



NR 421 Natural Resource Sampling COURSE SYLLABUS

Department of Forest and
Rangeland Stewardship
Warner College of Natural Resources

	Instructor	Teaching Assistant
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	Term:	Spring 2023
	Class Meeting Days:	Monday, Wednesday, and Friday
	Class Meeting Hours:	10:00 – 10:50am
	Class Location:	Weber 202
	Course Credits:	3

Welcome!

This class builds upon NR 220 (Natural Resources Ecology and Management) and ST301 (Introduction to Statistics). We will use various sampling designs and statistical theories to better understand AND explain the world around us. Our goal is help provide you with the critical skills and analytical insights for sustainable stewardship of our collective natural resources.

Course Overview

This course provides an overview of the theory, principles, and process involved in collecting, processing, and interpreting sampling data of natural resources. This is intended to provide an understanding of the sampling designs and statistical approaches commonly implemented within natural resource management.

It primarily focuses on the statistics and theory of natural resources and management sampling, including topics such as simple random sampling, stratified random sampling, systematic sampling, cluster sampling, and multiphase sampling. A major objective of the course is not only for students to learn the basics of sampling design but instill the importance of appropriate designs and what they mean for the standard error of the mean.

The course will reinforce these principles through a term project, where students will develop, implement, analyze, and report on a natural resource survey.

Course Goals and Objectives

This course should enable students with the following skills and knowledge:

1. Students should be able to **rephrase** the importance of the Law of Large Numbers and Central Limit Theorem to probability-based sampling.
2. Students should be able to **interpret** how steps within the Sampling Process fit together and how this is utilized in broader natural resource monitoring.
3. Students should be able to **discuss** and **justify** different approaches to determining sample size.
4. Students should be able to **describe** the structure and limitations of common sampling designs (i.e., simple random sampling, stratified random sampling, cluster sampling, and unequal probability sampling).
5. Students should be able to **evaluate** and **justify** the use of different types of multiphase sampling.
6. Students will **demonstrate** the ability to analyze datasets collected using common sampling designs.
7. Students should be able to **articulate** the results of a natural resource survey through written and visual presentations.

Course Prerequisites

ST301 (Introduction to Statistics) or equivalent and NR220 (Natural Resources Ecology and Measurements)

Required Texts and Materials

- Text: Scheaffer, Mendenhall, Ott, and Gerow. 2011 Elementary Survey Sampling (6th or 7th editions will suffice). Durbury Press.
- Scientific Calculator
- Supplementary (Optional) Texts and Materials will be provide by the instructor and posted on Canvas

Covid Information

The university's COVID information is at <https://covid.colostate.edu/>.

CSU's Land Acknowledgment Statement

Colorado State University acknowledges, with respect, that the land we are on today is the traditional and ancestral homelands of the Arapaho, Cheyenne, and Ute Nations and peoples. This was also a site of trade, gathering, and healing for numerous other Native tribes. We recognize the Indigenous peoples as original stewards of this land and all the relatives within it. As these words of acknowledgment are spoken and heard, the ties Nations have to their traditional homelands are renewed and reaffirmed.

CSU is founded as a land-grant institution, and we accept that our mission must encompass access to education and inclusion. And, significantly, that our founding came at a dire cost to Native Nations and peoples whose land this University was built upon. This acknowledgment is the education and inclusion we must practice in recognizing our institutional history, responsibility, and commitment.

<https://landacknowledgment.colostate.edu>

This is an Inclusive Classroom

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Source: <https://education.uiowa.edu/office-dean/policies/syllabus-checklist>

CSU's Principles of Community: <https://diversity.colostate.edu/resources/principles-of-community/>

- **Inclusion:** We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents, and contributions.
- **Integrity:** We are accountable for our actions and will act ethically and honestly in all our interactions.
- **Respect:** We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.
- **Service:** We are responsible, individually, and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.
- **Social Justice:** We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Library & Research Help

The CSU Libraries Help Desk provides both research (ph. 970-491-1841) and technical (ph. 970-491-7276) support. You can also email a librarian a research question (https://libanswers.colostate.edu/form?queue_id=332) or chat with the Libraries (<https://lib.colostate.edu/services/ask-us/>) for quick help. Explore an online research guide at <https://libguides.colostate.edu/agnatresourcesguides>.

