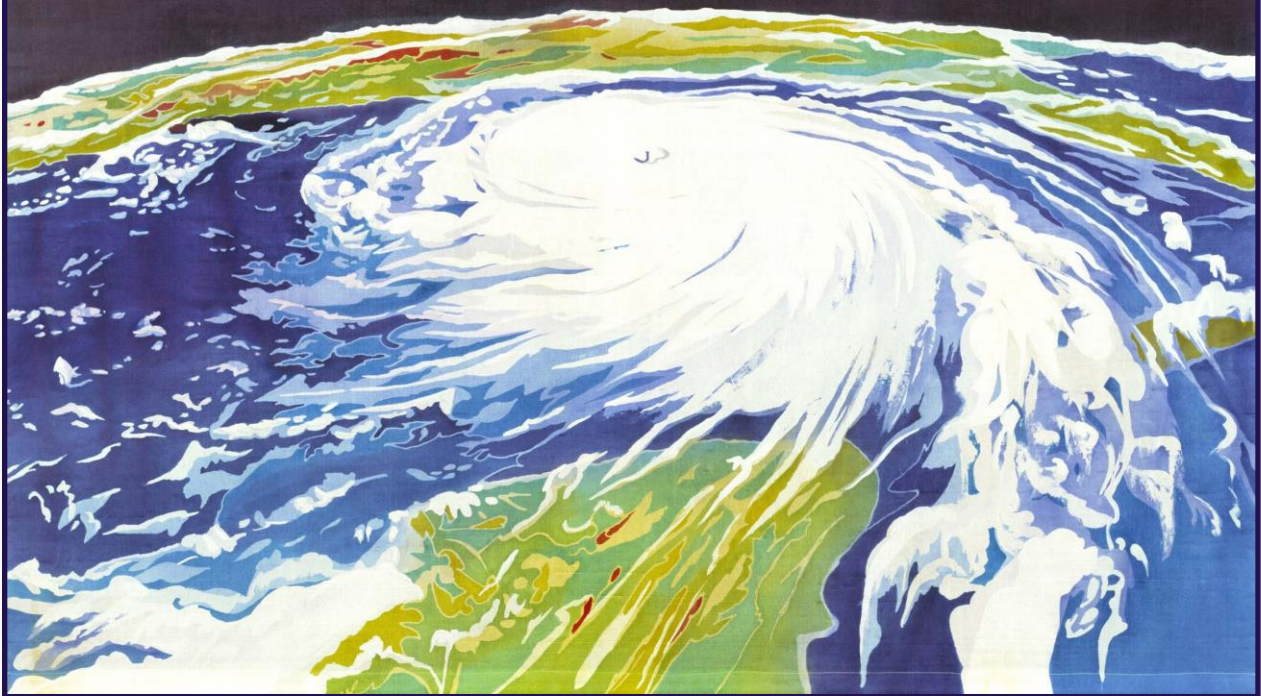


# CHARLESTON 2030 PROJECT CLIMATE ACTION GUIDELINES



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# Introduction

**Climate change has been described by ecological philosopher Timothy Morton as a “hyperobject”** -- a phenomena so inter-objective, massively diffused, and complex as to be impossible to essentialize to any one cause or effect, time or place, physical or mental marker. The climate crisis is so deeply intertwined with every aspect of modern life, both in what contributes to the crisis and what will be affected by it, as to be frankly overwhelming for the unprepared climate actor.

In developing our Charleston 2030 Project, an aspirational, eco-futurist examination of what Charleston could be if we pursued climate action like the science demands, we recognized the need to ground ourselves. Researching extant climate solutions in a variety of categories as identified by the scientists at Project Drawdown -- buildings, transportation, waste, food systems, and carbon sinks -- serves to root our climate advocacy in the wealth of existing studies and programs, now digested for use in substantive climate action.

This document holds a number of immediate benefits. It helps prepare us for assisting local municipalities pursuing climate action by giving us a wide array of action items to suggest. It identifies action items in the Lowcountry that are worth marshaling climate activists to pursue. Through the process, we’ve found overlaps of interest with the multitude of groups, organizations, and businesses working in these categories, which will help to expand our Coalition.

We also see this document as a first entry into the wide-ranging, fast-moving, ambitious climate action that this moment calls for. Here is the foundation -- upon it, we will build a cleaner, more equitable, more livable future.

# Buildings

## Executive Summary: Creating Neutral and Negative Buildings

As a large contributor to greenhouse gas (GHG) emissions and one of the categories of climate action over which the City has the most agency, this proposal outlines strategies, along with research and examples, relating to the mechanisms at a city's disposal to encourage environmentally friendly preservation, rehabilitation, restoration, and new construction. We propose two primary goals for the City: to reduce or eliminate individual GHG emissions from buildings as much as possible and to ensure housing affordability. Strategies presented here encompass the interactions between public policy tools, public organizational abilities, and private development.

The primary goal for buildings is to become GHG neutral or negative. GHG neutral buildings are defined as those that produce as much energy as they consume, thereby producing a net zero amount of GHGs. This is achieved through:

- A decrease of energy use through smarter building practices
- Efficient community models
- Lifestyle and attitude changes (Rocky Mountain Institute)

GHG negative buildings are those that produce more energy than they consume, exporting excess energy to meet off site demands. The most common ways this is accomplished is by:

- Developers using materials with drawdown capabilities
- Building operators undertaking offset initiatives

More information on the strategies to reduce GHG which informed this report can be found in [The Carbon-Free City Handbook](#).

## Physical Methods to Achieve GHG Neutral and Negative Buildings

### *Sustainable Materials*

Using sustainable materials is one of the most effective ways to harness the drawdown, or carbon absorption and storage, capabilities of buildings. Considerations of the life cycle and material costs should be made. Materials used should:

- Minimize upfront embodied carbon
- Utilize reclaimed materials
- Incorporate materials with drawdown potential

Materials that are listed on the living [Future Institute Red List](#) should be avoided. Concrete cement contributes as much as 5% of the world's GHG emissions, and so any consideration of upfront embodied carbon should look to concrete alternatives such as [ferrock](#).

In addition, see the construction industry white paper from [Builders for Climate Action](#).



## **Water Conservation and Management**

Conserving and managing water impacts the overall efficiency of a house or building. For new construction, some ways to maximize efficient water use are to:

- Establish green outdoor areas
- Collect and use rainwater
- Install green roofs and gardens
- Install on-site purification systems

For existing structures, one method could be to switch to an individual water meter, where a resident would pay for what they use instead of a fixed rate. Additionally rainwater could either be collected and reused, or diverted. A potential incentive program could be created by a utility provider to reimburse a home or building owner if rainwater is decoupled and discharged locally. A great city and country to look at for managing water is Denmark and the [Copenhagen Solutions for Sustainable Cities](#).

## **Energy Conservation**

Conserving energy means lowering GHG emissions, because fewer fossil fuels are used at power plants that produce the energy. Therefore, eco-friendly buildings have systems that:

- Measure, manage, and visualize energy usage in applications such as demand control for lighting and ventilation
- Include geothermal heat pumps and solar cells
- Install infrastructure to move away from natural gas

An efficient building envelope can be built to better passively manage heat, and LED lights can be installed to conserve energy. Some great resources for energy conservation are the [Carbon Free City Handbook](#), the [Living Community Challenge](#), and [Project Drawdown](#).

For existing buildings, conserving energy has different challenges than new construction because eco-friendly devices and systems cannot be built and designed from the ground up. Older buildings may be built with less modern, and therefore less efficient, materials than today. The exception to this is higher-end buildings built before air conditioning was popularized, which function quite well using passive and natural heating, cooling, and lighting. Ways to renovate buildings to become more energy efficient include:

- Insulating walls, doors, roofs, floors, and pipes
- Replacing less thermal efficient windows
- Using on-site renewable energy such as roof mounted solar, wall-mounted and PV surface treatments, or small building mounted wind turbines
- Replacing old and inefficient devices with new energy efficient devices such as LEDs, high efficiency motors for commercial applications, and appliances

## **Land Preservation**

The goal of preserving land is to work with, and not against, the environment to meet site-specific demands. The best way to utilize on-site resources to contribute to reduce net GHG

emissions is to utilize and protect natural carbon sinks. Some great resources are the [Living Building Challenge](#) and the Land Use Planning section (pg. 74-75) of the [Peterborough Community Sustainability Plan](#).

Green spaces around buildings should be maximized, and should incorporate native plants organized in such a way to maximize biodiversity and healthy ecosystem function. Green space that provides shade also serves to lower energy use through air conditioning.

Where possible, use of concrete and asphalt should be minimized, and more porous and carbon neutral or negative alternatives should be considered.

