



# **Meningeal Worm Transmission Factors: Problem and Prevention on Small Ruminant Farms**

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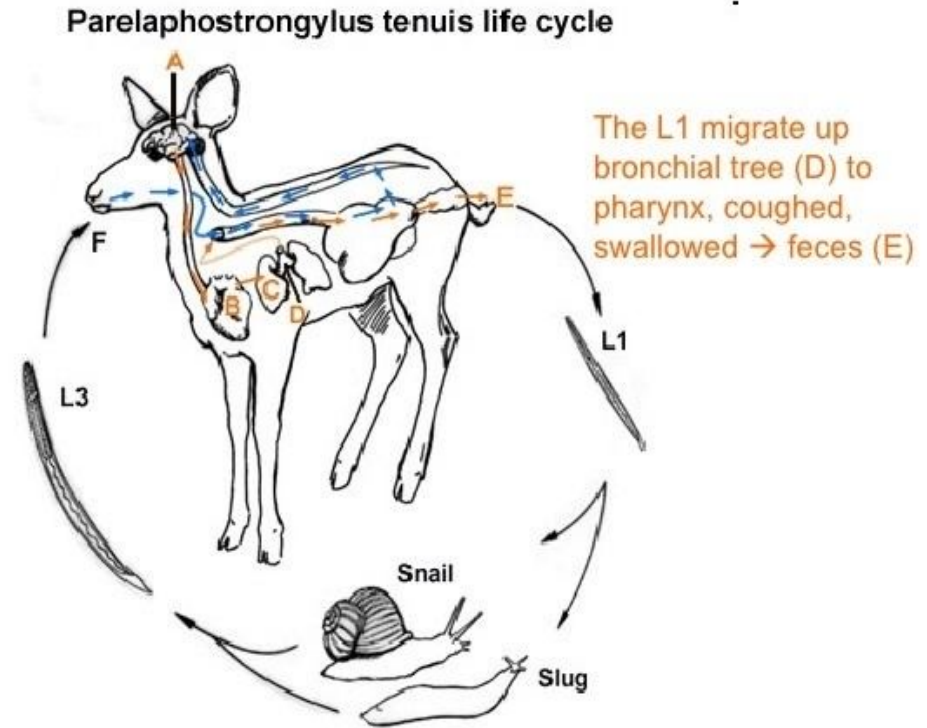




# Background & Lifecycle

- *Parelaphostrongylus tenuis* (*P. tenuis*; Meningeal Worm; brainworm)
- White-tailed deer are definitive hosts.
- Gastropods are intermediate hosts.
- “Dead end” hosts face clinical disease or death.
- Diagnostic issues
- Economic & emotional effects

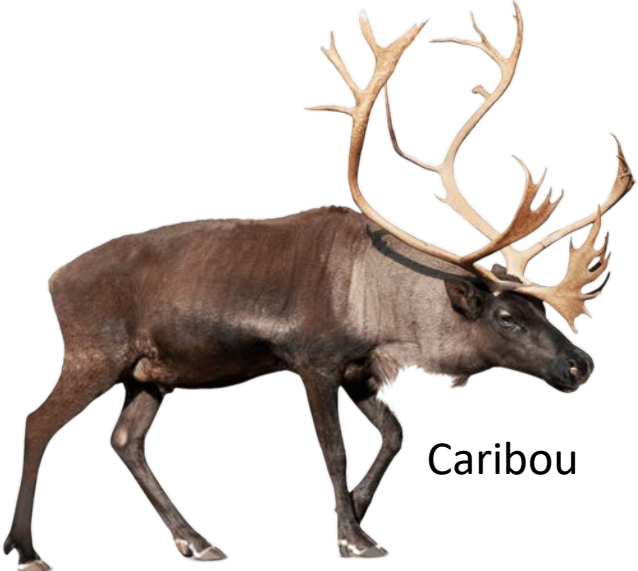
## Meningeal worm - *Parelaphostrongylus tenuis*



[Cornell University]



