INFECTIOUS DISEASES OF WILDLIFE
GEORGE MASON UNIVERSITY
Spring Semester 2022
3 Credit Hours

EVPP 560 001 (CRN 22623)/BIOL 560 001 (CRN 16795)

EXPL L111, 4:30–7:10 p.m. Tuesdays

Instructor: Esther C. Peters, PhD
Associate Professor
Department of Environmental Science and Policy, College of Science

Office: David King Hall (Room 3050)

Office Phone: 703-993-3462, 703-624-0143 (cell)

Office Hours: 3:30-4:30 p.m. Tuesdays or BY APPOINTMENT (send email request)
epeters2@gmu.edu

Prerequisite(s): Courses on Evolution, Ecology, Zoology and Conservation Biology or Instructor's permission.

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

Course Description

Globalization, habitat loss and fragmentation, the illegal wildlife trade, and other human activities have contributed to the increase of wildlife diseases across the globe. To meet these challenges, more state and federal agencies, organizations, and personnel are required to understand the wildlife-domestic animal-human interface in relation to infectious agents, biosecurity, and potential zoonotic diseases. This course is designed to provide a basic understanding of the fundamental principles of infectious wildlife diseases, their relationship to species and ecosystems conservation, and their effects on endangered species, domestic animal health, and public health.

The course is required for the new MS Conservation Medicine and Planetary Health concentration. It will help students applying for veterinary medical school (obtain an upper-level biomedical course) and allow those working on wildlife to have better understanding about the impact of disease agents on animals and humans. This course is appropriate for undergraduate students from Biology, Environmental Science and Policy, Public Health, Global Health, and Global Affairs, among others.

What this course CANNOT do

A single semester course in wildlife diseases cannot impart diagnostic skills or research capacity to address wildlife diseases for an individual. We offer *EVPP/BIOL 427/527 Conservation Medicine* and *EVPP 490/505 Planetary Health* during the Fall semester to deepen your knowledge in this topic. However, work that requires diagnostics or research tools must involve trained diagnosticians/researchers, and epidemiologists. For diagnostics, veterinary pathologists with wildlife experience and consultation from experienced wildlife biologists are required. This by no means limits wildlife disease work to individuals with diagnostic training. Wildlife diagnostics is only one part of wildlife disease ecology and may or may not be necessary in all research projects. In fact, the best wildlife disease research is generally done by transdisciplinary teams that include wildlife biologists, population biologists, ecologists, epidemiologists, veterinarians, public health experts, pathologists, toxicologists, microbiologists, parasitologists, modelers, sociologists, anthropologists, and others! We hope to emphasize that with examples for discussion.

The course is not designed as a comprehensive survey of wildlife diseases. It is impossible to discuss all causes of disease, but we will review certain disease-causing agents, including viruses, prions, bacteria, fungi, protozoa and parasites. We will focus on mammals, birds, reptiles, and amphibians and illustrate concepts important to the eco-epidemiological and evolutionary strategies of disease agents and their relationship to host species and the environment. We will emphasize the importance of proper diagnostics and how the biologist can facilitate this. Geographic distribution of selected infectious agents will be global, but emphasis will be on diseases that occur in North America.

Course Objectives and Student Learning Outcomes

During this course, we will examine the causes and mechanisms, pathobiology, ecology, epidemiology, and population significance of infectious diseases of wildlife. We will explore methods of diagnosis, control, prevention, and outbreak investigation as they apply to management and conservation of wildlife populations. Also, diseases crossing species barriers will be examined. Students will participate in individual and team assignments in order to be able to:

1. Describe and compare important infectious diseases of wildlife, including those caused by pathogenic microorganisms that are transmissible among humans, domestic animals, and wildlife.
2. Understand the evolution of pathogens and their hosts, as linked to environmental conditions.
3. Differentiate the proximate mechanisms of pathogenesis in wildlife diseases.
4. Describe the epidemiological principles and evaluate models of disease spread in wildlife populations.
5. Apply primary methods of diagnosis, prevention, and control of wildlife diseases.
6. Design a wildlife disease outbreak investigation.
7. Integrate wildlife diseases into principles of wildlife management, conservation, veterinary care and public health.

