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House of Representatives
COMMONWEALTH OF PENNSYLVANIA

HOUSE DEMOCRATIC POLICY COMMITTEE HEARING

Topic: The Environmental Economy

G-50 Irvis Office Building – Harrisburg, PA

September 14, 2020

AGENDA

2:00 p.m. Welcome and Opening Remarks

2:10 p.m. Panel One:

- Jacquelyn Bonomo
  Executive Director, PennFuture
- Stephen Herzenberg
  Executive Director, Keystone Research Center
- Sara Nicholas
  Policy Strategist, PASA Sustainable Agriculture
- Sharon Pillar
  Pennsylvania Consultant Advocate, Environmental Entrepreneurs

2:40 p.m. *Questions & Answers*

3:00 p.m. Panel Two:

- Lauren Imgrund
  Deputy Secretary of Conservation & Technical Services, Pennsylvania Department of Conservation and Natural Resources
- Faith Zerbe
  Water Watch Director, Delaware Riverkeeper Network
- Erin Cosgrove
  Director of Regulatory Affairs, Keystone Energy Efficiency Alliance

3:20 p.m. *Questions & Answers*

3:40 p.m. Closing Remarks

PennFuture

House Democratic Policy Committee Hearing
September 14, 2020

Jacquelyn Bonomo, President & CEO
PennFuture

Good morning, and thank you for the opportunity to address the House Democratic Policy Committee on how Pennsylvania can build a more sustainable economy.

I am Jacqui Bonomo, president of PennFuture, a statewide environmental advocacy organization working on clean air, water, energy and climate issues. I am speaking to you from my home in beautiful northeast Pennsylvania, in southern Luzerne County, as our organization has instituted a mandatory work from home policy since mid-March.

The COVID-19 pandemic has profoundly impacted Pennsylvania. Our eyes have been glued to news on case counts and the needless deaths caused by the virus. Well over 2 million workers have filed for unemployment since the pandemic hit the Commonwealth, creating one of the largest state unemployment crises in the country. The deep and rapid decline of our economy has been stunning and the uncertainty surrounding every business reopening, and event cancellation portends to a long road ahead.

Pennsylvania needs to take decisive state action to provide its residents a light at the end of the tunnel—family-sustaining job opportunities for today and a stronger, more resilient economy in the future.

But the pandemic shouldn't blind us to the fact that the state economy wasn't built to last before the pandemic. Economic analysis showed signs of weakness—state job growth was tracking worse than the national average. Even at its peak employment numbers, the Commonwealth had one of the worst racial equity rankings according to WalletHub. The United States trade war with China and the European Union significantly impacted steel and farmers. Communities throughout the Commonwealth are still recovering from industrial decline and the Great Recession. And Pennsylvania tied its hope of economic resurgence to gas frackers, pipelines, and petrochemicals only to see that industry fall flat—fossil fuel industries are reeling from bankruptcies, scaled back projects, and financial failure. We simply cannot rely on fracking and plastics to create a stronger economy.

Instead, there is a growing consensus that states like Pennsylvania should prioritize stimulus and recovery investments in sustainability, clean energy, and nature-based industries due to their powerful mix of benefits: shovel-ready job creation opportunities, retention of good-paying jobs, long-term prosperity, and significantly lower pollution. Numerous statements, reports, and proposals released during the pandemic by bipartisan and non-partisan political, business, academic, and financial leaders across the country back this up and I'm attaching PennFuture's new report *A Green Stimulus and Recovery Platform for Pennsylvania* as part of my written testimony that cite many of these statements and studies.

My basic message to this Policy Committee is this: don't treat recovery from the COVID-19 pandemic like we've treated past crises. The Great Recession should be a good learning tool—relying on steep budget cuts, waiting for federal funding, and laying off state workers is a recipe for economic malaise. Ten years of weak economic growth in the Commonwealth still hasn't brought Pennsylvania back to where it was before the Great Recession.

Instead, we need to think differently. We should reject the easy, traditional path of austerity measures that will surely be debated by this body over the coming months. It doesn't work. It slows down economic recovery and according to research on past recessions, is linked to worse public health outcomes because it becomes more difficult to protect the environment and enforce basic environmental protection laws. It wasn't long ago that Pennsylvania was cited for lax enforcement of bedrock clean water laws by the EPA after years of budget cuts to the Department of Environmental Protection, putting millions at risk. Every week there is another pipeline leak, explosion, and cancer cluster. We shouldn't let this type of future unfold again.

I want to summarize our main principles for any stimulus and recovery platform and I'm happy to dive deeper during questions.

First, keep our core environmental and conservation agencies, funds, and programs whole. Since the Great Recession, the DEPs workforce has declined by 25 percent and its budget cut by 40 percent. DCNR has built up a $1 billion maintenance backlog at our state parks and forests while it is seeing millions of more visitors than ever before. Similar budget cuts have also been levied at Pennsylvania's wildlife and river basin commissions. We're facing grave consequences today from these cuts and we should be talking about restoring and building out these important agencies, not taking the budget knife to them once again. It's dismaying that the House of Representatives spent important weeks this spring and summer debating bills that would have raided bedrock conservation funds like the Environmental Stewardship Fund and Keystone Recreation, Parks, and Conservation Fund. These types of actions are tone deaf to the needs of our residents and how we are all using public green spaces as a respite and important source of recreation.

Second, Pennsylvania should implement its own jobs program, such as a modern version of a *Civilian Conservation Corps*. Modeled after the popular new deal policy during the Great Depression, Pennsylvania could reinvent the so-called "tree army" to address the billions of dollars in natural infrastructure projects in all 67 counties—backlogged state park and forest

maintenance, green stormwater infrastructure, stream buffers, main street beautification, agriculture best-management practices, habitat management, and much more.

Rather than just a youth-based program, a modern-day Corps could leverage the large spectrum of skills from those that are unemployed, laid off from fossil fuel jobs, recently graduating from college during the pandemic, or re-entering the workforce.

Tens of thousands of jobs could be created with good paying wages and benefits. There are existing programs across the Commonwealth that offer a foundation to build from, including DCNR's Outdoor Corps, LandForce, and Power Corps PHL. While there is growing momentum at the national level to create similar programs, Pennsylvania is in a unique position because of its abundance of natural infrastructure to implement a similar program with or without federal help.

Third, support the fast-growing renewable energy sector and provide new opportunities for fossil fuel workers transitioning from failing coal and fracked gas industries. In the short-term, Pennsylvania's energy efficiency industry is poised for rapid growth and offers shovel-ready projects. Targeted investments in programs like the *Redevelopment Assistance Capital Program*, the *Pennsylvania Energy Development Authority*, DEP's *Small Business Advantage Grants Program*, and DCED's *Weatherization Assistance Program* will not only generate thousands of good-paying jobs, but also lower energy costs to small businesses and low-income residents.

Looking at longer-term recovery, Pennsylvania should continue the transition of its energy economy. Pennsylvania's aging fleet of coal plants are rapidly approaching retirement, and we need to begin planning on how to mitigate job losses and negative impacts on communities. To be successful and sustainable, we need alternatives that will not only allow economic development, but do so in a way that will also help us lower pollution and reach our climate goals.

Governor Wolf and the DEP have taken a step in this direction by working on a program to join the Regional Greenhouse Gas Initiative (RGGI), but with the assistance of the legislature that program can be more effective. House Bill 2856 (Rep. Comitta) are important steps forward that would direct funding specifically to workers and communities impacted by plant closures.

Furthermore, enabling community solar in Pennsylvania is also a common-sense step to spur jobs and economic development while helping families and businesses save money. Those who can't put solar panels on their roof could buy or lease a share of a larger system and treat the energy generated much the same way. Currently there are over 200 projects available today if only the law was changed. House Bill 531 (Rep. Kaufer) would do just that.

Fourth, Pennsylvania should make a significant investment in its nature-based small businesses and natural infrastructure. The pandemic is profoundly impacting our outdoor recreation and agriculture industries due to worker shortages, lockdowns, and less out-of-state

tourists. While Pennsylvanians are using our abundant natural resources in historic numbers, we cannot forget about the small businesses that build an important web around these green spaces, most being core businesses in our rural towns and mid-sized cities. In addition, our farmers were already reeling because of the United States trade wars with China and the European Union and the pandemic is taking many to the brink. Pennsylvania smartly made grants available to farmers through the *Working Capital Access Program* and *CARES Act* funding, but more is needed and these programs should be recapitalized and tailored to more nature-based businesses.

But these businesses also need the state to invest in fixing the natural infrastructure they so often rely upon. Pennsylvania's water infrastructure—stormwater projects, wastewater facilities, drinking water infrastructure, buffers, and the like—are in desperate need of funding. Targeted state investments in PennVest and added incentives for green infrastructure solutions would generate over 5,000 good-paying jobs for engineers and laborers.

We shouldn't also forget that Pennsylvania is home to hundreds of thousands of abandoned and orphaned oil and gas wells. These sources of legacy pollution pockmark our landscapes, cause drinking water issues, and can vent pollution into our air. DEP has located 9,000 priority wells for plugging, but there is not enough funding and work crews to do the job.

These 4 packages of green stimulus and recovery recommendations are some of the 45 made in our *Green Stimulus* report. Each would put Pennsylvania back to work now and lay the foundation for a stronger economy moving forward.

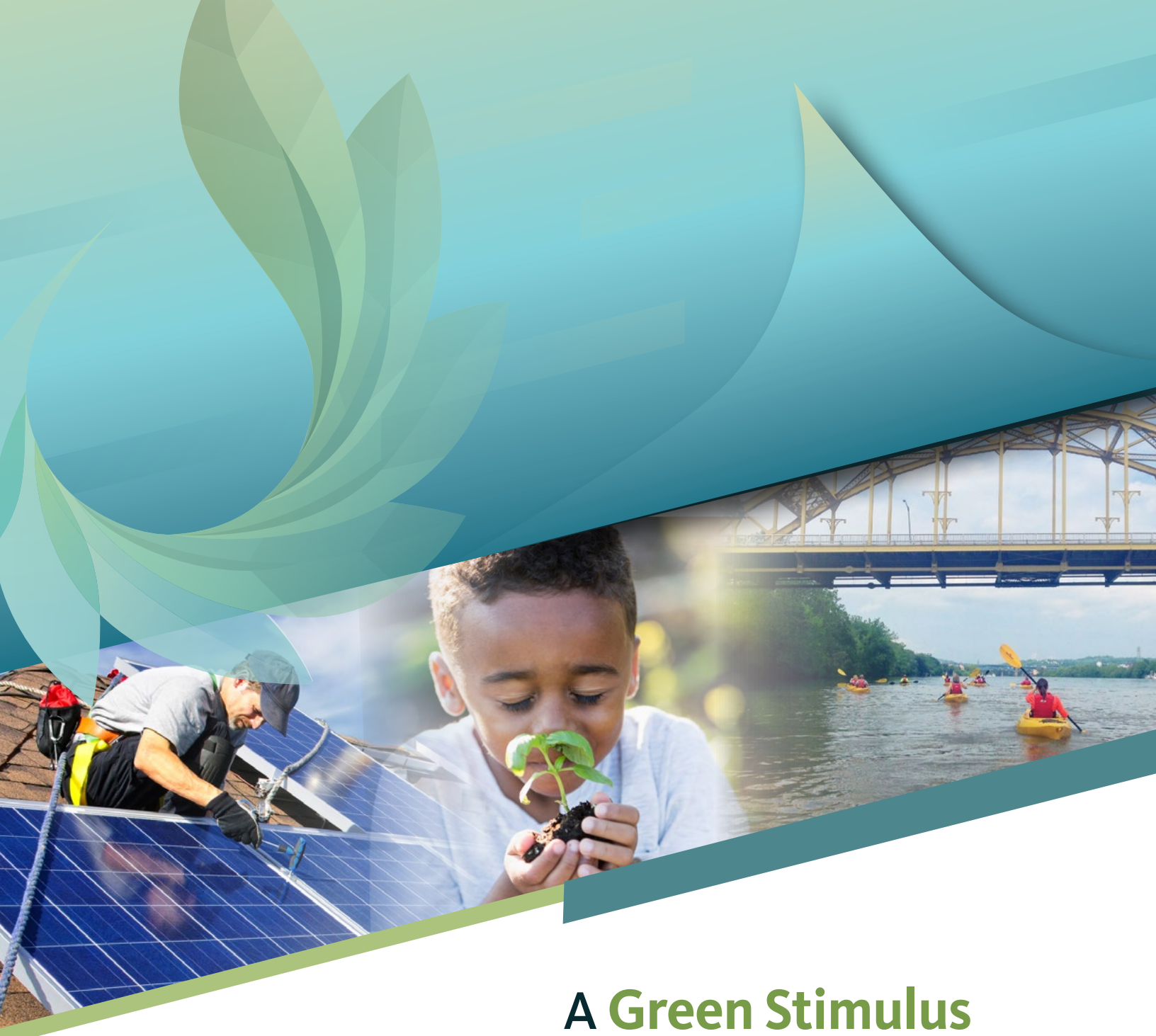
Clearly this plan moves Pennsylvania away from any further reliance on oil, gas, and coal, and in its place presents ideas, supporting policies and programs that turn the legacies of fossil fuel on our land, air and water into jobs that expand and grow a restoration industry.

And it anticipates expanding business in energy efficiency, renewable energy, and transportation that build resilience and adaptation to climate change. As just one illustration of how this is feasible for Pennsylvania to do more in this arena, let me point out WABTEC, Erie's largest employer—a union workplace—that recently announced it will be manufacturing 25 electric diesel locomotives for use in NY Transit. Pennsylvania has the workforce, technical no-how, natural infrastructure, and creativity to build a better future.

Lastly, we are greatly concerned about our recent non-college bound high school graduates, and about the less skilled among us that have lost jobs by the millions during this crisis. And we are concerned about our recent college graduates whose job prospects also have diminished so significantly, and who likely are saddled with loan debt. We wanted to be sure these folks are not forgotten, and indeed prioritized, for jobs, and jobs that strengthen our middle class in rural and urban areas alike. Recommendations like creating a *Civilian Conservation Corps* would do just that.

PennFuture published our report to provide a more balanced debate around the economy and we build back from the mess we're in today. It's easy to rely on the solutions from past crises, except we can't afford to. We know they don't work. Our economy before the pandemic was showing that and it's certainly showing it now. We stand ready to support developing a more sustainable, equitable, and resilient economy for our great Commonwealth and I hope we can move past the more destructive debates around austerity and fossil fuel subsidies so we can stop turning our back on the rapidly growing industries that don't pollute our air, water, and landscapes.

Thank you for your time.



A Green Stimulus and Recovery Platform for Pennsylvania

Putting Pennsylvania Back to Work and Investing in a Sustainable Economy

July 2020

PennFuture

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Executive Summary

The COVID-19 pandemic has deeply impacted Pennsylvania's public health, social fabric, and economy. While the initial stay-at-home measures implemented by state leaders to control the spread of the virus have loosened, public health concerns continue. The resulting strain on the state economy is without precedent, including historic unemployment rates, millions filing unemployment claims, and businesses shuttering for months or permanently. The pandemic and economic downturn are disproportionately impacting communities of color and regions already beset by pollution. In response, momentum is building to transform our nation's economy into one that is sustainable, resilient, and equitable.

This green stimulus and recovery platform lays out an agenda to take advantage of Pennsylvania's homegrown sustainable industries—nature-based, outdoor tourism, agriculture, and renewable energy businesses—to put people back to work as well as rebuild a more equitable economy through the lens of sustainability and clean energy. As Table 1 summarizes, **the stimulus proposals call for $2.83 billion in annual investments for the duration of the pandemic and other policy reforms, which we estimate will preserve or create over 389,000 jobs. Additional economic benefits would come from the recommendations on growing and transitioning to a clean energy economy.**

The policy recommendations made in this platform fall under five categories and are summarized below:

Avoid State Budget Cuts that Will Harm Economic Recovery

In times of recession, state policymakers often rely on agency cuts and layoffs to balance the budget against declining revenue, often targeting environmental, conservation, agriculture, and wildlife programs. Turning the budget knife on these programs again will only prolong our current economic decline. State policymakers should reject broad-based austerity measures and instead advance policies that build upon these important agencies to jumpstart the economy.

Preserve Nature-Based Small Businesses from Collapse

Safely Reopening and Supporting Nature-Based Small Businesses. Nature-based small businesses and outdoor recreation are crucial to the Commonwealth's economic recovery, particularly to more rural areas of the state. We recommend state policymakers do the following:

- Create a one-stop shop of recovery guidance for nature-based businesses.
- Develop a *Reopening Pennsylvania Nature Tourism* report on safely reopening during the pandemic.
- Launch an *Explore PA's Natural Beauty Campaign*, targeting in-state residents on how to safely take advantage of Pennsylvania's outdoor amenities during the pandemic.
- Pass legislation allowing small business tax deductions for safety measures and expenses.
- Increase funding for DCNR's *Community Conservation Partnership Program Grants* and temporarily eliminate the matching requirement.
- Provide operating grants of at least $25 million to state *Community Development Financial Institutions* and other regional economic development entities to support nature-based small businesses in regions impacted the most by the pandemic, including low-income black and brown communities and environmental justice areas.
- Re-capitalize the *COVID-19 Working Capital Access Program* by at least $100 million to support nature-based businesses in regions that may not be able to reopen during the summer and fall tourism seasons.

Support Small Farmers and Food Producers. Pennsylvania's farmers are in crisis. As a key player in the state economy, but also important stewards of our natural spaces looked at to reduce pollution, we recommend policymakers do the following to support them:

- Develop resources to connect job seekers to opportunities on farms during harvesting.
- Expand the *COVID-19 Working Capital Access Program* by $250 million and increase eligibility to keep small family farms from cutting payroll to avoid bankruptcy during the pandemic.
- Re-capitalize the *Resource Enhancement and Protection* tax credit by $25 million and allow for more flexible credit trading.
- Expand DCNR's *Riparian Forest Buffer* program to $1 million.
- Increase PDA's *Farmland Preservation* program to $76 million to preserve more farmland during the pandemic and offset reductions in county investments.
- Establish an *Agricultural Cost-Share Program* and initially fund it at $25 million per year to invest in farm pollution reduction projects that also improve land productivity.

"PENNSYLVANIA SHOULD IMPLEMENT A MODERN-DAY CONSERVATION CORPS TO PUT PEOPLE BACK TO WORK WITH FAMILY-SUSTAINING WAGES THAT REBUILD OUR NATURAL INFRASTRUCTURE."

Create a Green Jobs Program to Put Pennsylvania Back to Work

Create a PA Conservation and Economic Recovery Corps (CERC). Pennsylvania should implement a modern-day Conservation Corps (CERC) to put people back to work with family-sustaining wages that rebuild our natural infrastructure:

- Set a goal of hiring at least 15,000 unemployed Pennsylvanians in the first 12 months for at least 6-month terms, which could be extended based on their needs and project needs.
- In addition to unemployed skilled workers, CERC should also provide employment opportunities for students, graduates, youth, and black and brown communities which are being disproportionately impacted by the pandemic.
- Projects would focus on state park and forest maintenance, habitat management, green stormwater infrastructure construction, stream buffer implementation, Main Street beautification, agriculture projects, tree planting, and other natural infrastructure needs.

- CERC would provide family-sustaining wages of at least $24/hour, plus health benefits, paid sick leave, and paid time off.
- Counties should submit lists of CERC-based job opportunities, organized by DCNR's nature-based regions, heritage areas, urban communities, and environmental justice areas so that projects are equitably spread across the Commonwealth.

Address Legacy Drilling and Mining Pollution. Abandoned mines and orphaned oil and gas wells have created legacy pollution issues scarring Pennsylvania's landscapes, polluting its waters, diminishing outdoor activity experiences and holding back economic development. To create jobs and new development opportunities, policymakers should:

- Invest $453 million over 4 years in DEP's Abandoned & Orphan Well Program to clear a backlog of 9,000 abandoned wells that are "shovel-ready."
- Invest $220 million over 4 years in DEP for mine reclamation projects, doubling the number of projects sourced through existing funds.
- By pressuring Pennsylvania's elected federal policymakers, support and pass the RECLAIM Act, which would provide at least $300 million in mine reclamation funding to the state.

Modernize Our Homes and Businesses through Energy Efficiency Projects. Energy efficiency is one of the largest clean energy industries in Pennsylvania and is well situated to implement projects that save homeowners, renters, and businesses money as well as reduce pollution:

- Increase borrowing authority of the *Redevelopment Assistance Capital Program* by $250 million to issue grants for energy efficiency retrofits in schools.
- Re-capitalize the *Pennsylvania Energy Development Authority* by $100 million to provide financial vehicles for large efficiency projects.
- Work with the PUC to convene stakeholders to share best energy practices, develop new tools, and build consensus on advance payment provisions.
- Increase funding for DEP's *Small Business Advantage* program to $10 million and increase project caps for efficiency projects at small businesses.
- Expand the DEP *Small Business Pollution Prevention Assistance Account* to $20 million and expand loan eligibility to multifamily buildings.
- Expand DCED's *Weatherization Assistance Program* by $20 million to support grants to low-income housing retrofits.

Support Shovel-Ready Clean Water Infrastructure Projects. Pennsylvania has significant clean water infrastructure needs, many of which are shovel-ready, providing good-paying jobs, supporting utilities financially impacted by the pandemic, and providing clean water:

- Appropriate $360 million over 4 years to PENNVEST for drinking water and wastewater infrastructure projects, including set-asides for designing and implementing green infrastructure projects.
- Amend Act 30 of 2018 to include green stormwater infrastructure in the definition of "water conservation project," so that clean water projects are eligible for Commercial PACE programs.
- Create a *Green Stormwater Infrastructure Grant* program at DEP, initially funded at $25 million, to support projects in the design phase, including support for municipalities designing local projects.

	Total Investment	Jobs Preserved or Created
Preserve Nature-Based Small Businesses		
Support Nature-Based Tourism Businesses	$130 million	250,000
Support Small Farmers and Food Producers	$340 million	102,000
Green Jobs Program		
Conservation and Economic Recovery Corps	$905 million	15,000 (Minimum)
Legacy Drilling and Mining Pollution	$673 million	8,480
Shovel-Ready Energy Efficiency Projects	$397 million	7,940
Shovel-Ready Clean Water Infrastructure	$385 million	5,775
TOTAL, Jobs and Stimulus Proposals	**$2.83 billion**	**389,195**

Table 1. Summary of investment and job preservation and creation estimates of the green stimulus portion of the recovery platform.

Double Down on Pennsylvania's Resilient Clean Energy Economy

The following policy proposals are recommended as part of a broader economic recovery package to strengthen and expand Pennsylvania's rapidly growing clean energy industries.

Enable Community Solar. Pass legislation that allows for community solar, increasing by 50 to 75 percent the number of PA residents with access to solar power if they choose to do so. This would create good paying skilled labor jobs as well as reduce pollution. Current bipartisan bills exist to do so, including HB 531 and SB 705.

Incentivize Grid-Scale Solar. Amend the state Alternative Energy Portfolio Standards Act to ensure that a certain percentage of energy credits are obtained through competitively-bid long-term contracts as well as increase the share of electricity the state must source from renewable energy. Current bills exist to do so, including SB 600.

Expand Energy Efficiency Opportunities. Pennsylvania's energy efficiency laws have saved ratepayers significant money while reducing energy consumption and pollution. With a few tweaks, these laws could open up additional economic develop and job creation opportunities, including:

- Remove the investments caps in Act 129 to allow for more energy efficiency projects at no net cost to consumers.
- Enact legislation to require the PUC to inquire if investment in available energy efficiency measures could achieve the same goals in proposed electric utility rate increases.
- Amend Act 30 of 2018 to include multi-family residential units as eligible to participate in commercial PACE programs so that landlords can retrofit apartment buildings, creating jobs as well as improving the quality of life for renters.

Invest in Clean Transportation. The market for electric vehicles is growing and is expected to grow rapidly by 2030. Targeted investments in infrastructure would allow PA to take part in this growth, including:

- Prepare a transportation electrification opportunity assessment and set a statewide goal for vehicle electrification of at least 50 percent above business-as-usual by 2030. Existing bipartisan legislation exists to do so, including SB 596.
- Implement a cap-and-invest program to fund clean vehicles and infrastructure investments. One such initiative is the Transportation Climate Initiative Regional Policy Development Process.

Convene a Green Recovery Summit for Municipal Officials

Governor Tom Wolf should convene a statewide *Green Recovery Summit* of local and county officials to develop and adopt a sustainable and equitable economic recovery framework. The convening would develop a priority list of clean infrastructure projects so that state agencies can take quick action as well as provide a consensus framework document that will guide future stimulus and recovery investments at the local level.

Next Steps and Paying for State Stimulus and Recovery Policies

It is widely expected that the federal government will continue to leverage its historically low interest rates and borrow funds to support state and municipal recovery efforts. Pennsylvania's policy leaders, particularly Governor Wolf, should not be passive in these efforts and should work with state congressional leaders to shape future federal stimulus plans. Federal stimulus investments will provide funds for the types of programs recommended in this agenda as well as fill other state budget holes, freeing up flexibility to invest further in stimulus and recovery efforts. Certainly, federal stimulus dollars will not provide full funding for recovery efforts and state policymakers will have to develop new revenue options. This agenda provides a list of potential revenue options as part of a broader recovery reform platform.

Introduction

> "...THIS REPORT LAYS OUT A POLICY ROAD-MAP... TO PUT PEOPLE BACK TO WORK AND BUILD A MORE RESILIENT AND SUSTAINABLE ECONOMY ."

The social, economic, and environmental impacts of the COVID-19 health crisis are profound and are reshaping how we work, recreate, and live our daily lives. As of the drafting of this report, there have been over 90,000 cases of the disease in the Commonwealth and over 6,750 deaths.[1] Over 2 million workers have filed for unemployment insurance since the beginning of the pandemic, creating the largest unemployment rate—16.1 percent—in state history in April (Southwick, 2020). The state eased lockdown restrictions in May, resulting in a modest unemployment improvement of 13.1 percent, but millions remain out of work (Southwick, 2020). Some of the hardest hit areas in the state are black and brown communities where essential and low-wage workers reside, and preliminary reports show these are also areas with higher air pollution that exacerbate the impact of the disease (Wu et al., 2020). Many of Pennsylvania's 67 counties are reopening their economies, albeit with significant limitations.[2] The deep and rapid decline in Pennsylvania's economy is nearly double that of the Great Recession, with state gross domestic product (GDP) declining by at least 6.2 percent in 2020 (Independent Fiscal Office, 2020).

With these historic circumstances in mind, this report lays out a policy roadmap that leverages Pennsylvania's growing nature-based, clean energy, and sustainable industries to put people back to work and build a more resilient and sustainable economy. The policy proposals described herein have four overarching goals:

1. **Safely and equitably restarting the state economy in a way that limits the pandemic, reduces pollution, and protects human health.**
2. **Avoiding state budget cuts that will negatively harm economic recovery and nature-based businesses.**
3. **Targeting short-term economic stimulus investments that put Pennsylvanians back to work and provide family sustaining wages.**[3]
4. **Advancing long-term economic recovery investments to support environmentally sustainable infrastructure and industries that underpin resilient and equitable communities.**

In total, this policy platform is estimated to require $2.83 billion in annual investments for the duration of the crisis and recovery, which would preserve or create as many as 389,000 jobs in the Commonwealth, including nearly 37,000 immediate, shovel-ready jobs, while also reducing pollution, promoting our natural resources, and advancing public health. To put this in context, it would fill 45 percent of the 849,000 jobs lost during the pandemic, as of May 2020 (U.S. Bureau of Labor Statistics, 2020).[4]

Stimulus and Recovery Investments are Necessary to Rebuild the State Economy

The federal government has passed over $3 trillion in stimulus funds through the CARES Act and additional supplementals to cushion the immediate health and economic pain caused by shelter-in-place orders. Nonetheless, it will require years of federal, state and local investments to recover from the COVID-19 crisis and make our society and economy emerge stronger and more resilient.

"THE COVID-19 CRISIS IS EXACERBATING AND DEEPENING THESE ECONOMIC ISSUES SO RAPIDLY THAT IT REQUIRES SWIFT AND SIGNIFICANT ACTION BY STATE LEADERS."

These much-needed investments offer a historic opportunity for Pennsylvania to reshape its economy and transition toward a financially stronger, environmentally sustainable, and more equitable Pennsylvania. Pre-pandemic, Pennsylvania's economy showed signs of weakness (Gelinas, 2020). While statewide job growth remained steady through February 2020 and the unemployment rate was low, the state tracked worse than the national average. Even at this high level of employment, Pennsylvania had one of the worst racial inequity rankings for its economy (McCann, 2020). Employment was beginning to shrink as the United States' trade war with China continued to impact steel and agriculture producers.[5] Many communities, particularly in western and northeastern counties, remained left behind and experienced continued economic decline since the Great Recession (Alter et al., 2019). The oil and fracked gas industry was also reeling, portending to a steep decline and bankruptcies.[6] And according to a recent assessment by the *Brookings Metropolitan Policy Program*, Pennsylvania's ability to innovate and advance new industries and entrepreneurship had "gone flat" and faced significant challenges (Maxim and Muro, 2019).

The COVID-19 crisis is exacerbating and deepening these economic issues so rapidly that it requires swift and significant action by state leaders. It is largely expected that the federal government will implement additional rounds of economic stimulus and recovery packages to stem the impacts from the COVID-19 pandemic, as well as address problems caused by the complicated execution of initial subsidies to businesses and residents (Leonhardt, 2020). Pennsylvania will have to do the same to pass balanced state operating budgets and spend federal investment dollars, in addition to passing state-specific stimulus and recovery measures.

Stimulus and Recovery Investments Should Prioritize Green Projects and Industries

There is a growing consensus that prioritizing recovery investments in sustainability, clean energy, and nature-based industries offers a powerful mix of benefits: immediate job creation opportunities, retention of good-paying jobs, long-term prosperity, and lower pollution. Numerous statements, reports, and proposals have been released during the pandemic by bipartisan political, business, academic, and financial leaders across the country making the same fundamental point: governments should stimulate economic growth that will create jobs as well as provide significant co-benefits, like reducing air pollution, addressing climate change, and providing clean water.

Over 150 multinational companies, many with headquarters, facilities, and workers in Pennsylvania, issued a statement calling for governments around the world to "prioritize a faster and fairer transition from a gray to a green economy by aligning policies and recovery plans with the latest climate science" (Science Based Targets Initiative, 2020). CEO's and representatives from 330

U.S. Fortune 500 firms, trade associations, and small-and medium-sized businesses are also calling on Congress to "back a better economy by infusing resilient, long-term climate solutions into future economic recovery plans" (Ceres, 2020). A group of economists and leading academics and policymakers proposed an ambitious green stimulus bill to promote economic recovery and reduce pollution (Bozuwa et al., 2020). A coalition of financial investors representing trillions of dollars in investments have called for a "green recovery from the COVID-19 pandemic" (Holder, 2020).

This momentum for a green recovery is based on the growth of these industries during the last decade. Low-carbon economic growth has outpaced growth under business-as-usual policies, such as subsidizing fossil fuels (Mountford, 2020). Clean energy industries represent 3.3 million American workers, outnumbering fossil fuel jobs by 3 to 1 (Rickets et al., 2020). Increasingly, sustainable and nature-based industries are future-proof, rapidly growing segments of the economy. For example, the Dow Jones Sustainability Index (DJSI) has outperformed the S&P Global BMI by 4.48 percent as of June 2020, meaning companies that have stronger environmental and social performance are not only producing better results, but are weathering the pandemic more so than their polluting competitors (S&P Global Market Intelligence, 2020).

A green recovery would also provide a diverse mix of skilled jobs. According to analysis by the Pew Research Center, green industries require jobs that are characterized by analytical skills (e.g. programming, science, and mathematics), but also jobs that are characterized by labor-intensive skills (e.g. installation, maintenance, and equipment operation) (Kochhar, 2020). Green industries like solar installations and energy efficiency retrofits are emphasizing employment from traditional, existing skill categories like engineering, electricians, and laborers.

The same holds true for Pennsylvania. Nature-based, outdoor recreation industries represent over 250,000 jobs while generating over $29 billion in economic activity to the state each year (Outdoor Industry Association, 2017). The agriculture sector produces 280,000 jobs and generates $135 billion annually (TeamPA, 2018). And the clean energy sector is creating over 90,000 jobs, growing five times faster than the overall employment growth in the state (E2, 2019). Pennsylvania is well positioned to leverage its growing green economy to ensure that the recession is short-lived and people are put back to work as quickly as possible.

Avoid State Budget Cuts That Will Negatively Harm Economic Recovery

The COVID-19 crisis is going to put a significant strain on Pennsylvania's state government, increasing calls for budget cuts, special fund transfers, and state worker layoffs. Policymakers should reject pressure to cut their way out of the recession and instead learn from the Great Recession recovery: deep spending and public sector job cuts will put a drag on economic growth, further entrench racial inequality, and create a ripple effect through the economy, including environmental protection (Fischler, 2020).

The Independent Fiscal Office estimates the Commonwealth will lose $3.9 billion in revenue because of pandemic-related lockdown measures (IFO, 2020). A gradual reopening of the state economy will further depress revenue as will business restrictions and consumer uncertainty before a vaccine is developed. If additional spikes in infections leads to further lockdowns, the economic consequences will be even more severe. Making up for this lost revenue means relying on a limited number of options resulting from Pennsylvania's constitutional requirement to balance the operating budget every fiscal year: (1) Raise taxes and fees; (2) Cut spending and investments; (3) Float bonds; (4) Spend down reserve funds; and/or (5) Leverage federal stimulus spending to balance the budget.

Pennsylvania received $3.9 billion in discretionary federal stimulus dollars through the CARES Act. This money cannot be used to fill holes in the state budget, and can only be spent on coronavirus-related expenditures. The state legislature has developed a plan to spend $2.6 billion for nursing homes, county block grants, intellectual disability care, small business grants, research and development of a coronavirus vaccine, relief for farmers, higher education, and housing security. The remaining $1.3 billion has not yet been allocated as of the writing of this report (Caruso & Shanahan, 2020).

