



Superstorm Sandy: Learn & Adapt

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NYC Parks & Recreation

Parks

Superstorm Sandy

October 29, 2012



Superstorm Sandy's Strength

- Storm surge was 13-14 feet above Mean Low Water
- Massive power and transportation suspensions
- Second-costliest storm in U.S. history (after Katrina)



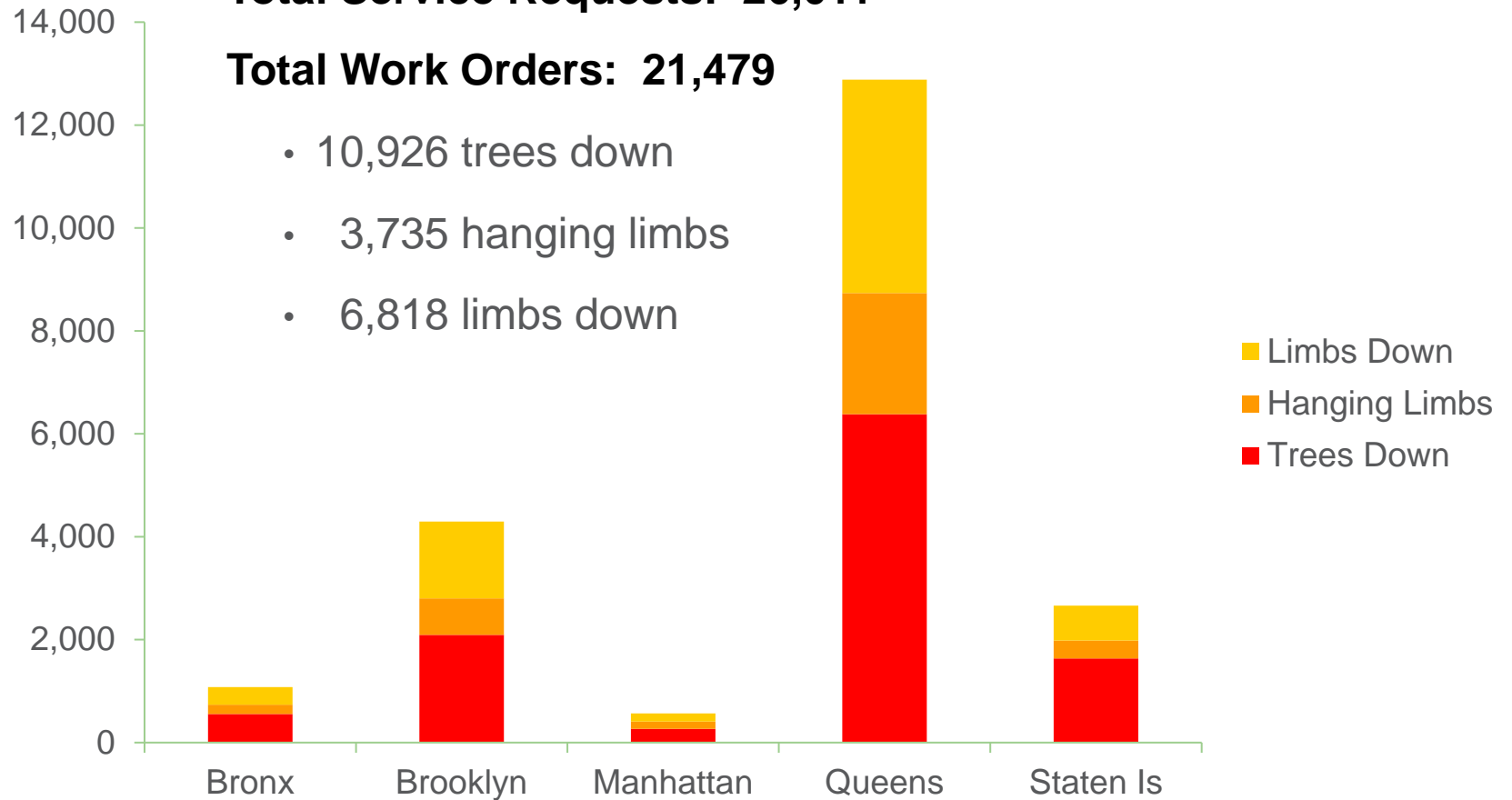
Sandy vs NYC Trees

47 Days of Activation

Total Service Requests: 26,011

Total Work Orders: 21,479

- 10,926 trees down
- 3,735 hanging limbs
- 6,818 limbs down

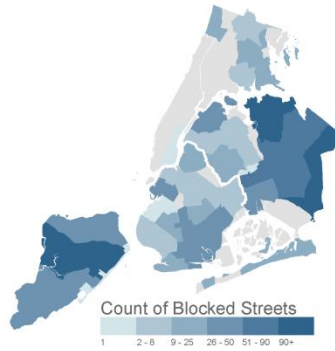
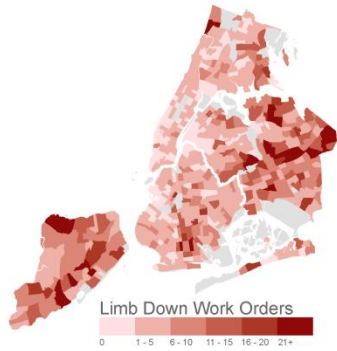
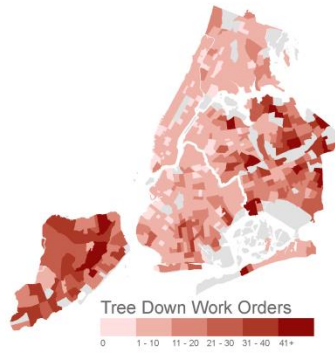
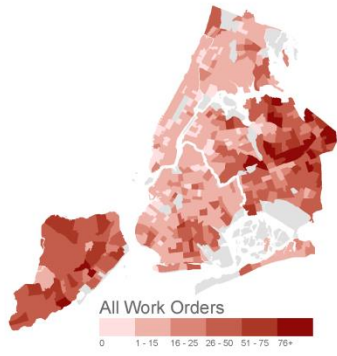


Damage - Aerial Salt Spray - Citywide



Work Orders and Blocked Streets Citywide

Duplicates Omitted.



Hurricane Sandy

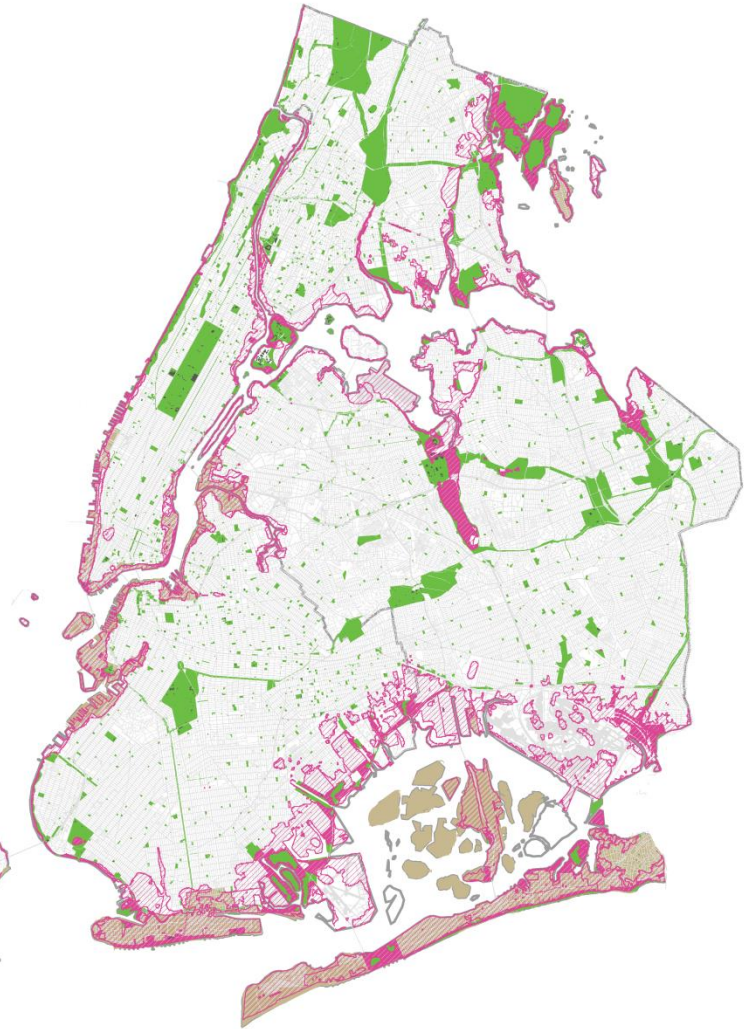
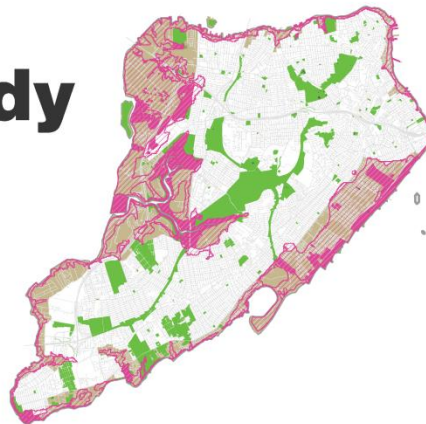
Work order data is drawn from the Forestry Management system for the period beginning on 10/29/2012 at 00:00 and ending 11/7/2012 at 12:00.

Blocked Streets data is from Sunday, November 4, after data from the Situational Awareness update was entered.

Evacuation zone data provided by NYC OEM.

Hindcast inundation areas data provided by FEMA.

Map prepared by Peter Tiso
Forestry, Horticulture, and Natural Resources GIS



Evacuation Zones and Inundated Areas



Damage – Late Leaf Out of Inundated Trees



London Plane With Salt Damage

The New York Times

Bare Trees Are a Lingering Sign of Hurricane Sandy's High Toll



Todd Heisler/The New York Times

A branch on the Lower East Side should have many more leaves at this time of year.

By **KIA GREGORY**

Published: August 18, 2013



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Post-Sandy Late Leaf Out Survey

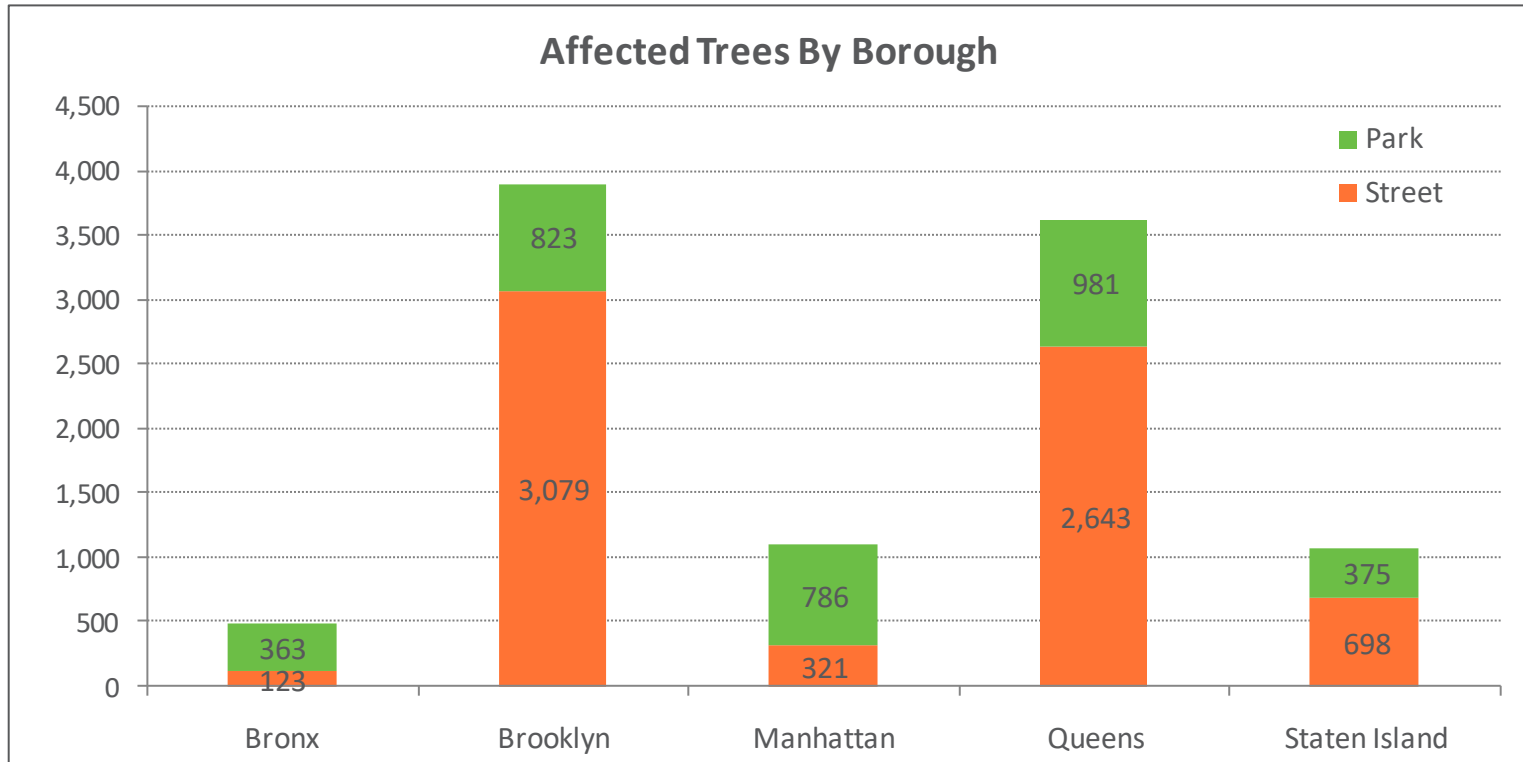
Affected Street Trees Compared to Street Tree Population in the Inundation Zone

Borough	Inundated Street Trees	Affected Street Trees	% Street Trees Affected
Bronx	749	123	16%
Brooklyn	17,414	3,079	18%
Manhattan	3,203	321	10%
Queens	18,084	2,643	15%
Staten Island	8,450	698	8%
Citywide Total	47,900	6,864	14%

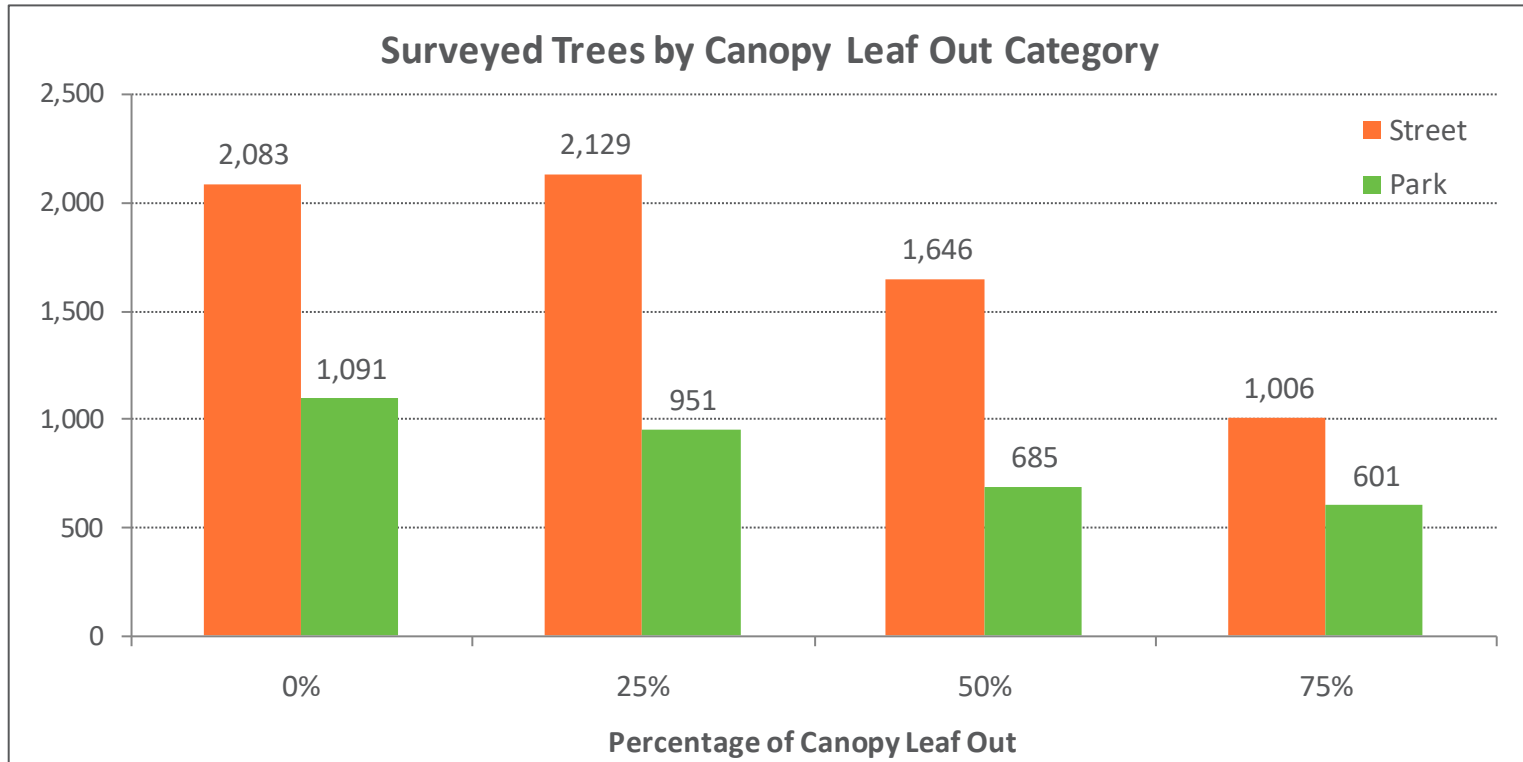
* estimated number of street trees within FEMA's Sandy inundation hindcast



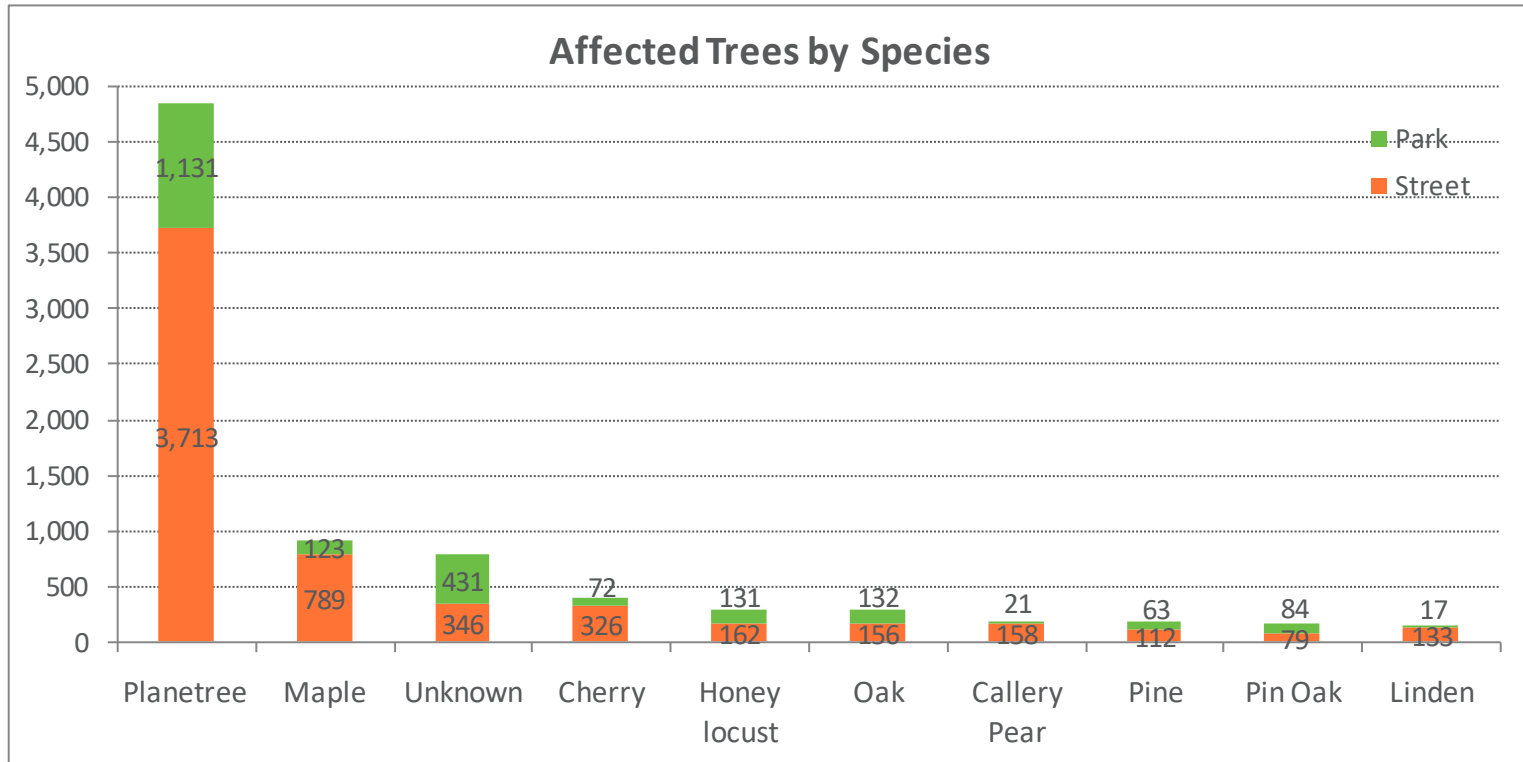
Late Leaf Out Survey Results



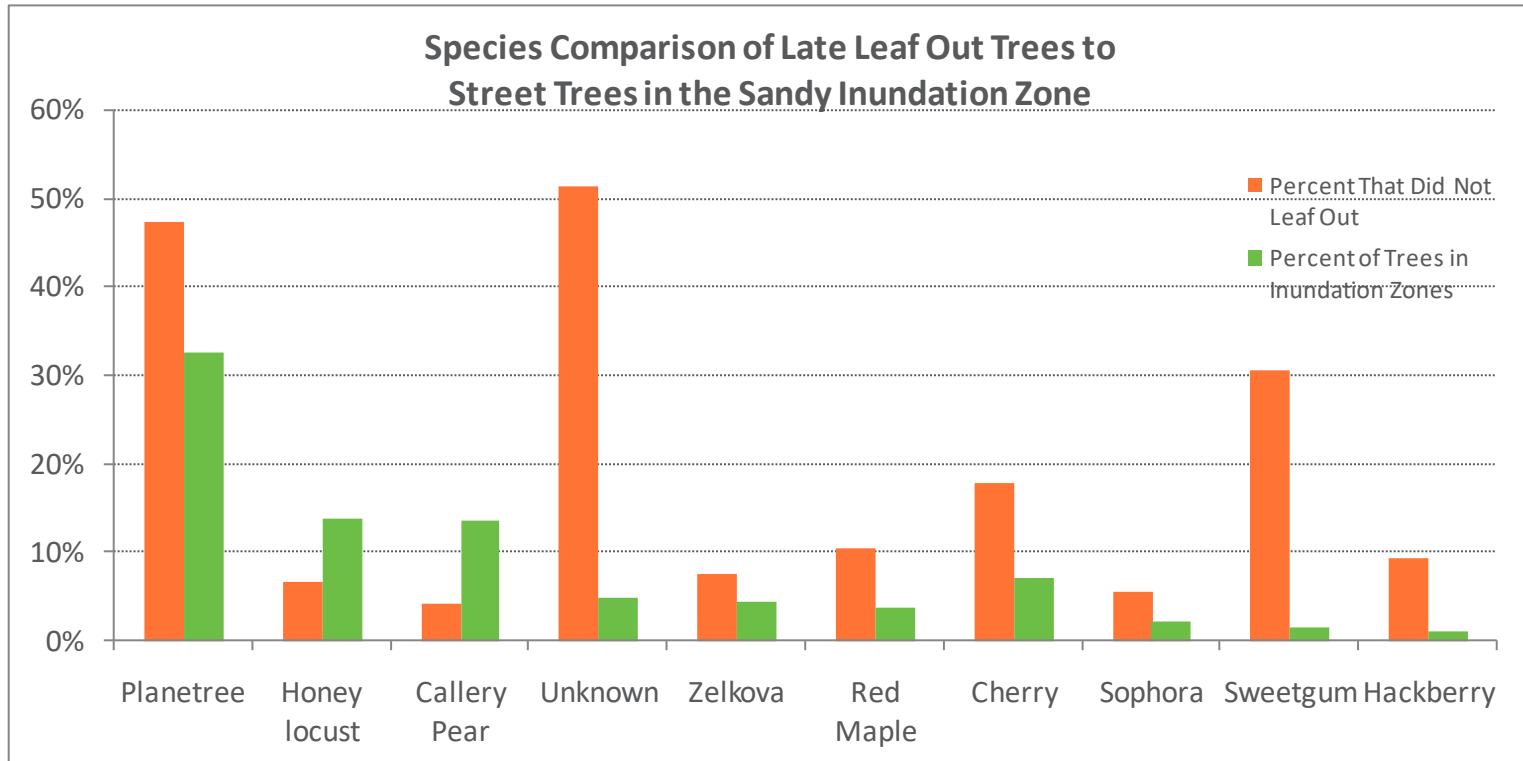
Surveyed Trees Canopy Leaf Out Distribution



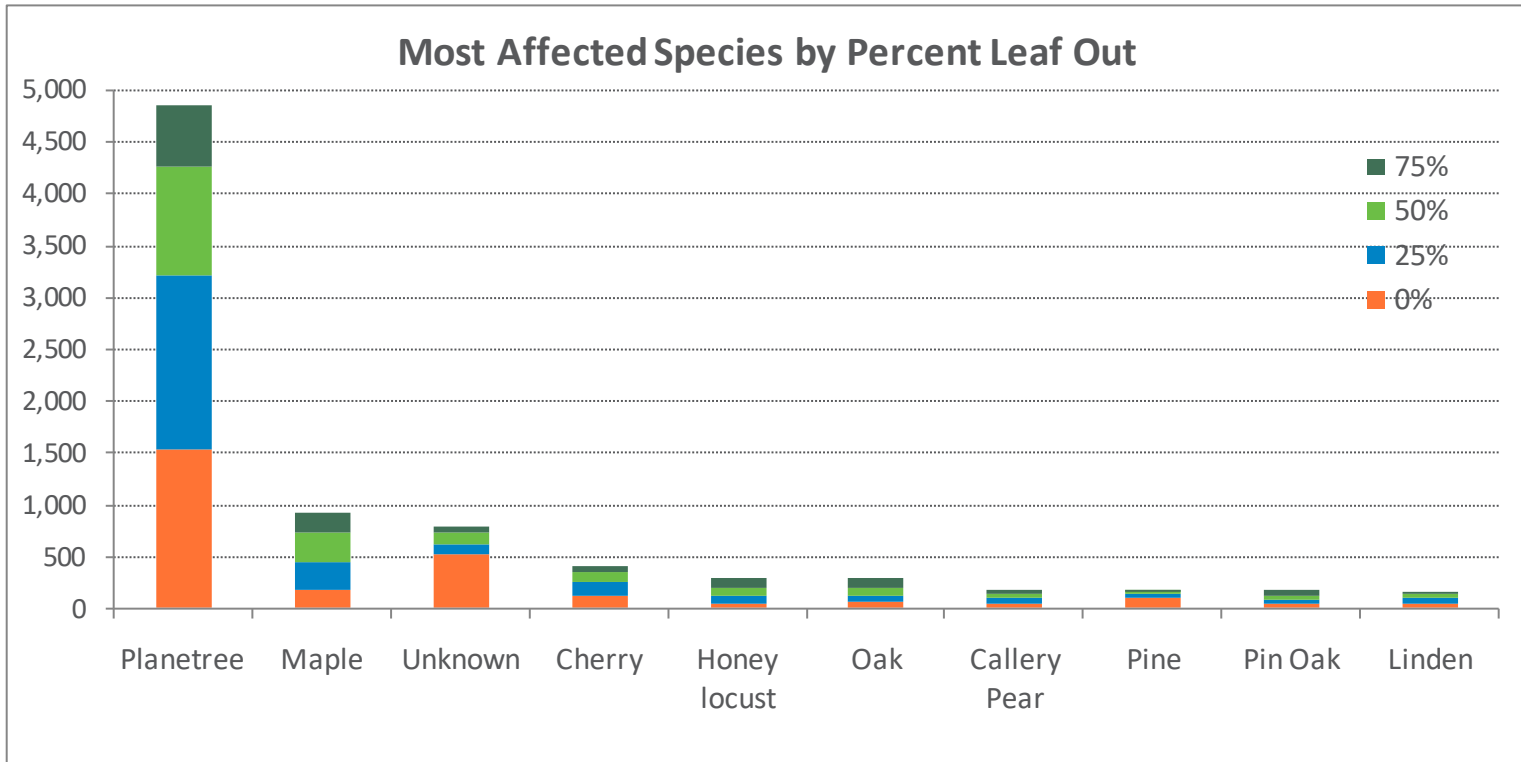
Late Leaf Out Affected Species



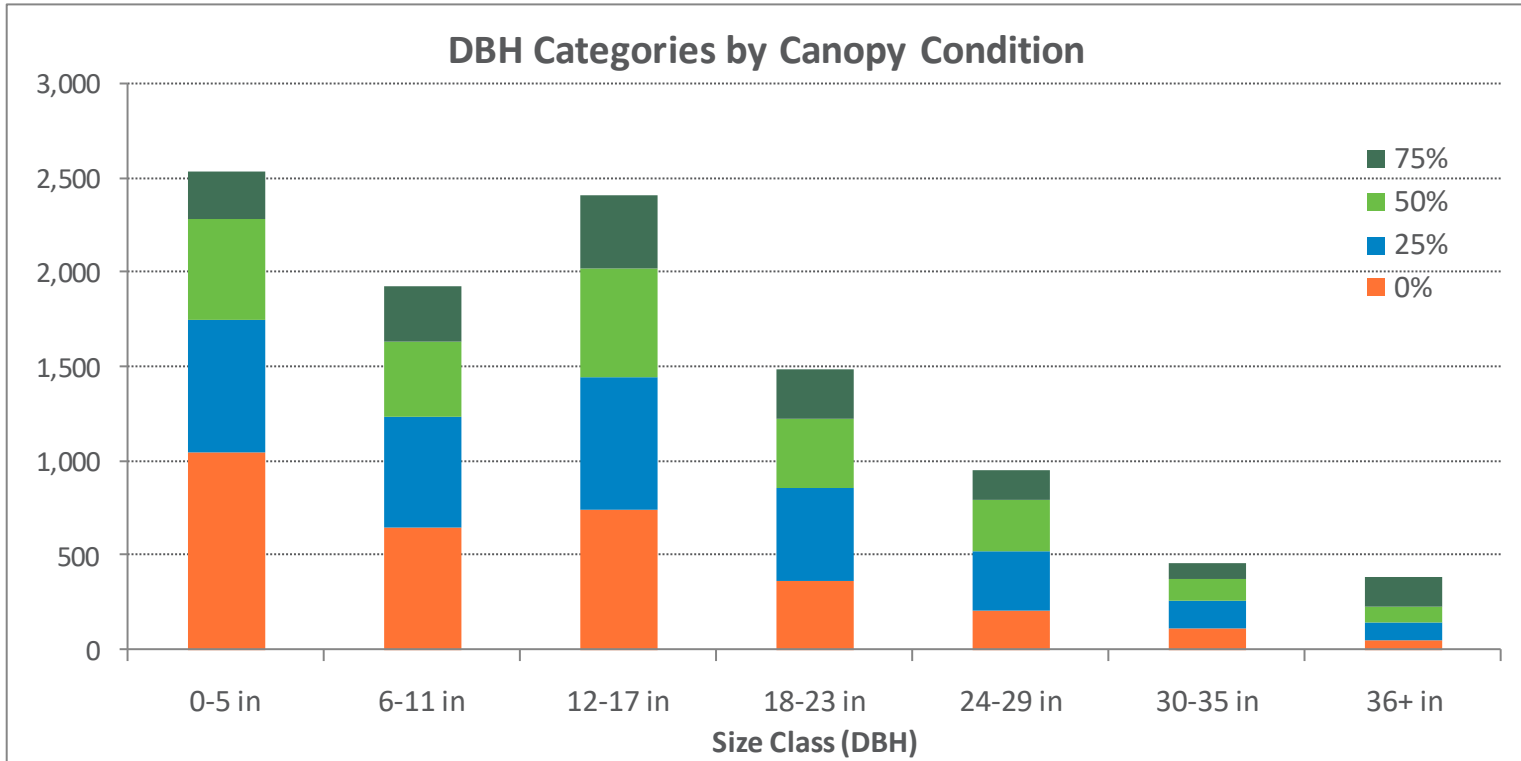
Late Leaf Out Affected Species



Affected Species by Canopy Condition



Affected Tree Diameter Distribution



Comparing Salt Impacts to Routine Removals

Late Leafout Trees

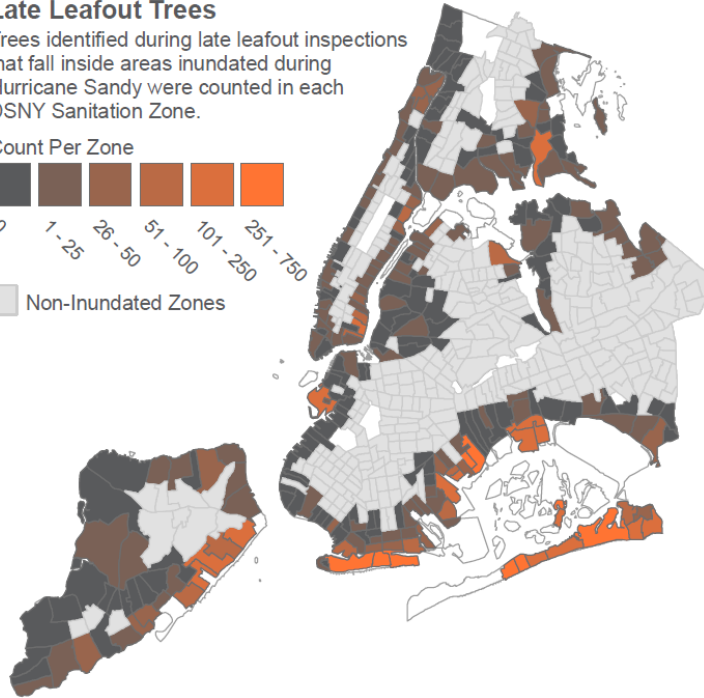
Trees identified during late leafout inspections that fall inside areas inundated during Hurricane Sandy were counted in each DSNY Sanitation Zone.

Count Per Zone



0 1-25 26-50 51-100 101-250 251-750

Non-Inundated Zones



Average Routine Removals

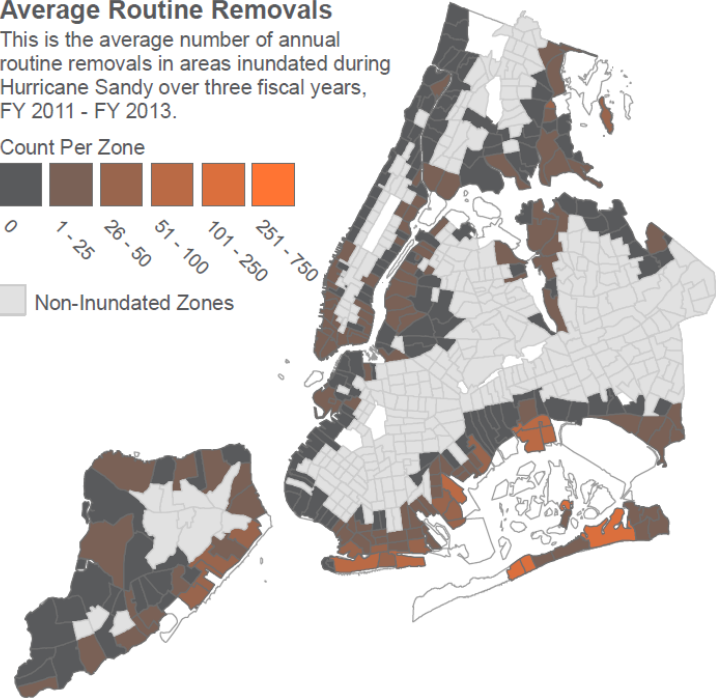
This is the average number of annual routine removals in areas inundated during Hurricane Sandy over three fiscal years, FY 2011 - FY 2013.

Count Per Zone



0 1-25 26-50 51-100 101-250 251-750

Non-Inundated Zones



We compared the Late Leaf Out salt impacted trees data with the average annual dead tree removals in the Sandy inundation zone from fiscal year 2011 to fiscal year 2013.

Difference Between Routine Removals and Late Leafout

By subtracting the count of average routine removals from the count of trees identified during the Late Leafout inspections, sanitation zones in which the greatest differences between routine tree removal and storm-related damage may exist are visible.

