Federal Aid in Wildlife Restoration

W-78-R-1

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Connecting Habitat Across New Jersey (CHANJ) Assessments

Interim Report

for

October 1, 2018–September 30, 2019

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
P.O. BOX 420
TRENTON, NJ 08625

NEW JERSEY DIVISION OF
Fish and Wildlife

DEPARTMENT OF ENVIRONMENTAL PROTECTION NEW JERSEY

WILDLIFE RESTORATION

PERFORMANCE REPORT

STATE: New Jersey **PROJECT NUMBER:** W-78-R-1

PROJECT TYPE: Research and/or Management

PROJECT TITLE: Connecting Habitat Across New Jersey (CHANJ) Assessments

STUDY NUMBER AND TITLE: Mammals

PERIOD COVERED: October 1, 2018 to September 30, 2019

JOB NUMBER AND TITLE: Connecting Habitat Across New Jersey (CHANJ) Assessments
Prepared by: Gretchen Fowles and MacKenzie Hall

OBJECTIVE (1): Assess functional connectivity at different scales across the landscape for at least five mammal species of differing movement capabilities by August 31, 2022.

OBJECTIVE (2): Develop Road Assessments for at least 20 road segments* represented in the CHANJ mapping that bisect cores and corridors by August 31, 2022. *Funds added to this grant in 2019 ($60,000 federal plus $20,000 match) will increase our goal to 35 Road Assessments.

Key Findings:

- Hold organizational meeting with The Nature Conservancy (TNC) at beginning of this period to develop plan for the coming year.
    - The ENSP CHANJ team met with project partners from TNC on February 5, 2019, and had several follow-up conversations with them during the spring to determine which road segments and stream culverts would be monitored during the 2019 field season (Year 2). It was decided that weekly roadkill surveys would continue along the same 178 transects as the previous year (referred to as Year 1 road segments) from approximately April 15-June 15, providing one full year of "active season" monitoring at those locations. After June 15, the road transects would switch to another set within the same two pilot areas delineated in Year 1 (called Bobcat Alley and High Mountain; Fig. 1). Again, a GIS spatial analysis was used to prioritize road segments based on (1) occurring within a CHANJ core or corridor, (2) intersecting a stream, (3) having protected land on one or both sides, (4) level of road (as an index of size), and (5) presence of a bridge, with priority given to potentially significant barriers to movement. Six motion-triggered cameras would remain at the same Year 1 stream-crossing structures while 10 additional cameras would be deployed at new structures proximate to the new (Year 2) road transects, to investigate wildlife usage of the various structures.

    - Field data forms were reviewed and slight adjustments were made based on Year 1 piloting.

