

Dr. Ellen Vincent 

# Sustainable Landscape Design

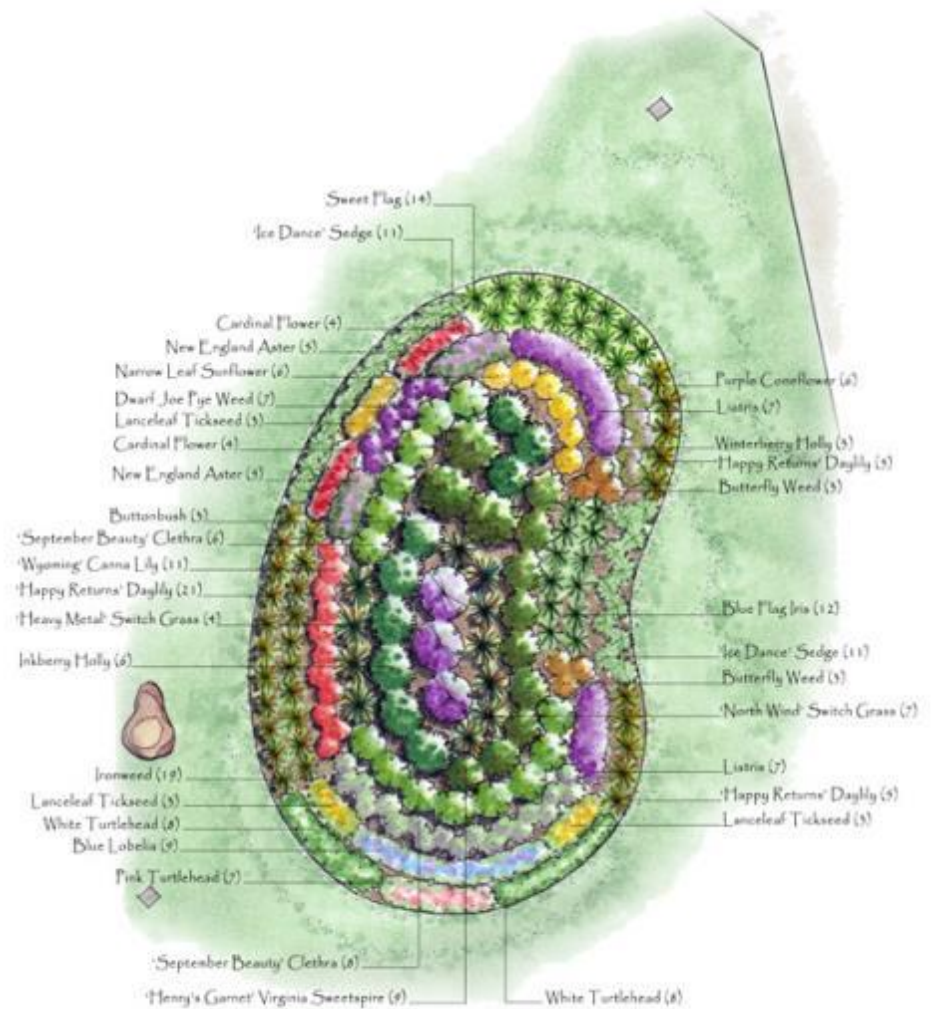


Advanced Master Gardener Training  
Columbia, SC  
13July2016



# “Sustainability” in landscapes

- Is a relative concept.
- Is a shift in thinking and practice.
- Is evolving.
- “They are still artificial landscapes inserted into highly disturbed site environments and maintained to meet the expectations of owners and occupants” (Cook & VanDerZanden, 2011, p. 1).



Renee Byrd design Byrdlandscapedesign.com

# Sustainable landscapes

- Ecologically more stable
- Require less inputs such as water, fertilizers and pesticides





# Sustainable development-historic definition

United Nations World Commission on Environment and Development created in 1983

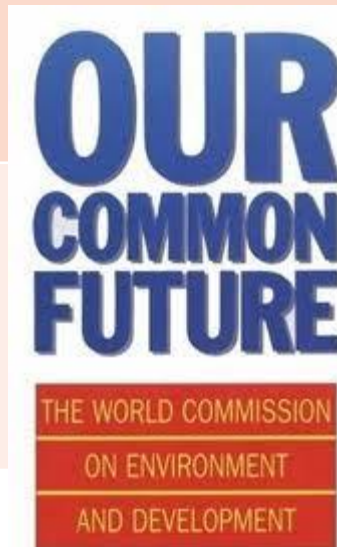
Chaired by Gro Harlem Brundtland, prime minister of Norway.



*Our Common Future* published in 1987  
Also known as *The Brundtland Report*

Claimed three components were essential to sustainable development: healthy environment, economic development, and social justice.

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



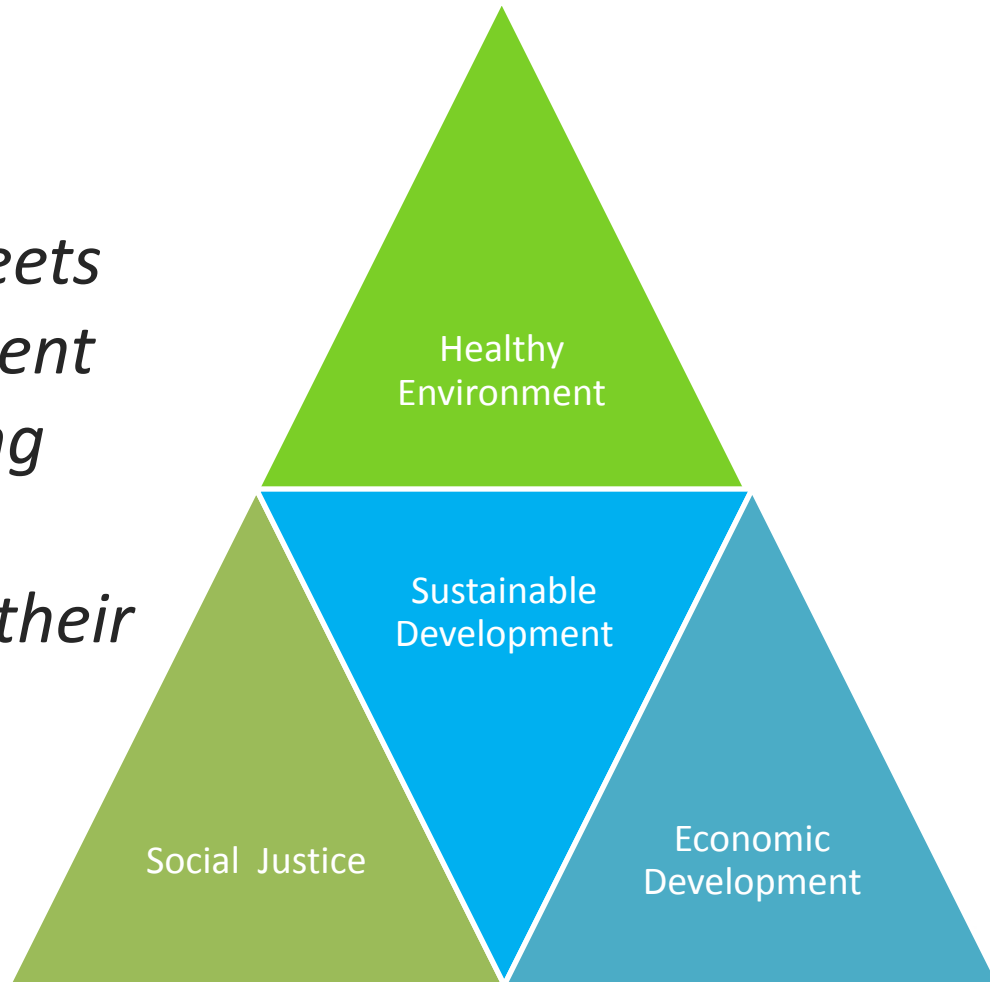
The World Commission on Environment and Development (1987). *Our Common Future*. Oxford: Oxford University Press

<http://www.google.com/imgres?q=Gro+Harlem+Brundtland&hl=en&client=firefox-a&sa=G&rls=org.mozilla:en-US:official&biw=1920&bih=1010&gbv=2&tbm=isch&tbnid=aD7pIDJh3zFtTM:&imgrefurl=http://news.harvard.edu/gazette/2002/10.03/09-sph.html&docid=E1gzh9kXl7rbcM&w=450&h=295&ei=YUJVTu2nJNOgtge73qWQAg&zoom=1&iact=hc&vpx=968&vpy=259&dur=1579&hovh=182&hovw=277&tx=57&ty=122&page=1&tbnh=135&tbnw=191&start=0&ndsp=68&ved=1t:429,r:17,s:0>

Cook, T. W. & VanDerZanden, A. (2011). *Sustainable landscape management*. Hoboken, NJ: John Wiley & Sons.

# Sustainable development-historic definition

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



Issue triad pyramid by Ellen Vincent

# Sustainable Sites Initiative: 2009-present



Collaborators for Sustainable Sites Initiative



# Sustainable Sites Initiative

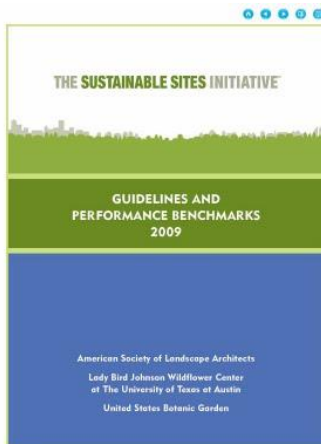
2009-Sustainable Sites Initiative (SSI) is piloting program as “case studies”.

Intention is to have SSI incorporated into the LEED Green Building Rating System.

Focus is currently on:

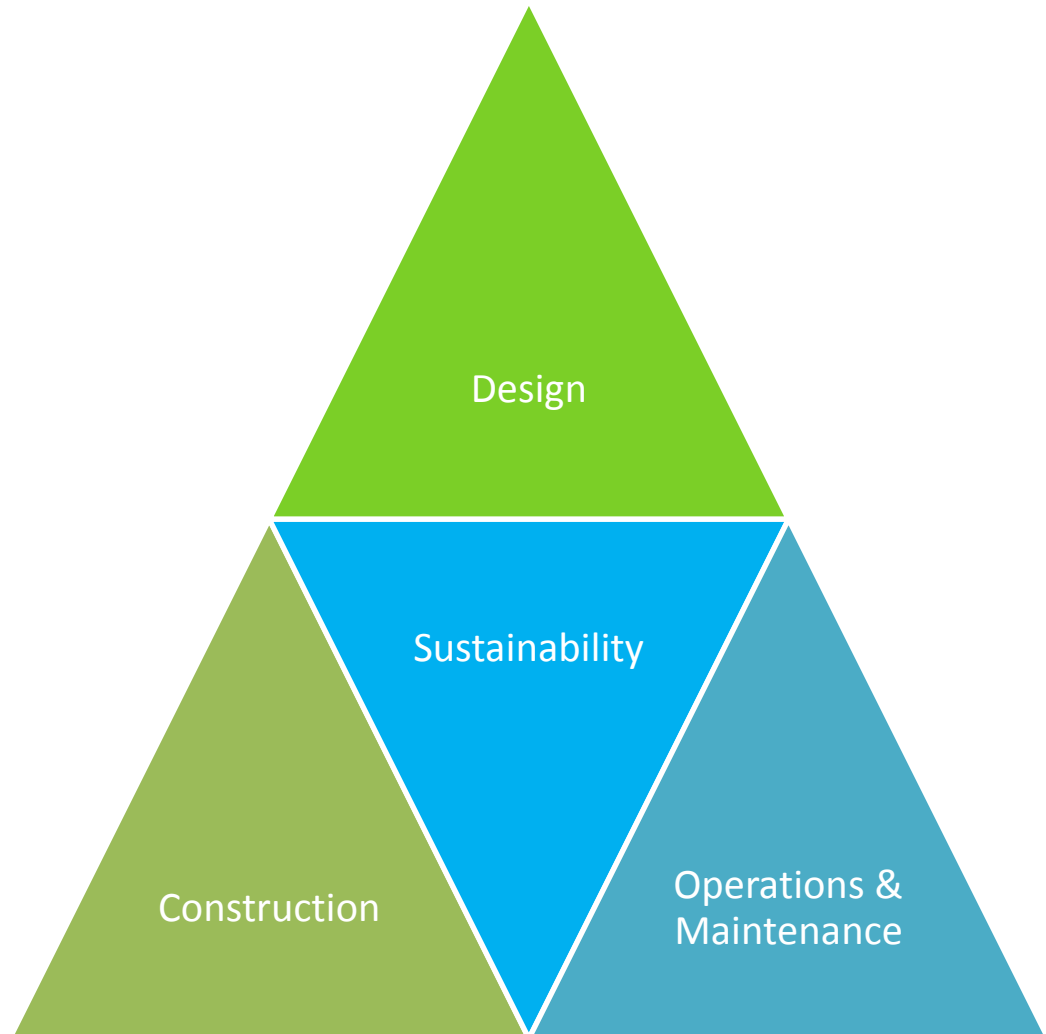
- Design
- Construction
- Establishment
- Operations and maintenance
- Monitoring and innovation of new developments

Program is designed to evolve over time.



# Sustainable Sites Initiative: modern definition

*“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”*  
(p. 5).



