

NR 510: Ecosystem Services – Theory and Practice

Fall Semester 2016, 3 credits
Colorado State University

Date and Time: Wednesdays from 9:00 – 11:30 AM

Location: Johnson Hall, Room 120

Instructor: Kelly W. Jones

Office Hours: Tuesdays 12:30pm -1:30pm or by appointment

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COURSE OVERVIEW

The field of ecosystem services presents a major new organizing framework for conservation and natural resources management that is being applied in diverse places globally. Ecosystem services are the conditions and processes through which natural and managed ecosystems, and their constituent species, sustain and fulfill human life. These services range from the provision of food and clean drinking water to climate regulation and flood mitigation to recreational activities and spiritual fulfillment, and much more. While these services from nature underpin our lives, most have been undervalued historically in land use, economic, and policy decisions. In extreme cases, the value of ecosystem services is only recognized after they are lost. In this course, we will examine the linked ecological, economic, and institutional challenges towards better characterizing the contribution of ecosystem services to human wellbeing, and the development of methodologies and institutions for integrating ecosystem services into decision-making. We will critically examine how these approaches are being advanced through research and practice by pioneering efforts in the academic, public, private, and nonprofit sectors.

COURSE OBJECTIVES:

- Develop depth of knowledge about the theoretical underpinnings of the field of ecosystem services by linking concepts from ecology, geography, economics, and social science (and other pertinent areas).
- Examine monetary and non-monetary methods for “valuing” nature and critically assess their assumptions and utility.
- Identify and use methodologies and tools to integrate ecosystem services into decision-making in the public, private, and nonprofit sectors.
- Critically examine policy efforts to design effective payment for ecosystem services programs and other institutional approaches for restoring and protecting ecosystem services.
- Identify key research-action areas and new frontiers of research-action in the field of ecosystem services.
- Empower students to integrate ecosystem services into decision-making in leadership positions across the public, private, and nonprofit sectors.
- Strengthen student’s written and oral communication skills for engaging policymakers, communities, the general public, and other audiences.

Course Materials: Class readings, assignments, lecture slides, syllabus, and other materials will be available electronically through CANVAS.

COURSE ASSIGNMENTS AND GRADING

Your evaluation in this course will be based upon the following assignments. **Please note that the second half of the semester will be a busy one, so making progress on your term paper/project during the first half of the semester is a good idea!**

	Title	# of Points	DUE Date
1	Valuation handout (group report)	100	Oct 5
2	Team-Led Paper Discussion and Paper Critique	100	Throughout semester with <u>paper critique due one week after your assigned session</u>
3	Team-Led Class Session and Blog Entry	100	Sept 21 (topic+paper selection) Oct 12 or Nov 9 (in-class facilitation) Nov 30 (blog entry)
4	Term Paper/Project Deliverables	300	Sept 28 (paper topic proposal) Oct 26 (first paper draft) Nov 9 (peer reviews) Dec 7 (final presentation) Dec 9 (final revised paper)
TOTAL POSSIBLE POINTS		600	

1. Valuation Exercise & Handout: Instructions will be provided in a separate handout.

2. Team-Led Paper Discussion and Paper Critique:

Paper Discussion (50 points): During four class periods (as identified by “Discussion Class” in the course schedule below), students will work together in teams of two to facilitate an ~60 minute in-class discussion on papers from the scientific literature; these papers are identified as “Discussion Paper” in the course schedule. **The student team is expected to email to the class 3-5 discussion questions on the reading no later than the Tuesday before the class period.** Each student in the course must come prepared to discuss these questions and critique the paper.

At the start of the discussion, the student team should provide a concise overview of the paper (10-15 minutes). In the summary, you should: (1) review the major points of the paper, (2) raise topics of interest (e.g., highlight novel results and conclusions), (3) raise any questions or objections you have with the methods, results, and/or conclusions, and (4) cite any parts of the paper that you don't understand and request clarification for the group discussion. **Following the summary, the student team should be prepared to actively generate and facilitate discussion for the rest of the ~60 minute discussion section.** You will be assigned a grade for leading the discussion.