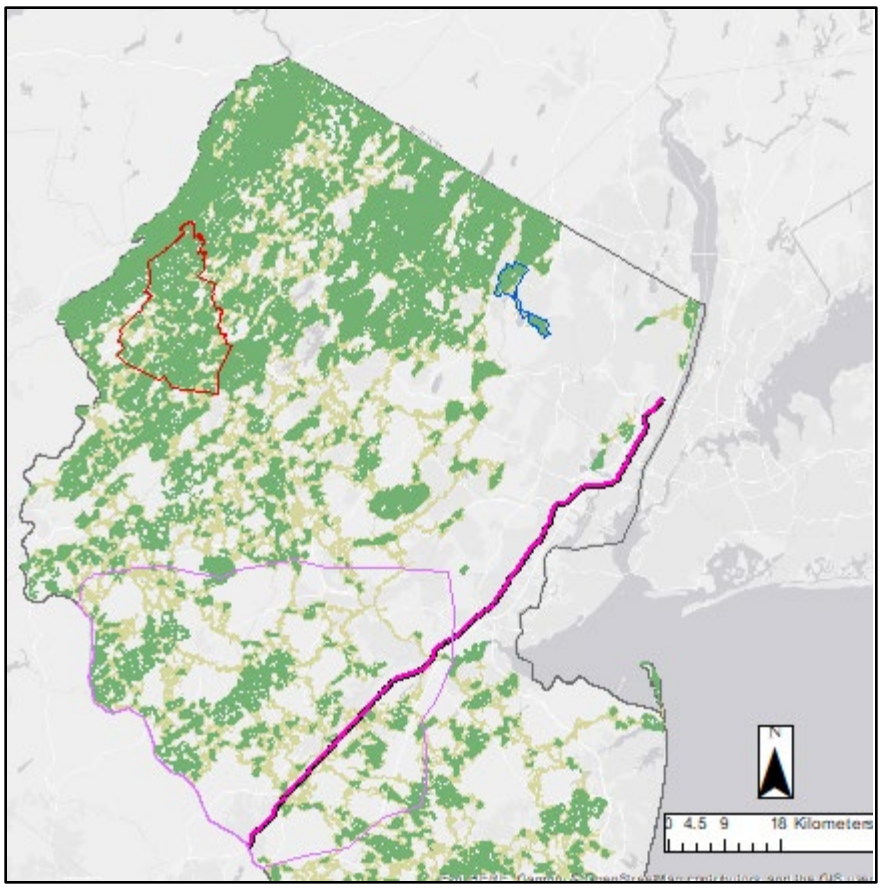


Figure 1. The two pilot areas selected for road assessments, Bobcat Alley (red outline) and High Mountain (blue outline), plus the additional Sourland Mountains area of interest (purple outline) where NAACC surveys are being conducted, are overlaid here on the CHANJ core and corridor mapping. The Route 1 corridor – which serves as the dividing line between north and south Jersey for this project – is also shown (bold pink line).

- Hold organizational meeting with culvert inventory surveyors at beginning of this period to develop plan for the coming year.
    - The ENSP CHANJ team met with our contractors from Montclair State University (MSU) on February 14, 2019, to discuss NAACC stream culvert survey locations and goals for the 2019 field season (Year 2). As with Year 1, MSU's survey efforts would prioritize the Bobcat Alley and High Mountain pilot areas (ideally overlapping with TNC's road segment assessment work) as well as core habitat areas of the Sourland Mountains.

- Solicit and compile results from roadkill survey, camera monitoring, culvert inventory.
    - TNC provided a spreadsheet and GIS shapefiles of all road segments that were assessed within the Bobcat Alley and High Mountain pilot areas during the work period. A variety of connectivity-related attributes were recorded for each road segment (e.g., number of lanes, speed limit, potential barriers to wildlife movement, surrounding land uses, etc.), and observations of any wildlife on roads (dead or live, both within and outside of the established CHANJ segments) were documented and georeferenced using the NJ Wildlife Tracker mobile app during weekly transect surveys.

The 178 Year 1 road segments (totaling 36 km; Fig. 2) were surveyed again weekly from approx. April 15-June 15, 2019, resulting in 41 new on-road mammal observations. Combined with the results from the previous season (approx. May 15-Oct 30, 2018), surveyors reported a total of 230 mammal observations (199 in Bobcat Alley and 31 in High Mountain). Fig. 3 shows the overall breakdown of mammal observations by species for all Year 1 segments combined. We will analyze the data more comprehensively using road and landscape variables and include the results in Road Segment Reports when these surveys are complete.

