Course Approval Form

For approval of new courses and deletions or modifications to an existing course.

registrar.gmu.edu/facultystaff/curriculum

Action Requested:

[X] Create new course [ ] Inactivate existing course

[ ] Modify existing course (check all that apply)

[ ] Title [ ] Credits [ ] Repeat Status [ ] Grade Type

[ ] Prereq/coreq [ ] Schedule Type [ ] Restrictions

[ ] Other:

Course Level:

[X] Undergraduate

[ ] Graduate

College/School: College of Science

Department: Environmental Science & Policy

Submitted by: Alonso Aguirre and Esther Peters

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Email: aaguirre@gmu.edu epeters2@gmu.edu

Subject Code: EVPP **Number:** 427

(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [X] Fall [ ] Spring [ ] Summer *Year* 2014

Title:

Current

Banner (30 characters max including spaces)

New: Disease Ecology and Conservation

Credits: (check one) [X] Fixed [ ] Variable 3 or to

Repeat Status: (check one) [X] Not Repeatable (NR) [ ] Repeatable within degree (RD) [ ] Repeatable within term (RT) Maximum credits allowed:

Grade Mode: (check one) [X] Regular (A, B, C, etc.) [ ] Satisfactory/No Credit [ ] Special (A, B C, etc. +IP)

Schedule Type: (check one) LEC can include LAB or RCT

[X] Lecture (LEC) [ ] Lab (LAB) [ ] Recitation (RCT) [ ] Internship (INT)

[ ] Independent Study (IND) [ ] Seminar (SEM) [ ] Studio (STU)

Prerequisite(s): 60 credits and BIOL 213 or BIOL/EVPP 305/306 and BIOL 308

Corequisite(s): None

Instructional Mode:

[X] 100% face-to-face

[ ] Hybrid: ≤ 50% electronically delivered

[ ] 100% electronically delivered

Restrictions Enforced by System: Major, College, Degree, Program, etc. Include Code.

Are there equivalent course(s)? [X] Yes [ ] No

If yes, please list EVPP 527

Catalog Copy for NEW Courses Only (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)	**Notes** (List additional information for the course)
Presents the trans-disciplinary discipline of conservation medicine, the study of relationships between organism and ecosystem health and environmental conditions. Topics include infectious and noninfectious diseases, pathogens, processes, and impacts on human, biotic, and ecosystem health, and how to address the consequences of diseases to populations and ecological communities.	This course will co-meet with EVPP 527. Undergraduate students in this course will have separate (shorter) reading and writing assignments and will be graded according to a different rubric than the graduate students.
Indicate number of contact hours: Hours of Lecture or Seminar per week: 3 Hours of Lab or Studio:	
When Offered: (check all that apply) [X] Fall [ ] Summer [ ] Spring	

Approval Signatures

Department Approval Date

College/School Approval Date

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Graduate Courses Only

Graduate Council Member

Provost Office

Graduate Council Approval Date

For Registrar Office's Use Only: Banner_____Catalog_____

Course Proposal Submitted to the Curriculum Committee of the College of Science

1. COURSE NUMBER AND TITLE: EVPP 427 Disease Ecology and Conservation

Course Prerequisites:
60 credits and BIOL 213 or BIOL/EVPP 305/306 and BIOL 308

Catalog Description:
Presents the trans-disciplinary discipline of conservation medicine, the study of relationships between organism and ecosystem health and environmental conditions. Topics include infectious and noninfectious diseases, pathogens, processes, and impacts on human, biotic, and ecosystem health, and how to address the consequences of diseases to populations and ecological communities.

2. COURSE JUSTIFICATION:

Course Objectives:
The goal of the course is to provide the necessary background for students to understand the concept of disease; biotic and abiotic factors that cause diseases in plants, animals, and humans; and the consequences of diseases to populations, communities, and ecosystems. The course will examine "one health" issues, including the emergence and resurgence of infectious disease agents and how they are investigated; the effects of global climate change on health; impacts of toxic chemicals and hazardous substances; and the health implications of habitat fragmentation, degradation, and loss of biodiversity. This knowledge will enable students to critically evaluate the impacts of diseases on ecosystem services and the role of conservation medicine.

Course Necessity:
Additional electives are needed for concentrations in the BS in Environmental Science program. No other course exists that covers these topics for undergraduate students. Some of the material is presented to students in the Smithsonian-Mason Semesters, but not all students can participate in that program.

Course Relationship to Existing Programs:
This course will be offered as an elective for the BS in Environmental Science concentrations. Undergraduate biology majors may also wish to take this course.

Course Relationship to Existing Courses:
This is a new course and no other course like it exists. This course will co-meet with the proposed EVPP 527 for graduate students. Undergraduate students in this course will have separate (shorter) reading and writing assignments and will be graded according to a different rubric than the graduate students.

