Urban flow ecology: Investigating relationships between flow, channel form, vegetation and ecosystem function

Flow Ecology
Project B1

This project will increase understanding of the establishment and extent of instream vegetation across the Melbourne's stream network, facilitating the development of effective management strategies to protect and improve this key ecosystem value.

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Research has shown that urbanisation drives increases in peak flow magnitude, frequency and geomorphically effective flows, increasing coarse sediment export and reducing organic matter storage, diversity and abundance of instream vegetation, and physical habitat complexity. However, we currently lack an understanding of which components of the flow regime are most significant at influencing sediment and organic matter dynamics and how they interact to influence instream vegetation, biodiversity and ecosystem function.

Instream vegetation provides habitat and refuge for in-stream biota, engineers biogeomorphic processes, increases hydraulic complexity, influences sediment and chemical fluxes and contributes to primary production in streams. While vegetation in riparian zones, wetlands and lakes has been studied extensively, knowledge of instream vegetation retention, germination, emergence, persistence and role as an ecosystem engineer remains less understood.

This research will investigate how key aspects of the urban flow regime influence channel form and instream values and services; with a strong initial focus on instream vegetation.

Methodology

This project seeks to investigate critical pathways and feedback cycles between flow, organic matter, instream vegetation and ecosystem structure and function. This research will be undertaken using a staged approach, beginning with:

- Develop key instream vegetation species habitat preference curves based on velocity, depth and substrate type.
- Identify key life-history stages, from propagule retention to established vegetation, that limit instream plant recruitment in streams under anthropogenic stress.
- Identify characteristics of the flow regime that explain limitations to instream vegetation establishment at the different life-history stages.
- Identify linkages between flow and instream vegetation in streams across the MW region with varying catchment characteristics and anthropogenic impacts.

This will be achieved through a large scale stream survey across the Melbourne Water region (~40–50 streams). The project will also undertake nursery and lab based experiments with sediments and plant material exposed to different flow velocity and depth treatments.

Expected outcomes

- An improved understanding of the linkages between flow, retention and instream vegetation.
- The development of more robust conceptual models for instream vegetation to aid management and prioritisation.
- An improved understanding of the nature and distribution of instream vegetation.

A key **impact** from this research will be more appropriate flow guidelines, which will help ensure the protection and establishment of instream vegetation.