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## South Carolina Biomass Council Project

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**South Carolina Biomass Council Project**

**Sam Balough and Taryn Long**

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## **Project summary and Relation to Sustainable Development Goals**

In response to the South Carolina Department of Transportation's Rural Roads Safety Program, we will be looking at roadside trees that have been or are going to be clear cut along the roads and highways. Our project will be a white paper resource for future tree cutting policy change and to advocate to mitigate roadside tree loss along the roadways in South Carolina. In addition, we will be looking at the effects cutting these trees has on flooding, extreme heat, biodiversity loss, air and water quality, and quality of life for citizens. Not only does protecting trees maximize the environmental benefits but it contributes to the state's economy and cultural identity. In this report, we will compare South Carolina's tree policies to other states and see what improvements implemented in other states can be applied here. Our work directly relates to many of the United Nation's 17 Sustainable Development Goals.

We looked at the ways cutting trees in general is a major contributing factor to climate change, which increases the intensity and frequency of extreme weather events. The South Carolina Mitigation Action plan identified counties that are most likely affected by these extreme weather events. <sup>1</sup>The Mitigation plan points out most vulnerable communities using the Social Vulnerability index which identifies counties that would struggle to prepare and deal with extreme weather events, such as flooding.<sup>2</sup> This relates to Goal 1, specifically target 1.5 that aims to build resilience in poor and vulnerable communities,<sup>3</sup> especially resiliency to climate related weather events. Communities in the Southeast are already prone to drought, hurricane, and extreme heat. Extreme heat is especially dangerous for infants and elderly populations.

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<sup>1</sup> "South Carolina CDBG-MIT Action Plan," South Carolina CDBG-MIT Action Plan § (2019), pp. 1-122.

<sup>2</sup> "South Carolina CDBG-MIT Action Plan," South Carolina CDBG-MIT Action Plan § (2019), pp. 1-122.

<sup>3</sup> "THE 17 GOALS | Sustainable Development"

Although we are working to change policy on cutting roadside trees, we are still concerned with South Carolina's driver safety. This relates to goal 3, health and well-being, and targets 3.6, which aims to have the number of global deaths related to traffic accidents recorded.<sup>4</sup>By doing research and collaborating with SCDOT we can study more traffic data and update past data.

Much of this initiative to protect the roadside trees is focused on how it can prevent risk hazards like flooding. Trees can intercept a lot of rainfall and reduce flooding and erosion. This also reduces the amount of water that flows into water reservoirs and must be treated, which will in turn improve the water quality. For example, in the article "Trees manage stormwater, naturally" from the Chicago Tribune says the US Forest service estimates that 100 mature trees can intercept about 14,000 gallons of water per year from flowing into storm sewers.<sup>5</sup>This reduces that amount of water that must be treated in a wastewater plant and keeps water from flooding in the streets. This relates to goal 6 sustainable management of water and sanitation for all,<sup>6</sup> specifically target 6.6 that works to restore water related ecosystems like forests and wetlands, the purpose of this report with regard to roadside areas.

Instead of seeing roadside trees as a threat, we know they can still be planted safely along with other roadside vegetation. This way the roads are safe, and we will not lose ecosystem services we need. This relates to goal 9 which is industry, innovation, and infrastructure, and directly relates to target 9.4 which aims to upgrade infrastructure to make it more sustainable.<sup>7</sup>

Allowing trees to stand on roadsides can be used as a type of natural infrastructure and it is much

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<sup>4</sup> "THE 17 GOALS | Sustainable Development"

<sup>5</sup> Beth Botts, "Trees Manage Rainfall, Naturally," [chicagotribune.com](http://chicagotribune.com), May 23, 2019,

<sup>6</sup> "THE 17 GOALS | Sustainable Development"

<sup>7</sup> "THE 17 GOALS | Sustainable Development"

more sustainable than cutting the clear zones, because it sequesters carbon, reduces cost of roadside construction, and protects the biodiversity found on the roadside.

Carbon sequestration is one of the more obvious benefits of trees. Increasing amounts of CO<sub>2</sub> in the atmosphere is one of the leading contributors to climate change. By protecting the roadside trees and advocating to develop a tree mitigation policy, trees can sequester and remove carbon from the atmosphere. Our project aims to take urgent action to combat climate change, which is Sustainable Development Goal 13.<sup>8</sup> SDG target 13.2 is to integrate climate change measure into policy. Our project advocates for protecting and mitigating tree loss with state policies and planning.

Sustainable Development Goal 15 is to “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity”.<sup>9</sup> This represents the main goal of our project. By changing policy to protect roadside trees, we are conserving the roadside tree ecosystem and the habitat they provide to countless other terrestrial organisms. If we can change the South Carolina Department of Transportation’s Roadside Tree cutting policy we can prevent the roadside habitat from being degraded and save the tree, plant, and animal biodiversity that exists within it.

Finally, our work relates to SDG 17 which is partnerships for the goals.<sup>10</sup> Much of our work has been meeting and interviewing professionals about their expertise about the roadside tree loss the state of South Carolina is experiencing. Along with creating a paper for others to base policy change from, we are seeking a passionate community of people who care about trees

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<sup>8</sup> “THE 17 GOALS | Sustainable Development”

<sup>9</sup> “THE 17 GOALS | Sustainable Development”

<sup>10</sup> “THE 17 GOALS | Sustainable Development”

and sustainable development. If the policy change occurs within SCDOT, hopefully our state and paper can be an example to other states and countries around the world about how trees can be a part of safe and sustainable roadside infrastructure.

Here in Georgetown County, we are primarily working with professionals to create a complete report to protect and plant trees on public land in South Carolina. Georgetown county faces many issues such as building resiliency in face of natural disasters (i.e. hurricanes and flood), high unemployment rates, and unsafe roads. After collaborating with stakeholders and professionals in the county, we hope our plan to protect and replant trees will combat many of the issues Georgetown County faces while also working to fulfill some of the Sustainable Development Goals listed above. Planting trees will reduce the county's contribution to climate change which will in turn reduce the frequency and intensity of natural disasters while also improving the community's resiliency to these events. Keeping trees on our roadsides also prevents erosion which protects the structural integrity of the roads and allows for safe travel. And our proposal to plant trees will hopefully open more jobs that provide steady work in the community. This relates to Sustainable development goal 8, decent work and economic growth.<sup>11</sup> Job positions in policy, planning, and maintenance could be created to help reach our goal of stricter tree policy.

