

Conservation Biology

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Spring 2022
Monday 14:00-15:50
(DISTANCE via MS Teams through Omicron wave)

Conservation biology is one of the newest ecological disciplines -- one that is specifically interested in applying ecological principles to the protection of biological diversity. Although many would want to claim that this is a well-developed (and even perhaps) mature field, I do not see this as the case. Instead, I agree with Susan Bratton that our current ability to design and care for nature reserves is similar to the record of the medical profession in 18th century Vienna, where patients had a greater chance of dying under a doctor's care than if diseases were let to run their own course. What is essential if Conservation Biology is to become a benefit (and not drain) on biological diversity is that all of its practitioners become constantly aware of their lack of understanding of natural processes, and be able to decide for themselves the relative merits of differing approaches in the lack of such information. Over the semester I hope to not only provide you with access to the knowledge needed to make wise conservation choices, but also to foster your ability to independently think about – and defend – your choices regarding conservation strategies. To do this we will first overview important ecological principles underlying conservation biology, and then second will apply these principles to real-world situations. The issue here is not just knowing the relevant concepts, but also to critically and objectively assess the major theories and paradigms which underlie this most important of ecological fields.

Expectations & Course Lectures

I will assume that you all have a good understanding of basic ecological principles, such as Hardy-Weinberg genetics, various competition models, community assembly theory, and biogeochemical cycling through ecosystems. I'll also assume that you will have a solid background in high school algebra. Attendance at lectures is strongly recommended, and is absolutely essential for doing well in the class. If you do have to miss a lecture, please see me, and try to obtain notes from a friend. We will not use a textbook, per se, as I have seen no single book which adequately covers the subject. Rather, we will read the original literature on the subject which I have compiled and has been made available on the course website on the IS portal. The best way to deal with the readings is to give them a very quick view before lecture. Then I will walk you through the papers in my lecture. At that point you will have enough background information to be able to fully understand the paper. So then commit to carefully reading each paper within a few days after lecture while the ideas are still fresh. Please keep up with your readings! It will be very easy to fall so far behind that you will not be able to catch up.

Because of the on-going Omicron COVID wave, the course will be initially taught via distance methods. My hope is that once this passes within 4-6 weeks we will be able to meet in person for the rest of the term.

Evaluation

Course grades will be based on two equally weighted exams. These will be comprehensive, covering all material presented in the class to that time, and will be based on essay questions, as this is the only way I have of really determining your basic understanding of the topics covered. Because of this being a distance course this semester, the exams will consist of short-essay-length responses to a series of questions in which you apply your readings and additional insights. These essays will be

open book / computer and you will have two weeks to respond. The issue will be sifting through the available information to make and defend your personal answer. Your score will be based on not only the accurateness of the science you present, but also how well you integrate these ideas and defend your position. Yes, I will know if you are plagiarizing. So don't. You won't like the consequences.

IMPORTANT DATES

April 11: Exam 1 due

May 23: Exam 2 due

Course Schedule

February 14: Course Introduction

February 21: Conservation Ethics

- *Introduction to Philosophical Ethics (Cobb, Leopold, Littlebird, Meyers)*

(Overview the main philosophical ethics perspectives including teleological and deontological approaches.)

- *An Island (McPhee)*

(Investigate the different ethical positions held by conservationists and developers through a class debate centered around Cumberland Island, Georgia.)

February 28: Humans and Biological Diversity

--*Negative Impacts (Baker et al., Kirch)*

(How exploitative human cultures have altered communities, species diversity, and ecosystem processes in the U.S. Midwest and Polynesia)

-*Positive Impacts (Harlan, Pistrick, Williams, Brush et al.)*

(Development and maintenance of food plant and animal diversity; fate of cultural biodiversity; centers of domestication.)

March 7: Population Genetics (Frankel & Soulé, Ehrlich)

(Processes which effect genetic diversity, and the relationship between genetic diversity, fitness, and extinction)

Population Biology (Krukeberg & Rabinowitz, Ehrlich & Murphy)

(Structure of populations and meta-populations; the factors leading to population endemicity; the seven forms of rarity).

