Planning for Street Trees: Duke Farms and Beyond

May 14, 2019

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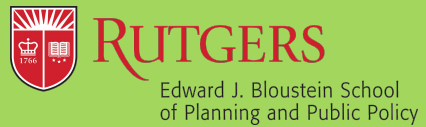
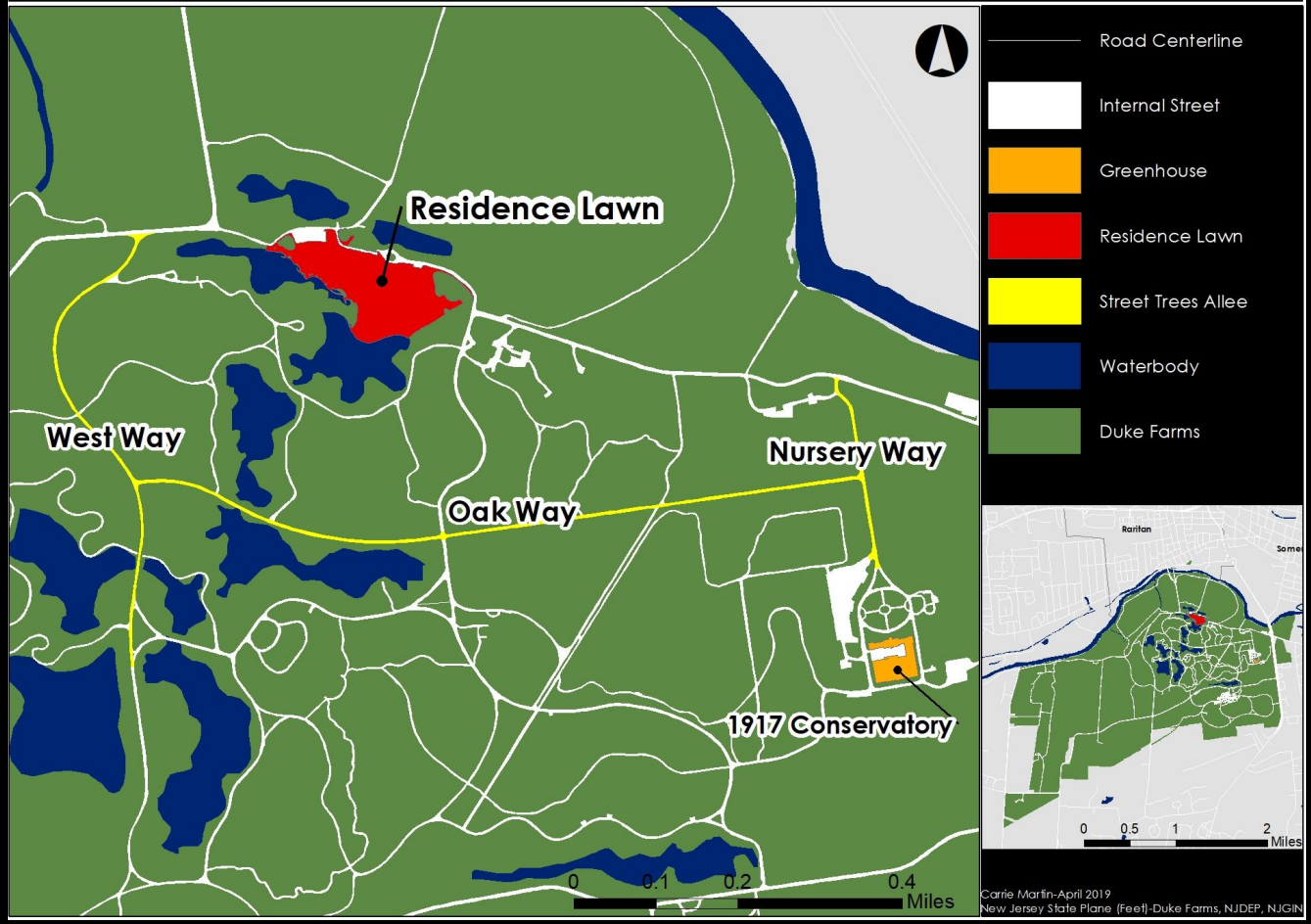


Duke Farms Project Locations




Don’t worry,
we will **allée** your fears.

