STUDENT ORGANIZATION SUSTAINABILITY INITIATIVE PROPOSAL FORM

Part I- General Information:

Name of Student Organization	Stroubles Creek Coalition (SCC), VT StREAM Lab
Contact/Responsible Person	Tom Saxton (SCC Coordinator)
Contact Office Held/Title	Cully Hession - Biosystems Engineering, StREAM Lab coordinator
Contact Email Address	thomascsaxton@gmail.com, chession@vt.edu
Contact Telephone Number	717-495-8402 (Tom), 540-449-6968 (Cully)

Part II- Project Cost Information

Estimated Cost of this Proposal	$15,000	See III.C. below
Estimated Savings -	$81,582 in ecosystem services at year 30. This number does not include benefits up to and beyond year 30.	See III.D. below
Net Cost of this Proposal =	$15,000	

Part III- Supporting Information

A. Please describe your sustainability initiative and attach supporting documentation.

This proposal seeks funding to support the Stroubles Creek Coalition (SCC) for ongoing riparian restoration efforts along portions of Stroubles Creek and tributaries owned by Virginia Tech. The requested funding will be used for various projects, including large-scale reforestation, restoration effectiveness monitoring and research, and public education/outreach. Project implementation will occur between November 2022 and March 2023.

Our success at restoring Stroubles Creek's riparian forest habitat to date is primarily thanks to historic funding from Green RFP grants. Your support and collaboration have been a critical driver to this project, not only continuing but growing. This project has influenced countless students as it develops the next generation of land managers and environmental stewards.

The sections of Stroubles Creek within the watershed boundaries of this project are listed as an impaired waterway by the Virginia Department of Environmental Quality (VA DEQ) and the US Environmental Protection Agency. The VA DEQ identified ten sources causing the impairment, and this project will positively address the top three sources from that list in an economic manner[11]:

1. Lack of streamside forest
2. Agricultural runoff
3. Increasing development and peak flows from stormwater runoff

For all of these project sites, SCC is working closely with VT StREAM Lab/ Biosystems Engineering, VT Site and Infrastructure Development, VT CNRE, VT School of Plants and Environmental Sciences, Virginia Tech's arborist (Jamie King), and the College of Agriculture and Life Sciences. Our goal is to support sustainable campus development, aid in campus riparian reforestation efforts, and provide valuable hands-on educational experiences for students.

The selected restoration sites are located in historically disturbed riparian areas, wetlands, and floodplains which are regularly inundated with stormwater runoff (primarily aggravated by impervious surfaces in Blacksburg). Many of these sites recently were fenced off from livestock grazing and now are experiencing a rapid influx of non-native, invasive vegetation such as autumn olive, multiflora rose, and tall fescue. These invasive species threaten biodiversity, negatively impact wildlife forage, severely hamper natural plant successional processes. Lower diversity of overall vegetation associated with invasive species has been found to not filter out pollutants from surrounding land uses or absorb stormwater runoff as effectively as a diverse, native riparian forest would be able to. By planting native seedlings, we can ensure the healthiest and most resilient riparian habitat, providing the most significant benefits to humans, water quality, and wildlife for years to come[7,8,9,10].

Restoring riparian buffers is the most reliable and cost-effective approach to improving water quality and managing stormwater runoff. Ensuring the health of a community's watershed is the foundation to a sustainable and resilient system economically, socially, and environmentally. By supporting our initiative, we can continue to take significant steps toward ensuring clean, fresh water for generations to come. This initiative will also achieve nine goals of VT's Climate Action Commitment and Sustainability Plan and support a global effort in the United Nations Decade of Ecological Restoration (the 2020s).

Image 1: Green RFP 2021 Overview map. The red boundaries are existing sites that require ongoing maintenance work to ensure a successful long-term project. Maintenance work includes monitoring and data collection, tree shelter maintenance, and follow up plantings to achieve the desired native plant density. The green boundaries are new targeted project sites that could begin by Spring 2023.

Image 2: Primary target sites for Spring 2023 (Green RFP 2021 implementation). The red areas will receive follow-up plantings to achieve the desired 435 trees/acre target and the green sites will receive initial native vegetation restoration work. The Inventive Lane Wetland Site will move forward in conjunction with VTSID, BSE, Jamie King (VT arborist), and CALS.

Image 3: Stroubles Creek flooding on VT StREAM lab in October 2018. This area is downstream of the VT campus. The flooding is primarily aggravated by the development of impervious surfaces within the watershed, the channelization of Stroubles Creek through Blacksburg and campus upstream, and the lack of streamside forests upstream. All stormwater from VT's campus drains to here. The culmination of these circumstances contributes to the poor health and condition of Stroubles Creek, leading to this section of the stream being listed as an impaired waterway by the VA DEQ. Through investment in a healthy, native riparian forest through this area, we can offset many of the environmental impacts of the Virginia Tech campus on the Stroubles Creek watershed. Furthermore, this investment will help protect the expanding Virginia Tech community and all communities downstream from stormwater and significant flooding events.

B. **How does this initiative help achieve the goals of the Virginia Tech Climate Action Commitment and Sustainability Plan?**

This project covers #1, 3, 4, 6, 7, 8, 14, 10, and 12 of Virginia Tech's Climate Action Commitment and Sustainability Plan.

1. This project reflects positively on Virginia Tech's efforts to have Stroubles Creek removed from the state's impaired waters list while further enhancing our reputation of being a Leader in Campus Sustainability *(#1 & 14 VT Climate Action Commitment).* To continue moving forward as national leaders in campus sustainability, we must focus on improving the health and condition of our watershed - the foundation of our community.
2. The project increases carbon GHG sequestration with increased vegetation biomass on campus[1,5]. According to the National Tree Benefits Calculator, upon reaching 10 inches in diameter (approximately 30 years in age), a single silver maple (*Acer saccharum)* will result in 503 pounds of atmospheric CO2 absorbed annually[4]. Silver maples are one of the native species to be planted in the vegetation restoration phase of the project *(#3 & 4 VT Climate Action Commitment).*

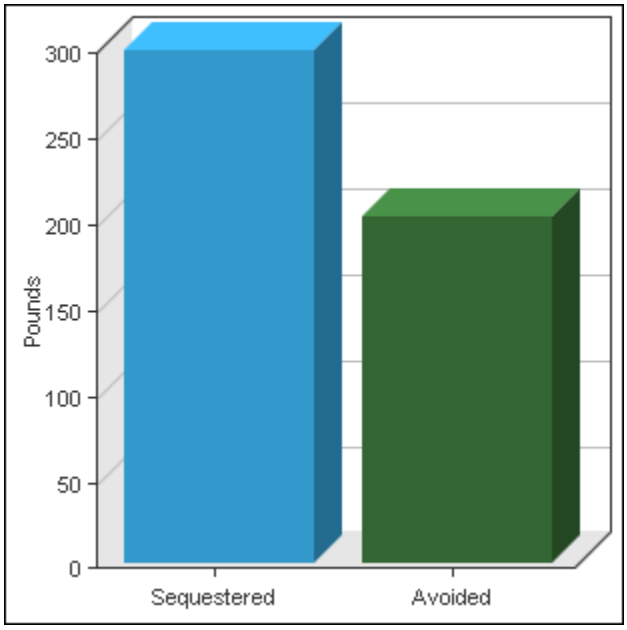

Figure 1[4]: CO2 sequestered or avoided annually at 10" diameter for a single Silver Maple[4].

3. Our project engages Virginia Tech students, faculty, and staff through a collaborative, multi-disciplinary restoration effort to optimize efficient and sustainable use of university resources *(#10 VT Climate Action Commitment).*
    a. Students from the College of Natural Resources & Environment (CNRE), the School of Plants and Environmental Sciences, The VT Environmental Coalition, the Society of American Foresters at VT, and the BSE StREAM lab will receive professional training on native vegetation establishment in riparian, wetland, and upland habitats.
4. This project is being incorporated into academic programs at Virginia Tech. It offers immense educational opportunities for students to gain hands-on experience with real-world environmental challenges, which can propel them to excellence in their careers *(#12 VT Climate Action Commitment).*

a. Students within CNRE's/Dr. Wiseman's Urban Forestry Management/Trees in The Built Environment courses will support the project through lab periods dedicated to managing wetland and riparian habitat restoration projects. Students will also collect data on tree survivorship by species.
b. Students from CNRE's/Dr. Sarah Karpanty's Conservation Biology course will support habitat restoration phases of the project for semester-long capstone projects. Students who have worked with us from this course in the past have told us it was the most rewarding experience of their academic careers. They will help with the wildlife habitat restoration and wildlife management aspects of the project.
c. Students from the Biological Systems Engineering's StREAM Lab will support all aspects of the project and research to provide valuable insights into the effects of land management practices on stream health and water quality.
d. Students within the School of Plants and Environmental Science/Leighton Reed's Environmental Restoration courses will support our projects through planting efforts and data collection
e. Students within CNRE's/ Dr. David Carter's Silviculture course will learn about significant reforestation projects through hands-on experience planting trees as instructed by SCC coordinators
f. Research conducted by Dr. Kevin Hamed and CNRE associates regarding least weasel populations on Stroubles Creek may be supported with funds from this grant. These funds could be used for least weasel nesting boxes in our project areas. Hamed's team is working on monitoring and expanding least weasel habitat within our project sites. Least weasels are a primary predator of voles and field mice found in extremely high densities in the tall fescue grass pastures that we work in. Our monitoring and data collection have determined that voles are a top cause of tree seedling mortality in our project areas. This collaboration will push forward a unique integrated pest management approach to improving tree survival rates through strengthening the numbers of least weasels that feed on voles.
g. Students from CNRE's/Marc Stern's Environmental Interpretation course will help develop educational signs along VT's portion of the Huckleberry Trail to highlight the project work.

5. The riparian vegetation that will be established along Stroubles Creek from this project will improve water quality by:

a. Mitigating pollutants and pesticides from Virginia Tech's agriculture fields and livestock, golf courses, runoff from impervious surfaces, and current and future campus development projects - these pollutants include nitrogen, phosphorus, heavy metals, pesticides, oil and grease, fecal coliforms, etc. [1,2,3,5].
    i. Eg. Nitrogen from livestock manure entering waterways through an ineffective riparian area eventually goes through a nitrification process and turns to gaseous nitrous oxide. The impact of 1 pound of nitrous oxide on warming the atmosphere is almost 300 times that of 1 pound of carbon dioxide[6] *(#3 & 4 VT Climate Action Commitment).*
b. Absorbing stormwater runoff from impervious surfaces[1,2,3,5]. According to the National Tree Benefits Calculator, upon reaching 10 inches in diameter (approximately 30 years in age), a single silver maple (*Acer saccharum)* will absorb 917 gallons of stormwater annually[4].
    i. The significant capacity of a healthy riparian buffer to absorb stormwater runoff is a huge step towards ensuring the resiliency of our communities to flooding events and similar natural disasters, particularly as these events become more extreme or unpredictable with future changes to the region's climate
c. Stabilizing soil to prevent stream bank erosion and sedimentation in the water [1,2,3,5].
d. Providing shade over the water keeps water temperatures low and oxygen levels high for aquatic species [1,2,3,5].

6. Trees planted in urban areas within the watershed reduce gas emissions through improving energy efficiency needs for building cooling through providing shade. Maximizing energy efficiency through landscape design is a large part of sustainable development and takes steps forward for LEED certifications *(#3,4,6,7 VT Climate Action Commitment).*

A 10 inch Silver maple will conserve 121 Kilowatt hours of electricity for cooling and reduce oil or natural gas consumption by 16 therm(s).[4]

Trees modify climate and conserve building energy use in three principal ways (see figure at left):

- Shading reduces the amount of heat absorbed and stored by buildings[4].
- Evapotranspiration converts liquid water to water vapor and cools the air by using solar energy that would otherwise heat the air[4].

- Tree canopies slow down winds, reducing the heat lost from home, especially where conductivity is high (e.g., glass windows)[4].

7. The project makes every effort to re-use planting material (tree tubes, stakes, flagging, etc.) as many times as possible before eventually recycling the materials. By funding this proposal, we will be able to organize project maintenance event days. This reduces waste and increases material re-use and recycling *(#8 VT Climate Action Commitment).*

C. What is the cost of your proposal? Please describe in adequate detail the basis for your cost estimate.

Total request: $15,000

This will continue our work as introduced in Section A. Project work will include native tree and shrub plantings, historic planting maintenance, data collection and monitoring, and funding several VT courses in-class/research work associated with this project (as mentioned in section B-4). Additional funds could go to designing and installing education/interpretive signs and reimbursing time/travel costs for SCC coordinators when they return to lead volunteer efforts.

Cost per tree break down:

Seedlings	$1.50
3'x3' Weedguard biodegradable weed mat and biodegradable stakes	$2.50
5-foot Tubex tree shelter or Vigilis Biodegradable Shelters	$3.72
5 foot wooden or PVC shelter stake	$1.43 wood/ 2.50 PVC
Project planning, site preparation (mowing/discing/or herbicide application), long term planting maintenance labor cost, lodging and perdiem for coordinators, fuel mileage reimbursement	$3.50
Estimated Total Cost	$12.65

Table 1: Estimated cost per tree breakdown at current rates in November 2021. Prices for materials could fluctuate between now and the proposed project implementation date. A maximum of 1,200 native trees and shrubs will be planted with these funds.

D. Please describe in adequate detail the basis for your savings estimate.

The trees planted through the funding of this proposal offer many ecosystem services. Their benefits increase over time. The annual benefits of a 10" silver maple (30 years old) are $86 annually, as calculated by the National Tree Benefits Calculator[4]. *These quantified benefits are a metric of year 30 and do not include the benefits up to and beyond year 30.* Without these benefits, Virginia Tech would need to resort to more expensive and less effective means of achieving the same results that the ecosystem services of a healthy riparian forest can provide.

$81,582 will be gained as a result of ecosystem services at year 30 for 1,185 native trees. We expect an 80% survivorship rate among the planted trees, so benefits were adjusted accordingly to reflect the final estimated benefits (benefits from 948 trees were calculated).

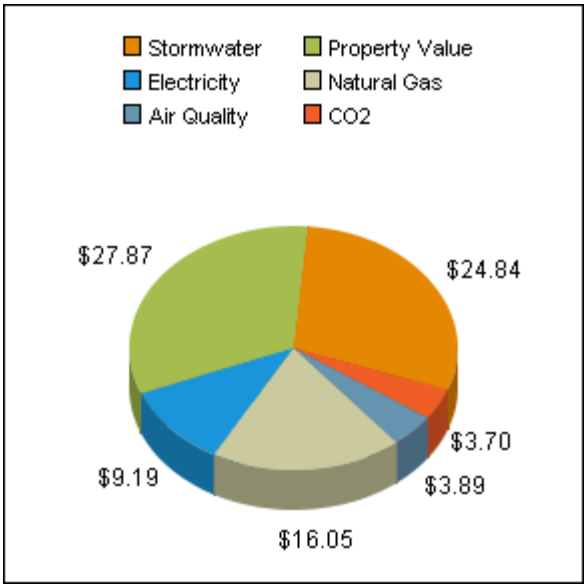

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Figure 2[4]: Benefits breakdown provided by the National Tree Benefits Calculator[4]

Total Savings- $81,582 in ecosystem services at year 30 (not including years up to and beyond year 30)

An additional benefit not added to the cost savings estimate is *t*he psychological benefit for humans. In a time of increased risk of psychological illnesses, the restoration and retention of riparian and urban forests have tremendous benefits for improving stress management and happiness. This is a value that likely vastly exceeds the uses outlined above.

Benefits from education opportunities for Virginia Tech students associated with this project are also not able to be quantified. This project is working to develop the next generation of environmental stewards and land managers.

E. Is this funding request an Ongoing or One-Time change (please check one)?

- **One-time** - Ongoing

F. **Is funding available for this request from another source? If yes, describe the funding (source, amount, etc.)**
We plan to use our Green RFP grant to apply to a Virginia Department of Forestry Grant (VADOF) (Trees for Clean Water Grant), which requires a $15,000 match. This will result in a project budget of $30,000 for spring 2022.

G. Conclusion

This proposal seeks to demonstrate Virginia Tech's global leadership in sustainability. By protecting and restoring the riparian areas along Stroubles Creek and its tributaries, VT supports the United Nation's Decade of Ecological Restoration (the 2020s) and VT's Climate Action Commitment and Sustainability Plan. To continue carrying the torch as global Leaders in Campus sustainability, we must focus on improving the health and condition of our watershed - the foundation of our community. The costs on behalf of Virginia Tech are minimal, yet the benefits are abundant and will increase over time. Restoring riparian areas and wetlands is the most cost-effective and reliable solution to improving water quality and managing stormwater runoff. This project will reduce catastrophic flooding impacts, connect fragmented habitats for wildlife, and take strategic steps to have Stroubles Creek removed from the Virginia DEQ/US EPA's list of impaired waterways.

Many projections of the potential effects of climate change illude an increase in extreme storm events and annual precipitation in our region. This results in a heightened risk of flooding, particularly in urban areas along waterways like Stroubles Creek on Virginia Tech's Campus. Restoring a native riparian forest along Stroubles Creek and its tributaries is a significant step towards increasing our community's resiliency to such events.

There are few areas of greater priority to conservation than riparian areas and wetlands along waterways. Clean water is the scarcest natural resource we have on our planet. In the spirit of *Ut Prosim*, is it our responsibility to take every means

necessary to protect this precious resource for present and future generations. We ask for your continued support and partnership in a collaborative effort to demonstrate Virginia Tech's continued commitment to environmental, economic, and social sustainability.

2019/2020 Green RFP Proposals

The 2019/2020 Green RFP project is still in the implementation phase. In November 2021, SCC coordinators returned to project sites for work. We collaborated with VT StREAMLab, Virginia Tech Corps of Cadets, Lambda Iota Mu, and Inmotion (Blacksburg Engineering Firm) to conduct necessary maintenance work across our historic Green RFP project sites. We performed various maintenance work such as removing tubes from large trees or dead trees for re-use in future plantings, replacing 1,000 tree shelter stakes on Docs Branch with PVC stakes, extending 850 4-foot tree shelters to a 6-foot height to reduce deer browse mortality on Docs Branch. Students from Eric Wiseman's course, Trees in the Built Environment, collected tree survivorship data by species across our Stroubles/Holtan sites funded from historic Green RFP proposals. This data will be used to drive future species selection on our sites. SCC leaders also led Dr. Leighton Reed's Plants for Environmental Restoration lab in project work on our Holtan Branch.

The remainder of the 2019/2020 Green RFP funds will support a 2,500 native tree planting on Docs Branch as outlined in the 2020 Green RFP grant. This will occur during the last week of February 2022.

Image 4: SCC coordinator, Tom Saxton, instructing students in Dr. Leighton Reid's Environmental Restoration course during a guest lab lecture. Location – Holtan Branch, November 2019

Image 5: Students in Dr. Leighton Reid's Environmental Restoration course planting seedling trees. Location - Holtan Branch, November 2019.

Image 6: VTCC helping on Docs Branch maintenance efforts. The VTCC covered all the areas of historic Green RFP projects associated with this project in November 2021.

Image 7: Tree shelter extensions installed by SCC and Inmotion Blacksburg in November 2019 (blue sections of tube). These trees were planted with Green RFP funds in 2020 but the 4 foot shelter heights chosen for that planting resulted in heavy deer browse. The tube extensions will ensure the investment made that year will be successful and the trees will survive.

2016/2017/2018 Green RFP Proposals

Our Green RFP proposals from 2016 and 2017 have been huge successes and significant steps forward to improving the health and condition of Stroubles Creek. The VT College of Agriculture and Life Sciences successfully installed 1,000 feet of livestock exclusion fencing along Stroubles Creek with the awarded funds. This fencing has already gone a long way to improving water quality by reducing sediment and livestock manure entry into the stream during recent storm events. The 2016 and 2017 grants funded the planting of 5,300 native trees (bare root seedlings and live stakes) along Stroubles Creek and its tributaries and included hundreds of VT students and many courses in our project work.

The 2018 Green RFP funded contractors to plant 945 additional bare-root seedlings with 4-foot tubes and weed mats on Docs Branch, a tributary of Stroubles Creek, in March 2020. This has brought the total number of trees planted through Green RFP funds to 6,245. Contractors were deployed when COVID-19 hit to reduce community contact spreading. We used it as a virtual teaching lab for Dr. Eric Wiseman's Urban Forestry lab, where he filmed the contractors working, asked questions, and put together an excellent video for the class. In the fall of 2020, students in VT CNRE and Lambda Iota Mu conducted survivorship counts and planting maintenance and found a 90% survival among these trees after the first growing season.

The benefits from these projects are numerous and will only increase with time, and are currently being researched/monitored by faculty and students from VT's StREAM lab and the College of Natural Resources and Environment.

Thank you for your previous support of this project by awarding us our proposal's 2016/2017/2018 funding. Without the support from the Office of Sustainability, these projects would have never been possible. Together, we are taking great strides forward to ensure clean water for tomorrow.

Image 8: SCC volunteers planting seedling trees. The fence in the background is the new livestock exclusion fencing to keep livestock away from Stroubles Creek. This project was through the Green RFP grant.

Image 9: Volunteer planting bare root seedlings between the new fence and Stroubles Creek funded by the Green 2016 RFP grant – Dec 2017.

Image 10: Hummingbird nest on a maple tree that was planted with Green RFP funds in December 2017

Image 11: Green RFP Funded SCC tree planting event on Stroubles Creek - December 2017

Image 12: Restoring riparian habitats with Green RFP funding - December 2017.

Image 13: Docs Branch planting in February 2020 that paid for with Green RFP funds.

Image 14: Docs Branch planting in February 2020 that was paid for with Green RFP funds.

Image 15: Holtan Branch in March 2016 during the construction of livestock exclusion fencing and native tree planting.

Image 16: Holtan Branch in November 2021 in the same location as Image 15 above, looking downstream.

About the Stroubles Creek Coalition

STROUBLES CREEK COALITION

@STROUBLESCREEKCOALITION

The Stroubles Creek Coalition (originally the Stroubles Creek Restoration Initiative) was formed in 2014 by Tom Saxton to improve the health and condition of Stroubles Creek by restoring heavily damaged riparian habitats through university-wide collaboration. Since 2014, the SCC has worked with partners to plant 27,500 native trees and improve livestock fencing around Stroubles Creek and its tributaries. The SCC has collaborated with Virginia Tech's Department of Site and Infrastructure Development, Biosystems Engineering (VT StREAM Lab), CNRE, the Office of Sustainability, the College of Agriculture and Life Sciences, Department of Horticulture, Virginia State Department of Forestry, Virginia Department of Environmental Quality, Conservation Services Inc., The New River Conservancy, the VA Department of Forestry, and around 2,000 VT students, alumni and Blacksburg locals.

Our work has been covered by media sources such as the Roanoke Times, the Collegiate Times, and VT News. This has reflected positively on Virginia Tech as the university continues to be a global leader in advancing the science and implementation of sustainability.

Appendix

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