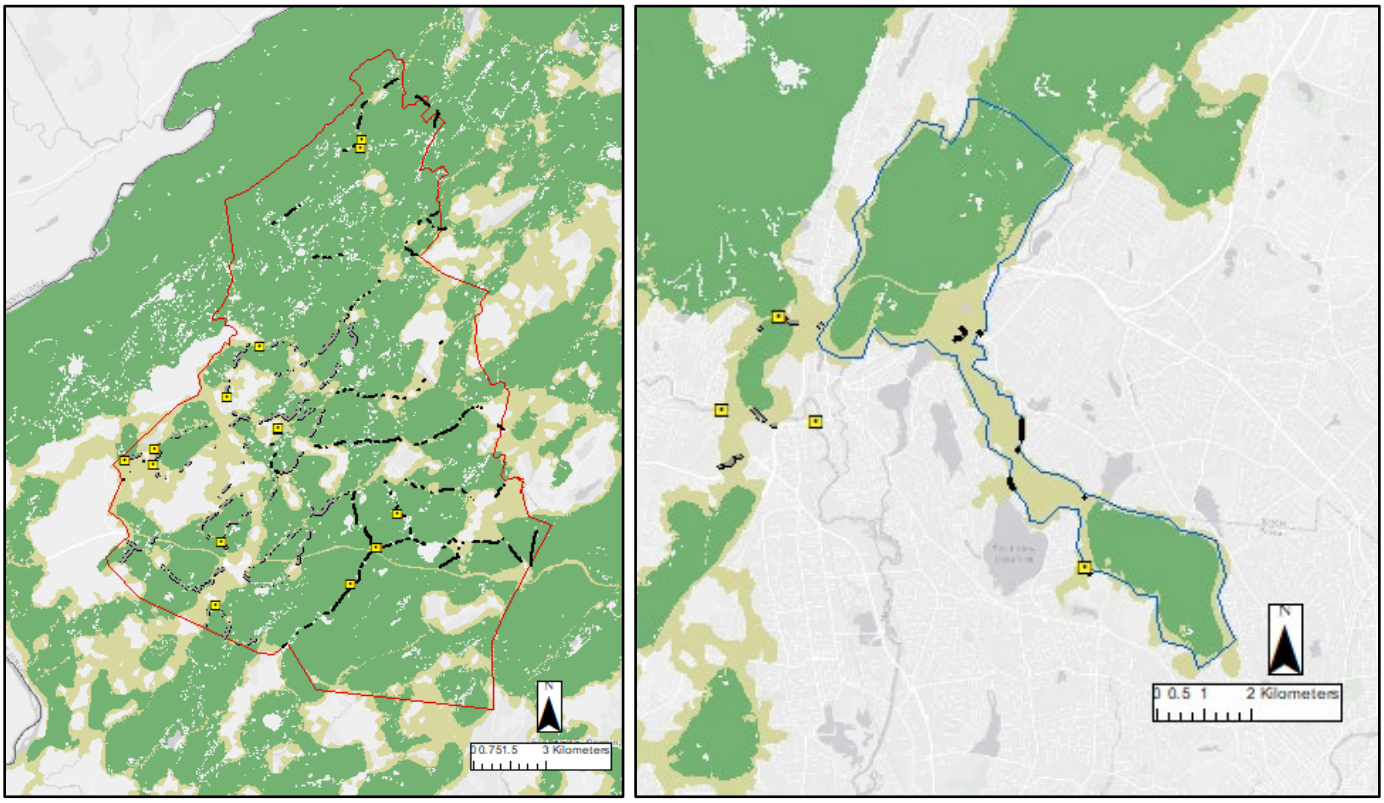


Figure 2. The Bobcat Alley (red outline) and High Mountain (blue outline) pilot areas, shown with the Year 1 road segments (N = 178; black lines), Year 2 road segments (N=232; gray lines with black outline), and camera monitoring locations at stream-crossings (N = 10+; yellow boxes) identified.

After June 15, 2019, 232 new road segments (totaling approx. 30 km) are being monitored within Bobcat Alley and High Mountain (Fig. 2.). As in Year 1, the Year 2 road segments represent a range of characteristics: length, traffic volume, ownership, and landscape context; some fall within CHANJ-mapped core habitats and others within corridors. These segments were surveyed weekly through October 30, 2019, and again from April 15-June 15, 2020, amounting to a full year of "active season" monitoring. The results from these Year 2 road segments will be summarized in our next interim report.

Segments vary widely in length and character, making direct comparisons between them difficult, but because every animal occurrence is plotted via the NJ Wildlife Tracker app, we will have the ability to analyze the data for potential roadkill hotspots and factors contributing to wildlife presence on roadways.