### ***Waste Management***

Waste from buildings must either be collected and moved off-site or used within the context of the building itself. An eco-friendly way to move waste off-site is to have sorting options for recycling plastic, paper, electronics, etc. Located in the “Waste Proposal” section of the Charleston 2030 Plan is an outline of a pay-as-you-throw trash collection service. An on-site way to deal with organic waste is to install compost infrastructure. Composting infrastructure can also be a city-wide system where compost is transported to a central site.

## **Public Policy and Organizational Methods to Achieve GHG Neutral and Negative Buildings**

### ***Incentive Programs***

It is not enough to simply know how to make buildings eco-friendly; developers and owners have to implement these practices. Eco-friendly building practices, rather than solely being financial burdens, can mitigate costs and allocate money towards green design teams and materials. Through incentive programs, the City can reward high efficiency green buildings without passing new codes, which can be detrimental to city-private relationships and obstructed due to external interests and interference. Some incentive options are below:

- Tax incentives
- Bonus density
- Expedited permitting
- Net metering
- Feed-in-tariffs
- Grants (including fee subsidization)
- Loans
- Insurance
- Tech/design assistance
- Permit/zone fee reductions
- Rebates and discounts on environmentally friendly products
- Leasing assistance



- [Green Building Incentive Trends](#)

Table 1 includes examples of incentive programs and associated links.

South Carolina	Dominion Energy has a Residential Discount Rate program for natural gas. Customers of Dominion Energy qualify for a discounted rate schedule if their home is ENERGY STAR qualified. Santee Cooper Public Service Authority provides up to \$3,100 in rebates to homebuilders for building homes qualifying as ENERGY STAR. In addition, Santee Cooper provides individual equipment incentive for certified heat pumps and water heaters. <a href="#">Dominion Residential Discount Rate program website</a>
Peterborough, CA	Peterborough has implemented a system called Community Improvement Plans which offer financial incentives for new affordable housing construction, redevelopment, and greening existing downtown buildings. <a href="#">Community Improvement Plan website</a>
Seattle, WA	Seattle provides an array of eco-friendly incentives. They have a free neighborhood tree program, appliance update rebates for multi-family buildings, and a Pay for Performance (P4P) framework which incentivizes energy savings over time. <a href="#">Business Tools and Resources website</a>
Arlington, VA	Developers pay 3 cents per sq. foot to the Green Building Fund; if LEED certified, the tax is refunded. In addition, developers can request larger than code-allowed buildings if LEED certified. <a href="#">NAIOP Green Building Incentive That Work, pg. 8</a>
Chicago, IL	Developers can expedite permit processing through the Green Permit Program in the Dept. of Construction and Permits. Developers can receive a waiver for the plan review fee with a higher-level green certification. The city also provides bonuses for density and \$5,000 in grants for green roofs. <a href="#">NAIOP Green Building Incentive That Work, pg. 8</a>
San Diego County, CA	San Diego provides expedited plan check for green construction which can save 7-10 days on a construction project; therefore, saving developers or homeowners time and money. If buildings meet green program requirements set by the county concerning areas such as recycled materials, greywater, and energy, the county will provide 7.5% savings in plan check and building permits. <a href="#">NAIOP Green Building Incentive That Work, pg. 8</a>
Portland, OR and Oregon State	Portland provides a competitive grant program where developers can apply for a grant provided by the city's Green Investment Fund if a building is high efficiency. Oregon provides a sustainable building tax credit if a building receives a green certification. The state also provides

	a Business Energy tax credit with building energy conservation, efficient equipment such as HVAC systems, and renewable energy. <a href="#">NAIOP Green Building Incentives That Work, pg. 9</a>
New York State	The New York State Energy Research and Development Authority provides resources to aid design teams in greening new or existing buildings. <a href="#">NAIOP Green Building Incentives That Work, pg. 9</a>
Cincinnati, OH	The city provides an automatic 100% property tax exemption for LEED certification, with a max of \$500,000 until LEED Platinum level. <a href="#">NAIOP Green Building Incentives That Work, pg. 10</a>

**Table 1: Incentive Programs**

### **Certifications**

Certifications are mentioned as qualifiers for various programs across almost all cities listed in the above section, so it is worth understanding how certifications work and why they are done. Certifications are a set of standards concerning how environmentally friendly a building is and is set by government or non-profit organizations. New buildings can be planned to meet certification standards, and old buildings can be improved to meet them.

Some best practices strategies for cities wanting to be environmentally friendly is to establish and adopt certification standards for city buildings. This can include a city offering a city-supported path to certification. A city can create a website or other publication materials that provide links to certification options. A city can ensure that supported certifications meet rigorous environmental standards. Low income residents and those in affordable housing should be accounted for in the adoption of certifications. Indoor occupant health should be included, and resiliency best practices should be determined and included.

Table 2 includes common certification programs and links to more information on each.

LEED	LEED is one of the longest-standing certifications and is notable for setting the precedent for it. LEED can be expensive, but as one of the most well-refined and widely recognized certifications in the world, it should be a part of any city-wide green building certification incentive program. <a href="#">LEED website</a>
National Green Building Standard	NGBS is an approved certification by the American National Standards Institute. It is intended for new construction and land development. According to the NGBS, it “provides practices for design, construction, and certification” and is a “Flexible, expansive point-based system for certification.” <a href="#">NGBS website</a>
Energy Star	Energy Star is intended for multi-family, mid- and high-rise new construction. Incentive programs around Energy Star typically involve public utilities. At the household level, Energy Star typically concerns appliances. It is sponsored through the EPA’s Multifamily High Rise Program. <a href="#">Energy Star website</a>

Living Building Certification	This certification is idealized for new construction. This certification considers place, water, energy, health and happiness, materials, equity, and beauty. It is unique in that it addresses environmental justice in certification. Only a handful of buildings in the world have achieved this certification. <a href="#">Living Future website</a>
Green Globes	Green Globes is self-proclaimed to be a business-friendly and affordable alternative to LEED. It provides “a customized guidance in the design, construction and operation of high-performance interiors and buildings” for new and existing structures. <a href="#">Green Globes website</a>
BREEAM	BREEAM is unique because it is not a “one-and-done” certification, but an provides ongoing ideas and options to consider. The organization works on a wide range of categories including energy, health and well-being, innovation, land use, materials, management, pollution, transportation, waste, and water. <a href="#">BREEAM website</a>
RELi Action List and Credit Catalog	RELi is a pilot program not yet accredited. IT focuses on resilience in difficult times as well as “socially and environmentally responsible design.” It includes a list of items that a city or developer can check off as objectives are completed. <a href="#">RELi website</a>

**Table 2: Incentive Programs**

## Environmental Justice Considerations

### ***Affordable Housing***

Affordable housing is defined as housing that doesn’t cost more than 30% of a family’s income, leaving 70% of income for food, clothing, transportation, and other. There are several ways to simultaneously bring down the costs of buildings and make them environmentally friendly. The key is to avoid undue stress on low-income residents. Some of these strategies include:

- Buy-down programs
- “Green fee” property taxes
- Codes for larger buildings with a greater capacity to self-fund renovations and use incentives to aid affordable housing
- Ensuring that renters see financial benefit from renovations or new policies

Below are two examples of innovative affordable housing developments.

#### [Othello Square, Seattle, WA](#)

- 71,000 sq. ft., 68 units
- 120kw PV, natural daylight and occupancy sensors, low-flow plumbing fixtures, ceiling fans, 100% LED energy star appliances, air tightness = 0.25 cfm/sf @75pa, heat pump water heater
- Kept materials palette simple
- Employed advanced framing techniques to reduce the amount of wood needed overall

- Reduced the underground parking scope 20% because there is a light rail station & many necessities within walking distance
- Reduced window size
- Opted for double-pane windows
- Added laminated glass to bedroom windows
- Eliminated one of the elevators & added a stairwell
- Sought out & achieved partners in the manufacturing industry for discounted materials

### [Hunter's View, San Francisco, CA](#)

- Phase I: 107 new units, Phase II: 179 new units
- Onsite stormwater management including cisterns and bioswale treatment areas
- On-site wastewater treatment
- Phase I: Affordable rental housing across three new buildings, as well as new roads, sidewalks, and utilities, services offices, and Promontory Park.
- Phase II: Affordable rental housing across three new buildings, as well as new roads, sidewalks, and utilities, Ironwood Park, and a community hub with a childcare center, wellness center, and additional services offices.

### **Weatherization**

The goal for the City should be to provide low-income households with weatherization services free of charge. The Department of Energy has a [Weatherization and Assistance Program](#). The state of South Carolina provides a weatherization program the South Carolina Office of Economic Opportunity's Weatherization Assistance Program. Eligibility for this program requires one's income to be at or below the 200% poverty rate. The Palmetto Community Action Partnership is a free program that does weatherization. Its tactics involve insulating attics, walls, and floors, weather stripping and caulking, insulating water heaters, air sealing, and furnace tune-up. Some notable eligibility requirements are to be a resident of Charleston, Berkeley, Dorchester, Beaufort, or Jasper County, meet Federal income eligibility guidelines, have a state-issued photo ID, and reside in a single-family dwelling.

