

# Assessing Gastropods as Parasite Vectors: Problem and Prevention on Maine Farms

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# Parasite Cookbook Recipe for Risk

## Ingredients:

Meningeal worm+ Deer

Snails/ slugs

Sheep/Goat/Alpaca

Pasture

## Cook Time

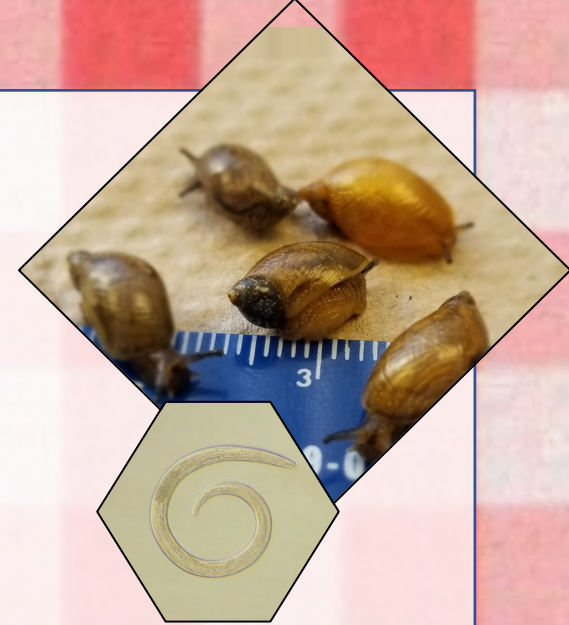
Spring~ Fall

## Makes Enough For:

One upset farmer

## Instructions:

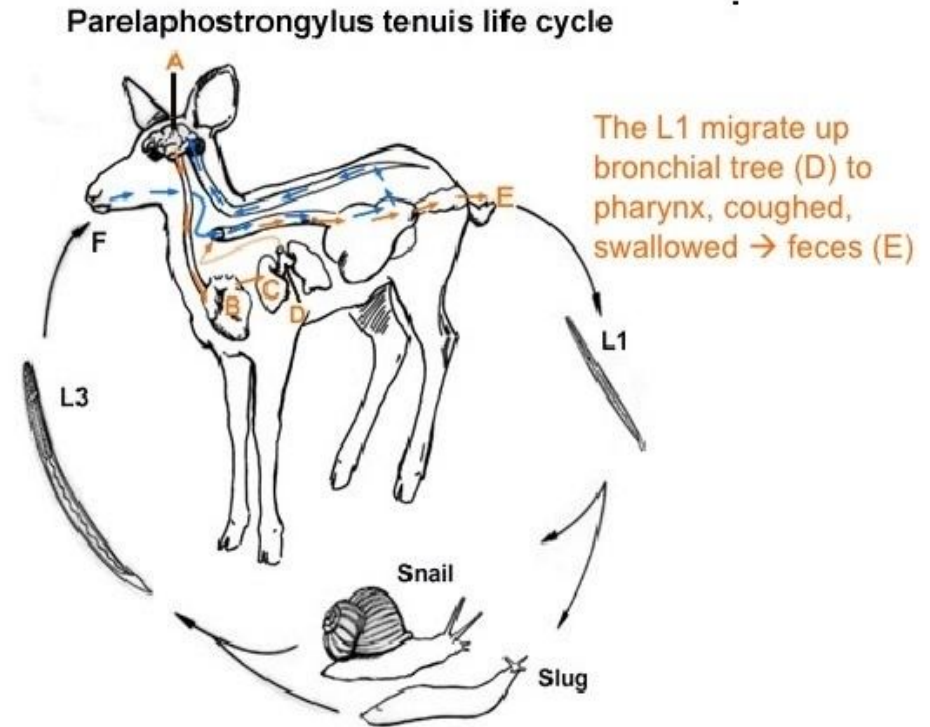
Combine all ingredients together.



# Background

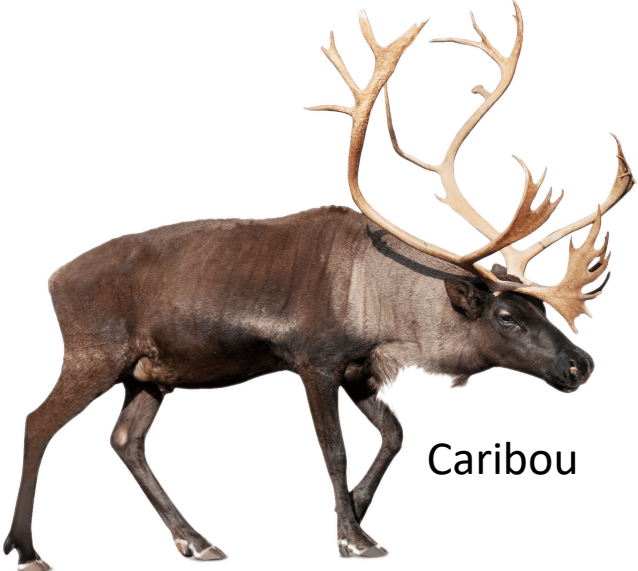
- *Parelaphostrongylus tenuis* (*P. tenuis*; Meningeal Worm; brainworm)
- White-tailed deer are definitive hosts.
- Gastropods are intermediate hosts.
- “Dead end” hosts face clinical disease or death.
- Diagnostic issues
- Economic & emotional effects

