EES

[QUICK GUIDE TO AN EES CAPSTONE]

Quick guide to an EES Capstone

August 2022

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 formal capstone requirements, as defined in the LUC OER and the capstone guidelines, as provided by the capstone coordinator, 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.

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Different types of capstones within EES

Within EES there are a range of different capstone models, with the most common ones being:

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), **laboratory experiments** or **online surveys.** Examples include:
    a. Conducting face-to-face interviews with stakeholders;
    b. Sending out an online 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 for a range of interrelated environmental and socioeconomic issues;
    c. Using a dataset which has been collected by someone else. For example, your supervisor might have a dataset available, or you might be able to obtain a dataset from an NGO or external research that you can use for your capstone.

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 an energy model to investigate the renewable energy transition;
    c. Modeling soil erosion and land degradation in relation to climate and land use change scenarios;
    d. Developing a model to rank or classify different resources management options;
    e. Utilizing GIS to analyze flood risk and riparian environmental change along large rivers.

4. Conducting a systematic literature review: This includes comprehensively summarizing existing data on a topic. You have been given detailed instructions about this in Research Design, and we use the Siddaway et al. 2019 approach within EES. It (most often) does not involve directly analyzing a dataset (read: statistically analyzing a dataset), but it could when you conduct a meta-analysis.

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!***

In all cases your proposal, which is in many ways the most important document which you develop in the capstone, **is due BEFORE the start of the semester when you formally do your capstone** (so, for most of your before the start of Semester 2 of your third year). This means that you have to start the capstone process well before this date. You need to scope the literature, talk to supervisors, come up with research questions, do some more scoping etc. All this is discussed in detail in the mandatory Research Design course for all 2nd year EES students.

When to find a supervisor:
The majority of students should begin to approach potential supervisors at the beginning of first semester of their third year.

There are **two** exceptions:
- 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 necessary.
- If you are studying abroad first semester of third year, it is recommended that you approach potential supervisors at the end of your second year.

So, most students will approach potential supervisors as soon as the semester starts. There is no standard procedure how to find a supervisor. In the end, there should be a good match between the research interests of both students and supervisors, and of course the supervisor's expertise. Usually this will involve writing emails, and / or dropping by during office hours, discuss ideas, scope the literature, come up with research questions, do some more scoping etc. Research interests of EES supervisors can be found at the end of this document. Please, note that Capstone supervision slots become more limited, as the deadline for submitting the supervisor form approaches.

Practical info about the capstone

The **components of your proposal** normally include the following sections:
a) Title page
b) Introduction
c) Background
   - This is optional: talk to your supervisor.
   - NOTE: In the capstone guidelines this is referred to as the literature review section, but in natural science journals this is called background
d) Research question (can be integrated at the end of introduction)
e) Material and methods
f) Timeline for the project
g) Optional: learning goals

Please, talk to your supervisor to about any additional details.

In general, we attach great importance to this document. A solid proposal demonstrates that students have put in the necessary effort at this stage, and have a good grasp of their Capstone topic. This is a necessary prerequisite for completing a successful thesis in the remaining semester. Please, note that a student who fails the capstone proposal is allowed to rewrite and resubmit it (once!) within 30 days.

The **components of the capstone** normally include the following sections:
a) Title page
b) Abstract
c) Introduction
d) Background
   - This is optional: talk to your supervisor!
   - NOTE: In the capstone guidelines this is referred to as the literature review section, but in natural science journals this is more often called background
e) Research question (can be integrated at the end of introduction)
f) Material and methods
g) Results
h) Discussion
i) Conclusion (can be integrated at the end of discussion)

Talk to your supervisor to confirm this, or if you want to deviate from this.