3. APPROVAL HISTORY:
This is the first time this course has been submitted for approval. It is based on an undergraduate course taught by Dr. Alonso Aguirre when he was at Columbia University and on a graduate seminar (Understanding Disease for Conservation and Ecosystem Management) taught by Dr. Esther Peters at George Mason University (Summer 2010, Spring 2011).

4. SCHEDULING AND PROPOSED INSTRUCTORS:

Semester of Initial Offering: Fall 2014

Proposed Instructors: Dr. Alonso Aguirre and Dr. Esther Peters

5. TENTATIVE SYLLABUS: Attached

DISEASE ECOLOGY AND CONSERVATION

EVPP 427-001 (CRN _____)

3 Credit Hours

GEORGE MASON UNIVERSITY

Fall Semester 2014
Lecture: 4:30–7:10 p.m. [Days]
[Building], Room [number]

Instructors: Dr. Alonso Aguirre and Dr. Esther Peters
Phones:
E-mails:
Office Hours, [Building, Room]: [Time], [Day]
or BY APPOINTMENT (send e-mail request)

Sign up for Mason Alert (e.g., weather closings, emergencies) at
https://alert.gmu.edu

Syllabus

Course Description

Conservation of biological diversity faces multiple challenges. The relationship of humans to impacts on terrestrial and aquatic organisms has been recognized, but conservation strategies traditionally have not included investigations of the symbioses and linkages among all organisms, and the continuum of environment and health, to frame protection policies and educate the public. In the 1990s, conservation medicine emerged as an inter- or trans-disciplinary discipline that studies the relationships between human, animal, plant, and ecosystem health and environmental conditions. Biomedical sciences are combined with conservation biology and other disciplines to trace the environmental sources of pathogens and pollutants, develop an understanding of the ecological causes of changes in human, biotic, and ecosystem health, and address the consequences of diseases to populations and ecological communities. This advanced course will provide a framework in which to examine the connections between condition of the planet and health of all species. It will also challenge students in the ecological sciences, health sciences and the natural sciences to think about new, collaborative ways to address ecological health. Understanding infectious and noninfectious diseases, pathogens, processes, impacts, and how to maintain healthy populations of species—and the ecosystem services the species provide—is the key to conservation.

Prerequisites: 60 credits and BIOL 213 or BIOL/EVPP 305/306 and BIOL 308

Course Objectives and Student Learning Outcomes

The course will examine health issues from various standpoints, including the emergence and resurgence of infectious disease agents and how they are investigated; the effects of global climate change on health; the increasing impacts of toxic chemicals and hazardous substances; and the health implications of habitat fragmentation, degradation, and loss of biodiversity.

Students will participate in individual and team assignments to be able to:

Explain the difference between health and disease;

Discuss biotic and abiotic agents causing diseases, the paradigm of disease, factors controlling diseases, and how they are investigated;

Define terms pertaining to health, disease, epidemiology, ecology, and medicine;

Analyze diverse readings on conservation medicine and its role in conserving species and ecosystems;

Collect examples of diseases occurring in terrestrial and aquatic organisms;

Evaluate recent reports on emerging diseases in wildlife, domestic animals, and humans and their effects on ecosystems; and

Explain how disease investigations can improve conservation projects.

Course Expectations

Each session will combine lectures, presentations by guest speakers, and student discussion. As with any 400-level course offering, ***this will not be an easy course***. The successful student **must read assignments, study supporting materials, and prepare assignments outside of class**. Self-directed study skills are important. Students need to organize material logically and communicate well orally and in writing. **The emphasis will be on understanding the basics.**

Class Preparation

"He who hesitates is lost...."

Reading, research, and assignments are detailed on the following class outlines. Any concerns about keeping up with assignments should be discussed with Drs. Aguirre and Peters.

More students are juggling work, research, internships, shadowing, and families. Please note "employment must not take priority over academic responsibilities. Students employed more than 20 hours a week are strongly urged not to attempt a full-time academic load. Students employed more than 40 hours a week should attempt no more than 6 credits per semester. Students who fail to observe these guidelines may expect no special consideration for academic

problems arising from the pressures of employment." Please consider your responsibilities and interests and plan accordingly to protect your health and GPA!

Class Participation

Students should come to class ready to participate in all activities (assignments completed prior to class). They should behave in a mature and professional manner and abide by the GMU honor code. **Please turn off cell phones or pagers before class begins. Absenteeism should be limited to illness or emergencies, or discuss concerns with one of the instructors.**

Students should notify the instructors before class if they must miss a class. **Multiple missed classes can affect student grades.** PowerPoints are NOT posted so you need to make every effort you can to attend. Students should contact classmates to obtain lecture notes and assignments, if necessary.