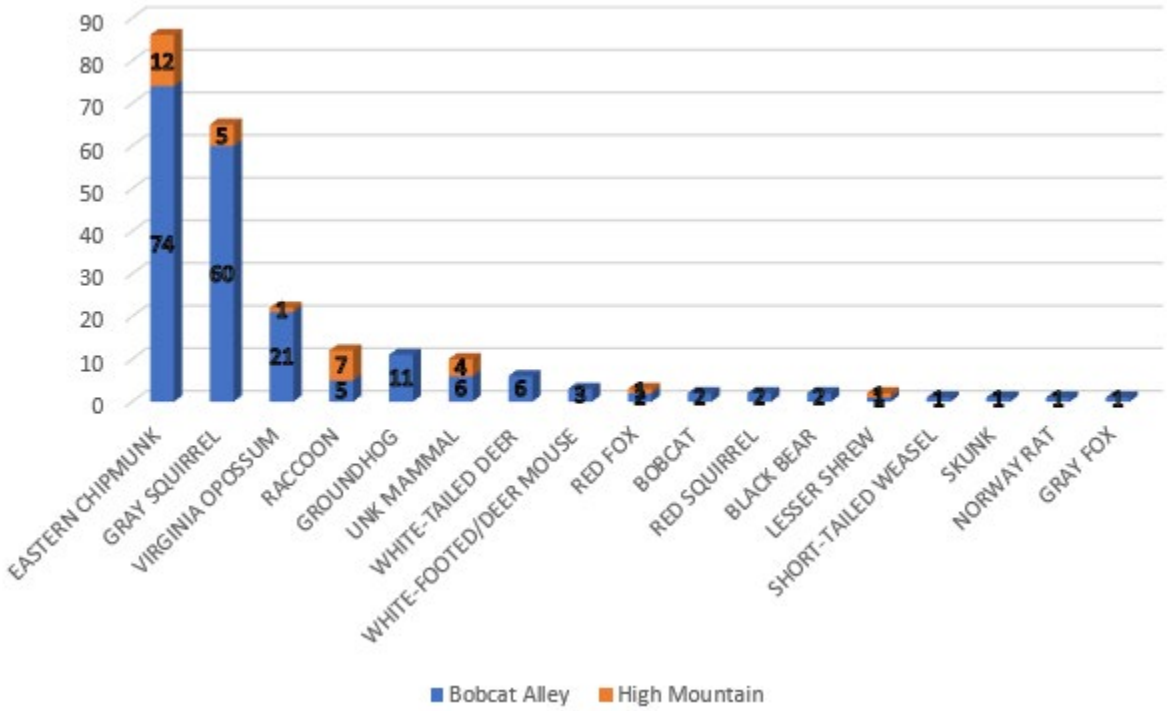


Figure 3. Total number of on-road mammal observations from Year 1 road segments (surveyed approx. May 15-October 30, 2018, and April 15-June 15, 2019), by species.

- TNC is still reviewing files but was able to give us some early results from the 16 motion-triggered cameras they have deployed at approx. 10 different stream-crossing structures along or proximate to monitored road segments within Bobcat Alley and High Mountain (camera locations are shown in Fig. 2). To date, just over 1,000 photographs of native mammals have been identified from these monitored locations, with 15 native mammal species represented (Fig.4). We will report further when the review of files is complete and analyses can be done of the various structure types and their use by different wildlife movement guilds. TNC has found it troublesome determining whether an animal passed through the monitored structures; they have made some adjustments to camera positioning and programming to improve the data being recorded.

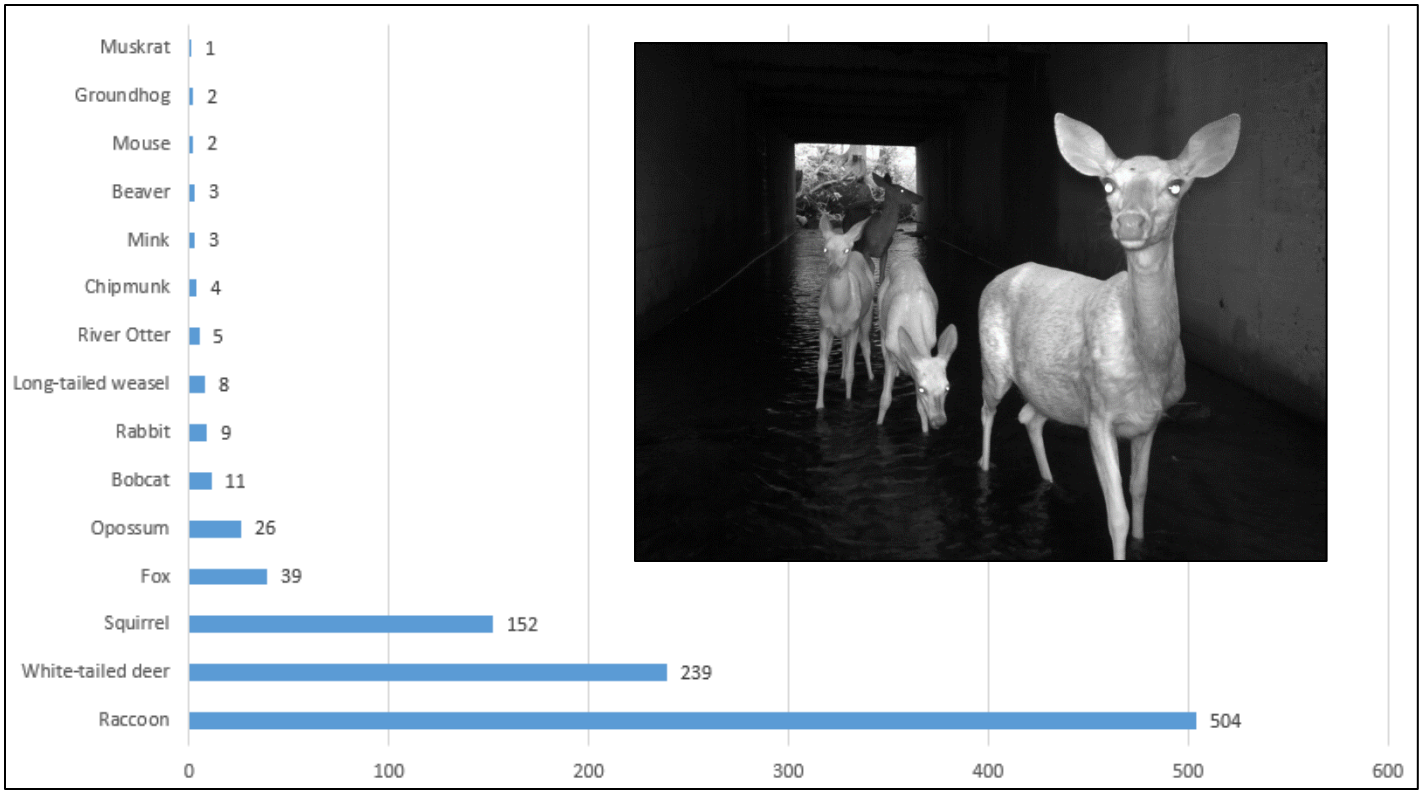


Figure 4. Preliminary tallies of mammal species captured by motion cameras at 20 different stream-crossing structures monitored within Bobcat Alley. (Inset: A White-tailed doe and her fawns pass through a box culvert. Photo courtesy of Neha Savant, The Nature Conservancy)

