NYC Parks / Cornell Urban Tech Hub Possible Data Projects

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Assignment: Prepare a brief description of the data that we have, data that we would like to have, and what we would like to know or understand better.

Goal(s): To identify trends and patterns to help strengthen NYC Parks' urban forestry program through a greater understanding of inputs and outputs in order to increase accuracy and efficiency, maximize existing resources, and anticipate and meet future needs.

Data Description:

NYC Parks' Forestry Management System (ForMS) is the database of record for the over 800,000 trees located in the public right of way and landscaped park areas that are individually managed by the agency. With an ArcGIS enterprise geodatabase containing NYC's inventories of street and park trees in the back end, it also houses all Service Request, Inspection, and Work Order records. Each tree asset and activity is spatially located. The schema and database architecture maintains relationships between assets and related activities.

Trees & Planting Spaces are separately managed assets. The tree inventory comprises 666,134 street trees collected during the 2015-2016 NYC Street Tree Census using a linear referencing methodology, resulting in highly accurate spatial locations. An additional 144,298 trees in the landscaped areas of parkland (non-forest locations) were collected in 2017-2018 in a first-ever inventory and added to ForMS as well. Tree attributes include, species, diameter at breast height, condition, structure, address, and commonly reference geographies such as borough, community board, etc. These assets, including planting spaces, are updated as part of all forestry activities including new tree planting, maintenance, and removal.

Service Requests, representing publicly reported tree conditions, stream into ForMS via NYC's 311 system. Service Requests contain information about the caller (if provided), details about the tree condition, and its location. Inspection records are created to document who performed the inspection, when it happened, what the observed condition was, and a risk rating. The inspection is associated to a tree asset and the service request that led to the inspection (if that was the trigger). Upon inspection, a Work Order is created (if needed) that specifies the type of work to be performed, the priority, and other details such as entity performing work, contract, and crew.

Description of Possible Projects:

1. **SEEING THE FOREST FOR THE TREES** - Build an internal forestry performance and management dashboard with strong data visualizations that include KPIs and detailed metrics pulled from the forestry management database for service requests, inspections, and work orders. This dashboard will help borough forestry managers and NYC Parks senior borough executives track performance over time, understand public reporting trends, monitor workflows and backlogs across different staff and operational areas, and focus on the differences in work needs between street and park trees. The dashboard has gone through technical requirements and user development survey process, has been substantially mocked-up, and is ready for building out on the appropriate platform.

2. **THE POWER OF THE PUBLIC SERVICE REQUEST** - Do public service requests align with actual tree risk and the need for work? If so, do the SR types align with the type of work that is warranted? What is the balance between chasing public SRs and conducting programmed inspections?
    a. What SR types consistently yield the most risk?
    b. What public SR types yield the most work orders? Are these high or lower priority?
    c. What are reasonable timeframes to inspect public SRs (by type of SR)? These timeframes (Service Level Agreements) should accommodate our staffing levels.
    d. Do the SRs that yield the most risk correlate to those that result in the most work orders?

3. **TREE FAILURE ORIGINS AND AVOIDANCE** - What trees are most likely to suffer tree damage or failure? Identifying the factors most likely to lead to damage/failure will improve interventions. If there are no clear factors, we can look more closely at tree risk identification methodologies.
    a. Analyze dataset of tree damage/failure cases during and outside of severe weather events including prior tree inspection and work order histories (individual trees as well as block pruning cohorts)
    b. Examine photographs, if available, from inspections (photos are now in ForMS) of trees that subsequently failed
    c. What are the independent variables that most predict future damage? (size, species, type and/or location of defect, tree location, risk rating, prior maintenance history, especially block pruning etc.)

4. **TREE RISK IDENTIFICATION FACTORS AND FALLABILITY** - What tree or other characteristics are most likely to impact risk ratings? How do changes in these variables change risk results? Is this relationship consistent across variables?
    a. Analyze Level 2 risk ratings (past 2 years)- variables to look at include:
        i. tree size
        ii. tree species
        iii. tree location (street/park)
        iv. tree location (borough)
        v. type/location of defect in risk rating
        vi. prior inspection history
        vii. prior work history
        viii. Inspection reason (public request or programmed work)
        ix. Inspection entity (in-house vs. consultant arborists)
    b. Quality Assurance #1: How reliable is our L2 inspection methodology in terms of overall risk , i.e. outcomes/consequences?
        i. Examine inspection and work history of all tree incidents that have negative outcomes (I.e. not just tree failures but tree failures with negative outcomes to property or people)
    c. Quality Assurance #2: How consistent is our L2 inspection methodology in terms of variation between inspectors?
        i. Need to design and implement a study of inspection consistency that is replicable and that we can operationalize results from

ii. What is the reason for the difference in the risk results (as a % of all inspections) between boroughs?
iii. Examine all photos of Priority A/B risk and post failure ratings for comparison and calibration