

EES



**[QUICK GUIDE TO AN EES
CAPSTONE]**

Quick guide to an EES Capstone

March 2017

This booklet is intended to inform students within the EES major about the following:

- Different types of capstone projects within the EES major
- Potential supervisors, including their research of interest and example capstone projects

Please realize that ultimately the capstone guidelines, as defined in the LUC OER and the capstone guidelines as provided by Dr. L Zicha, are binding. This document is intended to help within the process of finding a suitable supervisor and to provide a sense of the variety of research topics within the EES major.

Table of Contents

Different types of capstones within EES.....	2
When to start your capstone?	3
Who to work with?	3
Dr. Paul Behrens.....	4
Dr. Thijs Bosker	5
Dr. Patsy Haccou	6
Dr. Sarah E. Hinman	7
Dr. Peter Houben	8
Dr. Paul Hudson	9
Dr. Brid Walsh	10
Practical tips:.....	11
Outlines.....	11

Different types of capstones within EES

Within EES there are four different capstone models:

1. Collecting primary data: This involves collecting original data based on **field work** (which can include collecting environmental data with field equipment and instrumentation, questionnaires, interviews), or **laboratory experiments**.
Examples include:
 - a. Conducting face-to-face interviews with stakeholders;
 - b. Sending out a questionnaire and analyzing the data;
 - c. Conducting an experiment in the laboratory, such as on the impact of contaminants on organisms or changes in soil quality;
 - d. Collecting soil, sediment and/or water samples in the field related to human impacts on the environment, such as the impacts of land use change on soil erosion, microplastic contamination, climate change, and changes in flooding;
 - e. Conducting a field study on animals, for example the abundance of invasive species, or the biodiversity of plants in organic and conventional meadows.
2. Obtaining secondary data: In this case you do not collect your own data as described above, but you work on an already existing data set. This also includes meta-analyses. Examples include:
 - a. Analyzing a large dataset which is collected by, for example, the UN or FAO, water board, NOAA, NASA, or other government agencies, archives, and/or institutions;
 - b. Utilizing GIS to examine geospatial data in regards to a range of interrelated environmental and socioeconomic issues;
 - c. Extracting data from primary sources, and reanalyzing that data (meta-analyses).
3. Modelling: This can be the development of a new theoretical model, a new mathematical model, or spatial model (e.g. using GIS). Examples include
 - a. Developing a risk model for contaminant impacts;
 - b. Developing a dynamic model to predict changes in population size of exploited or endangered species;
 - c. Modeling soil erosion and land degradation in relation to climate and land use change scenarios;
 - d. Utilizing GIS to analyze flood risk and riparian environmental change along large rivers.
4. Conducting a critical literature review: This includes critically interpreting and comprehensively summarizing existing data on a topic. It (most often) does not involve directly analyzing a dataset (read: statistically analyzing a dataset) but it does

In some cases a capstone will consist of a combination of several of these components.

In addition, you might feel your work does not fit in one of these categories: please talk to your (potential supervisor on that case).

When to start your capstone?

When you start a capstone depends on you and your supervisor. Some will start a year in advance, others their last semester. However, especially if you decide to collect primary data, it is often important to start early, as data collection takes time. **Talk to your supervisor about this!**

If you are interested in collecting primary data (interviews, field work, lab work) we advise you to find a supervisor by the end of the second semester of your second year. This will allow you to collect this data during the summer.

If you decide to study abroad, we strongly urge you to find a supervisor, and start discussing a potential project **before you leave in your fifth semester**. Experience shows that writing a proper proposal requires time, and discussions with your supervisor prior to starting the work.

Who to work with?

Finding the right supervisor to matches your research interests is of great importance. The core team in the EES major consists of the following LUC staff members:

- Dr. Paul Behrens
- Dr. Thijs Bosker
- Dr. Patsy Haccou
- Dr. Sarah Hinman
- Dr. Peter Houben
- Dr. Paul Hudson
- Dr. Brid Walsh

Below you will find an introduction to each of these staff members, including examples of projects and capstone topics. This will help you identify a potential supervisor.

Of course, you can also decide to be supervised by someone else, including external supervisors.