Paper Critique (50 points): As a written deliverable for this assignment, each student will submit an **individual write-up of ~2 pages providing a scholarly critique of the assigned discussion paper**, in the context of that class period's topic and the field of ecosystem services. You have leeway to use this assignment to dive in-depth into an issue that piques your interest or unsettles you about the paper. But as general guidelines, you could address the following items: (1) summarize the paper's main results and conclusions, (2) discuss what you see as being novel in the paper (or if you don't see it as novel, discuss why), (3) critique the methods, results, and conclusions drawn (for empirical papers) or critique the logic behind the arguments advanced (for conceptual/synthesis papers), and (4) discuss what you see as important next research steps to build upon the researchers' conclusions. **The paper critique is due at the start of the class period one week after your assigned discussion section.** You are welcome to submit it the day you actually lead class, but I'm giving you an extra week as there hopefully will be insights generated from the class discussion that refine your thinking on the paper.

Your grade will be based upon discussion facilitation (50 points) and the *individual* paper critique (50 points).

3. Team-Led Class Session: Towards the end of the semester, students will work in teams of 3-4 people to lead one class period by choosing the topic and up to two papers for discussion. You will sign up for teams on the second day of class, and each team's responsibilities are described below. I'm more than happy to meet with teams to discuss their plan for how to run the class period, but I won't require you to meet with me beforehand. I will, however, approve the topic and paper choice.

- Sept 21: Choose a *topic* for your session and *1-2 engaging papers* (from years 2010 – 2016) for the class to read, and submit this to me for review. The topic can build upon one we've already covered or be a new topic area. The paper should be from the peer-reviewed literature or another well-respected outlet (e.g., World Resources Institute, The Nature Conservancy, Business for Social Responsibility).
- Oct 12 or Nov 9 (depending upon which class you sign up for): Facilitate class discussion and/or an activity related to your assigned topic and paper. Be creative!
- Nov 30: Submit blog entry on CANVAS, per instructions below. This can be submitted on "Discussions" in CANVAS at any time after your group finishes the team-led class session but all entries must be posted by Dec 1 for full credit.

Your grade will be based upon class facilitation (70 points) and the *individual* blog entry (30 points).

Blog entry (30 points): In addition to facilitating the class session, there is an *individual* deliverable for this assignment to write a short blog entry about the topic area. Your blog entry should be aimed at stimulating conversation and highlighting successes, challenges and barriers related to advancing the science of ecosystem services and the use of ecosystem services in natural resource decision making. Other members of the class are welcome to comment on the blog entry, but are not required to.

Please follow these **guidelines in writing your blog:**

- The article title must be intriguing or provocative.
- It may be framed as a statement of opinion or a question.
- The body is limited to 400 words. (The basic idea is being concise!)
- The objective is to inspire online discussion.
- Express your point of view in a way that invites the community to respond, either affirmatively or with a contrary opinion. Ask questions. Create openings for discussion.
- Tone and style should address the ES community of researchers and practitioners directly.

4. Term Paper/Project: Each student will use the primary literature to research and prepare either 1) a literature review on a current topic in the field of ecosystem services or 2) an analysis of an existing payment for ecosystem services program. Your paper should consolidate what is known about your topic, highlight information gaps, and set priorities for future research and practice. Detailed instructions will be provided in a separate handout. Please submit topic proposals by (or before!) Sept 28 (<1 page describing your topic and the justification for choosing this topic).

For this assignment, we will be using a peer review system. The first draft of your paper is due on Oct 26. The paper will then be peer reviewed by two other students, with these reviews due on Nov 9. I will serve as the manuscript editor consolidating the comments from both peer reviewers, and providing my additional comments (where necessary). You will then revise the paper according to the reviews and submit a final revised version on Dec 9.

On Dec 7, each student will deliver a 10-minute presentation with brief Q/A period. More instructions in the separate handout.

