

Spring 2018 (11/28/2017)

## **ESPM 3211/5211 Syllabus**

### **Survey, Measurements, and Modeling for Environmental Analysis.**

**Bulletin Description:** Introduction to survey, measurement, and modeling concepts/methods for study of natural resources and environmental issues. Emphasizes survey design for data collection, estimation, and analysis for issues encompassing land, water, air, vegetation, animal, soil, and human/social variables. 3cr.

Prerequisites: Math 1031 or 1051, ESPM 3012 or FW 4001 or Stat 3011 or Soc 3811 and computer competency (Word and Excel)

Grading basis: A/F; Format: Lectures, discussion/problem assignments plus short campus field trips.  
Semester(s): Spring    Lecture: 11:45am-1:00pm    Days: TTh    Rm 19 Green Hall

Instructor: David C. Wilson, Rm 330E Green Hall, Ph: 612-624-2202 Office.  
email: [wils0602@umn.edu](mailto:wils0602@umn.edu), Office hours – after class, by appointment; or stop by.  
(and for emailing, start the subject line with **ESPM 3211**).

Teaching Assistant: Claudia Nanninga, Rm 101B Green Hall, Ph 612-624-4280 Office  
Email: [nanni003@umn.edu](mailto:nanni003@umn.edu), Office hours – Wed., 10:30am-12pm and Th, 2-2:30pm.

Web access: <http://ay17.moodle.umn.edu/course/view.php?id=7429> and Email addresses are listed above.

Expected enrollment and audience: 20-25 undergraduate and graduate students from majors – including environmental science, policy and management, forest resources, forest and natural resource management, recreation resource management, fisheries and wildlife, agriculture, and graduate students in conservation biology, natural resource science and management, and public policy.

**Purpose/Objectives:** This course is a requirement/option for the following curricula: Environmental Sciences, Policy, and Management and Recreation Resources Management.

**Learning Outcomes:** Students who successfully complete the course will be able to design, conduct, analyze, and critique common surveys relating to the environment and natural resource issues.

**Primary Text:**

Ek, A. R. 2014. Survey, measurements and modeling for environmental analysis. Available as a textbook from the bookstore or via the course Moodle site as a pdf file. 147 pp.  
plus supplemental materials from the literature, handouts, ...some will be on the above and other sites.

**References (see Natural Resources Library in Hodson Hall):**

Avery, T. E. and H. E. Burkhart. 2002. *Forest Measurements*. 5<sup>th</sup> Ed. McGraw-Hill, NY.  
Manley, B. F. J. 2001. *Statistics for environmental science and management*. Chapman & Hall/CRC. NY.  
Moore, D. S., G. P. McCabe and B. A. Craig. 2009. *Introduction to the Practice of Statistics*. 6<sup>th</sup> Ed. Freeman & Co. NY.  
Reed, D. D. and G. D. Mroz. 1997. *Resource assessment in forested landscapes*. Wiley, NY.

<b>Grading (points breakdown):</b>	<b>Points</b>
Comment/Thinking Assignments ( <i>ad hoc</i> /conducted in class) [20 @ 5 pts each]	[100 ~ 25%]
Problem Assignments [5 @ 20 pts ]	[100 ~ 25%]
Exams - Problems/questions/essay [2 @ 50 pts ]	[100 ~ 25%]
Major Project - Survey Design Problem*	[100 ~ 25%]
<b>Total</b>	<b>[400 ~</b>
<b>100%]</b>	

\*Graduate students taking the class as **ESPM 5211** will be required to complete an expanded Major Project to be developed in consultation with the instructor.

**Exam aids:** A note sheet (8.5"x11", both sides) and a pocket calculator will be allowed for all exams. Students are encouraged to synthesize key concepts and formula on this sheet.

**Anticipated grading:** A=94%, A-=90, B+=88, B=86, B-=80, C+=78%, C=74, C-=70, D=66% (these percentages will not be raised, they might be lowered).

**Late assignments:**

**Late Comment/Thinking Assignments** will not be accepted. They are to be completed in class on the day assigned and turned in at the end of that class.

**Late Problem Assignments** will be penalized 2 points for each weekday or part thereof late. Exceptions will be granted for documented medical excuses or family emergencies. Assignments will typically be handed out on Tuesdays and due by the end of the day on Friday of the next week unless otherwise specified.

**Handouts/graded materials:** Copies of handouts will be available on the course Moodle site and after class in the ESPM 3211/5211 box located in Rm 115 Green Hall. Graded assignments not picked up in class can be obtained from the same location.

**Expectations of students:**

- Students should have all the prerequisites. In the case of exception by the instructor, self-study to remedy deficiencies is expected.
- Assigned materials are to be read before class and students will attend and participate in class.
- Students are encouraged to work in teams of 2-4 classmates on Assignments. However, each student must turn in their own copy of the work.
- All participants in team assignments will participate fully in the group effort and evaluation.
- Assignments are to be completed, organized, legible, using good grammar, and turned in on time – use of *Spellcheck* and *Grammarcheck* will be expected.
- Questions about grading will be brought to the attention of the TA within *two weeks* of the return of the problem or exam in question. If a satisfactory solution cannot be reached with the TA, the instructor will be informed and will make any final adjustments.
- For full credit, **SHOW WORK** including formula and intermediate steps.