Local nonprofit The Sustainability Institute can offer guidance or perhaps partnership due to local experience in weatherization retrofits.

### **Public Buy-In**

#### ***Public Structures and Spaces***

Public structures and spaces are an important consideration because the City has a considerably greater amount of control over them. The City should be a role model for private developers and individuals in its treatment of public structures and spaces in sustainable design and practices. This demonstrates that the City is invested in where it is trying to get others to invest. Strategies include green land maintenance, use of eco-friendly materials for management, and utilizing site-specific land design and maintenance tactics.

Establishing public buy-in is integral to creating lasting and meaningful change within Charleston that goes beyond superficial ideals. If the City focuses on its public buildings first, the community will come to understand that the City is committed to building green. The practices used in public green buildings can be transferred to commercial and residential buildings. This can include an education campaign related to all of the strategies listed in this paper about the benefits of green buildings.

# Transportation

## **Executive Summary: Reducing VMT and Vehicular Impact**

This section outlines strategies, along with research and examples, relating to the mechanisms at a city's disposal to encourage environmentally friendly preservation, restoration, and new construction of transportation systems. There are two primary goals for the city: reducing VMT (Vehicular Miles Traveled) and vehicular impact, and increasing responsible roads and pathways.

The primary goal of making changes to the current transportation system is reducing the carbon emissions put into the atmosphere by reducing the miles traveled of single-use vehicles, and to increase the use of reliable public transportation. This is achieved through an expansion of the current public transport system, an eco-friendly BCDCOG (Berkeley-Charleston-Dorchester Council of Government) plan, incentivizing the public, as well as an improved infrastructure.

## **Physical Considerations for Reducing VMT and Vehicular Impact, Increasing Responsible Roads and Pathways**

### ***Land Considerations***

The goal of preserving land is to work with, and not against, the environment to meet site-specific demands. The best way to utilize on-site resources to contribute to reducing net GHG emissions is to utilize and protect natural carbon sinks.

### ***Waste Considerations***

Waste from transportation materials must be recycled when appropriate, to be reused on sites that demand it, and to be done away with for the near future. The most drastic improvement that can be made in reducing waste in this department is by creating new housing developments with a life-cycle in mind, using smart materials. To reduce GHG emissions and future waste, it is imperative that the latter be implemented.

### ***Energy Considerations***

Conserving energy means less GHG emissions, and can only come with the implementation of both methods of reducing VMT and increasing responsible roadways. Energy will be conserved when single-use transportation is reduced and vehicles are greener; energy will also be leveled when the materials for these roads and pathways are made sustainably.



## ***Sustainable Materials***

Utilizing sustainable materials is one of the most effective ways to harness the drawdown capabilities of transportation. Considerations should be made to the life cycle and material costs. Materials used should minimize upfront embodied carbon, utilize reclaimed materials when possible, and use materials with drawdown potential where possible.

## ***Water***

Conserving and managing water impacts the overall efficiency of transportation routes. For new construction, some ways to maximize efficient water use is to establish green outdoor areas, use porous materials, collect and use rainwater, install bioswales, as well as install rainwater collection systems on existing routes and parking lots.

## **Public Policy and Organization Methods To Reduce The VMT and Vehicular Impact**

### ***Public Policy***

- Reliable public transportation
  - Expand bus lines and frequency
  - [Ways to improve bus systems](#)
  - [Give buses the green light at intersections](#)
- Environmentally friendly walk and bike plan
  - [U.S. cities with best bike plans](#)
  - [5 pavements of the future](#)
  - [Rubber sidewalks](#)
- Reduce food deserts so that citizens don't have to commute as far for groceries
  - Provide equitable access to food

### ***Incentive Programs***

- Carpooling
  - [Local carpooling with park & ride services](#)
  - [How to encourage employees to carpool](#)
- Rideshare programs
- Fuel efficiency
- Switching registration
- Refurbishing cars
- Repurposing cars
  - [Retrofit your car](#)

Table 1 includes examples of public policy programs.

New York City, NY	NYC allotted \$2.66 million annually throughout 2023 to upgrade 300 intersections per year with transit signal priority- a technology that holds green lights and shortens red lights for approaching buses. This system gives buses the right of way, leading them through the city at an increasingly faster rate.
Boulder, CO	Lightning Systems converted a 35-foot Gillig transit bus from diesel to a battery-electric system for the city of Boulder, Colorado, at a cost of \$260,000 for the 15-year-old bus. A comparable new electric bus costs close to \$750,000 on the low end. <a href="#">Retrofit buses</a>
Seattle, WA	Seattle was voted ‘best city bike plan’ in the US in 2018. This plan included an assessment of bike and pedestrian safety, adding bike lanes and sidewalks that are interconnected, reducing car speed in the metropolitan area, improving the bike share program, and improving the cycling community. <a href="#">W.A. Bike Plan</a>

**Table 1: Public Policy Programs**

Table 2 includes examples of incentive programs.

Seattle, WA	Seattle has used <a href="#">bicyclebenefits.org</a> to reward bikers all around the city. The program can be implemented in all american cities, and already exists in Charleston. The program offers bikers with store discounts, and provides business owners with a larger clientele revenue. <a href="#">Reward program for bikers</a>
Charleston, SC	Lowcountry Go is a carpooling program that already exists in the tri-county area, incentivising people to rideshare. <a href="#">LowcountryGo</a>
Madrid, Spain	Madrid, along with many other European cities, has banned low-efficiency cars in the downtown area of the city. Incentivising residents to improve their car efficiencies. <a href="#">EU bans</a>
Paris, France	A french startup, Transition One, retrofits fuel cars into electrical models, for less than half the price of the cheapest electric car (5,000 Euros).

**Table 2: Incentive Programs**

## ***Increasing Responsible Roads and Pathways***

The secondary but no less crucial goal of transportation is increasing responsible roads and pathways to not only reduce the carbon emissions put into the atmosphere but to also provide citizens with a promise of a sustainable future. This is achieved by following the Dutch's suggestions, implementing sustainable materials, utilizing natural CO<sub>2</sub> drawdowns, and smart city planning.

## **Public Policy and Organization Methods to Increase Responsible Roads and Pathways**

### ***Public Policy***

- Improve transportation pathways
  - Make sidewalks easily accessible for all
  - [8 ways to make friendly sidewalks](#)
- Allow for alternative materials for roads and pathways
  - [5 ways to pave the ground more sustainably](#)
  - [Recycled asphalt](#)
  - [Rubberized asphalt](#)
  - [Carbon concrete \(carbon negative\)](#)
  - [Rubber sidewalks](#)
- Implement bioswales
- Build smart parking lots
  - Made from alternative (carbon neutral or negative) materials
  - Solar overhangs
    - Solar panels overhead of parking spots to provide both shade/energy
    - Shade leads to cars emitting less CO<sub>2</sub> when starting
  - Electrical charging stations
  - [Solar overhangs and their benefits](#)

### ***Incentive Programs***

- For private property (parking lots, driveways, households)
  - Development incentives
  - Grants
  - Rebates/installation financing
  - Awards/recognition programs
  - Stormwater fee discounts

Table 3 includes examples of public policy programs

Aiken, SC	A 10,000 square foot Rubberway Rubberrock system was installed in the center of town in Aiken, South Carolina as a walking trail for residents. This rubber trail is porous to allow for rapid rainwater dispersion and quick drying. Another benefit of Rubberway is that it is non-slip, making for a safe pathway for the residents of this town. <a href="#">Who is using rubber pavement</a>
New Orleans, MS	As of 2019, all new lots in New Orleans must be built using porous pavement, and is one way the city hopes to fight its flooding issues. <a href="#">New Orleans porous lots</a>
Tacoma, WA	A large bioswale was constructed in the middle of a parking lot where all the water could drain efficiently and be cleaned by the natural landscaping. The bioswale worked so well, Tacoma did not have to add to its existing water treatment plant to manage runoff from Cheney Stadium. <a href="#">Why put bioswales next to roads?</a>
Montgomery, AL	The Montgomery County Planning Commission took a detailed approach to making parking lots more green and sustainable. They explored the issues associated with traditional parking lots and provided the design elements necessary to create green parking lots. It also focused on rewriting policy on parking lot design, to ensure the successful use of green design in new parking lots and in the redevelopment of existing lots. <a href="#">Sustainable parking lots</a>

**Table 3. Policy Programs**

Table 4 includes examples of incentive programs.

