BIO 4AE3. · 17 Sep 2025

ESTIMATING R_0 (or R_t)

estimate the parameters

given the model, $R_0 = \frac{\beta}{\gamma} \cdot N$

rate of new infections (incidence) =

$\beta \cdot S \cdot I$

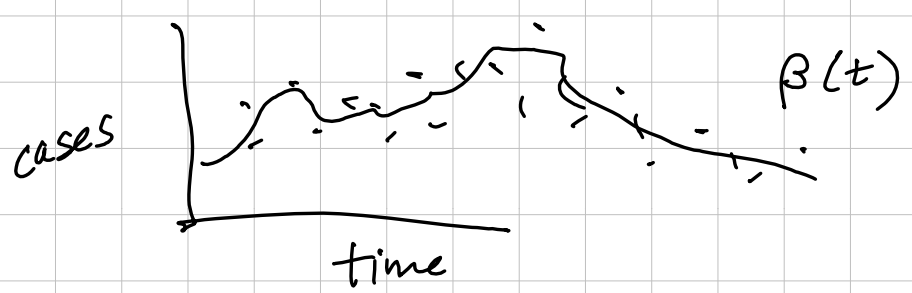
in a susceptible pop → $\beta \cdot N \cdot I$

per infected person → $\beta \cdot N$ (time^{-1})

rate of recovery = γ

→ infectious period = $1/\gamma$ (time)

→ $\frac{\beta N}{\gamma}$ ↔ individual-level



$r = \beta N - \gamma$

e^{rt}

$R_t^* = 1$ $\quad R_t = R_0 \cdot \frac{S}{N}$

$I = R_0 \cdot \frac{S^*}{N}$

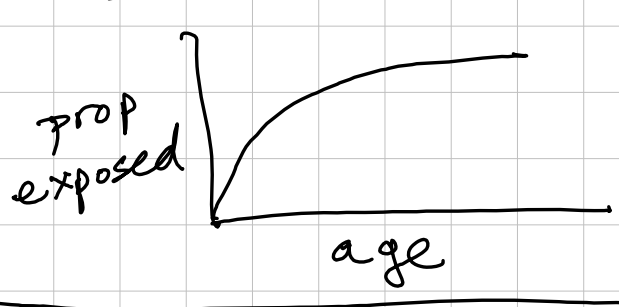
→ SEROSURVEYS. brucellosis in bison.

Recovered/immune

$I \approx 0$

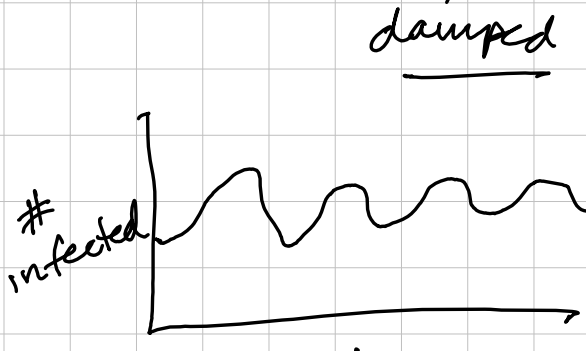
exposure surveys?

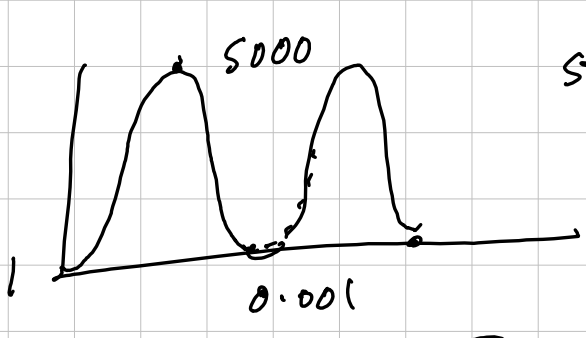
age-dependent exposure curves



DYNAMICS

SIR model predicts damped oscillations



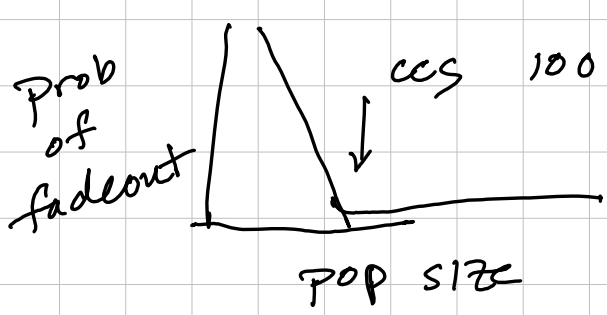


stochastic extinction

dep on pop size, R_0, host pop growth rate...

- CRITICAL community SIZE.

$R_0 \approx 18$



- PERSISTENT cycles.

seasonal forcing
evolution/strain shift
Stochasticity