

Research Experience Prior to 2002
Bowden Watershed Research Lab
William “Breck” Bowden

Integrated management of land and water resources in complex catchments: Until 2002 Dr. Bowden was the Program Leader for this suite of projects focused on research relevant to adaptive management of land and water resources in urban and intensively-utilized rural catchments. The core research focuses on surface-water/groundwater interactions, land use impacts on river water quality, characterization of riparian structure and function, catchment scale hydrological modeling, marine biogeochemical processes, and development of publicly-accessible knowledge bases linked to GIS databases and Web interfaces. Information about the program is disseminated via an interactive web site (<http://icm.landcare.cri.nz>). Currently Dr. Bowden co-leads an integrated, collaborative project called *Redesigning the American Neighborhood*. The goal of this project is to explore the costs and benefits of ecologically-oriented stormwater design options in sub-urban environments. This project is a collaboration among university researchers, municipal governments, resource managers, and residents. Publications from this work are just now (2005) in progress. Information about the RAN project can be found at <http://www.uvm.edu/~ran>.

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- Bowden, W.B. 1999. Integrated catchment management: a way forward toward sustainable land management. An internal position paper circulated among key science providers and stakeholders to explain and promote this area of research.
- Bowden, W.B. and R. Wilkinson. 2000. Analysis of stakeholder priorities for research on water resources in the Motueka River catchment. Prepared for the Tasman District Council, Richmond, New Zealand.
- Bowden, W.B. 2001. Ecological engineering at the catchment-scale for water management: the Motueka River initiative. Proceedings of the International Ecological Engineering Conference. Lincoln, New Zealand. November 2001.
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- Young, R.G., A.J. Quarterman, R.F. Eyles, R.A. Smith, and W.B. Bowden. 2005. Water quality and thermal patterns across a complex catchment: interacting influences of land cover, geology and longitudinal position. *New Zealand Journal of Marine & Freshwater Science*. 39: 803–825.

Linkages between benthic primary production and nitrogen cycling in Arctic tundra streams, North Slope, Alaska: A contribution to a large, inter-disciplinary program to better understand the basic ecosystem ecology of Arctic tundra landscapes, through an investigation of “bottom-up and top-down” controls on ecosystem processing. My research has contributed to a better understanding of Arctic streams ecosystems. The key findings of this on-going research are that benthic primary production is fundamental controller of N and P cycling in these streams and that the balance of N and P inputs has profound influences on the structure and function of the benthic autotrophic community structure and function. More information on this research program can be found at <http://ecosystems.mbl.edu/ARC/>.

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- Finlay, J.C. and W.B. Bowden. 1994. Controls on production of bryophytes in an arctic tundra stream. *Freshwater Biology* 32:455-466

- Arscott, D.B., W.B. Bowden, J.C. Finlay. 1998. Comparison of epilithic algal and bryophyte metabolism in an arctic tundra stream, Alaska. *Journal of the North American Benthological Society* 17(2): 210-227; Arscott, D.B.
- W.B. Bowden, and J.C. Finlay. (2000) Effects of desiccation and temperature/irradiance on the metabolism of 2 Arctic stream bryophyte taxa. *Journal of the North American Benthological Society* 19(2):263-273.
- Slavik, K., B.J. Peterson, L.A. Deegan, W.B. Bowden, A.E. Hershey, John Hobbie. 2004. Long-term responses of the Kuparuk River to phosphorus fertilization. *Ecology* 85(4):939-954.
- Benstead, J. P., L.A. Deegan, B.J. Peterson, A.D. Huryn, W.B. Bowden, K. Suberkropp, K.M. Buzby, A.D. Green, and J.A. Vacca. 2005. Responses of beaded Arctic stream to short-term N and P fertilization. *Freshwater Biology* 50, 277–290.

Influences of hyporheic dynamics on nutrient processing in arctic tundra streams: A related contribution to the same program. The key findings of this on-going research are that hyporheic processes are of fundamental importance to clear understanding of C, N, and P turnover in arctic tundra stream; a finding that was unexpected. Additional information on this and related projects can be found at <http://ecosystems.mbl.edu/ARC/>.

- Edwardson, K.J., W.B. Bowden, C. Dahm, J. Morrice. Transient storage and hyporheic transport in arctic tundra streams. *Advances in Water Resources* 26:907-923.
- Bradford, J.H., J.P. McNamara, W.B. Bowden, and M.N. Gooseff. 2005. Measuring thaw depth beneath arctic streams using ground-penetrating radar. *Hydrological Processes* 19: 2689–2699.

Flow path dynamics at hillslope to catchment scales: Hydrodynamics of runoff processes in landscapes under different land use. Recent research has focused on storm event hydrodynamics in tussock grasslands with native cover compared with those afforested with *Radiata* pine and on runoff processes in pasture land that may be subject to municipal development or modified farm management.

- Fahey, B.; W.B. Bowden; J. Smith; and D.L. Murray. 1998. Hillslope-wetland hydrological linkages in the headwaters of a tussock grassland catchment at Glendhu, South Island, New Zealand. pp. 157-164 in K. Kovar; U. Tappeiner ; N.E. Peters; and R.G. Craige (eds.), *Hydrology, water resources and ecology in headwaters. Proceedings of HeadWater'98, Meran-Merano, Italy, 20-23 April 1998.* IAHS Press. Wallingford, UK.
- Bowden, W.B., B.D. Fahey, J. Ekanayake, and D.L. Murray. Hillslope and wetland hydrodynamic in a tussock grassland, South Island, New Zealand. *Hydrological Processes* 15:1707-1730.
- Bowden, W.B. 2000. Report on the Joint US-Japan Seminar on Hydrology and Biogeochemistry in Forested Catchments. For the New Zealand Ministry for the Environment, International Science and Technology/Technical Participation Programme. Report on a workshop convened by Drs. J. McDonnell and T. Tanaka, at the East-West Center, Honolulu, Hawai'i, 1-4 February, 2000.

