



SPRINGFIELD



FORESTRY



CHOOSING TREES FOR STORM RESILIENCE

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Urban Forest Planning and Species Selection

Climate Considerations

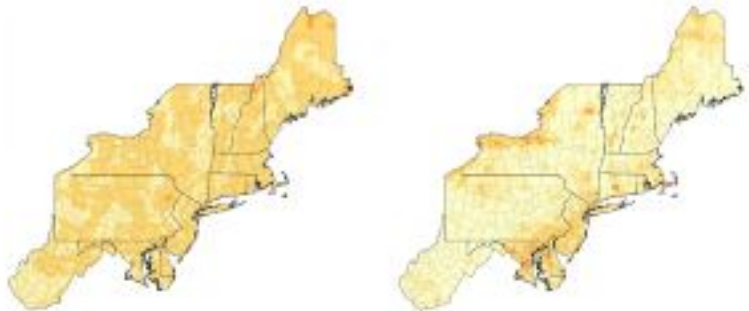
- Increased number and strength of extreme weather events including:
 - Heat Waves
 - Drought
 - Heavy downpours
 - Floods
 - Hurricanes
 - Winter Storms
 - Some uncertainty around other storm events (tornadoes, hail, thunderstorm and wind events)
 - Generally warming temperatures

Lengthening of the Freeze-Free Period

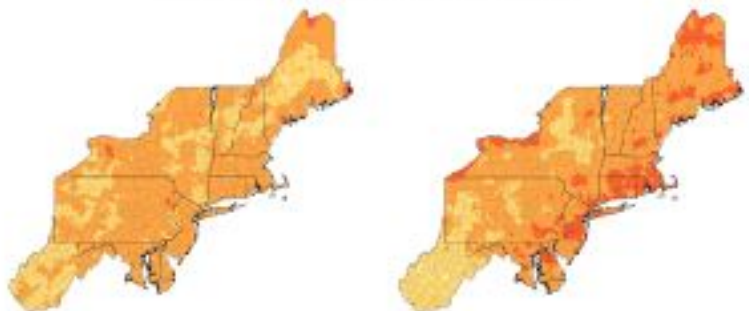
Last Spring Freeze

First Fall Freeze

2040–2069, Lower Scenario (RCP4.5)



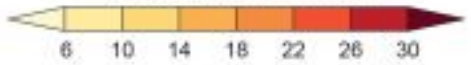
2040–2069, Higher Scenario (RCP8.5)



