

May 12, 2019

Preliminary Report: White-Tailed Deer (*Odocoileus virginiana*) Population Density Survey using sUAS Infrared in Watchung Borough, New Jersey

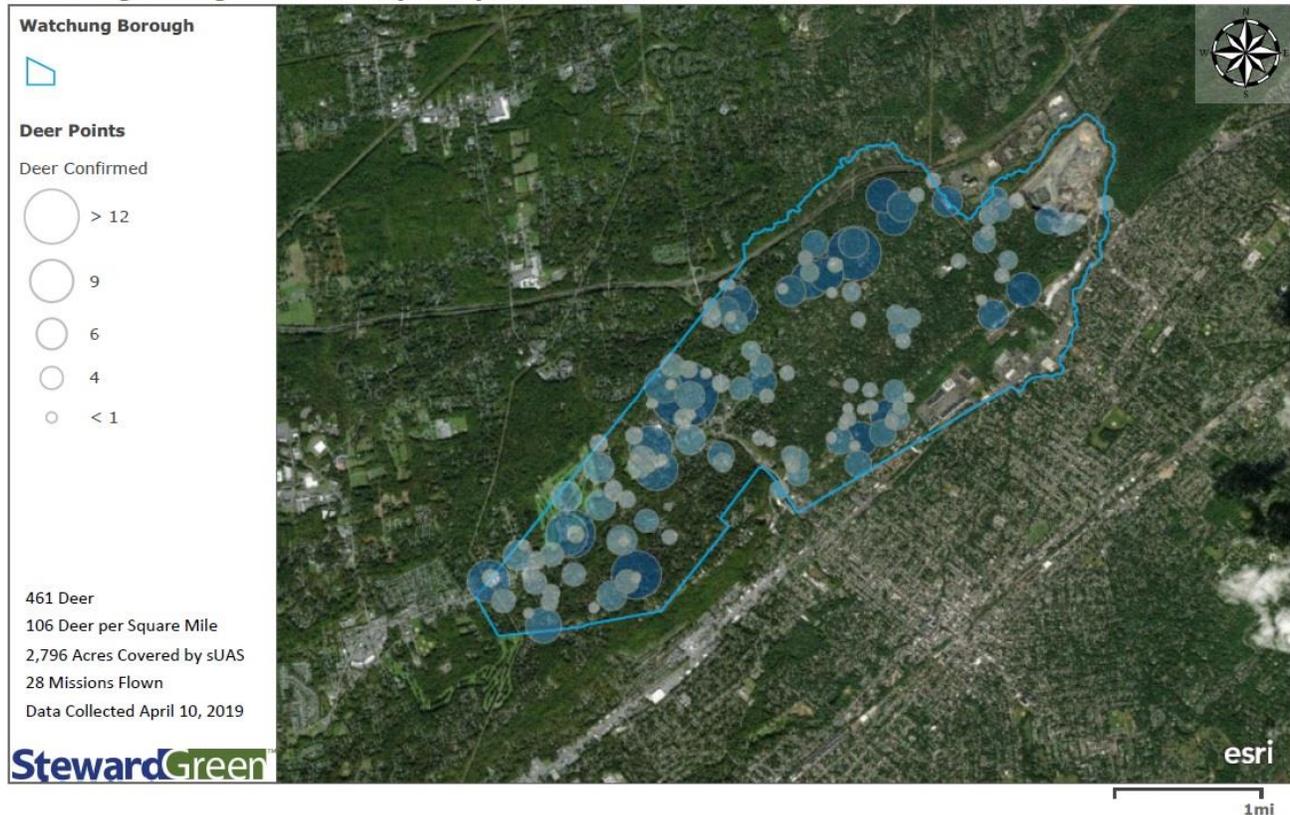
Objective. Provide Watchung Borough with an estimate of the white-tailed deer population density within limits of the Borough of Watchung.

Study Area. Watchung Borough comprises approx. 6 square miles, consisting mostly of residential, commercial, industrial, yet also minor open water, fragmented woodlands, parks and hardscape. It is one contiguous tract transected by a north/south running electrical transmission line. To the east is a fenced quarry, then beyond is the Watchung Reservation. Route 22 and suburban areas of the Plainfields borders the south, while Route 78 primarily borders the north. To the west lies even more suburbia in Green Brook Township.

Method. Steward Green LLC (SG) is providing Watchung Borough with infrared thermal digital aerial imagery analysis and reporting within Borough limits. The intent of the data collection is to confirm deer population densities at the time of data collection. The Project required nighttime thermal aerial photogrammetry of the project areas, most importantly collecting imagery that will best indicate White-tailed deer heat signatures.

Figure 1. Watchung Borough Deer Confirmed Minimum Population Density Map.