So far, the Pennsylvania legislature is opting to make budget decisions later in the year. In late May, the state passed a short-term, five month stop-gap budget that provides level funding (compared to FY19-20) for all state agencies and programs from July 1, 2020 through November 30, 2020. Legislators will then convene a special sine die session after the General Elections in November to debate a budget that accommodates the remaining seven months of the fiscal year.

For these future budgets, the recovery from the Great Recession provides a useful lesson on how to quicken the pace of economic recovery. Relying almost solely on slashing public sector jobs and investments prolongs the economic pain and makes a full recovery more difficult (White, 2019). These cuts have disproportionately affected women of color specifically and black and brown communities broadly as the dramatic cuts to public spending and the privatization of public services simultaneously subject them by further destabilizing their already precarious economic position (Emejulu & Bassel, 2018). Public sector spending still had not bounced back to pre-2008 levels before the pandemic struck.[7] Environmental agencies, including the Department of Environmental Protection (DEP) and the Department of Conservation and Natural Resources (DCNR), have taken the brunt of that workforce decline. The DEP's workforce declined by 25 percent and its budget has been cut by 40 percent (Phillips, 2020). The DCNR has been tasked with managing more parks and more visitors, but doing so with staffing cuts and a $1 billion backlog for maintenance and infrastructure (Pennsylvania Parks & Forests Foundation, 2018). Similar budget cuts have impacted Pennsylvania's wildlife and river basin commissions, as well. These deep cuts have come at a time when the challenges facing those agencies—such as the massive buildout in natural gas infrastructure, drinking water issues, and industrial and agricultural pollution—have greatly increased.

"ANY GREEN PLATFORM FOR PENNSYLVANIA SHOULD BE BUILT FROM THE BASIC PREMISE THAT ITS CORE ENVIRONMENTAL AND CONSERVATION AGENCIES AND PROGRAMS SHOULD REMAIN WHOLE AND, MORE IMPORTANTLY, BE BUILT UPON."

Turning the budget knife on those same agencies again will only prolong our current racial inequality and economic malaise. To this end, the state legislature is not off to a good start. It has debated bills during the pandemic that would freeze investments made from environmental and conservation special funds—separate state accounts created by the legislature to receive earmarked revenue for annual investments in conservation projects (Thrush, 2020). For example, the Environmental Stewardship Fund invests revenue raised from dumping trash in landfills and other state bonds to preserve farmland, clean up acid mine drainage, and build watershed protection projects. Not only do these projects create good-paying jobs, they also reclaim land for economic development and greenspaces for communities—the type of win-win projects the Commonwealth needs right now.

In fact, this green stimulus and recovery platform is a rejection of broad-based austerity measures that are often looked to by policymakers during economic downturns. A more strategic approach is needed, which is why this platform proposes new investments in environmental agencies, programs, and policies to spark economic development. Many economists similarly reject broad-based austerity and point to past use of these policies as detrimental to economic growth and social well-being.[8] In fact, austerity measures during the Great Recession have been linked to significant public health impacts and the inability to enforce environmental protection laws (Collett-White, 2019).[9]

Any green platform for Pennsylvania should be built from the basic premise that its core environmental and conservation agencies and programs should remain whole and, more importantly, be built upon. The proposals in this document assume that the relevant environmental, conservation, agriculture, and wildlife agencies are not cut, and the investments recommended herein would add agency capacity and programmatic dollars. To do otherwise is no less than cutting off our nose to spite the face—Pennsylvania would do well to strategically invest in its green economy to quickly emerge from the current recession.

Preserve Pennsylvania's Nature-Based Small Businesses from Collapse

Small businesses are crucial to Pennsylvania's economy and are being disproportionately impacted by COVID-19. They will need significant assistance to ensure that they do not close or file for bankruptcy. Pennsylvania's nature-based small businesses, such as outdoor recreation and agriculture, are being particularly threatened with financial hardship. State policymakers should prioritize efforts to ensure that these industries are financially protected so they can continue to support hundreds of thousands of jobs through the important summer and fall seasons.

Safely Reopen and Support Pennsylvania's Nature-Based Small Businesses

Jobs Created or Protected: *At least 250,000*
Total Cost: *$127 million to $132 million* [10]

Framing Statement

Nature-based businesses are of particular importance to the state economy due to the tourism and recreation generated by the state's abundant natural resources and natural beauty. The Outdoor Industry Association (2017) estimates that Pennsylvania's outdoor recreation industry generates $29.1 billion in economic activity to the state each year and creates 250,000 jobs. State parks alone generate over $1.1 billion in economic benefit (Mowen et. al., 2010). Safely restarting this industry is crucial to reopening Pennsylvania's economy as well as providing a much-needed respite for residents in need of outdoor recreation during these unsettled times.

The small businesses—hotels, diners, recreation guides, river guides, tackle shops, campgrounds, bike shops, and hunting shops—that are the backbone of this industry need support to make it through this crisis. The stay-at-home shutdown orders hit during the start of the spring tourism

season and could greatly impact the summer and fall seasons as well, threatening severe job losses and bankruptcies throughout the Commonwealth's scenic and natural areas. Rural counties would be particularly hard hit as they rely on tourism and outdoor recreation for their local economies (Briggs & Benshoff, 2020).

Recommended Policy Interventions

- In collaboration with Pennsylvania's network of *Small Business Development Centers*, create a one-stop shop online information sharing mechanism at the Department of Community and Economic Development (DCED) for nature-based businesses to quickly provide guidance, financial information, and online business recovery training.
- Develop a "Reopening Pennsylvania Nature Tourism" report in consultation with public health officials, DCED, and nature-based small business leaders that provides a plan on how to reopen tourism businesses, even on a limited basis.
- Launch an "Explore PA's Natural Beauty Campaign" for in-state residents that highlights open businesses and provides ideas about how to enjoy the outdoors and support the economy in a safe and healthy way during the summer and fall seasons.

"RURAL COUNTIES WOULD BE PARTICULARLY HARD HIT AS THEY RELY ON TOURISM AND OUTDOOR RECREATION FOR THEIR LOCAL ECONOMIES."

- Pass legislation that allows small businesses to claim deep cleaning contracts, cleaning supplies, personal protection equipment, and other safety measures as allowable business expenses to reduce their state taxes.
- Increase funding for DCNR's *Community Conservation Partnership Program Grants* program from $60 million to $62 million to support capacity building, training, and project funding to nature-based nonprofits that support areas of outdoor recreational importance.
- Temporarily eliminate the matching requirement for DCNR for two years to allow easier access to funds that will support nature-based businesses, including those that will benefit businesses indirectly through contract work with communities.
- Provide operating grants and program-related investments of at least $25 million to state Community Development Financial Institutions (CDFI), credit unions, and regional economic development entities to support nature-based small businesses in low income, black and brown communities, and environmental justice areas.[11] The Administration should work with state philanthropic foundations to match or augment these state investments so CDFIs are in a healthy financial situation and can quickly scale up operations and provide loans to businesses that haven't been able to access federal assistance.
- Re-capitalize the *COVID-19 Working Capital Access Program* through DCED and the *Pennsylvania Industrial Development Authority* (PIDA) to $100 million and expand eligibility for projected staffing and operating costs to support nature- based businesses in regions of the state that won't be able to open during the summer and fall tourism seasons.[12]

Support Pennsylvania's Small Farmers and Food Producers

Jobs Protected or Created: *45,000 to 102,000*[13]
Total Cost: *$325 million to $340 million*

Framing Statement

Pennsylvania's agriculture industry contributes $135.7 billion, or approximately 18 percent, of the state's gross product and supports 280,500 direct jobs (TeamPA, 2018).[14] This includes products like livestock, fruits and vegetables, dairy, forestry, landscaping and nurseries, beer, wine, hemp, and food processing. According to the most recent agricultural census in Pennsylvania, there are 59,309 farms in the state, 48,039 of which are 179 acres or less (Mondal & Solano, 2017).

Not only are these small farms an important food source and economic engine, they are also a key source of conservation. Whether it is preserving farmland for future generations, protecting streams from pollution, or enacting best practices to encourage soil health, farmers often are traditional stewards of our natural spaces throughout the Commonwealth.

They are also often looked at to reduce pollution, particularly the nutrients and sediment entering Pennsylvania waterways. For instance, runoff from agricultural lands in the Susquehanna and Potomac River Basins are the most significant source of pollution entering the streams and rivers that ultimately feed the Chesapeake Bay, in part causing severe impacts to sensitive species and habitats (PA Department of Environmental Protection, August 2019). The U.S. Environmental Protection Agency (EPA) has mandated that Pennsylvania cut this pollution load by 2025, meaning the state and farmers must collaboratively invest in reducing pollution while utilizing best farmland practices such as riparian forest buffers along streams, manure storage facilities, and healthy soil best practices. Implementing these practices not only reduces pollution, but they improve farm productivity and create jobs. For example, just one state-of-the-art dairy barn with manure management pits required 25 professionals to install from design through completion (Chesapeake Bay Foundation, 2011).

Prior to COVID-19, 75,000 jobs were estimated to be available in this sector over the next decade due to an aging workforce, immigration policies that have reduced the seasonal workforce, and a dairy industry in financial crisis (TeamPA, 2018). Many Pennsylvania farmers were also enduring

falling demand and prices because of the United States' trade wars with China and European countries. But the pandemic is creating a new gut punch to the industry because it is reducing or eliminating demand from schools, restaurants, office cafeterias, and meat purveyors, creating a financial environment that will lead to many family-run small farms going out of business (Marroni, 2020). Emergency financial loan programs offered by the federal government are often out of reach for small farmers because they don't have access to the same legal and accounting staff—or any administrative staff—that larger corporate farms benefit from (Finnerty, 2020). To put it simply, small Pennsylvania farmers are in crisis and the pandemic is pushing many to the breaking point, putting into question the farmers' livelihoods, preservation of Pennsylvania's lands, and our ability to limit water pollution.

"TO PUT IT SIMPLY, SMALL PENNSYLVANIA FARMERS ARE IN CRISIS...PUTTING INTO QUESTION THE PRESERVATION OF PENNSYLVANIA'S LANDS."

Recommended Policy Interventions

- Leverage the proposed *Pennsylvania Conservation and Economic Recovery Corps* (CERC) described below to provide farmers access to workers to implement conservation best management practices, watershed protection projects, and new farm practices.[15]
- In addition to the employment opportunities through CERC, the Department of Agriculture should be directed to develop guidelines and online resources, in collaboration with agriculture trade associations, so that unemployed job seekers have user-friendly access to opportunities on farms throughout the Commonwealth.
- Expand DCED's *COVID-19 Working Capital Access Program* (CWCA) to include an additional $250 million program solely aimed at keeping small family farms from cutting payroll and/or going bankrupt during the pandemic. The loan eligibility cap of $100,000 should be increased to up to $250,000 to provide significant cash support to farms through the summer crop and fall harvest seasons. Loan eligibility and interest rates should be low as many small farms don't have access to other sources of credit and are already cash-strapped.
- Re-capitalize the Resource Enhancement and Protection (REAP) tax credit from $13 million in FY 2019-20 to $25 million for FY 2020-21. The credit cap of $250,000 per agriculture operation should remain, but farms should be allowed to trade the credits after 6 months, rather than 12 months. REAP tax credits will cover 50 percent to 75 percent of conservation project costs, including no-till planting, riparian stream buffers, cover crops, and conservation plans. The tax credit was expanded through the *PA Farm Bill* to $13 million and was quickly allocated on a first-come, first-serve basis.
- Expand DCNR's *Riparian Forest Buffer* program from $500,000 to $1 million to directly support buffer projects on agricultural land. Grants should be allowed to cover greater than 50 percent of project costs.
- Double state funds for the Department of Agriculture *Farmland Preservation* program from $38 million in 2019 to $76 million.[16] This is important for two reasons: (1) it provides farmers an additional preservation option during the pandemic that protects the land while still providing a financial benefit; and (2) it offsets any reduction in county investment in farmland preservation due to budget cuts resulting from the recession. County investments accounted for 32.5 percent of farmland preservation funding in 2019.[17]
- Establish an *Agricultural Cost-Share Program* to provide direct support to farmers for installing conservation practices that can improve farm productivity and improve our rivers and streams. Initially fund the program at $25 million per year. Such programs exist in neighboring states such as Maryland and Virginia. A state cost-share program would leverage state and federal dollars and reduce the cost to farmers for stewarding the land.

Creating a Green Jobs Program to Put Pennsylvania Back to Work

Pennsylvania needs to get back to work and there is no easier way to do that than to invest in green jobs programs. The following recovery investments would take advantage of shovel-ready projects to modernize our green spaces, energy system, and water infrastructure. Each would also provide job opportunities in each of the Commonwealth's counties and to workers of various skill sets that reflect the diversity of unemployed, including high school graduates, college graduates, laborers and tradespeople, engineers, planners, and other technical experts.

Create a Pennsylvania Conservation and Economic Recovery Corps

Jobs Created or Protected: ***At least 15,000 in Year 1, depending on the salaries per worker and their length of employment.***

Total Cost: *Up to $905,625,000* [18]

Framing Statement

During the height of the Great Depression, the United States implemented a bold idea—provide the unemployed with job opportunities by building and maintaining environmental infrastructure like state park buildings, trails, tree plantings, forest roads, and flood barriers. For nine years, the Civilian Conservation Corps employed 3 million people, provided shelter and food, and required Corps members to send a portion of their earnings back home to their families, providing much-needed support to hard hit rural communities across America.

The program was so popular that even after its elimination because of World War II, states implemented scaled-down versions of the Corps to support youth job creation, conservation projects, and disaster response.[19] DCNR deploys an *Outdoor Corps* for 18-25 year-olds to conduct 10-month, paid employment to work on projects on state park and forest land.[20] In 2015, Representative Marcy Kaptur (D-OH) introduced the *21st Century Civilian Conservation Corps Act* to reestablish a national Corps to provide employment completing conservation and restoration projects.

While the United States is a much different place than in 1933, an equally bold idea is needed to provide Pennsylvania's unemployed with job opportunities during the COVID-fueled recession. That idea is to create a modern-day *Pennsylvania Conservation and Economic Recovery Corps* (CERC) to provide guaranteed work and family-sustaining wages for conservation projects around the Commonwealth. This would not be an expansion of the DCNR Outdoor Corps, but rather a jobs program to leverage the skills of the unemployed to help rebuild and maintain Pennsylvania's natural infrastructure.

While the immediate challenge is addressing the state's historic unemployment, the long-term natural infrastructure needs of Pennsylvania are also immense and provide a win-win opportunity. The Pennsylvania Parks & Forests Foundation calculated that the state park and forest infrastructure and maintenance needs totaled $1 billion (PPFF, 2018). Pennsylvania's *Phase 3 Watershed Implementation Plan* for the Chesapeake Bay Watershed estimates that the cost of pollution reduction projects in the Susquehanna River and Potomac watersheds, such as for forest buffers, soil health, and agricultural projects, is $521 million per year, of which a deficit of $324 million per year remains (PADEP, August 2019, p. 11). Governor Wolf's *Restore Pennsylvania* plan identified billions of dollars-worth of projects to build green stormwater infrastructure, flood control, brownfield cleanup, and other conservation projects (Wolf, 2019).

"WHILE THE IMMEDIATE CHALLENGE IS ADDRESSING THE STATE'S HISTORIC UNEMPLOYMENT, THE LONG-TERM NATURAL INFRASTRUCTURE NEEDS OF PENNSYLVANIA ARE ALSO IMMENSE..."

Put simply, there are billions of dollars-worth of natural infrastructure projects backlogged throughout the Commonwealth. CERC could help put a major dent in this backlog, leveraging existing program funding at state agencies, federal project and stimulus funds, as well as new state investments to put people back to work rebuilding Pennsylvania.

CERC should also support employment for high school students, recent college graduates, unskilled workers, workers in communities of color, and workers interested in the opportunity to learn new skills that will be transferable to future jobs. There is currently no clear trajectory in these populations and communities to develop skills and enter or re-enter the workforce. This plan would provide such a trajectory and likely cause the current lack of skilled workers that many Pennsylvania employers report to shrink (Hoffman, 2018; PA State System of Higher Education, 2016). For example, millennials who entered the workforce during the Great Recession have had, on average, lower wages (adjusted for inflation) and less accumulated net wealth than other generations (Kurz et al., 2018). CERC could help prevent this from happening to the current generation entering the workforce during the economic fallout from COVID-19 as well as help address the significant racial inequality in the state economy.

Recommended Policy Intervention

- Create the CERC as a new, independent commission that is jointly chaired by leadership from relevant environmental, conservation, agriculture, and economic agencies to quickly develop hiring guidelines, prioritize projects, leverage existing state project management expertise to ensure projects are efficiently managed, and ensure the program engages on projects throughout the Commonwealth.[21]
- Set a goal of hiring 15,000 unemployed Pennsylvanians in the first 12 months.[22] Workers would be hired on 6-month terms, which would be extended based on the needs of the workers and projects.[23] This would allow workers flexibility to find permanent full-time work elsewhere, while also providing a steady workforce for project development.

- Significantly expand maintenance, construction and installation of conservation and pollution reduction projects, including the following:
    - State park and forest maintenance
    - Habitat and wildlife management
    - Green stormwater infrastructure
    - Stream buffers
    - Invasive species removal
    - Main Street beautification projects
    - Implement agriculture best-management projects
    - Tree plantings and other conservation activities
    - Upgrade agency IT infrastructure
- Supplementary to the support described for small farmers above, a portion of CERC hires should be used to assist small Pennsylvania farmers if shortages in skilled labor occur. These hires should also be used to help farmers with technical assistance or with administrative burdens that often prevent them from completing best management plans or accessing available loans, grants, or tax credits.
- CERC should also target employment opportunities for recent graduates, workers without a degree, high school students, and workers in communities of color that have been disproportionately impacted by the pandemic.
- Wages should be able to support a family, so either prevailing wages for the area or at least $24/hour, which would provide the equivalent of a $50,000/year salary.
- Workers should also be provided health insurance, paid sick leave, and paid time off. Additional benefits, such as accreditation, community college credits, or other technical training could also be offered alongside the program so that long-term skills are provided. For example, flexibility could be provided that allows CERC hires to be provided access to discounted or free education at a regional state school or community college rather than getting paid a full salary.
- Require all Pennsylvania counties to submit lists of CERC-based job opportunities, such as organizing projects by DCNR's nature-based regions plus heritage areas, urban communities, and environmental justice areas, so that potential workers have access to projects close to their homes and the program is well integrated with county officials.

Create Jobs by Addressing Legacy Drilling and Mining Pollution

Jobs Protected or Created: *8,480 Total (5,400 for abandoned wells [24] & 3,080 for mine reclamation [25])*

Total Cost: *$673.2 million over 4 years ($453.2 million for abandoned wells and $220 million for mine reclamation)*

Framing Statement:

Pennsylvania's oil drilling and coal mining industries have left Pennsylvania with significant legacy pollution issues that endanger lives, pollute water and air, and hold back economic development in the surrounding areas. Over 200,000 acres of Abandoned Mine Lands exist statewide, representing historic mining sites active prior to 1977 that were inadequately reclaimed or protected and are hazardous because of landslides, fires, air pollution, and water pollution caused by acid mine drainage.[26] Another 200,000 to 750,000 unplugged legacy oil and gas wells pockmark the state, representing abandoned operations that were not properly encased and filled, potentially leaching methane, volatile organic compounds, and other pollution into the air and ground water. Any new economic development of these sites will cost private developers potentially millions of dollars in cleanup, making land reuse costly and, often, untenable.

Prior to the COVID-19 pandemic, the existing oil and gas well plugging workforce operated primarily as small businesses and directly employed 300 people. This small industry—backed by very limited state investment and further hampered by bankrupt or unknown well owners —is not operating at nearly the scale necessary (Weber, 2019). Econsult Solutions (2017, pg. 35) estimates that it will cost $8.4 billion to properly address legacy oil and gas wells. For its part, the PADEP only has 9,000 priority, unplugged wells in its database, though statewide assessments have pinned the number at between 300,000 to 760,000 (PADEP, Sept. 2018). While a fully staffed well plugging mapping effort is still needed in Pennsylvania to properly locate and assess all abandoned wells, addressing the priority list is still a significant effort. Plugging the wells on the priority list would be a win-win: improving environment outcomes as well as supporting a diverse mix of construction and labor jobs, many of which could come from workers in the struggling fracked gas industry and construction workers who struggled during the stay-at-home lockdowns.

Abandoned mine reclamation is an equally significant job and economic opportunity. According to the U.S. Department of Interior Office of Surface Mining Reclamation and Enforcement, Pennsylvania's high priority mine reclamation projects are unfunded by $3.9 billion (U.S. Department of Interior, 2020). The DEP believes the cost is closer to $5 billion (Frazier, 2020).

Funding to address these projects is limited by federal policy. The Surface Mining Control and Reclamation Act of 1977 provided for the restoration of historic mine lands inadequately addressed before 1977. Existing mining operations were assessed a fee per ton of coal, which is placed in the national Abandoned Mine Reclamation (AML) Fund and provides annual funding to Pennsylvania and other historic coal states for reclamation projects. Annual allocations to the states continue, albeit lower today because Congress lowered the fee on coal mining.[27] There is a bipartisan movement in the U.S. Congress to pass the *Revitalizing the Economy of Coal Communities by Leveraging Local Activities and Investing More Act* (RECLAIM Act), which would front load $1 billion from the AML Fund into larger allocations to coal

"PLUGGING OIL AND GAS WELLS...WOULD BE A WIN-WIN: IMPROVING ENVIRONMENTAL OUTCOMES AS WELL AS SUPPORTING A DIVERSE MIX OF CONSTRUCTION AND LABOR JOBS..."

states over 5 years. Based on the legislation's allocation formula, Pennsylvania would gain roughly $300 million for mine reclamation that must be tied to economic development projects.

Nonetheless, Pennsylvania should go beyond what the federal government and the RECLAIM Act would invest to boost mine reclamation and more quickly generate new economic opportunities for the Commonwealth. Reclamation projects around the state have shown the pollution and economic benefits of investing in these projects as quickly as possible. For example, in the Wyoming Valley, the Earth Conservancy has reclaimed nearly 2,000 acres of mine-scarred lands that are now available for commerce, attracting businesses such as Wegmans, Adidas, Spreetrail, and TruValue.[28] These projects also create ongoing operation and maintenance jobs when passive treatment systems are used (Hughes, 2019). Historically, Pennsylvania has invested in mine reclamation through *Growing Greener* funding and has proposed additional funding for projects through efforts like *RestorePA*.[29]

Creating jobs through addressing the backlog of legacy coal mining impacts and capping unplugged legacy oil and gas wells will spur economic development opportunities in communities hard hit by the pandemic as well as the recession.

Recommended Policy Interventions

- Invest $450 million over 4 years in the DEP's *Abandoned & Orphan Well Program* to clear out the 9,000 well backlog. Doing so will also require an additional $3.2 million invest- ment in the DEP program to hire eight full-time positions to administer and manage the program.[30] In addition to new state funds, the legislature could shift funds from Act 13 that are transferred to the Commonwealth Financing Authority back to DEP to partially support this effort.
- Appropriate $220 million over 4 years to the DEP to increase the number of mine reclamation projects and accelerate addressing the backlog of legacy coal mining impacts. This equates to providing a state match on federal investments in mine reclamation through the AML Fund, or $55 million per year. This would double the number of projects and allow existing projects to be completed quicker rather than be segmented over multiple funding cycles.[31]
- By pressuring Pennsylvania's elected federal policymakers, support and pass the RECLAIM Act, which would provide at least $300 million in mine reclamation funding to the state.

Deploy Shovel-Ready Energy Efficiency Projects to Modernize Our Homes and Businesses

Jobs Protected or Created: *7,940* [32]
Total Cost: *$397 million total*

Framing Statement

The energy efficiency sector is the single largest employer in the clean energy sector with 69,000 jobs, representing everything from insulation manufacturing and installers to efficiency engineers and high-efficiency windows production (E2, 2019). The energy efficiency sector is also the clean energy industry hardest hit by the COVID-19 crisis. The losses in the energy efficiency sector account for about two-thirds of all clean energy unemployment filings as electricians, plumbers, construction workers, energy auditors and others were unable to enter homes, offices and other buildings because of coronavirus quarantines (Renewable Energy World, 2020). As a large, growing, and sustainable industry, policymakers should focus investments on supporting these workers and projects.

Protecting existing and creating new jobs in energy efficiency will have three major impacts. First, it will help restore and grow our regional job market for skilled labor. Second, it will lower the cost of utilities for homeowners and businesses at a time when everyone is trying to make ends meet. Third, it will improve the overall quality of life for Pennsylvanians while they're stuck at home. The new normal is that staying at home also means staying safe from infection, but many people do not have access to safe, healthy, and affordable housing. As we move into the warm summer months, high cooling bills and energy inefficient homes will stress our already energy burdened region (Drehobl & Ross, 2016).[33]

Recommended Policy Interventions

- Increase the borrowing authority of the *Redevelopment Assistance Capital Program* (RACP) by $250 million to issue grants for energy efficiency retrofits in schools around the Commonwealth. In 2020, Governor Wolf proposed a $1 billion increase in RACP for lead and asbestos removal in schools, an important and priority investment. This additional increase would complement these potential toxic removal projects and allow for a more robust retrofit of school buildings at a time when they are closed and school years may be shortened.
- Re-capitalize the *Pennsylvania Energy Development Authority* (PEDA) by $100 million to provide low-interest loans, grants, and loan guarantees for large energy efficiency projects around the Commonwealth.[34]
- Work with the Public Utility Commission to convene energy distribution and energy efficiency companies to share best practices, develop new virtual tools for efficiency providers and explore issuing advance payments on contracts.[35]
- Invest in energy efficiency projects for small businesses by increasing funding for the DEP *Small Business Advantage* grants program from $1 million to $10 million. The grant cap should be increased from $7,000 to $10,000 and the matching cap increased from 50 percent to 75 percent. The program provides grants to small businesses of 100 employees or less to construct projects that save the business at least 25 percent on their energy bills annually.
- Expand the *Small Business Pollution Prevention Assistance Account* loan program at DEP from $2 million to $20 million to provide for large, low-interest loans up to $100,000 for energy efficiency projects such as HVAC, lighting, energy efficient machinery upgrades. Program loans provide up to 75 percent of project costs and are eligible for businesses of 100 employees or less, but the program should be expanded for multi-family buildings, providing an additional tool for landlords to provide better quality of life for its lessors.
- Expand DCED's *Weatherization Assistance Program* by investing $20 million to match the federal government's FY20-21 investment. The weatherization program through DCED is funded by the U.S. Department of Energy to provide grants, averaging $7,000, to low-income residents for energy assessments and housing retrofits.

Modernize Clean Water Infrastructure

Jobs Protected or Created: *5,775* [36]
Total Cost: *$385 million* [37]

Framing Statement

The COVID-19 crisis has placed a burden on water and wastewater utilities because of an expected loss of revenue, threatening the Commonwealth's clean water, rivers, and streams. Pennsylvania's water utilities have continued to operate as an essential service during the crisis, enacting moratoriums on utility shut offs and restoring connections to ensure residents continue to have access to water during the stay-at-home shutdowns (PUC issues, 2020). Much needed water infrastructure projects have also been delayed (American Water Works Association, 2020). Wastewater treatment facilities have seen an increase of trash in their systems because residents are flushing their personal protective equipment down toilets or littering on streets that then washes into combined sewer systems (Tanenbaum, 2020).

These COVID-19 impacts are putting a significant strain on water utilities. The American Water Works Association (AWWA) estimates an aggregate financial impact on water and wastewater utilities exceeding $27 billion or a 16.9 percent impact on water sector revenues nationwide (AWWA, 2020). Expected delays and reductions in capital expenditures will result in communities experiencing a reduction in economic activity by as much as $32.7 billion (AWWA, 2020). This adds to a significant funding problem for Pennsylvania's water utilities. The DEP's *Pennsylvania Water and Wastewater Gap Study* indicated a $18.6 billion "gap" in funding for drinking water and wastewater infrastructure from 2015 to 2025 (PADEP, 2015).[38]

The financial strain is not fleeting and will impact water utilities for years. Utilities will likely defer rate increases—their main source of revenue—in the short term to help residents cope with the pandemic and recession, which will further exacerbate revenue shortages (AWWA, 2020); however, the economic impacts on water utilities may mean larger rate increases are necessary over time to meet the costs of providing service and make up for lost revenue. Even before the COVID-19 water crisis, nationwide water rates were unaffordable for nearly 13.1 million households (Mack & Wrase, 2017). In Philadelphia, prior to the implementation of its income-based tiered-assistance

program, nearly 40 percent of residents could not afford to pay their water bills (Nadolny, 2017). In other words, the pandemic is going to set back the ability of water utilities to modernize their infrastructure and put a future strain on residents' ability to afford clean water.

These impacts threaten the Commonwealth's ability to provide clean water. Whether it is from direct impacts like more garbage flowing into our rivers or fewer green infrastructure projects keeping sewage from entering our streams, a financially strained water utility system means more pollution in the future. Water utilities are anchor institutions in their communities, providing essential public health service and family-sustaining jobs. Water infrastructure projects provide an important opportunity to jumpstart the state economy, while safeguarding clean water by investing in shovel-ready water and wastewater infrastructure projects as well as maintenance and repairs of the existing system.

Recommended Policy Interventions

- Appropriate $360 million over 4 years to the *Pennsylvania Infrastructure Investment Authority* (PENNVEST) for drinking water and wastewater infrastructure projects. Funds should be set aside to support the design of green infrastructure alternatives in project development, which would support higher numbers of jobs including architects, planners, and laborers. Funding should also initially prioritize completing existing projects to get the most immediate job creation benefit as well as investments that leverage federal cost-share to increase the number of funded opportunities.[39]
- Prioritize modern, green infrastructure water infrastructure solutions in state water investments—e.g. vegetated buffers, gardens, rooftops, and green spaces that naturally capture water—rather than traditional gray infrastructure—e.g. large tunnels, storage basins, treatment facilities —because they're quicker to develop, create immediate jobs, and provide equitable environmental benefits to communities (Neukrug and Koehler, 2020).
- Amend Act 30 of 2018 to include green stormwater infrastructure in the definition of "Water Conservation Project." This change would significantly increase available private capital through municipal Commercial PACE programs for green stormwater retrofits and projects without costing the state any funds.
- Create a *Green Stormwater Infrastructure Grant* program at DEP and initially capitalize the program at $25 million. Currently, there is no central funding mechanism for green stormwater projects at the state level, aside from PENNVEST, that are open to any type of water project.[40] This grant program would provide financial assistance to projects currently in the design phase so that they can be fully engineered. This would retain and create immediate jobs because much of this work can be done remotely by landscape architects, engineers, and planners. It could also be leveraged by municipal water utilities and municipal separate storm sewer system (MS4) permittees to support their green infrastructure projects through the design phase.

Advancing Economic Recovery by Doubling Down on Pennsylvania's Clean Energy Industries

The investments in nature-based industries and green job policies described in this platform are a down-payment on a more vibrant and sustainable economy. The policy recommendations would keep nature-based industries from collapsing as well as put many Pennsylvanians back to work at a time of great public health and economic uncertainty. Recovering from the pandemic should not stop with short-term stimulus efforts though. Policymakers should go further and shift the state economy away from the industries that have put the Commonwealth in the shaky economic position it is in by doubling down on Pennsylvania's growing clean energy economy.

For too long, Pennsylvania has relied on oil, steel and coal—and now fracked gas—to prop up its regional economies through natural resource extraction, putting the state at a competitive disadvantage during times of recession and national crisis. And it is now almost singularly focused on the petrochemical industry as another fossil fuel enterprise that would monopolize future economic activity, leaving small and mid-sized towns without long-term sustainable industries as well as a disastrous environmental legacy.

What all these industries have in common is the brutal economic and environmental conditions they leave behind. Small and mid-sized towns and cities throughout the Commonwealth have seen populations decline, youth flee their hometowns, and wealth leave to surrounding states with more stable and diverse opportunities. Boom-and-bust economic cycles have become the norm for blue collar and union workers. Towns are constantly on edge for the next big fossil fuel industry bankruptcy. Green spaces and landscapes are left scarred with culm piles, brownfields, and abandoned wells, affecting how municipalities can attract new businesses and tourism.

"EVEN BEFORE THE PANDEMIC, THE FOSSIL FUEL INDUSTRY WAS HEADING TOWARDS A FINANCIAL CLIFF AND THE COVID-19 PANDEMIC HAS ONLY MADE THE LIKELIHOOD INEVITABLE."

Transitioning Pennsylvania away from its dedication to natural resource extraction won't happen overnight, but doing so isn't impossible either. Even before the pandemic, the fossil fuel industry was heading towards a financial cliff and the COVID-19 pandemic has only made the likelihood inevitable (Richards, 2019). A recent report by CarbonTracker Institute predicted that the COVID-19 pandemic could cause a $25 trillion collapse in future fossil fuel profits (CarbonTracker Institute, 2020).

The fossil fuel industry has relied heavily on government interventions to stay afloat, but those come at a significant cost to taxpayers. Pennsylvania taxpayers provide more than $3.2 billion in fossil fuel subsidies, which equals $794 per Pennsylvania taxpayer (PennFuture, 2015, p. 5). Fossil fuel companies have already benefited from $1.9 billion in CARES Act tax credits to keep them afloat during the pandemic (Dlouhy, 2020). The very business model of the fossil fuel industry, even though it is well over a century old, requires taxpayers to pick up its tab before, during, and after its operation. In other words, industry profits are privatized, but its costs are born on society writ large.

