Stream micro-ecology: life in a biofilm

A layer of green or brown "slime" is usually found growing on boulders, driftwood, and other surfaces in streams and aquatic environments. This slime layer is known to scientists as a biofilm, and is a very important component of aquatic ecosystems. When viewed through a microscope, stream biofilms are revealed to be home to diverse and complex communities of microscopic organisms: algae, bacteria, fungi, protozoa, viruses, and tiny animals such as rotifers.

Stream biofilms and micro-organisms provide essential ecosystem services such as primary production, carbon and nitrogen fixation, and recycling of nutrients. Biofilms are an important source of food for stream life, and provide the basis of the food web that sustains larger animals such as insects, crustaceans, fish and birds.

MRQ

Monitoring Research Quarterly

Monitoring Research Quarterly is the newsletter of the Auckland Council's Research, Investigations and Monitoring Unit, RIMU. Each edition of the newsletter contains reports of RIMU's current work including information about recent publications, research, facts and trends about Auckland. This is the first edition for 2012. RIMU publications are available on the Auckland Council and Knowledge Auckland websites.

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Environmental Services hydrological team, gauging floods in all weather

While we were sitting comfortably at our desks during the storms in late March, it was business as usual for the RIMU Environmental Services hydrological team, out in the rain, gauging sediment and floods at Hoteo, Kaipara, Kaukapakapa, Tamahunga and Wairoa.

Hydrological team members at Kaukapakapa

The team included Nick Holwerda, Nick Reid, Clive Coleman, Ed Clayton, Matt Hope, Francess Mitchell, Simon Tredgett, Peter Hancock, Stacey Lockie and Craig Hosking. The sediment and flood information collected will be used to confirm that the sediment auto samplers, which are triggered during flood events, are in the right catchment locations by calibrating the auto sampler data with manual grab samples collected during storm events. The information will then be used to determine sediment loads and concentrations for individual flood events and annual yields as part of state of the environment reporting.

Scientists are concerned about sediment in water and believe that it is responsible for declining water quality and biodiversity. A catchment's surrounding land use, hydrological and physical characteristics are major determinants of the amount of sediment loss. Since it is impractical to monitor sediment in every water body in Auckland, the sites were selected based on the sediment-generating determinants that vary at each site. When enough data is collected, it will be used to calibrate a model to predict sediment yields across all water bodies with reference to a catchment's surrounding land use, hydrological and physical characteristics in the Auckland region.

Auckland wood burner tests

A wood burner testing programme was conducted in Auckland to investigate the effects of variables on emissions and measure emission factors reflecting real life operations. A burning cycle consisted of cold start, high burn and low burn. Three wood burners, two new and one old, were tested using a variety of woods including pine, blue gum and macrocarpa, creating a dataset of 155 test cycles.

The study shows that wet or damp wood emits much higher pollution than dry wood. Compared to dry wood, wet or damp wood increases emissions by more than a factor of two and the emission rates by more than 70 per cent. High burn produces less pollution than start up or low burn. Unsplit wood generally produces more emissions than split wood. The old burner has slightly higher emissions than the two new ones. The test results, published in *Air Quality and Climate Change*, provide a critical input into domestic emission estimates and quantitative information for assessing options to reduce domestic pollution from fires.

S Xie, K Mahon and J Petersen (2012). Effects of fuel and operation on particle emissions from wood burners. *Air Quality and Climate Change*, 46, 1, February 2012, pages 17-21.

Stream ecological valuation

The RIMU Environmental Science team has recently coordinated a review of the Stream Ecological Valuation (SEV), leading to two new publications *Stream Ecological Valuation (SEV): a Method for Assessing the Ecological Functions of Auckland Streams* (Auckland Council technical report, TR2011/009) and *Stream Ecological Valuation (SEV) A User's Guide*, Auckland Council's first Guideline Document (GD2011/001).

The SEV is a stream assessment technique originally published in 2006 and developed by scientists from Auckland Council, Waikato Regional Council, Massey University, Landcare Research and NIWA. It has been used extensively in Auckland and is commonly used in resource consent applications, determining land use impacts, stream restoration projects and is the primary tool used for river ecology state of the environment monitoring by Auckland Council.

Dr Martin Neale coordinated the review process and commented, "a huge amount of SEV data and experience has cumulated since 2006 and it was considered timely to utilise the data and experience to inform a review of the method." As a result, the SEV author panel was reconvened and aimed to resolve some performance issues and improve the guidance and supporting materials for the SEV. The outcomes of the review are a method that has been streamlined and simplified and a new illustrated user's guide printed on water resistant paper, designed to survive being used in the field.

Dr Neale working on an SEV

All of the SEV supporting materials are available free on the Auckland Council's technical publications and research page, www.aucklandcouncil.govt.nz/publications and inquiries about the SEV method, including a request for the *User's Guide*, can be sent to sev@aucklandcouncil.govt.nz.

Stream bacteria reveal all: life in the biofilm

A significant milestone was reached recently in new research to better understand stream bacterial communities and evaluate their use as indicators of stream health. Dr Martin Neale, RIMU freshwater scientist, has been leading the regional council involvement in a project with University of Auckland scientists since 2008.

