Statistics 435/535 Fall 2014

Quantitative Ecology

MWF 1300-1350, BEXL 324

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Office hours MW 1400-1530, or by appointment

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Web site Course information and materials will be posted on Blackboard (`http://my.oregonstate.edu`), under `ST_435_X001_F2014`. You need to have an ONID account (`http://www.onid.orst.edu`) in order to use Blackboard.

Objectives

To provide an overview of statistical methods that are useful for analyzing ecological data, and to improve students' ability to understand and evaluate the use of statistics in the ecological literature.

Learning outcomes

To obtain a working knowledge of several statistical methods commonly used in ecology; to be able to identify a wide variety of dependent data structures; (for ST 535 students) to be able to critically review ecological and statistical papers from the literature.

Prerequisites

ST 412/512 (Methods of Data Analysis) or equivalent experience, including the ability to use a statistical computer package. From the OSU course catalogue:

> **ST 511:** Graphical, parametric and nonparametric methods for comparing two samples; one-way and two-way analysis of variance; simple linear regression. **ST 512:** Multiple linear regression, including model checking, dummy variables, using regression to fit analysis of variance models, analysis of covariance, variable selection methods.

Student responsibilities

There is no textbook. Lectures will be supplemented with readings from the literature. Most of the readings will be discussed in class.

There will be a variety of short homework assignments (some done individually, some in small groups). These will involve literature searches, calculations, data analysis, and questions about readings. Because I usually discuss homework problems in class the day that they're due, *please hand in your assignment at the front of the room before class starts, or, if you're late, immediately after you enter the room*. No late papers will be accepted, period.

Groups or group representatives will occasionally be asked to make oral presentations of their results to the class.

Schedule

Following is a rough schedule of topics to be covered. *A detailed schedule of lectures and assignments will be maintained on Blackboard.*

Week	Topic
1	*Introduction* and general principles; experimental vs. observational data
1–2	*Statistical model building:* selection of explanatory variables
3–6	*Dependent data:* serial correlation, mixed-effects models, paired intervention analysis, spatial pattern analysis, smoothing and interpolation, trend surfaces, variograms
6–7	*Model validation:* internal and external cross-validation, bootstrapping, simulation of model-building strategies
8–9	*Computer-intensive methods:* bootstrapping, Monte Carlo simulation
10	Introduction to *Bayesian statistics* and decision analysis

Grading

80% of the grade will be based on the homework assignments, and 20% on class participation. The class participation score is a subjective assessment based on attendance, group participation, and involvement in class discussions. Undergraduate students will automatically receive full marks for class participation, *unless* their attendance is unsatisfactory.

At the end of the quarter, each student will be asked to evaluate the contributions of the other members of the group that he/she belongs to. These evaluations may influence the grades given to individual students.

Honesty in academic work

Incidents of academic dishonesty will be dealt with as outlined in the University's Academic Regulations (go to `catalog.oregonstate.edu`, click on *Registration Information* → *Academic Regulations*, and read AR 15).

Examples of academic dishonesty include, but are not limited to, verbatim copying of another student's homework assignment, unattributed use of material copied from an article, textbook or web site, and altering a homework assignment as I discuss it in class. Other examples and definitions can be found at `oregonstate.edu/studentconduct/regulations/index.php#acdis`.

Some references (* indicates on reserve at Valley Library)

Burnham, K.P., and D.R. Anderson. 2002. *Model selection and multimodel inference: a practical information-theoretic approach.* Springer, New York.

Crawley, M.J. 2007. *The R Book*. Wiley.

Gelman, A., J.B. Carlin, H.S. Stern, and D.B. Rubin. 1995. *Bayesian data analysis.* Chapman and Hall, London.

*Ludwig, J.A., and J.F. Reynolds. 1988. *Statistical ecology. A primer on methods and computing.* Wiley, New York. (QH541.15.S72 L83 1988)

Manly, B.F.J. 2001. *Randomization, bootstrap and Monte Carlo methods in biology,* 2nd Ed. Chapman and Hall, London.

*Manly, B.F.J. 2009. *Statistics for environmental science and management,* 2nd Ed. Chapman and Hall/CRC.

This is available as an electronic resource in the OSU library system.

R Development Core Team. 2014. *An Introduction to R*. Available at `http://www.r-project.org`, or via the help menu in R.

*Ramsey, F.L., and D.W. Schafer. 2013. *The Statistical Sleuth: A Course in Methods of Data Analysis*, 3rd Edition. Duxbury.

*Scheiner, S.M., and J. Gurevitch. 2001. *The design and analysis of ecological experiments,* 2nd ed. Chapman and Hall.

*Van Belle, G., L. Fisher, P.J. Heagerty, T. Lumley. 2004. *Biostatistics : A Methodology for the Health Sciences*, 2nd edition. Wiley. (On reserve for ST 551.)

Venables, W.N., and B.D. Ripley. 2002. *Modern applied statistics with S*, 4th ed. Springer.

Other resources

Included under *Course Documents* on Blackboard are (i) a list of ecological and statistical journals, and (ii) a long set of literature references, some of which will be referred to in class.