Using Data and Partnerships to Support the NYC Urban Forest

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Lead Scientist
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The Nature Conservancy

Photo credit: Diane Cook and Len Jenshel

Who We Are

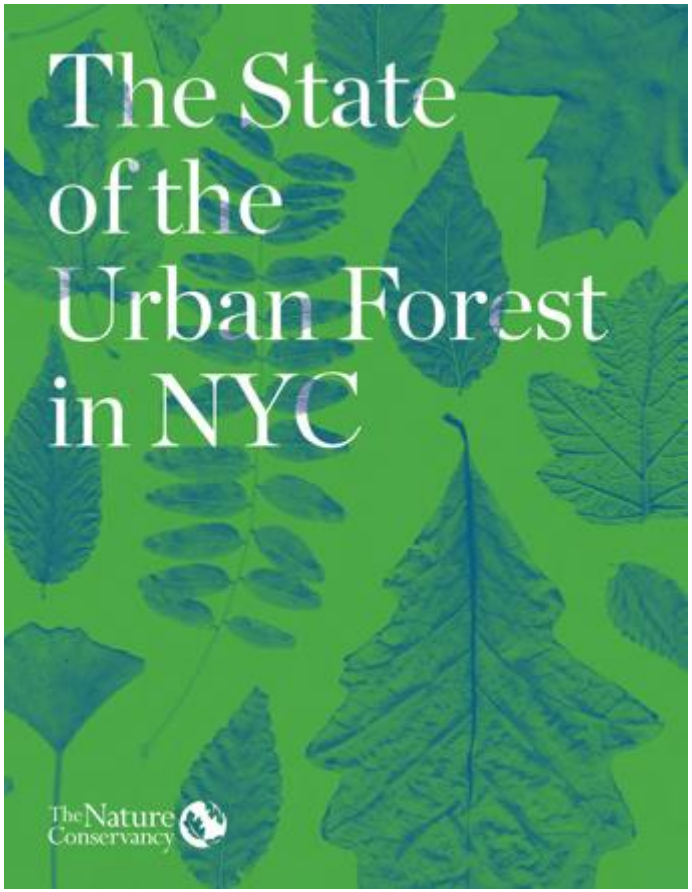
The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends.

Photo credit: Charles Gleberman

The Nature Conservancy

Future Forest NYC

- Science
- Partnership
- Convening
- Policy



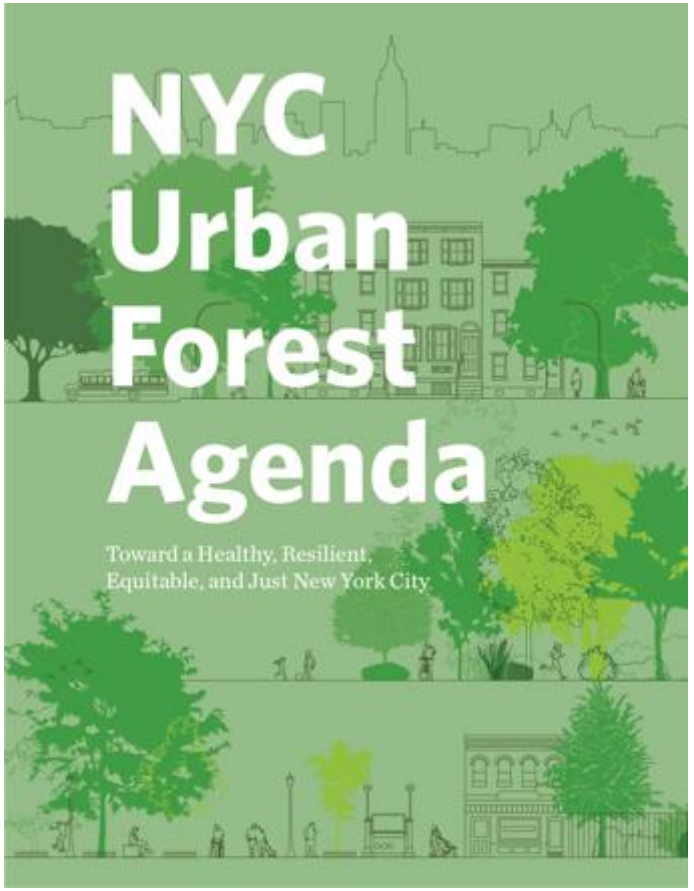


Photo credit: iStock.com/James Andrews

"The urban forest of New York City includes over 7 million trees, as well as the physical and social infrastructure that supports them."

Urban Forest Benefits

Removes 1,100 tons of pollutants from the air per year, which improves air quality and leads to fewer emergency room visits, lower rates of chronic diseases, and fewer hospitalizations

Stores 1.2 million tons of carbon and annually sequesters 51,000 tons of carbon (or 187,000 tons of CO_2)

Decreases air temperature by an average of 0.13˚F, therefore cooling city streets and mitigating the urban heat island effect and extreme heat

Reduces stress (as shown by slower heartbeats, lower blood pressure, and relaxed brain patterns) and promotes healing and contemplation

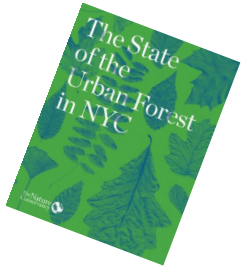
Increases the cohesiveness of communities by fostering stronger connections between neighbors, feelings of attachment to place, and an opportunity to experience nature

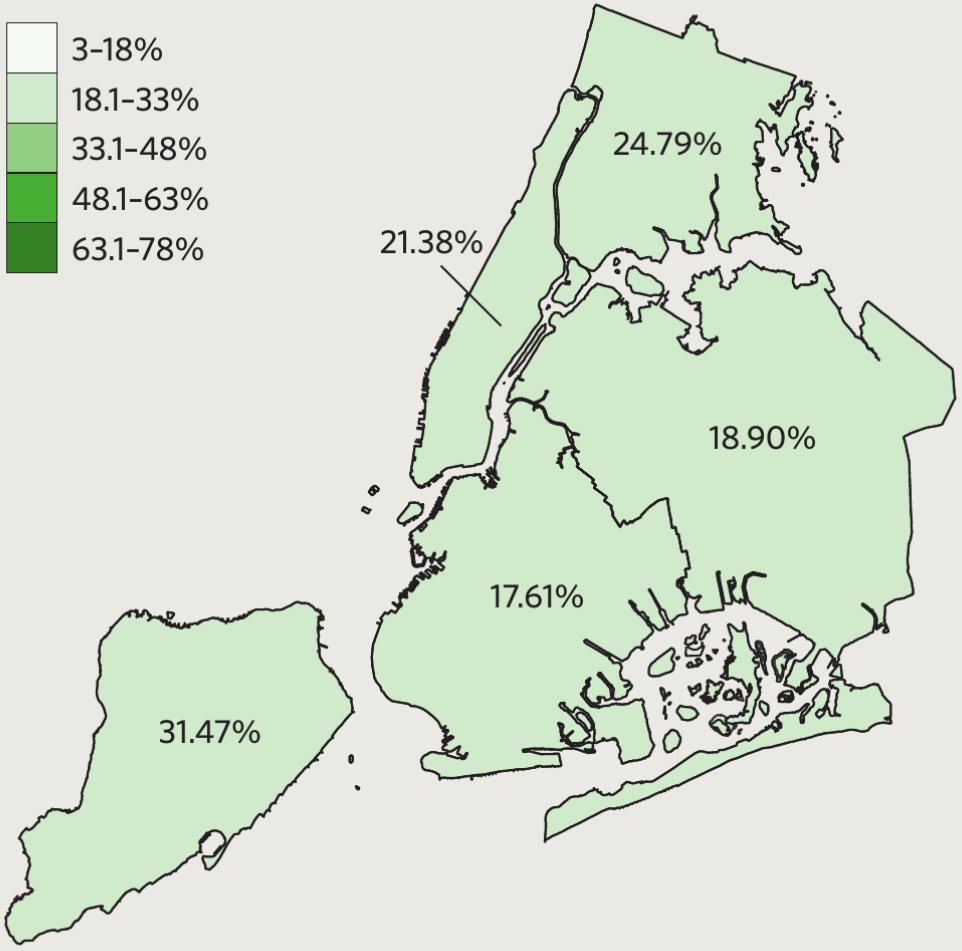
Encourages children and adults to spend more time outdoors engaging in physical activity, therefore reducing childhood obesity rates and improving fitness

Reduces stormwater runoff by 69 million cubic feet per year, decreases the rate that runoff travels off surfaces (e.g., streets and sidewalks), and stabilizes soil by preventing erosion

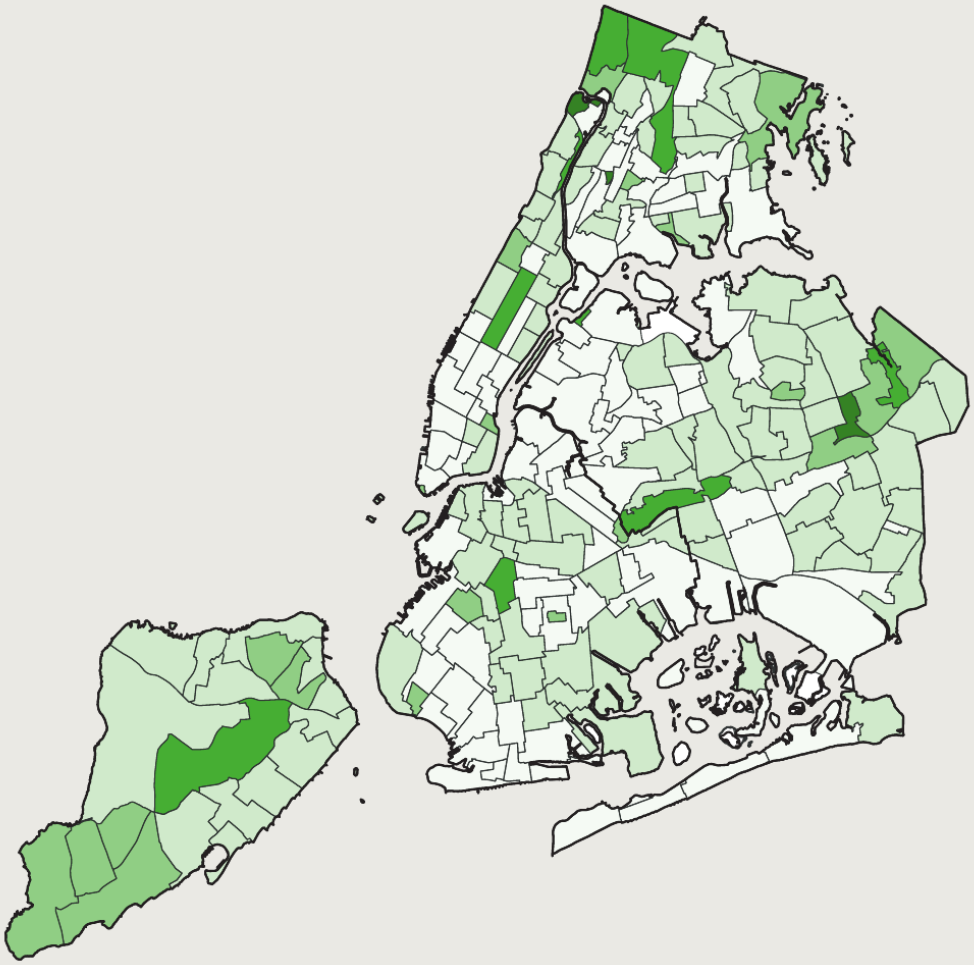
Provides habitat and refuge for a variety of wildlife and plant species and enables pollinators, seed dispersers, and other species to move throughout the region

