

PhD Programme in Sustainability Science at Stockholm Resilience Centre  
**An introductory Course to PhD studies at Stockholm Resilience Centre**  
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**DRAFT!!!**

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**Brief Description**

This new course serves as an introduction to advanced research studies at SRC. It communicates the research framework that is used by centre researchers, clarifies “ways of thinking and practicing” and “tacit knowledge” at SRC, i.e. the “softer” values that are essential for multi- and transdisciplinary advanced research at SRC (our “signatory pedagogy”). The course identifies outstanding major research challenges and research fronts in order for the PhD student to be able to understand where they can situate their research, and also how their research can contribute to developing any or several of these fronts. The course also relate the SRC “branch” of Sustainability Science to a wider historical context including fields of philosophy of science and provide practical advice on methods and approaches that will guide the PhD student in his or her research. The final exercise and examination is aimed to help the PhD student take a substantial step forward in its current most pressing research paper/project, through collaboration with peers and individual work. The course aims to take on a number of questions that many students ask themselves, including: What is it that is special with SRC, How are scientists working here, How can I fit in, What is my contribution, and How should I focus my work right now?

This course is providing answers to many of the questions that our PhD students are asking. Multidisciplinary sustainability science requires in depth collaboration between students from different disciplinary and cultural background. Many students with limited experience in such collaboration may feel uncertain about their roles and responsibilities, but may also find it difficult to relate their relatively limited research questions within their respective PhD project to the large and complex questions of sustainability. The course intends to provide an understanding of how their individual research projects can be directed towards becoming important aspects of existing research fronts, while also stimulating the culture of collaboration needed to become a skilled sustainability scientist. The course will stimulate learning as the students will be able to situate their own research project within the in house culture of sustainability science, the general field of sustainability science, but also in a historical and philosophical context of science. The written exercise will provide an opportunity for the student to summarise the learning outcomes in the context of their individual PhD project.

All students accepted to the SRC PhD program that have also taken our masters program can take the course. For students who did their master thesis elsewhere they can participate only after taken the summary course of the Masters program. This course will be given each year and will be mandatory for all PhD students. The course has an ambition to build a strong cohort of students and introduce all new PhD students to a large number of researchers at SRC.

**Motivation of the course structure, content and examination**

This course draws its development from a number of different theoretical approaches within teaching and learning. The course will take on a *cognitive constructivist* approach (Stewart 2012), in that it intends to take in to account the diverse previous experience that all PhD students have assimilated in their education and early PhD studies. The course is alternating

between lectures, discussions, seminars and individual/group exercises. These different learning activities will teach the students a number of critically important aspects for their research activities, while also being intended to provide “appropriate pacing” and reduce the risk of “cognitive overload”, see Stewart (2012). The course will provide a number of flexible frameworks (including the SRC research framework, an inventory of existing research fronts, a description of fundamentally different scientific approaches, and diverse toolboxes, i.e., methods) in which each individual student can situate their previous knowledge. The ambition is that the course will have a direct practical relevance for their real world situation, i.e. to represent a *problem based approach* (Brodie 2012), to the students’ individual project. An activation of their prior knowledge will, stimulated by the course content, enable them to actively develop their thinking in how they individually will develop their own PhD project (i.e. with what scientific methods, pursuing which specific research approach and with what basic scientific approach, etc).

The course will vary between lectures and group exercises/class discussions. Lecturers will provide a general framing within which students can develop a shared understanding. The course will leave substantial time for students to learn from each other. The combination of lecturers providing “scaffolding” which force students to extend their understanding of the issues they are actively dealing with represent an example of *social constructivism*, where teachers help students make the necessary connections to issues that they likely would be unable to achieve without teacher support (i.e. extending the *zone of proximal development*, see Vygotsky 1978 in Stewart 2012). The planned extensive collaboration between peers during the course is also related to *social and situated learning theories* emphasizing that students also learn by observing what other students do and from debating different points of view (Stewart 2012). The role of collaborative learning during this course will be an important aspect of building a multidisciplinary group, which includes a large number of different nationalities. Although every student will have different abilities to digest the course content in the context of his/her own PhD studies (e.g. depending on previous experience), it is still likely that the different experiences combined will benefit all students taking the course. The course will contribute to building a strong group of PhD students, with a shared understanding of “the rules of the game”, i.e., something that has been emphasizes to be especially important when working with international students (Barker 2012).

The design of the course, and its inclusion of three separate components, will help the students to successively link novel material and concepts to their previous experience. The discussions, and primarily the individual task for the exam (where the learning outcomes will be evaluated, see below), will enable students to extrapolate their learning in to potential future developments of their respective PhD projects. This conscious alignment between course activities and learning outcomes is referred to as *constructive alignment*.

The examination of the course will be an individual written task, where students will relate their new knowledge about research frameworks, types of collaboration and papers, existing research fronts, different approaches to conducting science, and novel methods, to their individual PhD projects. They will be able to relate their individual most pressing problems (papers they are writing or direction to take in their research, methods to use and questions to address) to the lectures and group discussions. The examination will be evaluated as either “pass” or “fail” but the ambition is that the each students will be well motivated to carry out this task, as it is intended to be a substantive way of thinking about how to further develop each individual PhD plan for the coming years.



### **Detailed description of the three sections of the course:**

#### *Section 1. Basics of doing research at SRC.*

Day 1. An introductory lecture will describe the research framework used, with a number of concrete examples. The students will have been asked to read a number of scientific papers beforehand and to come prepared for discussing the reading material and their own research projects in relation to this research framework. Questions such as a) What previous experience have you had working with this research framework, b) How does your research relate to this research framework, and c) How is the framework a constraint or opportunity for your individual research, will be addressed in smaller groups.

Day 2. Collaboration is a key ingredient when working in multidisciplinary teams. Different forms of collaboration will be described during the morning and discussions will follow on benefits and problems with different ways of collaborating. The previous (good and bad) experiences of the students from collaborating across disciplines will be discussed in smaller groups. The afternoon will be devoted to address a number of potentially unpleasant challenges that may occur when collaborating in large groups, using mock examples.

Day 3. Reading day

Day 4. An introductory lecture will provide an overview of existing research frontiers and exciting new areas that are currently in development. The lecture will be held by the research director of the centre and intends to stimulate the students to think about how they can relate their own research to exciting new scientific developments. The afternoon will be devoted to discussing their individual projects in relation to these research fronts, as perceived by the scientific leadership of the centre.

#### *Section 2: Linking theory to research questions*

Day 1. Students will attend an introductory lecture on the philosophy of science, specifically tailored to be relevant for Sustainability Scientists. This lecture will describe very different scientific disciplines and approaches, and provide a starting point for the discussions to follow. Here, students will discuss the literature on their reading list, and relate the approach, content and theoretical starting points for some of the articles in the reading list. This will provide practical guidance on very different scientific approaches and will be an opportunity to align the perceptions of different disciplinary traditions between students representing different disciplines.

Day 2. Sustainability Science and Resilience research has a relatively short academic tradition. Theories, concepts and terminologies are therefore not as established as in other, older scientific disciplines. This has generated both confusion, but also criticism. A lecture that summarizes the concepts used and associated criticism, will lead to a discussion on what type of criticism is valid and how to relate to that when conducting research.

Day 3. This day will start with group discussions where the content of the course thus far is related to individual research projects. The course leaders will provide individual tutoring to students before lunch and then work on individual assignments commence.

Day 4. Reading day and work on individual assignment

Day 5. This day start with an introduction of the specific challenges with doing multidisciplinary and transdisciplinary science. The lecture will be followed by a discussion

of different types of scientific approaches (stimulated by the reading material due for this day). The key challenge of PhD students to balance working in depth with a specific case study/method/approach, vs. a broader, but more shallow approach, will be substantially addressed in discussions.

*Section 3: Basic approaches, methods and the art of writing papers*

Day 1. After several days of frameworks, concepts and theories, this section will become much more practical. The first day will provide an inventory of different methods that the students can use during their PhD studies. The afternoon will be a full session of speed talks by senior researchers and PhD students a few years in to their project, that provide concrete examples of outcomes (i.e. papers) and the methods and approaches that were used for those papers.

Day 2. A lecture by senior scientists will describe different types of approaches for writing papers and the types of questions different papers can address. The lecture will draw on papers in the reading list and will be followed by a discussion of e.g. how different types of papers fill different functions and how different PhD projects may benefit from one or the other type of paper.

