

Supplementary Material File S1

Modifying factors for assessing tree species tolerance to coastal vulnerability factors; high-speed winds, salt-water flooding and salt spray

Scoring System	Description
ModFactor or Coastal Vulnerability Factor	A modifying factor that is considered to affect the establishment, growth, mortality rate, and regeneration of a species which could reduce or increase the habitat suitability or future abundance for that species. The three Modfactors in this analysis are 1)Salt Spray 2) Soil Salt and 3)Wind resistance
Score	A score, given as an integer ranging from -3 (low tolerance indicating negative effect on growth or survival) to +3 (high tolerance indicating survival resilience), which relates to the potential influence of a ModFactor on the species. A null value was assigned for species missing any data on Coastal vulnerability factors
Future Relevance	A value (a multiplier to Score) referring to the likely potential future relevance that a particular ModFactor could have on the distribution of a species over the next 50 years in a changing climate. Values range from 1 = not highly relevant over the next 50 years to 5 = likely to be an extremely important ModFactor. A default value of 4 was selected for all Modfactors for this analysis as we expect these factors to high relevance over the next 50 years
Weighted Score	A weighted score based on multiplication of the two default values (Score × FutureRelevance) for the species
Weighted Average	The average of the "Weighted Score" taken by using the number of modifying factors (here 3)
Converted Score	The average of all ModFactor scores (weighted) +4 to remove negative values
Converted Class	Categories assigned for overall tolerance based on Converted Score, Low : less than 5, Moderate: 5 to 9.9, High: Greater than 9.9
Tier	Tiers 1, 2, and 3 were assigned based on converted classes High, Moderate and Low, respectively

Tolerance	Numeric Assignment	Score (S)	Future Relevance (R)	Weighted Score (S*R)	Weighted Average (W) ((S*R)/3)	Converted Score (W+4)
High	6	3	4	12	4.0	8.0
Moderate to High	5	2	4	8	2.7	6.7
Moderate	4	1	4	4	1.3	5.3
Low to Moderate	3	-1	4	-4	-1.3	2.7
Low	2	-2	4	-8	-2.7	1.3
Poor	1	-3	4	-12	-4.0	0.0
Unknown	Null	Null	4	Null	Null	Null



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.

***Platanus x acerifolia* included in the list as it contributes to 28% of existing tier 1 population.

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 the 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 wires	References	Salt Spray Tolerance	Soil Salt Tolerance	Wind Resistance	Weighted Score	Weighted Average	Coverted Score	Overall Tolerance	Coastal Tier
<i>Amelanchier canadensis</i> *		Yes	Yes	[1,2]	Moderate	Moderate to High	Moderate to High	20	6.7	10.7	High	1
<i>Amelanchier laevis</i>		Yes	Yes	[3,4]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Betula nigra</i>		Yes	No	[2,5,6]	Low	Moderate	Moderate to High	4	1.3	5.3	Moderate	2
<i>Betula populifolia</i>		Yes	No	[6,7]	High	Moderate	Moderate	20	6.7	10.7	High	1
<i>Cedrus atlantica</i>		No	No	[8,9]	Moderate	Low	Low	-12	-4.0	0.0	Low	3
<i>Celtis occidentalis</i>	Chicagoland Magnifica	Yes	No	[10,11]	Moderate	Moderate	Low to Moderate	4	1.3	5.3	Moderate	2
<i>Chionanthus virginicus</i>		No	Yes	[2,6,11]	Low	Moderate	Moderate to High	4	1.3	5.3	Moderate	2
<i>Cornus florida</i>		Yes	Yes	[12,13]	Low	Poor	Moderate to High	-12	-4.0	0.0	Low	3
<i>Crateagus crusgalli</i>		Yes	Yes	[14,15]	High	Moderate	Low to Moderate	12	4.0	8.0	Moderate	2
<i>Diospyrus virginiana</i> *		Yes	No	[5,6,16]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Gleditsia triacanthos</i> var. <i>Inermis</i>	Halka Imperial Shademaster Skyline Streetkeeper	Yes	No	[6,14,17]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Ilex opaca</i>		Yes	No	[5,18]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Juniperus chinensis</i>	Hetzeli Kaizuka Ktleri Robusta green	No	No, check cultivar	[2,14]	High	High	Moderate	28	9.3	13.3	High	1
<i>Juniperus virginiana</i>		Yes	No	[2,5,6,10]	High	High	Moderate	28	9.3	13.3	High	1