## Meningeal worm - *Parelaphostrongylus tenuis*





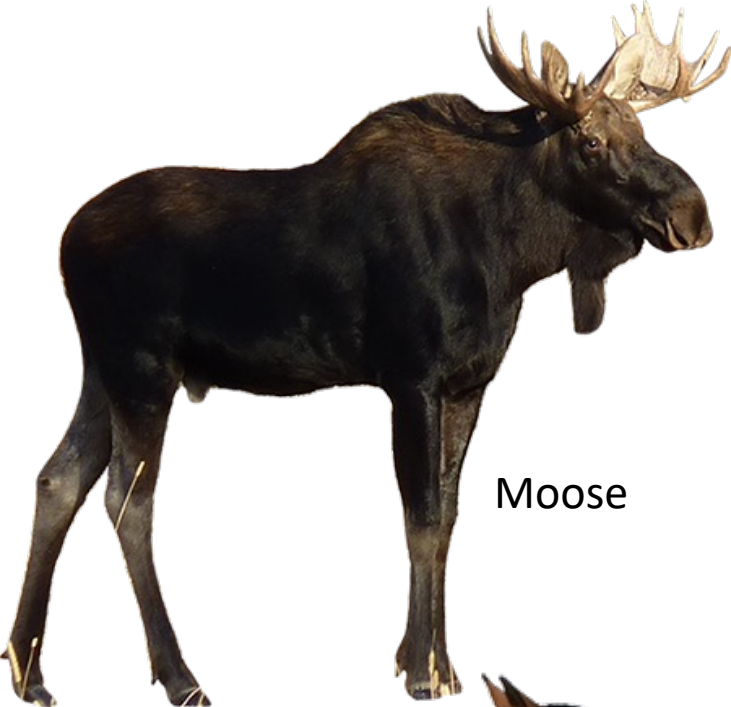
# Dead-end Hosts



Caribou



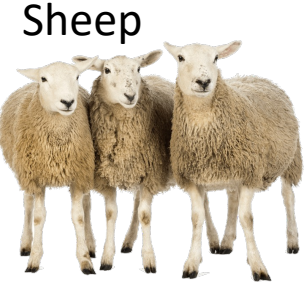
Elk



Moose



Bighorn Sheep



Sheep



Goats



Alpacas



Llamas

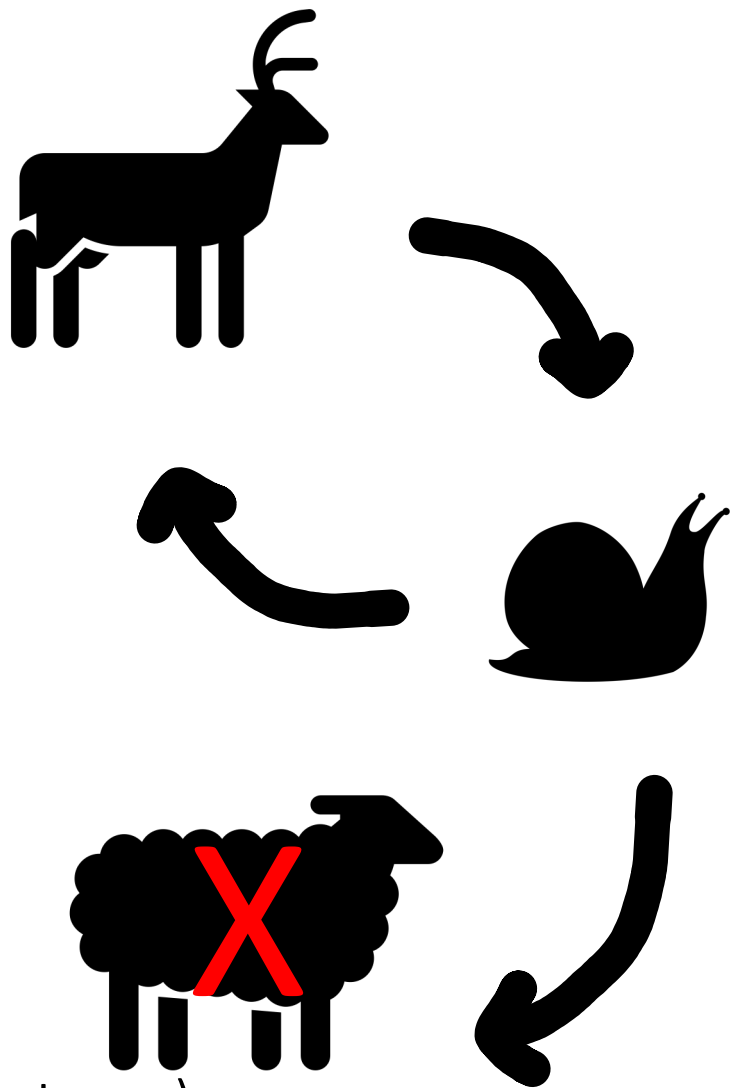


Horses