Supporting a vibrant, thriving clean energy industry in Pennsylvania is critical to the future success of Pennsylvania's economy and the well-being of its environment. Clean energy employs more than twice the number of workers as fossil fuel industries (E2, 2019). Diversifying and future-proofing the state's energy portfolio is one way to position the Commonwealth as an economic leader, providing new and environmentally-safe opportunities for its residents. Prior to the pandemic, one in three jobs in Pennsylvania were clean energy jobs (E2, 2019) and clean energy was adding jobs five times faster than the overall state employment growth rate. According to the U.S. Bureau of Labor Statistics Occupational Outlook, the fastest growing occupations between 2018 and 2028 will be solar photovoltaic installers and wind turbine service technicians. The median pay in 2018 for solar photovoltaic installers was $42,680 per year and for wind service technicians it was $54,370 per year. Overall, as of 2019, there were 90,000 jobs in clean energy industries (E2, 2019).

While Pennsylvania was an early leader in renewable development and we have significant potential for solar generation, surrounding states have seen far stronger solar growth in recent years. According to the Solar Energy Industries Association, Pennsylvania ranks 22nd in the nation in solar development with New Jersey, Maryland, New York, and even Massachusetts having more solar installed and more solar jobs than Pennsylvania. A joint project of the PADEP and the U.S. Department of Energy recently concluded a 30-month stakeholder-led project to investigate actions that

could increase the amount of in-state solar generation from our current target of 0.5 percent by mid-2021 to 10 percent by 2030. Reaching these goals could create more than 100,000 job-years of construction jobs and over 1,000 direct ongoing jobs (PADEP, April 2019).

The U.S. Department of Energy also reports over 71,000 energy efficiency jobs in 2019 with a year-over-year increase of 2,623 jobs (U.S. DOE, 2020). As the independent statewide evaluator reports, significant additional cost-effective energy efficiency reductions are available through the Act 129 program and there is considerable potential for increased energy efficiency jobs (PA Pennsylvania Public Utility Commission, 2020).

In addition to clean energy being a job creator, it is also a key tool for creating a cleaner environment. Projections indicate that to avert the worst impacts of climate change we must achieve net-zero carbon emissions by 2050. Achieving that target will likely require renewable generation being used for 70 to 85 percent of electricity by 2050, limiting emissions from industrial sources between 60 and 90 percent, and sharply limiting gas to around 8 percent of generation (Intergovernmental Panel on Climate Change, 2018). Despite the job growth, many market and legislative barriers still hamper Pennsylvanians from fully benefiting when compared to other states. Pennsylvania can continue this trajectory by adopting the following recommendations. They will not necessarily provide job opportunities immediately, but would instead support strong, forward-looking clean energy industries to continue growing in the state so that our recovery from the pandemic is swift.

Enable Community Solar

While the distributed (largely rooftop) solar market has been strong for the past few years, it is estimated that 50 to 75 percent of residents lack effective access to solar power. Those impacted includes those living in multifamily housing, renters, low-income families, houses located in shady areas, and other situations. One solution to immediately expand access to solar development is to enable community solar in Pennsylvania, allowing solar consumers to buy or lease a share of a centralized solar system and count the resulting generation much like if it came from their rooftop. Bipartisan bills in the House (HB531) and Senate (SB705) would accomplish this goal. As soon as this program is enacted, private solar developers would be able to invest in developing community solar systems in Pennsylvania.

Incentivize Grid-Scale Solar

In addition to small distributed solar systems that often range from 5 kilowatts (kW) to 3 megawatts (MW) in size, Pennsylvania also has significant potential to install larger grid-scale solar systems such as the 70MW system that BP Lightsource is building under contract with Penn State University, or the similarly-sized system that Community Energy is building to supply power to the city of Philadelphia. One issue holding back development is the inability to craft long-term contracts to sell the power generated, making it more difficult to secure private investment.

To incentivize development, a requirement could be added to the State's Alternative Energy Portfolio Standards Act to ensure a certain percentage of the energy and alternative energy credits be obtained through competitively-bid long-term contracts of between 12 and 20 years.[41]

For example, state legislators could pass SB600 to extend and expand the current Alternative Energy Portfolio Standards Act to require the state obtain 30 percent of its electricity from clean Tier 1 energy sources by 2030 with a significant carve-out for solar photovoltaic generation.[42] The solar targets in that bill alone could create over 100,000 construction jobs and over 1,000 on-going jobs at a net increase in consumer energy spending of 1.2 to 1.4 percent over the next 15 years (PADEP, November 2018), while making the necessary changes to allow for long-term contracting.

Expand Energy Efficiency Opportunities for Businesses, Homeowners, and Renters

Currently, Pennsylvania is in Phase III of the Act 129 Energy Efficiency Program and is working on developing Phase IV. As part of the Phase IV development, the Independent Statewide Evaluator (SWE) analyzed the potential for additional energy efficiency improvements and found that "if Pennsylvania were to pursue all cost-effective achievable potential per the Achievable Potential scenario, the SWE team estimated it would provide $5.80 billion in present value benefits to the economy, at a present-value cost of $4.75 billion. In other words, on average at full scale, for every dollar invested in efficiency, Pennsylvania would accrue $1.22 in economic benefits." Crucially, this is based on a very limited cost-benefit analysis and does not consider public health and environmental benefits. Nonetheless, it shows the significant benefit increasing investments in energy efficiency can have. To take advantage of this economic opportunity and expand the efficiency industry, three policies are recommended:

"ON AVERAGE AT FULL SCALE, FOR EVERY DOLLAR INVESTED IN EFFICIENCY, PENNSYLVANIA WOULD ACCRUE $1.22 IN ECONOMIC BENEFITS."

- ***Update Act 129:*** Unfortunately, Act 129 was designed with investment caps built into the program, which means many energy efficiency measures that can be deployed at no net cost to the consumer will not be required under the program. If legislation were passed removing the investment caps, the Public Utility Commission (PUC) would have the ability to ensure the program can maximize cost-effective emissions reductions.
- ***Consider Energy Efficiency in Utility Rate Cases:*** Currently, when an electric utility files for a rate increase with the PUC, the Commission must ensure that the proposed rate is "just and reasonable" (66 Pa.C.S. § 1301) before approval. Legislation could specify that such a determination requires the Commission to inquire if investment in reasonably available and cost-effective energy efficiency measures could achieve the same goals as a proposed rate increase.
- ***Expand Commercial Property Assessed Clean Energy (C-PACE):*** Pennsylvania recently took a positive step to encourage private investment in energy efficiency by enabling C-PACE. This program lets most commercial entities in participating municipalities obtain loans for clean energy investments that are paid for through property assessments. By lowering the risk for lenders, this makes private capital available at competitive rates. However, this program excludes commercial entities operating multi-family residential units. Nationwide data indicates that approximately 20 percent of the $1.5 billion of C-PACE financings have been for mixed use and multi-family projects (PACENation, 2019). In Philadelphia alone, over $40 million of mixed-use or multifamily projects have been prevented from accessing competitive capital that facilitates cleaner, healthier buildings. Based on C-PACE deal data from across the country, every $1 million of C-PACE financing deployed equates to a carbon impact of removing approximately 1,000 cars from the road (PACENation, 2019). Through 2019, $1.54 billion of C-PACE financing had been deployed, which created 17,848 jobs (Environmental Protection Agency, 2020). The average C-PACE project creates approximately 7 jobs and every $1 million of C-PACE investment and will generate approximately 12 job-years (PACENation, 2019). Legislators can expand private investment in energy efficiency by amending the state's C-PACE law to include multi-family residential units. This would provide a much-needed tool for landlords to retrofit apartment buildings and other multi-family dwellings.[43]

Build Clean Transportation Infrastructure

In many areas of the country, transportation emissions are the largest source of carbon pollution and create significant adverse health impacts—particularly in densely populated areas.

The market for electric vehicles is expected to experience significant growth as internal combustion vehicles are expected to decrease to 40 percent of the market share by 2030, and with appropriate investment, the Northeast and Mid-Atlantic could see a 60 to 80 percent reduction in carbon pollution by 2050. Reaching this level would require regional investments of $12 to $25 billion, but would return over $150 billion in savings to consumers. When both economic and environmental benefits are considered, net benefits grow to over $311 billion. Two policies are important to consider:

- ***Invest in infrastructure to support vehicle electrification:*** One avenue to expand electric vehicle infrastructure is to work with our existing electric distribution companies regulated by the Public Utility Commission by passing SB 596 (Mensch). This bill would require the preparation of a transportation electrification opportunity assessment, a statewide goal for vehicle electrification 50 percent above the business-as-usual case by 2030, and the development of a framework and plans to electrify transportation infrastructure.
- ***Implement a cap-and-invest program funding clean vehicles and infrastructure*** Currently, a number of states in the Northeast are working together on the "Transportation Climate Initiative Regional Policy Development Process" and have released a framework for a draft of the proposal. Under this framework, fuel suppliers would be required to report emissions to participating states consistent with state monitoring and verification requirements. They would also be required to obtain allowances sufficient to cover those emissions, most of which would be obtained through an auction. Proceeds from the auction would be returned to the participating state and would be invested to achieve carbon emission reductions, reduced air pollution, affordable access to transportation, and other policy goals.

Convening a Green Recovery Summit for Municipal Officials

It is important that the state stimulus and recovery efforts recommended in this framework do not lose sight of the county commissioners, mayors, and municipal officials often tasked with carrying out infrastructure projects. Ensuring that Pennsylvania's recovery is equitable across communities and the state is critical so that an uneven economic renewal does not settle in like it did after the Great Recession.

To this end, Governor Tom Wolf should convene a statewide *Green Recovery Summit* of local and county officials to develop and adopt an economic recovery framework. The convening would discuss a green economy, assess its existing reach across the Commonwealth, and develop prioritized clean and sustain- able infrastructure projects for investment so that state agencies and local officials are collaboratively working together and advancing projects as quickly as possible. Furthermore, it could be an avenue for federal officials and congressional staff to learn about shovel-ready projects and local sustainability needs while developing federal legislation.

Ultimately, the goal of the Summit is to build consensus and get state policy leaders on the same page. Stimulus and recovery dollars should be invested quickly to put people back to work, but it should also be done smartly. This platform document could provide a useful framework for such a convening, particularly because of its focus on infrastructure projects.

Paying for a Green State Stimulus and Recovery Package

The COVID-19 pandemic has created both a public health and economic crisis for Pennsylvania. Bold policies and investments are needed to fully recover from these historic challenges in a way that does not make the Commonwealth more prone to environmental devastation and boom-and-bust economies that have held our state back for generations.

To do this, state policymakers must explore diverse revenue options. The total cost of investing in this short-term stimulus and green jobs platform—$2.83 billion annually—is significant, but proportional to the circumstances the state finds itself in. Long-term economic recovery through doubling down on the clean energy economy would require additional policy changes. Ensuring that deep budget cuts will not hinder environmental protection and job recovery would require even more. In this time of crisis, we should not confine ourselves to how Pennsylvania has attempted—and often failed— to stimulate its economy in the past, lest we relegate ourselves to another slow, mediocre recovery. We can, and should, do better.

State Leaders Should Shape Federal Stimulus Investments

It is widely expected that the federal government will continue to leverage its ability to print and borrow money at historically low interest rates to provide stimulus investments for states and municipalities. Some—if not much—of those dollars may be used for many of the types of programs described in this platform. State policymakers will have some discretion on how those dollars will be used and can shape their stimulus investments accordingly.

More importantly, Pennsylvania's leaders, particularly Governor Tom Wolf, should not play a passive role in federal stimulus policy. States play a significant role in the development of federal stimulus response through formal channels created by the federal government (e.g. a task force) or informal avenues (e.g. Congressional delegation). For example, Governors played a key role in shaping the American Recovery and Reinvestment Act (ARRA) during the Great Recession, leading to roughly $275 billion of the $831 billion in total stimulus investments going directly to state and municipal

governments (Pew Charitable Trusts, 2019). This collaboration between state and federal officials allows for federal stimulus dollars to be directed at targeted programs as well as help plug important budget holes caused by the recession. This frees up the state to make even more targeted recovery investments that are tailored to state needs.

Implement New State Revenue Options

Federal stimulus dollars will not provide full funding for stimulus and recovery efforts, so policy-makers will have to develop new revenue. Additional revenue options are available to match the bold initiatives proposed herein to either directly fund the programs or support the payback of a larger bond initiative. Below is a list of innovative options, in no particular order, we believe the state should explore and implement as we recover from this unprecedented crisis:

- ***Establish a Pennsylvania Green Bank***
  A number of proposals have been made, including a green bank and Energy Investment Partnerships, [44] that have the same goal in mind: create a state entity that leverages federal, state, and private sector dollars to invest in clean energy and clean water infrastructure projects. The entity would be capitalized by the state and offer low interest or low-cost loans and other financing mechanisms to support the types of projects described in this platform.
- ***Close the "Delaware" Loophole***
  Establish combined reporting that requires corporations to more accurately report revenues earned in the state, rather than shift its tax burden between Pennsylvania and Delaware, where many businesses incorporate, but do not operate.
- ***Increase the Tipping Fee on Landfills***
  State lawmakers could amend Title 27 to increase the disposal fee for solid waste disposed of at municipal waste landfills. Not only should the fee be increased, but it should be expanded to also be levied on those who dump from waste treatment processes such as fracked gas well operations.
- ***Levy a State Fee on Single Use Plastic Bags***
  Implement a fee on single-use plastic bags to not only disincentivize plastic consumption and reduce litter in our streets and waterways, but also raise revenue for additional environmental programs.

- ***Eliminate Sales Tax Exemption for Bottled Water***
  Under Pennsylvania's tax code, bottled water is exempt from sales tax unlike other bottled drinks. This exemption could be eliminated to raise revenue as well as disincentivize the significant use of plastic water bottles.
- ***Expand Pennsylvania's P3 Program to Include All State Projects***
  Public-private partnerships (P3) are an opportunity to bring in private dollars into clean water restoration work. There are several types of P3s, such as pay-for-performance, Environmental Impact Bonds, and credit trading programs. In establishing a P3 program, Pennsylvania could leverage state money with private dollars to increase the funding available for clean water BMPs.
- ***Fully Implement Pennsylvania's Entrance into the Regional Greenhouse Gas Initiative***
  Pennsylvania is promulgating new rules that would create a carbon emission reduction program that is aligned with the Regional Greenhouse Gas Initiative (RGGI). Through this program, polluting entities would purchase annual credits to emit carbon and those revenues would be reinvested in pollution reduction programs. Fully implementing the program would create a pool of funds that could be used to support some of the recovery efforts described in this platform.

- ***Implement the Fair Share Tax Plan***
  The Fair Share Tax plan would divide Pennsylvania's personal income tax into a separate tax on wages and interest as well as a tax on income from passive wealth (e.g. dividends, capital gains, etc.). The plan would cut the income tax on wages from 3.07 percent to 2.8 percent and sets a new rate of 6.5 percent on income from passive wealth. According to analysis by the Pennsylvania Budget and Policy Center, the proposal would generate at least $2.2 billion in new annual revenue, while cutting or leveling taxes for most in the Commonwealth aside from out-of-state taxpayers and the richest fifth of taxpayers in the state (Pennsylvania Budget and Policy Center, 2019).

- ***Eliminate Long-Standing State Subsidies for Fossil Fuels***
  In 2015 PennFuture published an analysis identifying $3.2 billion worth of subsidies received by the fossil fuel industry in Pennsylvania each year (PennFuture, 2015). That amounted to $724 per taxpayer in the prior year. This includes exempting oil and gas reserves from property tax assessments—itself worth nearly $1 billion, a handout to Shell for the development of their ethane cracker plant worth $1.6 billion, and numerous other tax breaks.

  In the intervening years, we have seen a steady stream of proposals for many millions of dollars in new subsidies that will only take us further from reaching our climate goals. This includes HB1100 that, if passed, would result in hundreds of millions of dollars in additional subsidies for petrochemical plants, and SB 618 that would turn a $10 million subsidy for waste coal plants into a $45 million subsidy. Our recommen- dation remains that Pennsylvania should periodically review these fossil fuel subsidies, analyze the costs and benefits, and redirect these tax expenditures to cleaner alternatives.

- ***Levy a Severance Tax on Fracked Gas Drilling Production***
  The Commonwealth remains the only fracked gas drilling state that doesn't levy a severance tax. Instead, the industry and the legislature struck a deal during the early days of the industry to implement a so-called Impact Fee, which provides a flat fee per well that phases out over time. In comparison, a severance tax would generate revenue based on the amount of natural gas produced by the wells. In other words, Pennsylvania's fracked gas industry is paying far less than in other states, particularly as the number of new wells drilled decreases over time. A severance tax could be enacted to support the green stimulus proposals in this framework, particularly as Pennsylvania transitions away from the fracked gas industry to more sustainable economic development opportunities.

Summary of Green Stimulus and Recovery Reforms and Investments

Pennsylvania is contending with historic public health and economic challenges that require a bold vision for economic stimulus and recovery to put the Commonwealth on a stronger footing in the wake of the pandemic than what existed before. This report lays out a policy roadmap that leverages Pennsylvania's growing nature-based, clean energy, and sustainable industries to create at least 389,000 jobs and build a more resilient and sustainable economy. The policy proposals described herein have four overarching goals:

1. **Safely restarting the state economy in a way that limits the pandemic, reduces pollution, and protects human health.**
2. **Avoiding state budget cuts that will negatively harm economic recovery and nature-based businesses.**
3. **Targeting short-term economic stimulus investments that put Pennsylvanians back to work and provide family sustaining wages.**[45]
4. **Advancing long-term economic recovery investments to support environmentally sustainable infrastructure and industries that underpin resilient and equitable communities.**

Using these basic principles, the following policy recommendations are made to put people back to work, reduce pollution, and rebuild toward a more sustainable economy.

Investments and Policy Reforms Requiring Executive or Agency Action

Convene a Green Recovery Summit for Municipal Officials *(see page 29)*

Governor Tom Wolf should convene a statewide *Green Recovery Summit* of local and county officials to develop and adopt a sustainable economic recovery framework. The convening would develop a priority list of clean infrastructure projects so that state agencies can take quick action as well as provide a consensus framework document for future stimulus and recovery investments at the local level.

Safely Reopen and Support Nature-Based Small Businesses *(see page 12)*

- Create a one-stop shop of business recovery guidance for nature-based businesses.
- Develop a *Reopening Pennsylvania Nature Tourism* report on safely reopening during the pandemic.
- Launch an *Explore PA's Natural Beauty Campaign*, targeting in-state residents on how to safely take advantage of outdoor tourism during the pandemic.

Support Small Farmers and Food Producers *(see page 14)*

- Develop resources to connect job seekers to opportunities on farms during harvesting.

Address Legacy Drilling and Mining Pollution *(see page 19)*

- Pressure Pennsylvania's federal policymakers to support and pass the RECLAIM Act, which would provide at least $300 million in mine reclamation funding to the state.

Modernize Our Homes and Businesses through Energy Efficiency Projects *(see page 21)*

- Work with the PUC to convene stakeholders to share best energy practices, develop new tools, and build consensus on advance payment provisions.

Invest in Clean Transportation *(see page 29)*

- Implement a cap-and-invest program to fund clean vehicles and infrastructure investments. One such initiative is the Transportation Climate Initiative Regional Policy Development Process.

Investments and Policy Reforms Requiring Legislative Action

Avoid State Budget Cuts that Will Harm Economic Recovery *(see page 10)*

- Reject broad-based austerity measures to balance the state operational budget, particularly by rejecting cuts to environmental, conservation, wildlife, and agriculture programs, and instead advancing policies that build-on these important agencies to jumpstart the economy.

Safely Reopen and Support Nature-Based Small Businesses *(see page 12)*

- Pass legislation allowing small business tax deductions for implementing safety measures and expenses.
- Increase funding for DCNR's *Community Conservation Partnership Program Grants* and temporarily eliminate the matching requirement.
- Provide operating grants of at least $25 million to state *Community Development Financial Institutions* and other regional economic development entities to support nature- based small businesses, including in low-income black and brown communities and environmental justice areas.
- Re-capitalize the *COVID-19 Working Capital Access Program* by at least $100 million to support nature-based businesses in regions that may not be able to reopen during the summer and fall tourism seasons.

Support Small Farmers and Food Producers *(see page 14)*

- Expand the *COVID-19 Working Capital Access Program* by $250 million and increase eligibility to keep small family farms from cutting payroll or averting bankruptcy during the pandemic.
- Re-capitalize the *Resource Enhancement and Protection* tax credit by $25 million and allow for more flexible credit trading.
- Expand DCNR's *Riparian Forest Buffer* program to $1 million.
- Increase PDA's *Farmland Preservation* program to $76 million to preserve more farmland during the pandemic and offset reductions in county investments.
- Establish an *Agricultural Cost-Share Program* and initially fund it at $25 million per year to invest in farm pollution reduction projects that also improve land productivity.

Create a PA Conservation and Economic Recovery Corps (CERC) *(see page 16)*

- Set a goal of hiring at least 15,000 unemployed Pennsylvanians in the first 12 months for at least 6-month terms, which could be extended based on their needs and project needs.
- Projects would focus on state park and forest maintenance, habitat management, green storm-water infrastructure, stream buffers, Main Street beautification, agriculture projects, tree planting, and other natural infrastructure needs.
- CERC should supplement support for the agriculture sector as well as provide family-sustaining wages of at least $24/hour, plus health benefits, paid sick leave, and paid time off.
- Counties should submit lists of CERC-based job opportunities, organized by DCNR's nature-based regions plus heritage areas so that projects are equitably spread across the Commonwealth.

Address Legacy Drilling and Mining Pollution *(see page 19)*

- Invest $453 million over 4 years in DEP's *Abandoned & Orphan Well Program* to clear a backlog of 9,000 abandoned wells that are "shovel-ready."
- Invest $220 million over 4 years to DEP for mine reclamation projects, doubling the number of projects sourced through existing funds.
- Create a public-private program, through the *Environmental Good Samaritan Act*, to expand the number of PA small businesses working to plug and reclaim abandoned wells and mine land.

Modernize Our Homes and Businesses through Energy Efficiency Projects *(see page 21)*

- Increase borrowing authority of the *Redevelopment Assistance Capital Program* by $250 million to issues grants for energy efficiency retrofits in schools.
- Re-capitalize the *Pennsylvania Energy Development Authority* by $100 million to provide financial vehicles for large efficiency projects.
- Increase funding for DEP's *Small Business Advantage* program to $10 million and increase projects caps for efficiency projects at small businesses.
- Expand the DEP *Small Business Pollution Prevention Assistance Account* to $20 million and expand loan eligibility to multifamily buildings.
- Expand DCED's *Weatherization Assistance Program* by $20 million to support grants to low-income housing retrofits.

Support Shovel-Ready Clean Water Infrastructure Projects *(see page 23)*

- Appropriate $360 million over 4 years to PENNVEST for drinking water and wastewater infrastructure projects, including set-asides for designing and implementing green infrastructure projects.
- Amend Act 30 of 2018 to include green stormwater infrastructure in the definition of "water conservation project," so that clean water projects are eligible for Commercial PACE programs.
- Create a *Green Stormwater Infrastructure Grant* program at DEP, initially funded at $25 million, to support projects in the design phase, including support for municipalities designing local projects.

Enable Community Solar *(see page 27)*

- Pass legislation that allows for community solar, increasing to 50 to 75 percent the number of PA residents with access to solar power if they choose to do so. Current bipartisan bills exist to do so, including HB 531 and SB 705.

Incentivize Grid-Scale Solar *(see page 27)*

- Amend the state *Alternative Energy Portfolio Standards Act* to ensure that a certain percentage of energy credits are obtained through competitively-bid long-term contracts as well as increase the share of electricity the state must source from renewable energy. Current bills exist to do so, including SB 600.

Expand Energy Efficiency Opportunities *(see page 28)*

- Remove the investments caps in Act 129 to allow for more energy efficiency projects at no net cost to consumers.
- Enact legislation to require the PUC to inquire if investment in available energy efficiency measures could achieve the same goals in proposed electric utility rate increases.
- Amend Act 30 of 2018 to include multi-family residential units as eligible to participate in commercial PACE programs so that landlords can retrofit apartment buildings.

Invest in Clean Transportation *(see page 29)*

- Prepare a transportation electrification opportunity assessment and set a statewide goal for vehicle electrification of at least 50 percent above business-as-usual by 2030. Existing bipartisan legislation exists to do so, including SB 596.

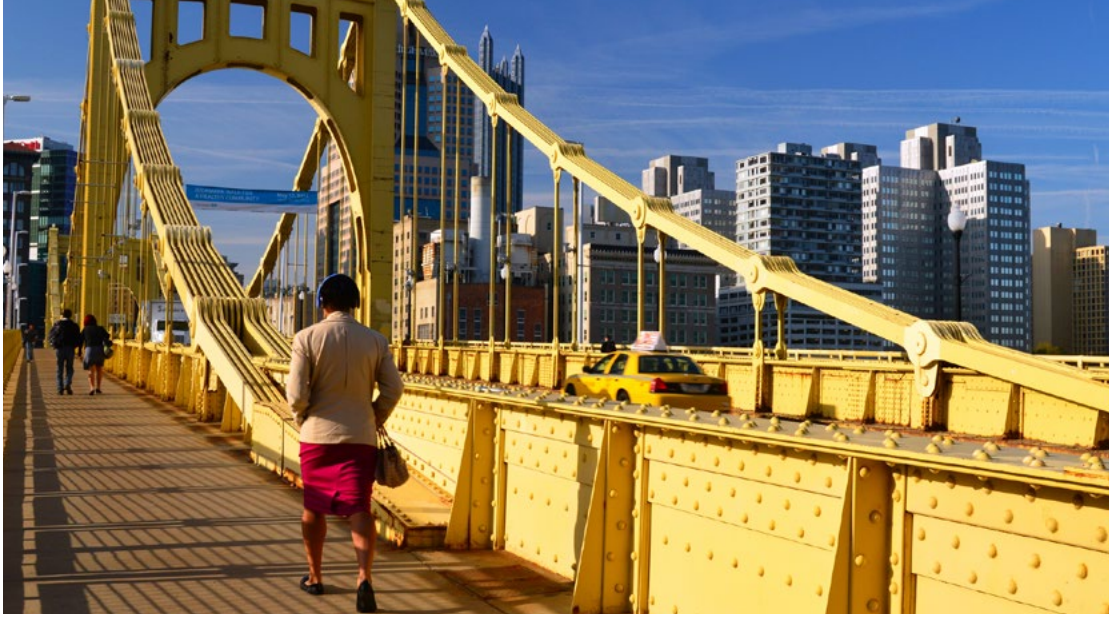
Conclusion

It is truly an unprecedented time in both Pennsylvania and the United States. A short decade after a historic global financial collapse, the state economy is being brought to its knees by a pandemic unseen in 100 years. Businesses are closing shop—many for good—as state leaders are all but forced to place restrictions on commerce and social interactions to limit the spread of the coronavirus and keep people safe and healthy. Until a viable vaccine or treatment is developed, the fear of infection will keep the state economy in a precarious limbo.

"THERE IS NO PLAYBOOK ON HOW TO NAVIGATE SUCH A CRISIS, BUT WE MUST PERSEVERE, ADAPT, AND ADJUST UNTIL THE THREAT OF THE VIRUS IS ELIMINATED."

There is no playbook on how to navigate such a crisis, but we must persevere, adapt, and adjust until the threat of the virus is eliminated. While the safety of the state population is the first priority for any elected official, the economy is a close second. Unemployment and business closures bring about their own version of social pain that must also be limited as much as possible. Pennsylvania entered the pandemic in an already precarious position. Many counties and regions still had not recovered from the Great Recession, if not the longer-term economic decline caused by the collapse of heavy industry in the United States. While unemployment was low pre-pandemic, warning signs were blaring as the fracked gas and petrochemical industry hit yet another series of financial headwinds, farmers were injured by the Trump Administration's trade wars with China and Europe, racial inequality continued to grow across the state, and the state's ability to spark innovation and entrepreneurship had run flat. The pandemic has accelerated the economic decline that many observers warned was already starting to happen.

Unfortunately, the economy has declined rapidly, putting millions out of work in a few short months. Pennsylvania's leaders should be working overtime to address the unemployment crisis, and this report lays out tangible investments to get people back to work safely. Historic times call for bold measures, and this policy agenda does not keep within the boundaries of past recessions because our current situation is not anything like those previous circumstances. Instead, it calls for bold investments and proposes new programming to rebuild our natural infrastructure, which not only provides people meaningful, profitable work, but it also creates a better, cleaner future—a true win-win.



"IMPLEMENTING THE REFORMS AND MAKING THE INVESTMENTS RECOMMENDED IN THIS POLICY PLATFORM WOULD BE IMPORTANT STEPS TOWARD BUILDING A MORE SUSTAINABLE, EQUITABLE, AND RESILIENT ECONOMY THAT PUTS PEOPLE BACK TO WORK TODAY..."

While this report is aimed at helping address the economic crisis, it is also an evergreen model for how state policymakers can diversify and modernize the economy. For too long, Pennsylvania has relied on natural resource extraction. The state has failed to grow its economy beyond this basic pillar, backing it into a corner whenever there is a national crisis or when the whims of the global market, investors, or even other countries hold it hostage. Stuck in this boom-and-bust cycle are its workers. Skilled labor, engineering, computer science, farm, white collar, blue collar, and service workers alike are impacted with little recourse. Black and brown communities continue to be beset by pollution and fewer economic opportunities. Decade after decade, state policymakers point to the same industries for help and the state gets the same results—a few boom years followed by environmental devastation and economic bust. A simple drive through small town Pennsylvania proves this point.

This time feels different. Many states surrounding Pennsylvania are diversifying their economies and pointing in new, more sustainable directions. Clean energy and the broader nature-based and sustainable industries have become bigger players than traditional fossil fuels, hiring a far more diverse set of workers for good wages. There is no reason why Pennsylvania cannot have the same. In fact, as this report details, we already have the underpinnings of these industries and they are ready to grow and expand operations. Natural resource extraction industries, like fracked gas and petrochemicals, are not offering a bold alternative as they scale back operations and face bankruptcies. Their time as economic leaders is waning. The traditional policy answer to an economic crisis—throw more taxpayer money at natural resource extraction industries—just does not fit Pennsylvania anymore.

Implementing the reforms and making the investments recommended in this policy platform would be important steps toward building a more sustainable, equitable, and resilient economy that puts people back to work today, but also advances industries to keep them employed in the future. We are also not shy about the platform's co-benefits: far less air, climate, and water pollution that makes people sick and impacts our communities. It is what makes these policies unique compared to other stimulus proposals. They simply cannot offer the important pollution reduction benefits that will greatly improve the quality of life of all Pennsylvanians.

Former Republican Governor of Pennsylvania and visionary leader of the U.S. Forest Service Gifford Pinchot once said that, "The vast possibilities of our great future will become realities only if we make ourselves responsible for that future." [46] We call on Pennsylvania's leaders to take responsibility for the future of the Commonwealth and charter a sustainable path through the fog of a global pandemic and economic crisis. Bold leadership is needed and the pieces of a broad and prosperous green recovery are in place, if only our political leaders choose to take advantage of them.

Endnotes

1 Cases are tracked daily through the Pennsylvania Department of Health, accessed on July 7, 2020.

2 Pennsylvania has moved 67 counties to either a "yellow" or "green" phase reopening. A yellow phase re-opening includes continuing telecommuting, if feasible, prohibiting large gatherings of 25 or more people, continued closure of gyms, spas, nail salons, and entertainment businesses, as well as limiting restaurants and bars to carry-out and delivery. The "green" phase allows for further easing of restrictions on economic activity as long as CDC and Department of Health guidelines are strictly followed, including larger gathering sizes and more business capacity. Nonetheless, even a green phase includes restrictions and recommends strict social distancing guidelines.

3 The United Way Worldwide defines Family-Sustaining employment as employment that pays a family-sustaining wage, offers benefits including paid sick leave, and offers career pathways that provide opportunities for wage and career advancement. Also, the family-sustaining wage calculator through MIT estimates that in Pennsylvania a single adult with one child needs $50,000 a year.

4 Note that Pennsylvania's Department of Labor and Industry does not county agriculture employment due to the difficulty in gathering timely data. Nonetheless, it's been well reported that farmers expect to be impacted by the pandemic, particularly as harvesting seasons begin in May. Referencing this state data does not ignore these issues, but rather is using the best available data for comparison.

5 A broad look at manufacturing can be found at Soergel (2020). A look at the trade impacts on steel and metal producers can be found at Daniel Moore (2020). A brief summary of impacts on Pennsylvania farmers before the Phase 1 U.S.-China trade deal, can be found at Pittsburgh Post Gazette Editorial (2019).

6 For a broader assessment of the industry, see Eavis (2020). In addition, it's clear that the fracked gas industry must rely on subsidies to prop it up due to its economic fragility. For a summary, see Stonesifer (2020).

7 The total workforce complement in 2005 was 84,038 compared to 78,242 in 2019 according to the Pennsylvania Office of the Administration State Government Workforce Statistics—2020 report.

8 A significant body of literature exists that point to the economic and social troubles caused by austerity measures implemented, most recently, in response to the Great Recession. For recent input from economic experts, see the impacts of austerity in the United Kingdom (New Statesman, 2020), the impacts of austerity throughout Europe (Krugman, 2015), the lack of impact of fiscal expansion on debt/GDP ratios (Coppola, 2017), and a longer look back at the impact of austerity during the Great Recession in the United States and Europe (Krugman, 2019).

9 See Stuckler and Basu, 2013.

10 Beyond the direct costs of the two loan program projected costs, the additional policies listed are assumed to cost between $500,000 and $1 million to develop a hub of information on the DCED website as well as develop the industry-specific reopening plan. In addition, it's difficult to estimate the cost in forgone tax revenue by allowing small businesses the ability to write-off clean and safety supplies, so a range in costs is provided.