Environmental impacts of applying municipal biosolids in forest lands (New England and New Zealand): Land application of biosolids (solid wastes from municipal and industrial wastewater treatment) has the potential to be an inexpensive alternative to traditional engineered waste treatment options and can substantially improve soil moisture and nutrient qualities with economic benefits in farming and forestry applications. However, inappropriate applications can lead to environmental degradation and potential health risks. Dr. Bowden has conducted research on the effects of biosolid loading rates on nutrient uptake by vegetation uptake and loss through soil leaching, in both the Northeast, USA and in New Zealand. The key finding from this research was that mechanisms that limit nitrate leaching losses will typically tend to limit the losses of other solutes that might be of concern in surface and ground water. With careful attention to the nature of the material being applied and the characteristics of the target environment, land application of biosolids can be a safe and economical alternative.

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- Catricala, C., W.B. Bowden, C.T. Smith, W.H. McDowell. 1996. Chemical characteristics of leachate pulp and paper mill residuals used to reclaim sandy soils. *Water Air and Soil Pollution* 89:1-21
- Hallet, R., C.T. Smith, and W.B. Bowden. 1999. Nitrogen dynamics in forest soils after municipal sludge additions. *Water, Air and Soil Pollution.* 112: 259-278.
- Smith, C.T., W.B. Bowden, T.E. Howard. 1993. Matching forest soils research with northeastern land use trends. Chapter 7 in T. Sims (ed.) *Agricultural research in the northeastern United States: a critical review.* Proceedings of the Northeast Branch of the American Society of Agronomy, 1992. American Society of Agronomy. Madison, Wisconsin.
- Bowden, W.B., J. Payne, R. McLaren, and A. Watson. 2001. Biosolids joint research programme: progress report for 2000/01. Prepared for Forest Research. July 2001.
- Watson, A.J. T.J.A. Davie, W.B. Bowden, and J.J. Payne. 2004. Drainage to shallow groundwater under a closed-canopy Radiata pine plantation on the Canterbury Plains, South Island, New Zealand *Journal of Hydrology (NZ)* 43(2): 111-122.

The Lotic Intersite Nitrogen Experiment (LINX): comparative nitrogen cycling in North American headwater streams: A collaborative project to compare N cycling in selected North American headwater streams and to test a number of key hypotheses about the influences of stream metabolism and hydrologic function on N cycling in streams. A key finding was that biogeochemical cycling of nitrogen was strongly linked to discharge rates and that nitrification was a surprisingly responsive component of the nitrogen cycle in these headwater streams. See <http://sparc.ecology.uga.edu/webdocs/linx/>.

- Wollheim, W.M., B.J. Peterson, L.A. Deegan, M. Bahr, M. J.E. Hobbie, D. Jones, W.B. Bowden, A.E. Hershey, G.W. Kling, and M.C. Miller. 1999. A coupled field and modelling approach for the analysis of nitrogen cycling in streams. *Journal of the North American Benthological Society* 18(2) 199-121.
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- Peterson, B. J., W. Wollheim, P. J. Mulholland, J. R. Webster, J. L. Meyer, J. L. Tank, N. B. Grimm, W. B. Bowden, H. M. Valett, A. E. Hershey, W. B. McDowell, W. K. Dodds, S. K. Hamilton, S. Gregory and D. J. D'Angelo. 2001. Stream processes alter the amount and form of nitrogen exported from small watersheds. *Science* 292: 86-90.
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Impacts of differing riparian zone geomorphology on nitrogen fluxes from a tropical rain forest to headwater streams: An investigation of N flux through the riparian zones of two tropical streams with distinctly different riparian flow paths. The key finding was that the rate, mode, and location of N processing were highly dependent on the geomorphology of the riparian zone, which in turn controlled hydrological flow paths.

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- Bowden, W.B. 1996. Best management practices for sustainable forestry: the functioning wetland interface. *Proceedings of the Society of American Foresters*, pp. 115-120.

Impacts of whole-tree harvesting on N₂O losses from a northern hardwood forest: Impacts of new forest harvesting method on losses of volatile forms of N from a forest ecosystem type that was known to be especially prone to soluble nitrogen loss (primarily as nitrate) in response to disturbance. The project identified a key link between hydrological transport and volatilization of nitrous oxide (N₂O) to the atmosphere.

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- Bowden, R.D., G. Geballe, and W.B. Bowden. 1989. Foliar uptake of ammonium and nitrate from fog water by *Picea rubens*. *Can. J. Forestry Res.* 19: 382-386.

Nitrogen cycling in tidal freshwater wetland: Influence of a unique and poorly understood coastal wetland type on water quality (N level) in a river draining an urbanizing watershed. The investigation focused on N turnover in wetland sediments, using ¹⁵N isotope dilution techniques. Major fluxes and stores of N in the wetland ecosystem were examined and quantified. Key interactions with the riverine system were identified.

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