Guinea Pig





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

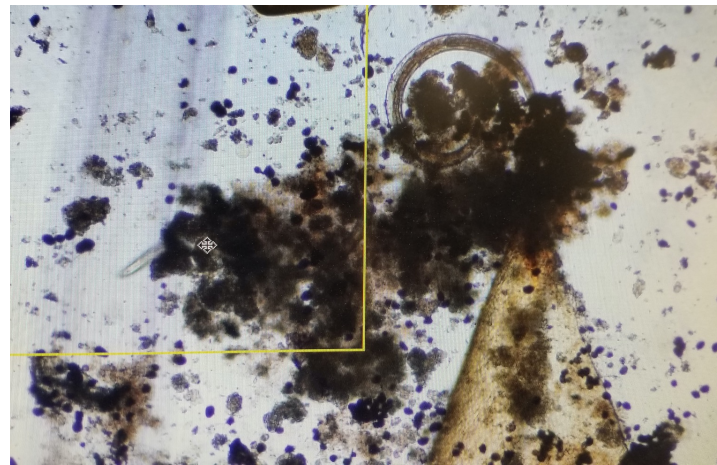
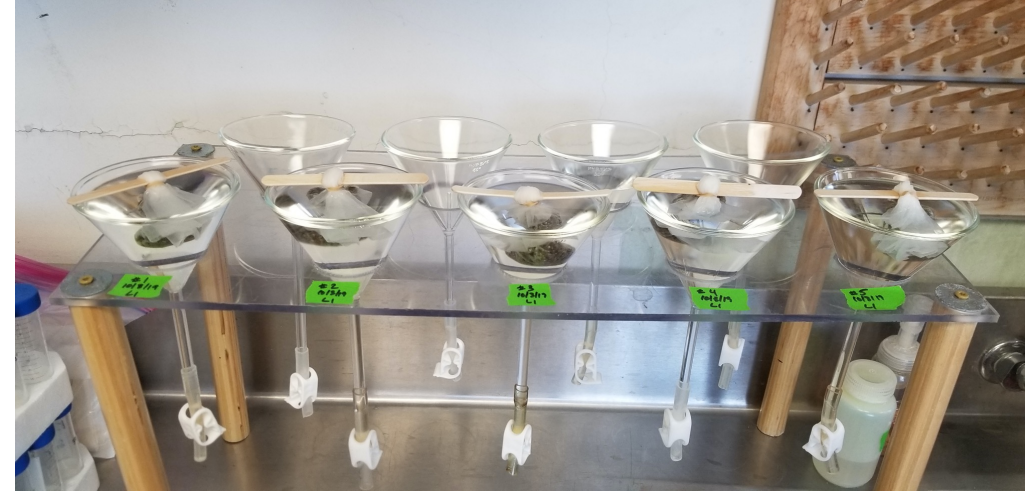
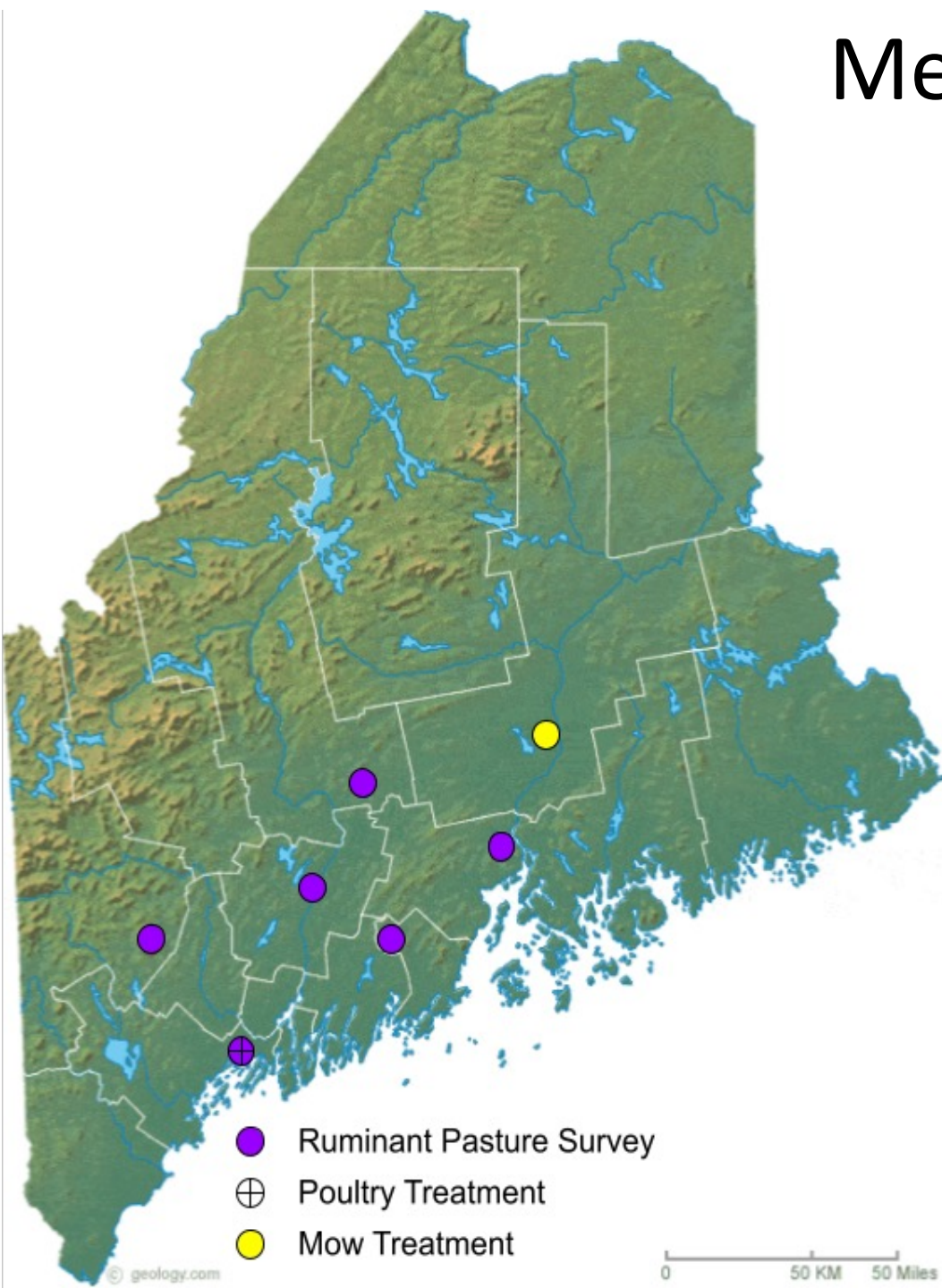


- Symptoms  
Ataxia (drunken stagger)  
Circling  
Head tilt  
Hind end weakness  
Blindness





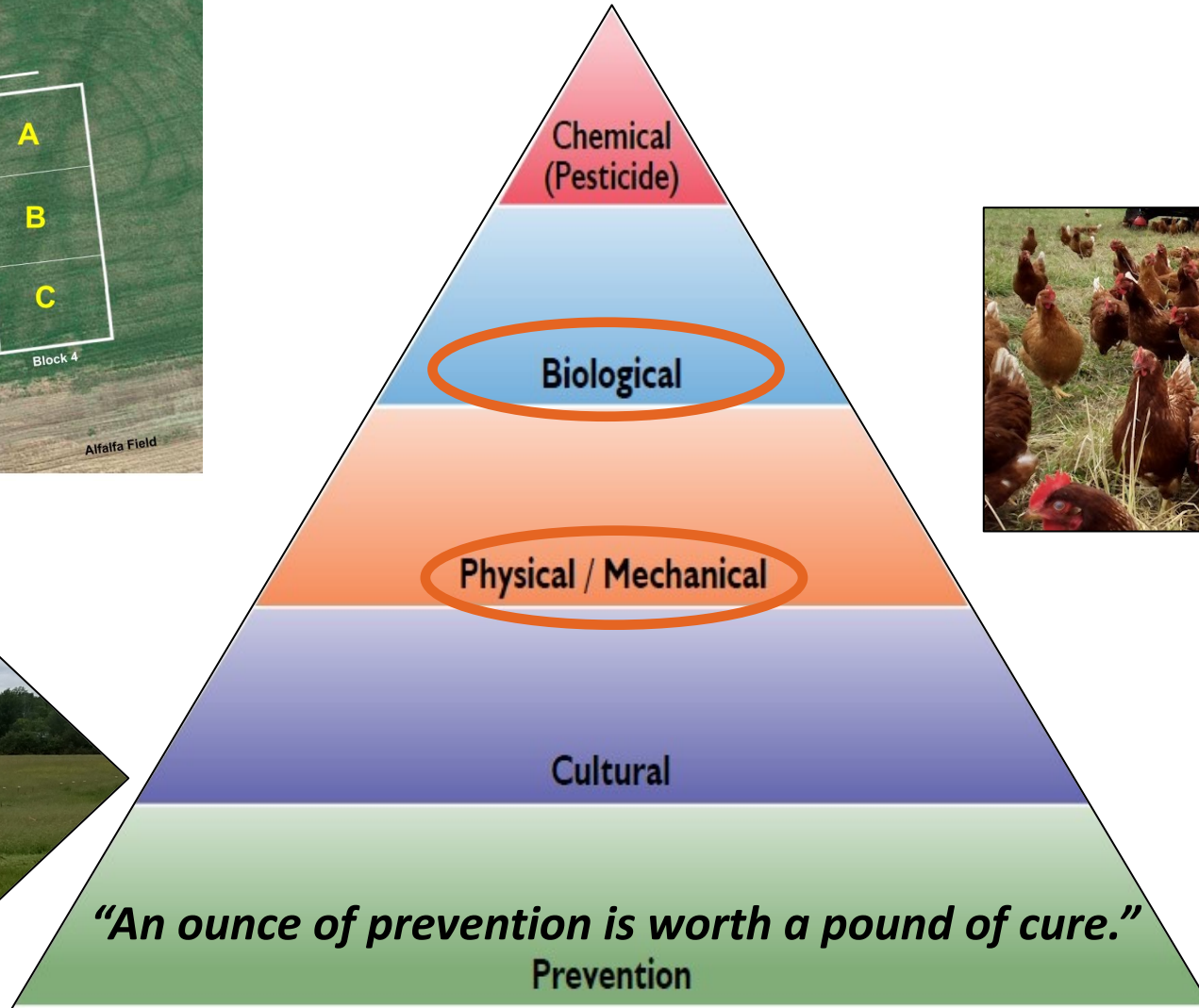
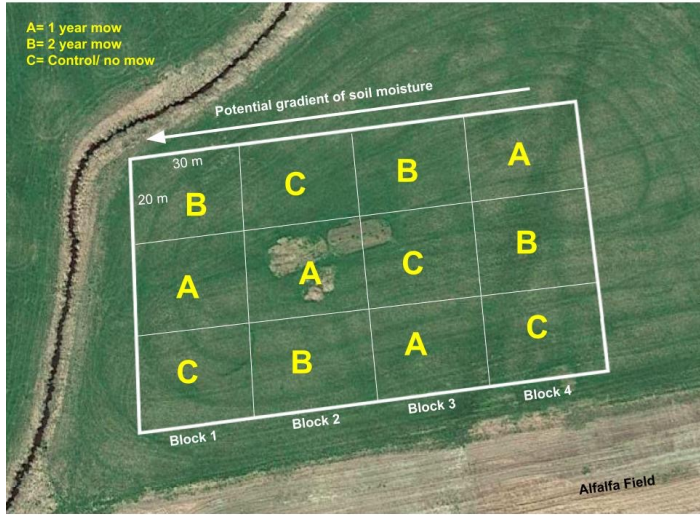
# Methods





# Methods: Prevention & Control

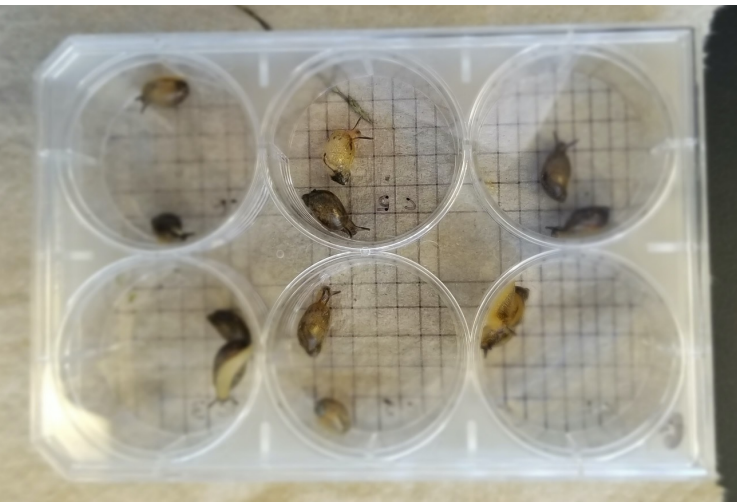
## Integrated Pest Management (IPM)



