

## **Biodiversity Conservation and Environmental Sustainability Interfacing Ecological and Social Sciences**

NR 5984; FWC 5984

3 hours, 1 day/week

*(The syllabus is still evolving; topics/readings/assignments may change to reflect student interests.)*

### **Instructors**

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### **Course theme**

This course examines the history, theories, current status, and future prospects, given ongoing global changes, of biodiversity conservation as a societal enterprise. It emphasizes the study, practice, and scientific and socioeconomic contexts of conservation, especially as it relates to emerging goals for sustainability. It synthesizes ecological, socioeconomic, and cultural perspectives as it explores cross-institutional and cross-disciplinary approaches to conservation. It encourages students to consider how they might engage science, policy, and other professionals in achieving conservation goals.

### **Learning objectives**

Upon successful completion of this course, students should be able to

- describe ecological, economic, and social conditions affecting biodiversity conservation
- describe ecological, economic, and social factors affecting sustainability
- compare and critique alternative approaches to biodiversity conservation and sustainability; evaluate their efficacy, practicality, and synergies
- synthesize ecological, economic, and social perspectives on biodiversity conservation
- critically evaluate roles for communities, science, themselves, and others in achieving biodiversity conservation and sustainability
- apply their developing professional expertise in the larger task of conserving biodiversity
- demonstrate improved writing and speaking skills; think more critically, synthesize knowledge and communicate clearly across disciplines

### **Methods**

This course includes weekly readings and seminar discussion, as well as combinations of oral presentations, independent research, creative thinking, and critical writing.

### **Grading criteria**

1. 20% -- **Weekly written response to readings** (<1 page). Critically evaluate and synthesize assigned readings and respond to specific questions posted for each week. Post written response on class discussion board by 5 pm the day before the readings are discussed in class. To promote interaction and group learning, we encourage students to

- reflect and respond to weekly posts by others.
2. 15% -- **Student-led discussions of readings** (most weeks). Discuss ideas with instructors 1 week in advance of discussion. Seed the week's discussion board with comments/questions on the following: a) key issues addressed in readings, b) how topic relates to previously discussed topics, c) any issues overlooked or misrepresented, and d) implications for the science or practice of conservation. Post these comments/questions at least 3 days before class. Review comments by classmates and develop a 1-page outline of issues/questions you plan to address in class. Post the outline to Scholar prior to class.
  3. 15% -- **Class activities and participation**. This course is largely a seminar; however we will also design classroom activities, including debates and small group exercises. Intermittently, students will present the products of group activities to the class. Students are expected to attend class and engage in thoughtful, constructive discussions.
  4. 20% -- "**Conservation Science in Action**": One of the goals of this course is to provide you with practical experience in the field of conservation science. Since conservation scientists play many roles in this interdisciplinary field, these assignments are designed to broaden your experience and perspective. Throughout the semester, you will complete the following written exercises on a conservation-based topic of your choice: (more detail provided in CBIA guidance.doc posted on Scholar)
    - Develop a **policy position** paper aka "policy brief" or "white paper": *2 pages max*
    - Create an **op-ed article** for a newspaper (following format recommendations for submission)
    - Develop an economic incentive/disincentive program targeting a change in human behavior that enhances conservation and/or sustainability.
  5. 30% -- **Synthetic Research Presentation**: Oral PowerPoint presentation (20 minutes) of independent research on a topic selected by student to reflect her/his interests and expertise; presentation will dig deeper into one or more of topics discussed in class and can overlap with CBIA. Learning objectives of this assignment include a) synthesize literature and concepts related to biodiversity conservation and sustainability and b) use the literature to understand and critique an innovative effort or approach to conserve biodiversity. The assignment has multiple parts: A) [5%] topic proposal (due in week 8); in a brief oral presentation, provide title and problem statement that describes the topic, who cares, why they care, and how topic relates to the course; also list at least five relevant references from the primary literature (NOT websites). B) [25%] the main presentation itself (due in week 14); the presentation will include: problem statement, review of literature discussed in class, review of new literature, project description showing relations to conservation, synthesis and explanation of interest to general viewers, based on concepts in literature review, description and review of alternative approaches, and complete literature cited.
  6. Grades for late assignments will be reduced one full grade per week. No assignment except the research presentation will be accepted after the last class period.

