Pablo Urrutia Cordero

Interview. October, 2020.

"The services offered by the SITES AquaNet infrastructure to researchers are unprecedented"

Pablo Urrutia Cordero
Researcher, Uppsala University

"I am a postdoctoral researcher whose interests lie in the fields of community ecology and global change science. My purpose is to deep our understanding on how biological communities react to environmental disturbances across temporal and spatial scales, as well as to find means to increase stability of critical ecosystem functions and services. To this end, I combine field observations, experimental approaches and statistical modelling. I am mostly attracted to using lakes and ponds as model system. Despite their importance to both the provision of key resources to human welfare and maintenance of biodiversity, these freshwater ecosystems are highly susceptible to changes in our global environment driven by human activities"

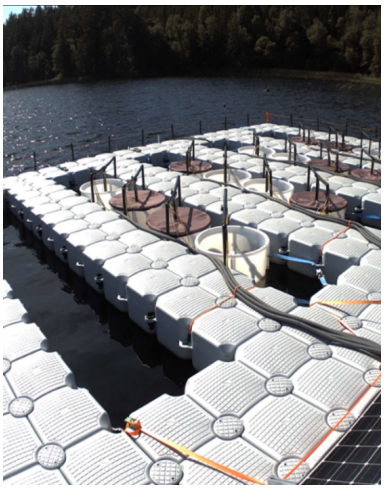
What is the motivation behind your project and how is it linked to SITES?

In times of accelerating environmental change, it is crucial to understand the multifaceted impacts of ecological stressors that affect ecosystems across temporal and spatial scales.

SITES AquaNet is a thematic program within SITES and a standardized infrastructure for national and international researchers to run modularized experiments across stations and seasons, allowing for generalization of responses of lake communities and ecosystem functioning to multiple stressors.

What is the purpose with the first test within SITES AquaNet modularized experiment?

In this first study we evaluated how lake plankton react and recover from pulse perturbations (finite duration) in the form of fish predation, as well as how these responses interact with and without the additional stress of press perturbations (constantly present) in the form of reduced light availability.



Both disturbances have connection to climate change. Changing temperatures and extreme heat events can boost the predation and reproduction rates of planktivorous fish species, with repercussions in the form of pulse perturbations for lower trophic levels through e.g., rapid changes in their functional and numerical responses.

Our modularized experiment across space and time offers a broad view of the mean and variance in the response of lake plankton to the interactive effects from these specific disturbances, but also aims at identifying general ecological phenomena, which may be potentially useful for predicting responses to other pulse and press disturbances regardless of their different nature.

Could you give us a brief description of the setup of the study?

With pleasure! Natural lake plankton communities (zoo-, phyto- and bacterioplankton) were exposed to the same combination of pulse (temporary presence of fish) and press (constant reduction of light availability) perturbations in **ten replicated outdoor mesocosm experiments**. The experiments were conducted **in five different lakes** located along a latitudinal gradient in Scandinavia during two different seasons (spring and summer), each consisting of a 2x2 factorial design of pulse and press disturbances with four replicates per treatment.

How come you used reduction in light availability as a press disturbance?
Because light availability is being reduced in many lakes in boreal and subarctic regions as a consequence of increased precipitation and associated cloud cover from climate change, or 'lake browning' from the discharge of terrestrially derived humic substances.

Which lakes and SITES stations were included in the study?

Lake Feresjön, Asa Research station
Lake Bolmen, Bolmen research station (a SITES associated station)
Lake Erssjön, Skogaryd Research catchment
Lake Erken, Erken Laboratory
Lake Stortjärn, Svartberget Research station

What was your hypotheses?
The setup allowed us to analyze **mean responses of both functional** (biomass/abundance) and **compositional** (temporal turnover) **aspects of the communities as well as the spatial and temporal variance of these responses**. We hypothesize that the three lake plankton communities quickly respond to the pulse perturbations, but both their function and composition will recover after the pulse ends. However, we expect the magnitude of the response and recovery pace of lake plankton communities to these perturbations to differ with the concomitant action of press disturbances, as well as across lakes and seasons.

