**Course leaders: Paul Kardol and Maria Myrstener**

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| **Module 1: Introduction to Forest Ecosystem Ecology + Writing + R** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Tue 2 Nov | 09:00-09:30  09:45-10:30 | Introduction  Lecture | Course introduction  Introduction to boreal forest ecosystems | PK + MM | Aspen  Aspen |
| 10:45-12:00  13:00-16.00 | Group projects  Group projects | Introduction to group projects + dividing students into groups  Project group meeting / reading | PK + SH + + VM + LF + KV + MK + WL | Aspen  Decide with project leader |
| Wed 3 Nov | 09:00-12:00 | Group projects | Group meeting with supervisors: experimental design |  | Decide with project leader |
| 13.00-16.00 | Lecture + exercise | How to write papers that are precise and concise, and easy to grasp | PK | Bokskogen |
| Thu 4 Nov | All day | Group projects | Set-up experiments |  |  |
| Fri 5 Nov | 09:00-12:00  13:00-16:00 | Exercise  Exercise | Introduction to R: data manipulation  R data manipulation | LK +MM | Datorsal 1A-B  Datorsal 3A-B |
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| Mon 8 Nov | 09:00-12:00  13:00-16:00 | Exercise  Own work | R data plotting  R practice  (+ Group Projects if needed) | LK + MM | Aspen+ Datorsal 1A-B |

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| **Module 2: Carbon** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Tue 9 Nov | 09:00-10.00  10.00-11:00  11.00-12.00 | Lecture  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  Carbon allocation, carbon budgets of  managed forests | MP  MP  JM | Björken  Björken  Björken |
|  | Afternoon | Reading |  |  |  |
| Wed 10 Nov | 09:00-10:00  10:00-12:00 | Lecture  Exercise | Carbon fixation and individual plant growth, water-use efficiency, controls  Demonstration: measurements of C-fixation and water use efficiency  Response curve analysis | NH  NH | Björken  Björken |
| 13:00-16:00 | Reading |  |  |  |
| Thu 11 Nov | 09:00-10:00  10:00-11:00 | Lecture  Lecture | Carbon loss from the ecosystem to the atmosphere  Degradation of organic matter and soil organic matter accumulation in the boreal landscape | JR  MÖ | Björken  Björken |
|  | 13:00-16:00 | Exercise | Biosphere – Atmosphere CO2 exchange | JC, JR (MP) | Datorsal 1A-B+  Björken |
| Fri 12 Nov | 09:00-12:00 | Exercise | Biosphere – Atmosphere CO2 exchange | JC, JR (MP) | Datorsal 1A-B  Datorsal 3A-B |
| 13:00-16:00 | Writing | Summary report writing from exercises | JC, JR (MP) | Datorsal 1A-B  Datorsal 3A-B |

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| **Module 3: Water** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 15 Nov | All day | Group projects |  |  |  |
| Tue 16 Nov | 09:00-11:00  13.00-16.00 | Lecture  Reading | Water cycle in boreal forests  (including assignment instructions)  Reading for water week | LK | Björken |
| Wed 17 Nov | 09:00-12:00  13:00-16:00 | Lecture  Assignment  (individual) | Eco-hydrology of individual plants  Human influences on water - modelling | NK | Björken |
| Thu 18 Nov | 09:00-11:00  13.00-16.00 | Interactive lecture  Optional computer lab | Human influences on the water cycle  Plotting in R | LK+NK  LK+MM | Aspen  Datorsal 1A-B  Datorsal 3A-B |
| Fri 19 Nov | 09:00-12:00 | Assignment (individual) | Hydrological modelling assignment (deadline Friday 23:59) | LK | Datorsal 1A-B  Datorsal 3A-B |

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| **Module 4: Cycling of nutrients, hydrogen ions and element biogeochemistry** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 22 Nov | 09.00-12.00 | Group projects |  |  |  |
| 13.00-16.00 | Reading | Reading for the biochemistry week |  |  |
| Tue 23 Nov | 09:00-10:45  11:00-12:00  13.00-16.00 | Lecture  Lecture  Own work | Soil components, mineral weathering and acid-base reactions  processes and cycling at different temporal and spatial scales  Nitrogen cycling and plant uptake  Reading | US  TN | Aspen  Aspen |
| Wed 24 Nov | 09:00-11:00  13:00-16:00 | Lecture  Exercise | Hydrogen ion budgets – theory  Individual work: Hydrogen ion budgets | US | Aspen  Datorsal 1A-B  Datorsal 3A-B |
| Thu 25 Nov | 09:00-11:00  13:00-16:00 | Lecture  Exercise | Microbial-soil redox processes in a landscape perspective  Individual work: Hydrogen ion budgets | MÖ | Aspen  Datorsal 1A-B+  Sälgen |
| Fri 26 Nov | 09:00-12:00 | Exercise | Individual work: Hydrogen ion budgets |  | Datorsal 1A-B  Datorsal 3A-B |
|  | 13:00-16:00 | Exercise | Individual work and symposium preparation in groups: Hydrogen ion budgets |  | Datorsal 1A-B  Datorsal 3A-B |
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| Mon 29 Nov | 09:00-12:00    13:00-16:00 | Exercise  Seminar | Symposium preparation in groups: Hydrogen ion budgets  Oral group presentations: Hydrogen ion budgets  Deadline reports: 23:59 | US + MÖ | Bokskogen  Bokskogen |

