Assessing the Impact of Deer on Forest Growth in Wetlands

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REU Summer Research Program

Objectives

- Our aim is to determine whether the local deer herd is affecting the natural regeneration of the wetland forests in the College Woods.
- The study will take place over several years.
- Phase 1: Establishing a baseline of the forest's structure, is now complete.
- Phase 2: Monitoring the change in seedling densities, is in progress

Why Perform this Study?

- "Last summer we saw lots of deer hanging out in the wetlands because it was so dry. If you take a walk through the forest, it looks like a bomb went off because there is no sign of young trees." – *Dr. Randy Chambers, Professor of Environmental Studies at the College of William and Mary.*

Phase 1 Breakdown

1. Know your enemy: Background information on the white-tail deer.

2. Fence construction.

3. Sampling to establish baseline.

Deer grazing habits

- Deer prefer edge habitats where there is a wider diversity of food, and an easy escape route from danger.
- Watering sites are often at the center of home ranges.
- Deer do not spend much time at the watering site unless water is scarce because it is unsafe.

Diet

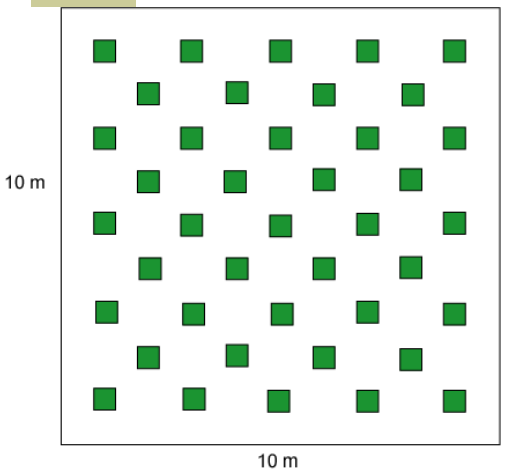
- Deer look for the most nutritious part of the plant: the meristem.
- They prefer forbs, but often will eat the young shoots of woody plants, as well as nuts – especially acorns.


Fence Building

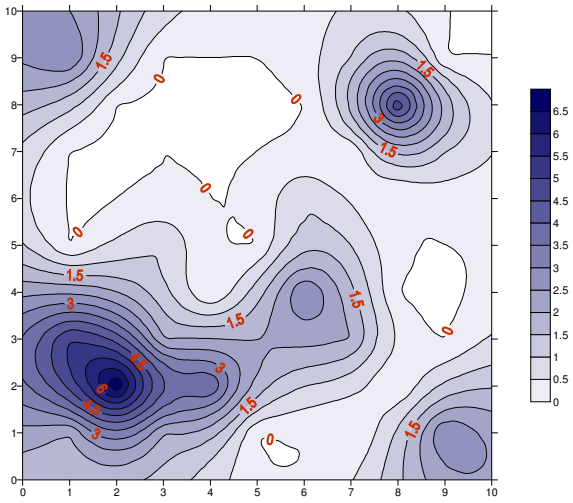
The Great Walls

- 3 10m x 10m fenced plots each paired with a sister control.
- 6 ft. high, with enough ground clearance for small critters to pass under.
- Galvanized steel.

Sampling procedure



1	9	0
1	9	0
1	9	3
1	9	0
1	9	0
2	8	4
2	8	0
2	8	1
2	8	1
3	7	0
3	7	5
3	7	0
3	7	1
3	7	0
4	6	2
4	6	0
4	6	0
4	6	0
5	5	0
5	5	3



Hypotheses

1. The number of individual seedlings will remain constant or decrease.
2. If deer are grazing, the unprotected control plots will show a greater seedling loss.

