

Syllabus: Quantitative Ecology Spring, 2014;

General/QFE14syl.doc

W. E. Bradshaw X 4542, 305 Pac. email: bradshaw@uoregon.edu Office Hours: Fri 2-3 pm
Teaching Fellow, Rudy Borowczak email: rborowcz@uoregon.edu

5 credit hours. Satisfies ecology and evolution concentration requirement for statistics or a field course, but not both. Pre-requisite: Bi 370 or another course that introduces regression and one-way analysis of variance or I. Expenses include about ~\$25 for a field kit, \$30 for required statistical software and \$90 deposit to cover field trip expenses.

This is a course on acquiring individual skills in the design of ecological experiments and the analysis and illustration of ecological data; students who complete the course know how to do things.

Quantitative ecology is a course in applied ecological statistics based on the philosophy that it is easier, less frustrating, and more meaningful to learn statistics when analyzing one's own data gathered in the field. Emphasis is on learning how to use various statistical methods to design and analyze ecological data collected in the field. Consequently, there is no text or exams and grading is based on homework and reports from data that students collect themselves during the five field trips.

Each trip goes to a different habitat: (1) Alton Baker Park in Eugene, (2) Whiteaker Creek in the Oregon Coast Range, (3) the Oregon Dunes and Siuslaw estuary, (4) the Oregon Cascades, and (5) Cape Arago and South Slough on the Oregon Coast. The first four trips are one-day trips; the last is an overnight, Friday-Monday (Memorial Day weekend).

The course starts out heavy on lecture for the first three weeks and the first three field trips involve specific experiments designed to illustrate each of the statistical methods introduced in lecture and a manual provided online. **The object is for each student to work up their own manual of worked examples for each method.** After the second week, lecture tapers off and the class meetings develop into workshops to analyze larger data sets and where the instructors can provide one-on-one assistance in data analysis. The fourth field trip involves semi-independent projects where the instructors suggest projects that the students might work on; however, students are free to work on their own project alone, in pairs, or in groups. The last field trip involves an independent project by each student working independently. During all field trips, the instructors provide on-the-spot guidance in the choice, design, approaches, and data gathering. During the last field trip, there is usually significant alumni participation, providing perspectives on how they used what they learned in the course later in life and, sometimes, providing assistances with larger independent projects.

Homework starts out by writing "Results" sections of a manuscript for *Ecology*, then "Results and Discussion," and, for the last two field trips, complete manuscripts for *Ecology*. At each progression, the instructors provide guidance on how to display quantitative data in tables and graphs, how to compose a scientific paper for publication.

The field trips are essential; they are absolutely required and there are no make-ups. **DO NOT TAKE THIS COURSE IF YOU CANNOT MAKE THE FIELD TRIPS:**

Sat, April 5; Sat, April 12; Sat, April 26; Sat, May 10; Fri-Mon, May 23-26*

* Memorial Day weekend

COURSE OUTLINE

Note for **HELP SESSIONS**: Bill and/or Alida will be in the room until the end of the scheduled class period or until the last student leaves, *whichever comes first*.

- I. Mon 3/30 Lecture: Goals and philosophy of course; logistics, field-trips
 Lab: 2:00 Mean, standard deviation, standard error, coefficient of variation, sources of variation, 1-way ANOVA
 3:00 Linear regression; introduction to transformation & central trend lines
 4:00 Introduction to JMP – Bring your laptop!

Fri 4/4 Lecture: tomorrow's trip

Sat 4/5 Field trip, Alton Baker Park: Reproductive allocation in teasel
 9:00 am - 5:00 pm. (walk from school)

Homework: Make up field kit, due 9 am, 4/7 (**10 pts, all-or-none**)
 Xerox field notebook and hand in copies 4/7 (**10 pts** based on organization and neatness)

- II. Mon 4/7 Lecture: Nested and 2-way ANOVA
 Lab: 2:00 continue with 2-way ANOVA with replication; meaning of interaction
 3:00-3:30 random vs. fixed effects in ANOVA
 3:30-5:00, workshop on Alton Baker data

Fri 4/11 Lecture: Tomorrow's field trip

Sun 4/12 Field trip: Whiteaker Creek: (1) Riparian tree communities; (2) abundance of swift stream insects (3) TBA 8:00 am - 7:00 pm (1 hr drive)

Homework: Analysis of Alton-Baker I, II, III; due 4/16 (**30 pts**)

- III. Mon 4/14 Lecture: Multiple regression, factor analysis and community ordination
 Lab: 2:00-3:00 Poisson, χ^2 , association, density, crowding, aggregation.
 3:00-4:00 ANCOVA
 4:00-5:00 Workshop on Alton-Baker data
 Homework: Whiteaker Creek reports due 4/27 (**35 pts**)

Fri 4/18 Help session.

