

WILD 595: Structural equation models for ecological data

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Office Hours: MF 0930-1050h; W 1100-1300h; Stone 307A

Lecture and lab:

0930-1050; TR, FOR 106

Prerequisites:

There are no formal prerequisite courses. However, I expect this class will be extremely difficult without at least some prior experience in R. Some previous experience using Bayesian MCMC or HMC software will also be very beneficial, although this is not required. If you're concerned, please feel free to reach out!

Grading:

This course is offered for a traditional letter grade only. It is not offered under the credit or no credit option. Please see Table 2 in this syllabus for a complete breakdown of how your grade will be calculated in this course.

Course Objective:

The objective of this course is to build familiarity with the use of causal structural equation models for ecological data, and to help you make progress towards completing your dissertation or thesis. This will include qualitative construction of models based on existing evidence in the literature and specific hypotheses developed by the student, as well as quantitative estimation of 'pathways' among variables. Throughout the course, we'll use paradoxical examples from ecology and other fields to clarify the need for structural/causal thinking in statistics when using observational data. Students will gain familiarity with data handling, a number of R packages including 'lavaan' and 'blavaan,' and constructing their own Bayesian structural equation models. The primary goal of the class is for students to explore the use of SEMs with their own data, but the instructor can provide or simulate data if this is untenable.

Readings:

Assigned readings from textbooks and scientific journals will be posted on Moodle at least one week prior to class.

Exams and quizzes:

There are no exams or quizzes.

Assignments and reports:

The primary assignment in the course will be for you to develop a Methods and Results section for one chapter of your thesis or dissertation. If you haven't yet completed data collection, please don't be concerned. It's generally relatively straightforward to simulate data in the same format as the data you'll eventually be analyzing.

In addition, there will be short homework assignments following each of the first six weeks. These will primarily consist of R scripts for your review with a few short questions attached in which you might be asked to modify code, or run similar analyses with different data.

Table 1. Tentative lecture and lab schedule.

WEEK	DATE	TOPIC	ASSIGNMENT
Section 1			
Week 1	Aug 27 Aug 29	Introduction: why SEM? why Bayes? Notation, distributions, and priors	
Week 2	Sep 3 Sep 5		
Week 3	Sep 10 Sep 12	linear models: lm() vs. brms() vs. custom Random and fixed effects	Potential proposal topic due
Week 4	Sep 17 Sep 19	glm() & link functions Egad! Multicollinearity!	
Section 2			
Week 5	Sep 24 Sep 26	Understanding direct & indirect effects SEMs: lavaan() vs. blavaan() vs. custom	
Week 6	Oct 1 Oct 3	Latent variables Latent variables continued	
Week 7	Oct 8 Oct 10	Composite covariates Cross lags	Final topic due
Section 3			
Week 8	Oct 15 Oct 17	Path analysis: resource selection functions Path analysis: reproductive success	
Week 9	Oct 22 Oct 24	Path analysis: occupancy models SEM: 'body condition' & 'individual quality'	
Week 10	Oct 29 Oct 31	Cross lags: density-dependence Cross-lags: life-history trade-offs	
Week 11	Nov 5 Nov 7	Concluding thoughts and coding assistance Coding assistance in classroom	
Section 4			
Week 12	Nov 12 Nov 14	Coding assistance in classroom Coding assistance in classroom	
Week 13	Nov 19 Nov 21	Coding assistance in classroom Coding assistance in classroom	
Week 14	Nov 26 Nov 28	Student presentations Holiday	
Week 15	Dec 3 Dec 5	Student presentations Student presentations	Final project due

Table 2. Grading.

Category	Description	Date	Points	%
Project	Potential topic		10	6.25
	Final topic		10	6.25
	Final project		80	50
Participation	Contributing to discussion and labs		60	37.5
Total			160	

Table 3. Tentative reading schedule.

Date	Day	Reading(s)
Week 1	Aug 27	Wright 1918, 1931; Burks 1926
	Aug 29	Banner et al. 2020, Lemoine 2019, McCarthy & Masters 2019
Week 2	Sep 3	
	Sep 5	
Week 3	Sep 10	
	Sep 12	
Week 4	Sep 17	
	Sep 19	
Week 5	Sep 24	
	Sep 26	
Week 6	Oct 1	
	Oct 3	
Week 7	Oct 8	
	Oct 10	
Week 8	Oct 15	
	Oct 17	
Week 9	Oct 22	
	Oct 24	
Week 10	Oct 29	
	Oct 31	
Week 11	Nov 5	
	Nov 7	
Week 12	Nov 12	
	Nov 14	
Week 13	Nov 19	
	Nov 21	
Week 14	Nov 26	
	Nov 28	
Week 15	Dec 3	
	Dec 5	

Course website:

The course will be hosted on GitHub.