March 14: Minimum Viable Populations (Gilpin & Soulé, Menges)

(Definition of minimum viable populations; equilibrium and non-equilibrium methods to determine this number for various circumstances)

Spatial Scale (Wiens, Palmer & White)

(Role of spatial scale in the observation of ecological process and pattern; scale vs. richness.)

March 21: Disturbance Ecology

-*Small Scale (Sousa, White)*

(Types of disturbances, patch dynamics, exogenous vs. endogenous disturbance regimes; return interval and intensity; impact on sessile and mobile organisms.)

-*Large Scale (Romme & Knight, Turner et al.)*

(Landscape diversity; quasi- vs. non-equilibrium landscapes; disturbance-diversity relationships; disturbance in the Yellowstone ecosystem.)

March 28: Habitat Fragmentation

-Short-term effects (Bierregaard et al., Robinson et al.)

(Effect of habitat fragmentation on organism abundance and movement; thresholds to response; relaxation in species richness)

-Long-term effects (Carlquist, Nekola)

(Evolutionary response of organisms to isolation; community responses to isolation; neo- and paleo-refugia.)

EXAM 1 (distributed at end of class)

April 4: Single Large or Several Small (SLOSS) Debate (Diamond, Simberloff & Gotelli)

(Should reserves be made few and large or many and small?)

Corridors Debate (Noss, Harrison, Simberloff et al.)

(Should reserves be connected by corridors?)

April 11: Dynamic Systems and Reserve Design. (Dolan et al., Pickett & Thompson)

(How to design [and manage] reserves which protect constantly changing communities.)

Reserve Integrity (Schonewald-Cox, Peters, Romme & Turner)

(How do processes outside of reserve boundaries affect biodiversity within reserves?)

EXAM 1 (due no later than 17:00)

April 18: *Hody Hody Doprovoody.*

April 25: Ex-situ vs. In-situ Conservation (Falk & McMahan, Hamilton)

(Should species be protected in artificial environments?)

Species Reintroduction (Cade, Bangs & Fritts, Allen)

(When, if ever, is reintroduction of species appropriate?)

May 2: Community Restoration (Jordan, Zedler, Bradshaw, Diamond)

(Can and should we attempt to recreate entire communities?)

Game Management (Rudolph & Hunter, Christman, Alverson et al., Kaufman)

(How have deer, duck, and fish management impacted total biodiversity?)

May 9: Exotic Species Problems and Responses. Vitousek, Bland & Temple, Carlton & Geller, Nuzzo, Scheffer

(How have exotic species introductions altered biodiversity? What can be done to fix things?)

EXAM 2: distributed at end of class May 9; returned no later than 17 on May 23

Articles:

February 21:

- Cobb, J.B. Jr. 1986. A Christian view of biodiversity. pages 481-485 in Wilson, E.O. & F.M. Peter (eds), *Biodiversity*. National Academy Press, Washington, D.C.
- Leopold, A. 1948. *A Sand County Almanac*. Oxford University Press, New York. pages 201-226.
- Littlebird, L. 1986. Cold water spirit. pages 476-480 in Wilson, E.O. & F.M. Peter (eds), *Biodiversity*. National Academy Press, Washington, D.C.
- McPhee, J. 1971. *Encounters With the Archdruid*. Farrar, Straus and Giroux Press, New York. pages 79-150.
- Meyers, N. 1983. By saving wild species we may be saving ourselves. *Nature Conservancy News*. pages 7-13.

February 28:

- Baker, R.G., Schwert, D.P., Bettis, E.A. III, and C.A. Chumbley. 1993. Impact of Euro-American settlement on a riparian landscape in northeast Iowa, USA: an integrated approach based on historical evidence, floodplain sediments, fossil pollen, plant macrofossils, and insects. *The Holocene*. 3:314-323.
- Brush, S.B., Carney, H.J., and Z. Huamén. 1981. Dynamics of Andean potato agriculture. *Economic Botany*. 35:70-88.
- Harlan, J.R. 1975. The Americas. pages 225-236 in: *Crops and Man*. American Society of Agronomy, Madison, Wisconsin.
- Kirch, P.V. 1983. Man's role in modifying tropical and subtropical Polynesian ecosystems. *Archeology of Oceania*. 18:26-31.
- Pistrick, K. 1995. Maramures and Muntii Apuseni -- crop plant diversity and living past in Rumania. *Seed Savers 1995 Summer Edition*. Pages 61-79
- Williams, J.T. 1986. Identifying and protecting the origins of our food plants. pages 240-247 in Wilson, E.O. & F.M. Peter (eds), *Biodiversity*. National Academy Press, Washington, D.C.

