

Conservation Biology
PřF:Bi8370
Jeff Nekola

Monday 14:00-15:50
A32-329
Spring 2020

SYLLABUS

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 provide you with the knowledge and experiences necessary to allow you to make such knowledgeable and independent assessments of conservation strategies. We will consider the important ecological principles underlying conservation biology and will apply these principles to real-world situations. Throughout, I hope that I will be able to foster in you the ability to critically and objectively assess the major theories and paradigms which underlie this most important of ecological fields.

Expectations

I will assume that you all have a good understanding of basic ecological principles, such as Hardy-Weinberg genetics, Lotka-Volterra competition, and biogeochemical cycling through ecosystems. I'll also assume that you will have a solid background in high school algebra. While a semester in each of chemistry, calculus, statistics, and ecosystem dynamics would also be helpful, if you haven't fear not -- I'll try and catch you up on these things as we go along. 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 a textbook, per se, either semester 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. 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.

Evaluation

Course grades will be based on three equally weighted parts: two exams. They 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. Except for extreme circumstances, I will not give test makeups. An unexcused absence from an examination will result in a score of 0 for that test.

IMPORTANT DATES

March 30: Exam 1

May 18: Exam 2 due

Course Schedule

February 17: Introduction to Philosophical Ethics

Conservation Ethics - I (Cobb, Leopold, Littlebird, Meyers)

(How the conservation of biological diversity has been ethically defined through utilitarianism, the land ethic, Native American, and Christian belief systems.)

Conservation Ethics - II (McPhee)

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

February 24: 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 2: 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 endemism; the seven forms of rarity)

March 9: 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 16: 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 23: 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.)

March 30: EXAM 1 (taken in class)

April 6: 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 13: 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?)

April 20: 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?)

April 27: 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 4: 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?)

May 18: EXAM 2 due by no later than 17:00

Articles:

February 17:

- 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 24:

- 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 2:

- 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. Soul_. 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 9:

- Gilpin, M.E. and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pages 19-34 in: Soul_, 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 16:

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 23:

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 6:

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 13:

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 20:

- 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.

April 27:

- 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 4:

- 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.