Diversity Statement:

Consistent with the UM Diversity, Equity, and Inclusion Plan, I will strive to include the representation of different identities, characteristics, experiences and perspectives of all students. I will aim to offer everyone what they need to succeed by increasing access, resources, and opportunities for all, especially for those who are systematically underrepresented and have been historically disadvantaged. I desire to create a welcoming learning environment in which differences are celebrated and everyone is valued, respected, and able to reach their full potential.

Land Acknowledgment:

The University of Montana acknowledges that we are in the aboriginal territories of the Salish and Kalispel people. Today, we honor the path they have always shown us in caring for this place for the generations to come.

Student Conduct:

Please reference the Student Conduct Code for any questions about student conduct. Briefly, do not use cell phones during class time. Cheating or plagiarism on any assignment or exam can result in a 0.

Add/Drop dates and overrides:

Please come speak with the instructor as soon as possible if there are any lingering override issues. September 16th is the last day to drop spring classes on Cyberbear with no 'W' (withdrawl) on your transcript and receive any applicable refunds. Oct 29th is the last day to drop the course and receive a 'W,' drops between Oct 30 and Dec 1 will receive a 'WP' or 'WF'. Please see this webpage (<https://www.umt.edu/registrar/calendar/autumn/default.php>) for more information.

Campus Resources

Mental Health Resources:

College students often experience issues that may interfere with academic success such as academic stress, sleep problems, juggling responsibilities, life events, relationship concerns, or feelings of anxiety, hopelessness, or depression. If you or a friend is struggling, we strongly encourage you to seek support. Helpful, effective resources are available on campus.

If you are struggling with this class, please visit during office hours or contact me by email.

Check in with your academic advisor if you are struggling in multiple classes, unsure whether you are making the most of your time at the University of Montana.

Reach out for Support-Curry Health Center Counseling-to make a counseling appointment call 406-243-4712 or email mary.rust@mso.umt.edu.

If you feel that you would benefit from general wellness skills to support your overall stress, reach out to Curry Health Center Wellness: 406-243-2809.

If you are experiencing a mental health crisis and seeking immediate help, call 911, go to the nearest hospital emergency room or call Campus Safety at (406) 243-4000.

If you have experienced sexual assault, relationship violence, bullying, intimidation, or discrimination contact Student Advocacy Resource Center (SARC): 406-243-4429; 24-hour support line: 406-243-6559.

COVID-19 Resources:

Curry Health Center is offering COVID-19 vaccines to anyone who would like one.

Curry Health Center offers free COVID-19 testing to UM students.

If you have COVID symptoms, please get a COVID test at Curry Health Center. To assist with contact tracing, please sign the self-disclosure form so that if you test positive, Curry can share this information with the health department and the University.

If you test positive for COVID, you will be required to self-isolate, per Missoula City/County Health Department protocol. Please let me know so I can help you to receive materials and keep up with the class.

If you need to attend class remotely, please take advantage of these resources for online and remote students.

Accessibility and Office for Disability Equity:

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or have a disability that adversely affects your academic performance, and you have not already registered with the Office for Disability Equity (ODE), please contact ODE in Lommasson Center 154 or 406.243.2243. I will work with you and ODE to provide an appropriate modification.

Cultural Leave Policy:

UM has a Cultural and Ceremonial Leave Policy: “Cultural or ceremonial leave allows excused absences for cultural, religious, and ceremonial purposes to meet the student’s customs and traditions or to participate in related activities. To receive an authorized absence for a cultural, religious or ceremonial event the student or their advisor (proxy) must submit a formal written request to the instructor. This must include a brief description (with inclusive dates) of the cultural event or ceremony and the importance of the student’s attendance or participation. Authorization for the absence is subject to approval by the instructor. Appeals may be made to the Chair, Dean or Provost. The excused absence or leave may not exceed five academic calendar days (not including weekends or holidays). Students remain responsible for completion or make-up of assignments as defined in the syllabus, at the discretion of the instructor.”

Food Pantry Program:

UM offers a food pantry that students can access for emergency food. The pantry is open on Tuesdays from 12 to 5 PM and Fridays from 10 AM to 5 PM. The pantry is located in UC 119 (in the former ASUM Childcare offices). Pantry staff operate several satellite food cupboards on campus (including one at Missoula College). For more information about this program, email umpantry@mso.umt.edu, visit the UM Food Pantry website or contact the pantry on social media (@pantryUm on twitter, @UMPantry on Facebook, um_pantry on Instagram).

ASUM Renter Center:

The Renter Center has compiled a list of resources (<https://medium.com/griz-renter-blog>) for UM students at risk of homelessness or food insecurity. Students can schedule an appointment with Renter Center staff to discuss their situation and receive information, support, and referrals.

TRiO Student Support Services:

TRiO serves UM students who are low-income, first-generation college students or have documented disabilities. TRiO services include a textbook loan program, scholarships and financial aid help, academic advising, coaching, and tutoring. Students can check their eligibility (www.umt.edu/triosss/apply.php) for TRiO services online. If you are comfortable, please see members of the teaching team. We will do our best to help connect you with additional resources.