Vision for Advancing Science of Stream Restoration

Sara Winnike McMillan, PhD, PE & Carmen Agouridis, PhD, PE, MPP, MBA

August 3, 2022

River revival: UW-La Crosse Plum Creek restoration a win-win for conservation efforts, experiential learning

Posted on July 29, 2022

State Awards $4.6M for Ecological Restoration and Climate Change Projects

11:37AM / Friday, July 15, 2022

Print Story | Email Story

BOS

three

Sections

The Washington Post

Democracy Dies in Darkness

MARYLAND

Maryland, behind in cleaning up Chesapeake, beefs up restoration efforts

Bipartisan Infrastructure Law: A Transformational Opportunity for Habitats

July 29, 2022

Historic climate resilience funding for NOAA, made possible by the Infrastructure Investment and Jobs Act, will improve habitat restoration, coastal resilience, and weather forecasting infrastructure.

Community Day Offers Activities to Celebrate and Learn How to Protect Marsh Creek in Howard

Citizen brings up concern for Peak Creek pollution

Mon, 08/01/2022 - 10:03 Posted in: NEWS

ADVERTISE WITH US GET UP DC CONTESTS ENVIRONMENT WASHINGTON COMM

ENVIRONMENT

Hundreds of trees cut down in Virginia, Maryland for controversial stream restoration projects

Cities are reducing runoff to the Chesapeake by rebuilding suburban streams and residents are concerned about why woods have to be leveled.

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration
SER

POLICY ARTICLE

International principles and standards for the practice of ecological restoration. Second edition

George D. Gann[1,2], Tein McDonald[3], Bethanie Walder[2], James Aronson[4], Cara R. Nelson[5,6], Justin Jonson[7,8], James G. Hallett[2,9], Cristina Eisenberg[10], Manuel R. Guariguata[11], Junguo Liu[12,13], Fangyuan Hua[14,15], Cristian Echeverría[16], Emily Gonzales[17], Nancy Shaw[18], Kris Decleer[19], Kingsley W. Dixon[20]

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration
SER

UN DECADE ON ECOSYSTEM RESTORATION

OPINION ARTICLE

Ten people-centered rules for socially sustainable ecosystem restoration

Marlène Elias[1,2], Matt Kandel[3], Stephanie Mansourian[4], Ruth Meinzen-Dick[5], Mary Crossland[6], Deepa Joshi[7], Juliet Kariuki[8], Lynn C. Lee[9], Pamela McElwee[10], Amrita Sen[11,12], Emily Sigman[13], Ruchika Singh[14], Emily M. Adamczyk[15], Thomas Addoah[16], Genevieve Agaba[3], Rahinatu S. Alare[17], Will Anderson[18], Indika Arulingam[7], SG̱iids K̲ung Vanessa Bellis[19], Regina Birner[8], Sanjiv De Silva[7], Mark Dubois[20], Marie Duraisami[14], Mike Featherstone[21], Bryce Gallant[7,22], Arunima Hakhu[7,22], Robyn Irvine[9], Esther Kiura[6], Christine Magaju[6], Cynthia McDougall[23], Gwiisihlgaa Daniel McNeill[19], Harini Nagendra[24], Tran Huu Nghi[25], Daniel K. Okamoto[26], Ana Maria Paez Valencia[6], Tim Pagella[27], Ondine Pontier[28], Miranda Post[9], Gary W. Saunders[29], Kate Schreckenberg[30], Karishma Shelar[31], Fergus Sinclair[6,27], Rajendra S. Gautam[32], Nathan B. Spindel[26], Hita Unnikrishnan[12,33], Gul̲xa taa'a gaagii ng.aang Nadine Wilson[9], Leigh Winowiecki[6]

GCB REVIEWS
Global Change Biology
WILEY

Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits

Alice Di Sacco[1] | Kate A. Hardwick[1] | David Blakesley[2,3] | Pedro H. S. Brancalion[4] | Elinor Breman[1] | Loic Cecilio Rebola[1,5] | Susan Chomba[6] | Kingsley Dixon[7,8] | Stephen Elliott[9] | Godfrey Ruyonga[10] | Kirsty Shaw[11] | Paul Smith[11] | Rhian J. Smith[1] | Alexandre Antonelli[1,12,13]

ELSEVIER
Contents lists available at ScienceDirect
Environmental Science and Policy
journal homepage: www.elsevier.com/locate/envsci

Core principles for successfully implementing and upscaling Nature-based Solutions

Emmanuelle Cohen-Shacham[a,b,*], Angela Andrade[a,c], James Dalton[d], Nigel Dudley[e,f], Mike Jones[a,g], Chetan Kumar[d], Stewart Maginnis[d], Simone Maynard[a,h], Cara R. Nelson[a,i], Fabrice G. Renaud[a,j], Rebecca Welling[d], Gretchen Walters[d,k,l]

ELSEVIER
Contents lists available at ScienceDirect
Global Environmental Change
journal homepage: www.elsevier.com/locate/gloenvcha

The political ecology playbook for ecosystem restoration: Principles for effective, equitable, and transformative landscapes

Tracey Osborne[a,*], Samara Brock[b], Robin Chazdon[c,d], Susan Chomba[e], Eva Garen[b], Victoria Gutierrez[f], Rebecca Lave[g], Manon Lefevre[b], Juanita Sundberg[h]