- The ENSP CHANJ team worked with TNC to draft a Road Segment Report template. Road Segment Reports will summarize information gathered about a given road segment, including roadkill statistics, barriers to wildlife movement, NAACC survey results, camera monitoring results, and recommendations for improving connectivity as needed. These reports will eventually be made available via a layer within the CHANJ Web Viewer.

- MSU provided an interim report on their NAACC culvert assessment efforts during the work period. They continued to recruit volunteers through meetings, presentations and field demonstrations, including one with an MSU *Wetland Ecology* class (24 graduate and undergraduate students) in October 2018 and another with a New Jersey City University *Field Ecology* class (nine undergraduate students) in July 2019. MSU's NAACC Certified Observer I, Kevin Zerbe, trained two land management planners from our Division of Fish and Wildlife as well as 12 people associated with the NY-NJ Harbor Estuary Program and Duke Farms' restoration team in July 2019. A digital project flyer was also developed and posted on the CHANJ website for passive volunteer recruitment, and MSU added a Habitat Connectivity Project page to their website to promote this and other related efforts.

  As a result, the MSU team registered 11 new volunteers in the NAACC database during this work period, including three Lead Observers directly involved in our contract with them. Since NAACC released the Terrestrial Connectivity Protocol in July 2019, MSU's David Hsu has obtained Certified Observer I credentials to submit and review terrestrial passage data, and is therefore serving as the primary reviewer for NAACC submissions across New Jersey.

MSU visited 113 NAACC road-stream crossings and were able to complete 67 assessments using the Terrestrial Connectivity Module during this work period. All data have been uploaded and reviewed within NAACC; Kevin Zerbe and David Hsu also reviewed at least 13 assessments submitted by other certified Lead Observers outside MSU (e.g., our ENSP seasonal technicians). Approx. 43% of all sites visited were inaccessible for surveys and will not count toward our project goals.

MSU's NAACC terrestrial connectivity surveys consisted of 17 sites within Bobcat Alley, 3 within High Mountain, 47 within the Sourland Mountains, and an additional 13 done by non-MSU Lead Observers in proximity to the pilot areas. The number of stream-crossing structures ranking within each terrestrial wildlife barrier category are summarized in Table 1 and illustrated in Fig. 5. Approx. 68% of the surveyed structures were found to be "significant" or "severe" barriers to terrestrial wildlife passage, while only 21% were found to be "insignificant," "minor," or "no" barrier to terrestrial wildlife passage (Fig. 6).

Table 1. Summary of NAACC stream-crossing structure survey results within each pilot area, by terrestrial wildlife barrier category.

			Barrier Category					
Area	Sites Visited	Inaccessible	No	Insignificant	Minor	Moderate	Significant	Severe
Bobcat Alley	31	14	3	0	1	0	5	8
High Mountain	21	18	3	0	0	0	0	0
Sourland Mts.	61	14	0	0	5	4	22	16
Other (non-MSU)	28	15	1	2	1	6	1	2
Total	141	61	7	2	7	10	28	26

