

Ecological Statistics and Design – ALS 5932/FOR6934

Fall 2008

3 credits

Course Objective:

The purpose of this class is to extend basic statistical knowledge obtained in introductory statistics classes, giving students experience with real-world data analyses. This course is meant to compliment the theory-based courses, with a more applied treatment of modeling topics in ecology and natural resources. Each topic will be presented with data and examples.

Instructors:

This course is team taught by four faculty associated with the Program for Ecological Statistics (PES):

Dr. Mike Allen
Department of Fisheries and Aquatic Sciences
317 Newins-Ziegler Hall
(352) 258 3454; email: msal@ufl.edu
Office hours: Tues-10:30-12:00

Dr. Christie Staudhammer
School of Forest Resources & Conservation
349 Newins-Ziegler Hall
(352) 846-3503; email: staudham@ufl.edu
Office hours: Tues 1-3, Thur 9:00-11:00

Dr. Bill Pine
Department of Fisheries and Aquatic Sciences
317 Newins-Ziegler Hall
(352)225 1643; email: billpine@ufl.edu
Office hours: Tues 10:30-12:00 or by
appointment

Dr. Linda Young
Department of Statistics, IFAS
430 McCarty Hall C
(352) 392-3067; email: ljyoung@ufl.edu
Office hours: Mon and Wed 1:55-2:45

Course Pre-requisite:

STAT 6166 or equivalent, or approval of instructors

Course Website:

http://floridarivers.ifas.ufl.edu/ecological_stats_2008.htm

Computers and software:

There will be extensive use of computers inside and outside of class. Examples and assignments will be given in commonly used programs such as R, Excel, and/or SAS. Students may choose the platform which best fits their needs; however, programming support may not always be possible in each platform. Students are required to have their own laptop for the course.

Required Text:

A course packet is available from Orange and Blue Textbooks (www.obtbooks.com).

Grades:

There will be 12 assignments based on analysis techniques presented in the labs (10 points each). You must turn in 9 of these 12 assignments. If you turn in more than 9, your overall lab score will be the average of all the labs you submit. Your total lab score will be scaled to 90 possible points

| Assignment | Points |
|---------------|--------|
| Labs (9 @ 10) | 90 |
| Participation | 10 |
| | |
| Course total | 100 |

Because discussion and interaction is a key component of the class, your participation will be worth 10 points. To receive full participation, students should regularly demonstrate (via informed comments or questions) that they have completed the required readings and lab exercises.

Topics:

1. Review of important statistical distributions – *Linda Young*
 - a. Discrete distribution
 - b. Continuous distributions
 - c. Assessing fit of distributions
2. Regression – *Christie Staudhammer*
 - a. Review of linear regression
 - b. Non-linear regression
 - i. Choosing a non-linear model
 - ii. Estimation techniques
 - iii. Comparing the fit of two (or more) models
 - iv. Evaluating assumptions
 - v. Models for non-normal data
 1. Overview of Generalized linear models (GzLMs)
 2. Models for count data
 3. Logistic models for discrete response
3. Spatial Statistics – *Linda Young*
 - a. Indices and Spatial Correlation
 - i. Indices of Aggregation
 - ii. Spatial correlation
 - iii. Moran's I and Geary's c
 - b. Geostatistical analysis
 - i. Intrinsic stationarity
 - ii. Semivariograms
 - iii. Kriging
 - c. Spatial point processes
4. Capture-Recapture Models – *Bill Pine*
 - a. Estimating abundance, survival , detection
 - b. Line transect methods
 - c. Closed models
 - i. Removal methods
 - d. Open models
 - e. Robust design
5. Indices – *Mike Allen*
 - a. Sampling Considerations
 - b. Measures of Richness and Diversity
 - c. Occupancy Models
 - d. Diet Composition/Resource Selection

