Geography 635: Advanced Biogeography
Topic for Fall 2017: Spatial and Temporal Dynamics of Vegetation

Course Description: Vegetation shows dynamic patterns over various spatial and temporal scales. Patterns of vegetation distribution result from the interaction of plants with the physical landscape, disturbances (e.g., fires, windstorms), and the actions of human societies. This seminar course focuses primarily on conceptual papers but also includes some empirical works. Additional course components include a field trip and a focus on writing science, including a research paper.

Course Objectives: Students will understand major developments of the last decades to century in ecological biogeography relevant to vegetation dynamics; they will understand contemporary debates in vegetation science; they will be able to evaluate these debates; they will analyze data and write a paper related to these issues; and they will learn ways to improve their scientific writing. By addressing important topics and executing their research papers well, the students will produce papers suitable for publication in a scientific journal.

Prerequisites: Geography 624 or approval of instructor

Instructor: Dr. Charles Lafon
Office: 207 CSA (Computer Services Addition) Building
Office Hours: M 3:00–5:00 pm, or by appointment
Phone: 862-3677
E-mail: clafon@geog.tamu.edu
Class Meeting Time and Place: M 6-9 pm, CSA 302
Field Trip to Big Thicket, East Texas: Saturday, Oct. 14 (all day); alternative date in case of rain: Oct. 21

Reading assignments: Several journal articles and/or book chapters are required each week, as indicated below. Each week we will read a chapter from the textbook, which focuses on writing: Schimel, J. 2012. *Writing Science: How to Write Papers that Get Cited and Proposals that Get Funded*. Oxford University Press. ISBN 978-0199760244.

To apply the insights gained from *Writing Science*, each week will evaluate certain aspects of the following journal articles in light of the chapter we have read that week. One particular benefit of analyzing these articles is their close relationship with the class research project that we will conduct. The insights gained from analyzing these papers can be applied directly to writing the class research paper.

- Tulowiecki, S.J. and Larsen, C.P.S. 2015. Native American impact on past forest composition inferred from species distribution models, Chautauqua County, New York. Ecological Monographs 85:557-581.

- Thomas-Van Gundy, M.A. and Nowacki, G.J. 2013. The use of witness trees as pyro-indicators for mapping past fire conditions. Forest Ecology and Management 304:333-344.

Grading:

Class participation makes up 20% of the course grade. Class participation includes (1) being present, (2) demonstrating that you have read each week's material and have thought carefully about it, (3) leading some of the class discussions (to be assigned), and (4) participating in the field trip. Each student will be assigned to lead approximately the same number of class discussions. During each week, we will discuss (1) the assigned readings (see below), (2) the *Writing Science* textbook, and (3) progress/problems with student research projects. Moreover, I encourage each student, and particularly the discussion leader, to consult additional works to elucidate the topic covered that week. Given that most of the assigned readings are conceptual in nature, it may be particularly useful to consult some related empirical papers. For information regarding approved absences please consult the student rules at http://student-rules.tamu.edu/rule7.htm. For late work submitted without an excused absence, 10% is deducted per day.

Writing-related assignments from each chapter of *Writing Science* are worth 30% of the course grade.

Short writing assignments make up 15% of the grade. These will be short but thoughtful responses to the assigned readings.

The remaining 35% of the grade will be based on your contribution to a research paper. The research paper will result from a collaborative effort between you and other students. The collaboration will yield a co-authored paper suitable for submission to a scientific journal. The paper will involve analyzing and interpreting an existing dataset. In past semesters, for example, students have used satellite imagery, LIDAR imagery, tree growth data, climate data, data from permanent vegetation inventory plots, or compilations of data from published articles to address various questions.

The project planned for this semester will involve the use of witness tree data from original land surveys to reconstruct some aspects of vegetation at the time of European settlement in the state of Georgia, for which much of the original data have been digitized and are available for download. The files are compressed in MrSID format, which requires us to download the GeoViewer from Lizard Tech.

