Syllabus: Quantitative Ecology Spring, 2012; General/QFE12syl.doc

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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 $45 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) Salt Creek Falls in 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*. For the last field trip, graduate students, in lieu of a written report, must present a 15-minute talk with Power Point based on their final project during the final exam period, just as they would at a national meeting. Their final report grade is based entirely on this talk. Undergraduates are required to attend the final exam and make written comments on each graduate students' talk, to be provided to the speakers. 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, and how to prepare a

formal talk.

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 7; Sun, April 15; Sat, April 28; Sat, May 12; Fri-Mon, May 25-28*

* 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 4/2 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 4/6 Lecture: tomorrow's trip

Sat 4/7 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 4/9 (10 pts)

II. Mon 4/9 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 4/13 Lecture: Help session

Sun 4/15 Field trip: Whiteaker Creek: (1) Riparian tree communities; (2) competition among trees; (3) Distribution and abundance of swift stream insects. 8:00 am - 7:00 pm (1 hr drive)

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

III. Mon 4/16 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
Fri 4/20 Help session.

IV. Mon 4/23 Lecture and Lab: Workshop on Whiteaker Creek data

Fri 4/27: Tomorrow's trip

Sat 4/28: Field trip to the Oregon Dunes. 9:00 am – 9:00 pm (1.5 hr drive)
High tide: 6:29 am; low 1:24 pm; high 8:10 pm

V. Mon 4/30 Workshop on Dunes data followed by help session

Fri 5/4: Help session

VI. Mon 5/7 Lecture - Lab: Help session on Dunes field trip

Fri 5/1: Tomorrow's field trip
Dunes reports due at start of class

Sat 5/12 Salt Creek Falls - 8:00 am – 7:00 pm (1.5 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 5/14 Lecture: organization of Arago trip
Lab: help sessions.

Fri 5/18 help session

Homework: Work on Salt Creek Falls report; formal, typewritten full manuscript required; *Ecology* format rigorously to be followed. Due Fri 5/25 (40 pts)

VIII. Fri 5/25: Get to Sunset Bay Campground, Cape Arago Hwy, south of Charleston, OR
(~3 hour drive)

Fri 5/25 to Mon 5/28, Cape Arago field trip = final independent project.
(low tide is 10:30 am on Saturday. 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. 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.

Tides	Sat 26th	-0.2 10:30 am	+6.1 5:24 pm (SS@8:46)
	Sun 27th	+0.1 11:12 am	+6.2 6:10 pm (SS@8:47)
	Mon 28th	+0.6 12:02 am	You're gone…..

IX. Mon 5/28 No lecture - we're at Arago ☺

Fri 6/1 Lecture: Help session on Arago

Homework: work on Arago report.

X. Mon 6/4 and Friday 6/8: Help sessions on Arago.

XI. Final exam 3:15 pm Monday June 11.

Undergraduate Arago reports are to be a formal, typewritten full manuscript required; tables typed; figures to be clear, illustrative, appropriately scaled and labeled; *Ecology* format rigorously to be followed. Due at the START of the final exam period (40 pts). Undergraduates are required to attend the final exam, or they will receive an "I" in the course (not taught again until 2011).

Graduate Arago reports are to be a formal, 15 min (absolute limit) talk, illustrated with PowerPoint graphics. The talk will be presented during the final exam period. (40 pts)

MINI REMINDER SCHEDULE

Field trips:

Sat 4/7 walk to Alton Baker Park 9am - 5pm
Sun 4/15 drive to Whiteaker Creek 9am - 7pm
Sat 4/28 drive to Oregon Dunes, 9am-9pm
Sat 5/12 drive to Salt Creek Falls 8am - 7pm
Fri-Mon 5/25-28 drive to Cape Arago, overnight; final independent project

Due Dates:

Assignment	Points	Due
Complete Field Kit	10	4/7
Alton Baker notebook	10	4/9
Alton Baker 1-3	30	4/16
Whiteaker Creek	75	4/27
Dunes	85	5/11
Salt Creek Falls report	40	5/25
Arago (Final Paper/Talk)	40	6/11 @ 3:15 pm

Quantitative techniques to be learned	Illustrative exercise
Linear regression, tests for linearity	AB 1
Use of regression to model non-linear surfaces	AB 1
Use of regression as a predictor	AB 1
3-dimensional plots and 3-space regression	AB 2
Analysis of covariance ANCOVA	DU 4
Nested ANOVA	DU 1
2-way ANOVA with replication	WC 3
Aggregation, density, crowding	WC 3
χ^2 and Poisson	WC 2, DU 2,3
Allometry and asymmetry	AB 1, WC 2, DU 4
Principal components	WC 1
Multiple regression	AB 2
Stepwise regression	AB 3