Tick control strategies for the management of louping ill virus in red grouse.

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THE MACAULAY LAND USE RESEARCH INSTITUTE

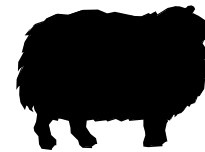research today for land use tomorrow

Talk Outline

- Background

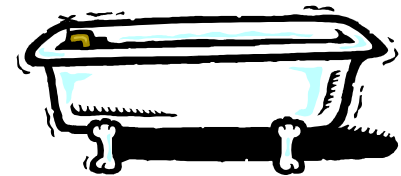- Tick control strategies

- Model Predictions

- Future plans

Louping Ill Virus (LIV)

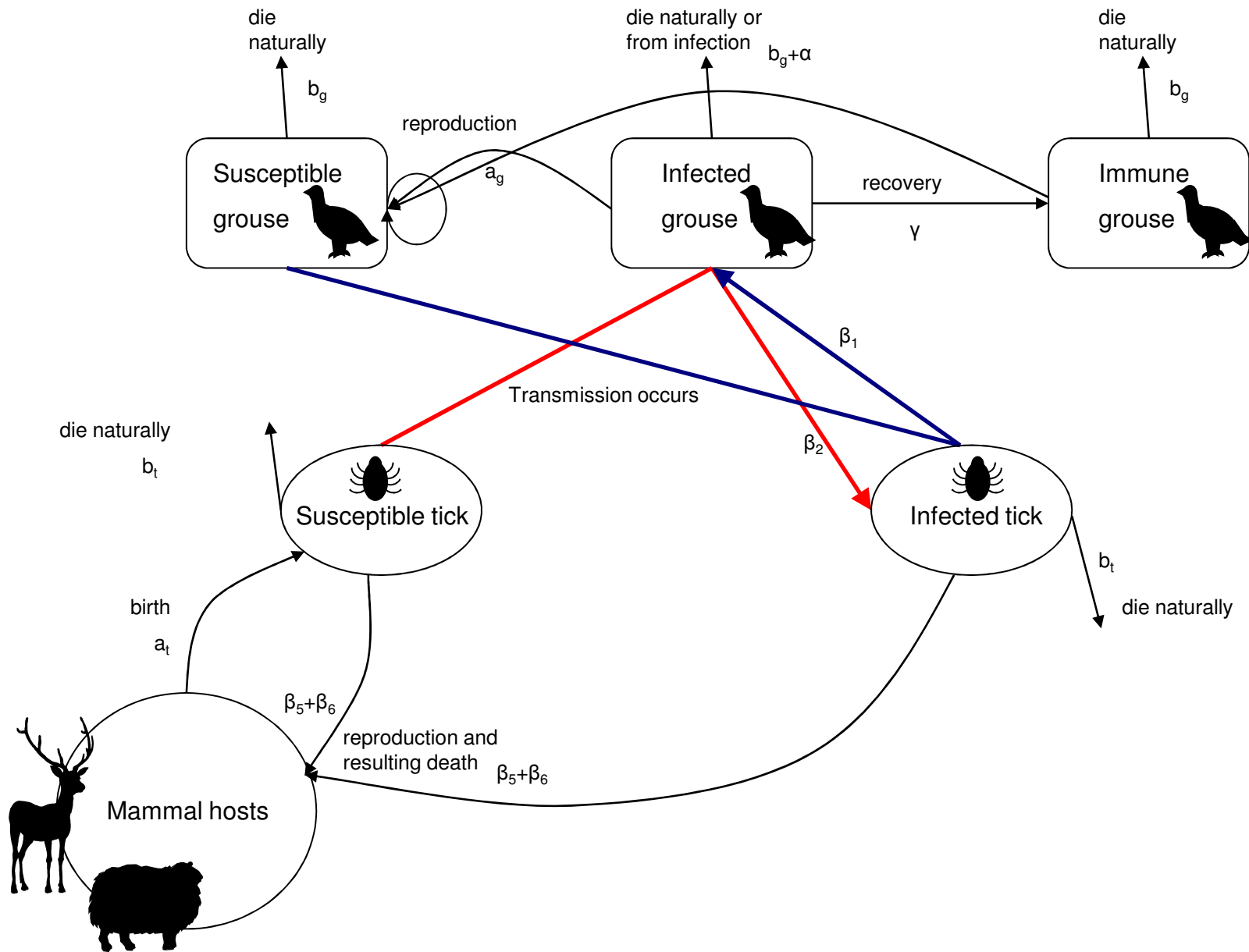- Tick borne disease

- Affects sheep and grouse

- Sheep vaccinated and 'dipped'