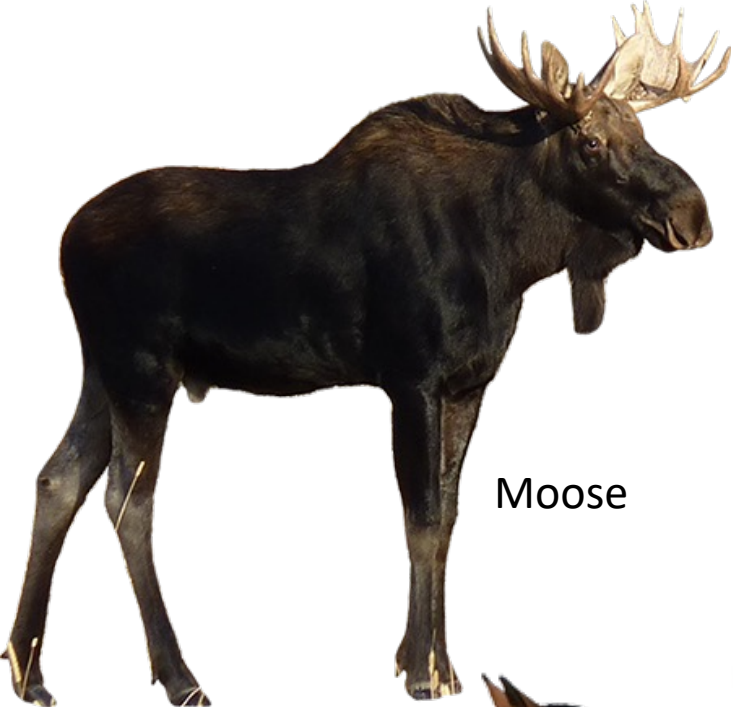
# Dead-end Hosts



Caribou



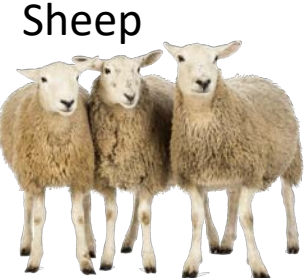
Elk



Moose



Bighorn Sheep



Sheep



Goats



Alpacas



Llamas



Horses



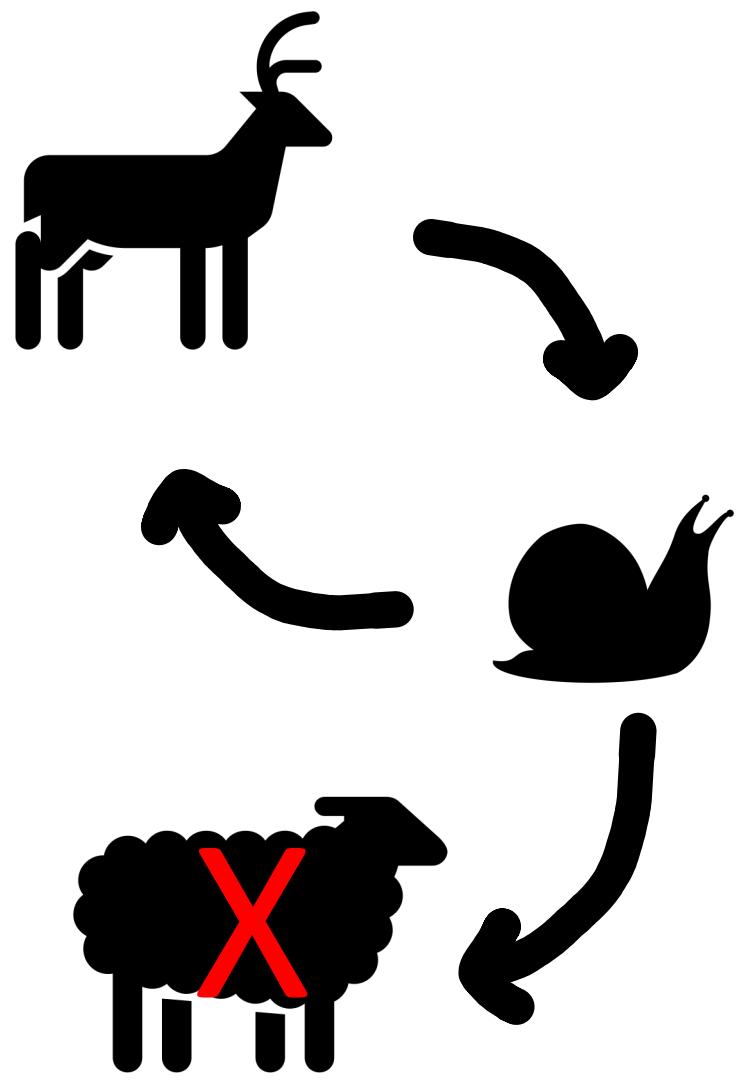
Guinea Pig



Photo: Dr. Steve Purdy, *P. tenuis* on alpaca spinal cord; Cycle: University of Pennsylvania