Day 3. Going from an idea to a finished paper is often a long and challenging road. This day will explore how to conceptualise and sharpen unique ideas in order to be able to study it. The students will now be well aware of the research frontiers to address and have an understanding of the methods available to them, as well as an understanding of different types of papers. This information combined will feed in to an exercise when students are encouraged to think actively about how their individual project can connect to other colleagues. This discussion will in part function as a peer assessment of students thinking of their assignment and also be an important stimulus for the students to continue working on their individual assignment.

Day 4. Work on individual assignment

Day 5. Assignment submitted

Day 6. Individual assignments are presented in the morning, and each student is assigned to comment on the content of another student's assignment.

**Course Learning Outcomes**

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It is expected that the student, after taking the course, will have:

- 1) An in depth understanding of SRC Vision, Mission and Research Framework
- 2) An understanding of the SRC “software” (signatory pedagogy) – i.e. the ways in which we work and key things that signifies the collaborative mode necessary for successful transdisciplinary Sustainability Science.
- 3) An understanding of key research fronts, as perceived by SRC senior researchers, and an understanding of how their individual research projects can relate to these fronts.
- 4) An understanding of important historical scientific and philosophical contexts of relevance for their individual PhD project
- 5) Knowledge about methods and tools of value for their individual PhD project
- 6) Have an introductory knowledge about different types of research papers and understanding of how to relate different types of question to different kinds of papers.

The ambition is that the course should be compelling to students by constituting a perceived important step forwards towards becoming independent researchers, that it will be *conceptual* as it teaches key concepts and skills that student will use throughout their education, and also that it is *constructively aligned*, with a clear connection between learning activities, assessment tasks and learning outcomes. The course will also be *challenging*, by introducing a number of complex issues and with high expectations that students are able to master them. The course will be very *consistent* with existing institutional values and well *connected* to the individual current situation the students are in their education. The course will also be *cost-effective* as teaching activities are such that most senior scientists can teach, and that the course intends to ensure a consistent and high level of basic knowledge among the PhD students. The course is also cost-effective as it is likely to reduce the risk of misunderstandings between students and supervisors as it teaches many things that can be obvious to supervisors but relatively unknown to students. This course thus covers all proposed seven Cs of successful curriculum design (Angelo 2012).

### Sections, Concepts, methods and applications

The course consists of three different sections, covering: The first section: Basics of doing research at SRC (4 days). This section introduces students to the research framework used by Stockholm Resilience Centre and how it relates to other aspects of Sustainability Science. This section also covers some fundamental aspects of the type of collaboration that is carried out at the centre (and which is different from many academic institutions) and identifies a number of research frontiers, which students can relate their individual research projects to. The second section: Linking theory to research questions (5 days) addresses important aspects of the philosophy of science, directly related to conducting multidisciplinary Sustainability Science. This section covers key theoretical concepts and include seminars on how to relate to them when practically carrying out research, while also containing lectures and discussions on special challenges and opportunities associated with conducting multidisciplinary research. The students will start working on their individual work during this section. The third section: Basic approaches, methods and the art of writing papers (5 days) provides more hands on advice on how to develop and carry out research during the students' PhD.

<b>Concepts</b>	<b>Methods</b>	<b>Applications</b>
<b>Component 1: Doing Research at SRC</b>		
Introducing the research framework Introducing means to effectively collaborate in research groups with a diversity of disciplinary/cultural backgrounds Introducing research frontiers	Lectures and discussions. Exercises that exemplifies awkward situations that may occur in larger groups with different disciplinary and cultural backgrounds	An introduction to the community of practice at SRC
<b>Component 2: Linking theory to research questions and design</b>		
Introducing different scientific epistemologies as a starting point for thinking about addressing multidisciplinary challenges Ways in which concepts and theories used by sustainability scientists can be criticised Understanding fundamental differences between within vs. multidisciplinary science	Lectures, discussions and seminars	Provides a fundamental understanding of the scientific context in which the PhD will operate.
<b>Component 3: Basic approaches, methods and the art of writing papers</b>		
Key methodologies used	Lectures and discussion. Work on	The students will be

Basic aspects of writing scientific papers From an idea to a finished paper	individual essay that connects learning within the course to the students individual PhD project	introduced to the “tools of the trade”
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## Schedule

