Ecology of the invasion of *Ligustrum obtusifolium* in the Shaw Nature Reserve: an examination of habitat suitability

Austin Lynn's REU project
Mentored by Dr. Sandra Arango-Caro

Why are invasive species relevant?

- Threat to biodiversity
- Alter ecosystems by changing dominant vegetation type, soil properties, patterns of herbivory

General attributes of biological invasions

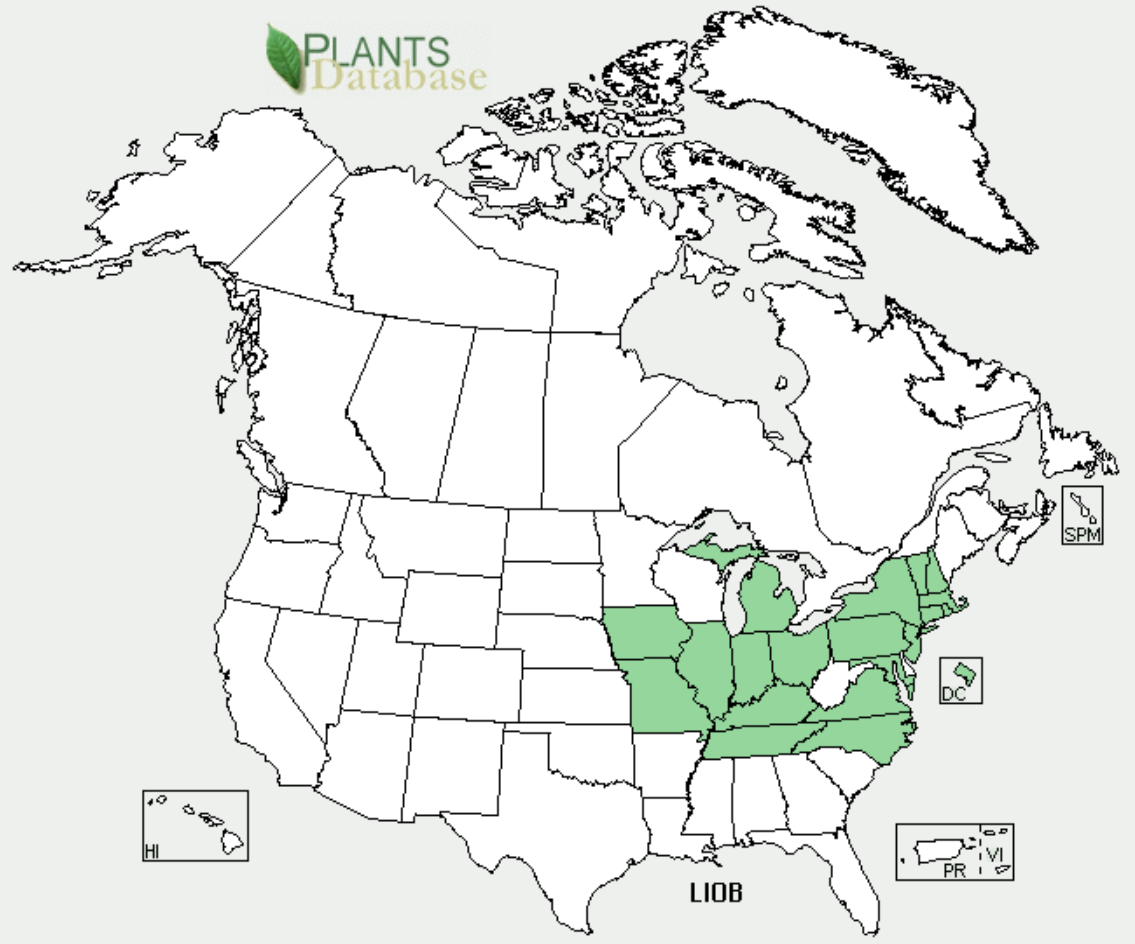
- Introductions of alien species are generally caused by humans
- Most introduced species do not flourish in the new environment (Mack et al. 2000)
- Lag times (Crooks 2005)
- Roads contribute to the distribution of exotics - disturbance (Flory & Clay 2006)
- Difficult to control, nearly impossible to eradicate (Grice 2009)

Ligustrum obtusifolium- Border Privet

Photo: James Trager

- Member of the Oleaceae (olive) family
- Other invasives- *L. sinense, L. japonicum, L. vulgare*
- Introduced from Japan and China in 1860
- MO is the western border of the distribution in U.S.
- The fruit (a drupe) is dispersed by birds

