SOIL QUALITY (SOS 6134)

3 Credits- Fall 2008

INSTRUCTOR: Dr. Zhenli L. He, Assistant Professor
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COURSE OBJECTIVES: Soil quality is the capacity of the soil to function within the ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health. In this course, **s**tate-of-the-art studies on soil quality and the principles, assessment and management of soil quality are examined with respect to biological production, plant and animal health, food security, and environmental quality. After studying this course, the students should be able to understand basic principles of soil quality and learn to assess and evaluate soil quality related to agricultural production and environmental quality.

DELIVERY METHOD: E-Learning System and CD (Powerpoint presentations and Reading materials)

TAUGHT FREQUENCY: Fall term

TARGET STUDENTS: Graduate students who wish to become specialists in the management of nutrients, soils, agroecosystems, and environmental quality.

CLASS ATTENDANCE: Not required

GRADING:

Homework:	30%
Chat room attendance	5%
Mid-term Examination:	20%
Review paper/presentation	20%
Final Examination	25%
Total	100%

There will be no make-up homework and exams. Late submission of assignments will result in reduced credit (10%) if it is not agreed upon in advance.

A	90 – 100%
B+	85 – 89%
B	80 – 84%
C+	75 – 79%
C	70 – 74%
D+	65 – 69%
D	60 – 64%
E	< 60%

ASSINMENTS/ EXAMS/PROJECTS /LECTURES

Soil quality is one of the rapidly-developing frontiers in soil and environmental sciences, with emphasis on soil's functions in plant and animal production, food safety, and environmental quality. This course involves many new concepts, principles, evaluation expertise, and test methods. It is important that the students have a good understanding of the concepts and principles. Therefore, in addition to lectures, the students will be also provided with supplementary course materials to read and homework to do at the end of each chapter. The students are required to submit homework report timely in order to obtain scores. The mid-term examination is designed to check the study progresses of each student so that some adjustment can be made based on student's performance. In addition, each student is required to conduct an independent soil quality evaluation project. For this project, students will select one of the soil quality related study areas (crop production-, animal production-, food safety-, environmental quality (water quality/air quality)-oriented soil quality issue), conduct a literature review based on journal articles, textbook chapters, and/or proceeding papers, discuss the characteristics of the concept/approach, its limitations, and benefits, submit a report, and present results of their independent study.

REFERENCES: Reference books, journal articles, and related information are provided by instructor

PREREQUISITES: Soil Science for Environmental Professionals (SOS 5050).

OFFICE HOURS

INSTRUCTOR: Open for e-mail and phone call at any time or chat room by appointment.

ACADEMIC HONESTY: As a results of completing the registration form at the University of Florida, every student has signed the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work and understand that my failure to comply with this commitment may results in disciplinary action up to and including expulsion from the University". *We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.*

UF COUNSELING SERVICES: Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include: 1) University Counseling Center – 301 Peabody Hall, 392-1575, personal and career counseling; 2) Student Mental Health, Student health Care Center, 392-1171, personal counseling, 3) Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual assault counseling, and 4) Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

SOFTWARE USE: All faculty, staff, and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

STUDENTS WITH DISABILITIES: Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Student Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation.

TOPIC OUTLINE OF SOIL QUALITY

Chapter 1. Definition and Concepts

1.1. What is soil quality?

Soil quality is the capacity of the soil to function within the ecosystem boundaries to sustain biological productivity, maintain environmental quality, and promote plant and animal health (Soil Sci. Soc. Am, 1997). Soil quality is a measure of the conditions of soil relative to the requirement of one or more species and /or to any human need or purpose (Johnson et al., 1997; Lal, 1997; Doran et al., 1998). Soil quality consists of physical, chemical, and biological components.

1.2. Why do we need soil quality concept?

The importance of developing the concept of soil quality was enhanced because of the need to apply soil science to address the problems of nonagricultural uses of soil (e.g., mineland restoration, urban uses and disposal of urban wastes, soil contamination and pollution by industrial activities, athletic and recreational uses of soil, and environmental regulatory functions with particular reference to water quality and the greenhouse effect). A strong need, therefore, arose to develop appropriate indicators of soil quality in relation to specific soil function (e.g., agricultural, urban, industrial, recreational, athletic, environmental, and waste disposal).

1.3 How do we evaluate soil quality?

1.4 What are the potential applications of soil quality in agriculture, food and environment?

Chapter 2. Soil Components and Basic Soil Quality Properties

2.1. Soil development and quality changes

2.2. Soil components and functions

- 2.2.1 Inorganic components
  - Primary minerals
  - Clay minerals
  - Oxides
- 2.2.2 Organic components
  - Organic matter
  - Humus
  - Soil organisms

2.3. General soil quality attributes

9.5 Other soil constraints for plant Health
9.6 Optimal fertilization and irrigation
9.7 Soil quality evaluation for plant health

Chapter 10. Soil Quality Management for Animal Health
10.1 Essential elements for animal health and growth
10.2 Forage quality and animal production
10.3 Nutrient imbalance
10.4 Toxic effects of heavy metals
10.5 Other contaminants
10.6 Soil quality evaluation for animal health