	Lectures	Class exercises	Home work
<b>Week 1:</b>			
<b>Section 1</b> Basics of doing research at SRC			
<b>SEPTEMBER</b>			
<b>Mon</b> 10:00-12:00 13:00-15:00	<b>AM:</b> Sustainability Science and Biosphere Stewardship (HÖ and LG)	<b>AM:</b> Discussion about pros and cons with this research approach, what does it mean in practice?	
<b>Tues</b> 9.00-12.00	<b>AM:</b> How to collaborate, share ideas and respect IPR (MN)	<b>PM: Workshop</b> (MN and HÖ) Group Discussions using mock examples of conflict in relation to authorship issues, non-respect for IPR and means of sanctioning	
<b>Wed</b>	<b>READING DAY</b> – Old classics that illustrate the history of Sustainability Science and novel papers that illustrates interesting research fronts		
<b>Thurs</b> 10:00-12:00 13:00-15:00	<b>AM:</b> Frontiers of Sustainability Science (CF)	<b>PM:</b> Discussion – how to relate individual PhD projects to research fronts, how to push new frontiers? (CF, LG, HÖ, MN, GP)	
<b>Section 2</b> Linking theory to research questions			
<b>Fri</b> 9.00-12.00	<b>AM:</b> Philosophy of Science – an introduction (verification vs. falsification, inductive vs. deductive science, realist vs social-constructivism). AB	<b>PM:</b> Seminar based on literature and philosophy of science lecture, deconstructing and understanding some of the classics. How do they relate to concepts discussed during class	
<b>Week 2:</b>			
<b>Mon</b> 9.00-12.00	<b>AM:</b> Concepts used and abused by Sustainability Scientists (GP)	<b>PM:</b> Discussion - What critique is valid and what is not? How to deal with different types of critique? (GP)	
<b>Tues</b> 9.30-12.30		<b>AM:</b> Group Discussions, How does my research approach and PhD project relate to concepts addressed in the previous days? (HÖ and MN) <b>PM:</b> Start work on individual assignment	
<b>Wed</b>	<b>READING DAY</b> – Read a range of papers which illustrate different ways of doing transdisciplinary papers, including in Science, Nature, Ecological, Social, integrated, Policy Forums, Opinions, etc		
<b>Thurs</b> 9:00-12:00	<b>AM:</b> Basics of transdisciplinary science – what is it and how is it different (FW)	<b>PM:</b> Discussion: Balancing depth vs. width, cooperation vs individual work	
<b>Section 3</b> Basic approaches, methods and the art of writing papers			
<b>Fri</b> 10.00-12.00	<b>AM:</b> An inventory of different methodologies used by Sustainability Scientists and description of support capacity at SRC (ÖB)	<b>PM:</b> How did you do it, specific case studies and how they were carried out (GP, TB, LG, HÖ, MN, JH-S, BC, LS, PO, VG, SB, EA) - A speed talk session	
<b>Week 3:</b>			
<b>Mon 3</b> 9.00-12.00	<b>AM:</b> The art of writing papers – what kind of papers are there	<b>PM:</b> Discussion on different types of papers – which are the	

	and what kind of questions to they address? MN and HÖ	distinguishing features and how to know when to focus on what type?
<b>Tues</b> <b>9.00-12.00</b> <b>13.00-14.00</b>	<b>PM:</b> Conceptualising, studying and pinning down your unique idea – how to do it? (CF, GP)	<b>PM:</b> Exercise that links research fronts to existing paper ideas and thinking about how SRC colleagues can help you move this idea forward
<b>Wed</b>	<b>Work on individual assignment</b>	
<b>Thurs</b> <b>9.00-12.00</b> <b>13.00-14.00</b>		<b>AM:</b> Submission of individual assignment <b>PM:</b> Preparation for peer assessment and self assessment
<b>Fri</b> <b>9.00-12.00</b> <b>13.00-14.00</b>	<b>PM:</b> Wrap up and evaluation (MN, HÖ)	<b>AM:</b> Show and tell results from exercise – my way forward (each student verbally comments on the paper he/she has read.

