PROGRESS REPORT

for

COOPERATIVE BOBCAT RESEARCH PROJECT

Period Covered:

1 July – 30 September 2013

Prepared by

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SUMMARY BY STUDY OBJECTIVES

OBJECTIVE I -- DEVELOP PROTOCOL TO ESTIMATE CURRENT ABUNDANCE OF BOBCATS AND TRACK POPULATIONS STATEWIDE.

Approach #1: Use of transmitter-equipped bobcats to model suitable habitats and generate density estimate based on area requirements.

A draft copy of Gregory Reed's MS thesis was provided in the previous report. A final copy was subsequently submitted. Chapters II and IV of that document addressed these topics.

Approach #2: Development of a method to monitor abundance of bobcat populations based on trail cameras and citizen scientist volunteers.

Determining an effective set of attractants – Data from the fifteen camera stations in the Barrington study area were collected on July 24. At each station, the vial of catnip oil was replaced with a catnip-soaked wick zip tied to a stick (Fig. 1). The red cup above the wick is intended to aid in gauging height of the specimen being photographed. This may facilitate capture-recapture analysis by aiding in differentiation of individual bobcats. CDs were replaced by halves of aluminum pie tins, which are larger and should be more obvious to wildlife. One camera was collected due to malfunction, presumably from moisture.

Figure 1. *Left: a 5 cm length of Tiki® brand fiberglass wick (Lamplight Farms Inc.) soaked in catnip oil and secured at a height of approximately 0.4 m via zip tie to a stick inserted into the ground. Red cut-off Solo® cup serves as a rain guard and reference for gauging animals' heights in photographs. Right: half of an aluminum pie tin serves as a visual stimulus.*

Cameras in the Rochester study area were collected on July 30 and 31. Two cameras malfunctioned due to moisture. The remaining 14 cameras in the Barrington study area were collected on August 21. Over 1000 trap nights were generated between the Barrington and Rochester surveys. Carnivores documented included black bear, coyote, gray fox, red fox, raccoon, house cat, opossum, and skunk.

Between August 10 and 24, 15 cameras were deployed in Durham (Fig. 2). Attractants at each station included the catnip wick/cup setup approximately 4.3 meters in front of the camera. A CD was hung at a height of 1-1.5 meters from a branch roughly above the wick/cup setup. A mixture of petroleum jelly and Caven's "Gusto" Long Distance Call Lure (Minnesota Trapline Products, Inc.) was prepared as an additional attractant. Because no bobcats were detected in the Barrington or Rochester trials, we assumed that the addition of Gusto was necessary to increase the probability of bobcat detection. Roughly 16 to 33 cm^3 of the Gusto mixture was smeared on 2 to 3 trees in the detection zone of each camera. Camera stations were spaced approximately 0.8 km apart.

