



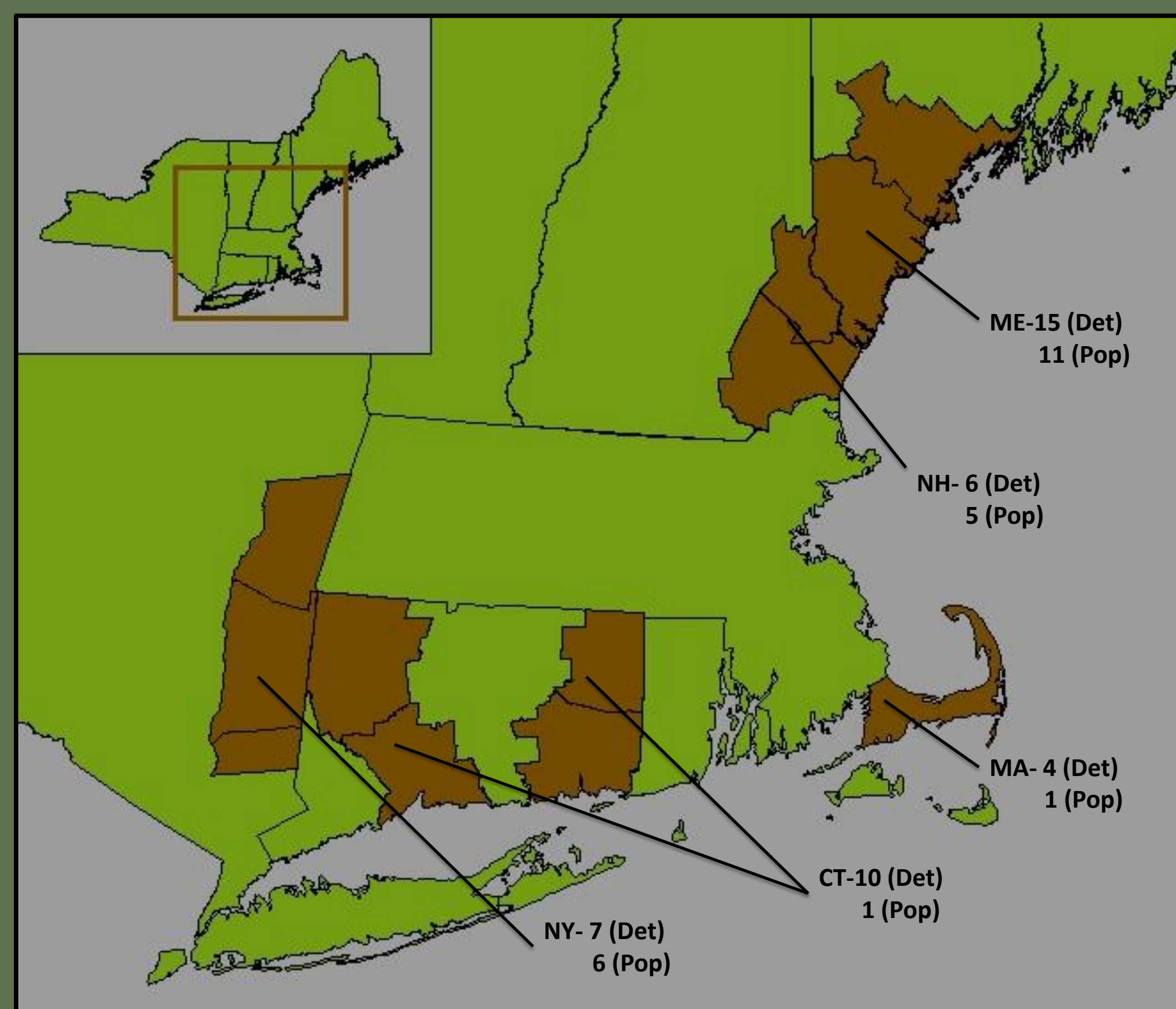
Introduction

In the case of rare and threatened species, such as the New England cottontail, a Species of Greatest Conservation Need in the Northeast, population monitoring is a challenge and is best accomplished by noninvasive, genetic methods. Current monitoring efforts for New England cottontails rely on genetic analysis of fecal pellets collected noninvasively during winter surveys. Occupancy status is typically evaluated based on a single visit. While this approach has proven successful for assessing the species' distribution on a range-wide scale, it may suffer from issues of detection¹ on a patch-specific scale. That is, if detection rates vary with environmental or other factors, then a seemingly unoccupied patch may not be truly vacant, but may appear so due to poor detection, i.e. a "false absence". Monitoring New England cottontails within an adaptive management framework will require taking into account factors that influence detectability. Beyond occupancy, knowledge of patch-specific abundance is also critical.

