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COURSE DESCRIPTION

WIS 5496: Research Design in Wildlife Ecology and Conservation

ROOM 3096 MCCARTY HALL B -- 3-5 PM -- TUES & THURS

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INSTRUCTOR:	DR. KATIE SIEVING -- 318 NEWINS-ZIEGLER HALL
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OFFICE HOURS:	Book office hours → https://chucao.youcanbook.me
	VARIOUS TIMES ON M AND W -- In Person or Zoom
WEBSITE:	E-LEARNING IN CANVAS -- HTTPS://LSS.AT.UFL.EDU/

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OVERVIEW AND COURSE GOALS

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WIS 5496 is for graduate students studying ecological disciplines related to conservation in the developmental phase of their research. This course begins with the logic and philosophy underlying scientific testing, and proceeds to the organization of rigorous research and sampling designs. While this is **not** a **statistics** or **methods** class, you will identify types of analyses and methodologies you will need to do your research correctly. However, you **will not** crunch numbers or **collect** data, but you **will** organize your thesis / dissertation research and complete a stunning research proposal for your committee and funding applications.

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COURSE MODULES

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MODULE I. ESSENTIAL SCIENCE PHILOSOPHY FOR ECOLOGISTS

What forms of truth does society expect of scientists? We will examine key historical themes defining current approaches in ecology. You will understand the fundamental importance of the **hypothetical deductive method** (HDM) and its adaptation in the effective use of both major **testing criteria** (falsification, confirmation). *Ecology relies 90% on* **confirmation**, *not* **falsification**, *but most ecologists don't know this because of a failure of philosophy to stand up and show them.* We will explore the common **modes** of scientific testing (verification, manipulation, comparison, correlation) and the various **types of inference** (causal, predictive, descriptive, and explanatory power) characteristic of new knowledge we create as scientists. We highlight the role of **theory** in guiding your work; how theories are constructed, tested, and how they evolve. Further, you will find and clarify a **theoretical framework** for your graduate research.

## MODULE II. RESEARCH DESIGN: STUDY STRATEGY, LOGIC, ORGANIZATION

Research design defines the **strategy** of your research (Fig 1). You will construct your studies plank by plank. What are your overall, and specific, **research aims**? How exactly do you state your **objectives**, **hypotheses**, critical **tests**, and **predictions**? How do you identify key **assumptions** you are making and how do you identify and deal with alternative/**confounding factors**? What is the scale / content of your study **domain**? What **theoretical framework** will provide the best context for your research? What **constraints** do you face? What type of **inferential power** is required [causal, predictive, descriptive, or explanatory] to reach your research goal? Which **design type** will get the inference you need [descriptive, case-control, comparative, (quasi-) experimental, modeling, meta-analysis, etc.]? What, specifically, belongs in the <u>beginning</u> of your **research proposal** [Introduction, Background,], <u>middle</u> [Research Objectives & Design, Proposed Methods] and <u>end</u> [Synthesis & Significance] of your proposal?

Sampling design defines the **tactics** of your research (Fig. 1). Here we establish the principles / steps in creating a **rigorous sampling design** including **power analysis** (min. sample size estimation); choice of **methods** (including statistical analysis approaches); layout of your **variable structure** for each analysis (predictors, responses, their measures and predicted relationships); & **alignment** of your hypothesis tests with specific predicted outcomes expressed as statistical hypotheses.

Part of the fun is that we also examine adjacent aspects of life as a conservation scientist. As an ecologist, **statistical modeling** is key to your survival. You need to keep abreast of different analysis philosophies so you can adapt them to your needs. *[Bayesians, frequentists, information theorists, & machine learners are cooking up new analyses of interest each day!]*. **Ethics** come in various forms as well. For example, the ethical rationality of your research design is a consideration that **conservation scientists** must consider. Also, day to day **conflicts** in science (over data, personality, attribution) inevitably arise for all scientists, so we will examine **ethical theories** that can aid you in deciding how to act when confronted with conflict.

