Summary
The Trinity Centre for Biodiversity Research (TCBR) is one of Ireland’s largest biodiversity research centres. The TCBR facilitates and conducts multidisciplinary and international research on biodiversity related topics. Since 2007 over 250 peer-reviewed articles were published as part of the TCBR group and over €7.5 million was raised in international research funding by our principle investigators. The TCBR provides a platform to scientists, environmental practitioners, policy makers and other interested parties, to share knowledge and develop frontier research on key questions related to biodiversity. The TCBR welcomes collaborative partnerships with interested individuals and organizations to facilitate local and international research and the dissemination of such research to an inclusive audience.

About the Authors
Sven P. Batke is a Ph.D. student at the Botany Department in Trinity College Dublin and is a post-graduate representative for the TCBR. He is currently working in Honduras on the diversity and distribution of mechanically dependent plants along a gradient of past hurricane impact.

Professor Jane Stout is the Director of the TCRB and the coordinator for the national project on biodiversity and ecosystem services (www.simbiosys.ie). She holds a lecturing position at the Botany Department in Trinity College Dublin. Her research expertise’s are in ecology and human impacts on biodiversity and ecosystem services.

About TCBR
The Trinity Centre for Biodiversity Research (TCBR) was launched in 2008 by Sir David Attenborough, with the objective to provide multidisciplinary expertise in biodiversity research. The TCBR is now one of the largest biodiversity research centres in Ireland, providing crucial research for the development of national, European and international policy and strategy recommendations. As economic development, human wellbeing, health, livelihoods and societies depend on biodiversity for the provision of ecosystem services and function, the TCBR aims are to provide an innovative opportunity to consolidate leading research expertise that can advise on the sustainable use and conservation of such services. Currently, three principle areas are covered through the TCBR:
• **Documenting and describing biodiversity:** including classical and molecular taxonomy and systematics, field inventory and characterisation of biodiversity, and reconstruction of palaeoecological environments.

• **Ecology and ecosystem functioning:** including understanding physiological responses of organisms to environments, community interactions, spatiotemporal relationships, ecosystem functioning and delivery of services, impacts of climate change and other human pressures (and their interactions) and predictive modelling under global change scenarios.

• **Biodiversity and sustainable livelihoods:** including conservation and management approaches, social and economic aspects, policy, mitigation/control and dissemination.

As part of Trinity College, The University of Dublin (TCD), the TCBR is working closely with existing centres and initiatives in Ireland and further afield, including the National Biodiversity Data Centre (www.biodiversityireland.ie), Quercus, the Northern Ireland Research Centre for Biodiversity and Conservation Biology, the Environmental Protection Agency, Teagasc, the National Botanic Gardens (www.botanicgardens.ie), Dublin City Council and other third level institutions in Ireland (including UCD, UCC, NUIM, DCU, UL, NUIG, Queens University Belfast) and overseas.

Currently, over 20 Principle Investigators (PIs) working together with TCBR were awarded a total of over €7.5 million in research funding (2007-2012). Approximately 65 Ph.D. students are currently working on biodiversity-related topics within the TCBR research group. Current research sites, amongst others, are located in countries such as Australia, South Africa, Indonesia, Honduras, the United States, Spain, France, the United Kingdom and the Republic of Ireland (Figure 1). Since 2009 PIs have published over 250 articles in peer reviewed international journals on topics such as

![Figure 1. Map of TCBR research sites](image)
“Response of farmland biodiversity to bioenergy crops”, “Climate-related changes in peatland carbon accumulation”, “Impacts of organic and conventional dairy farming on biodiversity” and “Pathogen control in drinking water”. In addition, the TCBR has been involved in a number of public outreach projects, including the Dublin Biodiversity Audio Tour (DBAT: https://www.tcd.ie/tcbr/biodiversity-audiotour/), which brings together biodiversity stories from around Dublin. The DBAT is a series of short, free-to-download pod-cast audio clips that takes the visitor on a journey of discovery through different locations around Dublin such as Bull Island, the National Botanic Gardens, the Natural History Museum and many more.

Recent and ongoing research

*Impacts of biofuel cropping on biodiversity and ecosystem services in Ireland*

International policy and government incentives to reduce reliance on fossil fuels have stimulated the rapid expansion of biofuel crop production globally. This has led to major land use change over a short timescale, without full understanding of the potential impacts of these changes on biodiversity and natural ecosystem processes, and the ecosystem services they provide. The EPA-funded SIMBIOSYS project investigated the impacts of growing *Miscanthus* (a fast growing perennial grass) and oilseed rape (an annual insect-pollinated seed crop) on insect and plant biodiversity and the delivery of pollination, pest control and carbon sequestration services. Large-scale field studies on 50 commercial farms in south-east Ireland were conducted between 2009 and 2012, comparing the two bioenergy crops with conventional cropping systems (Figure 2). Overall, the biodiversity in bioenergy crops was either higher than in conventional crops (e.g. there was higher vascular plant richness in *Miscanthus* stands planted on former conventional tillage, and higher solitary bee abundance and richness in *Miscanthus* and oilseed rape compared with conventional crops) or no different (e.g. no differences between crop types for hoverflies and bumblebees diversity) (Bourke et al. 2013). In terms of impacts