The goal of this project is to develop and implement noninvasive genetic monitoring tools for the estimation of occupancy and abundance of the New England cottontail throughout its range.

Objective 1: Evaluate the current presence/absence winter survey protocol through a systematic investigation of detection rates.

Objective 2: Develop a "genetic tagging" approach for estimating the numbers of cottontails occupying a habitat patch.



Number and location of range-wide detection (det) and population estimation (pop) sites monitored in this study, shown by state and county.

1) MacKenzie, D.I., J.D. Nichols, G.B. Lachman, et al. 2002. Ecology 83: 2248-2255.
 2) Hines, J.E., 2006. PRESENCE2. <<http://www.mbr-pwrc.usgs.gov/software/presence.html>>

Range-wide Noninvasive Monitoring of New England Cottontails

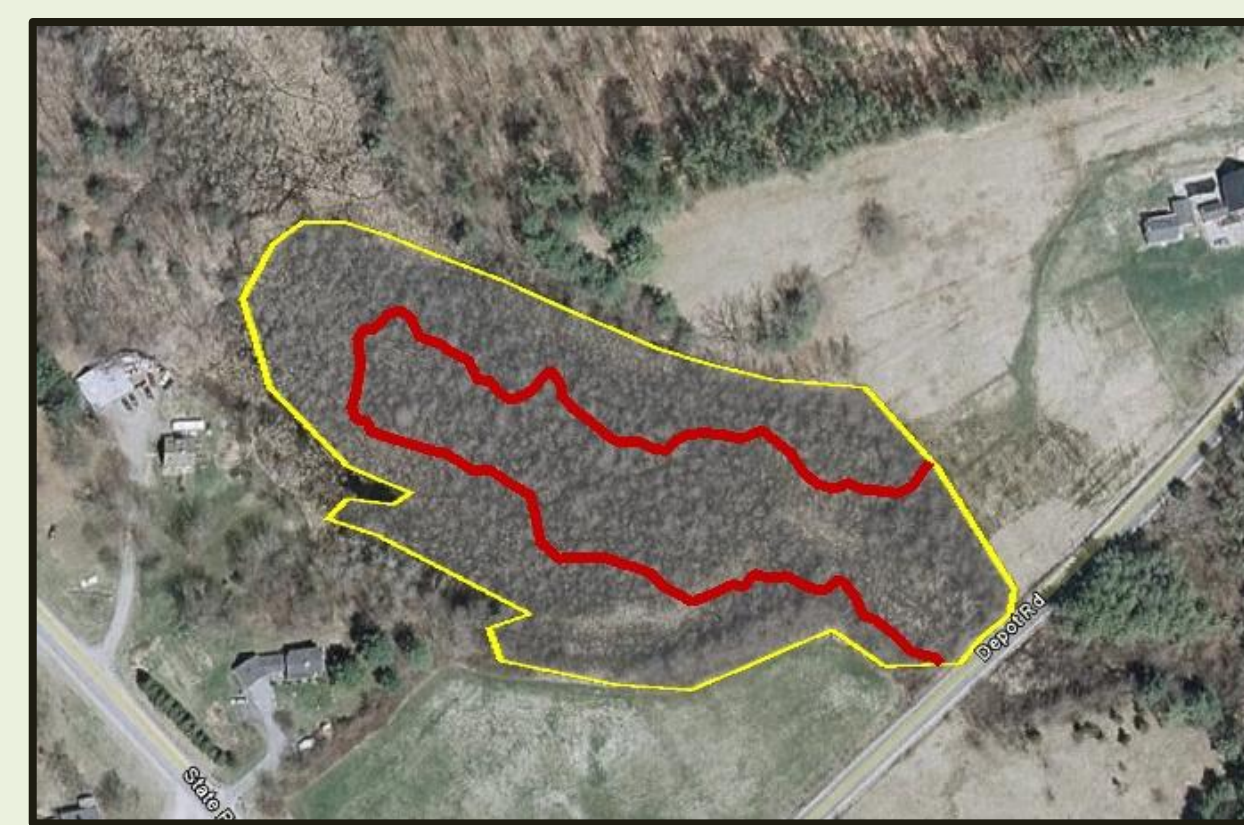
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Graduate Student: Daniel Brubaker, University of New Hampshire

Partners: WMI, USFWS, EDF, MDIFW, NHFG, CTDEP, NYSDEC, MassWildlife

Objective 1: Detection

Patches (n=38) ranging in size from 2-55 acres were delineated by landscape boundaries and systematically searched for presence of lagomorph fecal pellets.



