



SWS 6722

Soil-Landscape Modeling —

Integrative Ecosystem Modeling

Distance Education Course

INSTRUCTOR:

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CONTACT:

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TIMES: Spring semester odd years

CREDIT HOURS: 3

ENROLLMENT CAP: 20

FORMAT: Lectures, instructor facilitates class discussions, discovery and exploratory learning, self-motivated reading, and immersion in integrative ecosystem projects. The course counts towards the ICGIS certificate (<http://web.uflib.ufl.edu/icgis>).

TIME: Wednesdays 6:15 – 8:10 pm U.S. Eastern time (11 Period and E1 Period); Zoom chat.

PREREQUISITES:

A statistics or quantitative methods course at the graduate level (e.g., STA 6166, GEO 6160, ALS 5932, Introduction to Programming and Remote Sensing with R (GEO 6938)) and knowledge in GIS (e.g., SWS 5721C). If you do not fulfill these requirements seek permission from the instructor to enroll in this course.

COURSE GOAL AND OBJECTIVES:

Soil-landscape refers to the totality of an ecosystem—below-ground (soil and lithology) and above ground (climate, vegetation, land use, topography/landform) components, organisms (biota), and the human dimension (social systems, culture, people’s needs, beliefs, values, and opinions).

The goal of this class is to explore various concepts, qualitative, and quantitative methods to model and understand soil-landscape systems considering its biological and chemical composition, physical environment, social dimension, as well as values, needs, beliefs, and perceptions of people and

stakeholders. Understanding the totality of an ecosystem facilitates to better infer on environmental consequences (e.g., carbon dynamics, fate of nutrients, environmental induced trauma of people, environmental justice and gentrification, degradation of ecosystems and well-being of people). The specific course objectives are to:

- (1) Analyze and understand relationships between various dimensions of the soil-landscape system as an integrated whole.
- (2) Explore model approaches to assess, predict, simulate, and understand behaviors and responses to changes from an integrative ecosystem perspective.
- (3) Synthesize understanding of the totality of soil-landscapes into complex models.

The purpose of integrative ecosystem modeling is rooted in finding better answers to the wicked environmental problems of our time including global climate change, multi-hazard eco-disasters, food security, soil and public health. Diverse ecosystems exist with natural non-managed ecosystems in decline, conservation management systems, and tightly managed agro-forest and urban ecosystems to benefit people and provide ecosystem services.

Integral ecology/ies provide a whole system perspective that aim to integrate social and environmental system dimensions. The course is focused to broaden understanding of the totality of an integrated social-environmental system that considers people, stakeholders, and cultural sensibilities as important as biogeochemical processes. To solve environmental crises and specific problems (e.g., soil carbon losses or well-being and health of people) requires not only to study and understand the ecological, chemical, or physical processes but also the participation and thinking of people and decision-makers. This course aims to connect science facts and understanding and people.

LEARNING APPROACH:

A discovery style of leaning is used in this course as foundation to facilitate learning. This means to open your eyes and learn through deep understanding, rather than pre-prepared fixed/rigid class modules and assignments. We learn through dialogue, playful exploration, and critical reflection and discussion. Students will emerge themselves in the course topics through reading, critique of case studies (selected hot topic cases), and designing and creating their own projects to investigate an integral ecological topic.

The instructor uses coaching techniques to facilitate the learning process, including targeted Q&A sessions, unlocking self-motivation to study, learning as exploration, and multi-perspectival class discussions.

The course blends subjective and objective, knowledge-based (discussion and interpretation) and quantitative approaches (modeling). Note that the emphasis in this course is not as much on learning the specific technical nuts-and-bolts (step-by-step instructions) of specific quantitative methods. Rather the emphasis is on understanding in *what context* to apply a specific method to an ecosystem question/problem/crisis, *how to select* and *integrate* various qualitative and quantitative methods, *how scale* influences your models, *how to data mine* and *fuse* data and methods to address a complex ecosystem problem of interest. Environmental facts, empirical data, people's values and beliefs, and social needs are part of integrative ecological models.

COURSE PROJECTS:

Each student will work on two projects: (1) Literature project and (2) Integrative ecosystem modeling project. These projects are focused on the following:

- Literature project: (i) Select a topic related to integrative ecosystem modeling; (ii) Conduct a literature review based on a minimum of 10 peer-reviewed journal articles, textbook chapters, and/or proceeding papers; (iii) Submit a project report; and (iv) Present results of the project in class.
- Integrative ecosystem modeling project: (i) Define the significance of a specific ecosystem problem/crisis, (ii) Identify objectives and research questions how to study this specific ecosystem problem/crisis (hypotheses are optional), (iii) Select a study area, (iv) Identify method(s) how to investigate the ecosystem problem/crisis, (v) Produce a prototype integrative model and document results, (vi) Interpret and critically discuss findings, (vii) Submit a project report; and (viii) Present project findings in class.