Students may record the lectures (sound), but may not take photographs or videos. Instead, they should take notes, which will help them study for the exams. If using electronic devices (such as laptops, notebooks, tablets), please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism and can affect your grade.

If you are a student with a disability and you need academic accommodations, please notify one of the instructors and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS.

E-mail Communications

Drs. Aguirre and Peters will send e-mail messages only to your GMU e-mail account. Students must use their Mason email accounts—"MASONLIVE" account—to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information. Please be sure you check it often and keep your mailbox from getting "over quota" (filled up so you won't get any)! If you are not getting messages (e.g., masonlive issues), please give us an alternate e-mail address.

Assignments

Assignments should be prepared neatly (either hand- or type-written or computer-generated). Be sure to proofread your work to double-check facts, grammar, and spelling; use a spelling- and grammar-checking program if possible, but note that you cannot rely solely on it, proofreading is essential! Sloppily prepared assignments can adversely affect your grade, especially if improvement is not noted during the course.

> Assignments will not be accepted at all 15 days after the due date or after the last day of regular classes, whichever comes first. Grades on all assignments will be counted as part of the final grade. (A score of "0" will be given to assignments not turned in by 15 days after the due date or the last day of regular classes.)

Required Textbook

Aguirre, A. A., R. S. Ostfeld and P. Daszak. 2012. New Directions in Conservation Medicine: Applied Cases of Ecological Health, Oxford University Press, New York, 646 pp.

Links to other readings will be posted on Blackboard. A list of recommended books and proceedings on the subject is included at the end of the class schedule.

Course Assignments

In addition to reading and studying the textbook, other books, and journal papers, students will prepare two short written assignments of 400 words or less drafted as commentaries comparing, contrasting or critiquing two or more of the readings, in the style of Letters to *Nature* or *Science*.

> Each paper should be neatly prepared and proofread, especially checking for consistency, completeness, and correctness (Help: The Writing Center, OWL/On-line Writing Lab). Many online grammar resources are available now, including: http://classweb.gmu.edu/biologyresources/writingguide/PracticalTips.htm
>
> This book might help when writing:
>
> > Ross-Larson, B. 1996. *Edit Yourself: A Manual for Everyone Who Works With Words.* W.W. Norton & Co., New York, NY.

Grading Criteria

The total grade received for this course will be based on the following assignments and assessments:

Activity	Percent Contribution to Total Grade
Definitions of Terms	5%
Two written commentaries	25% (12.5% each)
Four surprise quizzes throughout the course	20% (5% each)
Mid-term Exam: Actual cases to be answered as a transdisciplinary team	25%
Final Exam: A 10-minute PowerPoint presentation on a current topic (addressed in the media) about the etiologic agent of an emerging disease, effects of disease(s) on species or populations, or risks to an ecosystem where emerging disease(s) have been found	25%
TOTAL	100%

The final grade will be based on this scale: A = 100–90, A- = 89–87, B = 86–80, B- = 79–77, C = 76–70, D = 69–60, F < 59. **A CURVE WILL NOT BE APPLIED.**

Academic Integrity

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification. Students are expected to complete the work on their own or as a team, depending on the assignment.

All exams will be completed by individuals in the classroom (those registered for the course).

Unless otherwise noted, these assessments will be taken without the use of study aids, memoranda, textbooks, other books, data, or other information available.

It is important to note that materials produced for this course, particularly for the research paper, require creativity in organization and presentation, but that the information presented within the paper or other product must be properly acknowledged as to its source. Statements of a general nature or that synthesize information from several sources need not be attributed to a specific source; however, statements of specific details or direct quotations ("between quotation marks") from books, journals, newspaper or other media articles, Internet web pages, or other authorities must be identified with the name of the author and year in the text and the full citation provided in a literature cited section at the end of the paper. The format for citations will be provided by the instructors.

Other Useful Campus Resources

WRITING CENTER: A114 Robinson Hall; 703-993-1200; http://writingcenter.gmu.edu

UNIVERSITY LIBRARIES: "Ask a Librarian" http://library.gmu.edu/mudge/IM/IMRef.html

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): 703-993-2380; http://caps.gmu.edu

LEARNING SERVICES: 703-993-2999; http://caps.gmu.edu/learningservices/; offer many good study skills workshops!

ACADEMIC COUNSELING PROGRAM: 703-993-2380: http://caps.gmu.edu/learningservices/academiccounseling.php

UNIVERSITY POLICIES
The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are

available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.

Weekly Lecture Schedule and Notes

Lecture 1. Week of August 25
Introduction
Explain the rationale and the mechanics of the Class, evaluations, dates and deadlines. General course overview including wildlife diseases, disease ecology and epidemiology.