Portland, OR	The City of Portland conducts many incentive programs, including the <a href="#">Clean River Rewards Program</a> , which offers a discount in stormwater utility fees to private-property owners who manage stormwater onsite.
Montgomery County, MD	Montgomery county coordinates RainScapes Rewards, a rebate program used to meet part of its municipal separate storm sewer system permit goals. The county provides rebates based on the amount of runoff captured. Residential properties are capped at \$2500, and institutional parcels are capped at \$10,000. <a href="#">Case studies for incentive programs</a>

**Table 4. Incentive Programs**

# Waste Management

## Executive Summary: Moving Toward a Circular Economy

This section provides recommendations for both the city and the public that aims to streamline and reduce the waste of our local economy. At the foundation of all these recommendations is the fact that a large scale consumer education campaign is necessary to the successful achievement of any of these goals. Without an educated public, many of these policies will be opposed and not met with the vigor and excitement that is necessary. Do people know, for instance, that food waste makes up the biggest category of landfill waste, which in turn directly leads to global warming? In order to implement a successful closed-loop waste management plan, citizen support, garnered by education campaigns, must underpin these policies.

## Pre-Production

First and foremost, the mantra *reduce, reuse, recycle* should be taken seriously when trying to move toward a [circular economy](#). What people often forget is that this aphorism is hierarchical, with *reducing* being of primary importance and *recycling* being a tertiary priority. That being said, a certain amount of consumption is necessary in daily life.

From here on out in the supply chain we believe it is easiest to frame goods in terms of organic and non-organic composition.

## Point of Production

### Non-organic

- Incentivize the production of *local* goods and materials. Small business loans can be introduced for businesses looking to produce goods locally.
- Implement plastic bag bans and generally steer away from the production of plastics.
- Enforce single-use plastic bans with substantial fines.
- Discourage the design strategy of planned obsolescence.

### Organic

- Agriculture that involves minimal to no tilling, pesticides, herbicides, insecticides or fungicides.
- Utilizing sustainable mariculture techniques, especially oyster farming locally which has a restorative effect on waterways and provides a great source of proteins and minerals.

- Proper water management involving drip irrigation, which can reduce water usage up to 60 percent. Robust and healthy soil matter is extremely important in keeping water in the soil as opposed to running off into estuaries and eutrophying the water.
  - [Watering the world](#)
- Supporting organic local agriculture through the use of community supported agriculture programs (CSA) minimizes transportation costs and acquaints residents with farmers leading to a strengthened community.
  - i.e. [Wando River Farms](#)
  - i.e. [Spade and Clover](#)
- Incentivizing personal “victory gardens” decreases the pressure on the agricultural industry to produce in mass monocultures and ship globally.
  - [San Diego Community Garden Incentive Program](#)
    - [Tax Breaks May Turn San Francisco's Vacant Lots Into Urban Farms](#)
- Encouraging a diversity in plant production for both food and textile use ( i.e. hemp production and [native plant strips in corn monocultures](#))
- Steer away from the Renewable Fuel Standard, which consumes about 40 percent of our corn production. Corn monocultures add up to about 97 million acres of US farmland (roughly the size of California) and use about 5.6 million tons of nitrogen annually. Additionally, ethanol leads to engine wear and less fuel efficiency.
  - [It's Time to Rethink America's Corn System](#)
  - [The Case Against More Ethanol: It's Simply Bad for Environment](#)

## Point of Consumption

### Non-organic

- Incentivize borrowing behaviour rather than consumption through community [lending libraries](#).
  - [Library of Things](#) : Instead of buying new tools and other products, people have the option of renting various things from the community Library of Things.
- Encourage the consumption of durable goods and remind people that buying quality made objects that can be repaired and passed down to generations is worthwhile. Incentivise the use of small zero interest loans for purchases where people want to invest in a decent product instead of choosing the cheaply made disposable product.



[Compostable Trash Bags](#)



[Biodegradable Dog Poop Bags](#)



[Bamboo Toothbrushes](#)



[Glass, Stainless steel, or Silicone straws](#)



[Biodegradable sponges](#)



[Reusable razor](#)



[Bamboo cutlery/Travelware](#)



[Reusable Cloth Diapers](#)



## Organic

- Encourage the consumption of “misfit” produce, i.e. food that cannot be sold in grocery stores for various reasons but is still perfectly edible. Give misfit markets a platform and make people aware that they exist and are readily available options for everyone. Destigmatize “ugly” produce.
  - [Misfit Market](#)
- Ban grocery stores and other food waste producing businesses from throwing away edible food and organic waste. Instead, require stores to donate excess, edible food to food banks and compost inedible food waste.
  - MA Commercial Food Waste Ban Economic Impact Analysis
    - [Report Template Blue](#)
    - <https://www.businessinsider.com/how-france-became-a-global-leader-in-curbing-food-waste-2018-1#:~:text=In%20February%202016%2C%20France%20became,food%20through%20unanimously%20passed%20legislation.>
  - [New York State: Food Donation and Food Scraps Recycling Law](#)
  - [France was the first country to ban supermarkets from throwing away unused food and the world is taking notice](#)
- Incentivise the use of a meatless diet. Delegitimize meat consumption or, at the least, discourage people from consuming ruminant animals (cattle, goats, and sheep) in favor of poultry and pigs which are more ecologically efficient.
  - [“California Assembly Passes Bill Incentivizing Plant-based Meals in Public Schools”](#)
- Impose higher taxes on meat products to encourage plant-based diets.

## After 1st Point of Use

### Non-organic

- Reuse- encourage the use of stores that sell used items such as Facebook Market, “Buy Nothing” groups, Craigslist, Ebay, Depop, Worn Wear, flea markets, thrift stores, antique stores, estate sales, and yard sales.
- [Repair-](#) encourage the use of local tailors to fix worn clothes and mechanics and technicians that will repair bikes, cars, boats, and small appliances.
- Upcycle- Hold community workshops that both teach and inspire upcycling techniques. Create a framework (possibly in the form of a Facebook page or community website) to share ideas and materials with the purpose of upcycling rather than throwing away. Users can post images of materials they have or want to get rid of and other users can either chime in with ideas on how to transform the material or offer to take the material and transform it themselves. This platform can double as a market for upcycled products to be resold and reused.

- Donate- though roughly [84 percent](#) of what people donate to thrift stores is thrown in a landfill anyway, it is still worth as a last resort giving objects that are about to be tossed another chance at the thrift store.

**Organic**

- Food reuse, rescue, and donating- changing unnecessarily burdensome health laws that don't allow food to be rescued from landfills.
- Ban the disposal of edible food for corporations, businesses and even residents
- Encourage food sharing among community members, family and friends.
- Encourage the use of apps such as [Unsung](#) where food can easily be donated to people who really need it. The app incentivises through tax deductions.

**Recycling**

**Non-organic**

- Improving recycling facilities to be able to handle the plastic, paper, metal, and glass output of the Charleston area.
- Require public events to be outfitted with recycling bins
- Expand access to recycling; provide recycling receptacles in all public areas
- Require businesses to offer recycling
- Offer and encourage textile recycling; textiles make up 6% of municipal solid waste.
  - Waste Zero offers [textile recycling](#) programs that go hand-in-hand with their Pay-As-You-Throw waste model.
- [Why Is Recycling Not Mandatory in All U.S. Cities?](#)

**Organic**

- Institute some version of a mandatory organic waste ban whether simply commercial or residential or both. Cities and states such as [New York](#), [Vermont](#), Massachusetts, Rhode Island California, and [Austin, Texas](#) have already implemented these programs in conjunction with Pay as You Throw (PAYT) programs. (table)

New York State (New York City exempt)	<a href="#">The Food Donation and Food Scrap Recycling Act</a> requires the major producers of food waste ie, grocery stores, colleges, hotels etc, to separate their food waste into wholesome and edible food that must be donated or food scraps that must be composted.
New York City	<a href="#">The Commercial Organics Law</a> states that certain NYC establishments are required to separate organic

	waste from landfill waste if they meet the minimum requirements.
Vermont	<a href="#">Vermont's Universal Recycling Law</a> bans “blue bin” recyclables, yard debris and food scraps from entering the landfill.
Massachusetts	The <a href="#">Commercial Food Material Disposal Ban</a> states that businesses and institutions that produce at least one ton of organic waste per week cannot dispose of organic waste in landfills.
Rhode Island	Rhode Island's <a href="#">Refuse Disposal Law</a> encompasses the <a href="#">Food Waste Ban</a> and the required separation of solid waste in recyclable and non-recyclable components. Businesses that produce more than 2 tons of organic waste per week are required to divert it from the landfill if located within 15 miles of a composting facility.
San Francisco, California	Banned organic waste and recyclables from residential and commercial landfill streams. Reduced landfill waste pickup to every other week based on reduction in weekly landfill waste.
Austin, Texas	<ul style="list-style-type: none"> <li>● Austin's <a href="#">Universal Recycling Ordinance</a> states that employees of food-permitted businesses have convenient access to landfill diversion methods for organic waste.</li> <li>● Commercial property owners must ensure that tenants have access to recycling services.</li> <li>● <a href="#">Austin restaurants</a> are not permitted to throw food into the landfill instead they must donate it if it's edible or compost it.</li> </ul>
Portland, Oregon	Banned organic waste and recyclables from residential and commercial landfill streams. Reduced landfill waste pickup to every other week based on reduction in weekly landfill waste.

