Project Summary
2017/18

Project 1.6
Spatial prioritisation of waterway management actions for biodiversity outcomes

River restoration activities such as stormwater management, riparian and catchment revegetation, fishway construction, weed management and environmental flows, are major areas of investment for Melbourne Water. A fundamental planning question is how to allocate this investment to achieve most cost-effectively improve instream biodiversity and river health outcomes at a whole-of-system level for the Port Philip and Westernport region. Despite the critical importance of this question, robust and systematic tools that take advantage of Melbourne Water's extensive biological and environmental data currently do not exist. This significantly constrains Melbourne Water's ability to justify expenditure in certain activities and locations and provide confidence to the business regarding investment strategies and outcomes.

Research aims

The primary aim of this project is to develop and test spatial planning tools so that different planning options and their associated costs and benefits can be evaluated by Melbourne Water and their stakeholders to inform the development of future Melbourne Water waterway management strategies. These planning tools are underpinned by quantitative ecological models for key biota (e.g. fish, invertebrates, platypus) which generate predicted biodiversity outcomes for a suite of contrasting waterway investment scenarios.

Research methods

This project integrates best-available GIS environmental data with robust habitat suitability models (HSMs), empirically-derived cost data and well-tested spatial planning tools to provide a sound platform for comparing the performance of alternative planning options. Collectively, the proposed portfolio of work includes the following main activities:

- Development of high-resolution GIS land cover data (imperviousness, vegetation cover) with a comprehensive hydrologic network for the entire Melbourne Water region
- Development of a comprehensive wetlands/ waterbodies spatial dataset for the entire Melbourne Water region.
- Development of habitat suitability models (incorporating key environmental variables/ management levers) for a range of key aquatic values i.e. fish, invertebrates, platypus, frogs and waterbirds.
- Development of decision support tools for exploring and planning for biodiversity outcomes from management actions under possible development and climate change scenarios.

Progress to date

Improved land cover and environmental spatial datasets have been developed along with habitat suitability models for macroinvertebrates, fish and platypus that are already being used to support the Healthy Waterways Strategy (HWS) process, and other projects undertaken by MW groups (e.g. Service Delivery and Integrated Planning). The focus in the coming year (Oct 2017-Oct 2018) will be on populating the waterbodies dataset with environmental predictors, developing habitat suitabiility models for

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wetland (off-stream) taxa such as frogs and water-dependent birds, developing cost estimation datasets for management actions, and systematic prioritsation to identify and evaluate cost-effective options and understand key trade-offs.

So far, the project has produced the following datasets and tools:

- high resolution land cover spatial datasets of impervious surfaces (2009), vegetation cover within 200m of a waterway (1996, 2006 and 2016), and woody weed cover, for the entire MW region
- updated MW region stream network and subcatchments spatial dataset.
- predictive models of in-stream temperature statistics for the region.
- incorporation of ISC data on vegetation and large woody debris (LWD) within the stream bank zone into the MW subcatchments predictor dataset
- comprehensively revised instream barriers spatial dataset with improved documentation of fishway installation dates and revision works (if any).
- comprehensive waterbodies spatial dataset for the MW region.
- habitat suitability models for ~60 macroinvertebrate families, ~20 fish species and platypus;
- 'Hydrosumm' tool: computes hydrologic indices and other summary data from hydrologic time series data.
- 'CatchmentExtractor' tool: extracts the (hydrologically-delineated) boundary for any stream reach in the MW region, and enables users to save this boundary polygon as an ESRI shapefile or MapInfo file.
- 'Bugmodels' tool: site-level macroinvertebrate analysis and reporting tool.
- 'LUMaR' tool: allows users to input raw macroinvertebrate data to calculate LUMaR (macroinvertebrate-based stream condition) scores.
- 'melbstreambiota' tool: this R package contains all the quantitative habitat suitability models for the ~60 macroinvertebrate families, ~20 fish species and platypus.
- first-cut basic Zonation biodiversity rank map (using equal weighting of input biodiversity features as represented by the ~60 macroinvertebrate families, ~20 fish species and platypus).

Project team

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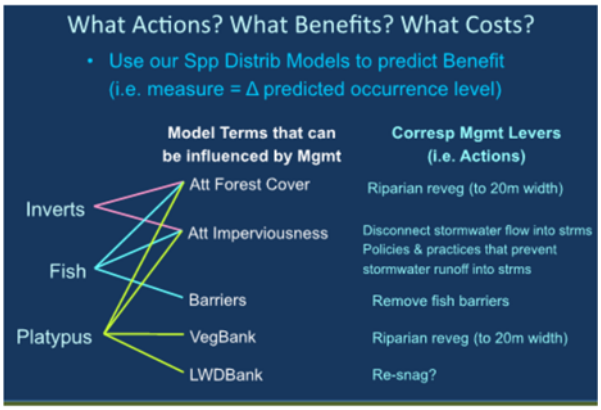

Figure 1: *Habitat suitability models (HSMs) are used to predict and quantify the expected benefit of management actions. The coloured lines extending from each major instream taxa group indicate which particular model terms (predictors) for that taxa can be influenced by management. The right-most column shows what the corresponding management levers are for each predictor.*