Conservation Medicine: Ecological Health in Practice.
Conservation Medicine is an applied science that focuses on discovering how the health of humans, animals and ecosystems are linked, and how we can manage those linkages to ensure the health of all. Conservation Medicine requires a transdisciplinary approach, bringing together public health experts, veterinarians, ecologists, conservation biologists and wildlife managers. Simply stated, Conservation Medicine is the practice of ensuring the ecological health of all organisms. It is especially relevant in today's human-modified landscapes, where habitat fragmentation and other signs of ecosystem illness are evident, and episodes of emerging human and wildlife diseases are increasing.

Required Readings:

Textbook: Foreword, Preface, Introduction, Chapters 1 and 2

Tabor,G. M., R. S. Ostfeld, M. Poss, A. P. Dobson, and A. A. Aguirre. 2001. Conservation biology and the health sciences: defining the research priorities of conservation medicine. In: M. E. Soulé and G. H. Orians (eds.). Research Priorities in Conservation Biology. 2nd edition. Island Press, Washington, D.C. Pp 165-173.

Lecture 2. Week of September 1 *Last Day to Add September 2*
Infectious Diseases and Epidemiological Approaches to Disease Investigation
This lecture will overview basic concepts and medical and epidemiological terminology we will encounter throughout the semester, i.e. incidence/prevalence, epidemic/epizootic, types of pathogens, modes of transmission. We will provide definitions and terms of these concepts and discuss why this course is important in the context of past, present, and future implications of disease effects on populations and ecosystems and vice versa.

Required Readings:

Textbook: Chapters 36, 37, and 38

Ostfeld, R.S., and R.D. Holt. 2004. Are predators good for your health? Evaluating evidence for top-down regulation of zoonotic disease reservoirs. Frontiers in Ecology and the Environment 2:13-20.

Ecology of Infectious Diseases

Introduction of the formal methods of study of infectious diseases in an ecological framework, including SI and SIR and other mathematical models. Ecological roles of pathogens, influences over host abundance and distribution. Apparent competition. Effects of pathogens on host fitness, evolution of host/pathogen systems, landscape epidemiology. We will include the theoretical side of population biology and epidemiology of disease and practical approaches to the study of disease in wildlife conservation.

Required Readings:

Anderson, R. M., and R.M. May. 1979a. Population biology of infectious diseases: part I. Nature 280: 361-367.

Anderson, R. M., and R.M. May. 1979b. Population biology of infectious diseases: part II. Nature 280: 455-461.

Ostfeld, R.S., G.E. Glass, and F. Keesing. 2005. Spatial epidemiology: an emerging (or re-emerging) discipline. Trends in Ecology & Evolution 20:328-336.

Lecture 3. Week of September 8
Global Climate Change and Disease Ecology
This lecture addresses the environmental changes in the world today including global climate change and the profound effect of environmental events such as ENSO, La Niña, and other events and changing patterns on the distribution and impact of infectious and vector-borne diseases in terrestrial and marine ecosystems

Required Reading:

Textbook: Chapters 8 and 9

Harvell, C.D., C.E. Mitchell, J.R. Ward, S. Altizer, A.P. Dobson, R.S. Ostfeld and M.D. Samuel. 2002. Climate warming and disease risks for terrestrial and marine biota. Science 296:2158-2162.

Patz, J. A., D. Campbell-Lendrum, T. Holloway, and J. A. Foley. 2005. Impact of regional climate change on human health. Nature 438:310.

Lecture 4. Week of September 15
Principles of Emerging Infectious Diseases and EIDs in Terrestrial Ecosystems
Emerging infectious diseases are diseases that have recently increased in incidence, expanded in geographic or host range, are newly recognized or are caused by newly-evolved pathogens due in most instances to anthropogenic environmental change. This lecture will address the basic concepts leading to the increasing threat of emerging diseases in terrestrial ecosystems. We will address the effects of globalization, a global economy, trade, and travel with recent examples, i.e. SARS, avian influenza.

Required Reading:

Textbook: Chapters 14, 15, and 16

Daszak, P., A.A. Cunningham, and A.D. Hyatt, 2000. Emerging infectious diseases of wildlife–threats to biodiversity and human health. Science 287: 443-449.

Friend M., McLean R. G. and F. J. Dein. 2001. Disease emergence in birds: challenges for the twenty-first century. Auk 118:290-303.

Lecture 5. Week of September 22 *Last Day to Drop September 26*
Emerging Infectious Diseases and Marine Ecosystems
We are witnessing a continuous spillover and spillback of old and new pathogens from terrestrial to and from marine ecosystems. This lecture will overview the severe changes occurring in the oceans and the ecological factors leading to the emergence of marine infectious diseases supported by multiple examples.