11 The Department of Environmental Protection defines an environmental justice area as any census tract where 20 percent or more individuals live in poverty, and/or 30 percent or more of the population is minority. This is based on the most current census tract data from the U.S. Census Bureau and the federal guidelines for poverty. https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/PA-Environmental-Justice-Areas.aspx

12 The COVID-19 Working Capital Access Program was created to support small businesses (less than 100 employees) in the Commonwealth by providing low or no-interest loans of $100,000 to cover 3 months of working capital costs. The Program was funded at $61 million and is fully expended as of the drafting of this report.

13 If the programs are targeted correctly toward small family farms, the goal is to protect the 48,039 small farms that are less than 179 acres, but also assume this support will induce additional economic benefits for landscape, food and beverage manufacturing, and forestry segments of the industry. As such, a range is provided. It's also difficult to assess new job creation potential of these programs, but increasing the conservation, buffer, and farmland preservation programs will provide new project support for both the CERC workforce described above as well as existing land accessors, watershed engineers, and project designers. A conservative range of 1,000 to 2,000 jobs for these policies is provided to reflect on this expected job creation.

14 TeamPA (2018) breaks employment data down further by noting that agriculture production (crops and animals) employ 80,645; forestry employs 64,078; food and beverage manufacturing employs 90,217; and landscaping employs 45,569.

15 It's assumed that these costs include the proposed program costs described in the section above for the Pennsylvania Conservation and Economic Recovery Corps.

16 The PA Department of Agriculture Bureau of Farmland Preservation manages and tracks preservation funding. Their most recent 2019 spending allocation data for state funds totaled $38 million.

17 According to the Bureau of Farmland Preservation, county governments invested $18,265,081 in 2019 compared to $56,264,081 total.

18 Cost estimate is based on the following calculation: $50,000/year salary plus 15 percent for benefits, or $57,500 total. For 15,000 new hires, this equals $862,500,000. Administration costs are assumed to be 5 percent or $28,750,000 for a total estimated cost of $905,625,000. It's assumed this is a maximum cost as the state will provide different salary grades for projects and this estimate assumes workers stay for a full year.

19 Many states have programs similar to the core ethic of the conservation corps, including the California Conservation Corps, Texas Conservation Corps, Montana Conservation Corps, and the Washington Conservation Corps. Many programs are certified through AmeriCorps.

20 Information about the Pennsylvania Outdoor Corps can be found here: https://www.dcnr.pa.gov/outdoorcorps/Pages/default.aspx

21 Leadership from the following agencies would be important to consider: Department of Environmental Protection, Department of Conservation and Natural Resources, Department of Community and Economic Development, Department of Agriculture, Game Commission, Fish & Boat Commission, and the County Conservation Districts.

22 CERC should consider diverse skill sets and job opportunities so that employment opportunities are available for laborers, engineers, architects, recent graduates, unskilled workers, and other trades.

23 This would be a 156 percent increase in workforce for environmental protection, agriculture preservation, and general conservation projects. According to the Pennsylvania Office of Administration Workforce Statistics Dashboard for 2020, DCNR's full-time workforce totals 1,245, plus an additional 1,300 seasonal employees during peak park and forest visitor season. DEP's full-time workforce totals 2,326. The Department of Agriculture totals 541, the Game Commission employs 642 workers, and the Fish & Boat Commission employs 348 workers. The total, existing workforce for the main environmental and conservation state agencies is 6,402.

24 Through conversations with the DEP and current well plugging companies, we estimate the existing well plugging workforce accounts for 15 Pennsylvania companies, each employing approximately 20 employees, or 300 total direct jobs. If the 15 currently operating companies were to add one crew of 6 to 8 employees to fulfill the proposal of plugging 9,000 wells over the next 4 years, this would add 100 new, direct jobs. The DEP internally estimates that the construction workforce needed to support plugging 9,000 wells would create 4,700 additional full time jobs. Broadly, the DEP estimates that 300 total jobs are created per $25 million invested in abandoned well plugging, or 5,400 jobs.

25 Dixon & Bilbrey (2015) calculated the economic benefit of abandoned mine reclamation by using the Department of Interior (DOI) annual economic benefit reports. For FY2012, 7,817 jobs were created from $490 million in AML investment and 4,761 jobs were created in FF2013 on $322 million. Respectively, this equates to 15.9 and 14.7 jobs created per $1 million invested in abandoned mine reclamation. A more recent FY2018 DOI economic report provides data that suggests 2,027 jobs were created in Pennsylvania on $55.7 million in AML grants, or 36.4 jobs per $1 million investment. Using a more conservative estimate—14 jobs created per $1 million invested—it's estimated that $220 million in investment would create 3,080 new jobs.

26 Pennsylvania has mined coal since 1790, beginning just 14 years after the Declaration of Independence was signed. Coal and mining was essential to this state, to families and to communities, and to the success of the country, but its hey-day is past. It has left a bewildering legacy of harm: Tens of thousands of lives have been lost in mining accidents and many more have been lost to a horrendous disease called black lung.

27 In 2008, Congress reduced the per ton fee on surface mined coal by 10 percent to 31.5 cents and underground mined coal by 10 percent to 13.5 cents. In 2013, the fees were reduced again to 28 cents and 12 cents respectively. Combined with an industry-wide reduction in coal mining, Pennsylvania's share of AML funds has fallen from a high of $67 million in 2012 to $33 million in 2019.

28 For a look at some of Earth Conservancy's reclamation projects, see: https://www.earthconservancy.org/projects/

29 For more information on Growing Greener, see: https://pagrowinggreener.org. For more information on RestorePA, see: https://www.governor.pa.gov/newsroom/governor-wolf-releases-seven-detailed-white-papers-on-restore-pennsylvania-initiative/

30 Through conversations with DEP, the approximate cost of properly plugging each abandoned well will cost $50,000. To clear out the 9,000 well backlog on DEP's priority list, it would cost $450 million or $112.5 million per year over 4 years. Eight new DEP full-time employees to support managing this program would each cost $100,000 per position for 8 positions or $800,000. The total cost over 4 years would be $3.2 million.

31 According to the DEP, AML Fund grants to Pennsylvania were $33 million in 2019 and are projected to increase to $55 million in 2020 and $54 million in 2021.

32 The American Council for an Energy-Efficient Economy provides job multipliers for investments in energy efficiency. Because of the diverse, and more labor intensive, nature of energy efficiency activities, projects average 20 gross jobs per $1 million of investment, of 7,940 projected new, gross jobs.

33 In an "Energy Burden" review of 48 major U.S. metropolitan areas that African-American and Latino households spend disproportionate amounts of their income on energy and that more energy efficiency measures would help close the gap by at least one-third. Philadelphia ranked 8th, with low-income households paying 8.8 percent of their household income on utilities - more than three times the amount than higher income households that pay on average 2.3 percent.

34 PEDA last awarded funds for 21 projects in 2014 for a total investment of $81 million. With an investment of $100 million, it's estimated that 25 large projects could be provided funding.

35 This convening was proposed by the Keystone Energy Efficiency Alliance (KEEA) in their Act 129 Phase IV public comments, found here: https://keealliance.org/keea-covid-policy-response/

36 The Value of Water Campaign study The Economic Benefits of Investing in Water Infrastructure finds that for every $1 million invested in clean water and wastewater projects, between 15 and 18 jobs are created. Using the more conservative number of 15 jobs, this includes 6 direct jobs and another 9 indirect jobs triggered by the initial investment. Therefore, based on a total proposed investment of $385 million, we estimate 5,775 jobs would be retained and created.

37 It's unknown what kind of job impact changes to the state C-PACE law would have, though it's estimated it would generate immediate project opportunities. As a result, the economic impact of that policy change is not included in the estimates for this report.

38 The study assumed that increasing rates on water and wastewater by 1.5 percent each would reduce the funding gap to $4.2 billion. Federal funds would further reduce the gap, leaving Pennsylvania with a $900 million state investment gap, of $90 million per year.

39 Federal water infrastructure investment vehicles, such as the EPA's Water Infrastructure Finance and Innovation Act (WIFIA) and the USDA Rural Water Program, all limit the percentage of projects that can be funded by federal or program resources.

40 Other states, including New York, Massachusetts, and New Jersey provide much broader state grant programs for green infrastructure, in addition to traditional methods of financing water projects.

41 In addition to small distributed solar systems that often range from 5 kilowatts (kW) to 3 megawatts (MW) in size, Pennsylvania also has significant potential to install larger grid-scale solar systems such as the 70MW system that BP Lightsource is building under contract with Penn State University, or the similarly-sized system the Community Energy is building to supply power to the City of Philadelphia. One issue holding back development is that, without long-term contracts to sell the power generated, it's difficult to secure private investment. To incentivize development, a requirement could be added to the State's Alternative Energy Portfolio Standards Act to ensure a certain percentage of the energy and alternative energy credits be obtained through competitively-bid long-term contracts of between 12 and 20 years.

42 See e.g. SB 600, Section 3.2.

43 It's unknown what kind of job impact changes to the state C-PACE law would have, though it's estimated it would generate immediate project opportunities. As a result, the economic impact of that policy change is not included in the estimates for this report.

44 For example, the Coalition for Green Capital and the Nature Conservancy have proposed a Pennsylvania Energy Investment Partnership as a way to support distributed energy projects.

45 The United Way Worldwide defines Family-Sustaining employment as employment that pays a family-sustaining wage, offers benefits including paid sick leave, and offers career pathways that provide opportunities for wage and career advancement. Also, the family-sustaining wage calculator through MIT estimates that in Pennsylvania a single adult with one child needs $50,000 a year.

46 Gifford Pinchot's quote can be found in his compendium of essays under the title The Fight for Conservation.

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Acknowledgements

The authors wish to thank all the staff at PennFuture for their feedback and thoughtful guidance during the creation of this report during the COVID-19 pandemic. This project provided a meaningful outlet for staff to advance the organization's mission during a time of great uncertainty, change, and fear. We hope that this report provides a positive vision for the Commonwealth when there is often little hope to be found in the day-to-day news. While there are many who supported this project, the authors would like to specifically call out a few: Jacquelyn Bonomo, Jared Stonesifer, Ezra Thrush, and Abby Jones from PennFuture, who provided significant research, editorial, and policy support throughout this project. We'd also like to thank G. Edward Deseve, Senior Fellow, University of Pennsylvania, and Ellen Lutz, PennFuture's Board of Directors, for providing outside expert review of the report including many thoughtful critiques and recommendations. The authors would lastly like to thank Barbara Erickson for her hard work and expertise in designing the report.

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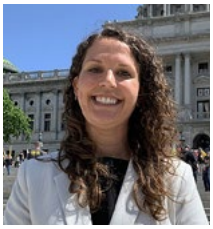
Matthew holds a B.Sc. in Meteorology from Millersville University as well as a M.Sc. in Science, Technology, and Public Policy from the Rochester Institute of Technology.

Madeleine Smith



Lena serves as a Campaign Manager for Clean Water Advocacy for PennFuture. In this role, Lena leads a high-impact campaign around clean water issues, focusing on elevating green stormwater infrastructure as a key environmental issue among Philadelphia's municipal leaders and residents.

Before joining PennFuture, Lena was a Senior New Jersey Organizer and Policy Advocate with Food & Water Watch, where she organized communities to protect the right to public water in Atlantic City and block fracked gas pipelines in the Pinelands. She also successfully lobbied the New Jersey Senate and other state policy makers around a fracking waste ban, as well as renewable energy policies.

Lena holds a M.S.W. in Social and Economic Development from Washington University in St. Louis, and a B.A. in Social Work and Spanish from Gordon College in Wenham, Massachusetts.

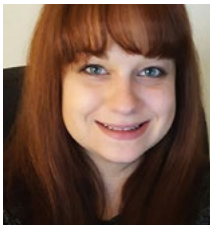
Rob Altenburg

Rob acts as the director of the PennFuture Energy Center, in which he analyzes and provides expert comments and testimony on legislation and regulations. Rob speaks extensively throughout Pennsylvania to students, community groups, and other organizations on climate and energy issues.

Rob previously spent nearly 22 years with the Pennsylvania Department of Environmental Protection. He calculated and predicted emissions from factories, vehicles, and off-road equipment. That led to predicting concentrations of air pollutants for the Bureau of Air Quality using computer models. He served as an executive policy specialist in DEP's policy office advising the governor's office and department executive staff on a variety of environmental and public health issues.

Rob also attended Widener Commonwealth Law School and graduated cum laude, earning certificates in both environmental law and administrative/constitutional law through Widener's Law and Government Institute. He is licensed to practice law in Pennsylvania.

Emily Baldauff



Emily manages PennFuture's issue campaigns, organizes coalition efforts, and maintains relationships with policymakers, members of the organization, and the general public. Overseeing a staff of experts, she is familiar with numerous environmental issues including watersheds, sustainability, urban issues, forest conservation, climate action, air pollution, and consumer energy issues.

She is the state lead for both the Coalition for the Delaware River Watershed (CDRW) and Climate Action Campaign (CAC). Emily also manages the "Our Pocono Waters" campaign, an Exceptional Value (EV) stream designation community and legislative outreach campaign in the Pocono Mountains region.

Emily earned a B.S. in Environmental Resource Management from Keystone College.

Sarah Bennett

Sarah is the Campaign Manager for Clean Water Advocacy in the Erie office. In this role she manages the Our Water, Our Future campaign advocating for clean water in the Lake Erie Watershed.

Prior to joining PennFuture, Sarah was the Chairperson of the Biology Department and Co-Director of the Environmental Science program at Mercyhurst University. She also previously served as the university's Sustainability Officer. In that role, Sarah oversaw university efforts toward sustainability, including energy benchmarking, and chaired the Green Team and Sustainability Fund Review Board.

Sarah earned her B.S. and M.S. in Zoology at Michigan State University.

Renee Reber

Based in the Harrisburg office, Renee leads PennFuture's clean water advocacy efforts in the Susquehanna basin and serves as the Pennsylvania state lead for the Choose Clean Water Coalition.

Prior to joining PennFuture, Renee served as an Associate Director of Clean Water Supply at American Rivers working in both the Delaware and Susquehanna river basins. At American Rivers, Renee focused on green stormwater infrastructure and municipal stormwater management. In her capacity as Associate Director, Renee also served on the Pennsylvania Department of Environmental Protection's Chesapeake Bay Stormwater Workgroup and on the Department of Conservation and Natural Resources' Riparian Forest Buffer Advisory Committee.

Renee holds a B.S. in Environmental Geography and a M.S. in Environmental Studies, both from Ohio University.

Organization Bio

PennFuture is leading the transition to a clean energy economy in Pennsylvania and beyond. We are protecting our air, water and land, and empowering citizens to build sustainable communities for future generations.

Citizens for Pennsylvania's Future—PennFuture—was created in 1998 as a statewide environmental advocacy organization. Since our founding, we have achieved significant legal and policy victories that reduce pollution and protect the environment. We have provided millions of dollars in pro bono legal services while setting critical precedents and enforcing environmental laws across the commonwealth.

Our team is working daily to protect public health, restore and protect natural resources, and move Pennsylvania toward a clean energy future. With offices in Harrisburg, Pittsburgh, Philadelphia, Erie, and Mt. Pocono, our team litigates cases before regulatory bodies and in local, state, and federal courts; advances legislative action on a state and federal level; provides public education; assists citizens in public advocacy; engages with grassroot citizenry to support environmental causes; and engages with communities to increase participation in democratic processes.

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Testimony Before the House Democratic Policy Committee - September 14, 2020

Stephen Herzenberg, Executive Director, Keystone Research Center
(herzenberg@keystoneresearch.org; 717-805-2318)

Chair Sturla and members of the committee, thank you for the opportunity to testify before you today. My name is Stephen Herzenberg and I am an economist and the executive director of the Keystone Research Center. I want to tell you about an exciting new campaign that we help lead called ReImagine Appalachia, along with our partners from PennFuture and the Pennsylvania Association for Sustainable Agriculture. Before you do anything else after this hearing I want you to take three minutes, Google "Reimagine Appalachia Facebook page" and pull up our campaign video (https://www.facebook.com/watch/?v=331010637929441). You know it's good because of our campaign's quality control: I drafted the first version of the script which was promptly thrown away and other members of our team asked to start again. It's a powerful video and you should watch it, like it, and share it. Today. OK?

Our ReImagine Appalachia campaign initially focuses on federal advocacy for a green stimulus, which we call a New Deal That Works for Us, which would be a great way to pull ourselves out of the COVID crash—with millions of new jobs performed safely outdoors. If we get a green stimulus or green new deal from Congress within the next year, states will have an important role administering portions of the funds. In addition, states and localities, including in Pennsylvania, will take their own actions in response to the fact that the world is literally on fire—and the consequences of a changing climate increasingly demand decisive action. ReImagine Appalachia offers a vision and issue priorities should guide state and local as well as federal action on climate—and should guide priorities in the entire state of Pennsylvania not just in our Appalachian counties.

Here is the short version of our campaign vision. Our nation faces multiple crises, including the pandemic, an economic downturn and the long -term challenges of economic inequality, racism, and climate change. ReImagine Appalachia argues that we can address these challenges together to achieve inclusive shared prosperity AND achieve net zero carbon emissions by 2050.

Expanding opportunity must be at the core of our climate response because all four of these states have experienced decades of rising inequality. From the early 1900s to 1940, the average incomes of the bottom 90% in these four states did not increase. From 1940 to 1977, the average income of the bottom 90% increased about three times in Pennsylvania and up to five times in the other states which started with lower incomes. Since 1977, the average incomes of the bottom 90% have again been flat and virtually all the gains of growth have gone to the top 10%. Is it any wonder that many working people are angry or apathetic about politics?

How do we ensure that that our response to a changing climate increases opportunity? It's not rocket science. We highlight two main ways. First, public investments and regulations that aim to reduce carbon emissions must come with strings attached so that new investment translates into to good new jobs that pay well and afford workers real rights to form a union. Thus, implementation of the Regional Greenhouse Gas Initiative (REGGI) or a potential new Pennsylvania Advanced Energy Portfolio Standard (AEPS) next legislative session should include such strings. Clean energy bills in Washington state, New York, and Minnesota provide partial models, including requiring prevailing wage standards, and encouraging or requiring project labor agreements on construction projects. Ensuring union rights and good wages must extend to permanent as well as construction jobs within growing clean energy sectors

or sectors, such as broadband, that support carbon emissions reduction (e.g., by enabling a smart, and more energy efficient, grid).

ReImagine also highlights that the strings attached to climate legislation should include two more specific priorities.

- We must give coal and other fossil fuel workers priority for good new jobs and, for workers close to retirement, wage insurance and protection for health care and retirement. Economists call this socializing the transition costs of action required for the benefit of all—in this case, reducing carbon emissions. Normal people call this basic fairness plus practical politics—these steps can make it easier to achieve consensus on the need for decisive action on climate.
- We must also ensure that diverse next-generation workers—including Black and Indigenous people of color, women, and low-wage workers—have access to the good new union construction and permanent jobs created through public investment. To achieve this goal, we can rely on a wealth of experience nationally—and in Philadelphia and Pittsburgh. The Philadelphia Area Labor Management Committee has since the 1990s been embedding economic opportunity plans within project labor agreements on construction projects. In Pittsburgh, the labor-management Builders' Guild and Partner4Work, the workforce development board, is currently expanding pre-apprenticeship training for diverse workers that leads to union jobs and/or construction apprenticeship.

The second main way to expand opportunity in conjunction with carbon emissions reduction is to protect workers' rights for ALL workers. Most jobs are neither "carbon" nor "green" jobs—at least in a narrow sense. But too many of the majority of jobs in the rest of the economy pay poorly, including in the services and in frontline sectors that employ essential workers (distribution, food processing, health care, childcare, grocery stores).

The Reimagine Appalachia framework also spells out the public investment needed to create a 21st century sustainable economy including by modernizing the electric grid—expanding renewable energy and universal high-quality broadband; growing manufacturing by making it cleaner and more efficient; building a sustainable transportation system; promoting energy efficiency; and boosting carbon absorption through regenerative agriculture, planting trees and restoring wetlands. One last proposal is revitalizing Franklin Roosevelt's Civilian Conservation Corps which from 1933 to 1941 employed 3 million people, the equivalent of 10 million today, or about 400,000 in Pennsylvania. As Penn Future has highlighted, states could also launch CCC-type programs. That said, the federal government's ability to deficit spend would make it easier to reach the scale necessary to give all willing and able-bodied adults family sustaining CCC jobs and the dignity that comes from work that contributes to the greater good.

The overall message driven home by looking hard at all the investments needed to reduce carbon emission is: "wow, that's going to create a whole lot of blue-collar, industrial and construction jobs." Yes, it is—a lot more such jobs than fossil fuel industries that have overpromised and undelivered and which market forces appear likely to shrink further in the next few years. With the right policies to ensure that the clean energy and infrastructure jobs created by climate response legislation are good, union jobs—and with real union rights for workers in all sectors—we can transcend longstanding blue-green divisions. We can create that New Deal that works for us which the 99%—in fact, just about everybody except the Koch Brothers—really want: a sustainable economy with shared prosperity, strong communities, and natural places protected and enhanced for the next generation.

Pasa SUSTAINABLE AGRICULTURE

Testimony Before the House Democratic Policy Committee - September 14, 2020

Sara Nicholas, Policy Specialist, Pasa Sustainable Agriculture
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Pasa is a 30-year old nonprofit organization that promotes farming and conservation of our natural resources as mutually beneficial efforts. We have 7,500 members, mostly farmers, as well as members who are primarily consumers and who care where their food comes from, how it is produced, and how it affects their health and the health of their families.

Our farmer members represent a wide variety of agriculture in Pennsylvania, from young farmers cultivating vegetables on 5 acres or less, to large-scale operators growing commodity crops in more conventional farming operations, and many in between. The COVID-19 pandemic has hit farm families especially hard, exposing weaknesses that have been emerging for the past decade. Between 2012 and 2017 - the latest USDA data available - there was a 10% loss of farms in the Commonwealth. Consolidation and national policies that promote large-scale industrial farming are partly to blame, but climate change and a vulnerable food supply chain have also played a role. The following legislative priorities reflect the interests of our farmer members and the mission of sustainable agriculture as a whole. We appreciate the opportunity to share these with you today.

Community solar - Many of our members have expressed an interest in a more sustainable and inexpensive way to generate electricity for their farm needs, and many have signaled an interest in small-scale solar. It turns out that solar arrays and sheep grazing work very well together. We have a few members who have built small arrays on their farms for personal use, and combined this with sheep grazing. Through trial and error, we've learned that goats and cattle are not as compatible with solar as sheep. House Bill 531 was introduced last year, and would enable farmers to install small-scale solar for on-farm use or for community use within several adjacent farms. Currently this is not allowed in Pennsylvania. Many farmers are already on the brink of insolvency due to COVID-19, long-term trends in dairy consolidation, and could use a break in energy costs. Most are not interested in the large industrial-scale type of solar, but want solar for their business use. Passing **House Bill 531** to amend the Alternative Energy Portfolio Standards to allow the development of community solar facilities would help many farm families meet this need.

Small meat processing bottleneck - Very early in the pandemic this year, it became obvious that our food supply chain was not as robust as many thought. One of the worst bottlenecks appeared in the meat supply chain, as midwestern meat processing plants, and at least one large plant in Pennsylvania, were shuttered due to COVID 19. One result is that large lots of livestock began flooding into Pennsylvania, where we still have a number of small and very small meat processing plants, crowding out local livestock producers and resulting in some

cases in herds that had to be culled. Expanding existing processing plants in PA, loosening rigid restrictions and high expenses in USDA meat inspection requirements, increasing federal cost share dollars in Pennsylvania, and expanding the PA Farm Bill's small meat grants program from $600K to $2 or $3 million/year would start to address this complicated situation. While most of the fixes for this are at the federal level, giving farmers more freedom to do custom butchering on their farms would be a great first step, especially poultry.

Driving PA Forward - Many of you know that farm workers from other countries do much of the essential labor at farms across the state, either as H2A visa holders or as undocumented workers. COVID 19 also affected the ability of many of these workers to get back into the US just as the field season was starting. These farm workers are highly skilled, highly efficient and hard working folks who usually return year after year to the same farm. Some farmers were able to get their workers in, others not, and discovered that hiring high school students or out of work restaurant workers was not the same, and struggled to get their crops planted, weeded and now harvested. On top of what farm workers experienced as far as exposure to the virus itself, often living in crowded conditions and without access to health care, farm workers are often stopped while driving to their jobs and can be fined, arrested or even deported.

Having a Pennsylvania driver's license would help many of these workers get to work, get their kids to school, or get relatives to a hospital, without having to worry about being fined, jailed or deported. Some of the workers we have heard from report driving to work at 1 in the morning to make sure they are available to do the milking that starts in a barn at 3am, because they're less likely to be pulled over by patrols. These folks need our help. The Driving PA Forward campaign has drafted a bill that would allow any farm worker, regardless of immigration status, to apply and get a driver's license. This humane legislation helps the farm economy, ensures farm workers can drive legally, and makes the roads safer by requiring license holders to know the laws. The bill has yet to be introduced as it is still looking for a republican co-sponsor.

Promoting the PA Farm Bill and REAP - Pennsylvania should be proud to have passed the first state Farm Bill in the country. One of the stand-out programs is the REAP tax credit program, which offers farmers or their sponsors a tax credit for completing conservation projects. The popular program usually is oversubscribed, and should be doubled from its current $13M to $25M. This year's version of REAP, launched in August, emphasizes projects that improve soil health - something Pasa staff have been working on and demonstrating on farms for many years. A small 1% increase in soil health organic matter has been shown in studies to absorb an additional 20,000 gallons of rainwater per acre, protecting farm soils against intense flooding as well as intense drought. In future legislation, we would like to see agencies and resources like PEMA and FEMA's emergency flood assistance go to farmers to install no-till, cover crops and other organic soil building practices that will save the Commonwealth millions of dollars in future years, and most importantly - protect our food sources.

Funding Chesapeake Bay conservation practices: The recent Watershed Implementation Plan (WIP) 3 effort completed last year by DEP, DCNR and PDA found that meeting federal

water quality standards for the Bay would require Pennsylvania to spend an additional $320M per year. After all the planning, local input and great ideas generated by the three-year WIP, it's time to put some funding in to address the problem. Farmers are willing to do more, but can't fund conservation efforts by themselves, and federal funds are not always available or the right fit. SB 1272, which will be introduced soon, would set up a program similar to the successful Dirt and Gravel Road Program to help farmers improve conservation practices through county Conservation Districts. This legislation is an important first step to addressing Bay requirements, and should be passed. This summer, Pasa staff produced a report, Water Farming, that shows how farming can be part of the solution to improving water quality, not just the problem. See our new report at
https://pasafarming.org/wp-content/uploads/2020/07/Water-Farming_Pasa-Sustainable-Agriculture.pdf

Promoting Farm Diversity and Agritainment

Given the slim margins of many agricultural businesses, even more pressured under the current pandemic, allowing farmers to expand their operations with events, corn mazes, hayrides, and other activities provides an additional income source and reminds the public how important farms really are. **HB 1348** would limit liability for these events, and is a common sense response to farms' needs to diversify and to augment farm income. A similar effort was passed by the General Assembly to limit liability for outdoor recreational activities, RULWA, and has been a boost to the state economy.

TESTIMONY OF E2 (ENVIRONMENTAL ENTREPRENEURS)

Sharon Pillar, Pennsylvania Consultant for E2 and the Renewables Work for PA Coalition

On Economic and Jobs Benefits of Clean Energy

Before the

Democratic Policy Committee, Pennsylvania House of Representatives

RENEWABLES WORK FOR PA

Harrisburg, Pennsylvania

September 14, 2020

(Verbal testimony presented virtually)

Chairman Sturla, Representative Webster, members of the Committee, thank you for inviting me and E2 to comment on the opportunities of the clean energy economy.

My name is Sharon Pillar and I am the Pennsylvania consultant advocate for E2 or Environmental Entrepreneurs. E2 is a national, nonpartisan group of business leaders, investors, and professionals from every sector of the economy who advocate for smart policies that are good for the economy and good for the environment. E2 members have founded or funded more than 2,500 companies, created more than 600,000 jobs, and manage more than $100 billion in venture and private equity capital. I work with E2 to lift up the business voice to decision makers and to advocate for policies that benefit the environment and economy.

In addition, I co-lead the Renewables Work for PA coalition along with partner organizations, the Mid-Atlantic Renewable Energy Coalition and the Pennsylvania Solar and Storage Industries Association. Renewables Works for PA is a coalition of more than 100 renewable energy businesses working together to increase Pennsylvania renewable energy goals.

My testimony today will:

- Outline the depth and breadth of the current clean energy economy
- Discuss clean energy job losses due to COVID-19 and other threats to renewable energy growth in the state
- Present a case for policy adoption that will create dynamic growth of tens of thousands of jobs and attract billions of dollars of private investment without requiring a dime in state revenues and help family farms

Clean Energy Economy and Jobs

E2 is known for their clean energy jobs reports, including the annual Pennsylvania Clean Jobs report. Even though this year's report will not be released until next week on September 23, we do have some job information to share.

We currently know that Pennsylvania has had a steady increase of clean energy job growth of about 6% every year since 2015 and we had more than 91,000 clean energy jobs pre-COVID. The majority of those jobs were in energy efficiency (almost 70,000), about 10% or close to 10,000 jobs were in renewable energy sectors, about 8,000 in clean vehicles, and more than 3,500 in grid modernization and storage. Clean energy jobs have outpaced jobs in the fossil fuel sector two to one, and one out of three jobs in the energy sector are clean energy jobs. The clean energy industry employs people in every county in the state and includes jobs across all educational levels. Last year, Pennsylvania ranked 11th in the nation for clean energy jobs.

While this sector has showed growth rates much above the average employment growth across the state, many of these industries have also been impacted by the pandemic.

Based on the latest numbers at the end of July, Pennsylvania has lost a total 18,689 clean energy jobs since Pre-COVID with more than 75% of those losses coming from the energy efficiency sector (see Table 1 below). Clean energy job losses were the highest in April and then have rebounded only slightly in June and July.[1]

Pennsylvania Clean Energy Job Losses Since Pre-COVID (as of July 31, 2020)

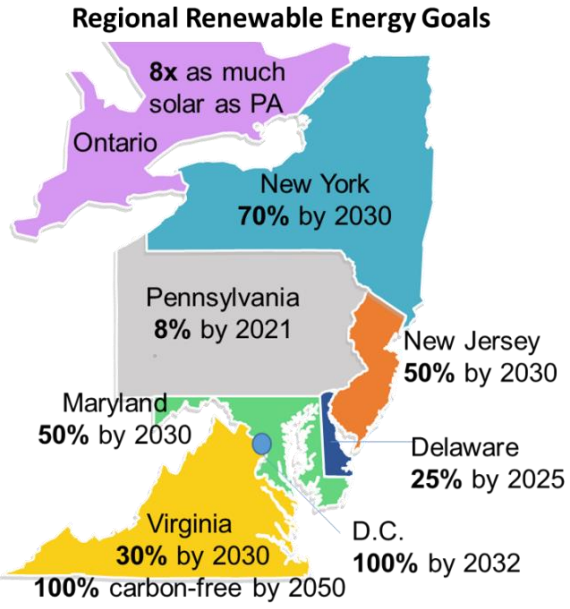
	Jobs Loss since Pre-COVID	Percent Decline
Statewide TOTAL	18,689	~20.6%*
Jobs losses in Energy Efficiency	14,463	20.2%
Counties with Highest Job Losses		
Allegheny	2,010	15.9%
Montgomery	1,169	12.9%
Lehigh	1,102	14.3%
Lancaster	644	14.1%
Berks	533	15.5%
Bucks	485	9.3%
Delaware County	399	12.0%

*Based on the latest Clean Jobs PA Jobs report of2019 with 90,772 clean energy jobs. [source: https://e2.org/reports/clean-jobs-pennsylvania-2019/]

While these industries have suffered, they also offer some of the largest job growth opportunities, particularly if some very important policies are passed on the state and federal level. Before I talk about those policies, I would like to mention other parallel impacts that the renewable energy sector is facing.

Additional hurdles to renewable energy sector growth in Pennsylvania

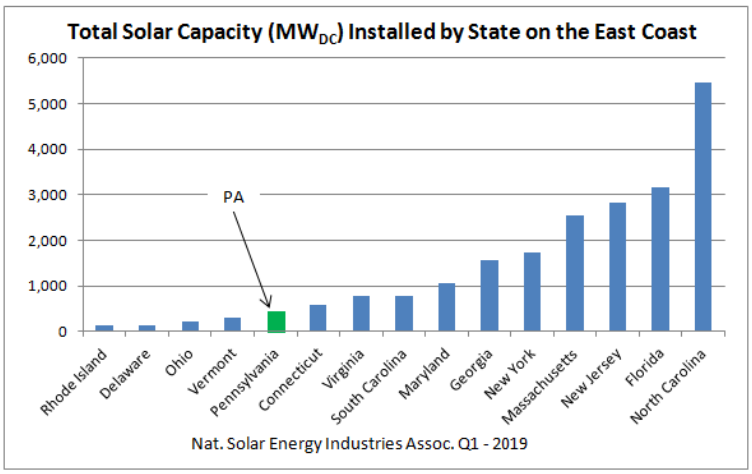
In addition to COVID, the renewable energy sector at a crucial moment that will determine growth. If current policies remain the same, the industry growth in Pennsylvania will be in slower than in other states with better policies and the industry will not rebound as well as it could. The solar industry is faced with rapidly declining tax credits on the federal level (30% in 2019, 26% in 2020, 22% in 2021 and 10% for commercial systems and 0% for residential solar in 2022) coupled with Pennsylvania's weak renewable energy goals in Tier I of the Alternative Energy Portfolio Standards (AEPS).



The AEPS (passed in 2004) has only an eight percent goal for "Tier I" resources, which include both renewable sources (solar, wind, low-impact hydropower, and geothermal) and non-renewable sources (coal-mine methane, biomass, and wood manufacturing waste products). Within this eight percent, there is a "carve-out" of one-half of one percent (0.5 percent) for solar photovoltaic (PV) electricity.