Tentative Schedule

| Week | Date | Monday: 10:40am – 11:35pm | Tuesday Lab : 7:25 – 8:50am or 9-10:25am | Wednesday: 10:40am – 11:35am |
|------|------------|---|---|--|
| 1 | 25- Aug | Welcome and Introduction – All led by LY | SAS/R starter - ALL | LY <i>Fitting distributions</i> |
| 2 | 1- Sep | <i>Labor Day - No Class</i> | LY <i>Fitting distributions</i> | CS <i>Review of Multiple Linear Regression</i> |
| 3 | 8- Sep | CS <i>Non-linear regression- basics</i> | CS <i>Non-linear lab: fit VonBertalanffy growth Curve to Sitka spruce tree data</i> | CS <i>Non-linear regression- evaluation and Model comparisons</i> |
| 4 | 15- Sep | CS <i>Generalized linear models Poisson regression</i> | CS <i>Poisson regression lab</i> | CS <i>Models for over-dispersed data ZIP and hurdle models</i> |
| 5 | 22- Sep | CS <i>Logistic regression</i> | CS <i>Logistic regression lab</i> <i>BP gone</i> | LY <i>Spatial Correlation</i> <i>BP gone</i> |
| 6 | 29- Sep | LY <i>Spatial Correlation</i> | LY <i>Spatial Correlation lab</i> | BP <i>How many are there? Detection issues of species and individuals</i> |
| 7 | 6- Oct | MA <i>Estimating richness, diversity</i> | MA <i>Estimating richness, diversity, in Excel Introduce bootstrapping *download Poptools Excel add-in</i> | MA <i>Estimating richness, diversity continued</i> |
| 8 | 13- Oct | BP <i>Estimating abundance Lincoln-Petersen</i> | BP <i>Estimating abundance Lincoln-Petersen simulation EXCEL</i> | BP <i>Estimating abundance Closed models</i> |

| Week | Date | Monday: 10:40am – 12:40pm | Tuesday Lab : 7:25 – 8:50am or 9-10:25am | Wednesday: 10:40am – 11:35am |
|------|--------|--|--|--|
| 9 | 20-Oct | BP <i>Estimating abundance</i> <i>Open models, Robust design</i> | BP <i>Program MARK</i> <i>Closed and open example</i> | BP <i>Estimating survival</i> <i>Kaplan-Meier type</i> |
| 10 | 27-Oct | BP <i>Quadrat and Line transect</i> <i>CS gone</i> | BP <i>Survival analyses lab</i> <i>CS gone</i> | MA <i>Sampling considerations, bias</i> <i>CS gone</i> |
| 11 | 3-Nov | MA <i>Resource selection methods (habitat)</i> | MA <i>Estimating resource selection and richness</i> | MA <i>Resource selection methods (diet analyses)</i> |
| 12 | 10-Nov | <i>No class</i> <i>BP and MA in Miami</i> | <i>Veterans Day - No class</i> <i>BP and MA in Miami</i> | LY <i>Spatial point patterns</i> <i>BP and MA in Miami</i> |
| 13 | 17-Nov | LY <i>Spatial point patterns</i> | LY <i>Spatial point patterns</i> | MA <i>Sample size estimation</i> |
| 14 | 24-Nov | MA <i>Sample size estimation</i> | MA <i>Sample size estimation</i> <i>Intensity (R, SAS)</i> | MA <i>Pseudoreplication and design of large scale experiments</i> |
| 15 | 1-Dec | BP <i>Ecosystem Experiments</i> | CS LY <i>Model selection</i> <i>Course evaluations</i> <u><i>Last day of Class</i></u> | |
| 16 | 8-Dec | | | |

Some References

- Kutner, M., J. Neter, C. Nachtsheim, W. Wasserman. 2003. *Applied Linear Regression Models, 4th Edition*. McGraw-Hill/Irwin.
- Schabenberger, O. and Pierce, F. J. 2001. *Contemporary Statistical Models for the Plant and Soil Sciences*, Boca Raton: CRC Press.
- Young, L.J. and J.H. Young. 1998. *Statistical Ecology: A Population Perspective*. Kluwer, Boston, USA.

POLICY ON ACADEMIC HONESTY

As a student, you have already agreed to the following statement:

I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action, up to and including expulsion from the University.

UF COUNSELING SERVICES

Resources are available on-campus for students having personal problems or lacking clear career and academic goals, which interfere with their academic performance. These resources include:

- **University Counseling Center**, 301 Peabody Hall, 392-1575, personal and career counseling
- **Student Mental Health**, Student Health Care Center, 392-1171, personal counseling
- **Sexual Assault Recovery Services**, Student Health Care Center, 392-1161
- **Career Resource Center**, Reitz Union, 392-1601, career development assistance and counseling