Required Reading:

Textbook: Chapters 18, 22, 23, and 27

Harvell, C.D., Kim, K., Burkholder, J.M., Colwell, R.R., Epstein, P.R., et al. 1999. Emerging marine diseases - climate links and anthropogenic factors. Science 285:1505-1510.

Ward, J. R., and K. D. Lafferty. 2004. The elusive baseline of marine disease: Are diseases in ocean ecosystems increasing? Plos Biology 2:542

Lecture 6. Week of September 29
Disease Ecology and Migratory Species
There is supported evidence of annual reintroduction of disease agents from areas south of the US by migratory birds such as avian influenza, equine encephalitis, and avian cholera. There is also evidence of movement of disease from Mexico to Canada and the US such in cormorants and exotic Newcastle disease. Questions regarding the overwintering and spreading of arboviruses such as West Nile encephalitis virus to new locations will be addressed.

Required Reading:

Textbook: Chapters 7, 20, and 28

Ezenwa, V. O., M. S. Godsey, R. J. King, and S. C. Guptill. 2006. Avian diversity and West Nile virus: testing associations between biodiversity and infectious disease risk. Proceedings of the Royal Society B-Biological Sciences *273*:109-117.

Rappole, J.H., S.R. Derrickson, and Z. Hubalek, 2000. Migratory birds and spread of West Nile virus in the Western Hemisphere. Emerging Infectious Diseases 6:319-328.

Schmidt, K. A. and R. S. Ostfeld. 2001. Biodiversity and the dilution effect in disease ecology. Ecology 82:609-619.

Lecture 7. Week of October 6
MID-TERM EXAMINATION – Take home exam received. Due 3 November 2014.

Lecture 8. Week of November 3
Habitat Loss/Fragmentation and Disease Ecology. This lecture will cover the effects of habitat destruction and fragmentation as they relate to disease ecology. Island biogeography and species extinction, edge effects of fragmentation, the role of disease in artificially isolated populations, and disease transmission related to the increased contact between humans, domestic animals and wildlife will be presented.

Required Readings:

Textbook: Chapters 10, 29, and 35

Aguirre, A.A., E.E. Starkey, and D.E. Hansen, 1995. Wildlife diseases in national park ecosystems. Wildlife Society Bulletin 23: 415-419.

Carsten T., I. Steffan-Dewenter and T. Tscharntke. 2003. Effects of landscape context on herbivory and parasitism at different spatial scales. OIKOS 101: 18–25.

Fahrig L. 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology Evolution and Systematics 34:487-515.

Hess, G. R. 1994. Conservation corridors and contagious disease - a cautionary note. Conservation Biology 8:256-262.

Lecture 9. Week of November 10
Disease Ecology and Conservation Biology
This lecture will discuss disease in conservation practice. Captive breeding, pathogen conservation, disease and protected areas, fragmentation/corridors, culling, monitoring techniques and risk assessment. Also the role of translocations, reintroductions, and other animal movements in the introduction of disease into naïve populations. We will discuss how disease has and does complicate conservation programs using many past examples.

Required Readings:

Textbook: Chapters 6, 39, and 40

Cunningham, A.A. 1996. Disease risks of wildlife translocations. Conservation Biology 10: 349-353.

LoGiudice, K., R.S. Ostfeld, K.A. Schmidt, and F. Keesing. 2003. The ecology of infectious disease: Effects of host diversity and community composition on Lyme disease risk. Proceedings of the National Academy of Sciences of the United States of America 100:567-571.

Lecture 10. Week of November 17
Prediction and Prevention of EIDs: New Programs, Tools and Models
Emerging zoonotic diseases are a major threat to public health globally. These diseases emerge from wildlife or livestock, and include HIV/AIDS, SARS, Ebola, Nipah and H5N1 avian influenza. Zoonotic diseases "emerge" when environmental changes and/or changes in human activities alter the relationship between people and animals and provide new opportunities for pathogens to spread to people. Rather than respond to the disastrous effects after they have emerged, our collaborations attempt to prevent these diseases from 'spilling over' from animals to humans or to halt them rapidly after that spillover by understanding what factors induce emergence and rapidly identifying ways of prevention, control, and mitigation. Our One Health approach that we call the practice of Conservation Medicine, brings together an understanding of human and wildlife health and the environmental changes that cause diseases to emerge and spread. It is evident that the world's pandemic prevention strategy is only beginning to take this broader view, as it has traditionally focused on the machinations of each pathogen strain and on the politics of surveillance, reporting, and trade regulation. The key factors that drive the emergence of new zoonotic diseases are related to a combination of human changes to the environment, agriculture, healthcare, and changes in demography, all against a background of a large pool of potential new zoonoses.

