Theory and experiments to decipher the role of time and space in ecological systems, from populations to ecosystems

Understanding the role played by time and space when an ecosystem is disturbed is essential for devising sustainable conservation and management policies. The SETE (Theoretical and Experimental Ecology Station), founded by Jean Clobert and Michel Loreau of the National Centre for Scientific Research, conducts innovative theoretical and experimental research to reach this goal in a unique research station.

The SETE (Theoretical and Experimental Ecology Station) is an interdisciplinary research station established in 2016 to study ecological systems in a rapidly changing environment. Founded by Jean Clobert and Michel Loreau, it aims to provide both theory and experimental methodologies to understand and predict the responses of ecological systems to environmental changes. The unique experimental platforms at the SETE station include terrestrial and aquatic metatrons, and field studies. The researchers are interested in the cascade of effects from the genotype-phenotype to the individual, population, community and ecosystem, resulting in changes in the functioning of the broader ecosystem.

ON COMMUNITIES AND ECOSYSTEMS

SETE also studies how global changes, such as climate change, habitat fragmentation and biodiversity changes, affect the dynamics of species interactions and ecosystem functioning. Researchers accomplish this by developing a whole new research field on the relationships between biodiversity and ecosystem functioning (BEF). SETE researchers have built the theoretical foundations of this research field, which studies how changes in biodiversity affect ecosystem functioning, stability and services. BEF theory is now recognised as a

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Behind the Research

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**SETE Objectives**

SETE conducts research to assess the broad roles played by time and space in changing ecosystems.

**Research Approaches**

Innovative research on the combined effects of climate warming and habitat fragmentation on community dynamics and ecosystem functioning.

**Funding**

- CNRS
- Ariège department
- ERC
- European funds
- ANR

**Collaborators**

- José Montoya, Julien Cote, Simon Blanchet, Delphine Legrand, Olivier Guillaume, Catherine Clerc, Alexis Chaine, Michelle Huet

**References**


**Personal Response**

To what extent do you believe the research performed at SETE is being correctly used by international governments to mitigate biodiversity loss and ecosystem collapse?

This is indeed an important question. First, the quality of the research and its robustness is key for our work to be taken seriously by policy makers. This is sadly not enough. We also need to have more time devoted to making our research accessible and to communicate on social networks, as well as participate at all social events that have the human-nature coexistence on their agenda. Finally, we have to increase our participation with nature societies and environmental agencies to build large-scale following up and/or experiments to speed up our knowledge on biodiversity and ecosystem as well as to transfer the acquired know-how.

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**Jean Clobert**

**Michel Loreau**

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**Studies**

Fundamental and empirically validated theory in biology, and is used in conservation policy globally. Most BEF studies, however, are conducted at very small scales, whereas SETE seeks to extend BEF theory to large temporal and spatial scales.

Studies in this field have also led to exciting new empirical discoveries. For instance, SETE produced a groundbreaking study focused on the effect of intraspecific diversity on ecosystem functioning using a mesocosm experiment. Researchers showed for the first time that losing the diversity of genes in a single population can have powerful effects on communities and the broader ecosystem, thus extending the BEF theory to include intraspecific diversity. They also studied the effects of climate fluctuations on the BEF relationship, and found that biodiversity loss mostly affects ecosystem functioning at intermediate timescales.

Lastly, SETE researchers are performing innovative research on the combined effects of climate warming and habitat fragmentation on community dynamics and ecosystem functioning. Although climate warming and habitat fragmentation are well studied in isolation, very little is known about their combined effects. SETE researchers use multiple species of phytoplankton and zooplankton that coexist in the aquatic metatopos to conduct this research.

Although the study has yet to reach its three-year duration, early publications from this study have already provided novel findings that will be essential for future research and for shaping new conservation strategies.

**VITAL ECOSYSTEM CONSERVATION RESEARCH**

As the global human population increases, human activities further exacerbate disastrous effects on ecosystems. Understanding the part played by time and space in response to these disturbances will be essential in ensuring biodiversity conservation and responsible use of ecosystem services.

There remain enormous difficulties and limitations in performing studies of ecosystems across time and space. The complexity of species interacting across multiple trophic levels and temporal and spatial scales makes this an ever-changing subject, which is a constantly challenging researchers. Moreover, the SETE team works with constant back and forth iterations between building models and conducting experiments, a time-consuming and challenging process.

Nevertheless, with their crucial research, the SETE team assist in designing practical conservation strategies. Their work is integral in shaping policy and inspiring further research for deeper understanding. Their work will help ensure the relationship between humanity and biodiversity and the environment is mutually sustainable in the long term. This generates for the SETE the constant obligation of transfer of this new knowledge to conservation and nature-monitoring agencies.

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**Observation of a zooplankton culture**

**A daphnia culture**

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