INFECTIOUS DISEASES OF WILDLIFE
EVPP 460/560
BIOL 460/560
3 Credit Hours

GEORGE MASON UNIVERSITY
Spring Semester 2020
Lecture: Tuesdays 4:30–7:10 p.m.
Innovation Hall Room 207

Instructor: Dr. A. Alonso Aguirre
Office: David J. King Hall 3005, Fairfax
Office Hour: Tuesdays 2:00–4:00 pm or BY APPOINTMENT (send e-mail request)
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Prerequisite(s): *Undergraduate students*: EVPP 301 OR BIOL308 and 60 credit hours; or Instructor's permission.

Graduate Students: 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**

SYLLABUS

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 diseases in wildlife, their relationship to species and ecosystems conservation, and their effects on endangered species, domestic animal health and public health.

The course is not required for any particular degree but 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, 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/BIOL427/527 Disease Ecology and Conservation* 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 tha 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 investigations 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. Identify important infectious diseases of wildlife, including diseases transmissible to domestic animals and humans.
2. Understand the evolution of pathogens and their hosts, as linked to environmental conditions.
3. Understand the proximate mechanisms of pathogenesis in wildlife diseases.
4. Describe the epidemiological principles and models of disease spread in wildlife populations.
5. Describe primary methods of diagnosis, prevention, and control of wildlife diseases.
6. Outline 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 assigned articles and book chapters, study supporting materials, and prepare assignments outside of class**. Self-directed study skills are important. **Students must be able to organize materials logically, and to communicate well both orally and in writing, in order to pass this course.**

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. Aguirre.

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.

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 articles provided in class.

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. Please use your SMART cell phones to participate in class, taking photos, notes, looking up references, doing calculations ONLY. No texting is allowed. 0Such 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 the instructor as soon as possible, and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS.

E-mail Communications

Dr. Aguirre will send e-mail messages only to your GMU e-mail account. Students must use their Mason email ("MASONLIVE" account) to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information regarding academic e-mail accounts. 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 an alternate e-mail address.

COURSE ASSIGNMENTS

1. Definitions of Terms

Each student is expected to identify 100 common terms in infectious diseases of wildlife and submit them ***written by hand***. This is a way to expose you to common terminology used in infectious disease of wildlife, and to help you remember some of these definitions while writing them. Terms must be selected from class materials and may not be copied from internet word searches. Terms must be numbered, and written legibly, on lined paper (notecards will not be accepted.). Terms are not required to be in alphabetical order, but if they are not in alphabetical order, they must demonstrate organizational thought such as grouped by theme (e.g., types of surveillance), or field (e.g., veterinary, human health, immunology). If you choose to define THEORIES, HYPOTHESES, or POSTULATES, you MUST state whether the term is still valid, cite the originator(s), cite the original publication, AND thoroughly explain the premise.

2. Written Commentaries

In addition to reading and studying scientific journal papers and book chapters provided in class, students will prepare written assignments in the style of *Letters to Science*. Undergraduate students will prepare **one written assignment,** and graduate students **two written assignments,** of 400 words (not including references, which are required). Written assignments will be drafted as a commentary, comparing, contrasting, or critiquing a recent (2018 or later) **technical paper from a peer-reviewed/refereed scientific journal**, on an infectious disease of wildlife (e.g., West Nile virus infection in alligators, mycoplasmosis in finches, epizootic hemorrhagic disease of deer). Popular media (magazine, TV, internet news) articles **will NOT be accepted.** If you find a popular media article that you find interesting, follow it all the way to the primary (original peer-reviewed/refereed scientific) publication on which the popular media article is based, and read and review THAT original scientific paper for your critique. Style guidelines can be found at *http://www.sciencemag.org/site/collections/online/eletters/guidelines.xhtml*

YOU MUST ATTACH THE PAPER YOU ARE REVIEWING TO YOUR SUBMISSION
Attachments can be .doc, .pdf, or other downloadable files. Attachments may NOT be in the form of a hyperlink.

Identify ***specific*** issues/critiques you have with **a paper of your choice from a peer-reviewed/refereed journal or popular magazine**. This can be something that you found problematic, interesting, ridiculous, or missing, and then compare and support your arguments with other sources in the literature. You are **encouraged** to search articles from all sources. Use Web of Science or other journal databases to do additional literature searches.

Make your critiques **explicit and clear**, e.g.: "I find three main critiques in the way this argument was presented." … paragraph 1, 2, 3.

Do not spend too many words describing the introduction, methods, results or conclusions of the article or report that you are critiquing. Try to give a **very brief overview** of the important points or methods and spend the majority of your paper giving **your own** "two-cents"! A good idea is to end with what you think needs to be done in the future (research, conservation

measures, mamangement strategies, policy), based on your critique. Be clear and concise, and **don't be repetitive** with your points, as you have only 400 words to make your argument. Make every word count (this may be one of the big challenges of the assignments and will train you for manuscript writing with editor-imposed word limits).

Proofread: Review your spelling and grammar before handing your work in! Avoid run-on or ambiguous sentences.

Each paper should be neatly prepared and proofread, especially checking for consistency, completeness, and correctness (Help: The Writing Center, OWL/On-line Writing Lab: https://writingcenter.gmu.edu/writing-resources**.** Many online grammar resources are available now. 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.

All statements of fact in your paper need to be referenced to some authority. Although you are able to access primary source material electronically, the use of web sites as a reference WILL NOT BE ACCEPTED. You should be using primary literature (e.g. peer-reviewed or refereed journal articles and papers) for your authoritative citations. Full references (all authors names, no "et. al.") should be provided in the Literature Cited section of your paper. As for citation style – use *Letters to Science* format but include all authors in the Literature Cited portion of the paper. Footnotes are reserved for limited explanatory material only.
The university provides access to Zotero resources for organizing literature, tracking citations, and building "literature cited" sections for your use. If you choose not to use these resources, use **proper structure for in-text citations:** author-year e.g., "AbuBakar *et al* (2011) isolated Nipah virus from pigs" or numbered reference (if you want to save words), e.g., "Nipah virus was isolated from pigs [1]." Likewise, use proper structure for references in the literature cited section:

References:

1. AbuBakar S, L-Y Chang, ARM Ali, SH Sharifah, K Yusoff, and Z Zamrod. 2004. Isolation and molecular identification of Nipah virus from pigs. Emerging Infectious Diseases 10:2228-2230.

Be sure to thoroughly PROOFREAD your entire paper, including the citations, and fix errors! Please use Word (either .doc or .docx files only) and e-mail your paper to me on the due date.

3. Midterm Exam

A take home meidterm exam will be given to pre-assigned teams using a transdiscipl;inary framework. *"Transdisciplinarity"* or *transdisciplinary thinking* (TD) employs perspectives and methods that transcend traditional disciplines and engage both researchers and practitioners in addressing real-world problems. The primary purpose of this approach is to pool and integrate the team expertise so that more efficient and comprehensive assessment and intervention 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.

4. PowerPoint Presentation

Not for Undergrads! Graduate students are required to give a final presentation via PowerPoint slides on a *contemporary* issue/topic relevant to *Infectious Diseases of Wildlife*. The issues/topics (*but not the contents*) for the presentations are not limited to those covered in class. Choose your favorite infectious disease of wildlife from a newspaper, magazine article, or scientific journal article. In your presentation, provide a brief background of the problem; describe the impacts of this disease to wildlife, domestic animals, humans and ecosystems; and concerns from an economic, cultural, environmental, and/or epidemiological perspective. Management implications may include discussion of mechanisms of control, prevention measures, and proactive intervention to reduce impacts of the pathogen.

Presentations will be **20-minutes total**, including 3-5 minutes for questions.

