

## Professor Alexander Milner

Professor of River Ecosystems

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### About

Professor Alexander Milner has been at the University of Birmingham for 15 years, where he was initially responsible for setting up the Environmental Science and Environmental Management degrees. He is now responsible for the Masters degree in River Environmental Management. His research involves river ecosystems in alpine and Arctic environments and has long term studies in Glacier Bay National Park and Denali National Park in Alaska. The study in Glacier Bay represents the longest continual study of stream succession and development within a primary successional framework. Other studies have included how water sources are changing in glacially influenced river systems with climate change and how these changes alter ecological structure and function.

### Qualifications

- PhD in Aquatic Ecology, University of London
- MSc in Applied Hydrobiology University of London
- BSc (Hons) in Biological Sciences, University of Aston

### Biography

1995 - present School of Geography, University of Birmingham

2008 - present Research Professor of Aquatic Biology, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK

1993 - 2008 Research Associate Professor of Aquatic Biology, Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK

1990-1995 Associate Professor of Aquatic Biology, Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, Alaska. 1990 to 1995.

### Teaching

Courses presently led or contributed to;

- Global Environmental Issues
- Advanced Issues in Environmental Science
- Ecological Systems
- Restoration of Aquatic Ecosystems
- River Ecology, Research and Management, River Assessment and Biomonitoring and River Restoration modules of the Masters in River Environmental Management

### Postgraduate supervision

#### Research Students since 2001

**Kieran Khamis** (EU) Climate change and streams in the French Pyrenees (co- Dr. Hannah).

**Svein Sonderland** (Norwegian Council) Diet of juvenile salmonids in streams with different riparian vegetation characteristics (co – Dr. Ledger).

**Ed Malone** (NERC) Nitrogen dynamics of different aged streams (co-Professor Pinay)

**Philip Blaen** (NERC) Hydroecology of streams near Ny-Alseund, Svalbard (co-Dr. Hannah)

**Chris Mellor** (School) Glacier-fed catchment in Lapland with changing water sources (co- Dr Hannah)

**Jill Crossman** (NERC) Upwelling channels of a braided river in interior Alaska (co- Dr Bradley)

**Megan Klaar** (Birmingham/Worcester) Geomorphological complexity and fish populations

**Helen Vincent** (NERC) Algal/grazer interactions in mecosms (co – Dr. Ledger)

**Rebecca Harris** (NERC/FBA) Effects of drought disturbance on stream channels (co-Dr Ledger)

**Sarah Cadbury** (NERC) Alpine streams in New Zealand (co – Dr. Hannah)

**Mike McDermott** (FBA) Meiofauna in new streams in Glacier Bay

**Lee Brown** (NERC) Alpine streams in the French Pyrenees (co – Dr. Hannah)

**Amanda Hewertson** (NERC/FBA) Colonization of a new watershed, Glacier Bay

**James Ray** (MPhil) (USGS) Chironomidae of streams of Denali National Park

**Kieran Monaghan** (School) Effects of salmon on invertebrates in Glacier Bay

## Research

Current Research:

### Research interests

- Colonization and ecological development of new streams
- River ecology, particularly community recovery following disturbance and long-term variation in benthic communities.
- Ecology of glacier-fed streams
- River restoration and enhancement

### **Hydroecology of glacier-fed river systems in Arctic and alpine regions (French Pyrenees, New Zealand, Lapland and Svalbard)**

The principal aims of these studies are (1) to characterize hydroecological patterns along a longitudinal gradient of ameliorating conditions and changing water source contributions downstream from the glacier terminus; (2) to investigate the temporal variability of the hydroecology at event, diurnal, seasonal and inter-annual time scales; (3) to gain further life history information of key macroinvertebrate species found in glacial rivers; and (4) synthesize the information gained into conceptual models applicable to the hydroecology of alpine and Arctic glacier-fed rivers. Past and current PhD students include Lee Brown, Sarah Cadbury, Chris Mellor, Philip Blaen and Kieran Khamis. Funding has been from NERC (studentships), the Leverhulme Trust, EU ATANS and ARCFAC. Collaborators include Dr David Hannah, Dr Lee Brown of the University of Leeds, Dr Emmanuel Castella of the University of Geneva, Dr Charles Pearson of NIWA, Christchurch and Professor Mike Winterbourn of the University of Canterbury.

