Factors Limiting New England Cottontail (*Sylvilagus transitionalis*) Populations in New York: Implications for Habitat Restoration

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ESF

Goals

- Effects of invasive vegetation and eastern cottontail on New England cottontail restoration

Project Objectives

- Population and Site Monitoring
- Resource Selection
- Survival / recruitment
  - Hunting
  - Invasive vegetation
  - Eastern cottontails
  - Management strategies
- Home Range (adult and juvenile)
- Dispersal (adult and juvenile)
  - Radio-tracking
  - Genetic (microsatellites)
- Parasites and Nutrition

Emily Reuber

Trapping Success

NEC/ Total Unique Adults and Juveniles:	110/196
NEC/Total Unique Collared and Transmittered	110/183
NEC/Total Adults Collared:	83/143
NEC/Total Young Transmittered:	32/55
NEC/ Total On Air Adults	**21/47**
NEC/ Total On Air Juveniles	**0/1**

Cranberry Mountain

	NEC 2014	EC 2014	NEC 2015	EC 2015	Total NEC	Total EC
08- Cranberry	4	0	8	1	**12**	**1**

- Trapping very successful this year
- Captured NEC in back larger management area (20 months post cut)

Patch Extinctions of NEC at
- Glynnwood
- Taconic-301 (recolonized)
- Wiccopee (recolonized?)

Red sites → shift from NEC to EC dominated in 2015

Single Site (Appalachian Trail) has more NEC than EC in 2015

Trapping Notes:
- Same areas trapped
- Similar Effort - Effort increased when NEC not trapped
- NEC Trapped at Wiccopee and Route 9 were in January 2015

Annual Trapping Trends

	NEC 2014	EC 2014	NEC 2015	EC 2015	Total NEC	Total EC
Appalachian Trail	4	3	9	3	**13**	**6**
Glynnwood	10	5	0	4	**10**	**9**
Taconic -301	5	0	1	0	**6**	**0**
Garrison Investments	6	3	3	12	**9**	**15**
Indian Brook Road	4	0	1	2	**5**	**2**
Wiccopee	17	3	1	1	**18**	**4**
Route 9	8	1	8	5	**16**	**6**
Cranberry	4	0	8	1	**12**	**1**
Ninham-Gypsy Trail	0	4	0	19	**0**	**23**
Ninham-Nichols	6	5	3	3	**9**	**8**
Wonder Lake	5	1	-	-	**5**	**1**
Wonder Lake West	-	-	1	8	**1**	**8**
Charcoal Burners	-	-	1	0	**1**	**0**
Hubbard Lodge	-	-	3	3	**3**	**3**
TOTAL	**69**	**25**	**34**	**50**	**103**	**75**
Total Juveniles	26	6	5	16	31	22
Total Adults	43	19	30	44	73	63

Habitat Use
Movements

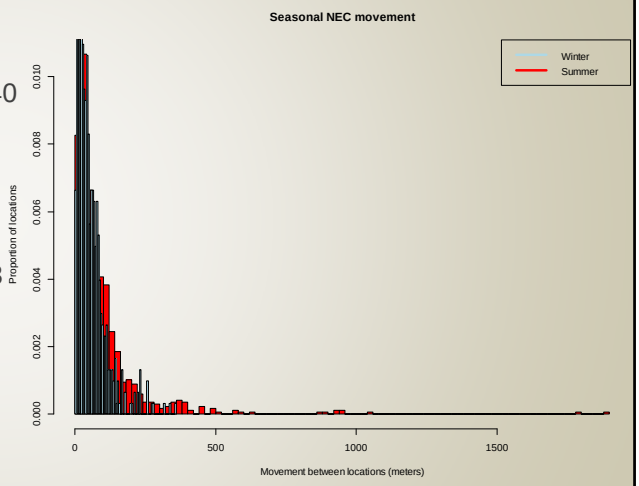
NEC

- $Median_{Summer}$ = 58 meters, N = 840
- $Median_{Winter}$ = 37 meters, N = 626

EC

- $Median_{Summer}$ = 54 meters, N= 283
- $Median_{Winter}$ = 43 meters, N = 294

Lit suggests NEC more reluctant to move outside cover → less cover in winter



Resource Selection
Part 1: Structure

- Logistic regression w/ random effect
- Examined selection for structure and vegetation composition

	Stems	Vegetative Canopy	Herbaceous Height		Woody Canopy	
	Both	Both	NEC	EC	NEC	EC
Leaf on	0	+	0	+	+	-
Leaf off	+ +				+	-

Resource selection
Part 2: Shrub Species

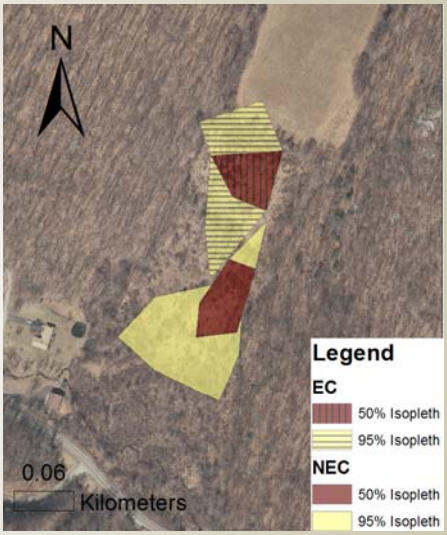
- Logistic regression w/ random effect
- Examined selection for structure and vegetation composition

	Rose	Native	Barberry	
	Both	Both	Leaf on	Leaf off
NEC	+ +	0	+	+ +
EC	-	+	0	+ +

Habitat Use
Home Range Size

New England cottontail

- 95% Isopleth: 1.60 ± 1.75 hectares, n = 23
- 50% Isopleth: 0.45 ± 0.41 hectares, n = 23



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Eastern cottontail
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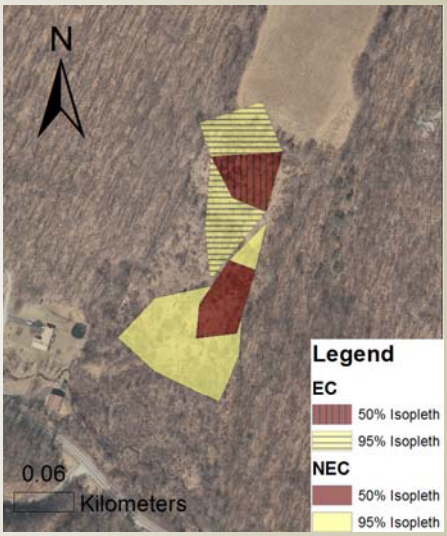
- 50% Isopleth: 0.33 ± 0.16 hectares, n = 11



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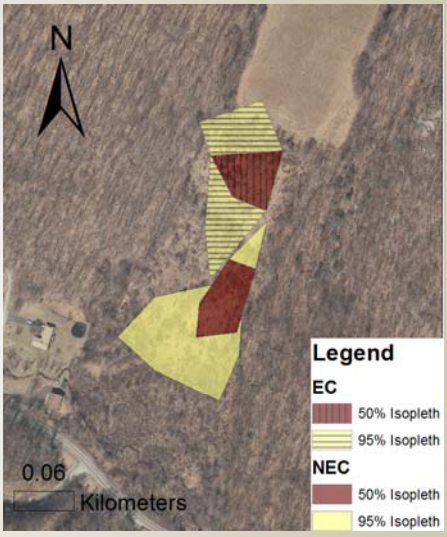
No interspecific differences:
- 95%: t = -0.75, df = 31.83, p-value = 0.46, n = 34
- 50%: t = -1.09, df = 31.51, p-value = 0.29, n = 34



Implications of demographic study so far

- Species turnover
  - EC push out NEC after poor winters, need to manage existing sites not just newly created sites
- Seasonal habitat changes
  - NEC using different summer habitat → suggests need to manage for patches of young shrubland/grassland within larger shubland management patches
  - Interspecific differences in habitat selection → manage in favor of NEC
- Newly identified habitat types
  - NEC using residential areas bordering shrubland
  - NEC are using grassland/ young shrubland
  - NEC using human structures and outbuilding as daytime/ winter refugia
- Contributions of road and hunting mortality
  - Implications for population persistence at certain sites
- Predator communities
  - Naturalized coyote potentially increasing predation on NEC –Creating predator pits? Increasing site extinctions
- Use of non-native vegetation
  - NEC using invasive rose and barberry, may benefit species

Genetic Analysis of NEC

- Identify unique individuals from ear clips (trapped/collared rabbits), and from fecal pellets.
- Initial plan to only look at ear clips (currently 75+ NEC)
- Now all pellets included (489 NEC)

EAR DATA

DNA Sam	Site	Lsa1 (Blue)	Lsa8 (Yellow)	Sat12 (Green)	INRA016 (Blue)	Genetic Sex ID	Sfl11	StrQ2	StrQ32
NEC16	519	169, 169	185, 185	121, 121	185, 185	100	216, 220	135, 147	174, 174
NEC18	576	167, 171	183, 185	121, 125	183, 185	101	216, 220	135, 150	174, 174
NEC24	517	169, 169	183, 185	121, 129	185, 185	100	216, 220	147, 147	174, 174
NEC44	599	167, 169	178, 185	116, 129	185, 185	101	216, 218	147, 153	174, 174
NEC23	505	167, 169	178, 185	121, 121	185, 185	101	220, 220	150, 150	174, 174
NEC3	504	169, 169	178, 185	116, 121	185, 185	101	216, 218	141, 150	174, 186
NEC31	585	165, 171	178, 178	121, 125	185, 185	100	218, 220	141, 150	174, 186
NEC54	534	165, 167	178, 178	121, 129	183, 185	100	220, 220	141, 150	174, 186

Genetic Analysis of NEC

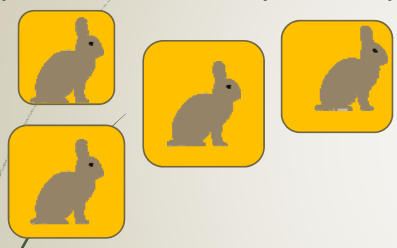
- Pellet data suggest multiple resampling of individuals
- Some pellets match trapped rabbit DNA

PELLET DATA

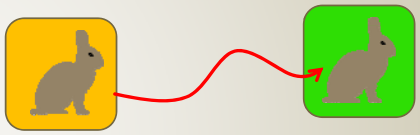
DNA Sample	Site	Lsa1 (Blue)	Lsa8 (Yellow)	Sat12 (Green)	INRA016 (Blue)	Genetic Sex ID	Identical profile(s)
EJG150	6	167, 169	178, 185	129, 129	185, 185	101	EJG150, NEC14
EJG155	6	167, 167	178, 185	129, 133	185, 185	101	
EJG157	6	169, 169	185, 185	133, 133	185, 185	101	
EJG159	6	167, 167	185, 185	133, 133	185, 185	101	EJG159, EJG160, EJG161, NEC12
EJG160	6	167, 167	185, 185	133, 133	185, 185	101	EJG159, EJG160, EJG161, NEC12
EJG161	6	167, 167	185, 185	133, 133	185, 185	101	EJG159, EJG160, EJG161, NEC12
EJG162	6	167, 167	178, 185	129, 133	185, 185	101	
EJG163	6	167, 169	178, 185	129, 133	183, 185	100	EJG163, EJG164
EJG164	6	167, 169	178, 185	129, 133	183, 185	100	EJG163, EJG164
EJG166	6	167, 169	185, 185	129, 133	185, 185	100	
EJG169	6	167, 167	185, 185	129, 133	185, 185	101	EJG169, EJG170