## **Case Studies**

### **Montgomery County, Maryland Roadside Tree Protection Program**

Many other states also have an interest in protecting urban forests and roadside trees as well. Montgomery County in Maryland worked to change the Maryland Department of

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<sup>11</sup> "THE 17 GOALS | Sustainable Development"

Transportation's tree laws in order to protect trees with stricter parameters. Montgomery county realized that trees not only provide us with vital ecosystem services but also serve as an economic asset. A tree calculator formulated by Casey Trees and Davey Tree Expert Co was displayed in the report. It states that one single maple tree is worth a total of \$8,616 in ecosystem services. It provides this monetary value by improving air quality, mitigating stormwater, increasing property value for homeowners, reducing the cost of heating and cooling, and sequestering carbon. <sup>12</sup>

In response to the need to protect trees, in 2013 Montgomery County enacted the Roadside Tree Protection Law. The law aims to maximize ecosystem and socio-economic services trees provide, limit unnecessary removal of trees, make sure trees are protected during construction and development, and make sure that cut trees are replaced with species that complement the roadside and contribute to the overall health of the urban forest.

The process used to decide if the Tree Protection Program is needed is outlined below. The Department of Permitting Services (DPS) goes out to assess the sites of proposed construction.

- The first outcome happens when a construction plan does not affect tree health of the roadside trees, so the Tree Protection Program is not required.
- Next, a construction plan indicates that some trees will experience the effects of the proposed development, but the trees will likely be able to survive. This outcome does Require a Tree Protection Plan to illustrate how trees will be affected, and how the effects can be mitigated.

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<sup>12</sup> Montgomery County Department of Permitting Services. "Montgomery County Roadside Tree Protection Law," 1.

- The third outcome is when the roadside trees present will not survive the proposed construction and must be removed. In this situation, the Tree Protection Plan is required to outline how the trees will be removed and how new trees will be planted.<sup>13</sup>

The document also emphasizes that a tree care professional should be assessing the construction sites and be working on these types of projects. Montgomery county hires Certified Arborists, professionals with Tree Risk Assessment Qualifications, and Registered consulting arborists to work on their permit planning. This ensures professionals that understand the health and wellbeing of tree species and urban forests have a say in the cutting, maintenance, and replanting of trees.

If the DPS reviews the Tree Protection Program and decides that a tree does need to be cut in order to finish construction, then the developer will have to pay a fine of 500 dollars. And if there is not a good option to replant another tree to minimize the impacts, another 250 dollars fine will be charged to the developer.<sup>14</sup> The DPS also suggests that tree risk and mitigation planning should be included in the beginning stages of the construction plan. This ensures trees are a priority from the start. There are a few factors that can justify roadside trees being removed. These factors include predevelopment health, predevelopment structural condition, Predevelopment and insect activity, relative age and life expectancy, impacts to roots systems, anticipated compatibility with right-of way functionality, and more.<sup>15</sup>

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<sup>13</sup> Montgomery County Department of Permitting Services. "Montgomery County Roadside Tree Protection Law," 8.

<sup>14</sup> Montgomery County Department of Permitting Services. "Montgomery County Roadside Tree Protection Law," 58.

<sup>15</sup> Montgomery County Department of Permitting Services. "Montgomery County Roadside Tree Protection Law," 7.



Overall, the Tree Protection Program in Montgomery County ensures that before trees are cut, a thorough assessment is done to assure the impacts construction has on tree health is mitigated. Anyone who wants to cut trees must obtain a permit and pay fines which deters developers from cutting down trees. The specifics and data in The Tree Protection Program document outline why trees need to be protected and how they can be conserved through policy changes. Although Georgetown County has some of these precautions in place, other practices from Maryland County can be applied. Before trees can be cut down in Georgetown, a permit should have to be obtained and the impacts of the cut should be described. Most importantly, it should be mandatory for other trees to be planted to replace the ones that have been cut.

### **Iowa's Roadside Integrated Vegetation Management**

The State of Iowa was experiencing poor water quality, erosion, and needed a new weed management system. In response, Iowa's Department of Transportation created an Integrated Roadside Vegetation Management (IRVM) program. The program was created so the State of Iowa could control non-native or invasive species on the roadsides and to reduce the amount of herbicide used to maintain the clear zone.<sup>16</sup> In conjunction with the IRVM, the Living Roadside Trust Fund (LRTF) was designed to financially support the new improvements to the roadside.<sup>17</sup> The IRVM aimed to maintain safe roadways, maintain sustainable vegetation, prevent soil erosion, control unruly species on the roadside without so many herbicides, and to plant the best adapted vegetation.

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<sup>16</sup> Brandt et al., "Integrated Roadside Vegetation Management," 1.

<sup>17</sup> Brandt et al., "Integrated Roadside Vegetation Management," 5.

The IRVM resource document suggests certain ways that counties can start a Roadside Management program like their own. First it says to hire or create a IRVM manager position so they can apply for LRTF grants, do more inhouse roadside work, and maintain the roadside vegetation. Additionally, there needs to be a IRVM Action group where county residents can get together and plan out their concerns and goals which they can then present to the county board. In the state of Iowa, each county's IRVM programs is run by a private group, an engineer's office, or a County Conservation Board. One of the major benefits of this programs is the ways the county can save money. By applying and receiving resources from the Living Resource Trust Fund, counties can get native seeds, public education, storage facilities, planting supplies and so on. This gives the IRVM manager a chance to do the work in house instead of hiring externally to do the roadside maintenance.

The counties who have IRVM make sure to plant a diverse array of wildflowers and grasses so they can survive weeds and roadside disturbances. The IRVM resources publication suggests planting a species from each type of following plants: quick establishing, warm-season grasses, cool-season species, legumes, showy and easy species, showy, early bloomers, and wet species.<sup>18</sup> If we were to create and implement a similar plan in South Carolina, then the species and plant type would have to be more suited for a coastal-plain environment rather than a Midwest prairie. In addition to plant type recommendations, they outline the proper seeding rate and seed storage practices to ensure the roadside vegetations survival. The plan mentions mowing in the first five years after planting to give the newly planted seeds a chance to grow,

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<sup>18</sup> Brandt et al., "Integrated Roadside Vegetation Management," 16,17.

then the amount of mowing necessary decreases.<sup>19</sup> This is an additional cost saving to using less insecticide.