Your grade for this assignment is as follows: paper topic proposal (25 points) + first paper draft (100 points) + two peer reviews (75 points) + final revised draft (75 points) + final presentation (25 points) = 300 points total.

Letter grades for the course will be assigned as follows:

Letter Grade	Percentage
A+	98-100% (and at instructor discretion)
A	94-97%
A-	90-93%
B+	88-89%
B	84-87%
B-	80-83%
C+	78-79%

C	70-77%
D	65-69%
F	<65%

COURSE SCHEDULE

NOTE on readings: “Required Readings” are ones that everyone should read *prior* to coming to class. For those who wish to read more on a given topic, I’ve also listed “Enrichment Readings”.

Date	Topics (Tentative)	Readings & Assignments <i>To be completed by date listed</i>
Week 1: Aug. 24	<i>No class on Aug 24 – Please read through syllabus & complete readings for Week 2/Aug. 31 before that class.</i>	
Week 2: Aug. 31	<ul style="list-style-type: none"> • Course overview • Introduction to Ecosystem Services 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • Bouma & Van Beukering (2015) Chapter 1: Ecosystem services: from concept to practice • Mace (2014) “Whose conservation?” <i>Science</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Danley and Widmark (2016) “Evaluating conceptual definitions of ecosystem services and their implications” <i>Ecological Economics</i> • Daily et al. (1997) “Ecosystem Services: Benefits supplied to human societies by natural ecosystems.” <i>Issues in Ecology</i> • Millennium Ecosystem Assessment (2005) <i>Ecosystems and Human Well-being: Synthesis</i> – p.1-24
Week 3: Sept. 7	<ul style="list-style-type: none"> • ES Core Concepts: Ecology & Geography 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • Bouma & Van Beukering (2015) Chapter 2: The role of biodiversity in the provision of ecosystem services • Bouma & Van Beukering (2015) Chapter 4: Mapping ecosystem services • Ricketts et al. (2004) “Economic value of tropical forest to coffee production” <i>Proc. Natl. Acad. Sciences</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Harrison et al. (2014) “Linkages between biodiversity attributes and ecosystem services: A systematic review” <i>Ecosystem Services</i> • Ruhl et al. (2007) Intro, Ch. 1, and Ch. 2. <i>Law and Policy of Ecosystem Services</i>
Week 4: Sept. 14	<ul style="list-style-type: none"> • ES Core Concepts: Economics 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • Ruhl et al. (2007) Ch. 3: Economics. <i>Law and Policy</i>

		<p><i>of Ecosystem Services</i></p> <ul style="list-style-type: none"> • Economist (2005) Rescuing Environmentalism. • Chichilnisky and Heal (1998) “Economic returns from the biosphere.” <i>Nature</i> • Gelling, P. “Forest loss in Sumatra becomes a global issue.” <i>The New York Times</i> 6 Dec. 2007 <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Heal (2000) Ch. 2: Basic Economics. <i>Nature and the Marketplace</i>
<p>Week 5: Sept. 21</p>	<ul style="list-style-type: none"> • Economic Value & Valuation Methods for Ecosystem Services 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • MEA Chp 6: Value and valuation methods (page 127-139) • Bouma & Van Beukering (2015) Chapter 6: Economic valuation methods for ecosystem services (SKIM) • Keeler et al. (2012) “Linking water quality and well-being for improved assessment and valuation of ecosystem services.” <i>Proc. Natl. Academy Sciences</i> • Cleveland et al. (2006) “Economic value of the pest control service provided by Brazilian free-tailed bats in south-central Texas.” <i>Frontiers in Ecology and the Environment</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Lopez-Hoffman et al. (2014) “Market forces and technological substitutes cause fluctuations in the value of bat pest-control services for cotton” <i>PLOS ONE</i> • Radiolab “How do you put a price tag on nature?” (Available online): http://www.radiolab.org/story/what-dollar-value-nature/ • Planet Money Podcast “Tallying up the pelican bill” (Available online): http://www.npr.org/sections/money/2010/07/30/128880374/the-friday-podcast-tallying-up-the-pelican-bill • The Ecosystem Valuation Website (a great resource!): http://www.ecosystemvaluation.org/uses.htm <p>ASSIGNMENT DUE: Topic and paper choice for team-led class sessions</p>
<p>Week 6: Sept. 28</p>	<ul style="list-style-type: none"> • Economic Value & Valuation Methods for Ecosystem Services (Finish) • Social Value & Non- 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • Diffendorfer et al (2014) “National valuation of monarch butterflies indicates an untapped potential for incentive-based conservation.” <i>Cons Letters</i> • Goldman (2015) “Putting a price on pollinators”