Course Expectations

Each session will combine lectures, class exercises, on occasion guest speakers, and student discussion. As with any cross-listed 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 must be able to organize material logically, and to communicate well both orally and in writing, in order to pass this course.**

Learning Modules

This course is organized into three modules in Blackboard: (1) Introduction to Infectious Diseases of Wildlife, (2) Infectious Disease Dynamics, and (3) Infectious Diseases of Wild Animals. Each module will have the following sections: (1) PowerPoint lecture that will be given during class (PDF provided), (2) required readings due before the start of class, (3) forms and descriptions for any exercise or assignment that will be done in class that you need to complete for grade. All course materials are available BB. Classes will be based on topics outlined in the following schedule, with assignments related to covered material and applied infectious diseases articles.

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 Dr. Peters.

More students are juggling work, research, internships, shadowing, and families. Please note "Although many students must work to meet living expenses, 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." (University catalog, section AP.1.2. Academic Load, see: http://catalog.gmu.edu/content.php?catoid=27&navoid=5365#attendance). Please consider your responsibilities and interests and plan accordingly to protect your health and GPA!

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 George Mason University honor code. **Please use your SMART cell phones to participate in class, taking photos, notes, looking up references, doing calculations ONLY.** No texting is allowed.

Absenteeism should be limited to illness or emergencies. Discuss any attendance concerns or anticipated issues with the instructor. Students should notify the instructor *before* the missed class if they must miss a class. **Multiple missed classes will affect student grades.** PowerPoint lectures will be posted so you have the highlights of each lecture. However, you need to make every effort to attend. Students should contact classmates to obtain lecture notes and

assignments, if necessary, as quizzes and exams will be based also from readings from the papers and other materials.

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.

E-mail Communications

Dr. Peters will send e-mail messages only to your GMU e-mail account. Students must use their Mason email accounts to receive important University information, including messages related to this class. Please be sure you check it often and respond to queries from Dr. Peters! If you are not getting messages, please send Dr. Peters an alternate e-mail address.

COURSE ASSIGNMENTS

All assignments must be submitted through Blackboard NOT email

Textbook and Required Readings

There is no textbook for this course. A list of the papers that students will read during the semester is found at the end of this syllabus and PDFs of the papers will be provided in Blackboard for ease of access. All students are required to read the papers in boldface in the list each week. Graduate students must read ***two extra preselected, refereed papers*** listed each week prior to each class and be ready to discuss them. Students will be tested on the readings and lectures in the quizzes (see below). Other sources of knowledge may be found in these resources:

Recommended Scientific Journals

Science Science | AAAS
EcoHealth https://www.springer.com/journal/10393
Journal of Wildlife Diseases
https://www.wildlifedisease.org/wda/PUBLICATIONS/JournalofWildlifeDiseases.aspx
Journal of Wildlife Management https://wildlife.onlinelibrary.wiley.com/journal/19372817
Journal of Zoo and Wildlife Medicine https://bioone.org/journals/journal-of-zoo-and-wildlife-medicine
Wildlife Health http://wildlifehealth.org

Recommended Book

Zimmer, Carl. 2021. A Planet of Viruses, 3rd edition. The University of Chicago Press, Chicago and London. https://www.amazon.com/Planet-Viruses-Third-Carl-Zimmer/dp/022678259X/ref=sr_1_1?crid=T8G1U5PY7KXJ&keywords=a+planet+of+viruses&qid=1642545654&s=books&sprefix=a+planet+of+viruses%2Cstripbooks%2C47&sr=1-1

Or read: https://www.sciencenews.org/article/viruses-alive-coronavirus-definition?utm_source=email&utm_medium=email&utm_campaign=latest-newsletter-v2&utm_source=Latest_Headlines&utm_medium=email&utm_campaign=Latest_Headlines