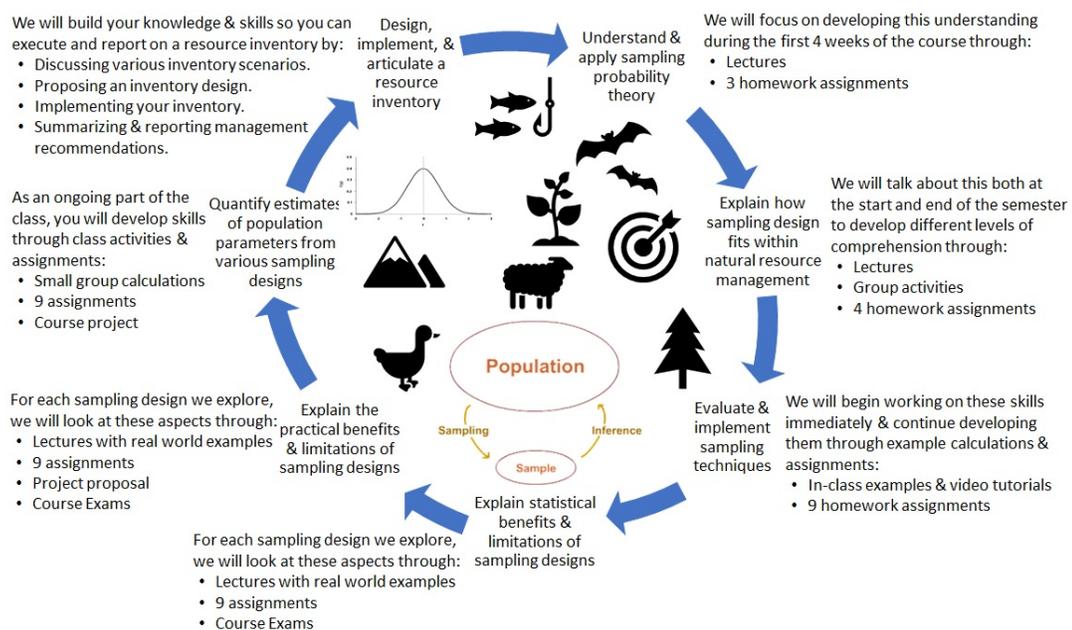
Important Dates to Remember

Last Day to Add/Drop Classes Without an Instructor Override: Sun, January 22, 2023
Registration Closes: Wed, February 1, 2023
Withdrawal and Repeat/Repair Deadline: Fri, April 14, 2023
Fall 2023 Registration begins: Mon, April 3, 2022 (check RamWeb for specific access date and time)
Spring Recess: Sat, March 11 – Sun, March 19, 2023
Last Day to Process a University Withdrawal: Fri, May 5, 2023
Final Examinations: Mon-Fri, May 8-12, 2023

Useful websites with important dates to remember

<https://registrar.colostate.edu/registration-dates/> (on campus)
<https://www.online.colostate.edu/faqs/important-dates.dot#fall> (CSU Online)

Graphical Depiction of Course Objectives



Course Schedule and/or Schedule of Assignments

Dates and content are tentative and any changes will be communicated in-person and via Canvas