Length of the capstone (also talk to your supervisor about this!)
- The word <u>limit</u> for a EES capstone is 7500 words (excluding references tables and figures and appendices/supplementary information).
- Extra details can be provided, but only in the supplementary information, and not in the

main body of the text.
- Most capstones are around 6000 words
- Watson and Crick managed to publish on the structure of [DNA in 1 page](#)... if they can be short and to the point when presenting one of the biggest discoveries of the last century you should be able to also keep it short and to the point (unless you think you have outdone them)

Some supervisors might ask you to also include:

- *Keywords* that describe your research – most often a somewhere between 5 and 7 keywords are added directly following the abstract
- *Highlights* – which consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Most often highlights consist of 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).
- *A graphical abstract* – which summarizes the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. Examples can be provided by your supervisor in case they would like you to produce one.

Use of tables and figures
- Many (but not all) capstones have figures and/or tables in them
- If you use figures and tables, the number can vary widely based upon the topic and conventions of your supervisor, ranging from perhaps 5 to 15. Check with your supervisor.
- Make sure not to present data twice (i.e. in a table and figure)
- If you have a table with minimal information simply integrate it within the text: no table needed in that case
- Try to limit copy-and-pasting figures from other papers in your capstone: simply refer to the original source. If you use a conceptual figure from another source it is best to redraft it, and not copy-paste.

Practical tips:

All of you have taken *Research Design* at the end of your second year… use the skills you were taught about in your capstone. Can't remember what we covered in the course? Go look at the syllabus and go over the items covered, and especially focus on the topics that apply to you.

In addition:
1. Use the EES writing guide: your supervisor has a copy… and you should have one as well by now! A copy is also available on the 'EES Major LUC' MS Team.
2. Use reference software, such as Mendeley or Endnote… it will save you time in the end!
3. Pick your favorite paper, and use it as a blueprint for organizing your capstone, and for understanding what level of detail is needed within a capstone

Also, in most programmes students are asked to present their research at the end of their capstone, either within the department, or even at an undergraduate conference. This is not the case at LUC, but it is still important to be able to concisely and clearly communicate your research. Therefore, we *strongly* recommend that you practice describing your capstone out-loud, or present it to your peers, friends or family. You should keep these questions mind (questions that follow the flow of an academic paper):

- What is the problem that this capstone addresses?
- Why is this approach important? (how does it differ from previous work)
- How do I do this analysis and what are my assumptions in making this analysis?
- What are the different possible findings? or What did I find? (if you have already done the work).
- How does this fit into the broader picture of research, what are the limitations of the work?

You should be able to answer these questions in speeches of 2 minutes (a pitch at a conference), 5 minutes (an interview for the radio), and 15 minutes (the normal length of a scientific presentation at a conference). This will train you in discussing your work, help with your writing and highlight any issues. In addition, keep your eyes open for opportunities to present your work at undergraduate research conferences, which are great venues to showcase your work, but also learn about other research projects.

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 (in alphabetical order):

- Dr. Thijs Bosker
- Dr. Marco Cinelli
- Dr. Achim Häger
- Dr. Sarah Hinman
- Dr. Paul Hudson
- Dr. Aisa O. Manlosa
- Dr. Joeri Reinders
- Dr. Paul Behrens

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.

Students are not permitted to solicit an external supervisor. They may contact the Capstone Coordinator to inquire if exemption may be granted.

Dr. Thijs Bosker

Research topics of interest:
- Plastic pollution (both microplastic and macroplastic)
- Citizen Science
- Marine Biology
- Ecotoxicology
- Urban biodiversity
- Biodiversity loss

Background:
I have a very broad interest in the field of Environmental Sciences. I use laboratory and field techniques to study the impacts of contaminants on ecosystem health. I addition, I am interested in urban biodiversity, for example using camera trapping or observations to study animals within cities. Topics of previous capstone students include:
- The distribution of microplastics (in The Hague, throughout Europe, in the Caribbean)
- The impact of plastics on plants and invertebrates
- Citizen science projects on plastic pollution
- The use of plastic in nest of coots in canals in Leiden
- Assessing the impact of recreation on animal behavior in a forest near The Hague
- Estimating the exposure of dolphin species to microplastics.

