Course: Genesis, Morphology, and Soil Classification

Identification

Code: SOL 848
Credits: 6 (3 hours theory - 3 hours practice)
Course load: 90 hours
Level: Master and doctorate
Professors: Fabrício de Araújo Pedron and Ricardo Simão Diniz Dalmolin
System: Annual (I semester)

Discipline objectives

Understand the genesis of soils through the process of weathering of rocks and sediments influenced by formation factors and processes; know the primary and secondary minerals involved in pedogenesis and its mineralogical evolution as well as its morphological, chemical, and physical implications; know and be able to determine the morphological characteristics and diagnostic properties of soil as well as establish relationships with other soil attributes, especially between the soil and environment; identify soil classes in the field and their distribution in the landscape; know the main taxonomic classification systems used in Brazil and the world and use them in the classification of Brazilian soils; know the soils of Rio Grande do Sul State and the main soils of Brazil, their genesis, morphological, physical, and chemical characteristics, and their taxonomic classification.

Syllabus

The course Soil Genesis, Morphology and Classification (SOL 848) initially works on soil definition and the fundamentals of petrography applied to soil science. Then, factors of soil formation processes are covered, weathering processes, and the basics of soil mineralogy and organic composition. Soil morphology is extensively discussed in lectures and practical classes. Taxonomic classification systems are presented and used extensively in the form of practical exercises. Soils and their relationship to the landscape of Rio Grande do Sul State and Brazil are also covered.

Methodology and/or teaching instruments

The main teaching tools used are lectures, discussion groups, seminars, field trips, laboratory practice, and study tours.

Forms of evaluation

There will be written exams (theoretical and practical), seminars, discussions of results from practical classes, and reports from field trips and classes.

Program: Title and Breakdown of Units

Unit 1

Definition of soil

1.1 - A brief history of soil science
1.2 - Soil definitions
1.3 - Soil as a natural body
1.4 - The soil as an anthropogenic body
1.5 - Soil characteristics and properties
1.6 - Environmental functions of soils

Unit 2

Soil morphology

2.1 - The soil profile
2.2 - Pedogenetic horizons
2.3 - Morphological characteristics of the soil
2.4 - Morphological description of the soil in the field

2.5 - Study of soil morphology
2.6 - Technical interpretation of soil morphological assessment

Unit 3

Petrography applied to soil science

3.1 - Composition and dynamics of the Earth's crust
3.2 - Theory of continental drift
3.3 - Rock types, genesis, and characteristics
3.4 - Geological evolution of Rio Grande do Sul State
3.5 - Effects of rocks on soil formation and composition
3.6 - Effects of rocks on landscape morphology

Unit 4

Weathering of rocks and minerals

4.1 - Physical and biophysical weathering
4.2 - Chemical and biochemical weathering
4.3 - Mechanisms of mineral alteration
4.4 - Alteration coverage in Rio Grande do Sul State

Unit 5

Soil composition

5.1 - Primary mineralogy and its effects on soil
5.2 - Secondary mineralogy and its effects on soil
5.3 - 2:1 Minerals
5.4 - 1:1 Minerals
5.5 - Oxides, oxyhydroxides, and hydroxides
5.6 - Soil organic composition
5.7 - Pedological aspects of organic matter

Unit 6

Factors in soil formation

6.1 - The theory of soil formation factors
6.2 - Source material
6.3 - Climate
6.4 - Relief
6.5 - Organizations
6.6 - Time
6.7 - Soil-landscape relationship in Rio Grande do Sul State

Unit 7

Soil formation processes

7.1 - General soil formation processes
7.2 - Specific soil formation processes
7.2.1 - Lessivage
7.2.2 - Latossolization
7.2.3 - Gleization
7.2.4 - Podzolization
7.2.5 - Ferralitization
7.2.6 - Pedoturbation
7.2.7 - Argillipedoturbation

7.2.8 - Calcification
7.2.9 - Salinization
7.2.10 - Solonization
7.2.11 - Solodization
7.2.12 - Organic soils
7.2.13 - Organic matter complexation
7.2.14 - Organic matter oxidation
7.2.15 - Silicification
7.2.16 - Anthrosolization

Unit 8

Research methods in soil genesis
8.1 - Difficulties in quantification
8.2 - Basic and advanced methods
8.3 - Case studies

Unit 9

Soil classification
9.1 - Basic principles, evolution, and importance
9.2 - Diagnostic soil characteristics and characteristics for classification purposes
9.3 - Pedons and polypedons
9.4 - Diagnostic horizons
9.5 - Brazilian soil classification (SiBCS)
9.6 - American soil classification (Soil Taxonomy)
9.7 - FAO/IUSS soil reference base (WRB)
9.8 - Exercises in soil taxonomic classification

Unit 10

Soils of Brazil and Rio Grande do Sul State
10.1 - Occurrence and distribution
10.2 - Morphology and classification
10.2 - Limitations and potentialities
10.3 - Exercises, seminars, and study trips to different regions of Rio Grande do Sul State.

Basic literature

IBGE. **Manual técnico de Pedologia.** 3 ed. Rio de Janeiro: IBGE, 2015. 430p.

KER J. C. et al. **Pedologia: fundamentos.** Viçosa: SBCS. 2012. 343p.

CURI N. et al. **Pedologia: solos dos biomas brasileiros.** Viçosa: SBCS. 2017. 597p.

Complementary literature

BRADY, N. & WEIL, R. R. **Elementos da natureza e propriedades dos solos.** 3 ed. Porto Alegre: Bookman, 2013. 686p.

BRASIL, Ministério da Agricultura. Divisão de Pesquisa Pedológica. **Levantamento de reconhecimento dos solos do Rio Grande do Sul.** Recife: DNPEA-MA, 1973. 431p. (Boletim Técnico N° 30)

BREEMEN, N. V.; BUURMAN, P. **Soil formation.** 2. ed., Dordrecht: Kluwer Academic Publishers, 2002. 404 p.

BUOL, S. W. et al. **Soil genesis and classification.** 4th ed., Ames: Iowa State University Press, 1997. 527p.

FANNING, D. S.; FANNING, M. C. B. **Soil morphology, genesis and classification.** New York: John Wiley & Sons, 1989. 395p.

IUSS Working Group WRB. **World reference base for soil resources 2015: Interenational soil classification system for naming soils and creating legends for soil maps.** Rome: FAO, 2006. 181p. (World Soil Resources Reports Nº. 106)

LEPSCH I. **19 lições de pedologia**. São Paulo: Oficina de Textos. 2011. 456p.

PEDRON F. A.; DALMOLIN R. S. D. **Solos arenosos do bioma Pampa brasileiro**. Santa Maria: Editora UFSM, 2019. 280p.

SANTOS H. G. et al. **Sistema brasileiro de classificação de solos.** 5ª ed., Brasília: EMBRAPA, 2018. 356p.

SANTOS, R. D. et al. **Manual de descrição e coleta de solo no campo.** 5. ed. Viçosa: SBCS, 2005. 100p.

SOIL SURVEY STAFF. **Keys to Soil Taxonomy.** 12. ed. Washington DC: U.S. Government Printing Office, 2014.

STRECK, E. V. et al. **Solos do Rio Grande do Sul.** 3 ed., Porto Alegre: Emater/RS, 2018. 252p.

TEIXEIRA, W. et al. **Decifrando a terra.** São Paulo: Oficina de Textos, 2001. 568p.