# Land use, water quality and human health risk: results from two small agricultural catchments


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## *Extended Abstract*

## 1. INTRODUCTION

Recent improvements in surface water quality in New Zealand have been attributed to a reduction in point source pollution (Ministry for the Environment, 1997). Attention has now shifted to the effects of diffuse, non-point source pollution associated with agricultural run-off, and its impact on the microbial quality of freshwaters. Indicator organisms such as faecal coliforms are frequently used to monitor faecal contamination of streams and rivers, and to assess the safety of recreational bathing sites. Conflicting data exist regarding the relationship between indicator organisms and actual disease-causing pathogens such as *Campylobacter* (Jones, 2001). *Campylobacter* is the most common cause of gastrointestinal illness in New Zealand, and has previously been detected in pastoral catchments in New Zealand (Till *et al*., 2000). The influence of land use on the distribution of faecal coliforms and *Campylobacter* was investigated at different spatial scales in two small agricultural catchments in Otago.

## 2. METHODS

Water quality sampling was carried out in two catchments in eastern Otago, South Island, New Zealand. The Lee Stream catchment lies 35 kilometers west of Dunedin City, and is approximately 6830 hectares in size. Predominant land cover is improved pasture, including sheep, beef and deer farming. The Tuakitoto catchment is located 50 kilometers southwest of Dunedin City, and is of a similar size (6450 hectares) to Lee Stream catchment. Land cover is also improved pasture, with sheep, beef and dairy farming. Sampling was undertaken in streams of increasing order (second to fifth order) in both catchments. Sampling for faecal coliforms, *Campylobacter* and other water quality variables was carried out on five occasions in each catchment. The Lee Stream catchment flows directly into the Taieri River, and additional sampling was carried out above and below the confluence of the Lee Stream and Taieri River. Land cover in each catchment was classified using SPOT4 satellite data. Five functional classes of land cover were used as a measure of catchment development: pasture, tussock, exotic forest, bare ground, and scrub (Buck, 2002).

## 3. RESULTS

The relationship between land cover, faecal coliforms and *Campylobacter* levels was complex, and high variability in bacteria levels was observed (figure 1). Second and third order streams showed the most variation in bacteria levels, both between different second order streams, and within individual streams on different sampling occasions. Fourth and fifth order streams tended to have the highest average bacteria levels. No correlation between bacteria levels and land cover was observed in either catchment. No significant correlation was observed between faecal coliforms and *Campylobacter*.

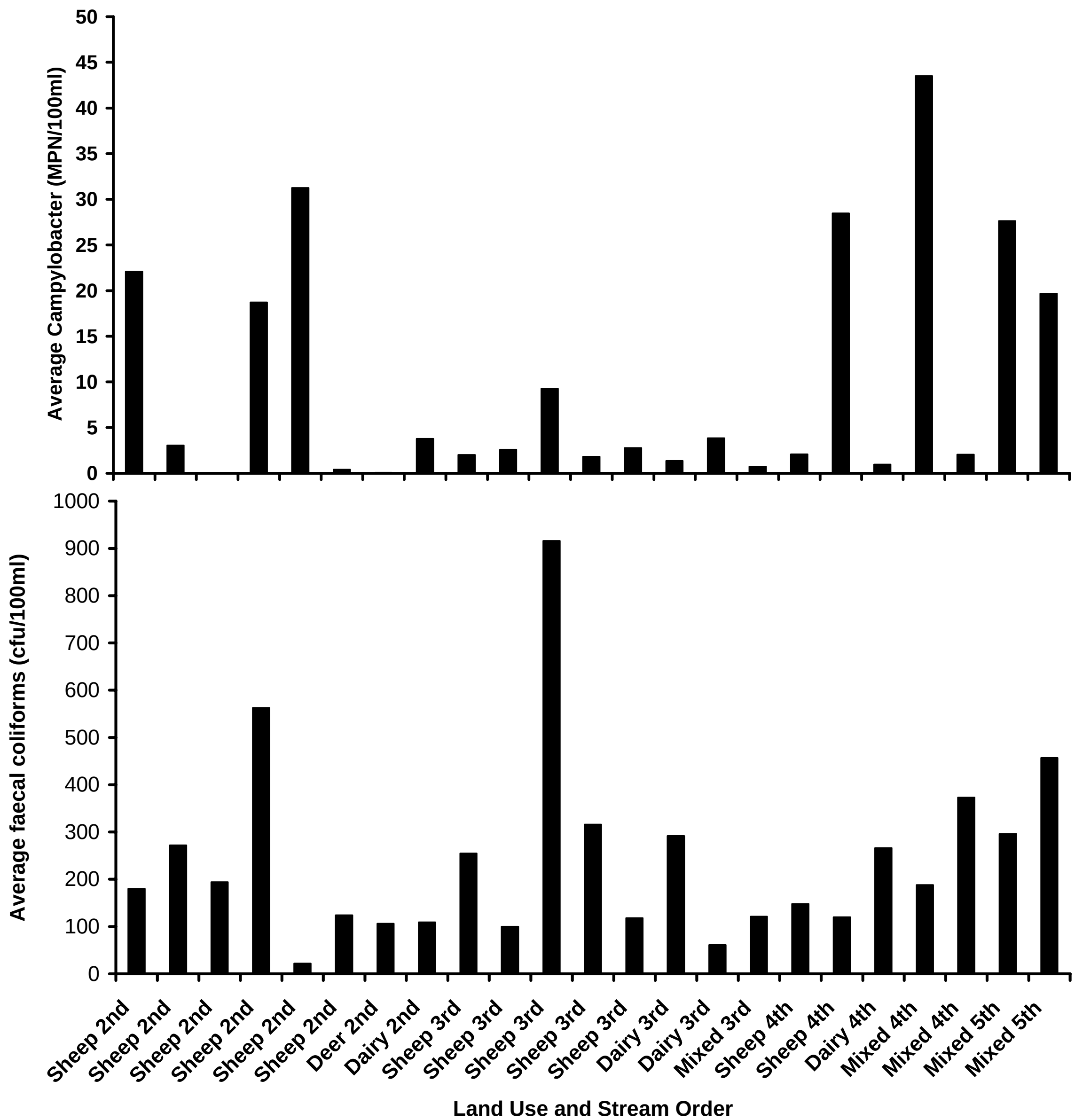


Figure 1. Average *Campylobacter* levels (top), and average faecal coliform levels (bottom) for each stream.

## 4. DISCUSSION

The inherent variability of bacteria levels in streams over time may explain the absence of a correlation between land use and bacterial water quality in these catchments. Environmental factors including rainfall, run off and presence of stock are likely to have a strong influence on bacteria levels and need to be taken into account in these types of analyses. This study illustrates the limitations of a strictly GIS approach for using land cover data to predict water quality and human health risk.

***Keywords and phrases*****:** Water Quality, Land Cover, GIS, Health Risk

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