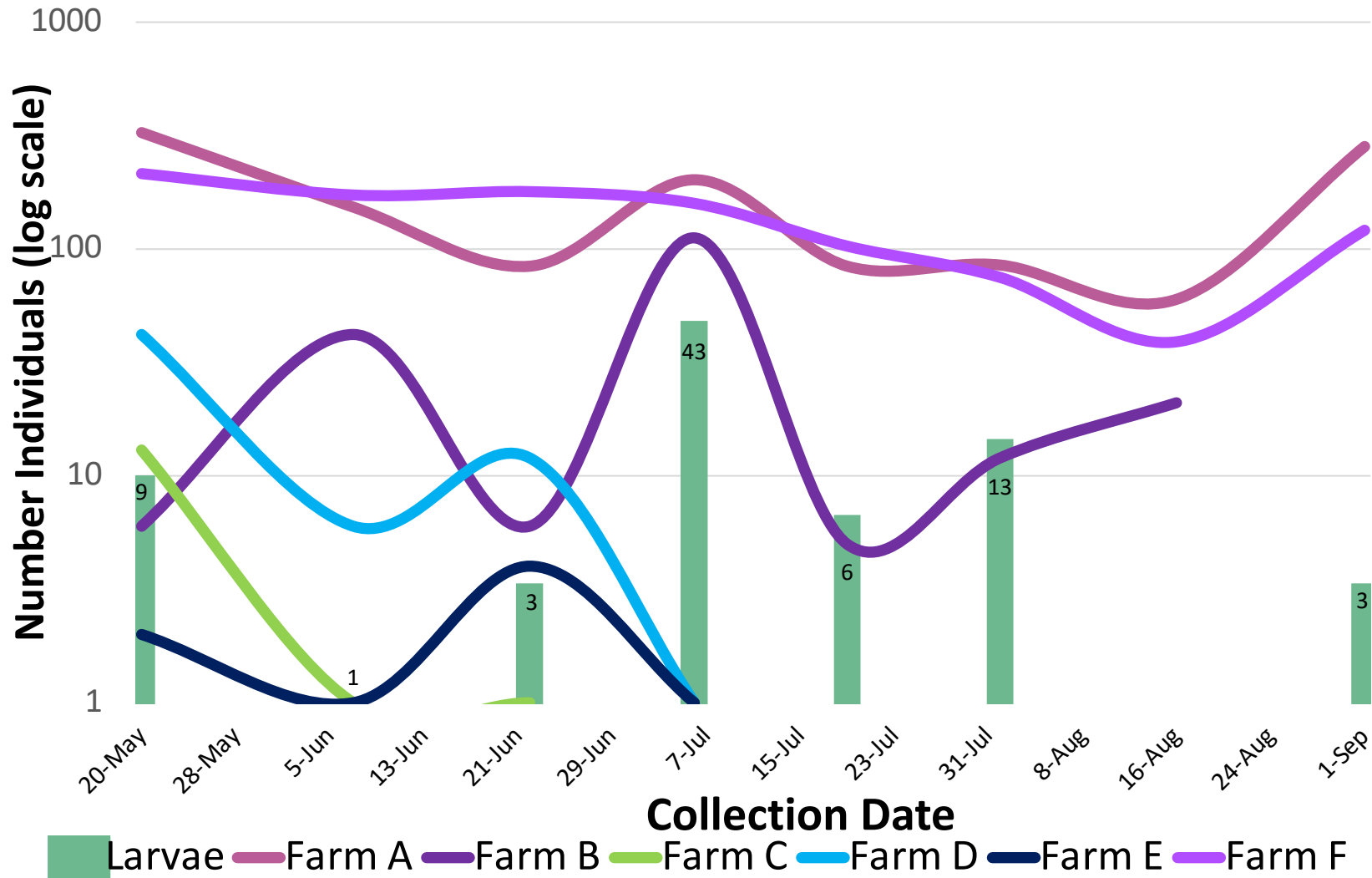


# Results: Gastropod Collection & Population Trend

- 2,639 gastropods collected (2,553 snails, 86 slugs)
- Population of gastropods and larvae are variable over time.
- Farm gastropod populations differ greatly.



Total larvae vs. gastropods by farm, May 20-Sept.1, 2021.