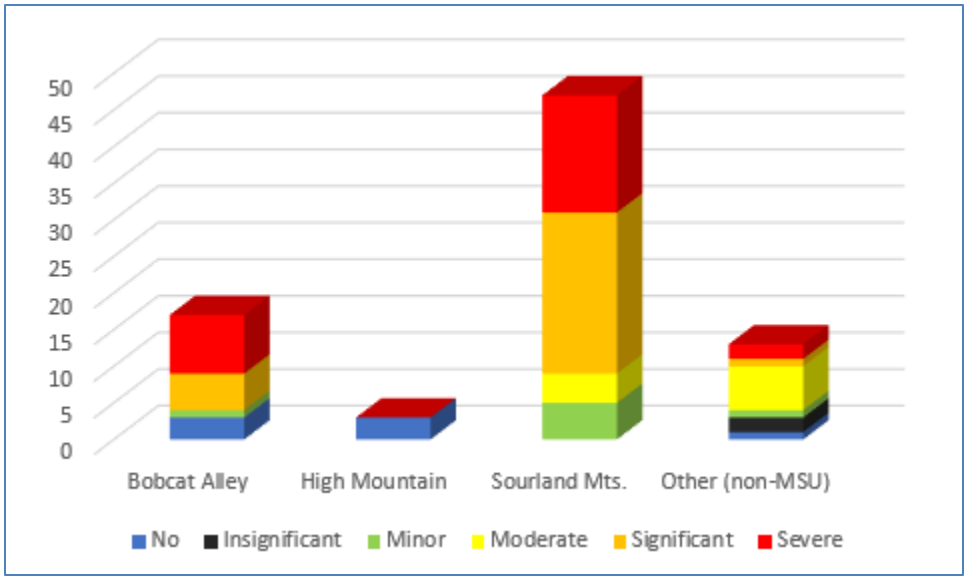


Figure 5. Summary of NAACC stream-crossing structure survey results within each pilot area, by terrestrial wildlife barrier category.

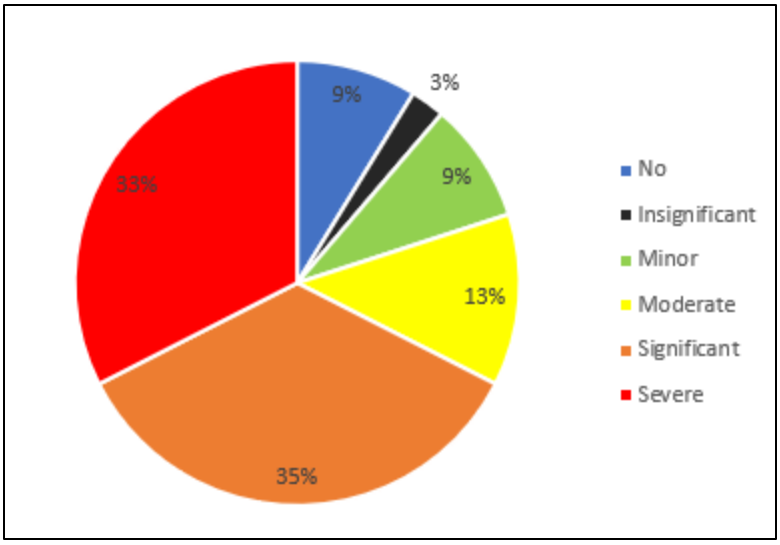


Figure 6. Combined NAACC stream-crossing structure survey results from all locations, by terrestrial wildlife barrier category.

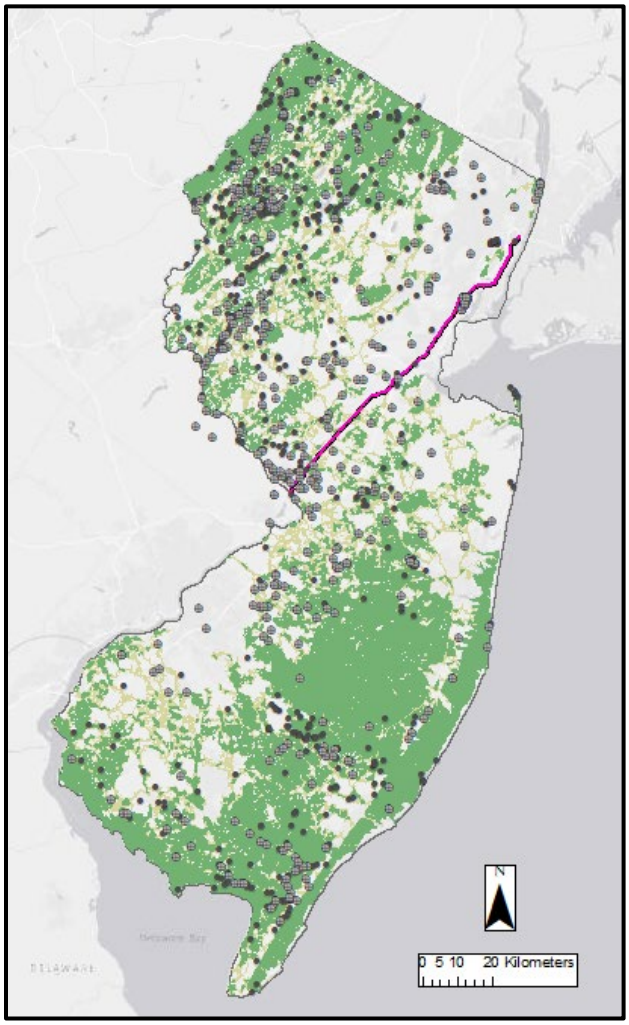
- With NAACC capacity and the number of certified Lead Observers growing across New Jersey, we proposed adding funds to this grant to cover additional stream culvert surveys, roadkill surveys, and Road Segment Reports in targeted CHANJ-mapped areas of the state. These additional funds ($80,000 total, including $20,000 in match) have been accepted and will be used to procure services from qualified contractors to perform the work.

