E^2M^2: Final Research Plan

Due on Sunday, January 21, 2018 at midnight

Prepare **FOUR** Powerpoint slides that you will share in a **three-minute oral presentation** to the class and other IPM guests on Monday morning. All slides must be in English.

Feel free to complete this assignment on any research topic of your choosing, either the topic that you have been developing all week, or a completely new system if you like.

1. Slide 1 has:
   a. The background to introduce your problem (1 sentence)
   b. The question your statistical model will answer (1 sentence)
   c. The question your dynamical model will answer (1 sentence)

2. Slide 2 has:
   a. Your statistical question
   b. The R function, response and predictor variables, and distribution for the statistical model.
   c. The hypothesized outcome.
   d. A graphical representation of your plan for data collection or analysis and/or a brief summary of the data you will use.

3. Slide 3 has:
   a. Your dynamical model question
   b. Your dynamical model diagram, with all states and processes defined. This will be an edited extension of the first half of the assignment you brought to the "Model Telephone" activity on Wednesday.

4. Slide 4 has:
   a. Up to three next steps that will help answer your questions.

   To help you prepare for Monday, please complete the following tasks on your own time:
   a. Please meet with **two other E^2M^2 students** between now and Monday to receive a critique of your statistical and dynamical framework before completing the slides.
   b. Once slides are completed, please give your **full-length three minute oral presentation** in practice to one other E^2M^2 student before Monday. This must be timed!

   Please acknowledge any partners who critiqued your original work or reviewed your presentation somewhere on your first slide.

Please send your completed slides on to Cara at cbrook@berkeley.edu by midnight on Sunday, January 21, 2018.

You have been assigned a meeting time and instructor/mentor pair from which you can solicit advice on any aspect of your final research plan **this Thursday afternoon**. Please see your name below for the details of your assigned meeting:

Time	Student	Instructor/Mentor
4:30-4:50pm	Soa Fy	Jess/Christian
4:50-5:10pm	Ines	Jess/Christian
5:10-5:30pm	Lady	Jess/Christian
5:30-5:50pm	Elysee	Jess/Christian
5:50-6:10pm	Christophe	Jess/Christian
4:30-4:50pm	Nomena	Amy
4:50-5:10pm	Avotra	Amy
5:10-5:30pm	Crisca	Amy
5:30-5:50pm	Jeannot	Amy
4:30-4:50pm	Mihaja	Fidy/Jean Marius
4:50-5:10pm	Ruva	Fidy/Jean Marius
5:10-5:30pm	Andry	Fidy/Jean Marius
5:30-5:50pm	Fenosoa	Fidy/Jean Marius
4:30-4:50pm	Lanto	Tanjona/Antso
4:50-5:10pm	Kiady	Tanjona/Antso
5:10-5:30pm	Hoby	Tanjona/Antso
5:30-5:50pm	Tsilavo	Tanjona/Antso
4:30-4:50pm	Mirana	Andres/Ornella
4:50-5:10pm	Anjasoa	Andres/Ornella
5:10-5:30pm	Mamy	Andres/Ornella
5:30-5:50pm	Fabien	Andres/Ornella
4:30-4:50pm	Ricky	Cara
4:50-5:10pm	Fara	Cara
5:10-5:30pm	Michael	Cara
5:30-5:50pm	Rado	Cara
5:50-6:10pm	Tahiana	Cara

Directions for Wednesday's assignment are included on the last two pages of this document if you need to review.

Part One: Make a Statistical Framework

- Ask a statistical question related to your system.
- Describe your data
- Write your response variable.
- Write the appropriate family/distribution associated with your model.
- Write the link associated with that distribution.
- Write out the R code, including the function and potential predictors, that you propose to use to address your question in a statistical modeling framework.
- Write a hypothesis about your expected findings from this model.

Example: What factors explain the geographic distribution of plague infection in *Rattus rattus* in Madagascar?

Data: You set four grids of 100 traps simultaneously in five different districts distributed all across Madagascar. All districts were trapped within two weeks of one another at two different times of year: once in the wet season and once in the dry season. You lethally sampled all captured *Rattus rattus* and carried out Rapid Detection tests for plague on each rat to give you counts of plague positive rats for each grid andsite. You also have corresponding data on the average elevation of each district and the average rainfall in the district during the month preceding your trapping session.