The slide presentation "rule of thumb" is 1 slide per minute so plan accordingly.
Your 1st slide should be a title slide with your name and title of the talk. Next should be an introduction & overview to the infectious disease followed by more specifics. Next you should discuss the implications and management issues related to the ecology of the pathogen-host-environment. Finally, you should provide conclusions in which the main points are highlighted. Presentations will be graded on the clarity of the presentation, the professionalism of the slides, the content of the material presented, 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 should 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 the development, agriculture, and conservation
g) Solutions to the problems outlined

Conclusions: Conclusions are sound and supported by data

Slides: Slides are well organized, logical, and easy to read and to interpret

Style: Delivery is clear, audible, with proper elocution and eye contact with audience

Time: Speaker 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 460/BIOL 460 % Contribution to Total Grade	EVPP 560/BIOL 560 % Contribution to Total Grade
Definitions of Terms	10%	10%
Class participation	10%	5%
Extra readings	-	5%
Two written commentaries	10% (one only)	10% (5% each)
Four surprise quizzes (5 given)	40% (10% each)	20% (5% each)
Mid-term Exam	30%	30%
PowerPoint presentation	-	20%
TOTAL	**100%**	**100%**

The final grade for *undergraduate students* will be based on this scale: A = 100–93%, A- = 92-90%, B+ = 89-86%, B=85-83, B- = 82-80%, C = 79–70%, D = 69–60%, F < 59%. **A CURVE WILL NOT BE APPLIED.**

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%. **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 or as a team outside 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 written assignments 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. See format for citations above.

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.

Course Schedule Spring 2020*

Week	***Date***	***Topic***
1	01/21	Introduction to the course
		Why infectious diseases of wildlife?
2	01/28	Wuhan Novel Coronavirus (2019-nCoV) case study
		Wildlife pathology and specimen collection/shipping
3	02/4	Infectious disease dynamics: Emergence and Global Health
		Case Study: Saiga antelope mass mortality event
4	02/11	Infectious disease dynamics: Ecology
		Infectious disease dynamics: Epidemiology
5	02/18	Infectious disease dynamics: Pathogens
		Infectious disease dynamics: Hosts
6	02/25	Infectious disease dynamics: Vaccination
		Infectious disease dynamics: Control Mechanisms
7	03/3	Wildlife disease surveillance; disease control operations; euthanasia
8	03/10	***Spring Break – No Class***
9	03/17	***Spring Break Extended – No Class***
10	03/24	Infectious diseases of wild mammals and birds
		Definitions of Terms Due – Pls scan and email to me
11	03/31	Infectious diseases of amphibians and reptiles
12	04/7	*SolveClimate 2030* online event
13	04/14	Mechanical and chemical immobilization /Stress
		Written Commentary due
14	04/21	CSI for wildlife
		Work on Final Exam
15	04/28	***Final Exam Due with PPT Presentations***

*In additon to the articles for each session, all graduate students are required to read **an extra preselected, refereed paper** listed below that need to be discussed in class.

Required Readings (Undergraduate required readings are in bold):

Week 1:

Rogall G.M. and J.M. Sleeman. 2016. The USGS National Wildlife Health Center: Advancing Wildlife and Ecosystem Health. USGS, Madison, Wisconsin, 6 pp.

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:

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. https://pubs.usgs.gov/itr/1999/field_manual_of_wildlife_diseases.pdf Chapters 1-3

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.

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

Week 3:

Fereidouni S., G.L. Freimanis, M. Orynbayev, P. Ribeca, J. Flannery, D.P. King, et al. 2019. Mass die-off of Saiga antelopes, Kazakhstan, 2015. Emerg. Infect. Dis. 25:1169-1176. https://dx.doi.org/10.3201/eid2506.180990

Kock R., M. Orynbayev, S. Robinson, S. Zuther, N. Singh, W. Beauvais, et al. 2018. Saigas on the brink: multi-disciplinary analysis of the factors influencing mass mortality events. Sci Adv. 4:eaao2314.

Week 4:

Disease Ecology and Wildlife Health in the Greater Yellowstone Ecosystem. Yellowstone Science 15(2):1-33.

