

**Project:** *Hydrological and contaminant modelling*

**Leader:** Tim Davie (Landcare Research, Lincoln)

**Collaborators:**

Robbie Andrew (Landcare Research, Massey)  
John Dymond (Landcare Research, Massey)  
James Barringer (Landcare Research, Lincoln)  
Jagath Ekanayake (Landcare Research, Lincoln)

**Issue:**

The influence of land use on water allocation from the Motueka River during low flows and nutrient contaminant movement in the catchment.

**Objective:**

Determine the effect of various land cover/land use scenarios on the water balance and nutrient/contaminant status of the Motueka catchment

**Progress:**

Work so far has concentrated on water balance modelling. Key results so far include:

- Development of a distributed water balance model (Andrew-Dymond model) for the Motueka, capable of simulated seasonal water balances and land-use change. This work has been successful in simulating water flows but is unlikely to progress much further as it has difficulties in being used for sediment and other contaminant/nutrient modelling.
- The model has been refined to improve lowflow estimation and rectify difficulties in the evaporation estimation.
- The SWAT model (USDA derived hydrological model) has been calibrated and validated for the Motueka catchment. Results show that it can predict river flows well but there are limitations due to:
  - Poor rainfall coverage within the catchment
  - Soil moisture representation does not correspond to measured values
- Land use change scenario modelling with the two different models show quite different results:
  - SWAT model shows very little difference between maximum *Pinus radiata* planting and original forest cover with current landuse yielding the largest amount of water.
  - The Andrew-Dymond model shows the highest river flows occurring under original forest cover (largely *Nothofagus* beech) with current landuse and maximum pine planting being very similar. Model mechanisms are currently being rechecked for research paper submission.

**Outputs:**

Andrew, R.M and Dymond, J.R. (in prep) A distributed model of water balance in the Motueka catchment, New Zealand. Paper being revised for submission to *Journal of Hydrology* (NZ).

Cao, W.; Bowden W.B.; Davie T.J.A.; and Fenemor, A. (2003) Multi-variable and multi-site calibration and validation of SWAT in a large mountainous catchment with high spatial variability. Paper for International SWAT conference and submitted to *Hydrological Processes*.

Cao, W.; Bowden W.B.; Davie T.J.A.; and Fenemor, A. (2003) Modelling Impacts of Land Cover Change on Critical Water Resources in the Motueka River Catchment, New Zealand. Poster presentation: AGU Chapman conference on Ecosystem Interactions with Land Use Change conference, Santa Fe, New Mexico, USA June 14-18. In preparation for submission to *Journal of Hydrology* (NZ).

Davie, T; Andrew, R.; Dymond, J. (2002) Modelling land use change at the large catchment scale: The Motueka example. "*All the easy water has gone*". *New Zealand Hydrological Society annual conference*, Blenheim, December 3-6, 2002.

Davie, T. and Basher, L. (2003) Suitability of the Andrew-Dymond model for modelling sediment movement in the Mouteka catchment. Internal Report for the Integrated Catchment Management Programme.

### **Future Directions:**

Future work is concentrating on the integration of hydrological modelling within the Integrated **D**ynamic **E**nvironmental **A**ssessment **S**ystem (IDEAS) framework. Work planned for the next year is:

- A report on the comparative strengths and weaknesses of different hydrological modelling schemes that could form a key part of IDEAS. These include the Andrew-Dymond model; SWAT; TOPNET; MIKE-SHE; and PLM.
- Participation in a collaborative learning workshop, including stakeholders, to map options for a conceptual framework for IDEAS catchment planning model.
- Collaboration with other researchers involved in IDEAS development (e.g. sediment modelling components)
- Extend work with SWAT to include nutrient budget modelling. In particular identify the data needs for this work.