**Course outline** (some of these topics may include guest discussants)

**First 4 weeks cover the landscape of conservation science**

**Week 1**

Introductions

Course overview, review of syllabus

Biodiversity problem/crisis defined

- Current patterns and trends (anthropocene)
- Changes in land use and climate
- Future trajectories and prospects

Reading assignment:

1. Foley, J. A., et al. 2005. Global consequences of land use. *Science* 309 (5734): 570-574.
2. Dudgeon et al. 2006. Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological Reviews* 81: 163-182. (diversity patterns, importance to society, patterns and drivers of decline, prospects for conservation)
3. One of the following:
  - a) Butchart et al. 2010. Global Biodiversity: Indicators of Recent Declines. *Science* 328: 1164-1168. (indicators of and trends for conservation progress and ecological pressure).
  - b) Rands et al. 2010. Biodiversity Conservation: Challenges Beyond 2010. *Science* 329: 1298-1303. (current trends in conservation success, needs for effective policy)
4. Kolbert, E. 2011. Enter the anthropocene. *National Geographic*, March: 60-85.  
(some dramatic photos)

Writing assignment:

*Write an essay (200 – 250 words) to define the biodiversity crisis from your perspective. Is there really a “crisis”? Explore social, economic, and ethical aspects as well as ecological and evolutionary implications in your definition.*

**Week 2**

Socioeconomic drivers of global change

- Human population demographics
- Importance of biodiversity relative to other human needs
- Globalization of markets and corporations

Reading assignment:

1. Cohen, JE. 2005. Human population grows up. *Scientific American*, September: 48-55.  
(analysis of human demography)
2. Millennium Ecosystem Assessment. 2005. Synthesis doc's can be found at:  
<http://www.maweb.org/en/index.aspx>.  
In Overall Synthesis, see Summary for Decision-makers (24 pp; main findings, anthropogenic drivers of global change, ecological and biotic metrics of change, links between socioeconomic and ecological systems, potential management actions)
3. International Monetary Fund. 2008. Globalization: a brief overview.  
<http://www.imf.org/external/np/exr/ib/2008/053008.htm>.
4. Bishop, T. et al. 2011. Globalization: Trends and Perspectives. *Journal of International Business Research* 10 (1).

### **Week 3**

#### Overview of the discipline Conservation Science

- Goals, tools, socio-political contexts
- Component disciplines
- Values of nature

#### Reading assignment:

1. Balmford, A. and R. Cowling. 2006. Fusion or Failure: The Future of Conservation Biology. *Conservation Biology* 20: 692-695. (10 major challenges for conservation)
2. McCauley, DJ 2006. Selling out on nature. *Nature* 443: 27-28. (primacy of ethics and intrinsic value as basis for conservation rather than commodification of nature)
3. Marvier, M. et al. Winter 2012. Conservation in the anthropocene: beyond solitude and fragility. *Breakthrough Journal* (<http://thebreakthrough.org/index.php/journal/past-issues/issue-2/conservation-in-the-anthropocene/>). (conservation philosophy, role of reserves/wilderness, relationships with indigenous peoples, resilience of nature)
4. Meine, C., M. Soule, and R. Noss. 2006. "A mission-driven discipline": the growth of conservation biology. *Conservation Biology* 20: 631-651. (history of conservation biology [discipline and journal], integration with other disciplines, scientific contributions, role in policymaking)

#### Writing assignment:

*Write essay to address Conservation Science's ability to resolve the biodiversity crisis. Does it include the right technical tools? Does it speak from the right platform to the right people? What does it lack?*