The projects encourage students to think critically and learn how to approach an unknown complex soil-landscape topic. Students have to demonstrate mastery, comprehension, application, and synthesis of a given set of concepts into a model framework.

COURSE WEB SITE:

UF Canvas course management system: <https://elearning.ufl.edu/>

SOFTWARE:

ArcGIS; R, and statistical software packages available by CALS, UF apps.

READING MATERIAL:

Reading material in this course is based on journal articles and select book chapters available through the UF library.

RECOMMENDED TEXTBOOKS and CHAPTERS:

Esbjörn-Hargens, S., & Zimmerman, M.E. (2009). *Integral ecology: Uniting multiple perspectives on the natural world*. Integral Books. (chapters 2, 5-8)

Grunwald, S. (Ed.). (2006). *Environmental soil-landscape modeling - Geographic information technologies and pedometrics*. CRC Press. (chapters 1 and 3)

Grunwald, S., Clingensmith, C. M., Gavilan, C. P., Mizuta, K., Kastner-Wilcox, R. K., Pinheiro, E. F. M., Cedia, M. B., & Ross, C. W. (2017). Integrating new perspectives to address global soil security: Ideas from integral ecology. In D. J. Field, C. L. S. Morgan, & A. B. McBratney (Eds.), *Global soil security* (pp. 319–330). Springer Nature Publ.

Landa, E. R., & Feller, C. (Eds.). (2010). *Soil and Culture*. Springer. (chapters 13 and 14)

McBratney, A. B., Minasny, B., & Stockman, U. (Eds.). (2018). *Pedometrics* (1st ed.). Springer. (or similar quantitative oriented soil-landscape or environmental modeling book)

Mickey, S., Kelly, S., & Robbert, A. (Eds.). (2017). *The variety of integral ecologies: Nature, culture, and knowledge of the planetary era*. State University of New York Press.

GRADING:

Literature project: 30%

Quantitative modeling project: 30%

Discussion posts: 30%

Participation in discussion: 10%

GRADING SCHEME:

Passing Letter Grade	Course Points	Grade Points
A	95-100	4.0
A-	90-95	3.67
B+	90-85	3.33
B	85-80	3.0
B-	80-75	2.67
C+	75-70	2.33
C	70-65	2.0
C-	65-60	1.67
D+	60-55	1.33
D	55-50	1.0
D-	50-45	0.67
S	45-below	0

Failing Grades	Course Points	Grade Points
E	0	0
WF	0	0
I	0	0
NG	0	0

Definitions

E = Failure

H = Deferred grade assigned only in approved sequential courses or flexible learning

I* / I = Incomplete

N* / NG = No grade reported

S = Satisfactory

U = Unsatisfactory

W = Withdrew

WF = Withdrew failing

The grading policy of UF will be followed in this course as outlined at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx#repeat>

EXPECTATIONS AND GRADING POLICY IN THIS COURSE:

It is expected that students attend the Zoom chat and study the assigned learning material provided on the course web site and reading material. The participation grade is based on active participation in class discussions. This means to engage and pro-actively participate in class discussions. Students are expected to work independently on their projects. Copying of results (reports) from other students will be considered as plagiarism. In this course the antiplagiarism software Turnitin is used.

Late submissions of the project reports will result in 15% reduction of points within 24 hours late submission and 30% reduction of points between 24-48 hours late submission. After more than 48 hours late submission zero points will be assigned. All exam and project reports need to be submitted through the UF course website. Submissions via email attachments will not be accepted.

The IT staff of the University of Florida provides the service to assist with technical problems (e.g., ArcGIS software, access to statistical software). The CALS virtual computer lab (VCL) is available for students in class to work on projects.