Week	Lecture Topics	Readings	Important Dates
Week 1	Course Overview & Numbers in Natural Resources		
Week 2	Foundations of Natural Resource Sampling Statistics Demystified	Chapter 2 <i>Statistics for Practical People</i>	
Week 3	Monitoring Made Sensible Review of Sample Types	Chapter 3 <i>Distributions, Standard Deviations, & Confidence</i>	Assignment 1 Due Monday
Week 4	Simple Random Sampling Sample Size Estimation	Chapter 4	
Week 5	Sample Size Estimation Continued		Assignment 2 Due Friday 'Shiny' Random Sampling Exercise Due Friday
Week 6	Systematic Sampling	Chapter 7 Chapman - "Plot Spacing"	
Week 7	Stratified Sampling	Chapter 5	Assignment 3 Due Wednesday 'Shiny' Systematic Sampling Exercise Due Friday
Week 8	Exam 1		Project Proposal Due Monday Assignment 4 Due Friday
UNIVERSITY-SANCTIONED BREAK: March 11 - 19			
Week 9	Exam 1 critique Double Sampling	Chapter 6 Iles – "BigBAF Sampling"	'Shiny' Stratified Sampling Exercise Due Monday
Week 10	Double Sampling continued	Tinkham et al. 2016	Assignment 5 Due Wednesday
Week 11	Cluster and Multi-Phase Sampling	Chapter 8 & 9 Cluster Sampling in a Nutshell	Assignment 6 Due Wednesday 'Shiny' Multi-Phase Sampling Exercise
Week 12	Developing Management Objectives Detecting Change	Writing Resource Objectives Elements of Sampling Design / Objectives	Project Memo Due Friday
Week 13	Exam Review Exam 2 Exam 2 critique and work time		Assignment 7 Due Friday
Week 14	Technology in Monitoring Project Presentations		Project Presentation Due Tuesday Assignment 8 Due Friday
Week 15	Other Things and Stuff		Project Report Due Wednesday
Final Exam – THURSDAY May 11th at 11:50am – 1:50pm			

Assignments

Assignments consist of numerical interpretation, data analysis, and critical thought exercises. Students are encouraged to work together, but all work handed in must be your own. You are required to show your work, credit will only be awarded if students show their work and doing so allows for partial credit. Be sure to double-check your answer for proper units and to determine if your answer is reasonable. *Failing to label units will result in a 50% deduction on the question.*

Each assignment will be available on the course website and should be handed in by the assigned time on Canvas. The lowest graded assignments will be dropped from your final grade (we all have bad weeks). Written answers can be typed in the provided box, and feel free to expand the box and use spell-check.

Practical Project

The course will develop the skills needed for students to complete an independent sampling practicum (you must collect data to analyze in the class). This practicum will require students to perform a preliminary evaluation from a site visit or previously collected data to determine the most feasible, rigorous, and statistically viable approach of sampling the population they define with appropriate management objectives in mind.

This will be formalized in a sampling proposal that should include information on the number, type, and protocols that will be used to locate and collect sample units. You must justify the techniques that you use in terms of both efficiency and statistical rigor. Then students will conduct their proposed inventory and generate a memo to update the client on their progress and any issues that arise.

This will be followed up by a formal report that summarizes the current conditions of the population in question and makes suggestions as to appropriate management actions to achieve the relevant management objectives. The finalized survey will be analyzed and presented as both a term paper and a presentation. A large component of this project will be evaluated based on your ability to use technical writing to convey statistical concepts.

Quizzes and Exams

Quizzes will generally consist of a short answer and a quantitative question with quizzes happening on Canvas approximately every couple of weeks. The two mid-term exams will be a combination of short answers, multiple-choice, True/False, and matching, with 2-4 simplified quantitative questions. These are designed to assess your understanding of key course concepts and your critical thinking ability. *All quizzes and exams are open notes, but notes must be on paper.*

Basis for Final Grade

Instructor reserves the right to adjust and alter assessments and due dates based on the progress of individuals or the class. All changes will be communicated in-person and via Canvas

Assessment	Points
Assignments (7/8)	350
Exams (2)	160
Quizzes (8 to 10)	100
Exercises (3 or 4)	80
Project Proposal	50
Project Memo	40
Project Presentation	40
Project Report	100
Final Exam	80
	1000

Letter grade assignment will be based on: A: 900-1000, B: 800-899, C: 700-799, D: 600-699, F: < 600 points.

GRADE	A	B	C	D	F
RANGE	90 – 100%	80 – 89%	70 – 79%	60 – 69%	< 60%

Canvas Information and Technical Support

Canvas is an online learning management system where course content, grades, and communication including due dates will reside for this course.