Response Variable: count plague positive rats

Family: Poisson

Link: Natural log

Potential Predictors:

R code

```
glmer (count_plague_positive_rats ~ trap_season + district_elevation + average_district__rainfall +
    (1|trapping_grid), family= "poisson")
```

Hypothesis

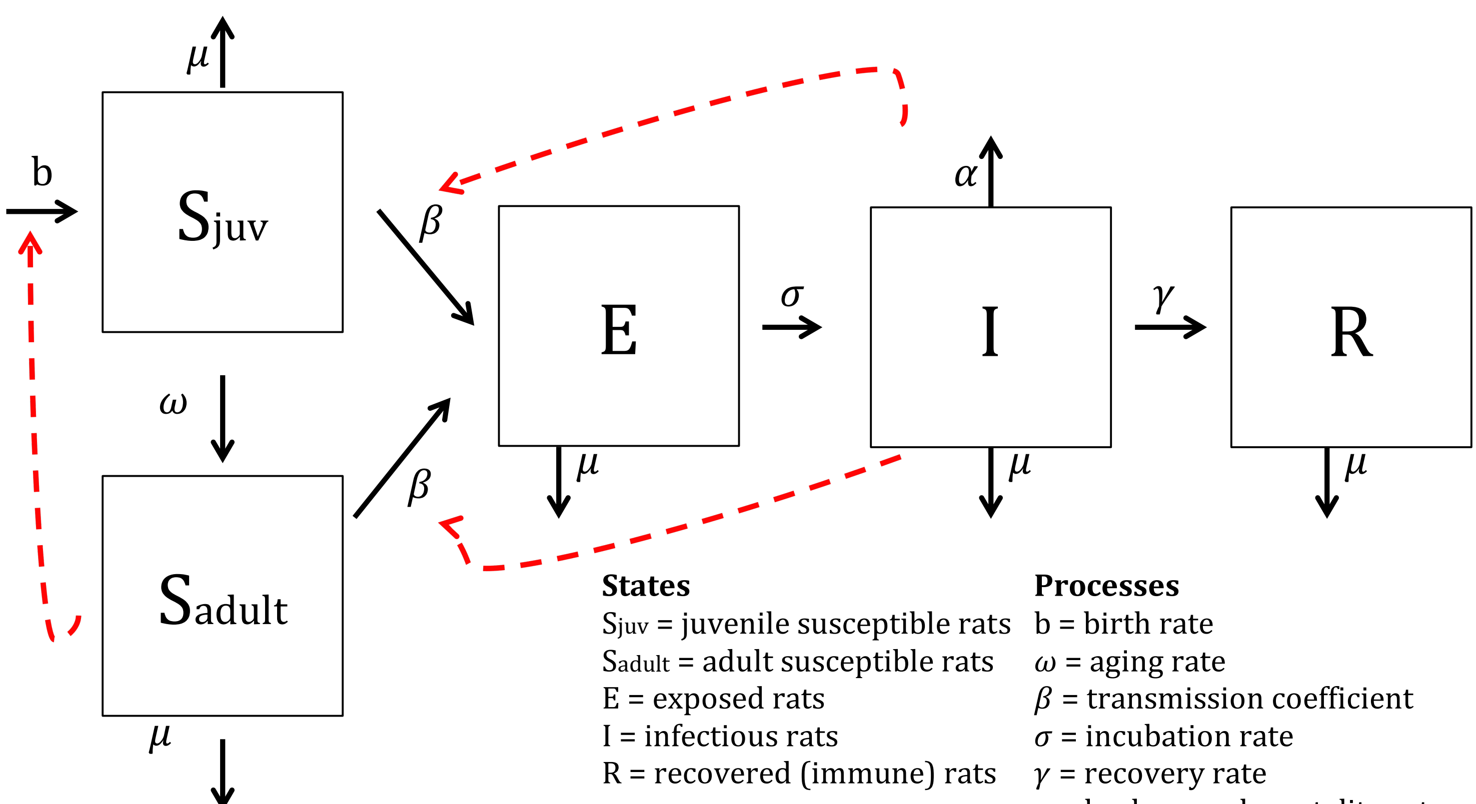
We predict that rat infection status will demonstrate significant positive correlation with increases in district elevation and rainfall. We anticipate no significant random effect of trapping_grid and trap_night and may drop these terms in later model selection.

Part Two: Make a Dynamical Model Diagram

- Construct a diagram that represents all of the individual states and processes of interest in your system.
    - For your own purposes, you can use whatever graphical conventions work best for how you think about the system.
- Draw a clean, clearly labeled version of your model diagram and bring it with you to tomorrow afternoon's 'Model Telephone' session.
    - Use arrows to represent the *transitions* from one category or state to another. Label transition arrows with descriptions of what variables or other factors will influence the rate at which the transition occurs.
    - Include a key that clearly states what any symbol/letter/abbreviation you use means.
    - Include your research question at the top of the page,

Example:

Can the Malagasy black rat (*Rattus rattus)* population independently maintain transmission of the plague bacterium, *Yersinia pestis?*



States
S_{juv} = juvenile susceptible rats
S_{adult} = adult susceptible rats
E = exposed rats
I = infectious rats
R = recovered (immune) rats

Processes
b = birth rate
ω = aging rate
β = transmission coefficient
σ = incubation rate
γ = recovery rate
μ = background mortality rate
α = infection-induced mortality rate
γ = recovery rate