Count Per Zone



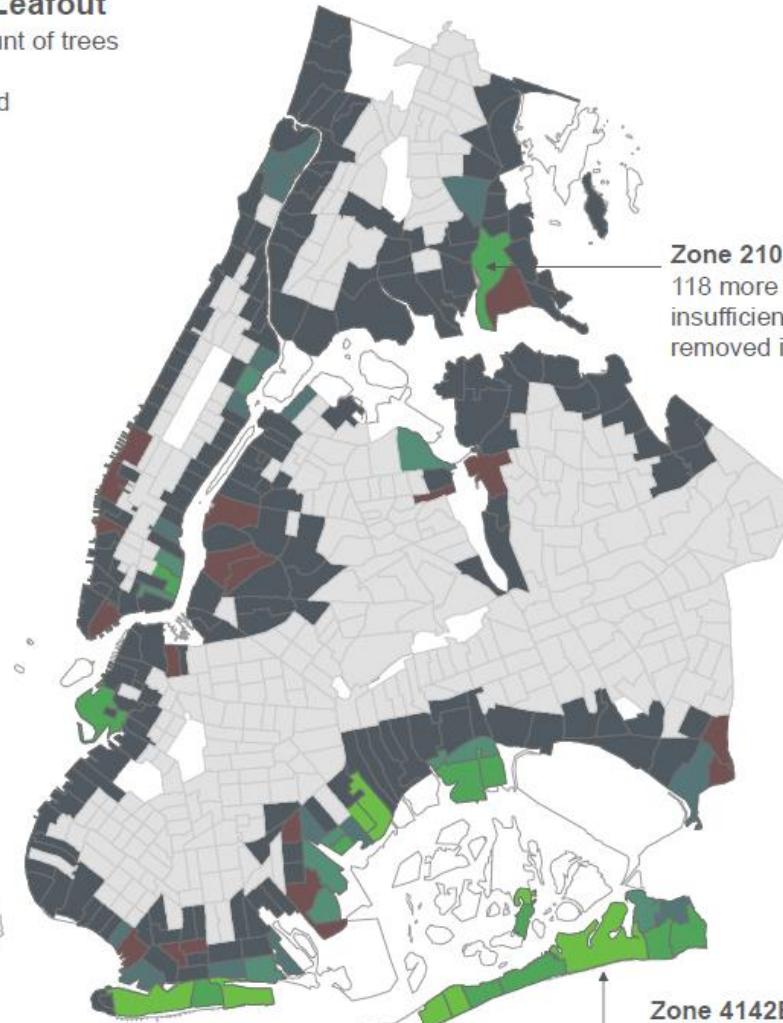
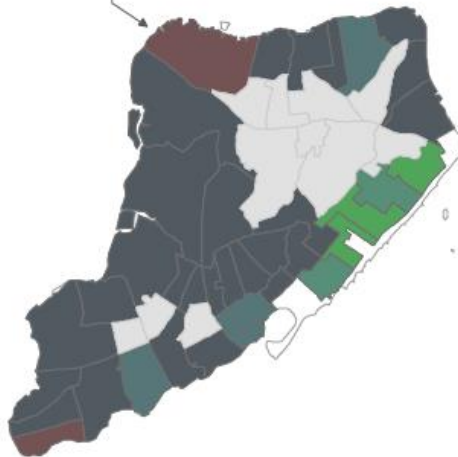
-1 - -7
0 - 25
26 - 50
51 - 100
101 - 250
251 - 750

Non-Inundated Zones

Negative numbers indicate zones where more trees were removed in an average year than are identified as insufficiently leafed out in post-hurricane surveys.

Zone 5014C

1 fewer trees were identified as insufficiently leafed out than are removed in an average year.



Zone 2103D

118 more trees were identified as insufficiently leafed out than are removed in an average year.

Zone 4142E

608 more trees were identified as insufficiently leafed out than are removed in an average year.

Zone 3132B

622 more trees were identified as insufficiently leafed out than are removed in an average year.



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Post-Sandy Late Leaf Out Survey

Where is the most coastal place I know?



Facing east in Fire Island

Extremely exposed yet still many trees



Facing southeast in Fire Island

Trees grow at the edge of the Great South Bay



Facing north, Fire Island

Refined guidance for coastal tree planting



NYC Tree Planting Coastal Species List

This species list is to be used as a guide for tree planting within New York City coastal areas.

*Species currently not available at our nurseries.

Coastal areas are delineated in the Street Tree Planting Survey Map layer "DPR_CoastalTiers".

Tier 1: Along the coastline; High exposure to high speed winds, salt-water flooding, and salt spray

Tier 2: Farther inland from the coastline; Moderate exposure to high speed winds, salt-water flooding, and salt spray

Tier 3: Along urban setting and away from coastline; Low to Moderate exposure to high speed winds, salt-water flooding, and salt spray

Species	Cultivar (s)	Native to NY	Planting under utility wires	Salt Spray Tolerance	Soil Salt Tolerance	Wind Resistance	Weighted Score	Weighted Avg (H/3)	Coverted Score (+4) to remove negative values	Overall Tolerance	Coastal Tier
<i>Amelanchier canadensis</i> *		Yes	Yes	Moderate	Moderate to High	Moderate to High	20	6.7	10.7	High	1
<i>Amelanchier laevis</i>		Yes	Yes	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Betula nigra</i>		Yes	No	Low	Moderate	Moderate to High	4	1.3	5.3	Moderate	2
<i>Betula populifolia</i>		Yes	No	High	Moderate	Moderate	20	6.7	10.7	High	1
<i>Cedrus atlantica</i>		No	No	Moderate	Low	Low	-12	-4.0	0.0	Low	3
<i>Celtis occidentalis</i>	Chicagoland Magnifica	Yes	No	Moderate	Moderate	Low to Moderate	4	1.3	5.3	Moderate	2
<i>Chionanthus virginicus</i>		No	Yes	Low	Moderate	Moderate to High	4	1.3	5.3	Moderate	2
<i>Cornus florida</i>		Yes	Yes	Low	Poor	Moderate to High	-12	-4.0	0.0	Low	3
<i>Crateagus crusgalli</i>		Yes	Yes	High	Moderate	Low to Moderate	12	4.0	8.0	Moderate	2
<i>Diospyrus virginiana</i> *		Yes	No	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Gleditsia triacanthos var. inermis</i>	Halka Imperial Shademaster Skyline Streetkeeper	Yes	No	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Ilex opaca</i>		Yes	No	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Juniperus chinensis</i>	Hetzell Kaizuka Ktleri Robusta green	No	No, check cultivar	High	High	Moderate	28	9.3	13.3	High	1





Thank You

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