### **Colonization and development of new streams in coastal Alaska**

Although succession is a key concept in terrestrial ecology, it is less well understood in the context of aquatic environments. **Glacier Bay National Park** (<http://www.nps.gov/glba/index.htm>) in southeast Alaska provides a superb natural laboratory in which we have been studying the evolution of aquatic ecosystems and predicting how successional processes interact with landscape geomorphology, and ecological factors within other ecosystems. More recently we have been focusing on the how geomorphological complexity increases over time in streams (Dr. Megan Klaar postdoc) and how the diet of juvenile salmonids shifts with differing riparian vegetation characteristics. Collaboration with Dr. Deb Finn (postdoc) to look at genetic variation in colonizing populations. Funding has included NERC, US National Park Service and the Freshwater Biological Association. Past and current PhD students include Elizabeth Flory, Kieran Monaghan, Ian Phillips, Amanda Veal, Mike McDermott and Megan Klaar, Ed Malone and Svein Sonderland. Collaborators include Dr Anne Robertson (Roehampton University), Dr Ian Maddock (University of Worcester) and Dr Lee Brown (University of Leeds).

### **Long term variation in benthic communities/upwelling channels of braided floodplains in Denali National Park, interior Alaska**

This is a study of long term natural variation in a number of streams of Denali National Park from 1994 to relate landscape factors including climate and look at persistence and stability of macroinvertebrate communities. We are also looking at the hydroecology of upwelling channels on a large braided glacial floodplain. Funding includes USGS US NPS and collaborators include Dr Chris Bradley and members of the Denali National Park Service. Past and current research students include Sarah Conn, James Ray and Jill Crossman.

Several research projects within the **Hydroecology Research Group** (<http://www.gees.bham.ac.uk/research/clusters/water/hydroecology.shtml>), include the recovery of benthic communities from drought disturbance in experimental channels and algal-herbivore interactions with Dr Mark Ledger. Past and present PhD students include Rebecca Harris and Helen Vincent.

## Other activities

Member of the European Science Foundation peer review panel (2006 -)

Member of the International Profiles Committee and Election/Place Committee of the North American Benthological Society.

Grants and Awards Committee, Freshwater Biological Association

Editorial Board – BMC Ecology (2005 - ), River Research and Applications (2007 - )

Member of the NERC Arctic Programme Advisory Group (March 2010 - )

## Publications

**Milner, A.M.**, A.E. Robertson, M. McDermott, M.J. Klaar and L.E. Brown (2012). Major flood disturbance alters river ecosystem evolution. *Nature Climate Change* DOI:10.1038/Nclimate1665.

Ledger, M.E., L.E. Brown, F.K. Edwards, **A.M. Milner** (2012) Drought alters the structure and functioning of complex food webs. *Nature Climate Change* DOI 10.1038/NClimate1684.

Brown, L.E. and **A.M. Milner** (2012) Rapid loss of glacial ice reveals stream community assembly processes. *Global Change Biology* DOI: 10.1111/j.1365-2486.

Jacobsen, D., **A.M. Milner**, L.E. Brown and O. Dangles (2012) Biodiversity under threat in glacier-fed river systems. *Nature Climate Change*. **2**; 361-364.

Finn, D., K. Khamis and **A.M. Milner** (2012) Biodiversity trends expected in streams following loss of small glaciers in the French Pyrenees. *Global Ecology and Biogeography* DOI: 10.1111/j.1466-8238.

Crossman, J., C. Bradley, J.N.W. David and **A.M. Milner** (2012) Use of remote sensing to identify areas of groundwater upwelling on active glacial floodplains; their frequency, extent and significance on a landscape scale. *Remote Sensing of the Environment*. 123: 116-126.

