

A small green seedling with two leaves is growing out of a crack in a dark, textured rock surface. The seedling is positioned centrally, with its stem and leaves extending upwards. The background is a blurred, dark grey rock face.

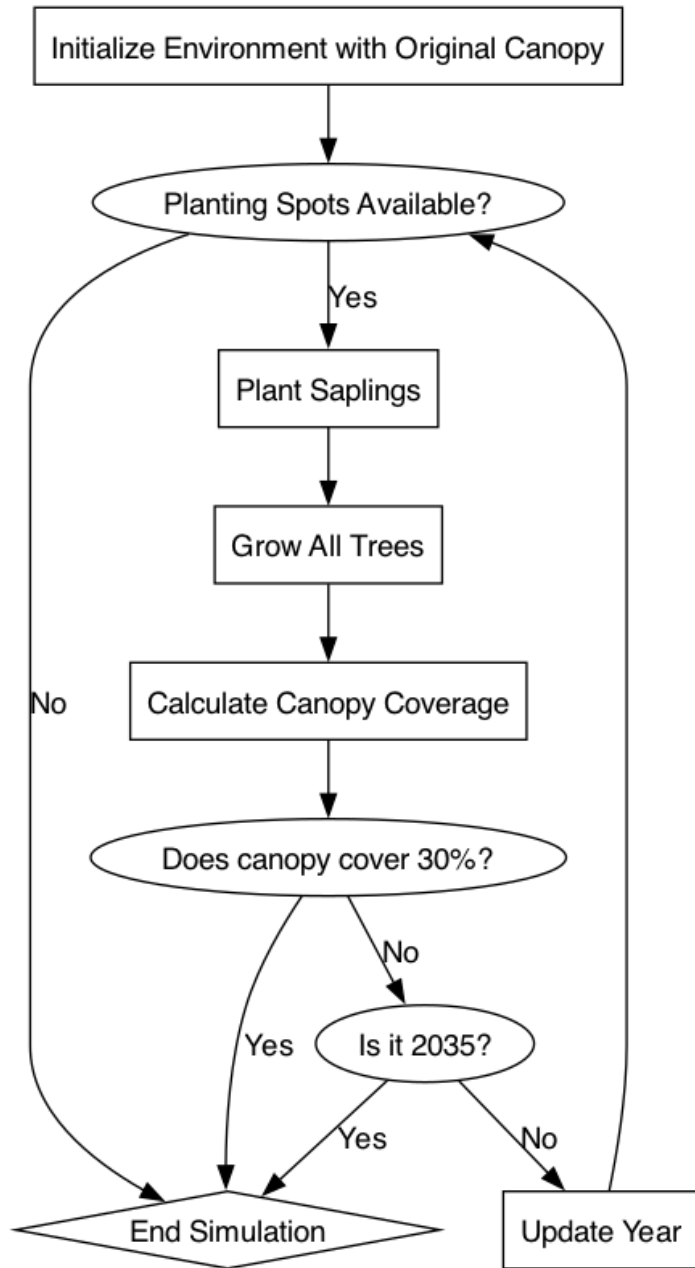
How **GREEN** Can We Grow?

Simulating NYC's Journey to 30% Tree
Canopy Cover by 2035

A photograph of a modern building with a lush, multi-story vertical garden facade. The building features dark, angular balconies and railings, with dense green plants and vines growing vertically along the exterior. The image is partially obscured by a white circular graphic element on the right side.

GOAL: COVER 30% OF NYC LAND AREA WITH TREE CANOPY

- The 2017 LiDAR project revealed that more than one-fifth of NYC's land area is covered by tree canopy, comprising 42,654 acres of green, or 22.08% of total land area.
- Based on these satellite images, the Forest for All NYC coalition released the "NYC Urban Forest Agenda" in June 2021.
- Developed collaboratively by almost 50 organizations, the NYC Urban Forest Agenda sets forth 12 priorities, including a goal to **achieve 30% canopy cover in New York City by 2035.**



SIMULATING PLANTING AND GROWTH

1. The simulation initializes an environment with the canopy measured by LiDAR in 2017 – 22.08%.
2. Once the model determines there are still available planting spots, it plants the number of saplings indicated by the initialized parameters.
3. Then, all planted trees – from the original canopy and the saplings planted during the model – grow by 1 year.
4. The model calculates the new area of the tree canopy, and what percent of NYC land it now covers. If it's 30% or greater, the simulation ends.
5. If the canopy doesn't cover 30%, the model advances by one year, and returns to check planting spots are available. The simulation ends once the year is 2035



CLASSES AND OOP

- `Tree` class that initializes an object whose attributes are provided by its randomly assigned species. Each species has its own growth and canopy size characteristics, based on real life growth patterns.
 - Attributes: age and canopy diameter, which will be updated throughout the course of the simulation.
 - Methods: determine the tree's diameter and calculate its canopy size. All tree objects begin with a canopy diameter that would exist for a sapling with a 3" diameter trunk
- The model also creates a custom parent class of `Tree`, called `Canopy`.
 - The class only initializes one object in the environment – a single canopy containing:
 - the original canopy and its growth, plus
 - the forest of planted `Tree` objects and their growth.