Figure 1. This class will give you confidence to conduct the correct study (best **STRATEGY**) and to conduct rigorous sampling (strongest **TACTICS**) so that your work will improve knowledge and practice. You want to always be in the **top right** quadrant. Otherwise, your science is not very good.
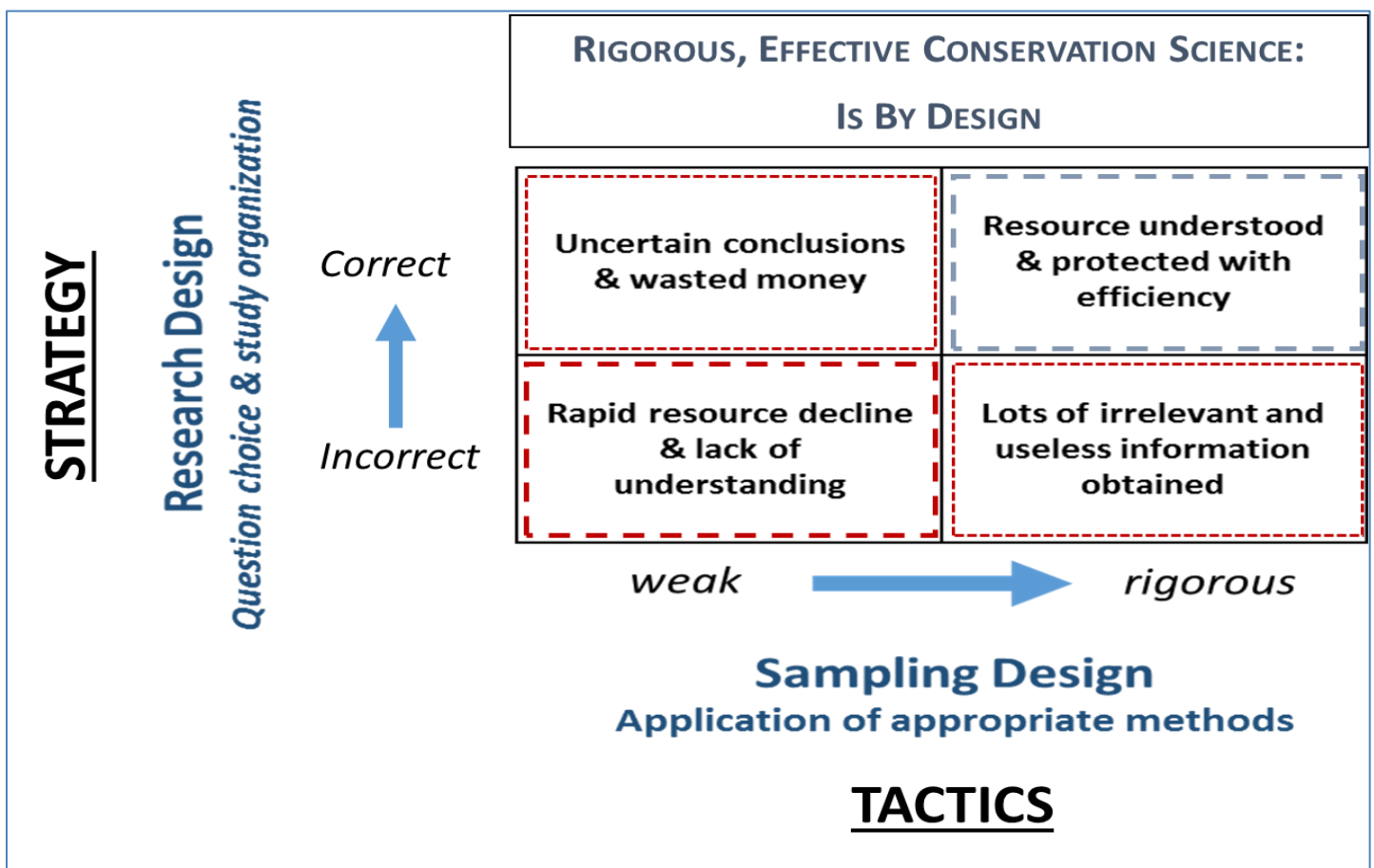
*Doing the **correct study poorly** (top left) or the **wrong study well** (bottom right) are <u>worse</u> options than doing the wrong study poorly (bottom left). Why!? Because people may actually think you did ok.*

<u>Specific Learning Objectives:</u> <u>You will understand..</u>
1. essential science philosophy/history; how "new" pluralism unites & invigorates natural science;
2. the structure, dynamics and utility for you of ecological theories, paradigms, and theory frameworks;
3. how hypothetical-deduction is a foundational logic of rigorous science;
4. how to apply different testing criteria, testing modes, and a full toolbox of research design groups;
5. best practices in sampling design, and how to deal effectively with sampling constraints;
6. how conservation objectives and ethics can influence study design, analysis, and interpretation of data;
7. how to organize and write an effective research proposal for different funding sources.