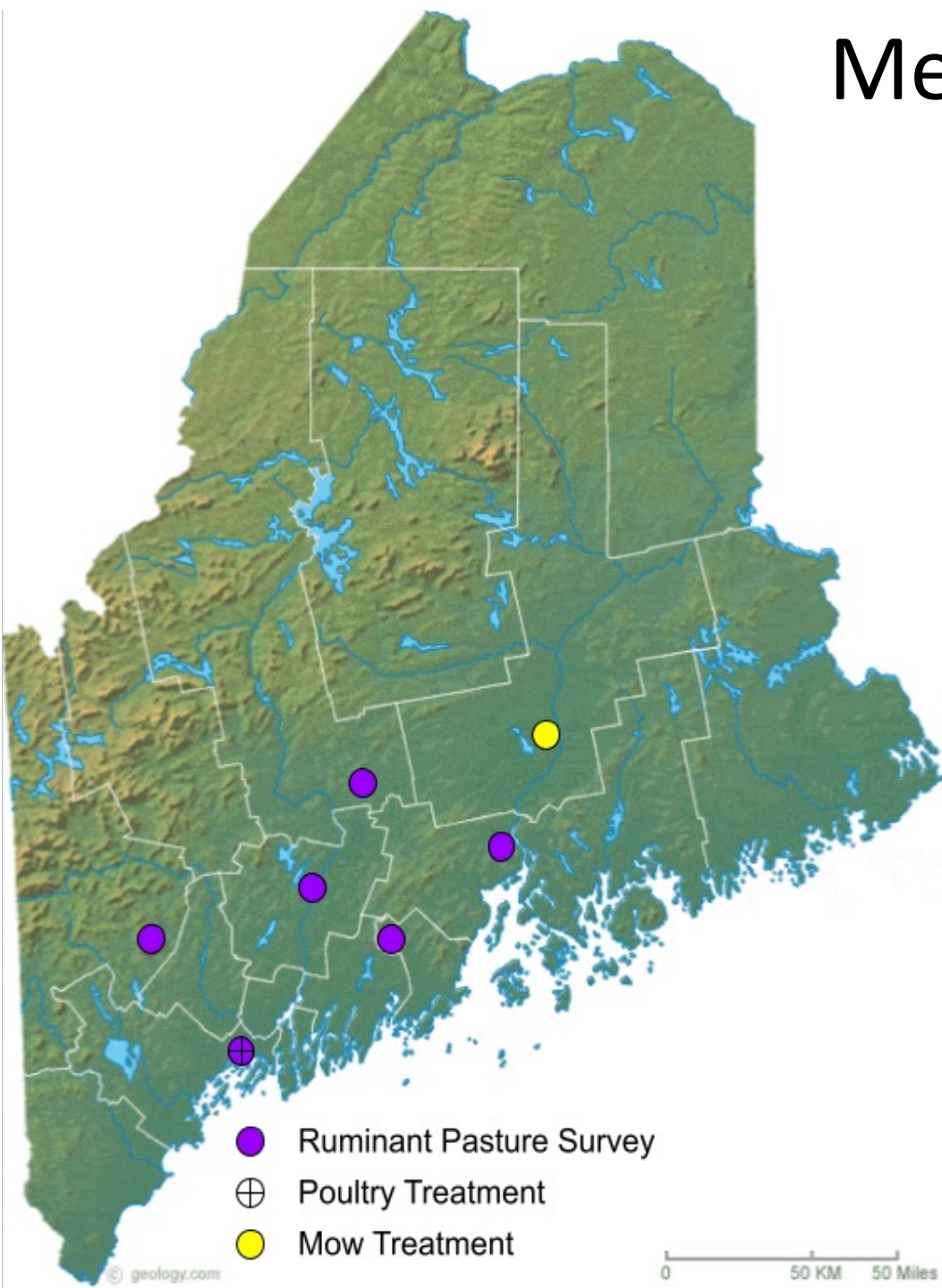
## Symptoms

- Ataxia (drunken stagger)
- Circling
- Head tilt
- Hind end weakness
- Blindness





# Methods





82316

My Network Places

Recycle Bin

Internet Explorer

Microsoft Outlook

Adobe Reader 7.0

Avast! Antivirus

Deer 2019

DFManager

Frozen, 3-...

4 hours Frozen, 3-...

LindseyF

Wes Phagocytosis

Nick

Tilapia 110x 11 H3s and Ig plat

1-853

12-21-17 diff 8 pics per ...

Shortcut to H3s and Ig plat

SharonPics

Shannon's lobster stuff

Shortcut (2) to Removable ...

1-3200

Tilapia 100x 2

Finder Option View Help

SPOT

SCALE

200  $\mu$ m

Capture Preview Color Level Scale Timelapse/Movie Microscope Image Quality

Image Size: 1360x1024

Shift Times: 1

Objective: 20x

Accumulation Mode: Average Count: 1

ISO Sensitivity:  ISO200  ISO400

Exposure Mode:  Auto  SFL-Auto

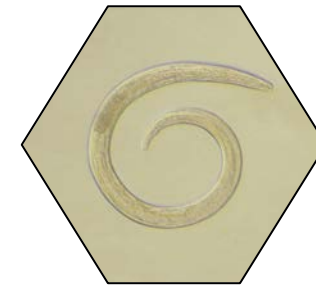
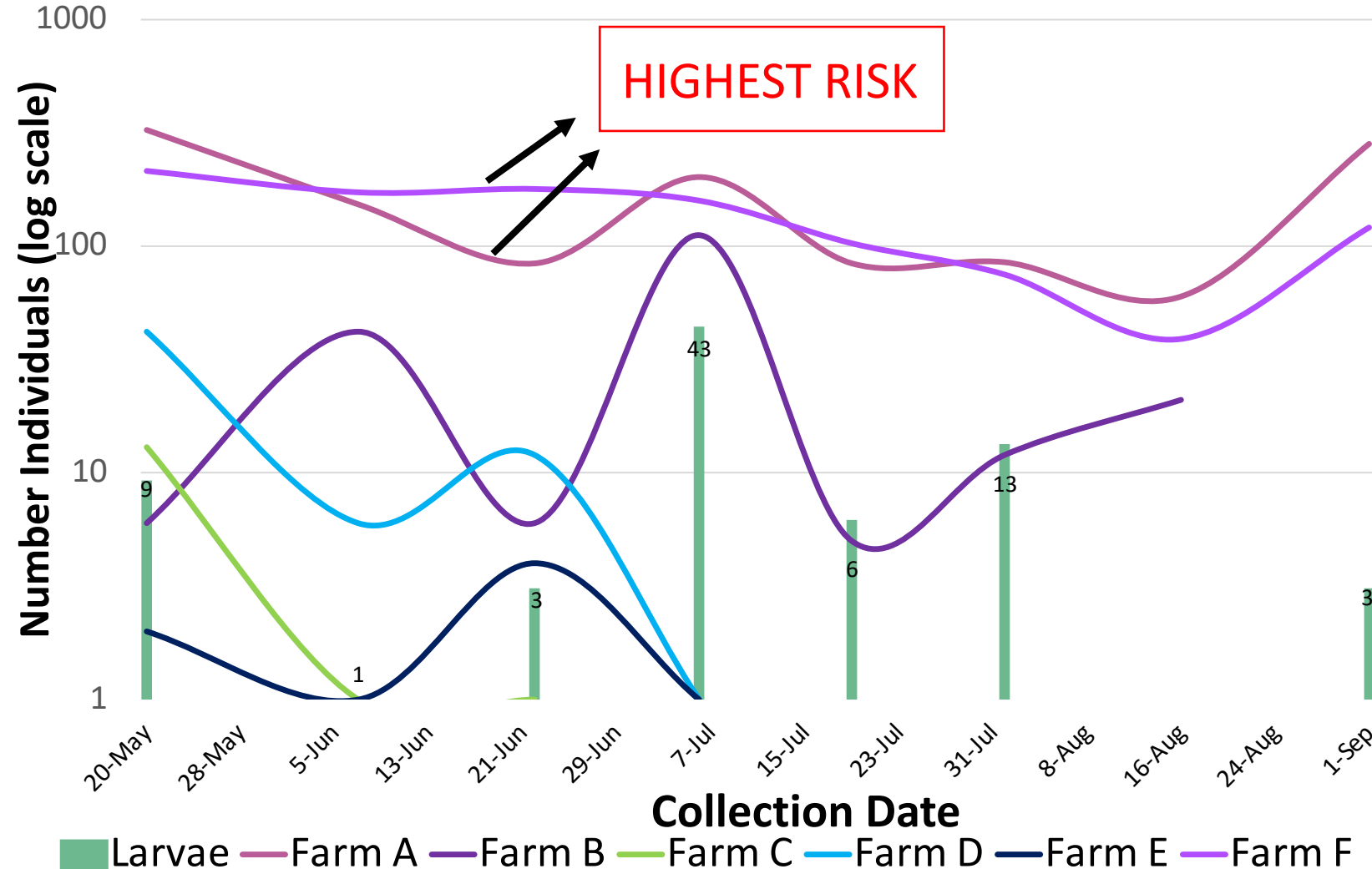
Spot:  30%  1%  0.1%