Class Exercises

Throughout the semester discussion of the required class readings during class will count towards your participation grade. A guest speaker is also planned, who has expertise in research on infectious diseases of wildlife and humans. Several exercises will be done during our class meetings that you will need to complete and submit in Blackboard. Graduate students are expected to prepare more detailed products, incorporating higher order thinking skills (ability to apply, analyze, evaluate, and create), and demonstrating in-depth understanding in problem

National Wildlife Health Center Exploration Sheet

What is the NWHC, what does it do, how does it do this? As part of a preassigned team, you will take a guided tour through this federal facility in the U.S. Geological Survey, to learn about its mission and operations to support the study and management of wildlife diseases.

Videoclip Exercise

You will develop a 20 min-videoclip with a different preassigned team to be presented in class at the end of the semester. You will select an ecosystem and you will need to compile required information about the geology, vegetation, animal species, wildlife diseases and possible disease vectors, the human population, and disease problems that will help you develop the script of your video. Information will be entered into a form during class sessions and submitted in Blackboard for a team grade (all members of the team receive the same grade).

Disease Information Sheet

Each member of a Videoclip team will complete one of these for a different infectious disease that may occur in the ecosystem.

Storyboard Planning

The storyboard is the outline of the content for the videoclip each team will prepare. An outline will be provided for each team to develop their video content and will be submitted in Blackboard for review by Dr. Peters prior to preparing the video.

Quizzes

Five announced quizzes will be given throughout the course. These will be timed, but will not be cumulative, and made up of short answer, multiple choice, fill in the blank, matching, definitions, and True/False. General questions about the lectures, papers, and class exercises will be fair game. Quizzes will be timed and open notes. Discussing the quiz or sharing information about it is prohibited. Quizzes will open on Tuesday after lecture at 7:30 pm and close the following Monday at 6:00 pm.

Final Exam

A take-home final exam will be given to different preassigned teams using a transdisciplinary framework. The primary purpose of this approach is to pool and integrate the team expertise so that more efficient and comprehensive assessment and intervention can be done in a case-by-case basis. The exam was designed to develop TD thinking and work as a TD team, to be analytic and to develop a sense of how infectious diseases of wildlife are related to biodiversity and its conservation, to domestic animal health, and to public health. You must answer all questions as a team as all members of the team will receive the same grade. The final exam is due at the end of the semester.

Videoclip Presentation

Teams will create a videoclip presentation based on the Storyboard Planning you developed earlier, which will be presented during the final exam scheduled time. Team members will provide an introduction and overview of your ecosystem, host species, and infectious diseases ("and"). Next you should discuss the implications and management issues related to the ecology of the pathogen-host-environment ("but"). Finally, you will cover the reason for presenting this and your concluding message to the audience ("therefore").

The videoclip presentation must look professional. Videoclip will be limited to 20 minutes, with 5–10 minutes for questions for a total of 30 minutes. Videoclips will be graded on the clarity of the presentation, the professionalism of the video quality, the content of the material covered, and your ability to answer questions posed by classmates and instructor. Each topic below will get a score ranging from **1** (poor), **2** (good), **3** (very good) **4** (excellent):

Literature Review: Scope of information gathering
Scientific knowledge: How accurate is the information presented
Management implications: All presentations address *at least 3* of the following areas:

(a) Effects of an infectious disease in wildlife species and populations, and their impact on domestic animal and human health
(b) Economic perspectives
(c) Cultural perspectives
(d) Socioeconomic perspectives
(e) Environmental policy angle
(f) Perspectives from development, agriculture, and conservation
(g) Solutions to the problems outlined

Conclusions: Conclusions are sound and supported by data.
Style: Delivery is clear and audible with proper elocution.
Time: Videoclip adheres strictly to time limit.

