

SUSTAINABLE LANDSCAPE DEMONSTRATION GARDEN

**Dr. Ellen
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**Clemson
University
Horticulture
Dept.**

**Planning +
Design in the
Built
Environment
14Feb2014**

WHAT IS THE DOMINATING THEORY?

<http://www.snre.umich.edu/ecomgt//graphics/faculty/nassauer.jpg>



Nassauer



Brundtland



Tallamy

Health in the
built
environment

Hester



http://www.kennuncorked.com/images_multiple_locations/sus_history_gro_harlem_brundtland.gif

<http://wildones.org/honorarydirectors/tallamydoug.jpg>

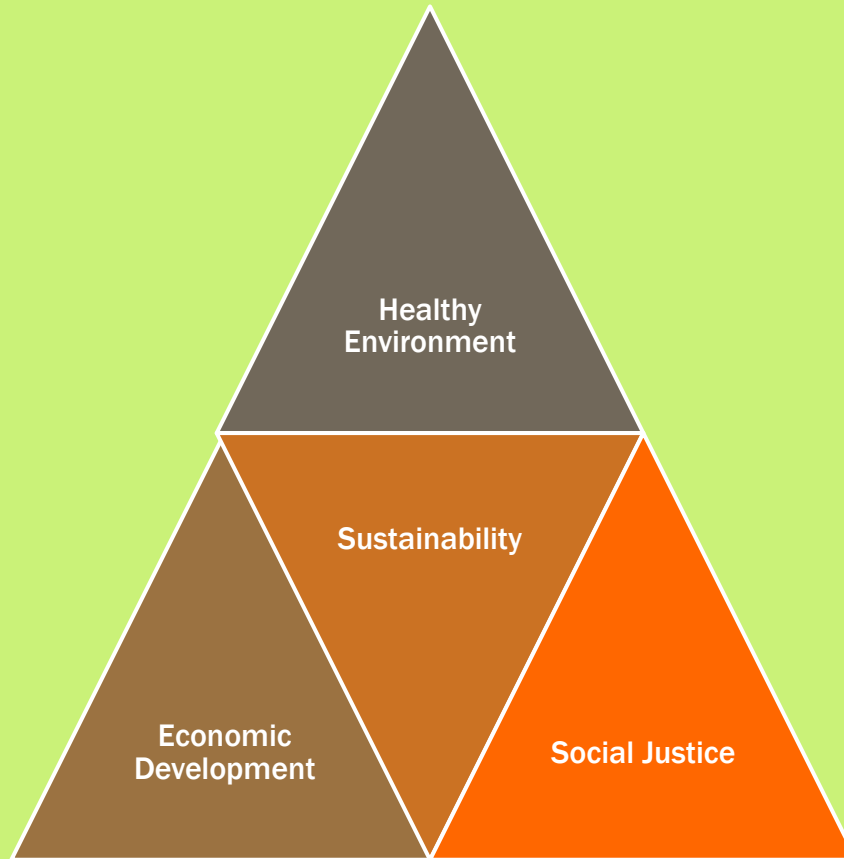
<http://www.pps.org/wp-content/uploads/2009/01/randolph-hester.jpg>

CAN YOU FIND TRIANGULATION IN THE METHODS?

- **Triangulation:** response to a social science question with **multiple measures or methods** that do not share the same methodological weaknesses.
- If different approaches produce similar findings, confidence in the results increases (Singleton and Straits, 2005, p. 574)

SUSTAINABILITY: HISTORIC DEF.

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission, 1987, p. 8).



The World Commission on Environment and Development (1987).
Our common future. Oxford: Oxford University Press.

GRO HARLAN BRUNDTLAND (B. 1939)

- Norwegian Minister for Environmental Affairs (1974-1979)
- Prime Minister of Norway (Feb – Oct 1981, May 1986-Oct 1989)
- Chair of United Nations World Commission on Environment and Development, published *Our Common Future* (April, 1987)
- Commission consisted of 22 members from 21 diverse countries (Borrowy, I. (2013) The Brundtland Commission: Sustainable Development as Health Issue, *Michael 10*: 196-206.)



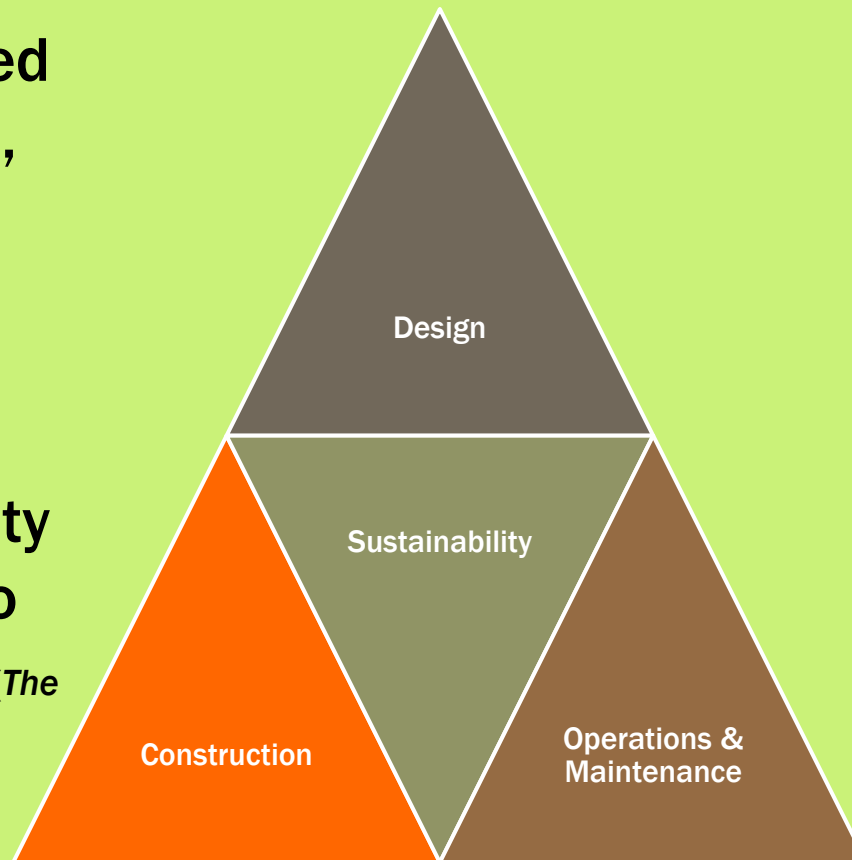
SUSTAINABILITY

- “The ‘environment’ is where we all live; and ‘development’ is what we all do in attempting to improve our lot within that abode. The two are inseparable” –Gro Harlem Brundtland (The Case for Sustainable Landscapes, 2009, p. 8).



SUSTAINABILITY: MODERN DEF.

“Sustainability is defined as design, construction, operations, and maintenance practices that meet the needs of the present without compromising the ability of future generations to meet their own needs” (*The Case for Sustainable Sites*, 2009, p. 5).



Sustainable Sites Initiative (2009). *The case for sustainable landscapes.*

THE SUSTAINABLE SITES INITIATIVE™

www.sustainablesites.org/



AMERICAN SOCIETY OF
LANDSCAPE ARCHITECTS

*ASLA Library & Education
Advocacy Fund*



Lady Bird Johnson

Wildflowercenter

THE UNIVERSITY OF TEXAS AT AUSTIN



UNITED STATES
BOTANIC GARDEN

- <http://asla.org/>
- <http://www.wildflower.org/>
- <http://www.usbg.gov/>

EXPERIMENTAL DESIGN RESEARCH QUESTION

- Does the sustainable landscape demonstration garden have potential to increase human and environmental health and wellness in the urban setting?
- If so, what are identifiable process(es) that have measurable results?