- Login: canvas.colostate.edu
- Support: <https://canvas.colostate.edu/support/>
- For passwords or any other computer-related technical support, contact the Central IT Technical Support Help Desk: <https://www.acns.colostate.edu/technical-support-services/>
- Voice: (970) 491-7276 | Email: help@colostate.edu

The Support pages identify the browsers, operating systems, and plugins that work best with Canvas. If you are new to Canvas quickly review the Canvas Student Orientation materials.

Course Policies

Late Work Policy

All late assignments will receive a **20% reduction** in credit for one week, after which the late assignment will not be accepted for credit. Students must notify the instructors at least 1 week before missing an assignment, report, quiz, or exam, or they will not be allowed to make it up.

Extra Credit Policy

Extra credit will be available through in-class example questions and questions related to assigned readings. You may earn a maximum of **50 points extra credit**, but it will only count toward your overall course grade if you earn a passing grade in the course. Meaning you can use it to improve your grade but not to simply pass the class, this is because you must first demonstrate a certain level of mastery of the material.

Grades of "Incomplete"

Per university policy, an instructor may assign temporary grade of Incomplete to a student who demonstrates that he or she could not complete the requirements of the course due to circumstances beyond the student's control and not reasonably foreseeable. A student must be passing a course at the time that an Incomplete is requested unless the instructor determines that there are extenuating circumstances to assign an Incomplete to a student who is not passing the course. When an instructor assigns an Incomplete, he or she shall specify in writing using the Department Incomplete Grade Form the requirements the student shall fulfill to complete the course as well as the reasons for granting an Incomplete when the student is not passing the course. The instructor shall retain a copy of this statement in his or her grade records and provide copies to the student and the department head or his or her designee. (Section I.6 of the *Academic Faculty and Administrative Professional Manual*). For more information: <https://registrar.colostate.edu/incomplete-grades/>

Disability Access

Colorado State University is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations must first contact the Student Disability Center before requesting accommodations from the professor. The Student Disability Center (SDC; <https://disabilitycenter.colostate.edu/>) is in room 121 of The Institute for Learning and Teaching (TILT) building. Their phone is (970) 491-6385 (V/TDD). Students who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations.

Attendance Policy

Life is complicated and we all have many challenges to balance our academic, professional, and personal obligations. We may find ourselves overworked, under-appreciated, and exhausted. We may have a great opportunity that conflicts with other priorities. A critical aspect to professionalism (see below) is timely communication. Please let the instructors know when you are unable to attend *prior to class* (barring emergencies) so we can find an alternative means to deliver this content. Missing class without a plan will negatively impact the experience of your peers, instructors, and yourself.

Students who will miss class due to participation in university-sanctioned extracurricular/co-curricular activities must inform their instructors prior to the anticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict regarding this policy, individuals may appeal using established University procedures.

For the purposes of this regulation, University-sanctioned activities include competitions, events and professional meetings in which students are officially representing the institution. Appropriate sanctioned activities include:

- a. Intercollegiate athletics;
- b. Collegiate club sports and competitions;
- c. Conferences and workshops recognized by the University not related to academics;
- d. Commitments on behalf of the University (ASCSU, band, etc.); and
- e. Professional activities recognized by the University related to academics.
- f. Department heads or their designated representatives must approve sanctioned professional and departmental activities. Other sanctioned activities must be approved by the appropriate program director on record with the Division of Student Affairs offices or the Department of Athletics.

Religious Accommodation

Participation in official University activities, e.g., an out-of-town athletic event, or special religious observances may provide a legitimate reason for an excused absence. The student is responsible for discussing this with the instructor at the beginning of the semester.

Final Exam Policy

Final examination week is part of the regular semester. Student attendance shall be consistent with university policy. If a student has three or more final examinations (not classes) scheduled for the same day or if conflicts of examination times occur, the student may negotiate a time change with the instructors involved. If the parties involved cannot find a mutually agreeable time, the Registrar's Office indicates which courses must be changed.

Note: The Registrar's Office must be notified at least one week prior to Final Examination Week to allow instructors time to make appropriate accommodations. It is the student's responsibility to initiate negotiations.

