Effects of the Water-Sediment Regulation Scheme (WSRS) on the expansion of *Spartina alterniflora* at the Yellow River Estuary, China

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In recent decades, the invasion of saltmarsh plant *Spartina alterniflora* (S. alterniflora) over a large part of coastal wetlands in China, including the Yellow River Estuary (YRE) as a regional economic hub and global ecosystem services hotspot, has caused increasing concern because of its serious threats to native ecosystems. During the same period, local authorities have implemented a Water-Sediment Regulation Scheme (WSRS) in the Yellow River for flood mitigation and delta restoration purposes. The altered hydrological regime has resulted in unintended changes to estuarine ecosystem. However, the direct consequence of the WSRS on the expansion of S. alterniflora remains unclear. In this study, quantitative relationship between the inter- and intra-annual expansion patterns of S. alterniflora represented by relevant landscape metrics and indicators that quantify the concurrent variations of river and sediment discharges as the proxy of the WSRS impacts were analysed over the period of Year 2011 to 2018, and the analyses were performed on the YRE as a whole and on five different zones subdivided based on the invasion sequence. The results showed that there was no significant difference in the inter-annual area variation of S. alterniflora between the years with and without WSRS. Compared with the years without WSRS (2016-2017), the intra-annual (monthly) increment of the various landscape metrics (i.e. NP (number of patches), CA (class area), LPI (largest patch index) and AI (aggregation index)) were found to be significantly higher in the initial stage of peak growing season (June-July) than in the mid- and late stages (July-September) in the years with WSRS (2011-2015, 2018) in the subregion located close to the south bank of YRE as the most prominent impact zone. In addition, F (mean flow), FF (number of high flow pulses), Tf (Julian date of maximum flow) and D (duration of WSRS) were identified as the explanatory variables for the intra-annual vegetation landscape pattern changes, and their relative contributions to resultant changes were also assessed. Our results broaden the understanding of estuarine hydrological disturbance as a potential driver regulating the saltmarsh vegetation, and also have implications for S. alterniflora invasion control at estuaries under changing environment.