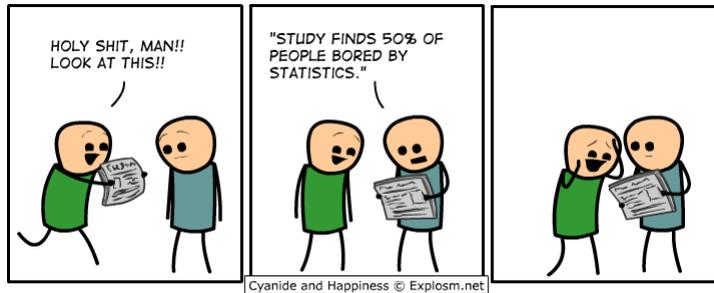


Course info



Info lecture
Statistics for Biologists III
Ayco Tack



nature communications

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Kea show three signatures of domain-general statistical inference

[Amalia P. M. Bastos](#) & [Alex H. Taylor](#)

[Nature Communications](#) **11**, Article number: 828 (2020) | [Cite this article](#)

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An [Addendum](#) to this article was published on 04 June 2020

<https://www.nature.com/articles/s41467-020-14695-1>
<https://www.bbc.co.uk/programmes/p08dx986>

BioStats III: Course outline

- | | |
|---|--|
| <ul style="list-style-type: none"> • L1: Distributions, probabilities and CLT • L2: Parameter estimation, CIs & hypothesis testing • L3: Correlation & linear regression • L4: Multiple regression • L5: ANOVA • L6: ANCOVA & transformations | <p>Basic statistics
(with many levels of understanding)</p> |
| <ul style="list-style-type: none"> • L7: Nested ANOVA, mixed models and VCs • L8: Two-way ANOVA • L9: Mixed effects models (random or fixed) • L10: Analysis of frequencies | <p>High-level</p> |
| <ul style="list-style-type: none"> • L11: GLM and GLMM • L12: Randomization and bootstrap • L13: Bayesian statistics part I • L14: Bayesian statistics part II • L15: Experimental design • L16: Summary | <p>Advanced statistics</p> |

3

A combination of theory & practice

- | |
|--|
| <ul style="list-style-type: none"> • 16 Lectures <ul style="list-style-type: none"> • Mostly in the morning • The majority by Ayco Tack • Four guest lecturers: Simon Liedholm, Laura van Dijk, Frank Miller & Matthew Low • The focus is on understanding statistical theory and concepts |
| <ul style="list-style-type: none"> • 8 Computer exercises <ul style="list-style-type: none"> • Mostly in the afternoon • Supervised by Laura van Dijk (& sometimes Ayco) • The focus is on learning to apply statistical theory and concepts (and learn some R on the way) |
| <ul style="list-style-type: none"> • 4 Test exercises <ul style="list-style-type: none"> • A full day to work on test exercises (one hour less for the final test exercise) • A question hour if you need advice • The aim is to (creatively) link ecological questions, statistics and scientific writing |

4

...some boring practicalities...

- **Course schedule**
 - <https://cloud.timeedit.net/su/web/stud1/rj165XQl706Z5QQv57063ZZ6y3Y750uQ3Y65Y1gQ70157.html#>
 - www.plantmicrobeinsect.com/teaching -> Course schedule (PDF)
- **Computer exercise schedule**
 - You can exercise from 1–5 pm
 - Loke will be there from 1–4 pm (one more hour this year)
- **Lecture PDFs and exercises**
 - www.plantmicrobeinsect.com/teaching
 - If you miss a lecture or exercise, always ask your fellow student for updates
- **Own laptop or university desktop**
 - Please inform me if you prefer the desktop

What is the course about?

From course syllabus:

Course content

The course covers advanced statistical concepts and methods that are currently in general use in biological research. The topics include linear models with one or more continuous and categorical variables, generalized linear models (for binomial and count data), statistical models for designs with random effects and multiple hierarchical levels (mixed models, blocks, nested designs and repeated measures). Bayesian statistics and the similarities and differences between Bayesian approaches and classical model fitting are also covered. The course aims at the application of statistical methods to research in the biological sciences.

Learning outcomes

It is expected that the student after taking the course will be able to:

- show insights into the most regularly used advanced statistical methods in biological research and show an understanding of the importance of such methods for the analysis of biological data
- apply these methods to biological data
- interpret the results of both classical and Bayesian statistical analyses

Grading criteria for “BioStatistics III” (7.5 hp) 2018-12-06 – 2019-01-18

a ... show insights into the most regularly used advanced statistical methods in biological research, interpret the results of both classical and Bayesian statistical analyses, and show an understanding of the importance of such methods for the analysis of biological data

b ... apply these methods to biological data

The assessment of the final grade will be based on four written reports (also referred to as ‘test exercises’), with each report graded from A to F (including finer adjustments using + and -, which are used for rounding when calculating the final grade: see below). These reports will be given equal weight when calculating the final course grade. Each individual report should have a pass grade (i.e. A, B, C, D or E) to pass the course (see next slide on what to do if an individual report is graded with an F or Fx). When the average of the grades for the four reports falls between two grades (e.g. when averaging A, B, A and B), the final grade will be decided by the balance of pluses and minuses. If the final grade is still equal after taking pluses and minuses into account, rounding will be based on active participation during the lectures.