Kock R..2014. Drivers of disease emergence and spread: Is wildlife to blame? Onderstepoort Journal of Veterinary Research 81: doi.org/10.4102/ojvr. v81i2.739

Vandergrift K.J., S.H. Sokolow, P. Daszak, and A.M. Kilpatrick. 2010. Ecology of avian influenza viruses in a changing world. Ann N Y Acad Sci 1195:113-128.

Week 5:

Dasgupta S. 2015. Ten shocking animal diseases that may threaten species. BBC Earth http://www.bbc.com/earth/story/20150Mass et al. 2016327-ten-scary-diseases-of-animals

Aguirre, A. A. 2010. 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.

Gilbert M., S.V. Soutyrina, I.V. Seryodkin, et al. 2015. Canine distemper virus as a threat to wild tigers in Russia and across their range. Integr Zool 10:329-343.

Week 6:

Wildlife Conservation Society. "Wildlife at risk around the globe: Scientists say vaccinating endangered carnivores of increasing importance." ScienceDaily, 12 February 2015. <www.sciencedaily.com/releases/2015/02/150212153953.htm>

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.

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. doi:10.1371/journal.pone.0028671

Week 7:

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. https://pubs.usgs.gov/itr/1999/field_manual_of_wildlife_diseases.pdf Chapters 4-6.

Maas M., A. Grone, T. Kuiken, G. van Schaik, H.I.J. Roest, and J.W.B. van der Giessen. 2016. Implementing wildlife disease surveillance in the Netherlands, a One Health approach. Rev Sci Tech Off Int Epiz 35:863-874.

Ryser-Degiorgis, M.-P. 2013. Wildlife health investigations: needs, challenges and recommendations. BMC Veterinary Research 9:223.

Week 8:

Spring Break – No Class

Week 9:

Friend, M. 2014. Why bother about wildlife disease?. U.S. Geological Survey Circular 1401, 76 p. http://dx.doi.org/10.3133/cir1401 pages 1-9.

Woods G.M., S. Fox, A.S. Flies, C.D. Tovar, M. Jones, et al. 2018. Two decades of the impact of Tasmania devil facial tumor disease. Integr Comp Biol 58:1043-1054.

Rahbek C. 2007. The silence of the robins. Nature News & Views (see LaDeau et al. 2007 below)

LaDeau S., A.M. Kilpatrick, and P. Marra. 2007. West Nile virus emergence and land-scale declines of North American bird populations. Nature 447: doi:10.1038/nature05829

Week 10:

Schumacher J. 2006. Selected infectious diseases of reptiles and amphibians. Topics in Medicine and Surgery. J Exotic Pet Med 15:18-24.

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

Fisher M.C. and T.W.J. Garner. 2020. Chytrid fungi and global amphibian declines. Nature Reviews Microbiology doi.org/10.1038/s41579-020-0335-x

Week 11:

Canadian Cooperative Wildlife Health Centre & WCVM Wildlife Health Fund. 2010. Capturing and Handling of Wildlife: Approaches to Reducing Stress. Western College of Veterinasry Medicine, Saskatoon, Saskatchewan, pp. 22-28.

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 12:

Solve Climate by 2030 Event.
We will meet at the Reading Room of the Library from 5:00 to 7:00 pm

Week 13:
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.

Gomez, A. and A. A. Aguirre. 2008. Infectious diseases and the illegal wildlife trade. Animal Biodiversity and Emerging Diseases: Annals of the New York Academy of Sciences 1149:16-19.

Smith K. M., C. Zambrana-Torrelio, A. White, M. Asmussen,C. Machalaba, S. Kennedy. K. Lopez, T. M. Wolf, P. Daszak, D A. Travis, and W. B. Karesh. 2017. Summarizing US wildlife trade with an eye toward assessing the risk of infectious disease introduction. EcoHealth 14:29-39.

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 14:

FINAL EXAM GIVEN

Week 15:

CONTINUE WORKING ON FINAL EXAM

Week 16:

FINAL EXAM DUE WITH PRESENTATIONS

FINAL PPT PRESENTATIONS FOR EVPP560

Selected References on Wildlife Diseases

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.

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