### **Week 4**

#### Links between biodiversity, ecosystem services, and human well-being

##### Conceptualizing ES

- provisioning vs regulating vs cultural ES

##### Quantifying ES; Monetizing ES, biota

- assessing tradeoffs

##### Multi-dimensionality of HWB

- relations to GDP, poverty, human health

##### Spatiotemporal relations between HWB and biodiversity

##### Synergies and antagonisms between promoting ES and biodiversity conservation

#### Reading assignment:

1. Raudsepp-Hearne et al. 2010. Untangling the Environmentalist's Paradox: Why is Human Well-Being Increasing as Ecosystem Services Degrade? *Bioscience* 60(8): 576-589. (relations between ES and HWB, rich vs poor, urban vs rural, complexity of HWB, role of technology)
2. McShane, T.O. et al. 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation* 144: 966-972. (limitations

of win-win approaches, tradeoffs between conservation and HWB, importance of socio-cultural contexts)

3. Keeler, Bonnie L., S. Polaskya, K. A. Braumana, K. A. Johnson, J. C. Finlay, A. O’Neill, K. Kovacs, and B. Dalzell. 2012. Linking water quality and well-being for improved assessment and valuation of ecosystem services. *Proceedings of the National Academy of Sciences* 109(45):18619-18624. (valuation of water quality-related services; biophysical and economic pathways linking actions to changes in water quality-related ES; examples of valuation approaches)

*Class debate on conservation efficacy of intrinsic vs utilitarian values of biota*

## **Second 4 weeks cover complexities of socioeconomic contexts for biodiversity conservation**

### **Week 5**

Ecological limits, boundaries, tipping points ... and alternative viewpoints

What is your Ecological Footprint? Take the quiz and summarize your results and impressions. See

<http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/> or <http://www.myfootprint.org/> or other calculators.

Reading assignment:

1. Dryzek, J. S. 2005. Chapter 3 – Growth forever: the Promethean response. Pp 51-71. (prevailing political worldview, antithesis of carrying capacity)
2. Simon, J. 1994. More people, greater wealth, more resources, healthier environment. *Economic Affairs* (April pp 22-29). (people as ultimate resource; environmental crises are wrong-headed; most socioeconomic trends are positive; economic freedom is crucial)
3. Daly, Herman E. 2005. Economics in a full world. *Scientific American* (Sept):100-107. (human economy as subsystem of biosphere; uneconomic growth; multiple forms of capital; resource fungibility; roles of markets and gov’ts in sustainability; consumption vs happiness)
4. Rockström, J. et al 2009. A safe operating space for humanity. *Nature* 461: 472-475. (planetary biophysical boundaries on human development; some boundaries (eg, biodiversity loss) already over-stepped)

*Eileen Crist (VaTech) as guest discussant.*

### **Week 6**

Economic systems as context for biodiversity loss and conservation

Reading assignment:

1. Sagoff, M. 2003. Cows are better than condos, or how economists help solve environmental problems. *Environmental Values* 12: 1-22. [3 illustrations of economic analyses in environmental decision-making; cost-effectiveness sometimes a better decision criterion than simple cost]

2. Czech, B., et al. 2000. Economic associations among causes of species endangerment in the United States. *BioScience* 50: 593-601.
3. Victor, P. 2010. Questioning economic growth. *Nature*, 468(7322), 370-371. [alternatives to national economic growth as a paramount policy; suggests replacing growth with stability, resilience and wellbeing as prime objectives; GDP vs Genuine Progress Indicator; viability of capitalism without growth]
4. Balmford, A. et al. 2002. Economic Reasons for Conserving Wild Nature. *Science* 297: 950-953. [economic benefits of conservation vs habitat conversion, macroeconomics vs microeconomics, failure of markets to represent benefits, public vs private benefits]

*Kurt Stephenson (VaTech) as guest discussant.*

## **Week 7**

### Sustainability as a conceptual framework

Define sustainability (weak vs strong)

Ecological, economic, social, and ethical dimensions

Personal, regional, and national perspectives

#### Reading assignment:

1. Norton, B. 2005\*. *Sustainability*: University of Chicago Press. Chapter 8: Sustainability and our Obligations to Future Generations. 304-355. (moral underpinnings of sustainability; weak vs strong sustainability; economists' simplification of sustainability)

\*Norton is a long, sometimes dense, read. **Focus on the first 2 sections** – no need to read the whole chapter (unless you cant help yourself).

