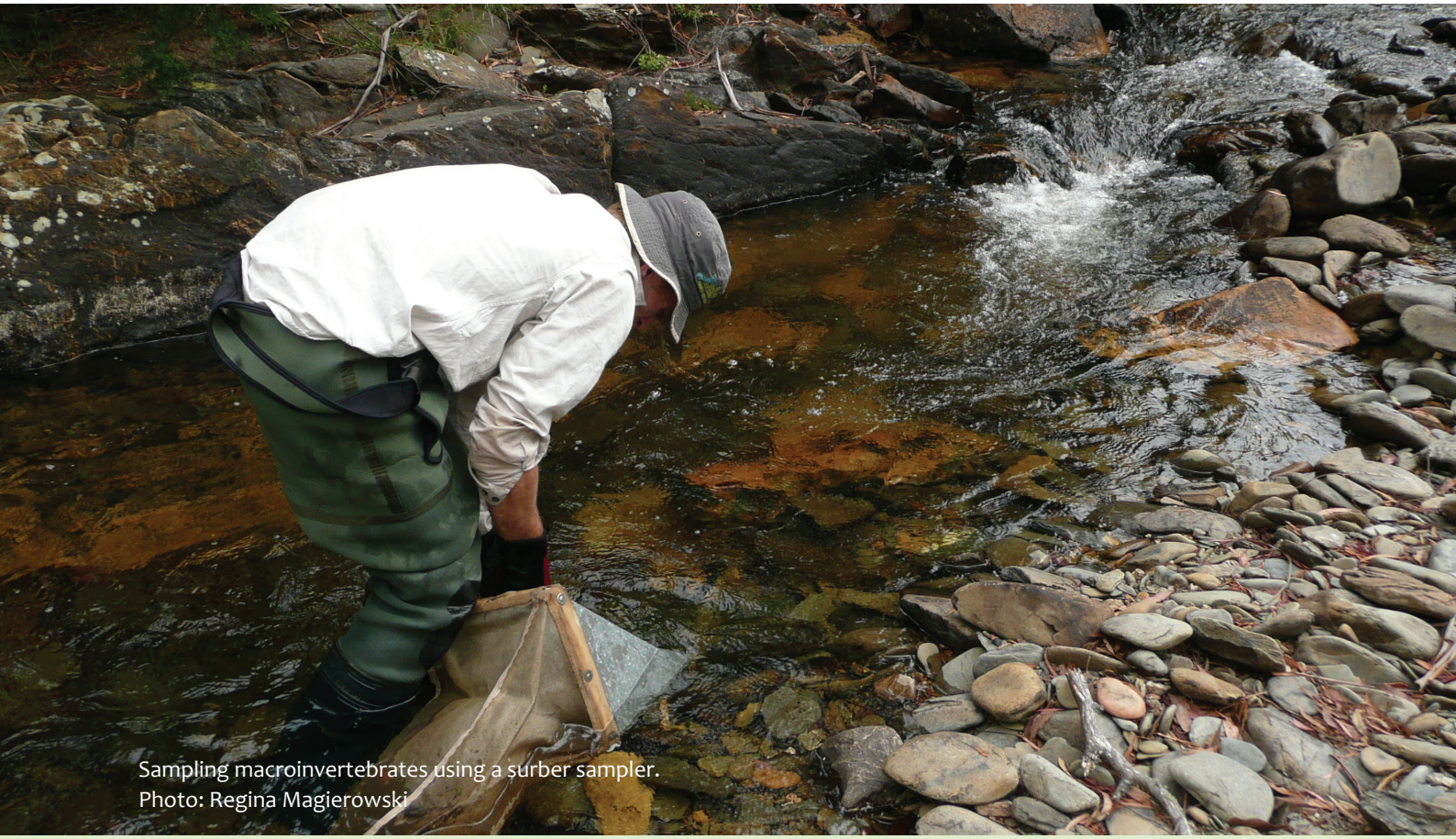
National Environmental Research Program

LANDSCAPES & POLICY *hub*



Sampling macroinvertebrates using a surber sampler.
Photo: Regina Magierowski

Balancing river health and land use in Tasmania: a 'what-if' tool for land managers

- The River Condition Tool for Tasmania is a modelling tool that land managers can use to explore the likely impacts of land-use changes on the health of the region's rivers.
- We trialled the tool for a number of sites in the two biggest catchments of the Tasmanian Midlands and found that it performed well when given the best data available.
- We recommend that, before using the tool for a catchment, land managers seek local knowledge about land use and make sure the land-use data used by the model is up to date.

Research summary

The River Condition Tool for Tasmania is a modelling tool that land managers can use to explore the likely impacts of land-use changes on the health of a region's rivers.

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Agriculture is set to intensify in the midlands

Irrigated agriculture is set to expand in the Tasmanian Midlands as the Midlands Water Scheme and the Lower South Esk Irrigation Scheme, commissioned in 2014 and 2013 respectively, deliver about 44,000 megalitres of water annually to almost 500 farms. We can expect to see some land converted to dairy; some crops expanded, including perennial horticulture; and an increase in livestock finishing, which can require improved pastures.

Exploring the likely consequences for river health

The Tasmanian Midlands is a biodiversity hotspot, with more than 180 listed threatened species. The health of the region's rivers has declined over the past 20 years.

Land use can influence the health of a river in many ways. For example, clearing land for agriculture exposes the soil, which can result in more sediments and nutrients being transported into the river via runoff. High levels of sediments and nutrients affect the health of all river life, including fish, invertebrates and algae, and the overall health of the river.

