BIOL 410

Tutorial 1

Outline

- Course overview questions
- Assignment 1
  - Structure
  - Components
  - Suggestions
- Cran R
  - Basics, platform for population models

Population modeling assignment

- Sequentially build a population model
- The model will be primarily visual and verbal, focused around a relationship diagram
- You are free to choose any species you like
  - However, your task will be easier if you choose a well-studied organism that has been the focus of considerable life-history and ecology research.
  - Choosing a species that you are interested will also help to keep the project interesting.
  - Specific population, or population of species in general

4 components

1. Life history
2. Intraspecific interactions and graphical life cycle
3. Interspecific interactions
4. Unified model, complete graphical representation of model

Part 1

- **Describe the life history of your organism. (Max 1 page text plus references)**
  - Provide a description of the life-history of the species.
    - What happens as individuals progress from birth do death?
    - What is the species' reproductive strategy (e.g., monogamous, polygamous, angiosperm, gymnosperm, etc.)?
    - What are the key sources of mortality?
  - Identify the age/stage/size classes that best represent the demographic structure of the population.
  - Briefly identify the key environmental factors and processes that likely influence the transitions between life stages. At this stage you don't need to provide quantitative data, just a description of the process. You might want to consider the size of your current population and suggest which of these processes is likely to have greater influence if you have current estimates of your population size.

Part 2

- **Describe the factors that influence within species processes, and produce a simple graphical representation of the species life cycle (i.e. diagrammatic life table). (1 page diagram, Max 1 page text plus references)**
  - Starting from the previously defined life history diagram, describe how each population process will result in a change in N. If possible, start to compile quantitative estimates of stage specific survival probabilities and fecundity.
    - Describe how the processes may interact (e.g. how do deaths influence births?).
    - If there is sufficient data available, build a life table and calculate R, G and r.
  - Describe how factors such as habitat quality, food availability and intraspecific competition influence survival and fecundity.
  - Describe when in the species life cycle dispersal occurs, and if intraspecific factors will influence immigration and/or emigration.
  - Identify environmental factors that may influence the population processes.
    - E.g. habitat quality influencing survival and fecundity
    - Habitat fragmentation influencing immigration and/or emigration rates
  - Produce a graphical population model that includes all of the above described population stages and population processes (transitions).

Diagrammatic life table

Attack dynamics
- **tree defences**
- **population synchronized**

Dispersal
- **habitat availability**
- **habitat search**
- **habitat selection**

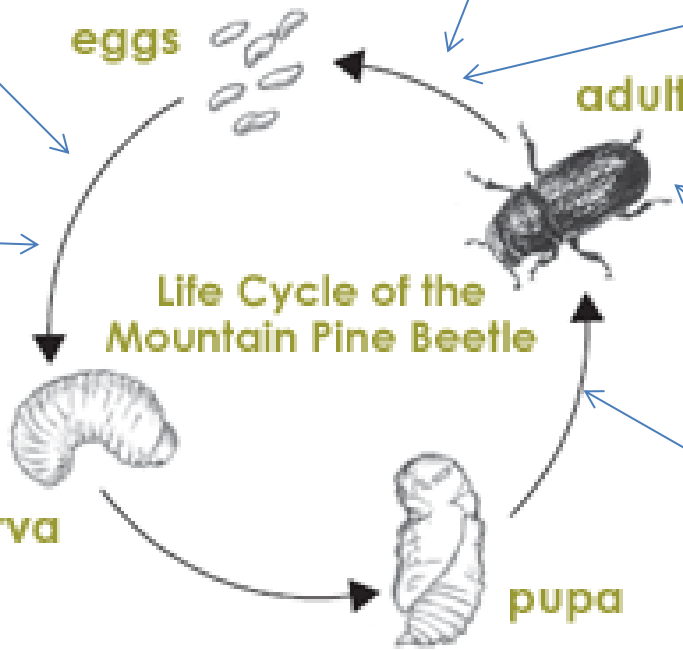
Overwintering survival

Growth + development
- **habitat quality**
- **tree defences**
- **competition (intra/inter)**

Predators
Parasitoids

Predators
Parasitoids

Insect population vigour



Part 3

- **Describe relevant interspecific interactions and processes, and estimate the relative magnitude of their impacts within the context of the above defined model. (Max 1 page text plus references)**
  - Most populations live in communities where other species can have a direct or indirect influence on the dynamics of the focal population. Describe the key interspecific interactions that will influence the dynamics of your population, considering factors such as:
    - Prey species and availability
    - Competitors
    - Predators
    - Parasites
    - Disease
  - Estimate the relative importance of each of these processes, and if possible produce a quantitative estimate of the processes population impact.