Grading Criteria

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

Activity	EVPP 560/BIOL 560 % Contribution to Total Grade
Class participation, extra readings discussions	20%
Videoclip Exercise (Team score)	5%
National Wildlife Health Center Exploration Sheet	5%
Disease Information Sheet	5%
Videoclip Story Board (Team score)	15%
Four announced quizzes (5 given, lowest dropped)	20%
Final Exam (Team score)	20%
Videoclip Presentation (Team score)	10%
TOTAL	**100%**

The final grade for *graduate students* will be based on this scale: A= 100–90%, B= 89-80, C = 79–70%, D= 69–60%, F < 59%.

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.

Sharing of materials may be limited by what those materials contain and where they are shared. Sharing of instructor-created materials, particularly materials relevant to assignments or exams, to public online "study" sites is considered a violation of Mason's Honor Code. *Some kinds of participation in online study sites violate the Mason Honor code: these include accessing exam or quiz questions for this class; accessing exam, quiz, or assignment answers for this class; uploading of any of the instructor's materials or exams; and uploading any of your own answers or finished work. Always consult your syllabus and your professor before using these sites.*

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 or as a team outside the classroom.

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 instructor will provide the format for citations.

Disability Accommodations

If you are a student with a disability and you need academic accommodations, please notify the instructor and contact the Office of Disability Services (ODS to request accommodations, with appropriate documentation (ds.gmu.edu/forms/). All academic accommodations must be arranged through the ODS. Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit http://ds.gmu.edu/ for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email:ods@gmu.edu | Phone: (703) 993-2474

Diversity and Inclusion

We seek to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own. The Anti-Racism and Inclusive Excellence Taskforce (ARIE) is continuing to consult with faculty, students, and campus offices to develop resources to support faculty in anti-racist teaching approaches. At Mason we remain committed to providing a safe learning, living, and working environment that embraces our diversity and is free from discrimination.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

George Mason University is committed to providing a learning, living, and working environment that is free from discrimination and a campus that is free of sexual misconduct and other acts of interpersonal violence in order to promote community well-being and student success. We encourage students who believe that they have been sexually harassed, assaulted or subjected to sexual misconduct to seek assistance and support. University Policy 1202: Sexual Harassment and Misconduct speaks to the specifics of Mason's process, the resources, and the options available to students. As a faculty member and designated "Responsible Employee," I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per university policy 1412. If you wish to speak with someone confidentially, please contact the Student Support and Advocacy Center (703-380-1434) or Counseling and Psychological Services (703-993-2380). You may also seek assistance from Mason's Title IX Coordinator (703-993-8730; titleix@gmu.edu).

Other Useful Campus Resources

NAME AND PRONOUN USE: If you wish, please share your name and pronouns with me and how best to address you in class and via email. I use "she/her/hers" for myself and you may address me as "Dr. Peters" in email and verbally.

RELIGIOUS HOLIDAYS: the calendar of religious holidays and observations is posted here (https://ulife.gmu.edu/religious-holiday-calendar/). Please let Dr. Peters know in advance if any religious observances affect your participation in class activities and assignments.

WRITING CENTER: https://writingcenter.gmu.edu

UNIVERSITY LIBRARIES: "Ask a Librarian" https://library.gmu.edu/tutorials/librarians-help

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): https://caps.gmu.edu

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

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.

Student communication of e-mail information (Opt-in Form):
https://provapps.gmu.edu/hb1app/.

NAMES AND PHONE NUMBERS OF CLASSMATES:

_____ _____

Notes:

Course Schedule

Week	*Date*	*Topic*
Introduction to Infectious Diseases of Wildlife		
1	01/25	Introduction to the course: syllabus, assignments, expectations
		Lecture: Why infectious diseases of wildlife?
2	02/1	Lecture: Definitions
		Exercise: National Wildlife Health Center Exploration
		Exercise: Videoclip Team Exercise
		Lecture: Wildlife disease surveillance
3	02/8	Lecture: Mechanical and chemical immobilization
		Exercise: National Wildlife Health Center Exploration
		Exercise: Videoclip Team Exercise
		Quiz 1 (after class take at home due 02/14)
4	02/15	Lecture: Forensic techniques: CSI for wildlife
		Exercise: National Wildlife Health Center Exploration
		Exercise: Videoclip Team Storyboard Development
5	02/22	Lecture: Wildlife pathology and specimen collection/shipping
		Exercise: National Wildlife Health Center Exploration (submit 02/28)
		Exercise: Videoclip Team Storyboard Development (submit 03/7)
		Quiz 2 (after class take at home due 02/28)
Infectious Disease Dynamics		
6	03/01	Lecture: Pathogens and Hosts
		Exercise: Disease Information Sheet
7	03/8	Lecture: Ecology and Epidemiology
		Exercise: Disease Information Sheet
		Quiz 3 (after class take at home due 03/14)
8	03/15	**Spring Break – No Class**
9	03/22	Lecture: Vaccination and Control Mechanisms
		Exercise: Disease Information Sheet
10	03/29	Lecture: Emergence and Global Health
		Exercise: Disease Information Sheet (submit 03/31)
		Quiz 4 (after class take at home due 04/4)
Infectious Diseases of Wildlife		
11	04/5	Lecture: Infectious diseases of wild mammals
		Exercise: Videoclip Presentation
12	04/12	Lecture: Infectious diseases of birds (**Final Exam Available**)
		Exercise: Videoclip Presentation
13	04/19	Lecture: Vector-borne diseases
		Exercise: Videoclip Presentation
		Quiz 5 (after class take at home due 04/25)
14	04/26	Work on final exam with Team during class
15	05/3	**Final Exam Due**
16	05/17	**Videoclip Presentations** (during Final Exam period, 4:30-7:15 p.m.)

Required Readings (All students read the papers in bold, posted each week in Blackboard):

Week 1* (Why infectious diseases of wildlife?)*:

Rogall, G.M., and J.M. Sleeman. 2017. The USGS National Wildlife Health Center: Advancing Wildlife and Ecosystem Health. USGS, Madison, Wisconsin, 6.

Stephen, C. 2014. Toward a modernized definition of wildlife health. Journal of Wildlife Diseases 50:427-430.

Stephen, C. 2017. Wildlife Health 2.0: Bridging the knowledge-to-action gap. Journal of Wildlife Diseases 53:1-4.

Week 2* (definitions, wildlife disease surveillance)*:

Sleeman J. M.; C.J. Brand, and S.D. Wright. 2012. Strategies for wildlife disease surveillance. *In*: A. A. Aguirre, R. S. Ostfield, and P. Daszak (eds). New Directions in Conservation Medicine: Applied Cases in Ecological Health, Oxford University Press, New York.

Kutz, S., and M. Tomaselli. 2019. "Two-eyed seeing" supports wildlife health. Science 364 (6446):1135-1137.

Grogan, L.F., L. Berger, K. Rose, V. Grillo, S.D. Cashins, and L.F. Skerratt. 2014. Surveillance for emerging biodiversity diseases of wildlife. PLoS Pathogens 10(5): e1004015.

Watsa M. and the Wildlife Disease Surveillance Focus Group. 2020. Rigorous wildlife disease surveillance. Science 369 (6500):145-147.

Week 3* (mechanical and chemical immobilization)*:

Arnemo, J.M., Ahlqvist, P., Andersen, R., Berntsen, F., Ericsson, G., Odden, J., Brunberg, S., Segerström, P. and Swenson, J.E. 2006. Risk of capture-related mortality in large free-ranging mammals: experiences from Scandinavia. – Wildlife Biology 12:109-113.

Dickens, M.J., D.J. Delehanty, and L.M. Romero. 2010. Stress: An inevitable component of animal translocation. Biological Conservation 143:1329-1341.

Kock, R.A., M.H. Woodford, and P.B. Rossiter. 2010. Disease risks associated with the translocation of wildlife. Rev sci tech Off int Epiz 29:329-350**.**

Week 4* (forensic techniques: CSI for wildlife)*:

Aguirre A.A., R. Catherina, H. Frye and L, Shelley. 2020. Illicit wildlife trade, wet markets and COVID-19: Preventing future pandemics. World Medical & Health Policy.

