

COURSE SYLLABUS

SOL SCI 375 – SOILS OF THE AMAZON REGION: GENESIS AND MINERALOGY

2 Credits (two 50-minute class periods each week)

Course Instructor:

Mauricio Fontes

Meeting Times: Tuesdays and Thursdays 2:25-3:15 pm

Location: Soils Building room 270

Course Objectives:

- *To acquaint students with the importance of the Amazon Rainforest Ecosystem for Latin America and World*
- *To acquire knowledge about the Amazon soils as dynamic but also as a non-renewable natural resource, especially in the (most of the times) impoverished soils*
- *To comprehend the importance of the soils in the Amazon rainforest ecosystem sustainability*
- *To understand the geographic distribution of the main soils classes in the Amazon region*
- *To comprehend the genesis: factors and processes of soil formation acting in the equatorial and tropical Amazon region*
- *To understand the general chemical and mineralogical characteristics of the predominant soil classes*
- *To define the basics of crystal chemistry and crystallography to understand the main suites of minerals of these soils*
- *To learn about the genesis and structure of the main Amazon soils primary and secondary minerals*
- *To apprehend the nature of the typical secondary minerals of occurrence in these soils*

Pre-requisites:

131 Earth's Soil: Natural Science & Human Use or 230 Soil: Ecosystem and Resource or 301 General Soil Science

Textbook:

There is no textbook but there is one recommended book to read specific chapters:

Buol, S.W., R.J. Southard, R.C. Graham, and P.A. McDaniel. 2011. Soil genesis and classification (6th edition). Wiley-Blackwell, UK. 543 pp. Freely available as e-book:

<http://onlinelibrary.wiley.com.ezproxy.library.wisc.edu/book/10.1002/9780470960622>

Grading and Exams:

Course grades will be determined based on three components: exam performance, the writing of an essay and class participation.

Exams (3)	20% (each)
Essay	25%
Class Participation	15%

Exams:

The first exam will focus on the importance of the Amazon region in Latin America and World context, plate tectonics and lowlands with equatorial forests, and soil forming factors in the Amazon region. The second exam will require acquaintance with the principles governing the basics of crystallography and X-ray diffraction to understand the mineralogy of Amazonia soils. The third exam will ask for the knowledge on the clay minerals suite of the Amazonia soils, the chemistry, mineralogy and geographic distribution of the Amazonia main soil classes and its significance to the sustainability of this important rainforest ecosystem.

Schedule

Spring 2020

Date	Lecture Topic
Day 1	Introduction, course syllabus, Soil Science and Earth Planet, Brazilian morphoclimatic domains, Importance of the Amazon Rainforest Ecosystem for Brazil and world
Day 2	Plate Tectonics and Amazon basin, lowlands with equatorial forests; Soils as a non-renewable natural resource
Day 3	Soil forming factors in the Amazon region Parent material: geology and geologic map, weathering, products of weathering.
Day 4	Soil forming factors in the Amazon region Climate: temperature and moisture, climatic type distribution, water balance
Day 5	Soil forming factors in the Amazon region Vegetation, macro/meso fauna, microorganisms
Day 6	Soil forming factors in the Amazon region Relief: main relief units of the Amazon region, Time as a development factor
Day 7	First exam
Day 8	Soil Mineralogy of Amazonia Soils: Introduction, importance of soil mineralogy
Day 9	Crystal Chemistry: atom, periodic table, hybridization, atomic and ionic radius, isomorphic substitution, ionization potential and electronegativity, chemical bonding

Day 10	Coordination of ions, Pauling's rules
Day 11	Basics of Crystallography, lattice points, unit cell, unit cell parameters, crystalline systems, Bravais lattices
Day 12	Miller Index, crystal directions
Day 13	X-ray diffraction: production, nature, interaction with crystalline matter, detection, utilization in soil mineralogy
Day 14	Systematic Mineralogy with emphasis on oxides/hydroxides and silicates
Day 15	Silicates: primary minerals and weathering of micas, feldspars, mafics
Day 16	Second Exam
Day 17	Secondary minerals: characteristics, influence on soils properties, charge development
Day 18	Clay minerals silicate 2:1: characteristics, genesis and formation of montmorillonite, vermiculite, hydroxi- interlayered minerals
Day 19	Clay minerals silicate 1:1: kaolinite structure, genesis, morphology
Day 20	Clay minerals silicate 1:1: kaolinite isomorphic substitution, charge development
Day 21	Clay minerals oxidic Fe oxides: main types, genesis, structure
Day 22	Clay minerals oxidic Fe oxides: formation, properties
Day 23	Clay minerals oxidic Al oxides: main types, structure, surface charge, morphology, properties
Day 24	Soils of the Amazon region: Brazilian soils classification equivalence to US Soil Taxonomy. Argisols and Latosols: physical-morphological, chemical and mineralogical characteristics
Day 25	Soils of the Amazon region, Plintosols and Gleisols: physical-morphological, chemical and mineralogical characteristics
Day 26	Soils of the Amazon region, Quartzsand Neosols and Spodosols : physical-morphological, chemical and mineralogical characteristics
Day 27	The high significance and importance of the soils for the Amazon rainforest ecosystem sustainability
Day 28	Third Exam
Day 29	Closing, Final Remarks