- The NAACC terrestrial connectivity data layer has been integrated into our CHANJ Web Viewer, so that as assessments are completed and approved within the NAACC database, they are instantly reflected in the CHANJ mapping. Site-based information is therefore readily available to the public and to connectivity advocates for identifying and tackling connectivity challenges/opportunities.

- Send DNA samples to lab and collaborate with lab regarding analysis, interpretation of results and next steps for scale if warranted.
  - The CHANJ team recruited an additional 25 volunteers from across the state to help with the DNA sample collection, for a total of now close to 90 volunteers. The volunteers represent individuals from CHANJ partner organizations, Division of Fish & Wildlife staff, trappers, wildlife rehabilitators, APHIS staff, and interested citizens. Each volunteer was given a sampling kit for clipping, preserving, and documenting each sample collected, as well as an instruction sheet and safety vest. The goal was set to collect at least 20 samples from each of the native terrestrial mammal species in the North and in the South regions, for a total of at least 40 samples collected per species across the state. Additional instructions were sent earlier this year to start filling in gaps in the sampling distribution for each species using maps with sample locations and county lines provided as guides.

  - An additional 420 samples, for a total of 1,103 samples across 24 native mammal species, were collected from carcasses (mostly harvested or roadkilled animals) and a few scats during the reporting period (Fig. 7). The samples were all retrieved from the volunteers, mapped in GIS, documented in a database, and sent to the National Genomics Center for Wildlife and Fish Conservation for genotyping.

- The lab genotyped the white-tailed deer (N = 111), opossum (N = 93), and raccoon (N = 125) samples (Fig. 8) to evaluate population structure of each of these species, since they had the highest sample numbers, most complete sample distribution, and represent species of varied movement capabilities. Genetic substructure was examined using a principal coordinates analysis (PCOa), and a clustering analysis was also conducted using the program STRUCTURE. Results of the analyses for white-tailed deer show that two genetic clusters are supported, though the split does not occur at the North – South delineation we identified and instead occurs farther south. The results of the analyses for raccoon and opossum did not detect any population substructure.



Species	North	South
American Beaver	11	13
Black Bear	73	0
Coyote	17	6
Eastern Chipmunk	29	5
Eastern Cottontail	48	69
Eastern Gray Squirrel	74	52
Flying Squirrel	5	0
Gray Fox	2	0
Groundhog	30	31
Mink	11	6
Mole	5	0
Muskrat	8	9
Northern River Otter	32	69
Porcupine	10	1
Raccoon	72	58
Red Fox	42	25
Red Squirrel	11	0
Shrew	6	0
Striped Skunk	20	12
Unknown	4	0
Virginia Opossum	52	41
Vole sp.	1	1
Weasel sp.	5	0
White-footed mouse	9	3
White-tailed deer	47	78
Total	**624**	**479**

Figure 7. The CHANJ core and corridor map (left) displaying the locations of DNA samples collected Year 1 (black dots) and Year 2 (gray dots) collected from native terrestrial mammal species across New Jersey. The North – South dividing line (pink) runs along the Rte. 1 corridor in central New Jersey and served as the starting point for the genetics analyses and as a guide for sample collection. The number of samples collected from each species to-date are displayed in the table (right), from both North and South of the dividing line.

