ESR 610/USP 610*: APPLICATIONS of ECOSYSTEM SERVICE ANALYSIS*
Spring, 2014, MCB 123
T-Th 10-11:50

Course goal: This course aims to provide participants an opportunity to apply ecosystem service concepts and methods to a pressing environmental challenge facing the Pacific Northwest. Participants will be introduced to an ongoing socio-ecological problem – Hydropower in the Columbia River – with an aim to study dimensions of this project that evaluates the advantages and disadvantages of applying an ecosystem services approach to managing the pressing challenges facing this ongoing socio-ecological challenge. Multiple analytical approaches learned from prior courses as well as new analytical and valuation approaches will be considered, in a collaborative format between instructors and students. Faculty and outside experts will participate in all phases of the class. For the problem, in this case hydropower in the Lower Columbia River Basin, students will be expected to use models and methods to characterize the potential tradeoffs involved in creating alternative ecosystem service scenarios and pose alternative solutions. This course will provide students with both understanding and experience in applying ecosystem services methods and modeling to help solve wicked environmental problems that affect urbanizing regions.

Prerequisites: ESR 692 and Geog 696, or lead instructors' permission

Faculty Instructors: Vivek Shandas (co-lead), Angela Strecker (co-lead), and others as appropriate.

Relevant Community Partners: Northwest Power and Conservation Council, Native Fish Society, Columbia River Inter-Tribal Fish Commission, Bonneville Power Administration, National Oceanic and Atmospheric Administration, Columbia River Gorge Commission, and others as appropriate.

General Pedagogical Approach: The course is divided into three phases. The first focuses on orientation and identification of the problem and its subcomponents. For this year our problem will focus on the management of hydropower in the Lower Columbia Basin – a broader description is provided below. The first phase will rely on extensive readings, lectures by area experts, and developing a research design that addressing one aspect of the problem. The second phase of the course aims to characterize the biophysical and socio-ecological challenge through gathering relevant data and structuring analyses that respond to the challenge. The second portion will require that course participants work in teams of 2-3, and propose a potential solution to one dimension of this challenge, including a scientific approach that will apply ecosystem services models and methods. The final third of the course will consist of students implementing their proposed models and methods and reporting their results to other students, faculty and community partners. Much of this course will be driven by the specific problem identification (phase one), and the collecting the relevant data.

Course Group Problem: Lower Columbia River and Estuary (LCRE) managers and scientists face major challenges: an altered hydrologic cycle, a changing legal framework for hydropower operations due to the 2014-2024 renegotiation of the Columbia River Treaty with Canada, and an upcoming (2014) Federal Columbia River Power System Biological Opinion for endangered Pacific salmonids. Water temperatures often exceed viability criteria for salmonids in summer, non-native species complicate restoration, and a sediment deficit threatens habitat and navigation. These challenges put the LCRE at a tipping point, where the system trajectory may undergo significant changes. Traditional economic drivers such as navigation, agriculture, and hydropower—themselves agents of disruptive change—will increasingly be constrained by competition for water in a warmer climate. Evolving global economic and demographic trends (e.g.,

population growth, deeper ship drafts and changing energy markets) threaten ecosystem services and the viability of LCRE navigation, and impede habitat restoration.

The LCRE, with >$15 billion in total cargo, is the largest US grain export gateway, exporting Columbia River-irrigated grain downriver via a navigation project made possible by dams. This integrated system of dams, locks and channels also regulates flow and reduces flooding. Negative impacts of the combined dam and channel system include: massive damage to fisheries; habitat destruction by dredged material disposal; low water levels in Portland-Vancouver Harbor that impede habitat access and hinder navigation; and a sediment deficit that causes coastal erosion and threatens habitat loss. The reservoir system also reduces flow variability, creating river habitats that are more hospitable to non-native species (transported in vessel ballast water) and reduces the ability for Native Americans to pursue their fishing rights.

Ecosystem services can potentially serve as a tool for understanding the tradeoffs between environmental flows, hydropower, agriculture, and the human management activities that are directly (and indirectly) impacting the system. As climate change and demographic shifts pose increasing demands on the system, including water demand/supply, land use alteration, population growth, and the tradeoffs for ensuring adequate environmental flows remains uncertain. For the purposes of this course, "environmental flows," are defined as, "…flows left in rivers, or restored to developed rivers, to sustain select [or key] ecological and societal values" (Arthington et al. 2010). Environmental flows attempt to mimic the natural flow regime by manipulating the timing and quantity of water released in managed hydrosystems, and are recognized as a key factor in the recovery of endangered Pacific salmonids. However, the economic costs of altering flows for ecological purposes are substantial, with an uneven distribution of costs across socioeconomic strata, and navigation, agriculture, and hydropower would likely be negatively impacted by most flow restoration scenarios. The ecosystem services that are provided by a natural flow regime in the LCRE have been largely ignored. Climate change adds an uncertainty to upcoming negotiations. Thus, the trade-offs between hydropower, navigation, consumptive uses, and environmental flows are a vital natural-human interaction, worthy of study.

Learning objectives:

1. Identification and characterization of a real world wicked problem in ecosystem services management for an urbanizing region.
2. Conceptualization of the underlying analytical frameworks of dominant biophysical, spatial and valuation models and methods for ecosystem service analysis for the selected wicked problem.
3. Application of major biophysical, spatial and valuation models and methods to example ecosystem service issues for the selected wicked problem.
4. Understand how to frame ecosystem services analyses for tractable research models and methods that yield salient findings for all relevant stakeholder groups.
5. Identify primary and secondary data sources needed to apply the relevant models and methods to the group problem and approaches for obtaining those data.
6. Apply relevant models and methods with currently available data or proxies to examine the relationships of interest and draw tentative conclusions or implications.
7. Present the findings of the modeling and methods applications to peer students, faculty and interested community partners.