IV. Mon 4/21 Lecture and Lab: Workshop on Whiteaker Creek data

Fri 4/25: Tomorrow's trip

Sat 4/26: Field trip to the Oregon Dunes. 9:00 am – 9:00 pm (1.5 hr drive)

High tide: 12:44 pm

V. Mon 4/28: Workshop on Dunes data followed by help session

Fri 5/2: Help session

VI. Mon 5/5 Lecture - Lab: Help session on Dunes field trip

Fri 5/9: Tomorrow's field trip

Dunes reports due at start of class (**35 Pts**)

Sat 5/10 Cascades - 8:00 am – 7:00 pm (1.75 hr drive) This trip will encourage semi-independent projects by pairs or groups of individuals. There are no “canned” exercises for this trip.

VII. Mon 5/12 Lecture: organization of Arago trip

Lab: help sessions on Cascades data

Fri 5/16 help session

Homework: Work on Cascades report; formal, typewritten full manuscript required; *Ecology* format rigorously to be followed. Due Fri 5/23 (**40 pts**)

VIII. Fri 5/23: Get to Sunset Bay Campground, Cape Arago Hwy, south of Charleston, OR
(~3 hour drive)

Fri 5/23 to Mon 5/26, Cape Arago field trip = final independent project.

We start early. I therefore strongly suggest leave Fri afternoon to arrive at the campground in daylight. The first morning always takes longer to make breakfast and CLEAN UP. We camp out, Fri, Sat, Sun nights and begin return by 2:00 pm 5/28) to avoid heavy Memorial Day traffic coming back from the coast. Yes, there are flush facilities and even showers ☺

Tides	Sat 24th	+1.5	4:53 pm	
	Sun 25th	+0.1	5:56 am	+1.7 5:45 pm
	Mon 26th	-0.4	6:47 am	You're gone.....

IX. Mon 5/26 No lecture - we're at Arago ☺

Fri 5/30 Lecture: Help session on Arago

Homework: work on Arago report.

X. Mon 6/2 Help session on Arago data
 Friday 6/8 Arago report due at start of class (40 pts)

Bi 473 Arago reports are to be a formal, typewritten full manuscript; tables typed; figures to be clear, illustrative, appropriately scaled and labeled; *Ecology* format rigorously to be followed. In addition to the formal, written report, Bi 573 students will present a 20 minute Power-Point presentation given to the entire class on the due date for the 473 reports. All Bi473 students must be present for this talk and fill out a short questionnaire concerning the talk (to be given anonymously to the speakers) or receive an INCOMPLETE in this class.

MINI REMINDER SCHEDULE

Field trips:

Sat 4/5 walk to Alton Baker Park 9am - 5pm
 Sat 4/12 drive to Whiteaker Creek 9am - 7pm
 Sat 4/26 drive to Oregon Dunes, 9am-9pm
 Sat 5/10 drive to Cascades 8am - 7pm
 Fri-Mon 5/23-26 drive to Cape Arago, overnight; final independent project

<u>Due Dates</u>	<u>Points</u>	<u>Due</u>
Complete Field Kit	10	4/5
Alton Baker notebook	10	4/7
Alton Baker 1-3	30	4/14
Whiteaker Creek	35	4/25
Dunes	35	5/9
Salt Creek Falls report	40	5/23
Arago (Final Paper/Talk)	40	6/6 @ 4:00 pm

Quantitative techniques to be learned

Linear regression, tests for linearity
 Use of regression to model non-linear surfaces
 Use of regression as a predictor
 Analysis of covariance ANCOVA
 Nested ANOVA
 2-way ANOVA with replication
 Aggregation, density, crowding
 χ^2 and Poisson
 Allometry and asymmetry
 Principal components
 Multiple regression
 Stepwise regression
 A-posteriori multiple comparison tests

Illustrative exercise

AB 1
 AB 1
 AB 1
 DU 4, WC4 Dens & Div = f(speed, RS)
 DU 1
 WC 3
 WC 3
 WC 2, DU 2,3
 AB 1, DU 4
 WC 1
 AB 2
 AB 3
 WC5 colonization of rocks @ 3 times?