**Title:** Ecological theory and applications

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**Lecturers:**

**Entry requirements:**

Ecological theory and applications builds on knowledge from Ecology and Experiments.

**Study path:**

Ecological theory and applications is a core course of the Ecology and Wildlife Management study path. It provides good preparation for Biodiversity and Landscapes, Sustainable Development Goals, and Tropical Ecology.

**Learning objectives:**

The central theme of this course is how ecological theory informs and is applied in conservation, management, and policy of socio-ecological systems. At the end of the course students are expected to:

1. Understand fundamental ecological theory and how humans interact with these theories
2. Understand the role of theoretical modeling in ecological research
3. Formulate and modify simple theoretical models in R
4. Situationally apply ecological theory and synthesize across theories for conservation, management, or policy
5. Conceptualize, develop, and present a group project applying ecological theory to an urban ecosystem

**Skills:**

* Using R for theoretical modeling
* Collecting observational data
* Processing and analyzing data in R
* Critically evaluating statistical output
* Basic plant identification of important plant families in the Netherlands
* Independently searching literature for relevant articles
* Working together in small groups on relevant ecological topics
* Giving and receiving feedback with peers
* Creating content that is targeted to a specific stakeholder group

**Contents and teaching methods:**

Ecological theory and applications explores the major pathways of ecological theory from competition between individual species to global ecosystems. Each week, we will explore an ecological theory and then examine how that ecological theory is applied in practice through a specific case study. These case studies include examining human interactions through the lens of competition theory, conservation policy in desert systems, water management and rewilding in important Dutch ecosystems, ecological restoration across landscapes, and global climate policy. These case studies examine the consequences of ecological theory across stakeholders, systems, and scales. These case studies include two field trips by bike as well as a small experiment and will include digital guest lectures from researchers in the US and Europe. The final project for the course will examine humans as drivers of ecological processes in urban/suburban ecosystems. The course will generally take a hybrid approach with course activities occurring both in person and online.

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| **Week** | **Topic** | **Execution and methods** | **Learning objectives** |
| 1 | How humans interact – Niche theory and competition | Introduction to the course  **Theory** - Introduction of competition and niche theory  **Case study** - How competition/ niche theory have been applied to humans | 1,2 |
| 2 | Facilitation - conservation policy in drylands | **Theory** - Introduction of facilitation into a simple competition and niche models  **Case study** - Conservation of desert/aridland systems, how sandy soils influence interactions  **Field trip -** Vliegbasis Soesterberg  **Digital guest lecture –** Dr. Alexandra Wright, California State University Los Angeles | 2,3 |
| 3 | Soil feedbacks – water management in the NL | **Theory** - Add possibility of soil feedbacks into models  **Case study** – Water management in peat in the NL | 3,4 |
| 4 | Populations to metapopulations – Rewilding in the Netherlands | **Theory -** Embed simple population dynamic model in a metapopulation  **Case study** – Rewilding in the Netherlands  **Field trip -** Oostvaardersplassen | 3,4 |
| 5 | Communities to metacommunities – Restoration and the role of big data | Imbed simple community model in a metacommunity  **Case study** - apply metacommunity theory to restoration efforts across landscapes  **Experiment –** Freshwater metacommunities  **Digital Guest Lecture –** Dr. Emma Ladouceur | 3,4 |
| 6 | Scaling up to the globe and dynamic vegetation models - Climate policy | Look at assumptions of global climate models, talk about how they differ from the models we’ve been working with. Think about the impact of those differences on climate policy and predictions.  **Student debate and discussion**: How can we bridge the gap between theory and policy?  **Digital Guest Panel:** Dr. Nadja Rüger, Prof. Dr. Akira Mori | 3,4 |
| 7 | Developing projects/collecting data | Applying ecological theory across socioeconomic gradients in Utrecht | 5 |
| 8 | Collecting/analyzing data/developing projects |  | 5 |
| 9 | Presenting/discussing results | Presenting final project presentation in digital mini-symposium with invited guests from several stakeholder groups | 5 |

**Assessment:**

Objectives 1-4 will be assessed both through four modeling exercises (40%) designed to be completed during course time and through an exam (30%). Objective 5 will be assessed with the final presentation (30%) during a mini-symposium on the final course day prior to the exam.

**Study material:**

A practical guide to Ecological Modeling by Karline Soetaert and Peter M.J. Herman

Course materials