Tree Canopy Distribution 2017





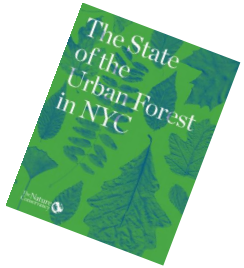
Boroughs

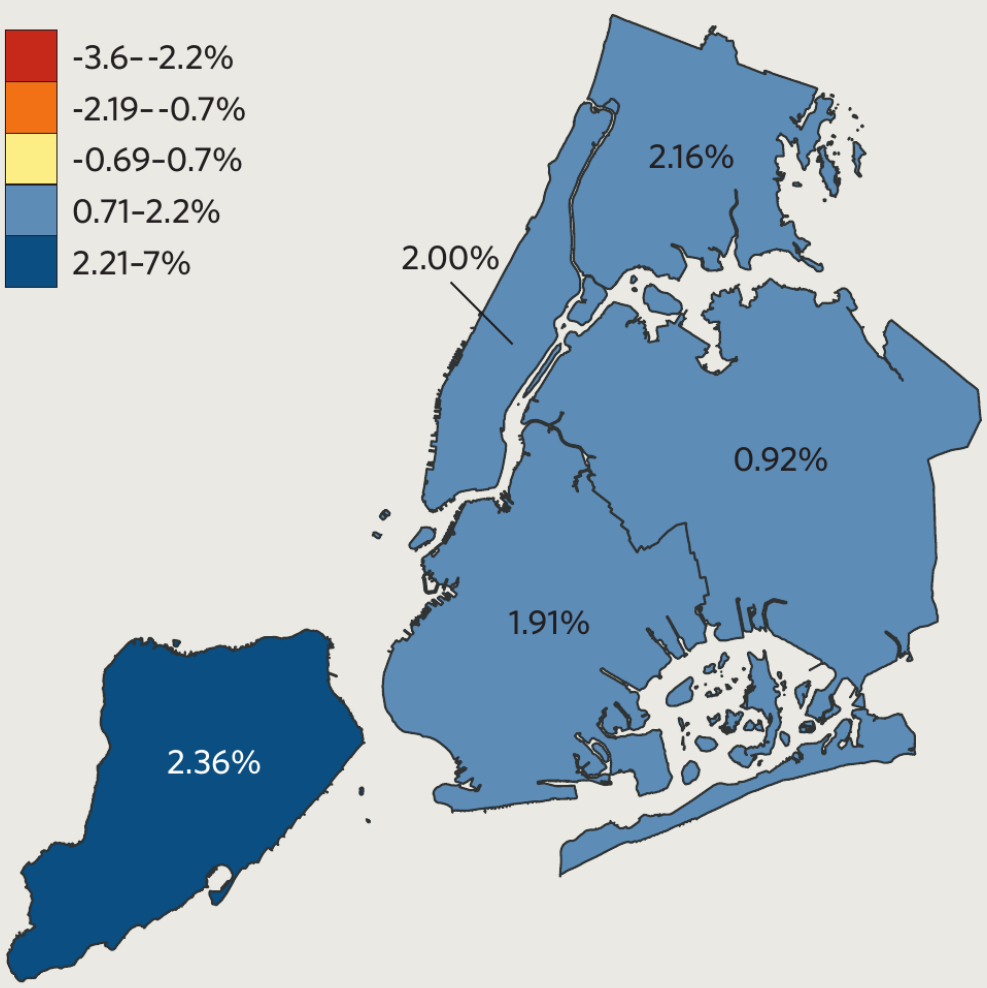


Neighborhood Tabulation Areas

Data sources: Percent Canopy Cover derived from 2017 Tree Canopy Change (2010–2017) data (NYC Department of Information Technology and Telecommunications); Administrative Boundaries from NYC Department of City Planning

Net Change In Tree Canopy 2010-2017





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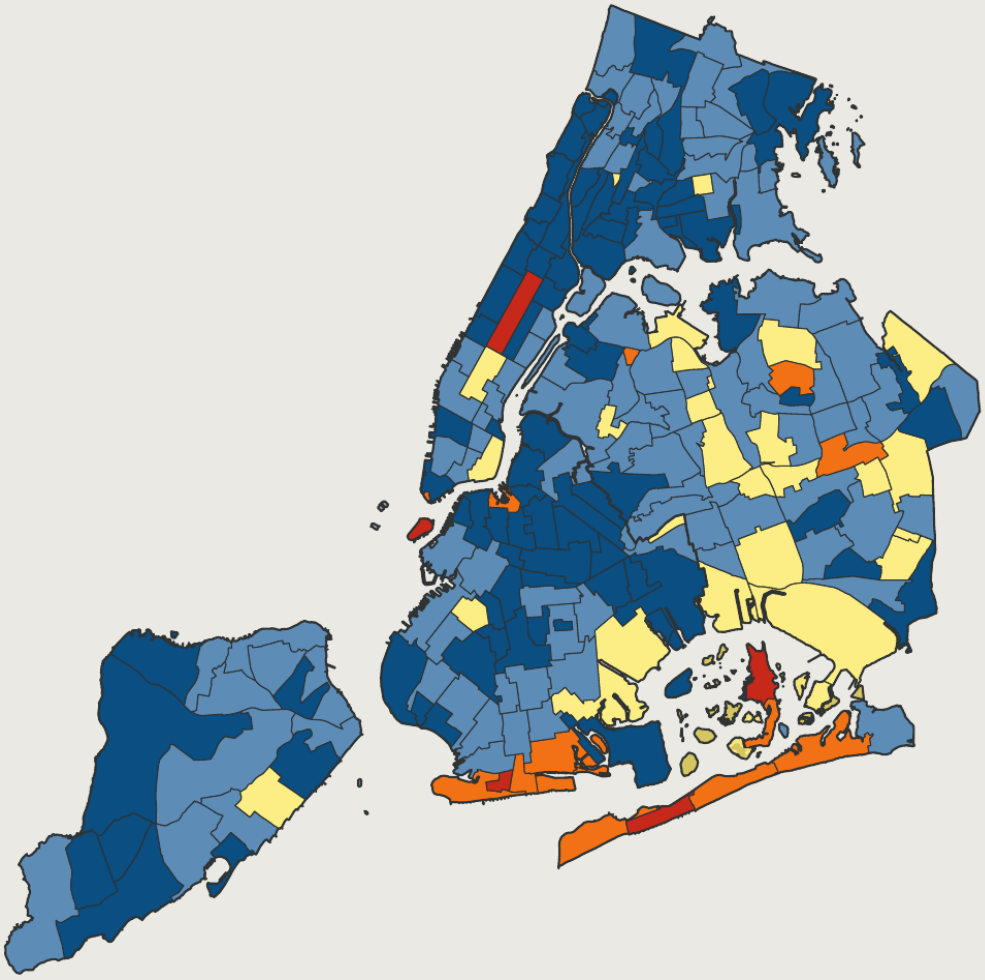
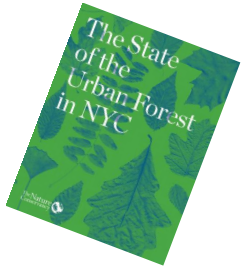
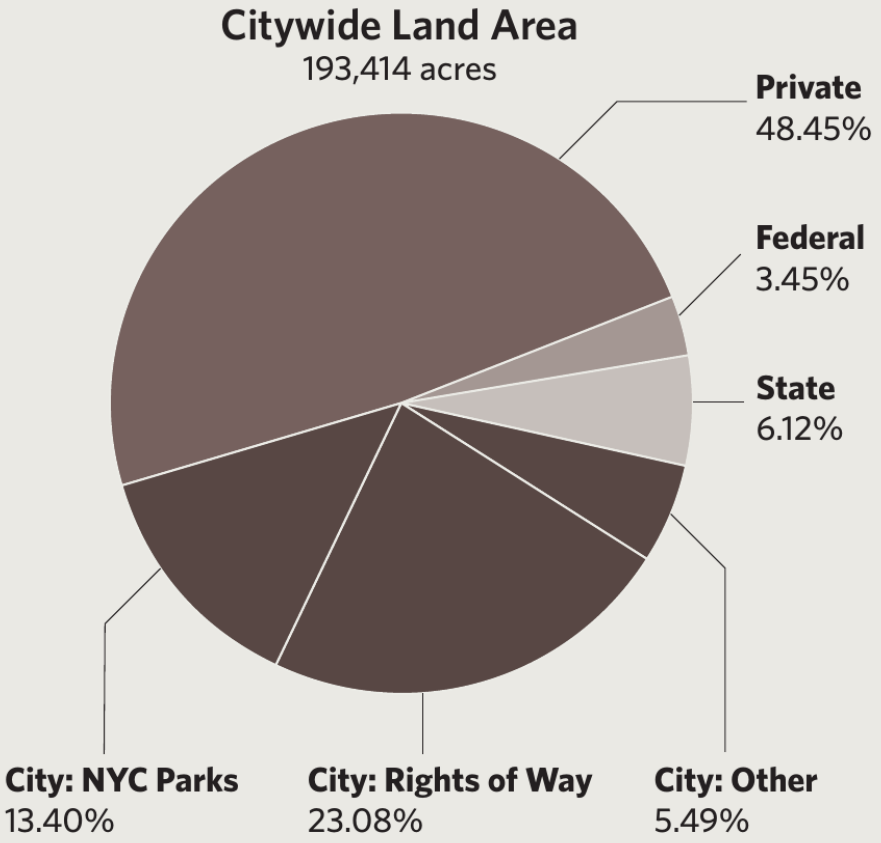


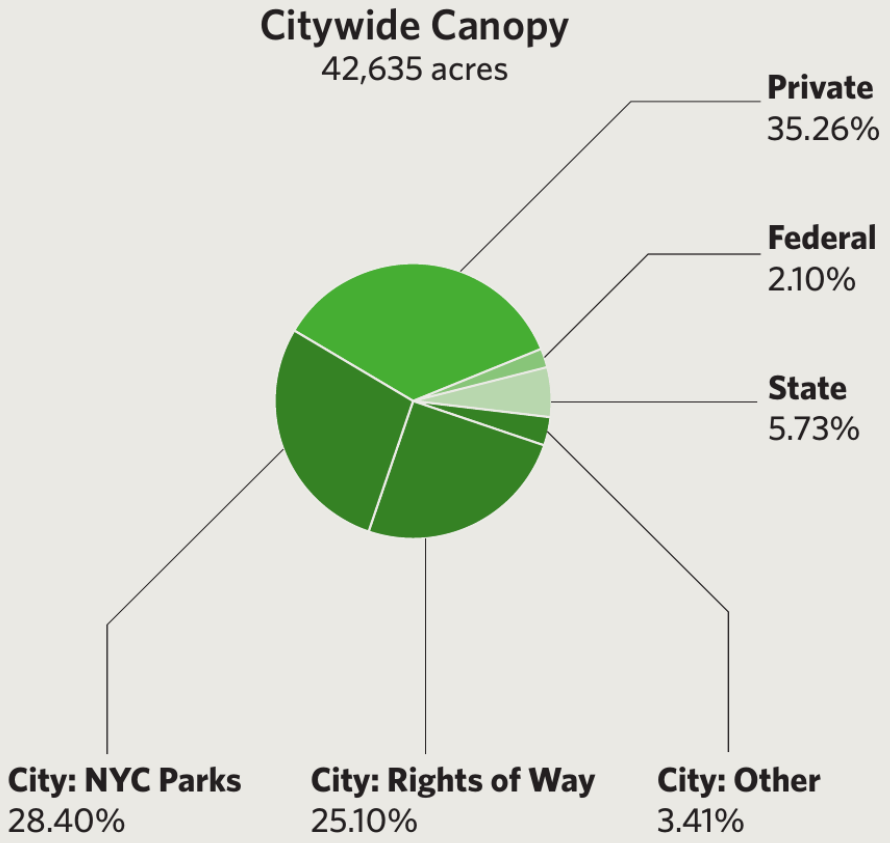
Neighborhood Tabulation Areas

Data sources: Percent Change in Canopy derived from 2017 Tree Canopy Change (2010–2017) data (NYC Department of Information Technology and Telecommunications); Administrative Boundaries from NYC Department of City Planning

Jurisdiction of Land and Tree Canopy

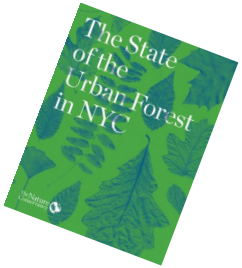




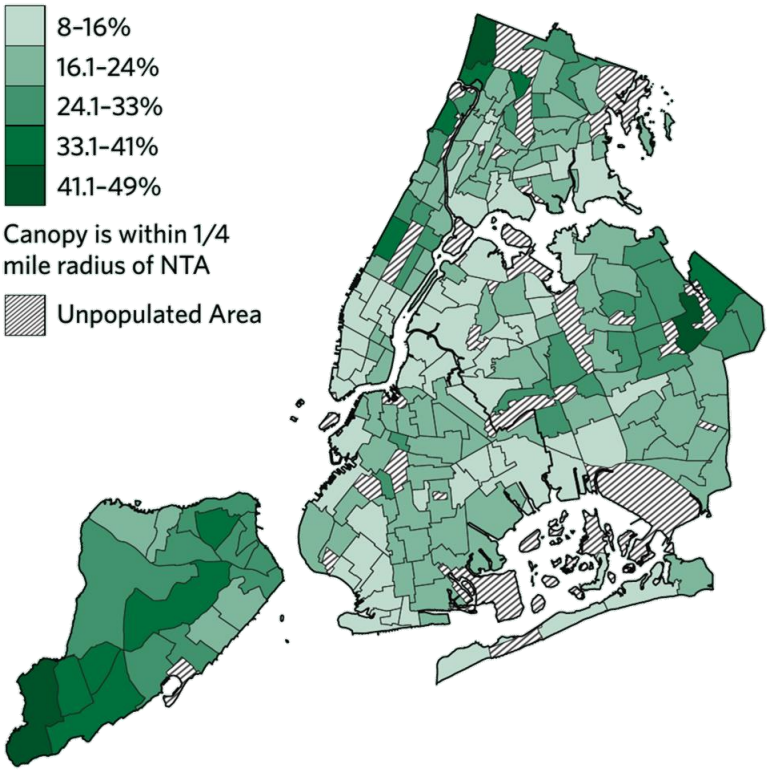


Data sources: Land Area derived from NYC parcel data MapPLUTO 20v6 (NYC Department of City Planning) and agency- or entity-specific datasets where available; Canopy metrics derived from 2017 Tree Canopy Change (2010–2017) data (NYC Department of Information Technology and Telecommunications)

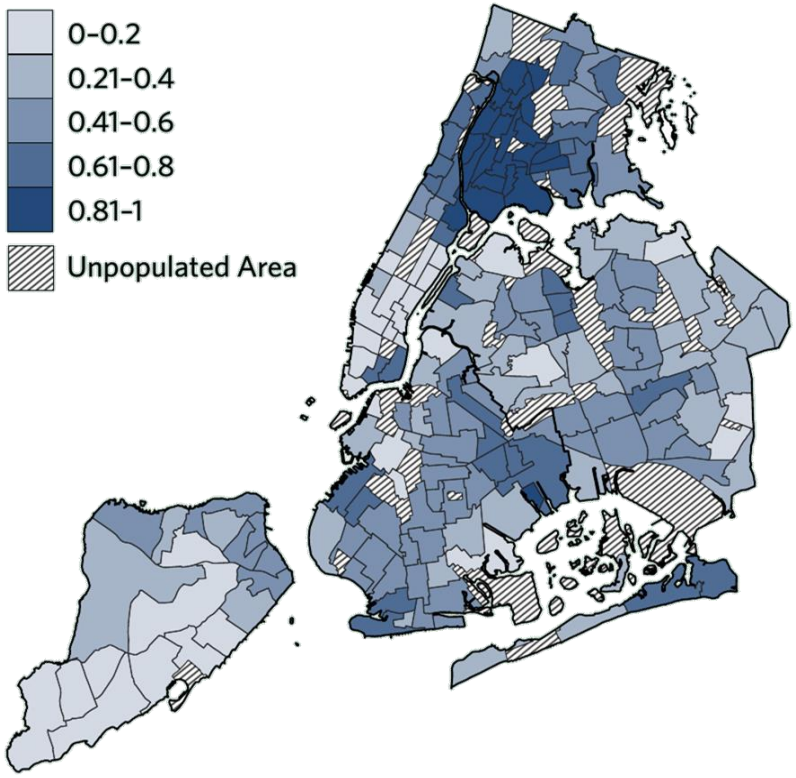
Unequal Distribution

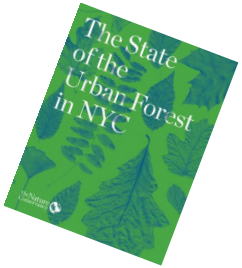


Tree Canopy



Social Vulnerability Index





Strengths

- A healthy and expanding forest with many kinds of trees
- Diverse people and institutions steward the urban forest
- Strong NYC Parks leadership
- Expansion opportunities


Photo by iStock.com/Terraxplorer

Challenges

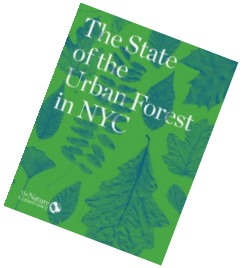


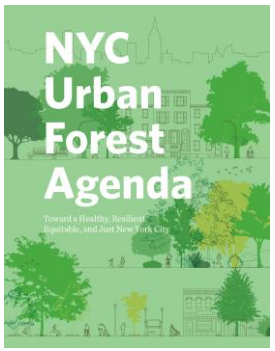

Photo by NYC Department of Parks and Recreation

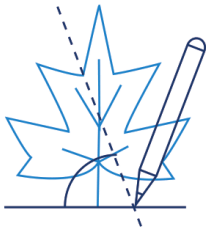
- Inequitable distribution of urban forest
- Patchwork of policies
- Insufficient and insecure funding
- Limited knowledge of NYC residents' attitudes
- Climate change
- Pests and diseases

Forest For All NYC: The Vision

- A healthy, biodiverse, robust, accessible, well-understood and resilient urban forest that *justly and equitably* delivers its multiple benefits to *all* NYC residents.
- *Protect, maintain, use, monitor, understand, promote, and expand the New York City urban forest*
- A *diverse and inclusive* coalition
- New York City expands its role as a *leader in urban forestry*

Credit: Tami Lin-Moges





Plan

Plan for the future of the NYC urban forest by adopting a coordinated, long-term vision for the protection and care of the urban forest and equitable distribution of its benefits.

ACTIONS:

- **1.1** Achieve 30% Canopy Cover by 2035
- **1.2** Support Development of Community-Scale Urban Forest Plans and Goals
- **1.3** Establish a Master Plan for the Urban Forest

Invest

Invest in the people, essential social infrastructure, and reliable funding sources that are critical to the long-term care and protection of the urban forest.

ACTIONS:

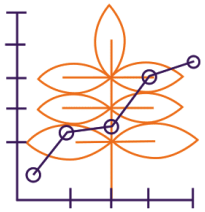
- **2.1** Grow and Sustain the Forest for All NYC Coalition
- **2.2** Cultivate Urban Forest Careers
- **2.3** Increase and Equitably Distribute Funding for Urban Forestry Projects

Manage

Manage our urban forest through its life cycle on public and private lands to increase its growth and resilience.

ACTIONS:

- **3.1** Strengthen Tree Regulations and Establish Incentive Programs
- **3.2** Set Tree Planting and Management Standards
- **3.3** Develop Conditions to Transform Wood Waste into a Sustainable Local Resource



Learn

Learn more about the NYC urban forest through research and monitoring, develop better practices related to forest management, and deepen the public's connection to the forest.

ACTIONS:

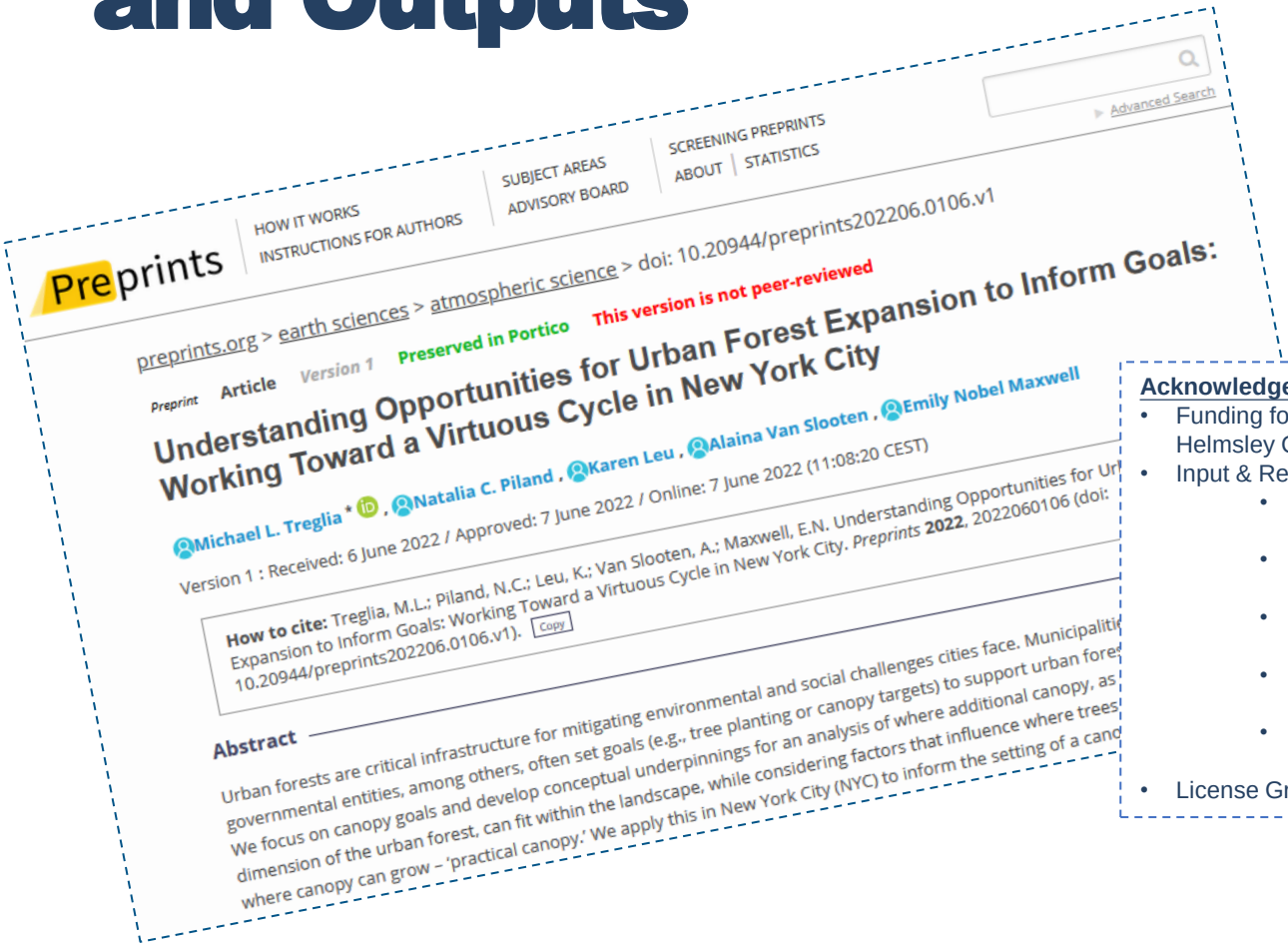
- **4.1** Create an Urban Forestry Research and Monitoring Agenda
- **4.2** Establish Citywide Educational and Tree Stewardship Events
- **4.3** Monitor Urban Forest Environment and Health

Practical Canopy

An Approach to Answer:

How much canopy can a landscape have given current conditions?

Practical Canopy Contributors and Outputs



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Understanding Opportunities for Urban Forest Expansion to Inform Goals: Working Toward a Virtuous Cycle in New York City

Michael L. Treglia * , Natalia C. Piland , Karen Leu , Alaina Van Slooten , Emily Nobel Maxwell

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Abstract

Urban forests are critical infrastructure for mitigating environmental and social challenges cities face. Municipaliti governmental entities, among others, often set goals (e.g., tree planting or canopy targets) to support urban fores We focus on canopy goals and develop conceptual underpinnings for an analysis of where additional canopy, as dimension of the urban forest, can fit within the landscape, while considering factors that influence where trees where canopy can grow – 'practical canopy.' We apply this in New York City (NYC) to inform the setting of a canc

Acknowledgements

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  - Sarah Charlop-Powers, Crystal Crown, and Clara Pregitzer, Natural Areas Conservancy
  - Lindsay Campbell, J. Morgan Grove, Rich Hallett, and Dexter Locke, USDA Forest Service, Northern Research Station
  - Jarlath O'Neil-Dunne, University of Vermont/USDA Forest Service, Northern Research Station
  - Tami Lin-Moges and Kate Galbo, The Nature Conservancy, New York State Cities Program
- License Grants for Esri Software Provided by Esri to The Nature Conservancy.

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How much tree canopy can NYC sustain? Study explores question, opportunities.

Updated: Aug. 16, 2022, 11:46 a.m. | Published: Aug. 16, 2022, 6:30 a.m.

The northwest section of Staten Island with graphics indicating canopy as of 2017 (green) and available practical canopy (blue). (Courtesy of The Nature Conservancy)

By Joseph Ostapnik | jostapnik@siadvance.com

Preprint:
https://www.preprints.org/manuscript/202206.0106/v1
Dataset:
https://zenodo.org/record/6547492
Recent News Coverage:
https://www.silive.com/news/2022/08/how-much-tree-canopy-can-nyc-sustain-study-explores-question-opportunities.html

Practical Canopy: Main Takeaways

- Practical canopy, **conceptually**, gives us an idea of where new trees could be planted and how much new canopy could be added if nothing about the underlying landscape changed
- It gives us **a method** to make the implicit assumptions about the landscape explicit with partners
- It **informs** the goals that align our support of the urban forest with explicit principles such as equity
- It becomes a **conversation starter and supports additional tools** for more specific, local decisions about tree planting, maintenance, and protection

Practical Canopy as a Method

The Nature Conservancy

Photo credit: Diane Cook and Len Jenshel

Spatial Opportunities and Priorities for Urban Forest Expansion

Existing Approach: The 3 P's*

- **Possible Canopy**
  - Where is it biophysically *feasible*?
- **Potential Canopy**
  - Where is it economically *likely*?
- **Preferable Canopy**
  - Where is it socially *desirable*?

*Raciti, S., Galvin, M., Grove, J. M., O'Neil-Dunne, J., Todd, A., & Clagett, S. (2006). Urban tree canopy goal setting: A guide for Chesapeake Bay communities. *United States Department of Agriculture, Forest Service, Northeastern State & Private Forestry, Chesapeake Bay Program Office, Annapolis, Md.*

Spatial Opportunities and Priorities for Urban Forest Expansion

Our Approach - Building on the 3 P's:

- **Practical Canopy**
  - For mapping where canopy *can likely go* based on land use and land cover constraints
    - Incorporates local data
    - Can incorporate values or preferences of land managers

Spatial Opportunities and Priorities for Urban Forest Expansion

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- **Priority Canopy**
  - For understanding where canopy is desired or needed
    - Accounts for needed services, community preferences, and equity considerations

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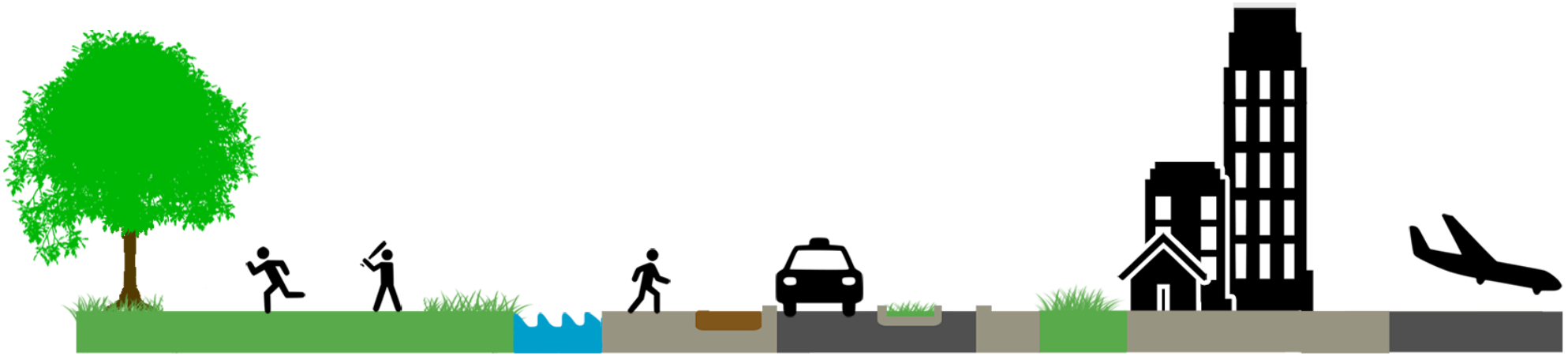
The Concept of Practical Canopy



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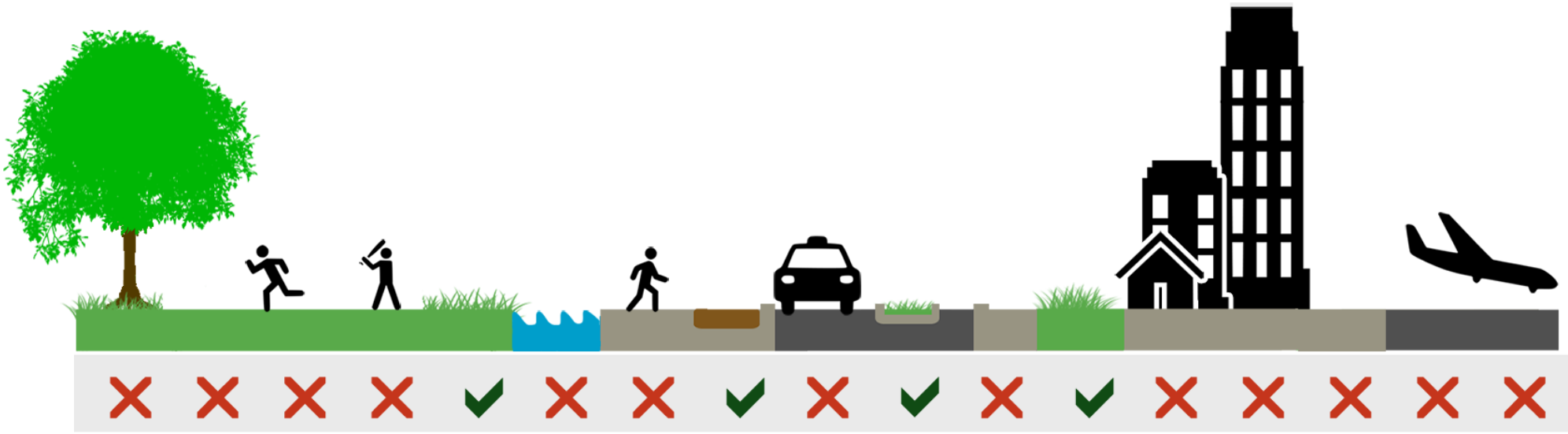
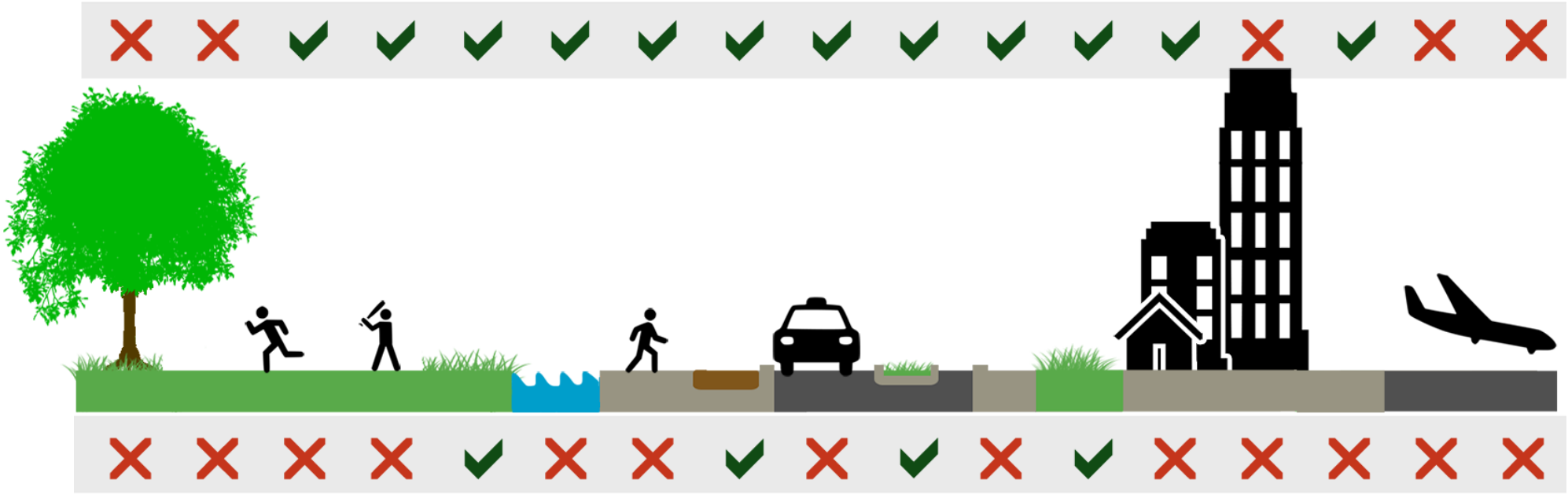


Can you plant a tree?

The Concept of Practical Canopy

Can canopy grow?



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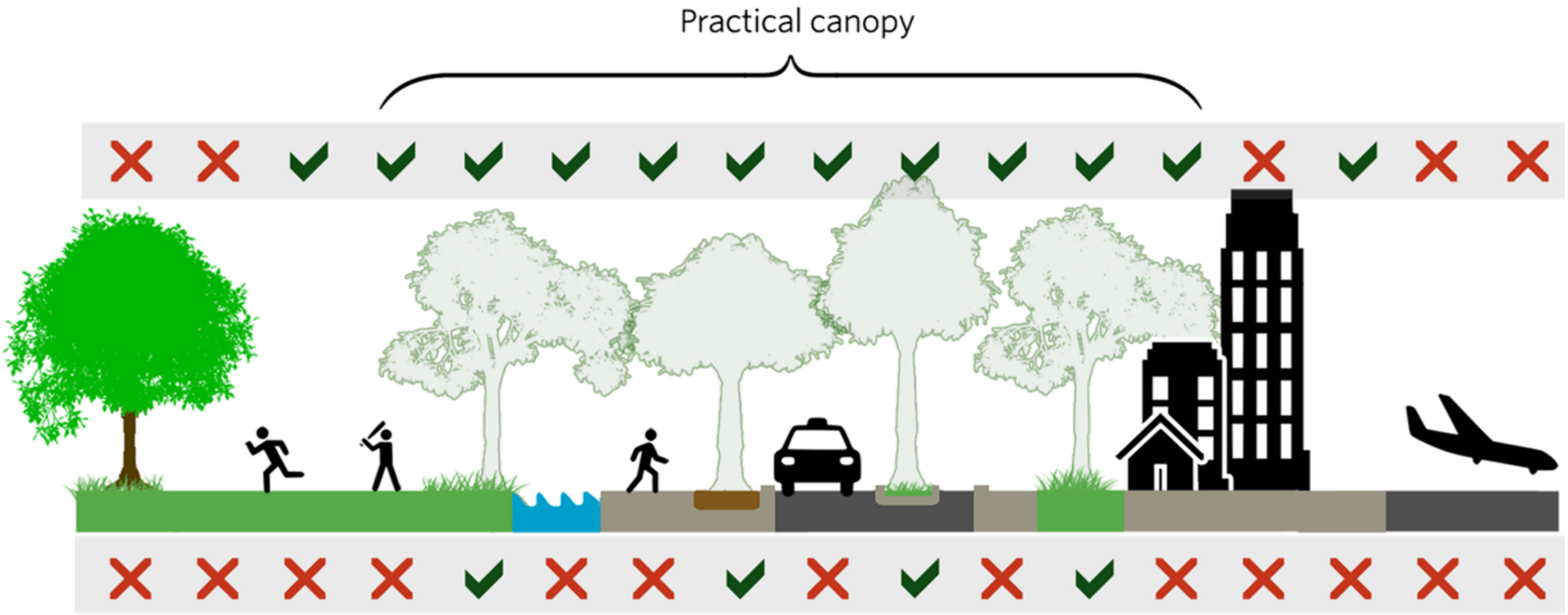


Strengths & Limits of our Analysis

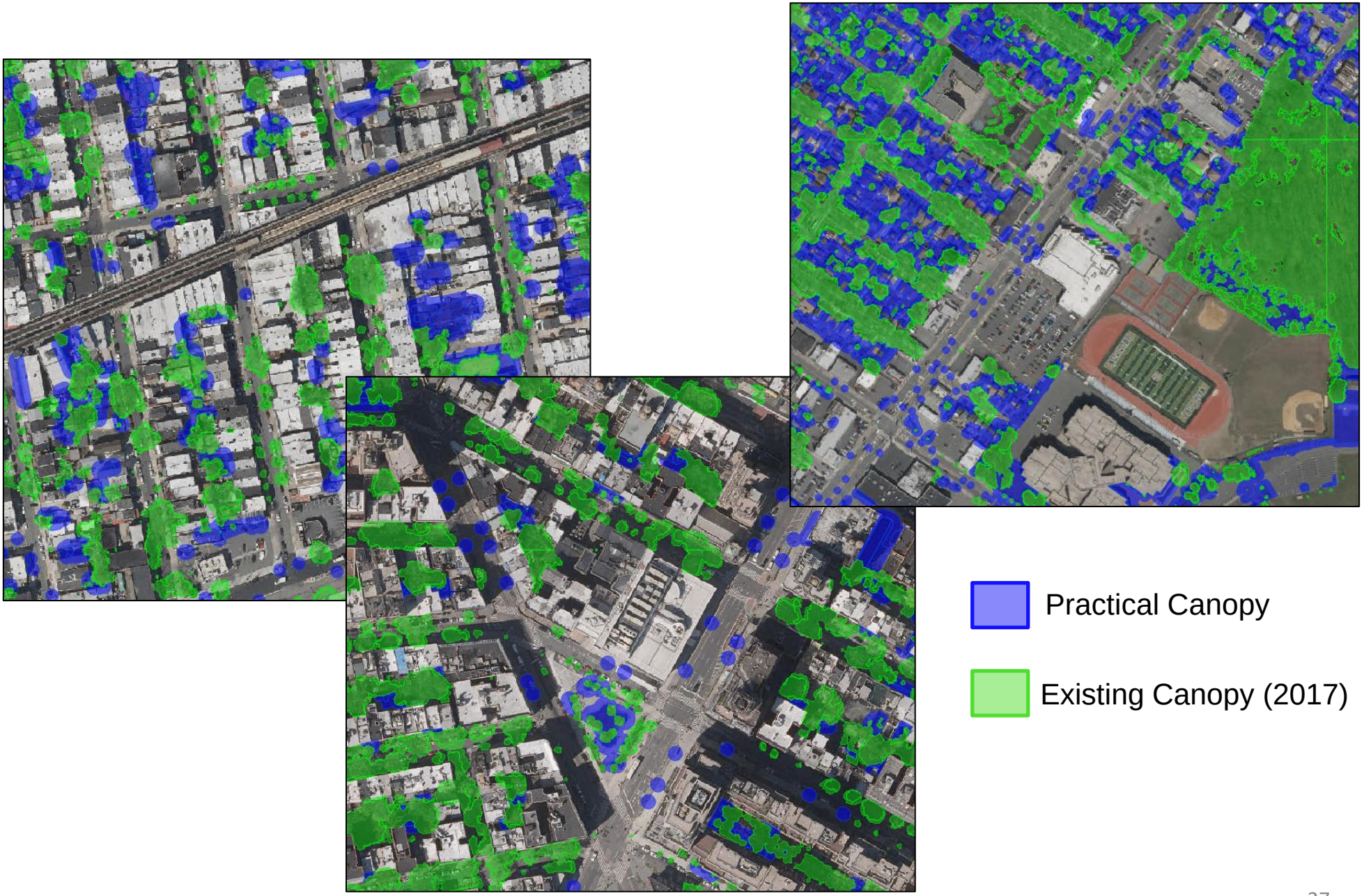
What Practical Canopy Does Well

- Incorporate canopy opportunity over short buildings & roads
- Incorporate knowledge about land use
- Yields informed estimates of opportunity for new tree plantings and their growth
- Grounds conversations about where these new tree plantings can go

What Practical Canopy Does Not Do Well

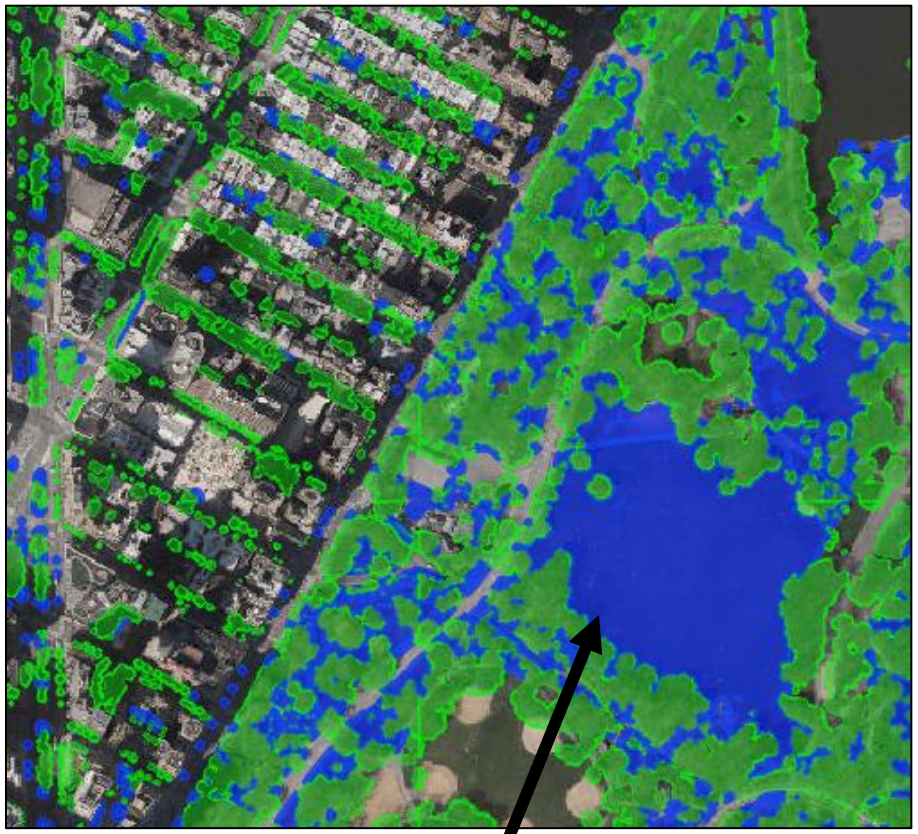
- Incorporate variables lacking data (e.g., underground infrastructure)
- Give information through time
- Tell you exactly what it would look like on the ground based on local perspectives

Some Examples



Examples of Data Limits

Infield of Kissena Velodrome
(Kissena Park, Queens)



Practical Canopy

Existing Canopy (2017)

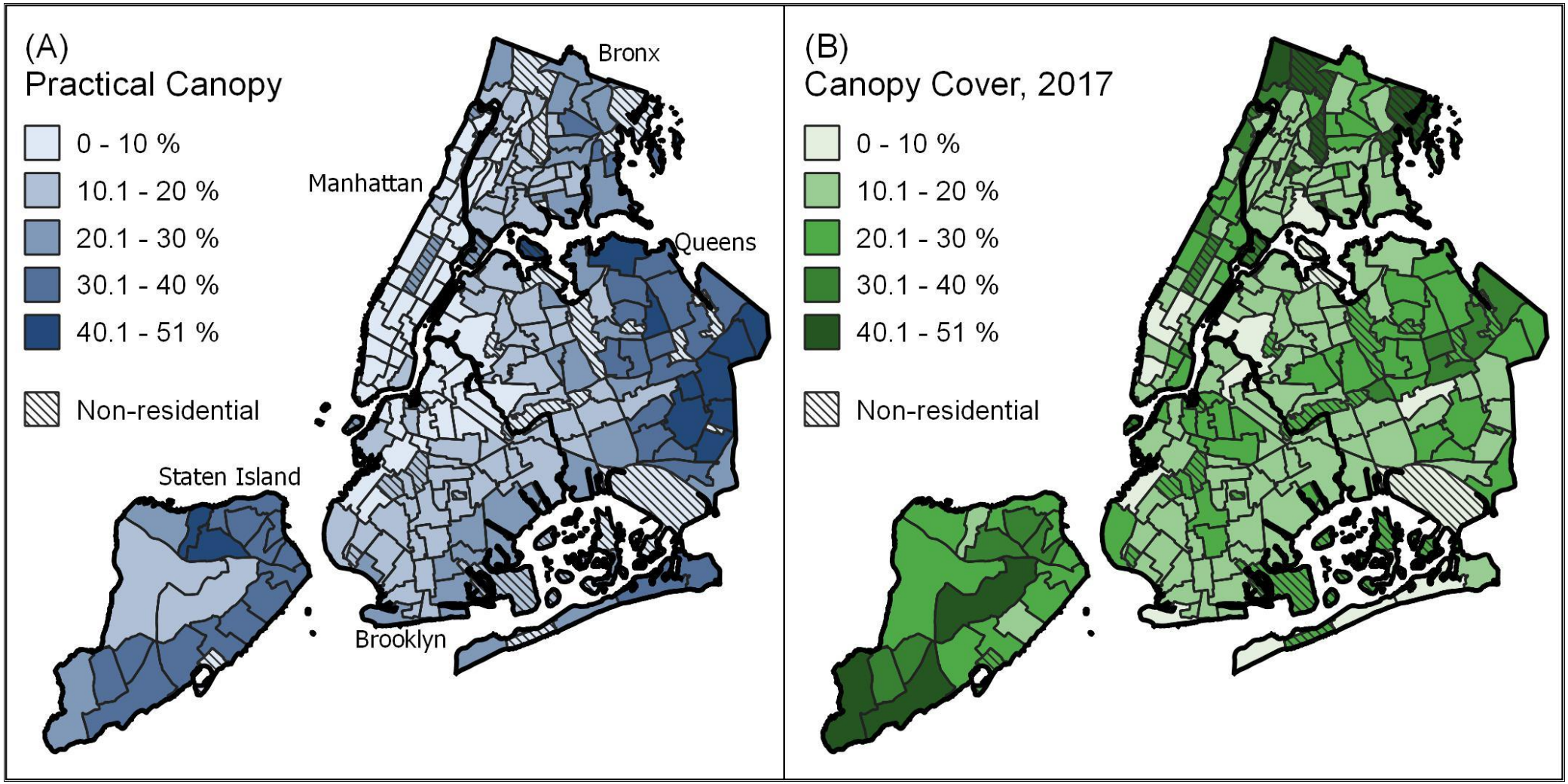
Sheep Meadow
(Central Park, Manhattan)

Practical Canopy Results Informed the Goal

The Nature Conservancy

Photo credit: Diane Cook and Len Jenshel

High-Level Results: Opportunities in NYC



High-Level Results:

- There is practical canopy in all neighborhoods (Neighborhood Tabulation Areas)
- Most practical canopy is on private property
- Expanding canopy only in areas of practical canopy could exacerbate inequities
- Total Practical Canopy: 39,287 Acres
  - 20.3% of Land Area
- Practical + Existing Canopy = ~40% canopy cover citywide

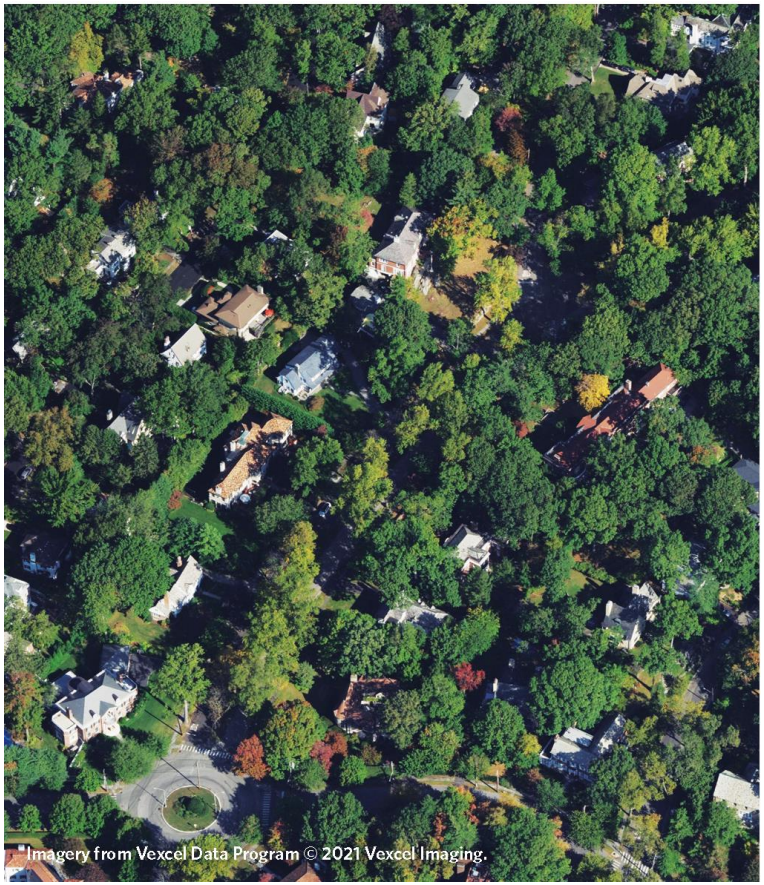


Photo credit: Diane Cook and Len Jenshel

Why 30%x'35?

- Visionary and Achievable
- **Informed by Data and Analysis**
- "Reasonable" Time Horizon
- Easy to Talk About

Photo credit: Diane Cook and Len Jenshel

What will it take to get to 30x35

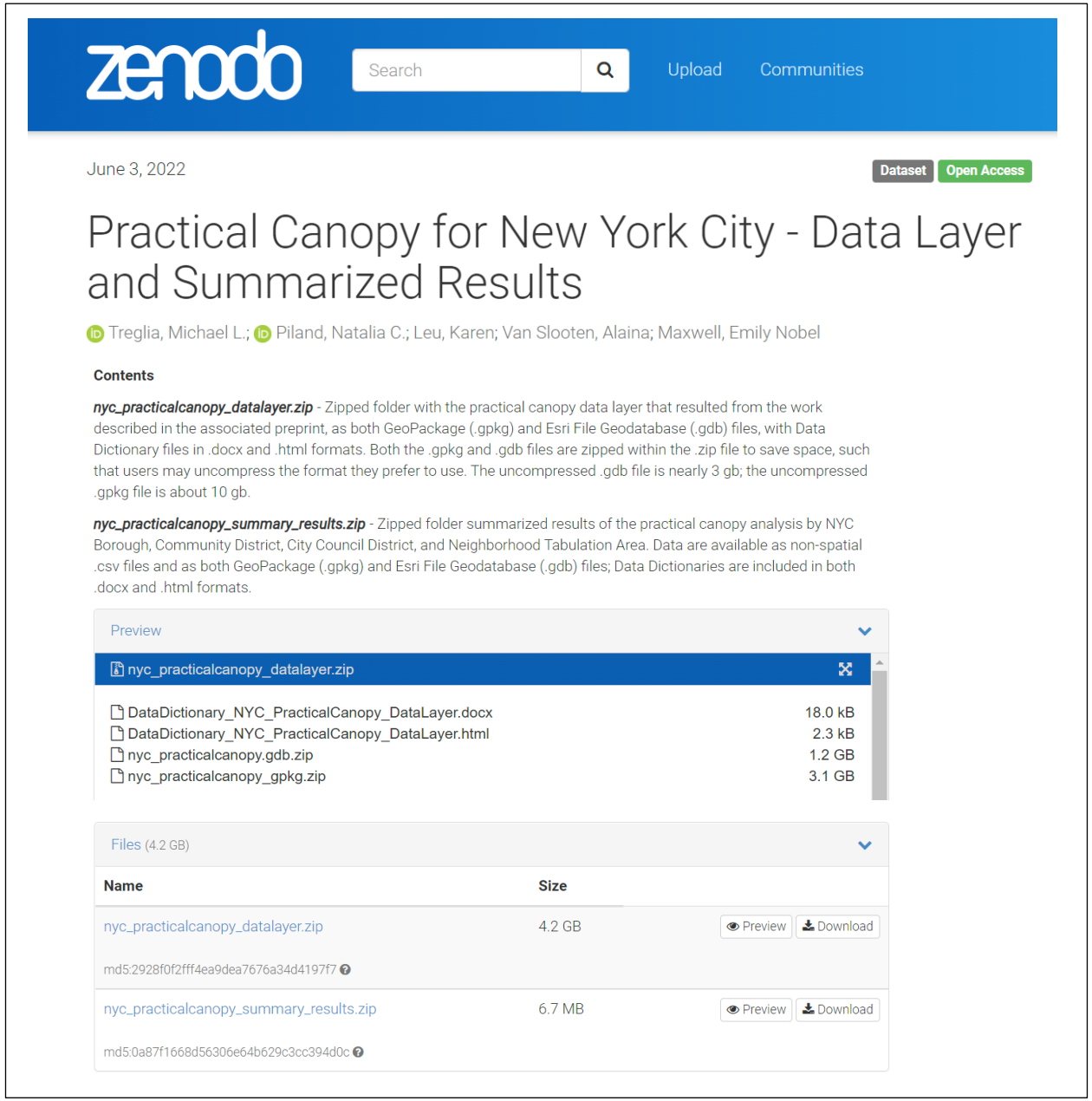
- Protection of existing urban forest
- Management, maintenance, and stewardship of existing trees
- New plantings and expansion of trees across all jurisdictions
- A heavy focus on both protecting and planting new canopy on private property

Practical Canopy as a Conversation Starter for Implementation

The Nature Conservancy

Photo credit: Diane Cook and Len Jenshel

Results as Open Data

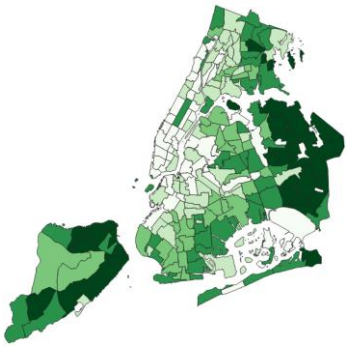


https://zenodo.org/record/6547492

Datasets: What They Look Like

Full Spatial Data

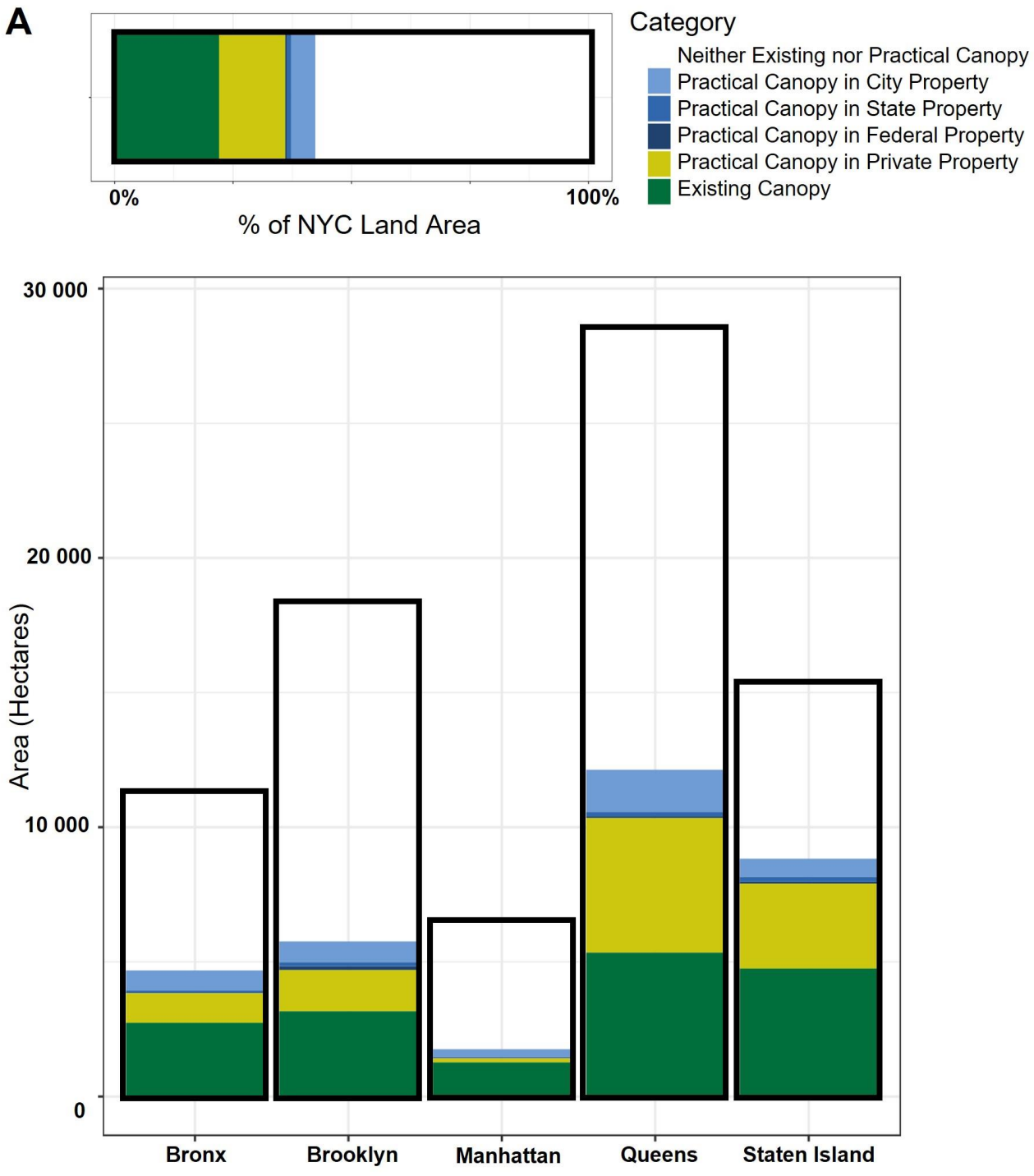
- Polygons denoted as Plantable Areas or Canopy Growth

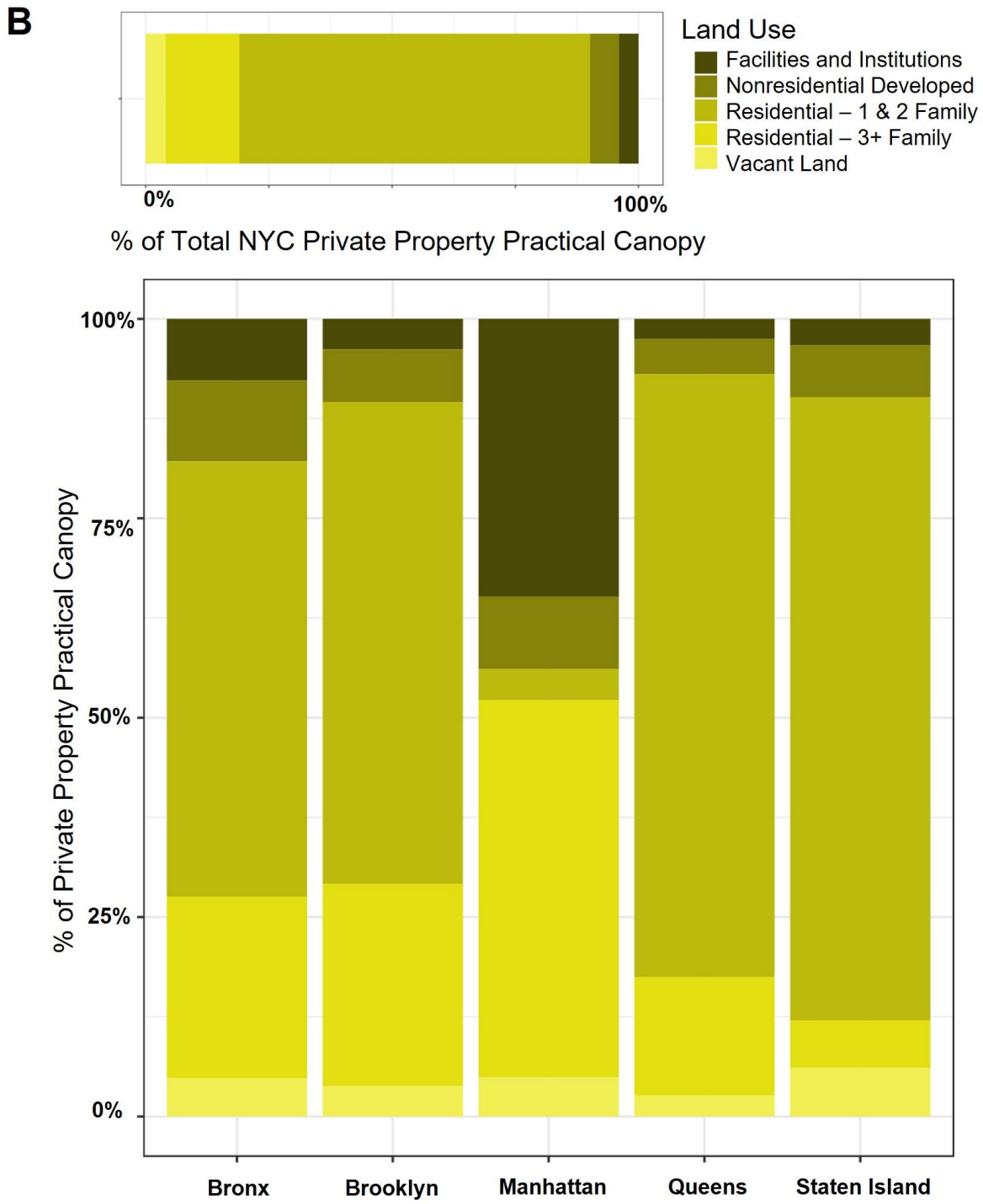


Summarized Data by Geographic Units

- Spatial and Tabular Data
- Information on:
  - Jurisdiction
  - Existing & Practical Canopy

ntaname	boroname	land_area_acres	canopy_2017_acres	canopy_2017_percent	practcanopy_total_acres	practcanopy_total_percent	practcanopy_source_plantable_acres	practcanopy_source_grown_acres	practcanopy_source_streettree_acres
Brooklyn Heigh	Brooklyn	229.19388	55.67932	24.29354	16.81528	7.33583	6.25537	8.01629	2.54162
Sheepshead Bi	Brooklyn	1454.1234	251.03534	17.26369	344.36017	23.68163	89.92667	211.54653	42.88696
Brighton Beach	Brooklyn	394.39916	47.48947	12.04097	61.54119	15.60378	14.15633	35.32408	12.06078
Seagate-Coney	Brooklyn	890.31314	71.73927	8.05776	198.02493	22.24217	85.92392	100.67426	11.42675
West Brighton	Brooklyn	200.61762	30.48566	15.19591	37.07014	18.47801	17.42794	17.33691	2.30529
Homecrest	Brooklyn	688.52084	112.54281	16.34559	115.71347	16.8061	20.35494	83.65993	11.6986
Gravesend	Brooklyn	719.50989	109.10509	15.16381	129.63598	18.01726	50.60886	64.17638	14.85075
Bath Beach	Brooklyn	471.41888	64.08138	13.5933	100.44377	21.30669	29.12046	60.15975	11.16356
Bensonhurst W	Brooklyn	1071.40886	122.50796	11.43429	155.42776	14.50686	22.63853	106.86125	25.92797
Bensonhurst E	Brooklyn	821.54684	95.32478	11.60591	120.98759	14.73039	20.4336	81.8185	18.7355
Dyker Heights	Brooklyn	686.83847	103.47349	15.06519	133.07987	19.37572	24.1003	95.14619	13.83338
Bay Ridge	Brooklyn	1542.08506	332.27522	21.54714	295.77334	19.18009	112.47601	167.17931	16.11801
Sunset Park We	Brooklyn	1147.61053	89.76127	7.82158	81.21038	7.07648	22.82024	42.48755	15.90259
Carroll Garden	Brooklyn	1023.91006	144.78832	14.14073	102.95489	10.05507	35.25918	55.03861	12.6571
Sunset Park Ea	Brooklyn	622.36341	92.53028	14.86757	55.57198	8.92919	15.2283	32.72818	7.6155
Stuyvesant Hei	Brooklyn	721.00403	168.32884	23.34645	70.02576	9.71226	18.12039	42.56023	9.34513
Park Slope-Gov	Brooklyn	975.87365	193.79185	19.85829	76.67395	7.85695	18.32878	49.07993	9.26523
DUMBO-Vinegz	Brooklyn	653.76108	125.834	19.24771	53.9313	8.24939	19.32064	22.60836	12.0023
Windsor Terra	Brooklyn	322.35372	76.44137	23.71351	48.34212	14.99661	11.83497	33.08629	3.42087
Kensington-Oc	Brooklyn	364.86008	69.15218	18.95307	55.42937	15.19195	10.61931	39.06402	5.74604
Flatbush	Brooklyn	1038.90744	265.56467	25.56192	153.02303	14.72923	39.87527	97.52445	15.62331
Midwood	Brooklyn	821.84516	193.11649	23.49792	145.78067	17.73822	27.89075	108.48132	9.4086
Madison	Brooklyn	628.53907	118.1426	18.79638	129.24102	20.56213	23.34737	97.44122	8.45242
Georgetown-M	Brooklyn	1594.67213	298.7544	18.73453	388.82067	24.38248	95.05424	276.31257	17.45385
Ocean Parkway	Brooklyn	408.22073	77.03204	18.87019	61.20002	14.99189	12.37416	44.72568	4.10019
Canarsie	Brooklyn	1884.73089	364.71776	19.35118	415.69509	22.05594	114.64148	263.93109	37.12252
Flatlands	Brooklyn	1247.51552	237.82121	19.06359	278.44196	22.31972	51.11906	198.81839	28.50451
Prospect Lefferts	Brooklyn	726.32992	119.87435	16.50412	98.21342	13.65955	27.20553	60.36596	11.64193