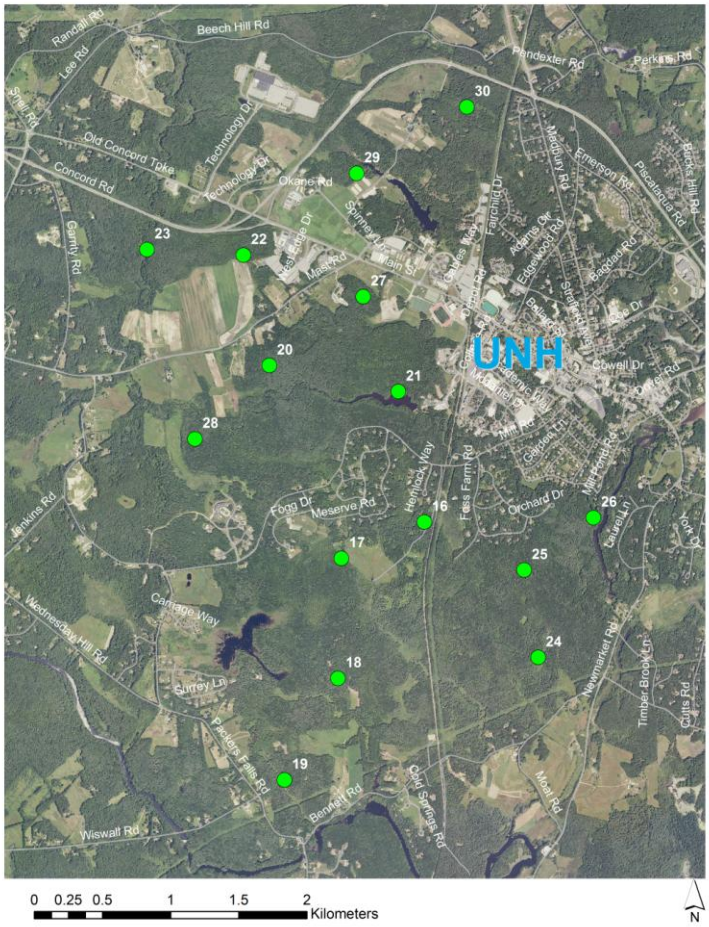


Figure 2. *Durham study area. Green dots indicate camera locations.*

Analyzing indices of bobcat abundance – Details for citizen science camera surveys were devised in an effort to validate the public sighting, hunter survey, and road mortality indices. WMU M, H2S, and I2 were selected for study area locations and are expected to harbor low, medium, and high bobcat abundances in 2013, respectively. These WMUs were selected from those with >2000 hunting hours for each of the past four years. Observation rates for WMUs with more hunting hours are thought be sounder indications of bobcat abundance, as they are based on more thorough surveys and likely cover a larger portion of the WMU. A large quantity of hunting hours also helps ensure that adequate hunter survey data will be collected in 2013 for synchronous comparison between camera and hunter survey indices, barring sudden changes in distribution of hunter survey efforts. Among WMUs with >2000 hunting hours for each year, average bobcat observation rates ranged from 0.44 to 2.65 bobcats seen per 1000 hunting hours. This range was divided into three even classes to create a classification system for bobcat observation rates (i.e., <1.18 = low, 1.18-1.91 = medium, and >1.91 = high). WMUs with observation rates that have varied substantially from year to year were assumed to continue to do so. Thus, WMUs were selected from those with observation rates that consistently fell into the low, medium, or high category for each of the past three years. This left six WMUs for which high (I2), medium (G1, H2S, L), or low (A2, M) bobcat abundance was expected for 2013, barring sudden changes in abundance and assuming that hunters' observation rate is a valid indication of abundance. Among the selected WMU expected to represent medium bobcat abundance, H2S had the most stable observation rates over the past four years. A2 was not selected as a study area location because low human density here is expected to result in a lower number of potential volunteers (1.19 persons/km^2; New Hampshire Office of Energy and Planning 2012).

WMU H2S, I2, and M range in total area from 887 to 1871 km^2, thus, potential survey scenarios were detailed for study areas 800 km^2 and smaller (Table 1). The survey effort needed in each WMU was estimated by modeling the relationship between survey duration D, number of bobcat detection events Z, detection rate R, and number of cameras involved in the survey C.

$$D = Z\ R^{-1}\ C^{-1} \qquad \textit{Equation 1}$$

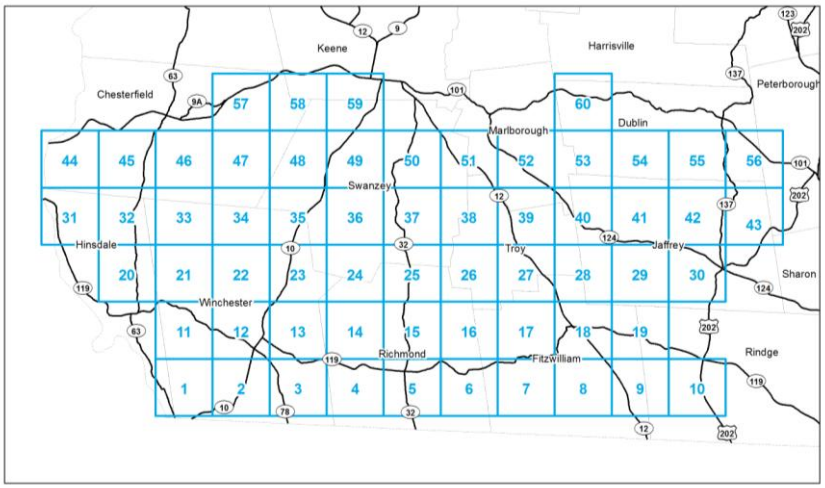
As the number of potential citizen scientists is unknown, survey scenarios were generated using various numbers of cameras at a set duration of the survey.