PURPOSE

- Create an urban sustainable garden model to promote environmental and human health and well-being.

- Should be replicable.

<http://www.clemson.edu/cafls/demo/index.html>



- Should be measurable.
 - Perception surveys of passersby
 - Soil sampling and analysis
 - Plant health rating sheets

GUIDING PRINCIPLES

1) Environmental educational displays are needed in the busiest, hectic urban environments in order to reach and influence greater numbers and diverse people (Hester, 2006)



Photo by B. Anderson



Photo by S. Lombardo

Pre-installation spaces on college campus 1,400 sf (left) 1,800 sf (right)

GUIDING PRINCIPLES

2) The display should be aesthetically pleasing as well as educational so as to generate sales and production of these less common, but environmentally beneficial [native] plants (Nassauer, 1997)



Designs: Reburn (2011); Lombardo-Fraser (2011); White (2012); Kelly (2012)

Nassauer, J. (1997) Cultural sustainability: Aligning aesthetics and ecology. In *Placing nature: Culture and landscape ecology*. Washington, D.C.: Island Press.

GUIDING PRINCIPLES

3) The experimental nature of the garden should include a participatory role for passersby to share their opinion and judgment of the display. Participation is engaged learning and often results in greater knowledge retention and continued involvement (Hester, 2006).



Photo by E. Vincent

Hester, R. (2006) *Design for ecological democracy*. Cambridge, MA: MIT Press.

PROCESS

- Assemble a diverse (career) interdisciplinary team.



Byrd, commercial design



Gerus, director of grounds



Hall, ethnobotanist



Park, professor & soils researcher



Tanner, extension



Vincent, prof of hort & health res



White, extension & water researcher

PROCESS

- Conduct a competitive design process using native plant selections to provide eco-system services, e.g. habitat and food source for native insects and animals (Tallamy, 2011).
- Install and maintain garden using low-maintenance techniques.
- Study environmental health and human perceptions.



Photo by E. Vincent

6" leaf mold compost tilled to a depth of 8"



Photo by E. Vincent

Girdling roots loosened prior to planting

PROCESS

- Provide on-site and Web educational materials.
- Student workers serve as educational ambassadors.



Asclepias tuberosa
Butterfly Weed

Environmental Horticulture
SAFES

Photos by E. Vincent



Sustainable Landscape Demonstration

Environmental bio-diversity through
healthy soils, diverse plants,
intelligent design, installation, and
maintenance.



STUDENT CONTRIBUTORS



**Fraser, HORT
designer**



**Lombardo, HORT
designer**



**Reburn, FOR
designer**



**Kelly, HORT,
designer**



**Cochran, HORT
install**



**Blakely, FOR
maintenance**



**Clarkin, ARCH
maintenance**



**Smolka, BIOSC
maintenance**

PRE-INSTALLATION



Pre-installation spaces on college campus 1,400 sf (left) 1,800 sf (right)

Hester, R. (2006) *Design for ecological democracy*. Cambridge, MA: MIT Press.

POST-INSTALLATION



Photos by E. Vincent



Post-installation spaces on college campus 1,400 sf (left) 1,800 sf (right)

Hester, R. (2006) *Design for ecological democracy*. Cambridge, MA: MIT Press.

PRE & POST INSTALLATION SURVEY DATA

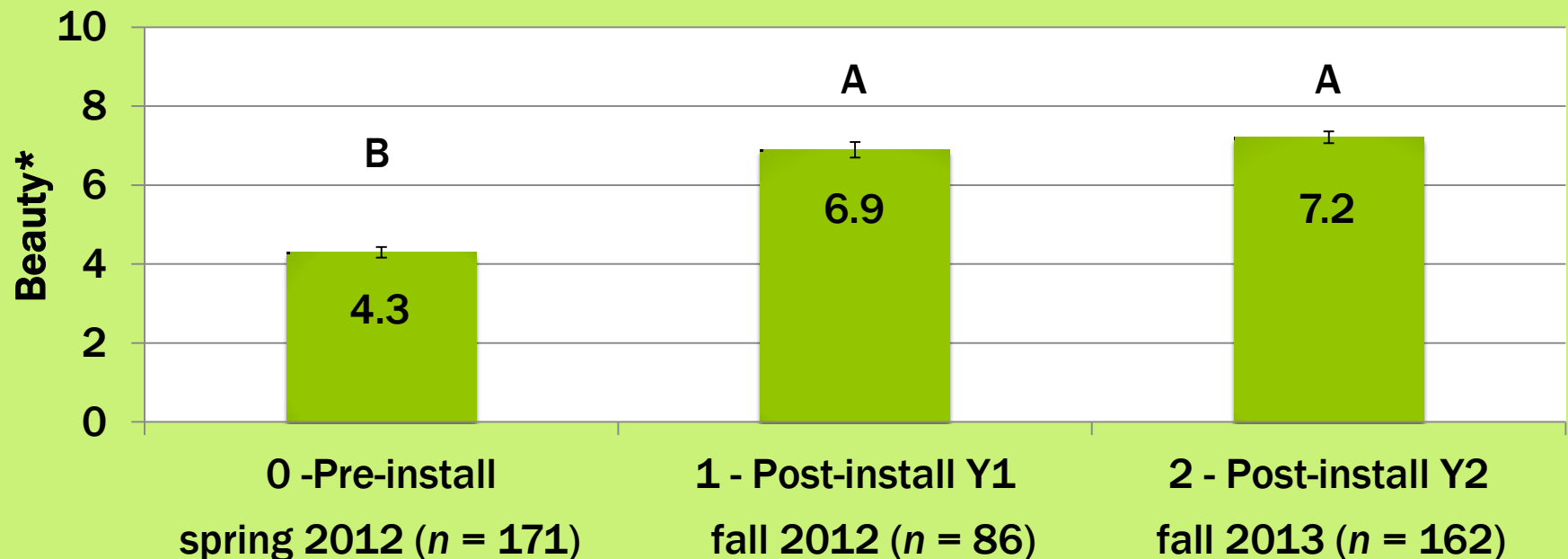
On a scale of 1 to 10, how aesthetically pleasing (beautiful) is the landscape to you?

Extremely poor

Average

Extremely high

1 2 3 4 5 6 7 8 9 10



*LS Means Differences Tukey HSD ($P < 0.0001$)

PRE & POST INSTALLATION SURVEY DATA

On a scale of 1 to 10, how well maintained does the landscape here appear to you?