Chapter 11. Soil Quality Management for Food Security
11.1 Food chain principles
11.2 Human nutrition and food
11.3 Food chain contamination: heavy metals and pesticides
11.4 Micro-nutrients, from soil to food
11.5 Soil quality management of quality food production
11.6 Soil quality evaluation for food security

BIBLIOGRAPHY

Soil Quality Websites: http://www.sarep.ucdavis.edu/soil/websites.htm

Books

1. Doran, J. W., Coleman, D. C., Bezdicek, D. F., and B. A. Stewart (Ed). 1994. Defining Soil Quality for a Sustainable Environment. SSSA Special Publ. No. 35, SSSA-ASA, Inc., Madison, WI.
2. Doran, J. W., and A. J. Jones (Ed). 1996. Methods for Assessing Soil Quality. SSSA Special Publ. No. 49, SSSA-ASA, Inc., Madison, WI.
3. Wilson, M. J. and B. Maliszewska-Kordybach (Ed). 2000. Soil Quality, Sustainable Agriculture and Environmental Security in Central and Eastern Europe. Kluwer Academic Publishers, Dordrecht, The Netherlands.
4. Schjonning, P., S. Elmholt, and B. T. Christensen (Ed). 2004. Managing Soil Quality: Chalenges in Modern Agriculture. CABI Publishing, Cambridge, MA.
5. Bloem, J., D. W. Hopkins, and A. Benedetti. 2006. Microbiological Methods for Assessing Soil Quality. CABI Publishing, London

Journal Articles

1. Letey, J; Sojka, RE; Upchurch, DR; et al. Deficiencies in the **soil quality** concept and its application. J SOIL WATER CONSERV, 58 (4): 180-187 JUL-AUG 2003

2. Sojka, RE; Upchurch, DR; Borlaug, NE Quality soil management or **soil quality** management: Performance versus semantics. ADV AGRON, 79: 1-68 2003

3. He, Z. L., X. E. Yang, V. C. Baligar, and D. V. Calvert. 2003. Microbiological and biochemical indexing systems for assessing acid **soil quality**. ADV. AGRON, 78: 89-138.

4. Jimenez, MD; de la Horra, AM; Pruzzo, L; et al. **Soil quality**: a new index based on microbiological and biochemical parameters. BIOL FERT SOILS, 35 (4): 302-306 JUN 2002

5. Wander, MM; Walter, GL; Nissen, TM; et al **Soil quality**: Science and process. AGRON J, 94 (1): 23-32 JAN-FEB 2002

6. Langley-Turnbaugh, SJ; Evans, CV A hierarchical evaluation of **soil quality** indicators in disturbed systems. J SOIL WATER CONSERV, 56 (3): 176-181 2001

7. Arshad, MA; Martin, S Identifying critical limits for **soil quality** indicators in agro-ecosystems. AGR ECOSYST ENVIRON, 88 (2): 153-160 Sp. Iss. SI FEB 2002

8. Nortcliff, S Standardisation of **soil quality** attributes. AGR ECOSYST ENVIRON, 88 (2): 161-168 Sp. Iss. SI FEB 2002

9. Filip, Z International approach to assessing **soil quality** by ecologically-related biological parameters. AGR ECOSYST ENVIRON, 88 (2): 169-174 Sp. Iss. SI FEB 2002

10. Karlen, DL; Andrews, SS; Doran, JW **Soil quality**: Current concepts and applications. ADV AGRON, 74: 1-40 2001

11. Schoenholtz, SH; Van Miegroet, H; Burger, JA A review of chemical and physical properties as indicators of forest **soil quality**: challenges and opportunities. FOREST ECOL MANAG, 138 (1-3): 335-356 NOV 1 2000

12. Knoepp, JD; Coleman, DC; Crossley, DA; et al. Biological indices of **soil quality**: an ecosystem case study of their use. FOREST ECOL MANAG, 138 (1-3): 357-368 NOV 1 2000

13. Leiros MC, Trasar-Cepeda C, Garcia-Fernandez F, et al. Defining the validity of a biochemical index of **soil quality.** BIOL FERT SOILS 30 (1-2): 140-146 NOV 1999

14. Staddon WJ, Duchesne LC, Trevors JT The role of microbial indicators of **soil quality** in ecological forest management. FOREST CHRON 75 (1): 81-86 JAN-FEB 1999

15. R, Elliott LF, Lynch JM Influence of **soil quality** on the function of inhibitory rhizobacteria. LETT APPL MICROBIOL 26 (2): 87-92 FEB 1998

16. Karlen DL, Gardner JC, Rosek MJ A **soil quality** framework for evaluating the impact of CRP. J PROD AGRIC 11 (1): 56-60 JAN-MAR 1998

17. Sims JT, Cunningham SD, Sumner ME Assessing **soil quality** for environmental purposes: Roles and challenges for soil scientists. J ENVIRON QUAL 26 (1): 20-25 JAN-FEB 1997