CONNECTICUT GREEN BANK
COMMUNITY SOLUTIONS

environmental infrastructure primer

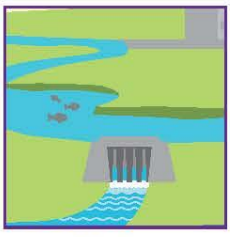
environmental markets guide


Environmental Markets


Land Conservation


Parks and Recreation


Agriculture


Water

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Environmental Markets

Guide

Prepared with Support From

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ENVIRONMENTAL MARKETS

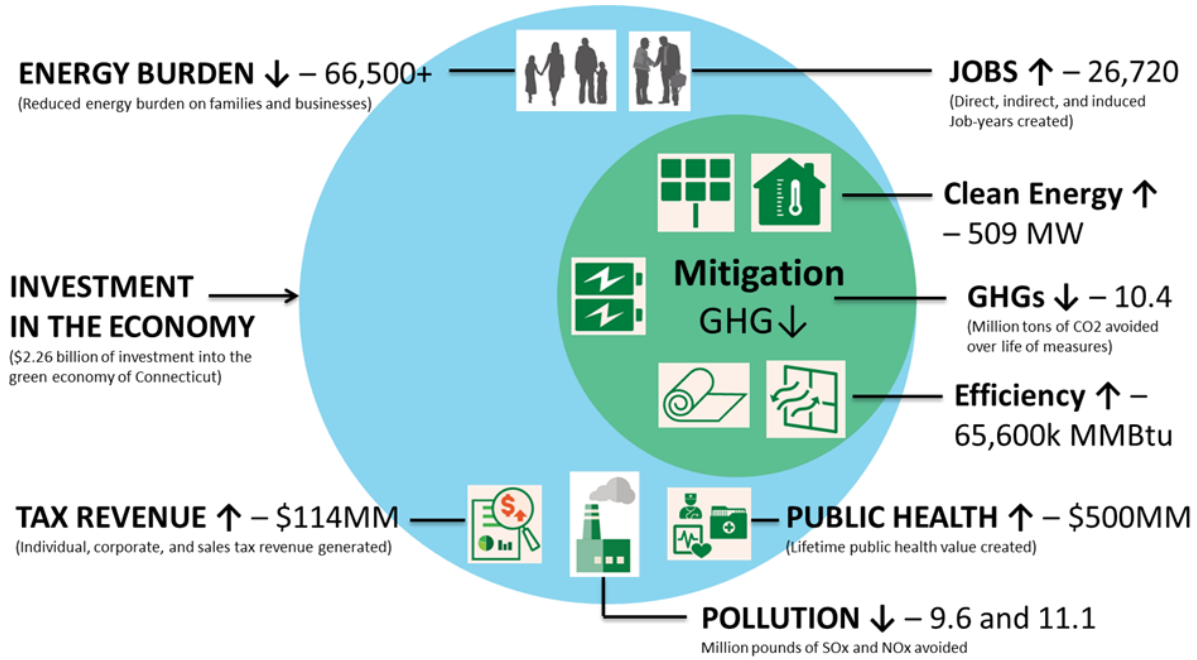
RESEARCH ON ENVIRONMENTAL INFRASTRUCTURE

1. Overview

On July 6, 2021, Governor Ned Lamont signed Public Act 21-115 "An Act Concerning Climate Change Adaptation" ("the Act") into law. The bipartisan-supported public policy was among the sixty-one (61) recommendations made by the Governor's Council on Climate Change ("GC3"), including a recommendation to expand the scope of the Green Bank beyond "clean energy" to include "environmental infrastructure" (i.e., Recommendation #57).

Since its founding over a decade ago, the Green Bank has focused its efforts on using a limited amount of public resources to mobilize multiples of private investment in Connecticut to increase and accelerate the deployment of "clean energy" to deliver social and environmental impact – see Figure 1.

Figure 1. Impact of the Green Bank with focus on "Clean Energy" Deployment and Mitigation of GHG Emissions (FY12-FY22)



Given its mission, the Green Bank helps the State of Connecticut achieve its ambitious public policy objectives (e.g., GHG emission reductions targets, renewable portfolio standards). In so

doing, by 2025, no less than 40 percent of investment and benefits from its programs are to be directed to vulnerable communities.[1]

The Act, expands the scope of the Green Bank beyond "clean energy" to include "environmental infrastructure," and includes the following key provisions:

- **Definition** – "environmental infrastructure" means structures, facilities, systems, services and improvement projects related to (A) water, (B) waste and recycling, (C) climate adaptation and resiliency, (D) agriculture, (E) land conservation, (F) parks and recreation, and (G) environmental markets, including, but not limited to, carbon offsets and ecosystem services;

- **Comprehensive Plan** – requirement for the Green Bank to develop a Comprehensive Plan[2] prior to implementing any programs or initiatives related to "environmental infrastructure";

- **Reporting** – inclusion of the Banks Committee and the Environment Committee, alongside the Energy and Technology Committee and Commerce Committee in terms of reporting; and

- **Bonding** – the ability to issue 25-year bonds for "clean energy" and 50-year bonds for "environmental infrastructure" (i.e., no more than the useful life of the projects), supported by the Special Capital Reserve Fund ("SCRF"), for up to 25 years to improve the rating of the bonds issued.

This document focuses on the cross-cutting nature of "environmental markets" within the "environmental infrastructure" definition, with a focus on "carbon offsets and ecosystem services". It is intended to provide readers with a common language, and appropriate expectations for the of the markets for carbon offsets and ecosystem services[3].

[1] "Vulnerable communities" means populations that may be disproportionately impacted by the effects of climate change, including, but not limited to, low and moderate income communities, environmental justice communities pursuant to section 22a-20a, communities eligible for community reinvestment pursuant to section 36a-30 and the Community Reinvestment Act of 1977, 12 USC 2901 et seq., as amended from time to time, populations with increased risk and limited means to adapt to the effects of climate change, or as further defined by DEEP in consultation with community representatives.

[2] https://www.ctgreenbank.com/wp-content/uploads/2022/08/Comprehensive-Plan_FY-2023_FINAL_080122-1.pdf

[3] Ecosystem services are the "benefits people obtain from ecosystems". https://www.fs.fed.us/ecosystemservices/About_ES/

2. Introducing Carbon Offsets and Ecosystem Services

Background

Markets for carbon offsets and ecosystem services were designed to embed the positive benefits and negative impacts (called externalities) of individuals on natural resources into market-based systems which financially incentivize environmental stewardship, conservation, and rehabilitation of natural ecosystems.

Projects can generate a variety of benefits, which may or may not be monetizable through existing markets. For example, some projects, such as urban green stormwater infrastructure, may result in both water quantity and water quality benefits. Water quality tends to focus on regulatory municipal stormwater to address Clean Water Act requirements and is fundable under the Clean Water State Revolving Fund (CWSRF). Water quantity, however, is most directly related to flooding during high rain events. Water quantity efforts are often, though not always voluntary and not a priority of CWSRF funding.

The past few years have seen monumental shifts in commodity supply chains and the global economy. One of the more encouraging shifts has been the mainstreaming of ecosystem services markets related to carbon and water. These markets are quickly becoming recognized as ubiquitous and necessary tools for facilitating a transition to a green economy.

State Action to Advance Environmental Markets[4]

In April 2022, Governor Hogan of Maryland signed into law SB0348/HB0653: The Conservation Finance Act of 2022. This is the first state law in the country that will codify the importance of leveraging private finance to advance environmental restoration efforts. A significant step is the adoption of "Pay for Success" contracts as an acceptable form of state contract under state procurement law. Pay for Success contracts can shift project risk by ensuring that contractors are only being paid when projects deliver the outcomes established in a contract. This law is a novel example of how states can modernize procurement procedures to catalyze environmental markets by allowing the state to directly purchase environmental outcomes such as water quality and carbon sequestration. This law impacts a wide range of sectors, with some highlights including:

Agriculture: Allows the Department of Agriculture to negotiate partnerships with experienced organizations who can assist private landowners with voluntary participation in carbon offset markets.

Water: Allows Maryland to purchase environmental outcomes from long-term or permanent green or blue infrastructure projects in the Susquehanna River watershed that provide water quality benefits to Maryland

Forestry: Allows the state to pay for the afforestation of state lands

[4] 2022 Regular Session - Senate Bill 348 Chapter (maryland.gov)

Structuring Markets

Successful carbon and ecosystem service markets share some common design elements which influence and create the underlying market conditions required to align financial incentives with positive environmental outcomes. If any one of these design elements is absent, flawed, or not accurately accounted for, market failures (increased polluted air, water, and habitat) are likely to occur. These critical design elements include[5]:

- **Non-Localized Environmental Impacts** – the environmental impacts being addressed by the market need to be looked at from a regional, national, or global perspective, account for the scale of their impacts even if the activities or projects implemented are conducted at the local scale. For example, greenhouse gas (GHG) emissions for a power plant in California increase the GHG emissions across the globe. Polluted water discharged in public waterways impacts the water quality of everyone downstream.

- **Reliable and Accurate Data** – data and the ability to accurately measure and monitor environmental impacts is paramount to effectively implementing a market-based system. Data should be verified by an independent third-party service to validate the integrity of the service and remove conflicts of interest. Without good data practices, there is no way to accurately determine supply and demand or enforce the rules of the market.

- **Target** – a target can be in the form of a cap (i.e., the upper limit of emissions or load in the water context) allowed in a regulatory system, or a reduction goal (i.e., a voluntary pledge to reduce a particular quantity of emissions or water use by a set date) in a voluntary system. Targets are usually set by policy and regulation, rather than economics, and they often become more ambitious over time. Ideally, a target is binding and carries penalties that incentivize compliance.

- **Clearly Defined Market Participants** – to establish market liquidity it is important to have a sufficiently large scope of coverage of the market, comprised of many entities with differing costs of compliance and reduction. This encourages investment in reduction strategies by some and trading to meet targets by others. To reduce transaction costs between parties, it is critical to have a standardized set of terms, definitions, operating rules, boundaries for activities, scientifically grounded methodologies, and units of.

- **Cost Containment** – since the typical laws of supply and demand do not always underpin price, it is often a good idea for proponents of ecosystem service markets to enable cost containment and risk reduction by supporting a floor price or other price volatility controls. These measures protect market participants and encourage investment in reductions strategies and projects that create a supply of credits for others in the system to buy or trade.

[5] https://www.theoutcomesfund.com/in-the-news/swof-original-introduction-to-ecosystem-services-markets-why-do-ecosystem-services-markets-exist-part-1-of-3

- **Enforcement** – effective enforcement is one of the most critical aspects of a successful ecosystem services market. While this can be a daunting task, without it, the market often lacks incentives to operate efficiently and effectively. For this reason, most regulated (i.e., legally enforceable compliance) markets carry a premium price compared to voluntary markets.

Improving Public Health Outcomes through Carbon Offsets and Ecosystem Services

Projects that deliver carbon offsets and/or ecosystem services are based on the foundation that there are positive human health outcomes (both quantitative and qualitative) from a healthy environment. Some examples of these impacts include:

- **Clean Air**: The connection between clean air and public health is well-established, as evidenced by the passage of the Clean Air Act of 1970. The EPA has concluded that in 2020, the Clean Air Act Amendments would prevent over 230,000 early deaths by reducing ambient particulate matter.[6] Low-income communities are more likely to be surrounded by polluted air and suffer from commensurately higher rates of asthma and other illnesses.

- **Clean Water:** Excess nutrients from fertilizer, wastewater, and stormwater runoff can cause harmful algal blooms. The EPA found that these algal blooms can cause a variety of adverse health effects (in humans and animals) through direct contact with skin during recreation, consumption through drinking water, or consumption of contaminated shellfish, which can result in neurotoxic shellfish poisoning and other effects.[7] The EPA estimated that the health impacts on Florida's coast from high bloom levels was nearly $140,000.