Spatial Opportunities and Priorities for Urban Forest Expansion

Our Approach - Building on the 3 P's:

- **Practical Canopy**
  - For mapping where canopy *can likely go* based on land use and land cover constraints
    - Incorporates local data
    - Can incorporate values or preferences of land managers
- **Priority Canopy**
  - For understanding where canopy is desired or needed
    - Accounts for needed services, community preferences, and equity considerations

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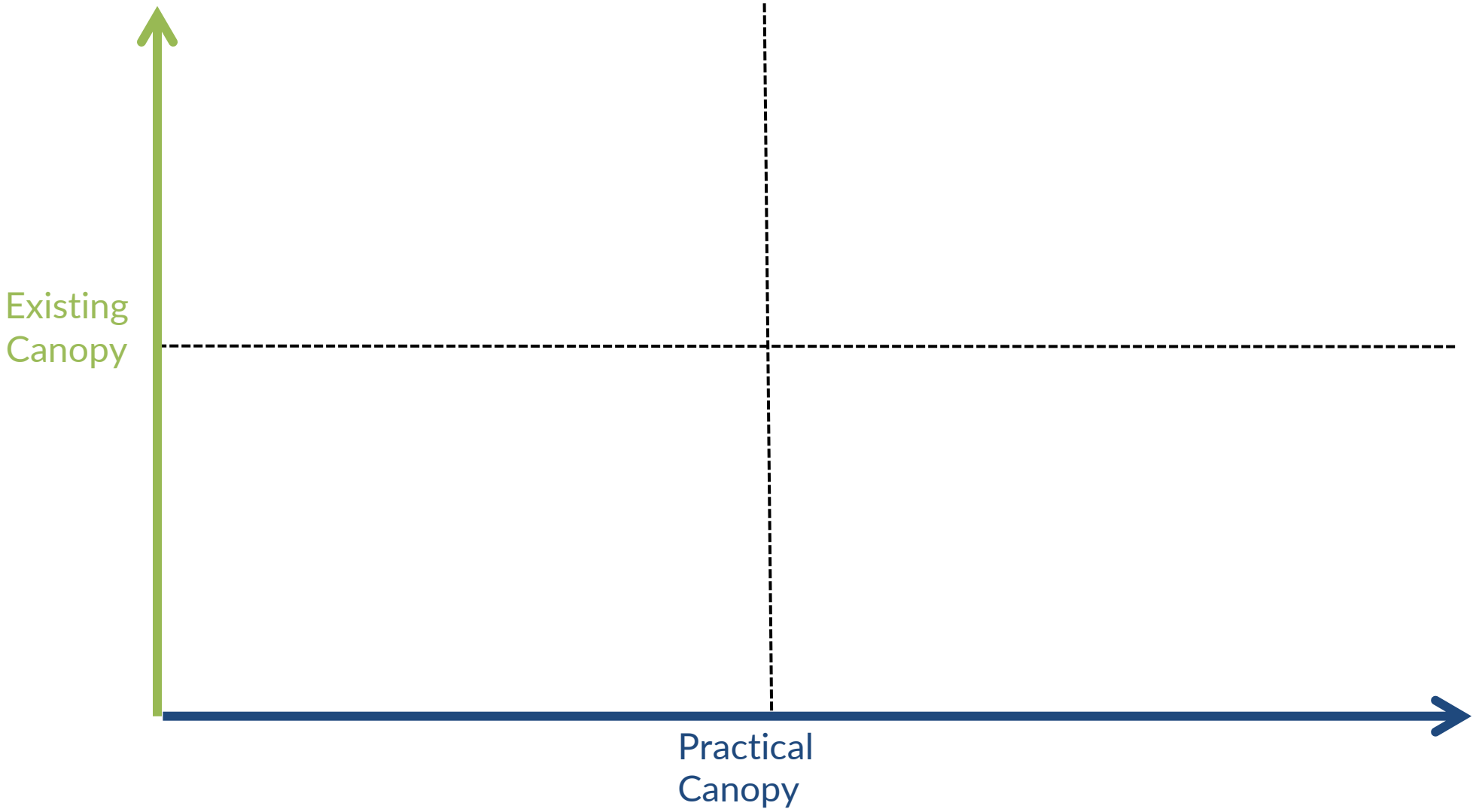
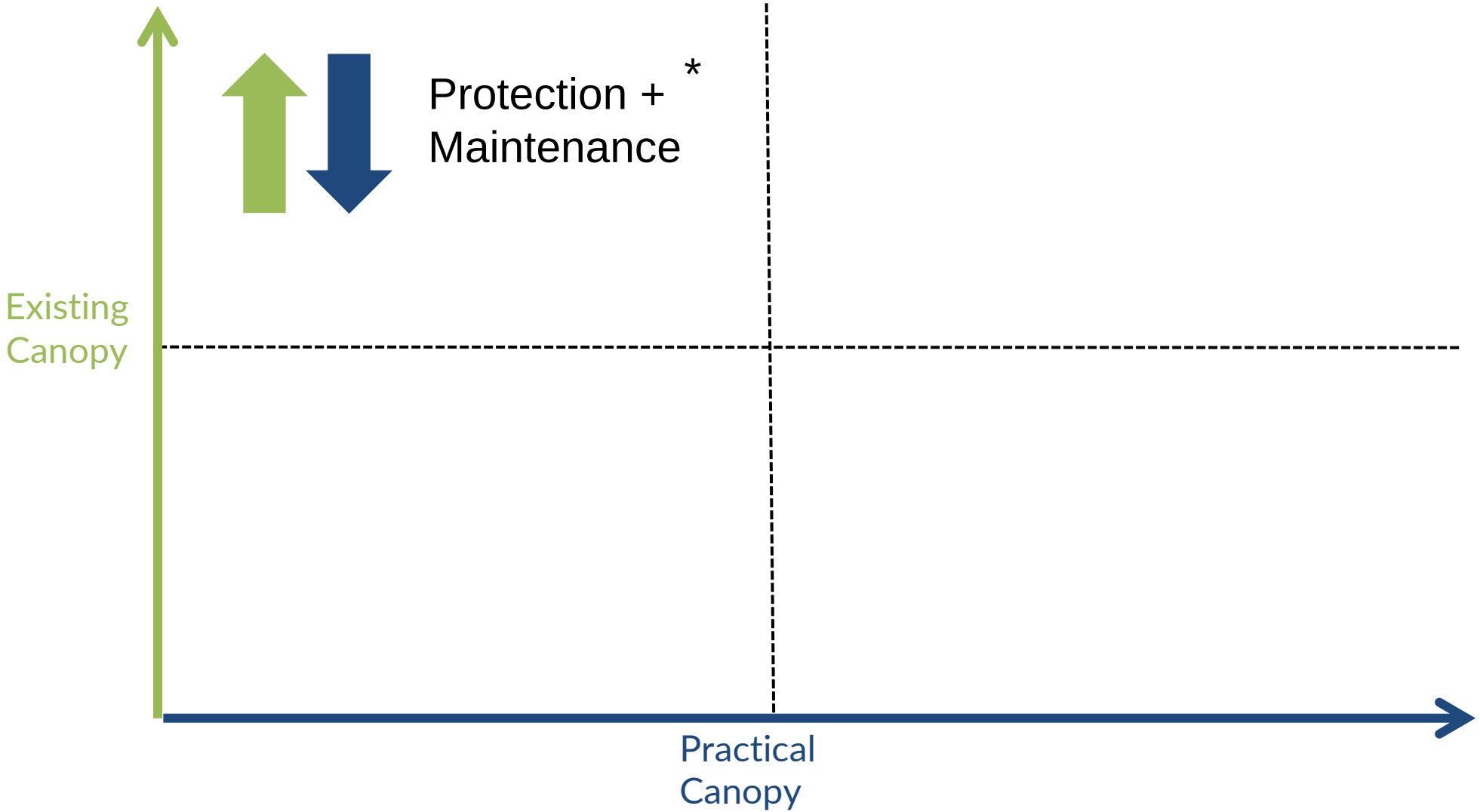
Practical canopy doesn't tell you what to do but it helps you start conversations towards priority canopy

Comparing Existing and Practical Canopy to Inform Strategies



Comparing Existing and Practical Canopy to Inform Key Strategies



* Protection + Maintenance/Stewardship are always important to maintain and grow the existing canopy

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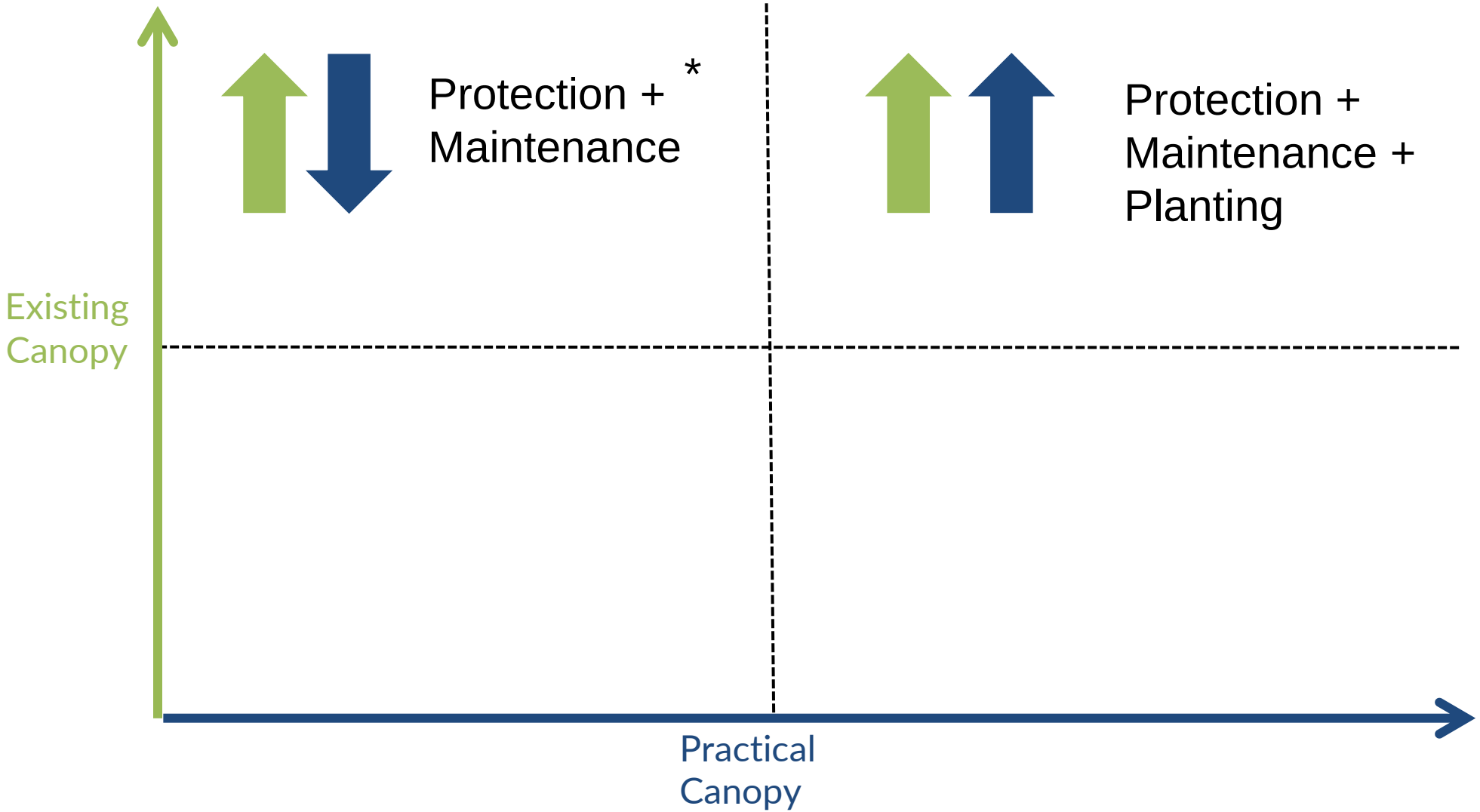