- 80% mortality in infected grouse

die
naturally
b_g

die naturally or
from infection $b_g+\alpha$

die
naturally
b_g

reproduction
a_g

Susceptible
grouse

Infected
grouse

recovery
γ

Immune
grouse

β_1

Transmission occurs

β_2

die naturally
b_t

Susceptible tick

Infected tick

b_t

die naturally

birth
a_t

$\beta_5+\beta_6$

reproduction and
resulting death $\beta_5+\beta_6$

Mammal hosts

Sheep 'tick mops'

- Actively use sheep treated with acaricide to 'mop up' ticks.

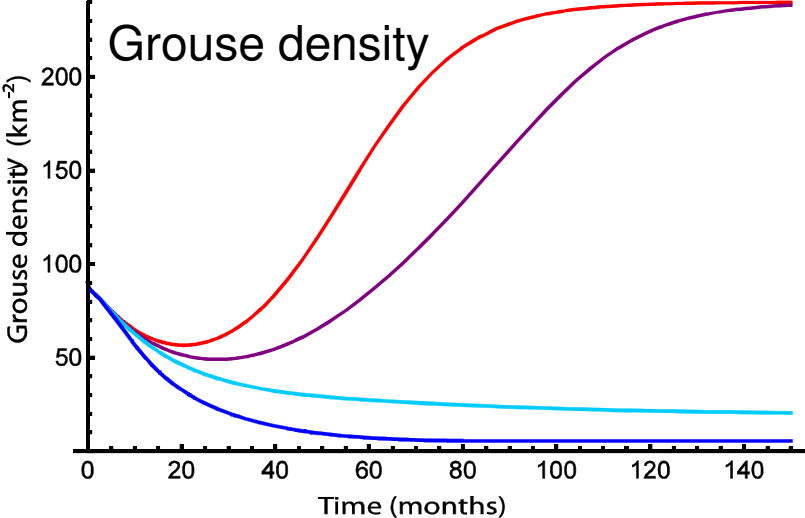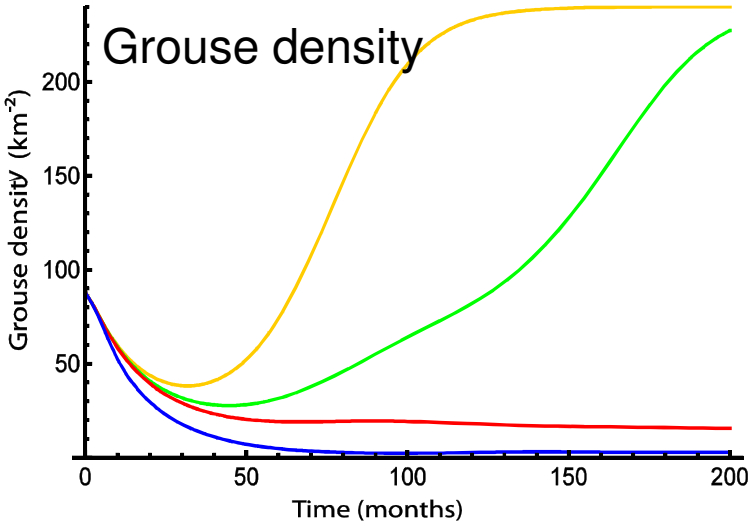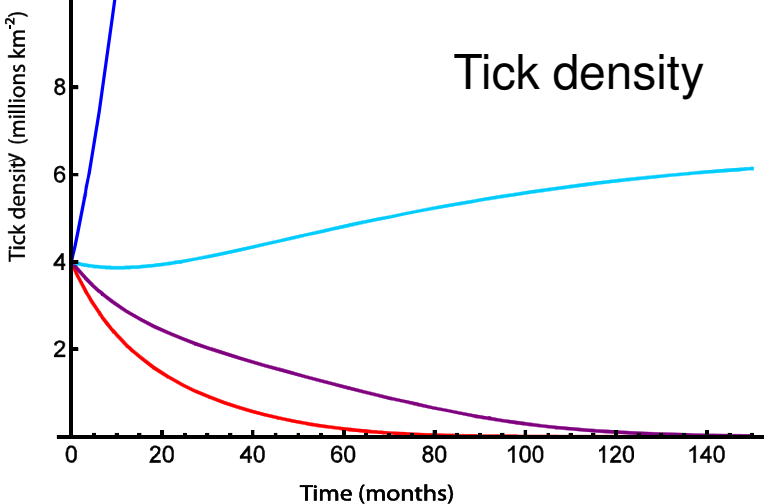What does the model predict when adding 50 treated sheep per km² to areas with different deer densities?
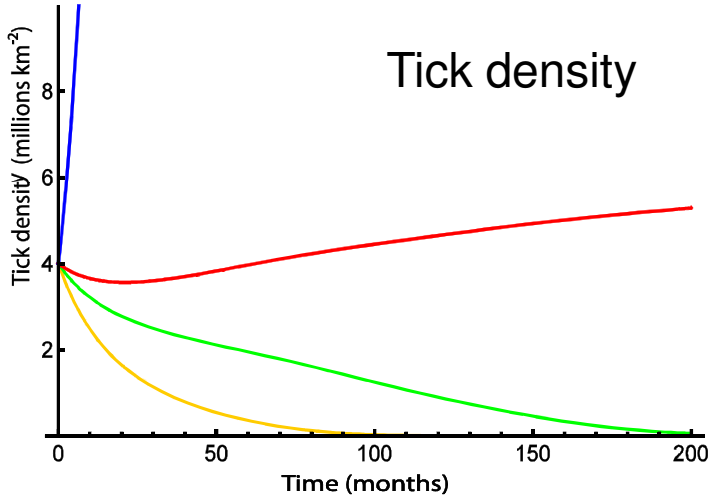
How does the sheep tick burden affect virus persistence?