Extremely poor

Average

Extremely high

1

2

3

4

5

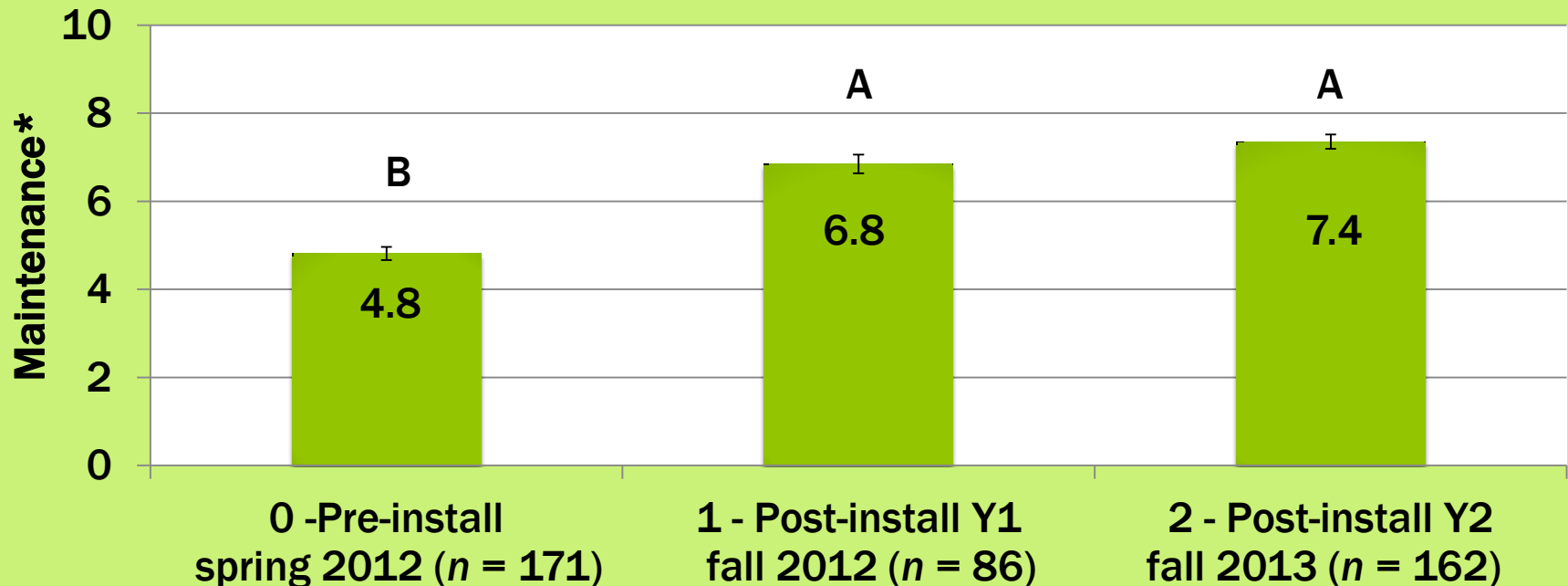
6

7

8

9

10



*LS Means Differences Tukey HSD ($P < 0.0001$)

PRE & POST INSTALLATION SURVEY DATA

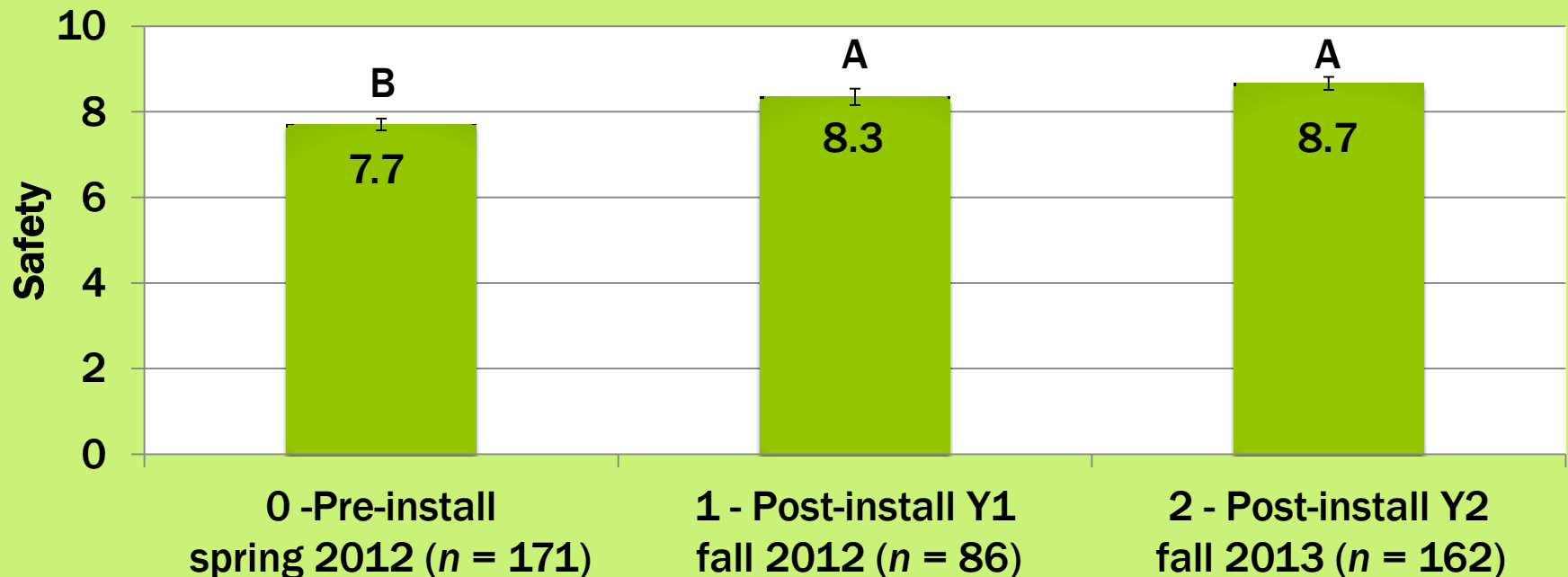
On a scale of 1 to 10, how **safe** do you feel in this landscape space?

