E^2M^2: Ecological & Epidemiological Modeling in Madagascar

January 13-20 & January 22, 2018

Centre ValBio, Ranomafana National Park & Institut Pasteur de Madagascar, Antananarivo

Along with Tanjona Ramidantsoa, I organize E^2M^2: Ecological and Epidemiological Modeling in Madagascar, an annual workshop for Malagasy students aimed to provide an introduction to the use of dynamical models in understanding ecological and epidemiological data. Students participate in a series of interactive lectures and computer-based tutorials and learn to fine-tune model-based research questions, develop clear model frameworks and corresponding equations, and fit models to real-world data. All students work closely with peers and instructors to develop a research plan for an ongoing or existing project integrating dynamical modeling with data collection and/or analysis in a biological system of their choosing. These research plans can then be used as a foundation for future dissertation or grant proposals.

Our 2018 clinic will take place from January 13-20, 2018 at Centre ValBio, Ranomafana National Park, Madagascar, with a mandatory closing session to follow at Institut Pasteur de Madagascar on January 22.

Our teaching team is comprised of: Matthew Bonds, Cara Brook, Andres Garchitorena, Jessica Metcalf, Calistus Ngonghala, Tanjona Ramiadantsoa, Fidisoa Rasambainarivo, Julio Rakotonirina, Hafaliana Christian Ranaivoson, and Amy Wesolowski.

2018 Syllabus:

Sat, Jan 13: (Travel)

- 6:30am: Depart from Tana (Institut Pasteur) via bus, travel to Ranomafana (lunch stop Antsirabe)
- 6:30-7:30pm: Dinner
- 7:30-8:30pm: Introductions and Road Map: What are we doing here? **(Cara)**

Sun, Jan 14: "Thinking About Data"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-9:30am: Lecture: Models and Data **(Tanjona)**
- 9:30-10:30am: Software installation and catch-up. Mentors + instructors make sure all students have the proper materials installed and work through 4 tutorials with them.
- 10:30am – 11:00am: Break
- 11:00am-12:00pm: 1-min student introductions and research presentations **(Cara)**
- 12:00-1:00pm: Lunch
- 1:00-3:00pm Lecture/Tutorial: Exploring & visualizing data in R **(Christian)**
- 3:00-3:30pm: Break
- 3:30-5:30pm: Lecture/Tutorial: Linear regression and simple statistics **(Andres)**
- 5:30-6:30pm: Free time
- 6:30-7:30pm: Dinner

Mon, Jan 15: "Deeper Thinking About Data"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30am-9:30am: Lecture: Introduction to mixed modeling **(Andres)**
- 9:30am-10:00am: Break
- 10:00am-11:00am: Tutorial: Mixed modeling in R **(Andres)**
- 11:00am-12:00pm: Writing Exercise: Formulating research questions **(HW)** **(Cara)**
- 12:00pm-1:00pm: Lunch
- 1:00-2:30pm: Lecture w/Tutorial: Introduction to occupancy modeling **(Fidy)**
- 2:30-3:00pm: Prep for hike
- 3:00-6:30pm: Afternoon hike in Ranomafana National Park
- 6:30-7:30pm: Dinner

Tues, Jan 16: "Thinking About Mechanism"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-10:00am: Lecture: Introduction to Compartmental Models and Differential Equations **(Jess)**
- 10:00-10:30am: Break
- 10:30am-12:00pm: Tutorial: Building Mechanistic Models in R **(Jess)**
- 12:00-1:00pm: Lunch
- 1:00-2:00pm: Small group session: Refining research questions for modeling **(Cara introduces + all instructors lead small groups)**
- 2:00-2:30pm: Writing Exercise: Creating a model world to address a research question **(HW)** **(Cara)**
- 2:30-3:00pm: Break
- 3:00-5:00pm: Exercise + Discussion: Dynamical Fever **(Christian + Cara)**
- 5:00-6:30pm: Mentor research presentations **(Jean-Marius, Ornella, Antso)**
- 6:30-7:30pm: Dinner

