Sick Cats Project

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Hello! Testing this. Try Comitting and pushing with a response to make sure we get the hang of this.

#install.packages("deSolve", dependencies = T)  
library(deSolve)  
require(deSolve)  
  
library(tidyverse) #install.packages('tidyverse)

## ── Attaching packages ──────────────────────────────────────────────────────────────── tidyverse 1.3.0 ──

## ✓ ggplot2 3.2.1 ✓ purrr 0.3.3  
## ✓ tibble 2.1.3 ✓ dplyr 0.8.3  
## ✓ tidyr 1.0.0 ✓ stringr 1.4.0  
## ✓ readr 1.3.1 ✓ forcats 0.4.0

## ── Conflicts ─────────────────────────────────────────────────────────────────── tidyverse\_conflicts() ──  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

# Written Paper

### Introduction

200 words, at least two references.

## The Model

**1. Describe core model equations in words**

starts with Lotka-Volterra predation model:

$$
\begin{align}
\frac{d N}{dT} &= rN(1-N/K)-\mu NP
\newline
\newline
\frac{d P}{dT} &= a\mu NP-dP
\newline
\end{align}
$$

where: N(T): population size of prey (birds) P(T): population size of predators (cats) T: time *r*: per capita growth rate *K*: carrying capacity *mu*: predation rate (per capita and unit prey) *d*: predator per-capita mortality rate *a*: trophic conversion efficiency

…incorporating FIV, P = Susceptible + Infected (with no recovery or immunity), and there is only one stage of the illness (FIV). so:

$$
\begin{align}
\ P= S + I
\newline
\newline
\frac{d S}{dT} &= a\mu NP-dS-\theta(P) \frac{S I}{P}
\newline
\newline
\frac{d I}{dT} &= \theta(P) \frac{S I}{P}-dI-\delta I
\newline
\end{align}
$$

where:

is the incidence is of proportionate mixing type if the contact rate between predator individuals in constant.

The incidence is of mass action type if the conact rate between predator individuals increases linearly with population size,

re-writing model equations, with i being disease prevalence:

They introduce dimensionless variables (in order to reduce the number of parameters), where:

$$
\begin{align}
B=N/K
\newline
C=P\mu /r
\newline
t=rT
\end{align}
$$

**so the main equations in the model are:**

$$
\begin{align}
\frac{d B}{dt} &= B(1-B)-BC
\newline
\newline
\frac{d C}{dt} &= eBC-mC-\alpha Ci
\newline
\newline
\frac{d i}{dt} &= ([\Gamma(C) - \alpha] [1-i] - eB)i
\newline
\end{align}
$$

where

$$
\begin{align}
\Gamma (C) &= \frac{\beta\_{PM}}{r} = \sigma\_{PM}
\newline
\newline
and
\newline
\newline
\Gamma (C) &= \frac{\beta\_{MA}}{\mu}C = \sigma\_{MA}C
\newline
\end{align}
$$

for proportionate mixing and mass action transmission respectively.

$$
\begin{align}
e &= \frac{\alpha \mu K}{r}
\newline
\newline
m &= \frac{d}{r}
\newline
\newline
\alpha &= \frac{\delta}{r}
\newline
\end{align}
$$

#### Coding the model

### Model Assumptions:

List model assumptions

### Variables and Parameters

Table of variables and parameters, meanings, units, and any values used in paper

#parameters.table <- data.frame("parameter" = c("r","K",paste($\mu$),"a","d",), "definition" = " ", "value" = , "units" =, stringsAsFactors = FALSE)

### Time Series

Show how outcomes differ as a function of interesting parameters. include caption.

### Bifurcation diagram

## Extension Section

1. Describe a modification to the model - in words and in math
2. Illustrate effects of modiification with one figure

### Discussion

1. 100 words + 2 references
2. Critique applicability/limitations
3. Interpret results - what is the ecological significance?