Genetic Analysis of NEC

Genetic population structure (between/within patches)

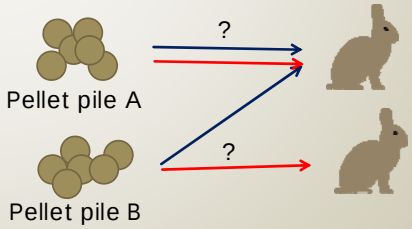


Dispersal

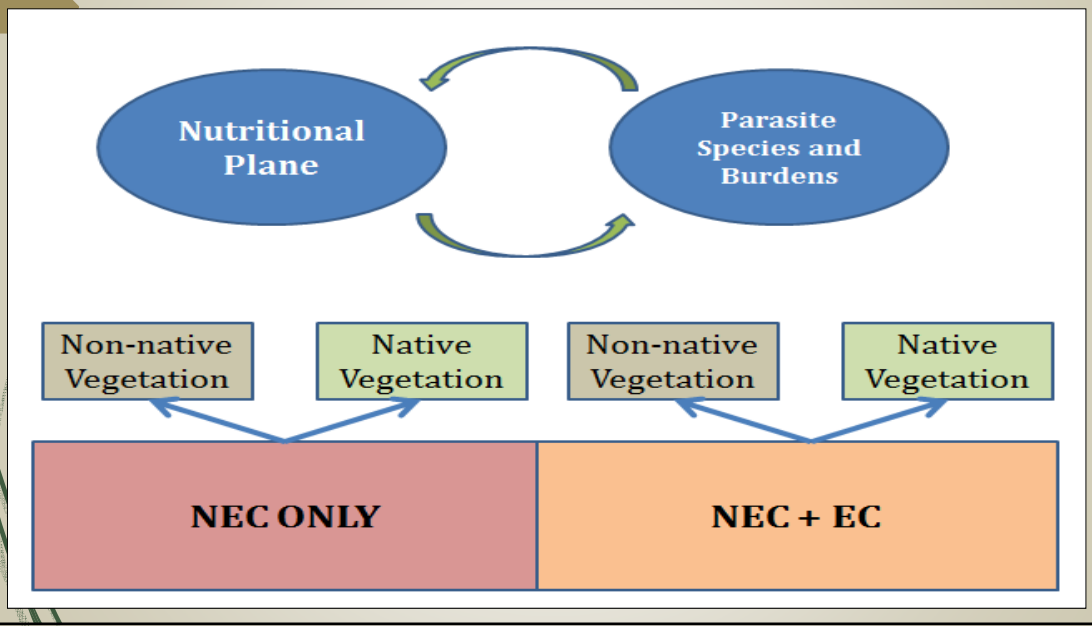


Population Size Estimates

Resampling individuals for parasite work



Parasites and Nutrition

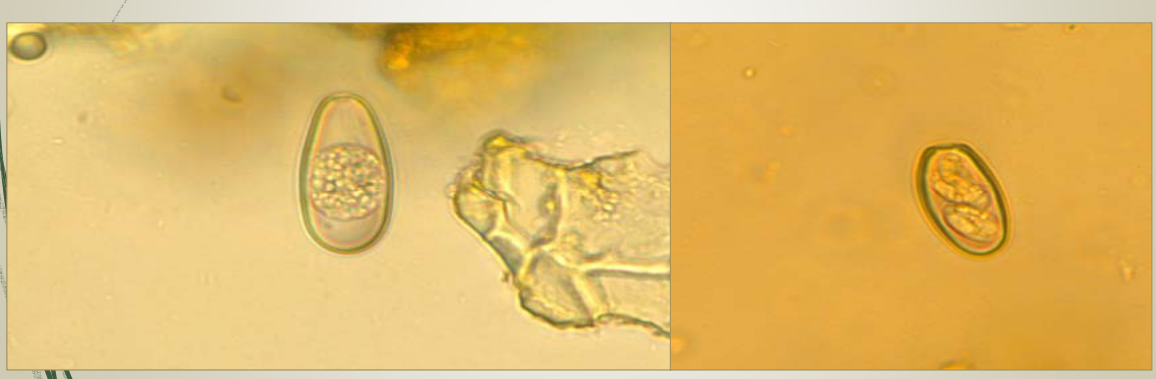


Gastrointestinal Parasites

- Species present include nematode (13 species), trematode (1 species) and protozoa (6 species?)
- 91% of all fecal pellets showed parasitism

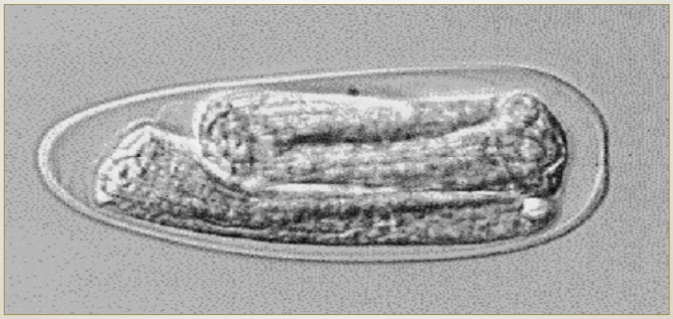
Eimeria spp.

- 86% of NEC
- 89% of EC



Obeliscoides cuniculi

- 9% of NEC
- 17% of EC

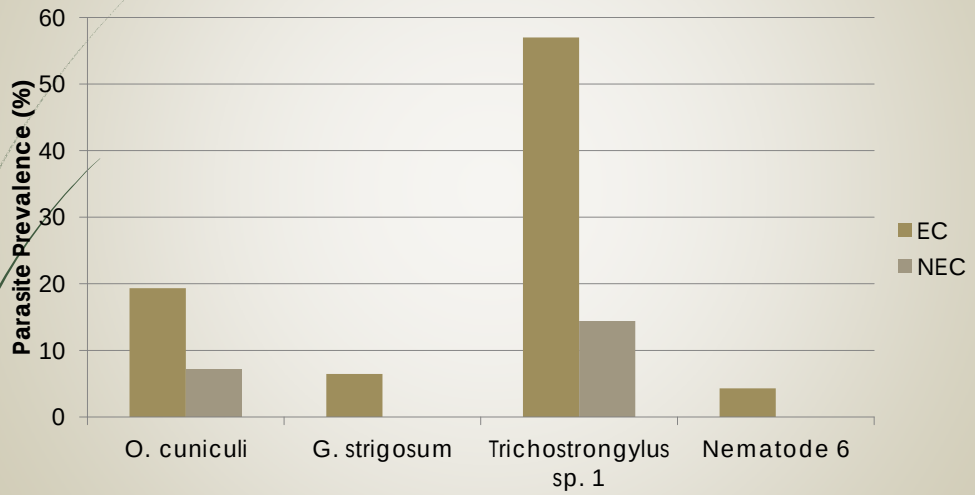


Trichostrongylus spp.

- 22% of NEC
- 55% of EC

Szkucik et al.

Parasite: Species Differences



Future Directions -

- Long term population monitoring trends
- Monitor new management areas-adaptive management
- EC abundance
  - Impacts on NEC abundance and recruitment
- Impacts of deer browse on young forest regeneration and suitability for NEC
  - Current use vs. availability study leads into this well
- Diet analysis with use/ availability analysis
- Impacts of naturalized and introduced predators (coyotes, feral cats) on NEC populations
  - Seasonal shifts in predation
- Hormones
  - Monitor reproduction
- Cooperative studies with Roger Williams and Queen's zoo
  - Nesting sites, interspecific breeding, maternal care (better application to field studies)

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