Figure 2. Left: Fast growing perennial *Miscanthus* for bioenergy production (image taken by J. Zimmermann). Right: Annual insect-pollinated oilseed rape (image taken by D. Stanley).
on ecosystem services, some positive effects were found: just two years after planting Miscanthus, a significant amount of carbon was already sequestered into soils (Zimmermann et al. 2012); bees from several hundred bumblebee colonies were attracted to individual oilseed rape fields (Stanley et al. 2013b), and were important for crop production; exclusion of pollinators from oilseed rape resulted in approximately 30% decrease in seed number and weight, equivalent to nearly €4 million per annum (Stanley et al. 2013a). There were tradeoffs associated with biodiversity in bioenergy crops however, and positive effects of Miscanthus on biodiversity can diminish with increasing Miscanthus productivity (Dauber et al. 2013). Although the project concluded that the bioenergy crops compared favourably with conventional crops in terms of biodiversity of the taxa studied at the field scale, the effects of large-scale planting could be very different (Bourke et al. 2013). In order to maintain biodiversity and ecosystem functioning and the delivery of ecosystem services at the same time as ensuring the sustainable development of climate change mitigation measures, a greater understanding of the impacts of management and processes operating at landscape scales are required.

Epiphyte diversity in Cusuco National Park, Honduras

Epiphytes are one of the most prominent plant life-forms in tropical forest canopies. It has been estimated that epiphytes account for approximately 9% of the global vascular plant diversity (Zotz 2013). Epiphytes provide important ecological functions within forest ecosystems such as mineral and nutrient cycling and they provide important habitats and foraging grounds to other canopy dwelling organisms.

Epiphytes have been studied extensively in the Neotropics, particular in South and South-Central American countries. However, less research has been carried out in North-Central America. As part of an ongoing TCBR biodiversity research project, and in collaboration with Operation Wallacea, an expedition set out in 2012 and 2013 to explore for the first time the diversity and distribution of epiphytes within a Cusuco National Park (CNP); a small nature reserve in the Northeast of Honduras.

In recent years, CNP has been under severe anthropogenic pressures and threats such as logging and shifting agriculture (e.g. coffee plantations) have resulted in a disturbance mosaic across the park. This has been further exacerbated by the occasional passing of hurricane storms (Batke et al. 2014). To reinforce the importance of CNP as a biodiversity hotspot, the investigators set out to provide important botanical base-line information for the park. Also, the researcher aimed to investigate the effect of past hurricanes on the distribution, diversity and composition of epiphytes within the Park. Rope-climbing methods were employed to sample epiphytes along the full vertical forest profile (Figure 3). To date, over 6000 individuals of epiphytes from over 200 different species have been identified (project video link: http://youtu.be/F1k7hocXbO0). Most species belonged to the Orchidaceae (orchids), Bromeliaceae (bromeliads), Polypodiaceae (ferns) and Araceae (nomadic
Several species were new additions to the Park, Honduras and/or Mesoamerica [e.g. Batke and Hill (2013)]. The forest canopy in CNP showed significant structural (e.g. increased canopy openness) and microclimate (increases in vapour pressure deficit) alterations as a result of past hurricane impacts (Batke and Kelly 2014). It was also found that the distribution, diversity and composition of epiphytes were altered due to these modifications. For example, epiphyte diversity was significantly reduced and the epiphyte communities shifted to disturbance tolerant species, on sites that have been more affected by hurricanes (Batke et al. unpubl. data). So far this project has highlighted the importance of CNP as a biodiversity hotspot and further stressed how important it is to incorporate historical disturbance events (e.g. hurricanes) in the study of species biogeography (Batke et al. in review).
The TCBR strategy

To realise the potential for the TCBR, our strategic plan is to:

- Enhance the quality and quantity of research on biodiversity across a wide range of disciplines. This will be achieved by networking to facilitate research development, research activities and knowledge transfer across a range of levels to improve research, training and education, capacity building and policy development.
- Intensify and expand appropriate links both within and outside TCD, in Ireland and internationally.
- Become recognised as the leading interdisciplinary biodiversity research group in Ireland.
- Secure national, European and international high quality collaborative research funding.
- Reinforce appropriate links within TCD, e.g. among ecological scientists, economists, environmental engineers, health workers, lawyers and political scientists.
- Strengthening links outside TCD, e.g. with the National Biodiversity Data Centre, the National Parks and Wildlife Service, relevant government departments, the National Botanic Gardens, the Irish Wildlife Trust, BirdWatch Ireland, and other appropriate environmental NGOs within Ireland.
- Strengthening links internationally, e.g. with the EU Joint Research Centres, Diversitas, Intergovernmental Panel of Biodiversity and Ecosystem Services
- Increase college, public and political awareness of biodiversity and its role in the delivery of fundamental ecosystem services.

How to get involved

The TCBR invites CIEEM members and the public to join our efforts to safeguard biodiversity and to gain and disseminate frontier knowledge on the sustainable management of biodiversity services. Please visit our website for further detail and a list of some of our most recent publications. We welcome contributions of any kind (e.g. research ideas and observations) and we would encourage active participation in this initiative. You can also join our online newsletter, which reports on the most recent TCBR projects (TCBR: https://www.tcd.ie/tcbr/).
References


