

Biodiversity in the Three Village Suburban Ant Colonies

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Abstract

Given the abundance, diversity, and small morphological differences of ants, they are an ideal subject for barcoding. Our ant campaign studied the patterns of ant distribution on varied areas (patio, wooded edges of the sport terrains) of our school grounds as well as of a large riparian garden. The ant variety was assessed both in terms of species and of functional groups. We also aimed to investigate the correlation of ant variety with the degree of habitat disruption. Only non-insecticide land-use intensification practices -mowing, fertilization and herbicide spreading- were used this year on school grounds.

Introduction

To what extent does land use affect the biodiversity of ants in the suburban Three Village Area?
Hypothesis : The number of active ant species differs between the main dining/residential area (D) and sports (B, C) and wooded areas (E) presenting an increased diversity in the less-disturbed areas.

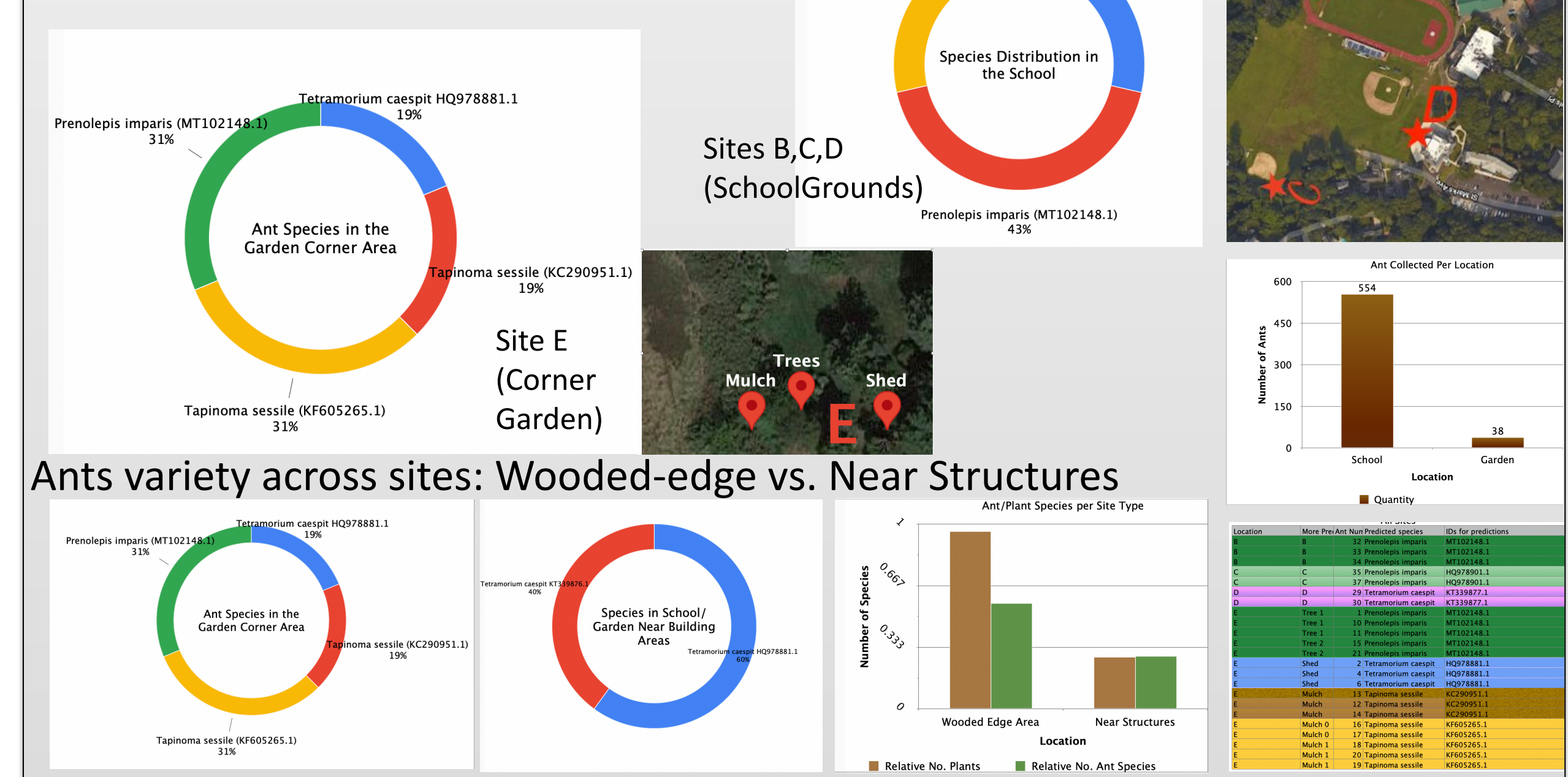
Three Village Area collection sites: school, large riparian garden