March 7:

- Ehrlich, P.R. 1983. Genetics and the extinction of butterfly populations. pages 152-163 in Schonewald-Cox, C.M., Chambers, S.M., MacBryde, B., and Thomas, L. (eds), *Genetics and Conservation*. Benjamin/Cummings Publishing Company, Inc., Menlo Park, California.
- Ehrlich, P.R. and D.D. Murphy. 1987. Conservation lessons from long-term studies of checkerspot butterflies. *Conservation Biology*. 1:122-131.
- Frankel, O.H. and M.E. Soulé. 1981. *Conservation and evolution*. Cambridge University Press, New York. pages 31-77.
- Krukeberg, A.R. and D. Rabinowitz. 1985. Biological aspects of endemism in higher plants. *Annual Review of Ecology and Systematics*. 16:447-479.

March 14:

- Gilpin, M.E. and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pages 19-34 in: Soulé, M.E. (ed), *Conservation Biology*. Sinauer Associates, Sunderland, Massachusetts.
- Menges, E.S. 1986. Predicting the future of rare plant populations: demographic monitoring and modeling. *Natural Areas Journal*. 6:13-25.
- Palmer, M.W. and P.S. White. 1994. Scale dependence and the species-area relationship. *American Naturalist*. 144:717-740.
- Wiens, J.A. 1989. Spatial scaling in ecology. *Functional Ecology*. 3:385-397.

March 21:

- Romme, W.H. and D.H. Knight. 1982. Landscape diversity: the concept applied to Yellowstone Park. *Bioscience*. 32:664-670.
- Sousa, W.P. 1984. The role of disturbance in natural communities. *Annual Review of Ecology and Systematics*. 15:353-391.
- Turner, M.G., Romme, W.H., and R.H. Gardner. 1994. Landscape disturbance models and the long-term dynamics of natural areas. *Natural Areas Journal*. 14:3-11.
- White, P.S. 1987. Natural disturbance, patch dynamics, and landscape patterns in natural areas. *Natural Areas Journal*. 7:14-22.

March 28:

- Bierngaard, R.O. Jr., Lovejoy, T.E., Kapos, V., Augusto dos Santos, A., Hutchings, R.W. 1992. The biological dynamics of tropical rainforest fragments. *Bioscience*. 42:859-866.
- Carlquist, S. 1974. *Island biology*. Columbia University Press, New York. pages 487-508.
- Nekola, J.C. 1999. Paleoreugia and neoreugia: A biogeographic analysis of isolated habitats in northeastern Iowa. *Ecology*. 80: 2459-2473.
- Robinson, S.K., Thompson, F.R. III, Donovan, T.M., Whitehead, D.R., Faaborg, J. 1995. Regional fragmentation and the nesting success of migratory birds. *Science*. 267:1987-1990.

April 4:

- Diamond, J.M. 1975. The island dilemma: lessons of modern biogeographic studies for the design of nature reserves. *Biological Conservation*. 7:129-146.
- Harrison, R.L. 1991. Toward a theory of inter-refuge corridor design. *Conservation Biology*. 6:293-295.
- Noss, R.F. 1987. Corridors in real landscapes: a reply to Simberloff and Cox. *Conservation Biology*. 1:159-164.
- Simberloff, D. and N. Gotelli 1983. Refuge design and ecological theory: lessons for prairie and forest conservation. Pages 61-71 in R. Brewer (ed.), *Proceedings of the Eighth North American Prairie Conference*. Western Michigan University, Kalamazoo, Michigan.
- Simberloff, D., Farr, J.A., Cox, J., and D.W. Mehlman. 1992. Movement Corridors: conservation bargains or poor investments? *Conservation Biology*. 6:493-504.