The final course grade will be determined according to the standard ten-point scale (A = 90-100%, B = 80-89%, C = 70-79%, D = 60-69%, F = less than 60%), but grades may be curved upward if necessary.

ADA Statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu.

Academic Integrity Statement and Policy. See http://aggiehonor.tamu.edu/. "An Aggie does not lie, cheat, or steal, or tolerate those who do."

Tentative Schedule of Topics:

Week 1 (Aug 28) Overview

Week 2 (Sept 4) Patterns and changes in American vegetation

Discussion Leader: _____

Writing Science textbook: Chapters 1 and 2

Vegetation articles:

(1) Cowell, C.M. 1995. Presettlement Piedmont forests: patterns of composition and disturbance in central Georgia. Annals of the Association of American Geographers 85:65-83.
(2) Wang, Y. 2005. Presettlement land survey records of vegetation: geographic characteristics, quality and modes of analysis. Progress in Physical Geography 29:568-598.

Week 3 (Sept 11) Plant species distribution and the ecological niche

Discussion Leader: _____

Writing Science textbook: Chapter 3

Vegetation articles:

(1) Holt, R.D. 2009. Bringing the Hutchinsonian niche into the 21st century: ecological and evolutionary perspectives. Proceedings of the National Academy of Sciences 106:19659-19665.
(2) Miller, J. 2010. Species distribution modeling. Geography Compass 4/6:450-509

Week 4 (Sept 18) Climate and the distribution of plant species

Discussion Leader: _____

Writing Science textbook: Chapter 4

Vegetation articles:

(1) Loehle, C. 1998. Height growth rate tradeoffs determine northern and southern range limits for trees. Journal of Biogeography 25:735-742.
(2) Kollas, C., Körner, C., and Randin, C. 2014. Spring frost and growing season length co-control the cold range limits of broad-leaved trees. Journal of Biogeography 41:773-783.
(3) Fei, S. et al. 2017. Divergence of species responses to climate change. Science Advances 3:e1603055.

Week 5 (Sept 25) Plant traits and species distributions

Discussion Leader: _____

Writing Science textbook: Chapter 5

Vegetation articles:

(1) Grime, J.P. 1977. Evidence for the existence of three primary strategies in plants and its relevance to ecological and evolutionary theory. American Naturalist 111:1169-1194.
(2) Smith, T.M. and Huston, M.A. 1989. A theory of the spatial and temporal dynamics of plant communities. Vegetatio 83:49-69.

Week 6 (Oct 2) Plant traits and species distributions

Discussion Leader: _____

Writing Science textbook: Chapter 6

Vegetation articles:

(1) Reich, P.B. 2014. The world-wide 'fast-slow' plant economics spectrum: a traits manifesto. Journal of Ecology 102:275-301.
(2) Moles, T.M. et al. 2014. Which is a better predictor of plant traits: temperature or precipitation? Journal of Vegetation Science 25:1167-1180.

Week 7 (Oct 9) Vegetation, biomes, and ecosystems

Discussion Leader: _____

Writing Science textbook: Chapter 7

Vegetation articles:

(1) Excerpt from von Humboldt, A. and Bonpland, A. 1807. Essay on the Geography of Plants, Fr. Schoell, Paris.
(2) Clements, F.E. 1936. Nature and structure of the climax. Journal of Ecology 24:252-284. (Focus on 253-257 and 280-282; skim the rest)
(3) Tansley, A.G. 1935. The use and abuse of vegetational concepts and terms. Ecology 16:284-307.
(4) Marks, P.L. and Harcombe, P.A. 1981. Forest vegetation of the Big Thicket, Southeast Texas. Ecological Monographs 287-305.

Week 8 (Oct 16) Vegetation distribution along environmental gradients

Discussion Leader: _____

Writing Science textbook: no assignment this week

Vegetation articles:

(1) Woodward, F.I., Lomas, M.R., and Kelly, C.K. 2004. Global climate and the distribution of plant biomes. Philosophical Transactions of the Royal Society B 359:1465-1476.
(2) Moncrieff, G.R., Bond, W.J., and Higgins, S.I. 2016. Revising the biome concept for understanding and predicting global change impacts. Journal of Biogeography 43:863-873.

