles and land use provides ample space for colonization, especially along wide watercourses with young riparian forests and relatively little human presence. The study area also provides an opportunity to record beaver adaptation to changed environmental conditions and the effect of beaver as a new actor on this fluvial scene.

1.2 Study area

The Orawa-Nowy Targ Basin is located in southern Poland, in the foreland of the high-mountain Tatra Massif. The flat basin floor is covered with a succession of glaciofluvial–alluvial fan terraces formed by highly dynamic rivers draining the Tatra Mountains. Severe climate conditions and the occurrence of a poorly permeable layer of silty, loess-like deposits formed in the Pleistocene allowed the development of peatland on the basin floor with a network of low-gradient blackwater streams. Direct and indirect human impacts have led to substantial deforestation of the basin and transformation of its fluvial systems which now span a range of river styles from island- and bar-braided morphologies functioning in a semi-natural manner to regulated and incised, bedrock channels, and artificial drainage ditches. Except steep bedrock streams, all these fluvial environments have been colonized by beaver within the last decade. Unfavourable climate conditions and poor soils in the basin limit agricultural use and development. This, along with state ownership of riparian areas in the wide river sections reduces human-beaver conflicts and allows for relatively undisturbed functioning of beaver colonies. However, local environmental conditions affect the success and results of beaver colonization.

2. PATTERNS OF BEAVER RECOLONIZATION

2.1 Beavers in wide and dynamic sections of the largest rivers

In the bar- and island-braided river reaches beaver now occupy and transform wide riparian areas but their activity spans the entire river width. The dynamic nature of the main channels precludes persistence of beaver dams and gravelly substrate limits burrowing so dams and ponds are constructed on low-flow channels. However, frequent changes of the channel architecture and flow pattern often result in regular destruction of these structures and forces beavers to relocate. Nevertheless, beaver activity facilitates localized but substantial deposition of fine sediment on otherwise gravelly floodplain.

Typical conical lodges are very rare; bank lodges are constructed in blocked side-channels if they are relatively stable and withstand floods. Instead of building lodges, beaver tend to locate their burrows in outer banks of the riparian area – in higher terraces built of finer sediment.

Beavers make particular use of vegetated bars and islands as these offer distant but secluded forage areas and a source of construction material. Attempts to use large wood accumulations for construction of dams are frequently recorded but these structures are either destroyed fast by flow (in main channel) or abandoned when low-flow channels dry up after floods.

In riparian areas, beaver activity has been pronounced with substantial share of the riparian trees cut within a short period, effectively diminishing the canopy cover over the floodplain. Some of the felled trees seem to be used as “gardens” – as cutting leads to cultivation of young resprouting branches that are next consumed. During floods, large amounts of woody material cut by beavers is transported and incorporated in log jams.

2.1 Beavers in smaller and low-gradient streams

In relatively narrow channels underlain by loam deposits burrowing dominates. Beaver dams are frequent and relatively high, dramatically changing water levels and inundation of valley floors.

Comparative to initial stream width, beaver created ponds can be 50-100 times wider and substantially deeper; they also persist throughout the year, creating new aquatic habitats and possibly affecting physio-chemical properties of the stream water. This is particularly interesting in the case of peatland streams with very acidic initial water conditions. Similarly, the effect of beaver presence in some of the low-gradient and polluted streams located in the vicinity of villages may positively impact water quality. In meandering streams, erosion patterns are often impacted around dams. In less accessible sites, with limited human presence or interest, dam building activity is unrestricted and has led to reorganization of flow across the entire valley floor. As low-gradient streams run through the part of the basin that is significantly deforested, impacts on riparian vegetation are comparatively high, and may limit further beaver colonization in the future due to the depletion of food sources.

2.3 Beavers in modified streams and river reaches

Beaver colonization also progresses along river sections severely modified by engineering works. In the straightened, narrow and incised river reaches beaver colonized high floodplain areas and restructured floodplain vegetation by removing most of the artificially planted trees. Here, beavers were observed to commonly utilize man-made structures as foundation for dams and ponds, excavate numerous tunnels and slides connecting burrows in the high river banks and the main channel, and build mud dams across the floodplain, effectively constructing a new floodplain wetland. These ponds are also effectively colonized and used by other species (e.g. amphibian breeding habitat). While the effects on the floodplain are evident and dramatic, the effects on the river bank may in the future lead to major changes in the architecture of these modified reaches, if multiple tunnels and slides connecting the main channel with the floodplain decrease bank stability and resistance to erosion during floods. This could lead to improved lateral connectivity in the most human-modified reaches. Similarly, in small streams draining extensive peat bogs and previously transformed into narrow drainage ditches beaver colonization and unrestricted activity has led to complete restoration of the former pattern of these watercourses over a very short time.

3. CONCLUSIONS

Rapid beaver colonization of the various types of watercourses in the foreland of the Tatra Mountains provides a unique opportunity to observe adaptation of beaver to current environmental conditions and assess impacts of their presence. Impacts of beaver on hydromorphology seem to depend on river scale – from so far negligible in the wide, dynamic sections to profound in small streams. In all cases, beaver activity seems to increase the variability of habitats and possibly counteracts the negative impacts of human modification, such as incision and loss of lateral connectivity of watercourses. However, the environmental effects of considerable change to riparian vegetation due to beaver foraging and construction activity may vary and needs to be monitored.