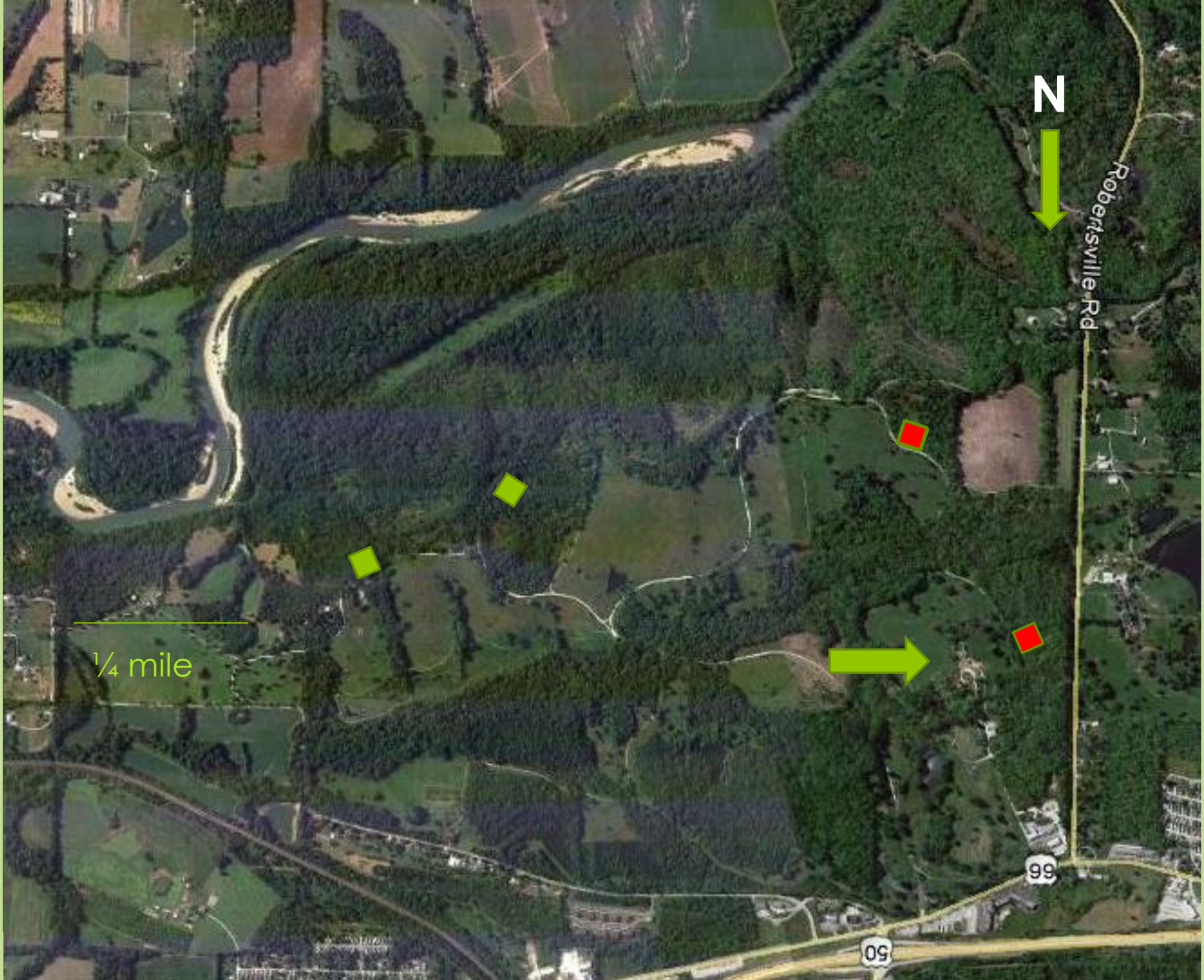
U.S. Distribution



(USDA 2012)

Traits of *Ligustrum obtusifolium*

- The privets form dense thickets which block sunlight from other plants
- Rapid vertical growth in low light condition (Morris et al. 2002)
- Chemical defenses (oleuropeins) in leaves that denature proteins and prevent herbivores from receiving nutrients (Konno et al. 1999)
- *Leptoypha hospita* and *Argopistes tsekooni* are insects native to China that can feed successfully on privet (Zhang et al. 2011)


N
Robertsville Rd
¼ mile
66
50

Management efforts

Privets have been controlled in the reserve with a variety of methods:

- Cut and paint
- Arial spray in riparian corridor
- Controlled burning
- Spray herbicide-Aquamaster (Glyphosate)
- Paint herbicide- Tordon (Roundup more effective)

Goals of my project

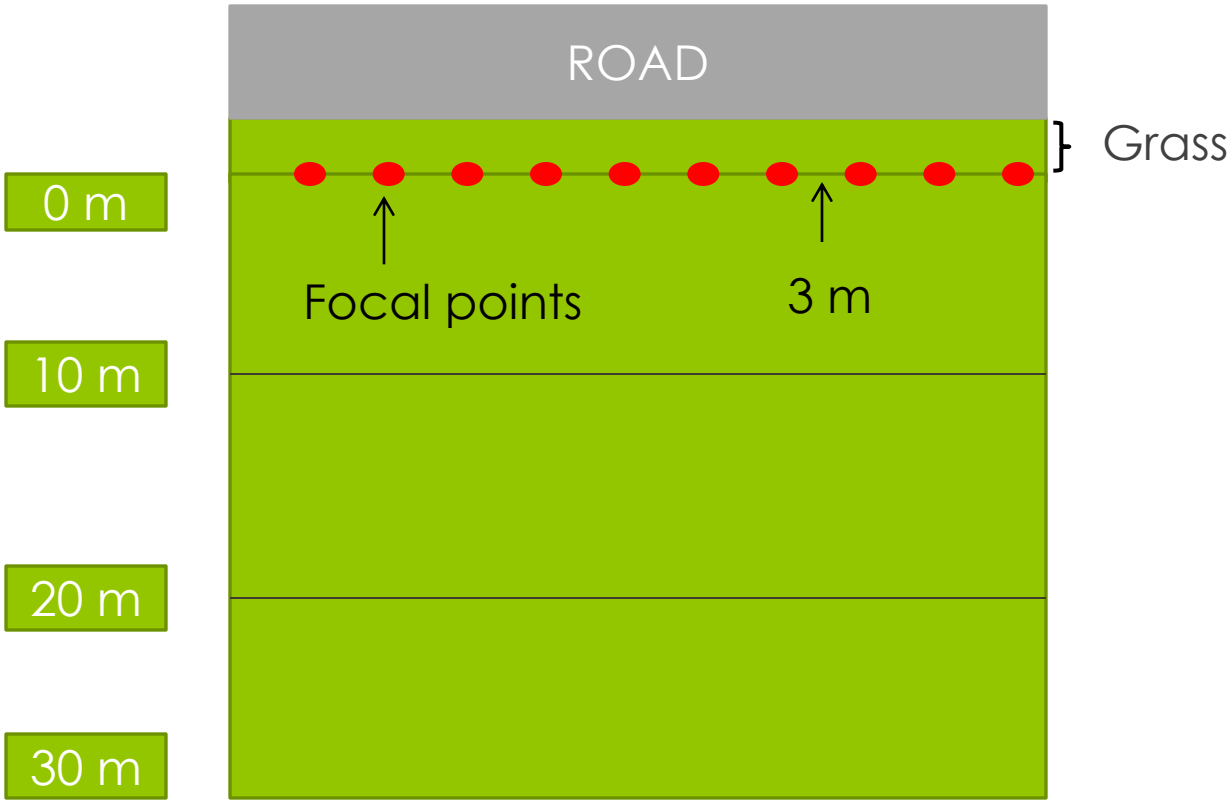
- To determine the suitable habitat of *L. obtusifolium* in the Shaw Reserve in terms of abiotic and biotic factors
- To determine if distance from roads influences habitat of privet
- To examine if the height of privet plants is related to herbivory damage and or richness
- To make recommendations for the future management of privet in the reserve

METHODS

Photo by Sandra Arango-Caro

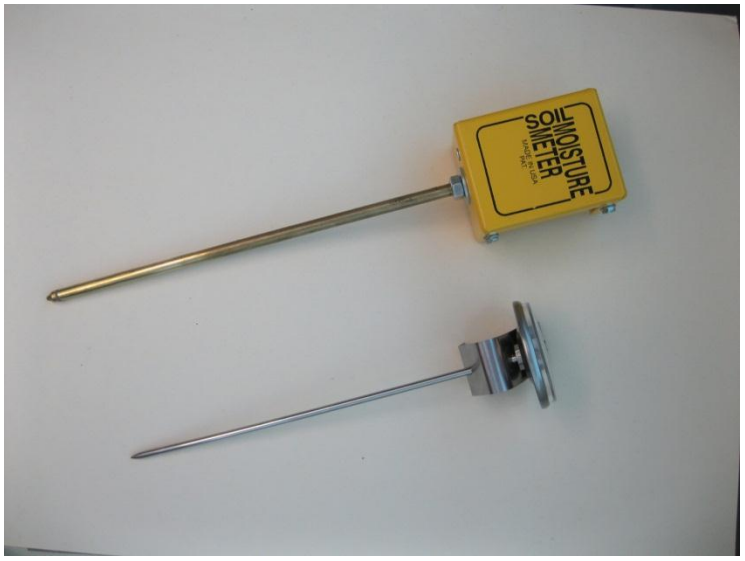
Table 1. Description of study sites.