- **Urban Tree Canopy:** One study showed that the relationship between the urban tree canopy, temperature, and health is estimated to reduce heat mortality and valued tree canopy heat reduction services between $5.3 billion and $12.1 billion annually across the entire country, estimating that the urban tree canopy helped avoid 19 percent to 27 percent of heat-related deaths annually.[8] Heat-related illnesses (HRIs) disproportionately affect low-income communities, with estimates showing that those suffering from HRIs are 3x more likely to be hospitalized if they are from the bottom income quartile compared to the top income quartile.

- **Public Parks:** Parks are appealing venues for physical activity that can help combat the sedentary lifestyle that produces some chronic diseases, including diabetes, heart disease, cancer, hypertension, arthritis, stroke, depression, and sleep disorders - which account for more than 20% of total US health care costs.[9] In addition to physical activity benefits,

[6] https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-second-prospective-study
[7] https://www.epa.gov/sites/default/files/2015-04/documents/nutrient-economics-report-2015.pdf
[8] https://www.tpl.org/sites/default/files/030822_Economic%20Benefits%20NYC_FinalE.pdf
[9] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3993093/

well-maintained parks may promote mental health, social cohesion, and general well-being.

Health outcomes are generally much more difficult to quantify and commoditize in a market structure. Because of this, key stakeholders in the health industry, such as insurers, are more likely to simply provide grant funding for green spaces and green infrastructure rather than trying to finance projects and tying the financing terms to specific outcomes. For example, the case study below demonstrates how health care funding can support green infrastructure – even if insurers are not participating in an ecosystem services market.

Health Insurers Investing in Nature Based Solutions[10]

In 2021, Blue Cross Blue Shield ("BCBS") of Massachusetts announced that it would provide $10.6M in funding over five years to address inequalities in environmental, food, and racial justice. BCBS acknowledged in their annual report that "that our health is directly linked to our environment". In particular, they acknowledged that many communities suffer from health disparities due to proximity to highly polluted areas. To address this, they undertook several actions:

- BCBS partnered with GreenRoots, a resident-led, grassroots, community-based organization in Chelsea and East Boston, to help fund their work to advance food justice through urban agriculture, address indoor air quality while sharing data on outdoor air quality in easily accessible, multilingual formats, and implement climate justice through the creation of new green spaces.
- In Boston, BCBS partnered with the Department of Parks and Recreation to offer free, in-person classes in local parks across the city and virtual workouts for every age and fitness ability
- BCBS provided funding support to Eastie Farm, which is dedicated to pursuing climate justice, improving food access, and fostering community resilience through the development of interactive urban agricultural spaces and environmental education programs.

3. Carbon Markets

Carbon markets are among the most long-established environmental markets and typically include projects that provide carbon sequestration or emissions reduction. Projects participating in these markets can be designed to explicitly provide carbon sequestration, or the carbon sequestration benefits can be an externality (or ecosystem service) of a project designed for other purposes. Carbon sequestration benefits can be quantified and sold in an environmental market as *"carbon offsets"*. A carbon "offset" or "credit" is the verified avoidance or capture of one metric ton of carbon dioxide (usually denoted as mtCO2) from the atmosphere.

Market Structure

Carbon offsets operate in both compliance and voluntary markets.

[10] https://www.bluecrossma.org/sites/g/files/csphws1866/files/acquiadam-assets/2021-Corporate-Citizenship-Report.pdf

Compliance markets are regulated by regional, national, or international carbon reduction regimes. In these markets, the price per credit can fluctuate[11] but will apply to all buyers & sellers and price changes can be tracked in real time.

Conversely, the *voluntary market* allows for entities conducting activities that result in a reduction of carbon in the atmosphere to quantify and sell those benefits to businesses, governments, nonprofit organizations, universities, municipalities, and/or individuals looking to purchase carbon offsets to meet their own emissions reduction objectives. In those transactions, the price per credit can be negotiated on a case-by-case basis. Quantifying the market price for the voluntary market requires averaging out available information to create an estimate.

Connecticut Green Bank's Electric Vehicle Carbon Credit Pilot Program

The Green Bank is enabled through CGS Sec. 16-245n (as amended by Public Act 21-115) to engage carbon offset markets using its "environmental infrastructure" authorization,[12] and also through its "clean energy"[13] authorization as applicable.

High-quality and credible carbon offsets are created under administrative bodies that operate developed certification protocols, determining the emissions reduction activity, scope, verifiability, and measurement procedures. At present, the Green Bank has one offsets project, using methodology VM0038[14] and VMD0049[15] published under the Verified Carbon Standard ("VCS") Program[i], administered by the nonprofit Verra. This methodology allows those with the rights to electric vehicle charging infrastructure to earn carbon credits based on vehicle charging activity. This project is a third-party aggregation, with the Green Bank as the sole project proponent, and all partners assigning to the Green Bank the rights and title to the environmental attributes of electric vehicle ("EV") charging transactions, so that the associated data sets may be converted into carbon offsets to make verifiable, permanent and liquid (tradable) claims of emissions avoidance.

Market Sizing

Compliance Markets

Globally, the financial data firm Refinitiv estimated that the value of the compliance offset market hit €760 billion in 2021[16]. In most cases, compliance programs exist as regional or national cap-and-trade emission trading schemes, such as the Regional Greenhouse Gas Initiative, the

[11] Live Carbon Prices Today, Carbon Price Charts • Carbon Credits

[12] Per Public Act 21-115, "environmental infrastructure" means "…and (G) environmental markets, including, but not limited to, carbon offsets and ecosystem services." "Carbon offsets, means any activity that compensates for the emission or carbon dioxide or other greenhouse gases by providing for an emission reduction elsewhere."

[13] Per CGS 16-245n, "clean energy" includes "…projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure…"

[14] https://verra.org/methodologies/vm0038-methodology-for-electric-vehicle-charging-systems-v1-0/

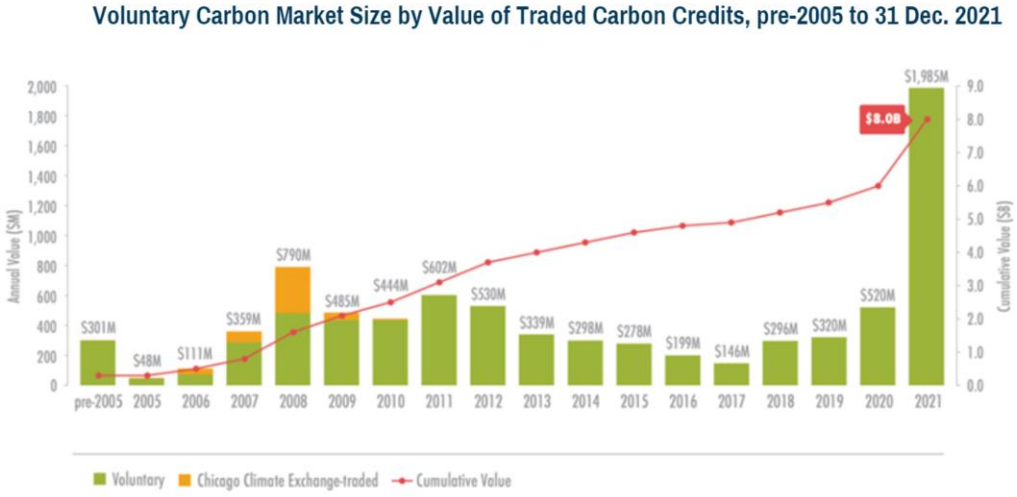
[15] https://verra.org/methodologies/vmd0049-activity-method-for-determining-additionality-of-electric-vehicle-charging-systems-v1-0/

[16] carbon-market-year-in-review-2022.pdf (refinitiv.com)

California Air Resources Board Offset Credit program[17], or the European Union Emissions Trading Scheme (ETS) [18]. The ETS is the largest compliance market in the world by a significant margin, garnering an estimated €23 billion of annual revenue in 2021. Domestically, California's cap-and-trade program generates $1.7B in annual revenue while RGGI generates ~$0.5 billion in annual revenue.

Voluntary Markets

In 2019, corporate carbon-neutral pledges fueled a record transaction volume in the voluntary offset market of at least 104 MtCO2e, with a value of $282.3M[19]. Between 2019 and 2020, the number of companies with net-zero pledges doubled, from 500 to more than 1,000.[20] This explosive growth continued in 2021, with the total market value for voluntary carbon markets increasing to nearly $2B – a nearly four-fold increase from 2020 transactions ($520 million)[21].



Market Registries

Carbon offset registries track offset projects and issue credits for each unit of emission reduction or removal verified and certified. All credits need to meet criteria for measurability, verifiability, sustainability, and additionality, but different registries have different criteria and definitions of a "carbon unit". After a registry issues offset credits, project developers are able to sell those credits in a marketplace.

Compliance Markets

As mentioned in Section 3.2, the Regional Greenhouse Gas Initiative (RGGI) is a regional carbon market. RGGI is a cooperative effort among eleven Eastern states to reduce carbon dioxide (CO2)

[17] See Appendix for additional detail
[18] See Appendix for additional detail
[19] Forest Trends Ecosystem Marketplace State of the Voluntary Carbon Markets 2020
[20] Value Of Carbon Market Update 2020 - Carbon Credit Capital
[21] Ecosystem Marketplace's State of the Voluntary Carbon Markets 2022 Q3

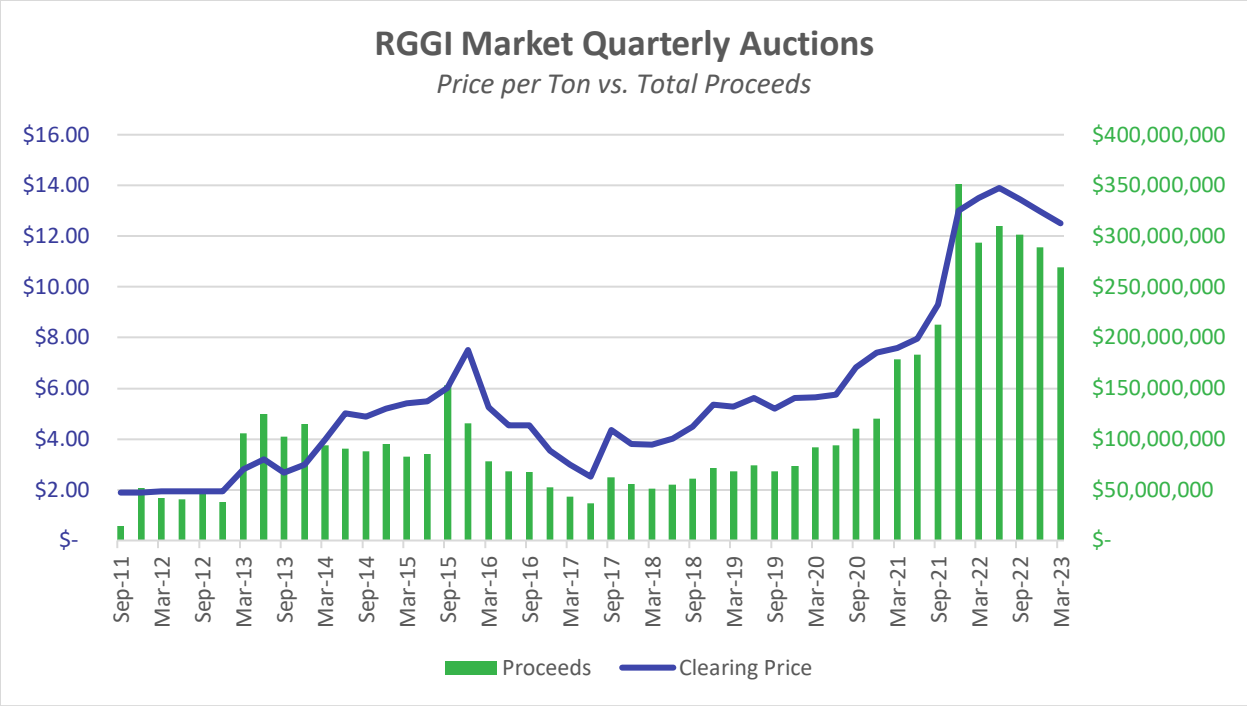
emissions from power plants within each participating state. The participating RGGI states include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia.[22]

RGGI is a market-based cap-and-invest initiative. Together, the participating states have established a regional cap on CO2 emissions, which sets a limit on the emissions from regulated power plants within the RGGI states. Within the RGGI states, regulated power plants must acquire one RGGI CO2 allowance for every short ton of CO2 they emit. The RGGI states distribute allowances at quarterly auctions, where they can be purchased by power plants and other entities. Over time, the regional cap declines, so that CO2 emissions decrease in a planned and predictable way.

Predictability is key because cap-and-trade markets are designed to give firms efficient incentives to reduce or offset emissions. In the short-term, high-emitting generators operate less frequently in favor of low emitting generators. In the long-term, the market will affect the decisions of firms to develop offset projects, to retire old inefficient generation, to retain existing zero-emissions generation, and to perform maintenance that increases fuel efficiency and lowers carbon-intensity. Predictable CO2 allowance prices decrease the risks associated with making long-term investments in reducing CO2 emissions.

The market for RGGI CO2 allowances consists primarily of purchases in the quarterly auctions that provide public information about the market value of CO2. However, there is also a secondary market that includes trading of allowances and allowance futures and options contracts in the secondary market. Since CO2 allowance prices can be volatile, the availability of futures and options contracts allows firms to protect themselves from the risks of such investments. RGGI prices have fluctuated over time[23]:

[22] RGGI_101_Factsheet.pdf
[23] Auction Results | RGGI, Inc.



Offset allowances are transferable and may be used by regulated power plants to meet up to 3.3% of compliance obligations in RGGI. CO2 offset allowances account for less than 0.01% of the total number of allowances issued by the program since its inception in 2009. Eligible project types include Reforestation, Improved Forest Management, and Avoided Conversion[24]. In Connecticut, afforestation is an eligible activity to generate carbon offset credits that can be traded on the RGGI market.

Voluntary Markets

The voluntary carbon offset registries track offset projects and issue credits for each unit of emission reduction or removal verified and certified. There are four leading voluntary carbon registries:

- **The Verified Carbon Standard** is used by most of the market, approximately 76%, and includes Agriculture Forestry and Land Use, Manufacturing, and Waste Management and Disposal as permitted practice areas, among others.

- **The Gold Standard** is the next most frequently used registry, used by approximately 11% of the market. The Gold Standard is used for renewable energy projects, including Biomass and Solar Power as permitted practice areas.

[24] https://www.rggi.org/allowance-tracking/offsets/offset-categories/forestry-afforestation

- **The Climate Action Reserve** is used by approximately 8% of the market and includes Conservation-Based Forest Management and Improved Forest Management as practice areas, among others.

- **The American Carbon Registry** is the leading offset project registry for California's cap-and-trade program but due to its U.S. focus, it has the smallest international market share of the carbon registries.

The different carbon registries have different practices that qualify for permit distributions, with each activity having a specific methodology needed to comply with the registry's qualifications. Below is a list of permitted practices by carbon registry.

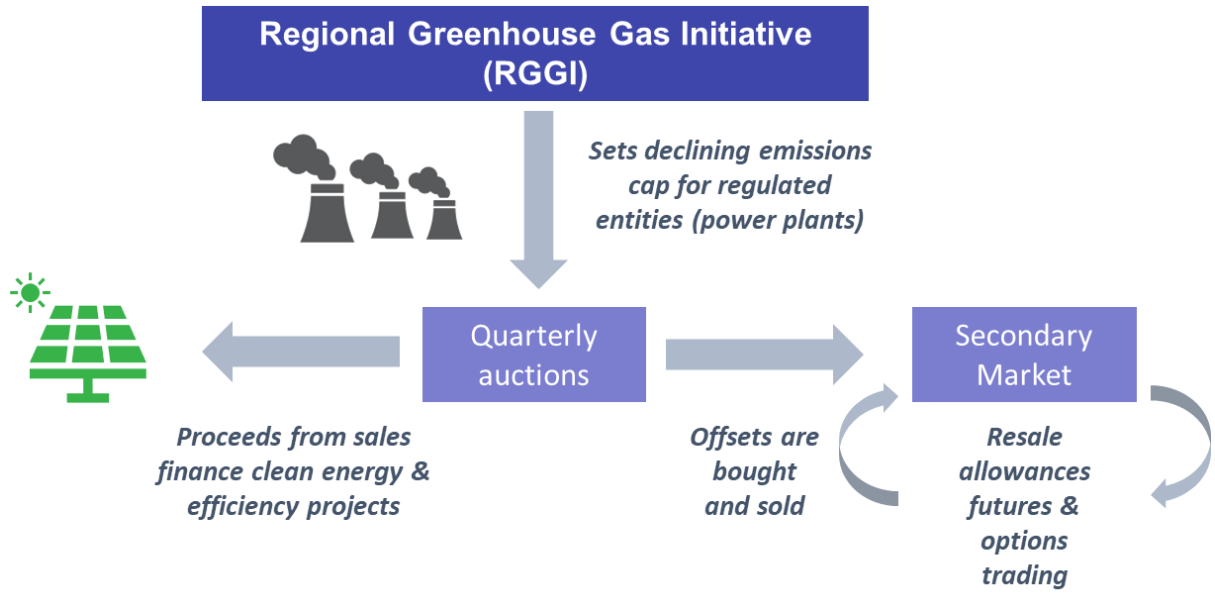
Standard[25]	**Verified Carbon Standard**	**Gold Standard**	**Climate Action Reserve**
Relevant Environmental Markets *Permitted Practices*	**Agriculture / Land Conservation** • Agriculture Forestry and Land Use • Livestock, Enteric Fermentation, and Manure Management **Energy** • Energy Demand • Energy Distribution • Energy Industries (Renewable/Non-Renewable) • Fugitive Emissions from Fuels (Solid, Oil and Gas) **Waste / Recycling** • Waste Handling and Disposal **Other** • Chemical Industry • Manufacturing Industries • Metal Production • Mining/Mineral Production • Transport	**Energy** • Biogas • Biomass or Liquid Biofuel • Energy Efficiency • Geothermal • Hydropower • Solar Power • Wind Power	**Agriculture / Land Conservation** • Avoided Conversion • Conservation-based Forest Management • Improved Forest Management **Energy** • Coal Mine Methane • Landfill Gas Capture/Combustion • Livestock Gas Capture/Combustion • Nitric Acid N20 **Waste / Recycling** • Organic Waste Composting • Ozone Depleting Substances

[25] Voluntary Registry Offsets Database | Berkeley Carbon Trading Project

Marketplace Buyers & Sellers

Compliance Markets

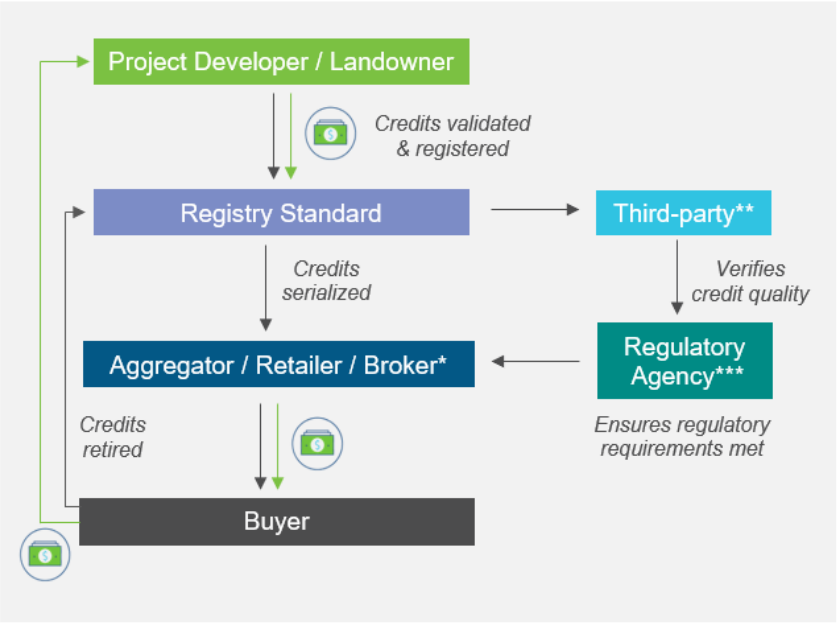
Participants in compliance markets include private companies and governments, depending on the regulatory structure. Compliance market buyers are companies and governments legally mandated to offset their carbon emissions. Sellers are public or private entities conducting activities more than any required level. Participants in compliance markets are motivated by regulations, selling carbon credits when activities have resulted in less carbon emissions than allowed and purchasing carbon credits when activities have resulted in more. In some instances, individuals that do not fall under compliance regulations may choose to purchase credits in compliance markets.



Voluntary Markets

In voluntary markets, corporations, airlines, and governments with emissions-reduction goals are buyers of carbon offsets. Sellers are entities conducting activities to a sufficient measurable level. Participants in voluntary markets are primarily motivated by Corporate Social Responsibility (CSR) goals, public relations, and environmental and social benefits. Once a registry issues offset credits, the project developer can sell them. But with no centralized voluntary marketplace, finding a buyer can be a multi-step, challenging process. Some project developers sell their offsets directly to end buyers. Others sell their offsets through a broker or an exchange, which provide platforms for buyers and sellers to meet; still others may sell to a retailer, who then resells offsets to an end buyer. Retailers take temporary ownership of an offset, while brokers and exchanges do not. Retailers are more likely to walk companies through the process of offsetting and provide more tailored, customized advice. The transaction phase includes any time an offset is sold. Yet once an end buyer is ready to claim that offset against their own emissions, s/he should retire it.

Retired offsets are no longer able to be traded in the market and represent emissions that are permanently "removed" from the atmosphere.



Market Pricing

Prices for voluntary offsets are generally lower than the prices for compliance offsets. One reason for this is that there is a much larger supply of voluntary carbon offsets on the market, which drives the price downward. Pricing for voluntary offsets is also more difficult to track because most voluntary offsets are transacted bilaterally and over the counter, without a

2021 Compliance Offset Market[26]	$ per MtC02e
California Carbon Allowances (CCAs) Futures (12/21)	$22.35
California Carbon Allowances Non-Exchange Cleared (SPOT) (12/21)	$22.35
California Carbon Offsets – Golden CCO	$15.00
Low Carbon Fuel Standard (LCFS)	$182.00
RGGI (12/21)	$8.90

2021 Voluntary Offset Market[1]	$ per MtC02e
Verified Carbon Standard	$4.17
Gold Standard	$3.94
Climate Action Reserve	$2.12
American Carbon Registry	$11.37

[26] Emissions Trading | Carbon Trading | BGC Environmental Brokerage Services (bgcebs.com)

centralized repository for price and volume data.[27] Because compliance program offset credits are generated and traded for regulatory compliance, they typically experience commodity pricing, where all offset credits in a particular program are priced similarly based on the dynamics of supply-and-demand, regardless of project type and other characteristics.

Voluntary offsets, on the other hand, have a wide variation in offset price and volume transacted, which reflects project type, region, co-benefits, standard, as well as buyer preference. Note – co-benefits are any positive impacts other than direct GHG emissions mitigation (such as improved air quality or soil health) resulting from carbon offset projects. Additionally, the heterogeneity of carbon credits means that many credits are being traded in volumes too small to generate reliable daily price signals.

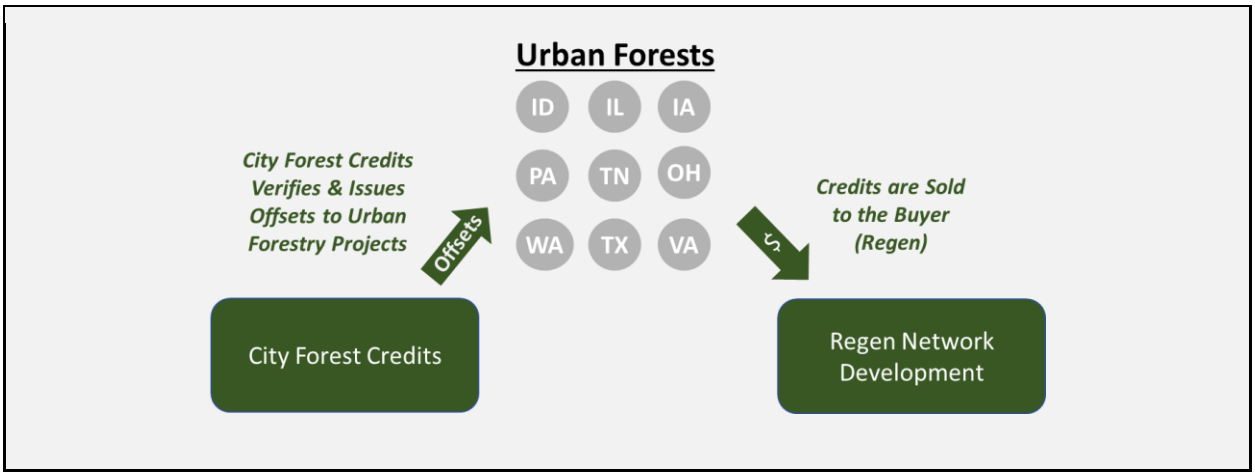
Case Study

Due to the subjective nature of pricing for voluntary carbon credits and the range of quality for voluntary credits, there can be an opportunity for high quality voluntary carbon offset to secure offset prices higher than the market average. For example, in April 2022 the nonprofit City Forest Credits issued offsets to 13 urban forestry projects across the country, and then sold the credits to a blockchain software development company for $31 per credit – 6 times the average voluntary offset credit price.[28] With the offsets amounting to 31,533 credits, the total transaction was $1M.

Carbon Offsets Example: City Forestry Credits

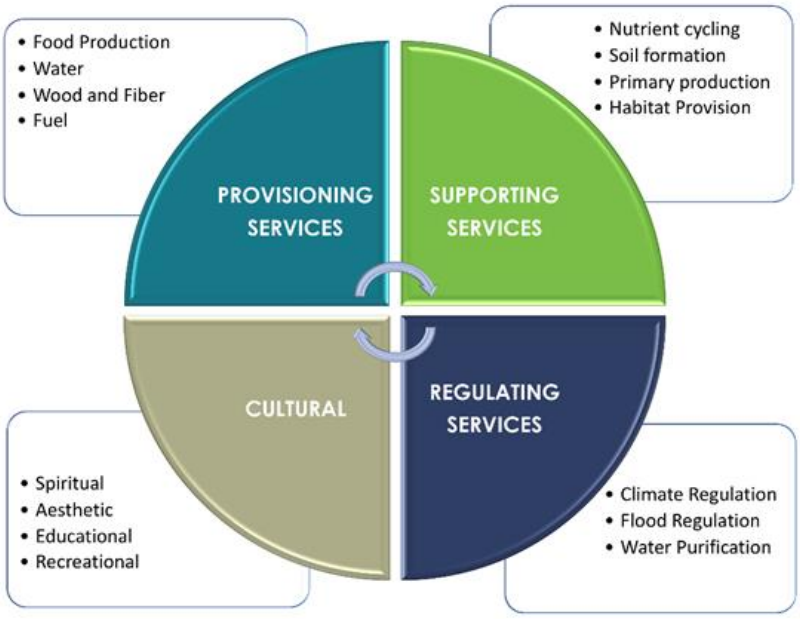
In 2022 City Forest Credits, a nonprofit carbon registry and project certifier, issued offsets to 13 urban forestry projects across the country. The projects then sold the credits to Regen Network Development, a blockchain software development company that says it's developing "a global marketplace for the Earth's ecosystem assets. The forests are located in Idaho, Illinois, Iowa, Ohio, Pennsylvania, Tennessee, Texas, Virginia and Washington, in cities such as Boise, Chattanooga, Cleveland, Pittsburgh and Richmond. For example, in Cleveland City Forests Credits is partnering with the Western Reserve Land Conservancy on a 27-acre site that will generate 4,139 credits[29]. Across all thirteen states, the offsets amount to 31,533 carbon credits, representing 31,533 metric tons of CO2. At a cumulative price of ~$1M, each credit was worth ~$32. The credits are being retired after the purchase, meaning they can't be resold. The planting projects will include workforce-training programs and focus tree-planting efforts in underserved communities. The purchase is expected to propel further interest in carbon credits from urban forests — both from tree-planting organizations looking for new ways to fund their work, and buyers searching for credits that help mitigate skepticism about the true impact of offset programs.

[27] State of the Voluntary Carbon Markets 2020 (forest-trends.org)
[28] Cities net $1M in carbon credit sale (axios.com)
[29] https://www.cityforestcredits.org/carbon-credits/carbon-registry/cleveland-forest-carbon-offsets/


Urban Forests
ID
IL
IA
PA
TN
OH
WA
TX
VA
City Forest Credits Verifies & Issues Offsets to Urban Forestry Projects
Offsets
Credits are Sold to the Buyer (Regen)
City Forest Credits
Regen Network Development

4. Ecosystem Services

Ecosystem services are the "benefits people obtain from ecosystems".[30] While scientists and environmentalists have discussed ecosystem services implicitly for decades, the Millennium Ecosystem Assessment (MEA) in the early 2000s popularized this concept. Below is conceptual diagram of ecosystem services as defined by the Millennium Ecosystem Assessment:



Source

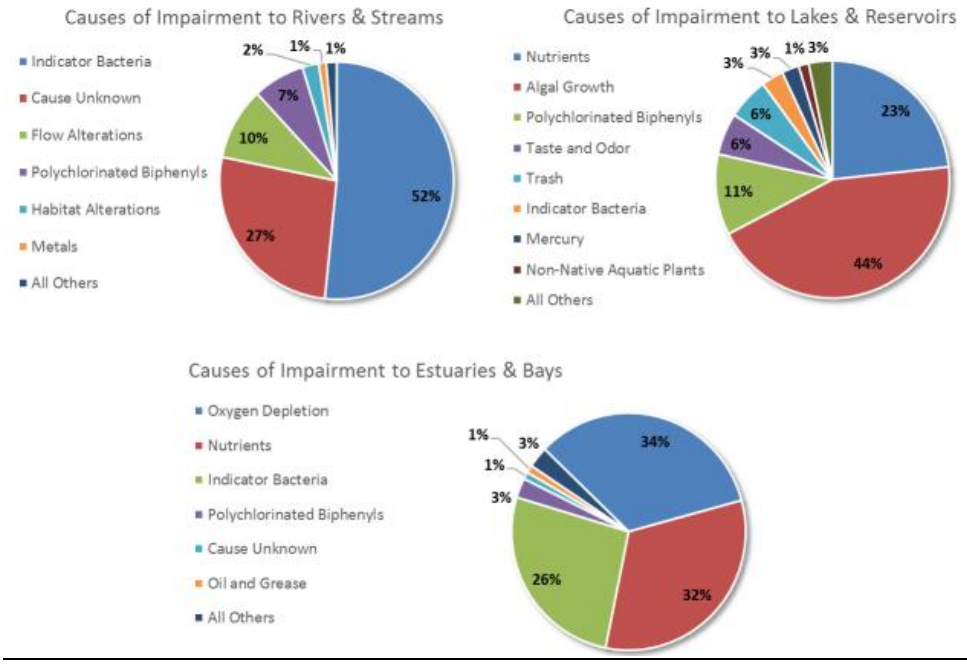
Many of these categories (ex. cultural-spiritual) are not well-suited for commercial markets. However, several of these ecosystem services can be broken down into categories that align with traditional financing mechanisms and innovative new approaches.

4.1. Water Quality

The cause of water quality impairment can vary across watershed, region of the state, or type of water body. The Connecticut State Water Plan lists the types of impairments across the state and the associated cause of the impairment. Lead and Copper are some of the primary drinking water quality concerns, but there are other contaminants (e.g., bacteria, nutrients, and the lack of oxygen) that are possible market opportunities to support efforts that improve the State's drinking water and surface water quality.

[30] https://www.fs.fed.us/ecosystemservices/About_ES/

Causes of Impairment Summary for Connecticut's Assessed Waters (2014)



Market Structure

Water quality markets typically result from the federal Clean Water Act or other legal requirements to reduce pollution. Buyers are usually regulated facilities operating under federal permits that limit their discharges—generally National Pollutant Discharge Elimination System (NPDES) permits. Deals may be made through one-on-one negotiations or via market structures such as clearinghouses and banks. Many programs incorporate credit aggregators or banks to collect credits from nonpoint sources and re-sell them to regulated facilities, and some have held reverse auctions to solicit credits from nonpoint sources.

Reverse auctions are another common structure. A Reverse auction is similar to an RFP in which a buyer requests bids from prospective sellers for specific types of credits and chooses from among the bids based on price, terms, or other factors. While many markets are for individual watersheds, they can also cover entire river basins. Over 50 formal water quality trading programs exist in the United States, including Connecticut's Nitrogen Credit Exchange Program[31] that identifies the maximum amount, or the Total Maximum Daily Load (TMDL), of nitrogen that can be discharged to the Long Island Sound. Water quality trading allows these permitted facilities to meet their discharge requirements by purchasing credits from credit providers instead of making more costly improvements to their own treatment facilities.[32]

[31] Nitrogen Control Program for Long Island Sound (ct.gov)
[32] GuidetoEnvironmentalMarketsforFarmersandRanchers.pdf (landcan.org)

Water quality impacts can come from a range of sources, including:

- **Municipalities** – The EPA's Municipal Separate Storm Sewer Systems (MS4s) program requires each municipality to take steps to keep the stormwater entering its storm sewer systems clean before that stormwater enters water bodies.[33] Additionally, wastewater treatment facilities may have to comply with TMDL requirements related to their discharge to waterways.

- **Agriculture** – Farmers must monitor their use of fertilizers and pesticides and soil runoff, both of which can negatively impact water quality and put a farmer under regulatory scrutiny.

- **Forests** – Demand for water quality credits can be driven by forestry operations, as operators pursue best management practices (BMPs) to reduce soil erosion and prevent or control pollution.

Market Activities

Municipalities:

The EPA's MS4 Stormwater Management Plan identifies measurable goals in each of the following six control measures: Public Education and Outreach; Public Participation and Involvement; Illicit Discharge Detection and Elimination; Construction Site Runoff Control; Post-Construction Runoff Control; and Pollution Prevention/Good Housekeeping. Wastewater treatment facilities that do not meet the state TMDL requirements have mandatory compliance schedule incorporated into their permit. Both MS4 Plan and the wastewater treatment facility permit can be drivers for water investment.