Dr. Paul Behrens

Research topics of interest:

- Climate change;
- The energy transition;
- The diet transition
- Nexus studies (climate-food, water-energy, land-diets etc.) ;
- Energy and environmental policy;
- Big data;

Background:

My work is mainly in integrated environmental modeling. That is, gaining insights into the environment and the impacts societies have by using (generally large) datasets of different resources (food, water, energy, carbon etc.). To give an example, recently we have found that recommended diets in high-income nations confer environmental (carbon, water, land) as well as health benefits. In other work, we found that there is electricity generation planned in regions of high environmental stress, highlighting a mismatch of water and energy policy.

The methods used can include input-output models (which student have successfully used), GIS, and LCA. But I'm not only all about the data and the maths! If you want to do energy/environmental policy (for example, how does electricity regulation work?) then come and talk to me.

Current projects:

- Climate change and the vulnerability of energy and agriculture sectors to water availability;
- Evaluation of the environmental impacts of dietary choices;
- Energy and economic transitions and climate change;
- Literature reviews on energy models;
- Spatial impacts of the energy transition.

Examples of previous capstone projects:

1. EU Energy - Water nexus in the context of climate change risks
2. Impacts of climate change on the potential of renewable energy sources in Europe
3. The consequences of the Fukushima nuclear disaster on Japan's future energy generation
4. Input-Output Analysis of Greenhouse Gas Emissions from European Recommended Diets by using EXIOBASE 2011
5. Reviewing the water, energy and climate change nexus on the water use by hydropower and bio-energy production
6. The Spatial Scales of Future Energy Systems

More info:

For publications click [here](#)

For exiobase see: <http://www.exiobase.eu/>

Dr. Thijs Bosker

Research topics of interest:

- Ecotoxicology;
- Multiple Stressors;
- Reproductive Toxicity (Chronic Toxicity);
- Risk Modeling;
- Distribution and Impact of Microplastics;
- Contaminants of Emerging Concern

Background:

In my research I use laboratory and field techniques to study the impacts of contaminants on ecosystem health, with a focus on stress-on-stress scenarios. I assess impacts at different levels of biological organization, including physiological changes, changes in vital rates and population and community level impacts. I use this data to develop risk models to predict the impacts of contaminants on the environment. At the moment my research is focused on microplastics and the long-term impacts of the Deepwater Horizon oil spill. I work with fish, invertebrates and plants. I also have an interest in conducting critical literature reviews and meta-analyses on topics related to contaminants in our environment.

Current projects:

- Determining levels of microplastics on beaches around the world (lab/field study);
- Determining the impact of microplastics on organisms, including invertebrates and plants;
- Literature reviews on stress-on-stress experiments;
- Impacts of contaminants on biodiversity.

Examples of previous capstone projects:

1. Meta-analysis on the influence of water salinity on fish response to estrogenic and androgenic endocrine disruptors
2. Modelling population-level impacts of anthropogenic and environmental stress on the sheepshead minnow (*Cyprinodon variegatus*) in the Gulf of Mexico.
3. An investigation into sampling and extraction methods for quantifying microplastics in beach sediment.
4. The combined effect of oil and dispersants on sheepshead (*Cyprinodon variegatus*) during the early life stages
5. Chronic Exposure of the freshwater flea (*Daphnia magna*) populations to microplastics
6. Microplastic abundance and characteristics in beach sediment across Europe

More info:

For publications click [here](#)

For microplastic research see: <https://lucmicroplastic.wordpress.com/>

Dr. Patsy Haccou

Research topics of interest:

- Ecological dynamics;
- Evolutionary dynamics;
- Evolutionary game theory;
- Bio-economic dynamics;
- Invasion processes;

Background:

My main research interests and specialization are, on the biological side, behavioural biology, evolutionary biology, and ecology. On the mathematical side my background and main interest lies in probability theory, especially the theory of stochastic processes.

My research focuses on modelling dynamics of evolutionary and ecological processes. Mathematical modelling involves not only a translation of concepts into mathematics and vice versa, but also choosing the right simplifications, preserving essential aspects of the studied system in a model. Sometimes existing mathematical results can readily be used to study biological problems. More often, however, proofs have to be generalized, and new results derived.