Site	Presence of privet	Type of habitat	Orientation	Slope	History of management	Coordinates
One	No	Woodland	NW 40°	<10%	Cut and paint, logging, burning	38°28'30"N 90°48'11"W
Two	Yes	Dense woodland	NE 60°	<10%	Cut and paint, spray herbicides, burning	38°28'30"N 90°49'41"W
Three	Yes	Dense woodland	NE 50°	<10%	Logging, burning	38°28'09"N 90°49'29"W
Four	No	Woodland	NE 130°	10-30%	Cut and paint, logging, burning	38°28'12"N 90°48'31"W


ROAD
Grass
0 m
10 m
20 m
30 m
Focal points
3 m

Abiotic Factors

- Light availability (µmol photons m-2 s-1)
- Air temperature and humidity
- Soil temperature and moisture



Biotic Factors

- Species richness
- Percent cover
- Proportion of herbivory on privet
- Presence or absence of fruits
- Height of focal plants


RESULTS

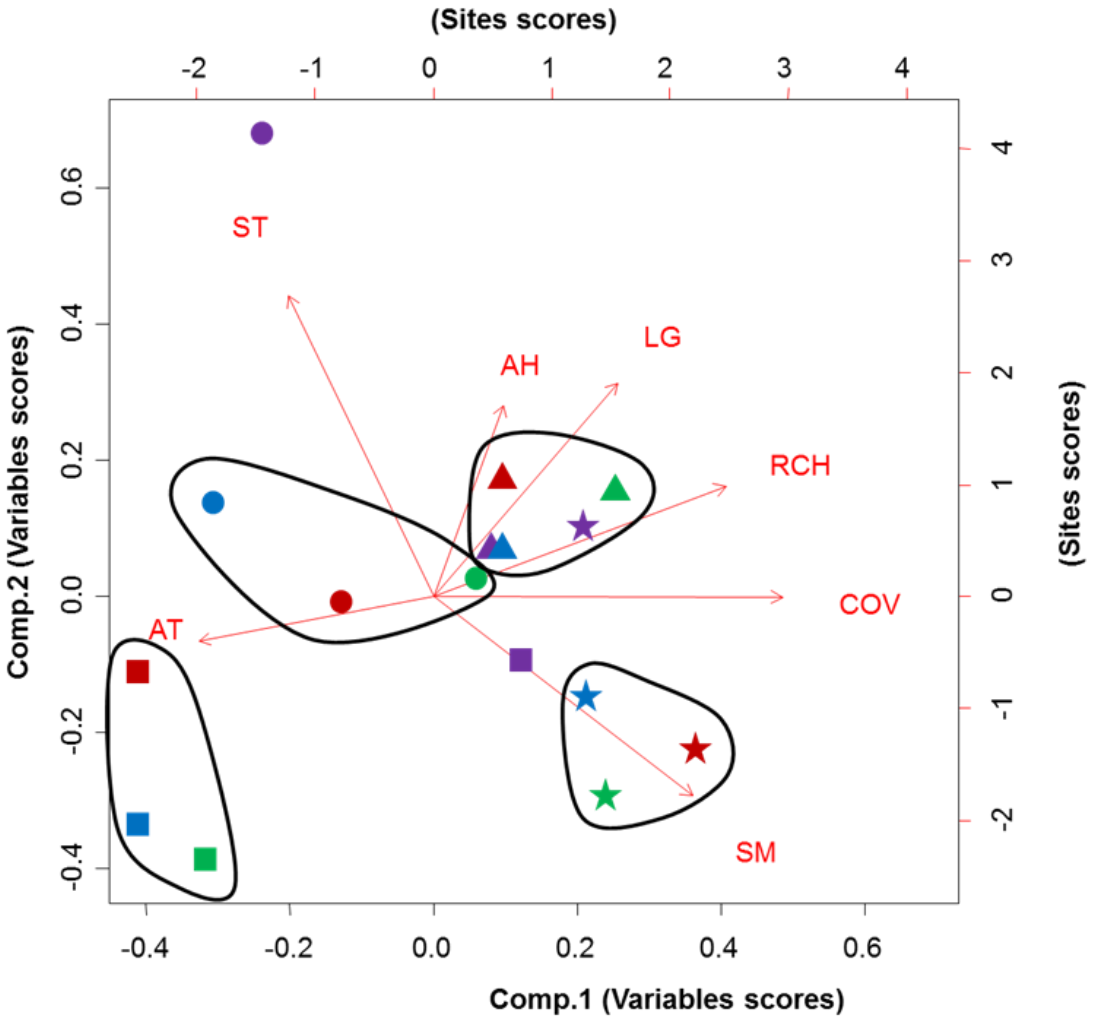
PCA of environmental patterns by site and distance from road