	<p>Monetary Valuation Methods for Ecosystem Services (Start)</p>	<p><i>Conservation Magazine</i></p> <ul style="list-style-type: none"> • [Discussion paper] Kenter et al. (2015) “What are shared and social values of ecosystems?” <i>Ecological Economics</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Kallis et al (2013) “To value or not to value? That is not the question?” <i>Ecol Econ</i> • Parks & Gowdy (2013) “What have economists learned about valuing nature? A review essay” <i>Ecosystem Services</i> • Scharks and Masuda (2016) “Don’t Discount Economic Valuation for Conservation.” <i>Conservation Letters</i> <p><u>ASSIGNMENT DUE:</u> Term paper topic proposal</p>
<p>Week 7: Oct. 5</p>	<ul style="list-style-type: none"> • Social Value & Non-Monetary Valuation Methods for Ecosystem Services 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • [Discussion paper] Bryan et al. (2010) “Comparing spatially explicit ecological and social values for natural areas to identify effective conservation strategies.” <i>Conservation Biology</i> • Berbes-Blazquez (2012) “A participatory assessment of ecosystem services and human wellbeing in rural Costa Rica using photo-voice” <i>Env Management</i> • (optional) Brown et al (2012) “Public participation PGIS: A method for identifying ecosystem services” <i>Society & Natural Resources</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Chan et al. (2012) “Where are cultural and social in ecosystem services? A framework for constructive engagement.” <i>BioScience</i> • Milcu et al. (2013) “Cultural Ecosystem Services: A literature review and prospects for future research.” <i>Ecology and Society</i> • Bieling (2014) “Ecosystem services as revealed through short stories from residents of the Swabian Alb (Germany).” <i>Ecosystem Services</i> • Bunse et al. (2015) “What can deliberative approaches bring to the monetary valuation of ecosystem services? A literature review.” <i>Ecosystem Services</i> <p><u>ASSIGNMENT DUE:</u> Valuation Handout</p>
<p>Week 8: Oct. 12</p>	<ul style="list-style-type: none"> • Student-Led Session: Topic TBD 	<p>Readings to-be-determined by student groups.</p>
<p>Week 9: Oct. 19</p>	<ul style="list-style-type: none"> • Payments for ecosystem 	<p>REQUIRED Readings:</p>