Crossman, J., C. Bradley, **A.M. Milner** and G. Pinay. (2012) Influence of environmental instability of groundwater-fed streams on hyporheic fauna on a glacial floodplain, Denali National Park, Alaska. *River Research and Applications*. DOI 10.1002/rra1619

**Milner, A.M.**, A.E. Robertson, L.E. Brown, S. Sonderland and A.J. Veal. (2011) Evolution of a stream ecosystem in recently deglaciated terrain. *Ecology* 92: 1924-1934

Crossman, J., I. Boomer, C. Bradley and **A.M. Milner** (2011) Water flow dynamics of groundwater-fed streams and their ecological significance in a glacierized catchment. *Arctic, Antarctic and Alpine Research*. 43 :364-379

Ledger, M.E., F. Edwards, L.E. Brown, G. Woodward, and **A.M. Milner**. (2011) Impact of simulated drought on ecosystem biomass production: an experimental test in stream mesocosms. *Global Change Biology*. 17: 2288-2297

Brown, L.E., F. Edwards, **A.M. Milner**, G. Woodward, and M.E. **Ledger**. (2011) Food web complexity and allometric scaling relationships in stream mesocosms: implications for experimentation. *Journal of Animal Ecology*. 80: 884-895.

Klaar, M.J., D. Hill, I. Maddock and **A.M. Milner** (2011) Interactions between instream wood and hydrogeomorphic development within recently deglaciated streams in Glacier Bay National Park, Alaska. *Geomorphology* 130:208-220.

Woodward, G., J.P. Benstead, **A.M. Milner** et al. (2010) Ecological networks in a changing climate. *Advances in Ecological Research*. 42:71-138

Brown, L.E., **A.M. Milner** and D.M. Hannah. (2010) Predicting ecosystem response to glacial meltwater dynamics; a case study of quantitative water sourcing and glaciality index approaches. *Aquatic Sciences* 72: 325-334.

McDermott, M.J., A.L. Robertson, P.J. Shaw and **A.M. Milner** (2010). The hyporheic assemblage of a recently formed stream following deglaciation in Glacier Bay, Alaska, USA. *Canadian Journal of Fisheries and Aquatic Sciences*. 67: 304-313.

Klaar, M.J., Maddock, I, and **A.M. Milner** (2010) The development of hydraulic and geomorphic complexity in newly formed streams in Glacier Bay National Park, Alaska. *River Research and Applications* 25: 1331-1338.

Brown, L.E, D.M. Hannah and **A.M. Milner** (2009) ARISE: A classification tool for Alpine River and Stream Ecosystems, *Freshwater Biology* 54:1357-1369

Monaghan, K.A. and **A.M. Milner** (2009) The effect of anadromous salmon redd construction on macroinvertebrate communities in a recently formed stream in coastal Alaska. *Journal of the North American Benthological Association*. 28:153-166

**Milner, A.M.**, L.E. Brown and D.M. Hannah (2009) Hydroecological effects of shrinking glaciers. *Hydrological Processes*. 23, 62-77

Ledger, M.E., R.M.L. Harris, P. D. Armitage and **A.M. Milner** (2009) Realism of model ecosystems: an evaluation of physicochemistry and macroinvertebrate assemblages in artificial streams. *Hydrobiologia* 617, 91-99

**Milner, A.M.**, A.E. Robertson, K. Monaghan, A.J. Veal and E.A. Flory. (2008) Colonization and development of a stream community over 28 years; Wolf Point Creek in Glacier Bay, Alaska. *Frontiers in Ecology and the Environment*, 6, 413-419

Harris, R.M.L., P. D. Armitage, **A.M. Milner** and M.E. Ledger (2008) Replicability of physicochemistry and macroinvertebrate assemblages in stream mesocosms; implications for experimental research. *Freshwater Biology*, 52, 2434-2443

Ledger, M.E., R.M.L. Harris, P. D. Armitage and **A.M. Milner** (2008) Disturbance frequency influences patch dynamics in stream benthic algal communities. *Oecologia*, 155, 809-819

Monaghan, K.A. and **A.M. Milner** (2008) Salmon carcasses as a marine derived resource for benthic macroinvertebrates in a developing post-glacial stream, Alaska. *Canadian Journal of Fisheries and Aquatic Sciences*, 65, 1342-1351

Monaghan, K.A. and **A.M. Milner** (2008) Dispersal mechanisms of macroinvertebrates colonizing salmon flesh in a developing Alaskan stream, *Acta Oecologia*, 34, 65-73

Cadbury, S.C., D.M. Hannah, **A.M. Milner**, C.P. Pearson and L.E. Brown (2008) Stream temperature dynamics within a New Zealand glacierized river basin. *River Research and Applications* 24: 68-89.

