The Ohio State University

Environment and Natural Resources 7333 Spring Semester 2020

# SUCCESSIONAL DYNAMICS OF FORESTS

## Syllabus

### Description and Objectives

The focus of this course will be the successional dynamics of forests. Forest succession or stand development results from the processes that cause changes over time in communities of trees. These major processes are establishment, growth, competition, and mortality. The emphasis in this course will be on temperate forest types of the eastern United States; however, other forests will also be studied.

The objectives of this course are:

- to learn how to reconstruct the past development of a forest stand by analyzing structural, spatial, and growth data; and
- to examine the processes affecting the development of forest stands.

### Course Format and Prerequisites

Lectures and discussion sessions will be held on Tuesdays from 8:00-9:50 a.m. in Room 460 of Kottman Hall. On Tuesdays, laboratory sessions will follow in the same room, and are scheduled from 10:05-noon. One or two all-day field trips will be taken, and each student must participate in all sessions. This course is offered during the spring semesters of even years only, and is worth three credit hours. This course is designed for seniors and graduate students. Written permission of the instructor is required.

### Reading Assignments and Lab Reports

The assigned readings from the recent literature are mostly online journal articles available through the Ohio State library system. Individual discussion sessions will be led by different members of the group.

Typewritten reports are required based upon each one of the major lab topics. These team lab reports will consist of an introduction and sections on the objectives, methods, and results of the lab, as well as discussion and answers to specific questions.

### Evaluation

The final grade for the course will be based on the following system:

| | Points |
|---|---|
| Midterm and Final Evaluations | 60 each |
| Lab reports | 70 each |
| Attendance & Participation (including leading a discussion) | 100 |

On-time attendance is required at all class sessions for full credit; tardiness or lateness for class is not acceptable. Participation is strongly encouraged and expected for the entire class period.

Final averages will be rounded upward to the next highest whole number for assigning letter grades. All concerns about any grade must be presented in writing within seven days after you are informed of the grade. All team lab reports must be typewritten on the front side of the paper only, and proofread to correct grammar and spelling errors. The printing needs to be clear and legible, and each page must be numbered. Each lab report is due at 10:05 a.m. on the due-date. Grades for lab reports will be reduced by 20% for each weekday they are late, including the first day. You are responsible for the major concepts presented within the reading assignments. Please notify the instructor in advance or as soon as possible (usually within 24 hours), if you are unable to be present for any class period, or to turn in a lab report. Only written proof of either a medical (health) problem or a death in the family will be accepted as an excused absence. Following University rules, we are required to check on your absence. You must bring in documentation that will allow us to verify that an illness, that has been diagnosed and that requires follow-up medical treatment, or a funeral, has resulted in an unavoidable and unplanned absence from class. This is the procedure that must be followed as required by University policies, as it applies to all students and as stipulated in this course syllabus.

DISABLED STUDENTS: If you need an accommodation based on the impact of a disability, you should contact us to arrange an appointment as soon as possible. At the appointment we can discuss the course format, anticipate your needs and explore potential accommodations. We rely on the Office of Student Life Disability Services for assistance in verifying the need for accommodations and developing accommodation strategies. If you have not previously contacted the Office for Disability Services, we encourage you to do so.

ACADEMIC MISCONDUCT: Submitting plagiarized work to meet academic requirements including the representation of another person's works or ideas as one's own: the unacknowledged use of another person's work and (or) paraphrasing of another person's work; the inappropriate or unacknowledged use of another person's ideas; and (or) falsification, fabrication, or dishonesty in reporting research results will be grounds for charges of academic misconduct.

This Publication and related material is available in alternative formats upon request. Please contact the Associate Director, School of Environment and Natural Resources, 210 Kottman Hall, 2021 Coffey Rd., Columbus, OH 43210-1085, (614) 292-2265.