Required Readings:

Textbook: Chapters 3, 41, and 42

Jones, K.E., Patel, N., Levy, M., Storeygard, A., Balk, D., Gittleman, J.L., Daszak, P. 2008. Global trends in emerging infectious diseases. Nature 451: 990-993.

Martens, P., A.J. McMichael, and J.A. Patz, 2000. Globalization, environmental change and health. Global Change and Human Health 1: 4-8.

McMichael, A.J., 1997. Global environmental change and human health: impact assessment, population vulnerability, and research priorities. Ecosystem Health 3: 200-210.

Lecture 11. 30 November 2010
The Wildlife Trade: Monitoring and Policy in Disease Ecology and Conservation
Today, live animals are moved inter-continentally for a variety of personal, social and economic gains. Tens of millions of live animals are traded annually for human consumption alone. Also, animals are moved for sporting reasons or illegally traded on a multibillion dollar market providing breeding grounds for disease emergence as countless animals are brought into close proximity to each other and to humans. In addition, the bushmeat and infectious disease emergence will be addressed.

Required Readings:

Textbook: Chapters 11 and 12

Deem, S.L., Karesh, W.B., and W. Weisman. 2001. Putting theory into practice: wildlife health in conservation. Conservation Biology. 15: 1224-1233.

DeMarcus, T. A., M. A. Tipple, and S. R. Ostrowski. 1999. U.S. Policy for disease control among imported nonhuman primates. J. Infect. Dis. 179 (Suppl. 1):S281-2.

Gomez, A. and Aguirre, A.A. 2008. Infectious diseases in the illegal wildlife trade. Animal Biodiversity and Emerging Diseases. 1149:16-19.

Hanselmann, R., Rodriguez, A., Lampo, M., Fajardo-Ramos, L., Aguirre, A.A., Kilpatrick, A.M., Rodriguez, J.P., Daszak, P., 2004. Presence of an emerging pathogen of amphibians in introduced bullfrogs (*Rana catesbeiana*) in Venezuela. Biological Conservation 120, 115-119.

Smith, K.F., Behrens, M.D., Schloegel, L.M., Marano, N., Burgiel, S. and Daszak, P. 2009 Reducing the risks of the wildlife trade. Science 324: 594-595.

Lecture 12. Week of November 24
Disease, Biodiversity, and Species Extinction
Infectious disease is listed among the top five causes of global species extinctions. However, the majority of available data supporting this contention is largely anecdotal. Extincton by infection is becoming more prevalent in threatened wildlife populations. Gobal climate change, habitat fragmentation, exotic species re-introduction and illegal trade are among the many anthropogenic changes stressing out populatons, causing immunosuppression and then disease becomes the last brick leading declines and even regional and global extinctions. Several examples including amphibian chytridiomycosis, canine distemper in black-footed ferrets, coccidiosis in *Partula* snails will be addressed. An evidence-based understanding of the role of infectious disease in species extinction and endangerment will help prioritize conservation initiatives and protect global biodiversity. Course evaluations will be completed.

Required Readings:

Textbook: Chapters 4, 5, and 30

McCallum, H. and A. Dobson. 1995. Detecting disease and parasite threats to endangered species and ecosystems. Trends Ecol. Evol. 10:190-194.

Scott, M.E. 1988. The impact of infection and disease on animal populations: implications for conservation biology. Conservation Biology. 2: 40-56.

Smith, K. F., D. F. Sax and K. D. Lafferty. 2006. Evidence for the Role of Infectious Disease in Species Extinction and Endangerment. Conservation Biology 20:1349-1357.

Throne, E. T. and E. S. Williams. 1988. Disease and endangered species: the black-footed ferret as a recent example. Conservation Biology 2:66-69.

Lecture 13. During FINAL EXAM period, as scheduled.
All PowerPoint Presentations.

Recommended Books and Proceedings on the Subject

Aguirre, A. A., R. S. Ostfeld, G. M. Tabor, C. A. House and M. C. Pearl (eds.). 2002. *Conservation Medicine: Ecological Health in Practice.* Oxford University Press, New York, 407 pp.

American Association of Zoo Veterinarians, Proceedings of the annual meeting. 1985 to present.

Anderson, R.M. 1986. Genetic variability in resistance to parasitic invasion: population implications for invertebrate host species. Symp. Zool. Soc. London 56:239-274.

Arkoosh, M.R., E. Casillas, E. Clemens, A.N. Kagley, R. Olson, P. Reno, and J.E. Stein. 1998. Effect of pollution on fish diseases: Potential impacts on salmonid populations. J. Aquat. Animal. Health 10:182-190.