On some topics I supervise students that want to do interviews or surveys, often related to the topic I am interested in (see examples above)

I have also supervised a large number of students who conducted a literature review. The focus of these reviews had a wide range, but is often focused on ecosystem health and biodiversity. Example include:
- The impact of changing climate on biodiversity of the Galapagos Island
- The impact of changing climate on whales
- Evaluation and comparison of approaches to prevent the international trade of wildlife.

In addition, if the capstone is of very high quality, I work with my students (after the completion of the capstone) to try and publish their work within international peer-reviewed journals.

I am open to discuss your own research ideas: as long as I feel able to supervise you well within the topic… simply email me to ask for a meeting.

NOTE: There are often opportunities to work with me over the summer, during which you participate in laboratory and sometimes field research (together with PhD and MSc students). This research can subsequently be used for writing your capstone.

More info:
- For a detailed list of publications here
- For more information on my research click here

Dr. Marco Cinelli

Research topics of interest:
- Decision support systems
- Sustainability, resilience, risk assessment
- Energy systems analysis
- Nanotechnology
- Medical devices for the Global South
- Policy analysis

Background:
My research focuses on the development of tools to support decision-making for complex problems with multiple stakeholders and conflicting interests. The key drivers of my work are the frameworks and methodologies that can be used to shape a sustainable and resilient future for the generations to come.

During my career, I conducted and supervised projects where (i) *literature reviews*, (ii) *interviews*, (iii) *surveys*, and (iv) *software modeling* are used and sometimes combined to solve pressing societal challenges. If you are interested in the synergistic use of impact assessment and decision aiding tools, you should come and talk to me.

Examples of past capstones:
- A decision-making model to aid the transition to sustainable heating for the Dutch horticulture
- A ranking model to assess the suitability of ventilators for low-income countries
- The role of decision analysis in supporting life cycle sustainability assessment of energy systems
- A multi-criteria decision analysis (MCDA) approach to assess the sustainability of fashion labels
- Sustainability assessment of roofing strategies in the Netherlands aided by MCDA

Potential capstone projects:
Coming from an environmental sciences and decision engineering background, I am open to a broad range of applied research topics, mostly dealing with the management of decision-making problems based on multiple criteria in the areas of energy science, materials and processes development, and chemical safety. Some potential topics for capstones include:
- SDGs, planetary boundaries & decision-making (see some ideas here)
- Sustainability and resilience assessment of the Dutch horticulture
- Resilience assessment of medical devices in low-income countries (see background here)
- Expansion of a software to support complex decision-making (see the model here)
- Explore the use of different concepts of sustainability (see here for some ideas) & resilience

You can either work on your own topic (if suitable), or work on one of my projects.
In addition, if the capstone is of high quality, I would be happy to work with my students (after the completion of the capstone) to try and publish their work in international peer-reviewed journals.

More info:
- For a detailed list of publications click here
- For the software I (co-)developed click here

Dr. Achim Häger

Research topics of interest

- Ecosystem services
- Biological diversity, functional diversity
- Forest ecology and management, agroforestry
- Landscape ecology
- Conservation biology, biological corridors, urban corridors
- Agroecology, sustainable agriculture
- Protected area management
- Remote sensing

Background:

My current research focuses on relationships between land management, functional diversity and ecosystem services in human-modified landscapes. I have been integrating research methods from natural sciences, such as field measurements, remote sensing and geo-spatial analyses, and social sciences, including surveys, interviews and workshops. Findings indicate that synergies between biodiversity conservation and ecosystem functions can help to increase the resilience of natural and managed systems to rapid environmental change. I have mostly worked in Central America. Coming back to Europe, I am planning to focus my research on more densely populated and urbanized settings. I am also interested in temperate forest ecology and management. I have currently initiated a research project on carbon cycling dune landscapes in The Hague in collaboration with Dr. Paul Hudson.