OIE and IUCN -SSC & WHSG. 2020. Guidelines for Working with Free-Ranging Wild Mammals in the Era of the COVID-19 Pandemic, 25 August http://www.iucnwhsg.org/sites/default/files/En_WHSG%20and%20OIE%20COVID-19%20Guidelines_0.pdf

Ogden, R., N. Dawnay and R. McEwing. 2009. Wildlife DNA forensics – bridging the gap between conservation genetics and law enforcement. Endangered Species Research doi: 10.3354/esr00144

Week 5 **(Wildlife pathology and specimen collection/shipping)*:***

Friend, M. and J-C Franson (eds). 1999. Field Manual of Wildlife Diseases: General Field Procedure and Diseases of Birds. US Geological Survey and U.S. Fish and Wildlife Service. http://www.nwhc.usgs.gov/publications/field_manual/ Chapters 1-3

McNamara T.S. 2015. Wildlife pathology studies and how they can inform public health. ILAR Journal 56:306-311.

Cooper, J.E. 2002. Diagnostic pathology of selected diseases in wildlife. Rev. sci.tech. Off. Int. Epiz. 21(1):77-89.

Week 6 **(pathogens and hosts):**

Brearley, G., J. Rhodes, A. Bradley, G. Baxter, L. Seabook, D. Lunney, Y. Liu, and C. McAlpine. 2012. Wildlife disease prevalence in human-modified landscapes. Biological Reviews.

Belsare, A.V., A.T. Vanak, and M.E. Gompper. 2014. Epidemiology of viral pathogens of free-ranging
dogs and Indian foxes in a human-dominated landscape in central India. Transboundary and Emerging Diseases 61(S1):78-86.

Clayton, B.A., L.F. Wang, and G.A. Marsh. 2012. Henipaviruses: an updated review focusing on the Pteropid reservoir and features of transmission. Zoonoses and Public Health 60:69-83.

Azab, W., A. Dayaram, A.D. Greenwood, and N. Osterrieder. 2018. Annual review of Virology: how host specific are herpesviruses? Lessons from herpesviruses infecting wild and endangered mammals. Ann. Rev. Virol. 5:53–68.

Week 7 **(ecology and epidemiology):**

Chauvenet, A.L.M., S.M. Durant, R. Hilborn, and N. Pettorelli. 2011. Unintended consequences of conservation actions: managing disease in complex ecosystems. PLoS ONE 6(12): e28671.

Tompkins, D.M., S. Carver, M.E. Jones, M. Krkošek, and L.F. Skerrat. 2015. Emerging infectious diseases of wildlife: a critical perspective. Trends in Parasitology 31:149-159.

Wallace RM, Gilbert A, Slate D, Chipman R, Singh A. 2014. Right place, wrong species: A 20-year review of rabies virus cross species transmission among terrestrial mammals in the United States. PLoS ONE 9(10): e107539.

Week 8: SPRING BREAK

Week 9 **(vaccination and control mechanisms):**

Bienen, L., and G. Tabor. 2006. Applying an ecosystem approach to brucellosis control: can an old conflict between wildlife and agriculture be successfully managed? Front Ecol Env 4(6):319–327.

Roeder, P., J. Mariner, and R. Kock. 2013. Rinderpest: the veterinary perspective on eradication. Phil Trans R Soc B 368:20120139.

Uehlinger F.D., A.C. Johnston, T.K. Bollinger and C.L. Waldner. 2016. Systematic review of management strategies to control chronic wasting disease in wild deer populations in North America BMC Veterinary Research 12:173.

Week 10 **(emergence and global health):**

Aguirre, A. A. and G. M. Tabor. 2008. Global factors driving emerging infectious diseases: Impact on wildlife populations. Animal Biodiversity and Emerging Diseases: Annals of the New York Academy of Sciences 1149:1-3.