Aronson, R.B., and W.F. Precht. 2001. White-band disease and the changing face of Caribbean coral reefs. Hydrobiologia 460:25-38.

Baer, G.M. (ed.). 1991. The Natural History of Rabies, 2nd. ed. 2 vols. Academic Press, Inc. New York.

Brack, M. 1987. Agents transmissible from simians to man. Springer-Verlag, Berlin.

Canadian Cooperative Wildlife Health Centre. Wildlife Disease Investigation Manual.

Chowdhury, N. and A. A. Aguirre (eds.). 2001. Helminths of Wildlife. Science Publishers, Inc., Enfield, New Hampshire, 514 pp.

Colborn, T., D. Dumanoski, and J.P. Meyers, 1996. Our Stolen Future, Dutton, New York.

Couch, J.A., and J.W. Fournie (eds). 1992. Pathobiology of Marine and Estuarine Organisms. CRC Press, Boca Raton, Florida, USA.

Daszak, P., A.A. Cunningham, and A.D. Hyatt. 2001. Anthropogenic environmental change and the emergence of infectious diseases in wildlife. Acta Tropica 78:103-116.

Davidson, Osha Gray. 2001. *Fire in the Turtle House: The Green Sea Turtle and the Fate of the Ocean.* Paperback: 272 pages. PublicAffairs; Pbk. Ed edition (August 12, 2003) ISBN-10: 1586481991, ISBN-13: 978-1586481995

Davidson, W.R. (ed.). 1981. Diseases and Parasites of White-tailed Deer. Tall Timbers Research Station, Misc. Publ No. 7 Tallahassee, Florida. 458 pp.

Davidson, W.R. and V.F. Nettles. 1997. Field Manual of Wildlife Diseases in the Southeastern United States, 2nd ed. Southern Cooperative Wildlife Disease Study, Athens, Georgia. 417 pp.

Davis, J.W. and R.C. Anderson (eds.). 1971. Parasitic Diseases of Wild Mammals. Iowa State University Press, Ames. 364 pp.

Davis, J.W., L. Karstad and D.O. Trainer (eds.). 1970. Infectious Diseases of Wild Mammals. Iowa State University Press. 421 pp.

Davis, J.W., L. Karstad and D.O. Trainer (eds.). 1981. Infectious Diseases of Wild Mammals, 2nd. ed. Iowa State University Press.
446 pp.

Dieterich, R. A. (ed). 1981. Alaskan Wildlife Diseases. University of Alaska, Fairbanks, 524 pp.

Dobson, A.P. and R.M. May, 1986. Disease and conservation. In: Soule, M. (ed.), Conservation biology: the science of scarcity and diversity, Sinauer Associates, Sunderland, Massachusetts , pp. 345-365.

Epstein, P.R. 1994. Framework for an integrated assessment of health, climate change, and ecosystem vulnerability. In Disease in Evolution: Global Changes and Emergence of Infectious Diseases, ed. M.E. Wilson, R. Levins, and A. Spielman, Ann. New York Acad. Sci. 740:423-435.

Garrett, K.A., S.P. Dendy, E.E. Frank, M.N. Rouse, and S.E. Travers. 2006. Climate change effects on plant disease: Genomes to ecosystems. Annu. Rev. Phytopathol. 44:489-509.

Gilbert, G.S. 2002. Evolutionary ecology of plant diseases in natural ecosystems. Annu. Rev. Phytopathol. 40:13-43.

Gog, J., R. Woodroffe, and J. Swinton. 2002. Disease in endangered metapopulations: the importance of alternative hosts. Proceedings of the Royal Society of London Series B-Biological Sciences 269:671-676.

Fairbrother, A., L. N. Locke, and G. L. Hoff. 1996. Noninfectious Diseases of Wildlife, 2nd ed. Iowa State University Press, Ames. 219 pp.

Fowler, M.E. (ed.). 1981. Wildlife Diseases of the Pacific Basin and Other Countries. Widlife Disease Association, Ames, Iowa. 262 pp.

Fowler, M. E. (ed.). 1986. Zoo and Wildlife Medicine. 2nd ed. Saunders Company, Philadelphia, Pennsylvania. 1127 pp.

Fowler, M. E. (ed.). 1993. Zoo and Wildlife Medicine: current therapy 3. Saunders Company, Philadelphia, Pennsylvania.

Fowler, M. E. and E. Miller (eds.). 1999. Zoo and Wildlife Medicine: current therapy 4. Saunders Company, Philadelphia, Pennsylvania. 747 pp.

Friend, M. and J. C. Franson (eds.). 2000. Field Manual of Wildlife Diseases: general field procedures on diseases of birds. U.S. Department of Interior, U.S. Geological Survey. Washington, D.C. 426 pp.