2. Hess, D.J. 2008. Localism and the Environment. *Sociology Compass* 2: 625–638. [localism as a social movement, antidote to corporate consolidation of the economy; pros and cons of localism as a tactic for regional sustainability]
3. Holden, E., and K. Linnerud. 2007. The Sustainable Development Area: Satisfying Basic Needs and Safeguarding Ecological Sustainability. *Sustainable Development* 15:174-187. [description of the sustainability concept born from sustainable development; framework for assessing the sustainability of present and future development policies for nations]

See [www.yale.edu/esi/](http://www.yale.edu/esi/) for example of composite index of national sustainability

## **Week 8**

### Links between biodiversity conservation and sustainability

Changing faces of environmentalism and conservation

Managing urban sprawl

Cradle to cradle resource budgets for manufactured goods

See whitehouse.gov website on top environmental issues

#### Reading assignment:

1. Salafsky, N. 2011 Integrating development with conservation: a means to conservation end, or a mean end to conservation? *Biological Conservation* 144: 973-978 [links between human and natural welfare; integration of and tradeoffs between socioeconomic development and conservation]
2. Newton, J. L. and E. T. Freyfogle 2005. Sustainability: a dissent. *Conservation Biology* 19: 23–32. [critique of meaning, goals, agents, outcomes of sustainability; risks for biodiversity conservation]
3. Krueger, R and D Gibbs. 2008. ‘Third Wave’ Sustainability? Smart Growth and Regional Development in the USA. *Regional Studies* 42: 1263–1274. [critique of “smart growth” as a mode of sustainable development; link to the UN’s (locally contentious) Local Agenda 21; politico-economic history of growth regulation]
4. Hostetler, M., W. Allen, and C. Meurk, 2011. Conserving urban biodiversity? Creating green infrastructure is only the first step, *Landscape and Urban Planning*, 100(4) 369-371. <http://www.sciencedirect.com/science/article/pii/S016920461100048X>

*Elisabeth Willis and Carol Davis (professional planners for Blacksburg and New River Valley) as guest discussants.*

**Remaining weeks cover strategies/tactics for achieving conservation, given the complexities**

**Week 9**

Conservation and sustainability in real landscapes

Managing landscapes to achieve conservation

Roles of scientists, professionals

Conservation planning

USFWS Habitat Conservation Plans

Reading assignment:

1. Wenger, SJ et al. 2010. Conservation planning for imperiled aquatic species in an urbanizing environment. *Landscape and Urban Planning* 9: 11-21. [local implementation of conservation plan for imperiled species; adaptive management of urbanization impacts]
2. Turner, WR et al. 2007. Global conservation of biodiversity and ecosystem services. *BioScience* 57: 868-873.[concordance in distribution of biodiversity vs ecoservices; global opportunities to conserve both]
3. de Groot, RS et al. 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity* 7(3):260-272. [quantifying ecoservices value in planning context; analyzing tradeoffs in land use]

*Bill Kittrell (The Nature Conservancy) as guest discussant.*

## **Week 10**

### Economic tactics for achieving biodiversity conservation

Payment for ecosystem services  
Eco-labeling and eco-certification

#### Reading assignment:

1. Kinzig, AP et al. 2011. Paying for ecosystem services – promise and peril. *Science* 334 (6056): 603-604. [using markets to induce people to take account of environmental costs of their behavior, problems with ES markets, importance of payment mechanism design and implementation, mechanisms for motivating people to provide scarce ESs that are public goods)
2. Kaiser & Edward-Jones. 2006. The Role of Ecolabeling in Fisheries Management and Conservation. *Conservation Biology* 20, (2) 392–398. [skim]
3. Dauvergne & Lister 2010. The Prospects and Limits of Eco-Consumerism: Shopping Our Way to Less Deforestation. *Organization Environment* 23: 132-147.
4. Milder, J. C., S. J. Scherr, and C. Bracer. 2010. Trends and Future Potential of Payment for Ecosystem Services to Alleviate Rural Poverty in Developing Countries. *Ecology and Society* 15 (2): 4 (19 pp).

