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# The role of in-stream vegetation as 'disturbance mitigators' in a Mediterranean-climate stream

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Fluctuating discharge (floods and droughts) is considered a major ecological disturbance and a source of temporal and spatial variation in many fluvial ecosystems. Community recovery after a disturbance event ('resilience') depends on its features (e.g. magnitude, duration, predictability) and adaptations of the community to the disturbace ('resistance'). The use of refugia (e.g. low shear stress areas during spates) is one of the mechanisms of the latter. Ecosystem engineers (EE) are organisms that cause structurally mediated changes in the abiotic environment, thereby, modulating community structure. Little is known on the interaction between ecosystem modulation by EE and environmental disturbances. The goal of this study was to assess the magnitude of effect of an ecological disturbance (floods and droughts) on community attributes (macroinvertebrates) in the presence of an EE (macrophyte patches). We suggest that in small agricultural streams, where boulders and wood debris are scarce or absent, patches of in-stream vegetation may be exploited as refugia by benthic macroinvertebrates during spates and near drying conditions. We assumed 4 possible effects of EE on community responses to a hydrological disturbance: 1) 'amelioration', 2) 'aggravation', 3) 'overturning' and 4) 'no-effect'.

For testing this hypothesis we analyzed the response of macroinvertebrate community in a small Mediterranean-climate stream (MCS) to seasonally predictable disturbance (stream discharge) in an un-vegetated patch (P1) and in both un-vegetated and vegetated patches (P1+P2). We found that whereas family richness and total density in the un-vegetated patch presented an "optimum" response to discharge ($R^2>0.65$, $p<0.05$), in the presence of vegetation patches this response was indistinctive ($R^2<0.25$, $p>0.05$; i.e. 'amelioration' effect). In contrast, the density of five families which were present in the stream the year round responded differently to fluctuating discharge: whereas in the presence of vegetation the density of Baetidae and Chironomidae larvae showed an 'amelioration' response (no significant decline with discharge), that of Caenidae larvae declined in both situations, with 'no effect' of the vegetation on the disturbance. Scud-shrimps (Gammaridae) were 'indifference' to increasing flow, whereas black-flies larvae (Simuliidae) responded positively, increasing in density with fluctuating discharge ('overturning' effect). The finding of this study emphasizes the role of in-stream vegetation as 'disturbance mitigators' and the importance of this biological component in maintaining biodiversity of MCS ecosystems. This calls for a sustainable stream management, specifically flood prevention measures by drainage authorities.