Course leaders: Paul Kardol and Lenka Kuglerová

**Corona restrictions**

Sälgen: max. 21 people

Aspen: max. 22 people

Bokskogen: max. 26 people

Björken max. 35 people

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| **Module 1: Introduction to Forest Ecosystem Ecology + R** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 2 Nov | 09:00-09:30  09:45-10:30 | Introduction  Lecture | Course introduction  Introduction to boreal forest ecosystems | PK, LK | Sälgen |
|  | 10:45-12:00 | Group projects | Introduction to group projects + dividing students into groups | LK, SH, CA, PK? | Sälgen |
|  | 13:00-16.00 | Group projects | Project group meeting / reading |  | No room assigned |
| Tue 3 Nov | 09:00-12:00 | Lecture + exercise | How to write papers that are precise and concise, and easy to grasp | PK | Bokskogen |
|  | 13.00-16.00 | Group project | Group meeting with supervisors: experimental design |  | No room assigned |
| Wed 4 Nov | All day | Group project | Starting of the group projects |  | NA |
| Thu 5 Nov | 09:00-12:00 | Exercise | Introduction to R: data manipulation | LK | Datorsal 1A-B |
|  | 13:00-16:00 | Exercise | R data manipulation | LK | Datorsal 1A-B |
| Fri 6 Nov | 09:00-12:00 | Exercise | R data plotting | LK | Datorsal 1A-B |
|  | 13:00-16:00 | Own work | R practice  (+ group projects if needed) |  | Datorsal 1A-B |

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| **Module 2: Water** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 9 Nov | 09:00-11:00 | Lecture | Water cycle in boreal forest | LK | Bokskogen |
|  | 13.00-16.00 | Reading | Reading for water week |  | Bokskogen |
| Tue 10 Nov | 09:00-12:00 | Lecture | Ecohydrology of individual plants (including assignment instructions) | NK | Björken |
|  | 13:00-16:00 | Exercise  (individual) | Draw the water cycle |  | Björken |
| Wed 11 Nov | 09:00-11:00  13.00-16.00 | Interactive lecture  Exercise  (individual) | Human influences on the water cycle (including assignment instructions)  Human influences on the water cycle  (deadline assignment Sunday 23:59) | LK, NK | Sälgen |
| Thu 12 Nov | All day | Online conference and group work | Hydrologidagen conference |  | Zoom |
| Fri 13 Nov | 09:00-12:00 | Exercise | Recreating conference | LK | Sälgen |
|  | 13:00-16:00 | Group projects |  |  |  |

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| **Module 3: Carbon** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 16 Nov | 09:00-10.00  10.00-11:00 | Lecture  Lecture | Principles of C-stores and C-fluxes, the roles of production, consumption and physical transport for the fluxes.  Methods to estimate carbon stores and fluxes | MN  JM | Aspen |
|  | Afternoon | Reading |  |  | Aspen |
| Tue 17 Nov | 09:00-10:00  10:00-11:00 | Lecture  Lecture | Carbon fixation and individual plant growth, water-use efficiency, controls  Carbon allocation | JM | Aspen |
|  | 13:00-16:00 | Exercise | Data and green house exercise on C-fixation (plus pressure bomb) | JM, TN | Datorsal 3A-B |
| Wed 18 Nov | 09:00-11:00 | Lecture | Carbon budgets of managed forests | JM | Aspen |
|  | Afternoon | FyF  +  Reading | Maja Sundqvist (Ecogain) |  |  |
| Thu 19 Nov | 09:00-11:00 | Lecture | Carbon loss from the ecosystem to the atmosphere  Degradation of organic matter and soil organic matter accumulation in the boreal landscape | MN | Aspen |
|  | 13:00-16:00 | Exercise | Biosphere – Atmosphere CO2 exchange | JC, AK (MP) | Datorsal 3A-B |
| Fri 20 Nov | 09:00-12:00 | Exercise | Biosphere – Atmosphere CO2 exchange | JC, AK (MP) | Datorsal 3a + 3b |
|  | 13:00-16:00 | Writing | Summary report writing from exercises |  | Datorsal 3a + 3b |