Extremely poor

Average

Extremely high

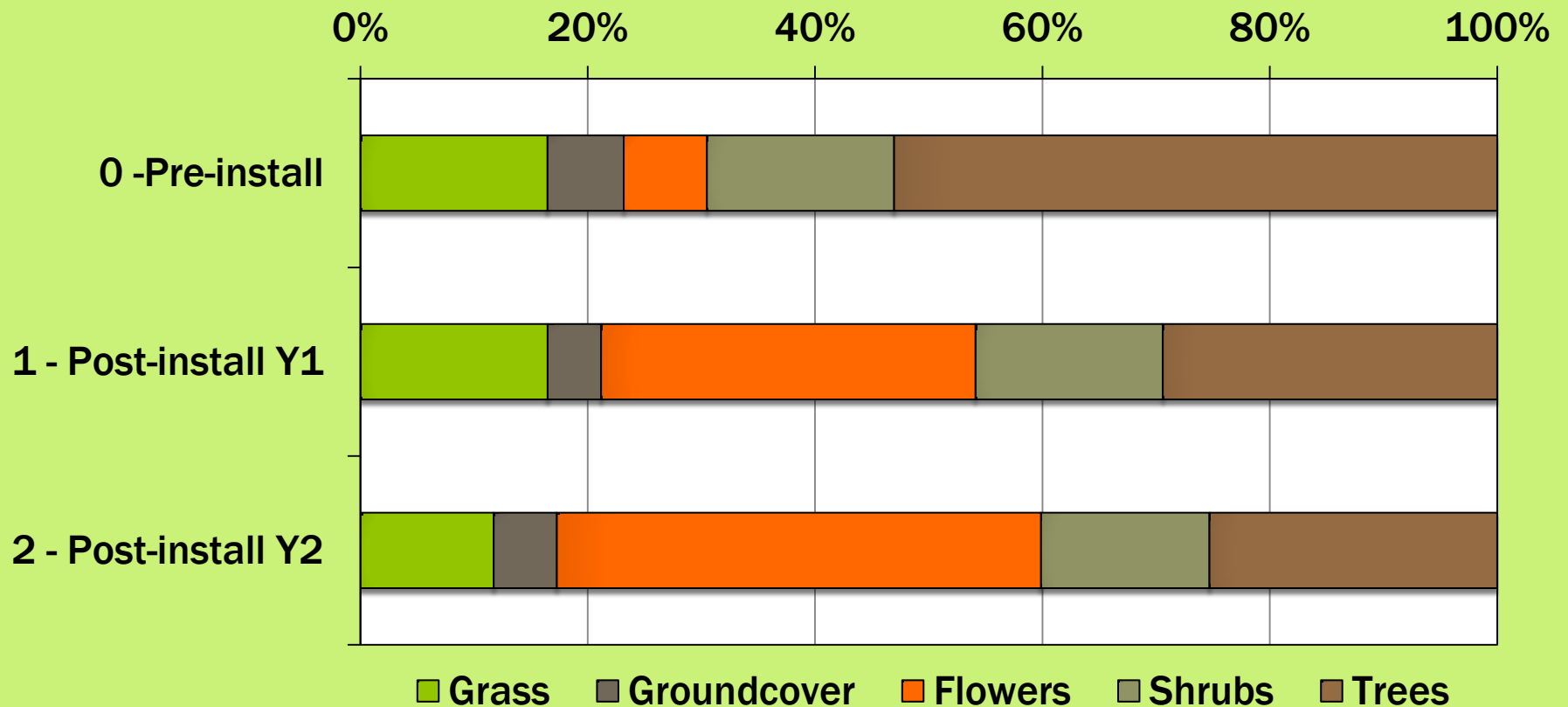
1 2 3 4 5 6 7 8 9 10



*LS Means Differences Tukey HSD ($P < 0.0001$)

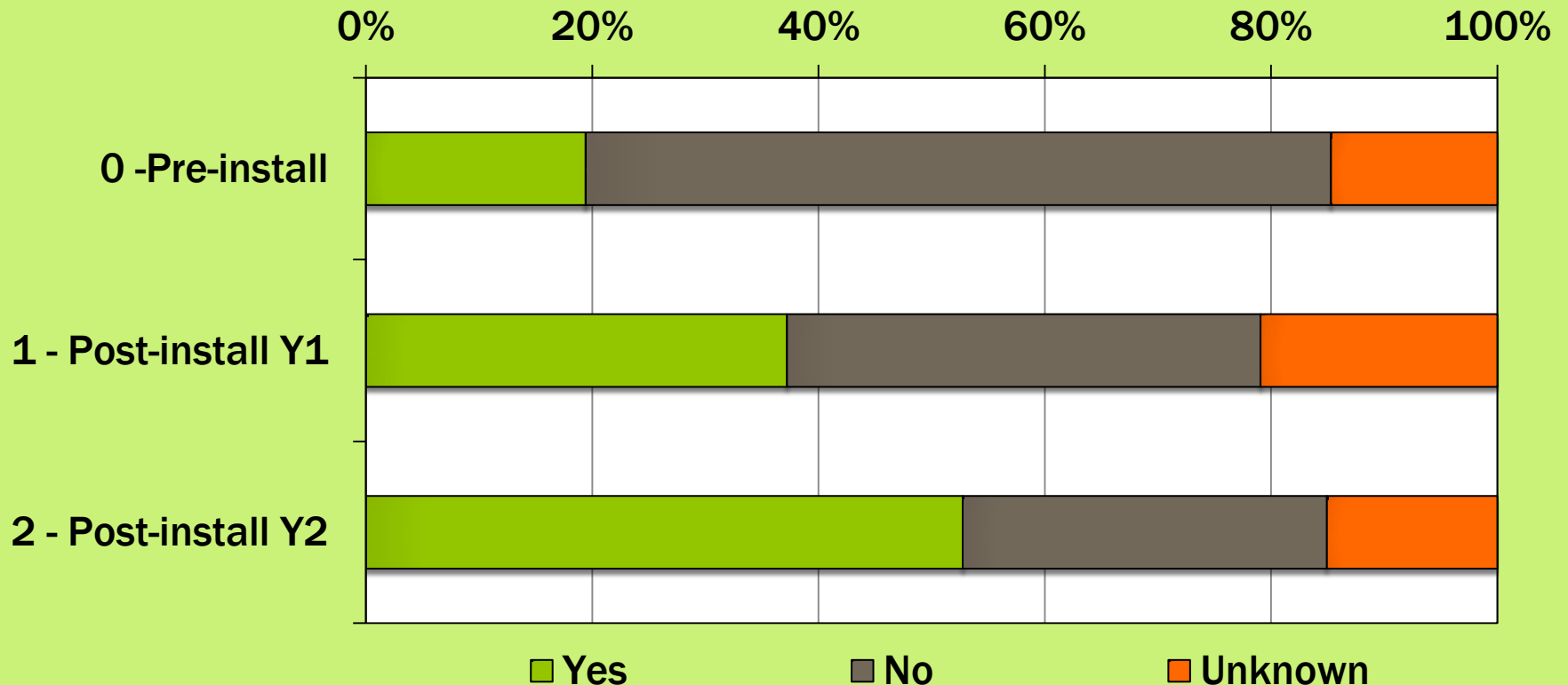
PRE & POST INSTALLATION SURVEY DATA

What type of plant here in this landscape do you most value or appreciate?