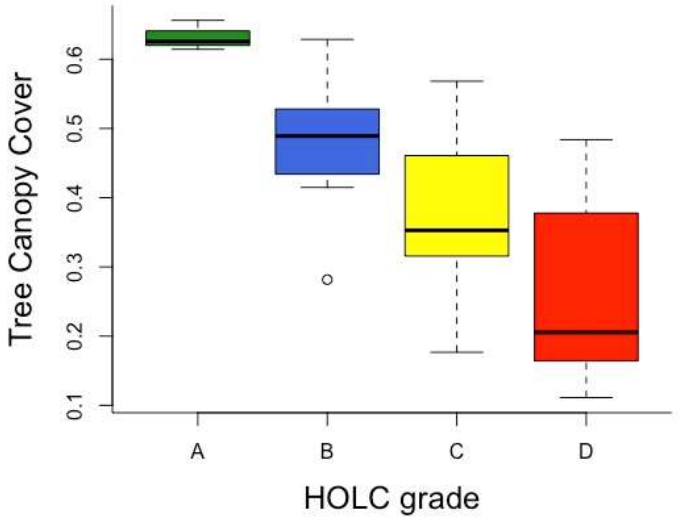
PLAN & MEASURE IMPACT

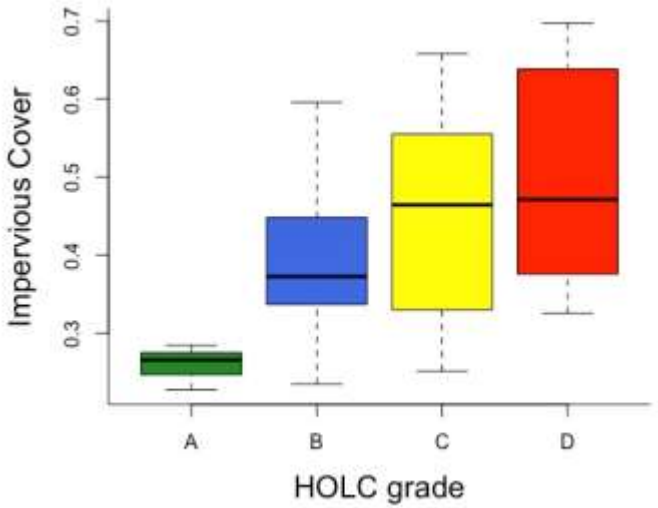
DESIGN FOR RESILIENCE

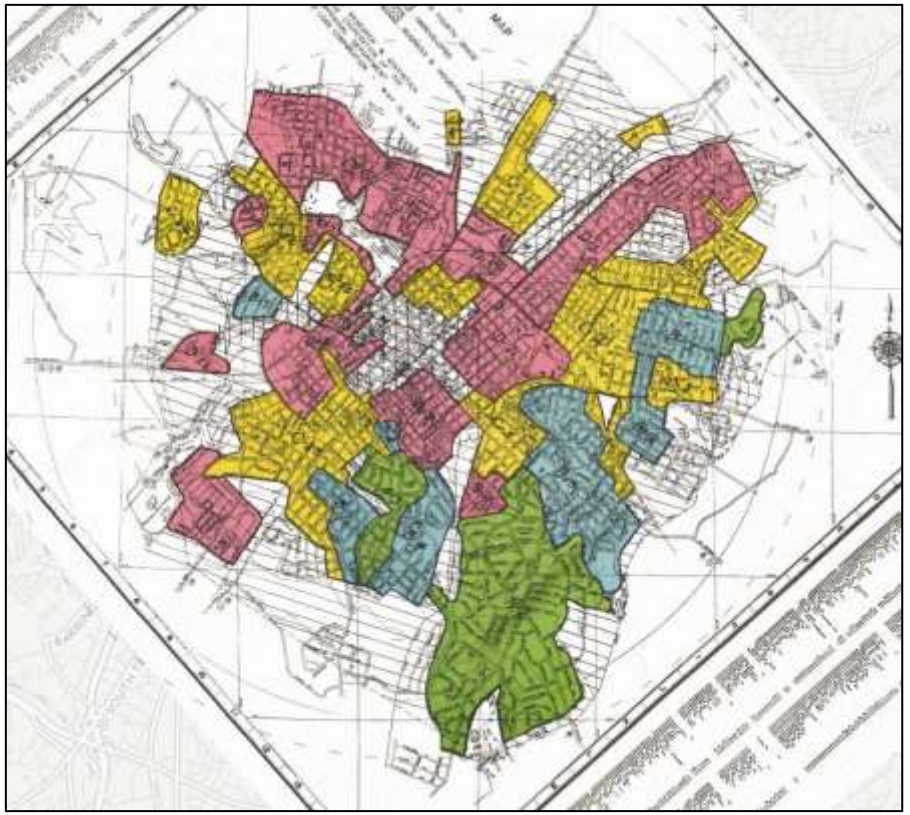
ENGAGE & EDUCATE

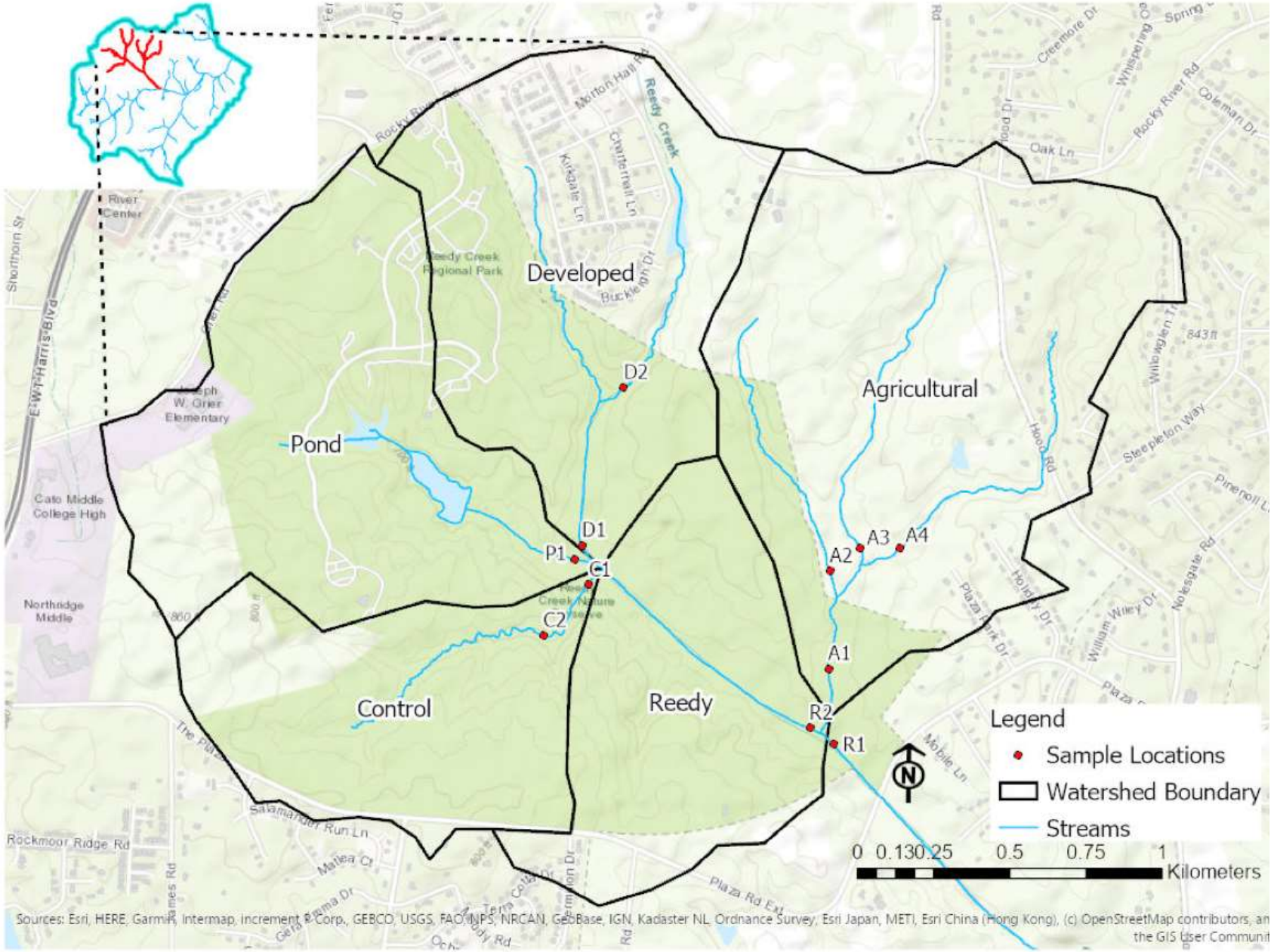