low burden model

high burden model

Low burden model: Deer density (per km²) on x-axis from 0 to 30, Sheep density (per km²) on y-axis from 0 to 300. A near-vertical blue line at about deer density 7. Left region labeled "Virus dies out", right region labeled "Virus persists".

High burden model: Deer density (per km²) on x-axis from 0 to 30, Sheep density (per km²) on y-axis from 0 to 300. A diagonal blue line. Upper-left region labeled "Virus dies out", lower-right region labeled "Virus persists".
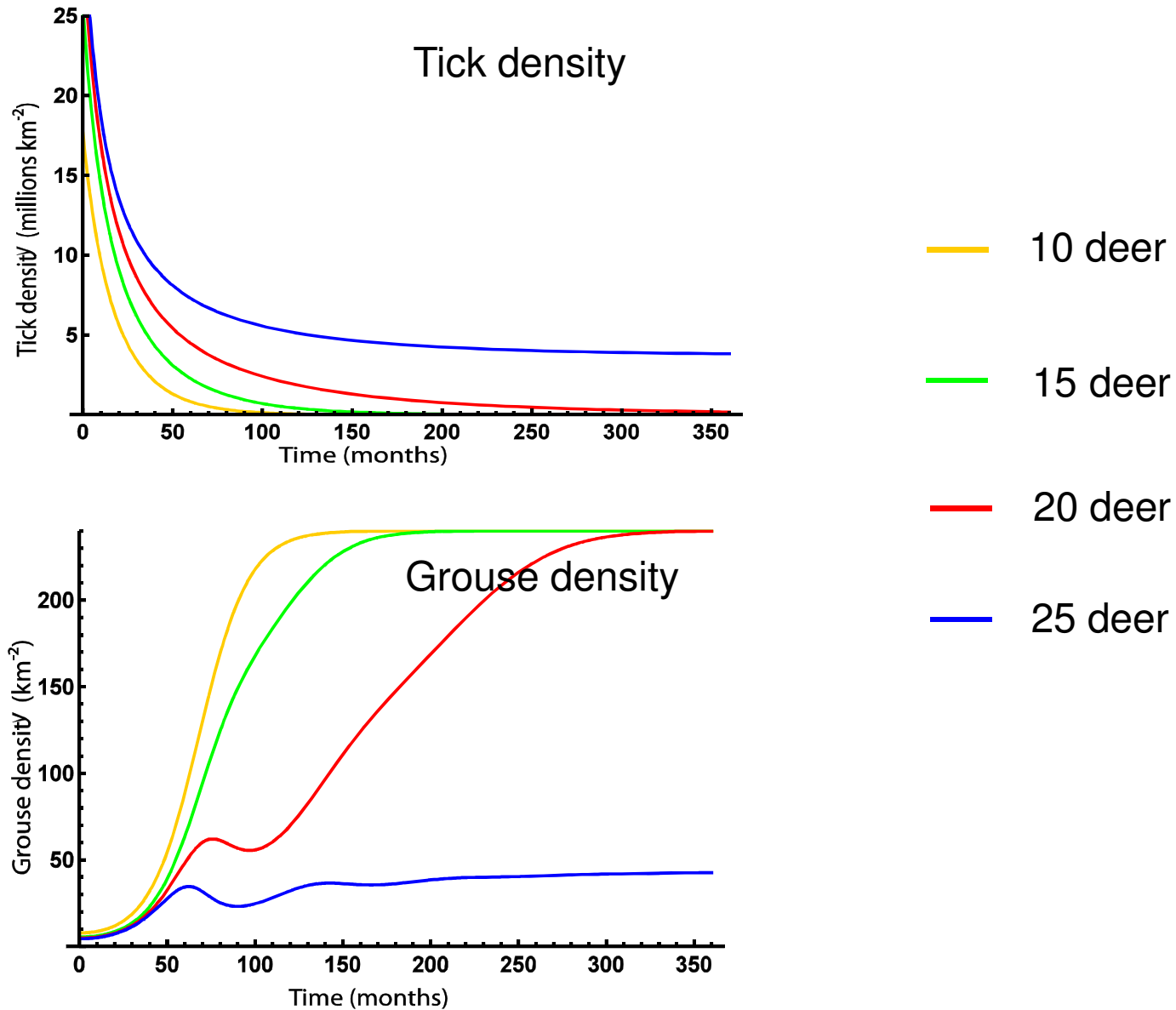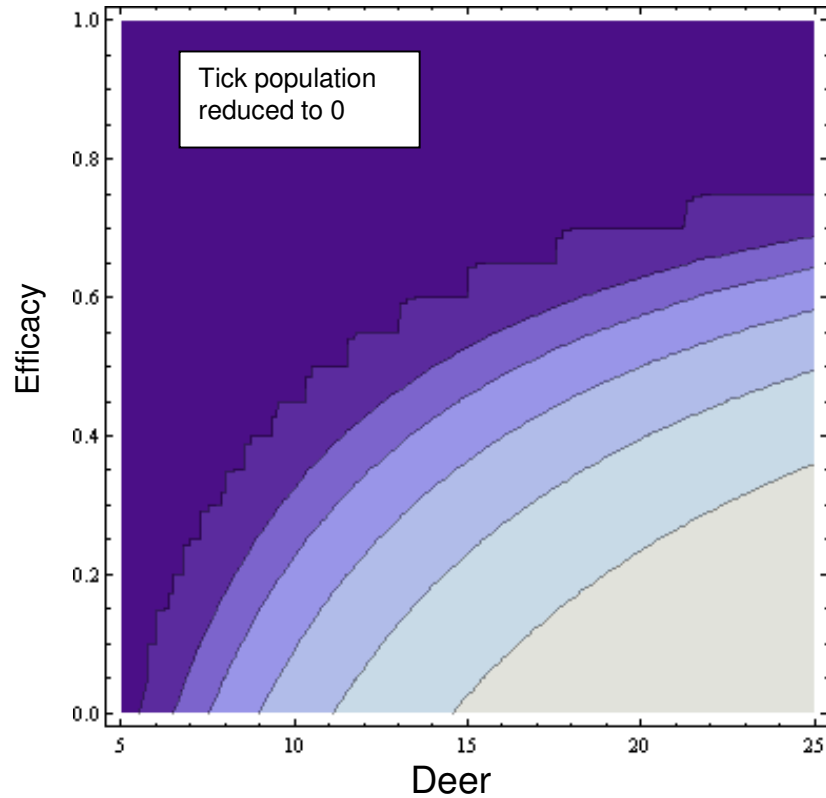
Aww!

- High deer densities reduce effectiveness of sheep tick mops

- Can we treat deer instead?