<u>Grading:</u>		
	Participation (attendance, preparation, in class presentation)	100
	Timely Homework exercises	200
	3 exams (125 pts each)	375
	Final Proposal	100
	Proposal Peer Review	100
	Total points	**875**

<u>Exams:</u>   Will be part take-home (written essay), and part in-class (short answers).
<u>Required Texts:</u>   None need to be purchased – all readings will be linked via CANVAS.

<u>Grading Philosophy:</u> I will not be grading your research topic or choice of research approach in this class.
I grade on effort (assignments/homework), participation, preparation, & improvement in research plan.
- Hard work in my class will directly benefit your research and your development as a scientist.
- Course grade will be determined on a percentage accumulation of total points (94% or more = A; 90-93% = A-; B+ = 87-89%; B = 84-86%; B- = 80-83%; C+ = 77-79%; C = 74-76%; etc.), unless application of a curve becomes necessary. UF grading policy: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

<u>Participation Points & Absences:</u> Complete your written homework and paper assignments on time! Late HW will lose points (5) each class they are late. Extended excused absences must be consistent with policies in the Catalog. See https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. **In my class** - just let me know when and why you can't be there, then it is YOUR responsibility to get with other students and catch up!

<u>Prepare for discussions in class:</u> I may assign students to lead discussions of assigned readings. Be prepared to lead (and contribute to) lively and thorough discussions that highlight understanding of the key concepts.

<u>Keep a reading journal:</u> It is the best way to prepare for discussions of readings! For each assigned reading, we will list the key concepts to know – write explanations of these concepts based on readings and then address any questions you have in class during discussions. Writing improves learning.

<u>Be professional in your peer reviews of others' work</u>: You will be required to critique (not edit) drafts of others' research proposals. Follow guidelines and give these reviews your best effort.

<u>AI and chatbots:</u> I will encourage you to utilize bots intelligently as useful tools in various aspects of scientific work, but large portions of exams will be done by **putting pencil to paper.** Make sure you understand and can write all your assignments yourself.

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. These evaluations are conducted online at https://evaluations.ufl.edu. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results.

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment. For more information on the Student Honor Code, please see: https://sccr.dso.ufl.edu/wp-content/uploads/sites/4/2018/08/The-Orange-Book-Web.pdf.

Software Use: All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate. Head for the **Help Desk** with ANY tech or software questions! https://helpdesk.ufl.edu/

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/. The DRC requires a testing contract for administering tests at the DRC, the terms of which must be defined by the student with their professor. ***Please let me know NOW*** if you need an accommodation.

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance. University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/. https://counseling.ufl.edu/services/guide-to-services/#clinical

Counseling Services:
- Groups and Workshops / Outreach and Consultation / Self-Help Library / Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Student Complaints:

- Residential Course: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

Recording in Class: As ever, you are free to record lectures in class, but please respect the privacy of your peers regarding their contributions to class dialogue. Please read https://aa.ufl.edu/policies/in-class-recording/, because it severely restricts your rights to share recordings with others – even study buddies.

FL Board of Governors Anti-Discrimination Regulation 10.005: In UF classrooms, this bill "… prohibits discrimination on the basis of race, color, national origin, or sex by subjecting any student or employee to training or instruction that espouses, promotes, advances, inculcates, or compels such student or employee to believe any of the concepts as defined in paragraph (1)(a) (see this document)."

Use of AI Chatbots – These are very useful tools if used intelligently (**your** intelligence far supersedes 'raw' AI when producing **your** own work). We will encourage sophisticated, learning-enhancing uses and discourage lazy uses.