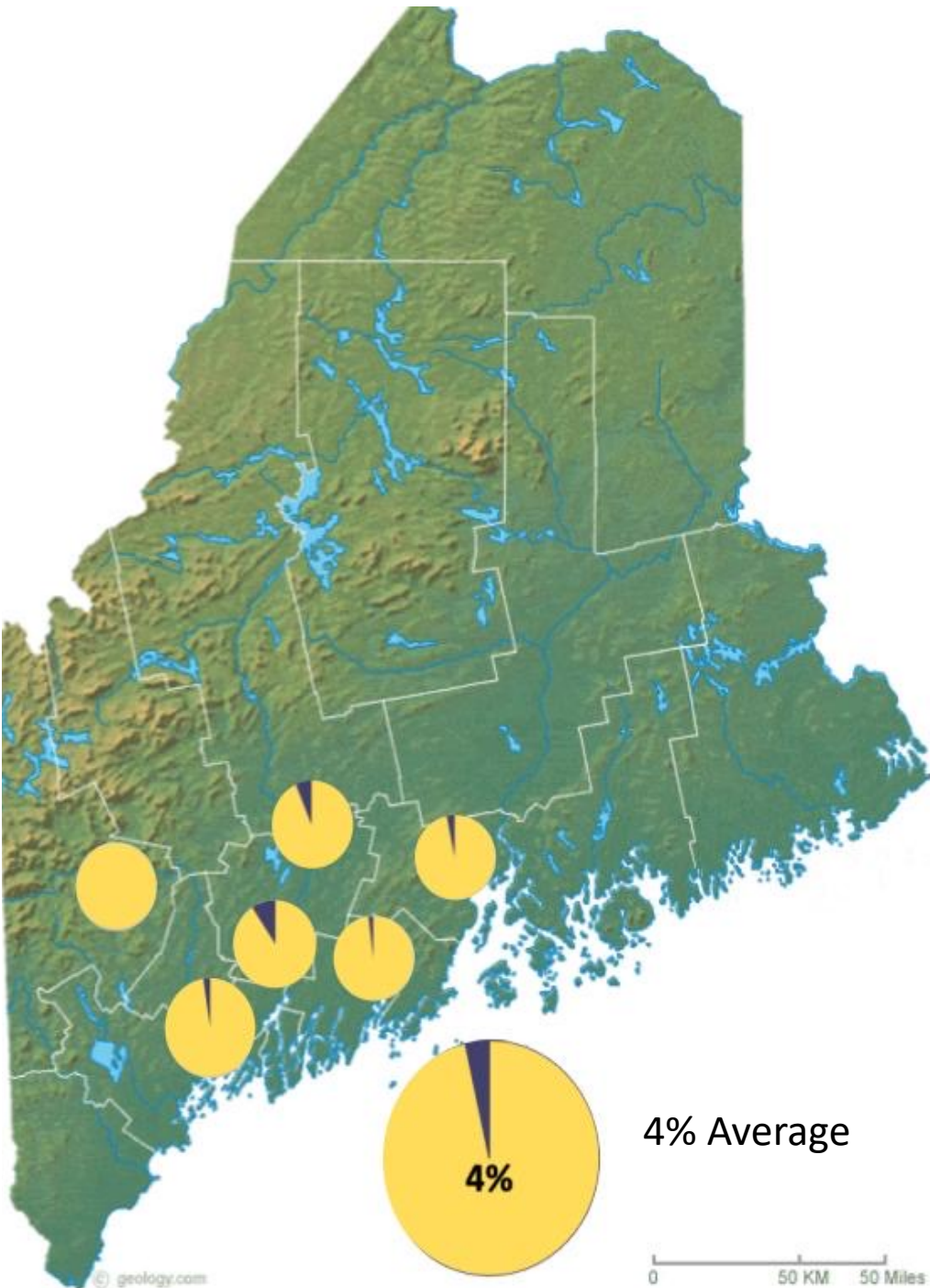




# Results- Larval Infection Rate by Farm

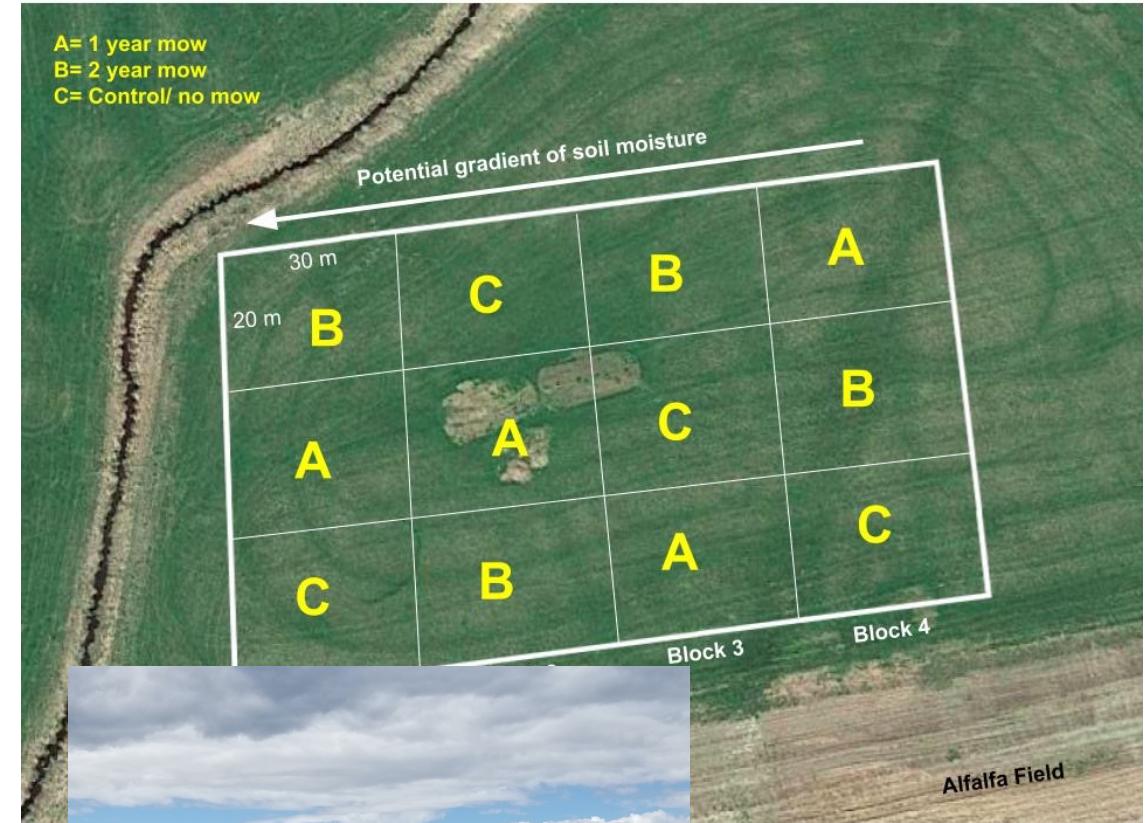
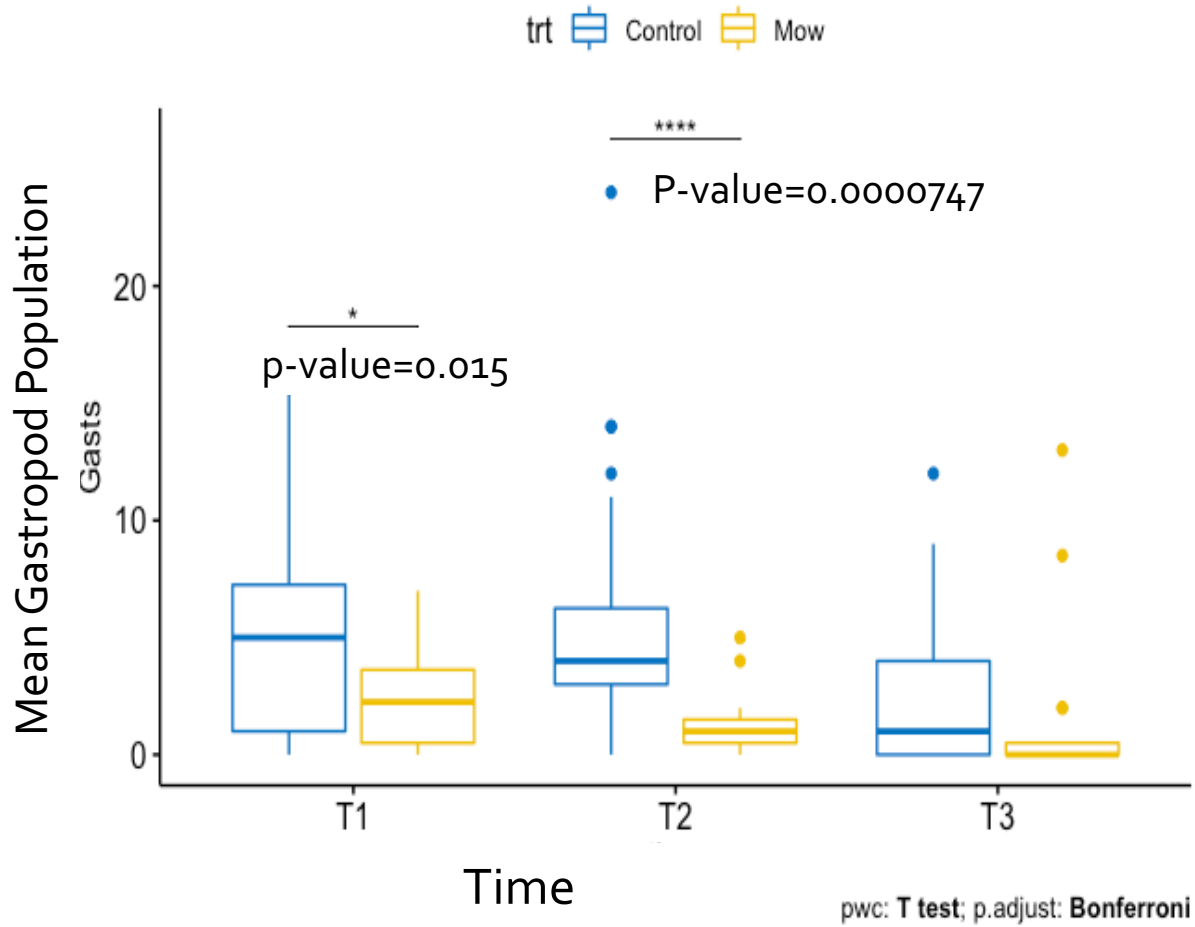
- 110 out of 2639 gastropods evaluated contained larvae (4%)
- Individual farms vary