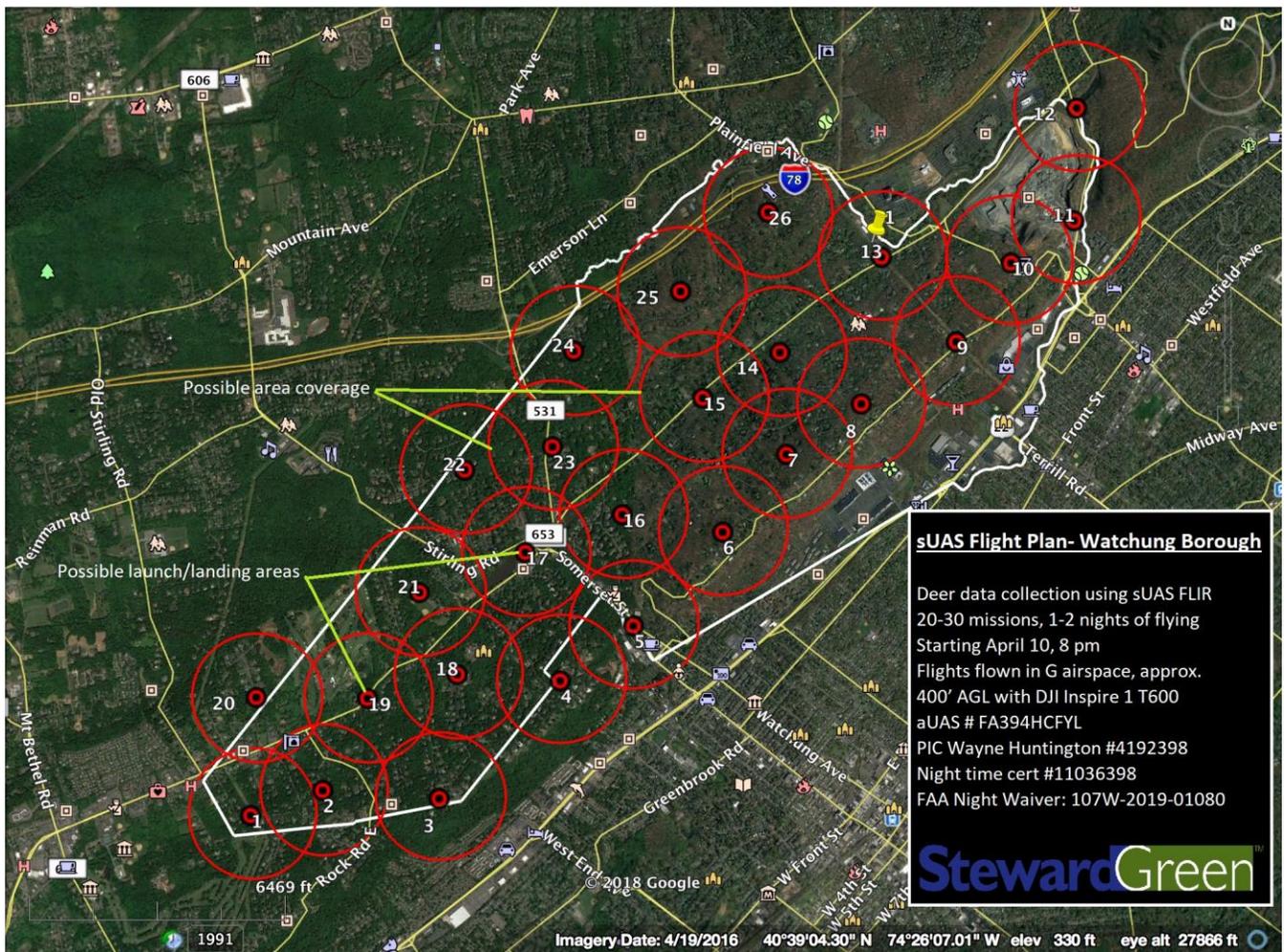
Watchung Borough Deer Density Study 2019



Requirements. The project area was within Class G airspace, SG is approved to perform UAS operations based on our certifications with FAA and standard procedures. Our mission was performed below 400 AGL. We collected the UAS data legally and safely. Before any sUAS flights were conducted, SG determined whether there were any Temporary Flight Restrictions (TFRs) issued by FAA. Since this was a nighttime operation, additional FAA nighttime pilot certifications, which we possess, were necessary. Additional FAA authorization were also required for nighttime flights, which we also maintain.