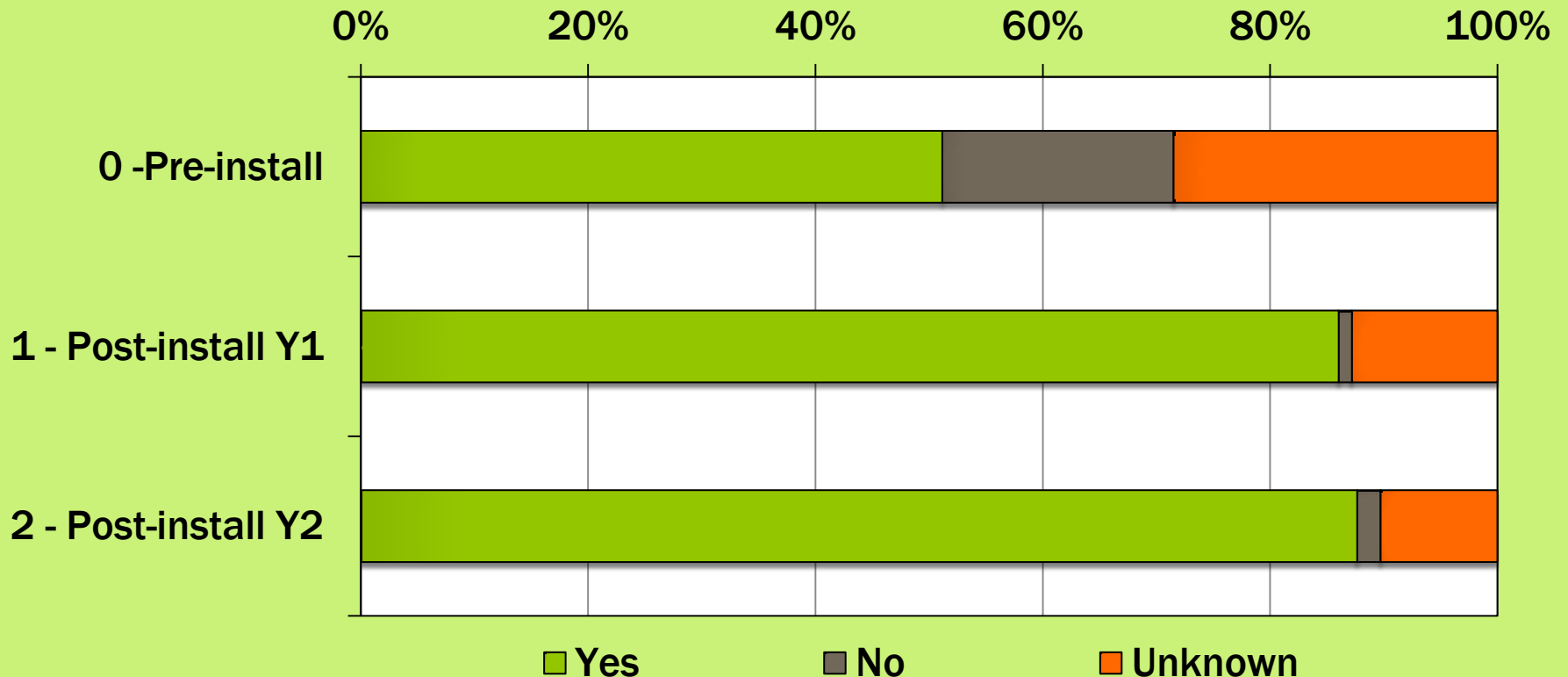
PRE & POST INSTALLATION SURVEY DATA

Does this landscape or the gardens right here teach you anything about soil, plants, or water?



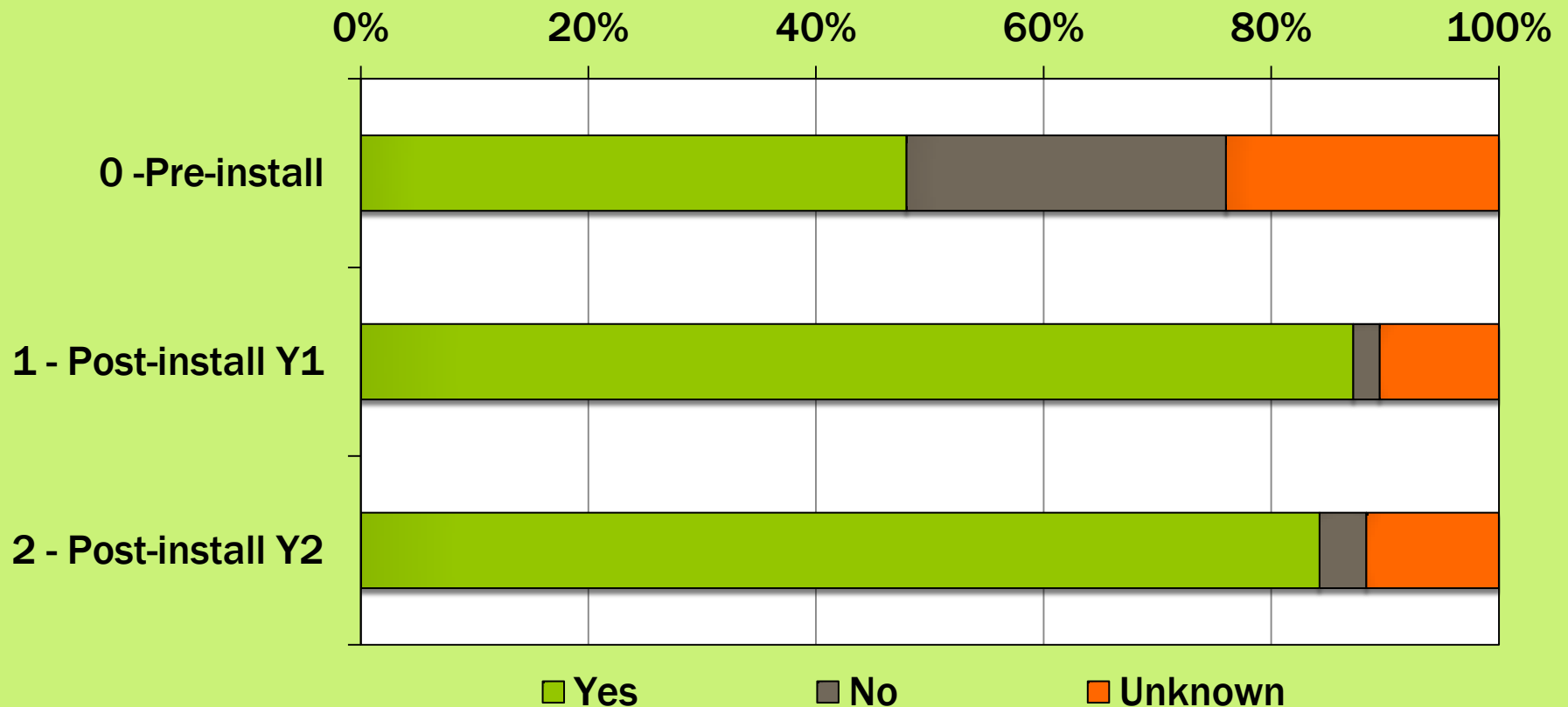
PRE & POST INSTALLATION SURVEY DATA

Do you think this landscape or the gardens right here are good for the environment?



PRE & POST INSTALLATION SURVEY DATA

Do you think this landscape or the gardens right here are good for human health and well-being?