Sites

- Site 1 – no privet
- Site 4 – no privet
- Site 2 – privet
- Site 3 - privet

Distances

0 m – purple
10 m – green
20 m – red
30 m – blue



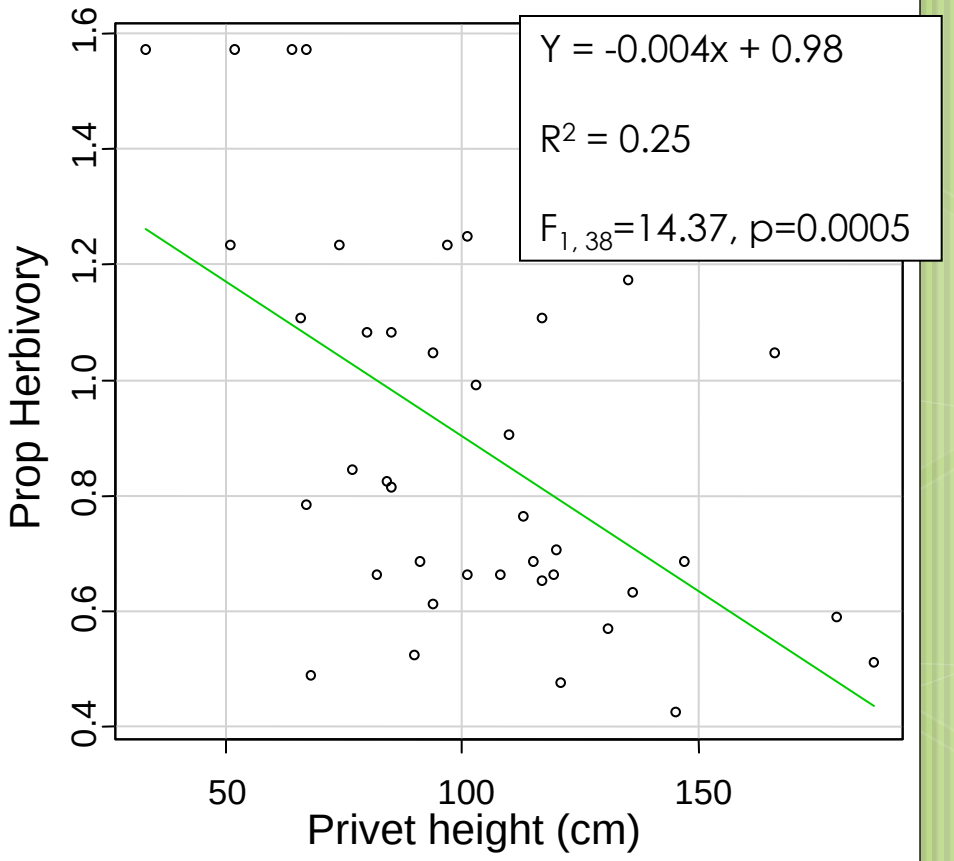
Relationship of privet height with richness

- No significant relationship between height of focal plants and species richness for both sites.

- Height of plant doesn't coincide with its ability to block sunlight from other plants

Plant height and herbivory

- Smaller plants- younger less developed leaves.



Recommendations

- *L. obtusifolium* could be on the verge of further invasion into the reserve
- Management in the reserve should continue
- Burning seems to be the most effective technique
- Focus on eliminating reproducing individuals.

Future Studies

- Analyze the data on species composition between sites infested with privet and uninfested
- Identifying herbivores
- Look at how privet habitat suitability varies with soil chemical composition
- Privet densities

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