Weekly course outline:
Note assigned items to be graded have due dates in **bold below**.

Week 1
Tues (Apr 1): Introduce course objectives and learning approach. Introduce the problem as an ecosystem management problem in an urbanizing region. IGERT/ISS fellows provide a summary of the first two courses – what they did, learned, and what the last two terms may mean for addressing the problem posed in this spring term course.

Readings Assigned: (1) Book chapter, Columbia River history and overview.

Thurs (Apr 3): Professor Emeritus David Ervin discusses 2013 Applications course – topic, objectives, process, and outcomes

Discussion of Readings: facilitated by course participants and instructors.
Student team chooses a reading and distribute to course participants.

Week 2
Tues (Apr 8): Bill Lang (PSU History, Emeritus) and David Jay (PSU Engineering) discussion about the scientific and cultural challenges/context of the Columbia River.

Readings Assigned: (1) Book chapter on Columbia River (tbd), (2) student group selected reading.

Thurs (Apr 10): Presentation by Peter Paquet (confirmed), NW Power and Conservation Council;

Discussion of Readings: facilitated by course participants.

Week 3
Tues (Apr 15): Work day– develop research questions, methods, and develop IRB protocol, if necessary. Develop questions for panelists, consisting of panel questions and with small groups.

Assigned Readings: (1) Specific dimension of the Columbia (tbd), (2) student group selected reading.

Thurs (Apr 17): **Students will each present a proposed model or method** that they might implement to address the Lower Columbia River issues. **They will also submit a 1-2 page summary of their presentation.** Class will then discuss and refine these approaches.

Discussion of Readings: facilitated by course participants.

** Saturday, 4/19, 8am – 12pm: Optional field trip to Bonneville Dam and hatchery; transportation TBD.

Week 4
Tues (Apr 22): Non-profit Panel: Presentation from outside experts on wicked problems in other socio-ecological systems: Bill Bakke (Native Fish Society), John Shurt (NWPCC), tba (CRITFC).

Assigned Readings: (1) Specific dimension of the Columbia (tbd), (2) student group selected reading.

Thurs (Apr 24): Government Panel: Elizabeth Garr (NOAA); Bill Maslen (BPA); and Darren Nichols (Columbia River Gorge Commission).

Week 5
Tues (Apr 29): Work session. Students will work in small groups to prepare Thursday (5/1) presentation.

Discussion of Readings: facilitated by course participants.

Thurs (May 1): Formal presentation of proposed approach by student groups. Each group will present their proposed approach. *IGERT core and interested associate faculty* will be on hand to give both oral and/or written feedback. Deliverable: detailed final project outline due.

Assigned Readings: (1) Specific dimension of the Columbia (tbd), (2) student group selected reading.

Week 6

Tues (May 6): Work session. No formal class meeting. Students will work in small groups on their projects on their own and with IGERT faculty liaisons.

Thurs (May 8): Work session. Students will work in small groups with course facilitators on-hand

Discussion of Readings: facilitated by course participants.

Week 7

Tues (May 13): Work session. No formal class meeting. Students will work in small groups on their projects on their own and with IGERT faculty liaisons.

Thurs (May 15): Work session. Students will work in small groups with course co-facilitators on hand.

Week 8

Tues (May 20): Work session. No formal class meeting. Students will work in small groups on their projects on their own and with IGERT faculty liaisons.

Thurs (May 22): Work session. Students will work in small groups with course co-facilitators on-hand.

Week 9

Tues (May 27): Work session. No formal class meeting. Students will work in small groups on their projects on their own and with IGERT faculty liaisons.

Thurs (May 29): Oral presentations. Students will present their final work with *IGERT core and associate faculty* and Lower Columbia River experts on hand to critique in both oral and written form.

Week 10

Tues (June 4): Work session. Students will work in small groups with course co-facilitators on-hand.

Thurs (June 6): Written group papers due. Debrief with co-facilitators to discuss successes and challenges of the course and group projects, and to identify next steps for publishing research findings.

Evaluation

Course participants will be evaluated on a 1000 point scale, according to the following:

Participation:	300 points
Paper Discussions:	200 points
Presentations:	200 points
Written Group Paper:	300 points
TOTAL	1000 points

Academic Integrity

Portland State University (PSU) takes academic integrity very seriously. PSU strives to provide students with the knowledge, skills, judgment, and wisdom they need to function in society as educated adults. To

falsify or fabricate the results of one's research; to present the words, ideas, data, or work of another as one's own; or to cheat on an examination or project corrupts the essential process of higher education. Students failing to adhere to these principles of academic integrity will be penalized (e.g. reduction of points, fail the course, etc.). For further information please refer to PSU's student conduct code (http://www.pdx.edu/dos/conduct.html) or consult the instructor if you are unsure what constitutes a breech of academic integrity.

Disabilities

Every effort will be made to accommodate individuals with disabilities. Please notify the instructor by the first week of the course so that any necessary accommodations can be arranged. More information can be found at: http://www.pdx.edu/iasc/drc_faculty_resources.html

Web-Based Course Management

We will be using D2L, an online course management system, to organize all course materials. Specific uses of D2L include: updates to the syllabus, readings, submitting assignments, communicating with the class, and posting relevant materials. *Please also use D2L to communicate (email) with the instructor*. D2L is located at: https://d2l.pdx.edu/. You will need to sign in using your user ID and password. Please contact PSU's HELP Desk (*tel. 503-725-HELP or email, help@pdx.edu*) if you are having any trouble with D2L.