University of Florida
Agronomy Department
Soil, Water, and Ecosystem Sciences Department
Fall 2025

Ecosystem Services: Theory, Methods, and Practice
AGR 4932/6932
SWS 6932

Instructor:

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Office hours: Monday 1:00 pm – 2:00 pm or by appt at McCarty Hall D, Rm G052A or on Zoom: https://ufl.zoom.us/my/chang.zhao.meeting.room

Course credits: 3

Teaching Format and Course Communications:

- 80-99% or 100% online.
- Pre-recorded lectures, supplementary readings, weekly chat sessions, discussion boards, assignments, and exams.
- Canvas eLearning Login: http://elearning.ufl.edu/
- Contact instructor through Canvas messaging system or email.
    - Allow 24 hours for a response during the week.
    - Questions posted over the weekend may not receive a response until Monday.

Pre-Requisites: None

Since this is a transdisciplinary course, there is no pre-requisite course. Students with fundamental knowledge in one or more of the following disciplines are encouraged to attend:

- Agricultural and life sciences, including agronomy, soil and water sciences, natural resources and environment, forest, fisheries, and geomatics sciences, wildlife ecology and conservation, food and resource economics, etc.
- Geography, urban and regional planning, sustainability, economics, social sciences and related disciplines.

Required Textbook: None

- Required readings are available on Canvas.
- Recommended textbook can be obtained from UF Library as a free ebook:
  - Potschin, M., Haines-Young, R., Fish, R., & Turner, R. K. (Eds.). (2016). Routledge handbook of ecosystem services. Routledge.
  - For UF students, full text of the book is available with unlimited user access through https://guides.uflib.ufl.edu/ebooks/

Required Technology & How to Obtain the Technology

Technology requirements include:

- Speakers, microphone or a headset for participating in live chat sessions.
- i-tree software: i-Tree delivers current, peer-reviewed tree benefits estimation science from the USDA Forest Service to all types of users with free tools and support. For more information: https://www.itreetools.org/
- InVEST software: InVEST® is a suite of free, open-source software models used to map and value the goods and services from nature that sustain and fulfill human life. For more information: https://naturalcapitalproject.stanford.edu/software/invest
- ArcGIS Pro: ArcGIS Pro is the premier desktop geographic information system (GIS) application that allows users to explore, analyze, and visualize data, create 2D maps and 3D scenes, and share their work. Students can install and use ArcGIS Pro free of charge on UF-owned or personally owned computers if it is for class purposes only. For more information about download and installation instruction, check the link from UF GeoPlan Center: https://www.geoplan.ufl.edu/software/arcgis-pro/
- Zoom: Zoom is an easy-to-use video conferencing service available to all UF students, faculty, and staff that allows for meetings of up to 300 participants. For more information: https://ufl.zoom.us/

Required Technology & Digital Information Literacy Skills

Technical skills required:

- Using the Canvas learning management system
- Using UFL email with attachments

- Creating and submitting files in commonly used word processing program formats, including Microsoft Excel, Word and PowerPoint
- Downloading and installing software, including i-Tree, the InVEST model, and ArcGIS Pro
- Using Zoom for live chat sessions

Digital information literacy skills include:

- Using online libraries and databases to locate and gather appropriate information
- Using computer networks to locate and store files or data
- Using online search tools for specific academic purposes, including the ability to use search criteria, keywords, and filters
- Analyzing digital information for credibility, currency, and bias (e.g., disinformation, misinformation)
- Properly citing information sources
- Preparing a presentation of research findings

Course Description:

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services, such as the supply of food and forage; regulating services, which involve climate regulation, air and water purification, carbon sequestration, and pollination; supporting services that are fundamental to the functioning of all other ecosystem services, such as soil formation, nutrient cycling, and primary production; and cultural services through spiritual enrichment, recreation, and aesthetic experiences.

In this course we will examine ecosystem services from an interdisciplinary perspective centering on the conceptual background, indicators, and various quantitative and qualitative approaches for ecosystem services assessments, including biophysical, socio-economic, model-, expert-, and citizen science-based methods. We will also review initiatives and applications that integrate ecosystem services assessments into policy and decision-making in various domains, such as natural capital accounting, biological conservation and land use planning.