Hannah, D.M., L.E. Brown, **A.M. Milner**, A.M. Gurnell, G. McGregor, G.E. Petts, B.P.G. Smith, and D. Snook. (2007) Integrating climatology-hydrology-ecology for alpine river systems. *Aquatic Conservation: Marine & Freshwater Ecosystems*. 17: 636-656

Brown L.E., **A.M. Milner** and D.M. Hannah (2007) Groundwater influence on alpine streams. *Freshwater Biology* 52:878-890.

\***Milner, A.M.**, C. Fastie, F.S. Chapin, D.R. Engstrom and L. Sharman (2007) Interactions and linkages among ecosystems during landscape evolution. *BioScience* 57:237-247.

\*Brown, L.E, **A.M. Milner** and D.M. Hannah (2007) Vulnerability of alpine stream biodiversity to shrinking snowpacks and glaciers. *Global Change Biology* 13:958-966.

**Milner, A.M.**, Brown, L.E. and Conn, S.C. (2006) The persistence of macroinvertebrate communities in interior Alaska streams; implications for biomonitoring. *Freshwater Biology*. 51: 373-387

Robertson, A.L. and **Milner, A.M.** (2006) The influence of stream age and environmental variables on structuring meiofaunal communities in recently deglaciated streams. *Limnology and Oceanography* 51:1454-1465

Ledger, M.E., Harris, R.M.L., **Milner, A.M.** and Armitage, P.D. (2006) Disturbance, biological legacies and community development in stream mesocosms. *Oecologia* 51:1454-1465.

Brown, L.E, Hannah, D.M and **Milner, A.M** (2006) Hydroclimatological influences on water column and streambed thermal dynamics in an alpine river system. *Journal of Hydrology* 325: 1-20

Brown, L.E, Hannah, D.M. and **Milner, A.M.** (2006) Short Communication: Thermal variability and stream flow permanency in an alpine river system. *River Research and Applications* 22: 493-501.

Brown, L.E, **Milner, A.M.** and Hannah, D.M. (2006) Persistence and stability of alpine stream macroinvertebrate communities and the role of physicochemical habitat variables. *Hydrobiologia* 540: 159-173

Brown, L., D.M. Hannah and **A.M. Milner** (2005) Spatial and temporal water column and streambed temperature dynamics within an alpine catchment: Implications for benthic communities. *Hydrological Processes* 19:1585-1610.

**Milner, A.M.** and Gloyne-Phillips, I.T. (2005) The role of riparian vegetation and woody debris in the development of macroinvertebrate assemblages in streams. *Rivers: Research and Application* 21:403-420.

**Milner, A.M.** and Piorowski, R.J.. (2004) Macroinvertebrate community assemblages in streams of interior Alaska following placer mining. *River Research and Applications* 20:719-731

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**Milner, A.M.** and York, G.S. (2001) Salmonid colonization of a new stream in Kenai Fjords National Park, southeast Alaska. *Archiv fur Hydrobiologie* 151:627-647

**Milner, A.M.**, Taylor, R.C. and Winterbourn, M.J. (2001) Longitudinal distribution of macroinvertebrates in two glacier-fed New Zealand rivers. *Freshwater Biology* 46:1765-1776

**Milner, A.M.**, Brittain, J.E., Castella, E. and Petts, G.E. (2001) Trends of macroinvertebrate community structure in glacier-fed streams in relation to environmental conditions: a synthesis. *Freshwater Biology* 46:1833-1848

Snook, D.L. and **Milner, A.M.** (2001) The influence of glacial runoff on stream macroinvertebrates in the Taillon catchment, French Pyrenees. *Freshwater Biology* 46: 1609-1624

Friberg, N., **Milner, A.M.**, Svendsen, L.M., Linegaard, C. and Larsen, S.E. (2001) Distribution of macroinvertebrates in streams of Greenland. *Freshwater Biology* 46: 1753-1764

Brittain, J.E. and **Milner, A.M.** (2001) Ecology of glacier-fed rivers: current status and concepts. *Freshwater Biology* 46:1571-1578

Robertson, A. and **Milner, A.M.** (2001) Coarse particulate organic matter: A habitat or food resource for the meiofaunal community of a recently formed stream *Hydrobiologia* 152:529-541