Current projects:

- Decomposition and carbon cycling in tropical montane cloud forests
- Long term monitoring of tropical forest dynamics in the Central Valley, Costa Rica
- Effects of land management and functional on tree diversity and carbon storage in tropical landscapes
- Carbon cycling and vegetation in managed dune landscapes

Examples of supervised projects:

Coming from a forestry and natural resources management background, I am open to a broad range of applied research topics, including interdisciplinary projects that bridge natural and social sciences. I am also interested in projects with a strong geo-spatial component.

- Spatial relationships between woody species diversity and above-ground carbon storage: Ecosystem service synergies across land-uses in a Costa Rican landscape
- Greenspace cooling island effect and connectivity of urban trees in The Hague
- The effect of drought on bare sand formation in Meijendel & Berkheide, The Netherlands: A GIS approach

Publications: https://scholar.google.com/citations?user=hBOqF2wAAAAJ&hl=en

Dr. Sarah E. Hinman

Research topics of interest:
- Urban-Environment Interaction;
- Port Cities and Health
- 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;
- A new collaboration on port cities and health;
- 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

Dr. Paul Hudson

Research topics of interest:
- Water resources and river management (broadly)
- Hydraulic infrastructure and rivers, esp. dams and related to flood control
- Flooding and climate change;
- Historic landscape change;
- Soil erosion;
- GIS and remote sensing applications to landscape change
- Historic maps and field work

You can either work on your own topic (if *suitable*), or work on one of my projects.

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.

In addition, if the capstone is of very high quality, I can work with the student (after completion) to publish their work within an international peer-reviewed journal.

2022 Opportunity: looking for a small team of students (2 to 4) to work on *river restoration* projects
- River *rewilding* in Limburg, NL in Natura-2000 riparian environmental corridors: Geul and Roer Rivers, examine recovery of aquatic habitat in relation to flooding and erosion.
- In collaboration with government agencies and other universities.
- Involves some combination of field work (physical environmental and human surveys/interviews), laboratory work for hydrologic and sedimentary analyses, and GIS analyses

Examples of previous capstone projects:
1. Dam removal in Spain and the EU Water Framework Directive
2. Changes in vegetation and flooding along the lower Mississippi: A GIS and remote sensing approach
3. Factors Influencing Farmers' Intentions for Climate Adaptation Strategies in Luxembourg
4. Practices and perceptions of soil erosion management for sustainability in vineyards, Montalcino, Italy
5. Utilizing GIS and Landsat image classification to analyze land cover change in response to coastal erosion, Pilote Barre, Senegal River delta
6. A GIS and remote sensing approach to assess aquatic spawning habitat for the Alligator Gar (*Atractosteus spatula*) along the lower Mississippi floodplain
7. Dam Removal, Perceptions Over Time by Local Actors: The Case Study of the Vezins and La-Roche-Qui-Boit Dam Removals in Normandy, France

More info: For publications see **here** and **here**

Dr. Aisa O. Manlosa

Research topics of interest

- Sustainable livelihoods
- Smallholder farming livelihoods, small scale fisheries, small scale aquaculture
- Food systems, food security, and nutrition
- Intersectional gender equality and sustainability
- Social justice
- Institutions and power
- Ocean equity
- Transdisciplinarity

Background

I am interested in sustainable livelihoods because I see it as one of the primary interfaces where humans impact on their environments, and where the environment influences human well-being. I have conducted research on smallholder farming livelihoods, small scale fisheries, and small scale aquaculture. For instance, I investigated how different smallholder farming livelihoods pursued by households in Ethiopia were influenced by the types of capital assets and resources that households had access to. In that context, whether individuals and households accessed or controlled resources depended on formal and informal institutions, equality, and power relations in society. I am therefore interested in how (un)sustainable livelihoods are influenced by social inequalities and unequal power relations, and how understanding these relations can be used to promote sustainable livelihoods.