Wed, Jan 17: "Fitting Models to Data"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-9:30am: Lecture w/Tutorial: Model Fitting in Practice – the Basic Concept **(Cara)**
- 9:30-10:00am: Break
- 10:00-11:00am: Exercise: Epidemics Cards **(Cara + Amy)**
- 11:00am-12:00pm: Tutorial: Model Fitting with Epidemic Cards **(Cara)**
- 12:00-1:00pm: Lunch
- 1:00pm-2:00pm: Lecture: Alternative Approaches to Model Fitting **(Andres)**
- 2:00-3:30pm: Model Telephone with Model Diagrams **(Tanjona)**

- 3:30-4:00pm: Break
- 4:00-5:00pm: Lecture: PIVOT's Role in E^2M^2 **(Matt)**
- 5:00-6:30pm Mid-session feedback
- 6:30-7:30pm: Dinner

Thurs, Jan 18: "Refining Your Work"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-9:30am: Lecture: Modeling Extensions – Metapopulation Theory, Incorporating Heterogeneity, etc. **(Tanjona)**
- 9:30-10:00am: Break
- 10:00-11:30am: Lecture w/Tutorial: Introduction to Network Modeling **(Fidy)**
- 11:30am-12:00pm: Final research plans **(HW) (Cara)**
- 12:00pm-1:00pm: Lunch
- 1:00pm-2:00pm: Lecture: Introduction to Spatial Modeling **(Amy)**
- 2:00-3:00pm: Tutorial: Spatial Modeling and Statistics in R **(Amy)**
- 3:00-4:00pm: Discussion of a scientific paper **(Tanjona)**
- 4:00-4:30pm: Break
- 4:30-6:30pm: Work time + one-on-one mentoring sessions **(all)**
- 6:30-7:30pm: Dinner
- *-00-10:00pm: Night hike: Ranomafana National Park

Fri, Jan 19: "Putting it all in Perspective"

- 6:30-8:00am: Breakfast
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-9:30am: Lecture: Model Evaluation and Comparison **(Jess)**
- 9:30-10:00am: Break
- 10:00am-11:30am: Tutorial: Model Selection with Age-Prevalence Data **(Cara)**
- 12:00-1:00pm: Lunch
- 1:00-2:00pm: Lecture: Modeling in Practice: The Life Cycle of a Modeling Project, from Conception to Publication **(Andres)**
- 2:00-3:00pm: Lecture: Looking back: How far have we come? **(Tanjona)**
- 3:00-4:30pm: Research plan work time + mentoring sessions **(all)**
- 4:30pm onwards: Afternoon off and farewell dinner in Ranomafana town

Sat, Jan 20: (Travel)

- 6:30-8:00am: Breakfast
- 8:00-9:00am: pack up and board bus
- Return to Antananarivo via bus

Mon, Jan 22: "Sharing Your Work" *(at Institut Pasteur de Madagascar in Antananarivo)*

- 9:00-11:00am: Closing ceremony and final student presentations **(Cara)**
- 11:00am-12:00pm: Final Feedback Session **(Julio)**
- 12:30-2:00pm: Farewell lunch
- 2:00-4:30pm: Mini-symposium: **"Modeling Insights Into Epidemiology and Ecology"** *(Instructor presentations)*
  - **Cara Brook** "Malagasy fruit bats as reservoirs for emerging viral zoonoses" (20 min. + 5 min. Q/A)
  - **Tanjona Ramiadantsoa** "Importance of large scale corridors for biodiversity conservation" (20 min. + 5 min. Q/A)
  - **Jessica Metcalf** "Vaccine preventable diseases: mathematical modeling for public health" (20 min. + 5 min. Q/A)
  - **Amy Wesolowski** ""Using novel data sources to understand the spatial distribution of vector-borne diseases" (20 min. + 5 min. Q/A)

  - **Fidy Rasambainarivo** "Interactions and disease transmission at the domestic animal-wildlife interface in Betampona, Madagascar" (20 min. + 5 min. Q/A)
- 4:30pm: Social Hour

Many of the materials and methods used in E^2M^2 were adapted from those previously developed by faculty at ICI3D:

Thanks to our sponsors: