University Mathematics and Statistics: Courses, Degrees and Careers

Professor David Warton

About Me

- Australian Research Council Future Fellow (→ mostly do research)
- Ecological Statistics (http://www.eco-stats.unsw.edu.au/), methods for:
  - Studying ecosystem response to human impacts (mining, climate change, ...)
  - Mapping where species occur and their main environmental drivers
- Supervise three PhD students (all female) doing ecological statistics projects
  - We currently have 45 postgrad students, 17 are female (38%)
Eco-stats research – examples of past projects

- Can we predict climate change effects on Blue Mountains biodiversity?
- Megafauna – what can we learn about an animal’s lifestyle from its fossil?
- What can we find out about whales from listening to their calls?
- Dinosaurs – how do body-brain size relationships compare to modern animals?
- What factors are associated with whether or not someone confesses to a crime?
- What is the expected rate of return for a new casino game?
What I like about maths (and especially eco-stats)

- Challenging – there are some pretty tricky problems out there.
- Interesting/important applications
- Variety – different projects require different solutions using different skills (not just mathematical skills)
- Constantly changing as technology changes brings new challenges/solutions
How did I get here

In primary school – Interested in spiders, maps, dinosaurs and Lord of the Rings!

In high school – “What’s the point of maths?”
Interested in environmental issues, “saving the world”.

Undergrad (Sydney) – Double major in maths and biology.
Looking to combine the two (using maths skills for something I cared about).

Postgrad (Macquarie) – Stats is really important in ecology (and elsewhere)
→ statistical ecology

Lecturer (UNSW) – still eco-stats, different problems, still motivated by ecology.
But maths is general – some of my methods have been used in:

▷ bioinformatics
▷ soil chemistry
▷ primate evolution
▷ questionnaire analysis
▷ the Mars Mission!
What high school maths do I use?

I think a lot about how to fit complex models to ecological data. This uses a whole lot of maths I learnt in high school:

**Probability** – To account for variability in data.

**Optimisation** – Especially maximisation of functions, Newton’s method *etc*

**Integration** – Especially numerical integration, Simpson’s method, *etc*

**Exponentials and logarithms** – Handy for dealing with multiplicative processes. Size, abundance, *etc*

**Trigonometry** – Really handy for dealing with cyclic processes. Time of day, seasonality.

So for me, there was a whole lot of point to high school maths!

But I’m supposed to be telling you about maths courses at uni...
The School's research encompasses an extremely broad spectrum of mathematics and statistics. We collaborate locally and internationally with leading mathematicians and statisticians, and with industry groups in areas as diverse as environmental modelling, biomathematics and biostatistics, computing, finance, medicine, engineering and physics. Classical and modern areas of pure mathematics such as analysis, algebra and combinatorics are also a focus.
Schools in the Faculty of Science

Aviation
Biotechnology and Biomolecular Sciences
Materials Science and Engineering
Optometry and Vision Science
Psychology

Biological, Earth and Environmental Sciences
Chemistry
Mathematics and Statistics
Physics
UNSW Faculties

Arts and Social Sciences
Australian School of Business
Built Environment
College of Fine Arts
Engineering
Law
Medicine
Science
UNSW Canberra at ADFA
Courses

• Course
  ▶ a unit of study, subject
  ▶ 6 units of credit (UoC), up to 6 contact hours per week
  ▶ eg MATH1131 Mathematics 1A + MATH1231 Mathematics 1B
  ▶ Assumed knowledge
    Mathematics and Statistics web page: Assumed knowledge
  ▶ The right first year mathematics course
    Mathematics and Statistics web page: Choosing first year mathematics courses

• Semester
  ▶ 4 courses (24 UoC)

• Year
  ▶ 2 semesters, 8 courses (48 UoC)

• Degree
  ▶ 3 years (144 UoC), 4 years (192 UOC), ...
Example Mathematics Courses

- MATH1131 Mathematics 1A (1,654 students)
- MATH1081 Discrete Mathematics (297 students)
- MATH2501 Linear Algebra (110 students)
- MATH2241 Introduction to Atmosphere and Ocean Dynamics (19 students)
- MATH2801 Theory of Statistics (91 students)
- MATH3041 Mathematical Modelling for Real World Systems (29 students)
- MATH3101 Computational Mathematics (21 students)
- MATH3831 Statistical Methods in Social and Market Research (25 students)
- MATH5855 Longitudinal data Analysis (12 students)
- MATH5665 Algebraic Topology (6 students)
Degrees with Mathematics Majors

- Science (3 years)
  - BSc - Bachelor of Science
  - Major + electives + general education (12 UoC)
  - Over 30 majors in science