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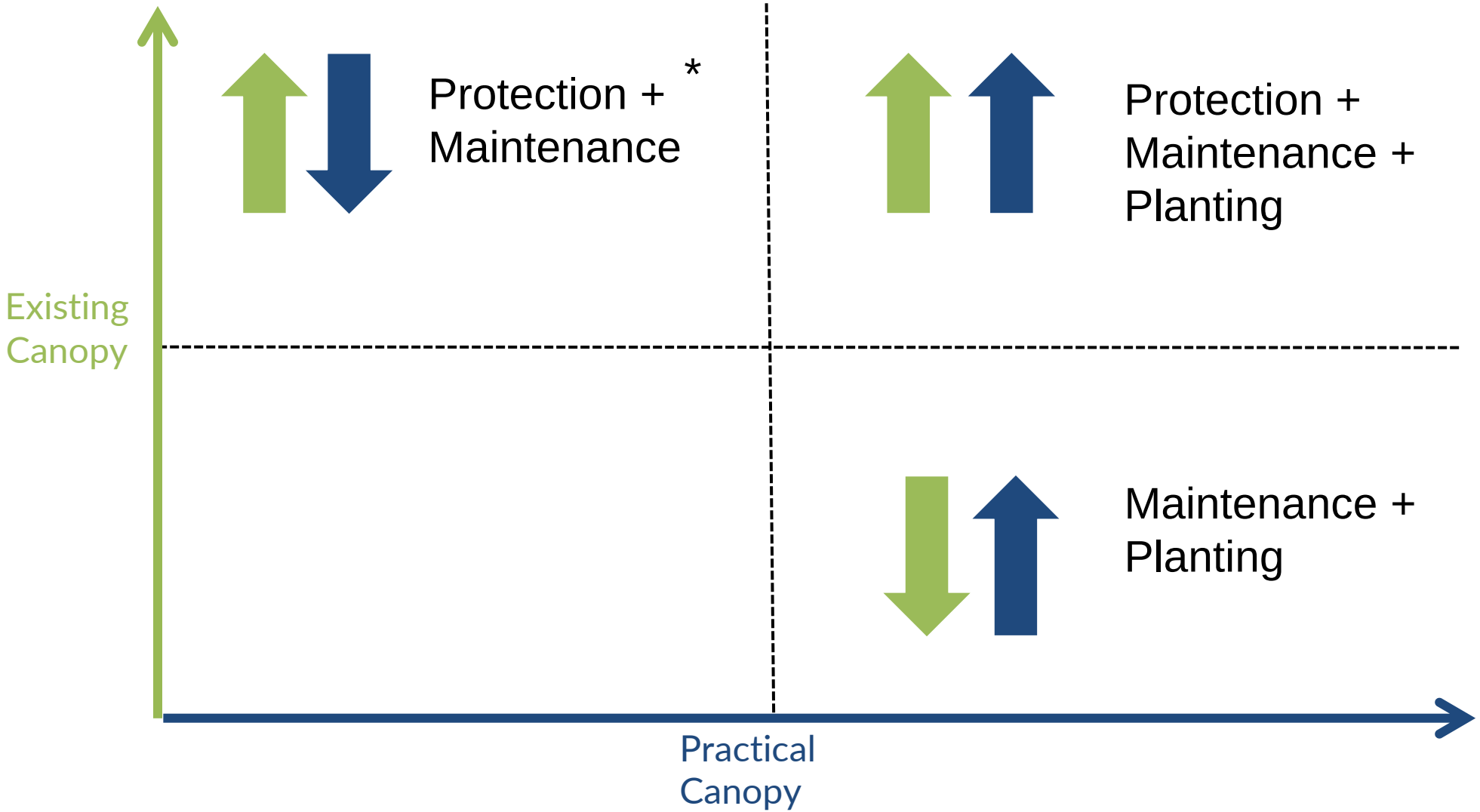

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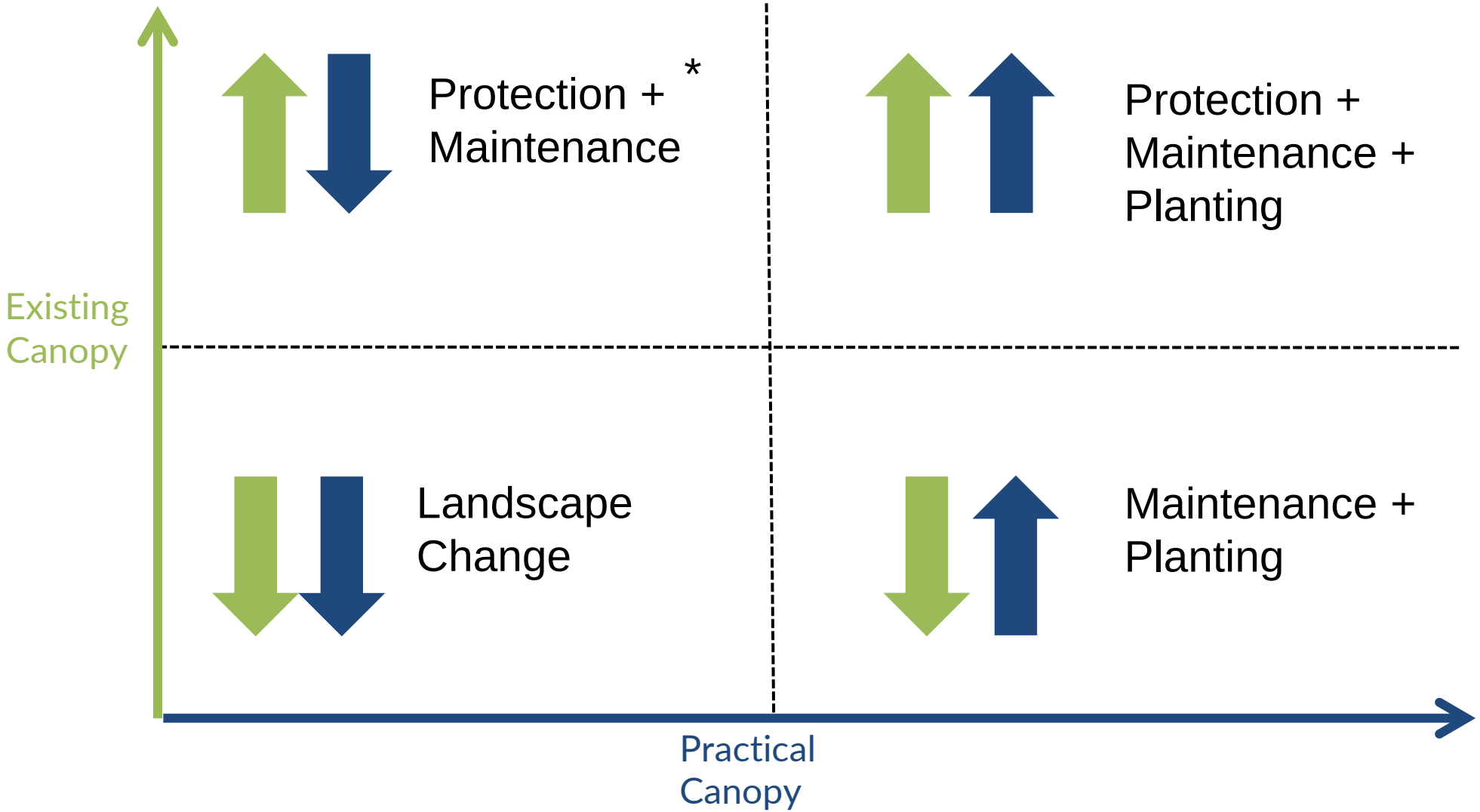

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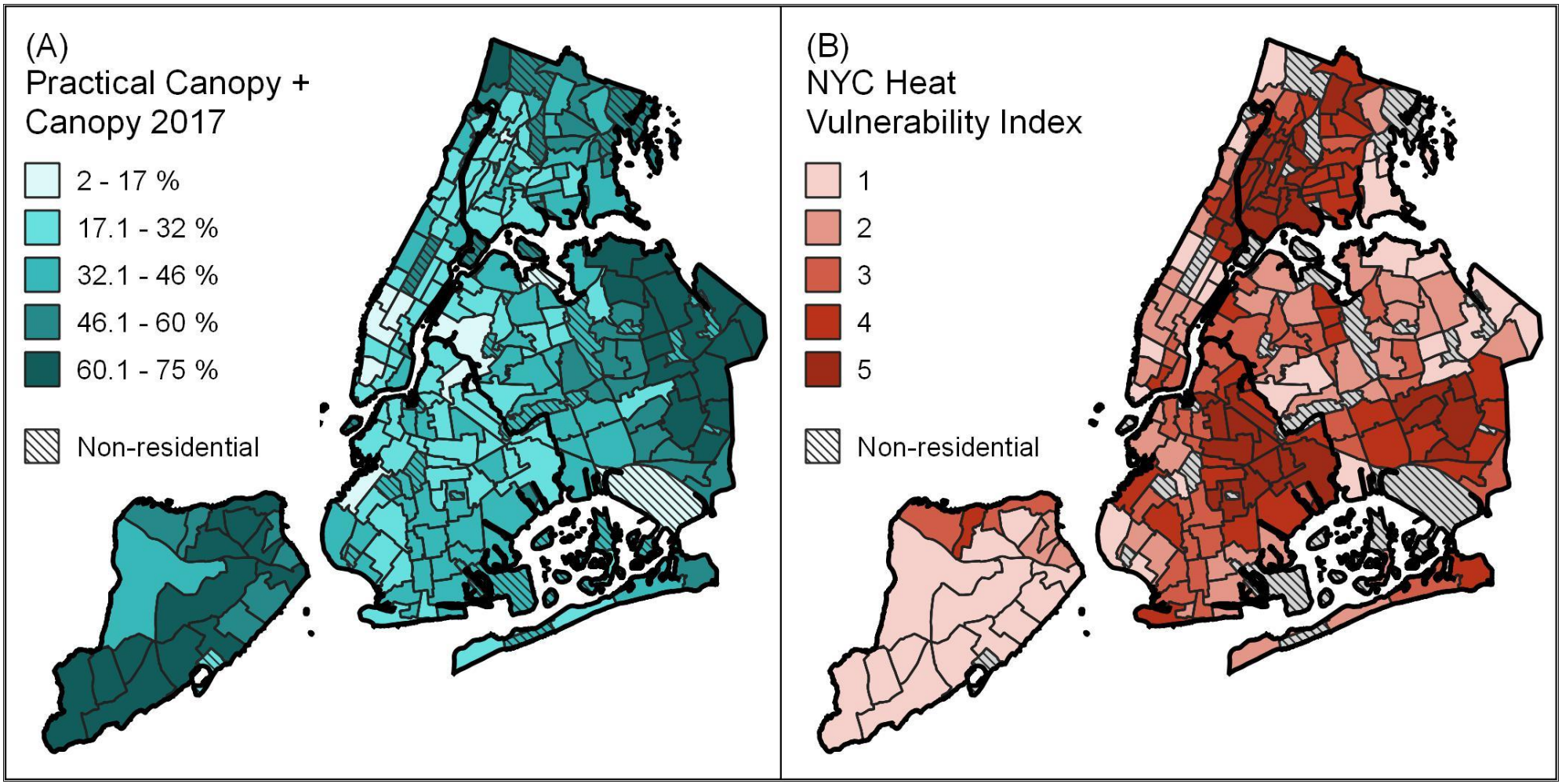
Bringing in Other Important Variables to Help Prioritize



Ongoing Work

Potential Products to Support Application

- **Data Interpretation Guide**
- **Community District or similar data guide**

We did it in NYC, and it could be done elsewhere….

- Practical canopy is a **concept** that can be applied to understand where new trees could be planted, and canopy could grow if nothing about the landscape changed
- It gives us **a method** to make the implicit assumptions about the landscape explicit (for ex., should a tree grow over a baseball field?) with partners
- It **informs** the goals that align our support of the urban forest with explicit principles such as equity (e.g., why do we want to increase tree canopy cover?)
- It becomes a **conversation starter and supports additional tools** for more specific, local decisions about tree planting, maintenance, and protection

Thank you! Questions?

Contact: Michael.Treglia@tnc.org

Resources

- Practical Canopy Preprint: https://www.preprints.org/manuscript/202206.0106/v1
- Practical Canopy Supplementary Data: https://zenodo.org/record/6547492
- The State of the Urban Forest in NYC: https://www.nature.org/content/dam/tnc/nature/en/photos/TheStateoftheNYCUrbanForest.pdf
- NYC Urban Forest Agenda: https://forestforall.nyc/wp-content/uploads/2021/06/NYC-Urban-Forest-Agenda-.pdf
- Forest for All NYC Website: https://forestforall.nyc/