

# SOIL BIOLOGY

Spring semester, 2019-2020

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|------------------|--|
| Coordinator      | <b>Irina Bezkorovaynaya</b> (Siberian Federal University, Russia)  |
| Credits          | 3 ECTS (optional course), 54 in-class hours  |
| Lecturer         | <b>Irina Bezkorovaynaya</b> (Siberian Federal University, Russia)  |
| Level            | BSc  |
| Host institution | <b>Siberian Federal University</b> , School of Ecology and Geography, Department of Ecology and Environmental Management |
| Course duration  | 1 semester (according to universities' curricula)  |

## Summary

The investigation of influence of soil biological processes and soil biota on global changes, especially in relation to global greenhouse gases and carbon cycle, necessitates knowledge of biological diversity and functions of soil biota.

Particular attention to soil biota functioning in different climatic and soil conditions, including permafrost ecosystems are paid.

## Target student audiences

2-year BSc students in ecology and environmental management

## Prerequisites

Required courses (or equivalents):

Soil science

Fundamental ecology

Ecology of microorganisms

Plant ecology

Animal ecology

## Goals and objectives

The main course objective is to review the theoretical foundations of soil biology and identify the features of soil biological processes in various climatic and soil conditions, including permafrost soils.

Course objectives:

1. To give theoretical foundations of soil biology.
2. To analyze role of soil biota in ecosystem functioning in various climatic and soil conditions.
3. To give a comprehensive overview of modern approaches to study biological processes in soils.

## General learning outcomes:

By the end of the course, successful students will:

- know the fundamentals of soil biology;
- know the place and role of soil biota in ecosystem functioning in various climatic and soil conditions, including permafrost ecosystems;
- be able to analyze data on primary and secondary production processes in soils.

## Overview of sessions and teaching methods

The course will include classroom and distance training using e-learning technologies.

The lessons in the audience will include lecture, interactive technologies, such as group work, discussions and the mini-conference.

During the self-studying according to practical lessons students should read, make notes of the publications proposed by the teacher, and be ready to discuss given topics.

## Course workload

The table below summarizes course workload distribution:

| Activities  | Learning outcomes  | Assessment  | Estimated workload (hours) |
|---|--|---|----------------------------|
| <b>In-class activities</b>  |  |   |                            |
| Lectures  | Knowledge of theory, concepts, methodology of soil biology   | Class participation   | 36                         |
| Moderated in-class discussions                                      | Understanding the place and role of soil biota in the ecosystem functioning;<br>- be able to analyze data on primary and secondary production processes in soils.              | Class participation and preparedness for discussions                | 9                          |
| In-class assignments for group work                                 | The ability of successful communication to address issues related to the assessment of the role of soil biota in ecosystem functioning in various climatic and soil conditions | Class participation and preparedness for discussions                | 9                          |
| <b>Independent work</b>   |  |   |                            |
| Preparation of a presentation for discussion at the mini-conference | The ability to competently and effectively present the material to the audience and enter into a discussion  | Presentation quality  | 18                         |
| Performance of control tasks on the on the e-learning course        | Knowledge the fundamentals of soil ecology and be able to analyze data on primary and secondary production processes in soils  | Completed task on the e-learning course                             | 18                         |
| Reading and discussion of assigned papers for seminars and          | Familiarity with and ability to critically and creatively discuss key concepts, tools and methods as presented   | Class participation, creative and active contribution to discussion | 18                         |

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| preparation for lectures | in the literature |  |            |
| <b>Total</b>             |                   |  | <b>108</b> |

## Grading

The students' performance will be based on the following:

Each student performs home assignment on the e-learning course - 20% of points.

At each seminar, students perform personal or group assignments - 60% of points.

The final presentation on mini-conference will be presented at the end of the course - 20% of the total points.