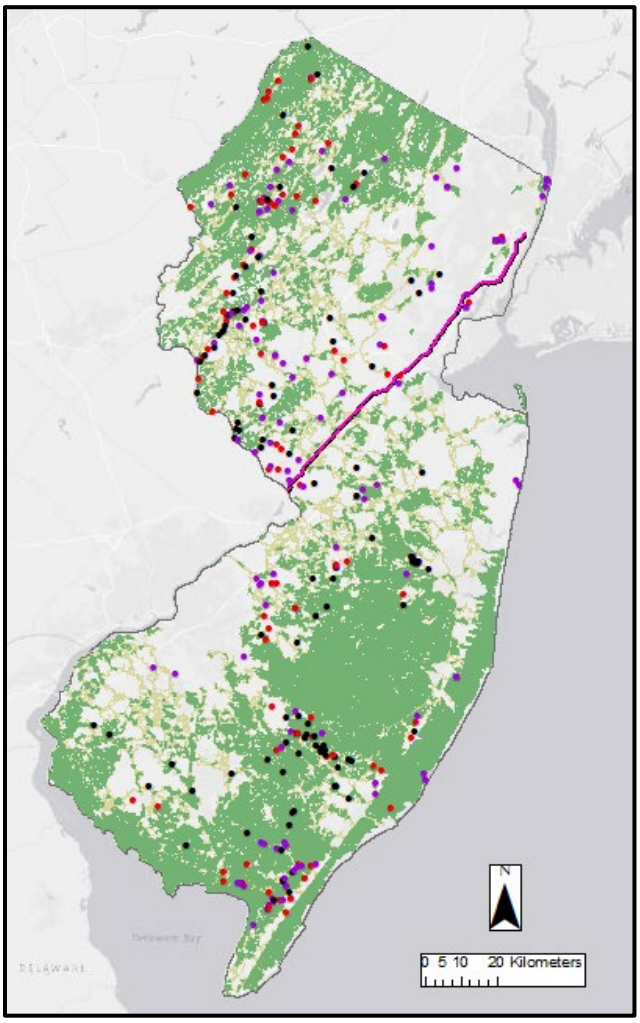


Figure 8. The CHANJ core and corridor map displaying the locations of DNA samples collected from white-tailed deer (black), opossum (red) and raccoon (purple) across New Jersey. The North – South dividing line (pink) is also displayed.

- Solicit and compile results from movement analysis
    - As mentioned in our previous interim report, our early work in this project is setting the groundwork for evaluating wildlife movement, but there is nothing yet to report.

Conclusions:

- Project partnerships established during Year 1 with TNC (for road assessment surveys) and MSU (for NAACC culvert assessments) continued during this work period, focusing on CHANJ-mapped habitats and road segments within the pilot areas established at the start of this project. These partners are serving a large portion of our project manpower and match.

- Road assessments, culvert assessments, and camera surveys are well underway to evaluate wildlife interaction with barriers and their use of CHANJ-mapped corridors. NAACC capacity is growing with MSU's continued outreach efforts, resulting in an increasing number of culvert surveys completed with each work period. We have currently completed 55% of our original proposed NAACC terrestrial connectivity surveys for the project.

- A large percentage of stream-crossing structures (68% of those surveyed during this work period) have been found to pose "significant" or "severe" barriers to terrestrial wildlife movement. With MSU personnel serving as NAACC Certified Observer I to expedite data submissions and review, and with NAACC terrestrial connectivity data now integrated into our CHANJ mapping in real-time, this information is readily available to the public and to connectivity advocates for identifying and tackling connectivity challenges/opportunities.

- We were approved to add $80,000 ($60,000 federal share and $20,000 match) to our project budget for additional culvert surveys, roadkill surveys, and competed Road Segment Reports within targeted CHANJ-mapped areas for the remaining grant period.

- The ENSP CHANJ team recruited 25 additional volunteers, for a total of close to 90 volunteers across the state helping with collection of DNA samples for the gene flow/functional connectivity component of this project.

- The volunteers collected over 400 samples during the reporting period across more than 20 mammal species, with adequate sample size and distribution for the lab to run preliminary analyses on several species representing different movement capabilities and population dynamics. All of the samples collected during the reporting period have been documented and sent to the lab.

- Preliminary population structure analyses have been run on 3 species to date: white-tailed deer, raccoon, and opossum. The analyses for white-tailed deer showed that 2 genetic clusters were supported, but those for raccoon and opossum did not detect any population substructure, which is surprising given their size and dispersal capabilities. We suspect that anthropogenic movement of rehabilitated or nuisance animals may explain the results.

Recommendations:

- Regroup with TNC to develop a plan for the next work period, including selection of Year 3 road segments and placement of additional cameras at culverts.

- Meet with MSU culvert inventory coordinators to develop a plan for the next work period, including refinement of priority locations and goals for the number of surveys to complete.

- Finalize a Road Segment Report template and produce at least 5 reports in Year 3 with the robust data collected during this project. Make Road Segment Reports accessible through the CHANJ Web Viewer.

- Further analyze road segment and roadkill data to determine potential roadkill hotspots and factors contributing to wildlife presence on roadways.

- Arrange contracts/purchase orders with new partners (and/or expand existing contracts) to fulfill our enhanced goals for NAACC surveys, roadkill surveys and Road Segment Reports.

- Continue to recruit and manage the large group of volunteers collecting DNA samples from terrestrial mammals across the state, particularly in areas of the state without many samples, and continue to provide updates on the study to the volunteers as well as refined guidance regarding sampling needs (e.g. species and locations needed).

- Continue to collaborate with the National Genomics Center for Wildlife and Fish Conservation on the genetic analyses, potential barriers to test, and sampling needs.

- Continue to look for collaboration opportunities with other mammalian projects taking place across the state that are collecting DNA or movement data.

- Identify 2-3 corridors to evaluate wildlife movement through, and begin efforts to monitor them in the next work period.