Coming to grips with the science of stream restoration

by Shane Brooks

In a huge project that spans the USA as well as Victoria (Australia), information describing stream restoration projects is being marshalled. The goal of this National Riverine Restoration Science Synthesis Project (NRRSS) is to analyse the extent, nature, scientific basis and success of stream and river restoration projects, and to present this information in a form that is useful to scientists, restoration practitioners and those making policy decisions for funding and implementation.

The restoration of streams and rivers has become a multi-billion dollar industry worldwide; yet in surprisingly few cases has the performance of completed restoration works been assessed. Of the thousands of restoration activities that take place each year, it appears that only a few are catalogued or monitored. Any analysis is typically done at local scale, often by visual survey, and few restoration projects' outcomes are evaluated, particularly in terms of ecological values. Whatever the reasons for this lack of recording and evaluation, it has meant that ecologists involved in stream restoration are rarely able to use observations from successful past projects to provide sound scientific guidance to current and future projects.

In a determined effort to change this situation, the NRRSS has developed a database framework in which to store data and metadata about completed restoration projects. Most contributors to the database, and most of the restoration works incorporated in it, are in the USA, but there is also a south-eastern Australian node, run by Shane Brooks and Sam Lake of Monash University and the CRC for Freshwater Ecology.

A key feature of the NRRSS database is that it does not restrict the types of activities that can be called 'restoration'. However, to sort the wide range of data being provided, the NRRSS team has identified 12 categories:

- riparian restoration
- educational activities
- channel reconstruction
- fishways
- stormwater control
- instream habitat enhancement
- bank stabilisation
- water quality
- flow manipulation
- dam removal
- land acquisition
- floodplain reconnection.

As there was little guidance on what constituted a successful stream restoration project, its definition became an NRRSS project in itself, and the outcome is published as 'Standards for ecologically successful river restoration' in the *Journal of Applied Ecology**.

The authors (members of the NRRSS team) first point out that restoration can be undertaken for multiple reasons (e.g. to protect infrastructure; to build social capital), only one of which may be to restore systems ecologically. Further, they emphasise that there is no universally applicable endpoint for ecological restoration projects. Local geology, climate, vegetation, land use, and species distribution must all be considered. However, they propose five criteria for identifying an ecologically successful stream restoration project:

- The project has had a guiding image from the start, describing the dynamic, ecologically healthy river that could exist at the site to be restored.
- The ecological conditions of the stream are measurably enhanced.
- The stream ecosystem is more self-sustaining than before the restoration.
- The restoration project has not itself harmed the stream.
- On completion, the ecological outcomes have been assessed in comparison to ecological conditions pre-restoration, and the results have been made available.

For applying the criteria, the team gives guidelines, and examples of suitable indicators.

And they propose that while restoration can be a success on many levels, it should not be labelled 'ecological restoration' unless it meets their five criteria.

Nodes included in the National Riverine Restoration Science Synthesis project in USA and Australia.
Map: NRRSS project

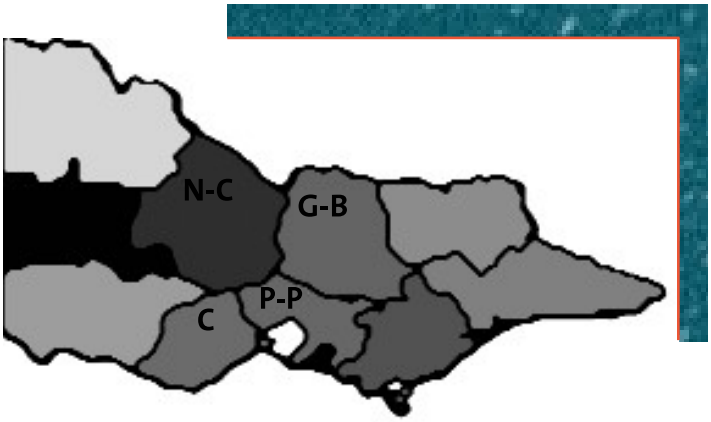
This list was developed during several workshops and after examining a number of existing and complementary databases. Projects are catalogued according to their stated goals. Later, detailed analysis will identify any mismatches between goals and actual outcomes.

The NRRSS team comprises widely respected research scientists — ecologists, engineers, geomorphologists — and stakeholders who are or have been closely involved in restoration practice and policy. They are grouped geographically into eight nodes (see map).

The Australian node is focusing only on Victoria. Shane and Sam have been working closely with the regional catchment management authorities (CMAs), which have supplied data from their restoration activities. So far, the information collected since July 2003 describes more than 2000 restoration projects initiated during 1999–2002 in Victoria by the Corangamite CMA, Goulburn/Broken CMA, Port Phillip CMA, and North Central CMA.