Why did you choose to focus on responses of lake plankton?
We focus on responses of lake plankton communities **because they drive many key ecosystem functions and services** delivered by lakes, such as drinking water, food resources, biogeochemical cycles, degradation of pollutants or climate mitigation. Moreover, lake plankton are particularly sensitive to environmental disturbances, as they display rapid community turnover in response to changes in the environment, including changes imposed by the surrounding landscape and atmosphere to their food web structure and interactions. Their sensitivity to disturbances provides us with a unique opportunity to test fundamental hypotheses in ecological stability theory.

What was the added value in performing data collection at SITES stations?

General predictions on ecological responses to perturbations are hard to achieve by single site experiments because of the context-specificity of responses. Being able to **conduct replicated experiments in a standardized way** across multiple SITES stations provides with the possibility to generalize the results across a wide range of environmental conditions.

Has a collaboration with other researcher, research groups and stakeholders taken place?

The implementation of the SITES AquaNet infrastructure and these first experiments originated from SITES funding to Helmut Hillebrand (Oldenburg University, Germany), Silke Langenheder (Uppsala University), Maren Striebel (Oldenburg University, Germany), Peter Eklöv (Uppsala University), David Angeler (SLU), Lars Tranvik (Uppsala University) and Eva Lindström (Uppsala University).

I, Pablo, supported this work with an International Postdoc Grant from the Swedish Research Council.

Linda Parkefelt (Sweden Water Research), Omneya Ahmed Osman and Bianka Csitári (Uppsala University), Lars-Anders Hansson and Egle Kelpsiene (Lund University), and Stefan Bertilsson, Maria Lundgren and Hjalmar Laudon (SLU) also participated in the project.

All authors are especially grateful to all SITES staff from the SITES stations and associates of Erken, Asa, Svartberget, Skogaryd and Bolmen who supported the experiments and generated the experimental data.

Where could we find the results and how can it be utilized by different stakeholders?

The experimental data is available at the SITES data portal.

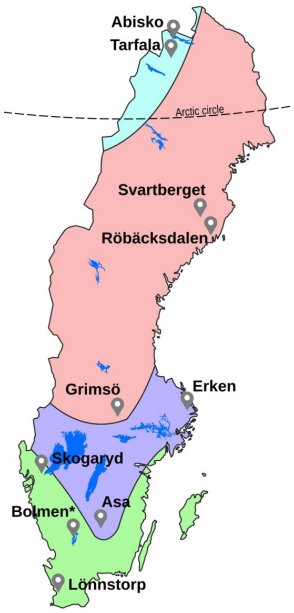
With our modularized experiment replicated in space and time, we aim to generate general predictions on how multitrophic communities respond to the interactive impacts of pulse changes in fish presence and press changes in reduced light availability. For example, how communities respond and recover from pulse disturbances with and without the additional stress by press disturbances? Do the functioning and composition of communities respond in the same way, and how do they differ as a function of their position in the food chain? How much response variability do we find across sites and seasons?

Being able to generalize these predictive results is critical information for water managers, as we would be able to identify general response and recovery patterns of communities across a wide range of environmental conditions, thus **generating knowledge for taking adaptive management actions** to buffer the effects of those perturbations.

What value do your see in SITES AquaNet as an infrastructure?

The services offered by the SITES AquaNet infrastructure to researchers are unprecedented.

1. SITES AquaNet offers **an open infrastructure** to researchers to use, thus making it accessible to research groups which lack mesocosm facilities.
2. It **enables conducting standardized experiments** across **multiple sites and seasons** in a coordinated fashion.
3. It enables **collecting high frequency data** with a costly sensor system, thus capturing ecological responses over multiple temporal scales.
4. It **supports researchers with expertise** as well as **technical aspects** for conducting the experiments, and
5. Researchers have the possibility to **use the SITES Data Portal for storing the data** generated from their projects.



If you want to find out more about Pablo´s background and current research topics and projects, **please visit his website**.