# Results: Gastropod Collection & Population Trend

- 5,391 gastropods collected.

- Population of gastropods and larvae are variable over time.

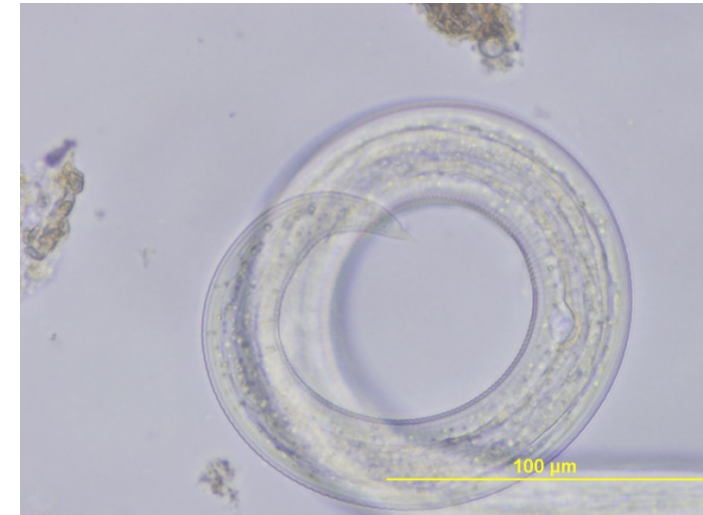
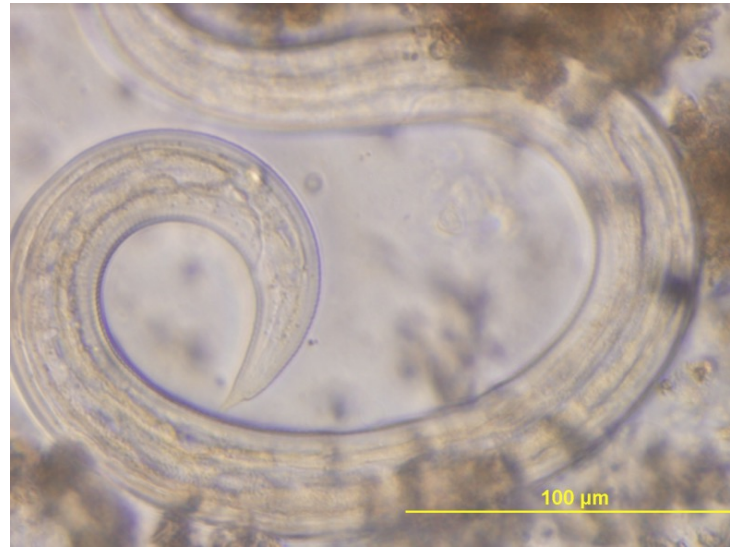
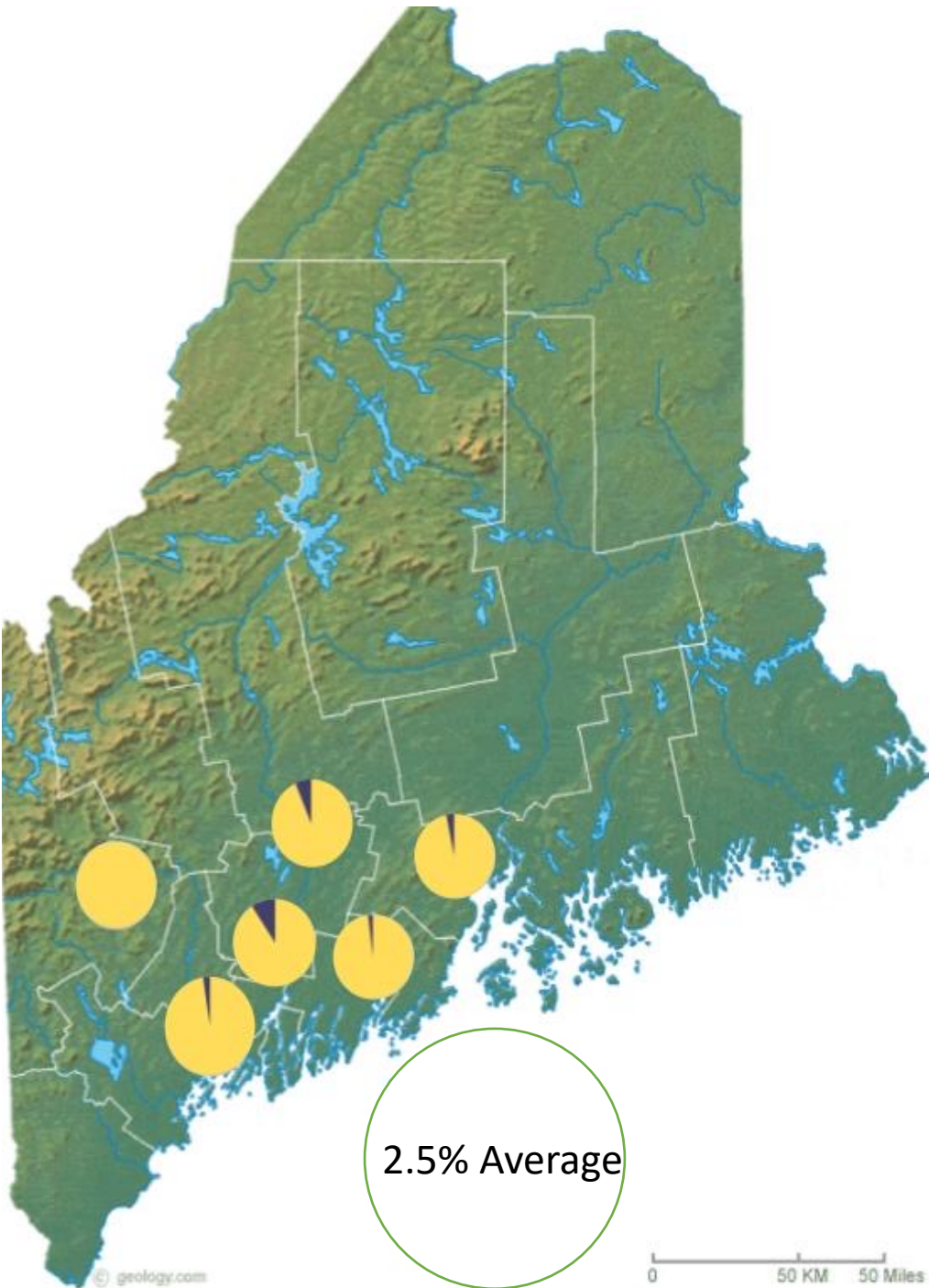
- Farm gastropod populations differ greatly.





