Seeking functional plant traits in 3 Dutch floodplains

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Introduction

Contrasting the cyclic rejuvenation of riparian vegetation of natural flowing rivers, vegetation in floodplains of the Dutch regulated rivers may mature to its climax successional stage. This stage yields high hydraulic roughness and low water storage capacity and hence, jeopardizes water safety during high water discharges. However, such situations are averted by for example clearing floodplain trees, floodplain excavation and grazing (Geerling, 2008).

Unfortunately, the efficiency of those active-ties lacks clear understanding. Moreover, other valuable ecosystem services of floodplains, like biodiversity, carbon sequestration and water purification, are often overlooked (Tockner and Stanford, 2002). So, gaining insight in steering processes of floodplain vegetation develop-ment may therefore support both efficient and holistic floodplain management.

By using the concept of functional plant traits, knowledge on the steering processes of Dutch floodplain vegetation may be widened. This trait-based approach presumes that the processes shaping distinct vegetation patterns can be linked directly to plant strategies (Shipley et al., 2016). An example of a steering process in Dutch floodplains is the presence of plant species that defend themselves against grazing by having spines or being toxic.

To unravel links between plant traits and steering processes, my research contains both field and modelling work. Here the first results of the fieldwork are presented. The aim of the fieldwork is to investigate whether the theoretical statements about linking traits and steering processes is applicable to Dutch floodplains and if so, use the retrieved data to fuel the modelling work.

Method

The fieldwork was undertaken in 30 plots of 1 m^2 that were located in 3 Dutch floodplains: Duursche Waarden (IJssel), Erlecomse Waard and Millingerwaard (both Waal). None of those plots contained full-grown trees. For each of those plots, (proxies of) environmental conditions were measured, like soil moisture, substrate and nutrient availability. For the plant traits, the plots were mapped in July 2016 using the Braun-Blanquet method (Braun-Blanquet, 1932, 1964). By using the TURBOVEG software (Hennekens and Schaminée, 2001), species-specific traits, like life span, growth form, seed morphology, flowering time were obtained. The percentage coverage, inherent to the Braun-Blanquet method, was used to construct 3 species classes: dominant (D), medium (M) and sparse (S). For the dominant species, specific leaf area and C, N and P leaf content were measured additionally. In addition, the Ellenberg indicators of the mapped vegetation were also obtained from TURBOVEG to add extra knowledge to the constructed database.

Firstly, some simple analyses were performed on the collected data to test whether there are differences between the 30 plots in terms of environmental conditions and plant traits. Currently, the more advanced statistics of the RLQ and fourth corner method (Dray et al., 2014) are applied to the data to assess how (groups of) traits are linked to (groups of) environmental conditions.

Results

The Ellenberg indicators revealed differences in environmental conditions between the plots, especially for soil moisture (see Fig. 1) and soil fertility and to a lesser extent for soil pH and light climate. Those indicators are based on a large amount of empirical findings that relate species community composition to environmental conditions. Therefore it can be assumed that variation in Ellenberg indicators means that the chosen plot locations do reflect variation in dominant steering processes and hence different functional trait compositions.

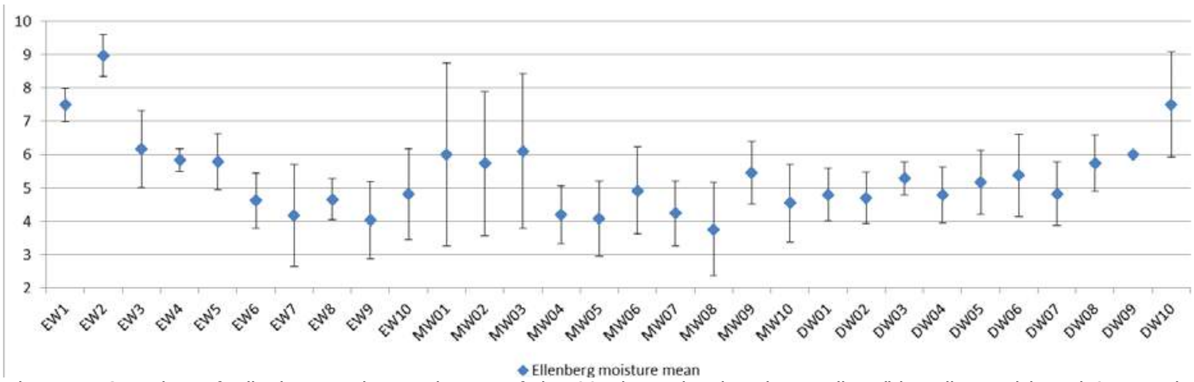

Figure 1: Overview of Ellenberg moisture classes of the 30 plots, showing the median (blue diamonds) and 2x standard deviation as error bars. Classes (y-axis) are indicators of: 2 = extreme drought, 3 = drought, 4 = drought and drought/moist, 5 = drought/moist, 6 = drought/moist and moist, 7 = moist, 8 = moist/wet, 9 = wet and 10 = water species. On the x-axis are the plots, where EW stands for Erlecomse waard, MW for Millingerwaard and DW for Duursche waarden.

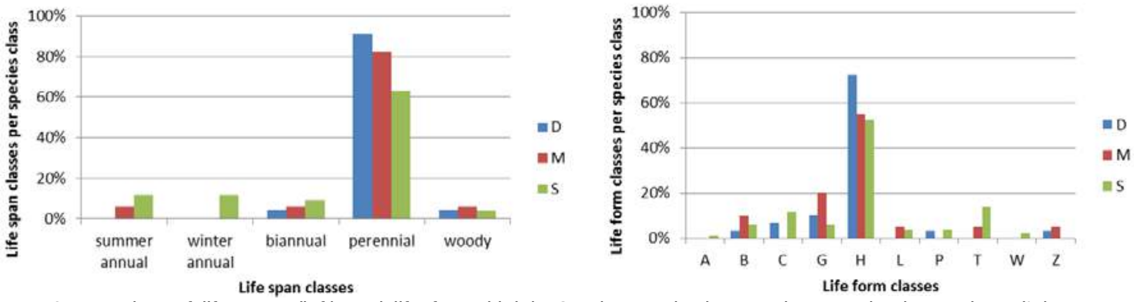

Figure 2: overview of life span (left) and life form (right). On the y-axis the species per dominant class (%). D, M and S represent the dominant classes. The classes in the right figure are: A = hydrophyte, B= helophyte, C=chameaphyte (herbaceous), G = geophyte, H = hemicryptophyte, L = liana, P = phanerphyte, T = therophyte, W = half parasite and Z = chameaphyte (woody).

Most of the mapped species are perennial. The exceptions that occur are mainly the less dominant species (Fig. 2, left). Moreover, being a perennial means that reserves need to be stored and this is mostly done around or below ground level (class G and H respectively, Fig. 2, right). Some other life forms do exist as well, but those appear, again, by the less dominant species.

Discussion and Conclusion

As most of the mapped species, especially the dominant ones, are perennial *and* have their remaining plant parts in winter around (mostly) or below ground level, one can conclude that no strong mechanical riverine processes (e.g. erosion and sedimentation) are steering the floodplain vegetation.

Furthermore, having reserves stored means that those plant species can kick-start their growth when the growing season starts. This indicates that biological processes, like the struggle for light, play important roles in shaping the observed vegetation patterns.

The planned data analyses are likely to disentangle traits and environmental conditions into more detail. This furthers the understan-ding of the dominant steering processes and the needed traits to handle those processes.

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