VALIDATION AND VERIFICATION

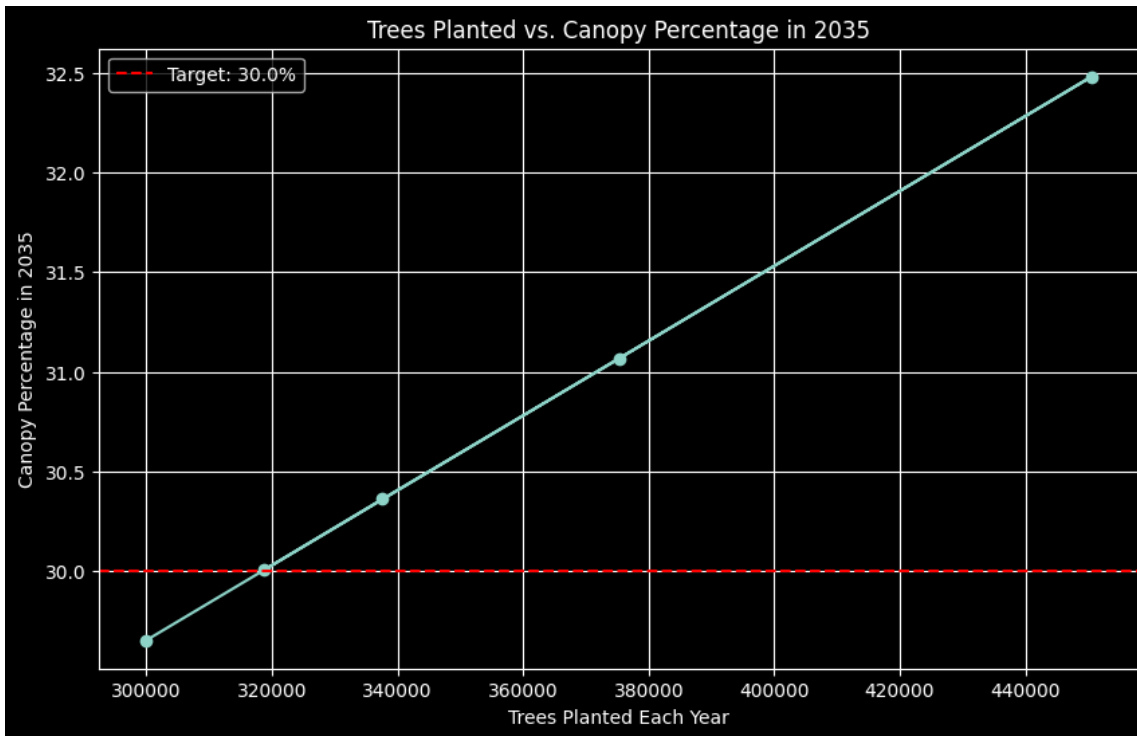


Historical Data Comparison: The model's outputs were compared against historical data to ensure consistency with observed trends. By simulating past years using actual planting data and comparing the results to known canopy coverage, we could assess the model's accuracy.