MODULE I. *Essential SCIENCE PHILOSOPHY FOR ECOLOGISTS*				
See Canvas for readings, reading concepts, and assignments // * SciPhi = Science Philosophy				
FALL '24	**TOPICS** (readings/assignments posted on CANVAS)		**Readings**	**Work Due** (Th)
Week of	**Tuesday**	**Thursday**		
Aug 20/22	----	**Course overview:** Science, history, philosophy, ecology, conservation & y'all	T: -- Th: Pickett ch1&2;	
Aug 27/29	**1600-1930 SciPhi*:** **Inductivism** & **Logical positivism,** Statements & meaning; induct, abduct, deduct; covering laws, covering law model of theory, <u>verifiability criterion</u>	**1930-1990 SciPhi:** **Falsificationism,** Conjecture & refutations, strong inference; reductionism; <u>falsifiability criterion</u>	T: **G**illies ch1; Th: **G**illies ch2; **P**latt1960	**HW1**: Reading Concepts
Sep 3/5	**1990-2010 SciPhi:** **Confirmationism,** <u>confirmation criterion</u>, confirmation bias, explanatory surplus, variety of evidence	**2000-now SciPhi:** **Pluralism,** Multicausality, hypothetical deduction and hypothesis-testing in real ecosystems.	T: **G**illies 1988; Lloyd ch8 Th: **Q**uinn&**D**unham; **S**avidge; **O**stfeldt&**K**eesing	**HW2**: WOS & Literature Review
Sep 10/12	**Modern Theory:** Theory content & ontogeny; paradigms & sub-disciplines; theory as framework & knowledge	**Modern SciPhi:** *Testing* hypotheses vs theories	T: **G**odfrey-Smith ch5; Pickett ch3&4; Thompson et al. 2020 Th: **P**ickett ch3&4;	**HW3**: My Theoretical Framework
Sep 17/19	**Review!** "Gainesville Circle" **Debate**: Testing, Theory & Objective Truth	# Midterm 1	T: Review all readings/notes; Pickett chs1&2, onward Th: --	

MODULE II. RESEARCH DESIGN: STRATEGY, LOGIC, INFERENTIAL GOAL				
FALL '24	**TOPICS** (readings/assignments posted on CANVAS)		**Readings**	**Work Due** (Th)
Date	Tuesday	Thursday		
Sep 24/26	**Research Proposal** Construction / Assessment	**Scientific Inference**: descriptive, causal, predictive (& more!) **Descriptive inference:** How science begins	T: TBA Th: TBA	**HW4**: Conceptual / Logic Diagrams
Oct 1/3	**Causal Designs 1:** *True & Quasi-experiments*; seek all 3 criteria for cause/effect (falsifiability)	**Causal Designs 2:** *Causal-comparative studies*; workhorse of ecology; uses confirmation to fulfill criteria	T&Th: James/McCulloch Cambell & Stanley	**HW5**: 2-page NSF proposal
Oct 8/10	**Causal Designs 3: Case-control causal designs;** sampling on outcomes w/screening & matching for hypothesis-testing. (Cancer anyone?)	**Predictive Designs: Sampling on outcomes** for correlation, prediction, & hypothesis-generation. • SDM, p/a; p-only • Use-availability • LULCC analyses	T: TBA Th: TBA	
Oct 15/17	**Other approaches** • systematic reviews, • meta-analysis, • modeling **Projects vs Programs** • MS, PhD, Career	**Design Practice & Diagnosis 1:**	T: TBA; Pickett et al. Ch 6 Th: TBA papers	**HW6:** <u>Outline</u> Proposal Background; <u>Complete</u> Research Objectives
Oct 22/24	**Design Practice & Diagnosis 2:**	Midterm 2	T: TBA papers	

MODULE III. *Sampling Design: Tactics, Rigor, Feasibility*

FALL '24	TOPICS (readings/assignments posted on CANVAS)			
Week of	Tuesday	Thursday	Readings	Work Due (Th)
Oct 29/31	**Ethics 1:** **Ethical theories** for confronting dilemmas scientists experience	**Sampling Design 1:** Scope, Baseline data, Sample units - Variable structure; (what r u measuring?)	T: Peach readings Th: Rooftop Biodiversity; Quinn & Keough	**HW6:** Advisor interview
Nov 5/7	**Sampling Design 2:** Sources of variability by design and how to reduce/control/use them	**Sampling Design 3:** Sampling & randomization strategies - purpose of randomization in ALL designs	Quinn & Keough	
Nov 12/14	**Sampling Design 4:** *Avoiding fatal flaws (a);* non-independent sampling, confounding factors, scale issues	**Sampling Design 5:** *Avoiding fatal flaws (b);* Rectifying variability and effect size with adequate sample size (power analysis)	Quinn & Keough	**HW7**: Proposal draft with Methods
Nov 19/21	**Sampling Design 6:** *Data analysis camps;* Frequentists, Bayesians, Simulators (*Monte Carlo/Markov*), and Algorithm Junkies (*e.g., machine learning, big data)*	**Ethics 2:** *Ethical rationality in conservation;* Minimizing error in statistical decision-making; Type II Error *as well as* Type I Error	T: TBA Th:	
Nov 26/28	Peer review of proposals NO CLASS	Thanksgiving NO CLASS		**HW8 & 9**: Proposal draft Due - swap
Dec 3/5	Midterm 3	READING DAY – No Class		
NO FINAL EXAM but you will hand in Final Proposal (HW10) with completed graphical abstract - Finals Week				