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| **Module 4: Cycling of nutrients, hydrogen ions and element biogeochemistry** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 23 Nov | 09.00-12.00 | Group projects |  |  |  |
|  | 13.00-16.00 | Reading | Reading for the biochemistry week |  |  |
| Tue 24 Nov | 09:00-10:45  11:00-12:00 | Lecture  Lecture | Soil components, mineral weathering and acid-base reactions  processes and cycling at different temporal and spatial scales  Nitrogen cycling and plant uptake | US  TN | Aspen |
|  | 13.00-16.00 | Own work | Reading |  |  |
| Wed 25 Nov | 09:00-11:00 | Lecture | Hydrogen ion budgets – theory | US | Aspen |
|  | 13:00-16:00 | Exercise | Individual work: Hydrogen ion budgets |  | Datorsal 1A-B |
| Thu 26 Nov | 09:00-11:00 | Lecture | Microbial-soil redox processes in a landscape perspective | MÖ | Aspen |
|  | 13:00-16:00 | Exercise | Individual work: Hydrogen ion budgets |  | Datorsal 1A-B |
| Fri 27 Nov | All day | Exercise | Individual work: Hydrogen ion budgets |  | Datorsal 1A-B |
|  | 13:00-16:00 | Exercise | Individual work and symposium preparation in groups: Hydrogen ion budgets |  |  |
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| Mon 30 Nov | 09:00-12:00 | Exercise | Symposium preparation in groups: Hydrogen ion budgets |  |  |
|  | 13:00-16:00 | Seminar | Oral group presentations: Hydrogen ion budgets  Deadline reports: 23:59 | US, MÖ | Aspen |

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| **Module 5: Microbes and soil fauna** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Where** |
| Tue 1 Dec | 09:00-11:00 | Lecture | Microbial ecology | MNH | Sälgen |
|  | 13.00-16.00 | Group projects |  |  |  |
| Wed 2 Dec | 09:00-11:00 | Lecture | Mycorrhizal symbiosis | MNH | Aspen |
|  | Afternoon | FyF  +  Reading | Clydecia Spitzer (PhD student) |  |  |
| Thu 3 Dec | 09:00-11:00 | Lecture | Microbial nitrogen fixation | MCN | Sälgen |
|  | 13:00-15:00 | Demo | Cyanobacteria, nematodes, tardigrades, collembola, mites | MCN, MG, PK | FVE lab |
| Fri 4 Dec | 09:00-11:00 | Lecture | Plant-soil biota interactions and feedbacks | PK | Sälgen |
|  | 13:00-16:00 | Reading or group projects |  |  |  |

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| **Module 6: The role of species and trophic interactions in ecosystem functioning** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 7 Dec | 09:00-11:00 | Lecture | Introduction to trophic interactions and food web ecology | PK | Aspen |
|  | 13:00-16:00 | Reading |  |  |  |
| Tue 8 Dec | 09:00-11:00  11.00-11:30 | Lecture  Assignment | Plant species and functional group effects  Plant economic spectra, nitrogen use efficiency  Introduction to assignment on *species and ecosystem functions* | MG  LK, PK | Sälgen |
|  | 13:00-16:00 | Assignment | Own work on the assignment on *species and ecosystem functions* |  |  |
| Wed 9 Dec | 09:00-11:00 | Lecture | Aquatic-terrestrial links and ecosystem functions  Cross-ecosystem resource subsidies | LK | Aspen |
|  | 13:00-16:00 | Assignment | Own work on the assignment on *species and ecosystem functions* |  |  |
| Thu 10 Dec | 09:00-12:00 | Assignment and discussion | Ignite talks and discussions *on species and ecosystem functions*  (report deadline Sunday 15th, 23:29) | LK, PK | Aspen |
|  | Afternoon | Own work |  |  |  |
| Fri 11 Dec | Whole day | Group projects |  |  |  |