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| **Module 5: Microbes, soil fauna, and soil food webs** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Where** |
| Tue 30 Nov | 09:00-11:00 | Lecture | Forest microbial ecology: An introduction  Introduction to assignment | KC  PK | Zoom / Björken  Björken |
| 13.00-16.00 | Group projects |  |  |  |
| Wed 1 Dec | 09:00-11:00  Afternoon | Lecture  Reading | Mycorrhizal symbiosis | NH | Björken |
| Thu 2 Dec | 09:00-11:00  13:00-16:00 | Lecture  Lab demo | Microbial nitrogen fixation  Fungi, cyanobacteria, nematodes, tardigrades, collembola, mites | SH  MCN + MG + PK | Björken  Forest veg. ecology lab |
| Fri 3 Dec | 09:00-11:00  13:00-16:00 | Lecture  Work on assignment | Soil food web ecology | PK | Aspen |
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| Mon 6 Dec | 09:00-11:00  13:00-16:00 | Lecture  Work on assignment | Plant-soil biota interactions and feedbacks | PK | Bokskogen |

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| **Module 6: The role of biodiversity in ecosystem functioning** | | | | | | |
| **Date** | | **Time** | **What** | **Topic** | **Who** | **Room** |
| Tue 7 Dec | | 09:00-11:00  11.00-11:30  13:00-16:00 | Lecture  Assignment  Assignment | Plant species and functional group effects  Plant economic spectra, nitrogen use efficiency  Introduction to assignment on *species and ecosystem functions*  Own work on the assignment on *species and ecosystem functions* | MG  PK | Björken  Björken |
| Wed 8 Dec | | 09:00-11:00 | Lecture | Aquatic-terrestrial links and ecosystem functions  Cross-ecosystem resource subsidies | MM | Pre-recorded  + Study questions on Canvas |
| 13:00-16:00 | Assignment | Own work on the assignment on *species and ecosystem functions*  (upload video latest by 23:59) |  |  |
| Thu 9 Dec | | 09:00-12:00  Afternoon | Assignment  Own work | Ignite talks and discussions *on species and ecosystem functions* | PK | Björken |
| Fri 10 Dec | | All day | Group projects |  |  |  |
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| Mon 13 Dec | 09:00-10:30  13:00-16:00 | | Lecture  Exercise | Statistical data analyses  R - continuous data | LK  LK+HB | Aspen  Datorsal 1A-B  Datorsal 3A-B |
| Tue 14 Dec | 09:00-12:00  13:00-16:00 | | Exercise  Exercise | R - categorical data  R - ordination | LK + HB | Datorsal 1A-B  Sälgen |
| Wed 15 Dec | 09:00-11:00  11:00-11:15  13:00-16:00 | | Lecture  Introduction  Group work | Biodiversity-ecosystem functioning and ecosystem resilience  Group project “Design your boreal biosphere”  “Design your boreal biosphere” | MG  MG | Björken  Björken |
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| Thu 16 Dec | 09:00-16:00 | | Group projects | Final harvest/data analyses |  |  |
| Fri 17 Dec | 09:00-16:00 | | Group projects | Final harvest/data analyses |  |  |
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| Mon 20 Dec | 09:00-10:00  10:00-11:00  13:00-16:00 | | Lecture  Lecture  Group work | Multi-functionality of terrestrial ecosystems  Aquatic biodiversity, connectivity and habitat heterogeneity  “Design your boreal biosphere” | PK  LK | Aspen  Pre-recorded or zoom |
| Tue 21 Dec | 09:00-12:00 | | Presentations | “Design your boreal biosphere” | MG + PK | Aspen |

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

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| **Module 8: Group projects: data analysis, interpretation, writing, oral presentations + course wrap-up** | | | | | |
| **Date** | **Time** | **What** | **Topic** | **Who** | **Room** |
| Mon 10 Jan | All day | Group projects | Data analyses and report writing | Group leaders |  |
| Tue 11 Jan | All day | Group projects | Data analyses and report writing | Group leaders |  |
| Wed 12 Jan | All day | Group projects | Report writing + presentation preparation | Group leaders |  |
| Thu 13 Jan | 09:00-12:00  13:00-16:00 | Group projects | Report writing + presentation preparation  Group presentations | Group leaders | Aspen  Aspen |
| Fri 14 Jan | All day | Wrap-up | Finish the Group Projects (written report)  Complete the course evaluation! |  |  |

HB = Hélène Barthelemy

JC = Jinshu Chi

JM = John Marshall

JR = Josh Radcliffe

KC = Karina Clemmensen

KV = Kishore Vishwanathan

LF = Leslie Forero

LK = Lenka Kuglerová

MCN = Marie-Charlotte Nilsson

MG = Michael Gundale

MK = Marcus Klaus

MM = Maria Myrstener

MP = Matthias Peichl

MÖ = Mats Öquist

NH = Nils Henriksson

NK = Nataliia Kozii

PK = Paul Kardol

NK = Nataliia Kozii

SH = Stefan Hupperts

TN = Torgny Näsholm

US = Ulf Skyllberg

VM = Vicky Mosquera

WL = William Lidberg