A decade ago Pennsylvania was a leader in solar and wind, but the state has fallen to 22nd and 19th, respectively.[2] Most neighboring states now have more aspirational goals of 50% or higher by 2030 (see Illustration for goals from other states).

As other states ramp up to build more renewable generation, this gap will widen and Pennsylvania will fall farther behind. As the sixth largest state in the nation, Pennsylvania embarrassingly lags behind most other East Coast states in deploying renewables (see graph below) and even worst when comparing on a per capita basis. This is a missed opportunity for our state in terms of jobs, private investment, and revenue generation for both local and state coffers.



Policy Recommendations for Economic Recovery

Expanding energy efficiency, clean vehicles, smart grid and storage sectors can add thousands more good paying jobs to the economy and policies that promote expansion of electrification of our transportation system and increase the goals of Act 129 should be considered. However, for the purpose of this hearing today, I want to focus on the single largest jobs and economic development opportunity that the state has seen in decades –increasing the renewable energy goals in the AEPS.

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Expanding the AEPS is the single largest jobs and economic development opportunity that the state has seen in decades - and can be accomplished without the use of any state revenues.

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By increasing Tier I of the AEPS to 30% with 10% in-state solar by 2030, Pennsylvania has the potential to create upwards of 100,000 jobs in the next ten years. Analysis done for the Finding Pennsylvania's Solar Future project revealed that moving to 10% solar will create 60,000-10,000 jobs (greater mixes of distributed generation will create higher job opportunities).

These job estimates were echoed by a study commissioned by Community Energy and completed by independent power analytics firm PowerGEM, LLC. The study concluded that moving to 10% solar would bring almost $10 billion in new private investment in the state and create more than 65,000 jobs for installers, sales people, accountants, lending institutions, electricians, surveyors, design and civil engineers, real estate agents, and geotechnical analysts, along with the full range of construction, operation and maintenance jobs.

In addition, adding this much solar to our grid would decrease the state's wholesale electric costs by $619 million annually and would lower wholesale electric prices across the multi-state utility power grid, PJM Interconnection, by $3 billion annually through peak shaving.[3] High penetrations of

renewables will decrease energy costs for everyone on the grid, spreading the benefits even to those who don't have solar installed on their rooftops.

This study also concluded that 10% solar goal would results in:

- 9.2 billion in private capital investment
- $5.3 billion in local economic benefit
- $4.1 billion in wages
- $2.3 billion in farmer lease payments
- $228 million in local tax revenue from grid scale solar projects.

And this research doesn't even include the tens of thousands of other jobs in the wind, low-impact hydro, and the methane digesters that would result from the increase renewable goals.

Pennsylvania has the potential to generate much more energy from renewables

On the renewable energy front, Pennsylvania has the potential to cost-effectively generate much greater amounts of renewable energy than the current five percent that is coming from wind, hydro and solar. According to the DEP's 2018 Energy Assessment, Pennsylvania has the potential to economically increase grid scale solar 3,687 percent and distributed generation solar 255 percent from 2015 – 2050. In the "Finding Pennsylvania's Solar Future" project, the DEP explored the question: whether Pennsylvania has sufficient technical and economic solar potential to meet 10 percent of in-state electricity demand with in-state solar generation by 2030. The report found that Pennsylvania does have such potential and recommended fifteen strategies for achieving it, including increasing the solar target in the AEPS by 2030.[4] Wind capacity is currently only 1,459 MW in Pennsylvania, but the state has the technical potential for 108,946 MW.[5]

If Pennsylvania is serious about tacking climate change, we must build a robust renewable energy market. The Regional Greenhouse Gas Initiative (RGGI) is an important policy to reduce carbon and while it will result in the increase in some renewables, it will likely result in a large build out of natural gas rather than of renewables.[6] Therefore, Pennsylvania needs both RGGI and an increase in Tier I of the AEPS in order to create a market signal to investors that Pennsylvania is open for business and to ensure that we create a diverse energy market. With business as usual or with RGGI, the state's generation mix is projected to become dominated by 70% natural gas by 2035. This is not a sustainable from an environmental or economic standpoint and as fossil fuel pricing is volatile and subject to market fluctuations.

Benefits to farmers and reuse of abandoned mine lands

Pennsylvania has lost more than 6,000 farms between 2012 and 2017 and more farms are filing for bankruptcy due to the pandemic. However, some farmers are starting to lease portions of their land to renewable energy development and continuing to farm the remaining land. These lease payments provide a steady annual income to the farmer for the length of the lease – about 20 years. In addition, many large scale solar and wind development incorporate grazing animals such as sheep and grow pollinator-friendly plant species, thus, expanding the economic opportunities in rural areas beyond just energy production.

The Finding Pennsylvania's Solar Future study also noted that "only 124 square miles (79,200 acres) of land will be needed to increase grid solar sufficiently to generate 10 percent of electricity. This is

less than three-tenths of 1 percent of Pennsylvania's total land area of 46,055 square miles." Pennsylvania has about 200,000 acres of abandoned mine land, so there is a huge opportunity to put these waste sites to use.

Waiting to unleash the economic powerhouse of renewable energy growth

Currently, there are more than five gigawatts (GW) -or about 4% of our electricity- of solar energy registered in the PJM queue. These are large scale utility projects that are in various phases of development. Many of these projects are just reserving their place while the developers wait for policy change. Increasing the AEPS sends a strong market signal to investors that Pennsylvania renewable energy market is open for business. The minute the AEPS is increased, a massive surge of development and job training will ensue, unleashing a flurry of economic activity that will ripple through the supply chain and throughout the entire state.

There are four bills in the Pennsylvania legislature that can unleash this development and none of them require state revenue. HB1195/SB 600 would increase Tier I of the AEPs to 30% by 2030 with 10% solar and HB2855/SB1297 increase the goals to 18% by 2025 with 5.5% solar – which is the same trajectory as HB1195/SB600. E2 and the Renewables Work for PA coalition support both of these bills.

A vibrant renewable energy industry is necessary to fight climate change. Increasing the AEPS now before it flat-lines in May of next year will bring tens of thousands of jobs, generate billions of dollars of private investment, produce millions in local property taxes and state revenue to Pennsylvania communities, and help to save family farms – all while reducing harmful emissions from fossil fuels.

We can have a healthy environment and a healthy economy.

Again, thank you for the opportunity to testify at today's hearing as you grapple with the awesome responsibility of trying to help our people, our economy and our environment thrive once again. I'm happy to answer any questions.

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[1] BW Research. Clean Energy Employment Initial Impacts from the COVID-19 Economic Crisis, July 2020, Revised https://e2.org/wp-content/uploads/2020/08/Clean-Energy-Jobs-July-COVID-19-Memo-Final_revised.pdf

[2] See https://www.seia.org/state-solar-policy/pennsylvania-solar and https://www.awea.org/Awea/media/Resources/StateFactSheets/Pennsylvania.pdf

[3] See https://www.communityenergyinc.com/blog/study-finds-replacing-10-of-pennsylvanias-electric-generation-with-solar-would-result-in-more-than-300-million-net-savings-annually-and-create-65000-jobs

[4] See Department of Environmental Protection, Energy Assessment Report for the Commonwealth of Pennsylvania (April 16, 2018). See also Pennsylvania's Solar Future Plan: Strategies to Increase Electricity Generation from InState Solar (November, 2018), available at https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/SolarFuture/Pages/Pennsylvania's-SolarFuture-Plan.aspx

[5] See https://www.awea.org/Awea/media/Resources/StateFactSheets/Pennsylvania.pdf

[6] See Natural Resources Defense Council report. https://www.nrdc.org/experts/mark-szybist/pa-needs-renewable-energy-goals-well-carbon-limits

House Democratic Policy Committee Hearing Testimony

Lauren S. Imgrund, Deputy Secretary Conservation & Technical Services

September 14, 2020

Chairman Sturla, Representative Webster and members of House Policy Committee, thank you for providing the Department of Conservation and Natural Resources with this opportunity to speak on the importance of outdoor recreation to Pennsylvania's communities. Pennsylvanians are seeking solace, fresh air, and exercise in the outdoors in record numbers during the current pandemic. There is unprecedented use of state and local parks, state forests, and trails as people seek safe places to maintain their mental and physical health.

For example, state parks this summer have seen unprecedented attendance levels. During May, June, and July, parks saw increases of more than a million visitors each month over the same periods last year, representing monthly visitation increases systemwide of as much as 36 percent, with some parks seeing 50 to 100 percent more visitors. Research commissioned by the Pennsylvania Environmental Council found that trail traffic spiked by as much as 200 percent in some areas during March when compared with the same period during the previous two years, and trail counters demonstrate that usage has continued over the summer.

Our outdoor recreational assets are true economic drivers worthy of the investments to keep them open, safe and welcoming. Not only do they support jobs and generate revenue, but they also provide the amenities and services that are so critical to the vibrancy of the places we call home. Access to the outdoors for all improves quality of life, which translates into attracting business and increasing housing values.

Increased outdoor recreation boosts Pennsylvania's economy, and will be crucial to the state's financial recovery. Annually, outdoor recreation in Pennsylvania generates $29 billion in consumer spending and $1.9 billion in tax revenue while directly supporting 251,000 jobs. This is the fifth largest state outdoor recreation economy in the country and includes lots of small businesses. A 2012 Penn State study found that the nearly 40 million annual state park visitors generate more than $1 billion in economic activity each year

Pennsylvania has more than 6,000 local parks and 12,000 miles of trails. Local governments, volunteer groups and individual citizens work to create and maintain these close to home parks, playgrounds, green spaces, and trails. These projects would be impossible without grants from the Keystone Park, Recreation and Conservation Fund and the Environmental Stewardship fund, which in turn leverage at least twice their amount in local dollars and support businesses across the Commonwealth (construction, planning, etc.). The Keystone Fund has supported projects in every county and half of Pennsylvania's municipalities.

Pennsylvania's new Outdoor Recreation Plan – *Recreation for All* – establishes this vision for Outdoor Recreation in our Commonwealth - *enjoyable outdoor recreation is welcoming to all and accessible in every Pennsylvania*

community. As part of the planning process, DCNR collaborated with the Trust for Public Land and the Pennsylvania Land Trust Association to understand access to outdoor recreation in Pennsylvania. The research identified areas with the greatest need and opportunity to develop new public recreational sites to serve Pennsylvanians who lack access. Park advocates and local governments can use this data in their comprehensive plans to assist in determining where to invest resources. These conservation and recreation projects inject millions of dollars into the economy, sustaining quality local jobs and keeping businesses that anchor communities—such as construction and engineering companies—afloat.

Outdoor recreation is also key to helping address some of today's pressing health care issues. There is mounting evidence that spending time outdoors benefits human health – and creating walkable, bikeable communities with access to parks and green spaces encourages active living. Nearly 90 percent of respondents to the plan's on-line survey agreed that outdoor recreation is an essential part of their lives and 80 percent would like to participate more in outdoor activities. The key to life-long participation is access – if people have access to safe, clean and ready to use parks and trails they will incorporate them into their daily lives.

Only a little more than half of Pennsylvanians can safely walk to a local park and some Pennsylvanians don't feel safe traveling to parks outside their neighborhoods. Participants in a Black focus group conducted for the plan indicated they felt uncomfortable in certain recreation areas where they did not encounter many other people of color. These issues have been brought into even sharper focus as Pennsylvanians and the country grapple with how we treat

every person equally and with respect. DCNR and our partners are focusing creating more welcoming spaces through, for example, telling the cultural and historical stories of people of color, partnering with multi-cultural groups and organizations, and promoting practices and programs that engage all people.

The COVID-19 pandemic and its fallout have made it abundantly clear that outdoor recreation is vital to Pennsylvania's economy and the wellbeing of millions of its citizens. In the most difficult time of their lives, people have turned to parks, forests, trails, and neighborhood green spaces. It has never been more important to invest in these resources and ensure they exist for future generations to turn to in their own times of need. Pennsylvania has incredible outdoor assets, and we need to continue our commitment at all levels of government to maintain, restore and expand these assets so that all people in every community have access to safe outdoor recreation and feel welcome in all places.

The Economic Value of Riparian Buffers in the Delaware River Basin

August 2018

Prepared for:

Delaware Riverkeeper Network

FINAL REPORT

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ECONorthwest specializes in economics, planning, and finance. Established in 1974, ECONorthwest has four decades of experience helping clients make sound decisions based on rigorous economic, planning and financial analysis.

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Disclaimer

ECONorthwest completed this project under contract to Delaware Riverkeeper Network.

Throughout the report we have identified our sources of information and assumptions used in the analysis. Within practical limits, ECONW has made every effort to check the reasonableness of the data and assumptions and to test the sensitivity of the results of our analysis to changes in key assumptions.

We gratefully acknowledge the assistance of the many individuals who provided us with information and insight. But we emphasize that we, alone, are responsible for the report's contents. We have prepared this report based on our own knowledge and training and on information derived from government agencies, the reports of others, interviews of individuals, or other sources believed to be reliable. ECONorthwest has not verified the accuracy of such information, however, and makes no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available.

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Executive Summary

Riparian buffers are strips of undeveloped land surrounding streams, rivers, ponds and reservoirs. They help to protect water bodies from the impact of adjacent land uses, and provide a suite of crucial ecological services including water purification, flood control, climate regulation, corridors for wildlife movement, and opportunities for outdoor recreation (Table ES1).

Over the past 300 years, nearly half of the Delaware River Basin's original riparian forests have been cleared. Remaining forests are threatened by expanding suburban development. In this report we value losses in ecosystem services that may result from ongoing trends in riparian development and land clearing in the Basin. Specifically, we assess the loss of ecosystem services associated with a 0.6 percent decline (nearly 1,700 acres) in natural riparian land cover within 100 feet of water bodies across the Basin, as occurred between 2001 and 2011. We then project this same rate of development over a 10-year time frame, 2018 to 2028.

Without more effective protection for riparian buffers, we estimate an annualized loss of approximately $981 thousand to $2.5 million in the value of monetized ecosystem services. Translated to a single acre, buffers provide over $10,000 per acre per year in monetized benefits (Table ES2), with additional non-monetized benefits expected to increase this total. Considering these benefits over time, policies that protect riparian corridors represent one of the most efficient investment opportunities facing communities in the Basin.

Total benefits over time, and with extension to even wider buffers, are clearly in the tens of millions of dollars. These benefits are orders of magnitude greater than the one-time costs of protecting these areas before they are developed. Providing these benefits through conservation rather than restoration is particularly cost-effective. The specific benefit categories addressed in this report are:

- Water Quality
- Carbon Storage
- Air Quality
- Flood Prevention
- Property Values
- Wildlife Habitat
- Outdoor Recreation

The connections that riparian corridors provide between fragmented habitats and land parcels are important for both wildlife (enabling dispersal and migration) and humans (a benefit that is increasingly highlighted in regional park and trail plans). Climate change and urbanization will increase the importance and value of buffer services (e.g., by allowing communities in the Basin to adapt to rising recreation demand, increased wastewater and stormwater discharges, and higher peak temperatures affecting streams). Table ES1 summarizes riparian buffer benefits, and Table ES2 summarizes monetary values for a subset of these benefits.

Table ES1. Benefits of Protected Riparian Areas

Source: ECONorthwest with data from multiple sources (see report)

Effect Category	Riparian Buffer Effects	Ecosystem Services
Water Quality	↑ Sediment capture ↑ Nutrient uptake and filtration ↓ Sediment, nitrogen and phosphorus delivered to waterways ↓ Summer water temperatures	↓ Water treatment costs ↑ Drinking water quality ↑ Water clarity ↑ Quality and quantity of water-based recreation ↓ Fish kills and algae blooms ↓ Reservoir and channel dredging
Community Appeal and Livability	↑ Aesthetic conditions surrounding nearby homes (shade, flood protection, noise reduction, privacy) ↑ Visual appeal of riparian recreation areas and water trails	↑ Residential property values ↑ Property tax base ↑ Quality and quantity of land- and water-based recreation
Aquatic Habitat	↑ Aquatic inputs (e.g., leaves, fallen trees, insects) for food and cover ↑ Bank stability ↑ Stream shading ↓ Summer stream temperatures ↑ Dissolved oxygen levels	↑ Recreational fishing opportunities ↑ Commercial fish harvests ↑ Abundance of sensitive aquatic species ↓ Habitat enhancement/replacement costs
Terrestrial Habitat	↑ Habitat for wildlife foraging and breeding ↑ Connections between isolated habitats ↑ Conduits for daily movement to annual migrations	↑ Hunting and wildlife viewing opportunities ↑ Abundance of sensitive wildlife species ↓ Habitat enhancement/replacement costs
Flood Control	↓ Runoff speed ↓ Downstream flood peaks ↓ Sediment loads	↓ Damage to downstream property and crops ↓ Flood insurance premiums ↓ Flood infrastructure and control costs ↓ Risk to human life
Carbon Storage and Air Quality	↑ Capture and storage of carbon, airborne particulates, nitrogen and sulfur dioxides	↑ Improved human health ↓ Healthcare costs ↓ Climate Change effects and extreme weather events ↑ Climate resiliency

Table ES2. Ecosystem Services Provided by Riparian Buffers in the Delaware River Basin, and Per-Unit Values

Source: ECONorthwest with data from multiple sources (see report)

Ecosystem Service Provided	Per-unit Value for Services
Nutrient Retention	$87 to $4,789 per acre per year
Carbon Storage	$4,762 to $8,477 per acre per year
Air Quality	$3 to $132 per acre per year
Aesthetic Values	+1% to +26% Property Price Premium
Flood Mitigation	Qualitative Description
Recreation	$63 per acre per year (lower bound)
Wildlife Habitat	Qualitative Description
Combined Buffer Services	$14/Household/Year

Introduction

Riparian areas occupy only three percent of the landscape but they provide a disproportionately diverse and important set of ecological services to society, and conservation benefits throughout the watershed (Table ES1).[1] These benefits are particularly important when much of the remainder of the watershed is developed, as in the Delaware River Basin.

In this analysis, we consider the potential benefits of protecting and restoring riparian areas across the Delaware River Basin. We begin by providing the economic framework for evaluating the value of ecosystem services provided by riparian zones. Next, we describe the status and recent trends of land cover within the Basin's riparian zones. We then consider the ecological functions of riparian areas and draw on peer-reviewed literature and governmental reports to assign economic values to these services.

The steps in this analysis are:

1. Provide an economic framework based on ecosystem services to assess riparian buffer benefits in the Delaware River Basin.
2. Quantify the existing area of riparian buffers and rates of loss across the Basin
3. Review existing literature on the economic benefits of riparian buffers relevant to the Basin and compile monetary values.
4. Estimate the monetary and non-monetary benefits associated with avoiding further loss of riparian buffers.
5. Consider policy design implications of economic findings, including urgency associated with urbanization trends.

The final results of this analysis are:

- A series of maps detailing the status and trends of riparian buffers in the Delaware River Basin
- A literature review of economic benefits of riparian buffers relevant to the Basin
- Monetary values of ecosystem services of riparian buffers in the Basin by relevant spatial and household units
- Net benefits over time for avoiding continued loss of riparian vegetation

Background on Ecosystem Services and their Economic Value

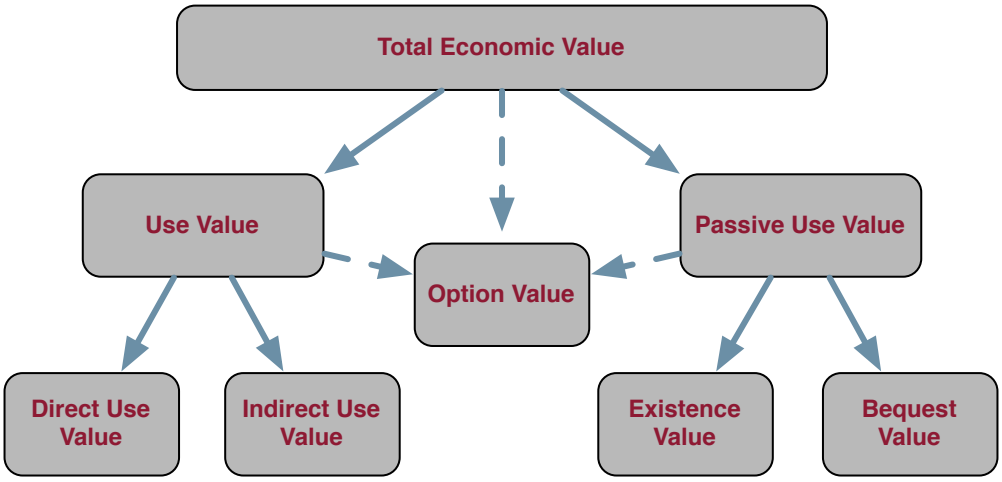
Ecosystem services are the benefits that humans derive from functional ecosystems. Identifying and accounting for ecosystem services in a systematic way provides a methodical approach for describing the numerous benefits provided by ecosystems. It can also ensure proper

[1] Jones, K.B., Slonecker, E.T., Nash, M.S., Neale, A.C., Wade, T.G. and Hamann, S., 2010. Riparian habitat changes across the continental United States (1972–2003) and potential implications for sustaining ecosystem services. *Landscape Ecology*, *25*(8), pp.1261-1275.

incorporation of demand into the valuation process, recognizing where a particular service is scarce and where it is not. Ecosystem service approaches strive to align valuation with market-based values to reduce criticism and translate benefits into cost-savings terms that will be relevant even to those for whom ecological protection is not an ethical priority. In this section we describe the conceptual framework for ecosystem services, and the techniques used to value them.

Ecosystem services exist only insofar as there is human demand for their supply. Furthermore, the value of ecosystem services is derived from the ways in which humans demand them. Figure 1 demonstrates the various types of economic value for ecosystem services. Total economic value is made up of several components. Direct use value describes the value associated with direct use of an ecosystem service such as breathing clean air or drinking clean water. Indirect use value describes the ecosystem services that precede direct services. Soil fertilization, for example, promotes tree growth, which in turn, plays a role in air purification.

Figure 1. Components of Total Economic Value
Source: ECONorthwest



Passive use values are less obvious but are, in some instances, greater than use values. Existence value describes an individual's demand for the existence of a particular object. Bequest value describes an individual's demand for the future existence of a particular object. Typically, these values are described in terms of an individual's willingness to pay for an object's current or future existence. For example, if an individual is willing to pay a positive sum of money to prevent bald eagle extinction, then she likely is placing existence value on the species. Similarly, if she would be willing to donate a positive sum of money to a conservation fund aimed at maintaining bald eagle health into the future, she likely is placing bequest value on the species.

Option value can fall into either the use or passive use categories. It describes the value of keeping the option open to use a resource or service in the future. For example, some residents of the Basin might feel that the region already has enough riparian habitat, but that there would still be value to additional habitat for the contingency that existing habitat declines, or science reveals a greater need for habitat.

Techniques for Estimating Value of Ecosystem Services

In the absence of well-formed markets, economists have developed techniques for estimating the value of ecosystem services based on the characteristics of the services and the benefiting population. Table 3 summarizes some of the primary techniques for valuing ecosystem services.[2]

Table 3. Techniques Used to Estimate Economic Value of Ecosystem Services
Source: ECONorthwest based on EPA (2009)

Avoided Cost	Estimate the value of a service by identifying and estimating the cost of future projects or programs that would be needed but for the current existence of the service.
Benefit Transfer	Estimate the value of a service at a particular site based on analyses estimating the value of a similar service in another geographic location.
Contingent Valuation	Estimate the value of a service with questionnaires asking respondents how much they would be willing to pay to protect the service, or how much they would be willing to accept to forego the service.
Hedonic Analysis	Estimate the value of a service by comparing property values of multiple households, controlling for several factors, and determining the impact of changes in quantity or quality of the service on property value.
Replacement Cost	Estimate the value of a service by identifying and estimating the cost for projects or programs required to replace the service.
Travel Cost	Estimate the value of a service by calculating the time and money spent by individuals traveling to enjoy or experience the service

Benefit analysis typically progresses from identification of benefits to estimating their monetary value. It is not feasible or appropriate to use dollar values for all potential benefits of riparian areas. Sufficient information is available to assign a dollar value to only a small subset of the total universe of ecosystem goods and services provided by riparian areas in the Basin (Figure 2). Other ecosystem goods and services, such as nutrient cycling, food production, and spiritual fulfillment, provide society with additional benefits, but resist quantification in physical and monetary terms. Other benefits might be theorized to exist, but cannot be identified and verified. Finally, there are potentially other valuable ecosystem goods and services that science does not currently allow us to recognize.

[2] U.S. Environmental Protection Agency. 2009. Valuing the Protection of Ecological Systems and Services: A Report of the EPA Science Advisory Board. Report No. EPA-SAB-09-012.

Figure 2. Hierarchy of Benefit Analysis
Source: ECONorthwest

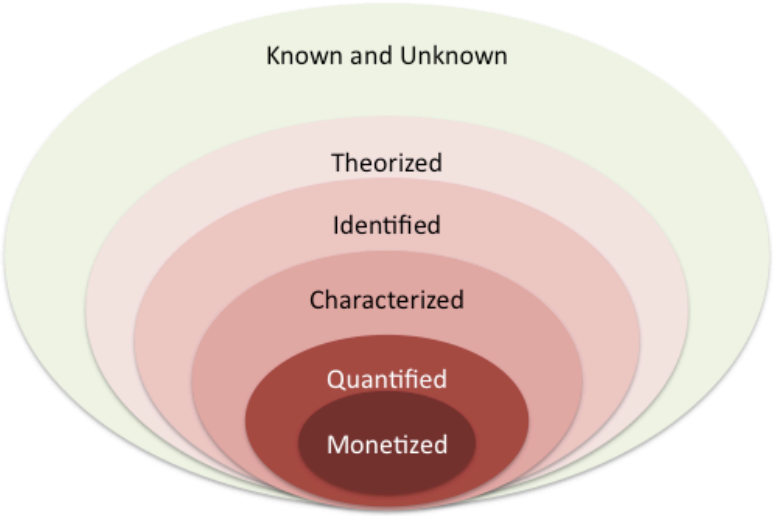


Table ES1 (pg. 7) shows the ecosystem effects and services provided by riparian buffers. Some of these benefits can be reliably measured using market prices, while others are best described by other means. The remainder of this report details the analyses necessary to value these services in the Delaware River Basin.

Riparian Land Cover in the Delaware River Basin

In this section we assess the current extent of intact riparian vegetation and trends in loss and recovery. We use data from the U.S. Environmental Protection Agency's (EPA) Watershed Index Online (WSIO) to describe riparian land cover composition, and trends between 2001 and 2011. The EPA data rely on LANDSAT remote sensing data that classify land cover within 30x30 meter cells. We exclude all watersheds that fall outside the Delaware River Basin.

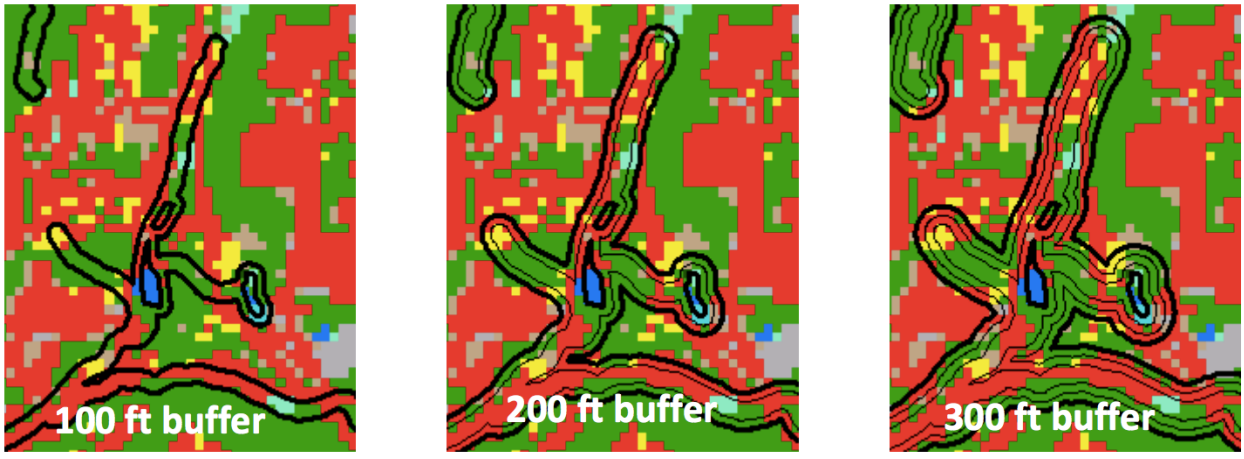
The WSIO data include information on land covers and land uses within the riparian zone, defined as a 108-meter (~ 350 feet) buffer around all surface waters and wetlands. The riparian zone includes the following land cover types:

> *Riparian Zone = Surface Water + Wetlands + Forest (including evergreen forest, deciduous forest, and mixed forests) + Shrub/Scrub + Grassland/Herbaceous + Urban (including high/medium/low intensity development and open space) + Agriculture (including pasture/hay and cultivated crops) + Barren Land*

Given the 30-meter (~100 feet) minimum cell size, LANDSAT data are *"… not of sufficient spatial resolution to adequately map riparian buffer vegetation within the widely accepted 100-ft (30 m) buffer width used as a common reference for buffer effectiveness"*.[3] EPA chose 108 meters (~ 350 feet) as the most accurate width to describe riparian land cover in their dataset.

Figure 3. Resolution of Satellite Imagery and Buffer Width

Source: Center for Land Use Education and Research, 2008. The Status of Connecticut's Coastal Riparian Corridors. University of Connecticut. http://clear.uconn.edu/projects/riparian_buffer/results/CLEAR_%20Summary_021508.pdf



[3] Goetz, S.J., Wright, R.K., Smith, A.J., Zinecker, E. and Schaub, E., 2003. IKONOS imagery for resource management: Tree cover, impervious surfaces, and riparian buffer analyses in the mid-Atlantic region. *Remote sensing of environment*, *88*(1), pp.195-208.

To estimate annual rates of land cover change, we divide the ten-year (2001-2011) change totals by ten. To approximate change in land cover at the policy relevant scale of 100 feet, we assume that land cover composition is the same in the 350- and 100-foot (30 meter) buffer zones and that roughly a third (30m/108m = 27 percent) of the annual/decadal change in the 350-foot zone occurs within the 100-foot zone. Previous analyses have confirmed that trends at 350 feet are representative of trends at 100 feet. For example, a previous study that had access to data at multiple scales (Figure 3) reported similar land cover composition and rates of change in the two buffer widths. The rate of development within in the 100-foot zone was slightly lower than that in the 300-foot zone, which the authors suggest may be a result of recently implemented 100-foot buffer protection policies.[4]

Figure 4 provides a map of the current distribution of riparian buffers in the Delaware River Basin. The data in this map are the basis for the results summarized in Figures 5, 6 and 7. Figure 5 shows the total riparian area within each state in the Basin. Pennsylvania has the most riparian land area in the Basin, and Delaware the least. New York has the highest proportion of natural and forested land within the riparian zone, while Delaware has the lowest (Figure 6 and Figure 7). Almost half of the Basin's historic riparian cover has been lost to agriculture, shopping malls, housing developments, and highways (Figure 7).

[4] Center for Land Use Education and Research, 2008. The Status of Connecticut's Coastal Riparian Corridors. University of Connecticut.