The project has involved seven councils (Auckland, Canterbury, Greater Wellington, Hawke's Bay, Horizons, Tasman and Waikato) contributing funds, resources and samples, leading to the collection of stream bacterial samples from 254 sites across the country.

The recently published report, *A Bacterial Community Index (BCI) for New Zealand Streams* (Auckland Regional Council technical report, TR2010/068) is a major output of the project to date. The report documents the development of the Bacterial Community Index (BCI), a tool for assessing the health of a stream based on the bacteria present in the biofilm. The work is a world first in stream ecology and has sparked much interest at international conferences.

Stream biofilms, or the slime on the tops of boulders, cobbles, plants and other stable surfaces, contain a range of naturally occurring microscopic organisms, including algae, fungi, protozoa and bacteria, in a complex community. Stream biofilms play key roles in primary production, cycling of nutrients, water quality, contaminant removal and energy flow in the stream food web.

The primary objective of the work was to develop an indicator of stream health based on bacterial communities. "There is a global push towards using multiple indicators for assessing the health of ecosystems, and the use of bacterial communities in streams offers an indicator that is simple to sample and can effectively discriminate amongst sites of differing quality," says Dr Neale. "However, the work has led to additional research outcomes, including a greater understanding of the biogeography of stream communities at a global scale and examining the functional roles of bacteria in streams, particularly in relation to the ecosystem services they provide."

Dr Neale will be working with Professor Gillian Lewis, and her team at the University of Auckland in 2012, to further develop the BCI and other research opportunities provided by the national dataset. In recognition of this work and to facilitate future research opportunities, Dr Neale has been awarded an honorary lectureship by the University's School of Biological Sciences.

Funded Services to Migrants and Refugees in Auckland

Auckland is an ethnically diverse city, with more than a third of its people born outside New Zealand. Auckland Council has demonstrated its commitment to support this important part of its population in the Auckland Plan and through the establishment of the Ethnic and Pacific Peoples Advisory Panels, the Economic Development Strategy and the co-chairing of the Auckland Regional Settlement Strategy. It is also evident in Council's funding of a number of settlement support projects, cultural activities, and Auckland Libraries' diversity initiatives.

Recognising that migrants' and refugees' early experiences are a critical component of successful integration, RIMU commissioned a research project that will inform Council initiatives in this area. *Funded Services to Migrants and Refugees in Auckland* was prepared by Alex Woodley and Dr Lisa Williams of Point Research Limited and provides a snapshot of funded services that support the settlement of migrants and refugees in Auckland.

Country of Birth for Auckland Residents
Top 10 countries (excluding NZ)
2006 Census

More than 90 interviews were conducted with philanthropic organisations and sector stakeholders as well as individuals within organisations funded to provide information, support or services to newcomers. Interviewees were asked about several topics including:

*   their organisation and the area in which they operated
*   which groups they offered services to, and during which phases of settlement
*   sources of funding
*   which services the organisation provided
*   how many people used the service each year
*   whether there was a waiting list for services or a charge for them
*   what was working well or not working well
*   whether there were any gaps and overlaps in service delivery.

The report provides comprehensive overviews of the services provided in eight main areas: employment, business, English language training and education, information, housing, recreation and leisure, culture and other services. The summary section for each area highlights information about organisations with funded programmes and services that benefit migrants or refugees in that space, as well as those that offer support but may not have targeted programmes or services. Subject areas can be studied separately or read as part of the wider report and each includes a list of recommendations and, where appropriate, a typology that provides a visual overview of how programmes and services are distributed.

The research draws the following conclusions:

*   the migrant and refugee sector is severely underfunded and as a consequence newcomers' needs are not adequately met
*   English language is critical to migrants' and refugees' wellbeing and more support is required to ensure its acquisition
*   there are significant gaps in services for skilled migrants
*   asylum seekers and migrants without permanent residence status have more difficulty settling in and access to fewer services
*   the sector requires more coordination in order to avoid duplication or gaps in services.