Some of the other main goals of the IRVM was to prevent erosion, improve water quality and to improve the integrity of the roadways. The 24<sup>th</sup> Annual Highway Report from the Safety Highway Administration reported that South Carolina was ranked 42<sup>nd</sup> in the percent of rural or other principal arterial pavement in poor conditions. These are two to four lane roads that connect different cities and regions.<sup>20</sup> The IRVM gives specific instructions to plan for erosion, how to prepare soils, and other flower planting guidelines. If the correct wildflowers and grasses are planted and taken care of the amount of erosion on the roadsides will be reduced which protects the structural integrity of the road.

Overall, Iowa and South Carolina share many of the same problems such as poor water quality, overusing herbicides, and poor structural integrity on roadways. Many of the similar practices Iowa uses can be used in South Carolina. A specific new position can be created to manage and maintain the newly planted roadside vegetation. This document is a great resource for planning and maintenance practices, and it proves that roadside planting can be done and be beneficial.

### **Florida State Right of Way Vegetation Management Economic Analysis**

In March of 2014 a report summarizing the Economic Benefits of the Ecosystem services from Right of Way Vegetation was released by The University of Florida. The report used The Benefit Transfer Method, which pulls economic values from previous studies, to

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<sup>19</sup> Brandt et al., “Integrated Roadside Vegetation Management,” 20-23.

<sup>20</sup> Baruch Feigenbaum, Gregory Fields, and Spence Purnell, “24th Annual Highway Report,” 31, 32.

evaluate the economic value of each ecosystem service provided by roadside vegetation.<sup>21</sup> For instance, the roadside ecosystems provide habitat to many pollinators in the state. The report stated the honeybees have an estimated value of 3.3 billion dollars worldwide. Although this number doesn't reflect the pollinators benefited by roadside habitat, it does show how improving roadside habitat can support the huge economy related to pollinators and agriculture.<sup>22</sup>

The Nature Conservancy says that the state of Florida spends about \$100 million on managing and controlling invasive species.<sup>23</sup> By planting and establishing native vegetation along roadways and reducing the amount of mowing, species will have a better chance of defending themselves other invasive species Although estimating the value of ecosystem services, especially for a specific area, can be tricky, these numbers give us a rough idea of the value roadside vegetation brings to the state by protecting these ecosystem services.

Beyond providing the state of Florida with important ecosystem services, the managed vegetation along the roadways has no known negative impacts on driver safety either. A study done in 2012-2013 evaluated a 1-mile strip of road on I-10 in Madison County that was used as a pilot study for this Reduced Mowing Project. To conduct this study, researchers conducted two observations at different points in the year, once being in March and once in October in three different areas along the stretch. During each observation they quantified the abundance of flowering showy wildflowers, non-flowering showy wildflowers, and non-native species. They mowed a 15ft area of clear zone closest to the road several times a year and mowed the entire

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<sup>21</sup> Harrison , George L. Tech. *Economic Impact of Ecosystem Services Provided by Ecologically Sustainable Roadside Right of Way Vegetation Management*, 11.

<sup>22</sup> Harrison , George L. Tech. *Economic Impact of Ecosystem Services Provided by Ecologically Sustainable Roadside Right of Way Vegetation Management*, 12.

<sup>23</sup> Harrison , George L. Tech. *Economic Impact of Ecosystem Services Provided by Ecologically Sustainable Roadside Right of Way Vegetation Management*, 13.

clear zone (36ft) only 1-2 times a year. They found that the clear zone strip that was mowed about several times per year was dominated by only a few species while the entire clear zone that was mowed 1-2 times a year had higher species diversity.<sup>24</sup> The reduction in mowing allowed native species to flourish and reduced the amount of money the state had to spend on fighting off invasive species. In addition to the increase in species diversity, Sherry Craft from the Florida Department of Transportation said that she is not aware of any adverse driver safety affects and has received no complaints from residents about the growing roadside wildflowers.<sup>25</sup> Here in South Carolina, SCDOT's main concern is the traffic accidents in the clear zones, but we can see that growing wildflower and reducing the amount of mowing over a year is safe for drivers, saves the state money, and increases sustainability on highways.

### **North Carolina Department of Transportation's Wildflower Program**

In 1985, the North Carolina Department of Transportation started their Wildflower Program. The program allows highway personnel to plant native wildflowers along the roadside environments. The initiative was originally started to improve the roadside beautification. The wildflower program guide states that the beautification of the highways improves the tourism economy that brings so much money to the state each year.<sup>26</sup> This point is also true for South Carolina. The South Carolina Department of Parks, Recreation and Tourism website states that tourism is a 2.3-billion-dollar industry in the state.<sup>27</sup> Planting roadside wildflowers and allowing

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<sup>24</sup> Harrison , George L. Tech. *Economic Impact of Ecosystem Services Provided by Ecologically Sustainable Roadside Right of Way Vegetation Management*, 15.

<sup>25</sup> Jeffery Norcini, "Madison County Energy Conservation Study 2012-2012 Survey of Roadside Vegetation" (Tallahassee, Florida, 2014), pp. 1-121, 7.

<sup>26</sup> US Department of Agriculture, "Wildflowers of North Carolina Roadsides," 1.

<sup>27</sup> "South Carolina Tourism," SCPRT, accessed March 30, 2021, <https://www.scprrt.com/tourism>.

native vegetation to grow can improve the overall aesthetics and contribute to the tourism economy that is so important to our state. Beyond improving the roadside aesthetic, wildflowers are important pollinator habitats, reduce erosion, reduce the amount of fertilizer and pesticides needed, and improve water quality.<sup>28</sup> Since the tree cutting policy for South Carolina is designed to improve driver safety, native wildflower and grasses can be used as an alternative to maximize the environmental benefits the roadsides can provide. The Lady Bird Johnson Wildflower Center has an extensive list of native wildflowers and plants of South Carolina. Some suitable wildflowers that can be planted on the roadside are blazing star, pink milkweeds, and butterfly weed which support pollinator populations as well.<sup>29</sup>