	services	<ul style="list-style-type: none"> • (optional) Bouma & Van Beukering (2015) Chapter 8: Market based instruments • Bouma & Van Beukering (2015) Chapter 9: Payments for ecosystem services • [Guest Speaker: D. Bennett] Bennett & Gosnell (2015) “Integrating multiple perspectives on payments for ecosystem services through a social-ecological systems framework.” <i>Ecological Economics</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Engel et al. (2008) “Designing PES in theory and practice: An overview of the issues.” <i>Ecological Economics</i> • Guerra (2016) “Assessing preconditions for implementing a payment for environmental services initiative in Cotriguacu (Mato Gross, Brazil).” <i>Ecosystem Services</i> • Ellison and Daily (2003) “Making conservation profitable” <i>Conservation Magazine</i> • TED Talk: Rob Harmon (9 min.) “How the market can keep streams flowing”: http://www.ted.com/talks/rob_harmon_how_the_market_can_keep_streams_flow.html
<p>Week 10: Oct. 26</p>	<ul style="list-style-type: none"> • Payments for ecosystem services 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • [Discussion paper] Muradian (2013) “Payments for ecosystem services as incentives for collective action” <i>Society & Natural Resources</i> • Jack et al. (2008) “Designing payments for ecosystem services: lessons learned from previous experience with incentive-based mechanisms.” <i>Proc. Natl. Academy Sciences</i> • (optional) Schomers (2013) “Payments for ecosystem services: a review and comparison of developing and industrialized countries.” <i>Ecosystem Services</i> <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Muradian et al (2013) “Payments for ecosystem services and the fatal attraction of win-win solutions” <i>Conservation Letters</i> • Wunder (2013) “When payments for environmental services will work for conservation” <i>Conservation Letters</i> (Response to Muradian 2013) • Wunder (2015) “Revisiting the concept of payments for environmental services.” <i>Ecological Economics</i> <p><u>ASSIGNMENT DUE:</u> First draft of term paper</p>
<p>Week 11:</p>	<ul style="list-style-type: none"> • Measuring Success of 	

Nov. 2	Ecosystem Services Projects	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • [Discussion Paper] Ferraro and Pattanayak (2006) “Money for nothing? A call for empirical evaluation of biodiversity conservation investments” <i>PLoS Biology</i>. • Redford et al (2013) “Fads, funding, and forgetting in three decades of conservation.” <i>Conservation Biology</i> • (optional) Bouma & Van Beukering (2015) Chapter 7: Trade-offs and decision-support tools for managing ecosystem services <p>Enrichment Readings:</p> <ul style="list-style-type: none"> • Asbjornsen et al (2015) “Assessing impacts of payments for watershed services on sustainability in coupled human and natural systems.” <i>Bioscience</i> • Naeem et al (2015) “Get the science right when paying for nature’s services.” <i>Science</i> • Howe et al (2014) “Creating win-wins from trade-offs? Ecosystem services for human well-being: A meta-analysis of ecosystem service trade-offs and synergies in the real world.” <i>Global Environmental Change</i> • Boyd et al. (2015) “Conservation Planning: A review of return on investment analysis” <i>Rev Environ Econ Policy</i>.
Week 12: Nov. 9	<ul style="list-style-type: none"> • Student-Led Session: Topic TBD 	<p>Readings to-be-determined by student groups.</p> <p><u>ASSIGNMENT DUE:</u> Term paper peer reviews</p>
Week 13: Nov. 16	<ul style="list-style-type: none"> • TBD 	<p>Readings TBD</p>
Week 14: Nov. 23	<ul style="list-style-type: none"> • <u>Thanksgiving Break</u> 	
Week 15: Nov. 30	<ul style="list-style-type: none"> • Reflection on Ecosystem Services Concept 	<p>REQUIRED Readings:</p> <ul style="list-style-type: none"> • Fisher and Brown (2015) Ecosystem services concepts and approaches in conservation: Just a rhetorical tool? <i>Ecological Economics</i> <p>Optional Readings – a bunch of them... read what you can to prompt your thoughts for a final reflective discussion, but knowing that the end of the semester is a busy period.</p> <ul style="list-style-type: none"> • Fletcher et al (2016) Questioning REDD+ and the future of market-based conservation. <i>Conservation Biology</i> • Dempsey and Suarez (2016) Arrested Development? The promises and paradoxes of “Selling nature to save

		<p>it” <i>Annals of American Association of Geography</i></p> <ul style="list-style-type: none"> • Guerry et al (2015) “Natural capital and ecosystem services informing decisions: From promise to practice.” <i>PNAS</i> • Schroter et al (2014) “Ecosystem services as a contested concept: A synthesis of critique and counter-arguments.” <i>Conservation Letters</i> • Luck et al. (2012) Ethical considerations in on-ground applications of the ecosystem services concept. <i>BioScience</i> • Kinzig et al. (2011) Paying for ecosystem services: promise or peril? <i>Science</i> • Redford and Adams (2009) Payments for ecosystem services and the challenge of saving nature. <i>Conservation Biology</i> • Armsworth et al. (2007) Ecosystem-service science and the way forward for conservation. <i>Conservation Biology</i> <p>ASSIGNMENT DUE: Team-Led Class Session Blog Entry (Can be submitted anytime but this is last possible date)</p>
<p>Week 16: Dec. 7</p>	<ul style="list-style-type: none"> • Final Presentations • Course Assessment 	<p>Assignment Due: Final presentations (in class)</p> <p>Assignment Due: Final revised paper (Dec 9)</p>