Past research

I have worked in various interdisciplinary and multi-cultural project teams in the past years such as the research program on Aquatic Agricultural Systems which sought to find solutions to reducing poverty and increasing food security in the Global South through aquatic foods, Social-Ecological System Properties Benefiting Biodiversity and Food Security which sought to find synergies between biodiversity conservation and food security, and Food for Future which explored how aquatic food systems have changed in certain parts of the world and what these changes may mean for the future of food.

Current involvement

I am driven to explore how poverty, hunger and malnutrition, and social inequalities can be addressed particularly in places where populations are vulnerable to the negative effects of environmental changes. I am open to supervising students who have a clear interest in one or some of the areas I indicated above. Students are also welcome to inquire about my ongoing research projects/involvement in certain networks and how they can be potentially involved. For instance, my current research involvement includes fish meal and fish oil trade in West Africa, the Ocean Equity for Sustainable Futures Working Group, and the Transdisciplinarity for Transformation Working Group.

Further information

This is my first time teaching at LUC, but in the past, I have co-supervised a bachelor's thesis at Leuphana University Lüneburg on the contribution of small scale aquaculture farmers' organizations to sustainable rural development. I am also currently co-supervising a PhD thesis at the Leibniz Centre for Tropical Marine Research on coastal environmental governance. In both supervisory experiences, I have supported students in publishing their work in academic journals.

You are welcome to send me an email (a.o.manlosa@luc.leidenuniv.nl) for an initial introduction and expression of interest. We can then arrange to meet in person to discuss in detail.

Find my publications in my Google Scholar profile.

Dr. Joeri Reinders

Research topics of interest:

- Climate change
- Extreme event analysis, extreme value theory
- Climate model output, paleo climate data
- Earth system/ watershed models and landscape change
- Fluvial geomorphology and sedimentology
- Floods and droughts
- GIS projects in geoscience

Background:

I have a broad research interest in topics related to climate change (in general) and its effect on natural disaster occurrences. Specifically, I studied (anthropogenically forced) changes in extreme hydroclimatic events such as floods, droughts, and storms during the Holocene. Climate change and land-use changes will affect the nature and occurrences of these extreme events, however, how exactly is difficult to determine regionally due to a lack of observed data (by nature extremes don't happen that often… luckily). To improve our understanding of these changes in extreme events, I use paleoclimate data, climate/hydrologic model output, and extreme value theory. In my previous research, I studied the severe floods on Texas rivers in the wake of Hurricane Harvey, to improve probability estimates of such an event happening again soon. With my work, I aim to integrate geoscience concepts with tools engineers and policymakers use to develop adaptation and mitigation strategies.

Current/possible projects:

I am more than happy to work with students that have an interesting research idea related to (regional) climate change and/or natural disasters, or that want to (learn how to) work with (simple) earth system models and atmospheric (climate) data. It would be advisable for a student to be comfortable with R or any other programming language, however, students don't need prior experience with the above-mentioned methods - just enthusiasm to learn. There are also plenty of climate change research questions to answer that are less model/data-heavy. We can also discuss capstone ideas about other geoscience topics and how to make them fit my expertise so I can help you succeed.

Some examples of possible projects are:

- How will different climate variables (temperature, precipitation, wind speed) change in region X under different climate change scenarios?
- What atmospheric conditions result in floods/droughts over region X and how will these conditions change in the future under different climate change scenarios?
- Applying Extreme Value Theory concepts to General Circulation Model output and observed (paleo) data to study regional changes of extreme hydroclimatic events in the past and future. (Students need to be comfortable with statistics).
- Developing a (simple) hydraulic model (using HEC-RAS or Deltares software) to study changes in river flow (and extreme discharges).
- How can we improve climate change projections in areas that have a limited (hydro)climatic data availability? (Could be a literature review).

Publications: https://scholar.google.com/citations?user=Rg8196AAAAAJ&hl=en&oi=ao

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 students 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/