## **Empirical Data**

### **Green Infrastructure Center Case Study**

The Green Infrastructure Center is participating in a multistate project focusing on Resilient Coastal Forests. The RCF (Resilient Coastal Forest) project examines current conditions of coastal forests and threats to the environment. The project will cover three different study areas: Virginia, South Carolina, and Georgia. The two-year project began in February 2019 and is funded by the associated state and the US Forestry Service. According to the GIC (Green Infrastructure Center) website, each state will have the following services for the study:

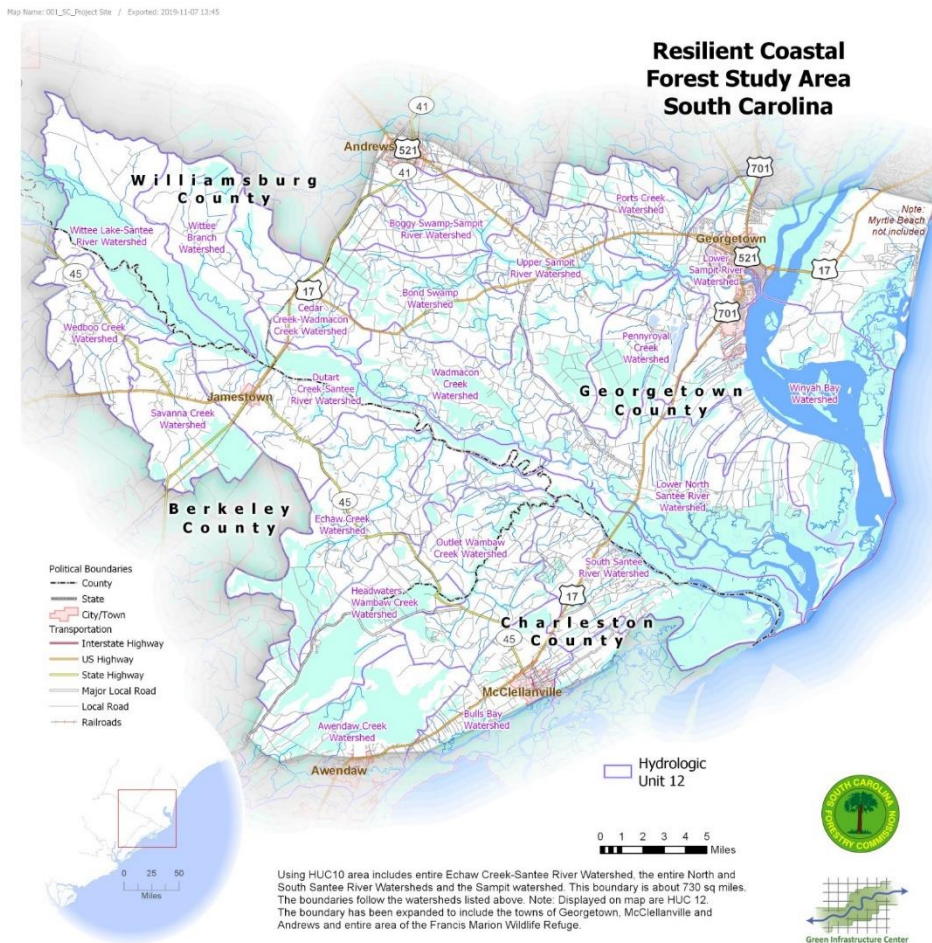
- **A State Advisory Group** of representatives from each state’s forestry department, plus other state agencies.

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<sup>28</sup> Jocelyn Benjamin, “Wildflowers Benefit Agricultural Operations, Agriculture.”

<sup>29</sup> “Lady Bird Johnson Wildflower Center - The Botanic Garden of Texas,”

- **A Regional Advisory Group** of representatives of local government officials, local foresters and other natural resource agencies, conservation groups and related organizations.
- **Community Engagement:** Local meetings are held several times a year to include community knowledge and share findings.<sup>30</sup>



**Figure 01.** Map of the Counties included the Resilient Coastal Forest Study in South Carolina.

<sup>30</sup> “Green Infrastructure Center Resilient Coastal Forests.”

<sup>31</sup> “Green Infrastructure Center Resilient Coastal Forests.”

The RCF Project Overview considers the benefits of trees that have been mentioned in this report and discusses threats to these areas. Development is one threat that is mentioned in the project overview, in addition to threats like hurricanes, saltwater intrusion, fires, drought, and pests. Interestingly, the GIC RCF project website includes a photo of street trees on Main Street in Georgetown, South Carolina, stating “*Urban forests are also key to liveability, as shown by these street trees in Georgetown, SC.*”



**Figure 02.** Front street in Georgetown, South Carolina.

The communities participating will receive the following, according to the project website:

- A detailed *land cover map* that characterizes forest area extent and high-value significant habitats.



- *Calculation of benefits* provided by the forested coastal landscape (e.g. storm buffering, pollution reduction and recreation.).
- *A threats analysis* to the coastal forested landscape, including storm surge potential, development risks, potential pest outbreaks and existing pest impacts, invasive herbaceous species, temperature changes and resultant heat stress, potential coastline changes and loss of coastal forests, and fire potential.
- *A resiliency plan* linking risks to opportunities for intervention (e.g. evaluating storm risks pre-storm, minimizing development in fire-prone and flood prone areas, and planning for forest change).
- *A web map* depicting information to use for planning and management of coastal forests in each state.
- *A case study book* detailing the process and outcomes, as well as how to replicate the process for coastal communities.
- *Implementation training workshops* (one per state), presentation, and a *webinar*.

Stu Sheppard, a GIS analysis with GIC, assisted in creating a map that shows where the SCDOT Rural Road Safety Project intersects with GIC RCF study area in South Carolina. The analysis concluded that a minimum of 398 acres of tree canopy will be cut, assuming the clear zone is cut to the minimum distance required per speed limit and average annual daily traffic (ADT). The minimum distance for clear zone is calculated from the following table:

**Clear Zone Distance Table**  
(in feet from edge of travelway)

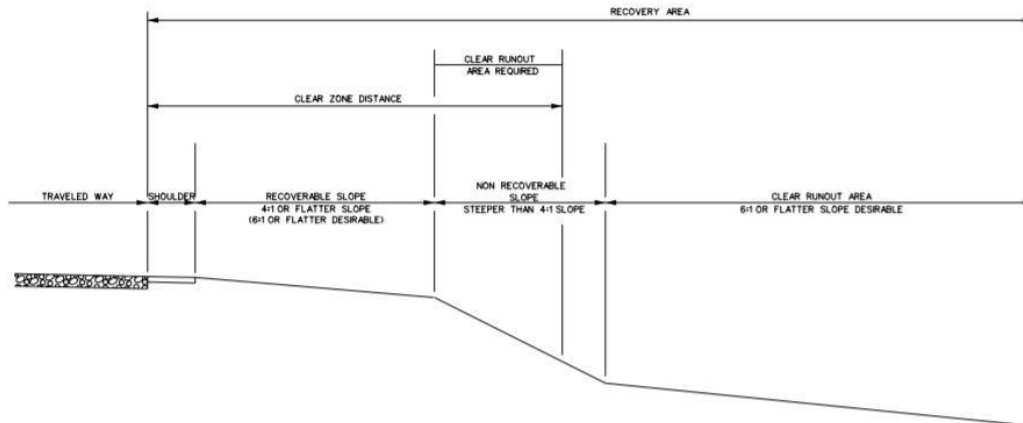
Design Speed	Design ADT	Fill Slopes			Cut Slopes		
		6:1 or Flatter	5:1 to 4:1	3:1	3:1	4:1 to 5:1	6:1 or flatter
40 MPH or less	Under 750	7-10	7-10	**	7-10	7-10	7-10
	750-1500	10-12	12-14	**	10-12	10-12	10-12
	1500-6000	12-14	14-16	**	12-14	12-14	12-14
	Over 6000	14-16	16-18	**	14-16	14-16	14-16
45-50 MPH	Under 750	10-12	12-14	**	8-10	8-10	10-12
	750-1500	12-14	16-20	**	10-12	12-14	14-16
	1500-6000	16-18	20-26	**	12-14	14-16	16-18
	Over 6000	18-20	24-28	**	14-16	18-20	20-22
55 MPH	Under 750	12-14	14-18	**	8-10	10-12	10-12
	750-1500	16-18	20-24	**	10-12	14-16	16-18
	1500-6000	20-22	24-30	**	14-16	16-18	20-22
	Over 6000	22-24	26-32*	**	16-18	20-22	22-24
60 MPH	Under 750	16-18	20-24	**	10-12	12-14	14-16
	750-1500	20-24	26-32*	**	12-14	16-18	20-22
	1500-6000	26-30	32-40*	**	14-18	18-22	24-26
	Over 6000	30-32*	36-44*	**	20-22	24-26	26-28
65-70 MPH	Under 750	18-20	20-26	**	10-12	14-16	14-16
	750-1500	24-26	28-36*	**	12-16	18-20	20-22
	1500-6000	28-32*	34-42*	**	16-20	22-24	26-28
	Over 6000	30-34*	38-46*	**	22-24	26-30	28-30

\* Clear zones are limited to 30 feet for practicality and to provide a consistent roadway template as long as previous experience with similar projects or designs indicates satisfactory performance. Where a site specific investigation indicates a high probability of continuing accidents, or such occurrences are indicated by accident history, the designer may provide clear zone distances greater than 30 feet, as indicated.

\*\* Since recovery is less likely on the unshielded, traversable 3:1 slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high speed vehicles that encroach beyond the edge of shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and accident histories. Also, the distance between the edge of the travel lane and the beginning of the 3:1 slope should influence the recovery area provided at the toe of slope.

**Figure 03.** Table used in analysis to calculate minimum size required for clear zones<sup>32</sup>

## CLEAR ZONE EXAMPLE OF AN EMBANKMENT



**Figure 04.** SCDOT diagram of road terminology, including clear zone.<sup>33</sup>

This analysis provides rough estimations for understanding the impact of the Rural Road Safety program on the RCF study area. Because the GIC RCF project was a two-year project that began in February 2019, it was concluded as of February 2021.

Findings are rough estimates as there were certain limiting factors to the analysis. Elevation data to by foot (inform slope data) is not currently available which is why calculations include minimum and maximum ranges for clear zones based on speed limit and annual daily traffic. Within the minimum distance required for clear zone's based on speed limit and ADT, calculations estimated 398 acres of tree canopy within this area. Almost 400 acres of tree canopy in the GIC RCF SC study area are at risk of being razed as a part of the Rural Road Safety

<sup>33</sup> "ClearzoneinfoSCDOT.Pdf."

Program. The analysis also found that in a two-inch storming event in South Carolina, 400 acres of tree canopy will hold about 14,7256 gallons of storm runoff.

### **South Carolina Traffic Data**

Over the past few years, the trees along highways in the state of South Carolina have been a target of clear cutting due to driver safety concerns. According to the 24<sup>th</sup> annual Highway Report, South Carolina ranked 20<sup>th</sup> in 2016 for overall Highway Performance rankings.<sup>34</sup> South Carolina ranks 50<sup>th</sup> in overall fatalities, which means the most fatal collisions occurred in South Carolina.<sup>35</sup> The South Carolina Department of Transportation has taken action to try and reduce the collision fatalities that happen here. One of the measures SCDOT took to improve driver safety was cutting 7 miles of trees along Interstate 26. This project cost the state about 5.3 million dollars and took about two years to complete.<sup>36</sup> Despite efforts to improve driver safety by cutting more trees in the clear zone, the total number of collisions, fatal collisions, and fatal collisions involving trees have not decreased significantly. Table 01. Illustrates how the numbers of accidents involving trees have fluctuated since 2014 but have not steadily decreased. It seems the state is putting a considerable amount of time and effort into improving driver safety without going back to see how effective previous improvements have been or coordinating with other offices and policies in the state.

**Table 01.** Traffic Safety Data from the South Carolina Collision Fact Book from years 2014-2018.<sup>37</sup>

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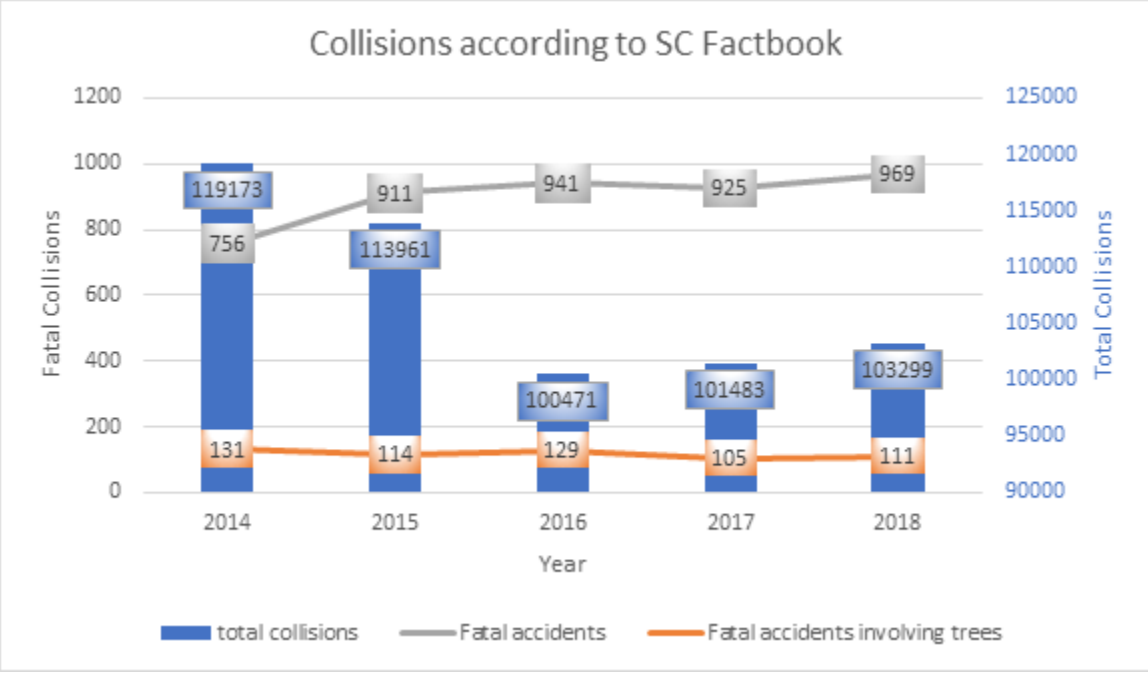
<sup>34</sup> Baruch Feigenbaum, Gregory Fields, and Spence Purnell, "24th Annual Highway Report," 2.

<sup>35</sup> Baruch Feigenbaum, Gregory Fields, and Spence Purnell, "24th Annual Highway Report," 40,41.

<sup>36</sup> Prentiss Findlay, "DOT Contractor Clear-Cutting Hundreds of Trees on I-26," Post and Courier (The Post and Courier, March 5, 2018), [https://www.postandcourier.com/archives/dot-contractor-clear-cutting-hundreds-of-trees-on-i-26/article\\_df051ef5-9cd2-54bd-afa8-736de69479ea.html](https://www.postandcourier.com/archives/dot-contractor-clear-cutting-hundreds-of-trees-on-i-26/article_df051ef5-9cd2-54bd-afa8-736de69479ea.html).

<sup>37</sup> "South Carolina Collision Factbook," 10.

	Total Collisions	Fatal Collisions	Fatal Collisions involving trees
<b>2014</b>	119,173	756	131
<b>2015</b>	113,961	911	114
<b>2016</b>	100,471	941	129
<b>2017</b>	101,483	925	105
<b>2018</b>	103,299	969	111



**Figure 05.** Graph of data points from the South Carolina Collision Factbook.

Continuing the trend of improving driver safety, the SCDOT has implemented the Rural Roads Program. The SCDOT website states that about 60% of fatal collision occur on the rural

roads in South Carolina.<sup>38</sup> The Rural Roads phase 1 began in the Fall of 2017 and aimed to combat these safety issues by implementing multiple roadside improvements. These improvements include rumble strips, wider and brighter pavement markings, brighter signs, high friction surface treatments, wider/paved shoulders, improved clear zones, guardrail and cable barriers, and safety edges.<sup>39</sup> In order to improve the clear zone immovable objects, such as trees and signs, must be removed for a certain amount of area based on speed limit, traffic volume, the slope of the clear zone, and crash data. The state plans to apply these modifications to 1,900 miles of roads in 10-mile segments. Phases 2 and 3 have been approved and will begin work soon. We believe a study should be done to determine if the extensive removal of trees along the right-of-way is still necessary considering that research has not been done to determine if previous cuts have been effective and if safety data improvements are due to other modification.

### **Ecosystem Services**

There are many ecosystem services trees provide. Trees can sequester stormwater, improve water and air quality, sequester and remove carbon emissions, provide habitat for wildlife and much more.

Each year the state of South Carolina loses more acres of trees. With the Rural Roads Program in place, more will be cut down. One of the most valuable ecosystem services trees provide is floodwater mitigation. The Floodwater Commission report states that one acre of forest will release 750 gallons of water while one acre of an impermeable surface like a parking lot will release about 27,000 gallons (about the volume of a one car garage) of water in a 1-inch

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<sup>38</sup> “Why Have Rural Roads Safety Program?”

<sup>39</sup> “Why Have Rural Roads Safety Program?”

rainfall event.<sup>40</sup> The report also mentions that a loblolly pine forest can intercept about 15% of rainfall. The Piedmont Community Tree Guide also supports this fact and says that a loblolly pine tree can intercept 1,265 gallons of water per year.<sup>41</sup> Despite these mitigation properties, loblolly pines along with other pine species, are not protected in South Carolina. Georgetown County specifically, and many other counties such as Horry and Charleston County, have experienced increased frequency and intensity of flooding in the past few years. With flooding being a growing concern, we cannot afford to lose the trees that help soak up and intercept rainwater. It is easy to see in figure 02. how much water can stand on property during a day of moderate to heavy rainfall.



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<sup>40</sup> McCaster, Henry, and Thomas Mullikin. "South Carolina Floodwater Commission Report."17.

<sup>41</sup> Gregory McPherson et al., "Piedmont Community Tree Guide" (Davis, CA: USDA Forest Service, 2006), pp. 1-95,



**Figure 06.** The pictures above were taken in February of 2021 in the town of Andrews in Georgetown County on day of moderate rainfall.

Another study done by the National Parks and Recreation Association examined how urban forest can improve air quality. A study done about urban forests in Chicago Illinois found that about 80 pounds of pollutants can be removed from the air annually per acre of urban forest. The economic value of this removal is estimated at \$300 per acre. This data can be applied to the roadside trees that can directly remove vehicle emissions on highways. Another study in the same report observed the amount of carbon that is removed by one acre of trees in different urban cities. The average amount of carbon stored annually per acre is 40 tons and the amount removed from the air is about 1.2 tons. This equates to about \$800 per acre per year in carbon



storage, and \$25 per acre per year in carbon removal.<sup>42</sup> Both factors can greatly reduce the states contribution to climate change.

An additional benefit of roadside trees and vegetation is the habitat it provides pollinators such as bees, butterflies, and birds. The Xerces Society of Invertebrate Conservation wrote a Roadside and Pollinator Guide about how to manage roadside vegetation. It mentions that roadside habitats can be a good new habitat for many pollinators. It states that more than 10 million acres of land in the US are roadsides and are usually protected from further development.<sup>43</sup> This can be a habitat for many pollinators and can connect previously fragmented land. Many research conclusions described in the guide support the idea that roadside habitats can benefit pollinators. Studies show that roadside habitats with high wildflower diversity and high abundance of native grasses support twice the number of pollinators, such as bees and butterflies, than roadside habitats with low wildflower and grass diversity and density.<sup>44</sup> Many of the planet's plants and agricultural crops are pollinated by these creatures and it is crucial for us to provide and protect land for them to survive on.

In addition to the important benefits listed above, protecting trees and mitigating for tree loss improves human health. Here in South Carolina, the summers get very hot and humid to the point where it can be dangerous. According to the US- Climate Data website, the average temperatures in Fahrenheit for the months of June, July, and August are 89, 91, and 88 respectively.<sup>45</sup> Young children, the elderly, and communities without air conditioning are mostly

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<sup>42</sup> Nowack, David, and Gordon Heisler. "Air Quality Effects of Urban Trees and Parks," 4,5.

<sup>43</sup> Hopwood, Jennifer. "Pollinators and Roadsides: Managing Roadsides for Bees and Butterflies," 1.

<sup>44</sup> Hopwood, Jennifer. "Pollinators and Roadsides: Managing Roadsides for Bees and Butterflies," 4,5.

<sup>45</sup> "Weather Averages Georgetown, South Carolina." Temperature - Precipitation - Sunshine - Snowfall. Accessed April 27, 2021. <https://www.usclimatedata.com/climate/georgetown/south-carolina/united-states/ussc0127>.

impacted by this extreme heat. The Piedmont Community Tree Guide published by the United States Department of Agriculture states that in an area with a 6-mile radius the temperature difference between a vegetated suburban area and a city can be up to 9 degrees Fahrenheit.<sup>46</sup> We can imagine how keeping trees in cities like Columbia and Charleston would make a hot summers day more enjoyable. Additional savings occur when businesses and citizens don't have to spend as much money to cool their homes in the summer months. A study done on Atlanta trees showed that a typical household saved about \$77 each year on air conditioning.<sup>47</sup>

Between mitigating floodwater, removing and sequestering carbon, removing pollutants, protecting biodiversity of roadside habitat, and reducing the temperature, we can see how trees are a great way to improve resiliency among many communities in South Carolina and how they contribute to the economy.

## **Mitigation Report**

In 2019, the South Carolina CDBG-MIT action plan was released to supplement the Disaster Relief act of 2018. The report was written to address how the state can improve its resiliency and prepare South Carolinians for future extreme weather events. In the past 5 years there have been major storms, such as Hurricane Joaquin, Hurricane Matthew, and Hurricane Florence that caused considerable damage to residents, properties, and cities.<sup>48</sup>

A few counties were identified as most vulnerable to weather events including Charleston, Clarendon, Dorchester, Florence, Georgetown, Horry, Marion, Sumter, and

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<sup>46</sup> Gregory McPherson et al., "Piedmont Community Tree Guide" (Davis, CA: USDA Forest Service, 2006), pp. 1-95, 16.

<sup>47</sup> Gregory McPherson et al., "Piedmont Community Tree Guide" (Davis, CA: USDA Forest Service, 2006), pp. 1-95,

<sup>48</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 4.

Williamsburg.<sup>49</sup> The Social Vulnerability Index, or SoVI, describes a county's ability to prepare for, respond to, and recover from hazards such as storm events.<sup>50</sup> This measures how likely they are to experience any number of hazards such as flooding, hail, erosion, and hurricanes. A score of 0 means least likely to happen while a score of 1 means likely to happen. Georgetown county was ranked second out of all the counties in South Carolina to experience a flood with a score of 0.61.<sup>51</sup> Each county was also asked to rank their risk hazards. Georgetown county identified flooding, hurricanes and coastal storms, severe storms, wildfire, drought, winter storms and freezes, hail, dam/levee failures, and earthquakes as risks.<sup>52</sup>

To mitigate the risk factors, the state plans to focus funding on the Pee Dee and Santee River watersheds by implementing flood-reduction infrastructure projects, housing buyouts, providing the local match funds the FEMA has provided, and activities to assist local governments to update their mitigation plans. The Action plan states that no less than \$50,978,000 will be directed towards the most impacted and distressed counties mentioned earlier.<sup>53</sup>

It is clear the state must take immediate action to build resilience when challenged with these hazard risks. The South Carolina Floodwater Commission Report suggests that natural infrastructure can be used to mitigate these impacts. The report suggests taking advantage of salt marshes, wetlands and floodplains, beaches and dunes, and forests which can be used to sequester floodwater and prevent flooding.<sup>54</sup> It is crucial to form a united front with other

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<sup>49</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 9.

<sup>50</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 12.

<sup>51</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 11.

<sup>52</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 12.

<sup>53</sup> Disaster Recovery Office, "South Carolina CDBG-MIT Action Plan," 66.

<sup>54</sup> McCaster, Henry, and Thomas Mullikin. "South Carolina Floodwater Commission Report," 16-18.

professionals and representatives of the state to work together to use natural infrastructure, like trees and vegetation along roadways which can mitigate flooding in the state.

### **Voices of South Carolina**

In addition to the compelling evidence that trees are needed for the state's safety and overall well-being, many South Carolinians have spoken out against the recent tree cuttings and the effects the clearing is causing.

One recent article in the Post and Courier explained how the SCDOT reversed their agreement to cut 17 miles along I-26. Now they plan to clear cut trees along 23 miles of I-26 and eventually clear enough trees to widen the road to a 6-lane highway. The article basically reports that most citizens opposed the plan, but the SCDOT went ahead with the plans to clear cut more trees anyways.<sup>55</sup>

Another incidence of trees being removed despite public outcry is the Meeting Tree in Cainhoy, South Carolina. The tree is a 50-foot tall, 300-year-old oak tree that symbolizes African American heritage and community. One man named John Sanders even camped out in the tree to keep it from being cut down to widen roads. Unfortunately, the tree was cut down on February 8, 2021, regardless of Sanders and other protesters efforts.<sup>56</sup> Sanders' determination along with others shows how serious South Carolinians are about protecting the natural environment and the historic sense of community that comes along with it.

### **Policy Recommendations**

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<sup>55</sup> Charles Rowe, "Stop Clear Cutting along I-26, Return to the Compromise Agreement,"

<sup>56</sup> Andrew Miller, "Despite One Man's Fight, Cainhoy's 'Meeting Tree' Comes down."

Currently in Georgetown County South Carolina, members of the planning committee are proposing change for tree policies. Currently in specific areas of Georgetown County and the Waccamaw neck, a Tree Care Permit is required before trees are cut but not before they are trimmed or pruned. The Zoning Administrator grants permits to individuals who wish to remove or do work on trees. Specific types of trees such as waterway trees, legacy trees, grand trees, and trees in wetlands are not allowed to be removed at all without a Zoning Administration approval. The new proposed Tree Protection Plan suggests:

- All Tree plans describe location, diameter at breast height (DBH), species, and total number of grand trees in canopy on the site.
- Identify the trees on the site that are to be detained and the total area they occupy, the area where the trees are to be replanted, and method of tree protection for the entire area.
- Placing an “x” over a circle on all trees that are to be removed.
- Limits of land disturbance in the future
- The tree replacement plan including caliper size and species for each tree replacement.

It is important to note that under current and future ordinances, pine species will not be protected. However, an economic analysis of trees done in the piedmont regions shows that over a year the net benefit of conifers (which include pines) is \$31-\$44 for every \$1 invested in protecting them. And the net benefit for every \$1 invested in protecting conifers over 40 years is between 1,760 and \$1,120.<sup>57</sup>

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<sup>57</sup> McPherson et al., “Piedmont Community Tree Guide: Benefits, Costs, and Strategic Planting,” 8,9.

Since we have data and important stakeholders in Georgetown County, we can use these resources as an example for other counties in the state to make change with their tree policies. The Nature Conservancy is working to compile data about canopy cover and areas of land that can be reforested. On the Nature Conservancy website, they have a tool called to Reforestation Hub that provides numbers about how much land is available for planting in each state.

REFORESTATION HUB											
National Summary   State Summaries   Advanced Query											
State Summaries											
Opportunity   Ownership   Acres   CO2   Trees											
State	Total Opportunity	Biological Corridors	Floodplains	Forest	Marginal Croplands	Grassy Areas	Pasture	Post-burn	Shrub	Streamside Buffers	Urban Open Space
New York	3.96 M	449,000	403,000	21,800	151,000	4,140	3 M	9,360	6,340	140,000	493,000
Ohio	4.8 M	400,000	1.1 M	97,900	170,000	37,600	2.31 M	11,200	2,850	469,000	1.07 M
Oklahoma	2.6 M	304,000	863,000	67,800	14,100	183,000	1.66 M	246,000	28,600	177,000	193,000
Oregon	1.81 M	195,000	409,000	107,000	253,000	125,000	580,000	201,000	347,000	101,000	226,000
Pennsylvania	4.59 M	383,000	417,000	153,000	220,000	20,800	3.05 M	5,250	18,400	186,000	872,000
Rhode Island	34,400	1,770	2,060	2,000	420	900	18,200	110	400	680	12,200
South Carolina	2.1 M	190,000	155,000	30,100	33,300	31,900	1.25 M	93,300	31,200	36,700	586,000
South Dakota	550,000	63,700	167,000	124,000	30,400	97,300	143,000	98,300	65,100	71,500	20,600

**Figure 07.** Total opportunity for tree planting in the State of South Carolina based on data from the Reforestation Hub on The Nature Conservancy website.<sup>58</sup>

The Reforestation Hub reports that there are 2.1M acres of available land for planting in South Carolina.<sup>59</sup> Although we are aiming to prevent more roadside trees from being cut, we understand that sometimes trees need to be cut to improve driver safety, to improve the overall health of the forest, and to make room for development to support the growing population in

<sup>58</sup> “Reforestationhub.org.”

<sup>59</sup> “Reforestationhub.org.”

South Carolina. So, if trees need to be cut from the roadside, there is still plenty of land that can and should be planted on. For every tree cut, another needs to be planted and maintained so we can still maximize the natural benefits trees provide us.

## **Conclusions and Next Steps**

Throughout this report, we have outlined the crucial reasons that we need to protect the roadside trees in South Carolina. There is not strong evidence that removing trees reduce the amount of traffic accidents, however there are positive benefits. They provide the state millions of dollars in ecosystem services, they improve the quality of life for countless South Carolinians, and they contribute to combatting climate change and build resilience in the face of climate related natural disasters. Other Departments of Transportation such as Montgomery County in Maryland, Iowa's DOT, and North Carolina DOT have all adopted stricter tree cutting policy, roadside vegetation plans, and planting initiatives. These changes have been successful and beneficial in their county or state and can be applied here in South Carolina.

Here in Georgetown County, we can promote and start more planting initiatives to increase the canopy cover in our state. On a state level, organizations such as the South Carolina Department of Transportation, Local Council of Governments, The Green Infrastructure Center, The Nature Conservancy, The South Carolina Biomass Council, the Floodwater Commission, and the South Carolina Disaster Recovery Office need to work together when deciding on tree policy, so all the policies and practices are united to improve the quality of life for South Carolina Residents.

In the future, a statewide initiative to include natural infrastructure on our roadsides is needed. If planned correctly, trees can serve as safety modifications, can improve the road

integrity, reduce flooding, and can bring more money to the state. In order to raise awareness and gain supporters, a newsletter updating citizens on recent tree happenings would inform residents so they can be a part of the tree conversation in the state. A petition would also be beneficial so that public officials and policy makers can understand the concerns South Carolinians have about our decreasing tree cover. The next intern to continue working will hopefully be able to reach more professionals and stakeholders to discuss tree policy, especially at the South Carolina Department of Transportation, and to propose tree cutting policy change to them.





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