- Sites B and C are sports areas close to the wooded campus edge
- Site D (Hollis patio) is a pavement area close to the canteen and dorms
- Site E is a neglected partially mulched wooded garden corner with an old shed, pine trees and low growing shrubs
- D were treated with herbicides: Tenacity(Syngenta), SpeedZone (Pbi Gordon Corporation), also C was treated with fertilizer Lebanon Pro Starter Fertilizer 10-20-15 (LebanonTurf)

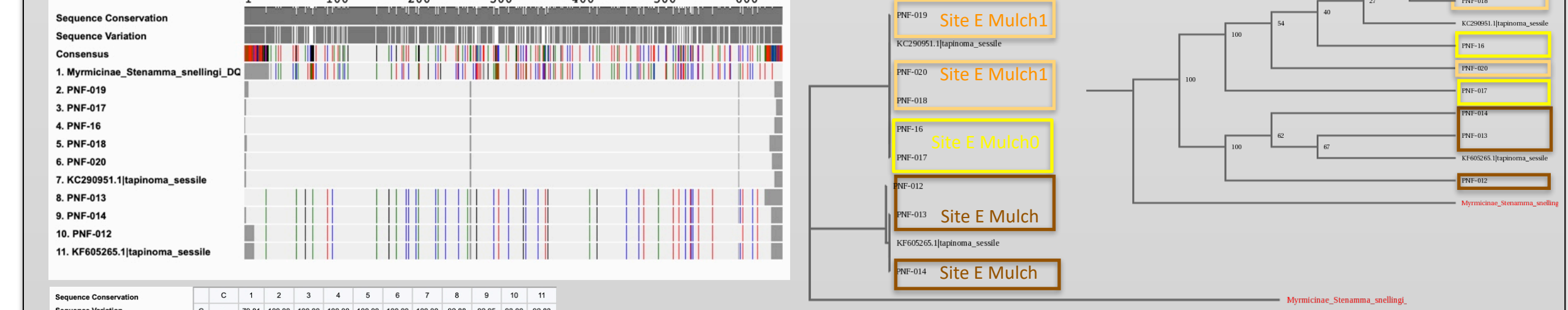
Methodology

- Site Baits: 2 large plastic tubes with sugar were placed on the mulched ground for 4 days in mid-March; during the day we checked the traps
- In addition, visual searches were conducted in a 2m radius of the site E, looking for signs of ant activity on the trees and near the shed, corresponding to the site E subdivisions named Trees, Shed
- On site E on the mulched ground we performed also two other collections in late autumn, Mulch0, Mulch1 for an adjacent timeline study
- Samples were collected in resealable bags, cleaned, and then transferred to ethanol vials to be stored in the freezer.
- From each site subdivision two ants were chosen randomly for DNA sampling, a few extra samples (< 1 per site) were added to include different looking ants (mainly larger ants and alates)
- Using a light microscope the selected ants were visually identified with taxonomic keys (documented in the DNALC database)
- DNA was extracted from the samples and isolated. PCR was performed for amplification. The results were then run through gel electrophoresis with a ladder to check for successful amplification and to determine which samples could be sequenced. All results were very good.
- All DNA sequences were analyzed in the DNA Subway Blue Line to evaluate nucleotide base differences with their corresponding species.
- Both neighbor-joining and maximum-likelihood phylogenetic trees were generated and analyzed

