Factors affecting composition of gravel bar vegetation in middle reach of a lowland river

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ABSTRACT

In this study, we investigated plant communities in relation to site-specific morphological properties and sediment structure on gravel bars along the middle Drava River in Slovenia. We sampled 143 plots of 5 × 5 m using species cover-abundance estimates. In addition, we considered the following habitat physical variables: elevation above the water line, texture of the substrate (silt, sand, gravel content) and bar age. Based on TWINSPLAN method, we distinguished four vegetation types: (G1) xerophilic and thermophilic ruderal stage; (G2) stage with sparse and herb-rich ruderal vegetation with species of semi-dry grasslands; (G3) initial vegetation stage of frequently disturbed mesotrophic and eutrophic sites and (G4) tall-willow stage. The most important factors determining a bar’s vegetation were elevation and gravel content. Our study shows that gravel bars of the middle Drava river system form a suitable habitats for species-rich plant communities. Their diversity is a function of high spatial heterogeneity coupled with the opposing forces of stress and disturbance.

INTRODUCTION

River ecosystems are increasingly recognized as playing a fundamental role in global ecosystem services (Zeng et al. 2015). These services include fresh water supply, harvestable resources, water and erosion regulation, self-purification, recreational enjoyment and spiritual fulfillment (Millennium Ecosystem Assessment 2005, Allan and Castillo 2007). Natural rivers and their floodplains are dynamic, as well as physically and biologically complex (Tockner et al. 2006). They are characterized by a set of fluvial styles, including straight, braided, wandering, and meandering channels (Richards et al. 2002). Owing to the high variability of features over space and time, rivers have the potential to support an varied biota and a range of environmental processes, such us flooding, channel platform instability, erosion and sedimentation, drought or waterlogging, energy flow and nutrient spiraling (Naiman and Décamps 1997, Gilvear and Willby 2006, Allan and Castillo 2007).

Bars are a characteristic component of many rivers (Gurnell and Petts 2002, Eremiášová and Skokanová 2014, Zeng et al. 2015), and can be defined as large bedforms resulting from sediment deposition, such as sand and gravel (Simons and Simons 1987). Many bars show considerable internal topographic, sedimentological and chronological variability, and their classification and evolution has been the subject of many geomorphological studies (e.g. Li et al. 2014, Ravazzolo et al. 2015, Wintenberger et al. 2015). According to their sediment composition, a major distinction is made between sand and gravel bars (Gilvear and Willby 2006).

Gravel bars are a typical feature of the braided gravel-bed rivers that were once widespread in temperate piedmont and mountain-valley areas (Tockner et al. 2006). Since these are transiently inundated at higher flows and subject to drying and wetting