- Municipal food waste and yard debris composting for industries and for households
  - Example: [Beaufort](#) subsidizes compost bins for residential use and outlines the benefits of the practice
  - Chicago offers a [block bin model](#), with a compost bin that neighbors all share. It gets picked up by a central company who then takes it to a larger compost site
  - [Orlando](#) offers free backyard composting bins, per request, to residents and offers convenient drop-off locations. [Orlando's commercial food waste program](#) provides pick-up
- Composting of downtown horse manure and excess straw and hay.

## Disposal

### Non-organic

- Institute a [PAYT program](#) that charges per weight and volume of trash, which many cities and states have already implemented. This disincentivizes landfill usage by giving citizens the opportunity to recycle and compost. <https://wastedfood.cetonline.org/wp-content/uploads/2019/07/Harvard-Law-School-FLPC-Center-for-EcoTechnology-CET-Organic-Waste-Bans-Toolkit.pdf>
  - A savvy public relations department may choose to frame PAYT instead as “Save as You Throw”
  - [Pay-As-You-Throw Success Stories](#)
- When landfills are absolutely necessary, a sustainable [landfill](#) should be implemented

### Organic

- All organic waste should be composted. Composting should be encouraged by offering municipal composting pick up services and bans on organic waste in landfills.
  - [City of Charleston 2016 Composting Pilot Project](#)
  - [Harvard Law “Bans and Beyond: Designing and Implementing Organic Waste Bans and Mandatory Organics Recycling Laws”](#)
  - [Organic Waste Legislative Update](#)



# Food Systems

## Executive Summary: Plant-Based, Sustainable Food Systems

Food systems make up a [quarter](#) of the world's greenhouse gas emissions, about 26% (Ritchie 2019). Within food production, nitrous oxide from nitrogen fertilizers produce the most powerful greenhouse gases. Methane emissions from cows and sheep are also huge contributors. Red meat in particular accounts for about 150% more greenhouse gas emissions than chicken or fish. This demonstrates that production and consumption have a larger contribution to GHG emissions than distribution. By implementing ways to encourage sustainable production and consumption GHG emissions coming from food systems can be decreased dramatically. This section provides recommendations in the areas of food production, distribution, and consumption.

## Food Production

### *Importance of Local Food Production*

Improving our agricultural framework, particularly urban agriculture in the City of Charleston's case, is a disaster [risk reduction strategy](#) because it builds resiliency into our food systems by sourcing food locally. This is especially important in a place like the coast of South Carolina where sea islands are prevalent and can easily be cut off from the resource grid during a natural disaster. Urban farms such as [Fresh Future Farms](#) provide crucial local

### *Local Sustainable Farms*

[Sweetgrass Garden](#) is a non-profit, sustainable farm that grows food on around 2 acres on Johns Island. Their farm recognizes that food production has a huge impact on climate change. They approach farming with permaculture techniques that are more sustainable and cost effective than traditional mono-cropping. They are also dedicated to educating the community on sustainable farming practices, its importance, and its benefits. Some of the most important practices they encourage are cover cropping, raised beds, composting, sheet mulching, and other practices that preserve organic matter. They also use animals like goats, chickens, and ducks, to manage the property, naturally fertilize, and act as pesticides. They also have bees that pollinate their crops and water management systems. The managers of Sweetgrass encourage other farms to engage in the same strategies. Their recommendations are to learn what grows best on the land and make the most of it. Diversity is key in a sustainable farm. While they are a 2 acre farm, they only farm around 1 acre. Using this 1 acre they have been able to donate 7,000 pounds of produce annually. [Spade and Clover Gardens](#) is an organic farm on John's Island striving to use sustainable practices.

Other Farms:

- [Fresh Future Farms](#)
- [Wando River Farms](#)

## **Community Agriculture**

Some examples of local community agriculture projects are:

- Green Heart Project- Urban Farm at Enston Home <https://greenheartsc.org/urban-farm-at-enston-home>
- MUSC Urban Farm: <https://web.musc.edu/resources/health-and-wellness/ohp/urban-farm>

## **Sustainable Aquaculture Practices**

[Greenwave](#) is a nonprofit organization using regenerative ocean farming practices without any input and a small carbon footprint. The model is beneficial for reforestation, restoration, and capturing carbon and nitrogen as well as using polyculture to raise animals. At the University of California, Santa Barbara, growing seaweed in 3.8% of federal waters off of the California coast would neutralize California's agricultural carbon emissions. Providing cows and pigs with seaweed would also reduce their methane emissions by large amounts.

## **Food Distribution**

Sustainability in food distribution can be defined as meeting the current needs for food while not compromising future generations' ability to meet their needs. At the current rate of climate change, the future generation's ability to produce food is being compromised.

Food Supply chains go from the agricultural producers, to manufacturers, to consumers. This process is complex and requires a lot of machinery and energy to get food from one place to another. Temperature control is one of the main concerns to maintain food quality during distribution. Temperature control increases energy costs when the products have to be shipped a long distance.

Local products are the key to reducing the carbon footprint in food distributions. The less distance the food has to travel to the consumer, the lower the energy costs are and the lower the carbon emissions are.

Food transportation and distribution is a necessary evil and an unavoidable step in the food supply chain. However, its effects can be lowered by implementing sustainable changes.

More Information:

- [https://www.researchgate.net/publication/226056734\\_Quality\\_safety\\_and\\_sustainability\\_in\\_food\\_distribution\\_A\\_review\\_of\\_quantitative\\_operations\\_management\\_approaches\\_and\\_challenges](https://www.researchgate.net/publication/226056734_Quality_safety_and_sustainability_in_food_distribution_A_review_of_quantitative_operations_management_approaches_and_challenges)
- [https://www.cleanmetrics.com/pages/Ch9\\_0923.pdf](https://www.cleanmetrics.com/pages/Ch9_0923.pdf)

## **Points of Mass Food Distribution**

### **K-12 Schools:**

- Schools are a point of mass consumption, and therefore a point of mass distribution.
- Incorporating local produce into school lunches and breakfasts can reduce the amount that schools rely on imported produce, reducing their carbon footprint.
- College Campuses: Like K-12 schools, college campuses are mass consumers of all kinds of foods. Dining Halls on campus rely heavily on large deliveries of products, especially produce. According to the College of Charleston, they participate in responsible sourcing and transportation management. These practices should be encouraged and monitored for all campuses, schools, and businesses in Charleston.
- <https://charleston.campusdish.com/Sustainability>

### **Hospitals:**

- MUSC and other hospitals must maintain one or more cafeterias with a wide range of food options. MUSC specifically gets their products from SODEXO, who has committed to reducing their carbon emissions. However, it is more beneficial for MUSC to also invest in local food in produce.

### **Hotels and Restaurants:**

- Tourism is a large part of Charleston's economy. Hotels and Restaurants have the responsibility of entertaining guests all year round and require a lot of food distribution to do so. Encouraging hotels and restaurants to get local produce wherever possible and stay away from importing the majority of their food products will reduce the amount of carbon emissions from food distribution and boost the local economy.

## **Practices for Creating a Sustainable Food Distribution System**

**Encourage Farm to Schools Programs:** These programs focus on buying, promoting, and serving local food in schools. It educates students on agricultural practices, health, and can provide hands-on learning with school gardens. These benefit the students and the local economy, and reduces the environmental impact.

Examples:

- In Vermont, schools spend more of their annual food budgets on local food than any other state -- nearly 30%. Vermont has a Farm to School Grant Program that brings together schools and local food producers. So far they have reached 30% of schools in their state: <http://www.farmentoschool.org>
- Nutrition Education on CCSD Schools website: Farm to Cafeteria
- CCSD Partnered with Green Heart to highlight an SC grown fruit or vegetable each month in the cafeteria along with a cooking video. "Harvest of the Month"
- A lot of kids get most of their meals from school, this program incorporates more fruits and vegetables into their diet and teaches them how and why they should be eating them. The local produce also reduces the school's carbon footprint: <https://ccsdschoolmeals.com/?page=NutritionEducation>.

**Increase permits and licensing for local vendors:** Spaces for local vendors and farmers to sell their produce is important to making climate-conscious food available. Local farms do not have to ship food across the country, therefore making it more readily available, less expensive, and better for the environment. Increasing the amount of places for farmers markets and local vendors will decrease the amount of people that have to rely on mass produced and distributed grocery store produce that creates excessive waste and emissions.