What are the model predictions for adding acaricide of 70% efficacy to deer at different densities?
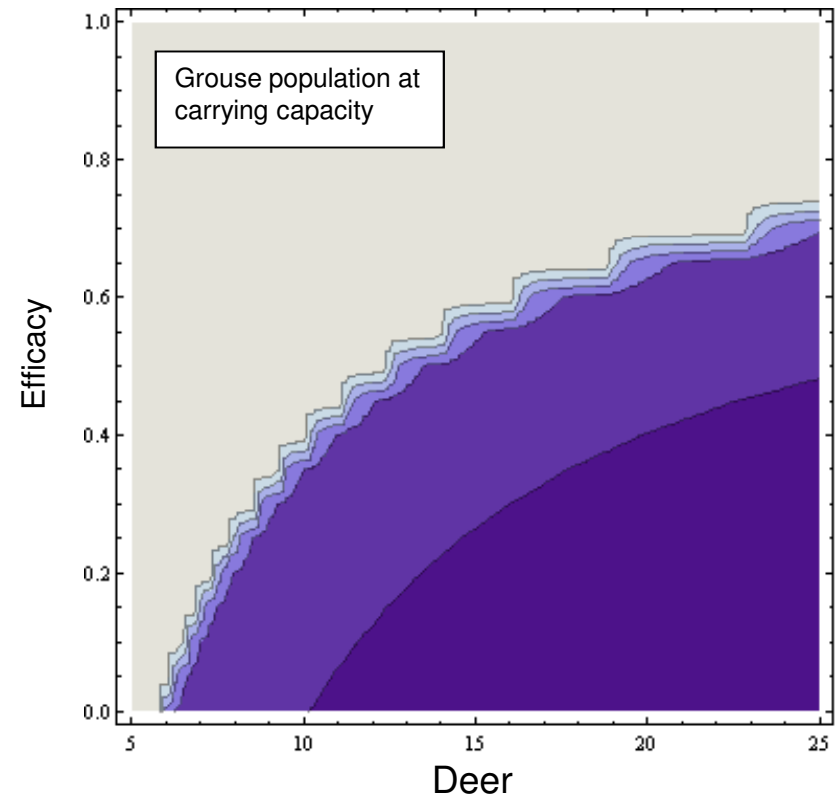
How does acaricide efficacy impact deer tick mop effectiveness?
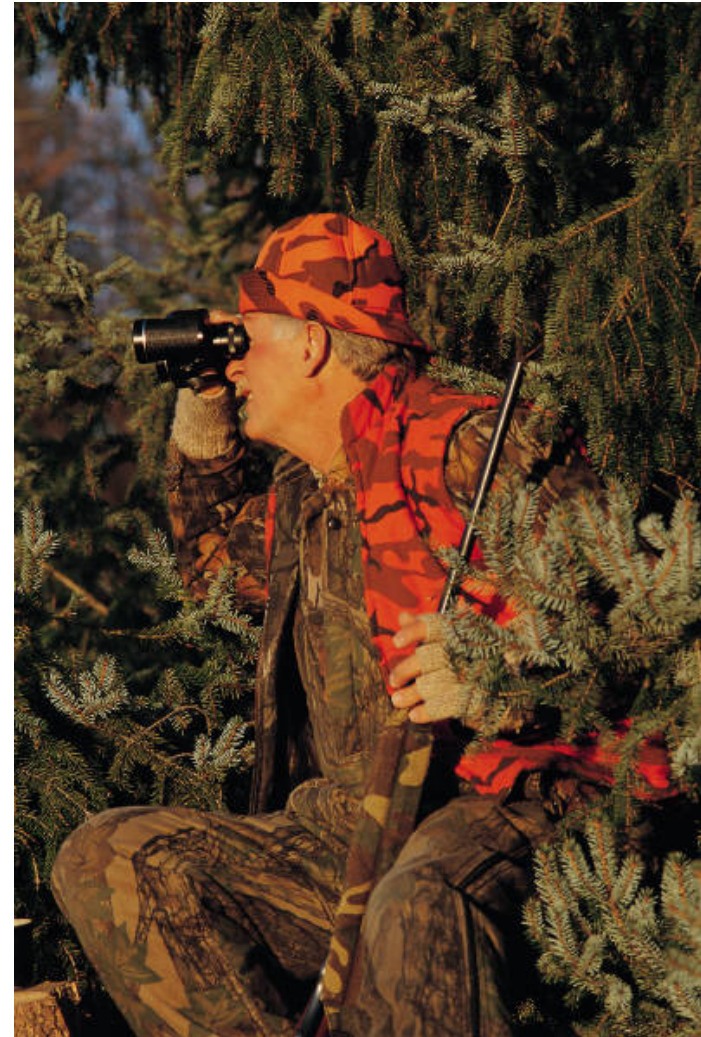
Predicted tick population density

