

# Elements of Successful Watershed Projects

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# Elements of Successful Watershed Projects

- **Objective**: achieve greater benefits/results of watershed projects.
- Share lessons learned, examples and insights.
- Questions?
- How could this presentation support your projects?
- **Russ@EcoGro.net**



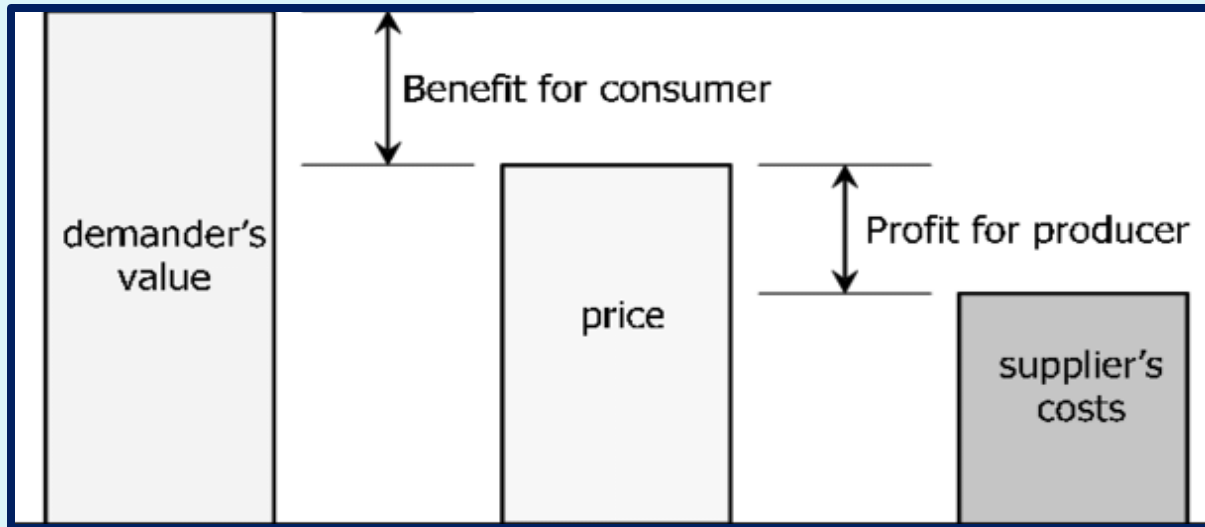
**“Do unto those downstream as you would have those upstream do unto you.”**

Wendell Berry









**Cost** = \$ amount to produce goods or provide a service

**Price** = \$ paid for goods or service

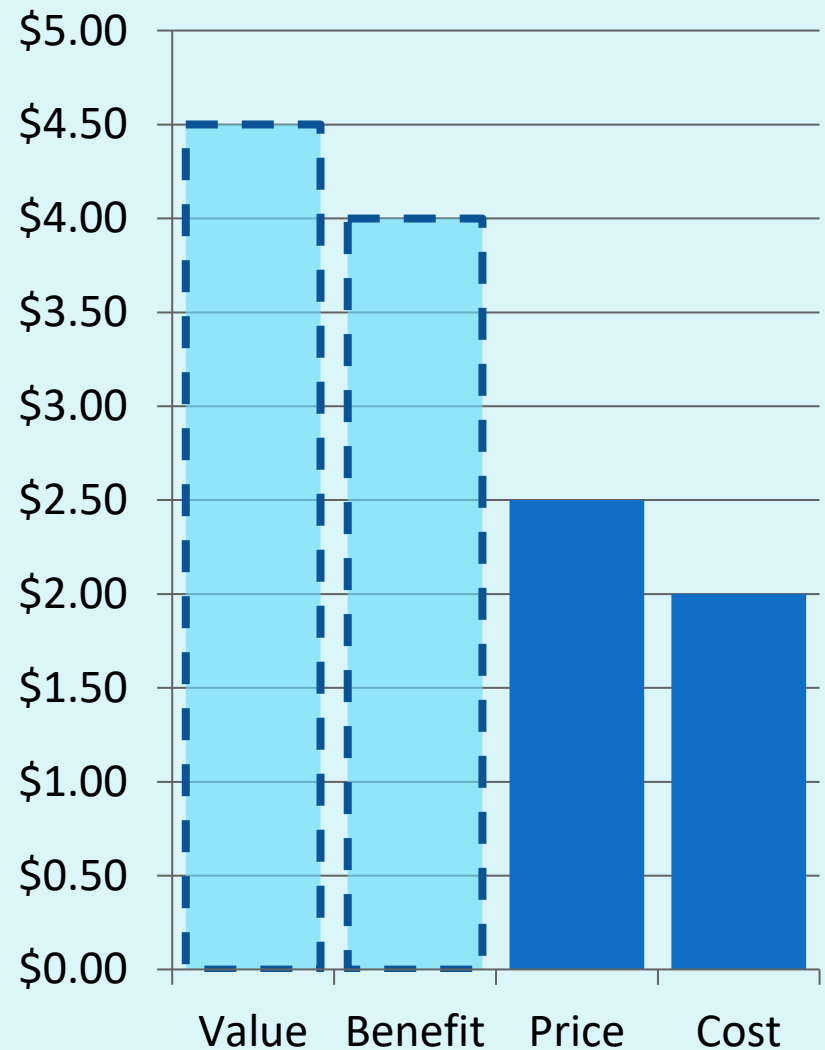
**Benefit** = what a consumer can gain from goods or service.

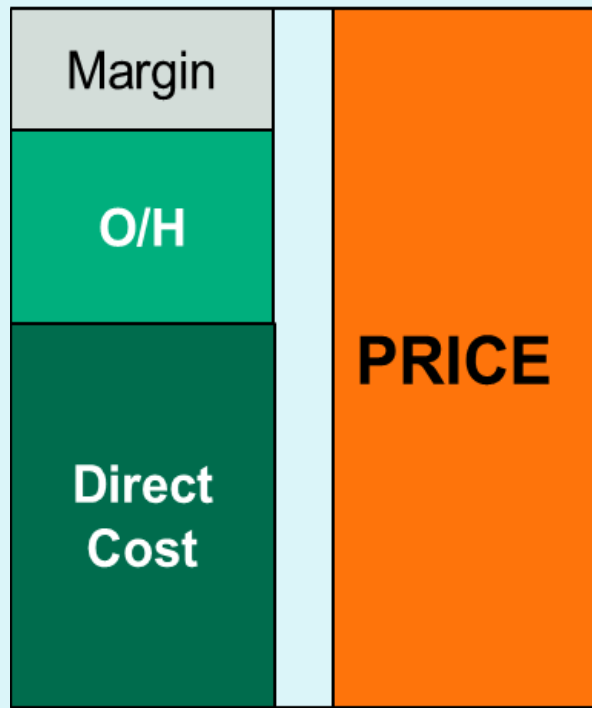
**Value** = perceived worth

Value is **subjective and relative** based on how a product is utilized and the context.

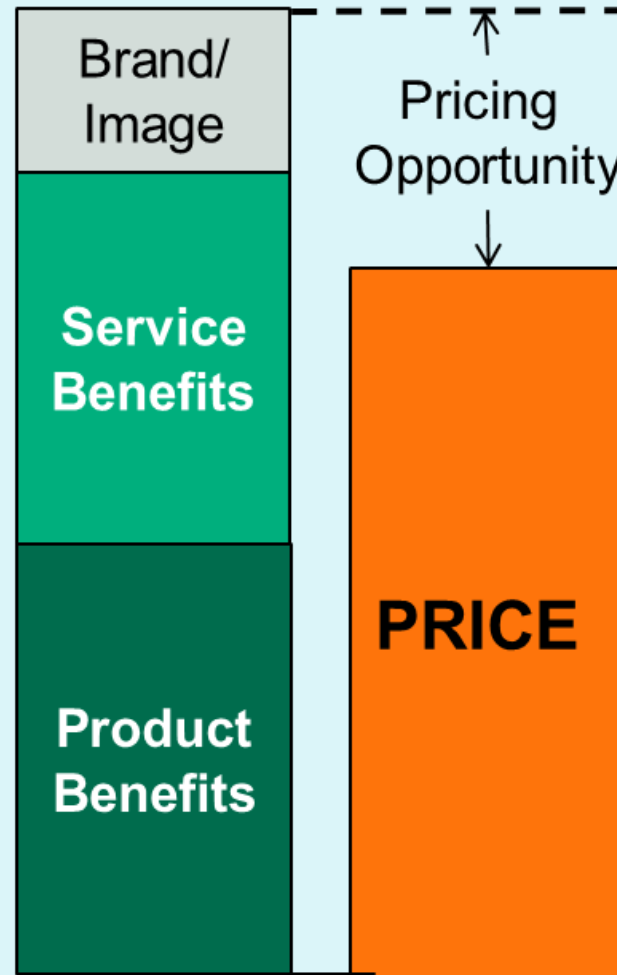
The goal of “**Value Added**” approach is to increase the margin between production Cost and Value/Benefit

- Provide a result or outcome that is greater than the price paid.