## **Week 11**

### Philosophy and spirituality in conservation and sustainability

Formation of an individual's identity  
Philosophical and religious foundations

#### Reading assignment:

1. Hull, R.B. 2006 (publisher draft as Word.doc). Chapter 9 -- Spiritual Nature. 14 pp. *in* Infinite Nature. Chicago Press. [influences of Judaism-Christianity on environmental thinking and policy; independence of science and religion; effects of Protestant work ethic on the American landscape]
2. Tucker, Mary. 2008. World Religions, the Earth Charter, and Sustainability. 20 pages. <http://fore.research.yale.edu/publications/projects/tuckerec3.pdf>  
[overview of the “greening” of world religions; development of ethical basis for living sustainably; religion as a mechanism for forging ethics and culture of sustainability]
3. Clive Hamilton. 2007. Self-Creation Under Consumerism and the Transition to an Ecological Consciousness. In “*Toward a New Consciousness: Creating a Society in Harmony with Nature.*” Aspen, CO. Yale School of Forestry and Environmental Studies. 17 pp. [role of consumerism (a pseudo-religion) in self-identity; people as citizens rather than consumers; globalizattion of culture]

Google “Bartholomew, Green Patriarch” – leader of 300M Orthodox Christians who preaches that harming nature is a sin.

Google Yale Forum on Religion and Ecology.

*Mike Ellerbrock (VaTech) as guest discussant.*

## **Week 12**

Engaging business and corporations to achieve conservation

Conservation implications of a global economy

Scenarios for 2050

Check out the impacts of products you frequently buy (<http://www.goodguide.com/about>)

but don't forget about Greenwashing (<http://www.greenwashingindex.com/>)

Reading assignment:

1. Brown-Lima, C. et al. 2010. An overview of the Brazil-China soybean trade and its strategic implications for conservation. TNC – Latin America. Parts 1 and 3 (18 pp).
2. Pdf - Dyllicks, T. and K. Hockerts. 2002. Beyond The Business Case For Corporate Sustainability. *Bus. Strat. Env.* 11: 130–141. [evolution of sustainable development; 6 criteria for corporate sustainability]
3. Robinson, JG. 2012. Common and conflicting interests in the engagements between conservation organizations and corporations. *Conservation Biology* (11 pp). [collaborations between corporations and NGOs are common and can mitigate negative environmental impacts but to date have provided minimal biodiversity benefits]

*Bruce Hull (VaTech) as guest discussant.*

## **Week 13**

Engaging human communities to achieve conservation

Community-based conservation

Social marketing as a conservation tool

Effects of protected areas on local communities

Reading assignment:

1. Berkes, F. 2007. Community-based conservation in a globalized world. *Proceedings of the National Academy of Sciences of the United States of America* 104:15188-15193 [integration of conservation and development requires dealing with multiple objectives, use of partnerships and deliberative processes, and learning from commons research to develop diagnostic tools. Discussion of “commons” theory and its applicability to CB conservation strategies]
2. Peatie, K., and S. Peatie. 2009. Social marketing: A pathway to consumption reduction. *Journal of Business Research* 62(2): 260-268. [potential of social

marketing t to contribute to consumption reduction and alter ingrained forms of consumer behavior and to successfully ‘de-market’ products]

3. Kennedy, A. (2010). Using Community-Based Social Marketing Techniques to Enhance Environmental Regulation. *Sustainability*, 2(4), 1138-1160. [how environmental regulation may be improved through the use of community-based social marketing techniques. Case studies where community-based social marketing techniques have been successfully used are examined]

*Tim Baird (VaTech) as guest discussant.*

**Week 14 - 15**

Student-led discussion; topics TBA, based on research presentations.