<http://www.registrar.colostate.edu/final-exams>

Professionalism Policy

Per university policy and classroom etiquette, mobile phones, iPods, smart watches, *etc.* **must be silenced** during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, *etc.*, and have been warned and may suffer a reduction in their final class grade.

When emailing the instructor or TA, please include your full name, CSU ID, and the course number in your email.

Academic Integrity

The Department of Forest and Rangeland Stewardship takes academic integrity seriously. At minimum, academic integrity means that no one will use another's work as their own. You can find an overview and CSU's definition of plagiarism here: <https://writing.colostate.edu/guides/guide.cfm?guideid=17>.

If you plagiarize you could lose credit for the plagiarized work, fail the assignment, or fail the course. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (under "Academic Integrity/Misconduct":

<http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/>).

This course will adhere to the CSU Academic Integrity Policies and Guiding Principles (<https://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity>) as found in the General Catalog and the Student Conduct Code (<https://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#student-conduct-code>).

Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask that you affirm the CSU Honor Pledge as part of completing your work in this course.

Further information about Academic Integrity is available at CSU's Practicing Academic Integrity: <https://tilt.colostate.edu/Integrity/StudentResources>

Title IX Information

CSU's Student Sexual Harassment and Violence policy, following national guidance from the Office of Civil Rights, requires that faculty follow CSU policy as a "mandatory reporter" of any personal disclosure of sexual harassment, abuse, and/or violence related experiences or incidents shared with the faculty member in person, via email, and/or in classroom papers or homework exercises. These disclosures include but are not limited to reports of personal relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus (e.g., see the CSU Health Network link below), disclosure by the student to the faculty member requires that the faculty member inform appropriate CSU channels to help ensure that the student's safety and welfare is being addressed, even if the student requests that the disclosure not be shared.

For counseling support and assistance, please see the CSU Health Network, which includes a variety of counseling services that can be accessed at: <https://health.colostate.edu/>. And the Sexual Assault Victim Assistance Team is a confidential resource for students that does not have a reporting requirement and that can be of great help to students who have experienced sexual assault. Some helpful websites: <https://safety.colostate.edu/sexual-assault-information/> <https://wgac.colostate.edu/support/sexual-assault/>

Non-Discrimination Statement

Colorado State University is committed to providing an environment that is free from discrimination and harassment based on race, age, creed, color, religion, national origin or ancestry, sex, gender, disability, veteran status, genetic information, sexual orientation, gender identity/expression, or pregnancy in its employment, programs, services and activities, and admissions, and, in certain circumstances, marriage to a co-worker. The University will not discharge or in any other manner discriminate against employees or applicants because they have inquired about, discussed, or disclosed their own pay or the pay of another employee or applicant. Colorado State University is an equal opportunity and equal access institution and affirmative action employer fully committed to achieving a diverse workforce and complies with all Federal and Colorado State laws, regulations, and executive orders regarding non-discrimination and affirmative action. The Office of Equal Opportunity is located in 101 Student Services. Source: <http://oeo.colostate.edu/non-discrimination-statement>

Mental Health and Wellness

CSU is a community that cares. You are not alone. CSU Health Network Counseling Services has trained professionals who can help. Your student fees provide access to a wide range of support services. Call Counseling Services at (970) 491-6053, and they will work together with you to find out which services are right for you. Visit <https://health.colostate.edu/about-counseling-services> to learn more and <https://health.colostate.edu/mhwb-resources/> for additional student mental health and well-being resources. If you are concerned about a friend or peer, use **Tell Someone** by calling (970) 491-1350 or visiting <https://supportandsafety.colostate.edu/tell-someone/> to share your concerns with a professional who can discreetly connect the distressed individual with the

proper resources. Rams Take Care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.

Student Case Management

Student case management (<https://studentcasemanagement.colostate.edu/>) is available to help students with extenuating life circumstances and connect them with resources. In some cases, after you and I discuss your situation, I may request verifiable documentation for class absences (<https://studentcasemanagement.colostate.edu/class-absences/>) from the SCM office if you request considerations for absences or missed coursework.

The following link/QRN code provides policies relevant to your courses and resources to help with various challenges you may encounter:

<https://col.st/2FA2g>