COURSE MODULES:

1. Introduction to Integrative Soil-Landscape Modeling

- a. Soil-landscape dimensions
- b. Spatial and temporal scales
- c. Wicked environmental problems

2. Integrative Ecosystem Modeling

- a. Quantitative ecosystem modeling: Data, data relations, artificial intelligence (machine learning and deep learning)
- b. Is the human a node in the system or an active participating agent that shapes the future of ecosystems?
- c. One model or multiple models to solve ecosystem problems?
- d. How do we know things?
- e. What role memes play in soil-landscapes?
- f. Integral theory, integral ecology, and integral ecologies

3. Modeling Approaches and Philosophies

- a. Tacit models: Expert-/knowledge-based models (e.g., soil surveys)
- b. Empirical models: State-budget models (e.g., carbon or nutrient stock assessments)
- c. Geospatial and geostatistical models (e.g., remote sensing supported modeling of terrestrial carbon)
- d. Stochastic and probabilistic models (e.g., soil carbon stock assessment)
- e. Fuzzy logic models (e.g., vague models of ecosystem health)
- f. Efficiency index models (e.g., efficiencies of net primary productivity of ecosystems based on Data Envelopment Analysis)
- g. Deterministic/mechanistic models: Process-based simulation models (e.g., Earth simulation modeling of global climate change)
- h. Autopoietic models: Multi-agent models
- i. Phenomenological models (e.g., inner soil, nature experiences, subjective ways of knowing)
- j. Survey models: Quantitative research models to understand people's beliefs, values, needs, and perceptions
- k. Bayesian Belief Networks (models that integrate people's beliefs into the modeling of ecosystems)
- l. Artificial intelligence modeling (machine learning and deep learning)
- m. Metaphors: Symbolic models (cultural memes)

4. Integrative Ecosystem Modeling

- a. Data mining

- b. Data fusion
- c. Triangulation
- d. Hybrid/mixed models
- e. Meta modeling (ensemble / multi-models, coupled and sequential models)
- f. Synthesis
- g. Models in context of politics and diverse socio-cultural systems

ATTENDANCE AND MAKE-UP WORK

Absences

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first class meeting.

In general, acceptable reasons for absence from or failure to participate in class include illness, serious family emergencies, special curricular requirements (e.g., judging trips, field trips, professional conferences), military obligation, severe weather conditions, religious holidays and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) must be excused. Other reasons also may be approved.

You cannot participate in classes unless you are registered officially or approved to audit with evidence of having paid audit fees. The Office of the University Registrar provides official class rolls to instructors.

If you do not participate in at least one of the first two class meetings of a course or laboratory in which you are registered, and you have not contacted the department to indicate your intent, you can be dropped from the course. You must not assume that you will be dropped, however. The department will notify you if you have been dropped from a course or laboratory. You can request reinstatement on a space-available basis if you present documented evidence.

The university recognizes the right of the individual professor to make attendance mandatory. After due warning, professors can prohibit further attendance and subsequently assign a failing grade for excessive absences.

Religious Holidays

The Florida Board of Education and state law govern university policy regarding observance of religious holidays. The following guidelines apply:

- Students, upon prior notification to their instructors, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith.
- Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence.
- Students shall not be penalized due to absence from class or other scheduled academic activity because of religious observances.

If a faculty member is informed of or is aware that a significant number of students are likely to be absent from class because of a religious observance, the faculty member should not schedule a major exam or other academic event at that time.

A student who is to be excused from class for a religious observance is not required to provide a second party certification of the reason for the absence. Furthermore, a student who believes that he or she has

been unreasonably denied an education benefit due to religious beliefs or practices may seek redress through the student grievance procedure.

Illness Policy

If you are absent from classes or examinations because of illness you should contact your instructors. You should contact your college by the deadline to drop a course for medical reasons. You can petition the Dean of Students Office to drop a course for medical reasons. The university's policy regarding medical excuse from classes is maintained by the Student Health Care Center.

Twelve-Day Rule

Students who participate in athletic or extracurricular activities are permitted to be absent 12 scholastic days per semester without penalty. (A scholastic day is any day on which regular class work is scheduled.) Instructors must be flexible when scheduling exams or other class assignments.

The 12-day rule applies to individual students participating on athletic or scholastic teams. Consequently, a group's schedule that requires absence of more than 12 days should be adjusted so that no student is absent from campus more than 12 scholastic days.

If you previously have been warned about absences or unsatisfactory work you should not incur additional absences, even if you have not been absent 12 scholastic days. It is your responsibility to maintain satisfactory academic performance and attendance.

ONLINE COURSE EVALUATION PROCESS

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>."

ACADEMIC HONESTY

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that

facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>. The updated (2018) UF Student Honor and Student Code of Conduct can be found at: <http://gatortimes.ufl.edu/2018/08/20/updated-uf-student-honor-and-student-code-of-conduct/>.

SOFTWARE USE:

All faculty, staff and students of the university 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.

SERVICES FOR STUDENTS WITH DISABILITIES:

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

CAMPUS HELPING RESOURCES:

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/*
 - Counseling Services
 - Groups and Workshops
 - Outreach and Consultation
 - Self-Help Library
 - Wellness Coaching
- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*

RECORDINGS:

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to

keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.