Species	Cultivar (s)	Native to NY	Planting under wires	References	Salt Spray Tolerance	Soil Salt Tolerance	Wind Resistance	Weighted Score	Weighted Avg (H/3)	Coverted Score (I+4) to remove negative values	Overall Tolerance	Coastal Tier
<i>Koelreutica paniculata</i>	Rose Lanterns Gold Candle Fastigiata	No	No, check cultivar	[4,6,19]	Moderate	Moderate	Low to Moderate	4	1.3	5.3	Moderate	2
<i>Lagetroemia indica</i>		No	Yes	[5,12]	Moderate	Low	Moderate to High	4	1.3	5.3	Moderate	2
<i>Liquidambar styraciflua</i>		Yes	No	[2,12,18]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Magnolia grandiflora</i>		No	No	[2,12]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Magnolia virginiana</i>		Yes	Yes	[2,6]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Malus spp.</i>		Yes	Yes, check cultivar	[9,20]	Moderate	Moderate	Low to Moderate	4	1.3	5.3	Moderate	2
<i>Nyssa sylvatica</i>	Forum Red Rage	Yes	No	[5,6,10,18]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Pinus nigra*</i>		No	No	[2,14]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Pinus parviflora*</i>		No	No	[14,21]	Moderate	Moderate	Moderate	12	4.0	8.0	Moderate	2
<i>Pinus rigida</i>	Sand Beach	Yes	No	[10,18]	High	High	Moderate to High	32	10.7	14.7	High	1
<i>Pinus strobus</i>		No	No	[22,23]	Unknown	Poor	Moderate to High	-4	-1.3	2.7	Low	3
<i>Pinus sylvestris</i>		No	No	[14,24]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Pinus thunbergii</i>		No	No	[2,10]	High	High	Moderate to High	32	10.7	14.7	High	1
<i>Platanus x acerifolia**</i>		No	No	[25,26]	Poor	Poor	High	-12	-4.0	0.0	Low	3
<i>Prunus maritima*</i>		Yes	Yes	[6,10]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Prunus x cistena</i>		No	Yes	[6,9]	High	High	Moderate to High	32	10.7	14.7	High	1
<i>Quercus acutissima</i>		Yes	No	[27,28]	Moderate	Low	Low	-12	-4.0	0.0	Low	3
<i>Quercus alba</i>		Yes	No	[2,18,22]	High	Moderate	Low to Moderate	12	4.0	8.0	Moderate	2
<i>Quercus bicolor</i>		Yes	No	[10,14]	Moderate	Poor	Moderate	-4	-1.3	2.7	Low	3
<i>Quercus imbricaria</i>		No	No	[14,29]	High	Low	Moderate to High	12	4.0	8.0	Moderate	2
<i>Quercus macrocarpa</i>		No	No	[2,10]	High	Moderate	Moderate to High	24	8.0	12.0	High	1
<i>Quercus palustris</i>		Yes	No	[2,5,10]	Low	Poor	Moderate to High	-12	-4.0	0.0	Low	3
<i>Quercus phellos</i>	Hightower	Yes	No	[2,14,30]	High	High	Moderate	28	9.3	13.3	High	1

Species	Cultivar (s)	Native to NY	Planting under wires	References	Salt Spray Tolerance	Soil Salt Tolerance	Wind Resistance	Weighted Score	Weighted Avg (H/3)	Covered Score (I+4) to remove negative values	Overall Tolerance	Coastal Tier
<i>Quercus robur</i>		No	No	[2,14]	High	Moderate	Low to Moderate	12	4.0	8.0	Moderate	2
<i>Quercus stellata*</i>		Yes	No	[2,18]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Quercus virginiana*</i>		Yes	No	[2,31]	Moderate to High	High	Moderate to High	28	9.3	13.3	High	1
<i>Styphnolobium japonicum</i>	Regent	No	No	[14,32]	Moderate	High	Unknown	16	5.3	9.3	Moderate	2
<i>Taxodium ascendens</i>	Nutans	No	No	[33]	Moderate	Moderate	Moderate to High	16	5.3	9.3	Moderate	2
<i>Taxodium distichum</i>		No	No	[2,5,31]	Moderate	Moderate	High	20	6.7	10.7	High	1
<i>Zelkova serrata</i>		No	No	[9,34]	Moderate	Low to Moderate	Moderate to High	8	2.7	6.7	Moderate	2

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