Course Learning Objectives:

After successfully completing the course, students will be able to:

- Identify the definition and common classifications of ecosystem services.

- Contrast different ecosystem services terminologies and interpret the ecosystem services cascade framework.
- Illustrate ecological structure and functions, and socio-ecological processes that underpin the delivery of different types of ecosystem services.
- Identify ecological indicators used to measure ecosystem services.
- Examine and compare the different methods of quantifying, mapping and valuing ecosystem services.
- List and discuss major intergovernmental and governmental programs and initiatives that mainstream ecosystem services into policy instruments.
- Identify existing data, variables and indicators and develop an analysis for ecosystem services assessments.

Topic Outline:

Week	Module	Topics
8/21-8/22	0. Orientation	i. Course introduction ii. Vetting online sources
8/21-8/27	1. Concept of Ecosystem Services	i. Definition of ecosystem services (ES) ii. Key findings of the millennium ecosystem assessment (MEA)
8/28-9/3	2. Ecosystem Services Terminologies and Classifications	i. ES terminologies: supply, demand, flow ii. The ES cascade framework iii. Common terminologies and classifications of ES iv. Related concepts: ecosystems, biomes, land use and land cover, biodiversity.
9/4-9/10	3. Supporting Services	i. Primary productivity ii. Nutrient cycling iii. Soil formation
9/11-9/17	4. Regulating Services	i. Carbon storage and sequestration ii. Micro-climate regulation iii. Pollination services

9/18-9/24	5. Provisioning and Cultural Services	i. Food, fiber, timber and fuel production ii. Nonmaterial benefits that arise from the interaction between people and ecosystems
9/25-10/1	6. Integrating Ecosystem Services in Management	i. Daily's framework from measurements to decision-making ii. Case study: the i-Tree canopy tool
10/2-10/8	Exam 1	i. Covers materials in modules 1-6
10/9-10/15	7. Quantifying and Mapping Ecosystem Services	i. Ecological production functions (EPFs) ii. A tiered approach for quantifying and mapping ES iii. Emerging data and technologies for measuring ES
10/16-10/22	8. Valuing Ecosystem Services	i. Rationale for economic valuation of ES ii. Fundamentals of economic value iii. Opportunity costs iv. **Project outline due on Saturday October 11th**
10/23-10/29	9. Monetary Valuation of Ecosystem Services	i. Direct market valuation ii. Revealed preference methods iii. Stated preference methods iv. Value transfer
10/30-11/5	10. Non-Monetary Valuation of Ecosystem Services	i. Pitfalls of monetary valuation ii. Cultural, shared and social values iii. Non-monetary valuation
11/6-11/12	11. Decision-making analysis (DMA)	i. Trade-offs in ES ii. Cost-benefit analysis iii. Multi-criteria analysis
11/13-11/19	12. Paying for Ecosystem Services	i. Market-based instruments (MBIs) ii. Payments for ecosystem service (PES) iii. Key factors that influence the effectiveness of MBIs

11/20-12/3	13. Revisiting the concept and methods of ecosystem service	i. Critique and weaknesses of ES methods ii. Environmental justice and ES iii. Study exercise questions for Exam 2 iv. **Final project paper due on Saturday December 6th**
12/6-12/12	Exam 2 (during finals week)	i. Covers materials in modules 7-12 and the last week of the semester

Disclaimer:

Because ecosystem services is a dynamic contemporary field of study specific topics may be added or shifted within the above schedule. Please note, the grading structure will not differ from what is outlined below.

Grading Structure:

Graduate Students*

Assessment Type	Percent of Final Grade
Exams (2 total)	28
Assignments & On-line Discussions	35
Project Paper	25
Chat Participation	12

*Compared to undergraduate students, graduate students have different requirements for their projects and additional questions in assignments and exams to receive graduate level credits for this class.