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| **Module 7: Biodiversity and multi-functionality of forest ecosystem** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 14 Dec | 09:00-10:30 | Lecture | Statistical data analyses | LK | Datorsal 1A-B |
|  | 13:00-16:00 | Exercise | R - continuous data | LK | Datorsal 1A-B |
| Tue 15 Dec | 09:00-12:00 | Exercise | R - categorical data | LK | Datorsal 1A-B |
|  | 13:00-16:00 | Exercise | R - ordination | CA | Datorsal 1A-B |
| Wed 16 Dec | 09:00-11:00  11:00-11:15 | Lecture  Introduction | Introduction to biodiversity-ecosystem functioning and ecosystem resilience  Group project “Design your boreal biosphere” | MG | Aspen |
|  | 13:00-16:00 | Group work | “Design your boreal biosphere” |  |  |
| Thu 17 Dec | 09:00-16:00 | Group projects | Final harvest/data analyses |  |  |
| Fri 18 Dec | 09:00-16:00 | Group projects | Final harvest/data analyses |  |  |
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| Mon 21 Dec | 09:00-10:00  10:00-11:00 | Lecture  Lecture | Multi-functionality of terrestrial ecosystems  Aquatic biodiversity, connectivity and habitat heterogeneity | PK  LK | Sälgen |
|  | 13:00-16:00 | Group work | “Design your boreal biosphere” |  |  |
| Tue 22 Dec | 09:00-12:00 | Presentations | “Design your boreal biosphere” | LK, PK, MG | Sälgen |
|  | 13:00-16:00 | Group projects  R drop in | If needed (or free afternoon) | Group leaders |  |

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| **Module 8: Global perspectives of forest ecosystems** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 4 Jan | 09:00-16:00 | SimBio exercise | Ecosystem Ecology | PK | Datorsal 3a + 3b |
| Tue 5 Jan | 9.00-10.15  10:30-11:00 | Lecture  Assignment | Global changes in forest ecosystem ecology – methods  Instructions for assignment: Current topics in (Boreal) Forest Ecosystem Ecology – controversies and uncertainties | PK, LK | Sälgen |
|  | 11:00-16.00 |  | Own work on the assignment |  |  |
| Wed 6 Jan | All day | Epiphany |  |  |  |
| Thu 7 Jan | 09:00-12:00 | Assignment | Preparation for debate:  Current topics in (Boreal) Forest Ecosystem Ecology – controversies and uncertainties |  |  |
|  | 13:00-16:00 | Debate | Current topics in Forest Ecosystem Ecology – controversies and uncertainties | LK, PK | Sälgen |
| Fri 8 Jan | 09:00-16:00 | Group projects &  R drop-in | Analyses of group project data help | LK | Datorsal 1A-B (13-16h) |

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| **Module 9: Data analysis and interpretation, oral presentations, wrap-up** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 11 Jan | 09:00-16:00 | Group projects | Data analyses and report writing | Group leaders |  |
| Tue 12 Jan | 09:00-16:00 | Group projects | Data analyses and report writing | Group leaders |  |
| Wed 13 Jan | 09:00-16:00 | Group projects | Report writing + presentation preparation | Group leaders |  |
| Thu 14 Jan | 09:00-12:00  13:00-16:00 | Group projects  Group projects | Report writing  Group presentations | Group leaders | Sälgen (13-16h) |
| Fri 15 Jan | 09:00-16:00  Midnight | Wrap-up  Group projects | Finish the Group Projects (written report)  **Complete the course evaluation!**  Deadline for written report |  |  |

AK = Anne Klosterhalfen

CA = Corentin Abgrall

JC = Jinshu Chi

JM = John Marshall

LK = Lenka Kuglerová

MCN = Marie-Charlotte Nilsson

MG = Michael Gundale

MH = Mona Högberg

MN = Mats Nilsson

MÖ = Mats Öquist

PK = Paul Kardol

NH = Niles Hasselquist

NK = Nataliia Kozii

SH = Stefan Hupperts

TN = Torgny Näsholm

US = Ulf Skyllberg