Part 4

- **Combine information from the previous sections into a complete population model and create a graphical representation of the models structure. (1 page diagram, Max 1 page text plus references)**
  - Evaluate the relative importance of all previously described interactions and processes (both intraspecific and interspecific), and identify key factors that you think should be retained in the final model. Provide a written justification for your decisions that is supported by primary literature references. The decision to retain a process or state should reflect both the estimated importance of the factor as well as the ability to accurately estimate required rate and state variables.
  - Consider potential second order interactions between the retained processes and briefly describe these indirect interactions.
  - Finally, consider limitations of your model now that it is nearing completion. Models are representations of reality, thus, no model is a perfect reflection of a real population. Modellers must be aware of what is missing from their models and be prepared to speculate or hypothesize the effects of such omissions. This could include omitted processes (abstraction) or a description of knowledge gaps for your species of interest.

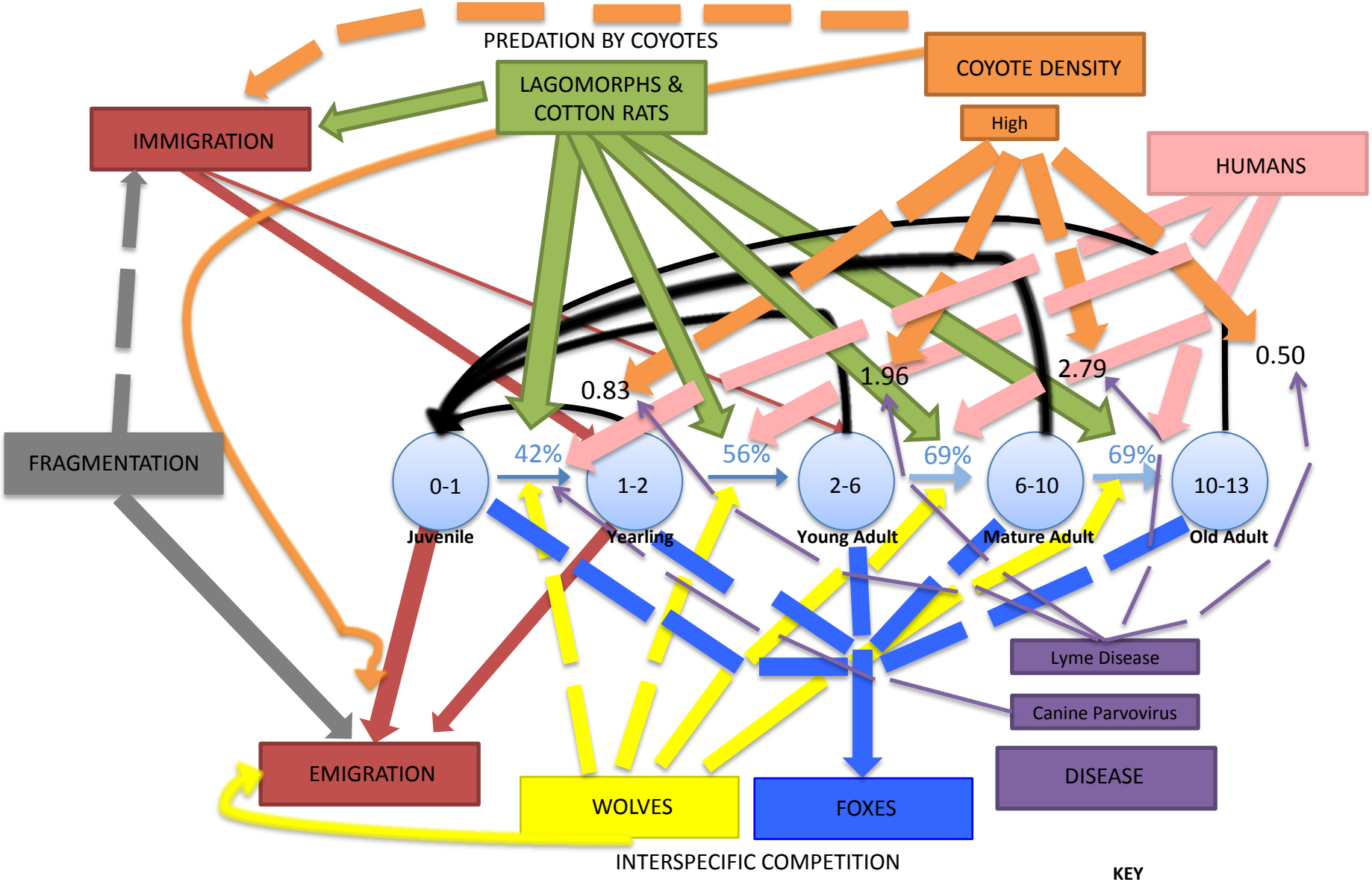


Figure 1. A loop diagram depicting coyote population dynamics.

Evaluation

- 4 x 5% = 20%
- Oct. 15
- Nov. 5
- Nov. 19
- Dec. 3

Modeling platform

- Cran R
- State variables
- Coefficients and rates