FAO. 2020. Global emergence of infectious diseases: links with wild meat consumption, ecosystem disruption, habitat degradation and biodiversity loss. Rome. https://doi.org/10.4060/ca9456en.

Gallana M., M.-P. Ryser-Degiorgis, T. Wahli, and H. Segner. 2013. Climate change and infectious diseases of wildlife: altered interactions between pathogens, vectors and hosts. Current Zoology 59:427-437.

Week 11 **(infectious diseases of mammals):**

Aguirre, A. A. 2013. Parasitic diseases in wildlife and domestic animals: new trends of disease emergence. *In* P.C. Lefevre, J. Blancou, R. Chermette, and G. Uilenberg (eds.). Infectious and Parasitic Diseases of Livestock 1: General Considerations. Viral Diseases. Lavoisier, France, pp. 73-77.

Sackett, L.C., S.K. Collinge, and A.P. Martin. 2013. Do pathogens reduce genetic diversity of their hosts? Variable effects of sylvatic plague in black-tailed prairie dogs. Molecular Ecology 22(9):2441-2455.

White R.J. and O. Razgour. 2020. Emerging zoonotic diseases originating in mammals: a systematic review of effects of anthropogenic land-use change. Mammal Review 50:336–352.

Week 12 **(infectious diseases of birds, reptiles, amphibians):**

Descamps, S., S. Jenouvrier, H.G. Gillchrist, and M.R. Forbes. 2011. Avian cholera, a threat to the viability of an arctic seabird colony? PLoS ONE 7(2); e 29659.

Aguirre, A. A. and P. Lutz. 2004. Sea turtles as sentinels of marine ecosystem health: is fibropapillomatosis an indicator? EcoHealth 1:275-283.

Eskew, E.A. and B.D. Todd. 2013. Parallels in amphibian and bat declines from pathogenic fungi. Emerging Infectious Diseases 19(3):379-385.

Week 13 **(vectorborne diseases):**

Gallana M., M.-P. Ryser-Degiorgis, T. Wahli, and H. Segner. 2013. Climate change and infectious diseases of wildlife: altered interactions between pathogens, vectors and hosts. Current Zoology 59:427-437.

Marra, P. et al. 2004. West Nile virus and wildlife. BioScience 54:393-402.

Samuel, M.D., B.L. Woodworth, C.T. Atkinson, P.J. Hart, and D. LaPointe. 2015. Avian malaria in Hawaiian forest birds: infection and population impacts across species and elevations. Ecosphere 6 (6):104-121.

Week 14:

No readings, work on Final Exam

Week 15

Final PPT Presentations

Selected References on Wildlife Diseases

Aguirre A. A. and E. E. Starkey. 1994. Wildlife disease in U.S. national parks: historical and coevolutionary perspectives. Conservation Biology 8:654-661.

Aguirre, A.A., R.S. Ostfeld and P. Daszak (eds.). 2012. New Directions in Conservation Medicine: Applied Cases of Ecological Health, Oxford University Press, New York, 639 pp.

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.

Atkinson, C.T., N.J. Thomas, and D.B. Hunter (eds.). 2008. Parasitic Diseases of Wild Birds. Wiley-Blackwell. Ames, Iowa, 595 pp.

Botzler, R.G. and R.N. Brown. 2014. Foundations of Wildlife Diseases, University of California Press.

Brown C and C Bolin. 2000. Emerging Diseases of Animals. ASM Press: Washington DC.

Canadian Cooperative Wildlife Health Centre. 2010. Wildlife Disease Investigation Manual 3rd ed.

Childs, JE et al. (eds.) 2007. Wildlife and Emerging Zoonotic Disease: The Biology, Circumstances, and Consequences of Cross-Species Transmission. Springer Verlag: New York.

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

Collinge, S.K. and C. Ray. 2006. Disease Ecology: Community Structure and Pathogen Dynamics. Oxford University Press: New York.

Conover, M.R. and R. M. Vail. 2015. Human Diseases from Wildlife. Taylor & Francis Group, CRC Press.