POST INSTALLATION SUMMER 2013



Photo by E. Vincent

June 2013

INITIAL RESULTS-PERCEPTION SURVEYS

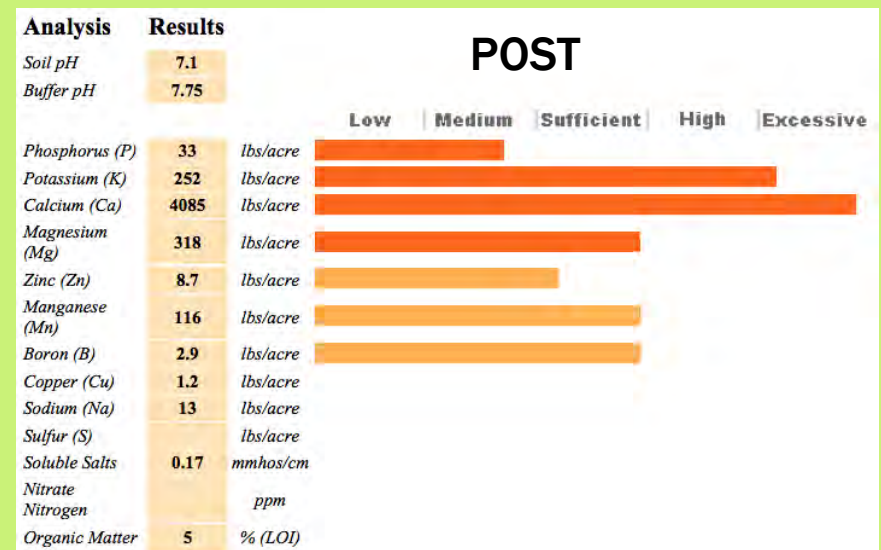
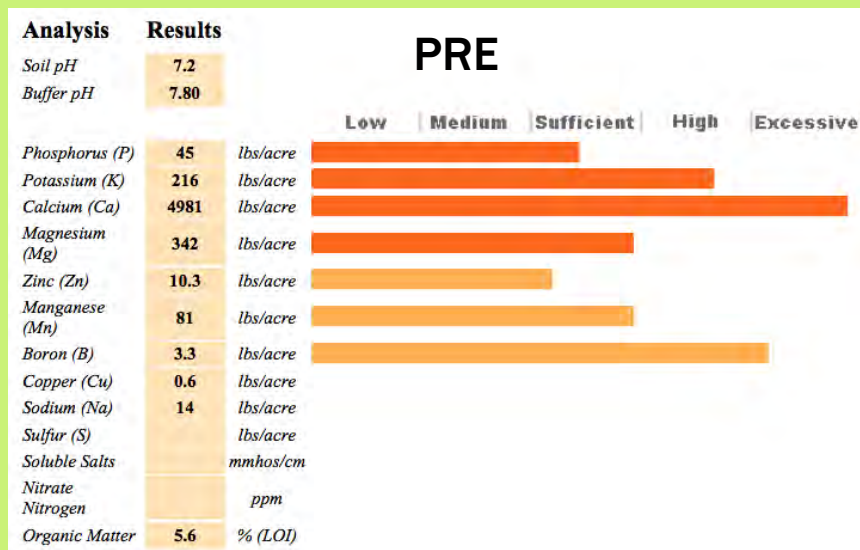
- Positive changes in perception of aesthetics and the quality of maintenance encouraging, considering that perennial plants generally require two complete growing seasons to reach peak performance and the post-installation survey was conducted after only one growing season.
- 38% increase in aesthetic perception
- 30% increase in landscape maintenance perception



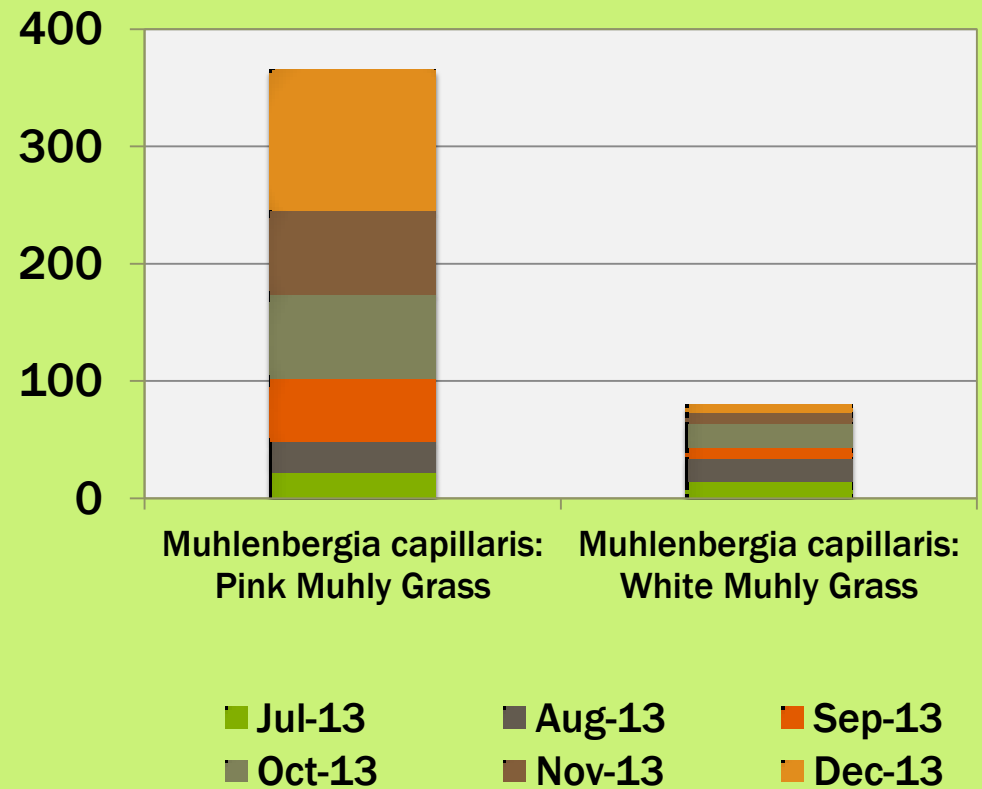
Photo by J. Windham

PRE & POST SOIL SAMPLE DATA

- Minimal change between pre & post soil sample data for
 - minerals
 - organic matter
 - CEC suggest
- Depletion of most minerals did not occur while plants establishing



WEB ANALYTICS (WEB HITS)



WEB ANALYTICS (WEB HITS)

3

Symphotrichum patens



Late purple aster (65)

4

Carex flaccosperma



Blue wood sedge (64)

5

Fothergilla gardenii

'Mt. Airy'



Dwarf fothergilla (59)

6

Echinacea purpurea



Kim's knee high (51)

Photos by Sarah White

WEB ANALYTICS (WEB HITS)

6



Flowering Dogwood (51)

7



Narrow-leaf Sunflower (51)

7



Butterfly weed(48)

8



Goldsturm black-eyed susan (47)

WEB ANALYTICS (WEB HITS)



MUHLENBERGIA CAPILLARIS

Latin name: *Muhlenbergia capillaris*

Common name: Pink Muhly Grass

Flowers: Showy¹² light purple late summer into autumn

Fruit: Not noticeable

Height & Width: 3' x 3'¹²

Type: Perennial ornamental grass¹²

Habit: Upright grass¹²

Wetland indicator category:** FACU¹⁷

Texture: Fine textured basal foliage¹²

Growth rate: Medium¹²

Light: Sun to light shade¹²

Moisture: Very drought tolerant¹²

Soil: Well drained soil does well in hot dry sandy sites¹

Zones: 6-9¹²

Origin: Western-central United States¹²



Photo by Walker Massey

Ecosystem benefits:

Aesthetically pleasing foliage & flowers

Low maintenance

Deer Resistant: High

MUHLENBERGIA CAPILLARIS 'WHITE CLOUD'

http://myfolia.com/retailers/854-park-seed/catalogue_items/73797-muhly-grass-white-cloud

Latin name: *Muhlenbergia capillaris*
'White Cloud'

Common name: White Muhly Grass

Flowers: Showy¹²

Fruit: Not noticeable¹²

Height & Width: 3' x 3'¹²

Type: Perennial ornamental grass¹²

Habit: Upright grass¹²

Wetland indicator category:** FACU¹⁷

Texture: Fine textured basal foliage¹²

Growth rate: Medium¹²

Light: Sun to light shade¹²

Moisture: Very drought tolerant¹²

Soil: Well drained soil does well in hot dry sandy sites¹²

Zones: 6-9¹²

Origin: Western-central United States¹²



Ecosystem benefits:

Aesthetically pleasing foliage & flowers

Low maintenance

Deer Resistant: High

CAREX FLACCOSPERMA

Latin name: *Carex flaccosperma*

Common name: Blue Wood Sedge

Flowers: Non showy flowers⁹

Fruit: Insignificant⁹

Height & Width: 1' x 1'⁹

Type: Sedge⁹

Wetland indicator category:** FAC+(2)