Grade	Teaching goal
A	Outstanding ability to use a & b and ability to clearly motivate the use of specific methods or models and interpret the outcome.
B	Excellent ability to use a & b and ability to clearly motivate the use of specific methods or models and interpret the outcome.
C	Very good ability to use a & b and ability to compare the use and suitability of methods and models and interpret the outcome.
D	Good ability to use a & b , and ability to use methods and models and interpret the outcome.
E	Acceptable ability to use a & b .
Fx	Partly unacceptable ability to use a & b .
F	Major shortcomings in the ability to a & b .

...some more on grading...

- **Grading is based on four test exercises**

- When you fail a test exercise (Fx), you can make an appointment for a re-exam after the course ends. You can then upgrade your grade to D or E. The re-exam will be half the size of a normal test exercise.
- When you fail a test exercise (F), you can make an appointment for a re-exam after the course ends. You can then upgrade the grade to E. The re-exam is the same size as the normal test exercise.

- **Some additional notes**

- Don't worry about this if you are active!
- More details on the test exercises will follow during the course

Recommendations from 2019

- *Go to the lab exercises, and try to understand what you are doing. If not ask questions! Don't just copy the code*
- *Do all the exercises and try to think a lot about what they mean. Also if you're not sure why you are doing a certain part of the exercise: ask! The exercises are sort of set up to get you thinking about statistics and to make you understand some underlying stuff, and if you don't get what you're supposed to understand, that may affect how easily you understand the test exercises.*
- *Also, if you do have the opportunity: read the R-book. I get that it isn't mandatory, and I didn't have it and so did not read it. But, I suspect parts of the test exercises may have been easier if I had read the chapters.*
- *Read the material given to you. It is not obligatory but it will make your life easier.*
- *Team up for the exercises and help each other. Read the books and google questions. It's a very intensive course.*
- *Do not miss classes and go do computer classes*
- *Try not to be scared of Ayco when he asks you to answer a question... he does try to help you learn.*

...and the recommendations from 2018...

- *Try to understand what are you doing in each moment, not only apply tests, ask yourself "why".*
- *Work hard and do your best all the time.*
- *Use simon in the lab exercise if at all he will be the one taking you, he is a great teacher too.*
- *Use the practice exercises to identify concepts you don't understand - and then ask!*
- *Make sure you know how to use R before hand, work with other people as it'll further your understanding and make sure you catch up on any lectures you missed*
- *Do not struggle alone with the exercises. You will learn more if you talk with someone else when you have problems.*
- *If you have any own data to do stats with along side with the course, that would be great. When you need to (try to) apply what you have learned to other data, which was not chosen to match the topic of the day, you learn more and come up with better questions to ask.*
- *The course is really useful but time-consuming.*
- *Go through the exercises and attend lectures. You will have what you need for the tests.*
- *Make sure to have a basic knowledge of R before taking the course!!!*

Recommendations from previous years

- *Ask questions. If something is hard to grasp, make sure you take the opportunity to ask the teachers about it.*
- *Ask many questions during the computer exercises (many of the best in-depth discussions happened there), and read up on any subjects that you're not very familiar with before the lecture in question.*
- *To read the literature, as it really helps in your understanding*
- *Practice practice practice, and make sure you really understand the different models etc.*
- *Do the exercises carefully. Also be aware of that they would take time to do if you are not so familiar with R.*
- *Go to the exercises*
- *Take every computer exercise seriously!*
- *Go to the lectures and try to do all the exercises*
- *It's a tough but very important course. Take it only if you have no other big obligations at the same time, you will need to focus 100%*
- *Team up with others and help each other, its actually fun!*
- *The home exams are graded strictly...pay lot of attention to the first one and ask the teacher what should be in it.*