Figure 4. 350-foot Riparian Buffer Zones in the Delaware River Basin

Source: ECONorthwest with data from the US EPA's Watershed Index Online

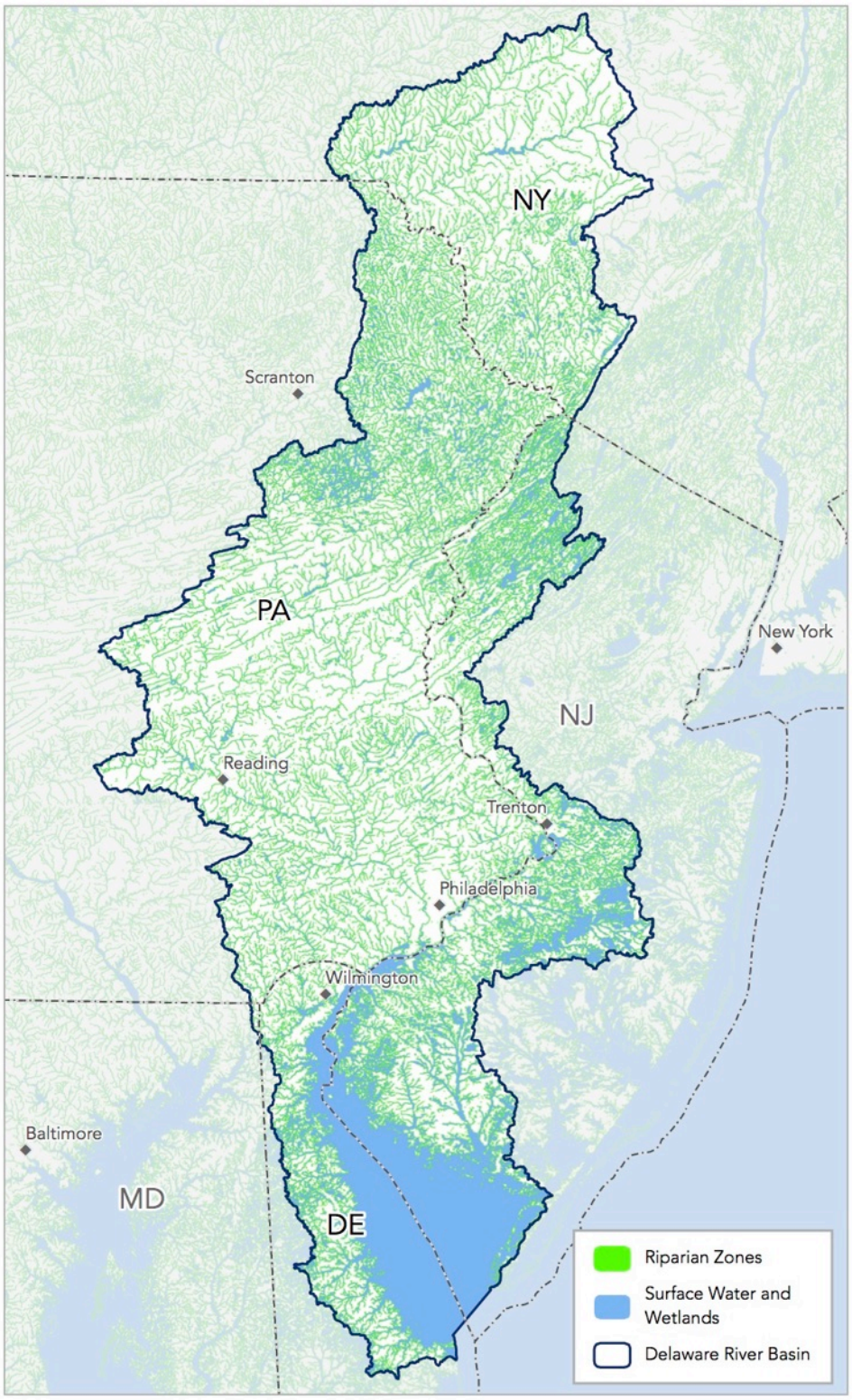


Figure 5. Land Cover Acreages within the Riparian Zone (350-foot Buffer), Delaware River Basin, 2011

Source: ECONorthwest with data from the US EPA's Watershed Index Online

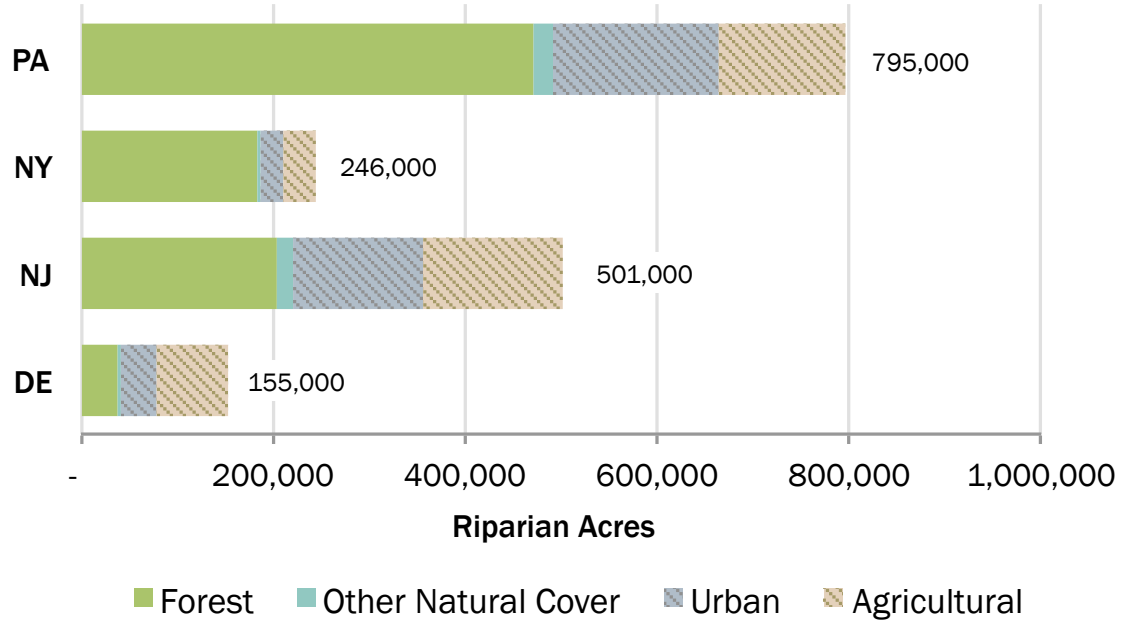


Figure 6. Land Cover Composition within the Riparian Zone (350-foot Buffer), Delaware River Basin, 2011

Source: ECONorthwest with data from the US EPA's Watershed Index Online

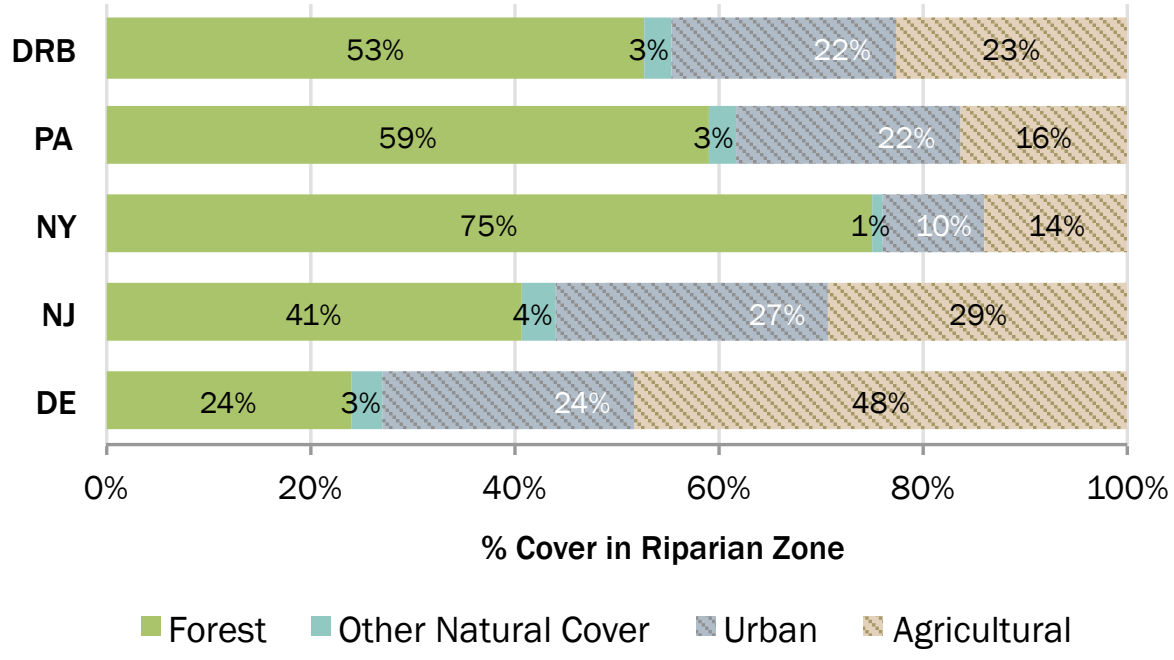
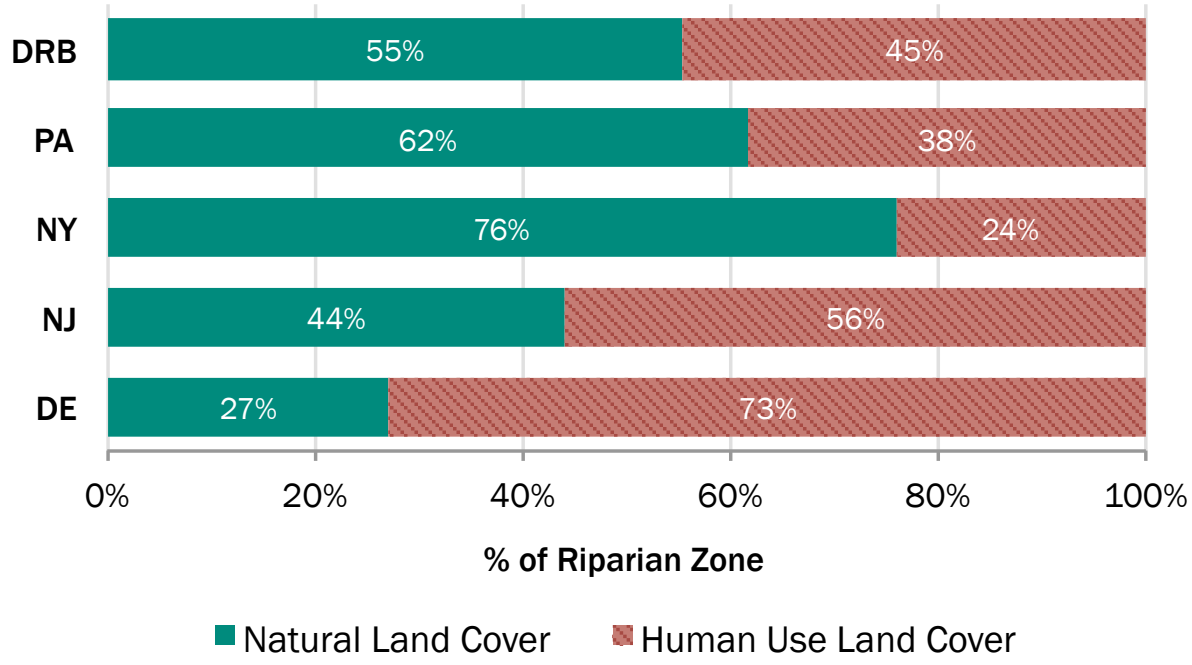


Figure 7. Percent Developed and Undeveloped Cover within the Riparian Zone (350-foot Buffer), Delaware River Basin, 2011

Source: ECONorthwest with data from the US EPA's Watershed Index Online



Trends in riparian land cover are summarized in Figures 8, 9, and 10, as well as Table 4. Urban development (defined on page 18 of this report) in the riparian zone increased between 2001 and 2011, while forests and agriculture declined. Studies of riparian land cover composition and change conducted elsewhere have reported similar trends.[5]

Forested cover and natural cover generally declined in all Basin states, while agricultural use declined in three out of four states (increasing slightly in New York State). WSIO data include watershed-scale totals in 2001 and 2011, but not which land uses replaced others. For example, a watershed may have lost forest on the whole between 2001 and 2011, but the data do not

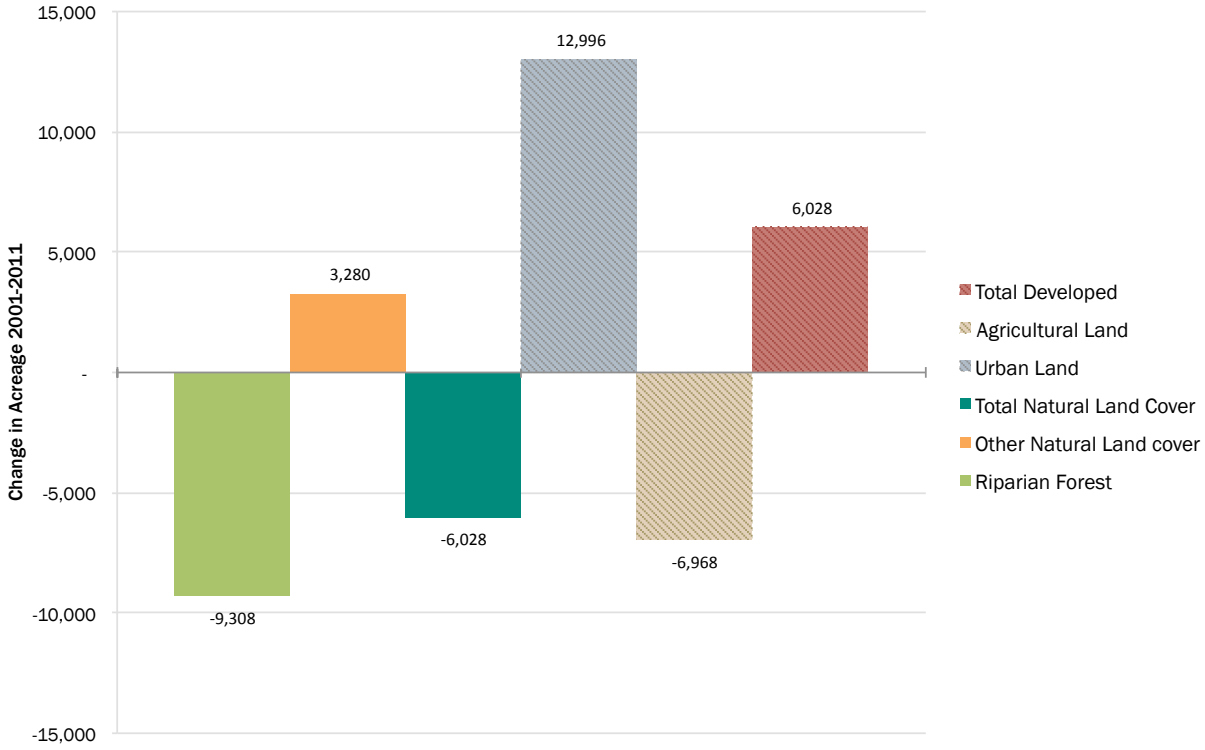
[5] See, for example:

- Center for Land Use Education and Research, 2008. The Status of Connecticut's Coastal Riparian Corridors. University of Connecticut.
- Jones, K.B., Slonecker, E.T., Nash, M.S., Neale, A.C., Wade, T.G. and Hamann, S., 2010. Riparian habitat changes across the continental United States (1972–2003) and potential implications for sustaining ecosystem services. Landscape Ecology, 25(8), pp.1261-1275.
- Newcomb, D.J., Hale, K., Phillipuk, C.R., Schleifer, D. and Stanuikynas, T.J., 2002. Surface Water and Riparian Areas of the Raritan River Basin: A technical report for the Raritan Basin Watershed Management Project.
- Price, W. and Sprague, E., 2011. Pennsylvania's Forests: How They are Changing and Why We Should Care. Pinchot Institute for Conservation.
- Wickham, J.D., Wade, T.G. and Riitters, K.H., 2011. An environmental assessment of United States drinking water watersheds. Landscape Ecology, 26(5), p.605.

specifically report whether those acres transitioned to urban, agriculture, or another natural land cover.

Figure 8. Land Cover Changes in the Riparian Zone (350-foot Buffer) 2001-2011, Delaware River Basin

Source: ECONorthwest with data from the US EPA's Watershed Index Online



Urban land cover includes multiple kinds of human development:[6]

- **Developed, Open Space** - *areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.*
- **Developed, Low Intensity** - *areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units, residential yards and lawns.*

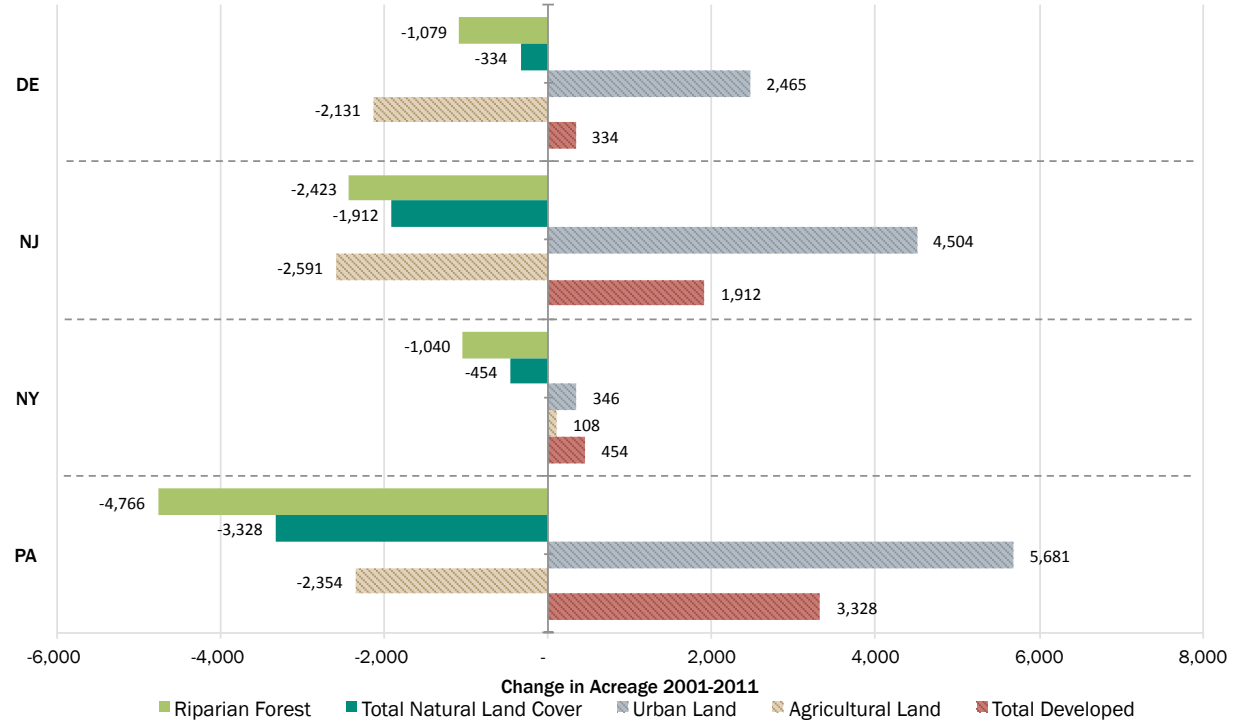
[6] Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. *Photogrammetric Engineering and Remote Sensing*, v. 81, no. 5, p. 345-354

- **Developed, Medium Intensity** - *areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.*
- **Developed High Intensity** - *highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.*

Urban cover therefore includes both urban and suburban development, as well as roads, utility lines, and lawnscapes. Each of these land cover types has different effects on the environment but the limitations of the land cover data do not allow for us to account for these differences.

Figure 9. Land Cover Changes in the Riparian Zone (350-foot Buffer) by State, 2001-2011, Delaware River Basin

Source: ECONorthwest with data from the US EPA's Watershed Index Online



It's also important to note that not all of the lost riparian forest area was necessarily developed for human uses. Natural land cover types often transition to other natural land cover types. For example, in Pennsylvania nearly 4,800 acres of riparian forest were lost between 2001 and 2011 (Figure 10), but fewer acres of natural land cover were lost overall (-4,800 acres of riparian forest vs. -2,900 acres of natural land cover, overall). Some of these forest acres shifted to shrub/scrub and grasslands.[7]

[7] These trends can be explored with NOAA's Land Cover Atlas (choose watersheds, then the forests tab to see an accounting of which land covers replaced forest cover): https://coast.noaa.gov/ccapatlas/.

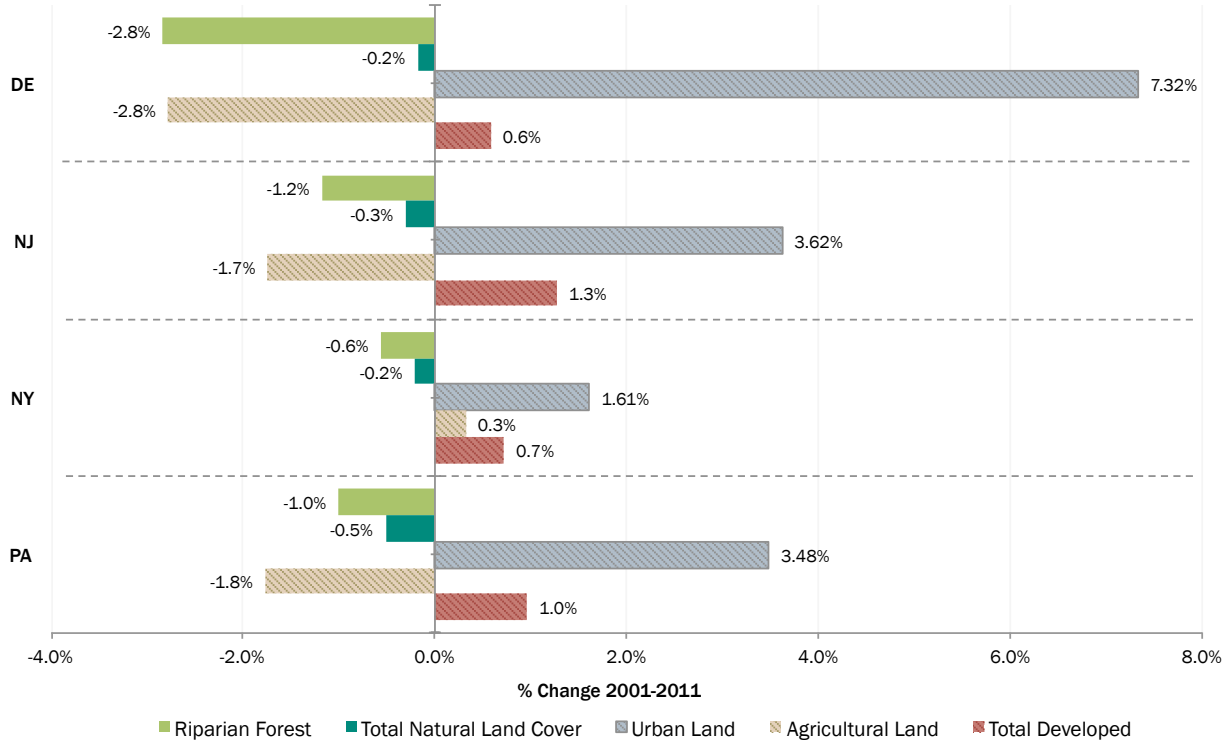
- **Shrub/Scrub -** *areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.*
- **Grassland/Herbaceous -** *areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling (in which case they would classified as agricultural land), but can be used for grazing. The grassland/herbaceous category also does not include residential yards and lawns – these are included in either the 'low intensity urban development' or the 'developed open space' categories.*

Non-forest categories of natural land cover – shrub/scrub and grasslands – increased on the whole during between 2001 and 2011.

Trends in land cover change can be understood in absolute (i.e., total acres of forest lost) and relative to total stock (i.e., acres of forest lost compared to total acres of forest). For example, Pennsylvania lost over four times as many acres of riparian forest as Delaware (Figure 9), but Delaware lost a larger share of its total riparian forest than Pennsylvania (2.8% loss in DE vs. 0.6% in PA; Figure 10).

Figure 10. Percent Land Cover Change in the Riparian Zone (350-foot Buffer) by State, 2001-2011, Delaware River Basin

Source: ECONorthwest with data from the US EPA's Watershed Index Online



These change estimates include the effects of existing protection policies, such as buffer protection ordinances in Pennsylvania and New Jersey and protection through public ownership generally. For reference, 18 percent of the Delaware River Basin is protected by

federal, state, and local governments or as private conservation easements through land trusts accessible to the public.[8]

Implications for Buffer Protection

Information about development trends in the riparian zone allows us to estimate the amount of undeveloped riparian land that could be preserved with policy changes and community protection. As described in the next section ('Buffer Widths and Vegetation Cover'), studies suggest 100 feet is the minimum functional buffer width for most objectives, while 350 feet of width are needed for habitat benefits.

Based on the net change in natural land cover within 100 feet of streams between 2001 and 2011, buffer ordinances adopted throughout the Basin would protect nearly 1,700 acres over ten years, or 167 acres a year. For a 350-foot buffer, over 6,000 acres of natural land cover would be protected over 10 years (Table 4).[9] This assumes constant development rates in the future matching those of the period 2001 to 2011 and does not account for potential variances or development exceptions, which would decrease the number of acres on which development is prevented. We also chose to use the net loss of natural land cover as the basis for policy modeling instead of lost forestland.[10] Forested buffers provide the greatest diversity and amount of ecosystem services, so transition to a grass or shrub dominated state will still result in a net loss of services. Our estimates of ecosystem services lost to development are likely underestimates to the extent they omit loss of conversion from forested buffers to other natural land cover.

[8] Kauffman, G., Belden, A. and Homsey, A., 2009. Technical Summary: State of the Delaware Basin Report.

[9] See earlier discussion for buffer width basis.

[10] Some of the decline in riparian forest observed between 2001 and 2011 was due to natural disturbances and processes (e.g., flooding, windthrow), and some could be due to prior misclassification of forest land cover. An unknown portion of the transition from forest to shrub/scrub and grassland could also conceivably be due to human clearing (for grazing, for example), but might not be detected and/or categorized as one of the urban uses defined above. Only transition to land covers classified as 'urban' can be reliably linked to human development.

Table 4. Development of Natural Riparian Areas and Net Loss of Riparian Cover in the Delaware River Basin by State and Buffer Width (Acres), 2001-2011

Source: ECONorthwest with data from the US EPA's Watershed Index Online

State	350-ft Buffer Zone		100-ft Buffer Zone	
	Net Loss of Riparian Forest	Net Loss of Natural Land Cover	Net Loss of Riparian Forest	Net Loss of Natural Land Cover
2001 - 2011				
DE	-1,079	-334	-300	-93
NJ	-2,423	-1,912	-673	-531
NY	-1,040	-454	-289	-126
PA	-4,766	-3,328	-1,324	-924
DRB	-9,308	-6,028	-2,585	-1,674
Annual Average				
DE	-108	-33	-30	-9
NJ	-242	-191	-67	-53
NY	-104	-45	-29	-13
PA	-477	-333	-132	-92
DRB	-931	-603	-259	-167

Riparian Ecosystem Services in the Delaware River Basin

The Chesapeake Bay Program identifies riparian forest buffers as being perhaps the single best practice to maintain and improve the quality of downstream waters and habitats:

> *"Riparian forest buffers provide critical barriers between polluting landscapes and receiving waterways using relatively little land. Forest buffers reduce the adverse effect of excessive nitrogen, phosphorus, and suspended sediment inputs. Per acre, they likely provide more benefits and are more cost-effective than any other* [management practice], *especially when considering the added high value habitat at the critical juncture of land and water."*[11]

Categories of Benefit

We focus our analysis on these identified functions and benefits of riparian areas in the Delaware River Basin:

- **Water Quality Protection** (specifically, treatment and prevention of nutrient and sediment pollution, interception of urban stormwater runoff, and drinking water provision)
- **Carbon Sequestration**
- **Mitigation of Air Pollution**
- **Provision of Habitat and Movement Corridors for Fish and Wildlife**
- **Flood Prevention**
- **Improvements in Property Values**
- **Outdoor Recreation Opportunities**

Buffer Widths and Vegetation Cover

The size (width and area) and vegetative cover type determine a buffer's capacity to provide ecosystem services and benefits. Generally speaking, wider buffers provide greater benefits. Each of the ecosystem services above also requires a certain minimum area or size of land area surrounding water bodies to be fully realized. Many reviews suggest that 100 feet is the minimum width at which all of the relevant services are provided.[12] Some services are realized relatively quickly (e.g., bank stabilization), while other services require much larger widths to

[11] Chesapeake Bay Program. 2014. Buffering the Bay: A Report on the Progress and Challenges of Restoring Riparian Forest Buffers in the Chesapeake Bay Watershed.

[12] Sweeney, B.W. and Newbold, J.D., 2014. Streamside forest buffer width needed to protect stream water quality, habitat, and organisms: a literature review. *JAWRA Journal of the American Water Resources Association, 50*(3), pp.560-584.

provide efficient services (e.g., 300 feet for wildlife habitat). Depending on a water body's position in the watershed, the type of vegetation present, adjacent land uses and slope, some buffers may require thousands of feet to provide ecological functions and benefits.[13] Forested riparian buffers, as opposed to grass or shrub dominated buffers, deliver the greatest range of environmental benefits (Table 5).[14]

Table 5. Buffer Vegetation and Effectiveness
Source: NRCS. 1999. Managing Streamside Areas with Buffers.

Benefit	Grass	Shrub	Tree
Stabilize Bank Erosion	Low	High	High
Filter Sediment	High	Low	Low
Filter Nutrients, Pesticides, Bacteria			
Sediment-bound Particle Removal	High	Low	Low
Soluble Particle Removal	Medium	Low	Medium
Aquatic Habitat	Low	Medium	High
Wildlife Habitat			
Range/Pasture/Prairie Wildlife	High	Medium	Low
Forest Wildlife	Low	Medium	High
Flood Protection	Low	Medium	High
Water Temperature	Low	Low	High

Multiple vs. Single Service Provision

Some of the environmental services provided by forested riparian areas might be partially provided by human-built structures and technologies, such as reservoirs for flood control and wastewater treatment plants for pollutant removal. However, these substitutions are directed at single functions rather than the multiple functions that riparian areas carry out simultaneously, including functions not easily replicated. Unlike built alternatives, riparian buffers support multiple habitat benefits while also improving water quality, aesthetics, etc.[15]

This also highlights the importance of recognizing the complementary benefits of riparian buffers for other natural and built assets in a watershed. Buffers can make other resources, such as downstream water bodies and adjacent forests, more functional and valuable. They are also complementary within their own system, in that upstream buffers can make downstream buffers more beneficial and vice versa.

[13] Schueler, T., Site Planning for Urban Stream Protection, Metropolitan Washington Council of Governments 111 (1995), at 3.

[14] Lowrance, R. R. 1997. Water quality functions of riparian forest buffer systems in the Chesapeake Bay watershed. Environmental Management 21(5): 687-712.

[15] Sweeney, B.W. and Newbold, J.D., 2010. Removal of Nonpoint Source Pollutants by Riparian Buffers: A Short Summary of the Scientific Literature.

A. Values of Specific Ecosystem Services

We provide ranges in service values to account for the fact that marginal benefits will not be constant across the Basin. Ecosystems and individual parcels of land vary considerably in quality and capacity to provide specific services, and the value of these services can also depend on the regional context.[16] For example, buffers adjacent to agriculture provide a different mix and magnitude of benefits than those adjacent to forests or residential properties.

The demand curve for most ecosystem services is presumed to be downward sloping, suggesting diminishing returns. The marginal value of benefits provided by riparian buffers should decrease as the portion of a given area constituted by buffers increases. [17] With some ecosystem services, such as carbon sequestration, extrapolating values across large acreages could be relatively accurate because marginal benefits are likely to be nearly constant. Other services, such as habitat provision, may be even more valuable on large acreages.

All values are in 2017 dollars unless noted otherwise. Literature values were updated to current year dollars using the Consumer Price Index.

1. Water Quality

Riparian areas act as natural filtration systems that improve water quality by absorbing excess amounts of sediment, nutrients, and other contaminants from urban and agricultural runoff.[18] Streamside vegetation also supports a large number and diversity of aquatic insects that process pollutants and further improve water quality.[19]

Figure 11 shows stream segments in the Basin that do not meet minimum standards for certain uses (such as fishing and swimming). Beyond their ability to address specific pollutants, forested riparian buffers are also linked to stream health and quality generally (see Table 20, pg. 42).

[16] Kauffman, G.J., 2016. Economic Value of Nature and Ecosystems in the Delaware River Basin. *Journal of Contemporary Water Research & Education, 158*(1), pp.98-119.

[17] Ballard, J., J. Pezda and D. Spencer. 2016. An Economic Valuation of Southern California Wetlands. University of California – Santa Barbara.

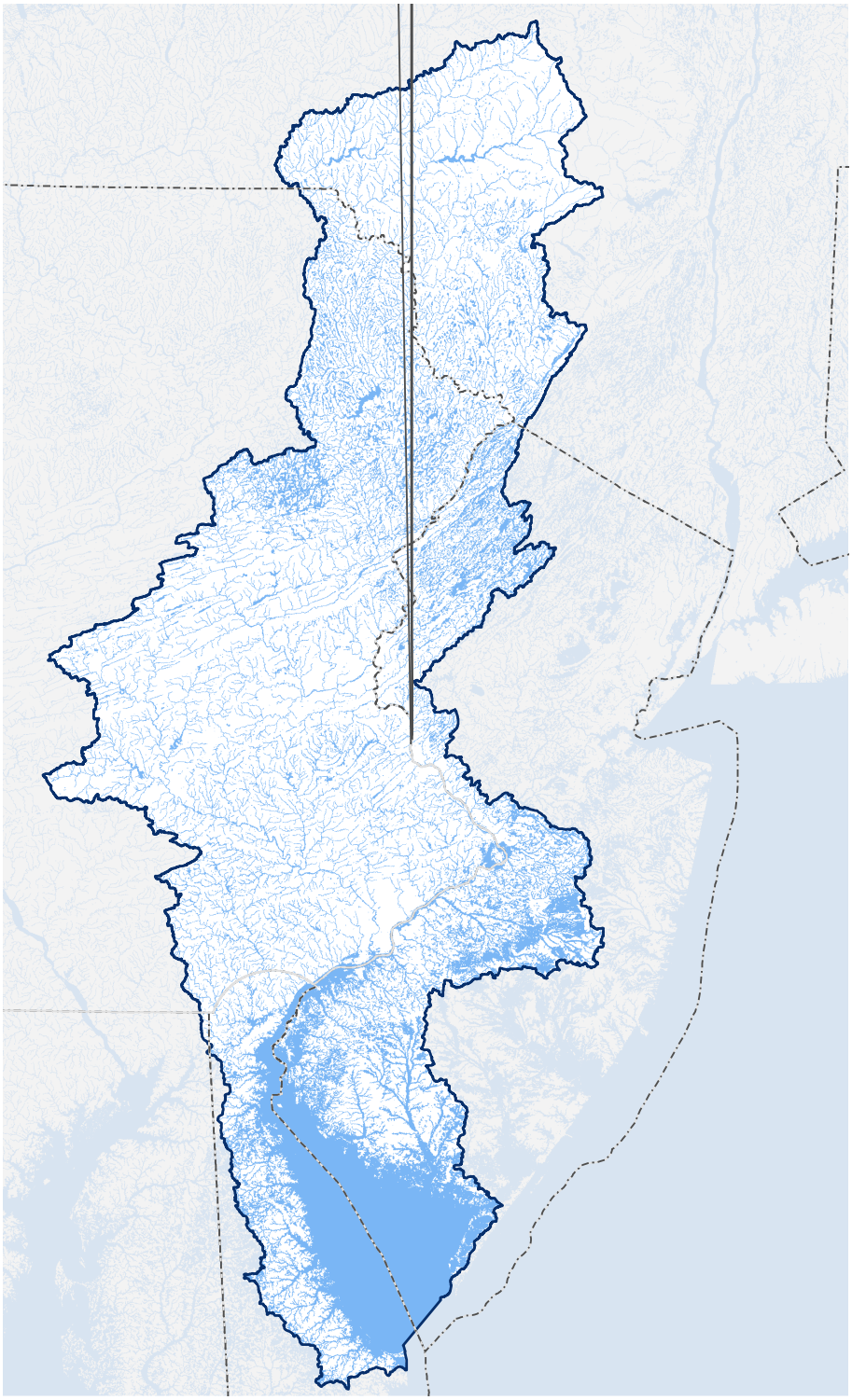
[18] Sweeney, B.W. and Newbold, J.D., 2014. Streamside forest buffer width needed to protect stream water quality, habitat, and organisms: a literature review. *JAWRA Journal of the American Water Resources Association, 50*(3), pp.560-584.