Records and data for restoration projects in Victoria before 1999 are hard to obtain. On the other hand, since being set up in 2001, a voluntary reporting and management system called CAMS (Catchment Activity Management System), run by the Dept of Natural Resources and Environment (now Sustainability and Environment), is proving a very useful source of data on restoration works in the last three years. Being Web-based, CAMS forms a central repository for information about on-ground activities, supplied by organisations all over Victoria.

At the moment, the NRRSS team as a whole is in Stage II of the project, evaluating the state of the practice of stream restoration and identifying completed projects that have been demonstrably successful and the reasons for that. This stage is going to take another six months to complete, since the database already contains information about 27,000 projects, assembled from 188 data sources and more than 200 personal contacts.



Catchment regions of Victoria: N-C = North Central, G-B = Goulburn-Broken, C = Corangamite, P-P = Port Phillip.
Map: Dept of Sustainability and Environment, Victoria

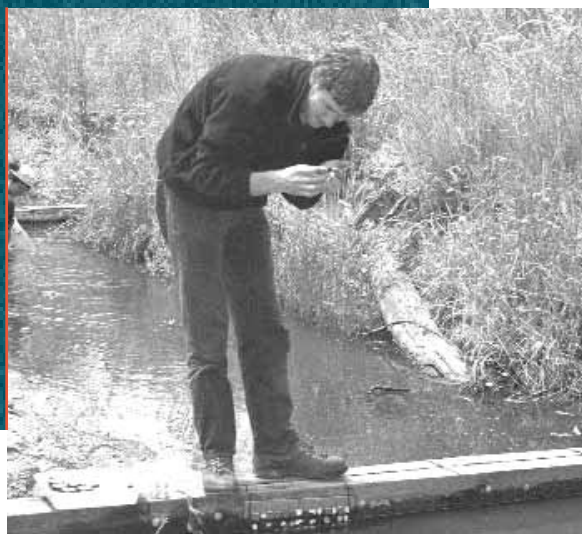
One of the benefits of the huge NRRSS project database is that it does not duplicate regional databases such as CAMS, though it may mine them for particular types of data.

Following, or partly concurrent with, the evaluation stage, the team plans to identify and report on the links between ecological theory and stream restoration (for example, the roles of refuges for freshwater biota, connectivity and natural processes). That process should highlight unanswered questions, which could stimulate new research.

By the end of the project, scientists and restoration practitioners hope to have access to specific

recommendations that they can use as a basis for future stream restoration research and activities. And ultimately, the knowledge and experience currently being stored by the NRRSS project should help communities and river management groups to practise restoration works that achieve their objectives efficiently and at minimum cost.

The general momentum being generated by systems such as the NRRSS database and CAMS must surely eventually lead to more individual restoration works being reported, monitored and evaluated.



An example of stream restoration by installing wooden structure. Photo: CRCFE

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Reference

* Palmer M.A., Bernhardt E.S., Allan J.D., Lake P.S., Alexander G., Brooks S., *et al.* (2005) Standards for ecologically successful river restoration. *Journal of Applied Ecology* (in press); posted at http://www.blackwellpublishing. com/.

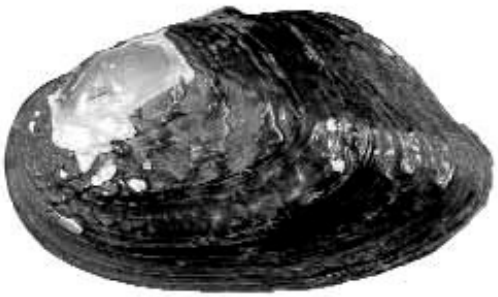
The National River Restoration Science Synthesis Project is run by a working group of the US National Center for Ecological Analysis and Synthesis (NCEAS). NCEAS is a research centre funded by the US National Science Foundation to be a catalyst for collaborative ecological research on major fundamental and applied problems in ecology. The centre is administered through the University of California at Santa Barbara and provides logistic and technical support to individuals and working groups as well as being a repository for the outcomes of synthesis projects.

The creature feature for this issue is the Glenelg River mussel.

Family: Hyriidae

Species: *Hyridella glenelgensis*

The Glenelg River mussel (*Hyridella glenelgensis*) is the smallest of the freshwater mussels of Australia, reaching a maximum recorded size of 52 mm. Its most distinguishing feature is the pattern of ridges or 'sculpture' on its shell. This mussel is most often found in areas of stream with significant amounts of riparian vegetation and it prefers sandy sediment where the water flow is relatively strong. Like all other mussels, the Glenelg River mussel is a filter feeder and lives off plankton that it removes from the water column through a siphon. This rarest of the Australian freshwater mussels is listed under the *Victorian Flora and Fauna Guarantee Act (1988)* and was once known throughout the Glenelg River system. Its range has contracted and it now lives only in one small tributary of the Glenelg River in south-western Victoria. Recent surveys have found several new populations in this tributary, some containing over 100 individuals.



Hyridella glenelgensis. Photo: Museum Victoria

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