Friend, M. (ed.). 1987. Field Guide to Wildlife Diseases. U.S. Department of Interior, Fish and Wildlife Service. Resource Publication 167. Washington, D.C. 225 pp.

Garrett, L. 1994. The Coming Plague: Newly Emerging Diseases in a World Out of Balance. Penguin Books, New York, New York, USA.

Gilbert, G.S., and S.P. Hubbell. 1996. Plant diseases and the conservation of tropical forests. BioScience 46(2):98-106.

Goettsch, W., J. Garssen, W. Slob, F. de Gruijl, and H. Van Loveren. 1998. Risk assessment for the harmful effects of UVB radiation on the immunological resistance to infectious diseases. Environ. Health Perspect. 106(2):71-77.

Grifo, F.T. and J. Rosenthal, 1997. Biodiversity and Human Health, Island Press, Washington, D.C.

Hoff, G.L. and J.W. Davis (eds.). 1982. Noninfectious Diseases of Wildlife. Iowa State University Press, Ames. 174 pp.

Hughes, T.P., A.H.Baird, D.R. Bellwood, M.Card, S.R. Connolly, C. Folke, R. Grosberg, O. Hoegh-Guldberg, J.B.C. Jackson, J. Kleypas, J.M. Lough, P. Marshall, M. Nystrom, S.R. Palumbi, J.M. Pandolfi, B. Rosen, and J. Roughgarden. 2003. Climate change, human impacts, and the resilience of coral reefs. Science 301:929-933.

Jackson, J.B.C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner, and R.R. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293:629-638.

Lenihan, H., F. Micheli, S. Shelton, and C. Peterson. 1999. The influence of multiple environmental stressors on susceptibility to parasites: An experimental determination with oysters. *Limnol. Oceanogr.* 44:910-924.

Lessios, H.A. 1988. Mass mortality of *Diadema antillarum* in the Caribbean: What have we learned? Ann. Rev. Ecol. Systemat. 19:371-393.

Levin, B.R., M. Lipsitch, and S. Bonhoeffer. 1999. Population biology, evolution, and infectious disease: Convergence and synthesis. Science 283:806-809.

McCallum, H., and A. Dobson. 2002. Disease, habitat fragmentation and conservation. Proceedings of the Royal Society of London Series B-Biological Sciences 269:2041-2049.

McCallum, H.I., A. Kuris, C.D. Harvell, K.D. Lafferty, G.W. Smith, and J. Porter. 2004. Does terrestrial epidemiology apply to marine systems? Trends Ecol. Evol. 19(11):586-591.

Monath, T.P. (ed.). 1988. The Arboviruses: Epidemiology and Ecology. IV vols. CRC Press, Inc. Boca Raton, Florida.

Nesse, Randolph M., and George C. Williams. 1996. Why We Get Sick: The New Science of Darwinian Medicine. Paperback, Random House. ISBN-13: 9780679746744.

Newman, M.C., and C.H. Jagoe. 1996. Ecotoxicology: A Hierarchical Treatment. Lewis Publishers, Boca Raton, FL.

Olsen, O.W. 1974. Animal Parasites: their life cycles and ecology. University Park Press, Baltimore, 3rd ed.

Patz, J.A., T.K. Graczyk, N. Geller, and A.Y. Vittor, 2000. Effects of environmental change on emerging parasitic diseases. International Journal for Parasitology 30: 1395-1405.

Patz, J.A. and W.K. Reisen, 2001. Immunology, climate change and vector-borne diseases. Trends in Immunology 22: 171-72.

Real, L.A. 1996. Sustainability and the ecology of infectious disease. BioScience 46(2):88-97.

Thorne, E. T., N. Kingston, W.R. Jolley, and R. C. Bergstrom (eds.). 1982. Diseases of Wildlife in Wyoming. Wyoming Game and Fish Department, Cheyenne, Wyoming. 353 pp.

Vicente, V.P. 1989. Regional commercial sponge extinctions in the West Indies: Are recent climatic changes responsible? Mar. Ecol. Prog. Ser. 10:179-191.

Williams, E.H., Jr., and L. Bunkley-Williams. 2000. Major marine ecological disturbances of the Caribbean. Infect. Dis. Rev. 2(3):110-127.

Wobeser, G. A. 1998. Diseases of Wild Waterfowl, 2nd ed. Plenum Press, New York, 324 pp.

Wobeser, G. A. 1994. Investigation and Management of Disease in Wild Animals. Plenum Press, New York, 263 pp.

Wobeser, G.A. 2006. Essentials of Disease in Wild Animals. Blackwell Publishing Professional, Ames, Iowa.