

Summary of Findings

STRIVE Report No. 68

BIOCHANGE – Biodiversity and Environmental Change an Integrated Study Encompassing a Range of Scales, Taxa and Habitats

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BioChange was an interdisciplinary, multi-institutional study. Its main aim was to develop integrative research activity that would, now and in the future, address important issues affecting Irish biodiversity, with outputs directly linked to policy support both regionally and nationally.

Background

Biodiversity is currently declining at rates comparable to major extinctions in geological history, driven by anthropogenic impacts, yet biodiversity underpins the ecological functions that provide the many natural goods and services on which life, livelihoods and sustainable living depend. Understanding how human activities impact on biodiversity, developing effective methods to mitigate impacts, and restoring degraded ecosystems are essential to major international policy objectives that aim to reduce the rate of biodiversity loss. Maintaining and enhancing provision of ecosystem goods and services will be key to delivery of the UN Millennium Development Goals.

Four work packages addressed the main drivers of biodiversity loss – habitat loss and fragmentation, invasive non-native species, pollution, and over-exploitation – in a variety of habitats and at differing spatial scales. Two cross-cutting projects provided accessible information on biodiversity, and made recommendations on improved biodiversity governance. BioChange also produced high-quality biological and sociological data.

Key Points

- Simulated climate change and the removal of grazing resulted in rapid changes in biodiversity.
- Small sites have both intrinsic local value and broader landscape values and should not be undervalued.
- Invasive species have wide impacts on biodiversity. For example, zebra mussels were found to alter nutrient cycling and reduce aquatic invertebrate diversity, while Japanese knotweed invasion resulted in reduced plant species richness.
- Biodiversity indicators should be carefully selected. BioChange found that plant diversity did not reflect invertebrate diversity in wetland habitats.
- Easy-to-access information is fundamental in halting biodiversity loss. BioChange has produced a database of alien plant species in Ireland, taxonomic information online and an interactive key to the vascular plants of Co. Clare and south Connemara.
- While these outputs should already have considerable benefits to stakeholders who need this information, upscaling of these outputs to provide coverage of more taxonomic groups, and geographically to provide national coverage is a priority.
- It is clear that Ireland needs to assign long-term natural/semi-natural study sites for both on-going monitoring and experimental manipulation: this is the only way in which we are going to obtain reliable information to predict future biodiversity response to environmental and other land-use change.

Outputs/Concluding Remarks

BioChange attempted to investigate the impacts of major drivers of biodiversity loss in a variety of Irish habitats. During the project, training was provided for researchers in a number of areas, including GIS, desk study and report writing, effective presentations, and statistical analyses. The provision of well-trained and highly qualified researchers will increase Ireland's capacity to meet the needs of future biodiversity research, policy making and implementation, and practical management of Ireland's biodiversity resources.

The varied research outputs have directly furthered scientific knowledge in the areas of ecology and conservation. BioChange has also developed an invaluable suite of monitoring sites that, given adequate funding, can form the basis of on-going experimentation and research to provide real insight into long-term impacts of pressures on biodiversity. Other

major outputs include the provision of accessible biodiversity information. Many of the BioChange outputs and findings have direct relevance to policy implementation and in some cases illustrate the need to improve mechanisms for generating and implementing biodiversity policy.

Leading on from the specific research findings, and the numerous discussions within BioChange around these findings, there are a series of recommendations, these are listed on page 50-54 in the Synthesis report.

The Synthesis report can be downloaded at the EPA Website:

<http://www.epa.ie/downloads/pubs/research/biodiversity/>

For Further Information

Contact Louise Scally (BEC Consultants Ltd, 26 Fitzwilliam Street Upper, Dublin 2, lscally@biodiversityresearch.ie)

Peer Reviewed Publications

Atalah, J. and Crowe, T.P. 2010. Combined effects of nutrient enrichment, sedimentation and grazer loss on rock pools assemblages. *Journal of Experimental Marine Biology and Ecology* **388**, 51–57.