Patches ≤6 acres were surveyed intensively via loose transects (red line) with ~30 meter spacing.



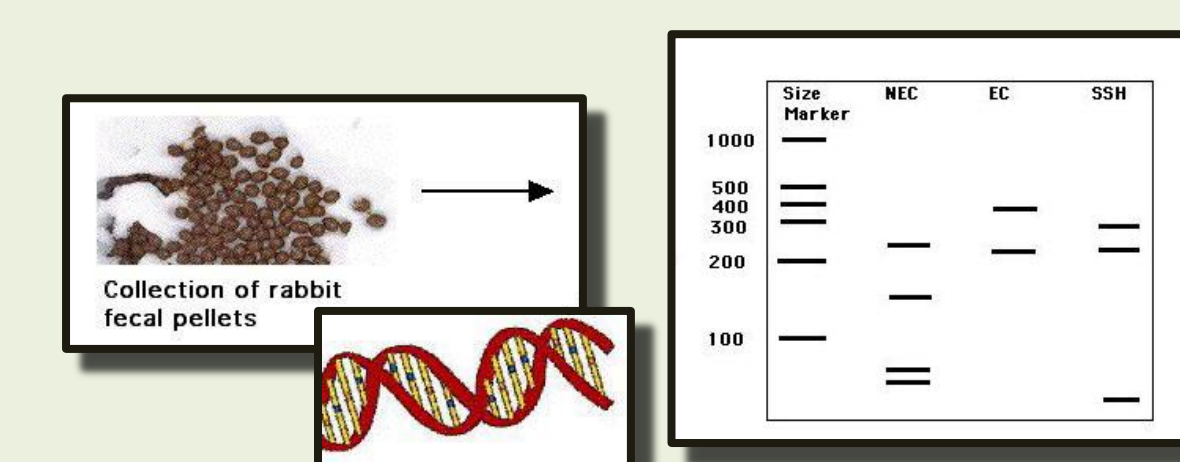
Patches >6 acres were surveyed via multiple 2 acre subplots (green outline) for a search area of 6 acres or 20% of the total patch area.

Occupancy was determined by presence of cottontail sign.



Cottontail fecal pellets and tracks.

Species identity was confirmed by a diagnostic mtDNA test of fecal pellets.



Detection rates and sources of variation were determined using an occupancy modeling approach with covariates of:

- snow & other weather conditions
- observer effect & search effort
- patch size & vegetation cover

Preliminary Results: Detection

Top ranking models ($\Delta AIC < 5$) from program PRESENCE² for 22 detection sites in Maine and New Hampshire.

Mdl	Model Parameters	AIC	ΔAIC	AICwght	Par.
1	Pdr+Depth+Knldge	108.88	0.00	0.373	5
2	Pdr+Depth+DaysStd+Knldge	110.60	1.72	0.158	6
3	Pdr+Depth+Days<2+Knldge	110.70	1.82	0.150	6
4	Srvy(1-3,4-6)+Pdr+Depth+Knldge	110.86	1.98	0.372	6
5	Srvy(1-3,4-6)+Pdr+Depth+DaysStd+Knldge	112.58	3.70	0.157	7
6	Svy(indv)+Powder+Depth+Knldge	112.75	3.87	0.144	10
7	Pdr+Depth+Knldge	113.67	4.79	0.091	4
8	Pdr+Depth+DaysStd+Knldge+Size+Obs	113.84	4.96	0.084	8

Covariates: Pdr (powdery snow), Depth (Snow Depth >12in.), Knldge (Prior knowledge of pellet locations), DaysStd (No. Days since snow event), Size (Patch Size), Srvy (Survey Period)

Preliminary results from ME/NH suggest that prior knowledge of cottontail activity increases detection, while the presence of powdery or deep snow (>12 in.) decreases detection of New England cottontails.