Cost +



Optimized Value

## Trees for Bees and Other Pollinators

Bees and other pollinators rank at the top of the list of important insects, moving pollen from flower to flower to ensure pollination and the resulting production of many of our most important fruits and vegetables. Our supermarket shelves and dining room tables would look dramatically different if not for pollinators —



especially bees. But in many areas, parasites, a lack of forage, and other factors are threatening bee health and survival. Trees' flowers are a critical source of forage for bees, providing nutrient-rich pollen and nectar that bees use for food and to make honey.



# Stream bank stabilization



- **Basic needs:** stabilize eroding bank, protect exposed infrastructure

## Additional benefits of nature-based approach:

- shade keeps water cooler
- increase dissolved oxygen
- safety of park users
- aesthetic / attractive
- **stakeholder preference for “green” options**

When applied to “green infrastructure”, the value-added approach can be used to address **social, economic and environmental** factors:

- cost/benefit comparisons of management scenarios,
- operations and life-cycle costs,
- stormwater treatment and environmental outcomes,
- user experiences and perceptions,
- cultural or social significance,

## **The Impact of Green Stormwater Infrastructure Installation on Surrounding Health and Safety**

| Michelle C. Kondo, PhD, Sarah C. Low, MS, Jason Henning, PhD, and Charles C. Branas, PhD  
American Journal of Public Health | March 2015, Vol 105, No. 3



## HEALTHY TREES HEALTHY PEOPLE

The Healthy Trees - Healthy People project is designed to enhance engagement with local parks and improve human health, while training participants in tree identification, health assessments, and pest detection. Study participants will be given specially developed maps of local parks and asked to walk on a regular basis for 8 weeks. Measurements of weight, blood pressure, physical activity, stress, and tree knowledge will take place before and after the program.

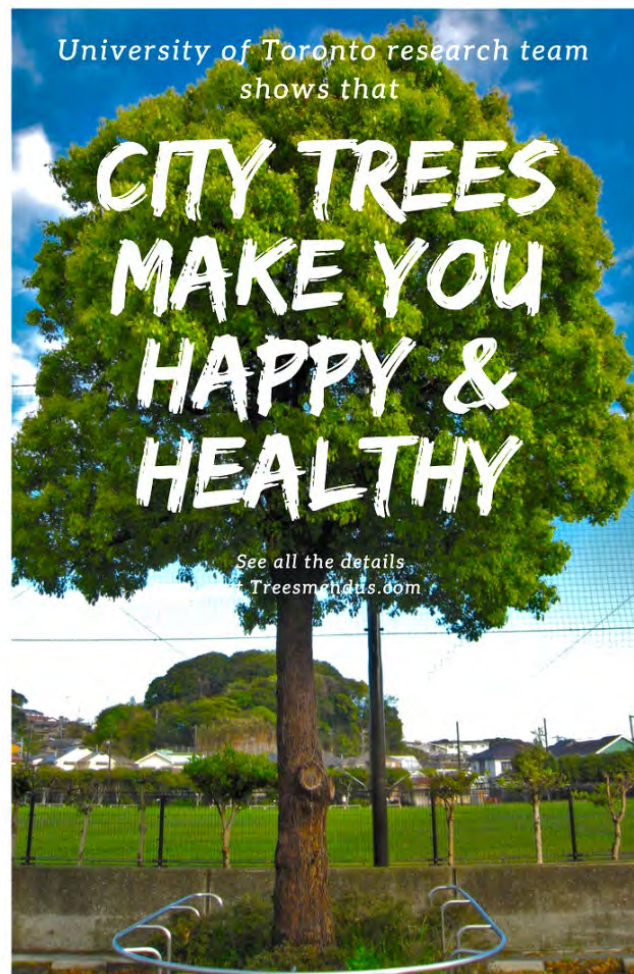
### DO YOU HAVE AN INTEREST IN:

- ✓ Trees
- ✓ Tree Health
- ✓ Physical Activity
- ✓ Healthy Eating
- ✓ Local Parks

Become a citizen  
scientist while learning  
about trees, tree health,  
and your health!



FOR MORE INFORMATION:  
healthytreeshealthypeople@uky.edu  
859-257-3054



# Campus Tree Walks

## What Is A Tree Walk?

The genesis of the Campus Tree Walk project stems from a cross-disciplinary interest in **preventative medicine**. These walks exist to facilitate both **stress reduction** and **mindfulness**. Literature in ecology and healthcare suggest that being in nature stimulates stronger **holistic health**. If this is the case, then there is a moral responsibility to promote this information, particularly to highly stressed populations, i.e. university students and hospital patients. Walks and other resources are available below.

## Choose Your Walk



[LIBRARY  
TREE WALK](#)



[PRESIDENTIAL  
TREE WALK](#)



[HOSPITAL  
HEALING  
GARDEN](#)



[KENTUCKY  
TREE WALK](#)



[IN-PERSON  
NATURE  
THERAPY](#)



[ANYWHERE  
TREE WALK](#)



[ARBORETUM  
WOODS  
TREE WALK](#)

There is a strong relationship between human health and the natural environment. Studies have shown that being with trees can improve not only mental health, but physical health as well. Several institutions have already capitalized on these principles, such as by constructing "healing gardens" in hospitals, where *recovery rates are heightened and nursing-staff turnover rates are reduced*.

If you would like to learn more about the connection between health and nature, please refer to the articles provided.

[Nature Therapy and Preventative Medicine](#)

...

["Shinrin-Yoku," or Japanese forest bathing](#)

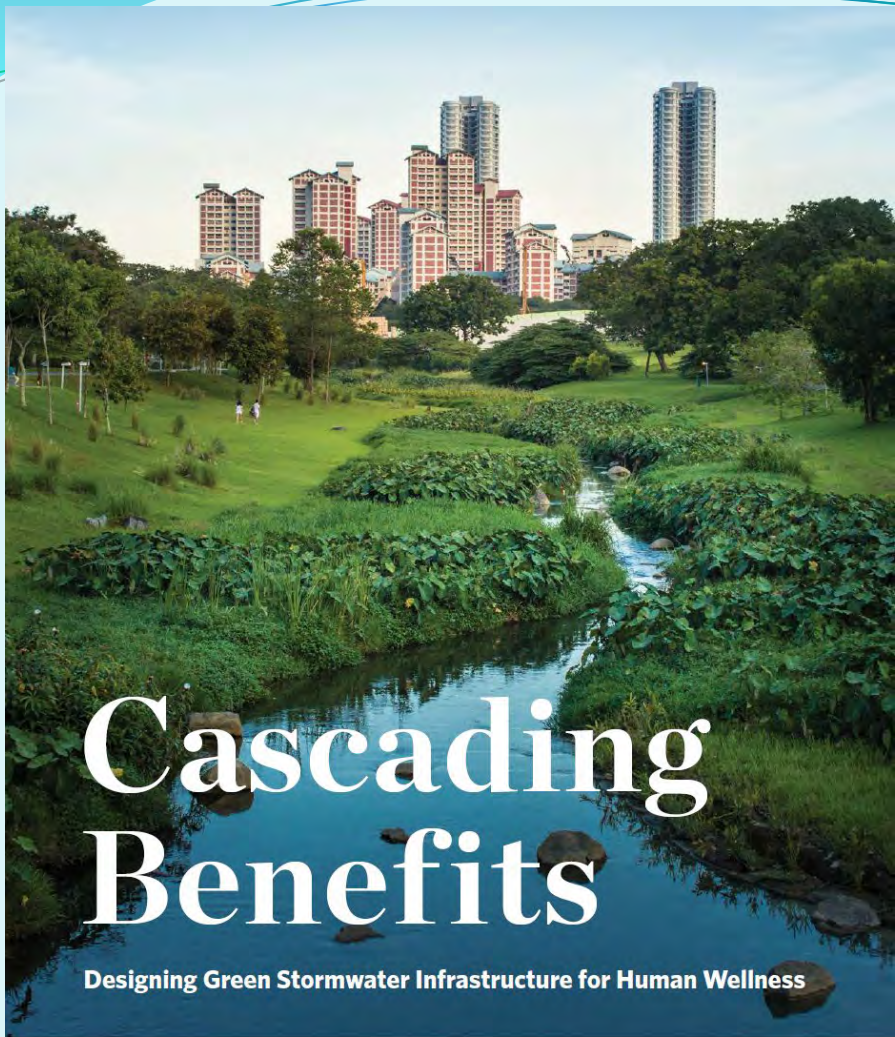
...

[The Influence of Urban Green Environments on Stress Relief Measures](#)

...

[Healing gardens in healthcare](#)





# Cascading Benefits

Designing Green Stormwater Infrastructure for Human Wellness



## 2018 PARKLANDS EXPLORER Pathways to Wellness



Embark on a pathway to wellness for body and mind! The 2018 Parklands Explorer: Pathways to Wellness program, *presented by Trilogy Health Services and The Bufford Family Foundation*, invites community members of all ages and abilities to join Parklands Interpretive Rangers each month to traverse a new hiking trail and delve into a related educational topic. Parklands Explorer hikes are FREE and open to all at 10 a.m. on the second Saturday of each month. From April through September, arrive at 9 a.m. for bonus wellness activities, such as Yoga, Tai Chi and meditation.

DATE	WELLNESS ACTIVITY (9:00 AM)	EXPLORE (10:00 AM)
JAN 13		<i>Forest Management</i> , Coppiced Woods Trail
FEB 10		<i>Geology</i> , Limestone Gorge Trail
MAR 10		<i>Reading the Landscape</i> , Big Beech Trail
APR 14	<i>Heart Healthy Walking</i> by American Heart Association	<i>Biodiversity: The Heart of The Parklands</i> , Riparian Ramble Trail
MAY 12	Yoga by YMCA at Norton Commons	<i>Who's Eating the Ash Trees?</i> , Hickory Trail
JUNE 9	Yoga by YMCA at Norton Commons	<i>Forest Succession</i> , Paw Paw Trail
JULY 14	<i>Functional Body Movement</i> by 502 Fit Pass	<i>The Importance of Wetlands</i> , Black Willow Trail
AUG 11	<i>Tai Chi</i> by Grandmaster Mingye Ding	<i>How Water Shapes Land</i> , Paw Paw Trail
SEPT 8	<i>Intro to Mindfulness Meditation</i> by Earth & Spirit Center	<i>Botany: Why Plants Make the Place</i> , Riparian Ramble Trail
OCT 13		<i>Birds &amp; Their Ecological Functions</i> , Valley of the Giants Trail
NOV 10		<i>Parklands History</i> , Seaton Valley Trail
DEC 8		<i>Sinkholes</i> , Highland Crossing

SEE BACK FOR DETAILS ON WELLNESS ACTIVITIES. REGISTER AT [THEPARKLANDS.ORG/EVENTS](http://THEPARKLANDS.ORG/EVENTS).

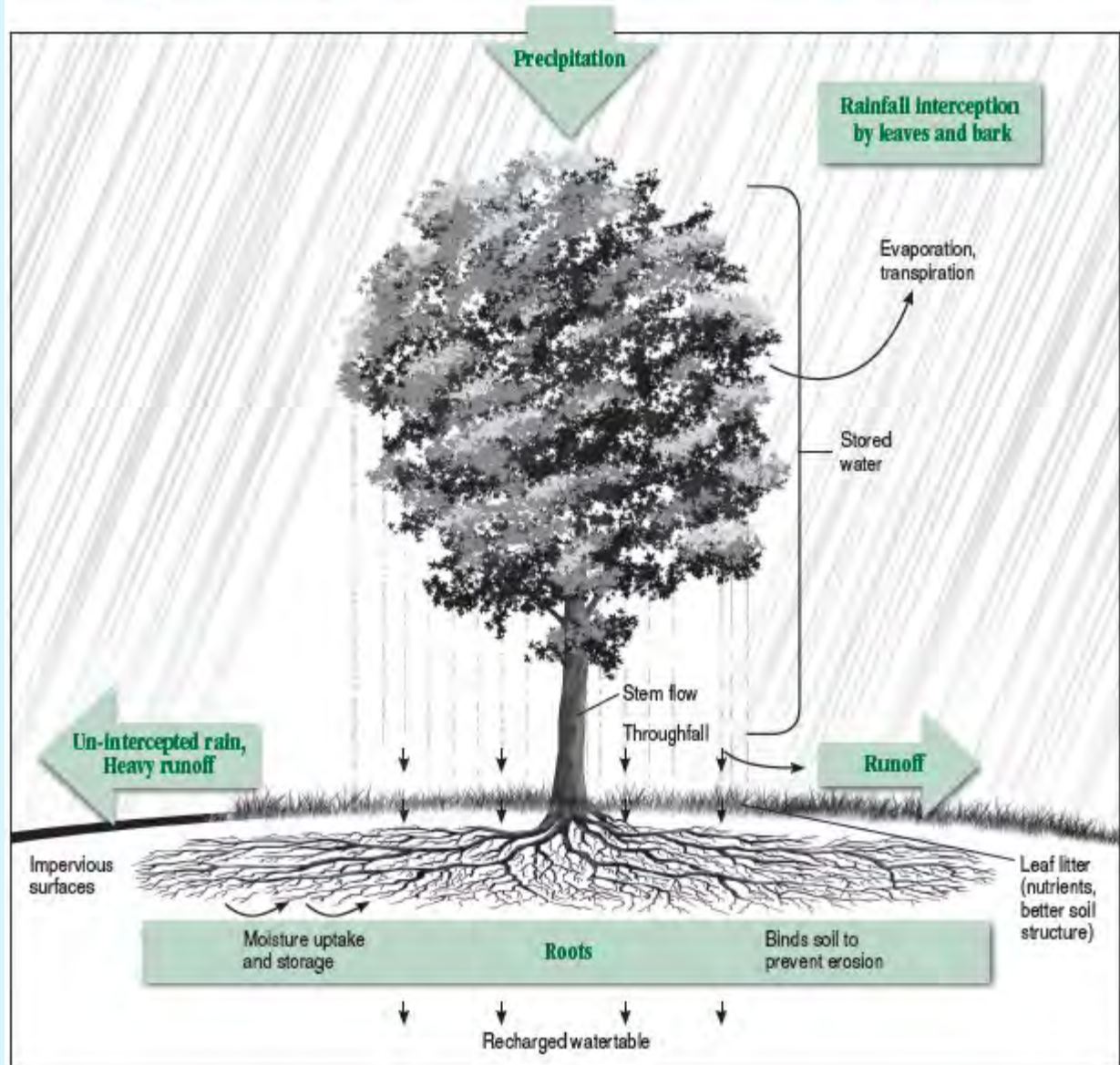
Presented by:

Special thanks to our wellness partners:

The Bufford Family Foundation

FOR YOUTH DEVELOPMENT \* FOR HEALTHY LIVING FOR SOCIAL RESPONSIBILITY

# Important Ways a Tree Helps with Stormwater Management




# National Tree Benefit Calculator

Beta

[www.TreeBenefits.com](http://www.TreeBenefits.com)

Overall Benefits | Storm Water | Property Value | Energy | Air Quality | CO2 | About the Model



Benefit Category	Value
Stormwater	\$17.87
Property Value	\$54.38
Electricity	\$1.62
Natural Gas	\$2.37
Air Quality	\$1.99
CO2	\$4.80


**Breakdown of your tree's benefits**  
Click on one of the tabs above for more detail

This **12 inch Bur oak** provides overall benefits of: **\$83 every year.**

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 17 inches, it will provide **\$105** in annual benefits.



Bur oak  
*Quercus macrocarpa*



- Plants and landscaping tend to increase property values.
- Trees tend to increase in benefits and value over time.



## Landscaping Alternatives

One Site, Three Solutions



Riparian properties have unique characteristics and challenges. The following landscape plans illustrate three possible alternatives for the same piece of property. These plans all improve water quality, stabilize the shoreline, and attract wildlife, they differ in the amount of water that can be seen from the house—or the amount of house that can be seen from the water. The alternatives can be modified to create a specialized plan depending on the existing site conditions and the objectives of the owners.

### Existing Conditions

- Lawn is mowed to the water's edge
- Rock bluff above water
- Wet area
- Minor erosion along shoreline
- Back of house faces east



### Complete the following steps for all three alternatives upon receipt of applicable permits:

- Repair erosion along shoreline by planting native vegetation in conjunction with coconut fiber rolls (flexible "logs" made from coconut hull fibers) to stabilize bank, trap sediment, and encourage plant growth.
- Plant native sun-tolerant species in riparian zone.
- Build dock and walkway. A straight walkway creates a channel for runoff, which increases the risk of erosion. A curved walkway slows the flow of runoff from the house to the water.

Fig. 4.9 © Riparian Restoration Fact Sheet, 2004



### Alternative Two: Provide Privacy with Many Views

If you want privacy but still want to see the water, plan your landscape with "windows" so you have several different views.

- Plant a variety of dry and moist upland (wet area) species in clumps, as determined by site conditions, leaving open spaces to create framed vistas.
- In selected areas, add a mixture of large sun-tolerant shrubs for diversity and to create focal points.

# Woodfield Pond (2006)





# Woodfield Pond (2018)





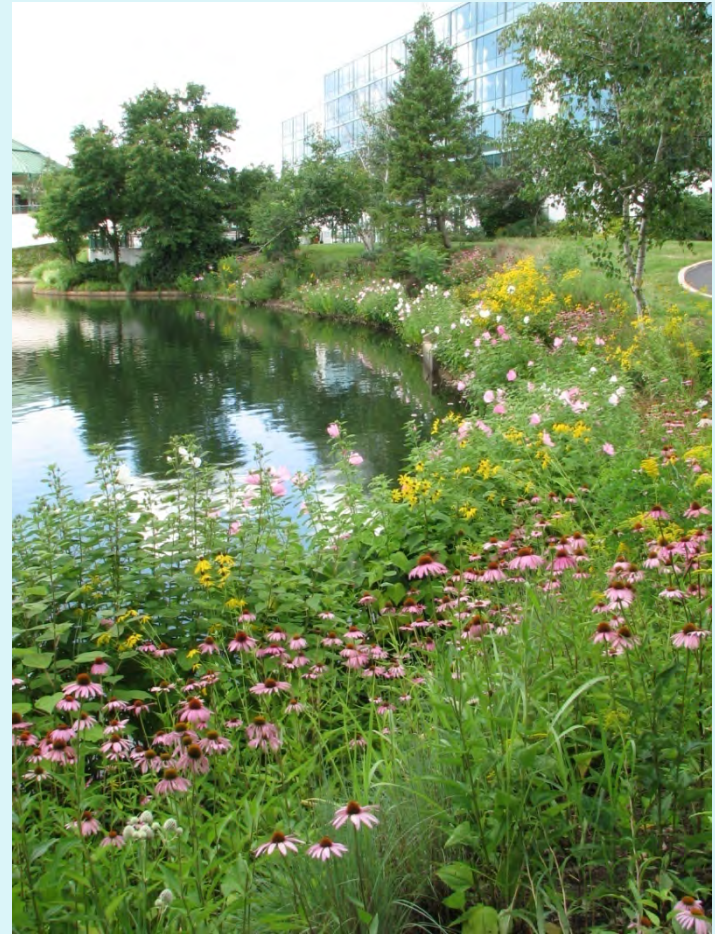
DANGER  
KEEP OFF  
ICE  
OR  
CLIMBING



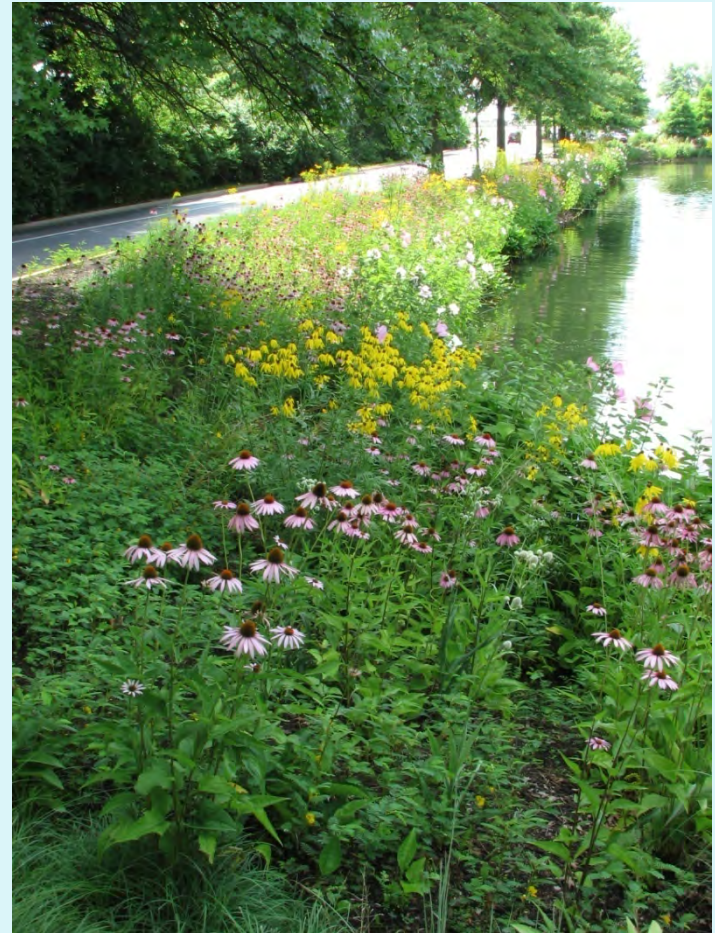
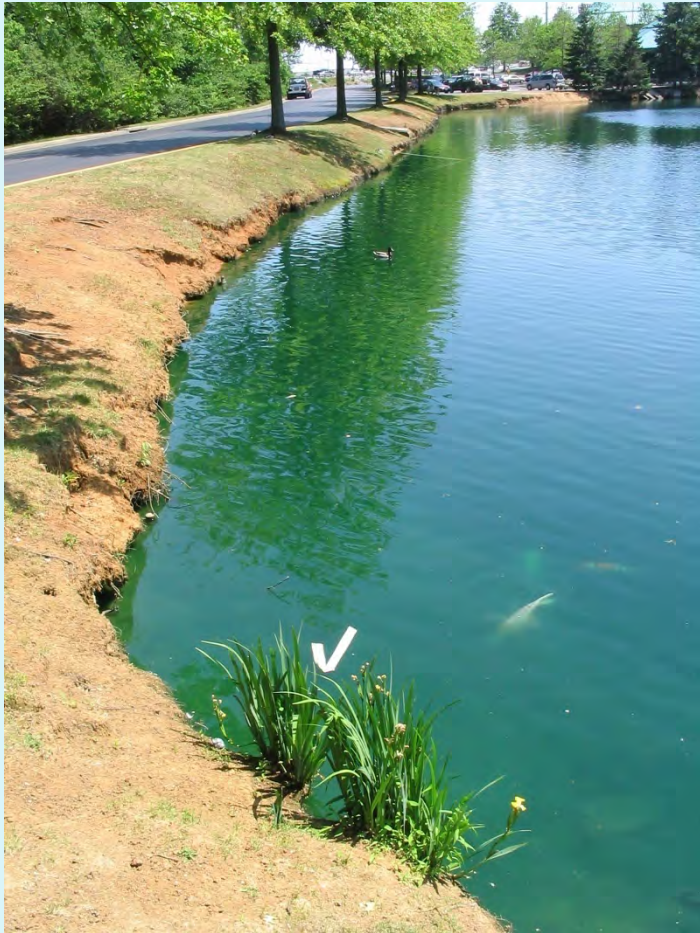
# Value is perceived worth

- Include considerations for a potential partner's **history, experiences and expectations.**
- Understand **what motivates your clients.**
- Work with **key decision makers with agency/capacity to sustain your project.**
- How will your client see a **positive return on investment?**
- Provide situations that are **worth more than the costs of doing nothing.**

# Lexington Green (2008 & 2013)



# Lexington Green (2008 & 2013)



# Lexington Green (2008 & 2018)



## Values Added (realized benefits)

- increased safety, reduce sediment & dredging in pond, Lexington In Bloom Award, reduce goose poop (bacteria and nutrients), reduce costs of AquaShade, increase retail and recreation destination, LFUCG Environmental Commission Award.

# Millcreek Elementary (2009)



# Millcreek Elementary (2009)

## Mill Creek <http://www.millcreek.fcps.net> Wetland and Stream *Restoration Project*

  
**It's about kids.**  
Fayette County Public Schools



Mill Creek is currently under construction. We are creating habitat for fish, bugs, and streamside plants. Please stay out of the construction zone until the project is completed. We look forward to showing the project later this fall. Thank you for your patience.

**Location:** Millcreek Elementary School  
1212 Reva Ridge Way, Lexington, KY 40517

**Funded by:** KDFWR Wetland and Stream Mitigation Program  
5-Star Restoration Challenge Grant

Project Partners:



# Millcreek Elem. (2009 - 2015)



KENTUCKY FISH & WILDLIFE COMMISSIONER'S NEWSLETTER

October 2009

—VOL. 4 NO. 10—



Youth dove  
hunts held  
Page 6

## Mill Creek mitigation project completed

**T**he Kentucky Wetland and Stream Mitigation Program recently completed construction on Mill Creek, a small perennial stream in Lexington. The project is located at Millcreek Elementary School and will serve as an outdoor classroom for grades K-4. Mill Creek was essentially a large ditch prior to construction. The flood stresses in the original channel were so great, that during flood events, fish, amphibians and bugs had trouble persisting there and the banks were badly eroding.

Students from Millcreek Elementary and staff from Transylvania University learn about stream ecology by sampling aquatic invertebrates already present in the recently restored stream channel.

In order to relieve flood stresses, provide temperature stabilization, nitrogen treatment and instream habitat for fish and bugs, the stream valley was reshaped and a new channel constructed. Like many natural channels, Mill Creek now has what is called a hyporheic zone in which some water flows through substrates beneath a channel. These areas help to stabilize stream temperatures, provide refugia for small

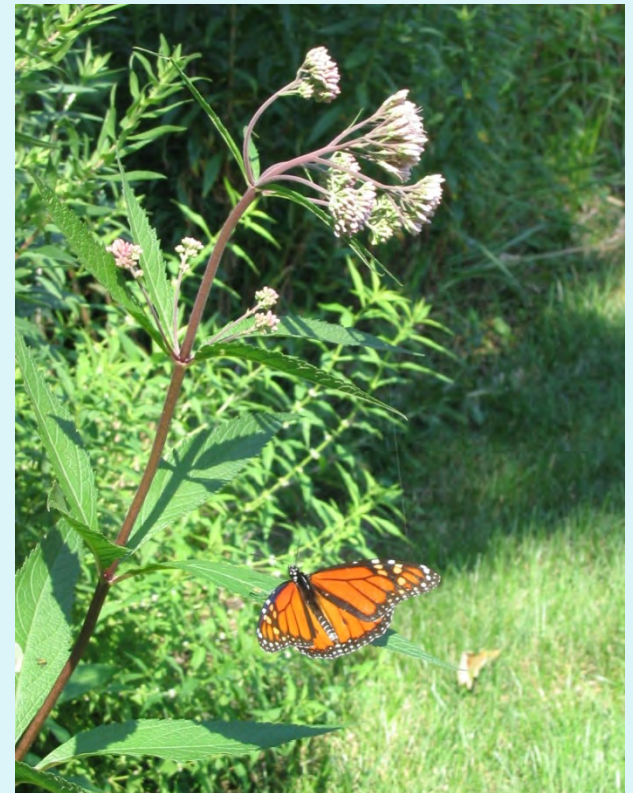
fishes and invertebrates and can help treat excessive nitrogen loads in the watershed. Like all construction projects, the site is a little muddy at first, but once the site has a chance to green up this spring with

planted vegetation Mill Creek will look like a healthy stream. The school is very excited about [See "Creek," page 2](#)

**INSIDE:**  **3** Officers promoted  **4** Youth hunt  **6** New greenhouse







# Millcreek Elementary (2011)



## Values Added (realized benefits)

- Stream Days for hands-on environmental education, increased safety, increased stream wildlife habitat, reduced mowing, U of L monitoring and academic research on design approach

# Clays Mill Elementary (2013)



# Clays Mill Elementary (2013)

## Spring's Branch



### STORMWATER QUALITY IMPROVEMENT PROJECT

### at Clays Mill Elementary

Go Cats!



FUNDED BY THE  
LFUCG WATER QUALITY MANAGEMENT FEE THROUGH THE  
STORMWATER QUALITY PROJECTS INCENTIVE GRANT PROGRAM

PARKS  
& RECREATION  
LEXINGTON, KY



Riverine Systems, LLC

RIDGEWATER  
RESTORATION & MANAGEMENT



livegreenlexington



UK  
UNIVERSITY OF  
KENTUCKY  
College of Agriculture





# Clays Mill Elementary (2013-18)



# Clays Mill Elementary (2013-19)



## Values Added (realized benefits)

- increased safety, hands-on environmental education, increased stream wildlife, reduced mowing, LFUCG stormwater incentive grant funding, enjoyment by park users / neighbors, featured in Southsider article.

# Clays Mill Elementary (2018)

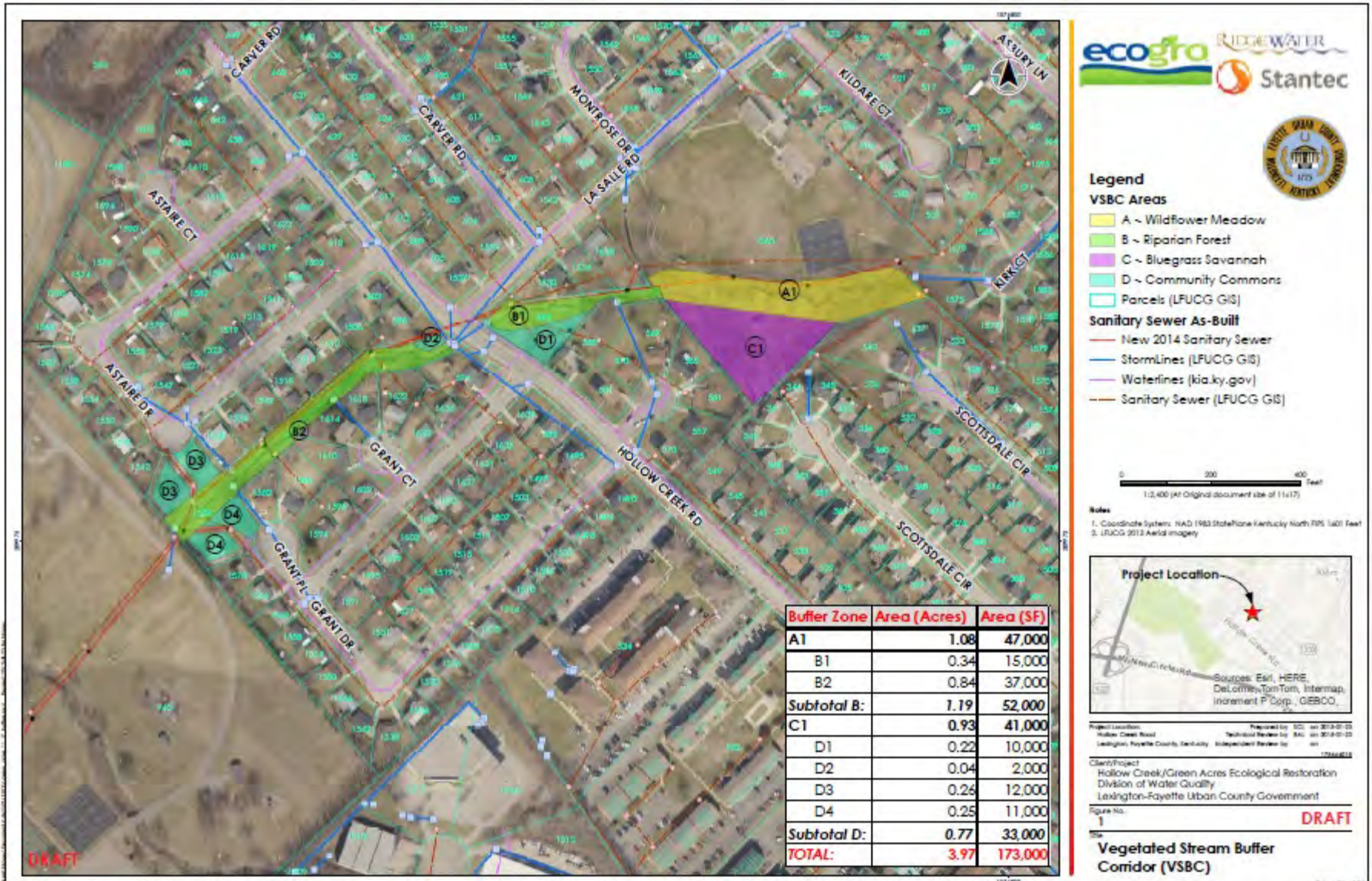


## Values Added (realized benefits)

- Stream stewardship training site for BCTC students, UK staff and Friends of Wolf Run volunteers.



# Green Acres 2015



### Legend

#### VSBC Areas

- A - Wildflower Meadow
- B - Riparian Forest
- C - Bluegrass Savannah
- D - Community Commons
- Parcels (LFUCG GIS)

#### Sanitary Sewer As-Built

- New 2014 Sanitary Sewer
- StormLines (LFUCG GIS)
- Waterlines (kia.ky.gov)
- Sanitary Sewer (LFUCG GIS)



- Notes:**
- Coordinate System: NAD 1983 StatePlane Kentucky North FIPS 1401 Feet
  - LFUCG 2013 Aerial Imagery



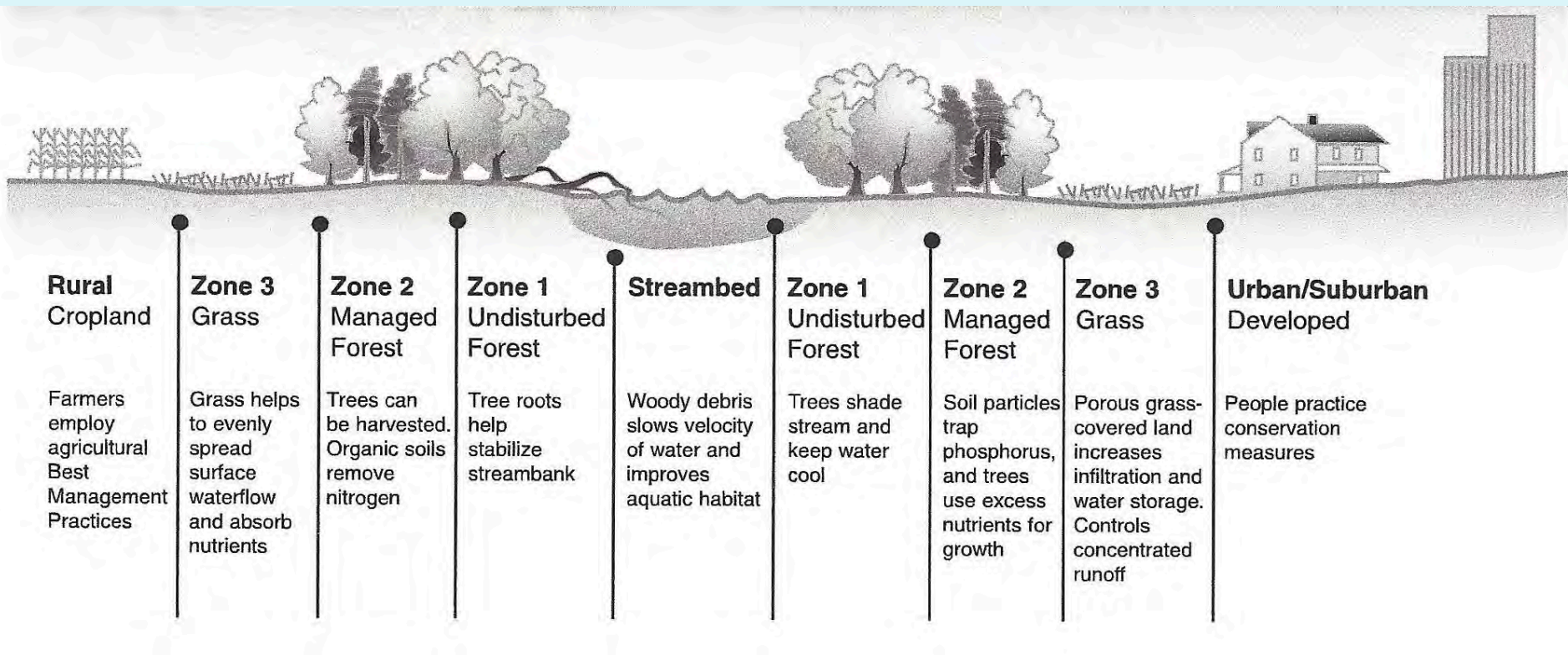
Project Location: Hollow Creek Road  
 Prepared by: GSI on 2014-01-22  
 Technical Review by: SAC on 2014-01-22  
 Lexington, Fayette County, Kentucky. Independent Review by: on 1/22/2014

Client/Project: Hollow Creek/Green Acres Ecological Restoration  
 Division of Water Quality  
 Lexington-Fayette Urban County Government

Figure No. **1** **DRAFT**

Vegetated Stream Buffer Corridor (VSBC)

# Three zones – each managed differently for ecosystem functions and site context



A diagram of the three zones from *“Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers”*.

## Understanding the Buffer Zone: Function and Management

Comprised of two or three zones, these zones become areas where specific plants and management are combined to create a forested riparian buffer that is highly effective at improving and maintaining water quality and aquatic habitat.

ZONE (Location, species choice)	FUNCTION	MANAGEMENT
<b>Zone 1</b> (Beginning near the edge of the stream) (fast growing trees/shrub species)	<ul style="list-style-type: none"> <li>• Shade the stream and moderate water temperature</li> <li>• Provide bank stabilization</li> <li>• Enhance aquatic habitat with organic matter</li> <li>• Final filter of material moving through the buffer</li> <li>• Reduce velocity of over-the-bank flood waters</li> </ul>	<ul style="list-style-type: none"> <li>• Unmanaged zone, trees allowed to mature &amp; fall into stream contributing important large woody debris</li> <li>• Large woody debris not allowed in streams with tile drainage or other specific drainage functions.</li> <li>• Along above streams selective harvest, with replacement from planting or coppice resprouting</li> <li>• Logging equipment excluded</li> <li>• Grazing is excluded</li> </ul>
<b>Zone 2</b> (Beginning at the edge of Zone 1) (fast and slower growing trees and shrub species)	<ul style="list-style-type: none"> <li>• Provide maximum infiltration</li> <li>• Uptake of Non-Point Source (NPS) nutrients and chemicals</li> <li>• Storage of NPS pollutants</li> <li>• Breakdown NPS pollutants</li> <li>• Provide forest-grown products</li> <li>• Enhanced wildlife habitat</li> <li>• Reduce velocity of over-the-bank flood waters</li> <li>• Trap debris moving in flood waters to keep it out of crop fields</li> </ul>	<ul style="list-style-type: none"> <li>• Active management encouraged</li> <li>• Marketable products encouraged from trees and shrubs were feasible</li> <li>• Harvest should stimulate new growth</li> <li>• Avoid soil compacting activities</li> <li>• Grazing excluded • Wildlife activities such as bird watching or lease hunting</li> </ul>
<b>Zone 3</b> (Beginning at the edge of Zone 2) (grass and forb species)	<ul style="list-style-type: none"> <li>• Slow surface runoff converting concentrated flow to sheet flow</li> <li>• Slowed runoff drops most sediment/debris at outside edge of zone</li> <li>• Remaining sediment is filtered from sheet flow</li> <li>• High infiltration of water delivering NPS nutrients &amp; chemicals to soil filter</li> <li>• Uptake of nutrients and chemicals</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain vigorous vegetative growth</li> <li>• Remove biomass – mow and bail so as not to smother remaining plants.</li> <li>• Remove biomass – flash grazing possible with fencing of woody zones</li> <li>• Remove biomass – burn on 3-5 year cycle</li> <li>• Work accumulated sediments away from the buffer edge, back into the field</li> </ul>


On non-recreational or non-incised streams, Zones 1 and 2 are often combined, and management becomes more closely aligned to that of Zone 2 alone. In each of the zones it is important to recognize the role that buffer health plays in maintaining function. Healthy and actively growing vegetation provides the best capture and utilization of problem NPS nutrients and chemicals prior to their entering waterways.

# Training Manual

## for Applied Agroforestry Practices

### 2013 Edition

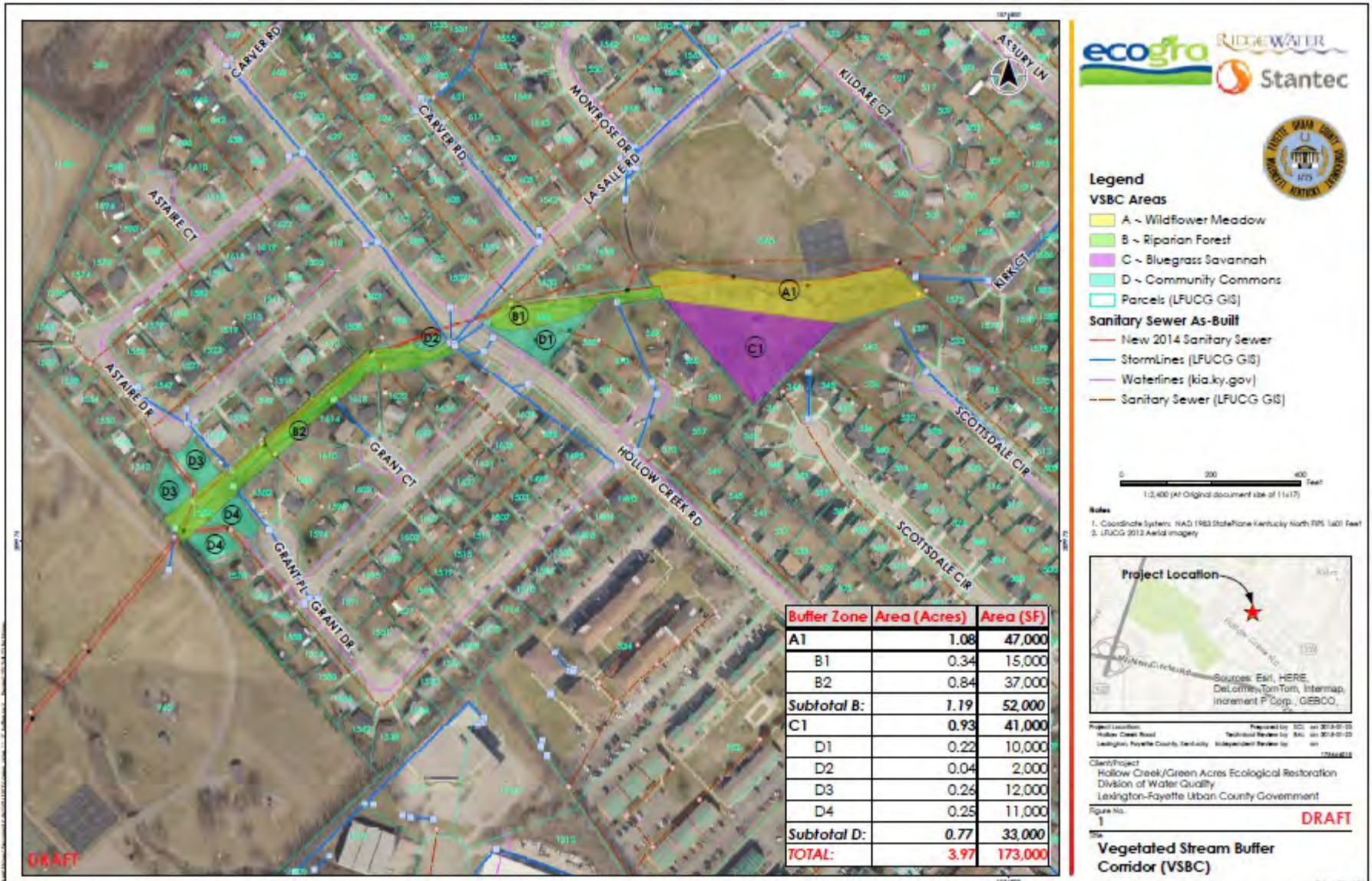


 The Center for Agroforestry  
University of Missouri

*A Global Center for Agroforestry, Entrepreneurship and the Environment*



# Green Acres 2015



- Legend**
- VSBC Areas**
- A - Wildflower Meadow
  - B - Riparian Forest
  - C - Bluegrass Savannah
  - D - Community Commons
  - Parcels (LFUCG GIS)
- Sanitary Sewer As-Built**
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- Notes**
1. Coordinate System: NAD 1983 StatePlane Kentucky North FIPS 1401 Feet
  2. LFUCG 2013 Aerial Imagery



Project Location: Hollow Creek Road, Lexington, Fayette County, Kentucky. Prepared by: GSI, Inc. on 2014-01-25. Technical Review by: SAC, Inc. on 2014-01-25. Independent Review by: SAC, Inc. on 2014-01-25.

Client/Project: Hollow Creek/Green Acres Ecological Restoration, Division of Water Quality, Lexington-Fayette Urban County Government.

Figure No. 1

**DRAFT**

**Vegetated Stream Buffer Corridor (VSBC)**

Page 01 of 01

# Green Acres

## Community Food Forest

- American chestnut
- hazelnut
- wild plum
- serviceberry
- persimmon
- pecan & hickory
- paw paw
- walnut
- mulberry



# Green Acres

- Give it “**Curb Appeal**”
- Invest in most visible or accessed areas



# Green Acres

- Single pass mower width along fence.



# UK / FEMA Alumni Drive (2016)

- UK, Bell Engineering, Bluegrass Contracting
- 2 stormwater basins and stream channel





# UK Alumni Drive (2016)



- increased monarch butterflies and pollinators, UK Entomology and Biosystems & Ag. Eng. research

# UK Alumni Drive (2015)



# UK Alumni Drive (2016)



# UK Alumni Drive (2017)



# UK Alumni Drive (2018)



# UK Alumni Drive (2019)



# UK Alumni Drive (2020)



# UK, Alumni Drive (2015 & 2020)



## Values Added (realized benefits)

- increased safety, reduce flooding, increase stream base flow, incorporated with educational programs and academic research, reduce mowing, increase wildlife, beautification of campus



# UK Alumni Drive #2 (2019)



**“How can you call this restoration?  
It looks like a tornado just tore it up.”**

# What is “ecological succession”?



# It's easier to work with the flow of succession than fight it.



Maintenance

# “Maintenance” versus “Management”.

Management



Field:  
Crabgrass

Year 1  
Crabgrass,  
horseweed

Year 2  
Ragweed,  
heath aster

Years 3-25  
Broomsedges,  
perennial flowers,  
shrubs, pines

Years 25-100  
Pine forest,  
hardwood  
understory

Years 100-200  
Remnant pines  
with young oak  
and hickory trees

Years 200+  
Oak-hickory  
climax forest



# maintenance



## Related Terms

building codes

application pro...

grant

web hosting

fixed asset man...

## Definitions (4)

See Examples

Cite Term

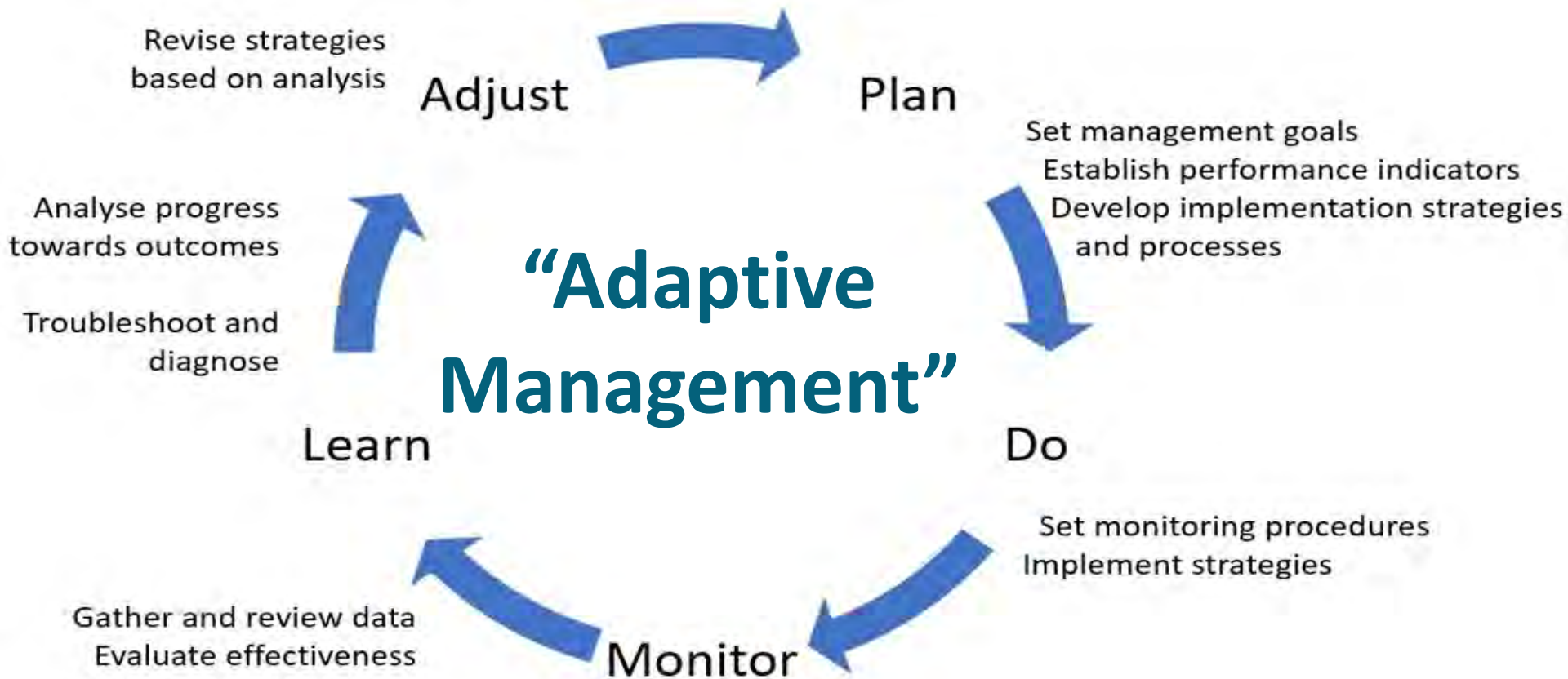
Add to Flashcards

**1.** Activities required or undertaken to conserve as nearly, and as long, as possible the original condition of an asset or resource while compensating for normal wear and tear.

**2.** Accounting: A periodic cost incurred in activities that preserve an asset's operational status without extending its life. Maintenance is an expense that, unlike capital improvement (which extends an asset's life), is not capitalized.

**3.** Engineering: Actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life.

- **Maintain original condition**
- **Address wear and tear, or reduce loss**
- **A cost or expense to keep in service (no ROI)**



- **Growth and development**
- **Build capacity, abilities or increase benefits**
- **An investment, profitable (positive ROI)**

Maintenance

# “Maintenance” versus “Management”.

Management



Field: Crabgrass	Year 1 Crabgrass, horseweed	Year 2 Ragweed, heath aster	Years 3-25 Broomsedges, perennial flowers, shrubs, pines	Years 25-100 Pine forest, hardwood understory	Years 100-200 Remnant pines with young oak and hickory trees	Years 200+ Oak-hickory climax forest
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## When is a project “finished”?

## Understanding the Buffer Zone: Function and Management

Comprised of two or three zones, these zones become areas where specific plants and management are combined to create a forested riparian buffer that is highly effective at improving and maintaining water quality and aquatic habitat.

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<b>Zone 1</b> (Beginning near the edge of the stream) (fast growing trees/shrub species)	<ul style="list-style-type: none"> <li>• Shade the stream and moderate water temperature</li> <li>• Provide bank stabilization</li> <li>• Enhance aquatic habitat with organic matter</li> <li>• Final filter of material moving through the buffer</li> <li>• Reduce velocity of over-the-bank flood waters</li> </ul>	<ul style="list-style-type: none"> <li>• Unmanaged zone, trees allowed to mature &amp; fall into stream contributing important large woody debris</li> <li>• Large woody debris not allowed in streams with tile drainage or other specific drainage functions.</li> <li>• Along above streams selective harvest, with replacement from planting or coppice resprouting</li> <li>• Logging equipment excluded</li> <li>• Grazing is excluded</li> </ul>
<b>Zone 2</b> (Beginning at the edge of Zone 1) (fast and slower growing trees and shrub species)	<ul style="list-style-type: none"> <li>• Provide maximum infiltration</li> <li>• Uptake of Non-Point Source (NPS) nutrients and chemicals</li> <li>• Storage of NPS pollutants</li> <li>• Breakdown NPS pollutants</li> <li>• Provide forest-grown products</li> <li>• Enhanced wildlife habitat</li> <li>• Reduce velocity of over-the-bank flood waters</li> <li>• Trap debris moving in flood waters to keep it out of crop fields</li> </ul>	<ul style="list-style-type: none"> <li>• Active management encouraged</li> <li>• Marketable products encouraged from trees and shrubs were feasible</li> <li>• Harvest should stimulate new growth</li> <li>• Avoid soil compacting activities</li> <li>• Grazing excluded • Wildlife activities such as bird watching or lease hunting</li> </ul>
<b>Zone 3</b> (Beginning at the edge of Zone 2) (grass and forb species)	<ul style="list-style-type: none"> <li>• Slow surface runoff converting concentrated flow to sheet flow</li> <li>• Slowed runoff drops most sediment/debris at outside edge of zone</li> <li>• Remaining sediment is filtered from sheet flow</li> <li>• High infiltration of water delivering NPS nutrients &amp; chemicals to soil filter</li> <li>• Uptake of nutrients and chemicals</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain vigorous vegetative growth</li> <li>• Remove biomass – mow and bail so as not to smother remaining plants.</li> <li>• Remove biomass – flash grazing possible with fencing of woody zones</li> <li>• Remove biomass – burn on 3-5 year cycle</li> <li>• Work accumulated sediments away from the buffer edge, back into the field</li> </ul>


On non-recreational or non-incised streams, Zones 1 and 2 are often combined, and management becomes more closely aligned to that of Zone 2 alone. In each of the zones it is important to recognize the role that buffer health plays in maintaining function. Healthy and actively growing vegetation provides the best capture and utilization of problem NPS nutrients and chemicals prior to their entering waterways.

# Training Manual

## for Applied Agroforestry Practices

### 2013 Edition



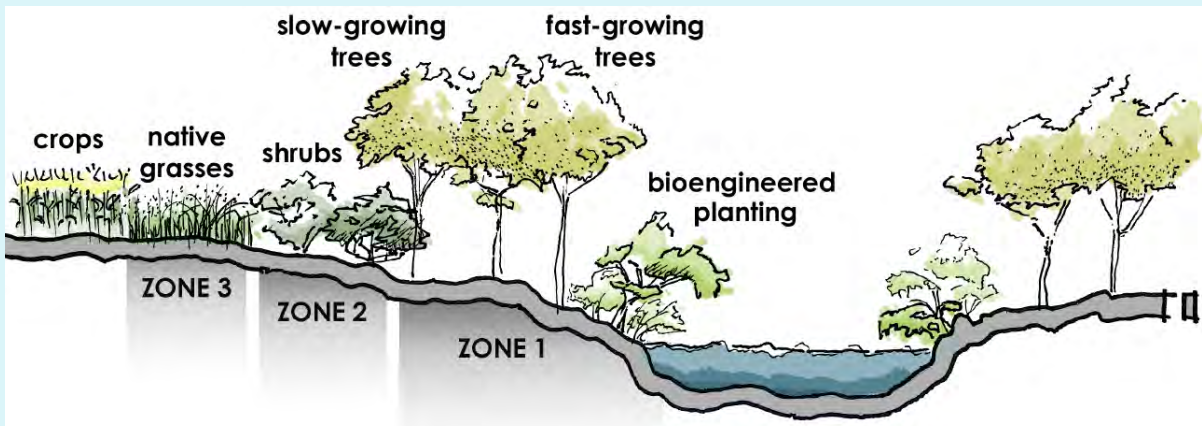
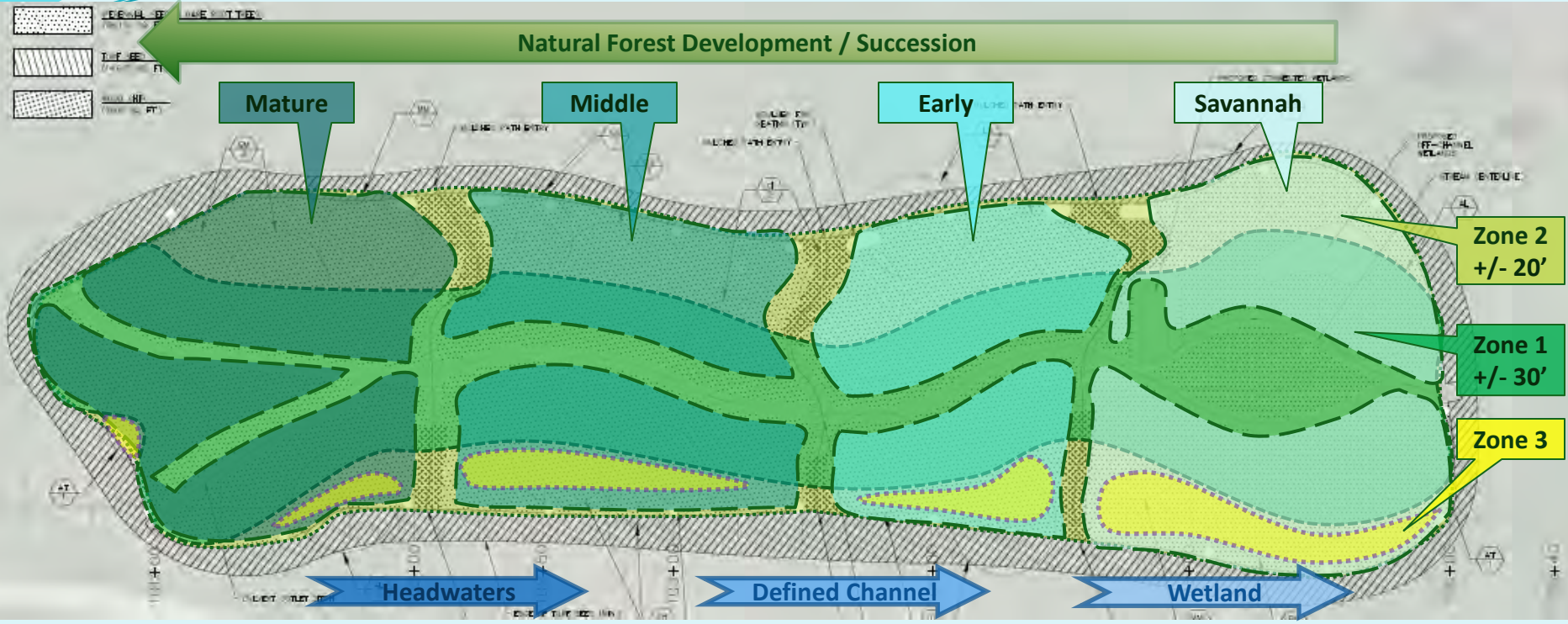
 The Center for Agroforestry  
University of Missouri

*A Global Center for Agroforestry, Entrepreneurship and the Environment*





# UK Alumni Drive Stormwater Project (2019)



- Savannah: native grasses, wildflowers and few trees (years 1 – 5).
- Early Forest: fast-growing (pioneer) species of trees and shrubs (years 5 - 10).
- Middle Forest: moderate-growing trees, canopy and understory (years 10 – 30).
- Mature Forest: slower-growing and shade-tolerant trees and shrubs (years 30 +).

From: "Agroforestry: Riparian Buffer Strips" UK Cooperative Extension Service (FOR-112)

# UK Alumni Drive #2 (2020)

## Food Forest

- American chestnut
- hazelnut
- wild plum
- serviceberry
- persimmon
- pecan & hickory
- paw paw
- elderberry
- **sunchokes**



# What phase is the project in now?



Field:	Year 1	Year 2	Years 3-25	Years 25-100	Years 100-200	Years 200+
Crabgrass	Crabgrass, horseweed	Ragweed, heath aster	Broomsedges, perennial flowers, shrubs, pines	Pine forest, hardwood understory	Remnant pines with young oak and hickory trees	Oak-hickory climax forest

**“The care of the Earth is our most ancient and most worthy, and after all our most pleasing responsibility. To cherish what remains of it and to foster its renewal is our only hope.”  
—Wendell Berry**



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