Examples of previous work:

- Survival analysis models applied to predation risk and foraging behaviour;
- Game theoretic models for studying patch leaving under competition;
- Branching process models for effects of temporal environmental fluctuations on evolutionary and ecological processes

Current projects:

- Modelling invasions in spatial and temporally varying environments;

Examples of previous capstone projects:

I have not supervised capstone projects at LUC yet.

More info:

For publications click [here](#)

Dr. Sarah E. Hinman

Research topics of interest:

- Urban-Environment Interaction;
- Geographic Information Systems;
- Health and Environment;
- Urban Green Space

Background:

My research has grown from an interest in how changes to the physical environment impact the use urban space. This resulted in research on connections between urban land use and public health in historical context, with an emphasis on exploring local level statistical patterns of infant mortality and/or the locations of cases of infectious diseases such as typhoid fever. All of my research employs the use of geographic information systems as an analytical tool and often the work also requires the use of spatial statistical techniques.

Current projects:

- Exploring the location and demographic composition of infant mortality hot spots in Baltimore, Maryland;
- Comparing the locations of different disease hot spots in 1909 Washington, DC;
- In development: exploring questions of origins and equality of urban green spaces in Europe

Examples of previous capstone projects:

1. Rewilding on Dartmoor? Land Use, Ownership, and Policy Barriers
2. Biodiversity Protection and Tourism in Glacier National Park: A Delicate Balance
3. Where Does the Water Go? Mitigating Consequences of Global Urbanisation
4. Measuring Health in the City: Applying the Urban Health Index to Rotterdam Neighborhoods
5. Who Benefits from Urban Regeneration Policies? Measuring Property Value Spillover Effects of State-Led Gentrification in the City of Rotterdam, The Netherlands
6. Are Contaminated Soils Influenced by Environmental Injustice? An Analysis of the Province of Gelderland, The Netherlands

Dr. Peter Houben

Research topics of interest:

- Linking soil life to landscape (ecosystem services) functions;
- Soil geography: (field) mapping of soil ecosystem services;
- Soil functional change under climate change;
- Soil functions management in land planning schemes

Background:

Research interests focus on the **co-evolution of human-environment interactions** (with respect to Earth surface and processes). Another focus is on the ties between **soil ecosystem services** (as derived from classic soil functions) and how these are represented by current approaches to mapping and interpreting soils. In general, (semi)quantitative methodologies are employed that allow for combining (own) **field data recording** and **GIS applications** in manifold ways. Depending on the scope of studies, advanced **laboratory analyses** (using external laboratory facilities) of sample materials can be part of the methodological setup. As some of the suggested topics address quite fundamental issues, more detailed **literature reviews** in the form of a capstone thesis will equally contribute to further develop research in the fields outlined above. There are some opportunities to link current field teaching activities to capstone projects. This could include independent field stays for capstone research and data collection in the Eifel Mountains (W Germany) and the Rieding Valley (Austrian Alps).

Potential capstone projects:

- Medieval floodplain metamorphosis and hydropower production (GIS-based reconstruction of pre- and post-medieval floodplain hydraulic parameters, working with DEMs and geological data)
- Assessing HANPP of a medieval model community (spatial model of M.A. field layouts and crops; quantification via using GIS tools)
- Late ice-age environments as a result of stone-age, human, niche construction
- Mapping of soil ecosystem types (lit. review, field sampling and lab study incl. cultivating microbial indicator species in the LUC lab)
- Soilscape and/or vegetation change in the Rieding Valley, Austria

Own field data recording and sampling can be conducted independently (Eifel Mts., Rieding Valley). In addition, when signing up with a research group of U of Salzburg (A), field data collection could also be done within the framework of a research internship using the Rieding Valley research station. Note, projects that involve own field work will require to use the summer break before study year 3 for field recordings and sampling. Such activities, therefore, needed planning already in the second semester of year 2.

Examples of previous capstone projects:

1. Domestic flows and transboundary virtual flows of phosphorous in the course of Dutch (non-livestock) agricultural production
2. Topsoil properties of conventional and permaculture farming sites along a hillslope-floodplain sequences in northern Thailand (Pai region)

More info: For publications click [here](#)

Dr. Paul Hudson

Research topics of interest:

- Hydrology and flooding;
- Historic landscape change;
- Meandering river channel dynamics;
- Floodplain sedimentation and riparian environmental change;
- Soil erosion;
- Sediment transport;
- Geographic Information Systems (GIS).