Many low income areas are also food deserts. As a result, the residents rely on mostly packaged and processed food that has low nutritional value and a negative impact on the environment. Access to fresh local food decreases this reliance on unhealthy foods and decreases their carbon footprint. The harmful effects of food distribution increase with the distance food products have to travel. The best way to encourage climate-responsible food practices is to boost and engage local farmers and produce.

Example:

- In Minneapolis, a network of mini-markets was created with the help of the [Institute for Agriculture and Trade Policy](#). The city of Minneapolis passed a permit that allows for the selling of locally grown produce on organizations' and vendors' property. This policy has increased access to fresh food in low income areas. The Institute for Agriculture and Trade Policy recognizes that agriculture and climate change are directly tied. Part of their mission is, “to advocate for policies and approaches that empower farmers and rural communities to develop appropriate, bottom-up solutions; reduce greenhouse gas emissions and help farmers and communities adapt; and advance a fair and just transition toward more climate resilient, agroecological systems for farmers and rural communities”.

**Encourage Local Farmers engaged with Programs like Greener Fields Together:** [Greener Fields Together](#) is a sustainability program for the entire produce value chain run by [PRO\\*ACT](#). Their goals are to: decrease the environmental impact of the industry by using sustainable practices and ensuring availability and safety of produce for foodservice and retail partners in all industry segments. They define sustainability as: “managing the growing, handling and distribution of produce to ensure a long-lived, healthy and safe supply of products without causing severe or irreversible damage to the planet and its population.” They engage national farmers by studying their management and encourage environmentally friendly practices that are proven to be successful. They support local farms as well by providing Good Agricultural Practices training and food safety audit assistance. Restaurants and other food retail locations can display the Greener Fields Together seal to demonstrate their commitment to sustainability and local produce if they adopt and implement the sustainability improvements.

**Engage Businesses in Programs like Climatesmart:** They cut costs and cut carbon by working with businesses and host partners. They provide training and user friendly software to measure carbon emissions and plan emission reductions.

- Carbon Emissions in the Food and Beverage Sector- A Climate Smart Industry Brief
  - <https://climatesmartbusiness.com/wp-content/uploads/2014/06/CS-Food-and-Beverage-Sector-Industry-Brief-digital.pdf>
- Carbon Emissions in Food Processing and Distribution:
- Food and Beverage Distributor:
  - Key emission sources: fleet, refrigerants
  - Top reduction strategies: green routing
  - Refrigeration system retrofit, driver training
  - Fuel and refrigerants are the largest emission source
  - Refrigerants leaking from the cooling systems released greenhouse gases equivalent to 71 1 tonnes of carbon,
- A company worked with them to be more sustainable, some of their strategies included:
  - “Smart Routing”: smarter planning for distribution to minimize the amount of driving and better trained company drivers in driving habits and a company wide non-idling policy, was created.
  - Retrofitting refrigeration equipment to avoid leaks.
  - Using their waste cooking oil to produce biodiesel for the trucks
  - Installing GPS tracking system on all of the vehicles as a long term strategy.
  - Future plans: address the sales team travel by rewarding sales reps for getting fuel efficient cars, review where they sell to minimize driving, allowing drivers to act as sales reps for remote areas.

**CSA: Community Supported Agriculture.** CSA allows consumers to buy local, seasonal food directly from the farmer. CSA is a good way for consumers to rely less on produce from the grocery stores that may have traveled long distances to get there. By investing in a CSA, consumers can receive local produce from the area that will boost the local economy and reduce an individual's carbon footprint.

## Food Consumption: Climate-Responsible Practices

### *Individual Diet Change Impacts*

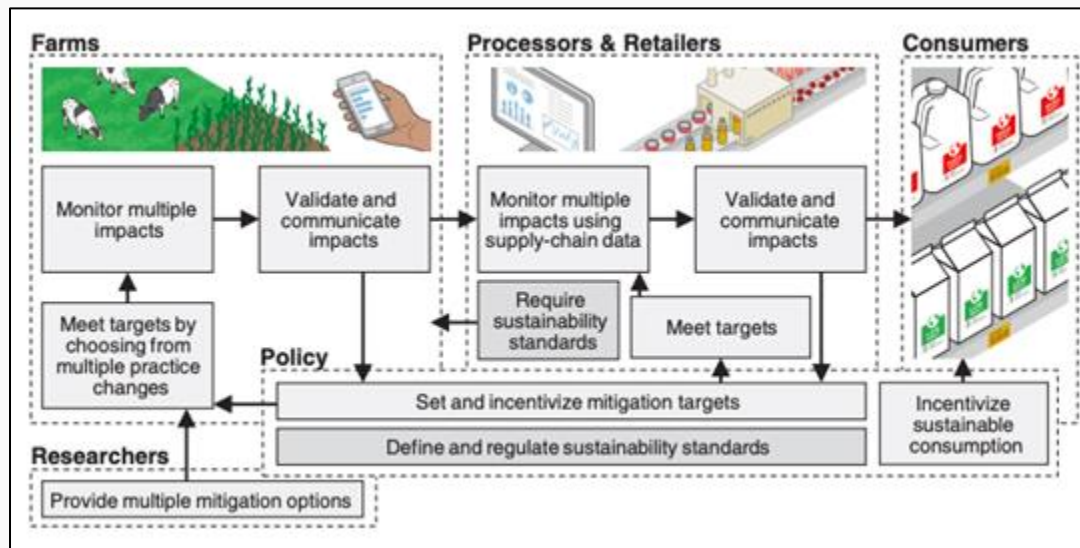
Buying local food can reduce personal average greenhouse gas emissions but only by 4-5%. Substituting part of one day a week's worth of calories from red meat and dairy products with chicken, fish, eggs, or vegetables achieves more greenhouse gas reduction than switching to a diet based entirely on locally produced food. If the average household substitutes their calories from red meat and dairy for chicken, fish or eggs one day a week, they would save 0.3 tCO<sub>2</sub>eq. If the average household replaced those calories with plant-based alternatives they could save 0.46 tCO<sub>2</sub>eq. Going dairy and red meat free just one day a week would save a comparable amount of CO<sub>2</sub> to having a [zero food miles-diet](#).

Moving from meat and dairy reliant diets to diets that exclude meat and dairy can have a drastic impact on land use, arable land, acidification, eutrophication, and freshwater

withdrawals. All of these factors also contribute to the reduction of greenhouse gas emissions. Food land use could be reduced by 76%.

There is a huge potential to reduce GHGs by simply modifying the consumer diet. The demand for dairy and red-meat especially drive the majority of emissions from food systems.

This graphic from the study linked below is a graphical depiction of the mitigation framework the study suggests.



<https://science.sciencemag.org/content/360/6392/987/tab-pdf>

## ***Incentives For Healthy & Vegan Diets***

The Carbon Free City Handbook:

- Marshall, Texas (USA) | Mayor launched a nonprofit to promote a plant-based diet, after his own personal health scare and recovery  
<https://www.nytimes.com/2014/01/26/us/the-mayor-went-vegan-then-spread-the-word.html>
- In 2016, Barcelona (ESP), officially declared itself a “veg-friendly” city and began promoting and supporting vegetarian and vegan diets. To provide more options for people interested in a plant-based diet, the city created a guide and app to help residents and visitors find local food options. Barcelona also created an incubator program for entrepreneurs, investors, and consumers. Finally, the city led by example, introducing “meatless Mondays” at all city- owned food services and requiring vegetarian and vegan options at events promoted by the city.

John Hancock Vitality Program:

- Insurance program that gives incentives to those who live a more vegetarian and vegan lifestyle by documenting receipts in restaurants, grocery stores, (etc.)  
<https://www.johnhancockinsurance.com/vitality-program.html>



## Points Of Mass Consumption

**K-12 schools:** Charleston County Schools are a part of the National School Lunch program. They provide lunch and breakfast for students at varying prices. They must follow certain health guidelines and regulations that require them to teach the students about balanced meals and food health. The students are taught that meat is the only source of protein and that milk is a necessity to have a balanced meal. The schools are also not required to provide vegan or vegetarian options for students. As a result, schools are one of the biggest consumers of, meat and dairy products

- More Information: <https://ed.sc.gov/districts-schools/nutrition/meal-programs/national-school-lunch-program>

No schools are required to provide meat and dairy alternatives, though tofu and soy yogurt have been credited as meat alternatives as long as they are recognizable as a meat substitute. This encourages the idea that meat and milk are necessary food groups and are the only sources of protein. This is not true, and does not represent a balanced diet.

- More Information: <https://www.fns.usda.gov/cn/crediting-tofu-and-soy-yogurt-products-school-meal-programs-and-cacfp>

Much would be accomplished by introducing plant based meals into school lunches and reducing the amount of meat sourced protein and dairy milk being served. There are other alternatives that are healthier and better for the environment.