Predicted grouse population density

Deer Culling

•Legal culling occurs on many estates for
    habitat management
    tick control

•Stalking another source of income

How does culling 70% of the deer compare to acaricide treatment at 70%?
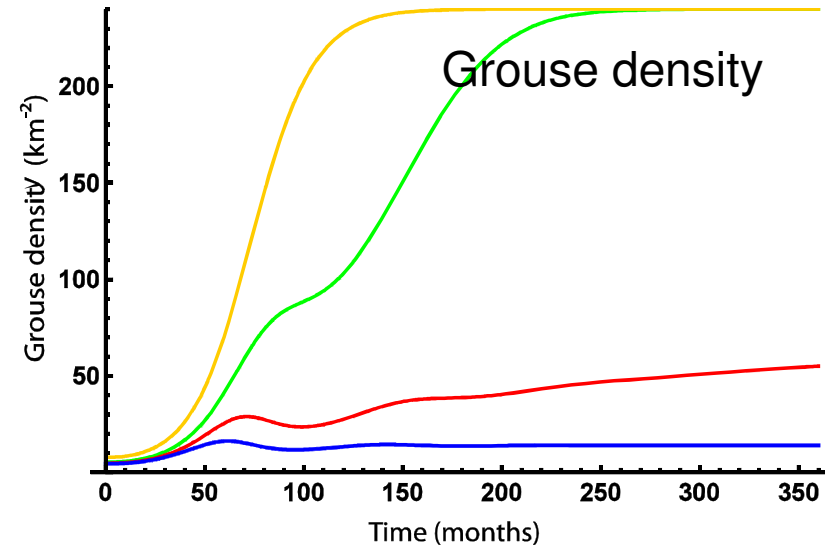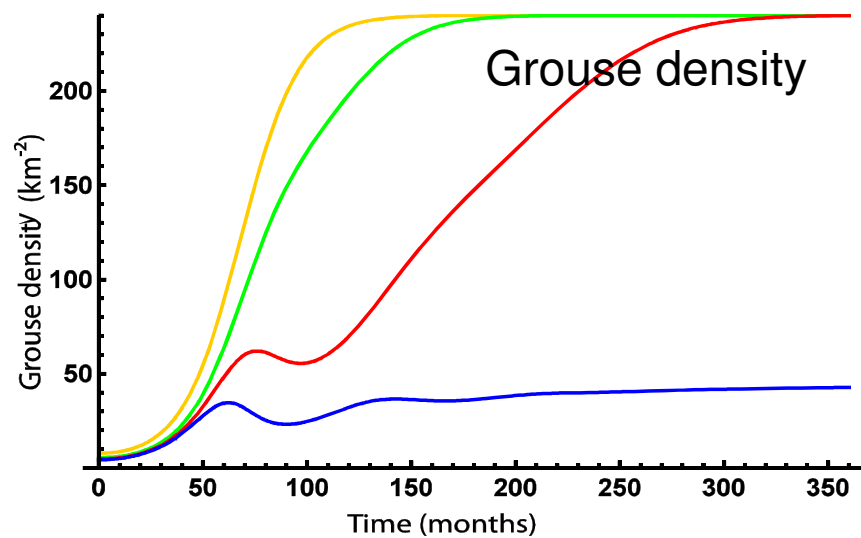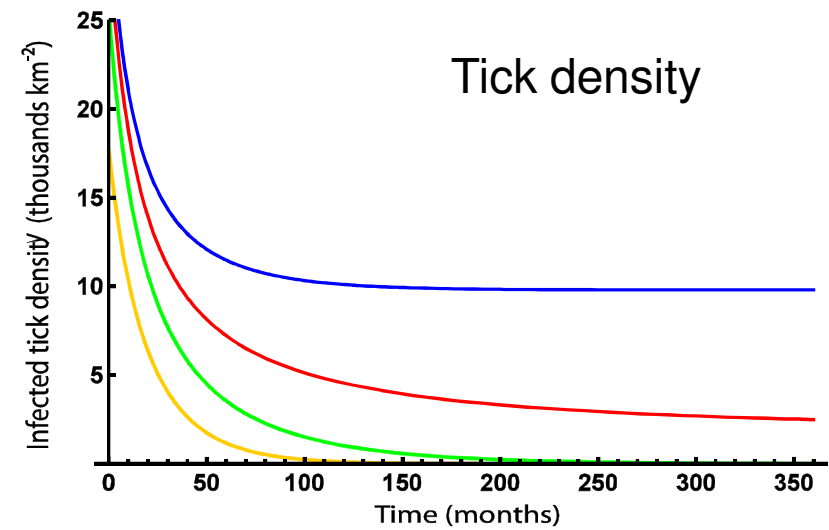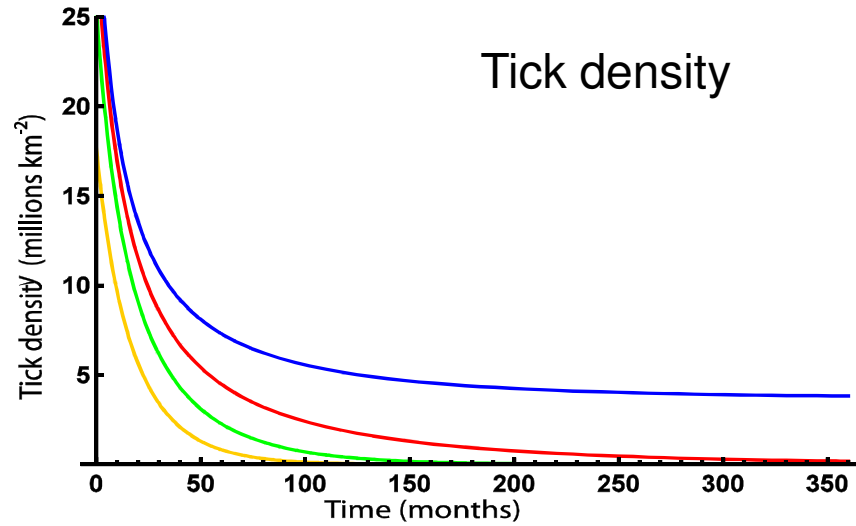
— 10 deer   — 15 deer   — 20 deer   — 25 deer