Undergraduate Students

Assessment Type	Percent of Final Grade
Exams (2 total)	28
Assignments & On-line Discussions	35
Project Paper	25
Chat Participation	12

Rubrics will be provided with graded activities. See Canvas assignments for individual rubrics.

Grading Scale:

Percentage	Letter Grade
>=91.0	A
90.0 – 90.9	A-
87.0 – 89.9	B+
81.0 – 86.9	B
80.0 – 80.9	B-
77.0 – 79.9	C+
71.0 – 76.9	C
70.0 – 70.9	C-
67.0 – 69.9	D+
64.0 – 66.9	D
60.0 – 63.9	D-
<60.0	E

Current UF grading policy for assigning grade point averages can be found here: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Project paper

Each student will conduct an independent study and submit a project paper (800-1200 words). When preparing the project papers, students are required to submit an outline (30% of the grade for the project) due on **Saturday October 11th**. The project paper is due on **Saturday December 6th**. More details about the requirements, rubrics, and tips will be provided on Canvas.

Undergraduate students will each pick a regulating/cultural ecosystem service as the focus of their projects. The paper will cover topics including how the provision of this ecosystem service differs by ecosystems and land use and land cover, how it can be quantified, mapped, and valued.

Graduate students are expected to develop a draft suitable for future publication at the UF/IFAS Electronic Data Information System. The topic can be anything related to ecosystem services, such as highlighting certain ecosystem services in Florida agroecosystems, identifying the approaches in quantifying and valuing ecosystem services, and outlining the benefits of incorporating ecosystem services in decision making. Graduate students are strongly encouraged to contact the instructor to discuss potential research topics.

Chat Sessions

Chat sessions will be scheduled weekly, and all students are expected to participate. Chat sessions will be held outside of the Canvas course framework using Zoom. Students will need access to a computer with audio and a web camera (optional) to take this course. The first chat session will take place on **Monday August 25th, 6:00 pm - 7:00 pm**. Other chat sessions will be scheduled after course registration to best accommodate everyone's schedule.

Additional sessions per week may be added to accommodate conflicting schedules based on instructor discretion. If you are unable to attend a chat session, chat sessions may be replaced with watching the recordings and answering make-up assignments on Canvas at the instructors' discretion.

Policy on the Use of Generative Artificial Intelligence Tools: You may use generative artificial intelligence (AI) programs, e.g. ChatGPT, to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity. You may not submit work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material. Submitting work containing any content generated by AI when not explicitly cited or not directed to do so by the instructor will be considered an act of academic dishonesty.

Class Demeanor or Netiquette: All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats.

Privacy Disclaimer: Our chat sessions are 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.

Attendance and Late Policy:

Requirements for class attendance (module participation), make-up assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Late assignments and projects will be accepted for 3 days after the submission date and will lose 10% of the grade per day that they are late. After 3 days (including Saturdays and Sundays) the assignment will no longer be accepted, and the student will receive a zero for that assignment.

Academic Policies and Resources

Academic policies for this course are consistent with university policies. See https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/

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.

Campus Health and Wellness Resources

Visit https://one.uf.edu/whole-gator/topics for resources that are designed to help you thrive physically, mentally, and emotionally at UF.

Please contact UMatterWeCare for additional and immediate support.

Privacy and Accessibility Policies

For information about the privacy policies of the tools used in this course, see the links below:

- Instructure (Canvas)
  - Instructure Privacy Policy
  - Instructure Accessibility
- Microsoft
  - Microsoft Privacy Policy
  - Microsoft Accessibility
- Sonic Foundry (Mediasite Streaming Video Player)
  - Sonic Foundry Privacy Policy
  - Mediasite Accessibility (PDF)
- I-Tree
  - i-Tree USDA Privacy Policy
  - i-Tree USDA Accessibility

- InVEST
    - Stanford Online Privacy Policy
    - Stanford Digital Accessibility
    -
- ArcGIS Pro
    - ESRI Privacy Policy
    - ESRI Accessibility
- Zoom
    - Zoom Privacy Policy
    - Zoom Accessibility