Issue triad pyramid by Ellen Vincent



# Sustainable Sites Initiative-resilient communities

## 2014: SITES v2 Rating System and Reference Guide

Sustainable landscapes create **ecologically resilient communities** better able to withstand and recover from episodic floods, droughts, wildfires, and other catastrophic events.

Program is designed to adapt over time.



# Sustainable Sites Initiative

**2014-SITES v2 is negotiating with Green Building Council to be part of LEED and receive certification.**

**Over 30 Certified Sites.**

Focus is currently on:

- Resiliency
- Ecosystem services
- Human health
- Materials
- Soil & vegetation
- Water



**2015-Sustainable SITES Initiative SITES® is produced by Green Business Certification Inc. (GBCI)**

Program is designed to evolve over time.

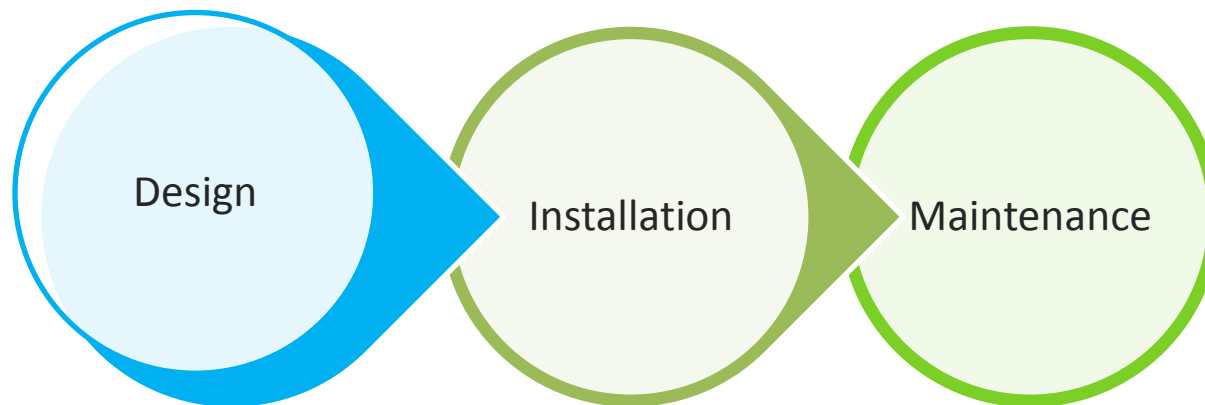
# SSI levels of certification



Certification Level	Points
SITES Certified	70-84 points earned
SITES Silver	85-99 points earned
SITES Gold	100-134 points earned
SITES Platinum	135+ points earned

# Sustainable landscapes initiative

- **Alignment (cooperative communication)** is needed between design, installation, and maintenance phases (p. 15).





# Absence of communication alignment

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- “Maintenance is currently ongoing in the 99% of all existing landscapes that were neither designed with sustainability in mind nor constructed using sustainable methods” (p. 12).
- “Maintenance contractors historically have been out of the decision making process until the landscape is completed” (p. 12).
- “They [maintenance contractors] inherit all of the underlying problems associated with the site...” (p. 12).

# Absence of communication alignment

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- Designed bed lines are altered by installation professionals
- Plant selection is altered by installers due to availability
- Plants not suited to the area are called for in the design
- Soil is damaged due to compaction during construction
- Existing tree's roots are damaged during construction
- An intended screen is pruned
- A layer is destroyed by limbing up a tree

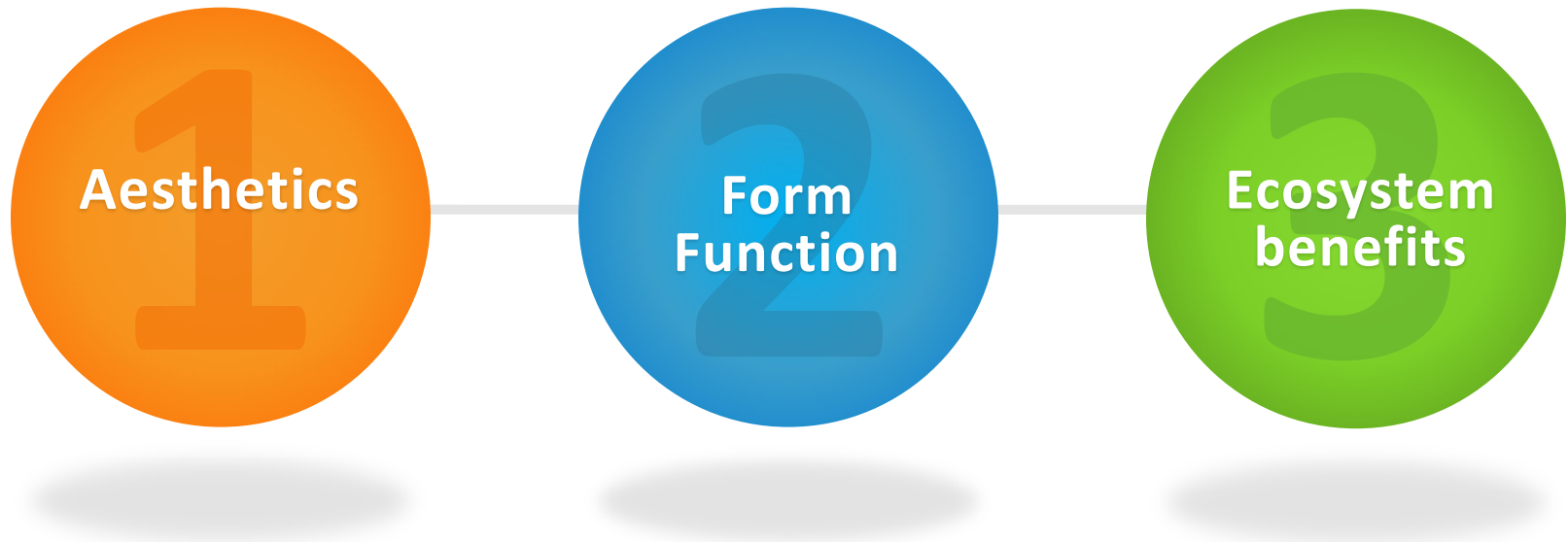
# Absence of communication alignment

- Existing tree's roots are damaged during construction



Cook, T. W. & VanDerZanden, A. (2011). *Sustainable landscape management*. Hoboken, NJ: John Wiley & Sons.

# Design intent





# Design intent

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- Design intent is the designer's vision for a site.
- This conventionally deals with (1) **aesthetic** and (2) **functional** landscape goals.
- Sustainable design adds (3) **ecosystems services** to the design intent (p. 18).