Agriculture:

Eligible credit generating agriculture and farmland BMPs commonly include tillage and nutrient management projects. The BMPs that are eligible for generating credits vary by program, but commonly include practices that reduce erosion, increase water infiltration into the soil, filter run-off, and provide a buffer between farming activities and environmentally sensitive areas. The Natural Resource Conservation Service (NRCS), an agency within the U.S. Department of Agriculture, lists close to 100 practices that reduce nutrients in surface water, such as installing filter strips, using nutrient management strategies, planting riparian buffers, or adopting reduced or no-till agriculture.

Forestry:

In the forestry sector, water quality enhancing BMPs include limiting stream crossing, preventing the construction of additional roads on the property, establishing wide stream buffers, restricting disturbance to stream buffers, and avoiding or limiting fertilizer application when possible. When

[33] Municipal Stormwater (ct.gov)

operating forest management on the property, additional BMPs include using low-ground-pressure equipment, using alternatives to bladed or plowed lines, and minimizing soil disruption during site prep.[34]

Market Buyers & Sellers

Buyers are point source pollution facilities, such as public wastewater treatment plants or private industrial sites. Sellers are nonpoint sources in the same watershed as the point source, such as farmers, ranchers, and foresters. Nonpoint sources do not operate under NPDES permits and can sell credits by undertaking voluntary pollution reduction actions. Farmers, ranchers, and foresters can often implement BMPs that achieve the amount of water quality improvement needed for a watershed at a cost much lower than installing point source infrastructure upgrades.

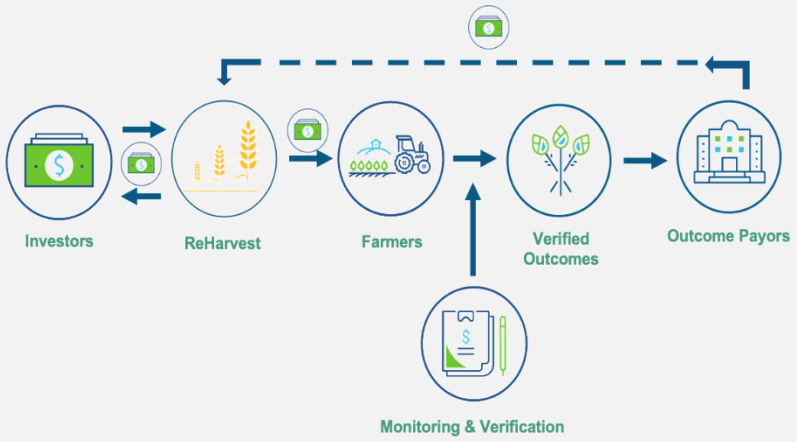
[34] WQ0115.pdf (ncforestservice.gov)

Case Study

Pay-for-Success: Soil & Water Outcomes Fund (SWOF)

The Soil and Water Outcomes Fund (SWOF) is a joint venture of AgOutcomes (a subsidiary of the Iowa Soybean Association) and ReHarvest Partners (a subsidiary of Quantified Ventures) which meets demand for verified environmental outcomes from a range of stakeholders by financing improved environmental outcomes on cropland in Midwestern states and with a recent expansion into New York. Investing entities finance loans put out by ReHarvest Partners. These loans are backed by revenue from sales contracts for environmental outcomes.

The SWOF works with farmers to identify best management practices and then uses its revolving loan funds to pay farmers to make the practice changes. Practices are not prescribed, and payments are tied to verified outcomes in carbon sequestration, nitrogen runoff reductions, or phosphorus sequestration. After verification, the environmental outcomes are sold to beneficiary customers via service contracts or procurement agreements. Customers include municipal governments, water and wastewater utilities, state departments of agriculture, USDA-NRCS and companies with sustainability goals. For private companies, they are specifically focused on scope three "inset" carbon credits, e.g., they sell carbon to the companies that buy from those farmers in order to offset the carbon emissions of those companies. They have designed their credit program so that it can be stackable with other incentive programs, because the prices that companies are paying for carbon credits are not enough to cover practice changes. The fund works with the EPA and state regulators to ensure that water credits can be applied towards Clean Water Act permits or banked for future use. Sales revenue is used to repay investors and scale the program.

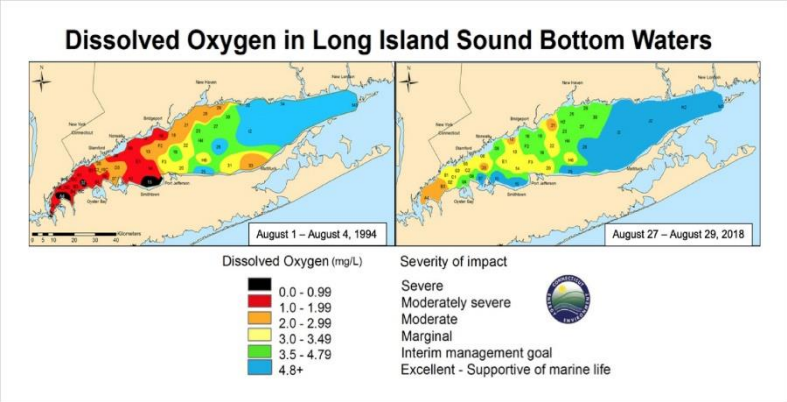


Credit Market Example: Connecticut Nitrogen Credit Exchange Program[35, 36, 37, 38, 39]

In order to combat hypoxia in the Long Island Sound, which resulted from excessive nitrogen discharge from human activities, DEEP developed an innovative nitrogen-trading program, the Connecticut Nitrogen Credit Exchange Program, among 79 sewage treatment plants located throughout the state. This program identifies the "Total Maximum Daily Load" of nitrogen that can discharged into the Sound without impairing its health. Between 2002-2014, the Nitrogen Credit Exchange has reduced the nitrogen load from that source by nearly 65%.

The program encouraged denitrification at WPCFs with increased Clean Water Fund (CWF) grants, spread nitrogen removal upgrades over thirteen years (thereby reducing the financial impact on the CWF), and provided a fiscal alternative to the immediate expenditure of capital funds. The trading program is estimated to have saved $300-400 million by targeting facility upgrades that will have the greatest water quality benefits.

The trading program is governed by a general permit and is centrally managed by the Nitrogen Credit Advisory Board, which also sets prices. In 2017, the NCAB established the value of an equalized nitrogen credit for buyers at $6.61 per equalized pound and sellers at $2.59 pound for trading. Also in 2017, thirty-three facilities were required to purchase credits equivalent to 979 lbs in order to remain in compliance with the NGP. Those payments totaled $2,361,356 and were shared amongst the forty-six facilities selling credits equivalent to 2499 lbs.



[35] Clean Water Solutions to Reduce Nitrogen Pollution - Long Island Sound Study
[36] AN ACT CONCERNING THE SUSTAINABILITY OF THE NITROGEN CREDIT EXCHANGE PROGRAM.
[37] Public Act No. 01-180 for Substitute Senate Bill No. 1012
[38] Connecticut's Nitrogen Trading Program
[39] NitrogenReport2017pdf.pdf (ct.gov)

4.2. Water Quantity

Communities pursue water quantity projects to enhance resilience to flooding and sea level rise and are of increasing importance with more intense rainfall and hurricanes as a result of climate change. Stormwater is the water quantity challenge that is most often targeted by municipalities and is managed through green and grey infrastructure.

Stormwater runoff refers to water that is not absorbed by soil (because the surface is saturated or sealed), and flows on impermeable land cover, such as roads. In natural settings, the surface is usually permeable and can absorb large amounts water, resulting in minimal stormwater runoff.[40] Urban areas experience high amounts of stormwater runoff due to the large amount of impermeable surface (e.g., roads, sidewalks, parking spaces, housing properties) which results in inhibited infiltration, interrupted hydrological cycles, and thus significantly higher surface runoff volumes and peak flows.

Urban conditions cause stormwater to reach receiving streams and sewage systems quickly and in large volumes, resulting in higher peak flows. This is a particularly challenging issue for older cities with combined sewage systems. These systems collect sewage and stormwater and channel it to wastewater treatment facilities. During heavy precipitation events, these systems do not have sufficient capacity to handle the excess water (and resulting overflow) and discharge the mixed, untreated wastewater and stormwater directly into streams and rivers, causing pollution and further negative environmental impacts for these water bodies.

Flooding from tidal systems, riverine overflow, and sea level rise are additional water quality challenges that can impact both urban and rural communities. Impermeable surfaces, as well as low elevation of roads, buildings, sea walls and berms, increase community vulnerability to flooding and can result in stormwater system overwhelm, putting people and property at risk.

Unlike carbon offsets or water quality markets, there is no commoditized external market for avoided stormwater runoff and flood risk reduction. For example, an individual couldn't purchase a credit for gallons of stormwater reduced the same way one could purchase carbon offset credits through a verified marketplace. Instead, any agreements for 3rd parties to pay for water "quantity" benefits need to be agreed upon on an ad hoc basis. Therefore, private individuals and organizations have few external incentives to pursue costly activities such as green roofs or permeable pavements.

[40] Stormwater Markets: Concepts and applications (iisd.org)

Market Structure

Municipalities tend to select water quantity projects to implement that are projected to save money, often in a 1-to-1 ratio of dollars invested to dollars saved, due to tight municipal budgets. Market mechanisms can result in more ambitious or numerous projects being implemented because a greater number of stakeholders are investing, with the benefits also being at a greater scale.

Below are some of the financial tools used in the stormwater market:

- **Credit Trading** – Stormwater retention credits are a common option for the trading of allowances. One example is Washington D.C.'s specific credit for property developers. Since projects are required by the municipality to meet a 1.2-inch runoff retention standard, developers are allowed to buy credits when their projects do not comply with the limit.

- **Environmental Impact Bonds** – Environmental Impact Bonds (EIBs) represent innovative financing mechanisms aimed at mobilizing private capital investors to supplement public investment. A distinctive feature of this kind of public-private partnership is that the investors are only repaid if the desired social outcomes are achieved. Quantified Ventures worked with Washington D.C. to issue the first "Pay-for-Success" EIB in September 2016. The 30-year tax-exempt municipal bond (with a mandatory tender in year five) foresees payments by either the municipal water utility or investors based on predetermined performance requirements.

- **In-Lieu Fees** – In-lieu fee programs are designed to allow developers that are not able to meet the runoff regulation requirements, to pay a fee for the expected runoff volume that their projects could generate. These fees are used by governments for the construction of runoff mitigation facilities like the ones implemented in Park Ridge, Illinois; Aspen, Colorado; and San Antonio, Texas.

- **Permittee-Responsible Mitigation (Offsets)** – Also known as payment for performance (P4P), the offset or voluntary action compensation is implemented after benefits are accrued (regardless of the focus of the intervention). The metrics used can vary. For example, MS4 activities in Maryland are quantified based on acres of impervious surfaces while Pennsylvania looks at the volume of sediment.

Market Activities

Communities typically consider a mix of green and grey infrastructure when exploring projects to address water quantity challenges. Green infrastructure in the context of stormwater comprises natural and/or man-made elements that provide, improve, or restore ecological and hydrological functions and processes to manage wet weather impacts.[41] According to the U.S. Environmental Protection Agency, green infrastructure "uses vegetation, soils, and natural processes to manage water and create healthier urban environments".[42] Other terms in the literature that are commonly used to refer to green infrastructure are low-impact development, rainwater management or natural stormwater management.

There are numerous green infrastructure activities that can help reduce the risks of stormwater and flooding, for example:

- **Green Roofs** – Green roofs – a roof of a building that is covered with layers of vegetation – usually consist of four layers: waterproof membrane, drainage layer, growing medium, and vegetative cover layer.