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.

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. and Z.S. Cubas (eds.). 2001. Biology, Medicine, and Surgery of South American Wild Animals. Iowa State University Press, Ames, 536 pp.

Franson, J.C., Friend, M., Gibbs, S.E.J., and Wild, M.A., eds., 2015, Field manual of wildlife diseases: U.S. Geological Survey Techniques and Methods 15, variously paginated, http://dx.doi.org/10.3133/tm15

Friend, M. 2006. Disease Emergence and Resurgence: The Wildlife-Human Connection: Reston, Va., U.S. Geological Survey, Circular 1285, 400 p., Reston, Virginia
http://www.nwhc.usgs.gov/publications/disease_emergence/

Friend, M. and J-C Franson (eds). 1999. Field Manual of Wildlife Diseases: General Field Procedure and Diseases of Birds. US Geological Survey and U.S. Fish and Wildlife Service.
http://www.nwhc.usgs.gov/publications/field_manual/

Grenfell, BT et al (eds). 1995. Ecology of Infectious Diseases in Natural Populations. Cambridge University Press: Cambridge, UK.

Hatcher, MJ and AM Dunn. 2011. Parasites in ecological Communities. Cambridge University Press: New York.

Hudson, PJ et al (eds). 2001. The Ecology of Wildlife Diseases. Oxford University Press: New York.

Leighton, F.A. 2010. The Training Manual on Wildlife Diseases and Surveillance: Workshop for OIE National Focus Points for Wildlife. World Organisation for Animal Health (OIE), Paris, France.
http://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/WGWildlife/A_Training_Manual_Wildlife.pdf

Miller R.E. and M.E. Fowler (eds.). 2015. Fowler's Zoo and Wildlife Medicine Vol 8. Elsevier Saunders, St. Louis, Missouri. 773 pp.

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

Morand, S. and B.R. Krasnov (eds). 2010. The Biogeography of Host-Parasite Interactions. Oxford University Press: New York.

Nunn, C.L. and S. Altizer. 2006. Infectious Diseases in Primates: Behavior, Ecology and Evolution. Oxford University Press: New York.

Ostfeld, R.S., et al. 2008. Infectious Disease Ecology: The effects of ecosystems on disease and disease on ecosystems. Princeton University Press: Princeton, New Jersey.

Poulin, R. and S. Morand. 2004. Parasite Biodiversity. Smithsonian Books: Washington DC.

Romich, J.A. 2008. Understanding Zoonotic Diseases. Thomson Delmar Learning: New York.

Samuel, W.M., M.J. Pybus, and A.A. Kocan (eds.). 2001. Parasitic diseases of Wild Mammals 2nd ed. Iowa State University Press, Ames, 559 pp.

Schmid-Hempel, P. 2011. Evolutionary Parasitology. Oxford University Press: New York.

Scott, M.E. and G. Smith. 1994. Parasitic and Infectious Diseases Epidemiology and Ecology. Academic Press: New York.

Stearns, S.C. (ed). 1999. Evolution in Health and Disease. Oxford University Press: New York.

Thomas, F., J.-F. Guegan, and F. Renaud (eds). 2009. Ecology and Evolution of Parasitism. Oxford University Press, New York.

Thomas, N.J., D.B. Hunter, and C.T. Atkinson (eds.). 2007. Infectious diseases of Wild Birds. Blackwell Publishing, Ames, Iowa, 484 pp.

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.

Williams, E.S. and I.K. Barker. 2001. Infectious Diseases of Wild Mammals 3rded. Iowa State University Press, Ames, 558 pp.

Wobeser, G. A. 2007. Disease in Wild Animals: Investigation and Management 2nd ed. Springer, Heidelberg, Germany, 387 pp.

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

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

Wildlife Disease Websites

www.nwhc.usgs.gov/
https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nwrc/sa_nwdp/ct_nwdp
https://wwwnc.cdc.gov/eid
http://www.wildlifedisease.org/WDA/default.aspx