# Design intent



Aesthetics



# aesthetics

- **adj.** **1.** concerned with beauty or the appreciation of beauty. **2.** sensitive to beauty.
  - **n.** **1.** philosophy of the beautiful, esp. in art.
  - 2.** set of principles of good taste and the appreciation of beauty. (Oxford Desk Dictionary and Thesaurus, 2007, p. 14).



# Design intent: Aesthetics



Rugged aesthetic

Berkeley Marina



# Design intent: Aesthetics





# Design intent: Aesthetics



R

San Francisco Botanical Garden



# Design intent: Aesthetics



R





# Design intent: Aesthetics: The High Line, NYC



Photo by Paulina Pena

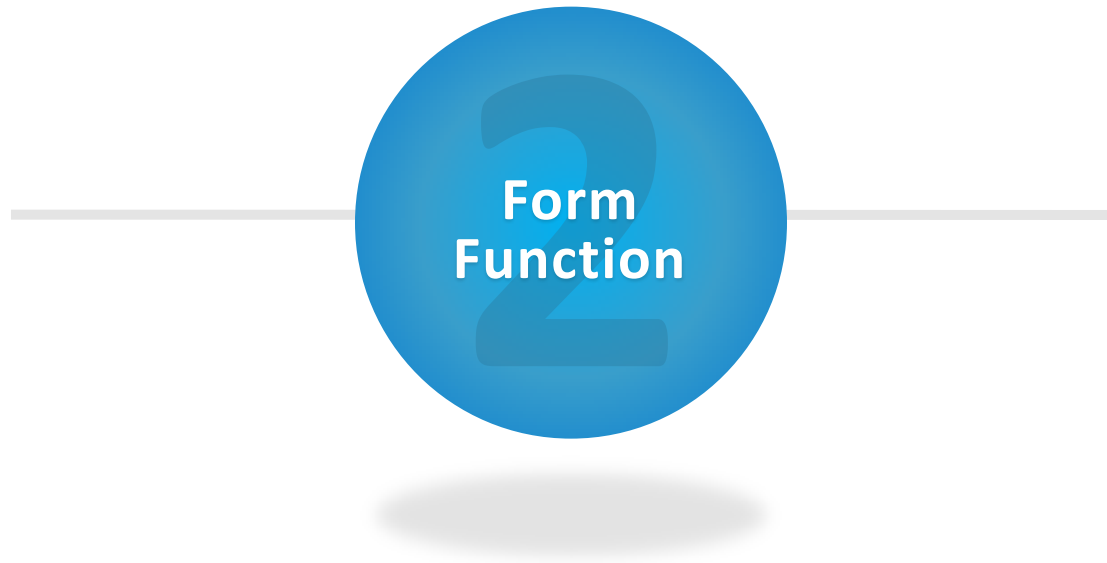


# Design intent: Aesthetics: The Sustainable Landscape Demonstration Garden, Clemson University



Photo by Ellen Vincent

# Design intent



# Design intent: Function

- The design **function** affects **how the landscape will be used** by employees, clients, customers, the public, or homeowners (p. 21).
- Two major **categories** of function:
  1. Size is appropriate for use and maintenance
    - Falls Park in Greenville, SC hosting public events. Too many people cause dead turf and trampled flower beds.
    - Falls Park: Plenty of room for mowers and electric carts.
  2. There are suitable access points and circulation routes
    - Rock Quarry Park in Greenville, SC has no truck access. Mowers are carried in by hand.