- **Rainwater Harvesting** – Capture of runoff generated from impermeable areas in a storage facility (wide range of sizes available). Shared and integrated rainwater harvesting systems are two common types.

- **Rain Gardens/Bioretention** – Relatively small, ground-level spaces consisting of a mixture of sand, vegetation, and organic filter media to treat polluted runoff.

- **Bioswales** – Narrow, below-ground-level sloped drainage areas with grass or vegetation. These can continue over long distances. Located next to roads and walking paths, at roadway medians, shoulders, and parking lots.

- **Planter Boxes** – Bio-infiltration-based structures with vertical walls. Located in transportation corridors or parking areas.

- **Permeable Pavements** – There are different types including porous asphalt, permeable concrete, permeable pavers, open-matrix pavement.

- **Constructed Wetlands** – Relatively large, natural ponds to collect rainwater. Detention ponds stay dry during times of no rainfall whereas retention ponds hold a constant amount of water.

- **Urban Tree Canopy** – Trees can be planted on private and public properties and can promote stormwater absorption and soil stabilization.

[41] Stormwater Markets: Concepts and applications (iisd.org)
[42] Stormwater Markets: Concepts and applications (iisd.org)

- **Land Conservation** – Protection of natural open spaces and sensitive areas within and adjacent to urban areas, such as riparian areas, wetlands, and steep hillsides. Land conservation measures take place on a neighborhood or city scale.

In the stormwater management context, grey infrastructure refers to the typical built infrastructure solutions employed to manage water, including gutters, sewers, and tunnels, among other project types. Incorporating green infrastructure solutions alongside grey infrastructure to manage water quantity can result in lower costs to municipalities and more resilient utility systems.[43]

Market Buyers & Sellers

Participants in the stormwater market are dependent on the implementation tool used.

There is no centralized market for buyers and sellers in this market because the risks and benefits of these investments are confined to discrete geographic areas. Generally, investments in utility-scale green infrastructure are made by municipalities and other government actors rather than private organizations. However, there is an opportunity to include private actors in the market.

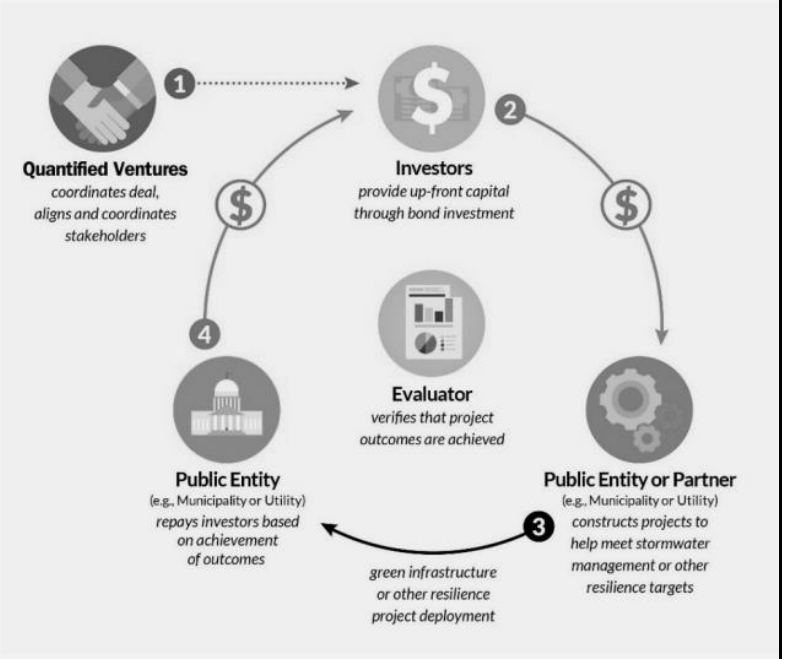
[43] Integrating Green and Gray: Creating Next Generation Infrastructure

Case Study

Environmental Impact Bond Example: Hampton Virginia

Quantified Ventures partnered with the Chesapeake Bay Foundation and the City of Hampton, VA to design and issue a $12M EIB. Hampton's three critical nature-based projects are expected to add more than 8.6 million gallons of storage capacity for stormwater that would otherwise contribute to flooding and polluted runoff in the Newmarket Creek watershed, a key environmental, economic, and transportation corridor. Water equity in the City will be enhanced as low- to moderate-income communities that have suffered the most from chronic flooding will see improved conditions.

The City attracted the usual mainstream municipal bond investors based on Hampton's excellent credit rating as well large ESG-oriented bond investors, who were attracted by the bond's enhanced impact measurement. The increased investor demand led to the bond being well oversubscribed – with the majority bought by ESG funds – putting downward pressure on interest costs. The project is still under construction and has no outcomes to report as of June 2022.

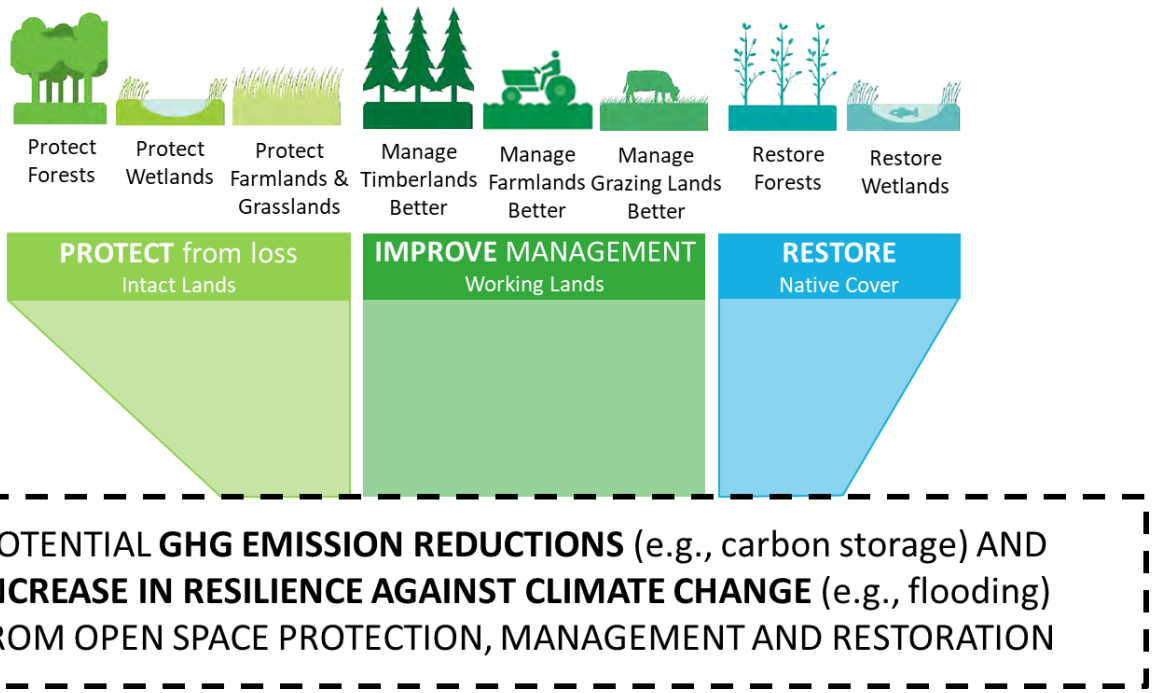


4.3. Wetland and Habitat Restoration

There are approximately 220,000 acres of wetlands in Connecticut representing about 7% of land within the state, which includes tidal and inland wetlands. Of the 91 miles of coastline, tidal wetlands are the most vulnerable natural resource in the face of climate change and rising sea levels.[44] These resources are among the most biologically productive resources in the world, provide habitat for wildlife, improve water quality by trapping sediments and filtering contaminants, protect shorelines, and are a source of carbon sinks. Inland wetlands, including the 5,800 miles of rivers and 65,000 acres of lakes,[45] are key resources in terms of stormwater retention and rivers and ponds provide water retention to mitigate flooding, and they are essential to surface and underground fresh water, provide critical habitat to wildlife, and are a source of

[44] "Wetlands Sub-Group Report 2020" of the Working & Natural Lands Working Group of the Governor's Council on Climate Change (p. 6)
[45] "Rivers Sub-Group Report 2020" of the Working & Natural Lands Working Group of the Governor's Council on Climate Change (p. 4)

carbon sinks. Wetlands provide a number of ecosystem services, including provision services (e.g., food, water), regulating services (e.g., carbon sequestration, moderation of extreme storms), support services (e.g., habitat, biodiversity), and cultural services (e.g., recreation, tourism, physical and mental health).



Market Structure

Wetland, habitat, and biodiversity markets focus on the replacement of wetlands, habitat, vegetation, and other natural features that are damaged by development or land use actions. Credits are generally produced through restoration of specific habitat types, although occasionally credits can be achieved through protection of intact habitats. Wetland mitigation banking is commonly used to compensate for wetland impacts from development, but it is also used for impacts from agriculture.

A wetlands mitigation bank is a wetland area that has been restored, established, enhanced or preserved, which is then set aside to compensate for future conversions of wetlands for development activities[46]. Once they've secured the approval of regulatory agencies, permittees can purchase credits from a mitigation bank to meet their mitigation requirements. Given they are the ones selling the credits, the mitigation bank sponsor is ultimately responsible for the success of any mitigation activities. These mitigation banking activities are performed "off-site," meaning it is at a location not on or immediately adjacent to the site of impacts, but within the

46 https://www.epa.gov/sites/default/files/2015-08/documents/compensatory_mitigation_factsheet.pdf

same watershed. The value of the credits is determined by quantifying increases in wetland acres or improved wetland functions.

There are two types of mitigation banks. Wetland or stream mitigation banks offer mitigation credits to offset permitted ecological damages that impact wetlands and streams. These are regulated and approved by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA). Conservation banks offer mitigation credits to offset permitted project activities that negatively impact endangered species and/or their habitats. These are regulated and approved by U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS).

The market is constrained by the complex and time-consuming process for certifying mitigation and conservation banks. While formal banks provide the most dependable way to supply wetland and habitat credits, it is difficult to navigate the extensive review and approval process for new banks in Washington. This option will appeal to only the most dedicated farmers and ranchers.

The Environmental Protection Agency[47] has defined four distinct components of a mitigation bank:

1. **Bank site** – the physical acreage that is restored, established, enhanced, or preserved.
2. **Bank instrument** – the formal agreement between the bank owners and regulators establishing liability, performance standards, management and monitoring requirements, and the terms of bank credit approval.
3. **Interagency Review Team (IRT)** – the interagency team that provides regulatory review, approval, and oversight of the bank.
4. **Service area** – the geographic area within which permitted impacts can be compensated for at a given bank. Regulatory agencies determine service areas based on physical and ecological attributes such as watersheds, soil types, species recovery units, or species and population distributions.

Market Activities

Mitigation can come in one of four forms: restoration, creation, enhancement, or preservation[48]. Restoration is the rehabilitation of a wetland or stream with the goal of returning it to its original state – often resulting in the net gain of wetland function or acres. A wetland can also be created by manipulating the physical, chemical and/or biological characteristics of the site – which also results in a net gain in wetland acres and function. Enhancement focuses specifically on improving one or more wetland functions, such as water quality, and results in a net gain of wetland function but not acreage. Preservation entails the permanent protection of wetlands through legal mechanisms such as conservation easements but does not result in the net gain of wetland acreage and can only be used in certain circumstances. While projects may vary across each of

47 https://www.epa.gov/cwa-404/mitigation-banks-under-cwa-section-404
48 https://www.epa.gov/sites/default/files/2015-08/documents/compensatory_mitigation_factsheet.pdf

these four types of mitigation, broadly speaking restoration activities include restoring the hydrology, removing invasive species, planting native species, prescribed fires, and more.