In addition to making area-specific recommendations designed to address these issues, Alex Woodley and Dr Williams note that Auckland Council is well-placed to play a leading role in supporting migrants and refugees by welcoming them upon arrival, participating in the coordination of services, providing leadership and acting as an advocate when necessary. Because a significant proportion of Auckland's population is foreign-born, the authors argue that the issues identified in the report do not reflect marginal concerns and need to be at the forefront of Council's strategic direction with solutions achieved in collaboration with community stakeholders. The report is available on the Auckland Council and Knowledge Auckland websites or from Dr Carina Meares in RIMU's Social and Economic Research team.
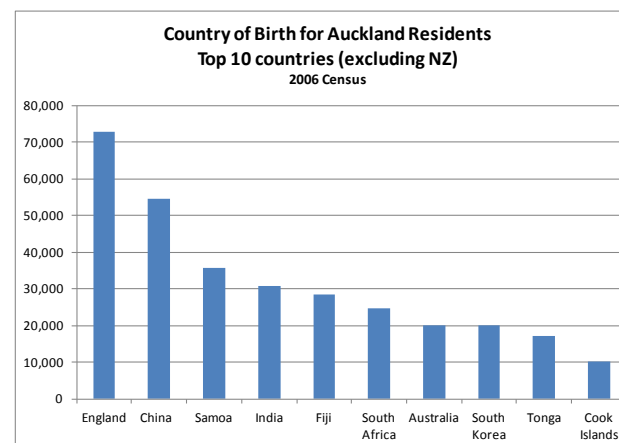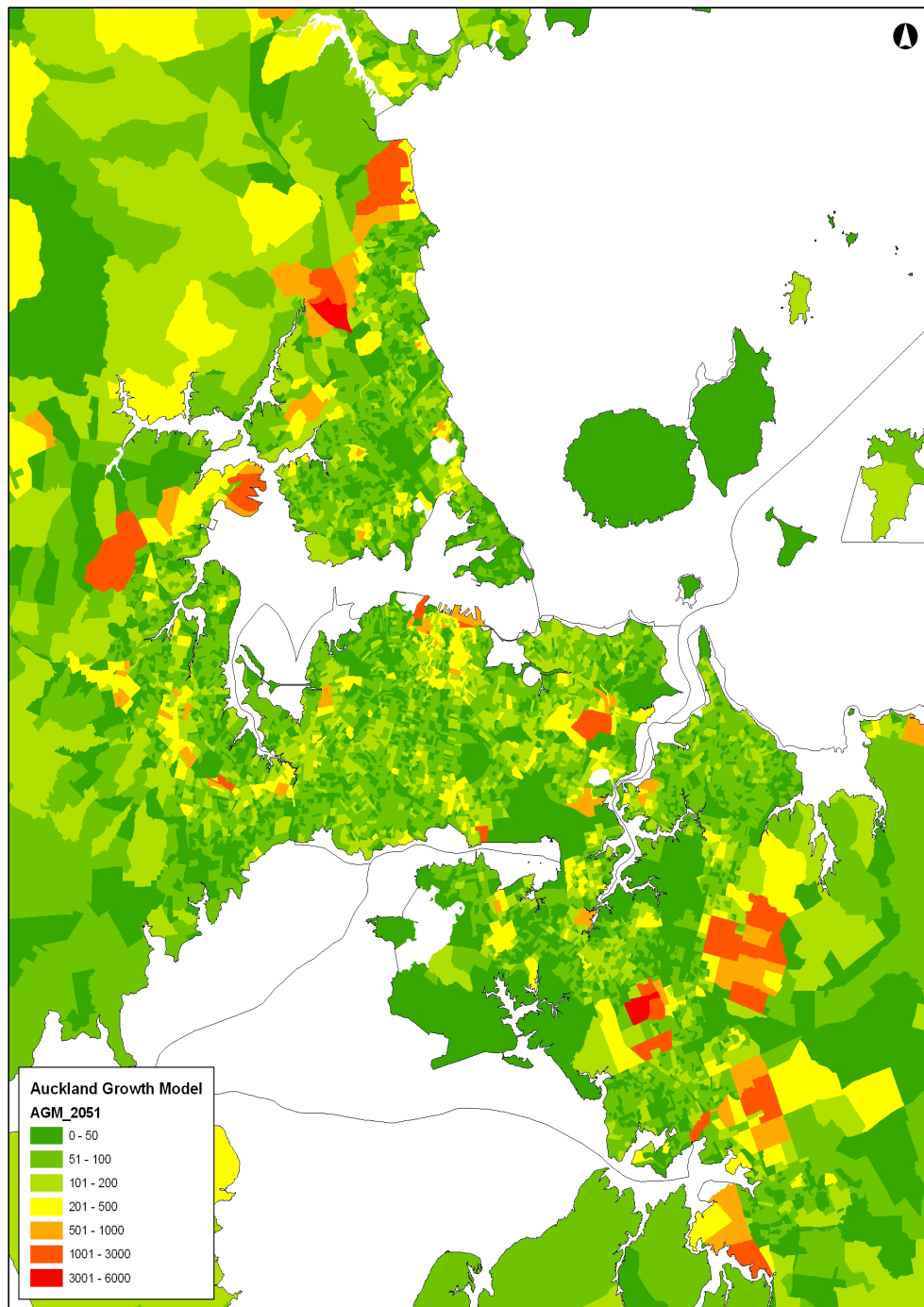
The Auckland Residential Futures Model

The Auckland Residential Futures Model provides growth projections by meshblock to 2051. It is a 'scenario model' providing a spatial simulation of possible residential growth and it models potential residential capacity based on anticipated growth in demand for residential dwellings.

Population, households and dwellings projections from the Model can be shown on a map by local board, area unit and meshblock, annually from 2006 to 2031 and five-yearly to 2051.

Map of Auckland modelled dwelling growth meshblocks, 2006-2051

Auckland Growth Model
AGM_2051

- 0 - 50
- 51 - 100
- 101 - 200
- 201 - 500
- 501 - 1000
- 1001 - 3000
- 3001 - 6000

Auckland Dwelling Growth,
2006 to 2051 (MB)

Source: Auckland Council Growth Model

Map Produced by
Research, Investigations
& Monitoring, Regional Strategy,
Auckland Council