[19] Sweeney, B.W., Bott, T.L., Jackson, J.K., Kaplan, L.A., Newbold, J.D., Standley, L.J., Hession, W.C. and Horwitz, R.J., 2004. Riparian deforestation, stream narrowing, and loss of stream ecosystem services. *Proceedings of the National Academy of Sciences of the United States of America*, *101*(39), pp.14132-14137.

Figure 11. Stream Segments Listed as Impaired by the EPA

Sources: ECONorthwest with data from the US EPA Water Quality Assessment and TMDL Tracking (ATTAINS) database, EPA 2002 Impaired Waters Baseline National Geospatial Dataset, and the Pennsylvania Department of Environmental Protection 2016 Integrated Water Quality Report.

Note: Stream impairments only include categories 4 (polluted streams that do not require a TMDL) and 5 (polluted waters that require a TMDL).



Nitrogen and Phosphorus Reductions

High concentrations of nutrients such as nitrogen and phosphorus can fuel excessive plant growth (e.g., nuisance algae) and lower dissolved oxygen levels in streams and lakes. Nutrient concentrations are a commonly used indicator of water quality.

We begin by estimating the amount of nitrogen and phosphorus discharged to the environment with and without riparian buffers. We use a database of nutrient loadings for various land uses and land covers in the Chesapeake Bay in the absence of similar information for the Delaware River Basin.[20] Our nutrient accounting methodology is based on that of the Chesapeake Bay Program, the North Carolina Buffer Mitigation Program, and the USDA Conservation Reserve Enhancement Program (CREP).

The value provided by buffer policies is not only for the water filtration services that buffers provide, but also the problems that are avoided when other land uses are excluded (Table 6). The nutrient reduction benefit of riparian buffers includes both the nutrient retention associated with keeping an acre of forest from turning into urban or agricultural uses - measured as the difference in nutrient loadings between forest and developed land uses (Table 6) – and the buffer's treatment of runoff from upland acres.

Table 6. Increase in Nutrient Delivery with Land Use Change

Source: ECONorthwest with data from University of Maryland Center for Environmental Science and Maryland Department of Natural Resources (http://dnr2.maryland.gov/ccs/Documents/trustfund/AgricultureandForestCalculator.xls)

1: The composite value is an average of the developed, crop and pasture land covers.

Values may not sum due to rounding

Land Use/Land Cover	Nitrogen (lb/acre/yr)		Phosphorus (lb/acre/yr)	
	Average	Range	Average	Range
Developed	7.5	0 - 21.7	0.5	0 - 1.1
Crop	15.5	0 - 44.7	1.1	0 - 3.7
Pasture	5.1	0 - 17.1	0.6	0 - 1.2
Composite Urban/Agricultural[1]	9.4	-	0.7	-
Forest	1.9	0 - 5.8	0.1	0 - 0.1
Increase in nutrient delivery with loss of streamside forest	**7.5**	**-**	**0.7**	**-**

The values shown in Table 6 are consistent with previously reported estimates.[21] Based on guidance from the Chesapeake Bay Commission, we assume that an acre of riparian buffer

[20] Data are available online at http://dnr2.maryland.gov/ccs/Documents/trustfund/AgricultureandForestCalculator.xls

[21] Stephenson, K., Aultman, S., Metcalfe, T. and Miller, A., 2010. An evaluation of nutrient nonpoint offset trading in Virginia: A role for agricultural nonpoint sources? *Water Resources Research*, *46*(4).

treats four upland acres with respect to total nitrogen loads and two upland acres with respect to phosphorus and sediment (see next section for sediment calculations).[22]

To account for varying effectiveness of individual buffer units as well as the range of buffer widths used in the source literature, we use a range of 48 to 95 percent for nitrogen capture/treatment, 36 to 79 percent for phosphorus (Table 7), and 70 to 96 percent for sediment (Table 12, next section).[23]

Table 7. Nutrient Loads and Estimates of Buffer Treatment Capacity
Sources: ECONorthwest with data from sources cited in text.

Nutrient Factors		Land Use/Land Cover					
		Pasture		Developed		Crops	
Total Nitrogen	Loading rate (lb/ac/yr)	5.1		7.5		15.5	
	Discharge to buffer w/ 4:1 upland/buffer ratio	20.5		29.9		62.2	
	Removal efficiency	48%	95%	48%	95%	48%	95%
	Nitrogen yield (lb/ac/yr)	**9.8**	**19.4**	**14.4**	**28.4**	**29.8**	**59.0**
Total Phosphorus	Loading rate (lb/ac/yr)	0.6		0.5		1.1	
	Discharge to buffer w/ 2:1 upland/buffer ratio	1.2		1.0		2.1	
	Removal efficiency	36%	79%	36%	79%	36%	79%
	Phosphorus yield (lb/ac/yr)	**0.4**	**1.0**	**0.3**	**0.8**	**0.8**	**1.7**

For comparison, the North Carolina mitigation program (described in the next section) assumes that each acre of riparian buffer within 50 feet of streams prevents 75.77 pounds of nitrogen and 4.88 pounds of phosphorus per year from reaching waterways. Buffers in Maryland and Georgia were found to retain 23 to 65 pounds of nitrogen (67 to 89 percent of inputs) and 1.1 to 2.6 pounds of phosphorus (24 to 81 percent of inputs) per acre of buffer per year.[24]

We value each pound of nitrogen and phosphorus with the cost of removal or prevention using various practices. Loss of riparian buffers will increase the costs of nitrogen and phosphorus removal, while buffer protection will allow society to avoid these control costs. The costs of removing nitrogen are generally between $4 and $58 per pound, while phosphorus removal costs $24 to $399 per pound (Table 8).[25] Removal costs vary based on the technology used, the

[22] Riparian Buffer Expert Panel, 2014. Recommendations of the Expert Panel to Reassess Removal Rates for Riparian Forest and Grass Buffers Best Management Practices.

[23] Hawes and Smith. 2005. Riparian Buffer Zones: Functions and Recommended Widths. Prepared for the Eightmile River Wild and Scenic Study Committee

[24] Lowrance, R. R. 1997. Water quality functions of riparian forest buffer systems in the Chesapeake Bay watershed. Environmental Management 21(5): 687-712.

[25] Van Houtven, G., Loomis, R., Baker, J., Beach, R. and Casey, S., 2012. Nutrient credit trading for the Chesapeake Bay: An economic study. *RTI International, Research Triangle Park, NC.*

US Environmental Protection Agency. 2002. Economic Analysis of the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations - Appendix E Cost-Effectiveness Analysis. Washington, DC.: Office of Science and Technology, Pub No. EPA-821-R-03-002.

scale of treatment, and landscape setting. The cost to remove or prevent a pound of nitrogen or phosphorus from farm runoff and drainage, for example, is typically 4 or 5 (and as high as 10 or 20) times less than the cost to remove the same amount from municipal wastewater or urban stormwater.[26]

Table 8. Increase in Nutrient Delivery with Buffer Losses

Sources: ECONorthwest with data from sources cited in text.

Nitrogen		Low	High
1) Increase in TN export with land use change (lb/acre/yr)		7.5	
2) Loss of TN removal from nonpoint source runoff (lb/acre/yr)		9.8	59.0
Total increase in nitrogen delivery (lb/acre/yr)		17.3	66.6
Treatment cost per pound of nitrogen:	$4	$63	$241
	$58	$1,012	$3,885
Total Increase in N treatment costs with buffer loss ($/acre/yr)		$241	$3,885
Phosphorus		**Low**	**High**
1) Increase in TP export with land use change (lb/acre/yr)		0.7	
2) Loss of TP removal from nonpoint source runoff (lb/acre/yr)		0.3	1.7
Total increase in phosphorus delivery (lb/acre/yr)		1.0	2.3
Treatment cost per pound of phosphorus:	$24	$24	$55
	$389	$394	$905
Total increase in P treatment costs with buffer loss ($/acre/yr)		$55	$905
Combined N+P ($/ac/yr):	Low prices	**$87**	**$296**
	High prices	**$1,406**	**$4,789**

Annual service losses repeat year after year, and build cumulatively. For example, in year one we value the losses associated with 167 acres of riparian forest, and in the second year we value losses from 334 acres. In the first year there are not only 167 acres of newly developed lands discharging more nutrients than the forested riparian acreages did previously, but also 668 upland acres that have lost their nitrogen filtration barrier (based on a 1 to 4 treatment ratio), and 334 acres that have lost their phosphorus and sediment filtration barrier (based on a 1 to 2 treatment ratio).

To produce an estimate of potential losses between 2018 and 2028 (Table 9), we apply the mid-range of values (Table 8; $296 to $1,406 per acre, rather than the upper and lower extremes of $87 to $4,789 per acre).

[26] National Association of Clean Water Agencies. 2011. Controlling Nutrient Loadings to U.S. Waterways: An Urban Perspective

Table 9. Annual and Projected Nutrient Costs from Riparian Development

		DE	NJ	NY	PA	Basin Total
Net Loss of Natural Land Cover (100-ft buffer, acres/yr)		-9	-53	-13	-92	-167
Low Buffer Effectiveness, Low Avoided Treatment Costs (-$87/acre/yr)		-$806	-$4,613	-$1,095	-$8,028	-$14,543
Low Buffer Effectiveness, High Avoided Treatment Costs (-$1,406/acre/yr)		-$13,055	-$74,699	-$17,726	-$129,988	-$235,468
High Buffer Effectiveness, Low Avoided Treatment Costs (-$296/acre/yr)		-$2,750	-$15,733	-$3,733	-$27,378	-$49,595
High Buffer Effectiveness, High Avoided Treatment Costs (-$4,789/acre/yr)		-$44,459	-$254,390	-$60,365	-$442,675	-$801,889
Total NPV 2018-2028 (mid-range values, cumulative effect, 3% discount rate)	Low Range (-$296/acre/yr)	-$126,992	-$726,636	-$172,426	-$1,264,450	-$2,290,503
	High Range (-$1,406/acre/yr)	-$602,932	-$3,449,930	-$818,646	-$6,003,368	-$10,874,876
2018-2028 Annualized	Low	-$12,699	-$72,664	-$17,243	-$126,445	-$229,050
	High	-$60,293	-$344,993	-$81,865	-$600,337	-$1,087,488

The Chesapeake Bay Commission and North Carolina Buffer Mitigation Program value nitrogen and phosphorus treatment costs separately and additively. However, many treatment practices will treat both nutrients simultaneously, so under some treatment scenarios and circumstances there may be double counting when avoided costs are valued separately.

North Carolina Buffer Mitigation Program

Since 1997, North Carolina has actively managed development within its riparian zones to maintain and improve water quality in the state's streams and bays. The state has designated 50-foot riparian buffers, and sets "exempt," "allowable," "allowable with mitigation," and "prohibited" uses within this regulated buffer zone.[27] Impacts that are "allowable with mitigation" must be offset by the restoration of buffers elsewhere within the same watershed.

Mitigation is based on the nutrient (nitrogen and phosphorus) loading that will result from land use changes over a 30-year period. Compliance options include providing stormwater BMPs at the development site to offset the lost nutrient treatment capacity, or paying to create a new riparian buffer elsewhere in the watershed.

This mitigation approach has effectively created a market for forested riparian buffers. The North Carolina Ecosystem Enhancement Program (NCEEP), a state agency, completes stream, wetland, and riparian buffer mitigation projects and sells credits to other agencies, private companies, or individuals that need to purchase mitigation as part of a development project. NCEEP's nutrient offset credit rates vary by watershed, but current prices range from $9 to $21 per pound of nitrogen and $167 to $382 per pound of phosphorus.[28]

NCEEP estimates that over a 30-year period, one acre of forested riparian buffer prevents 2,273 pounds of nitrogen and 146.4 pounds of phosphorus from reaching surface waters. Taking the average of the watershed nutrient prices, one acre of forested riparian buffer has a value of: $14.99/lb. X 2,273 lbs. of nitrogen over 30 years = $34,061 and $274.78/lb. X 146.4 lbs. of

[27] Chatham Conservation Partnership. 2011. Chatham Conservation Plan Appendix G - Forest Resources: Economic Analysis for Water Quality

[28] North Caroline Department of Environmental Quality. 2016-17 Statewide Stream & Wetland & 2017 Riparian Buffer Rates. https://deq.nc.gov/about/divisions/mitigation-services/dms-customers/fee-schedules

phosphorus over 30 years = $40,227. This equates to $2,476 per acre year for both nitrogen and phosphorus reductions, which is two to eight times higher than the nutrient values we apply in our analysis.

The combined nutrient removal value for one acre of restored forested riparian buffer over a 30-year period is $74,288. The price for a riparian buffer mitigation credit through NEEP is currently $1.16/square foot, which translates to $50,530/acre. The net benefit of an acre of riparian buffer, in this case, would be about $24,000 over a 30-year period.[29] Riparian wetlands are slightly more expensive to offset and produce, at $40,297 to $71,273 per acre. These costs include land purchase (at least $19,000 an acre and often more depending on how urbanized the watershed is), long-term maintenance and monitoring, as well as relatively high transaction costs (e.g., for permitting, planning and program management).[30]

The values above are meant to illustrate and confirm the magnitude of potential benefits and costs associated with nutrient retention and treatment by buffers. These are essentially one-time payments/losses/benefits, and NCEEP's nutrient prices are specific to the region's water quality goals.

Based on mitigation applications to NCEEP between 2005 and 2010, more than half of the costs/benefits associated with the buffer mitigation rule have been incurred by the North Carolina Department of Transportation, and another third by private developers.[31]

Sediment Reductions

Roots, stems and fallen trees in a riparian buffer slow the flow of surface runoff, allowing sediment to settle out and be trapped before reaching streams and lakes. Capturing sediment before it reaches waterways creates a number of benefits for local communities and industries (Table 10).[32] For example, excessive sediment loads impose damage and control costs on multiple kinds of infrastructure (e.g., reservoirs, power plants, roads, canals), exacerbate flooding, and lower catch rates for commercial and recreational marine fisheries. The categories and values shown in the table below are based on models that the USDA Economic Research Service uses to assign monetary values to changes in soil erosion and sediment deposition.[33] These models provide information on the costs and damages associated with a ton of sediment discharged to regional waterways, with values specific to the northeastern region.

[29] Ibid

[30] RTI International and the Center for Watershed Protection. 2007. A Study of the Costs Associated with Providing Nutrient Controls that are Adequate to Offset Point Source and Nonpoint Source Discharges of Nitrogen and Other Nutrients. Prepared for the North Carolina General Assembly's Environmental Review Commission

[31] North Carolina Department of Environmental and Natural Resources. 2015. Fiscal and Regulatory Impact Analysis - Buffer Mitigation Rules.

[32] Hansen, L. and Ribaudo, M., 2008. Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment. USDA Technical Bulletin Number 1922

[33] Ibid

Table 10. Benefits of Sediment Capture

Source: ECONorthwest with data from Hansen and Ribaudo 2008

Note: categories without ranges are those for which have values specific to the Northeast region. All cost figures are in 2017$.

Categories	Description of Benefit	Value ($/ton)
Reservoir services	Avoided cost of dredging reservoirs	$0 to $1.86
Navigation	Avoided cost of dredging harbors and shipping channels	$0 to $6.75
Irrigation ditches and channels	Reduced cost of removing sediment and aquatic plants from irrigation channels	$0.01
Road drainage ditches	Less damage to and flooding of roads	$0.27
Municipal water treatment	Lower sediment removal costs for water-treatment plants	$0.36
Flood damages	Reduced flooding and damage from flooding	$1.04
Marine fisheries	Improved catch rates for marine commercial fisheries	$1.25
Marine recreational fishing	Increased catch rates for marine recreational fishing	$2.12
Municipal & industrial water use	Reduced damages from salts and minerals dissolved from sediment	$1.96
Steam powerplants	Reduced plant growth on heat exchangers	$0.89
	Total ($/ton)	**$8 to $17**

We use the same accounting method and data sources used for nitrogen and phosphorus to estimate the increase in sediment discharge that occurs when natural buffers are replaced by urban and agricultural development.

Table 11. Increase in Sediment Delivery with Land Use Change

ECONorthwest with data from University of Maryland Center for Environmental Science and Maryland Department of Natural Resources (http://dnr2.maryland.gov/ccs/Documents/trustfund/AgricultureandForestCalculator.xls)

Land Use/Land Cover	Sediment (TSS) (lb/acre/yr)	
	Average	Range
Developed	359	0 - 1,236
Crop	1,054	0 - 5,178
Pasture	210	0 - 1,401
Composite Urban/Agricultural[1]	541	-
Forest	52	0 - 267
Increase in nutrient delivery with loss of streamside forest	**489**	**-**

Table 12. Sediment Loads and Estimates of Buffer Treatment Capacity

Sources: ECONorthwest with data from sources cited in text.

Sediment Loading and Removal Factors	Land Use/Land Cover					
	Pasture		Developed		Crops	
Loading rate (lb/ac/yr)	210		359		1,054	
Discharge to buffer w/ 2:1 upland/buffer ratio	420		718		2,109	
Removal efficiency	70%	96%	70%	96%	70%	96%
Sediment yield (lb/ac/yr)	**294**	**403**	**502**	**689**	**1,476**	**2,025**

We estimate that every acre of riparian buffer lost to development will increase sediment discharge by approximately 800 to 2,500 pounds (0.4 to 1.3 US tons) per year (see Table 13 below). These estimates are consistent with values used in the Conservation Reserve

Enhancement Program's (CREP) project accounting, which assumes that 0.5 and 0.1 tons are generated by an acre of row crop and pasture, respectively.[34]

We use loading estimates from the Chesapeake Bay database for consistency with nitrogen and phosphorus accounting, but these estimates likely do not capture the upper range of possible sediment capture by buffers. For example, over a 100-year period (1880-1979), a riparian zone in a coastal plain agricultural watershed in Georgia accumulated an estimated 190,667 to 283,276 pounds of sediment (95 to 142 US tons) per acre per year.[35] Additionally, our accounting likely does not capture the sediment discharges associated with construction projects, which could be an important stressor given the scale of urbanization occurring in the Basin. Estimates of uncontrolled construction-site sediment loadings range from 7.2 to 1,000 tons per acre per year.[36]

Table 13. Increase in Sediment Delivery with Buffer Losses and Economic Values
Sources: ECONorthwest with data from sources cited in text.

Sediment Delivery	Low	High
1) Increase in sediment export with land use change (lb/acre/yr)	489	
2) Loss of sediment removal from nonpoint source runoff (lb/acre/yr)	294	2,025
Total increase in sediment delivery (lb/acre/yr)	783	2,513
Benefit Categories	**Low ($/acre/yr)**	**High ($/acre/yr)**
Reservoir services	$0.00	$2.34
Navigation	$0.00	$8.48
Irrigation ditches and channels	$0.01	$0.02
Road drainage ditches	$0.11	$0.34
Municipal water treatment	$0.14	$0.46
Flood damages	$0.41	$1.31
Marine fisheries	$0.49	$1.58
Marine recreational fishing	$0.83	$2.66
Municipal & industrial water use	$0.77	$2.46
Steam powerplants	$0.35	$1.12
Total Costs/Damages ($/acre/yr)	**$3.1**	**$20.8**

The value of sediment control by an acre of natural riparian buffer will generally fall between $3 and $21 per acre per year, with the largest potential benefits realized in avoided dredging costs,

[34] See, for example, the Wisconsin CREP worksheet at https://datcp.wi.gov/Documents/CREPEnvirBenefitReport.doc

[35] Lowrance, R., J.K. Sharpe, and J.M. Sheridan. 1986. Long-term sediment deposition in the riparian zone of a coastal plain watershed. Journal of Soil & Water Conservation 41:266-271.

For a review of sedimentation rates, see Lowrance, R., Altier, L.S., Newbold, J.D., Schnabel, R.R., Groffman, P.M., Denver, J.M., Correll, D.L., Gilliam, J.W., Robinson, J.L., Brinsfield, R.B. and Staver, K.W., 1997. Water quality functions of riparian forest buffers in Chesapeake Bay watersheds. Environmental Management, 21(5), pp.687-712.

[36] Langland, M. and Cronin, T., 2003. A summary report of sediment processes in Chesapeake Bay and watershed (No. 2003-4123).

enhanced catches for marine fishing, and reduced damage to municipal and industrial water infrastructure.

Table 14. Annual and Projected Sediment Costs Associated with Riparian Development

		DE	NJ	NY	PA	Basin Total
Annual Net Loss of Natural Land Cover (100-ft buffer, acres/yr)		-9	-53	-13	-92	-167
Low (-$3/acre)		-$29	-$164	-$39	-$286	-$518
High (-$21/acre)		-$193	-$1,103	-$262	-$1,919	-$3,475
Total NPV 2018-2028 (cumulative effect, 3% discount rate)	Low	-$1,327	-$7,591	-$1,801	-$13,210	-$23,929
	High	-$8,899	-$50,918	-$12,083	-$88,605	-$160,505
2018-2028 Annualized	Low	-$133	-$759	-$180	-$1,321	-$2,393
	High	-$890	-$5,092	-$1,208	-$8,861	-$16,051

These costs mount over time, building cumulatively with annual loss of buffer capacity. Over the next ten years we project that total sediment–related costs across the basin due to buffer loss will fall somewhere between $24 and $161 thousand. These impacts are low in comparison to the other categories addressed in this report, which is due in part to the low costs of removing sediment. These values could be substantially greater than these estimates suggest given that much higher rates of sediment capture by buffers have been reported in the literature.

With the exception of damages to marine recreational fishing which are included in the recreation valuation section, we do not include sediment-related costs in the final summation of costs, shown in Table 26. At the local scale, secondary costs such as these might be of more prominent importance. Well-implemented and managed riparian buffers can effectively address site-specific needs. The total cost of sediment pollution caused by riparian habitat loss might be low across the Basin, but the localized value can still be an important factor for assessment.

Urban Stormwater Treatment

As vegetated areas are replaced, the ability of the land to absorb and filter stormwater runoff is reduced. Flooding, bank erosion, and runoff subsequently increase. Impervious surfaces also reduce groundwater recharge and infiltration for stream base-flows.

Based on municipal stormwater treatment costs in the Basin, protecting or restoring one acre of forested riparian buffer could save $540 to $1,898 per year (Table 15). Urban treatment costs are based on stormwater volume, as opposed to the concentration of specific nutrients. The full replacement costs associated with stormwater treatment (e.g., for construction of retention ponds), as opposed to the marginal treatment costs, are much higher at $2.03 per cubic foot.[37]

[37] New Jersey Department of Environmental Protection, 2007. Valuing New Jersey's Natural Capital: An Assessment of the Economic Value of the State's Natural Resources.

Streamside property owners in communities with stormwater crediting programs can lower monthly stormwater bills by decreasing impervious cover on their property.[38]

Table 15. Costs of Stormwater Treatment by Land Cover

Sources: ECONorthwest with data from the Trust for Public Land.[39]

We apply lower runoff values for all categories; forest runoff can be as high as 20 percent, suburban can be as high as 60 percent, dense urban as high as 70 percent, and city commercial as high as 80 percent.[40]

The runoff coefficient is the proportion of rainfall that is converted to storm water runoff.

Average Rainfall/ac/yr = 150,000 cu. ft./acre			Stormwater Treatment Cost ($/cu. ft.)		Annual Savings Per Acre of Riparian Forest	
			Philadelphia, PA	Wilmington, DE		
Land Cover	**Runoff Generation**	**Runoff/ac/yr** (cu. ft./acre)	$0.012	$0.023	Low	High
Forest	5%	7,500	$90	$173	-	-
Suburban Residential	35%	52,500	$630	$1,208	$540	$1,035
Dense Urban Residential	50%	75,000	$900	$1,725	$810	$1,553
City Commercial	60%	90,000	$1,080	$2,070	$990	$1,898

The Problem of Channelized Flow: Buffers can be less effective at treating water pollution in urban environments. Models concerning the effectiveness of riparian buffers typically assume that water flows evenly across the landscape and interacts with the buffer equally at all points. In nature and particularly in urban environments this is rarely the case and certain areas will receive more runoff than others, which can quickly overwhelm a buffer's filtering capacity. Because of channelization and pipes, stormwater in urban environments often goes straight from impervious areas to receiving water bodies, passing through pipes and bypassing riparian buffer treatment zones altogether. An urban buffer's ability to treat stormwater depends on how much the flow has become channelized before it enters, and how long it is detained in the buffer. However urban buffers also provide many other unique benefits in an urban setting including reduction of heat island effect, reduced concentrations of air pollutants (Section 3) and increased property values (Section 5).

Drinking Water Source Protection

The Delaware River Basin provides water for roughly five percent of the US population. Most of the drinking water entering the streams in the Basin initially passes through riparian buffers in headwater regions. Headwaters account for approximately 75 percent of the total waterway length in watersheds.[41] Riparian buffers will often be more effective along small or low-order

[38] http://www.phillywatersheds.org/whats_in_it_for_you/reduce-your-stormwater-fees

[39] Trust for Public Land. 2008. How Much Value Does the City of Philadelphia Receive from its Park and Recreation System?

Trust for Public Land. 2009. How Much Value Does the City of Wilmington Receive from Its Park and Recreation System?

[40] Pennsylvania Department of Environmental Protection. 2012. Erosion and Sediment Pollution Control Program Manual.

Pennsylvania Department of Transportation. 2015. PennDOT Drainage Manual.

[41] Meyer, JL. 2003. Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands. Washington (DC): American Rivers, Sierra Club.

streams than larger or high-order streams since most water delivered to channels from uplands enters along low-order streams.

Forested areas (including riparian buffers) decrease costs by reducing the need to clean and filter public drinking water:

- Portland, Oregon avoided purchasing a $200 million filtration treatment system for its water supply by protecting 102 square miles of its watershed. This avoided cost constitutes an economic benefit of just under $3,000 per acre for water filtration services.
- New York City draws half of its drinking water from three reservoirs located in the Catskill Mountains in the headwaters of the Delaware River. By spending $1.5 billion on watershed protections, New York City has avoided spending at least $6 to $8 billion in capital costs for the construction of a water filtration plant, as well as the $300 million it would cost every year to operate that plant.

In both examples, building a treatment plant would not have generated the wide array of ancillary ecosystem services provided by the conservation alternative, such as carbon sequestration, wildlife habitat, and recreational opportunities.

Water quality is also reflected in elevated property prices (Section 5) and increased number and quality of recreational trips (Section 6).

2. Carbon Storage

Riparian areas contribute to climate regulation by storing carbon in biomass (e.g., vegetation and soils). When riparian areas are replaced by other land cover types, such as agriculture or residential development, the stored carbon is released into the atmosphere as greenhouse gases that contribute to climate change.

We collected information on the amount of carbon stored above ground, below ground and in the soil in various kinds of riparian forests as well as alternative land uses, and estimate the net loss in carbon storage that occurs when an acre of streamside forest is developed.[42] To quantify the economic value of carbon sequestration, we use an estimate of the social cost of carbon in the atmosphere ($31 per ton of CO_2 in $2010, or $127 per metric ton of CO_2 equivalent in $2017).[43] The social cost of carbon estimates the present value of the stream of annual costs and

[42] Based on the overall accounting method outlined in the InVEST package (Carbon Storage and Sequestration: Climate Regulation), as well as regional values reported in:

Industrial Economics. 2011. Economic Valuation Of Wetland Ecosystem Services In Delaware. Prepared for the Delaware Department Of Natural Resources And Environmental Control.

Smith, J.E., Heath, L.S. and Hoover, C.M., 2013. Carbon factors and models for forest carbon estimates for the 2005–2011 National Greenhouse Gas Inventories of the United States. *Forest Ecology and Management*, *307*, pp.7-19.

[43] Nordhaus, W.D., 2017. Revisiting the social cost of carbon. *Proceedings of the National Academy of Sciences*, p.201609244. Estimates of the social cost of carbon vary widely, and ours can be considered a conservative value.

damages (e.g., changes in agricultural production, flooding, wildfire, human health, drought etc.) expected to result from the emission of one metric ton of CO_2.

Table 16. Land Use Change and the Value of Lost Carbon Storage Capacity
Sources: ECONorthwest with data from the InVEST package, IeC 2011 and Smith et. al 2013.

Land Use/Land Cover		Carbon Storage (metric tons/acre)			
		Aboveground	Belowground	Soil	Total
Developed		-	-	16	16
Agriculture		4	2	22	28
Rangeland		1	1	30	32
Oak/Hickory		41	6	21	69
Elm/Ash/Cottonwood		31	4	45	81
Maple/Beech/Birch		48	6	28	82
Change in Carbon Storage with Land Cover Change (metric tons/acre)					
Oak/Hickory	To Developed	-41	-6	-6	-53
Elm/Ash/Cottonwood		-31	-4	-30	-65
Maple/Beech/Birch		-48	-6	-13	-66
Oak/Hickory	To Agriculture	-37	-4	1	-41
Elm/Ash/Cottonwood		-27	-2	-23	-52
Maple/Beech/Birch		-44	-4	-6	-54
Oak/Hickory	To Rangeland	-40	-5	8	-37
Elm/Ash/Cottonwood		-30	-4	-16	-49
Maple/Beech/Birch		-47	-5	1	-51
Value of Change in Carbon Storage ($/acre)					
Oak/Hickory	To Developed	-$5,258	-$795	-$722	-$6,775
Elm/Ash/Cottonwood		-$3,937	-$573	-$3,766	-$8,276
Maple/Beech/Birch		-$6,114	-$764	-$1,599	-$8,477
Oak/Hickory	To Agriculture	-$4,742	-$537	$103	-$5,175
Elm/Ash/Cottonwood		-$3,421	-$315	-$2,941	-$6,676
Maple/Beech/Birch		-$5,598	-$506	-$774	-$6,878
Oak/Hickory	To Rangeland	-$5,103	-$691	$1,032	-$4,762
Elm/Ash/Cottonwood		-$3,782	-$470	-$2,012	-$6,264
Maple/Beech/Birch		-$5,959	-$660	$155	-$6,465

Table 17. Annual and Projected Values of Lost Carbon Storage

		DE	NJ	NY	PA	Basin Total
Net Loss of Natural Land Cover (100-ft buffer, acres/yr)		-9	-53	-13	-92	-167
Low (-$4,762/acre)		-$44,210	-$252,967	-$60,028	-$440,199	-$797,405
High (-$8,477/acre)		-$78,697	-$450,299	-$106,853	-$783,584	-$1,419,432
Total NPV 2018-2028	Low	-$388,436	-$2,222,600	-$527,409	-$3,867,640	-$7,006,084
3% Discount Rate	High	-$691,441	-$3,956,372	-$938,822	-$6,884,650	-$12,471,285
2018-2028 Annualized	Low	-$38,844	-$222,260	-$52,741	-$386,764	-$700,608
	High	-$69,144	-$395,637	-$93,882	-$688,465	-$1,247,128

In contrast to the water quality and air pollution mitigation value, which repeat every year, we value losses in carbon storage as one-time events.

3. Air Quality

Streamside forests improve regional air quality. Forest Service researchers have quantified the capacity of trees to capture air particulates and how this translates into reduced healthcare costs.[44] The economic benefit of trees is highest in urban areas where human populations and the health effects of air pollution are concentrated.

Table 18. Annual and Projected Air Pollution Damages from Riparian Development
Source: ECONorthwest with data from EPA and Nowak et. al. 2004

		DE	NJ	NY	PA	Basin Total
Net Loss of Natural Land Cover (100-ft buffer, acres/yr)		-9	-53	-13	-92	-167
Low Value: Rural ($3 to $7/ac/yr)		-$51	-$276	-$42	-$652	-$1,021
High Value: Urban ($42 to $132/ac/yr)		-$584	-$2,312	-$1,722	-$11,728	-$16,346
Total NPV 2018-2028 (cumulative effect, 3% discount rate)	Low	-$1,371	-$7,843	-$1,861	-$13,648	-$24,723
	High	-$56,477	-$323,155	-$76,683	-$562,336	-$1,018,651
2018-2028 Annualized	Low	-$137	-$784	-$186	-$1,365	-$2,472
	High	-$5,648	-$32,316	-$7,668	-$56,234	-$101,865

Similar to water quality effects, we assume that air pollution losses from forest conversion repeat year after year, and build cumulatively. For example, in year one we value the losses associated with 167 acres of riparian forest, and in the second year we value losses from 334 acres.

4. Flood Mitigation

Riparian areas with undeveloped floodplains provide overbank storage for floodwaters and help attenuate large magnitude floods by reducing the height, velocity and destructive power of floodwaters downstream. Trees and other riparian vegetation help slow the speed and power of floodwaters.[45] For example, forest vegetation was shown to lower stream water elevations from 32 feet to 17.3 feet for a 100-year flood.[46] Buffers also ensure that structures are set back a safe distance from the water's edge. Reducing a property's proximity to waterways and floodwaters reduces the potential for flooding and damages.

The costs of floodplain protection and the benefits of avoided damages are realized by different groups. For instance, the costs of flooding are often spread among many downstream property

[44] Nowak, D.J., Hirabayashi, S., Bodine, A. and Greenfield, E., 2014. Tree and forest effects on air quality and human health in the United States. *Environmental Pollution*, *193*, pp.119-129.

[45] U.S. Environmental Protection Agency, 2006. Economic Benefits of Wetlands. EPA843-F-06-004.

[46] Castelle et al. (1994) Wetland and stream buffer size requirements - a review. Journal of Environmental Quality, 23(5): 878-882.