Process. Site reconnaissance included 2 days of FAA mandatory daytime inspections of the project area to access ingress/egress, potential launch/landing points, site hazards, obstructions, flight patterns, etc. High voltage electric lines and towers, cell phone and radio towers, water towers, severe changes in elevation, large trees, etc., were noted during these investigations. Launch/landing sites were also pre-determined (see Figure 2). We then met with Watchung Borough Police to inform them of our intended night to fly, what to expect, what to tell residents if asked, etc.

Figure 2. Watchung Borough sUAS Launch/land coverage Map.



We flew 28 missions the night of April 10 starting at 8:30 PM and early morning of April 11 ending at 4:30 AM, covering areas systematically, at least once with multiple crews and sUAV's. All missions were conducted safely without incident. The police station was our home base and charging point. Conditions were excellent as the ground temps were cool and the skies were clear. Deciduous trees had not yet leafed out and evergreen tree coverage was minimal to moderate. Other heat signatures observed included boulders, pockets of water, streams, streetlights, active chimneys, drain inlets, electric transformers, cars in driveways and other mammals.

Imagery was collected using a VTOL small Unmanned Aerial System (sUAS) with high-resolution visual imaging thermal infrared sensors flying manual missions to ensure complete coverage of the study area, adequate image overlap, and repeatability. We collected enough quality data to conclude saturation data collection of all project areas flown, approximately 2,796 acres. Watchung Borough is comprised of approximately 3,860 acres; thus, we are thoroughly providing information for 72.4% of the total borough. This is a very good sampling, representative of Watchung Borough. Some areas not encompassed in the sampling include the fenced quarry (approx. 150 acres fenced), areas north of route 78 (approx. 130 acres), industrial/retail areas to the south (approx. 452 acres) and areas in town that were simply not visible in the coverage (approx. 332 acres). See table 1.

Table 1: Areas not covered by sUAS

Areas not covered by sUAS due to visibility, fences or industry:			
Area	Acres	Reason not covered	
Quarry to the East	150	Fenced	
North of Rt. 78	130	Likely separate deer population	
South Industry	452	Industrial/retail	
Misc. areas within tow	332	Loss of visibility/coverage	

Thermal imagery was analyzed both in the field and then more thoroughly in the lab to determine accurate heat signatures of deer. We performed a “minimum”, or “deer confirmed” and “maximum”, or “deer possible” count from the analysis of the data. The minimum count includes deer confirmed from the data, while the maximum count includes deer counted that were likely, yet not confirmed as deer. The number counted as “minimum” is based on a few factors. Since there were areas not covered in the data collection, yet deer located consistently across the borough, we can assume there were deer in some of those areas as well, except for the fenced quarry or any other areas properly fenced to exclude deer. Also, as with any infrared data collection, there can be areas that are “unseen”, such as underneath evergreen trees, or other obstacles, where deer can be present yet not seen as a heat signature. Still, there are “possible” deer observed in the data collection that are not counted in the “minimum deer” analysis. See Figure 1, Table 2 and Figure 3.

This information was then used to create geographic location maps with points of interest (the heat signatures of deer), mission and data information.