## Course schedule

| Day                               | Time            | Topic   | Lecturer                |
|-----------------------------------|-----------------|---|-------------------------|
| January 23,<br>2020<br>Thursday   | 10:15-<br>11:50 | Lecture: Introduction to soil biology. Modern problems of soil biology.   | Irina<br>Bezkorovaynaya |
| January 29,<br>2020<br>Wednesday  | 15:55-<br>17:30 | Seminar: Modern problems of soil biology.   | Irina<br>Bezkorovaynaya |
| January 30,<br>2020<br>Thursday   | 10:15-<br>11:50 | Lecture: The fitness of the soil environment.   | Irina<br>Bezkorovaynaya |
| January 30,<br>2020<br>Thursday   | 10:15-<br>11:50 | Lecture: The role of soil in evolution of living matter. The peculiarity of the living matter of terrestrial ecosystems. The planetary role of living matter. | Irina<br>Bezkorovaynaya |
| February 05,<br>2020<br>Wednesday | 15:55-<br>17:30 | Seminar: The fitness of the soil environment.   | Irina<br>Bezkorovaynaya |
| February 06,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Soil producers of organic matter. The roots of higher plants.  | Irina<br>Bezkorovaynaya |
| February 13,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: The diversity of soil algae. Ecological and trophic relationships of soil producers with other representatives of soil biota.                        | Irina<br>Bezkorovaynaya |
| February 19,<br>2020<br>Wednesday | 15:55-<br>17:30 | Seminar: The diversity soil producers of organic matter.  | Irina<br>Bezkorovaynaya |
| February 27,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Soil microorganisms. Ecological and trophic diversity of soil fungi and bacteria.  | Irina<br>Bezkorovaynaya |
| March 05,<br>2020<br>Thursday     | 10:15-<br>11:50 | Lecture: Soil fauna: diversity and function.  | Irina<br>Bezkorovaynaya |
| March 11,                         | 15:55-          | Seminar: Ecological and trophic relationships   | Irina                   |

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| 2020<br>Wednesday              | 17:30           | of soil micro- and macroorganisms.   | Bezkorovaynaya          |
| March 12,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Geography of soil diversity. Soil biota of extreme cryogenic ecosystems (Arctic, Subarctic ecosystem).                                | Irina<br>Bezkorovaynaya |
| March 19,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Functional groups of soil organisms.  | Irina<br>Bezkorovaynaya |
| March 25,<br>2020<br>Wednesday | 15:55–<br>17:30 | Seminar: Functional diversity of soil biota in extremal cryogenic ecosystems (Arctic, Subarctic ecosystem).                                    | Irina<br>Bezkorovaynaya |
| March 26,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Elementary soil biological processes: litter formation.   | Irina<br>Bezkorovaynaya |
| April 02,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Elementary soil biological processes: humus formation; decomposition of humus; mineral formation; biodegradation of minerals.         | Irina<br>Bezkorovaynaya |
| April 08,<br>2020<br>Wednesday | 15:55–<br>17:30 | Seminar: The participation of functional groups of soil biota in elementary soil biological processes.   | Irina<br>Bezkorovaynaya |
| April 09,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Ecological successions of soil biota in the process of transformation of soil organic matter (microorganisms and soil invertebrates). | Irina<br>Bezkorovaynaya |
| April 16,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: Features of soil food webs.   | Irina<br>Bezkorovaynaya |
| April 29,<br>2020<br>Wednesday | 15:55–<br>17:30 | Seminar: Ecological successions of soil biota in the process of transformation of soil organic matter (microorganisms and soil invertebrates). | Irina<br>Bezkorovaynaya |
| April 30,<br>2020<br>Thursday  | 10:15-<br>11:50 | Lecture: The participation of soil organisms in the biological cycle.  | Irina<br>Bezkorovaynaya |
| May 07, 2020<br>Thursday       | 10:15-<br>11:50 | Lecture: Metabolic and modulating soil processes.  | Irina<br>Bezkorovaynaya |
| May 13, 2020<br>Thursday       | 15:55–<br>17:30 | Seminar: Metabolic and modulating soil processes.  | Irina<br>Bezkorovaynaya |
| May 14, 2020<br>Wednesday      | 10:15-<br>11:50 | Lecture: Soil biota and soil health.   | Irina<br>Bezkorovaynaya |
| May 21, 2020<br>Thursday       | 10:15-<br>11:50 | Lecture: Soil biota in environmental control. Methods of soil bioindication. The basic principles of their use.                                | Irina<br>Bezkorovaynaya |
| May 27, 2020<br>Wednesday      | 15:55–<br>17:30 | Seminar: Soil biota in environmental control.  | Irina<br>Bezkorovaynaya |

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| May 28, 2020<br>Thursday | 10:15-<br>11:50 | Lecture: The importance of soil-biological research for understanding the processes of functioning of the biosphere. | Irina<br>Bezkorovaynaya |
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## Literature

Coleman, D. C., Callaham, M. A., & Crossley Jr, D. A. (2017). Fundamentals of soil ecology. Academic press. ISBN: 978-0-12-805251-8

Lavelle, P., & Spain, A. V. (2001). Soil ecology. Springer Science & Business Media. ISBN: 0-306-48162-6

Soil Atlas of the Northern Circumpolar Region <https://esdac.jrc.ec.europa.eu/content/soil-atlasnorthern-circumpolar-region>

Global soil biodiversity atlas <https://www.globalsoilbiodiversity.org/atlas-introduction>