Habit: Upright clumps⁹

Texture: Medium¹⁶

Growth rate: Slow¹⁶

Light: Part shade¹⁶

Moisture: Medium to wet¹⁶

Soil: Fine or medium¹⁶

Zones: 5 to 8⁹

Origin: Southeast⁹



Ecosystem benefits:

Shade tolerant

Wetland tolerant

Low maintenance

Deer Resistant: High



<http://www.missouribotanicalgarden.org/PlantFinder/FullImageDisplay.aspx?documentid=5208>

http://plants.usda.gov/java/largeImage?imageID=cafl3_004_avp.jpg

SYMPHYOTRICHUM PATENS

Latin name: *Symphyotrichum patens*

Common name: Late Purple Aster

Flowers: Thin rayed purple ¹⁷

Fruit: Not noticeable¹⁷

Height & Width: 3' x 3' ¹⁷

Type: Perennial¹⁷

Habit: Forb/herb ¹⁷

Wetland indicator category:** N/A

Texture: Coarse¹⁷

Growth rate: Moderate ¹⁷

Light: Full sun ¹⁷

Moisture: Medium¹⁷

Soil: Coarse to medium soils ¹⁷

Zones: 7 to 8¹⁷

Origin: Southwest to eastern United States¹⁷



Photo by Walker Massey

Ecosystem benefits:

Drought tolerant

Low maintenance

Attracts butterflies

HELIANTHUS ANGUSTIFOLIUS

http://www.wildflower.org/image_archive/640x480/PCD2414/PCD2414_IMG0016.JPG

Latin name: *Helianthus angustifolius*

Common name: Swamp sunflower

Flowers: Prolific 2-3" flowers in fall with narrow yellow petals surrounding a brown or purple disc³

Fruit: Inconspicuous¹⁶

Height & Width: 5-7' x 4' ³

Type: Perennial¹⁰

Habit: Upright¹⁵; Flowering herb¹⁶

Wetland indicator category:** FAC, FACW¹⁷

Texture: Medium¹⁶

Growth rate: Moderate¹⁶

Light: Full sun to part shade²

Moisture: Medium to wet¹⁰

Soil*: pH preference 4-7¹⁶; tolerates Sandy, Sandy Loam, Medium Loam, Clay Loam, Clay, Acid-based soils¹⁰

Zones: 5-9³

Origin: Eastern North America¹⁶



Ecosystem Benefits:

Wetland tolerant (for bog or pond area)

Attracts birds

Special value to native bees

10: http://www.wildflower.org/plants/result.php?id_plant=HEAN2

ASCLEPIAS TUBEROSA



<http://www.bing.com/images/search?q=asclepias+tuberosa&FORM=HDRSC2#view=detail&id=27D409B3CECC4FEEF3D5C2590BA8B536503346AB&selectedIndex=37>

Latin name: *Asclepias tuberosa*

Common name: Butterfly Weed

Flowers: Vibrant orange umbels that produce colored follicles if left³

Fruit or cones: Ornamental follicles

Height & Width: 1'x1.5'³

Type: Herbaceous¹⁶

Wetland indicator category:** Not available¹⁷

Texture: Coarse¹⁶

Growth rate: Initially slow, medium when established³

Light: Full sun³

Moisture: Low¹⁶

Soil*: Course to medium soils¹⁶

Zones: 4-9³

Origin: Eastern North America¹⁶



<http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/b490/asclepias-tuberosa.aspx>

Ecosystem Benefits

Attracts: Hummingbirds , Butterflies

Larval Host: Grey Hairstreak, Monarch, Queens

Nectar Source: yes

Deer Resistant: High

http://www.wildflower.org/mobile/plants/result.php?id_plant=astu

EUPATORIUM MACULATUM

Latin name: *Eupatorium maculatum*

Common name: Spotted Joe-Pye Weed

Flowers: Flat-topped clusters in late summer with 9-15 flowers^{3,13}

Fruit: Inconspicuous¹⁰

Height & Width: 5-7' x 4'³

Type: Herbaceous perennial¹⁰

Habit: Upright¹⁰

Wetland indicator category:** FACW¹⁷

Texture: Medium¹⁸

Growth rate: Medium¹⁸

Light: Sun to part shade¹⁰

Moisture: Wet to moist^{10,13}

Soil*: Loamy and calcareous soils^{10,13}

Zones: 4 - 8³

Origin: Eastern North America¹⁶

Ecosystem Benefits:

Use Wildlife: Not a preferred food source for herbivores, but may be eaten occasionally by deer, rabbits and livestock.

Conspicuous Flowers: yes

Fragrant Flowers: yes

Interesting Foliage: yes

Attracts: Butterflies

Larval Host: The caterpillars of some moth species feed on various parts.

Nectar Source: yes

Special value to native bees

http://www.wildflower.org/plants/result.php?id_plant=EUMA12



http://www.wildflower.org/image_archive/640x480/PCD1285/PCD1285_IMG0061.JPG

ECHINACEA PURPUREA 'KIM'S KNEE HIGH'

Latin name: *Echinacea purpurea* 'Kim's Knee-High'

Common name: Purple coneflower

Flowers: Purple-pinkish petals surround a raised brown/bronze-colored center disk^{2,12}

Fruit: Inconspicuous³

Height & Width: 2' x 2'³

Type: Herbaceous perennial^{4,10}

Habit: Upright^{3,12}

Wetland indicator category:** Not available¹⁷

Texture: Coarse⁴

Growth rate: Medium⁴

Light: Full sun to part shade

Moisture: Dry to medium¹⁰

Soil*: Tolerates clay, sandy to rich soils^{10,12}

Zones: 3 - 8²

Origin: Midwestern to Eastern United States, including South Carolina¹⁶

Ecosystem Benefits:
Use Wildlife: Echinacea spp. attract butterflies and hummingbirds.
Use: Medicinal
Conspicuous Flowers: yes
Nectar Source: yes
Deer Resistant: No
Special value to native bees

http://www.wildflower.org/plants/result.php?id_plant=ECPU



http://www.wildflower.org/image_archive/640x480/SAW/SAW_01215.jpg

ECHINACEA LAEVIGATA

Latin name: *Echinacea laevigata*

Common name: Smooth Purple Coneflower

Flowers: Purple to pink, showy and delicate drooping purple rays. Blooms June to August¹²

Fruit: Not significant¹³

Height & Width: 2-5' x 1.5-2'¹²

Type: Herbaceous perennial¹²

Habit: Upright, cascading, mound¹⁶

Wetland indicator category:** No Wetland indicator was available for this plant.