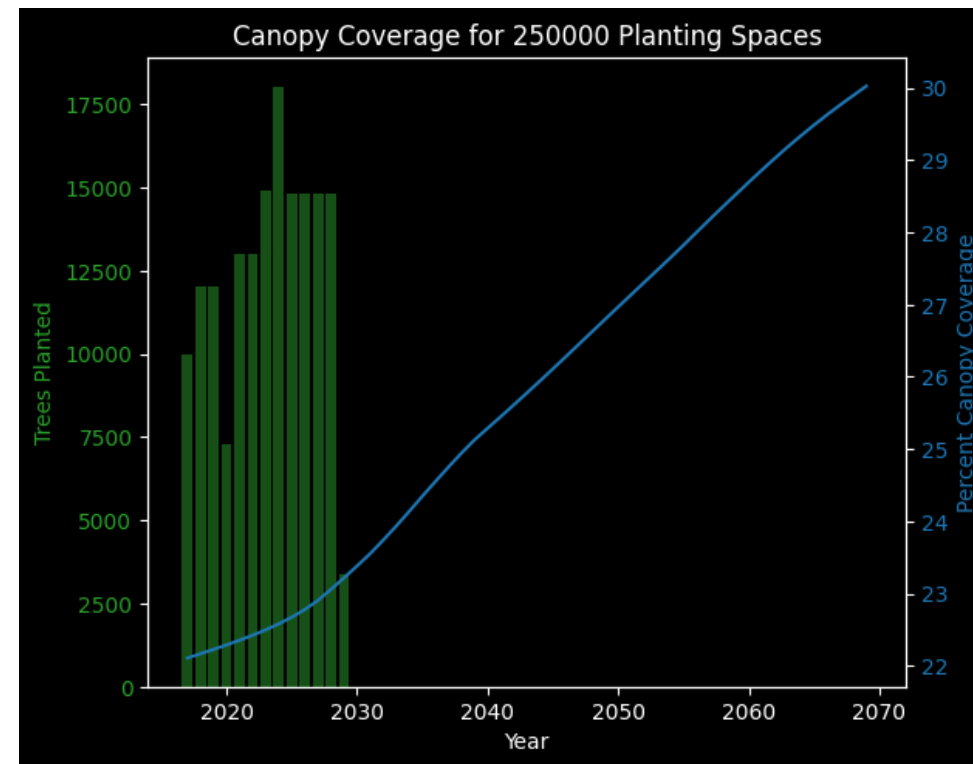
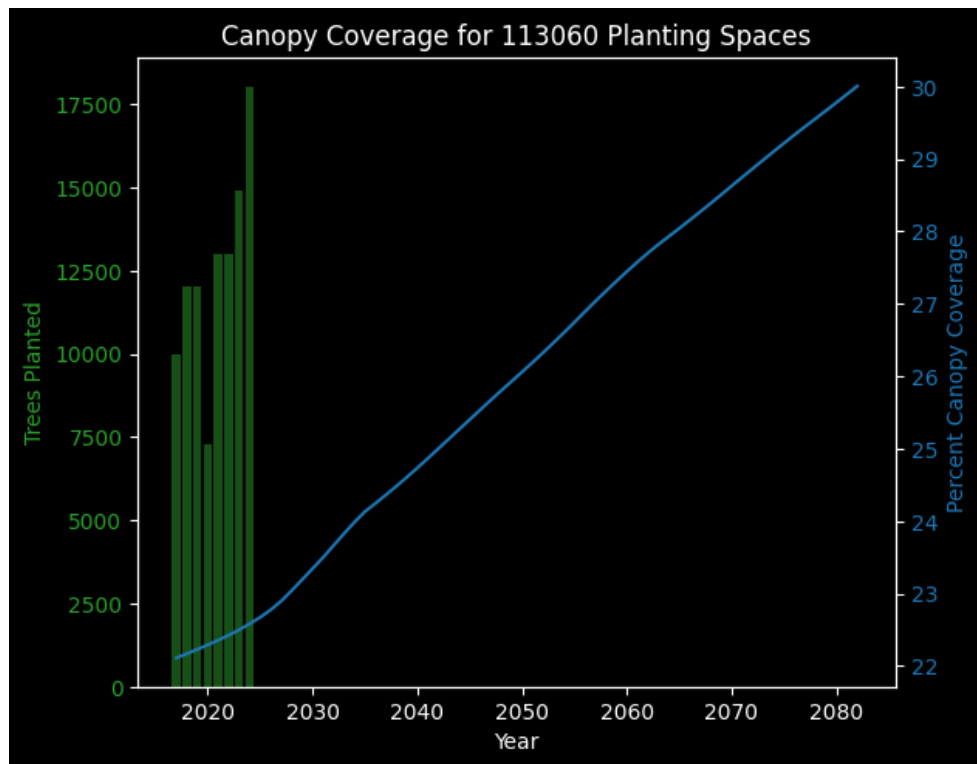


Sensitivity Analysis: This analysis adjust parameters such as the growth rates, planting rates, and species distribution to analyze the sensitivity of the model, as well as identify critical parameters that have significant impacts on the model's output to understand the robustness of the model.

SWEEPING PARAMETERS



- NYC needs to plant at least 318,812 trees per year from 2025 to 2035 to reach 30% canopy in time.
- The parameter sweep reveals the NYC Urban Forest Agenda's 30% coverage goal is practically impossible.
- As of July 2nd, 2024, New York City Dept of Recreation identified 113,060 possible planting spaces across the five boroughs, although others believe there may be an opportunity to plant approximately 250,000 additional street trees as well as more in parks and private land.
- These numbers are nowhere near the required 3.18 million spaces that are needed to achieve the desired 30% canopy coverage by the 2035 deadline.



HOW LONG UNTIL 30% ACHIEVED?

- After examining these findings, another model was developed to examine how long achieving 30% canopy coverage will take if all available planting spaces are used by 2035. The model was run twice, once with each estimate of available planting locations.
- There are only current estimated 113,060 available planting spaces still available in the city. If these spots are all planted with saplings by 2035, the target canopy coverage won't be met until 2083. Increasing planting spaces to 250,000 could achieve the goal by 2069.



CONCLUSION

- Planting 318,812 trees annually is necessary to achieve 30% tree canopy coverage by 2035.
- Only estimated 113,060 available planting spaces still available in the city.
- If these spots are all planted with saplings by 2035, the target canopy coverage won't be met until 2083.
- Increasing planting spaces to 250,000 could achieve the goal by 2069.