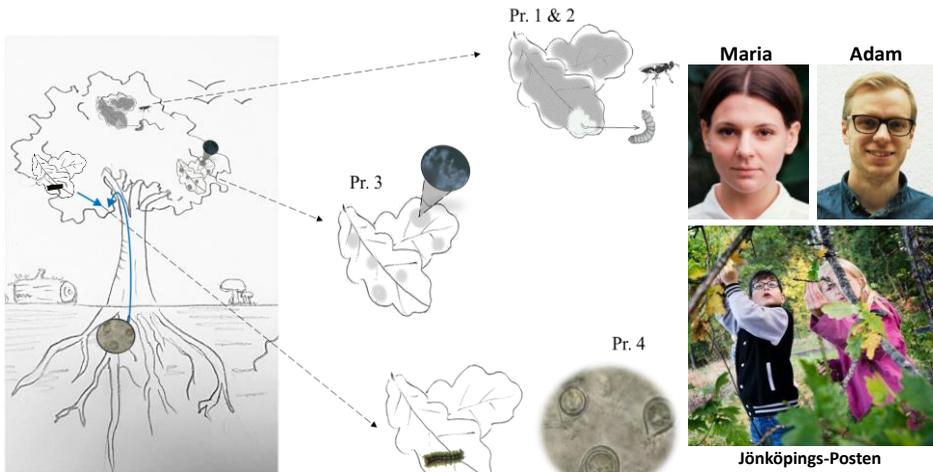
...and some more recommendations...

- *Good that you don't ask if we should take a break, many students don't know their own best interest.*
- *Take the other statistic course first, than that one...*
- *A good understanding of theory before they continue with exercises*
- *Don't take it without knowing the basics!*
- *Make sure that the level of the course is not too high for them. Indeed, the pace of the course is quite intense: every week we reach a higher level of complexity, and I know that some of the students struggled during the course.*
- *Take the course! Of course it depends on your statistical background, but overall I think the course managed to go through the basics in a clear way, and go through the advanced stuff without going too deep into the inner workings of Markov chains for instance.*
- *Keep your R scripts tidy. Do your best to absorb as much as possible from the lectures and be active on the exercises*
- *Work with R, get a real feel for it so that it does not limit you.*
- *Work hard from the start*
- *Practice the basics in R before you start the course. It is not needed, but it helps*
- *Keep your R scripts tidy*

...what I usually do...

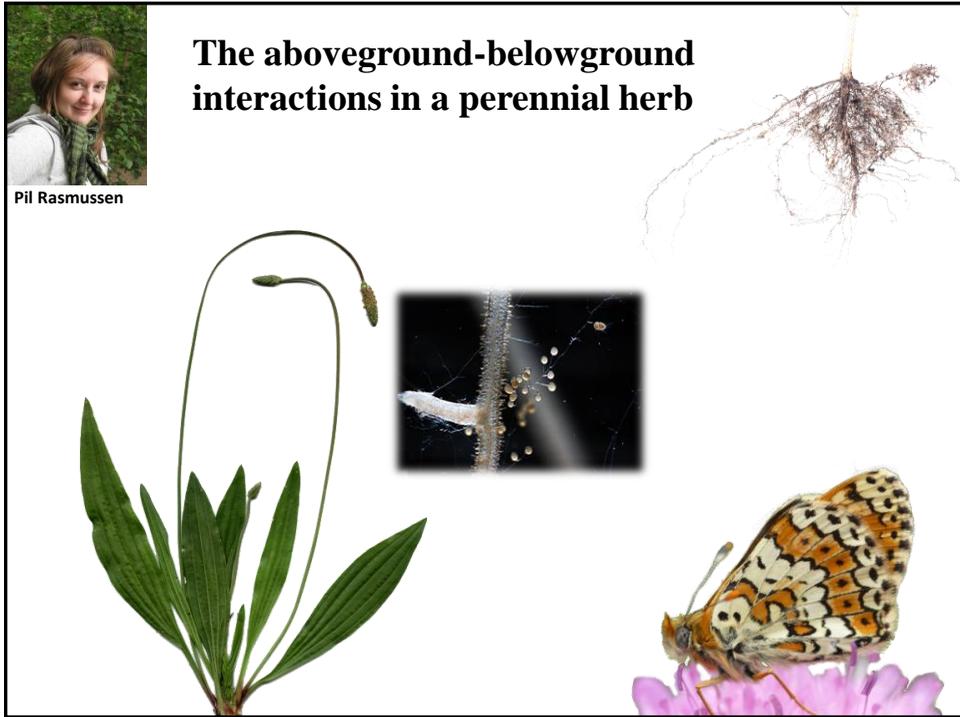
www.plantmicrobeinsect.com
www.su.se/profiles/atack

Oaks, insects & microbes



The aboveground-belowground interactions in a perennial herb

Pil Rasmussen



Wild coffee, insects & pathogens



Pest and pathogens



Small-holder farmers



*Knut och Alice
Wallenbergs
Stiftelse*

Insect Biome Atlas

NRM



SU



SLU



KTH



Four aims:

- Describe the taxonomic and biological composition of (nearly) all insect in Sweden and Madagascar using massive parallel sequencing
- Understand the history of colonization of Sweden and Madagascar
- Relate biodiversity to ecosystem functioning
- Identify the composition and role of the microbiome associated with the insect biome