# Results- Larval Infection Rate

- 2.5% average statewide
- Larval intensity varies (1-33!)
- Individual farms vary



	2021	2022	Total
<b>Gastropods Collected</b>	2634	2757	5391
<b><i>P.tenuis</i> Imaged</b>	93	187	280
<b>Gastropods Infected w/ <i>P.tenuis</i></b>	120	133	254

# High Risk Farms (or areas of high risk)

## *Abundance:*

- Stepping on snails
- Present all grazing season



## *Gastropod Behavior:*

- Climbing vs. burrowing
- Active night & morning

*High larval intensity (dose):*  
1-5 (animal likely will be OK- alpacas very sensitive)  
~10 (symptomatic)  
20+ (quick symptoms)

## *Use:*

- White-tailed deer (any time!)
- Livestock- night & mornings

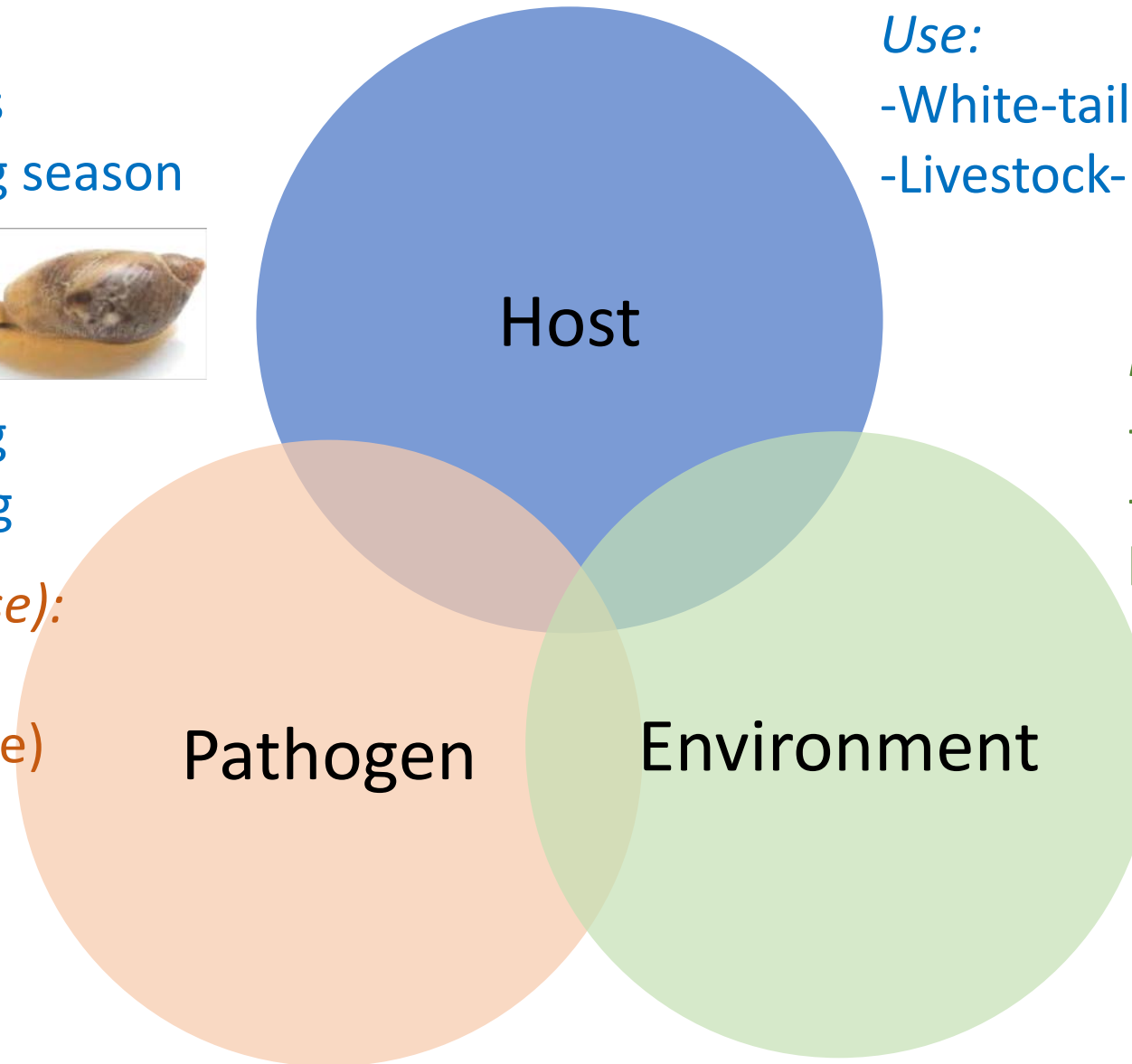
## *Microclimates:*

- Shade
- Tap-rooted, broad leaf plants



*High & retained soil moisture:*

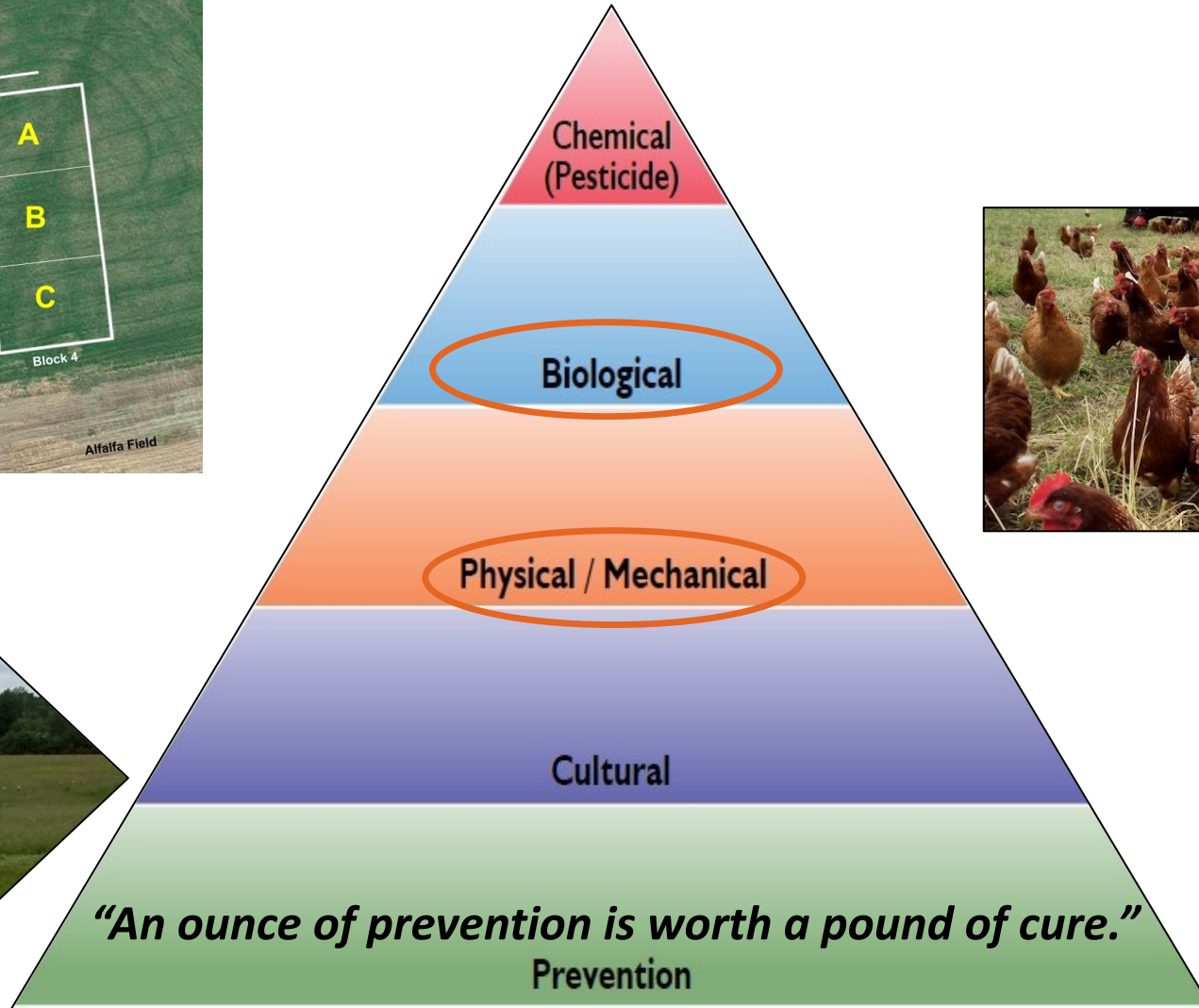
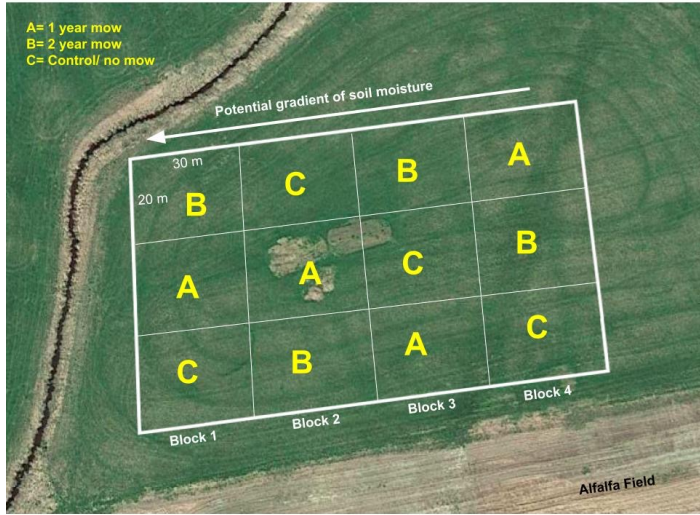
- Intensive rotation
- Drainages