Parameters influencing detection may be either site specific (patch size) or survey specific (snow depth)

Future analyses will investigate the following additional covariates on the full suite of 38 detection sites range-wide:

- search effort (area searched)
- temperature & weather events (rain, wind)
- stem density

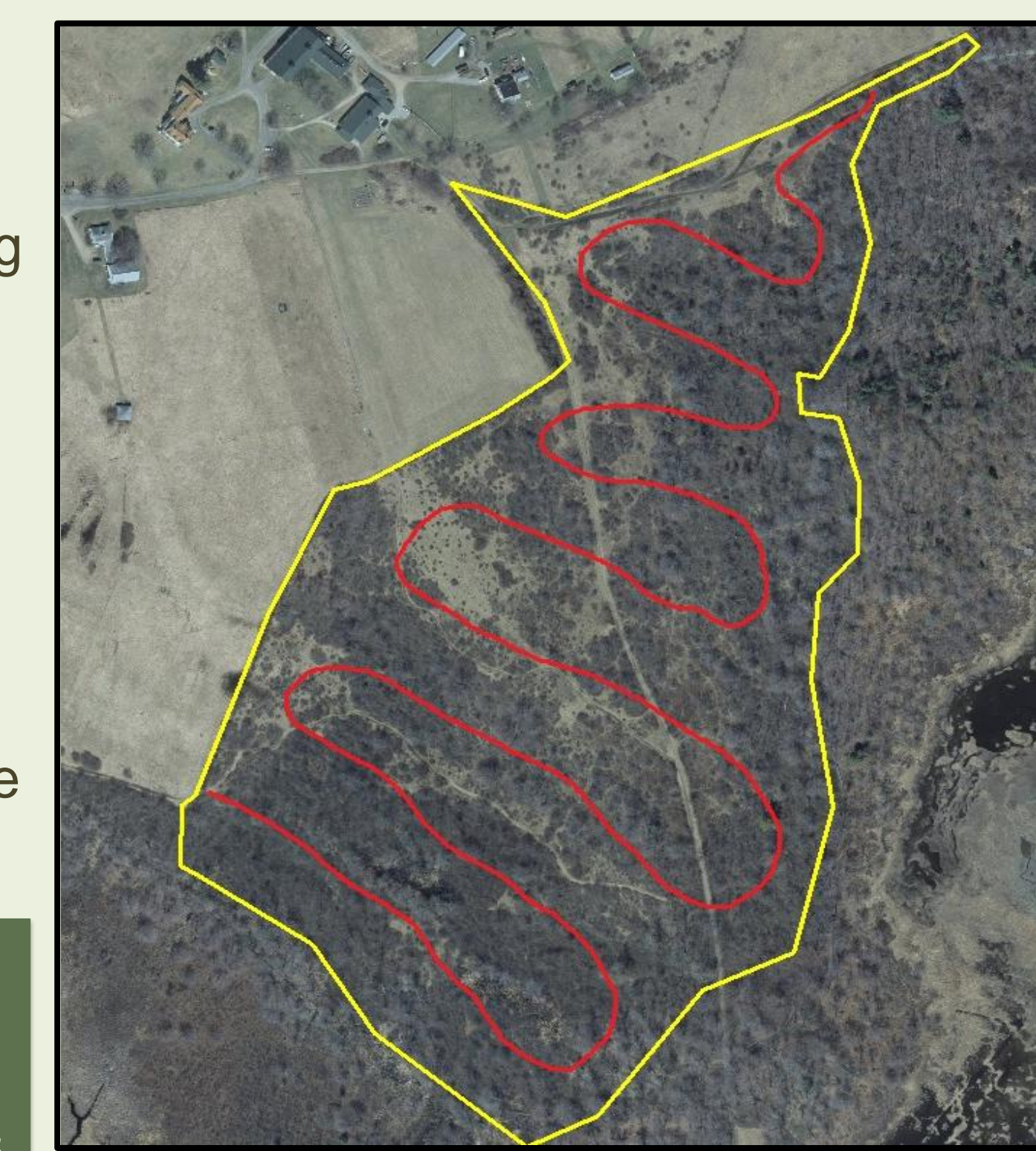
Objective 2: Population Estimation

Population estimation surveys were conducted on 22 sites range-wide.