While land clearing may be an important source of sediments, the reason the sediments make it to the river is because there is no riparian vegetation to stop them. Riparian vegetation can prevent riverbanks from eroding and can trap sediments carried overland by runoff.

The anticipated changes in land use in the Tasmanian Midlands could put more pressure on the region's already stressed waterways, presenting a challenge to land-use planners, natural resource managers, farmers and the community as decisions about managing freshwater ecosystems become complicated by the demands of agricultural production.

The River Condition Tool for Tasmania

The impending land-use changes in the Tasmanian Midlands call for a tool that land managers can use to explore different land-use scenarios and their likely consequences for river health.

The River Condition Tool for Tasmania is one such tool. It differs from other types of environmental models in that it translates the science into scenarios that can be understood by people without specialist skills and knowledge.

Land managers can use the tool to assess changes that may occur to the ecological condition of a river (or river reach, section, site) as a result of a variety of changes — changes driven by planning (for example, land and water use at catchment scale); by large-scale investment (for example, riparian rehabilitation across a catchment); or by small-scale investment (for example, restoring riparian forest in a single river reach). They can explore many different scenarios simultaneously.

Estimate river metabolism: Oxygen and light levels are monitored using submersible probes and the data is used to estimate river metabolism. Photo: Regina Magierowski

Rapid assessment: Macroinvertebrates were collected using 'live-picks' according to a national standard for rapidly assessing the health of rivers. Photo: Regina Magierowski

How the tool works

The tool comes pre-populated with data about the catchment, which land managers are free to replace or update. It includes data on current land use, hydrology, vegetation condition, unsealed roads, and river slopes.

For a given scenario, the tool calculates the likelihood of changes occurring to a range of factors that affect or are indicative of river health — examples are amounts of phosphorus, nitrogen and sediment; turbidity; density of invertebrates; number of species of mayflies, stoneflies and caddisflies; algae cover; and the amount of riparian shade. The main outputs are scores for the Tasmanian River Condition Index (macroinvertebrates, algae and overall river condition).

The predicted outcomes are expressed as probabilities, or levels of certainty, rather than as absolute numbers. For example, if nitrogen concentration in a river reach is set to 'low' (<0.5 mg/L) and riparian vegetation condition is 'good' (>80% cover), the tool will factor this into its calculation of algae cover which, under these circumstances, is likely to be 'very low'. This approach is useful for explaining solutions to people who may be seeking a definitive answer when none exists.

Once set up, the tool can also be run in the reverse direction which can help establish the causes of a particular river health problem, such as low levels of aquatic life.

How the tool performed in the midlands

We validated the tool for five sites in the region's two biggest catchments — the South Esk and Macquarie catchments.

First we ran it with existing data to generate predictions. Then we compared the predicted values with field data, which we had collected for each site.

The tool performed well for three of the five sites, with the best results in the Macquarie catchment. For the other two sites, the main reason for the discrepancy between the tool predictions and the field data was that some native grasslands, which were categorised in the tool as 'non-production native vegetation', were being grazed by merino sheep, and this grazing affected water quality.

Recommendations for land managers using the tool

Based on our trials of the tool in the Tasmanian Midlands, we make the following recommendations.

Seek out local knowledge

The River Condition Tool for Tasmania is only as good as the catchment data used. When classifying land-use data for use with the tool, land managers must look beyond the readily available land-use data and seek out local knowledge to make sure that the classifications in the tool reflect how the land is being managed on the ground.

Similarly, when interpreting the results, land managers need to be aware of the local factors that may influence individual catchments.

Use the most up-to-date land-use data

Land managers should source the most up-to-date land-use data possible, especially for catchments where agriculture is becoming more intensive because these changes can affect river health.

Ground-truth the data on riparian vegetation

Where possible, land managers should collect field data on riparian vegetation cover to make sure that it correlates with the data incorporated into the tool. As an example, the tool used riparian condition data as a proxy for cover; however, at one site we found that the native vegetation was predominantly grasses that had been grazed and, therefore, did not provide shade. If field data cannot be collected, the TASVEG 3.0 map from the Tasmanian Government Department of Primary Industries, Parks, Water and Environment (DPIPWE) may be useful.

Where to from here?

We have run workshops for land managers from DPIPWE, NRM South and NRM North, training them in how to set up and use the River Condition Tool for Tasmania. We continue to be available to train land managers in how to use the tool and to advise them on how to update the tool's default data for their catchment.

Who are the researchers?

Dr Regina Magierowski

Regina is a freshwater ecologist at the University of Tasmania. Her research focuses on understanding patterns and processes in aquatic ecosystems to better understand the influence of humans on aquatic ecosystem health.

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Trish Clements

Trish completed her masters studies at the University of Tasmania School of Geography and Environmental Studies. Her studies focused on validating the River Condition Tool for Tasmania for a number of sites in the Tasmanian Midlands.

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Collaborators

The River Condition Tool for Tasmania was developed by Landscape Logic, a research hub under the Commonwealth Environment Research Facilities program. Professor Peter Davies from the University of Tasmania and Dr Steve Read from Forestry Tasmania co-led the Landscape Logic Tasmanian river health project.

Further reading

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About the NERP Landscapes and Policy Hub

The Landscapes and Policy Hub is one of five research hubs funded by the National Environmental Research Program (NERP) for four years (2011–2014) to study biodiversity conservation.

We integrate ecology and social science to provide guidance for policymakers on planning and managing biodiversity at a regional scale. We develop tools, techniques and policy options to integrate biodiversity into regional-scale planning.

The University of Tasmania hosts the hub.

www.nerplandscapes.edu.au

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