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:

Please follow instructions for installing packages in R here.

Follow along with R tricks posted through the week here.

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
- 8:00-8:15am: Road Map and Daily Agenda **(Cara)**
- 8:15am-9:45am: Lecture/Tutorial: Introduction to mixed modeling **(Andres)**
- 9:45 - 10:00am: Coffee Break. Prep for hike!
- 10:00am-1:00pm: Morning walk in Ranomafana National Park
- 1:00pm-2:00pm: Lunch
- 2:00 - 3:00pm: Writing Exercise: Formulating research questions **(HW) (Cara)**
- 3:00-3:30pm: Break
- 3:30-5:00pm: Lecture/Tutorial: Introduction to occupancy modeling **(Fidy)**
- 5:00-6:30pm: Free time, or one-on-one mentoring
- 6:30-7:30pm: Dinner

Tues, Jan 16: "Thinking About Mechanism"

- 6:30-8:00am: Breakfast
- 8:00-8:15am: Road Map and Daily Agenda **(Cara)**
- 8:15-10:15am: Lecture/Tutorial: Introduction to Compartmental Models and Differential Equations **(Jess)**
- 10:15-10:45am: Break
- 10:45am-12:00pm: Group exercise: Refining research questions for modeling **(Cara)**
- 12:00-1:00pm: Lunch
- 1:00-2:00pm: Small group session: Refining research questions for modeling (cont.) **(all instructors lead small groups)**
- 2:00-2:15pm: Writing Exercise: Creating a model world to address a research question **(HW) (Cara)**
- 2:15-2:45pm: Break
- 2:45-4:30pm: Exercise + Discussion: Dynamical Fever **(Mentors: Jean-Marius, Ornella, Antso)**
- 4:30-6:00pm: Mid-session feedback **(Julio)**
- 6:00 - 6:30pm: Free time
- 6:30-7:30pm: Dinner

Wed, Jan 17: "Fitting Models to Data"

- 6:30-8:00am: Breakfast
- 7:00-8:00am: Mentoring as needed
- 8:00-8:30am: Road Map and Daily Agenda **(Cara)**
- 8:30-10:30am: Lecture/Tutorial: Model Fitting in Practice – the Basic Concept **(Cara)**

- 10:00-10:30am: Break
- 10:30-12:00pm: Exercise: Epidemics Cards **(Cara + Amy)**
- 12:00-1:00pm: Lunch
- 1:00pm-2:00pm: Tutorial: Model Fitting with Epidemic Cards (continued from above) **(Amy)**
- 2:00-3:30pm: Model Telephone with Model Diagrams **(Mentors: Jean-Marius, Ornella, Antso)**
- 3:30-4:00pm: Break
- 4:00-5:00pm: Lecture: PIVOT's Role in E^2M^2 **(Andres)**
- 5:00-6:30pm: Mentor research presentations **(Jean-Marius, Ornella, Antso)**
- 6:30-7:30pm: Dinner

Thurs, Jan 18: "Refining Your Work"

- 6:30-8:00am: Breakfast
- 7:00-8:00am: Mentoring as needed
- 8:00-8:15am: Road Map and Daily Agenda **(Amy)**
- 8:15-10:00am: Lecture/Tutorial: Introduction to Network Modeling **(Fidy)**
- 10:00-10:30am: Break
- 10:30-12:00pm: Lecture/Tutorial: Introduction to Model Evaluation and Comparison **(Jess)**
- 12:00pm-1:00pm: Lunch
- 1:00-1:15pm: Final research plans **(HW) (Cara)**
- 1:15pm-3:00pm: Lecture/Tutorial: Introduction to Spatial Modeling **(Amy)**
- 3:00-4:00pm: Lecture: Modeling Extensions – Spatial mechanistic models **(Tanjona)**
- 4:00-4:30pm: Break
- 4:30-6:30pm: Work time + one-on-one mentoring sessions **(all)**
- 6:30-7:30pm: Dinner
- 7:30-9:30pm: Night hike: Ranomafana National Park (optional)

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

- 6:30-8:00am: Breakfast
- 7:00-8:00am: Mentoring as needed
- 8:00-8:15am: Road Map and Daily Agenda **(Cara)**
- 8:15-9:30am: Research Snapshots **(all)**

- 9:30am-10:30am: Discussion of a scientific paper **(Tanjona + Mentors: Jean-Marius, Ornella, Antso)**
- 10:30-11:00am: Break
- 11:00-12:00pm: Research plan work time + mentoring as needed **(all)**
- 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
- 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: