

A Panax-centric View of Invasive Species and a Case Study on the Effects of Garlic Mustard



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What are Invasive Species?

Invasive species – A non-native species whose introduction causes economic, environmental or human health-related harm



Emerald Ash Borer

*H. Russel,
Michigan State University*



Why Care About Invasives?

- \$120 billion/yr economic losses¹
- Displace native species
 - Resource competition
 - Alteration of soils
 - Allelopathy
 - Alteration of habitat
 - Alteration of ecosystem function²



Invasive Species and Ginseng?

- Some invasive species invade high-quality forests¹
- Understanding mechanisms by which non-native species can impact native plants can aid in management of invasions



Native trout lily among invasive garlic mustard seedlings

¹Nuzzo 1999

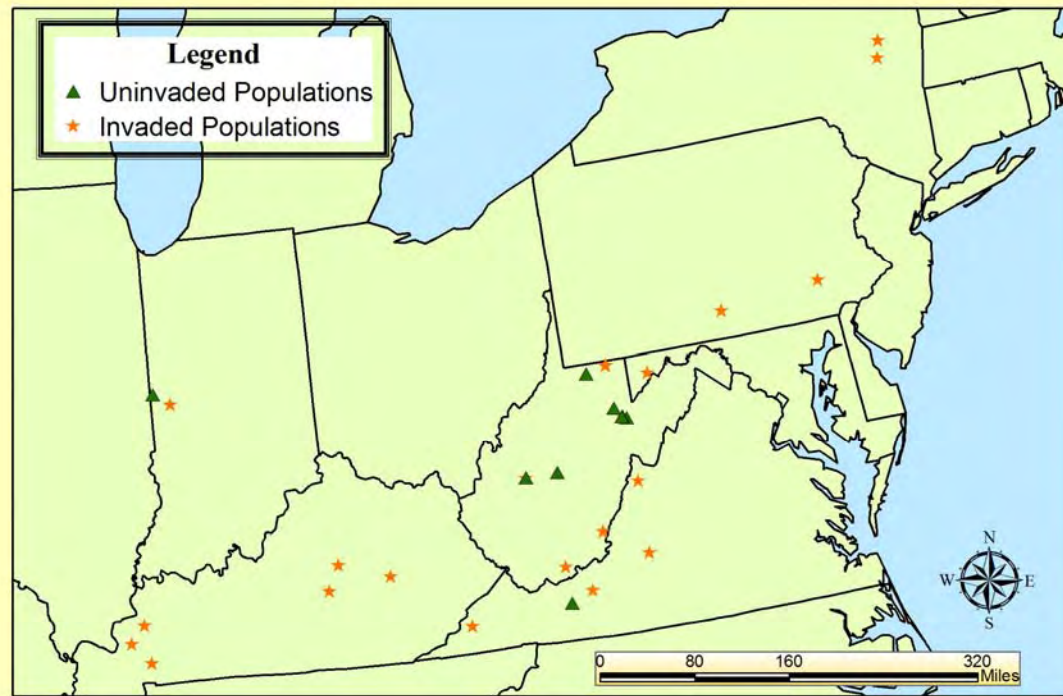
Research Questions

- What is the level of exposure ginseng populations and individuals to invasive species?
- What invasive species are the most prevalent?
- What factors may predict invasive presence?



Methods

- 30 natural populations
 - 2006 (N=4,540)
 - 2007 (N=4,279)

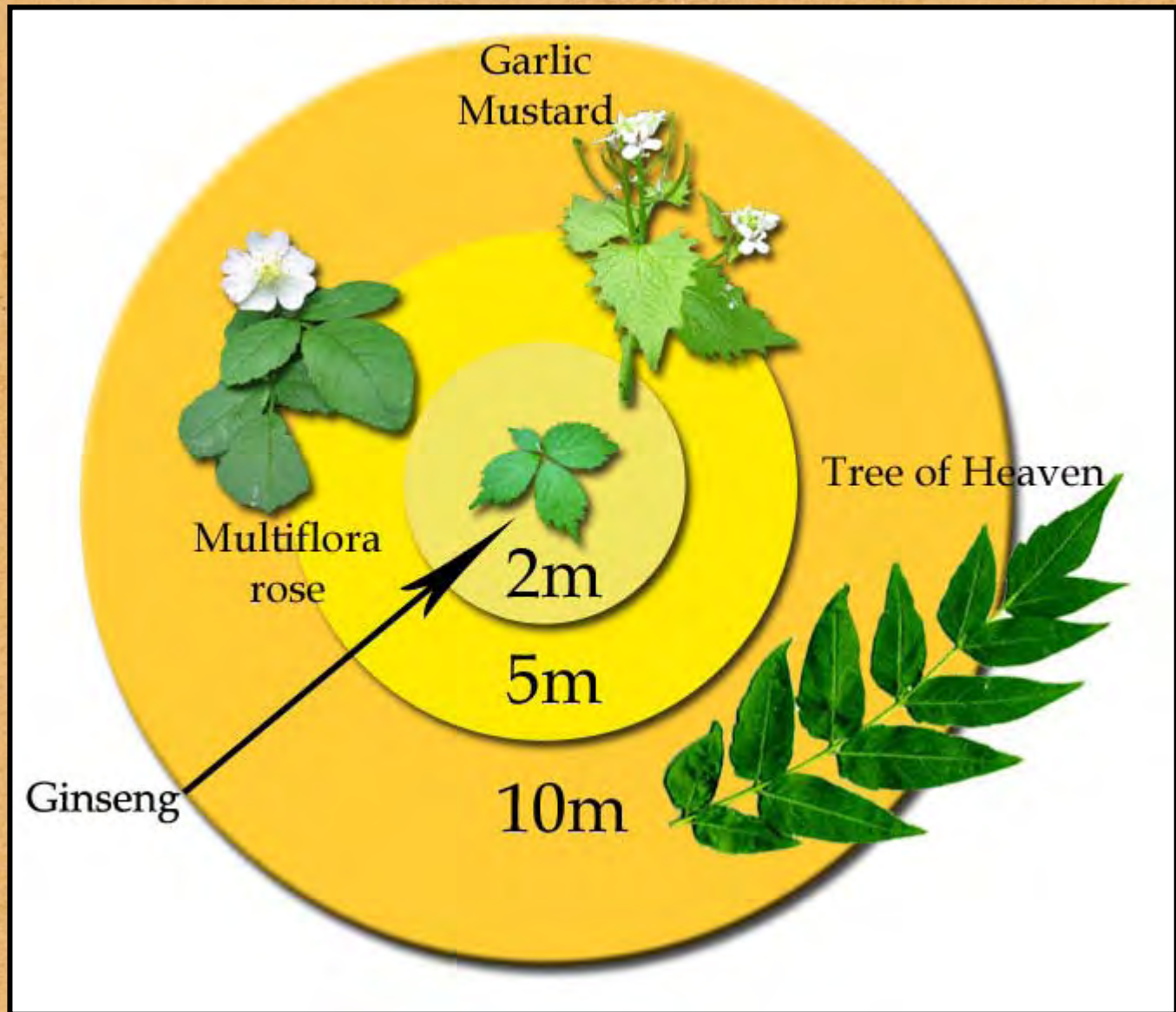


How to Survey for Invasives

- Traditional presence/ absence sampling
 - Quadrats
 - Transects
- Why do we care?

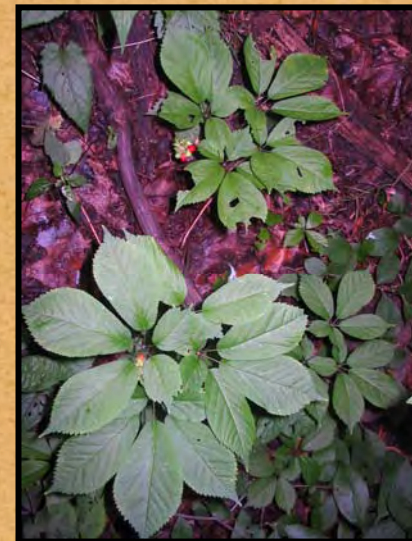


Plant-centric Sampling



Methods

- Presence was related to:
 - ginseng population size
 - elevation
 - latitude
 - presence of harvest
- Size classes exposed to invasives



Results

- 63-70% of study populations contained at least one invasive
- Approximately 1/3 of all ginseng individuals had an invasive within competitive range



Multiflora rose

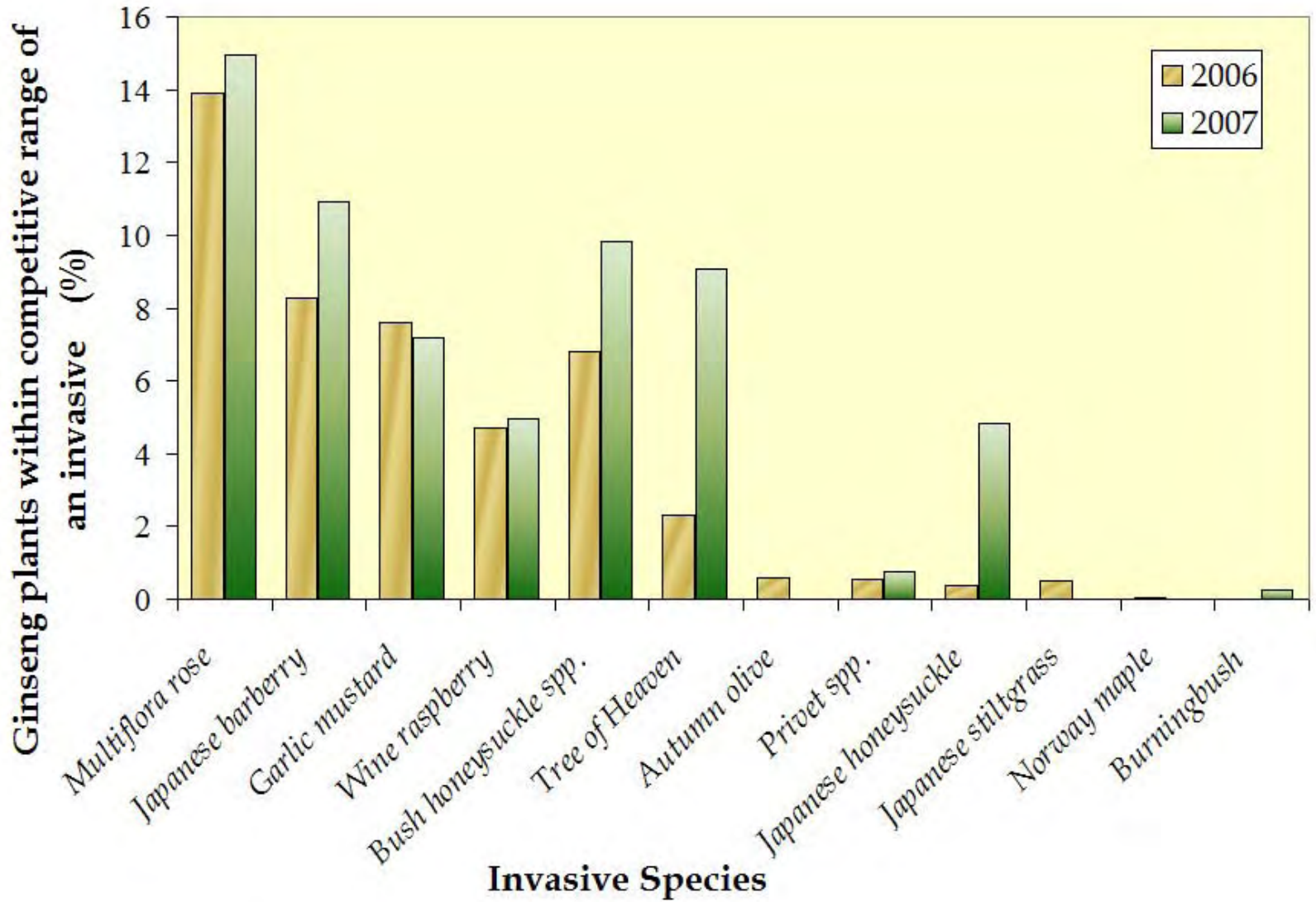


Japanese barberry

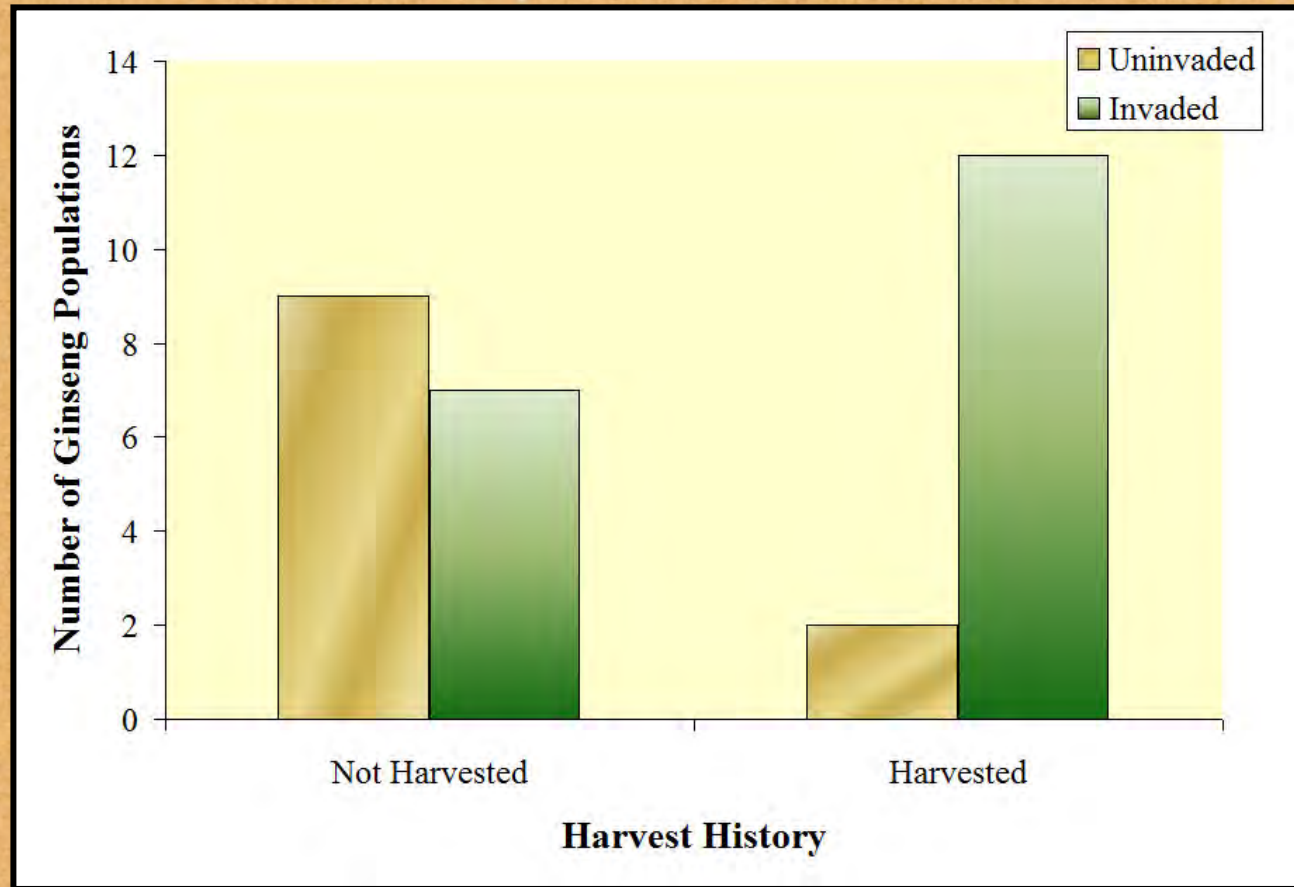


Bush honeysuckle

Results



Results



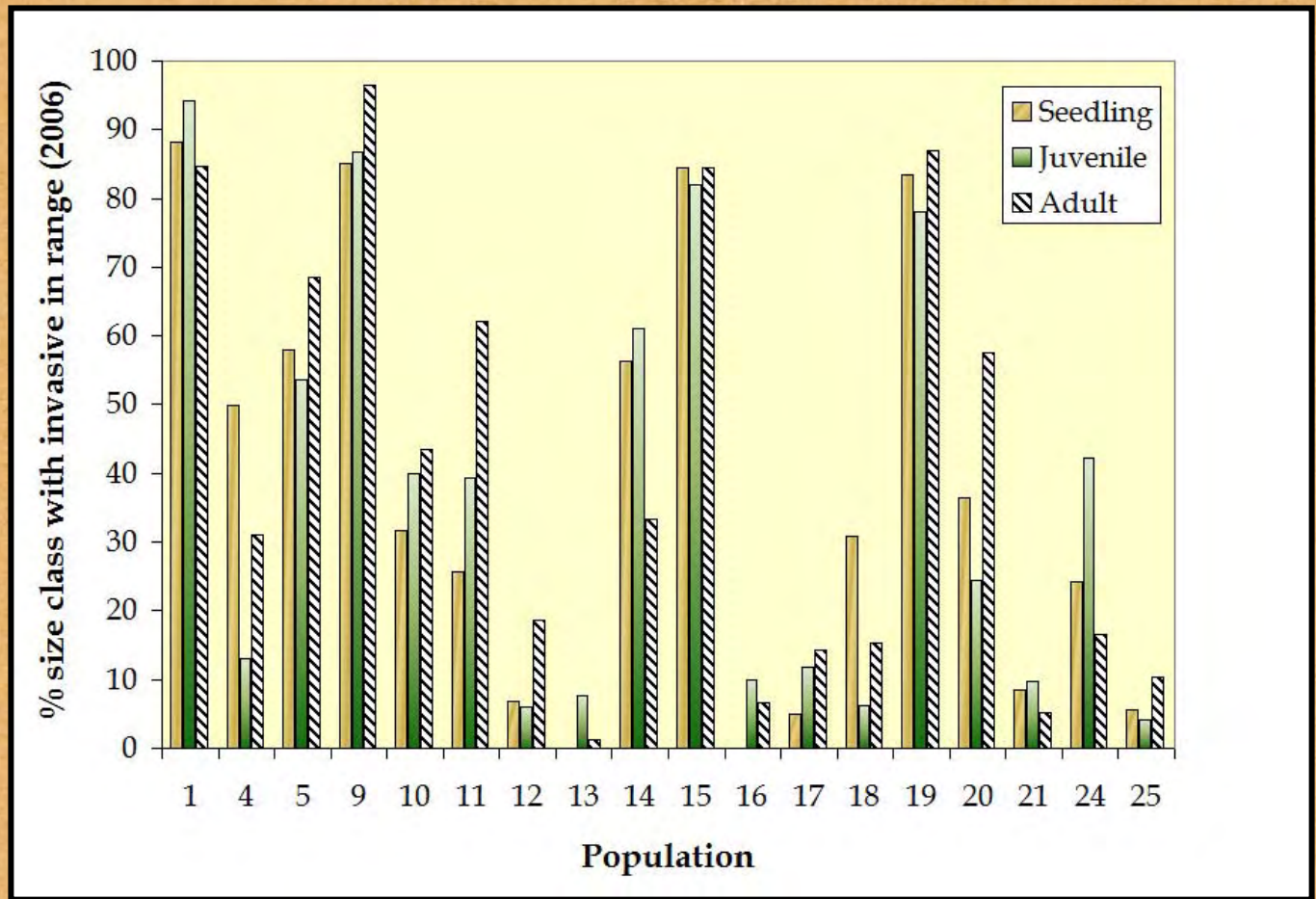
- Harvested populations were more likely to have invasive species (L-R= 6.016, $p=0.0142$)
- Elevation and latitude did not significantly predict presence of invasive species ($p>0.05$)

Results



- In 2007, significant positive relationship between population size and presence of invasives ($p=0.0297$)

Results



- Different size classes were not equally exposed to invasive species ($p < 0.0001$)

Discussion

- 1st to document plant-centric exposure to invasive species
- Most prevalent species similar to other studies¹²³
 - Generalist dispersal
 - Previous land-use
- Allelopathic invasives



Discussion

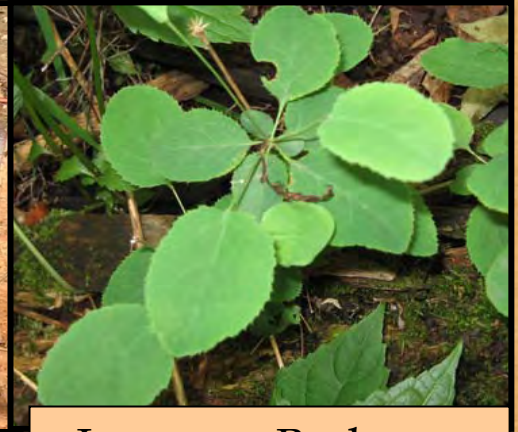
How may invasive species affect ginseng?



Garlic Mustard



Tree Of Heaven

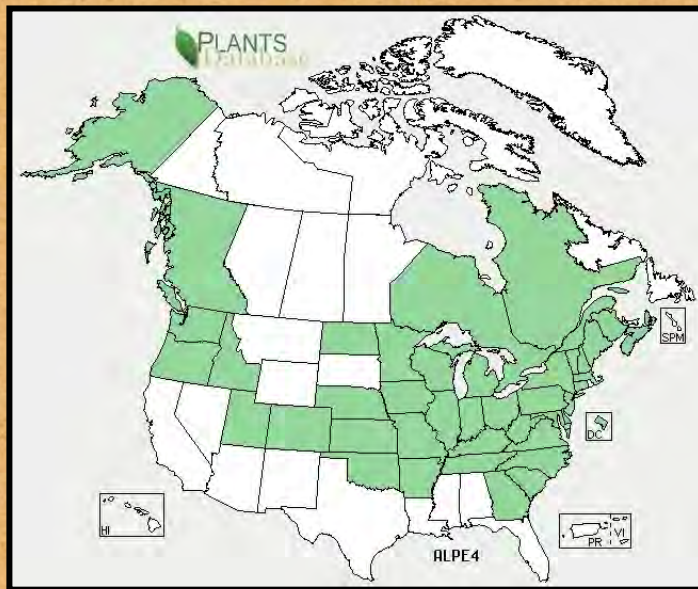


Japanese Barberry



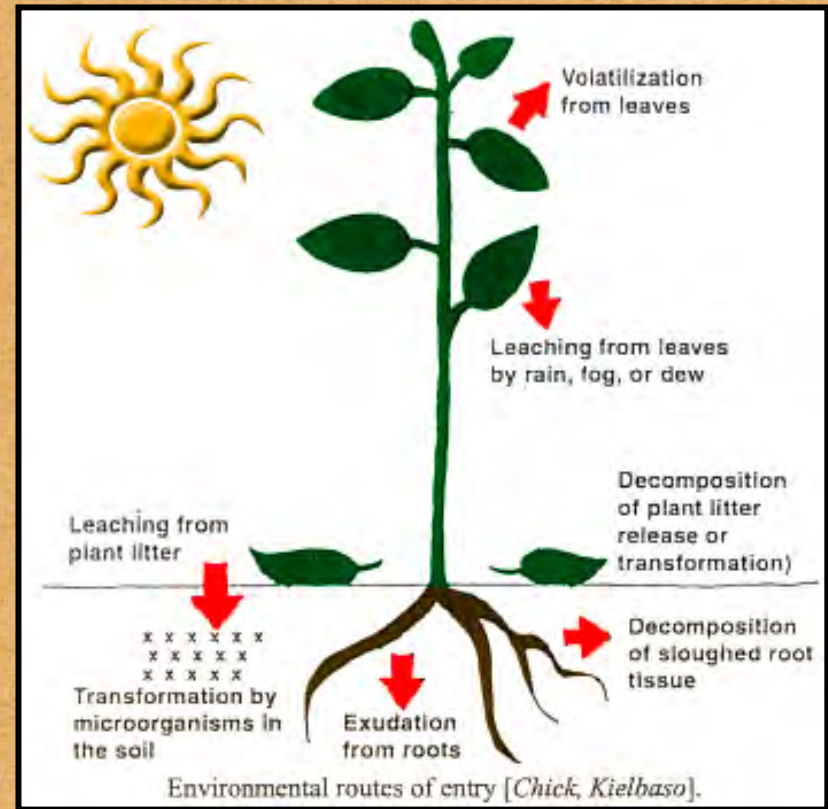
Garlic Mustard

- Widespread invasion
- 5/30 ginseng populations
- Biennial
- Reduces species diversity
- Potentially allelopathic



Allelopathy

- Chemical alteration of soil
- Garlic mustard
 - Glucosinolates
- Activated carbon
 - Affinity for organic compounds
 - May cause nutrient interference¹



Modified from Chick and Kielbaso 1998

¹Lau et al. 2008

Research Question

- Does garlic mustard competitively and/or chemically affect survival and growth of ginseng seedlings more than a similar, native competitor?



American Ginseng



Garlic Mustard



Striped Violet

Methods

- NY wild ginseng seedlings
- Striped violet and garlic mustard seedlings collected from field
- Activated carbon
- Study conducted over 2 yrs

	Ginseng	+S. Violet	+G. Mustard
- AC	N=50	N=50	N=50
+ AC	N=50	N=50	N=50



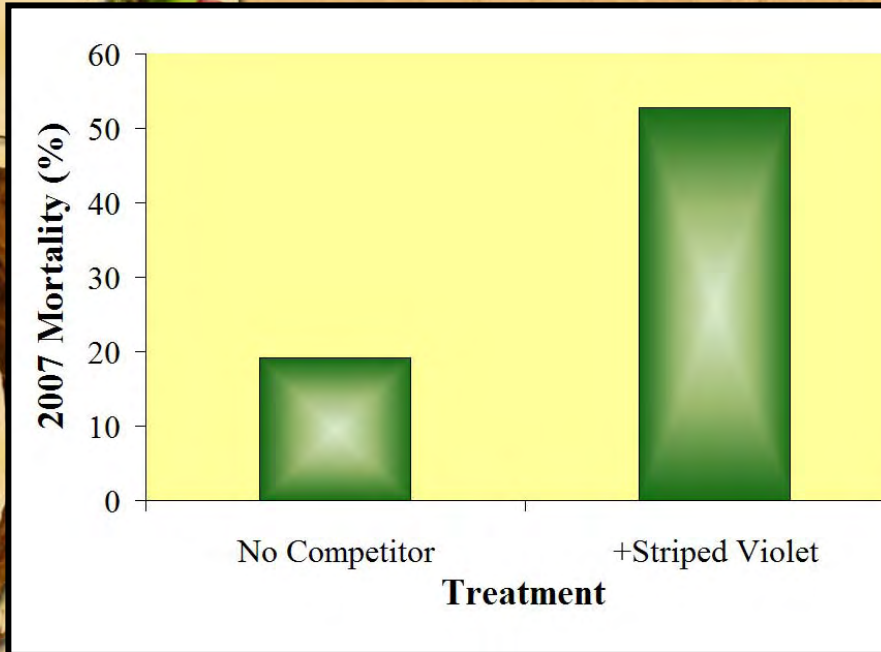
Methods

- Survival ('06, '07)
- Ginseng growth ('07)
 - Shoot and root length
 - Shoot and root mass
 - Root: shoot ratio
 - Total biomass
 - Relative growth rate of leaves