April 11:

- Dolan, R., B.P. Hayden, and G. Soucie. 1978. Environmental dynamics and resource management in the U.S. National Parks. *Environmental Management*. 2:249-258.
- Peters, R.L. II. 1988. The effect of global climate change on natural communities. Pages 450-461 in E.O. Wilson (ed.), *Biodiversity*. National Academy Press, Washington, D.C.
- Pickett, S.T.A. and J.N. Thompson. 1978. Patch dynamics and the design of nature reserves. *Biological Conservation*. 13:27-37.
- Romme, W.H. and M.G. Turner. 1991. Implications of global climate change for biogeographic patterns in the greater Yellowstone ecosystem. *Conservation Biology*. 5:373-386.
- Schonewald-Cox, C.M. 1988. Boundaries in the Management of nature reserves. *Bioscience*. 38:480-486.

April 25:

- Allen, W.H. 1994. Reintroduction of endangered plants. *Bioscience*. 44:65-68.
- Bangs, E.E. and S.H. Fritts. 1993. Reintroduction of gray wolves to Yellowstone National Park and central Idaho. *Endangered Species Technical Bulletin*. 18:1,18-20.
- Cade, T.J. 1988. Using science and technology to reestablish species lost in nature. Pages 279-287 in E.O. Wilson (ed.), *Biodiversity*. National Academy Press, Washington, D.C.

Falk, D.A. and L.R. McMahan. 1988. Endangered plant conservation: managing for diversity. *Natural Areas Journal*. 8:91-99.

Hamilton, M.B. 1994. Ex-situ conservation of wild plant species: time to reassess the genetic assumptions and implications of seed banks. *Conservation Biology*. 8:39-49.

May 2:

Alverson, W.S., Waller, D.M., and S.L. Solheim. 1988. Forests to deer: edge effects in northern Wisconsin. *Conservation Biology*. 2:348-358.

Bradshaw, A.D. 1990. The reclamation of derelict land and the ecology of ecosystems. Pages 53-74 in W.R. Jordan III, M.E. Gilpin, and J.D. Aber (eds.), *Restoration Ecology*. Cambridge University Press, Cambridge.

Christman, S.P. 1984. Breeding bird response to greentree reservoir management. *Journal of Wildlife Management*. 48:1164-1172.

Diamond, J. 1990. Reflections on goals and on the relationship between theory and practice. Pages 329-336 in W.R. Jordan III, M.E. Gilpin, and J.D. Aber (eds.), *Restoration Ecology*. Cambridge University Press, Cambridge.

Jordan, W.R. III. 1988. Ecological restoration: reflections on a half-century of experience at the University of Wisconsin-Madison Arboretum. Pages 311-316 in E.O. Wilson (ed.), *Biodiversity*. National Academy Press, Washington, D.C.

Kaufman, L. 1992. Catastrophic change in species-rich freshwater ecosystems. *Bioscience*. 42:846-858.

Rudolph, R.R. and C.G. Hunter. 1964. Greentrees and greenheads. Pages 611-618 in J.P. Lindusky (ed.), *Waterfowl Tomorrow*. U.S. Department of Interior, Washington, D.C.

Zedler, J.B. 1988. Restoring diversity in salt marshes: can we do it? Pages 317-325 in E.O. Wilson (ed.), *Biodiversity*. National Academy Press, Washington, D.C.

May 9:

Bland, J.D. and S.A. Temple. 1993. The Himalayan Snowcock: North America's newest exotic bird. Pages 149-155 in B.M. McKnight (ed.), *Biological Pollution: the Control and Impact of Invasive Exotic Species*. Indiana Academy of Science, Indianapolis.

Carlton, J.T. and J.B. Geller. 1993. Ecological roulette: the global transport of nonindigenous marine organisms. *Science*. 261:78-82.

Nuzzo, V. 1993. Distribution and spread of the invasive biennial *Allaria petiolata* (Garlic Mustard) in North America. Pages 137-145 in B.M. McKnight (ed.), *Biological Pollution: the Control and Impact of Invasive Exotic Species*. Indiana Academy of Science, Indianapolis.

Scheffer, V.B. 1993. The Olympic goat controversy: a perspective. *Conservation Biology*. 7:916-920.

Vitousek, P.M. 1988. Diversity and biological invasions of oceanic islands. Pages 181-189 in E.O. Wilson (ed.), *Biodiversity*. National Academy Press, Washington, D.C.