Goals

Create aesthetic tree allées

Transferability to urban settings

Increase carbon sequestration

Align with Duke Farms Stewardship Plan

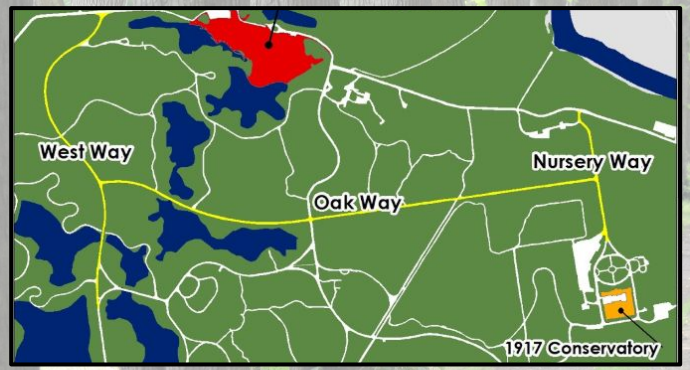
Duke Farms Stewardship Plan

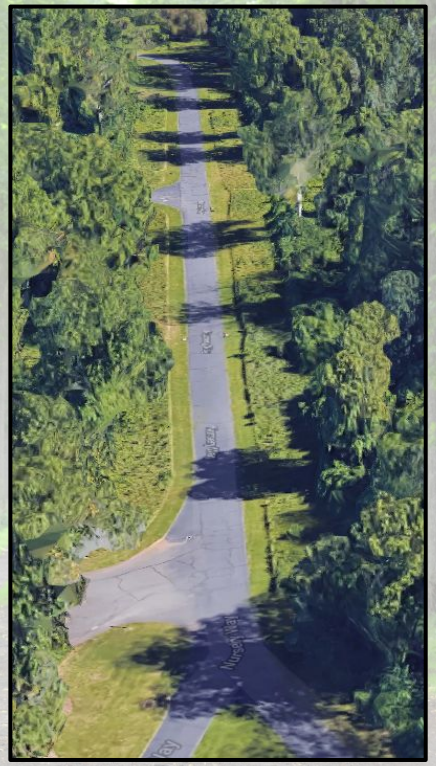
- Develop plant propagation and reintroduction plan
- Integrate stewardship and related programmatic goals
- Foster monitoring and research
- Engage in climate change mitigation
- Implement sustainable agricultural practices

Source: Duke Farms, https://www.dukefarms.org/about/

Existing Conditions

Nursery Way
Cleared for allées



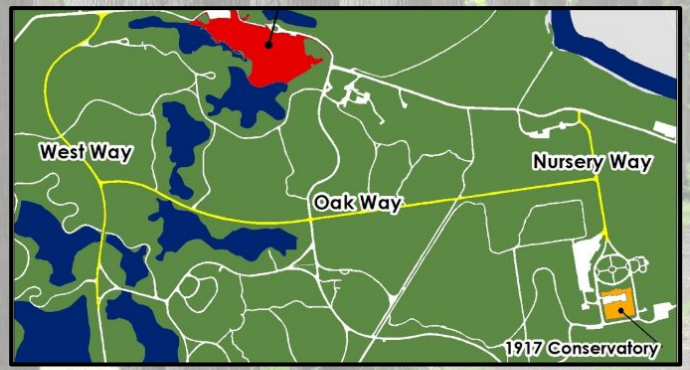


Existing Conditions

Oak Way

Allée comprising 88 red oaks

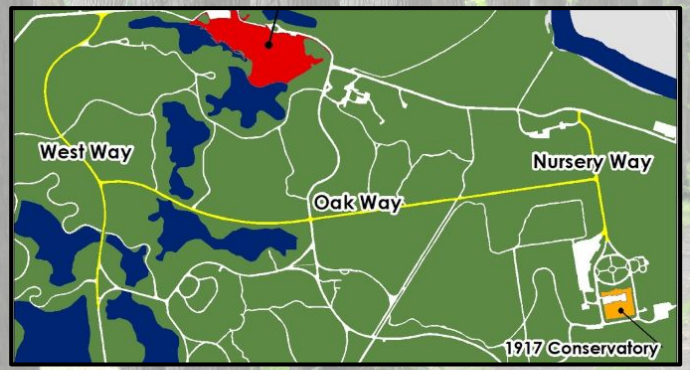
Western portion has no allées, some forested areas



Existing Conditions

West Way

Allée on northern part of West Way with trees of differing size, comprising 36 trees. Southern portion has no allées, some forested areas.