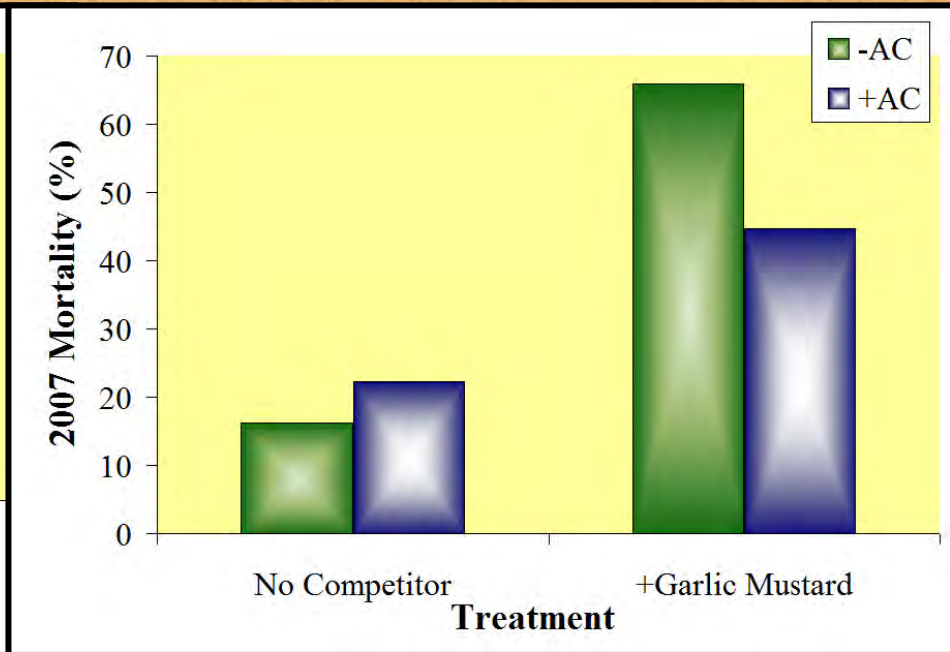
Results/ Discussion

Striped Violet Addition



$p < 0.0001$

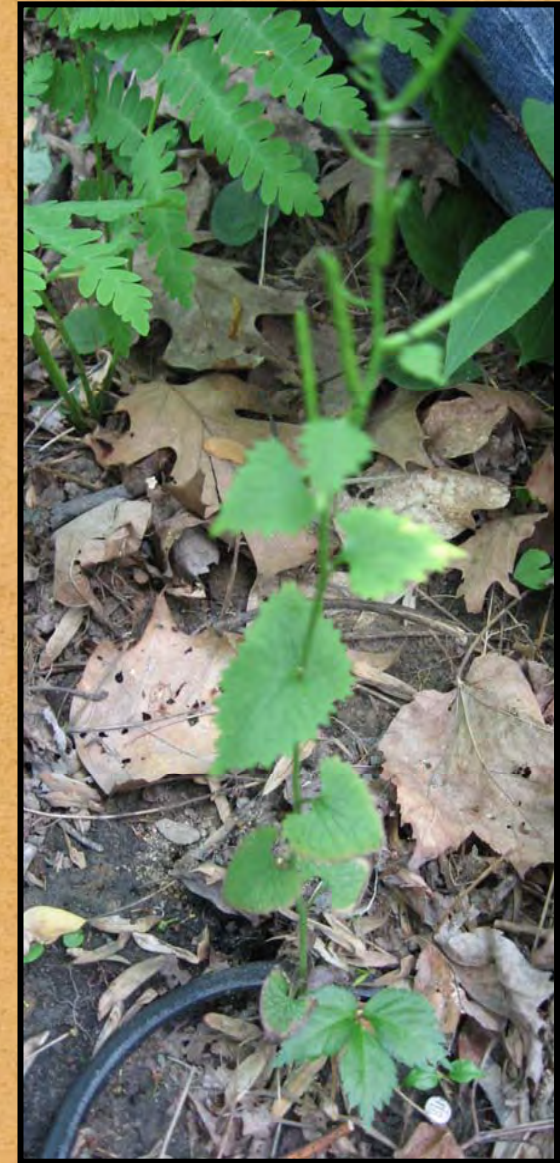
Garlic Mustard Addition



$p = 0.0859$

Results/ Discussion

- Garlic mustard effects
 - Trend for allelopathy
 - No effect on growth
 - No differential effect of invasive or native species
 - Species-specific?
 - Cumulative?



General Conclusions

- High level of invasion
- Garlic mustard 3rd most prevalent
 - Recruitment
 - Demographic effects
- How may ginseng respond to other invasives?



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