Acaricide

Tick density

Culling

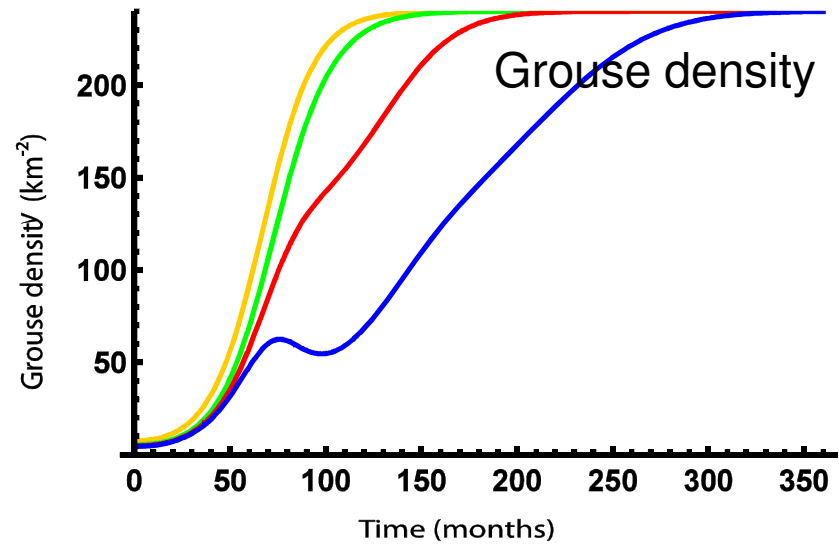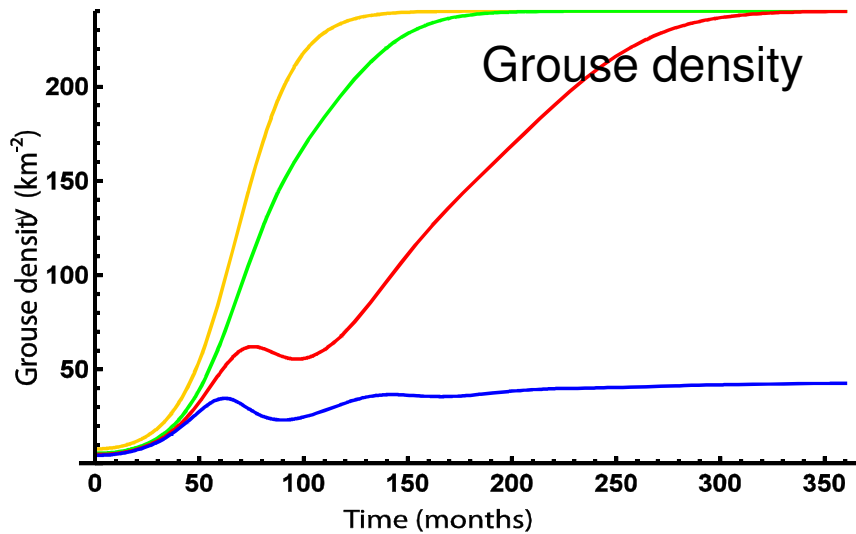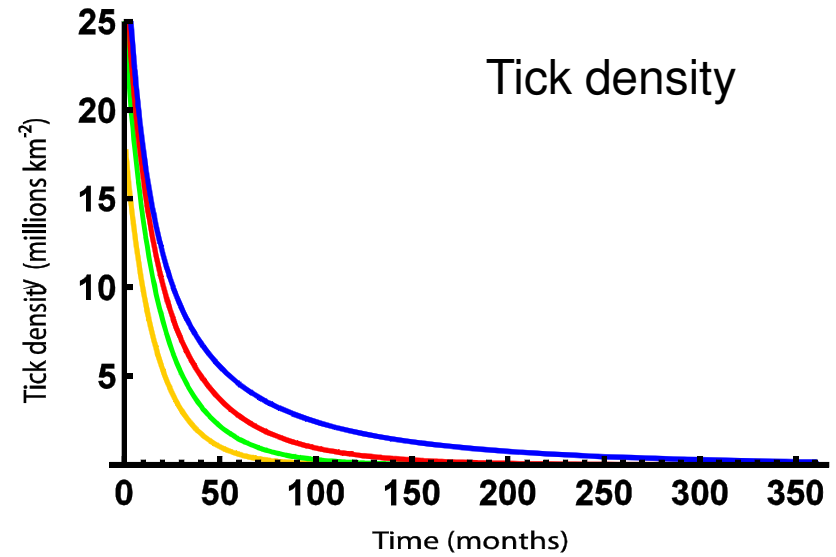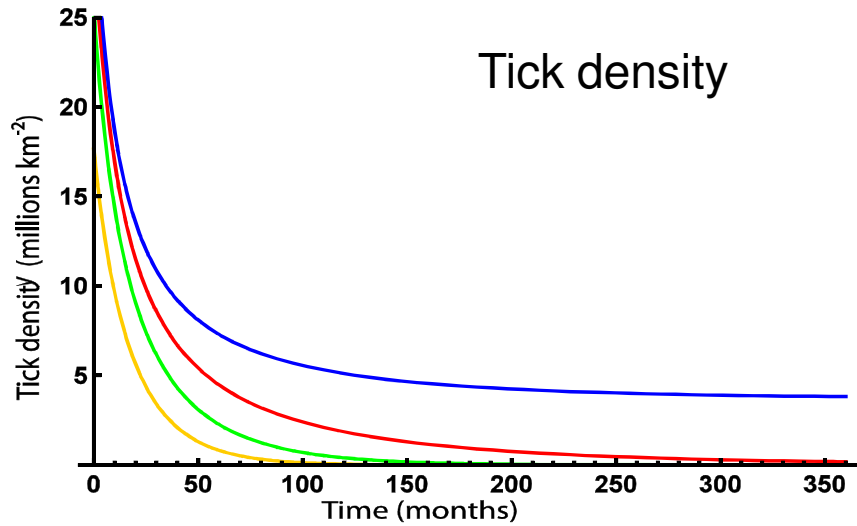Tick density

Grouse density

Grouse density

How does a combination of culling (20%) followed by 70% acaricide compare?

— 10 deer   — 15 deer   — 20 deer   — 25 deer

Acaricide only

Tick density

Culling and acaricide

Tick density

Grouse density

Grouse density

Conclusions

Sheep tick mops

- depend on sheep tick burden
- less effective with high deer density

Deer tick mops

- more effective with low deer density
- success improved if efficacy high
- more effective than culling
- combination may be optimum

Future Plans

- Acaricidal leg bands

- Hand in my PhD thesis!

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landowners/shepherds for data
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