Examples:

- A One day a week plant-based diet was introduced in schools in Oakland and Los Angeles. Oakland saved \$42,000 by cutting animal products served in schools by 30%. The school district was able to cut its carbon footprint by 14% annually and save 42 million gallons of water (The Carbon Free City Handbook: <https://rmi.org/insight/the-carbon-free-city-handbook>)

**Colleges/Universities:**

- [https://www.earth.com/news/healthier-campus-food-could-reduce-carbon-emissions/?fbclid=IwAR38Xhpnclhyn4LHRXTL\\_brIjvFFEPqsFqdqhOb3maO6zQg5s6qE DEZ7BIY](https://www.earth.com/news/healthier-campus-food-could-reduce-carbon-emissions/?fbclid=IwAR38Xhpnclhyn4LHRXTL_brIjvFFEPqsFqdqhOb3maO6zQg5s6qE DEZ7BIY)

**Restaurants:** People would be well-served if restaurants changed the usage of language on menus or descriptions of meals as means to encourage more plant-based item consumption. For example, instead of describing foods as “meat free,” use terms such as “enjoyable” and “delicious”.

- A study done in the United Kingdom <https://www.wri.org/publication/encouraging-sustainable-food-consumption-using-more-appetizing-language>
- Introduce Carbon labels at restaurants, venues, and other points of large mass food distribution. Carbon labels will educate consumers about the impact food consumption has on the environment. These labels will show the carbon footprint of the meals served.

## Reduced Food Waste/Food Rescue

Food rescue, also called food recovery or food salvage, is the practice of gleaning edible food that would otherwise go to waste from places such as restaurants, grocery stores, produce markets, or dining facilities and distributing it to local emergency food programs.

The recovered food is edible, but often not sellable. Products that are at or past their “sell by” dates or are imperfect in any way (such as bruised fruit or next-day bakery items) are donated by grocery stores, food vendors, restaurants, and farmers markets. Or perhaps the food is unblemished, but restaurants may have made or ordered too much or may have good pieces of food (such as scraps of fish or meat) that are byproducts of the process of preparing foods to cook and serve. Also, food manufacturers may donate products that marginally fail quality control, or that have become short-dated.

Organizations that encourage food recovery, food rescue, sharing, gleaning and similar waste-avoidance schemes come under the umbrella of food banks, food pantries or soup kitchens.

Examples:

- Food Rescue US: <https://foodrescue.us>
- Sustainable America Food Rescue Locator: <https://foodrescuelocator.com>

## National Action to Support Local Food Systems

- Support the [Agricultural Resilience Act](#) presented by [Chellie Pingree](#)
- Support the Climate Stewardship Act
- Support the Farm System Reform Act introduced by Cory Booker

# Carbon Sinks

## Executive Summary: The Importance of Carbon Sinks in Climate Action

In addition to actively reducing GHG, any climate action plan has to actively protect and promote carbon sinks, which are any reservoir that accumulates and stores carbon-containing compounds, thereby lowering the concentration of CO<sub>2</sub> in the atmosphere. The two most important carbon sinks are vegetation and the ocean. Combined, these sinks absorb nearly half of the CO<sub>2</sub> that human activities pump into the atmosphere, so they play a critical role in reversing climate change.

This section provides recommendations for ways to protect, maintain, and expand carbon sinks, both naturally-found and manmade.

## Preservation of Naturally Existing Carbon Sinks

### Protect Existing Wetlands

*Wetlands are abundant in the Lowcountry and are very efficient at sequestering and storing carbon.*

**Stricter & better implementation of regulations:** County and State regulations regarding development, filling, and dredging of wetlands are strict, but not enforced. DHEC has the power to approve most permits regardless of their effect on the environment. Stricter city regulations and better enforcement of the current regulations can reduce the number of dangerous developments being allowed.

- Charleston County Stormwater Program Permitting Standards and Procedures Manual: <https://www.charlestoncounty.org/departments/public-works/files/StormwaterTechnicalManual-2nd-edition.pdf?v=43>
- South Carolina code of Laws on Coastal, Tidelands and Wetlands: <https://www.scstatehouse.gov/code/t48c039.php>
- Beaufort County Form-Based Code: This land development regulation has helped Beaufort adjust to new urban growth effectively by protecting natural resources from development. Protecting natural resources and keeping development in urban areas allows the natural carbon sinks to thrive.  
(<http://www.cityofbeaufort.org/DocumentCenter/View/976/The-Beaufort-Code?bidId=>)

**Implement the Dutch Dialogue Recommendations:** The Dutch Dialogues provide recommendations that will prevent future flood risk, preserve the natural beauty of the area, and preserve wetlands that are vital to water drainage. These wetlands are also critical carbon sinks that are of great value to climate change mitigation. The recommendations to reduce filling, protect coastal zones, prevent future development, protect and sustain intertidal

zones, restore marshes, and sea level adaptation can maintain the health and function of wetlands. Dredging and filling wetlands diminishes their function, reducing their effectiveness as a carbon sink. Following their guidelines will preserve natural carbon sinks vital to mitigating climate change.

- Dutch Dialogues Final Report: [https://www.charleston-sc.gov/DocumentCenter/View/25055/Dutch-Dialogues-Charleston\\_Final-Report-September-2019](https://www.charleston-sc.gov/DocumentCenter/View/25055/Dutch-Dialogues-Charleston_Final-Report-September-2019)

**Incentivize private easement programs:** An easement is a legal agreement that limits development on private property. It is done voluntarily with the purpose of conserving the land. The landowners get to keep the land as long as they abide by the agreement and may receive compensation or incentives. There are multiple programs that provide easements and assistance on land conservation.

Some examples are the [NRCS's Wetlands Reserve Easements](#), [The Nature Conservancy, Lowcountry Land Trust](#), and the [South Carolina Conservation Bank](#). Encouraging landowners to participate in an easement agreement would result in the protection of natural carbon sinks that are vital to mitigating climate change. Tax reductions or compensation are good incentives.

**Stricter travel/access restrictions:** The recreational use of the marsh and waterways are detrimental to the health of the wetlands. Stricter travel and access restrictions would preserve the function of the wetlands and in turn its natural carbon sink capabilities.

- **Improved no wake restrictions in narrow tidal creeks:** Narrow Tidal Creeks by nature are more susceptible to corrosion. They are also areas where there is no regard for speed or appropriate travel behavior. Stricter travel restrictions in tidal creeks would include more and improved no wake restrictions to limit the disruption of the environment.

**Provide tidal marsh migration paths to accommodate sea level rise:** Sea level rise is a threat to the health and function of existing wetlands. Tidal marshes have the ability to adapt to sea level but only in the right conditions. Preparing for tidal marsh migration will preserve the marsh capabilities as a carbon sink even with the threat of a rising sea level. Development often stands in the way of natural tidal marsh migration-- by limiting developments within these paths, the marsh has a greater chance of surviving.

A study done by the Nature Conservancy found that there is strong evidence suggesting migration space is imperative for the survival of South Carolina's coast line. The objective of this study was to estimate the vulnerability and resilience of tidal habitats on the Southeastern coast. Their main concern was rising sea levels in conjunction with rising population, expansion, and the land's ability to adapt. Their maps show that the SC coast has moderate water quality and a relatively good drainage area but a poor buffer zone. The estimated resilience scores from the maps for the Charleston area were either average or slightly below average.

- Link for more information on the ecological impact of the salt marsh: <http://www.oceanhealthindex.org/methodology/components/salt-marsh-area>

- Link to useful publications and resources regarding wetlands and sea level rise:

<https://www.aswm.org/wetland-science/wetlands-and-climate-change/sea-level-rise>

**Better mitigation practices for unavoidable wetland loss:** There are certain developments that may involve unavoidable wetland destruction or loss. As a result, action needs to be taken to make up for this unavoidable loss, as outlined in The Clean Water Act. One act is mitigation banking, the development and enhancement of wetlands to compensate for wetland loss. While mitigation banking already exists in South Carolina, it should be better enforced for all developers that will be affecting the wetlands, along with the current requirements for compensatory mitigation.

Links to more information:

- [https://www.epa.gov/sites/production/files/2015-08/documents/compensatory\\_mitigation\\_factsheet.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/compensatory_mitigation_factsheet.pdf)
- <https://www.epa.gov/cwa-404/background-about-compensatory-mitigation-requirements-under-cwa-section-404>
- <https://floridadep.gov/water/submerged-lands-environmental-resources-coordination/content/mitigation>
- <https://ecology.wa.gov/Water-Shorelines/Wetlands/Mitigation/Wetland-mitigation-banking/Mitigation-bank-projects>
- <https://www.gao.gov/assets/250/247675.pdf>

**Enforce green space perimeters:** The space between a roadway and the wetlands is a critical area. Roadways and construction leech pollution into the marsh or wetland, causing harm. The wetlands around roadways with no buffer zones or perimeter are low functioning and run the risk of not being effective carbon sinks. To protect their carbon sink capabilities, stricter regulations on these greenspace perimeters need to be enforced. An increase in greenspace around walkable roadways are also valuable. They increase the amount of carbon storage available in an urban setting and improve the quality of life.