Sites were surveyed intensively during a single visit to collect pellets from multiple rabbits while also resampling a portion of the individuals.

Individual cottontails are identified by their unique genetic signatures obtained from 10 microsatellite loci; these data are used in mark-recapture population estimation (see right).

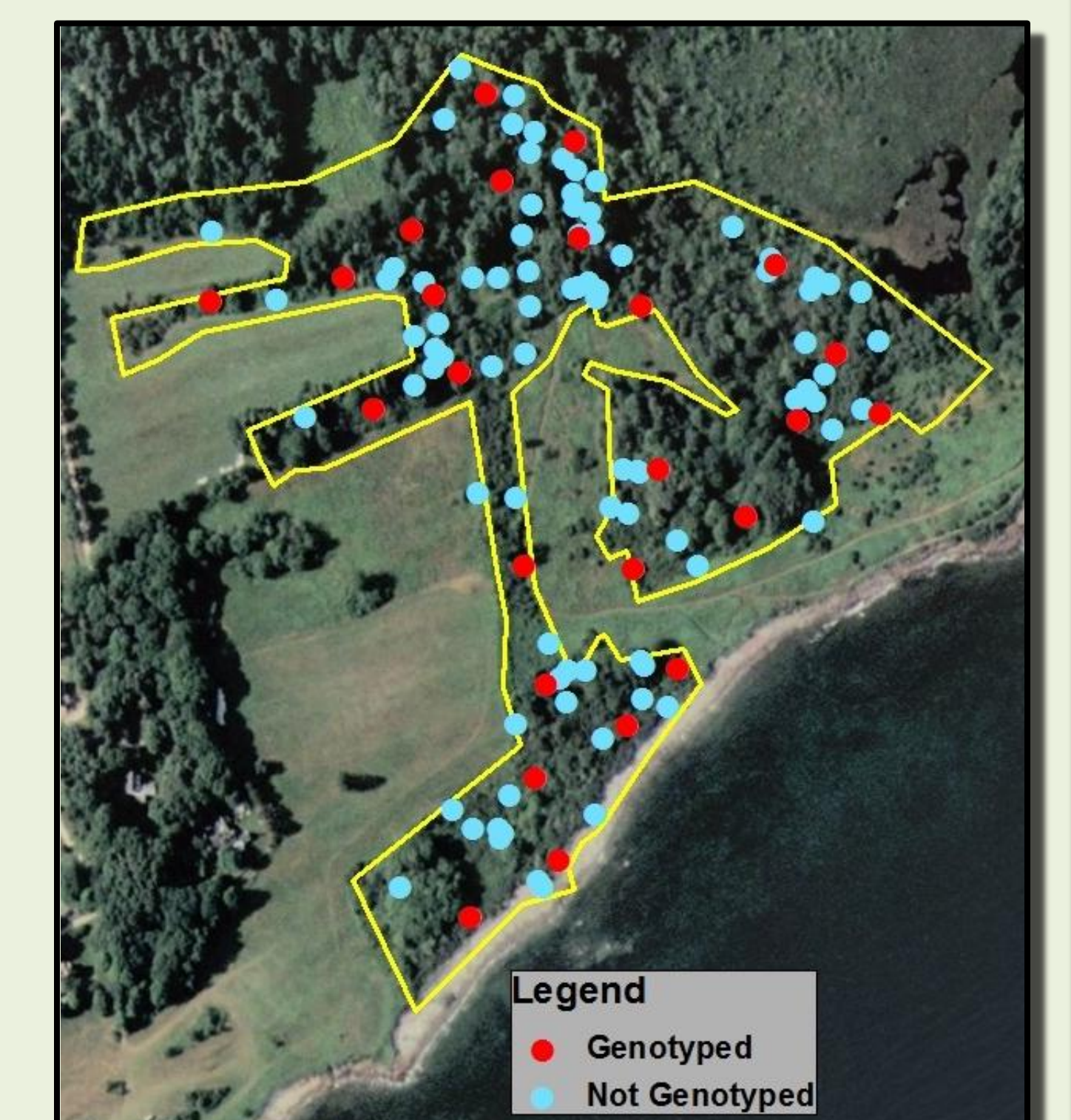
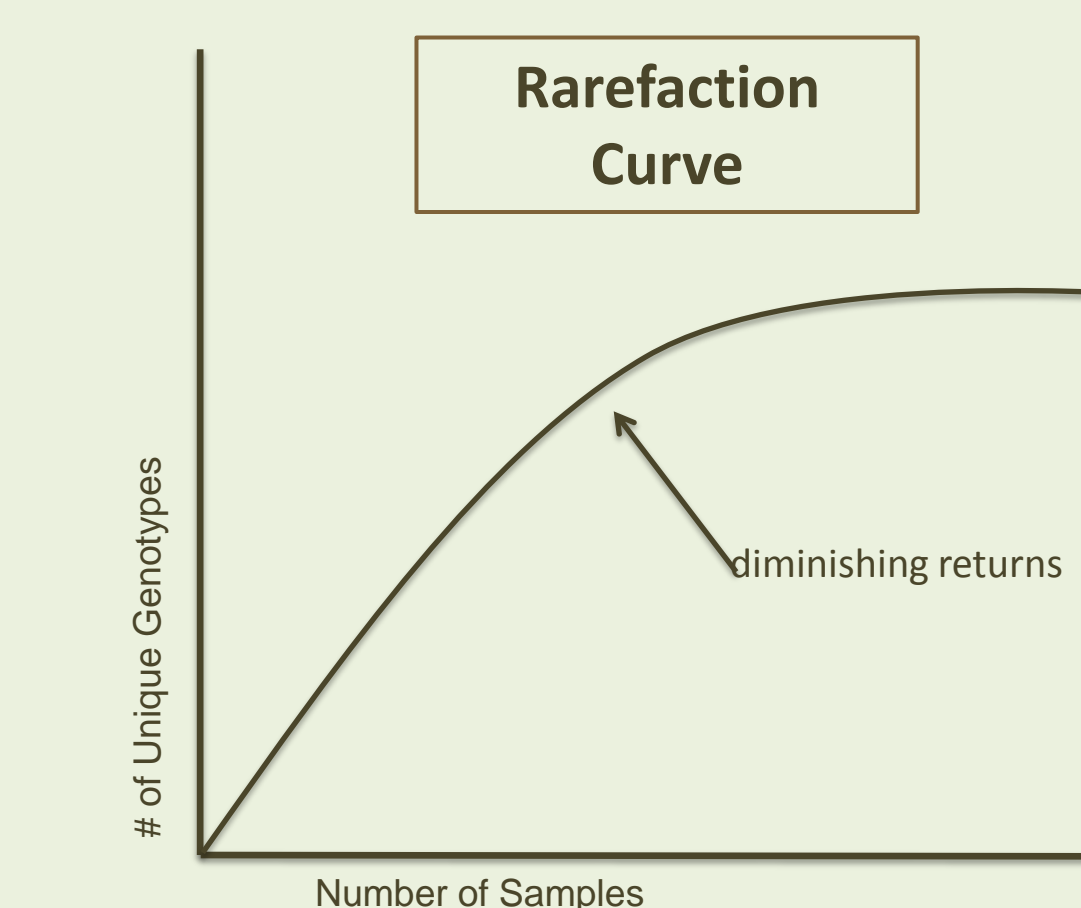
This approach will provide the first patch-specific population estimates of New England cottontails range-wide, and a tool for evaluating the success of management actions.



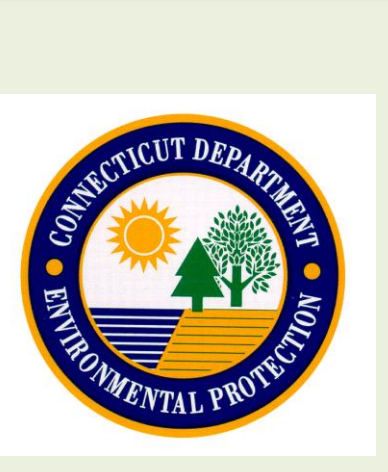
Population estimation surveys are exhaustive; pellets are collected every 50-75 meters following loose transects (red line).

As increasing numbers of pellets are sampled, the number of newly sampled individuals (unique genotypes) plateaus.

Abundance is estimated by the ratio of new/resampled genotypes.



Locations of samples collected during a population survey of in Cape Elizabeth, ME. Red dots indicate selected samples ~50 m apart that will be genotyped for population estimation. We will evaluate whether genotyping additional samples (blue dots) will increase the precision of the estimates.



ACKNOWLEDGEMENTS

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