Sampling grids were created by mapping 60 13.33 km^2 survey units in each WMU, generating three 800-km^2 study areas (Fig. 3). A grid of 13.33 km^2 cells was generated in ArcMap 10 and overlaid on the bobcat habitat suitability model developed by Reed (2013). Reed's model was colorized such that areas of habitat suitability >0.4 were visually distinct from less suitable areas (Fig. 4). The 60 grid cells in each study area were selected by eye such that the amount land area with suitability >0.4 covered by all 60 cells was maximized.

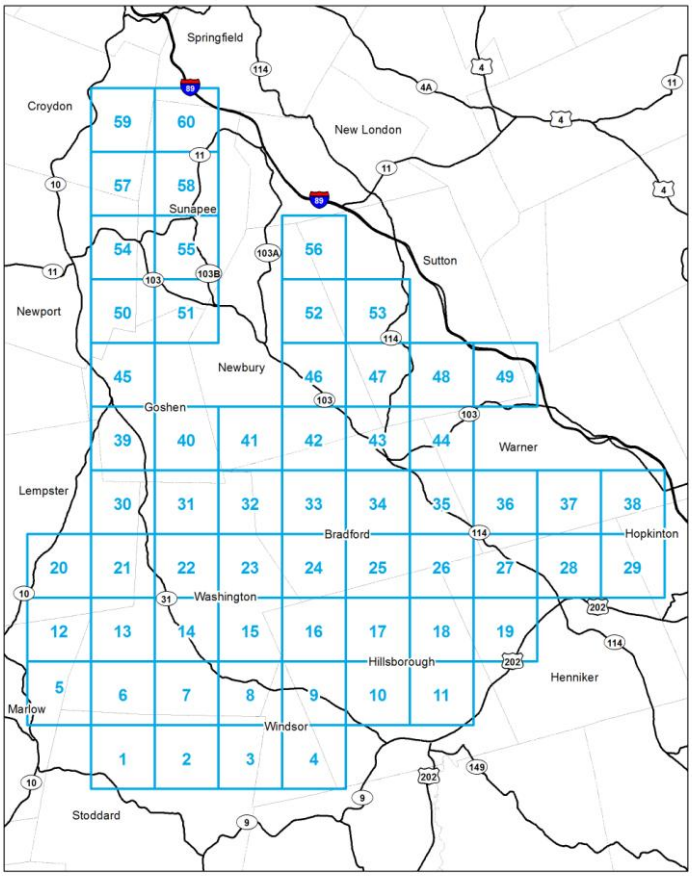
Table 1. *Camera densities, number of trap-nights, and anticipated bobcat detections for 100, 80, 60, and 20 cameras spread across 800, 400, and 200 km² survey units. Camera densities are expressed in cameras / km². Number of trap-nights (measured in 24 hour days) was calculated using survey duration of 14 days. Number of anticipated bobcat detections was calculated using a detection rate of 0.02 detections/trap-night (Equation 1). The approximate numbers of bobcats expected to occupy each survey unit are provided in the rightmost column. These estimates are based on bobcat densities of 5.4 individuals per 100 km² (HR = 23.8 km²; Fig. 6 in Litvaitis et al. 2013).*

Area (km^2)	Cameras	Camera density	Trap-nights	Detections	Bobcats
800	100	0.13	1400	28	43
800	80	0.10	1120	22	43
800	60	0.08	840	17	43
800	20	0.03	280	6	43
400	100	0.25	1400	28	21
400	80	0.20	1120	22	21
400	60	0.15	840	17	21
400	20	0.05	280	6	21
200	100	0.50	1400	28	11
200	80	0.40	1120	22	11
200	60	0.30	840	17	11
200	20	0.10	280	6	11