Market Buyers & Sellers

Buyers are typically public and private entities with development projects that result in damages to wetlands and other habitats and who must offset these damages in order to secure permits for their projects. If a development project has wetland impacts, local, state and federal laws require that these impacts be mitigated through restoration of wetlands on the development site or, in areas with mitigation banks, by buying credits from the bank. The largest buyers are typically utilities and road and highway agencies that have limited opportunities to avoid wetland impacts for their large, linear projects. Other buyers can include wind development projects and oil and gas pipeline projects. While impacts to other habitats and biodiversity are just as common, there are fewer buyers because the regulation of these resources is not as stringent as for wetlands. Farmers and ranchers could do wetland or habitat restoration on their land, which generates credits that a broker could sell.

Mitigation Banks involve three different parties[49]:

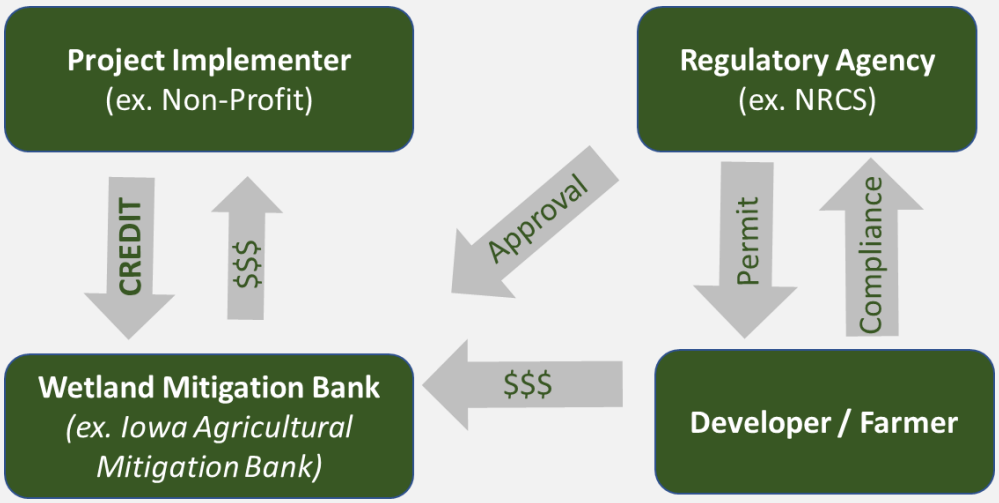
1. **Mitigation Bank Owner –** completes environmental restoration on a specific site to sell mitigation credits
2. **Regulatory agencies and inter-agency review team –** approves mitigation project and require mitigation for infrastructure and development projects
3. **Client/Permittee –** needs to offset environmental impacts from infrastructure projects ranging from a new housing development to a transportation expansion

[49] Mitigation Banking 101 - WES (wesmitigation.com)

Case Study

Mitigation Banking Example: Iowa Agricultural Mitigation

Iowa Agricultural Mitigation is a non-profit wetland mitigation bank for Iowa. Farmers, while exempted from Section 404 of the Clean Water Act, must comply with the Food Security Act and offset any wetland converted for commodity production through mitigation. IAM creates credits through investing in large-scale mitigation projects, and then sells them to farmers who need mitigation. IAM typically sells ~35 credits per year but this fluctuates depending on economic conditions. IAM is currently the only provider of agricultural-specific wetland mitigation credits in Iowa and has received $1.7M in NRCS funding. Current price is $15,000 per credit. Most buyers typically only require a single credit.



4.4. Parks & Recreation and Brownfields

Public parks and recreation facilities are typically provided as a public good and are offered for free or low cost and maintained by local municipalities or state agencies. The facilities often lack an adequate revenue streams to directly fund maintenance and improvements and operate at a loss despite providing valuable services to a community.

Nationwide, outdoor recreation is a massive economic driver which generates $689 billion in annual consumer spending and is responsible for 4.3 million jobs[50], $65.3 billion in federal tax revenue, and $59.2 billion[51] in state and local tax revenues. This represents 1.8% of the United States GDP, five times bigger than the United States film industry. Demand has also increased dramatically due to the COVID-19 pandemic, with the percentage of the population that participated in outdoor recreation rising to 52.9% in 2020 - up from 50.7% in 2019 - the largest one-year jump on record. Outdoor recreation added $3.3 billion in value to Connecticut's economy in 2020.[52]

Brownfield & Community Rejuvenation in Meriden

The City of Meriden, Connecticut, has layered ecosystem services projects to revitalize its downtown. The City's "Meriden Green" project began in 2007 and included brownfield site repair, the construction of large urban park, flood mitigation and stormwater management, and housing redevelopment. The project leveraged private, local, state, and federal investment to complete the project.

Source

Across the country, land managers of outdoor recreation assets in rural communities are facing increasing strain from the impacts of overuse and climate change. Due to stagnant or declining budgets, land managers have neither the resources to properly mitigate climate impacts nor to strategically capitalize on increased visitation. Instead, land managers become locked in a pattern of deferred maintenance and siloed decision-making. When land managers are only able to fund necessary maintenance rather than investing in projects of strategic importance, opportunities for the surrounding communities to benefit from the public lands are diminished. This is an area where innovative financing can provide upfront capital for strategic projects and unite land managers and stakeholders around a common vision.

Environmental Justice and Brownfields

In urban areas, safe and vibrant outdoor recreation is a critical component of public health and community wellbeing. Neighborhood parks can provide space for respite, athletic pursuits, and interaction with nature. Parks and other urban green spaces can also provide environmental benefits, by absorbing stormwater, reducing extreme heat, sequestering carbon, and providing cleaner air and a reduction in asthma rates. However, low-income and communities of color have not received the same level of investment for recreation amenities, leading to significant

[50] https://www.bea.gov/Bureau of Economic Affairs 2021; U.S. Bureau of Economic Analysis (BEA)
[51] Outdoor Recreation Roundtable 2020; Outdoor Recreation Satellite Account
[52] Outdoor Recreation Satellite Account, U.S. and States, 2020 | U.S. Bureau of Economic Analysis (BEA)

disparities in access to parks and open space. Additionally, the loss in benefits from these green assets can be compounded by other environmental injustices.

Not only are many low-income and communities of color lacking in beneficial recreation amenities, they have also historically been targeted for the siting of harmful activities or industries. Communities that experience disproportionate public health effects from fossil fuels, transportation emissions, and other forms of pollution are referred to as "environmental justice communities". Studies have connected harms including asthma, low birth weights, and lead poisoning to the disproportionate exposure to air pollution and toxic chemicals in low-income neighborhoods.[53] Environmental justice communities face increased exposure to the harms of climate change. In urban areas, environmental justice communities are more likely to be impacted by the effects of extreme heat waves, and less likely to have reliable or affordable ways to cool down. When they face extreme weather impacts in the form of fire or flooding, environmental justice communities are more likely to experience longer outages and less likely to be able to afford to start a new life elsewhere. The Fourth National Climate Assessment found that low-income communities in urban and rural areas face disproportionate harms.[54] In June 2022, the Department of Health and Human Services announced the establishment of the Office of Environmental Justice in the Office of Climate Change and Health Equity to coordinate the Department's efforts to protect the health and wellbeing of vulnerable populations and disadvantaged communities.[55]

Low-income communities and communities of color are also more likely to live in fence-line communities that are near polluting fossil fuel infrastructure. These communities have long fought for regulatory interventions to mitigate the harms caused by fossil fuel infrastructure, including heavy industrial manufacturing, and are increasingly forcing the decommissioning of this infrastructure. However, once the polluting facilities are closed, capital is required to rebuild, repair, and renew damaged community infrastructure. Currently, communities depend on scarce philanthropy and governmental grants to undertake these rebuilding efforts.

In some cases, the land where the now-closed facility operated has suffered such strong environmental degradation that it will be classified as a brownfield site. A *brownfield* is a property where the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. It is estimated that there are more than 450,000 brownfields in the United States, with over 500 in Connecticut.[56] Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures from undeveloped, open land, and both improves and protects the environment.

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[53] DOI: Socioeconomic Disparities and Air Pollution Exposure; Urban green space, public health, and environmental justice

[54] Fourth National Climate Assessment (globalchange.gov)

[55] Department of Health and Human Services: Establishment of the Office of Environmental Justice

[56] Brownfields Site Inventory (ct.gov)

Private investors are often wary of the high costs and regulatory burden associated with redeveloping a brownfield property, which results in these sites being undervalued on the market. Financial mechanisms that can incentivize brownfield remediation and address the market inequities can make it possible for investment and revenue to flow into the surrounding communities.

Market Structure

Funding is only a single part of holistic approach to parks and recreation-based economic development that leverages and connects existing tools and agencies to integrate conservation, recreation, and economic development goals so that all parties are working toward the same vision. Because stakeholders involved in rural economic development tend to be fragmented across multiple programs and departments, bridging the disconnect between land managers and local communities requires a collective approach that intentionally integrates these players into a formal structure. This approach will require changing the way projects are funded and the types of agencies that are considered in the parks and recreation ecosystem. At the federal and state level, there is a need to connect public works, health, and economic development agencies on projects whose benefits span across their portfolios, while at the local level there is a need to provide innovative financial solutions to support local, under-funded governments that need it. The long-term goal is to adapt stakeholders' definition of community development to link parks and recreation and adjacent economies.

Market Activities

There is an enormous range of potential parks and recreation activities that public lands can be used for, including:

- **Public parks** – Public parks that are well maintained, facilitate multi-season activities, and are accessible to a wide number of nearby residents can provide a much-needed recreation and relaxation site for a community. Amenities such as playgrounds, picnic shelters, game areas, and walking paths can add to the utility and appeal of the park and the installation of green infrastructure can enhance the park's ecosystem services.

- **Game Areas** (ex. tennis, basketball) – The establishment of game areas can benefit a community by providing unstructured recreation and facilities for youth or adult sports leagues that will benefit residents, attract visitors, and promote the local economy.

- **Walking and Hiking Trails** – Walking and hiking trails can provide a recreation activity that improves public health and can attract visitors who partake in the activity elsewhere.

- **Mountain Biking Trails** – Mountain biking trails require limited construction and maintenance and can facilitate recreation for mountain biking sport enthusiasts, which can lead to increased tourism for rural areas and contribute to the local economy.

- **Camping** – In rural areas, campgrounds can allow for increased use of a recreation area, allowing for individuals to spend more time in the natural space and providing lodging that caters to different interests.

- **Hunting** – In rural areas, hunting can provide a recreation opportunity in a variety of landscapes.

- **Boating/Fishing** – In waterfront communities, a boating and/or fishing recreation service can utilize natural outdoor features to support economic growth in an area. The inclusion of blue infrastructure in site planning can enhance the ecosystem services of the amenity.

Parks and recreation facilities can be categorized as "active" or "passive", tend to have different stakeholder ownership and management.[57]

- **Active Recreation:** Municipalities tend to be the lead stakeholder for active outdoor recreation sites and the highest use frequency index is for swimming

- **Passive Recreation:**
  - Statewide – hunting
  - Municipalities – boating, fishing, passive park use, beach use, trails
  - Other – camping

In instances where the public land is a brownfield site, there are required steps to remediate the degradation of the land that must occur before it transitions to being a place of outdoor recreation. These steps include an analysis of the proposed cleanup process, a codified community relations plan, and ongoing assessment of the cleanup activities. These activities can be expensive and time consuming, often disincentivizing private investments and forcing interested parties to rely on grant opportunities.