# Design intent: Function (size and access)



Falls Park, Greenville,  
SC

Photos by Ellen Vincent





# Design intent: Function (size and access)



Rock Quarry Garden,  
Greenville, SC

Photos by Ellen Vincent



Poor access for  
equipment

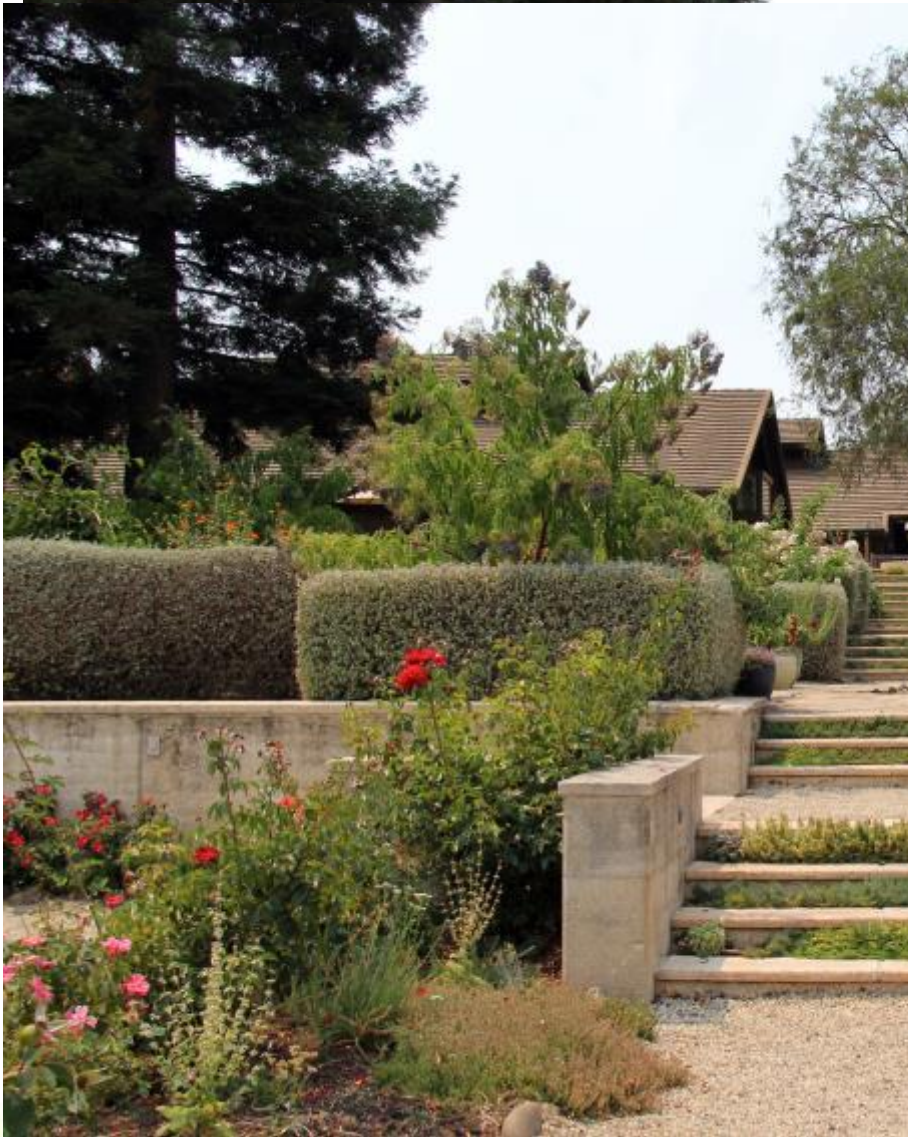


# Design intent: Function (size and access)





# Design intent: Function (size and access)



# Design intent

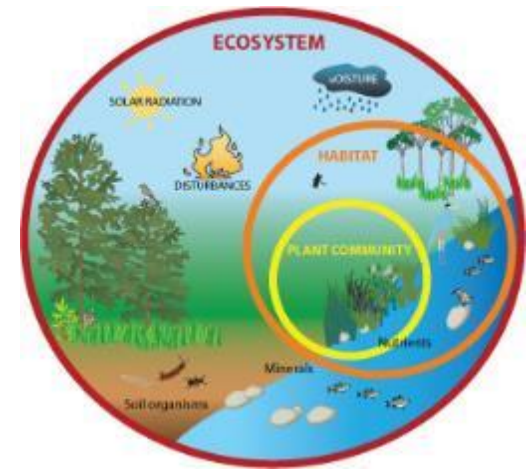




# Ecosystem defined

- Ecosystem is a complex set or relationships among:  
Living resources + habitats + residents (p. 81)

- Living resources = plants + animals
- Environmental elements = water + soil
- Residents = people



- *If one part of the ecosystem is damaged or disappears, it has an impact on everything else* (p.81).

# Ecosystems

- Healthy ecosystems are in balance
- Sustainable ecosystems contain biodiversity (p. 81)

***Biodiversity*** (def.) “the sum total of the variety of life and its interactions and can be subdivided into (1) genetic diversity; (2) species diversity; and (3) ecological or ecosystem diversity” (p. 81)

–defined by National Biological Information Infrastructure (NBII)

- Ecological landscape design treats landscapes as ecosystems (p. 81).

# Ecosystem services

Photo by E. Vincent



Photo source: North American Butterfly Association (see notes for Web location)

## 12 ecosystem services identified by Sustainable Sites Initiative (p. 83)

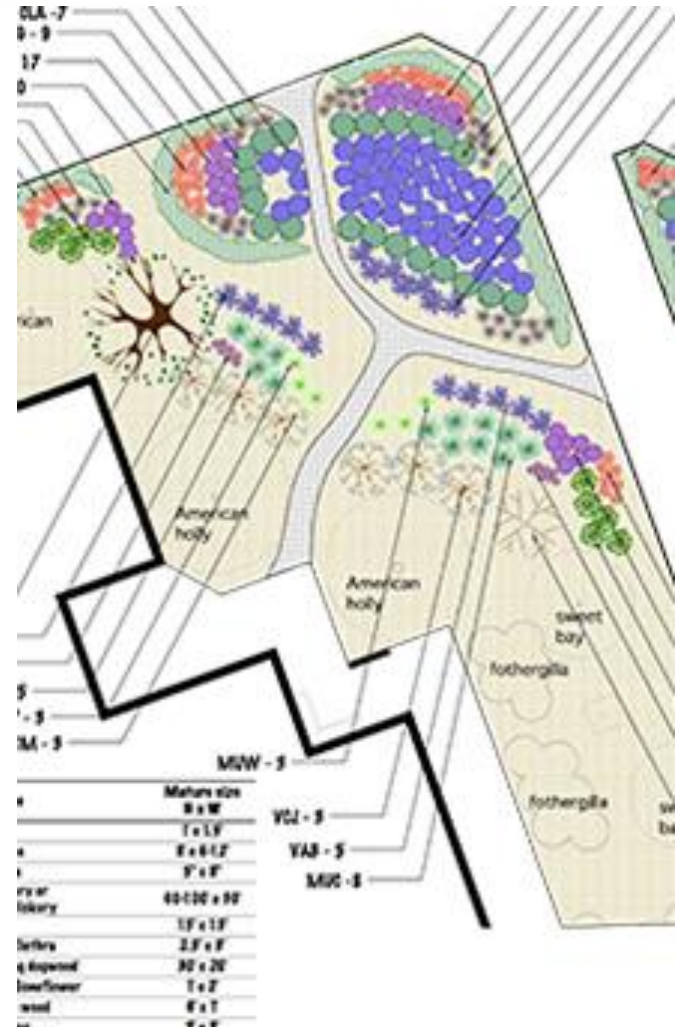
Global climate regulation	Erosion and sediment control	Waste decomposition and treatment
Local climate regulation	Hazard mitigation	Human health and well being benefits
Air and water cleansing	Pollination	Food and renewable nonfood products
Water supply and regulation	Habitat functions	Cultural benefits

Cook, T. W. & VanDerZanden, A. (2011). *Sustainable landscape management*. Hoboken, NJ: John Wiley & Sons.

<http://www.hummingbirdsplus.org/wp-content/uploads/2015/09/Ruby-Throated-Hummingbird.jpg>

# Design intent: Ecosystem benefits

- Ecosystem benefits are the goods and services provided by healthy ecosystems
- Examples:
  - Pollination of crops by bees, bats, or birds
  - Flood protection provided by wetlands
  - Filtration of air and water by vegetation and soils (The Case for Sustainable Landscapes, 2009, p. 6).



Allison Kelly  
Sustainable Landscape Demonstration  
Garden



# Ecosystem benefits-historical work

Rachel Carson, (1907-1964) marine biologist, author

*Silent Spring* (1962) published two years before she died of cancer



Believed man was assaulting the environment through excessive use of insecticides (DDT) (p. 7).

“contamination of air, earth, rivers, and sea with dangerous and even lethal materials” –Carson 1962 (p. 6).

Work spurred **creation of the U.S. Environmental Protection Agency (EPA)**; and spurred the ban on DDT and other insecticides.

<http://www.google.com/imgres?q=Rachel+Carson&hl=en&client=firefox-a&sa=G&rls=org.mozilla:en-US:official&biw=1920&bih=1010&gbv=2&tbn=isch&tbnid=5YnjENqAGFTFTM:&imgrefurl=http://www.uncoverage.net/tag/rachel-carson/&docid=dBrEfvzkQRUMIM&w=600&h=460&ei=vDxVTvLXIlmDtgf8yICQAg&zoo m=1&iact=hc&vpx=1158&vpy=126&dur=11106&hovh=197&hovw=256&tx=93&ty=138 &page=1&tbnh=135&tbnw=157&start=0&ndsp=73&ved=1t:429,r:8,s:0>

# Ecosystem benefits-historical work

Rachel Carson, (1907-1964) marine biologist, author

Ellis Reid, 1<sup>st</sup> grader in NC



<http://www.google.com/imgres?q=Rachel+Carson&hl=en&client=firefox-a&sa=G&rls=org.mozilla:en-US:official&biw=1920&bih=1010&gbv=2&tbn=isch&tbnid=5YnjENqAGFTFM:&imgrefurl=http://www.uncoverage.net/tag/rachel-carson/&docid=dBrEfvzkQRUMIM&w=600&h=460&ei=vDxVTvLXIIImDtgf8yICQAg&zoom=1&iact=hc&vpx=1158&vpy=126&dur=11106&hovh=197&hovw=256&tx=93&ty=138&page=1&tbnh=135&tbnw=157&start=0&ndsp=73&ved=1t:429,r:8,s:0>



Photo courtesy of Laurie Reid



# Ecosystem benefits

- Not currently accounted for in our economic calculations (The Case for Sustainable Landscapes, 2009, p.6).
- Usually under-considered by land use decision makers.
- + May be **increased** by using healthy ecosystems as a model during development.
  - See Biomimicry Institute ‘Ask Nature’ Web page at <http://www.asknature.org/>.

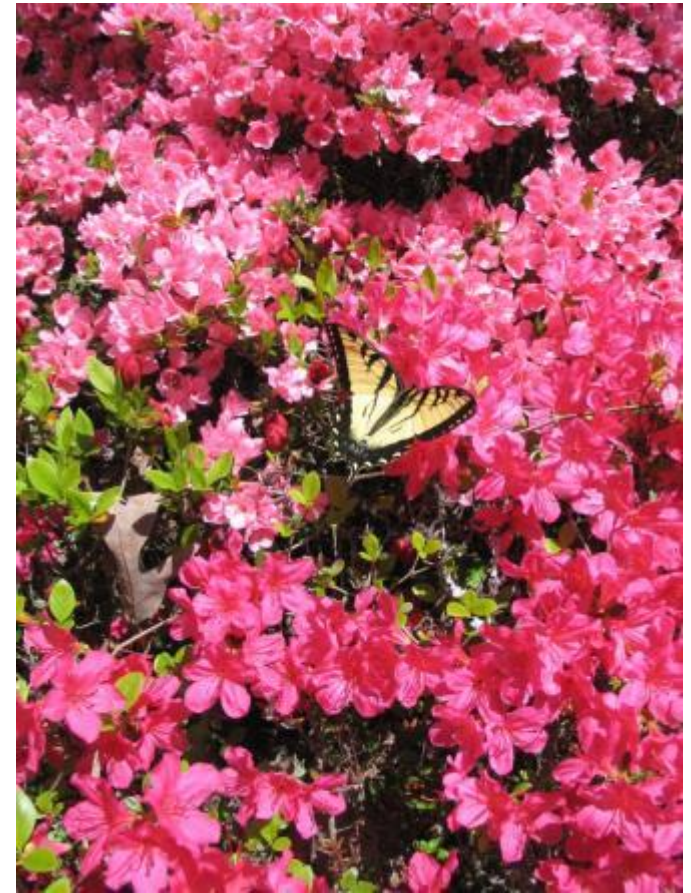


Photo by Ellen Vincent



# Ecosystem benefits



- Lady Bird Johnson Wildflower Center Native Plant Database:
- <http://www.wildflower.org/plants/>

Photo by Ellen Vincent



# Ecosystem benefits-*Baptisia australis*

## BENEFIT

- **Use Other:** Plant juice turns purple on exposure and is a fair substitute for true indigo in making blue dye.  
**Warning:** Other plants in this genus are poisonous if ingested, although no human fatalities have been recorded. Sensitivity to a toxin varies with a person's age, weight, physical condition, and individual susceptibility. Children are most vulnerable because of their curiosity and small size. Toxicity can vary in a plant according to season, the plant's different parts, and its stage of growth; and **plants can absorb toxic substances, such as herbicides, pesticides, and pollutants from the water, air, and soil.**  
**Conspicuous Flowers:** yes

## VALUE TO BENEFICIAL INSECTS

- Special Value to Native Bees  
Special Value to Bumble Bees

This information was provided by the Pollinator Program at **The Xerces Society for Invertebrate Conservation.**



*Baptisia australis* Blue false indigo

<http://www.nps.gov/plants/pubs/chesapeake/img/Herbaceous/Baptisia-australis-1-USFWS-.jpg>

# Ecosystem benefits-*Echinacea purpurea*

## BENEFIT

**Use Wildlife:** Echinacea spp. attract butterflies and hummingbirds.

**Conspicuous Flowers:** yes

**Nectar Source:** yes

**Deer Resistant:** No

## VALUE TO BENEFICIAL INSECTS:

- Special Value to Native Bees

This information was provided by the Pollinator Program at **The Xerces Society for Invertebrate Conservation.**



Photo by Walker Massey

*Echinacea purpurea* Purple coneflower  
Sustainable Landscape Demonstration  
Garden, Clemson University



# Ecosystem benefits-*Cercis canadensis*

## BENEFIT

**Use Food:** Add flowers and flower buds to salads, breads and pancakes. They have a slightly sour taste, high in vitamin C. Young pods may be eaten raw, boiled or sauteed. (Tull)

**Use Other:** Boiled in water, redbud twigs produce a yellow dye. (Kershaw)

**Conspicuous Flowers:** yes

**Fragrant Flowers:** yes

**Attracts:** Birds

**Deer Resistant:** Moderate

## VALUE TO BENEFICIAL INSECTS

Special Value to Native Bees

Special Value to Bumble Bees

Provides Nesting Materials/Structure for Native Bees

This information was provided by the Pollinator Program at **The Xerces Society for Invertebrate Conservation**.



*Cercis canadensis* Eastern redbud

[https://www.wildflower.org/gallery/result.php?id\\_image=30110](https://www.wildflower.org/gallery/result.php?id_image=30110)

# Ecosystem benefits-*Magnolia virginiana*

## BENEFIT

**Use Ornamental:** Attractive, aromatic, showy, blooms are ornamental

**Use Wildlife:** Very low. Nectar-moths, Nectar-beetles

**Conspicuous Flowers:** yes

**Fragrant Flowers:** yes

**Attracts:** Birds

BUTTERFLIES AND MOTHS OF NORTH AMERICA (BAMONA)

Sweetbay silkmoth (*Callosamia securifera*)



*Magnolia virginiana* Sweetbay magnolia



Laval host

Lady Bird Johnson Wildflower Center Native Plant Database  
[https://www.wildflower.org/plants/result.php?id\\_plant=ECPU](https://www.wildflower.org/plants/result.php?id_plant=ECPU)