**Contact Info**

| INSTRUCTOR | OFFICE HOURS |
|---|---|
| David M. Hix, Professor<br>The Ohio State University, School of Natural Resources<br>365A Kottman Hall<br>phone: (614) 292-1394<br>[Note: voice-mail is available at any time]<br>e-mail: hix.6@osu.edu | **Will be using email -**<br>Usually<br>Thursdays from 12:00-1:30 p.m.,<br>or by appointment |

## Tentative Lab Schedule

| Date | Subject |
|---|---|
| **January** | |
| 7 | Introduction to the lab portion of the course;<br>discuss the sampling design for the field work.<br>Note: The field data to be collected will be analyzed by the class. |
| 14 | open – suggest attending the EPN breakfast entitled, "The Bourbon Barrel Connection" |
| 21 | **Field trip to collect data**<br>Field trip to the former Barnebey Center property (Fairfield County) to collect data.<br>Leave at 7:30 a.m. and return approximately 4:30 p.m. Dress for the weather!<br>Bring your own provisions (lunch & snack foods and water). |
| 28 | Lab 1: Analyzing the structure of the canopy |
| **February** | |
| 4 | Lab 1 - continued |
| 11 | Lab 1 - continued |
| 18 | Lab 2: Examining the spatial patterns of trees of various sizes |
| 25 | **Midterm Evaluation** |
| **March** | |
| 3 | Lab 2 - continued |
| 10 | ***No classes – Spring Break Week*** |
| 17 | ***No classes – Spring Break Week extended*** |
| 24 | Lab 3: Interpreting the plots of diameter distributions and fitting them with the Weibull function |
| 31 | Lab 3 - continued |
| **April** | |
| 7 | Lab 4: Evaluating age distributions and radial growth patterns |
| 14 | Lab 4 - continued |
| 21 | Final considerations of the age structure and pattern of development of the Barnebey forest stand |

## Tentative Course Outline

| Dates | Subject | Tentative Reading assignments |
|---|---|---|
| **January** | | |
| 7 | Introduction to the study of successional patterns | |
| 14 | open – suggest attending the EPN breakfast entitled, "The Bourbon Barrel Connection" | |
| 21 | **Field trip to collect data**<br>Field trip to the former Barnebey Center property (Fairfield County) to collect data.<br>Leave at 7:30 a.m. and return approximately 4:30 p.m. Dress for the weather!<br>Bring your own provisions (lunch & snack foods and water). | |
| 28 | Analysis of canopy structure<br>(including vertical profiles and crown maps) | Baker and Wilson (2000)<br>Saiful and Latiff (2017) |
| **February** | | |
| 4 | Examination of tree spatial patterns<br>(uniform, random, aggregated) | Leopold *et al*. (1985)<br>Murray and D'Amato (2019) |
| 11 | Interpretation and fit of diameter distributions | Shifley and Lentz (1985)<br>Sun *et al*. (2019) |
| 18 | Age distributions | Kincaid and Parker (2008)<br>Vlam *et al*. (2017) |
| **25** | **Midterm Evaluation** | |
| **March** | | |
| 3 | Assessing radial growth increment patterns | Lorimer and Frelich (1989)<br>Trotsiuk *et al*. (2018) |
| 10 | ***No classes – Spring Break Week*** | |
| 17 | ***No classes – Spring Break Week – extended*** | |
| 24 | Disturbances in forest stands | Whitney (1990) & Larson and Green (2017) |
| 31 | Regeneration establishment;<br>gap-phase and reciprocal replacement | Runkle (1998)<br>Vickers *et al*. (2017) |
| **April** | | |
| 7 | Measurement of competition and<br>relationships with growth | Holmes and Reed (1991)<br>Harper (2017) |
| 14 | Prediction of mortality and<br>modeling individual-tree survival | Buchman *et al*. (1983)<br>Kweon and Comeau (2019) |
| 21 | Summarize & review | |
| **27** | *Final Evaluation - online* | |

## Tentative Reading Assignments

Baker, P.J., and Wilson, J.S. 2000. A quantitative technique for the identification of canopy stratification in tropical and temperate forests. Forest Ecology and Management **127**: 77-86.