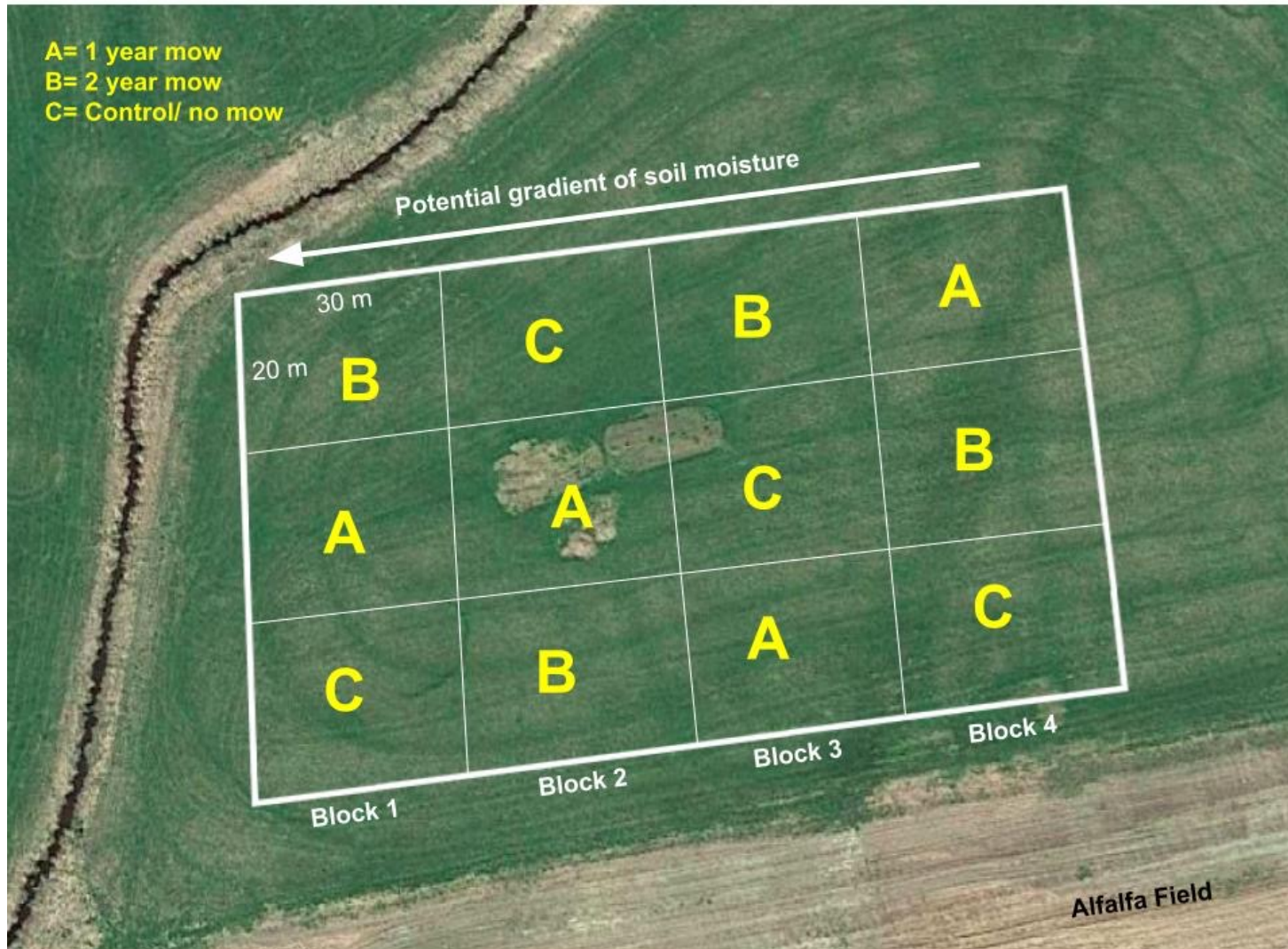
# Methods: Prevention & Control

## Integrated Pest Management (IPM)



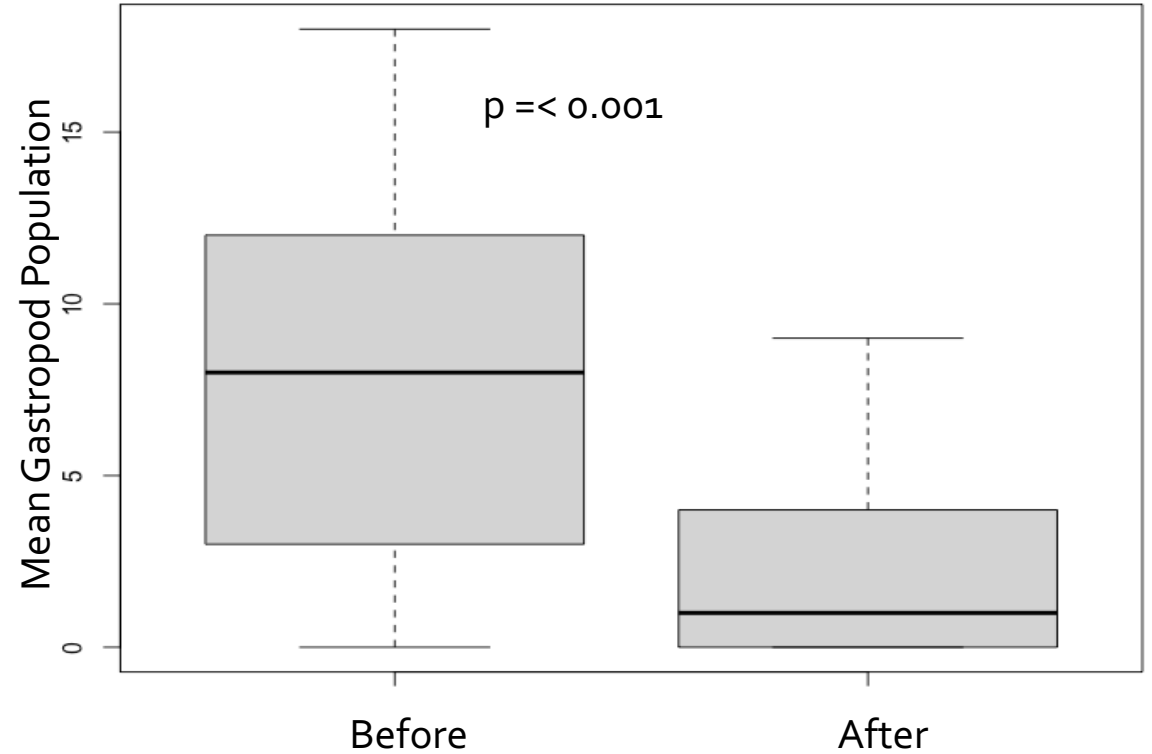


# Prevention- Mowing





# Prevention- Pastured Poultry

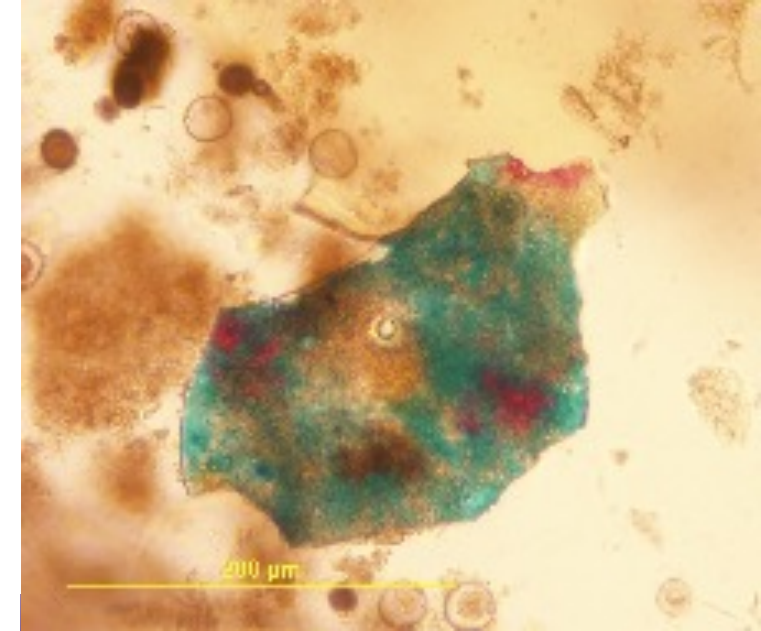


Mean gastropod population box and whisker plot of before and after poultry treatment. N= 24 replications.

# Other Findings



Microplastics  
Top: Digested snails  
Bottom: Deer fecal



*Leucochloridium paradoxum*  
Green-banded broodsac



# Parasite Cookbook Recipe for Risk

## Ingredients:

Meningeal worm+ Deer  
Snails/ slugs (thousands)  
Sheep/Goat/Alpaca/ Llama  
Pasture (moist soils, mixed veg.)

## Cook Time

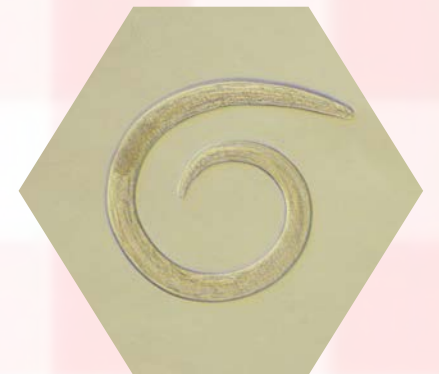
Spring- Fall

## Instructions:

Combine all ingredients together.

## Makes Enough For:

One upset farmer





# Thank You!

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- Advisors Dr. Anne Lichtenwalner , Dr. Debra Kantor & Graduate Committee
- Denise Cole, Research Assistant & EES student
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- Lyndsey Koyanag, former REU student
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