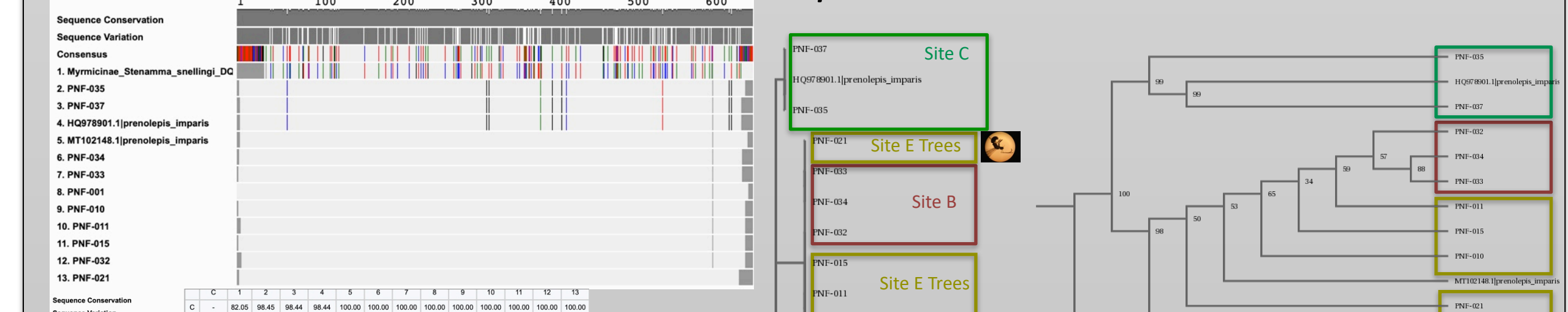
Tables & Figures



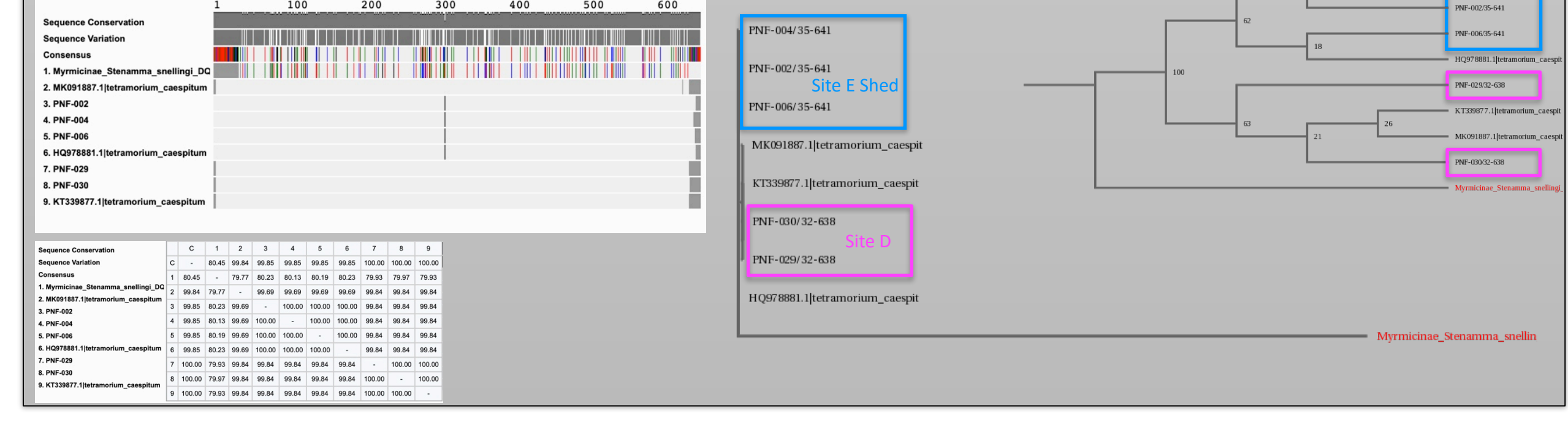
• BLAST search/Phylogenetic trees *T. sessile*



• BLAST search/Phylogenetic trees *P. imparis*



• BLAST search/Phylogenetic trees *T. caespitum*



Results

- All sites are developed, but ants seem to respond to small habitat differences.
- wooded-edge areas: Specialist -*P. imparis*- a dominant woodland seed disperser species; it is a “cold climate specialists most active during cool weather, foraging when many invasive species are inactive,... aggressive toward other ants”(Cuatle et al. 2016)
 - ▶ The cladogram shows how the presence of alate ants (1), (21) during the swarming season increases the variety among the ants from the same site and even in the same subspecies.
- patio/building areas: Opportunist -*T. caespitum*- “the “pavement ants” are polyandrous, unspecialized, a 'weedy' species of disturbed sites with low ant diversity” (Andersen, 1997)
 - ▶ The cladogram shows a variety among the ants from the same site and even from the same subspecies. This might support the presence of a polygynous super-colony on site D.
- mulched areas: Opportunist -*T. sessile*- an adaptable native species, polygynous, polyandrous, a “back-seat driver of biodiversity loss” moving in vacant niches (Sayler et al., 2014)
 - ▶ The cladogram shows a large intra-subspecies variety with unclear common ancestors for the samples suggesting a seasonal nest shift, as well as different related polygynous nests.
- The wooded garden corner shows more diversity than the school grounds
- Surprisingly the baiting traps had each only one species, per collection.
- The density discrepancy between the school and garden traps is 1:15.

Discussion

Our ant habitat specialization hypothesis was confirmed across the sites. The impact of land-use practices on diversity was unclear even if the wooded garden corner shows slightly more diversity. Arguably, we actively searched for diversity on site E. However, there is a positive correlation between the ants’ diversity and the plant diversity across sites. The presence of only one species per trap might be the result of an aggressive food source competition during the colder weather.

Given the season’s scarcity of food, it is reasonable to assume a positive correlation between the ant nest density and the number of workers captured in traps. Thus, we might infer that the school habitats supported larger colonies than the garden. On both locations, the within-colony genetic diversity might be an indicator of the presence of polygynous super-colonies of *T. caespitum* and respectively *T. sessile* . For the *P. imparis* it is unclear if the ants found in the same place originated from related(same) nests, March being their active foraging season. The exclusive presence of *P. imparis* in the wooded-edge might also be a seasonal bias.

Acknowledgements

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- DNALC, *Chelex Isolation Protocol: Isolate DNA at Home, LabProtocol*