Farm	# Gastropods	Infection rate (%)	Mean Larva Intensity
Farm A	1277	5	1.6
Farm B	204	2	1.2
Farm C	15	7	1
Farm D	65	10	4.7
Farm E	8	0	-
Farm F	1067	3	1.8





# Results: Prevention- Mowing

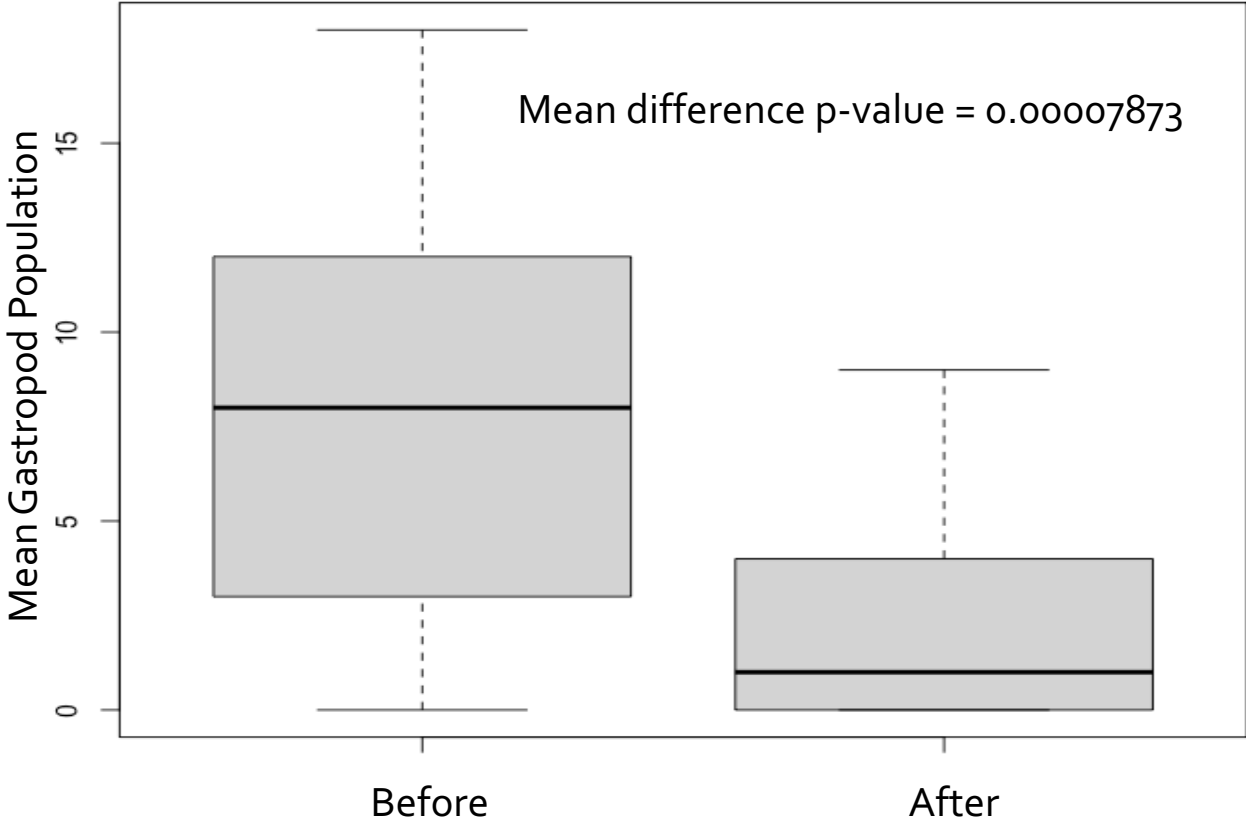


Mean gastropod population box and whisker plot of mow vs. control (no mow) treatments.

June (T1) & July (T2) significant effects:  
P=0.015 and P<0.01



# Results: Prevention- Pastured Poultry



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





## Conclusion

- Pastured poultry exposure across gastropod abundant areas can lower snail and slug populations.