Background:

Hudson's research investigates human impacts on the environment, and specifically flooding, soil erosion, river adjustment, sediment transport, as well as the management of floodplain environments. More broadly, Hudson's scholarly interests concerns environmental change of large rivers through the lens of physical geography, and geomorphology and hydrology in particular. His research utilizes a field based approach augmented with GISc mapping and analysis of satellite imagery and historic cartography. As a geomorphologist his research is both disciplinary and interdisciplinary, and Hudson has collaborated with archaeologists, biologists, geographers, historians, geologists and engineers. Hudson has research projects in the Netherlands (Rhine delta), eastern Mexico, Texas, and along the Lower Mississippi River in Louisiana and Mississippi.

Current projects:

- Human impacts to the lower Mississippi River and floodplain (GIS and remote sensing based, analysis of government data sets),
- Hydrologic connectivity and sedimentation in relation to riparian environmental change along the Rhine River (involves field work),
- Impact of floodplain engineering on flooding (international),
- Digital landscapes: utilizing historic cartography and archival materials to reconstruct landscape change along the Rhine delta, the Netherlands

Examples of previous capstone projects:

1. Geomorphic analysis of changes to islands in the lower Mississippi River
2. A GIS and remote sensing approach to assess aquatic spawning habitat for the Alligator Gar (*Atractosteus spatula*) along the lower Mississippi floodplain
3. Avalanche hazards and mitigation strategies: Linkages to climate and environmental change in Serfaus, Austria
4. Utilizing the Revised Universal Soil Loss Equation (RUSLE) to Model soil erosion in Malawi
5. Sedimentary analysis of floodplain cores along the Lower Mississippi River
6. A GIS approach for land use planning in relation to groundwater hazards in Central Germany
7. Flooding and hydrologic connectivity along the Nederrijn-Lek Rivers, the Netherlands
8. The impact of Capes Dam on sedimentation along the San Marcos River, Texas
9. River channel erosion in response to intensive urbanization of Little Walnut Creek watershed, Austin, Texas

More info: For publications see [here](#) and [here](#)

Dr. Brid Walsh

Research topics of interest:

- Energy citizenship
- Community and rural development
- Participatory processes and planning in environmental resource management
- Sustainable development policy-making in tourism
- Energy and climate policy

Background:

My research interests focus on energy and society interactions (e.g. the formation of stakeholder perceptions towards infrastructure projects), energy policy, community development and ecotourism. Recent projects have explored the formation of community attitudes towards proposed large scale infrastructure, the meaning of 'community' within community energy development projects, and the formation of regional identity through tourism campaigns. I am interested in projects that employ qualitative (interviews/thematic analysis etc.) and quantitative (survey/or GIS) methodologies, in addition to literature reviews.

Current projects:

- Exploring the rights and responsibilities of communities within infrastructure planning processes
- Defining 'energy citizenship' and exploring the concept in practice.
- What does 'community' mean in the context of renewable energy developments? What should it mean?
- Exploring identity construction along the Wild Atlantic Way coastal tourism drive in Ireland

Examples of previous capstone projects:

1. "Powering Dutch wind energy": perspectives of a collaborative wind energy project in Haarlemmermeer Zuid.
2. How does the development of renewable energy affect Samsø's tourism industry?
3. What are the influences of consultation and funding mechanism on community perception of a wind farm?
4. Is the consumption behavior of millennial college students in a LAS setting with a limited budget affected by the green-washing of products?
5. The safety of deepwater exploration and production in the US: the effects of the Deepwater Horizon oil spill.
6. The effect of community engagement on the perceptions of mining: A case study from Southeast Australia.
7. The road to Paris: How contributions to the Green Climate Fund are essential for a successful agreement at the 21st conference of parties in Paris.
8. Social capital in integrated conservation and development projects

More info:

For publications click [here](#).

