Merging studies in allelopathy, phenology and community transfer to enhance community biotic resistance: plant engineering as a control method of invasive plants

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Abstract

Aquatic invasive plants are now identified as a main problem in many European rivers. Unfortunately, this phenomenon became particularly critical in floodplains where many restoration, conservation and ecological management programs aimed to set 'blue corridors' and create the ecological continuity required to restore biodiversity. Moreover, these zones are now often concerned by recent civil engineering works to recover more natural fluvial dynamics but that consequently create a large amount of bare soil surfaces highly favorable to the invasive colonization.
In order to avoid massive colonization of these floodplains by invasive plants, stakeholders should thus develop new ecological control methods of invasive plants. We here explore some control methods aiming to enhance biotic resistance of native communities and therefore prevent invasions.

We here present both experimental results exhibiting the. negative allelopathic effects of a local macrophyte species, *Potamogeton lucens* (and hybrids) on invasive species and some field study cases on the Upper Rhine Floodplain, using this allelopathic effect. Community biotic resistance was enhanced in theses study cases through several methods: (i) **Macrophytes transfer**; (ii) **Soil propagule bank transfert**, both methods as a way to enable a quick local species colonization and/or limit the invasions, through the settlement of biotic interactions (allelopathy, competition); and (iii) a **temporary disconnection** to connect restored sites with potential invasive plants' sources when these plants invasiveness is lower due to their **phenology**. Several restoration types were studied: creation of shallow water zones in a former gravel pit and channels recreation within the Rhine floodplain.

Our results suggest that the transfer of a local macrophyte species (or one of these hybrids) that may develop negative allelopathic effects on invasive species together with a timing of restoration in accordance with the species (local and invasive) phenology could efficiently be used as control method of the invasive *Elodea nuttallii*.

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