Study Area A



Study Area B



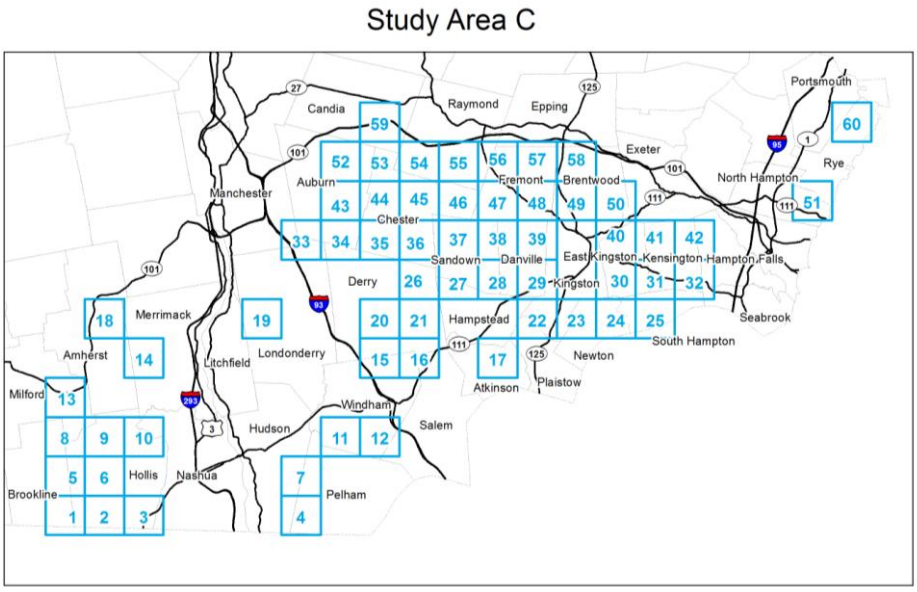


Figure 3. *Study areas A, B, and C in WMU H2S, I2, and M, respectively. Study areas consist of 60 13.33 km^2 grid cells.*

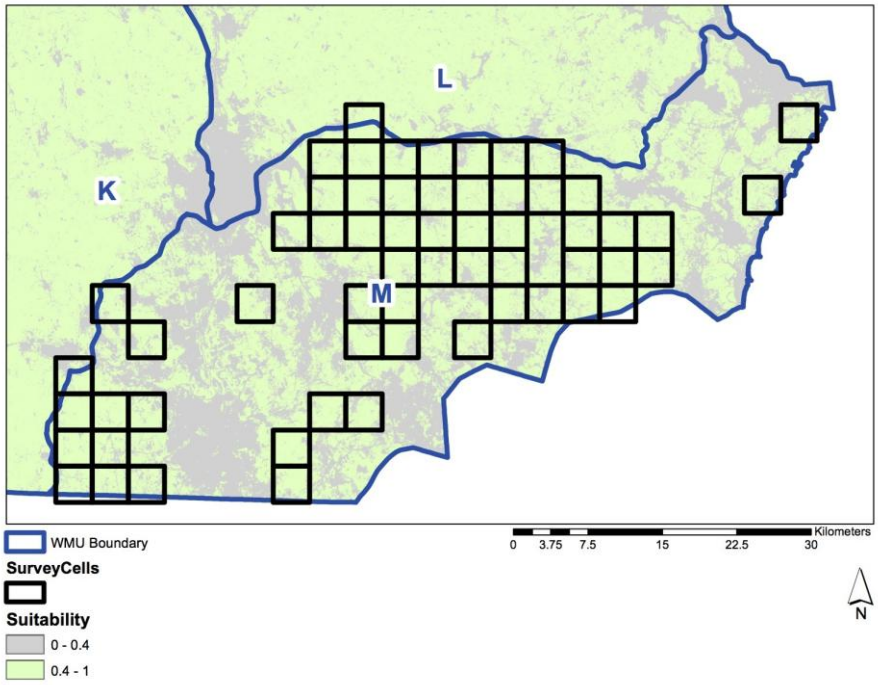


Figure 4. *60 13.33 km^2 grid cells arranged about WMU M such that the amount of land area with habitat suitability >0.4 is roughly maximized.*

Approach #3: Evaluate the application of population genetics using tissue from road-killed bobcats.

Rory Carroll has begun work on this objective as part of his MS thesis project.

OBJECTIVE II -- COMPARE ABUNDANCE OF BOBCATS IN NEW HAMPSHIRE TO POPULATIONS IN ADJACENT STATES.

Chapter IV of the Gregory Reed's thesis addressed this objective.

OBJECTIVE III -- IDENTIFY POTENTIAL WILDLIFE CORRIDORS.

Chapter III of Gregory Reed's thesis addressed this objective.

LITERATURE CITED

Litvaitis, J. A., G. Reed, T. Mahard, and M. K. Litvaitis. 2013. Progress Report for Cooperative Bobcat Research Project, University of New Hampshire, 1 April – 30 June 2013.

New Hampshire Office of Energy and Planning. 2012. 2011 population estimates of New Hampshire cities and towns. Concord, NH.

Reed, G. C. 2013. Bobcats in New Hampshire: understanding the relationships between habitat suitability, connectivity and abundance in a changing landscape. M.S. Thesis, University of New Hampshire, Durham, N.H.