# Ecosystem benefits-*Nyssa sylvatica*

## BENEFIT

**Use Ornamental:** Shade tree, Fall conspicuous, Bog or pond area, Water garden

**Use Wildlife:** Substrate-insectivorous birds, Fruit-birds, Fruit-mammals, Browse, Nectar-bees

**Attracts:** Birds

## VALUE TO BENEFICIAL INSECTS

Special Value to Honey Bees

This information was provided by the Pollinator Program at **The Xerces Society for Invertebrate Conservation.**



*Nyssa sylvatica* Blackgum

*N. sylvatica*  
'Wildfire'



[https://www.wildflower.org/gallery/result.php?id\\_image=35398](https://www.wildflower.org/gallery/result.php?id_image=35398)



Lady Bird Johnson Wildflower Center  
Native Plant Database  
[https://www.wildflower.org/plants/result.php?id\\_plant=ECPU](https://www.wildflower.org/plants/result.php?id_plant=ECPU)  
[www.saundersbrothers.com/\\_ccLib/image/plants/DETA-591.jpg](http://www.saundersbrothers.com/_ccLib/image/plants/DETA-591.jpg)



# Ecosystem benefits-*Taxodium distichum*

*Taxodium distichum*

Bald cypress

## Benefit

**Use Ornamental:** Fall conspicuous, Long-living, Attractive

**Use Wildlife:** Cover, Nesting site, Substrate-insectivorous birds, Seeds-granivorous birds, Seeds-Small mammals

**Interesting Foliage:** yes

**Attracts:** Birds

**Deer Resistant:** Moderate



Photo by E. Vincent

Tree is a larval host and/or nectar source for:

**Baldcypress sphinx** (*Isoparce cupressi*)



<http://www.silkmoths.bizland.com/IsoparcecupressiJuly18Alabamaadb.jpg>

# Native plant design: Lady Bird Johnson Wildflower Center



Photo by E. Vincent

Lady Bird Johnson Wildflower Center Austin, TX



# Native plant design: Lady Bird Johnson Wildflower Center



Photo by E. Vincent

Lady Bird Johnson Wildflower Center Austin, TX



# Native plant design: Lady Bird Johnson Wildflower Center



Photo by E. Vincent

Lady Bird Johnson Wildflower Center Austin, TX

# Group discussion

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- What is your opinion regarding using native plants now?
- What was your opinion about using native plants 10 years ago?
- Do you have a favorite native plant?





# Sustainable design

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## *Right plant right place*

- Objective is to create or preserve a **plant community** that needs minimal inputs of:
  1. water
  2. fertilizer
  3. pesticides
  4. maintenance as plants mature (become established) (p. 19).



# Sustainable design

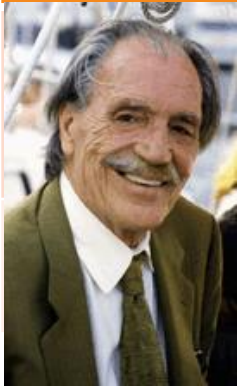
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- **Identify and plan for what is already there.**  
Enrich and enhance.
- Restore existing habitats that will be damaged during construction.
- Create new habitats where possible and provide **linkages** between new and existing habitats-both on site and with surrounding areas (p. 19).

# Site analysis: Identify what is already there

Ian McHarg (1920-2001) landscape architect/urban planner at University of PA focused on the built environment

*Design with Nature* (1969)



Promoted careful **site analysis** to avoid destruction of natural ecosystems and yet allow for recreation and tourism (p. 8).

Work contributed to the development of geographic information systems (GIS)

<http://www.google.com/imgres?q=ian+mcharg&um=1&hl=en&client=firefox-a&sa=N&rls=org.mozilla:en-US:official&gbv=2&biw=1920&bih=1010&tbn=isch&tbnid=BkVVtNk0JgitzM:&imgrefurl=http://www.upenn.edu/almanac/between/McHarg.html&docid=rpAkY9mJ4EKyOM&w=135&h=224&ei=tT5VToL7C9Kgtgeip-iPAg&zoom=1&iact=hc&vpx=554&vpy=139&dur=374&hovh=126&hovw=86&tx=94&ty=97&page=1&tbnh=126&tbnw=86&start=0&ndsp=76&ved=1t:429,r:3,s:0>

# Site analysis: Identify what is already there

Item	Location(s)
Soil type: physical, chemical, and biological	Soil analysis at University or private laboratory
Seasonal precipitation (monthly plus annual precipitation)	Normal monthly precipitation at NOAA: <a href="http://www.ncdc.noaa.gov/oa/climate/online/ccd/nrmlprcp.html">http://www.ncdc.noaa.gov/oa/climate/online/ccd/nrmlprcp.html</a> Clemson: <a href="http://www.clemson.edu/extension/irrigation/irrig_mgmt/precip_amnts.html">http://www.clemson.edu/extension/irrigation/irrig_mgmt/precip_amnts.html</a>
Sun and shade pattern change during day, during growing season, and over lifetime of landscape	On site observations
Microclimates (wind, shade, and sun exposure, and humidity) in a small area within landscape	On site observations
Culturally important items	On site observations; user interviews; search local publications



# Sustainable landscapes: Use what is already there

- Use existing site topography (p, 31)
- Minimize grading with terraces
- Design a dry river bed to temporarily guide and hold water during a rain event.



Photo by Ellen Vincent

Dry stream bed by Bob Vickery  
The Planter's Touch

# Sustainable design: Use what is already there

- Use existing hardscape (p. 32).
- Brick, concrete and stone can be reused for patios, walkways, and driveways.
- Add to existing hardscape (p. 32)
- Avoid transporting debris and depositing in landfill.



Photo by Ellen Vincent

“Detroit” office used by Stoner Landscape



# Sustainable design: Use what is already there



Photo by Ellen Vincent

Crushed glass mulch at Lady Bird Johnson Wildflower Center



# Sustainable design: Use what is already there

- **Use existing plants** (p, 32).
- The oldest trees may not be able to withstand construction impacts while **younger trees have more recuperative power.**
- Protection must be mandated for existing plant material. (p. 32)



Photo by Ellen Vincent

Seabrook Island, SC

# Identify culturally significant items: Trees of merit

Angel  
Oak on  
John's  
Island,  
SC



Photo by Ellen Vincent

Preserving older trees of significance must take priority



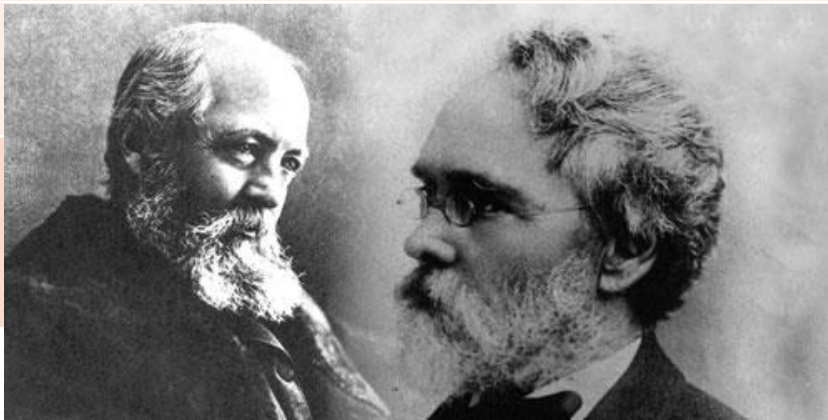
# Sustainable design-linkages for communities

Mid 1800s Frederick Law Olmsted (1822-1903) and Calvin Vaux (1824-1905)

*Developed plans for Central Park and Prospect Park in NY City.*

Olmsted is the “Father of landscape architecture” (p. 2).