Atalah, J. and Crowe, T.P. (in preparation). Pollution as a driver of biodiversity change in rocky shores: using molluscan assemblages as biomonitoring tool. Target journal *Marine Pollution Bulletin*.

Atalah, J., Kelly Quinn, M., Irvine, K. and Crowe, T.P. 2010. Impacts of invasion by *Dreissena polymorpha* on the performance of macroinvertebrate assessment tools for eutrophication pressure in lakes. *Hydrobiologia* **654**, 237–251.

Fitch, J.E. and Crowe, T.P. 2010. Effective methods for assessing ecological quality in intertidal soft-sediment habitats. *Marine Pollution Bulletin* **60**, 1726–1733.

Fitch, J.E. and Crowe T.P. In press. Combined effects of temperature, inorganic nutrients and organic matter on ecosystem processes in intertidal sediments. *Journal of Experimental Marine Biology and Ecology*.

Gittings, T. 2007. *Odontomyia angulata* (Panzer, 1798) a soldierfly (Diptera, Stratiomyidae) new to Ireland. *Irish Naturalists' Journal* **28**, 419.

Gittings, T. and Speight, M.C.D. 2008. *Colobaea pectoralis* (Zetterstedt, 1847) and *Pherbellia dorsata* (Zetterstedt, 1846), snail-killing flies (Diptera, Sciomyzidae) new to Ireland. *Irish Naturalists' Journal* **29**, 116–118.

Higgins, T., Grennan, J. and McCarthy, T.K. 2008. Effects of recent zebra mussel invasion on water chemistry and phytoplankton production in a small Irish lake. *Aquatic Invasions* **3**, 14–20.

Milbau, A. and Stout, J.C. 2008. Factors associated with alien plants transitioning from casual, to naturalized, to invasive. *Conservation Biology* **22**, 308–317.

Milbau, A., Stout, J.C., Graae, B.J. and Nijs, I. 2009. A hierarchical framework for integrating invasibility experiments incorporating different factors and spatial scales. *Biological Invasions* **11**, 941–950.

O'Callaghan, E., Foster, G.N., Bilton, D.T. and Reynolds, J.D., 2009. *Ochthebius nilssoni* Hebauer new for Ireland (Hydraenidae, Coleoptera). *Irish Naturalists' Journal* **30**, 19–23.

Williamson, M., Dehnen-Schmutz, K., Hill, M., Kühn, I., Klotz, S., Milbau, A., Pyšek, P. and Stout, J.C. 2008. The distribution

of range sizes of native and alien plants in four European countries and the effects of residence time. *Diversity and Distributions* **15**, 158–166.

Williamson, M., Stout, J.C., Dehnen-Schmutz, K., Milbau, A. and Hall, A.R. 2008. A provisional list of Irish archaeophytes. *Irish Naturalists' Journal* **29**, 30–35.

Wojtal-Frankiewicz, A., Frankiewicz, P., Jurczack, T., Grennan J. and McCarthy, T.K. 2010. Comparison of fish and phantom midge influence on cladocerans diel migration in a dual basin lake. *Aquatic Ecology* **44**, 243–254.

Theses Submitted or in Preparation

Atalah, J. 2009. *Multiple anthropogenic stressors as drivers of biodiversity change in aquatic systems: impacts, indicators and monitoring*. Unpublished PhD thesis, University College Dublin.

Cunningham, C. 2009. *Impact of landscape composition on pollinator diversity and pollination services*. Unpublished MSc thesis, Trinity College Dublin.

Eschmann, C. *An evaluation of the effects of predicted climate change on Ascophyllum nodosum*. Provisional PhD thesis title, National University of Ireland, Galway.

Fitch, J.E. 2010. *Effective monitoring of marine ecosystems: the response of intertidal benthic communities to multiple stressors*. Unpublished PhD thesis, University College Dublin.

Grennan, J. *The impact of invasion by Zebra mussels (Dreissena polymorpha) in County Clare lakes*. Provisional PhD thesis title, National University of Ireland, Galway. 40 *Biodiversity and Environmental Change: An Integrated Study*