- Advanced Science or Advanced Mathematics
  - B Science (Advanced Mathematics) UAC 429300 (4 years)
  - B Science (Advanced Science) UAC 429350 (4 years)
  - B Commerce/B Science (Advanced Mathematics) UAC 424200 (5 years)
  - Automatically include honours

- Dual Degrees (not exhaustive)
  - BSc/BA - Bachelor of Science, Bachelor of Arts (4 years)
  - BSc/BEd - Bachelor of Science, Bachelor of Education (4 years)
  - BEng/BSc - Bachelor of Engineering, Bachelor of Science (5 years)
  - BCom/BSc - Bachelor of Commerce, Bachelor of Science (4 years)
  - BSc/LLB - Bachelor of Science, Bachelor of Laws (5 years)
Advanced Mathematics Degrees

• Plans in Advanced Mathematics
  ▶ Applied Mathematics
  ▶ Pure Mathematics
  ▶ Statistics
  ▶ Quantitative Risk
  ▶ High Performance Students Plan (Invitation only)

• Plans in Advanced Science (relevant to Mathematics & Statistics)
  ▶ Physical Oceanography

• 4 year degrees including honours
  ▶ ATAR ≥ 95
  ▶ maintain high grade point average

• Dual degrees
  ▶ Advanced Mathematics + Arts (5 years)
  ▶ Actuarial Studies + Advanced Mathematics UAC 424350 (5 years)
  ▶ Economics + Advanced Mathematics UAC 424460 (5 years)
  ▶ Engineering + Advanced Mathematics UAC 429330 (6 years)
  ▶ Law + Advanced Mathematics UAC 426000 (6 years)
Talented students

- High Performance Students Plan in Advanced Mathematics
  - Very top Mathematics students
  - ATAR $\geq 98$, HSC Maths Ext 2 $\geq 97$ or Maths Olympiad training
  - By invitation only: write to Head, School of Mathematics and Statistics
    head.MathsStats@unsw.edu.au
  - Design your own degree with approval of Academic Mentor

- Talented student schemes
  - Talented students tutorials
  - Higher versions of core Mathematics and Statistics courses
  - Mentors
  - Specially tailored degrees
  - Higher level subjects
  - Summer vacation scholarships
  - Science and Mathematics Olympiad
Scholarships

- All universities offer scholarships, including specialist ones
  - UNSW AAA scholarship to top student in each school
  - Co-op scholarships
  - Teachers scholarships
  - Rural scholarships
  - For minority groups
  - UNSW web page http://www.scholarships.unsw.edu.au/

- School of Mathematics and Statistics scholarships
  - First year Scholarships
  - Rural Scholarships
  - Teachers Scholarships
  - Statistics Scholarships
  - Alma Douglas Scholarship
  - Meteorology and Oceanography Scholarships
  - Mathematics and Statistics web page: scholarships
Skills and Careers

- Problem solving skills
- Modelling skills
- Abstract, logical, creative, and critical thought
- IT capable
- Skills to collect the right data and analyse it
- Scientific and quantitative communication skills

Portable:

- You could change careers several times
- The majority of future jobs are unknown today
- It is a global economy
- Adaptability and ability to learn new things are crucial
Skills and Careers

- “If possible do Maths. It is the single most useful ability to have in your kit-bag to equip you for any eventuality.”
  - Ross Gittens, Economics Editor, Sydney Morning Herald

- “Do as much mathematics and statistics as you can in your degrees – these skills will empower your professional life.”

- CareerCast.com rates different jobs according to work environment, salary, employment and promotion prospects.

- In 2015, mathematician is ranked as the #3 job and statistician is ranked #4 out of 200 different careers. Ahead of doctors, engineers, physicists, accountants, economists, lawyers,...
Example Graduates – Maths & Stats

**Georgia Tsambos** – *Advanced Maths / Arts, 2013*. Had a summer internship with the Reserve Bank and offered full-time work.

**Robyn Stuart** – *PhD, 2014*. Research Assistant at The Kirby Institute for Infection and Immunity. Soon to start a research position in Denmark.

**Michelle Dunbar** – *BSc (Hons) 2008, PhD 2012*. Vice-Chancellor’s Research Fellow at UoW (SMART Infrastructure Facility).

**Leah Shepherd** – *BSc (Hons) 2008*. Statistician (and PhD student), University College, London.
- UNSW
  - http://www.science.unsw.edu.au
  - http://www.maths.unsw.edu.au
  - http://www.maths.unsw.edu.au/highschool/high-school

- Future students