Week 9 (Oct 23) Vegetation disturbances and succession

Discussion Leader: _____

Writing Science textbook: Chapter 8

Vegetation articles:

(1) Pulsford, S.A., Lindenmayer, D.B., and Driscoll, D.A. 2016. A succession of theories: purging redundancy from disturbance theory. Biological Reviews 91:148-167.
(2) Stallins, J.A., Mast, J.N., and Parker, A.J. 2015. Resilience theory and Thomas Vale's *Plants and People*: a partial consilience of ecological and geographic concepts of succession. Professional Geographer 67:28-40.

Week 10 (Oct 30) Fire as a disturbance agent

Discussion Leader: _____

Writing Science textbook: Chapter 9

Vegetation articles:

(1) Sauer, C.O. 1950. Grassland climax, fire, and man. *Journal of Range Management* 3:16–21
(2) Midgley, J.J. and Rebelo, A.G. 2008. Life-history evolution as an explanation for the absence of the tree life-form in Cape fynbos. South African Journal of Science 104:89-90.
(3) Staver, A.C., Archibald, S., and Levin, S.A. 2011. The global extent and determinants of savanna and forest as alternative biome states. Science 334:230-232.
(4) Bond, W.J. and Keeley, J.E. 2005. Fire as a global 'herbivore': the ecology and evolution of flammable ecosystems. Trends in Ecology and Evolution 20:387-394

Week 11 (Nov 6) Fire as a disturbance agent

Discussion Leader: _____

Writing Science textbook: Chapter 10

Vegetation articles:

(1) Archibald, S.A. et al. 2013. Defining pyromes and global syndromes of fire regimes. PNAS 110:6642-6447.
(2) Arthur, M.A. et al. 2012. Refining the oak-fire hypothesis for management of oak-dominated forests of the eastern United States. Journal of Forestry July/August 2012:257-266.
(3) Harris, R.M.B. et al. 2016. Climate-vegetation-fire interactions and feedbacks: trivial detail or major barrier to projecting the future of the Earth system? WIREs Climate Change 2016. Doi 10.1002/wcc.428.

Week 12 (Nov 13) People and vegetation dynamics on changing landscapes

Discussion Leader: _____

Writing Science textbook: Chapter 11

Vegetation articles:

(1) Ellis, E.C. et al. 2010. Anthropogenic transformation of the biomes, 1700 to 2000. Global Ecology and Biogeography 19:589-606.
(2) Denevan, W.M. 1992. The Pristine Myth: the landscape of the Americas in 1492. Annals of the Association of American Geographers 82:369-385.

Week 13 (Nov 20) People and vegetation dynamics on changing landscapes

Discussion Leader: _____

Writing Science textbook: Chapter 12

Vegetation articles:

(1) Young, K.R. 2014. Biogeography of the Anthropocene: novel species assemblages. Progress in Physical Geography pp 1-10.
(2) Ruddiman, W.F. et al. 2015. Defining the epoch we live in: is a formally designated "Anthropocene" a good idea? Science 348:38-39.
(3) Blumler, M.A. 2007. Invasion rules: ecological or geographical? Papers of the Applied Geography Conference 30:395-406.

Week 14 (Nov 27) Vegetation history and pattern on patchy landscapes

Discussion Leader: _____

Writing Science textbook: Chapter 13

Vegetation articles:

(1) Sprugel, D.G. 1991. Disturbance, equilibrium, and environmental variability: what is 'natural' vegetation in a changing environment? Biological Conservation 58:1-18.
(2) Phillips, J.D. 2007. The perfect landscape. Geomorphology 84:159-169
(3) Cullum, C. et al. 2016. Ecological classification and mapping for landscape management and science: foundations for the description of patterns and processes. Progress in Physical Geography 40:38-65.