Saiful, I., and Latiff, A. 2017. Stand profile topography of a primary hill dipterocarp forest in Peninsular Malaysia. Journal of Tropical Forest Science **29**: 137-150.

Leopold, D.J., Parker, G.R., and Ward, J.S. 1985. Tree spatial patterns in an old-growth forest in east-central Indiana. pp. 151-164 *in* Fifth Central Hardwood Forest Conference Proceedings. Edited by J. O. Dawson and K. A. Majerus. University of Illinois, Urbana-Champaign. Last accessed: Dec. 18, 2019. http://www.ncrs.fs.fed.us/pubs/ch/ch05/CHvolume05page151.pdf

Murray, H.F., and D'Amato, A.W. 2019. Stand dynamics and structure of two primary Champlain Valley clayplain forests, Vermont. Northeastern Naturalist **26**: 95-115.

Shifley, S., and Lentz, E. 1985. Quick estimation of the three-parameter Weibull to describe tree size distributions. Forest Ecology and Management **13**: 195-203.

Sun, S., Cao, Q.V., and Cao, T. 2019. Characterizing diameter distributions for uneven-aged pine-oak mixed forests in the Qinling Mountains of China. Forests **10**: article 596.

Kincaid, J. A., and Parker, A. J. 2008. Structural characteristics and canopy dynamics of *Tsuga canadensis* in forests of the southern Appalachian Mountains, USA. Plant Ecology **199**: 265-280.

Vlam, M., van der Sleen, P., Groenendijk, P., and Zuidema, P.A. 2017. Tree age distributions reveal large-scale disturbance-recovery cycles in three tropical forests. Frontiers in Plant Science **7**: article 1984.

Lorimer, C. G., and Frelich, L. E. 1989. A methodology for estimating disturbance frequency and intensity in dense temperate forests. Canadian Journal of Forest Research **19**: 651-663.

Trotsiuk, V., Pederson, N., Druckenbrod, D.L., Orwig, D.A., Bishop, D.A., Barker-Plotkin, A., Fraver, S. and Martin-Benito, D. 2018. Testing the efficacy of tree-ring methods for detecting past disturbances. Forest Ecology and Management **425**: 59-67.

Whitney, G.G. 1990. The history and status of the hemlock-hardwood forests of the Allegheny Plateau. Journal of Ecology **78**: 443-458.

Larson, E.R., and Green, M.A. 2017. Fire history at the confluence of the Driftless Area and Central Sand Plains of Wisconsin: A case study from Castle Mound Pine Forest State Natural Area. Natural Areas Journal **37**: 309-321.

Runkle, J.R. 1998. Changes in southern Appalachian canopy tree gaps sampled thrice. Ecology **79**: 1768-1780.

Vickers, L.A., Larsen, D.R., Dey, D.C., Knapp, B.O., and Kabrick, J.M. 2017. The impact of overstory density on reproduction establishment in the Missouri Ozarks: Models for simulating regeneration stochastically. Forest Science **63**: 71-86.

Holmes, M. J., and Reed, D. D. 1991. Competition indices for mixed species northern hardwoods. Forest Science **37**: 1338-1349.

Harper, G. 2017. Lodgepole pine and trembling aspen competition: Neighbourhood studies within 22 to 39 year-old pine plantations of northern British Columbia. Forestry Chronicle **93**: 226-240.

Buchman, R. G., Pederson, S. P., and Walters, N. R. 1983. A tree survival model with application to species of the Great Lakes region. Canadian Journal of Forest Research **13**: 601-608.

Kweon, D., and Comeau, P.G. 2019. Relationships between tree survival, stand structure and age in trembling aspen dominated stands. Forest Ecology and Management **438**: 114-122.