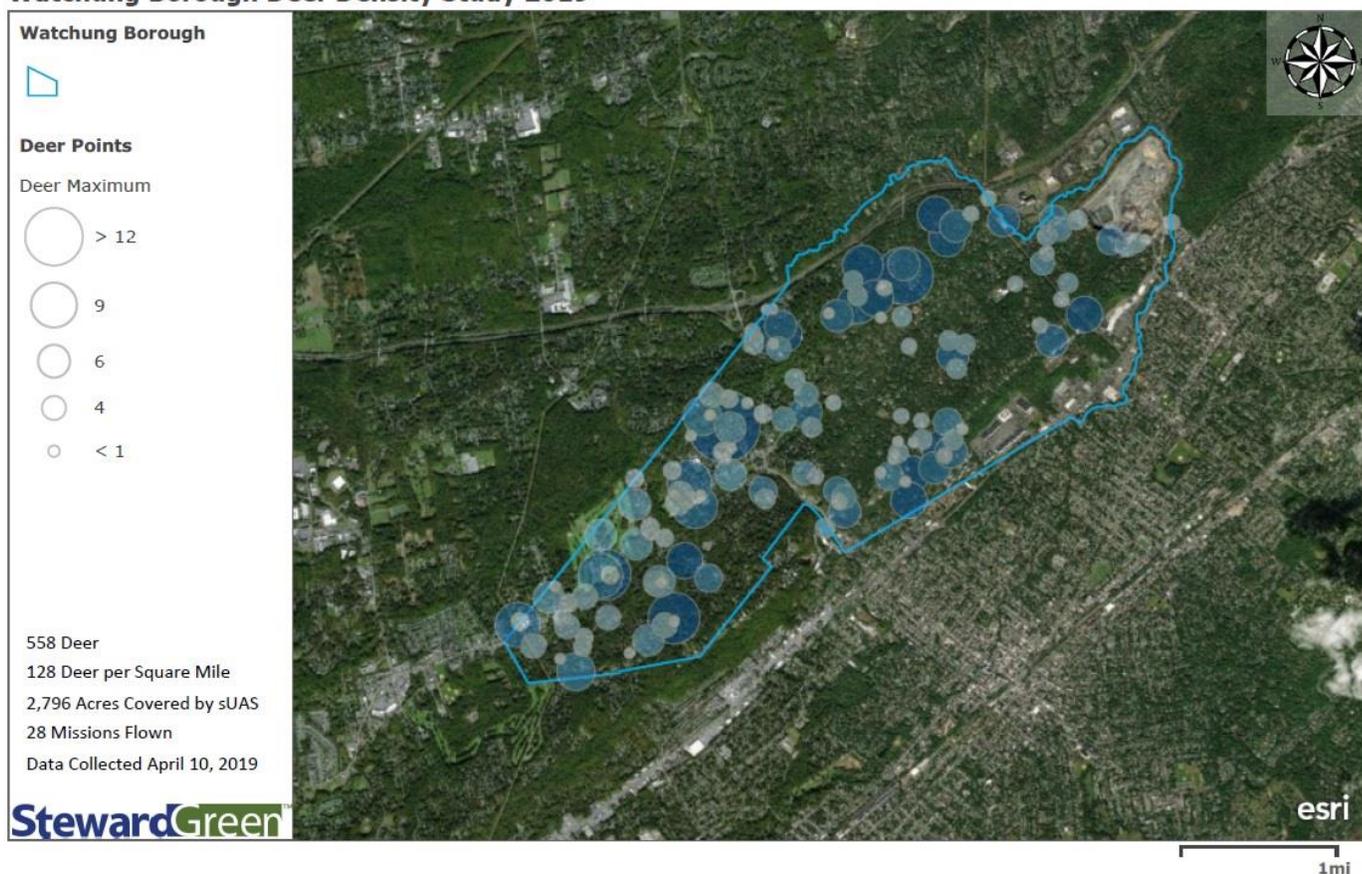
Results. At a minimum, there were 461 deer counted in Watchung Borough, which equates to 106 deer per square mile for areas covered in the data collection. See Table 2.

Table 2: Deer population density results

	AC COVERED	DEER MAX	DEER SM	DEER MIN	DEER SM	Missions
Crew I	1900	398	134	301	101	15
Crew II	896	160	114	160	114	13
Totals	2796	558	128	461	106	28

Figure 3. Watchung Borough Deer Maximum Population Density Map.

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Summary. Healthy deer density is considered 5-15 per square mile by many wildlife biologists, ecologists and environmental professionals*. ALL the areas surveyed in Watchung Borough have a SEVERE deer density that is beyond the threshold of carrying capacity, that has likely led to intensified invasive flora, depleted habitat for (tick eating) ground nesting birds (oven birds, grouse, etc.) and possible starvation/disease for the deer. Woodlands do not appear to be healthy at all in Watchung, as there is severe lack of native flora understory and the next generation of trees (seedlings and saplings).

Property owners likely experience deer in this condition eating landscape plants even beyond what deer will not normally ingest, such as boxwood. This type of overabundance of deer often also results in increased vehicular accidents, injury and unfortunately, some even fatal. Somerset County remains one of the highest vehicular accident counties related to deer in New Jersey.

End of Preliminary Report

Steward Green LLC has been consulting clients for many years in conservation, wildlife habitat regeneration and ecosystem services development. Our lead consultant has been performing successful heat signature work since 2001, starting with helicopter, then airplane mounted Forward Looking Infrared (FLIR). In 2013, we started using sUAS with thermal infrared sensors as the technology became more reliable, the data collected with better quality, more affordable and safer than traditional methods.

*with a biodiverse habitat in place, a healthy density of deer is approximately 5-15 per square mile, depending on foraging abundance for deer AND other place-based species. None of the project areas measure close to a healthy habitat, evidenced by a profusion of invasive flora species, absence of native understory and absence of other place-based fauna species.

References:

Drake, D., M. Lock and J. Kelly. 2002. Managing New Jersey's Deer Population. Rutgers Agricultural Experiment Station, Rutgers University Press.

Maslo, B. and S. Wehman. 2013. An overview of white-tailed deer status and management in New Jersey. Cooperative Extension Fact Sheet FS1202. Rutgers, The State University of New Jersey, New Brunswick, NJ.

Tallamy, Doug. Professor and Chair of the Department of Entomology and Wildlife Ecology at the University of Delaware in Newark, Delaware. Deer Management Handout