HÖ (Henrik Österblom), LG (Line Gordon), MN (Magnus Nyström), CF (Carl Folke), GP (Garry Peterson), AB (Arvid Bergsten), FW (Frances Westley), ÖB (Örjan Bodin), TB (Thorsten Blenckner), JHS (Jonas Hentati-Sundberg), BC (Beatrice Crona), PO (Per Olsson), LS (Lisen Schultz), VG (Victor Galaz), SB (Stephan Barthel), EA (Erik Andersson)

### Assessment and Grading

Examination will be conducted through one written and oral presentation that described critical next steps in a selected research paper that the student is currently working on, combined with a peer assessment of another students written assignment.

Component	Weighting (%)	Learning Outcomes
Written assignment	50%	1-5
Oral presentation	20%	1-5
Peer Assessment	20%	1-5
Self Assessment	10%	1-5
Attendance in class and discussion	Compulsory	1-5
Module Review	Compulsory	
	100%	

Attendance of lectures is compulsory. Attendance means active participation. The student should be prepared for and take an active role in class discussions. The individual course evaluation at the end of the course is compulsory.

### Reading list – Resilience Classics

Adger W.N. 2000. Social and ecological resilience: are they related? *Progress in Human Geography* 24(3): 347-364.

Becker, C. D., and E. Ostrom. 1995. Human-Ecology and Resource Sustainability – the Importance of Institutional Diversity. *Annual Review of Ecology and Systematics* 26:113-133.

Bengtsson, J., P. Angelstam, T. Elmqvist, U. Emanuelsson, C. Folke, M. Ihse, F. Moberg, and M. Nyström. 2003. Reserves, Resilience and Dynamic Landscapes. *Ambio* 32:389-396.

Berkes F, Hughes TP, Steneck RS, Wilson J, Bellwood DR, Crona B, Folke C, Gunderson

LH, Leslie HM, Norberg J., Nyström M, Olsson P, Österblom H, Scheffer, M, Worm B. (2006). Globalization, roving bandits and marine resources. *Science* 311: 1557-1558.

Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10:1251-1262.

Carpenter, S.R., Walker, B.H., Anderies, J.M. and Abel, N. (2001) From metaphor to measurement: Resilience of what to what? *Ecosystems* 4(8), 765-781

Dietz, Thomas, Elinor Ostrom, Paul C. Stern. 2003. The Struggle to Govern the Commons. *Science*. Vol. 302. no. 5652, pp. 1907 – 1912.

Elmqvist, T., C. Folke, M. Nyström, G. Peterson, J. Bengtsson, B. Walker, and J. Norberg. 2003. Response diversity, ecosystem change, and resilience. *Frontiers in Ecology and the Environment* 1(9):488-494.

Holling, and G. K. Meffe. 1996. Command and Control and the Pathology of Natural Resource Management. *Conservation Biology* 10(2): 328-37

Holling, C.S. 1973. Resilience and stability of ecological systems. *Ann. Rev. of Ecol. and Syst.* 4: 1-23.

Scheffer, M., S. Carpenter, J. A. Foley, C. Folke, and B. Walker. 2001. Catastrophic shifts in ecosystems. *Nature* 413:591-596.

Westley, F. 2002. The devil in the dynamics: adaptive management on the front lines in Panarchy: understanding transformations in human and natural systems edited by L.H. Gunderson and C.S. Holling. Island Press, Washington, DC.

Ostrom, E., Dietz, T., Dolsak, N., Stern, P. C., Stonich, S., & Weber, E. U. (Eds.). (2002). The drama of the commons. National Academies Press.

### **Reading list – research frontiers and types of research papers**

(will be updated annually)

#### **References**

Angelo, T. 2012. Designing subjects for learning: practical research-based principles and guidelines. Pages 93-111 in Hunt, L and Chalmers, D (eds). *University teaching in Focus – A learning-centred approach*. Routledge, London and New York

Barker, M. 2012. Teaching international students. Pages 199-213 in Hunt, L and Chalmers, D (eds). *University teaching in Focus – A learning-centred approach*. Routledge, London and New York

Brodie, L. 2012. Problem-based learning. Pages 145-163 in Hunt, L and Chalmers, D (eds). *University teaching in Focus – A learning-centred approach*. Routledge, London and New York

Stewart, M. 2012. Understanding learning: theories and critique. Pages 3-20 in Hunt, L and Chalmers, D (eds). *University teaching in Focus – A learning-centred approach*. Routledge, London and New York