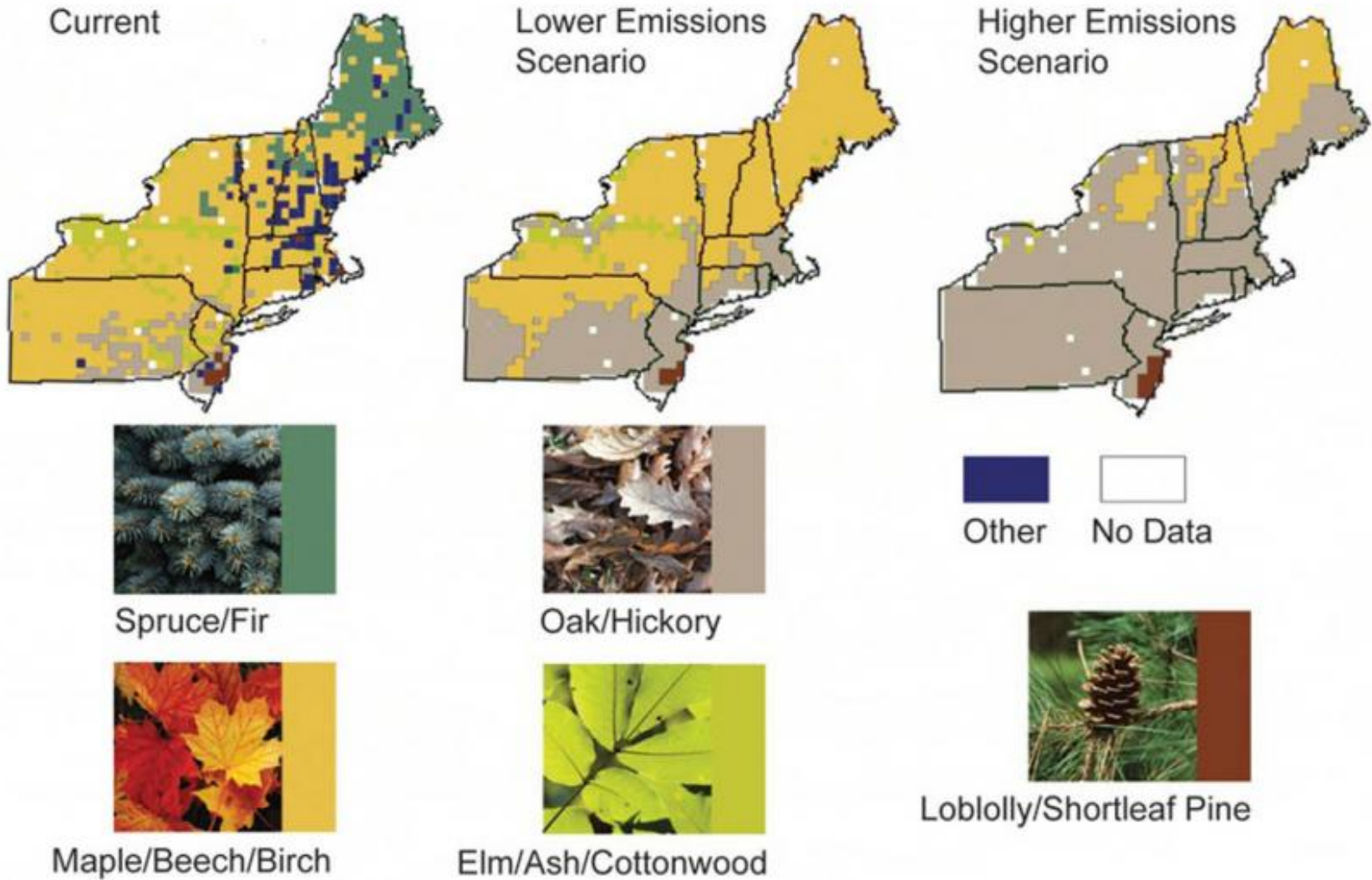
2070–2099, Higher Scenario (RCP8.5)



Change in Number of Days

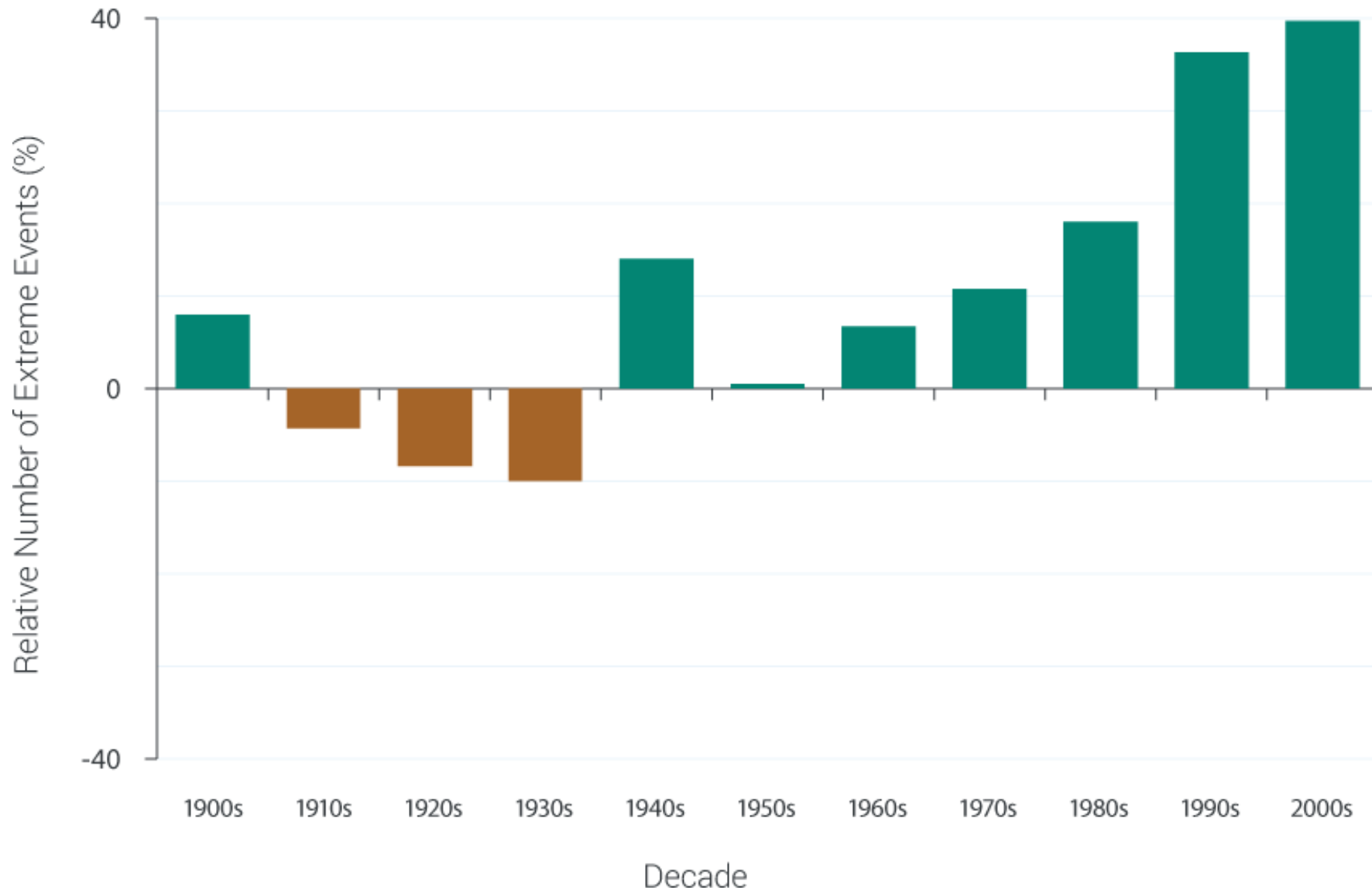


Credit: 2018 Northeast: In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*



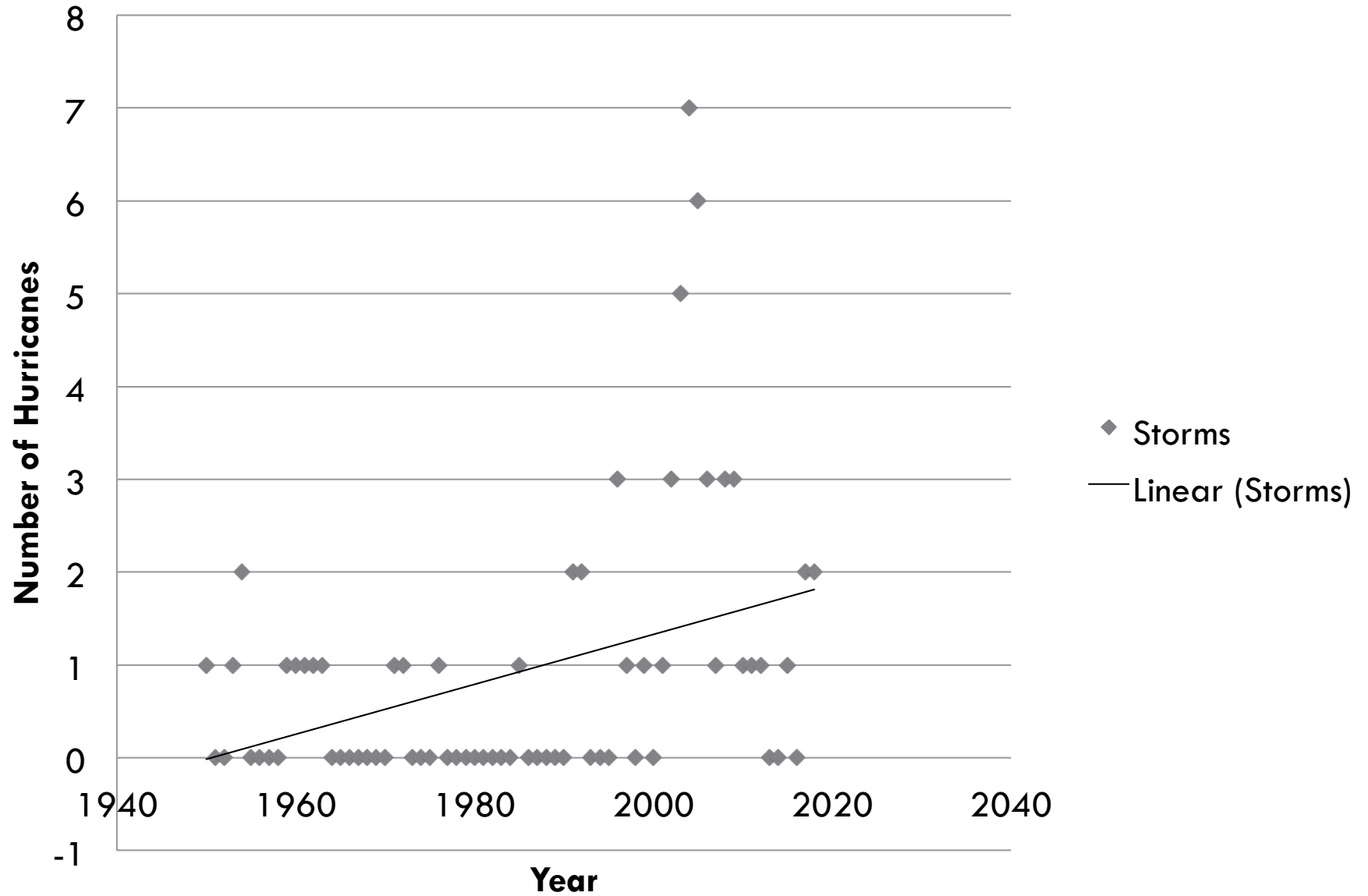
Source: USGCRP (2009) *Global Climate Change Impacts in the United States*

Observed U.S. Trend in Heavy Precipitation



Soucre: *2014 Climate Change impacts in the United States: Third National Climate Assessment*

New England Hurricane Frequency



Types of Storm Damage

- ❑ Wind Throw
- ❑ Crown Twist
- ❑ Stem Failure
- ❑ Root Failure
- ❑ Branch Failure
- ❑ Flooded Root Systems
- ❑ Salt Water inundation





Credit: David V. Bloniarz



Credit: David V. Bloniarz



2019.02.25



07/27/2018



Credit: Alexander Sherman



Credit: Ryan Armburst, Kansas Forest Service, Bugwood.org

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Why do trees fail during a storm?

- Weakened limbs from rubbing, prior storm damage, poor pruning
- Decay at branch collar
- Included bark
- Under-developed root systems due to limited space
- Root decay
- Root loss due to construction activity
- Inundated roots systems

Case Studies

June 2011: EF3 Tornado Springfield, MA

October 2011: Early Snow Storm Springfield, MA

October 2012: Hurricane Sandy New York, NY





Credit: David V. Bloniarz

Tornado 06/01/2011

Species	Number of Trees Removed
Acer platanoides	148
Acer saccharum	85
Quercus rubra	64
Tilia cordata	60
Acer rubrum	48
Quercus palustris	41
Quercus coccinea	34
Acer saccharinum	22
Tilia americana	18
Quercus alba/ Ailanathus altissima	14 (ea.)



Credit: David V. Bloniarz

Nor'easter 10/29/2011

Species	Number of Trees Removed
Acer platanoides	34
Pyrus calleryana	21
Celtis occidentalis	20
Quercus palustris	17
Tilia cordata	15
Acer saccharum	12
Acer rubrum	11
Quercus rubra	10
Malus spp.	5
Acer saccharinum	5



Credit: U.S. Coast Guard Petty Officer 2nd Class Rob Simpson. Photo in the public domain.

Salt Water Inundation Observations

Good Performers

- ❑ *Acer platanoides*
- ❑ *Acer rubrum*
- ❑ *Gleditsia triacanthos*
- ❑ *Ilex* spp.
- ❑ *Juniperus* spp.
- ❑ *Picea pungens*
- ❑ *Prunus* 'Kwanzan'
- ❑ *Zelkova seratta*

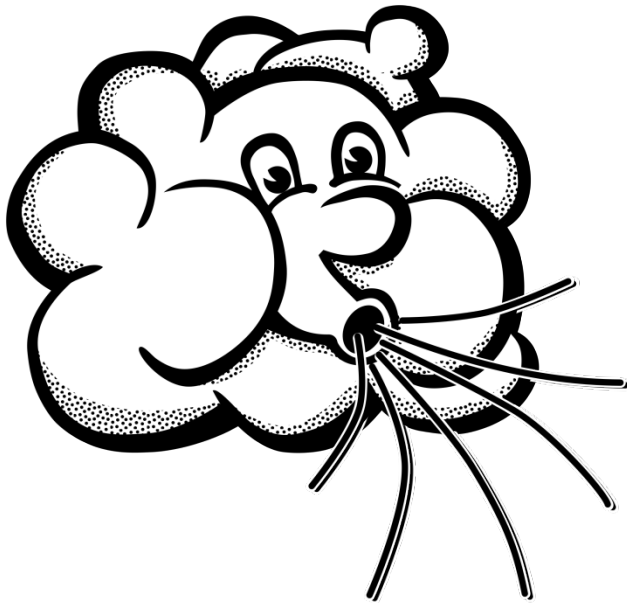
High Mortality

- ❑ *Acer palmatum*
- ❑ *Liriodendron tulipifera*
- ❑ *Magnolia* spp. (mixed)
- ❑ *Pinus* spp. (mixed)
- ❑ *Platanus X acerifolia*
- ❑ *Thuja* spp. (Arborvitae)

Species Selection



"Sherman's Scale of Storm Resilience"



Use This!



Use This?



Don't Use This!



Serviceberry/Shadbush

Amelanchier x grandiflora 'Autumn Brilliance'



Size: 20' x 12'

Flowers: White, before leaves emerge, in early spring

Fall Color: Brilliant gold to orange and red

Site Conditions: Partial shade

Growth Rate: Medium

Cultural Notes: Berries edible for people & wildlife

Native Region: Eastern US & Canada





Amur Maackia

Maackia amurensis



Size: 20' x 20'

Flower: White, upright spike of flowers, in July

Leaf Color: Leaves emerge looking silvery in spring; fall color is not showy

Site Conditions: Quite variable; prefers full sun; fixes nitrogen

Growth Rate: Slow to Medium

Cultural Notes: Hardy to urban conditions; disease free

Native Region: Manchuria, Korea





River Birch

Betula nigra



Size: 40' x 40'

Fall Color: Yellow, dropping early

Bark: Reddish-brown to orange exfoliating bark; highly variable

Site Conditions: Legendary heat tolerance; well-suited to areas wet during part of the year, yet dry during others

Growth Rate: Medium to fast

Cultural Notes: One of the finest native birches; don't prune until summer due to sap flow

Native Region: Eastern US



Hackberry

Celtis occidentalis



Size: 40' x 40'

Flower: Not showy; edible orange-red (pitted) fruits

Fall Color: Yellow, yellow-green

Site Conditions: Variable; withstands acid and alkaline conditions; urban tolerant

Growth Rate: Medium to fast

Cultural Notes: Broad top of ascending arching branches

Native Region: Eastern & Central US





Turkish Filbert

Corylus colurna



Size: 40' x 25'

Fall Color: Yellow, not outstanding

Site Conditions: Thrives in hot summers & cold winters; pH adaptable; urban tolerant; *once established*, drought tolerant

Growth Rate: Medium

Cultural Notes: No serious diseases; can be difficult to transplant

Native Region: Southeast Europe & Western Asia





Hardy Rubber Tree

Eucommia ulmoides



Form: Round

Fruit: Capsule

Tolerates: Salt, Drought

Growth Rate: Slow

Size: Large

Native Region: China

Notes: Bark becomes furrowed and textured with age





Ginkgo

Ginkgo biloba



Size: 50' x 30'

Fall Color: Gold

Site Conditions: Highly adaptable and tolerant of urban stresses

Cultural Notes: Unique fan-shaped leaves; tends to be open in youth, filling out as it ages; only male trees planted; pest & disease free

Growth Rate: Slow to medium

Native Region: Eastern China



Kentucky Coffeetree

Gymnocladus dioicus



Size: 60' x 50'

Fruit: Reddish brown, leathery pod

Fall Color: Variable

Bark: Unique bark pattern and irregular branching habit; no two alike

Site Conditions: Full sun; adaptable to a range of tough conditions

Cultural Notes: Late leafing out in spring; seeds toxic

Growth Rate: Slow to medium

Native Region: Northeast to Midwest US





Sweetgum

Liquidambar styraciflua



Size: 60' x 35'

Fall Color: Yellow, orange, red

Site Conditions: Not pollution tolerant; needs large area for root development

Cultural Notes: May take a couple of years to establish

Growth Rate: Medium to fast

Native Region: Eastern US & Mexico



Tuliptree

Liriodendron tulipifera



Size: 70' x 35'

Fall Color: Golden yellow

Flower: Yellow-green & orange tulip-like flower in May/June

Site Conditions: Needs large area for root development

Growth Rate: Fast

Cultural Notes: Magnificent, fast growing tree

Native Region: Eastern US



Flowering Crabapple

Malus spp.



Size: 20' x 15'

Flower: Pinkish red, April-May

Fall Color: Orange to red

Wildlife Value/Use: Small red fruits eaten by birds and other wildlife, persist into winter

Growth Rate: Moderate

Cultural Notes: Disease-resistant

Native Region: Central Asia



Dawn Redwood

Metasequoia glyptostroboides



Size: 70' x 25'

Fall Color: Bronze

Site Conditions: Does well in low lying areas

Cultural Notes: Distinctive buttressed base and feathery leaves; seldom requires pruning

Growth Rate: Fast

Native Region: Eastern Szechuan and western Hupeh, China



Tupelo/Black Gum

Nyssa sylvatica



Size: 30' x 20'

Fall Color: Gold to orange to scarlet to purple

Wildlife Value/Use: Small black fruit eaten by many birds & mammals

Site Conditions: Shelter from wind; not for heavily polluted areas

Growth Rate: Slow to medium

Native Region: Eastern US & Canada



American Hophornbeam

Ostrya virginiana



Size: 25' x 20'

Fruit: Small hanging fruit resembling hops

Fall Color: Yellow in fall, dropping early

Site Conditions: Full sun or partial shade; slow to establish after planting; found in the wild in rocky soil

Growth Rate: Slow

Cultural Notes: Graceful and handsome small tree with drooping branches and rounded outline; "Cat-scratch" bark

Native Region: Eastern & Central North America

Eastern White Pine

Pinus strobus



Size: 80' x 40'

Fall Color: Evergreen

Site Conditions: Full sun or partial shade; prefers moist, well-drained soil; intolerant of pollution

Growth Rate: Moderate to fast

Cultural Notes: Susceptible to pest and disease problems, does poorly in high pH soils

Native Region: Chicago area, Illinois, North America

Source: New England Wildflower Society



London Planetree

Platanus acerifolia 'Bloodgood'



Size: 70' x 60'

Fruit: Fuzzy, spherical fruiting balls approx. 1" diameter, usually form in pairs and persist through winter

Bark: Light brown bark exfoliates to expose a creamy white and olive inner bark

Fall Color: Yellow-brown

Site Conditions: Withstands high pH conditions and urban pollutants

Growth Rate: Medium

Native Region: Europe



Callery Pear

Pyrus calleryana



Size: 50' x 35'

Flower: showy white flower

Site Conditions: Full sun; moist, well-drained soil

Growth Rate: Moderate

Cultural Notes: Invasive qualities, fruit produces unpleasant smell

Native Region: China and Vietnam





Swamp White Oak

Quercus bicolor



Height: 50' x 50'

Fall Color: Yellow to bronze

Fruit: Acorn

Site Conditions: Grows naturally in low lying, moist sites, but tolerates drought, salt, and soil compaction in urban areas.



Cultural Notes: Attractive grayish brown flaking bark when young

Growth Rate: Slow to medium

Native Region: New England



Pin Oak

Quercus palustris



Size: 60' x 25'

Fall Color: Bronze to red

Fruit: Acorn

Site Conditions: Tolerant of wet soils

Growth Rate: Medium to fast

Cultural Notes: Attractive branching pattern; shallow root system

Native Region: Eastern US



Green Pillar Oak

Quercus palustris 'Pringreen'



Size: 50' x 15'

Fall Color: Red

Fruit: Acorn

Site Conditions: Tolerant of wet soils

Growth Rate: Medium to fast

Cultural Notes: Columnar growth; shallow root system

Native Region: Eastern US



Weeping Willow

Salix babylonica



Size: 50' x 50'

Form: graceful broad-rounded crown of weeping branches

Site Conditions: Full sun or partial shade; thrives in moist soils

Growth Rate: Fast

Cultural Notes: Not generally used in residential landscapes, susceptible to breakage; does well by rivers and streams

Native Region: Northern China





American Elm

Ulmus americana 'Valley Forge'



Size: 60' x 40'

Flower: Not showy

Fall Color: Yellow, varying intensity

Site Conditions: Variable; strong pH and soil salt tolerance

Growth Rate: Medium to fast

Cultural Notes: Vase-shaped, arching form

Native Region: Eastern & Central US



Takeaways

- Plan the forest for the climate of the future
- Don't be afraid to experiment (and fail)
- Young tree structural pruning is essential
- Take the time to observe and record (mentally and physically)

Questions?



Thank you!