 Course Overview
This course provides an overview of the theory, principals, 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. The course will also cover sampling designs for specialty forest products, fuels management, and rare populations. 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 principals through a term project, were students will develop, implement, analyze, and report on a natural resource survey.

 Course Goals and Objectives
Students will gain an understanding of and familiarity with:
1. The Survey Process;
2. Design of sample schemes, including simple random sampling, stratified and cluster sampling, double sampling procedures, and sample size determination;
3. The analysis of data, including point estimation and variance estimation methods;
4. Aspect of data collection;
5. Sources and control of non-sampling error;
6. Reporting and presenting of results, confidentiality of data.

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

 Required Texts and Materials
- Book: Scheaffer, Mendenhall, Ott, and Gerow. 2011 Elementary Survey Sampling (5th, 6th, or 7th editions will suffice). Durbury Press.
- Scientific Calculator

 Library & Research Help
The CSU Libraries Help Desk provides research and technical assistance either in person at Morgan Library or by phone at 970-491-1841. Jocelyn Boice is the librarian supporting this course. Contact her by email at jocelyn.boice@colostate.edu or by phone at 970-491-3882 to ask questions or set up an appointment for in-depth research help.
**Important Dates to Remember**

- **Exam 1:** Fri, Mar 11, 2016
- **Project Proposal:** Fri, Mar 4, 2016
- **Spring Break:** Sat, Mar 12, 2016 – Sun, Mar 20, 2016
- **Project Update Memo:** Mon, Mar 28, 2016
- **Exam 2:** Fri, Apr 15, 2016
- **Project Poster:** Wed, Apr 27, 2016
- **Project Report:** Fri, Apr 29, 2016
- **Final Examination:** Sect 1 - Tue, May 10, 2016, 7:30 – 9:30 am
  Sect 2 - Thu, May 12, 2016, 7:30 – 9:30 am

**Assignments**

Assignments will consist of numerical, 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 all work on a separate sheet in an organized and as neat a fashion as possible, failure to show your will result in a loss of up to 60% of the questions point value. Be sure to double check your answer and determine if your answer is reasonable. *Credit will only be awarded if students show their work and doing so allows for partial credit.*

Each assignment will be available on the course website and should be handed in by the end of lecture/lab of the week following when the material was covered. The lowest graded assignments will be dropped from your final grade *(we all have bad weeks).* Written answers are encouraged to be typed and turned in on a separate piece of paper. Any typed answers must use Times New Roman 12 pt font, 1 inch margins, and at least 1.5 line spacing.

**Project & Poster Presentation**

The course will develop the skills needed for students to complete an independent sampling practicum. This practicum will require students to perform a preliminary evaluation from a site visit or previously collected data in order 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 the sample survey. 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 landowner on their progress and any issues that may have occurred. 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 poster.

**Basis for Final Grade**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percent of Final Grade</th>
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</thead>
<tbody>
<tr>
<td>Assignments (8/9)</td>
<td>40%</td>
</tr>
<tr>
<td>Exams (2)</td>
<td>25%</td>
</tr>
<tr>
<td>Project Proposal</td>
<td>5%</td>
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<tr>
<td>Project Memo / Report</td>
<td>15%</td>
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<tr>
<td>Project Poster</td>
<td>5%</td>
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<tr>
<td>Final Exam</td>
<td>10%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</tbody>
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Letter grade assignment will be based on: A: 90%-100%, B: 80%-89%, C: 70%-79%, D: 60%-69%, F: < 60%.

**Course Policies**

**Late Work Policy**

Late assignments can be handed in up to one week past the due date for a **20% deduction** in credit. Beyond that, late assignments will not be accepted. Students must notify the instructors at least 1 week before missing an assignment, report, or quiz, or they will not be allowed to make it up.
Extra Credit Policy
Periodic extra credit will be available and will be announced in lecture. An extra credit problem set will be made available and announced in lecture. Extra credit will only count toward your overall course grade if you have a passing grade in the course.

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)

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 Resources for Disabled Students before requesting accommodations from the professor. Resources for Disabled Students (RDS; http://rds.colostate.edu/home) is located in room 100 of the General Services 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
Students must inform the instructors prior to any anticipated absence and take the initiative to make up missed work in a timely fashion. In the event of a conflict in regard to this policy, individuals may appeal using established University procedures. 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.

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.
Any student who has a conflict with the examination schedule must inform the instructor as soon as possible before the examination. If an agreement cannot be reached between the instructor and student as to the appropriateness of a make-up examination the student should appeal to the department head.

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

Professionalism Policy
Per university policy and classroom etiquette; mobile phones and electronic devices must be silenced during all classroom and lab sessions. 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 may suffer a reduction in their final class grade. When emailing the instructor or TA, please do so in a professional manner by including a salutation, complete sentences, and 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. The CSU writing center defines plagiarism this way:

Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. Done on purpose, it is cheating. Done accidentally, it is no less serious. Regardless of how it occurs, plagiarism is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."


If you plagiarize in your work 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 (see page seven, column two: http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf).

Of course, academic integrity means more than just avoiding plagiarism. It also involves doing your own reading and studying. It includes regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students. 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, we will ask you to sign the CSU Honor Pledge as part of completing all of our major assignments. While you will not be required to sign the honor pledge, we will ask each of you to write and sign the following statement on your papers and exams:

"I have not given, received, or used any unauthorized assistance."

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: http://www.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. The web address is http://www.wgac.colostate.edu/need-help-support.

Source: http://oeo.colostate.edu/title-ix-sexual-assault
Non-Discrimination Statement

Sample Designs and Related Topics
I. Characteristics of Biological Populations
   Small scale vs. large-scale patterns
   Mobile vs. stationary populations
II. Sampling Biological Populations
   Decision making process (Objective of survey sampling)
   Characterizing a Population Using Sample Data
   Graphical (Spatial vs. Non-spatial)
   Numerical (Spatial vs. Non-spatial)
   Central Limit Theorem
III. Statistical Distributions
   Binomial distribution
   Poisson distribution
   Normal distribution
   t-distribution
   Chi-square distribution
IV. Statistical Inferences (Parametric and nonparametric)
   Comparison of sample means
   Comparison of sample variances
V. Sampling Units
VI. Simple Random Sampling
VII. Spatial Patterns of Biological Populations
VIII. Stratified Random Sampling
IX. Systematic Sampling
X. Cluster Sampling
XI. Multiphase Sampling
   Ratio estimators
   Regression estimators
   Double sampling with post stratification
XII. Multistage Sampling
XIII. Adaptive Sampling
XIV. Model-Based and Model Assisted Sampling