Methods

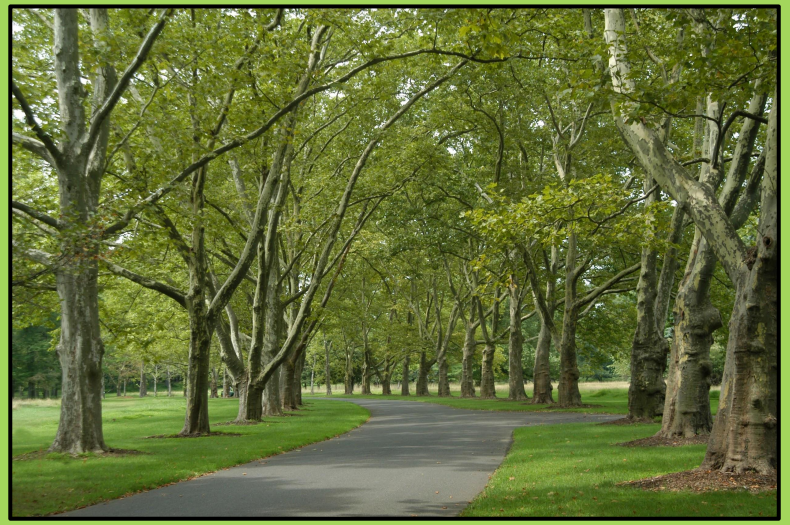
- Site visit
- Discussion with Duke Farms staff
- Species selection
- Spacing considerations
- Allee design
- iTree
- Sequestration potential

Species Selection

- Environmental co-benefits: prioritizing carbon storage, but also including streamflow reduction, pollutant removal, etc.
- Resilience to disease and pests
- Resilience to climate change
- Nativity to NJ
- Duke Farms established street tree species
- Other co-benefits, including aesthetics, pollination (for flowering species)

Design-Option 1

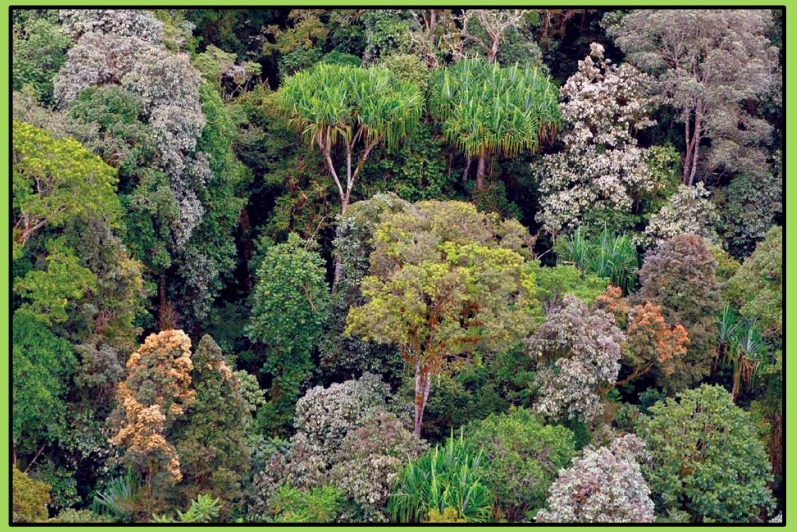
- "Monoculture-Lite"
- 249 trees
- **Species**: American Sycamore, London Plane
- Benefits:
    - Traditional aesthetics
    - Visual unity (great for wedding photos)
    - Avoids "Simple Single Species Syndrome Sickness"