Texture: Fine¹⁶

Growth rate: Moderate¹²

Light: Full sun to part shade¹²

Moisture: Dry to medium¹²

Soil: Tolerates clay soil, dry soil, shallow and rocky soil¹²

Zones: 3-8¹²

Origin: Southeastern United States¹⁶

Note: *This plant is on the United States threatened and endangered species list*¹⁶

Ecosystem benefits: Special value to native bees



***RUDBECKIA FULGIDA* 'GOLDSTURM'**

Latin name: *Rudbeckia fulgida* var. *sullivantii*
'Goldsturm'

Common name: Goldsturm Black-eyed Susan

Flowers: Yellow rays with black center disk¹²

Fruit: Inconspicuous¹⁰

Height & Width: 2-3' x 1-2'¹²

Type: Herbaceous perennial¹²

Habit: Upright, clump forming¹²

Wetland indicator category:** FAC¹⁷

Texture: Coarse¹⁰

Growth rate: Medium²

Light: Full sun²

Moisture: Medium to dry¹²

Soil*: Tolerates a wide variety of soils¹²

Zones: 3-9¹²

Origin: Eastern North America, including South Carolina¹⁶



Ecosystem Benefits:

Attracts: Birds

Special value to native bees

NEXT STEPS-PLANT RATINGS SHEETS

- Commercial ratings of individual plants
- Please visit the Sustainable Garden and rate the plants
- Ratings sheets available on line at all times
- Clemson Web; Sustainable Landscape Demonstration; Plants; Plant Ratings Sheets
- http://www.clemson.edu/cafls/demo/images/plant_ratings_sheet.pdf



Photo by J. Windham



College of Agriculture, Forestry and Life Sciences

CU > CAFLS > Sustainable Landscape Demonstration > Plant Profiles > Plant Profiles

Plant Profiles

Sources



- Home & Garden Information
- Extension
- Agricultural Services
- Experiment Station
- Livestock-Poultry Health
- Regulatory Services
- Centers & Institutes
- Public Service

Plant Profiles

- **PLANT RATING SHEETS** (PDF)
- *Amsonia tabernaemontana*: Eastern Blue Star
- *Andropogon glomeratus*: Bushy Bluestem
- *Asclepias tuberosa*: Butterfly weed
- *Baptisia australis*: Blue False Indigo
- *Calycanthus floridus*: Carolina Allspice
- *Carex flaccosperma*: Blue wood sedge
- *Carya ovata*: Shagbark Hickory
- *Chionanthus virginicus*: Fringe Tree

INDIVIDUAL PLANT RATING SHEET

Browser window showing the Individual Plant Rating Sheet form.

Form structure:

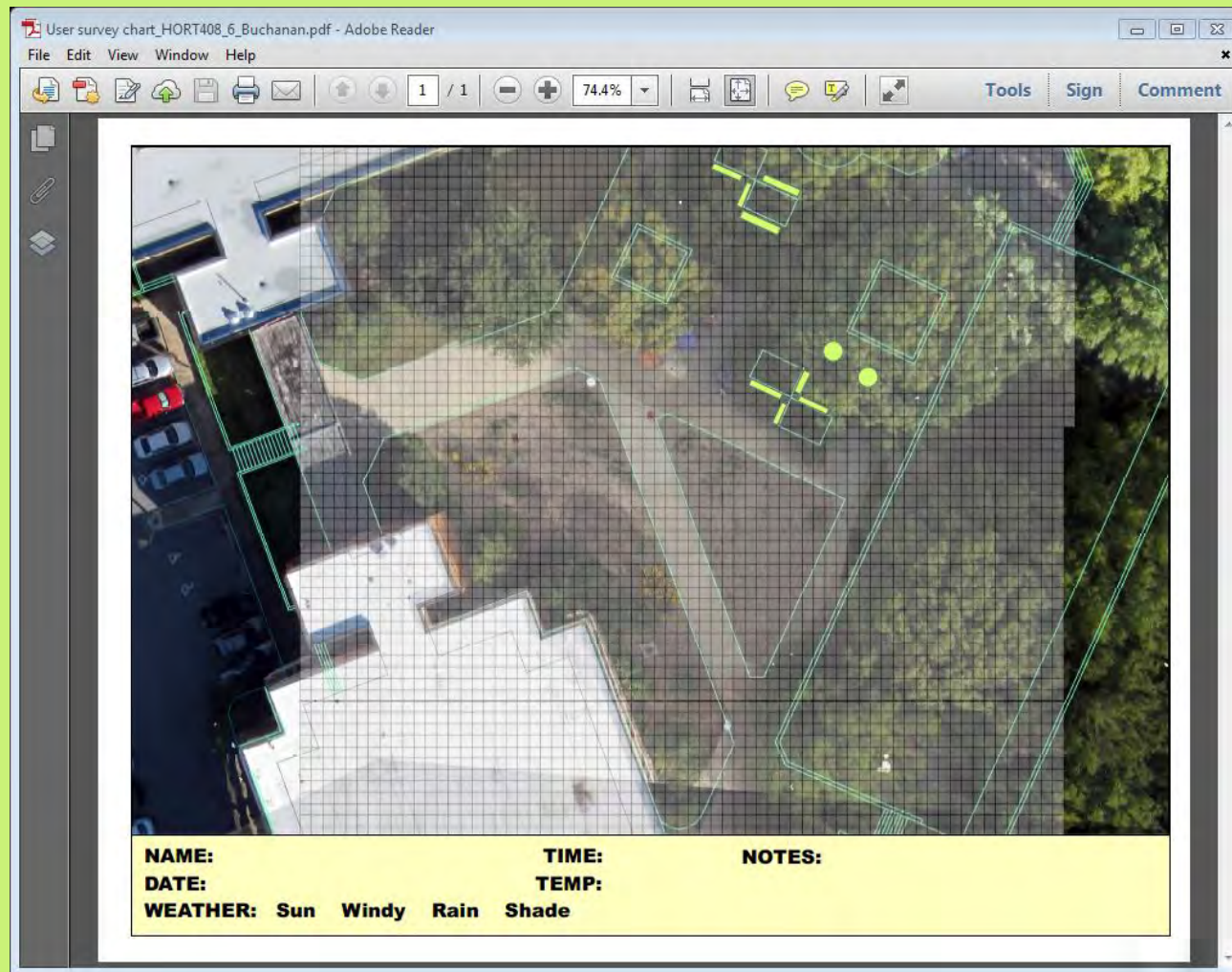
Plant name:	Poor	Average			Excellent	N/A	Comments
	1	2	3	4	5		
Bloom color							
Bloom shape							
Foliage color							
Foliage habit (behavior)							
Size							
Plant health							
Overall appearance							

Plant name:	Poor	Average			Excellent	N/A	Comments
	1	2	3	4	5		
Bloom color							
Bloom shape							
Foliage color							
Foliage habit (behavior)							
Size							
Plant health							
Overall appearance							

Dr. Ellen Vincent ellenav@clemson.edu Fax: 864-656-4960 Poole Ag Center Room 173 Clemson, SC 29634-0310
Thank you for completing this plant rating sheet!

NEXT STEPS – OBSERVATIONS USER

Inspired by
William H.
Whyte's
*Social life of
small urban
spaces*
(1980).



Graph
created by
Russell
Buchanan,
graduate
student of
Dr. Chris
Post
(Forestry).

WHAT IS THE DOMINATING THEORY?

<http://www.snre.umich.edu/ecomgt//graphics/faculty/nassauer.jpg>



Nassauer



Brundtland



Tallamy

Healthy
environment

Hester



http://www.kennuncorked.com/images_multiple_locations/sus_history_gro_harlem_brundtland.gif

<http://wildones.org/honorarydirectors/tallamydoug.jpg>

<http://www.pps.org/wp-content/uploads/2009/01/randolph-hester.jpg>

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- If different approaches produce similar findings, confidence in the results increases (Singleton and Straits, 2005, p. 574)

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ISA Certified Arborist

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**Sustainable Landscape Demonstration Garden : <http://www.clemson.edu/cafls/demo/>
Vincent research, pubs, presentations: <http://www.clemson.edu/cafls/research/vincent/>**