CSC-RUB PhD Project Proposal

**Title:** Ecological restoration under climate change: Repair of heatwave mediated biodiversity loss

**Sector of research:** Biodiversity Research, Community Ecology, Restoration Ecology

**Degree awarded:** PhD, Dr.rer.nat.

**Keywords:** Biology, biodiversity, climate change, coexistence, conservation biology, community ecology, competition, competitive exclusion, ecological modeling, ecological modelling, ecological restoration, ecosystem function, ecosystem services, extinction, extinctions, extreme events, food web, food webs, food web interactions, freshwater ecology, global warming, heat, heatwave, heatwaves, heat wave, heat waves, persistence, population dynamics, predation, priority effect, priority effects, restoration ecology, species richness, stability, stress, stressor, stressors, temperature.

**Supervisor of PhD project:** Prof. Dr. Matthijs Vos, Theoretical and Applied Biodiversity Research, Ruhr University Bochum, e-mail: Matthijs.Vos@rub.de

**Research focus of supervisor:** Worldwide, ecosystems increasingly experience heatwaves and other extreme events. Climate change leads to local losses of biodiversity and ecosystem function. Attempts to repair these losses often fail, as the mechanisms governing successful restoration are poorly understood. We use experiments and ecological modelling to explain what mechanisms help to restore diversity and function in ecological communities that experienced an extreme event. We have expertise in theoretical work (ecological modelling with Matlab) and lots of experience with experimental community dynamics in our climate facilities. This allows us to study replicated ecological communities experiencing heatwave disturbance and a wide variety of subsequent measures to repair them.

**Publications:** In the last 5 years: 9 papers that were cited 96 times. Selected papers:


**Second Supervisor of PhD project:** Prof. Dr. Ralph Tollrian, Department of Animal Ecology, Evolution and Biodiversity, Ruhr University Bochum.
Summary of research plan:

**Background:** Extreme events and the associated biodiversity loss can change ecological communities in ways that make their repair exceedingly difficult. This has been called ‘community closure’ and ‘resistance of the degraded state against restorative interventions’. The problem is thought to result from priority effects, indirect interactions among species, changes in competition and predation and from a loss of coexistence mechanisms.

**Study objective:** This project addresses the intricate ways in which extreme events, species richness and coexistence mechanisms interact to produce either successful recovery or the system getting stuck in a damaged state. The central aim is to develop expertise that enhances our capacity to restore damaged ecological communities to diverse and fully functioning systems. The theoretical work will generate hypotheses and quantitative predictions that are subsequently tested using climate-controlled experimental communities.

**Expected Results:** The project can lead to three publications (1 theoretical and 2 experimental papers) and to international conference presentations as output.

**Methods:** We perform analysis of alternative ecological model scenarios using Matlab and replicated community dynamics experiments in the lab using algae, ciliates and rotifers in temperature controlled Multitron incubator shakers. Counts of the different sampled species are made by microscopy and/or use of a Flowcam.

**Candidate Requirements:** An MSc degree in Ecology, Community Ecology, Theoretical Ecology, Restoration Ecology or a related discipline is requested. The candidate preferably has practical experience in experimental plankton ecology / community dynamics and/or in ecological modelling. Strong conceptual thinking is a requirement. We are an international group and request team player attributes! Excellent English language skills are mandatory.

**Motivation for CSC application:** In our group you have the unique chance to combine experimental and theoretical research approaches. The research will contribute to a more successful repair of ecological communities damaged by extreme events. We offer training in the study of replicated experimental communities experiencing different temperature scenarios and in the use of Matlab for ecological modeling. You will be integrated in our International Graduate School of Biosciences (IGB) and have the opportunity to attend international courses and conferences to enhance your career development.