Design 1	Sequestration
Nursery Way	1,347,873.8
Oak Way	3,695,783.0
West Way	372,195.0
Total	*5,415,851.8*

Source: calculations performed with iTree Species; Image Source: https://www.flickr.com/photos/dukefarms/7110381695

Design-Option 2



- "Mix It Up"
- 249 trees
- **Species**: American Sycamore, London Plane, Black Gum, Cucumber Magnolia
- Benefits:
  - Increased resilience to disease, pests
  - Visually interesting, surprising
  - Pollination (magnolia)

Design 2	Sequestration
Nursery Way	1,198,018.4
Oak Way	3,280,379.9
West Way	327,621.2
Total	*4,806,019.5*

Source: calculations performed with iTree Species
Image source: https://www.labroots.com/trending/earth-and-the-environment/12778/biodiverse-forests-resilient-drought

Design-Option 3

- "Best of both worlds"
- 332 trees
- **Species**: American Sycamore (~75-100 ft), Umbrella Magnolia (~15-30 ft)
- Benefits:
  - Resilience to disease
  - Visually interesting with formal allée elements
  - Pollination!

Design 3	Sequestration
Nursery Way	1,260,348.2
Oak Way	3,492,765.8
West Way	357,265.4
Total	*5,110,379.4*

Source: calculations performed with iTree Species
Image Photos: http://stmnf.com/magnolias/magnolia-tripetala/; http://www.cirrusimage.com/trees.htm

Comparisons with Design for All Streets in Study Area

Design	Sequestration
1	*5,415,851.8*
2	*4,806,019.5*
3	*5,110,379.4*

Design Recommendation

Existing Sequestration Potential

- Oak Way: 1,271,068 Lbs.
- West Way: 850,647.1 Lbs.
- Nursery Way: 0 Lbs.

Total Sequestration: 2,121,715.10 Lbs.

Recommended Sequestration Potential

- Nursery Way (Design 1): 1,347,873.8 Lbs.
- Oak Way (Design 3): 3,492,765.8 Lbs.
- West Way (Design 1): 372,195.0 Lbs.

Total Sequestration: 5,212,834.60 Lbs.

433

Trees

7,344,549.70 Lbs.

Total Sequestration

Budget

***Projected Costs - First Year Analysis: 306 Trees ($50,000 Allotted Budget)**

Tree Cost (American Sycamore, London Plane, Cucumber Magnolia)	**Transportation / Delivery Cost** (50 mile sourcing - 15 truck loads at 3$ per mile with return	**Labor Hours** (2 hours per tree for planting)	**Labor Costs** ($25 per hour)	**Irrigation** (25 waterings annually -30 gallons per tree)	**Water Cost** (1 cent per gallon)	**Maintenance Resources / Soil Turnover** ($50 per Tree annually)	**Total Cost**
$13,356	$2,250	612	$15,300	226,500 gallons	$2,265	$15,300	**$48,471**

**From a survey of nursery prices:

Tree Species Type	Number of Trees	Cost per 5-6' sapling	Total Cost
American Sycamore	306	$39.95	$12,224.70
Cucumber Magnolia	306	$49.95	**$15,284.70**
London Plane	306	$39.99	$12,236.94
Black Gum	306	$30.99	$9,482.94
Bradford Pear (only last 25 years)	306	$24.95	**$7,634.70**
Cherry Blossom	306	$37.00	$11,322.00

*Dat.com for trucking per mile rate, Howmuch.net for landscaping labor costs and time, Aroborday.org for tree watering recommendations, American Water for water rate **Lowes, Home Depot, Halka Nursery, Willis Orchards Co., Arbor Day.org, thetreecenter.com, fastgrowingtrees.com,

Phases of Implementation

1. Plan - Prepare - Local Sourcing Analysis
2. Planting Operations
3. **2 Year Intensive Management Period - Growth - Maintenance - Watering - Soil Turnover**
4. Long Term Rotational Maintenance / Storm Management
5. Analysis and Evaluation of Resiliency, Disease / Pest Potential, Design Performance, Climate Change, and C02 Sequestration