Believed that cities were stressful and that nature (parks) were therapeutic.



Created “natural” landscapes that were highly manufactured.

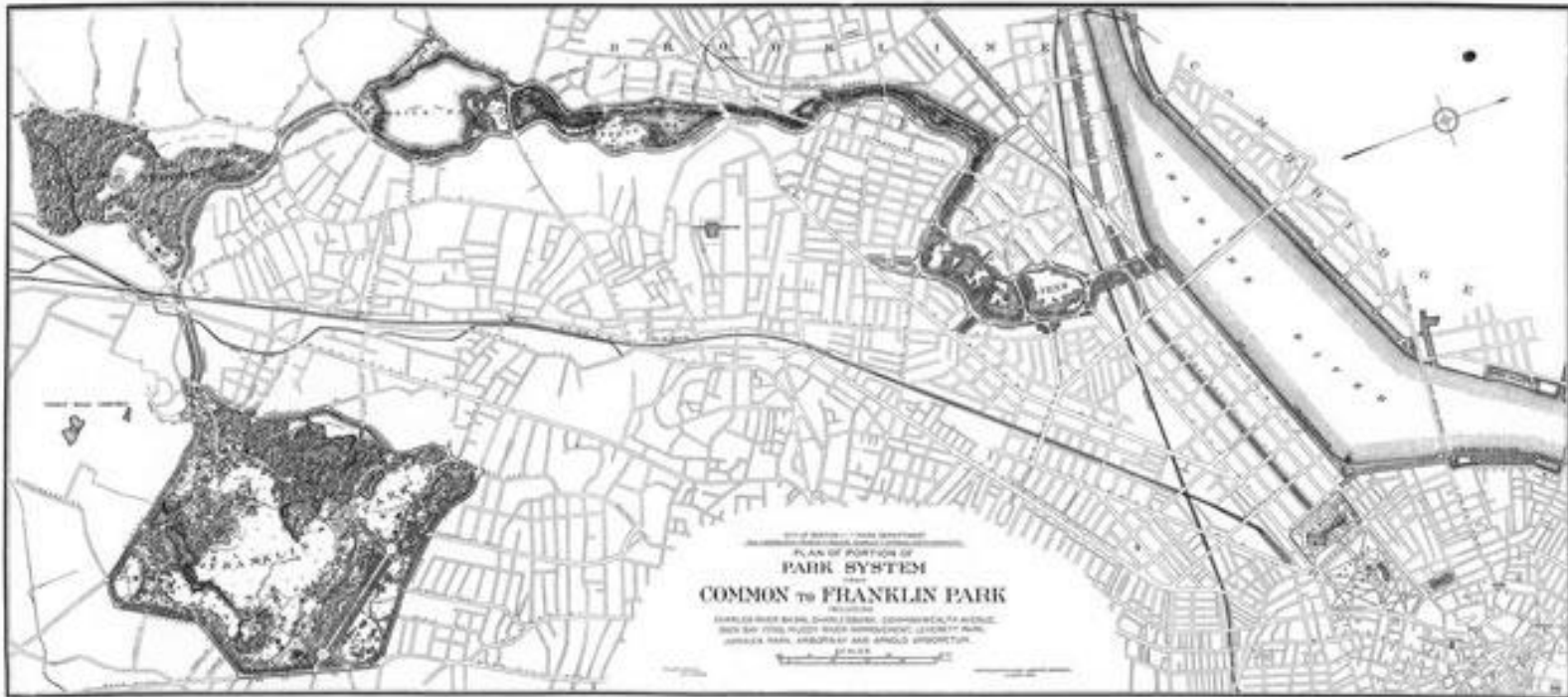
Created Boston’s ‘Emerald Necklace’ and Olmsted led Biltmore Estate landscape plan.

<http://www.google.com/imgres?q=Olmsted+and+Vaux&num=10&um=1&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&gbv=2&biw=1920&bih=1010&tbm=isch&tbnid=2oobvCJWzzMtUM:&imgrefurl=http://www.prospectpark.org/about/history/architects&docid=6N84G5aTRXQCIM&w=500&h=250&ei=kDZVTpybMYXBtGfPpPCPAg&zoom=1&iact=hc&vpx=150&vpy=111&dur=2983&hovh=159&hovw=318&tx=130&ty=109&sqi=2&page=1&tbnh=89&tbnw=177&start=0&ndsp=64&ved=1t:429,r:0,s:0>

Cook, T. W. & VanDerZanden, A. (2011). *Sustainable landscape management*. Hoboken, NJ: John Wiley & Sons.



# Linkages-Emerald Necklace Boston by Olmsted



<https://www.asla.org/guide/site.aspx?id=40785>

The Emerald Necklace today 1,100-acre chain of green spaces connecting the Boston and the 1837 Public Garden to five parks and an arboretum designed by Olmsted, which are linked by parkways and waterways: The Arnold Arboretum (1872), Back Bay Fens (1878), Franklin Park (1881), The Riverway (1892), Olmsted Park (1892), and Jamaica Pond (1892).

# Linkages-Central Park NYC by Olmsted & Vaux



Olmsted & Vaux's original Greensward Plan from 1858 for 778 acres.

# Sustainable landscape design

- Search for sustainable strategies has begun.
- Techniques are evolving.

The High  
Line, NYC  
by Piet  
Oedolf



[https://s3.amazonaws.com/production.assets.thehighline.org/page\\_panels/page\\_panels\\_template\\_c\\_1436827712.jpg](https://s3.amazonaws.com/production.assets.thehighline.org/page_panels/page_panels_template_c_1436827712.jpg)



# Group discussion

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- What does your favorite landscape/garden link to?



# Global feedback loop

- Human behavior and decisions are part of the global feedback loop.
- What people do affects the health and well-being of the planet;
- Which in turn affects human health and well-being (physical, mental, economic, and social) (The Case for Sustainable Landscapes, 2009, p. 6).



rsd.gsfc.nasa.gov

Earth from GOES-8



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