COURSE POLICIES

Academic Integrity: As required by the CSU Faculty Council – “This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (<http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf>) and the Student Conduct Code (<http://www.conflictresolution.colostate.edu/conduct-code>). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.”

Requests for Assignment Extensions: In fairness to your fellow classmates, extensions on due dates for assignments will not be granted except in cases where extenuating circumstances arise. If this is the case, please let me know at the earliest possible opportunity to request an extension. In the absence of being granted an extension, the policy below applies for late submissions.

Policy on Late Assignments: Late assignments (those not turned in at the specified date and time) will be penalized one letter grade per calendar day (including weekends). After five calendar days have passed, the assignment will receive a grade of zero.

Availability of Student Accommodations: If you have university-approved circumstances, please contact me after the first class so that we can make a plan for accommodations to ensure a productive semester together.

ADDITIONAL INFORMATION SOURCES – for those wishing to dive further into this field, consider these suggestions as a good start but certainly not comprehensive as this field continues to expand rapidly.

Books

- Bouma and Van Beukering (2015) *Ecosystem services: from concept to practice*, Cambridge University Press
- Ruhl, Kraft, and Lant (2007) *The Law and Policy of Ecosystem Services*, Island Press
- Kareiva, Tallis, Ricketts, Daily, and Polasky, eds. (2011) *Natural Capital: Theory and Practice of Mapping Ecosystem Services*, Oxford University Press
- Daily, ed. (1997) *Nature's Services: Societal Dependence on Natural Ecosystems*, Island Press
- Daily and Ellison (2002) *The New Economy of Nature*, Island Press

Websites

- Ecosystem Marketplace: <http://www.ecosystemmarketplace.com>
- Mercados Ambientales: <http://mercadosambientales.com> (in Spanish!)
- Forest Carbon Portal: <http://www.forestcarbonportal.com>
- Watershed Connect: <http://watershedconnect.org>
- SpeciesBanking.Com: <http://www.speciesbanking.com>
- Ecosystem Marketplace Community Portal: <http://community.ecosystemmarketplace.com>
- Ecosystem Commons: <http://ecosystemcommons.org>
- Natural Capital Project: <http://naturalcapitalproject.org>
- The Ecosystem Services Partnership: <http://www.fsd.nl/esp/>
- Millennium Ecosystem Assessment: <http://www.maweb.org/en/index.aspx>
- IPBES: <http://www.ipbes.net>
- World Bank, Wealth Accounting and the Valuation of Ecosystem Services (WAVES): <http://www.wavespartnership.org/waves/>
- World Resources Institute, Mainstreaming Ecosystem Services Initiative (MESI): <http://www.wri.org/project/mainstreaming-ecosystem-services>
- Gund Institute for Ecological Economics: <http://www.uvm.edu/giee/>
- Betty and Gordon Moore seminar series on ecosystem services: <http://www.moore.org/ecosystemserveseminar.html>
- Ecosystem services podcast tutorial: http://www.keckfutures.org/conferences/ecosystem-services_podcast_home.html
- The Economics of Ecosystems and Biodiversity (TEEB): <http://www.teebweb.org>
- TEEB lecture series: <http://environment.yale.edu/TEEB>
- A community on ecosystem services (ACES): <http://www.conference.ifas.ufl.edu/aces/index.html>
- National ecosystem services partnership: <http://nicholasinstitute.duke.edu/initiatives/national-ecosystem-services-partnership>