Plan & measure impact

Charlotte, NC: Impacts of Redlining Still Felt Today









Reedy Creek – Charlotte NC

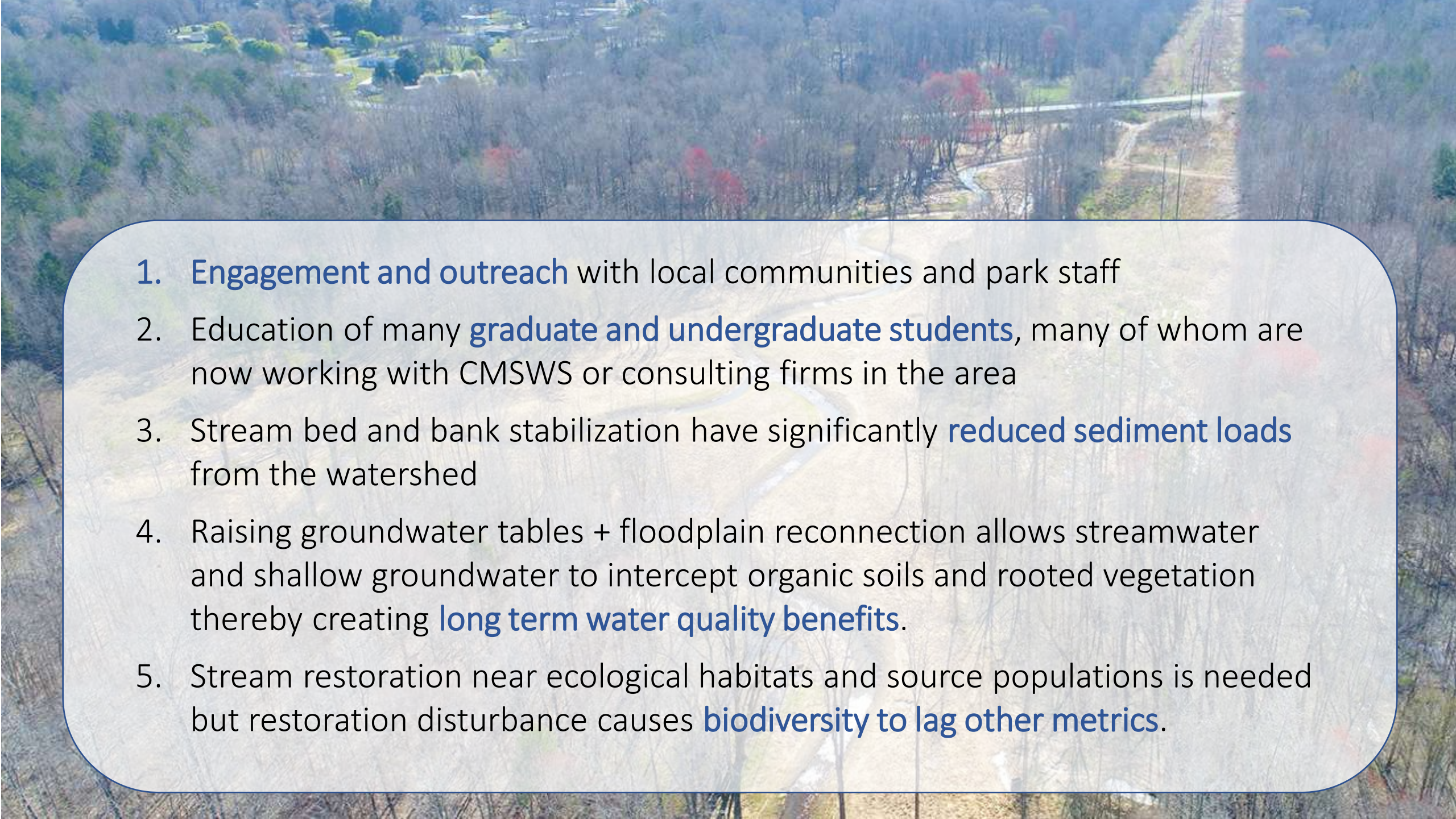
Partnership between government, universities, and private companies.

Investment in understanding through data-driven, research-back projects

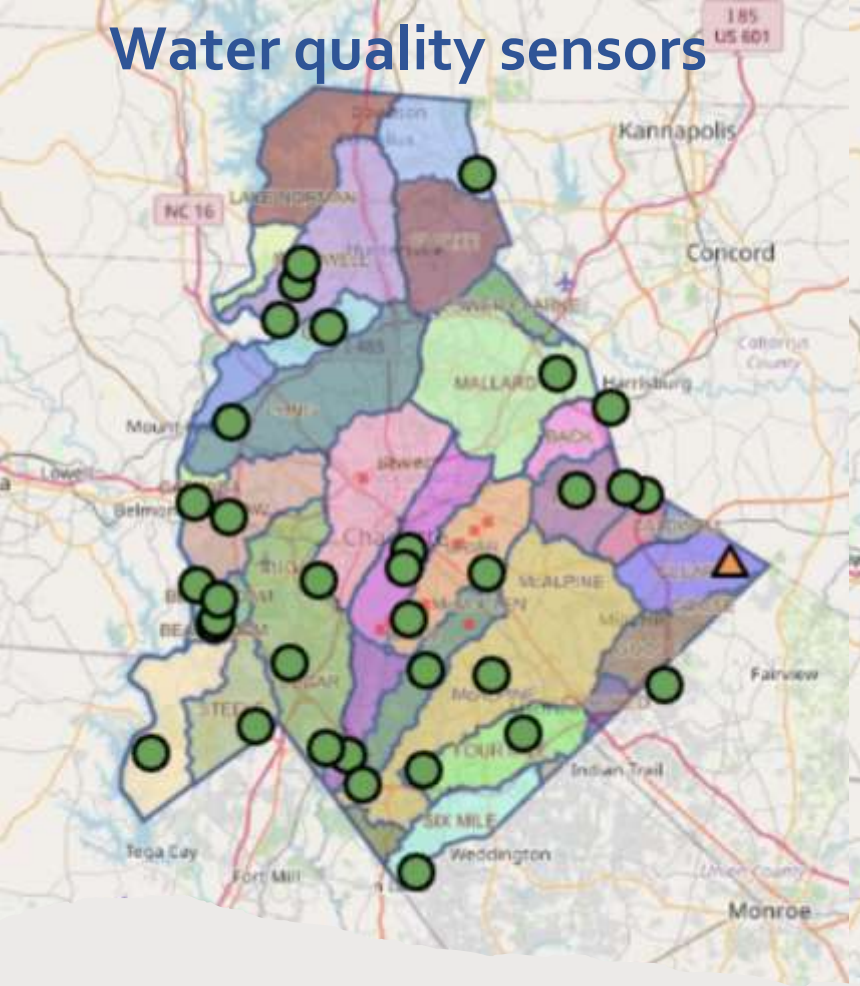
Multi-year monitoring of hydrology, water quality, and ecology before, during and after restoration

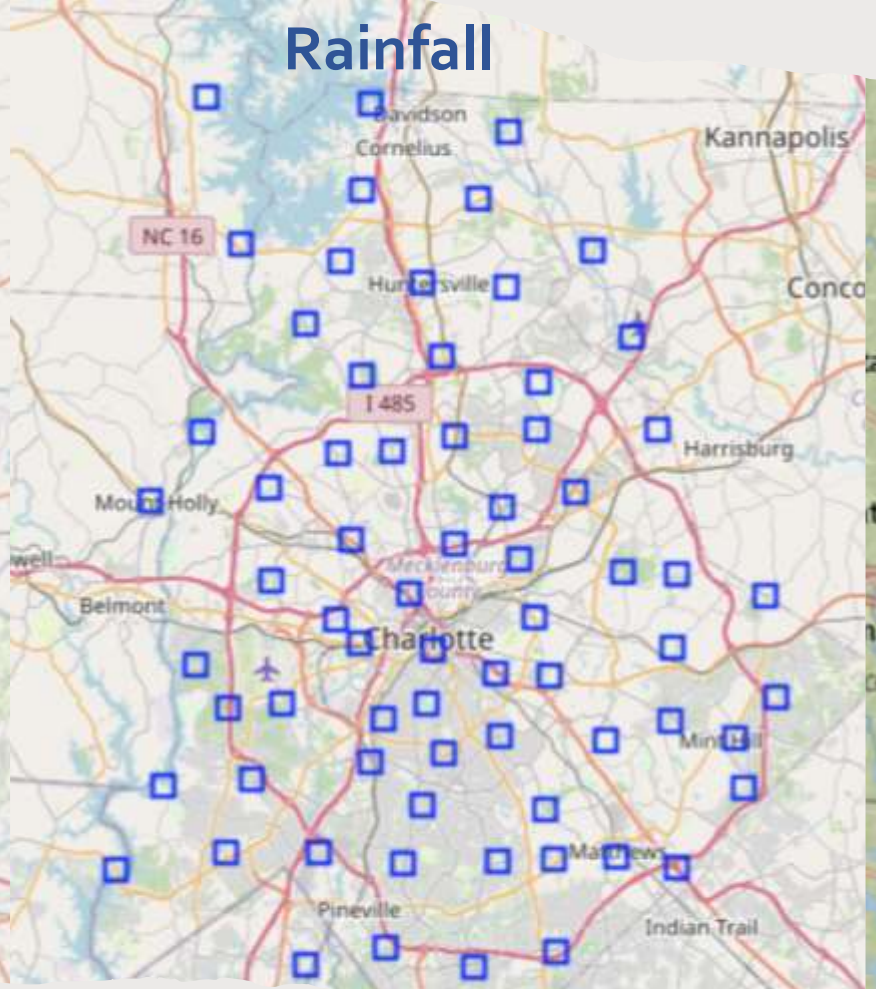

BUCKLEIGH BRANCH
BEFORE
CONSTRUCTION
AFTER
CONSTRUCTION

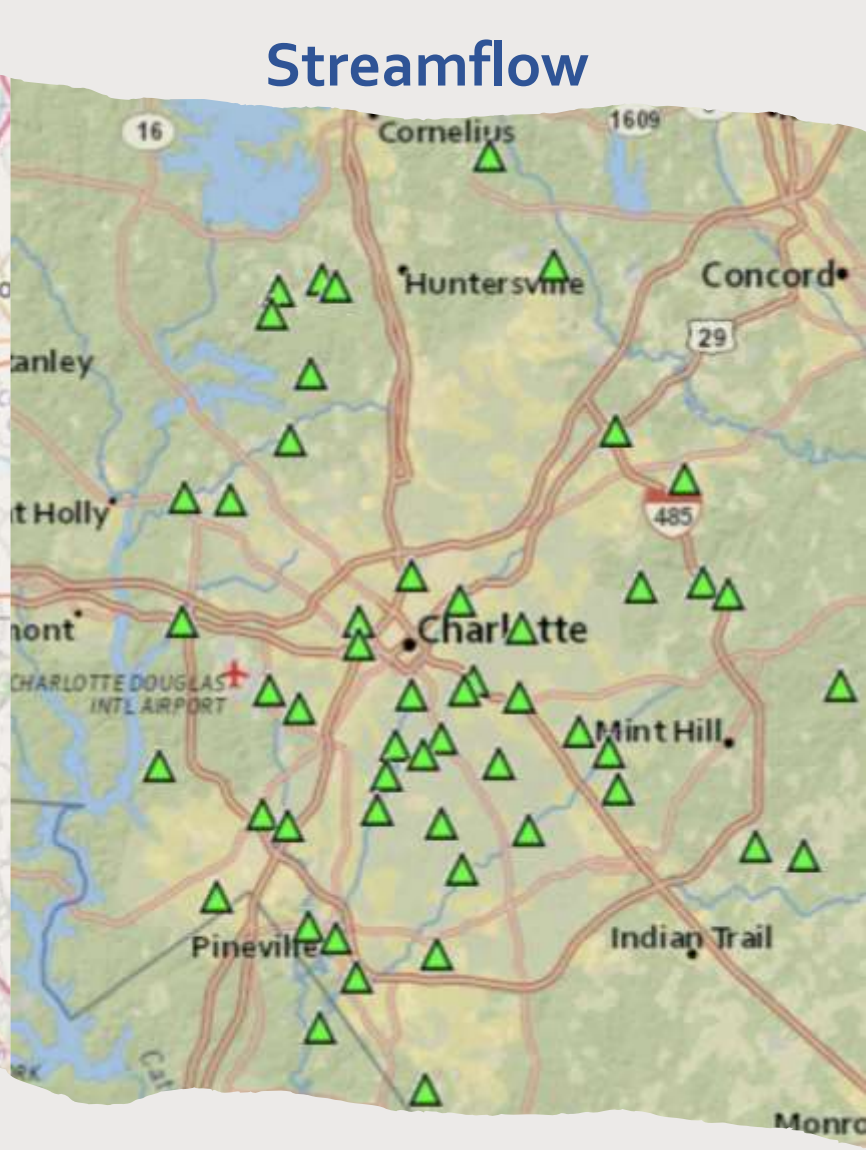

BUCKLEIGH BRANCH



1. Engagement and outreach with local communities and park staff
2. Education of many graduate and undergraduate students, many of whom are now working with CMSWS or consulting firms in the area
3. Stream bed and bank stabilization have significantly reduced sediment loads from the watershed
4. Raising groundwater tables + floodplain reconnection allows streamwater and shallow groundwater to intercept organic soils and rooted vegetation thereby creating long term water quality benefits.
5. Stream restoration near ecological habitats and source populations is needed but restoration disturbance causes biodiversity to lag other metrics.

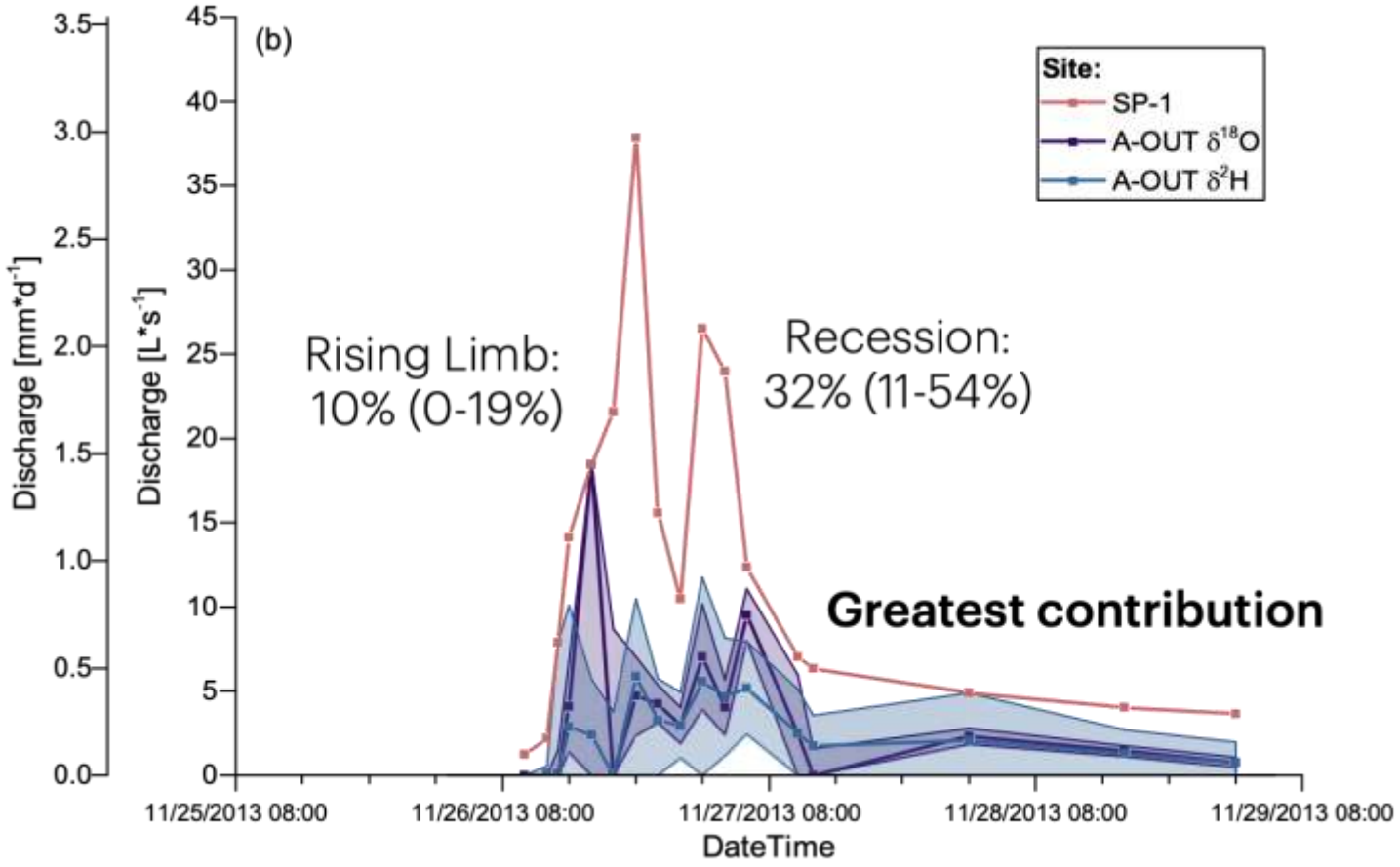




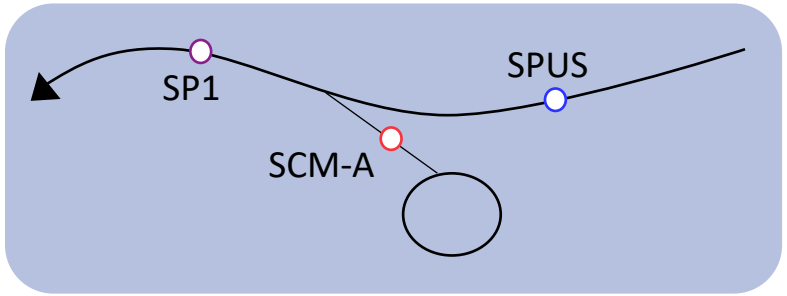


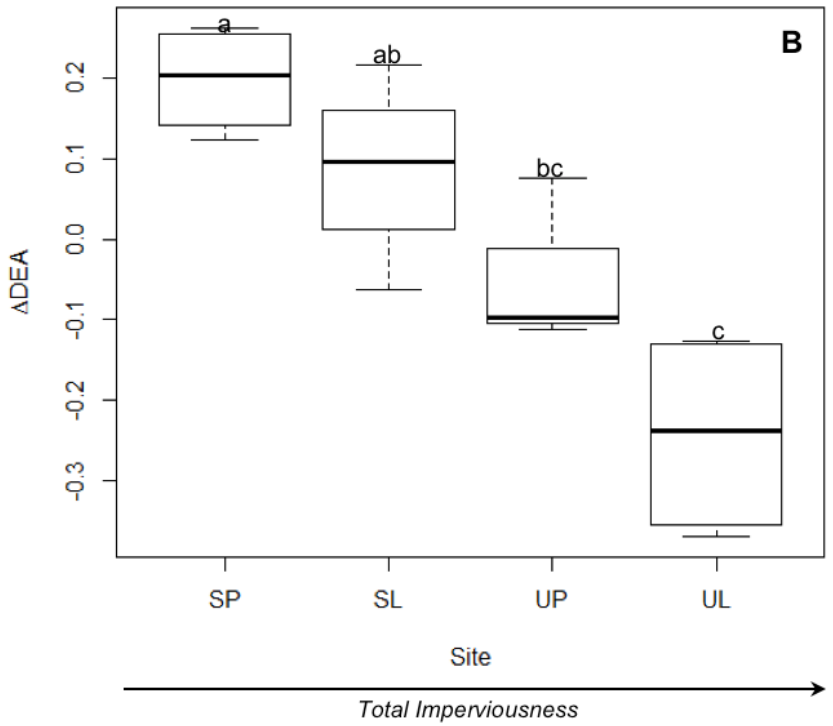
Investments in long-term monitoring data

Cumulative effects of nature-based solutions



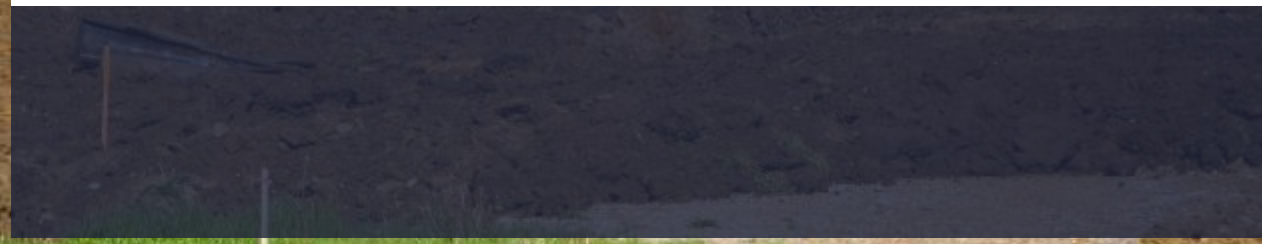
Jefferson et al. 2015 HYDRO PROC

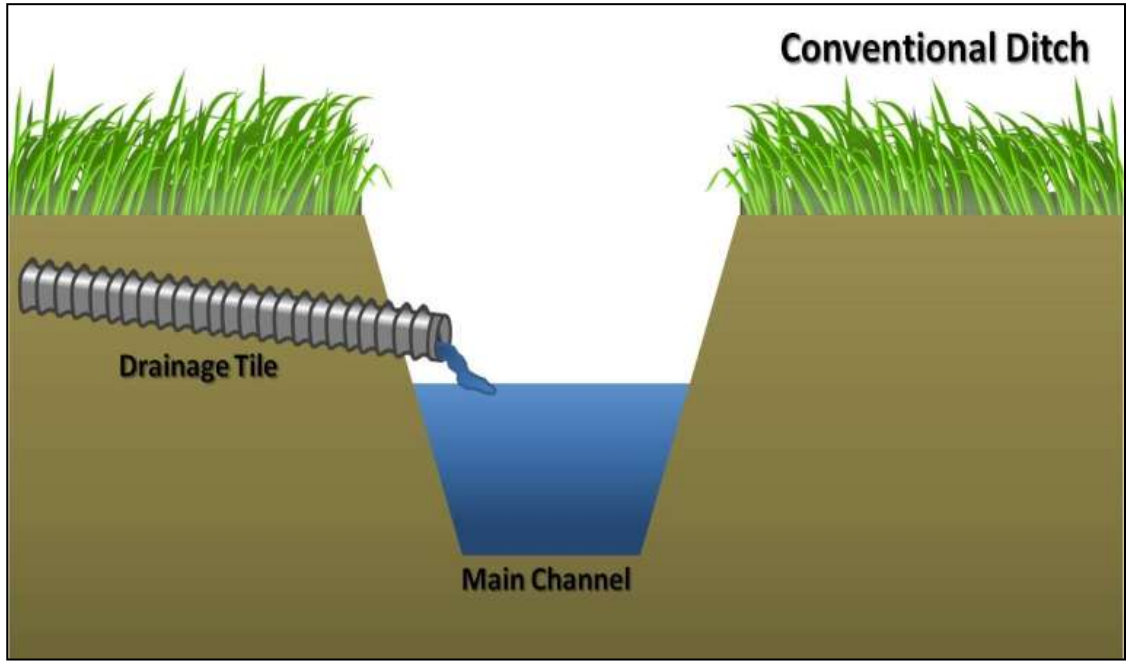


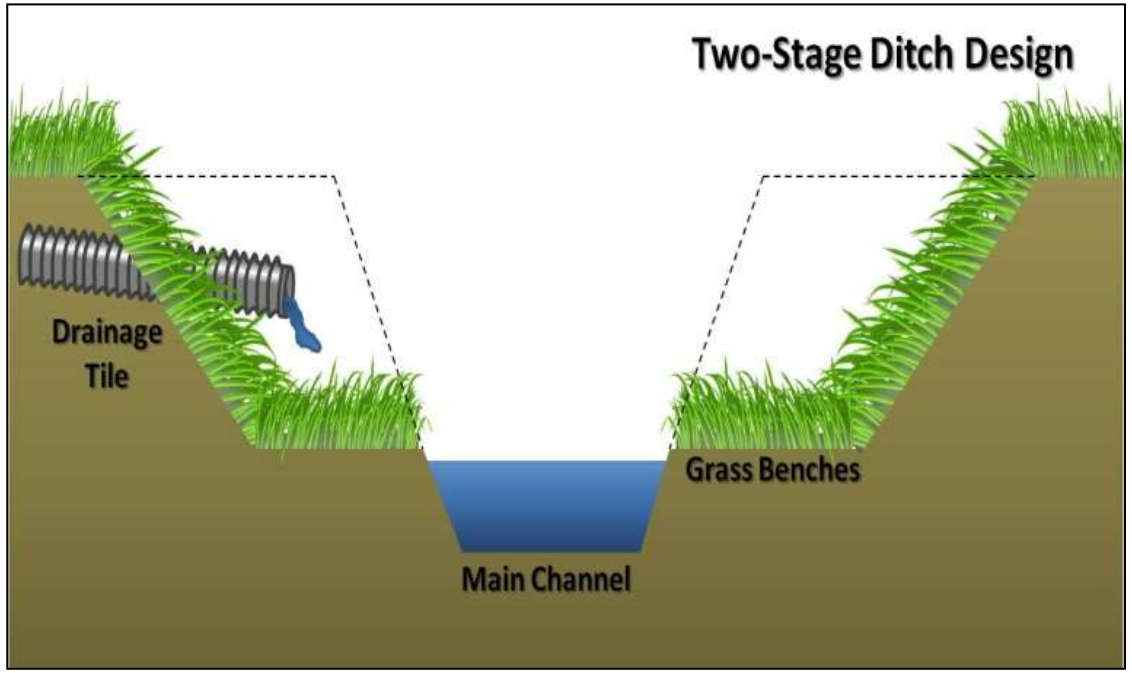


Rivers et al. 2018 WATER

Design for resilience







Channelized

During late-fall construction

After one growing season

Self-forming channels

Educate & engage

"Science requires an engagement with the world, a live encounter between the knower and the known." – Parker Palmer

Partnerships

"Alone we can do so little; together we can do so much." – Helen Keller


Biosystems &
Agricultural Engineering
College of Engineering
College of Agriculture, Food and Environment


College of Agriculture,
Food and Environment
Forestry and Natural Resources


College of
Engineering
Department of Civil Engineering


College of Arts
and Sciences
Department of Earth and
Environmental Sciences


College of Agriculture,
Food and Environment
Landscape Architecture


Environmental
Quality Management


Kentucky Water
Resources Research
Institute


Sustainability


OFFICE OF SURFACE MINING
RECLAMATION AND ENFORCEMENT


FEMA


KENTUCKY ENERGY & ENVIRONMENT CABINET


green
forests
work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Kentucky
College of Agriculture,
Food and Environment


DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA


KENTUCKY
Division of
Water


kaee
Kentucky Association for
Environmental Education


USDA
NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service


UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY


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engineering


Friends of
Wolf Run


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GREENSOURCE


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INSTITUTE
for Sustainability
and the Environment


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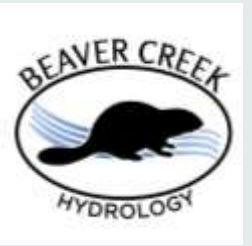
Proud
Kentucky
Department
of Agriculture


FAYETTE COUNTY
PUBLIC SCHOOLS


BEAVER CREEK
HYDROLOGY


KENTUCKY
DEPT. OF
FISH & WILDLIFE
RESOURCES


ecogro


RIDGEWATER
RESTORATION & MANAGEMENT


Stantec

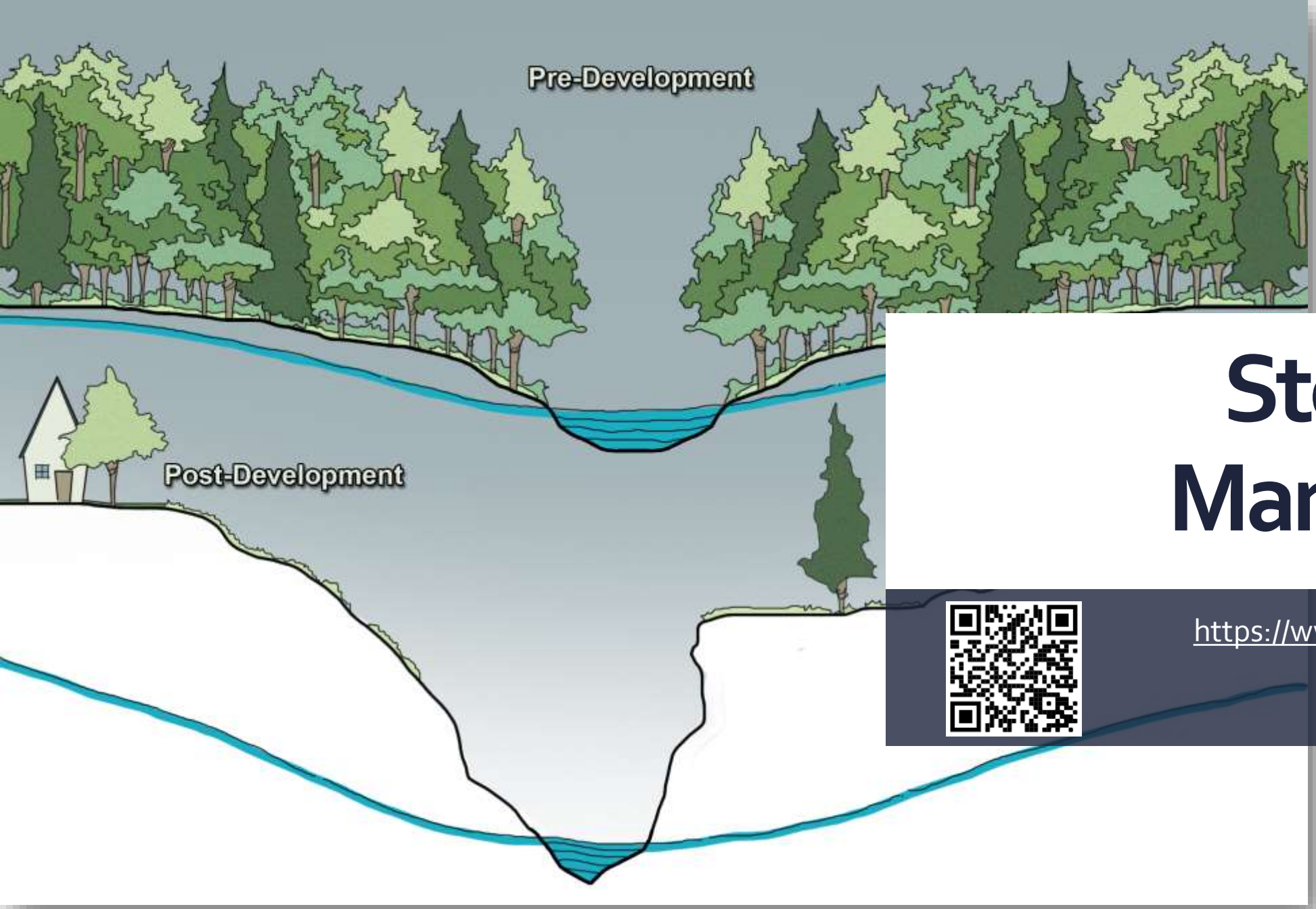

KBN
KENTUCKY BEEF NETWORK


EDEN SHALE FARM


Student
Sustainability
Council


LEXINGTON


Kentucky
Master Naturalist



Stormwater Management

https://www.uky.edu/env/stormwater

Mission:

Maximize the infiltration and evapotranspiration of stormwater, protect water quality, and conserve water resources.

How we're going to do it:

1. Maximize stormwater infiltration and evapotranspiration
2. Minimize negative impacts to water quality across all operations
3. Optimize the use of water in campus facilities
4. Optimize the use of water on campus grounds
5. Conduct water-focused outreach and engagement on campus

https://www.uky.edu/sustainability/sustainability-strategic-plan

Vaughn's Branch (Big Elm Fork) Stream Restoration

https://bit.ly/3ErJRMq


KENTUCKY
© 2016 Google
1988
38°01'19.51" N 84°30'30.91" W elev


CAUTION
Area Subject
To
Flash
Flooding

Workforce Development

"Education is the most powerful weapon which you can use to change the world" – Nelson Mandela


Andrew
Rhodes

UT to Hickman Creek Stream Restoration

https://bit.ly/35mgJpc


1
2
3

Outreach

"Nothing in science has any value to society if it is not communicated." – Ann Roe


WHAT IS SEDIMENT
YOU CARE ABOUT
HOW DOES LANDUSE
WHAT IS TURBIDITY?

Take-aways

What's next?

- Define success locally
- Take a systems approach
- Enhance resilience through self-design
- Integrate biophysical & social dimensions in project site selection
- Training the next generation of scientists & engineers requires partnerships & meaningful experiences

Contact Information & Resources

- Sara Winnike McMillan, PhD, PE
- Email: smcmillan@purdue.edu
- @EBOWSara on Twitter
- https://saramcmillan.weebly.com/

- Charlotte stream restoration
- To Build a Better Ditch

- Carmen Agouridis, PhD, PE, MPP, MBA
- Email: carmen.agouridis@uky.edu
- Office Phone: (859) 257-7203

- Restoring Streams
- Central Kentucky Backyard Stream Guide
- UK Watershed Protection and Restoration (YouTube)
- KYH2O (Podcast series)
- Backyard Streams