### **Protect Forested Areas**

*Forests are another greenspace excellent at sequestering and storing carbon. Given there are few forested areas left in Charleston, it's imperative to protect them and maintain their health and function.*

**Stricter Logging Regulations:** The trees and forest capacity in and around Charleston are vital assets to carbon sequestration, yet logging regulations have not been strictly enforced. To preserve the forest's carbon sink capabilities, trees need to be protected with stricter enforcement of logging regulations.

## **Restoration of Currently Damaged and Failing Carbon Sinks**

### **Natural Wetland Restoration**

**Allowing regrowth of historic wetland areas:** Historical wetland areas are at the most risk for flooding and damage. Water tends to follow its natural path -- as a result, some areas that

used to be wetlands will suffer the most from flooding and damage as the sea level rises. By allowing wetlands to slowly grow back into these areas, the wetland's health will increase and so will its function, helping to prevent any further damage to the area.

Links to more information:

- <https://www.epa.gov/wetlands/principles-wetland-restoration>
- <https://www.epa.gov/wetlands/basic-information-about-wetland-restoration-and-protection#:~:text=Wetland%20restoration%20is%20the%20manipulation,rebuiding%20a%20former%20wetland%3B%20and>

**Improving health of existing wetlands:** The function of existing wetlands must be preserved for them to be active carbon sinks. Some factors that affect wetland function are nutrient runoff, rising sea levels, and developments. Creating buffer zones is a potential solution to preserve the

Links for more Information:

- <https://www.oceanfdn.org/sites/default/files/Laffoley%20The%20Management%20of%20Natural%20Coastal%20Carbon%20Sinks-.pdf>
- <https://www.epa.gov/wetlands/wetlands-restoration-definitions-and-distinctions>
- [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_010838.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010838.pdf)

### ***Reforestation of Native Trees***

**Reforestation** is the process of replanting an area with trees. Reforestation is an effective way to bring down carbon emissions in the atmosphere while also bringing back the natural biodiversity of an area and returning it to its health. Native trees should be used, as they are more likely to do well and succeed in areas that need to be reforested.

Links to more information:

- <https://www.nrs.fs.fed.us/pubs/56770>
- <https://science.sciencemag.org/content/365/6448/76>
- <https://ui.adsabs.harvard.edu/abs/2017AGUFMGC21B0949N/abstract>

### ***Restoration of Native Ecosystems***

**Climate friendly yard programs:** Climate friendly yard programs encourage the use of sustainable gardening and landscaping practices as well as the incorporation of native plants. This provides carbon sequestration potential, a reduction in the use of water, and an increase in the overall health of ecosystems.

Links to more information:

- <https://www.ucsusa.org/resources/climate-friendly-gardener>
- <https://www.ecohome.net/guides/3402/grass-lawn-alternatives-eco-friendly-bee-friendly/>
- <https://extension.umd.edu/hgic/topics/climate-friendly-gardening-practices>



## Creation of New Carbon Sinks

### **Afforestation**

**Urban “food forests”:** A food forest is a gardening or land management system that mimics a woodland ecosystem substituting edible trees, shrubs, perennials and annuals. An urban food forest can be a smaller version of this within an urban setting. Most of the time it requires the work and collaboration of a community. Some examples are the [Sherrett Food Forest](#) in Portland and [Beacon Food Forest](#) in Seattle. These food forests demonstrate a more sustainable way to use land and grow food, along with sequestering more carbon.

Compared to traditional farming and agriculture, food forests can reduce carbon emissions greatly.

**Tiny forest projects:** A tiny forest is a densely packed forest of native trees about the size of a tennis court. Tiny forests are perfect for urban areas with little greenspace. The tiny forests bring all the benefits of a forest like biodiversity, carbon sequestration, and cooling effects, but in a way that maximizes a small piece of land. Tiny forests are usually compact, fast-growing, with low-management needs. They are able to create a small functioning ecosystem to restore the health of an area.

Links to more information:

- <https://ideas.ted.com/how-to-grow-your-own-tiny-forest/>
- <https://earthwatch.org.uk/working-with-business/tiny-forests>
- <https://medium.com/@Kalpavriksha/afforestt-how-to-grow-a-tiny-forest-anywhere-quick-72cddf240eb>
- <https://www.goodnewsnetwork.org/tiny-forests-spring-up-around-europe/>

### **Carbon Sink Farms**

**Sorghum:** Sorghum is a powerful carbon sink. It is annual, harvestable, non-invasive, 3x more effective as a carbon sink than trees, cost effective, and good for removing particulates from air. Sorghum is easily managed and can also be harvested and used for a profit. Sorghum grown in vertical bio-crop farms can be placed close to large carbon emitters like factories and plants that can double the growing season per year, thus doubling the carbon sequestration. A South Carolina based company called [Agri-Tech Producers](#) has a patented Combined Remediation Biomass and Bio-Product Production (CRBBP) Process that is very successful in removing carbon from the air cost-effectively.

Link for more information:

- <https://www.sorghumcheckoff.com/all-about-sorghum>
- <https://www.intechopen.com/books/biomass-for-bioenergy-recent-trends-and-future-challenges/sorghum-an-important-annual-feedstock-for-bioenergy>

**Bamboo:** Bamboo has the potential to be a powerful carbon sink. It is perennial, harvestable, and has a “clumping” species that is non-invasive. When managed properly, Bamboo is a prime candidate for reforestation and afforestation efforts. Bamboo grows much quicker and has a shorter life cycle than most trees. Bamboo can also be harvested and used for



socioeconomic benefits. It can be made into durable products that will prolong its carbon storage.

Links for more information:

- [https://www.researchgate.net/publication/267392447\\_Bamboo\\_and\\_Climate\\_Change\\_Mitigation](https://www.researchgate.net/publication/267392447_Bamboo_and_Climate_Change_Mitigation)
- <http://www.fao.org/tempref/docrep/fao/012/k6887e/k6887e00.pdf>

## RESOURCES (Local Groups that Work on Carbon Sinks)

**South Carolina Conservation Coalition:** <http://www.conservationcoalitionsc.org>

Coalition of organizations that work to preserve the natural resources of the state, promote the efficient use of water resources and conservation of land. They support environmental Law, policies and regulations.

**The Carolina Wetlands Association:** <http://carolinawetlands.org/index.php/state-of-the-wetlands/>

“Promotes the understanding, protection, restoration, and enjoyment of North and South Carolina's wetlands and associated ecosystems through science based-programs, education, and advocacy.”

Strategy Plan:

- Secure recognition for vulnerable wetlands
- Report on the status and value of wetlands to influence decision making
- Support services and knowledge for wetland protection and management with land trusts and other conservation groups
- Establish relationships with county and municipal decision makers to support wetland management
- Educate about wetlands
- Increase awareness

**Coastal Conservation League:** <https://www.coastalconservationleague.org/projects/climate-change-and-south-carolina/>

- Project Conservation Bank: The funding source for Land Protection. Using a portion of the state real estate transfer fee, funds are acquired and used to give grants to protect lands, including wetlands.
- Project Protection of Marsh Hummocks: They are working to protect islands, latest conservation victory was protecting Pappy's island from developers in 2016.
- US Army Corps of Engineer Sea Wall project: The army corps of engineers proposed protecting charleston with a sea wall, the CCL expresses their concern for the project suggesting it will do more harm to the land than it will do good for the human environment

- Water resources: they are always working towards protecting the low countries waters from overuse and withdrawal. This includes wetlands.
- Supporting Charleston County Greenbelt program

**Lowcountry Land Trust:** <https://www.lowcountrylandtrust.org/land-conservation/>

Acquire and protect critical properties, conserved lands access 17 counties from 1 acre to 12000.

**South Carolina Environmental Law Project:** <https://sclcp.org/focus-area/water-and-wetlands>

Mission Statement: “To protect the natural environment of South Carolina by providing legal services and advice to environmental organizations and concerned citizens and by improving the states system of environmental regulation”

Focus Area: Water and Wetlands

- Action examples: challenge developments, dredging permits, provide legal help by representing other conservation groups, appeal permits, challenge SCDHEC

**Sierra Club South Carolina Robert Lunz Group:** <https://www.sierraclub.org/south-carolina/robert-lunz>

- Right now this group is teaming up with SCLCP to challenge the permitting of “Long Savannah”, a development that would affect 200 acres of wetlands in West Ashley's Church Creek Basin.
- They are also working on a Beyond Coal campaign that is trying to force South Carolina regulators to act on very old, outdated and expired permits for three coal-generating plants in the state.

### **Watershed Resources Registry**

<https://watershedresourcesregistry.org/about.html>

- Helps map natural resources in areas that are critical for preservation and restoration.