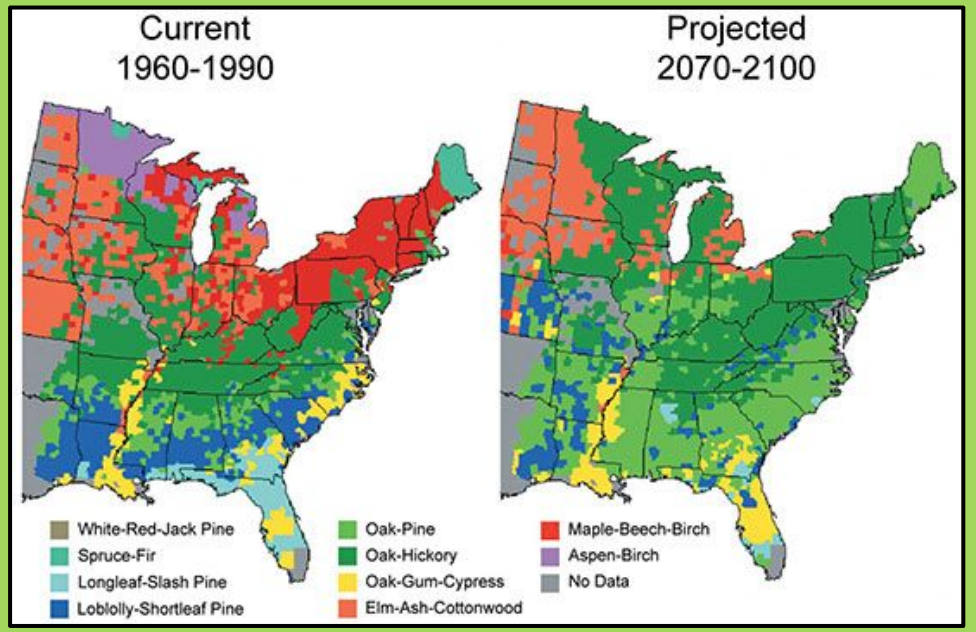
Confronting Climate Change

Limits on Species Selection

- Habitat loss
- Hardiness zones
- Diversity

Future

- pest resurgence, fire, flooding, disease

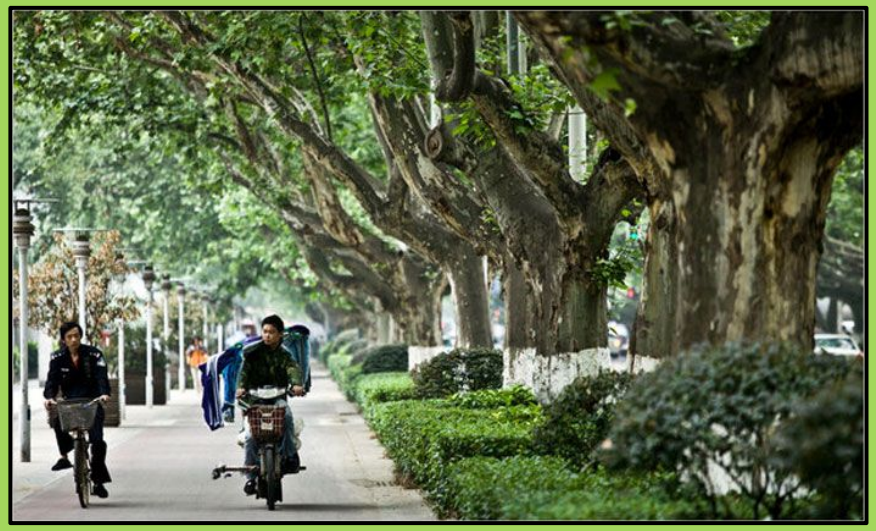


Source: MassAudubon, https://www.massaudubon.org/our-conservation-work/climate-change/effects-of-climate-change/on-natural-habitats/forests

Beyond Duke Farms

Linkages to Region

Goal: Duke Farms street trees as a resource and model for municipal street tree practice/**planning** in NJ towns



Beyond Duke Farms

<u>Crossover into planning practice</u>

- Understanding of co-benefits in other planning disciplines
  - Design
  - Transportation
  - Community
  - Redevelopment
  - Resiliency

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Thank Yous