The Changes according to species

Plot	% ground cover	Elm	Ash	Dogwood	Swamp Dogwood	Maple	Ironwood	Beech	Oak	Holly	Blackhaw	E. americana
Control 1 (June)	15.6	87.8	468.3	58.5	0	68.3	312.2	29.3	0	0	9.7	165.9
Control 1 (July)	16.7	29.3	400.2	29.3	0	146.4	253.8	19.5	19.5	0	0	146.4
Change	**0.071**	**-0.666**	**-0.145**	**-0.499**	**0.000**	**1.143**	**-0.187**	**-0.334**	**19.500**	**0.000**	**-9.700**	**-0.118**
Fence 1 (June)	26.8	9.8	29.3	0	0	9.8	75.1	0	0	0	0	175.6
Fence 1 (July)	12.8	0	29.3	0	0	0	19.5	0	0	0	0	97.6
Change	**-0.52238806**	**-9.8**	**0**	**0**	**0**	**-9.8**	**-0.740346**	**0**	**0**	**0**	**0**	**-0.444191344**
Control 2 (June)	32.1	48.8	39	48.8	0	0	19.5	0	0	9.7	0	380.5
Control 2 (July)	24.5	29.3	48.8	9.7	39	0	0	0	0	19.5	0	273.3
Change	**-0.236760125**	**-0.39959**	**0.251282**	**-0.8012295**	**39**	**0**	**-19.5**	**0**	**0**	**1.010309**	**0**	**-0.28173456**
Fence 2 (June)	18.3	78	0	29.3	29.3	0	19.5	0	0	0	0	29.3
Fence 2 (July)	7.9	68.3	39	9.8	9.8	0	0	0	0	0	0	322.1
Change	**-0.568306011**	**-0.124359**	**39**	**-0.665529**	**-0.66552901**	**0**	**-19.5**	**0**	**0**	**0**	**0**	**9.993174061**
Control 3 (June)	14.9	39	224.5	48.8	0	29.3	29.3	0	9.8	0	0	117.1
Control 3 (July)	9.6	0	117.1	29.3	0	9.8	0	9.8	0	0	0	78.1
Change	**-0.355704698**	**-39**	**-0.478396**	**-0.3995902**	**0**	**-0.665529**	**-29.3**	**9.8**	**-9.8**	**0**	**0**	**-0.333048676**
Fence 3 (June)	12.8	9.8	39	9.8	39	0	39	0	0	0	0	0
Fence 3 (July)	9.8	19.5	29.3	0	9.8	0	19.5	0	0	0	0	78.1
Change	**-0.234375**	**0.989796**	**-0.248718**	**-9.8**	**-0.748717949**	**0**	**-0.5**	**0**	**0**	**0**	**0**	**78.1**

Flood

Flood

Trends?

- In general, seedling populations decreased.
- Elm, flowering dogwood, and ironwood decreased in all control plots.
- *E. Americana* decreased in all control plots, and increased in the two fenced plots unaffected by the flood.
- The amount of ground cover decreased.
- Number of maple seedlings did not reflect the relative dominance in the adult community. Deer commonly graze on maple.

Disclaimer: My ability to correctly identify seedlings has greatly improved since I started the survey. I have less confidence in my June numbers than my July numbers.

ANOVA Analysis

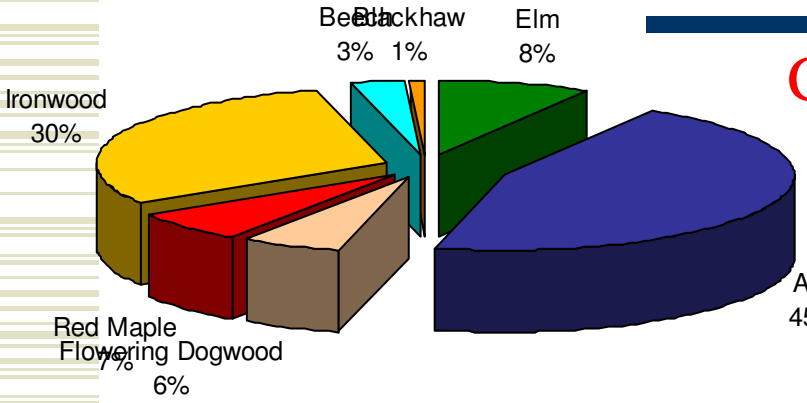
- Tests for significant variation among plots, and more importantly, treatments.
- Only *E. americana* showed significant variation due to treatment: P-value of .285 in June became .042 in July.
- *E. americana* is common east of the Mississippi River, and deer are known to eat it.

Community Indices

- Community Similarity: comparing the actual percentage composition of two plots.
- Coefficient of Community: Comparison of species diversity.
- Index of Dominance: Indicator of the heterogeneity of a plot.

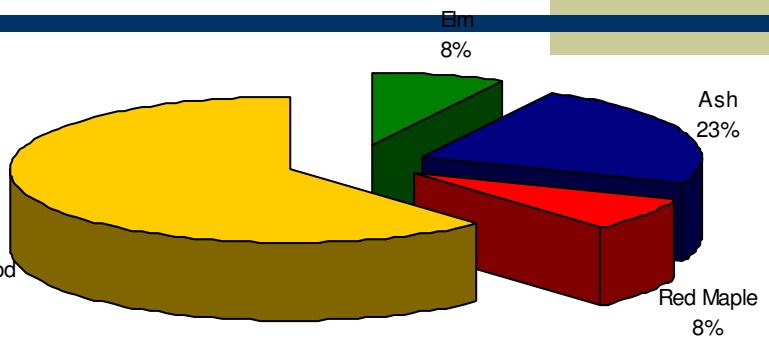
Community Similarity

Control 1 (June)

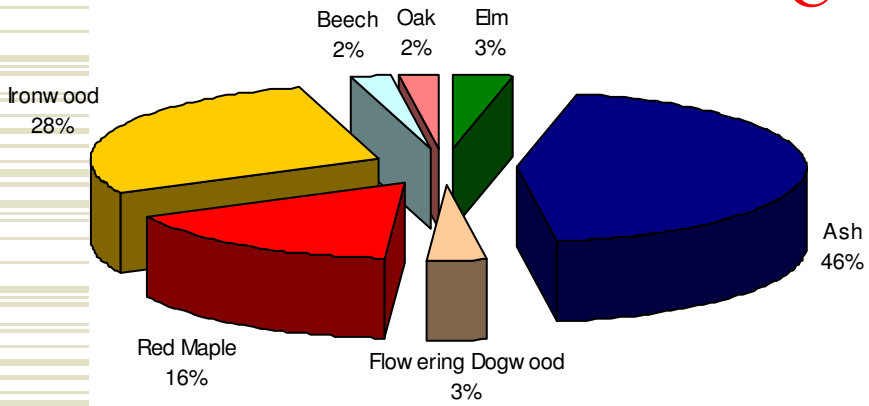


C=.68

Fence 1 (June)

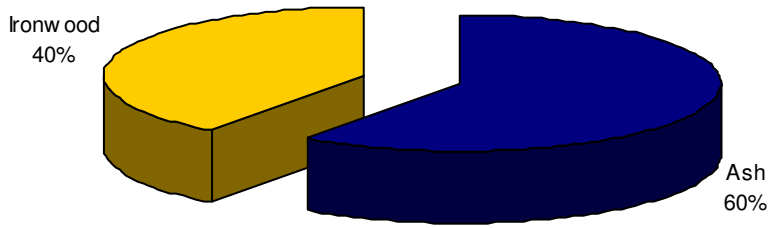


Control 1 (July)



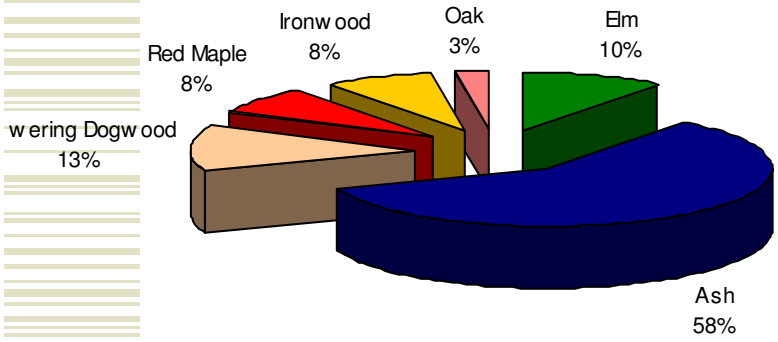
C=.74

Fence 1 (July)

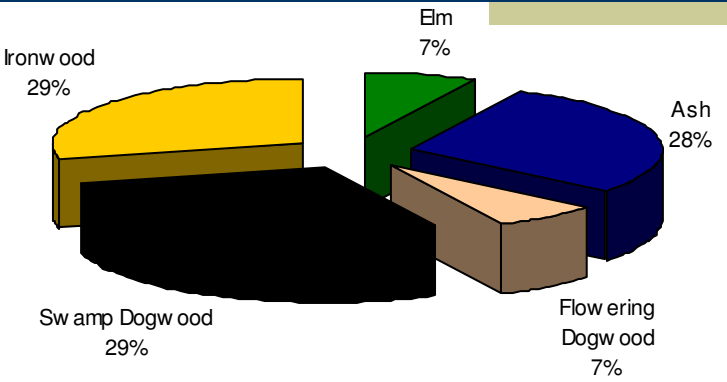


Community Similarity (cont.)

Control 3 (June)

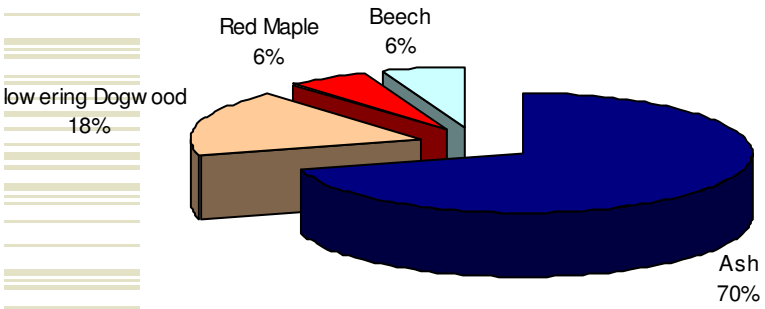


Fence 3 (June)



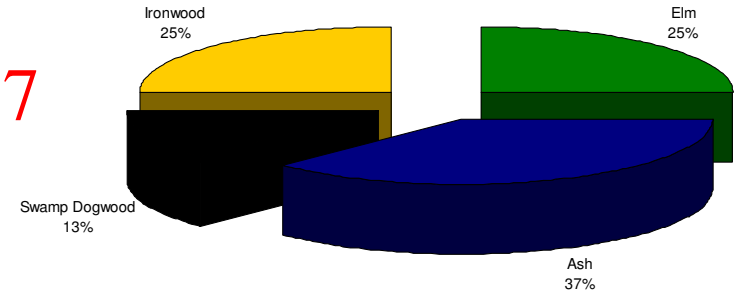
C=.50

Control 3 (July)

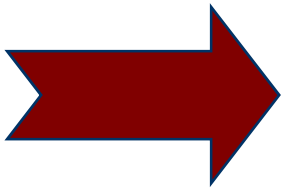


C=.37

Fence 3 (July)

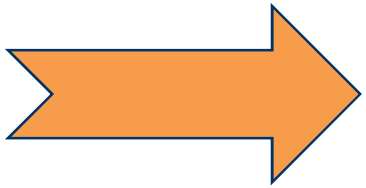


Coefficient of Community

June		***July***
Plot pair 1: ***.73***		Plot pair 1: ***.44***
Plot pair 2: ***.67***		Plot pair 2: ***.89***
Plot pair 3: ***.73***		Plot pair 3: ***.25***

Index of Dominance

June	*July*
Control 1: .319	Control 1: .308
Fence 1: .444	Fence 1 : .520
Control 2: .247	Control 2: .244
Fence 2: .326	Fence 2: .396
Control 3: .387	Control 3: .536
Fence 3: .255	Fence 3: .281



What do the indices indicate?

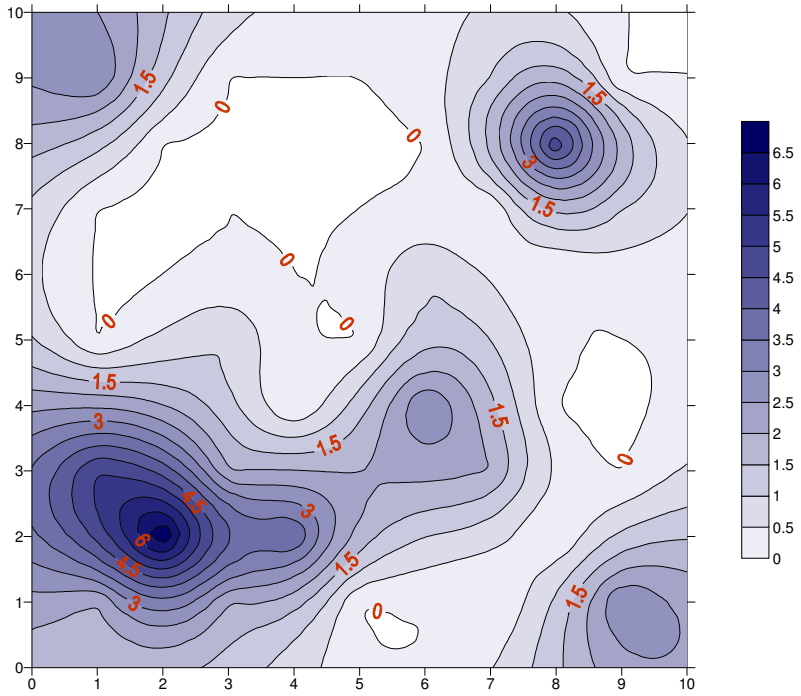
1. The flood eliminated a significant amount of new growth in Fence 1 and Control 3.
2. There was a loss of species diversity during the summer.
3. The control plots have NOT changed significantly more than the fenced plots.

Going Surfing!

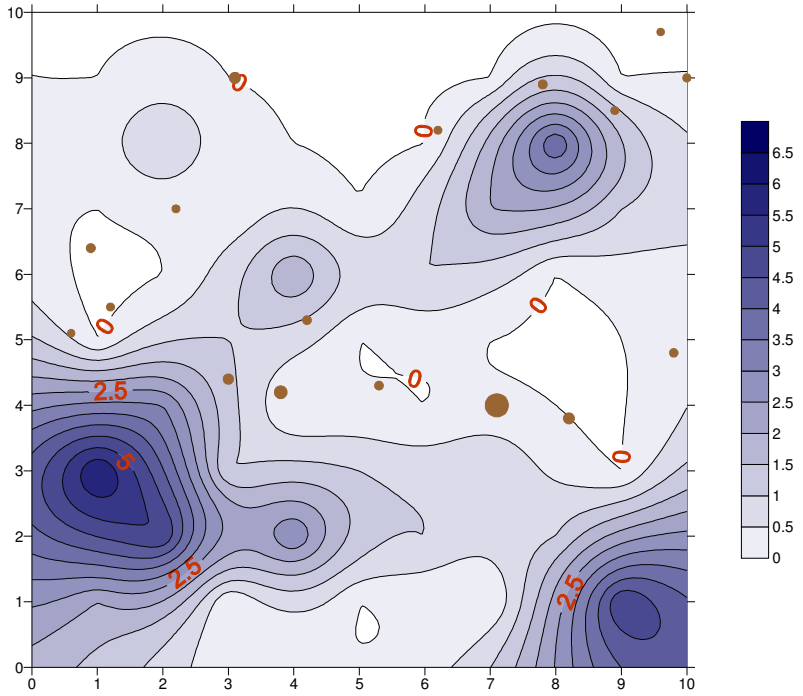
Going a step further, we can not only monitor the changes in numbers of seedlings, but also their spatial densities.

Swamp Ash in Control 1

June

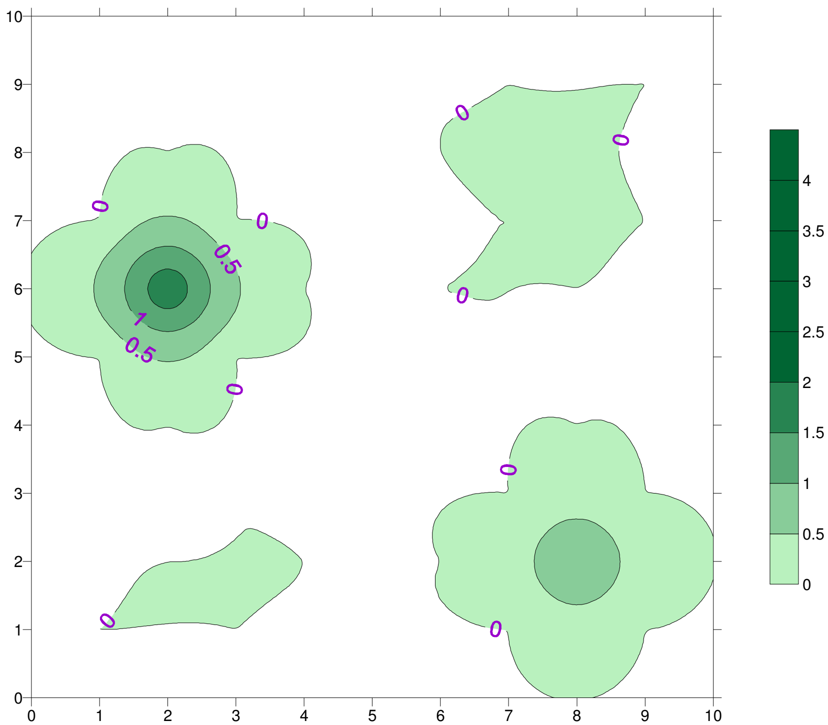


July

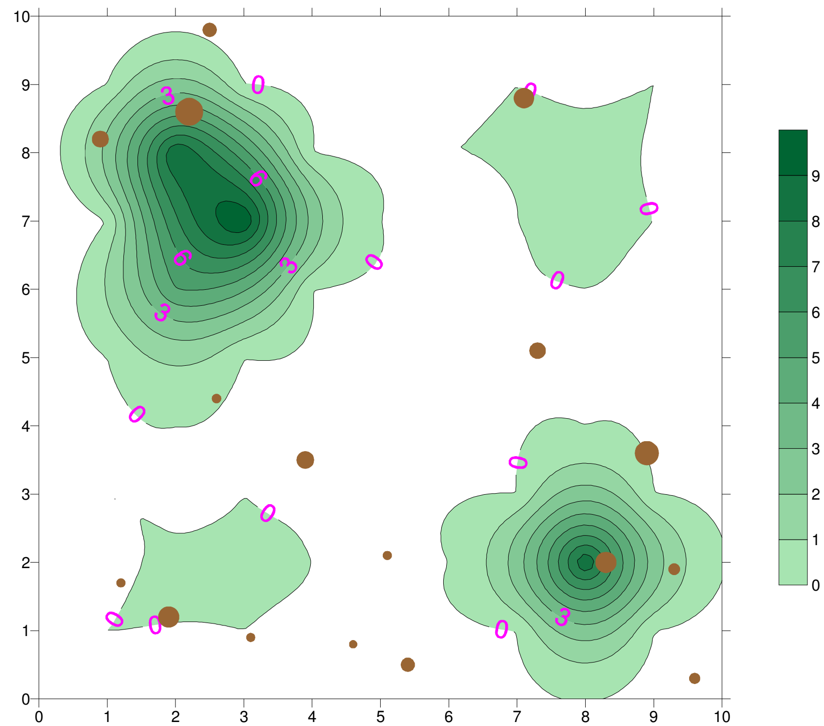


Hearts-a-bustin, aka *Euonymous americana* in Fence 2

June

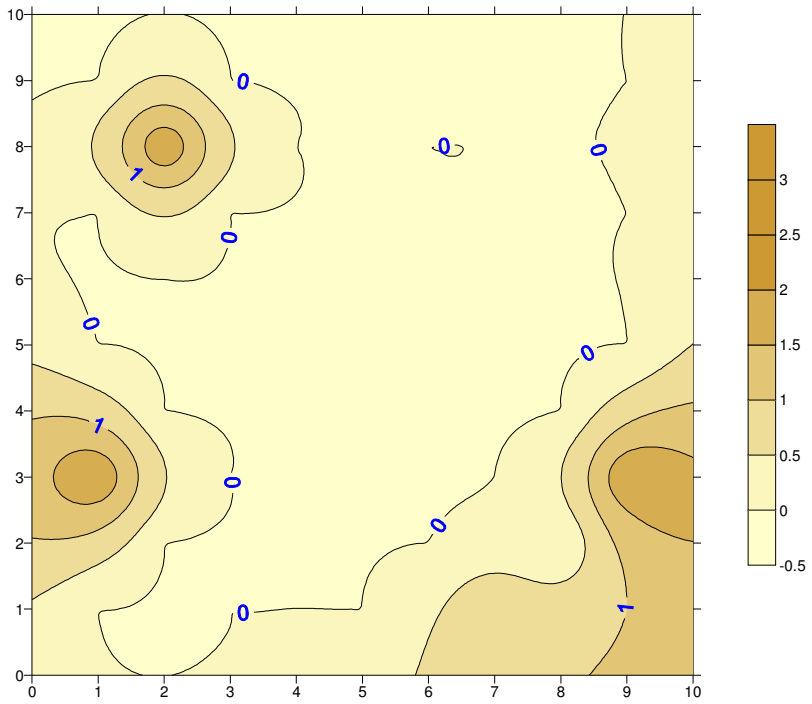


July

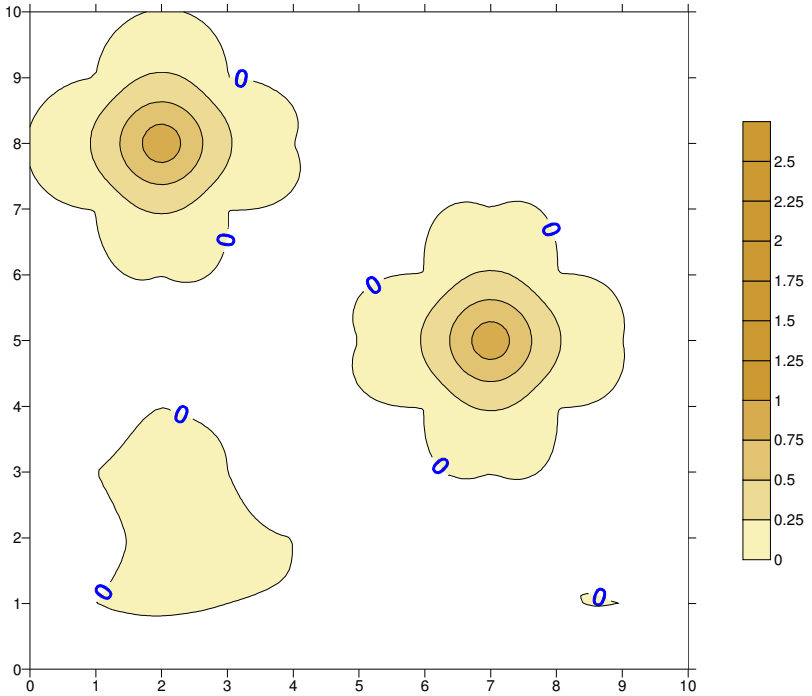


Ironwood in Fence 1

June



July



Where do we go from here?

1. Continued sampling for next 2 or 3 years.
2. Infrared camera shots around the streams off Compton Drive.
3. Special interest in *E. americana* as a potential indicator of deer grazing pressure.

I'd like to thank Dr. Chambers for his energy and encouragement, as well as advice. I'd also like to thank Tim for his technical expertise, the GIS class, and the many games of racquetball. And a final thanks to Huw for his help measuring the trees…even though I haven't used those data yet!

The End