**Student academic integrity:** ALL students should read: *Student Conduct and Academic Integrity* at <http://www1.umn.edu/oscai/>. Academic dishonesty in any portion of the academic work for this course shall be grounds for awarding a grade of F or N for the entire course. Academic dishonesty includes (but is not limited to): cheating on assignments or examinations; plagiarizing; submitting false records of

academic achievement; submitting the same paper (or substantially similar papers) to meet the requirements of more than one course without the approval and consent of all instructors concerned; taking or using test materials without faculty permission; or interfering with another student's work.

### **Course content coverage/outline**

- 1) Survey design and assessment concepts for natural resources and environmental variables
  - motivation and rationale for survey and attention to design
  - fundamental statistical and sampling concepts - randomization, replication, stratification
  - distribution concepts and the Central Limit Theorem
  - survey design procedure, sources of error, and error estimation
  - statistical significance
  - single stage or phase surveys
    - simple random sampling
      - sample selection, standard errors, and confidence intervals
      - sample size determination
      - list sampling and sampling in a plane
      - sample unit size, shape, and distribution
      - estimation of proportions
      - standard error of products
    - systematic sampling, stratified sampling, and regression
  - estimation
    - sampling and estimation with probabilities proportional to size
    - comparisons among estimators and survey designs
  - multistage and multiphase surveys
  - estimation of change
  - estimation of population size
- 2) Spatial and temporal patterns of natural resources and implications for survey design
- 3) Theory, practice, and basic units of measurement
- 4) Measurement technologies, procedures, surveys, and monitoring systems
  - land resources, land survey, and real estate appraisal
  - statistical and spatial (map) data sources and their utility
  - atmospheric, water, and vegetation resources
    - public, societal infrastructure and human resources
  - agricultural, soil, and mineral resources
  - wildlife and other animal resources
  - environmental assessment procedures (e.g., EIS)
  - design of monitoring systems
- 5) Statistical analysis and modeling
  - concepts and rationale for modeling
  - model development, verification, and validation
  - examples of models including usage, analysis, and inference

### **Some subject matter examples planned:**

- agricultural crop and range surveys, soil surveys

- air and water quality monitoring
- climate characterization and change
- environmental impact statements
- forest and habitat surveys
- resource growth and change prediction
- land survey and real estate valuation
- land use change analysis
- models of forest, wildlife, and human population dynamics
- models of biophysical processes, local to global
- spatial patterns of natural resources
- surveys of recreation resource users
- economic data and models
- traffic/use monitoring
- population size estimation
- public opinion/attitude/background surveys
- wildlife and fisheries surveys

**Tentative Lab/Problem Assignments (A1-5):**

- 1) Case study interpretation for survey design and statistics review
- 2) Identifying the essential elements of survey design, sample size estimation, Land Survey
- 3) Sampling for estimation of proportions, systematic sampling, stratified sampling
- 4) Regression, ratio, and PPS estimation
- 5) Multistage and multiphase surveys and population size estimation

*Note that all assignment submissions will occur via the course Moodle site.* Submissions will include documents and/or spreadsheets and MUST be clear (see the “Assignment Requirement” handout on Moodle for instructions). All assignments will be due by 11:59pm on the specified day (typically Tuesdays).

**Final Project:**

Design a survey of an environmental system or a model of system dynamics (due by 11:59pm on Friday, May xx).

## ESPM 3211/5211 Course schedule

(Approximate subject matter coverage, exams, due dates, and reading)

Dates (due)	Topic	Reading
1/20	Survey design concepts	Chapter 1
1/22	Statistical fundamentals	Chapter 2
1/27	Continued	
1/29 (A1)	Basic sampling methods... simple random sampling	Chapter 3.1
2/3	Continued..... sampling & inference	
2/5	Continued..... survey errors & significance	
2/10	Measurement of land resources, maps, aerial imagery	Chapter 6.1
2/12 (A2)	Basic units of measurement, survey cost factors	Chapter 5 & 3.10
2/17	Basic sampling method: systematic sampling	Chapter 3.2
2/19	<b>Exam 1 (on material through 2/17)</b>	
2/24	Basic sampling method: stratified sampling	Chapter 3.3
2/26 (A3)	Continued	
3/3	Basic sampling method: regression estimation, modeling	Chapter 3.4
3/5	Continued	
3/10	Basic sampling method: pps estimation	Chapter 3.5
3/12 (FT)	Advanced sampling method: multistage sampling Field Trip	Chapter 3.6
<b>3/16-3/20</b>	<b>BREAK WEEK!!!</b>	
3/24	Advanced sampling method: multiphase sampling	Chapter 3.7
3/26 (A4)	<b>Major Project Topic due</b>	
3/31	Estimating change and population size	Chapter 3.8-3.9
4/2	Continued	
4/7	Continued	
4/9	Growth, mortality and spatial patterns in nature	Chapter 4
4/14 (FT)	Field Trip & Review	
4/16 (A5)	<b>Exam 2 (on material through 4/14)</b>	
4/21	Surveys & measurement and by subject	Chapter 6.2-6.8
4/23	Continued	Chapter 7
4/28	Modelling	
4/30	Project Work Day	
5/1	<b>Major Project Report due</b>	
5/5	Environmental Impact Statements	Chapter 6.9
5/7	Review of Major Project reports Common survey implementation problems	

A# – Assignment 1, 2, 3, 4, or 5 is due the next day (Friday) by 11:59 PM

FT – Field trip