Market Buyers & Sellers

The "buyers" of outdoor recreation services are the users, but often they are not purchasing outdoor recreation outcomes directly. Rather, the benefit of this market is captured in the environmental and public health outcomes or the money that recreation users spend offsite but as a direct result of partaking in the recreation. For example, if a family decides to go camping, while they may pay a nominal campground fee, the economic value generated is primarily focused on what they are spending on food, equipment, gas, and other goods and services that support that activity.

Conversely, the "sellers" of outdoor recreation services are often public land managers who do not generate revenue directly from the users of their land. The outdoor recreation "buyers" and

[57] Information is pulled from the Connecticut Green Bank's Environmental Infrastructure Parks and Recreation Observations from January 2022 Stakeholder Outreach

"sellers" can consider a pay-for-success model, whereby the benefits of the project are quantified and trigger investment repayment from the revenue-collecting "buyer", to bridge the disconnect.

When the land being developed for parks and recreation or commercial purposes is a brownfield site, the costs of clean-up and redevelopment are higher, disincentivizing buyers. This often results in the property being left in limbo because the existing owners may have little use for the sites while its condition is discouraging potential buyers. However, if those costs can be overcome and brownfield sites can be redeveloped, there are likely to be significant economic benefits. In addition to the economic benefits, brownfield remediation and urban parks can have significant health benefits. In fact, many health providers have begun supporting investments in urban parks because improved community health translates to lower costs for those payors.

More than 400 studies have shown the numerous health benefits from spending time in nature. Over the past decade, medical professionals have begun to prescribe time in nature as a treatment and strategy for improved health outcomes.[58] Research has demonstrated that there are fewer opportunities to experience nature in a safe and healthy way in socioeconomically disadvantaged communities. In urban areas, robust and healthy tree canopies are most often found in wealthy and white neighborhoods, emphasizing the importance of centering environmental justice when considering where to invest in public green space.[59]

[58] Health Benefits | Parkrx
[59] Tree Equity Score - American Forests

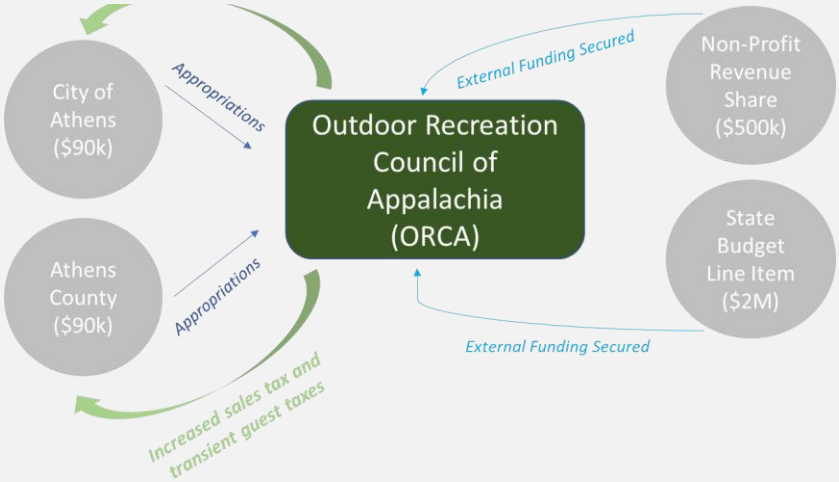
Case Study

Revenue-Sharing Example: Baileys Trail System

Quantified Ventures structured an outcomes-based transaction to fully fund the construction and operations of the Baileys Trail System, an 88-mile, premier mountain biking trail system in Athens County, Ohio, on the Wayne National Forest. The upfront cost of building the Baileys Trail System was paid for through a mix of state funding and $500k in private financing, with repayment tied to the successful achievement of the economic development outcomes, in this case increased sales tax and transient guest taxes.

Athens County, the City of Athens, the City of Nelsonville, the Village of Chauncey, and York Township formed the Outdoor Recreation Council of Appalachia (ORCA) to manage the cross-boundary infrastructure. This innovative governance structure unlocked federal & state funding, and led effort to raise financing from local impact investors.

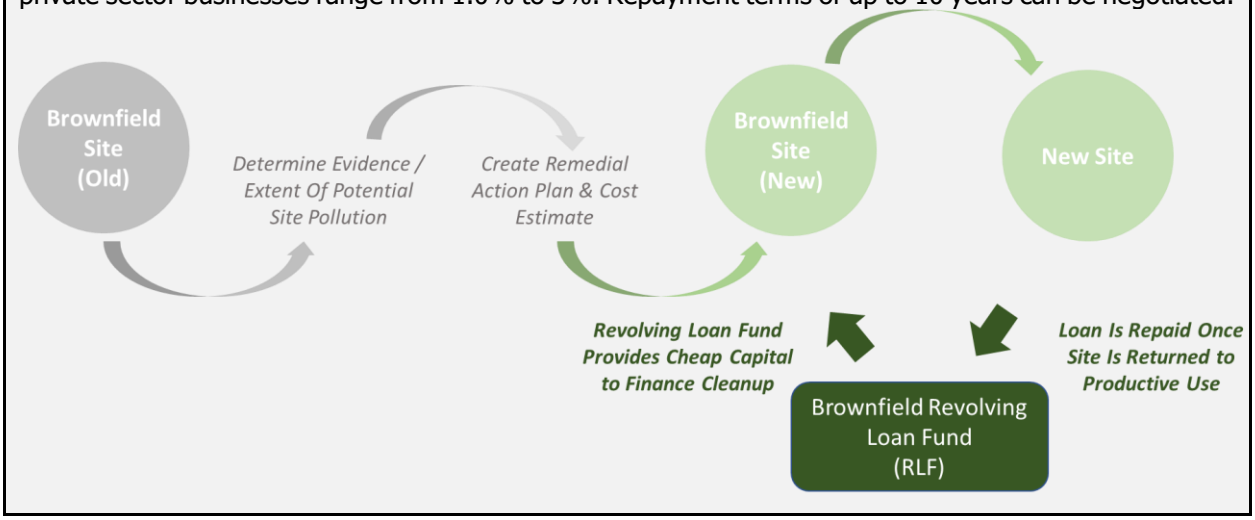
The City of Athens and Athens County will provide $90,000 each, or $180,000 total annually for twenty years. The City and County have committed to additional tax increment payments based on increases in hotel and sales taxes respectively. Those funds are projected to increase over time as visitation increases.



Revolving Loan Fund Example: West Virginia Brownfields RLF

The Brownfields Revolving Loan Fund makes financing available to public, private and non-profit borrowers for the remediation of properties contaminated with hazardous substances. Conducting environmental cleanups enables these properties to be redeveloped and returned to productive use. Not only will the removal of hazardous substances improve community health, but the remediation of these properties can make them desirable for development and will improve the property values of the surrounding properties.

Brownfields RLF can offer low-interest loans to eligible local government entities, nonprofits, and private sector businesses to assist them in the cleanup of properties contaminated with petroleum or hazardous substances. Interest rates for government and non-profit borrowers range from 0% to 1.5%. Rates for private sector businesses range from 1.0% to 3%. Repayment terms of up to 10 years can be negotiated.



5. Key Terms and Acronyms

- **Externality:** the positive and negative impacts of actions beyond their primary goal

- **Ecosystem Service:** the benefits people obtain from ecosystems.[60]

- **Environmental infrastructure:** means structures, facilities, systems, services and improvement projects related to (A) water, (B) waste and recycling, (C) climate adaptation and resiliency, (D) agriculture, (E) land conservation, (F) parks and recreation, and (G) environmental markets, including, but not limited to, carbon offsets and ecosystem services.[61]

- **Carbon Offsets:** Carbon Offsets are measurable outcomes from carbon sequestration activities, traded in voluntary and compliance markets, whereby regulations, sustainability priorities, and public relations are motivators for buyers and sellers.

- **Carbon Registry:** entities that track offset projects and issue credits for each unit of emission reduction or removal verified and certified.

- **National Pollutant Discharge Elimination System (NPDES) permits:** A program that addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Created in 1972 by the Clean Water Act, the NPDES permit program is authorized to state governments by EPA to perform many permitting, administrative, and enforcement aspects of the program.[62]

- **Municipal Separate Storm Sewer Systems (MS4s) program:** A program administered by the U.S. Environmental Protection Agency that requires each municipality to take steps to keep the stormwater entering its storm sewer systems clean before that stormwater enters water bodies.[63]

- **Total Maximum Daily Load (TMDL):** the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that pollutant.[64]

- **Environmental Impact Bonds (EIBs):** A bond whereby the payment terms are linked to agreed-upon environmental outcomes.

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[60] https://www.fs.usda.gov/ecosystemservices/About_ES/index.shtml
[61] Governor Lamont Signs Executive Order Directing Connecticut State Agencies To Implement Actions That Reduce Carbon Emissions and Adapt to Climate Crisis
[62] National Pollutant Discharge Elimination System (NPDES) | US EPA
[63] Municipal Stormwater (ct.gov)
[64] Overview of Total Maximum Daily Loads (TMDLs) | US EPA

- **Pay-for-Success:** A contracting and financing mechanism in which investors provide upfront capital for a program or intervention, with payments tied to the achievement of specific measurable outcomes.

- **Environmental Justice Communities:** Communities that experience disproportionate public health effects from fossil fuels, transportation emissions, and other forms of pollution. Studies have connected harms including asthma, low birth weights, and lead poisoning to the disproportionate exposure to air pollution and toxic chemicals in low-income neighborhoods.[65]

- **Brownfield:** a property where the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. It is estimated that there are more than 450,000 brownfields in the United States, with over 500 in Connecticut.[66]

- **In-Lieu Fee:** In-lieu fee programs are designed to allow developers that are not able to meet the runoff regulation requirements, to pay a fee for the expected runoff volume that their projects could generate.

[65] DOI: Socioeconomic Disparities and Air Pollution Exposure; Urban green space, public health, and environmental justice

[66] Brownfields Site Inventory (ct.gov)

6. Appendix

European Union Emissions Trading System (ETS)

The EU ETS[67] follows a cap-and-trade approach: the EU sets a cap on the amount of greenhouse gases that can be emitted within one calendar year for companies in particular sectors, and those companies need to hold an European Emission Allowance (EUA) for every ton of CO2 they emit within one calendar year. They receive or buy these permits – and they can trade them. Companies must hold allowances corresponding to their CO2 emissions, making power production from burning coal and other fossil fuels more expensive and clean power sources more attractive. The system incentivizes firms to become more energy efficient because they can then sell their emissions permits on the market.

California Air Resources Board (CARB) Offset Credit Program

The Cap-and-Trade Regulation establishes a declining limit on major sources of GHG emissions throughout California, incentivizing investment in cleaner, more efficient technologies. The Regulation applies to emissions that cover approximately 80 percent of the State's GHG emissions. CARB creates allowances equal to the total amount of permissible emissions (i.e., the "cap). One allowance equals one metric ton of carbon dioxide equivalent emissions (using the 100-year global warming potential). Each year, fewer allowances are created and the annual cap declines. The Compliance Offsets Program[68] is an important cost-containment element within the broader Cap-and-Trade Program. Offset Credits are issued to qualifying projects that reduce or sequester greenhouse gases (GHG) within the program's protocols, and those credits represent verified GHG emissions reductions from sources not subject to a compliance obligation in the Cap-and-Trade Program. In addition to their climate and other environmental benefits, offset credits provide important cost containment and compliance flexibility for covered entities.

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[i] The VCS Program is the world's most widely used greenhouse gas (GHG) crediting program.

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[67] https://www.cleanenergywire.org/factsheets/understanding-european-unions-emissions-trading-system
[68] https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/about