

## The last line of defence

The strip of land alongside a river or stream is known as the riparian zone. This strip provides a last line of defence for freshwater ecosystems from degradation by intensive land uses. Forested streamside buffers, for example, protect streams from a dramatic habitat change such as clearing the land for agriculture or housing. Buffers also greatly reduce the effects of logging by trapping materials in runoff. NIWA research has shown that forested riparian areas can also protect streambanks from erosion, maintain natural inputs of leaf litter, and provide

suitable conditions for aquatic insects to complete the terrestrial phase of their life cycle. These influences protect biodiversity. Small, unshaded streams receive over 20 times more sunlight than those with forested riparian areas, which often results in nuisance blooms of algae and high water temperatures which eliminate sensitive invertebrates.

In pastoral areas, fencing out stock eliminates their direct faecal input, while litter layers and plant roots of riparian buffers filter sediment and nutrient contaminants from runoff. NIWA is developing packages to help assess the health of streams and the effects of riparian strips on water quality. These tools will underpin the widespread and effective use of riparian management to protect our aquatic ecosystems through projects such as Environment Waikato's 'Clean Streams' initiative.



# Freshwater

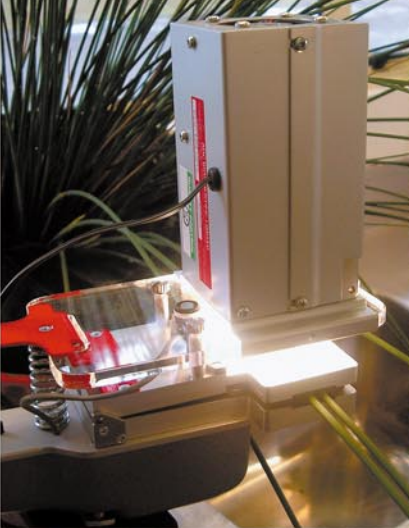
## Uncovering the secrets of lake health

Mention LakeSPI (pronounced 'Lake Spy') and one may be forgiven for conjuring up thoughts of scientists with magnifying glasses sneaking about in the shallows of lakes. But LakeSPI is a valuable tool used to determine the health of a lake. Many New Zealand lakes are threatened by the effects of changes in land use and invasions by alien aquatic plants. LakeSPI – 'Lake Submerged Plant Indicators' – is based on the principle that a lake can be characterised by the composition and depth of its native and invasive plants. Submerged plants are used as clues to lake ecological condition because they are easy to observe and they reflect the environmental conditions of a lake over an extended period of time. Thus, LakeSPI helps lake managers monitor trends in lake condition over time, so they can assess how effective their management practices are.



*Invasive weed species in Lake Taupo. The taller of the two is Lagarosiphon major (common oxygen weed), which has been the main weed in Taupo for many years, and the shortest plant is a recent and more serious invader called Ceratophyllum demersum (hornwort).*

*Mary de Winton recording submerged vegetation.*



*A fen wetland near Okarito on the West Coast in the early stages of recovery after severe damage by a major fire.*

*Measuring photosynthesis in a native rush. If we understand how different nutrient levels and water regimes affect photosynthesis and growth, we can better predict the survival and development of plants in restoration projects.*

### Creating and restoring wetlands

Most of New Zealand's original wetland area was destroyed by the late twentieth century; drained and burned for urban and rural development. Today, less than 10% of the original wetland area remains. The benefits of wetlands in providing habitat for a wide range of organisms – plants, invertebrates, fish, and birds – are well understood, and wetland creation and restoration projects have become essential for re-establishing at least a small echo of what was lost.

Although government agencies, community groups, and private individuals are enthusiastically tackling wetland restoration, we still know very little about how to manage wetlands. How much water is needed, and

how should the depth vary over the year? What plants are suitable for the site, and how much water fluctuation can they tolerate? What is the nutrient input, and how will it affect the health of the wetland?

NIWA and Landcare Research have been collaborating in a FRST-funded project to determine how water management and nutrient enrichment control the community composition of wetlands, and how the physical and biological processes that occur in natural wetlands can be mimicked to improve the success of wetland restoration projects. By understanding more about how water should be managed for the benefit of wetland fauna and flora, our research is helping reach the goal of having more healthy wetlands in the landscape.



### Exotic fish threaten lakes

Many small New Zealand lakes are now cloudy, and the spread of exotic fish may be to blame. Koi carp are a major problem in Australia, and recent European studies show that other coarse fish species now in New Zealand (e.g., rudd, goldfish, gambusia, perch, catfish) can damage lakes. These fish can disturb lake sediments and increase siltation. They can alter planktonic foodwebs and increase algal growth. Some fish reduce rooted plants, which results in erosion and siltation. They may also mobilise plant nutrients, which increases algal growth.

In New Zealand, many coarse fish populations are not kept in check by natural predators, but when they are reduced or removed, water quality improves. NIWA is increasing its work with regional councils and FRST to determine which species cause problems. This will help with fish control and lake restoration, and with educating the public to prevent the spread of these fish.

*Koi carp and other coarse fish are a major biosecurity concern.*



*Large lakes are generally less vulnerable to water quality decline than small ones, but, even when we take this into account, the water clarity of lakes containing coarse fish is lower than in lakes without them.*