## Recommendations

- Incorporate active, pasture- hardy breeds
- Poultry exposure to pasture *before* small ruminants.
- 2021 study: duck willingly eat snails & 25% of the larvae expelled.





# Conclusion

- Mowing showed significant impacts on gastropod abundance.

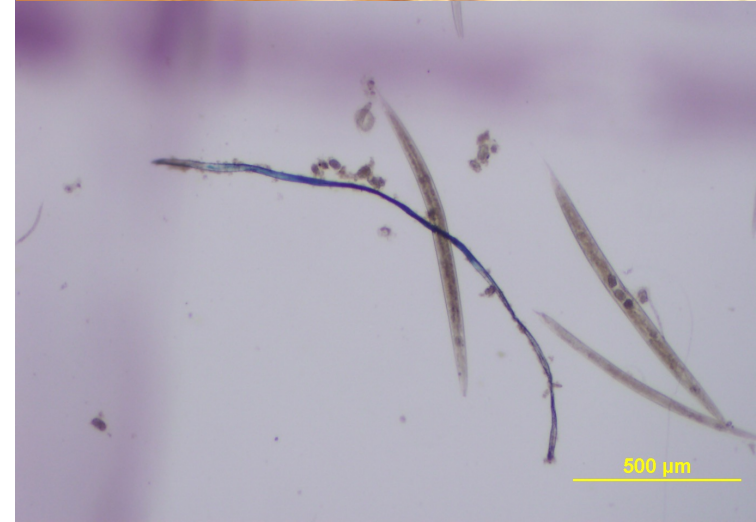
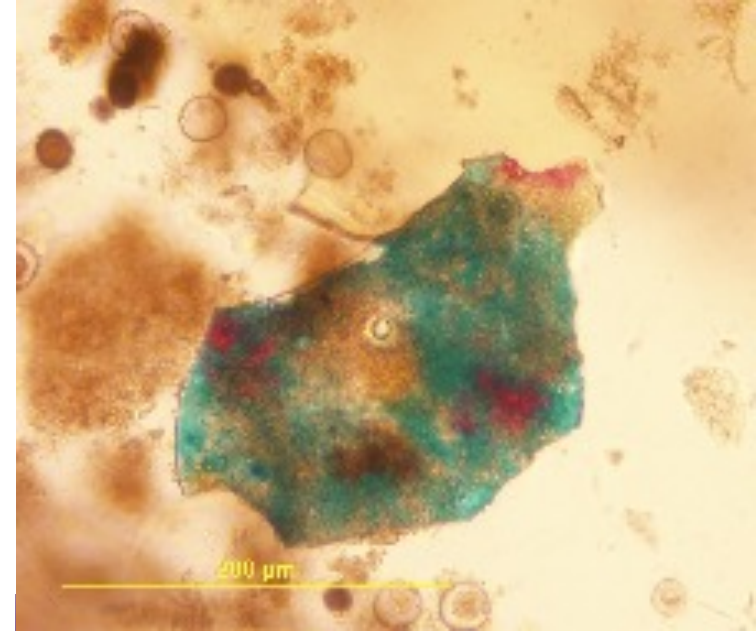
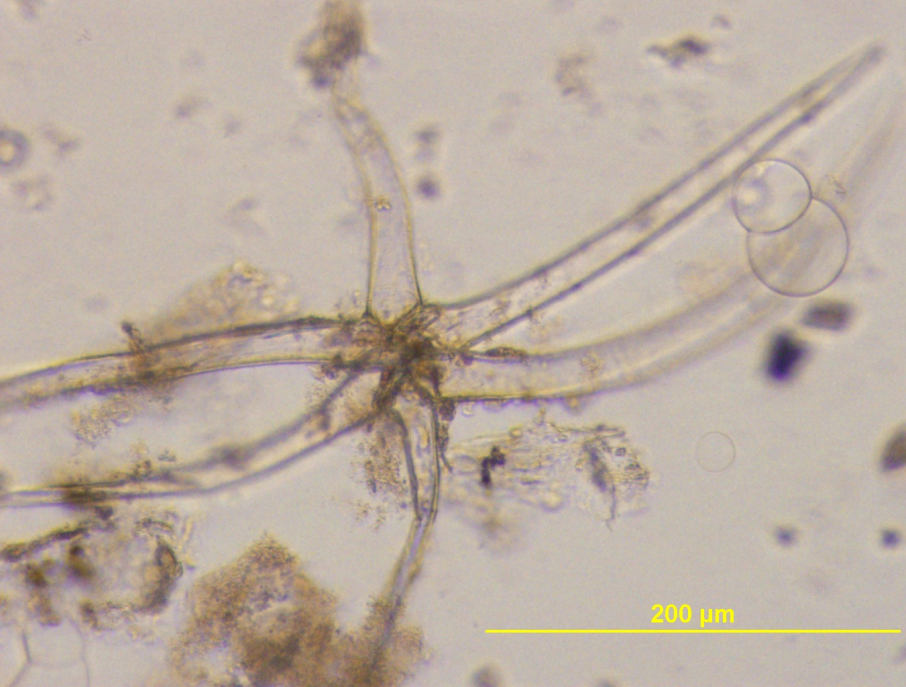
# Recommendations

- Repeated mowing over a grazing season, or two then, introduce livestock.
- Combined effort of pastured poultry and mowing.



# Other Findings

Microplastics  
Top: Digested snails  
Bottom: Deer fecal



Myxozoa? (Actinospore)



*Leucochloridium paradoxum*  
green-banded broodsac





# Thank You!

- Dr. Anne Lichtenwalner
- Dr. Debra Kantor
- Graduate Committee
- Denise Cole, Research Assistant & EES student
- Tuuli Overturf, AVS graduate
- Lyndsey Koyanag, former REU student
- Ann Bryant, Former Research Assistant
- Nathan Bieber, MDIFW Deer Biologist
- Joshua Hatley, Witter Farm Superintendent
- Tom Rounsville, Molecular Diagnostic Professional, UMaine Cooperative Extension