Practical tips:

1. Use the EES writing guide: your supervisor has a copy
2. Use reference software, such as [Mendeley](#) or [Endnote](#)... it will save you time in the end!
3. Write an outline before you start: see below

Outlines

Our experience shows us that it helps to write an outline before you start working on your proposal, and discuss this in detail with your supervisor. Below you will find an example outline:

EXAMPLE OUTLINE:

Microplastics on our beaches? An investigation into sampling and extraction methods for quantification of microplastics in beach sediment

Introduction:

- Trends in plastic consumption, leading to microplastics
- What is a microplastic?
 - Variation in definition etc. Why this poses an issue. The definition followed in this study.
- Why are we concerned about microplastics?
 - Ingestion- by many organisms at different trophic levels
 - POP association...
 - Toxicity studies
 - Food web bioaccumulation (or magnification?)
- Where are we finding microplastics?
 - Onshore and offshore studies.
 - In organisms
 - Focus on beach studies: beaches key habitat, important for ecosystems.
- Current variability in sampling/extraction methods
 - Variation in sampling
 - Sample size variation
 - Sample depth
 - Number of sample per stretch of beach
 - Beach zones samples (single or multi-zonal studies)
 - Variability in extraction methods
 - Use of dry weight/or unspecified
 - NaCl solution preparation

- Stirring time
 - Settling time
 - Repeat extractions per sample
 - Filtration
 - Analysis: use of microscope, further analysis (weight, sizes)
- The purpose of this research
 - Investigate and determine parameters of microplastic extraction methodology, and set out a clear and replicable methodology
 - Apply the methodology to Meijendel beach.

Objectives

- Suggest standardised method for microplastic extraction from sediment samples, based on investigation of methodological parameters
- Extract microplastics from beach sediment from Meijendel, Netherlands.
- Quantify abundance and distribution of microplastics along this beach segment.
- Determine whether there are differences in abundance and distribution at different beach zones (subtidal, hightide line, supralittoral).

Hypotheses (for Meijendel beach samples)

- H1. Microplastics are present in the beach sediment
- H2. Microplastics abundance changes with increasing distance from the sea

Methods

- Literature review to determine common practice (leading on from intro or with intro)
- Study design. Two parts: investigating methodology of extraction; determining abundance of microplastics on Meijendel beach (samples and control).
- Data collection
 - Studying specific microplastic sampling/extraction parameters (Qualitative and quantitative):
 - Drying samples (quantification)
 - Making up ultra-saturated NaCl solution + filtering! (quantification and observation)
 - Required settling time after flotation technique (qualitative observation)
 - Stirring speed and time (quantification and observation)
 - filtration method (observation)
 - replicate extractions (quantification)
 - Counting: Microscope use (qualitative/observation)
 - Microplastic abundance from Meijendel samples
 - Sampling methodology
 - Extraction methodology
- Statistical analyses:

Analysis of Meijendel data:

- Test to determine whether there is significant microplastic abundance (t-test)

- Test to determine distribution patterns from samples (ANOVA (2 way)).

Results expected

- Presentation of findings with regards to microplastic sampling and extraction techniques. Required settling time, required stirring speed and time, required ratio of sand to NaCl etc...
- Presentation of findings regarding microplastic sampling at Meijendel beach- average abundances, identified patterns in distribution, statistical significance?

Discussion

- Combine main findings- optimum parameters and therefore suggested methodology
- Having a more standardized approach to microplastic sampling will increase the strength of studies, by allowing clear comparisons between studies, and simplifying data for policy makers, to accelerate the awareness of microplastic pollution.
- Findings regarding microplastics in Meijendel beach sediment.
- Significance of findings- addition to previous work (complimenting previous studied by clarifying methodology. Findings add to growing literature of microplastics in beach sediment, following trend of significant quantities being found etc.
- The growing body of literature stresses the need for governments to take microplastic pollution as a serious threat to our marine ecosystems. This study adds to this?
- Suggested future research- into the routes of microplastic movement? Into the availability of microplastics (and their associated contaminants) in beach sediment for local ecosystems.

Sources and Acknowledgments

Time line:

- First draft of proposal to be completed by Sunday 18th October.
- Updated proposal to be completed by Wednesday 4th November.
- Results and data analyses first draft by start of block 3.
- Updated results and data analysis by end of block 3.
- Discussion to be completed by end of block 3.
- Final edits to be completed in block 4.

Personal goals:

- I want to improve data display skills, and learn/try out more with statistics, improve general academic paper writing skills.