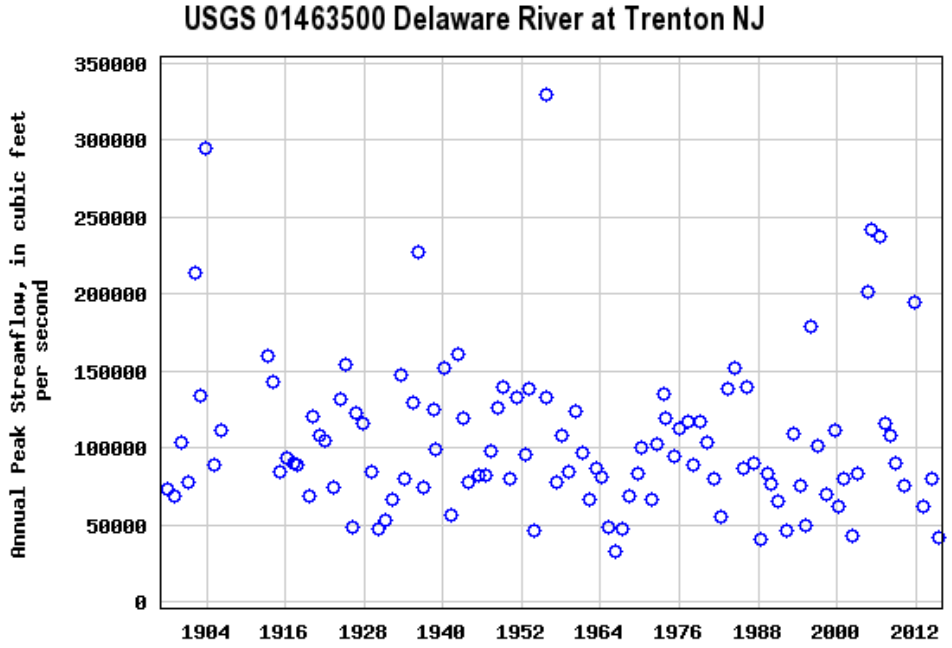
owners and insurance agencies, whereas the opportunity costs of conserving riparian areas must be borne by relatively few upstream landowners and municipalities.[47]

A riparian protection program that prohibits development in both the floodway and the flood fringe preserves natural areas for absorption of flood sized flows and protects structures from flood damage. The potential for flood damages associated with various flood stages has been characterized for many specific communities in the Basin.[48]

Figure 12. Annual flood peaks recorded on the Delaware River at Trenton, N.J., 1898-2015

Source: USGS, https://nwis.waterdata.usgs.gov/nj/nwis/peak/?site_no=01463500&agency_cd=USGS

Note: From September 2004 to June 2006, the Delaware River in New Jersey, New York, and Pennsylvania experienced three major floods that caused extensive damage.



In 2009, the DRBC Flood Advisory Committee recommended that communities *"incorporate the buffer concept as part of a comprehensive floodplain management program to protect communities from flood damage"*, and identified fixed 100-foot buffers and variable width buffers as appropriate policies. The New Jersey Flood Mitigation Task Force and the Association of State Floodplain Managers echoed these recommendations in separate reports.[49]

Flood risk and flood damages are highly site and event-specific. For example, avoided damage depends on the type, value and density of buildings in the floodplain, as well as flood heights.

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[47] Watson, K.B., Ricketts, T., Galford, G., Polasky, S. and O'Niel-Dunne, J., 2016. Quantifying flood mitigation services: The economic value of Otter Creek wetlands and floodplains to Middlebury, VT. Ecological Economics, 130, pp.16-24.

[48] Delaware River Basin Commission. No Date. Flood Impacts by Location.

[49] New Jersey Flood Mitigation Task Force, 2006. Report on Delaware River Flood Mitigation.

Association of State Floodplain Managers. 2013. How-To Guide for No Adverse Impact – Infrastructure.

Few studies have addressed the topic of riparian cover and flood damages in a way that might be directly transferrable to and quantifiable in the context of the Delaware River Basin.

Suspended sediment in streams increases the frequency and severity of flooding. We estimate that every acre of riparian buffer lost to development increases flood damages by $0.4 to $1.3 due to sediment effects alone (see Section 1). Based on sediment erosion and deposition locations, under some circumstances this value might be considerably higher.

The largest flood-related benefit of a buffer policy would likely be that of preventing further development in floodplains. Not building in floodplains in the Chicago metropolitan area, for example, was estimated to save an average of $900 per acre per year in flood damages.[50]

Many regions in the Delaware River Basin face repetitive flood loss claims.[51] To help avoid flood damages, the state of Pennsylvania has voluntarily 'bought out' and demolished nearly 1,400 homes and removed 3,500 people from dangerous flood areas since 1996.[52]

Riparian buffers are creditable under the Federal Emergency Management Agency's Community Rating System (CRS).[53] Mitigation activities (like buffer ordinances and other floodplain management activities) can improve a community's rating and earn 5 percent incremental discounts on flood insurance premiums.

A number of other studies document the flood mitigation effects of, and economic justification for, protecting natural floodplains:

- In 1976 the Army Corps of Engineers used an avoided-cost approach to estimate the economic costs and benefits of wetland and floodplain preservation in the Charles River Basin, Massachusetts.[54] The Corps estimated that the loss of 8,442 acres of wetlands within the Charles River system would have resulted in annual flood damages of over $17 million, and chose to purchase and protect the floodplain parcels from development rather than constructing expensive flood control structures. This translates into roughly $2,000 per acre in avoided damages ($8,621 in $2017 dollars).
- A recent study conducted in Vermont reported an annual flood damage reduction of $459,000 from conserving 17,989 acres ($25.50/acre) of woody wetlands and floodplain forests. This is substantially lower than other values reported in the literature, and the

[50] Johnston, D.M., Braden, J.B. and Price, T.H., 2006. Downstream economic benefits of conservation development. *Journal of water resources planning and management*, *132*(1), pp.35-43.

[51] Delaware River Basin Commission. No Date. Flood Insurance Claims In The Delaware River Basin.

[52] Pennsylvania Emergency Management Agency. *What is Hazard Mitigation*.

[53] FEMA. 2015. Fact Sheet - The Community Rating System 2015 Works to Protect Natural Floodplains.

Delaware Riverkeeper Network. 2015. Appendix A - Sample Riparian Ordinance.

[54] Thibodeau, F.R. and B.D. Ostro. 1981. An Economic Analysis of Wetland Preservation. Journal of Environmental Management, 12:19-30.

authors suggest that this is because the benefits accrue to a relatively small population of downstream beneficiaries.[55]

- A widely applied meta-analysis of wetland studies found that flood attenuation benefits provided by wetlands were between $166 and $3,256 per acre per year, with a mean value of $732 (2017$).[56]
- Allen et al. (2003) concluded that the existence of woody corridors along the Missouri River during a large flood in 1993 prevented and reduced levee damage by almost half. Areas with wider woody corridors had less levee damage, and buffer widths of 300 to 500 feet were the most protective.[57]

5. Property Values

For amenity reasons, landowners tend to prefer forested buffers to barren streambanks.[58] Forested riparian buffers were widely preferred in a photo-based survey of rural and suburban landowners, with 90 percent of suburban landowners preferring forested riparian buffers to non-vegetated corridors.[59] Additionally, in a recent study of nearly 12,000 American adults and children, seven out of 10 children surveyed said they "would rather explore woods and trees than play on neat-looking grass."[60]

A review of academic research papers on the amenity values and resulting property price effects of riparian areas concluded that the presence and quality of riparian buffers can enhance property values by less than 1 percent to upwards of 26 percent.[61] Home prices generally increase with proximity to a stream or buffer zone.

Of particular relevance to the policy context in the Delaware River Basin is a 2009 study by Bin et. al, which examined housing prices after several counties in North Carolina established a mandatory buffer rule. The authors concluded that limiting streamside development and tree removal did not have a significant impact on the value of riparian properties. They suggest that

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[55] Watson, K.B., Ricketts, T., Galford, G., Polasky, S. and O'Niel-Dunne, J., 2016. Quantifying flood mitigation services: The economic value of Otter Creek wetlands and floodplains to Middlebury, VT. Ecological Economics, 130, pp.16-24.

[56] Woodward, R.T. and Wui, Y.S., 2001. The economic value of wetland services: a meta-analysis. *Ecological economics*, *37*(2), pp.257-270.

[57] Allen, S.B., Dwyer, J.P., Wallace, D.C. and Cook, E.A., 2003, Missouri River flood of 1993: role of woody corridor width in levee protection. Journal of the American Water Resource Association, 39(4), pp.923-933.

[58] Sullivan, W.C., Anderson, O.M., Lovell, S.T., 2004. Agricultural buffers at the rural-urban fringe: an examination of approval by farmers, residents, and academics in the Midwestern United States. Landscape and Urban Planning. 69, 299–313.

[59] Kenwick, R. a., Shammin, M. R., & Sullivan, W. C. 2009. Preferences for riparian buffers. Landscape and Urban Planning, 91, 88–96.

[60] Kellert, S. and DJ Case and Associates. 2017. The Nature of Americans National Report: Disconnection and Recommendations for Reconnection.

[61] American Rivers. 2016. The Economic Value of Riparian Buffers.

the policy may not have changed how property owners would have used or managed the land in the absence of the rule and/or that the environmental amenities protected by the buffer policy (e.g., visual aesthetics, water quality of adjacent streams, wildlife watching values) raised property values enough to offset any negative impacts.

In practice, it is difficult to isolate the effect of improved aesthetics while avoiding double-counting of benefits -- such as air quality, water quality, and flood control -- that also impact property values. For example:

- Heightened flood risk can lower property values. Qui (2006) found that homes in the FEMA floodplain were worth 4.7 to 5.6 percent less than similar homes outside of the floodplain. Other studies have shown that homes in the floodplain tend to have 4 to 12 percent lower prices.[62]
- Improvements in water quality often elevate housing prices. A study conducted by the EPA found that clean water can increase the value of single family homes within 4,000 feet of the water's edge by up to 25 percent.[63] The City of Philadelphia estimates that installation of green stormwater infrastructure in the city will raise property values two to five percent, generating $390 million over the next 40 years in increased values for homes near green spaces.[64]

6. Fish and Wildlife Habitat

Riparian corridors are some of the most diverse, dynamic and complex habitats on Earth.[65]

- As part of the Atlantic flyway, the riparian habitats of the Delaware River Basin are used by hundreds of resident and migratory bird species for feeding, nesting, and/or breeding. Bird abundances in floodplain forests can be twice as high as upland forests.
- Recreationally and commercially important fish species like trout, shad, herring, alewife, and striped bass use forested streams and rivers to spawn.[66]
- Riparian areas are especially important to amphibians and reptiles due to the fact that their lifecycle requires access to water.

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[62] Qiu, Z., Prato, T. and Boehrn, G., 2006. Economic Valuation of Riparian Buffer and Open Space in a Suburban Watershed. *JAWRA Journal of the American Water Resources Association*, *42*(6), pp.1583-1596.

[63] U.S. Environmental Protection Agency. 1973. Benefit of Water Pollution Control on Property Values. EPA-600/5-73-005.

[64] Philadelphia Water Department. 2009. Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control—A Long Term Control Plan Update. Summary Report.

[65] Naiman, R.J., Decamps, H. and Pollock, M., 1993. The role of riparian corridors in maintaining regional biodiversity. *Ecological applications*, *3*(2), pp.209-212.

[66] CBP (Chesapeake Bay Program), 1997. Riparian Forest Buffer Panel Report: Technical Support Document. (CBP/TRS 167/97)(EPA903-R-97-007)

Table 19 shows the preferred buffer widths for various wildlife species. Wildlife habitat needs in general greatly exceed the 100-foot area protected by buffer policies.

Table 19. Buffer Widths Required by Various Wildlife Species

Source: Ellis, J.H. 2008. Scientific Recommendations on the Size of Stream Vegetated Buffers Needed to Protect Wildlife and Wildlife Habitat, Part Three, The Need for Stream Vegetated Buffers: What Does the Science Say? Report to Montana Department of Environmental Quality, EPA/DEQ Wetland Development Grant. Montana Audubon, Helena, MT.

Species	Desired Buffer Width (feet)
Great Blue Heron nest	820–985
Cavity nesting ducks	600
Bald Eagle nests	400–1,320
Pileated Woodpecker, fisher, mink	330–600
Large mammals, bobcat, red fox, otter, muskrat, dabbling ducks	330
Wood Duck	250–600
Osprey, pine marten	200–330
Amphibians and reptiles, Belted Kingfisher, beaver	100–330
Small mammals	40–300
Hairy Woodpecker	130
Deer, Ring-necked Pheasant	75
Mourning Dove, Downy Woodpecker	50
Songbirds	50–660
American Redstart, Spotted Towhee	660
Warbling Vireo	300
Brown Creeper, Ruby-crowned Kinglet, Swainson's Thrush	200
Red-eyed Vireo, Brown Thrasher	130
Black-capped Chickadee, White-breasted Nuthatch	50
Cold water fisheries	**100-300**

Riparian Forest Cover and Aquatic Habitat Health

A stream's ability to provide ecosystem services depends on the quality and quantity of surrounding tree cover. Studies evaluating the effectiveness of forested riparian buffers suggest that where natural riparian habitats are protected, fish diversity can be maintained with up to 15 percent impervious cover in the watershed, and aquatic insect diversity can be maintained with as much as 30 percent impervious cover.[67]

In 2001, the State Legislature of Georgia reduced the minimum width of mandatory-forested riparian buffers along designated trout streams from 100 feet to 50 feet. Researchers examined the importance of forested buffers to trout populations in the Appalachian Mountains in Georgia. They concluded that streams with 50-foot wide buffers had higher temperatures than

[67] Schueler, T. R. 2003. Impacts of impervious cover on aquatic systems. Center for Watershed Protection, Ellicott, MD, Monograph No. 1 , 140p.

those with 100-foot wide buffers, with a predicted 66 to 97 percent reduction in trout reproductive success in streams with narrower buffers.[68]

Another study examining the influence of riparian buffers and impervious cover on stream health rankings found that watersheds with the best overall stream conditions had, on average, greater than 65 percent tree cover within the 100-foot riparian buffer zone and less than six percent impervious cover distributed throughout the watershed (Table 20). The other rankings ('good', 'fair', 'poor') had progressively lower levels of riparian tree cover and greater impervious cover.[69]

Table 20. Stream Health Rankings and Forested Buffers
Source: Goetz et. al. 2003

Stream Health Ranking	Forested Buffer	Impervious Cover in Local Catchment
Excellent	76.8%	3.6%
Good	71.3%	4.9%
Fair	63.2%	13.9%
Poor	56.3%	19.5%

Habitat Connectivity

Riparian vegetation along river channels functions as a primary regional migration corridor for most wildlife species. Woody vegetation must be present for many terrestrial species to find needed cover while traveling across otherwise open areas.[70]

Fragmentation results in the loss of wildlife habitat and movement corridors, which in turn results in wildlife decline and extirpation. Habitats that become isolated islands surrounded by development lose much of their ecological value even though the habitat may not be directly

[68] Jones. K.L., G.C. Poole, J.L. Meyer, W. Bumback and E.A. Kramer. 2006. Quantifying expected ecological response to natural resource legislation: a case study of riparian buffers, aquatic habitat and trout populations. Ecology and Society 11(2):15

[69] Goetz, S.J., Wright, R.K., Smith, A.J., Zinecker, E. and Schaub, E., 2003. IKONOS imagery for resource management: Tree cover, impervious surfaces, and riparian buffer analyses in the mid-Atlantic region. *Remote sensing of environment*, *88*(1), pp.195-208.

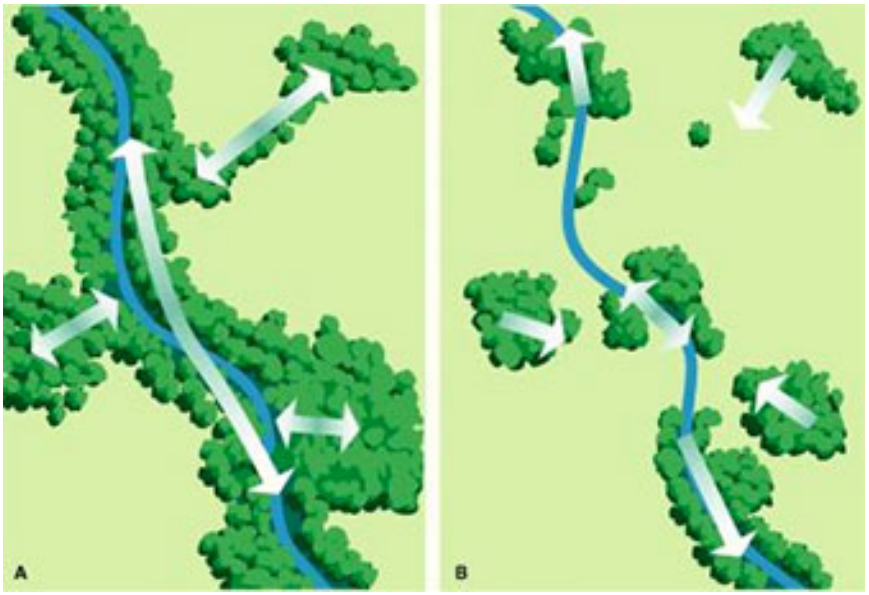
Goetz, S.J., 2006. Remote sensing of riparian buffers: past progress and future prospects. *JAWRA Journal of the American Water Resources Association*, *42*(1), pp.133-143.

Snyder, M.N., Goetz, S.J. and Wright, R.K., 2005. Stream health rankings predicted by satellite derived land cover metrics. *JAWRA Journal of the American Water Resources Association*, *41*(3), pp.659-677.

[70] USDA NRCS. 1996. Riparian Areas Reservoirs of Diversity.

affected (Figure 13).[71] Researchers have suggested a nation-wide network of wildlife corridors along rivers to facilitate wildlife migration and enable adaptation to climate change.[72]

Figure 13. Movement Corridors and Habitat Connection
Source: http://conservationcorridor.org/wp-content/uploads/riparian_diagram.jpg



Increased riparian habitat can also benefit commercial operations by protecting wildlife populations. In addition to sediment-related benefits for marine fisheries (see Section 1), other examples include:

- **Pollination by native pollinators:** The Nature Conservancy estimates that protecting and restoring habitat for native pollinators can boost agricultural earnings on New Jersey tomatoes farms by $30 to $222 per acre.[73]
- **Pest control by forest birds:** birds control many insect pest species. The cost to replace the biological control provided by forest birds with pesticides or genetic engineering has been estimated to be at least $7.34 per acre.[74]

[71] Newcomb et. al.. 2002. Surface Water and Riparian Areas of the Raritan River Basin - A Technical Report for the Raritan Basin Watershed Management Project.

[72] Fremier, A.K., Kiparsky, M., Gmur, S., Aycrigg, J., Craig, R.K., Svancara, L.K., Goble, D.D., Cosens, B., Davis, F.W. and Scott, J.M., 2015. A riparian conservation network for ecological resilience. *Biological Conservation*, *191*, pp.29-37.

[73] The Nature Conservancy. No Date. Analysis of Native Pollinator Benefits to New Jersey Farms.

[74] Moskowitz, K. and Talberth, J., 1998. The economic case against logging our national forests. *Santa Fe, New Mexico: Forest Guardians.*

Existence Values

About half of the animal species of concern in the Mid-Atlantic Region are dependent on wetlands, streams, rivers, and riparian areas.[75] Riparian protection and restoration efforts could improve conditions for federally-listed endangered species such as the Atlantic sturgeon, as well as more common species such as blueback herring and alewife that have experienced widespread declines from historical levels. Economic research on passive-use values suggests particularly high value for rare species.

7. Recreation

Loss of riparian forest can affect both land and water-based recreational opportunities. For example, development can reduce the total area of forest available for certain types of recreational activities, or it can reduce enjoyment by altering the visual appeal of streamside recreation areas. In a study of nearly 12,000 American adults and children, seven out of 10 children surveyed said they "would rather explore woods and trees than play on neat-looking grass."[76] The quantity and quality of riparian habitats also strongly influences the availability of wildlife populations that in turn support a variety of recreational activities. Insofar as riparian buffers provide habitat and improve wildlife populations, the quality of hunting, fishing, wildlife viewing, nature photography, and other wildlife-dependent activities will be improved. Riparian corridors can provide important opportunities for trail development along waterways, maintaining public access.

Recreational effects can be measured in a variety of ways, including number of trips taken, consumer spending on travel and equipment, as well as 'consumer surplus', which refers to a person's enjoyment of a recreation activity above and beyond what they actually pay for it. Economists at the USDA Economic Research Service have developed models to describe the recreation benefits of the U.S. Department of Agriculture's Conservation Reserve Enhancement Program (CREP).[77] This program pays private landowners to retire agricultural lands from production and convert them to forests and grasslands, with a particular emphasis on planting in riparian areas. Based on nation-wide recreation participation data and information about regional land cover, the models estimate the gain in recreational use and consumer surplus that occurs when an acre of land is converted from cropland to natural cover. This is essentially the process of buffer loss and development in reverse and therefore represents an appropriate and useful set of values to assess incremental changes in recreation due to land use change.

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[75] Brooks, R.P. and Serfass, T.L., 2013. Wetland-Riparian Wildlife of the Mid-Atlantic Region: An Overview. In *Mid-Atlantic Freshwater Wetlands: Advances in Wetlands Science, Management, Policy, and Practice* (pp. 259-268). Springer New York.

[76] Kellert, S. and DJ Case and Associates. 2017. The Nature of Americans National Report: Disconnection and Recommendations for Reconnection.

[77] Feather, P., Hellerstein, D. and Hansen, L., 1999. Economic valuation of environmental benefits and the targeting of conservation programs: the case of the CRP. USDA Economic Research Service. Agricultural Economic Report No. 778.

Table 21 shows per-acre consumer surplus values for various recreational activities in the Northeastern region. Every acre of natural riparian land converted to alternative uses results in a loss of $62.8 in recreational use and enjoyment, on average. This loss in use and enjoyment could be due to a number of factors including lower recreation participation, less access, or reduced wildlife populations that reduce the quality of hunting and viewing.

Table 21. Value of Private Lands for Recreation

Source: ECONorthwest with data from Feather and Hansen 1999 and Hansen and Ribaudo 2008

Note: the per-acre estimate for marine recreational fishing is transferred from sediment related impacts described in Section 1.

Recreation Type	Value (consumer surplus/ac/yr)
Wildlife viewing	$49.0
Pheasant hunting	$8.6
Freshwater recreation	$3.4
Marine recreational fishing	$1.7
Total	**$62.8**

Cumulative losses amount to approximately $48.5 thousand per year, summing to a projected $485 thousand over the course of the next ten years (Table 22).

Table 22. Annual and Projected Recreation Losses Associated with Riparian Development

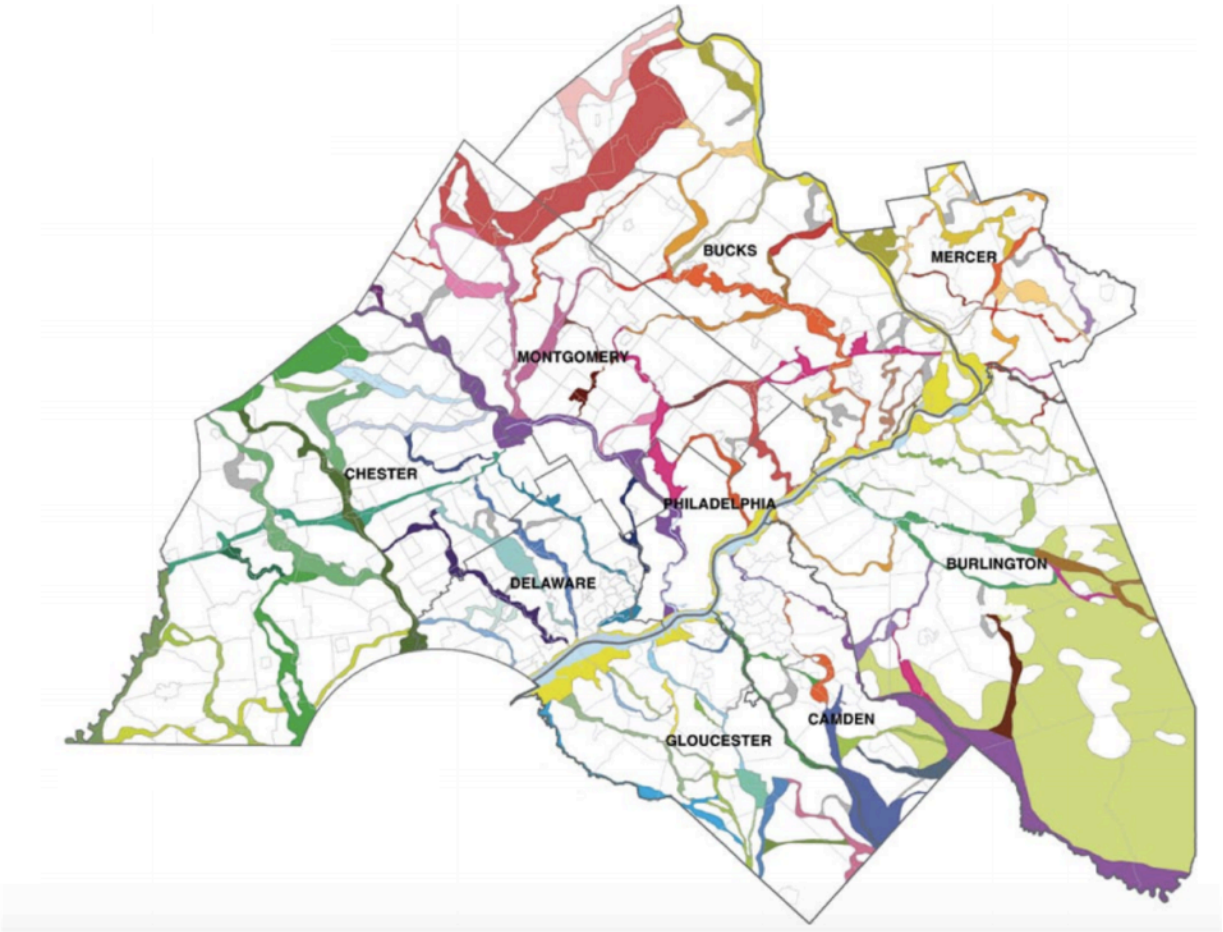
	DE	NJ	NY	PA	Basin Total
Annual Net Loss of Natural Land Cover (100-ft buffer, acres/yr)	-9	-53	-13	-92	-167
Annual Loss in Consumer Surplus ($63/acre)	-$583	-$3,334	-$791	-$5,802	-$10,509
Total NPV 2018-2028	-$26,910	-$153,975	-$36,537	-$267,938	-$485,359
2018-2028 Annualized	-$2,691	-$15,397	-$3,654	-$26,794	-$48,536

A study in Philadelphia estimated that restoring riparian vegetation and developing streamside parks would increase recreational trips by almost 350 million over 40 years, translating to roughly $950/ac/year in additional consumer surplus (2009$).[78] Riparian corridors are an important part of Philadelphia's GreenPlan, regional riverfront access initiatives, and other planning efforts.[79] For example, in 2009 the Delaware Valley Regional Planning Commission (DVRPC) developed an open space plan which links the region's watersheds and parks to a two-state, nine-county network of streams, trails, and greenways (Figure 14).

[78] The Conservation Fund. 2014. Ecosystem Services Literature Review. Prepared for the Chicago Metropolitan Agency for Planning.

[79] Wallace Roberts & Todd. 2010. GreenPlan Philadelphia.

Figure 14. Planned Network of Streams, Trails, and Greenway Connections in the Delaware Valley
Source: Delaware Valley Regional Planning Commission and GreenPlan Philadelphia



Other studies demonstrate the close link between water quality, habitat restoration, and spending on outdoor recreation. For example:

- In the central Appalachian region, restoring streams to support fish could generate an additional $239 million in freshwater fishing expenditures across the region.[80]
- Research has demonstrated that, for every extra meter of visibility in a lake, recreationists are willing to travel 56 minutes farther (equivalent to US$22 in travel costs).[81]

[80] Jackson, L.E., Rashleigh, B. and McDonald, M.E., 2012. Economic value of stream degradation across the central Appalachians. *Journal of Regional Analysis & Policy*, *42*(3), p.188.

[81] Keeler, B.L., Wood, S.A., Polasky, S., Kling, C., Filstrup, C.T. and Downing, J.A., 2015. Recreational demand for clean water: evidence from geotagged photographs by visitors to lakes. *Frontiers in Ecology and the Environment*, *13*(2), pp.76-81.

- The improvements in water quality achieved in the Chesapeake Bay by 1996 alone increased the value of recreational use (beach use, boating, and striped bass sport fishing) by $357.9 million to $1.8 billion (1996$).[82]

Collectively, riparian buffers improve conditions for outdoor recreation on-site and elsewhere in the watershed. Outdoor recreation importance to quality of life, public health, and general regional attractiveness to businesses and skilled workers make it an important contributor to regional economy stability and growth.

B. Aggregate Value of Riparian Buffer Services

People appreciate and value riparian buffers directly and with recognition of the collective suite of amenity and ecological services they provide. Johnston et al. (2015) published a valuation study estimating Maine residents' Willingness to Pay (WTP) for protecting and restoring riparian habitat (Table 23).[83] Based on a general population survey of three towns in south coastal Maine, the authors estimated that households in the study watershed were willing to pay an average of $0.140/year/additional foot of riparian development setbacks (the survey question specifically asked about WTP to increase the currently protected buffer area of 100 feet to 200 feet).

[82] Morgan, C. and Owens, N., 2001. Benefits of water quality policies: the Chesapeake Bay. Ecological Economics, 39(2), pp.271-284.

[83] Johnston, R.J., C. Feurt and B. Holland. 2015. Ecosystem Services and Riparian Land Management in the Merriland, Branch Brook and Little River Watershed: Quantifying Values and Tradeoffs. George Perkins Marsh Institute, Clark University, Worcester, MA and the Wells National Estuarine Research Reserve, Wells, ME.

These annual household values are supported by a previous study that examined New York residents' willingness to pay for different types of coastal habitat restoration in the Peconic Estuary system: Johnston, R.J., Grigalunas, T.A., Opaluch, J.J., Mazzotta, M. and Diamantedes, J., 2002. Valuing estuarine resource services using economic and ecological models: the Peconic Estuary System study. Coastal Management, 30(1), pp.47-65.

Table 23. Representative Household WTP (Willingness to Pay) for Riparian Protection Measures and Benefits

Source: Johnston et al. 2015

Outcome	Description of Outcome *(All effects are within the MBLR Watershed)*	Value per Household, per Year *(Additional taxes/fees that each household would be willing to pay, per year)*
Riparian Land Condition	The number of riparian acres with natural vegetation.	**$0.044** per additional acre with natural vegetation.
River Condition	The average ecological condition of area rivers, measured using a 100-point aquatic biotic index.	**$1.280** per point increase in the biotic index
Recreational Fish	The average number of brook trout per 1000 square feet of river.	**$3.833** per additional fish, per 1000 square feet of river
Swim Safety	The percentage of days during which government tests show that area beaches (Laudholm, Drakes Island, Crescent Surf and Parson) are safe for swimming.	**$2.020** per percentage point increase in safe swimming days
Setbacks	The minimum width of the riparian area where development is restricted, in feet.	**$0.140** per foot of **increased** development setbacks.
Enforcement	Whether enforcement is increased to prevent illegal development or clearing on riparian land.	**$17.310** for increased enforcement and inspections, compared to the status quo

Table 24. Estimated Household Values for Increased Riparian Protection

Source: U.S. Census 2010; Johnston et. al. 2015

State	Number of Households in Basin (2010)	Total Annual WTP for 100-foot Development Setback
Delaware	330,944	$4,633,215
New Jersey	1,070,859	$14,992,027
New York	48,585	$680,184
Pennsylvania	2,188,921	$30,644,894
Delaware River Basin	**3,639,309**	**$50,950,320**

We can apply these values to the Delaware River Basin in multiple ways. Using 2010 Census data on the number of people living in the Basin, we estimate the number of households by dividing the population by average family size (2.5). A 100-foot development setback program (or an increase to 200 feet in states that already have 100 foot buffers, for example) would be worth $14 to households every year, summing to nearly $51 million every year across the Basin.

These per household values align well with those reported elsewhere in the literature. For example, Holmes et al. (2004) report that annual household WTP for a riparian restoration program in North Carolina ranged from $0.95 – $74, depending on the spatial scale of restoration.[84] Similarly, a meta-analysis examining household willingness to pay to protect farmland from development found that mean annual household WTP per acre ranges from

[84] Holmes, T.P., Bergstrom, J.C., Huszar, E., Kask, S.B. and Orr, F., 2004. Contingent valuation, net marginal benefits, and the scale of riparian ecosystem restoration. *Ecological Economics*, *49*(1), pp.19-30.

$0.0001 in Colorado and Wyoming to $21.90 in Massachusetts, with an average across all studies of $1.80.[85]

Summary of Riparian Ecosystem Services in the Delaware River Basin

In summary, riparian buffers in the Delaware River Basin provide tens of thousands of dollars in benefits per acre annually, with evidence that additional non-monetized benefits would substantially increase these totals (Table 25). Furthermore, households and homeowners benefit from riparian buffers in multiple ways, including aesthetics, recreation access and quality, and appreciation for habitat and wildlife. With greater population density, more potential beneficiaries also increase the total economic value provided per segment of riparian buffer.

Table 25. Summary of Ecosystem Services Values by Riparian Buffers in the Delaware River Basin
Source: ECONorthwest with data from a number of sources (see report)

Ecosystem Service Provided	Per-unit Value for Services
Nutrient Retention	$87 to $4,789 per acre per year
Carbon Storage	$4,762 to $8,477 per acre per year
Air Quality	$3 to $132 per acre per year
Aesthetic Values	+1% to +26% Property Price Premium
Flood Mitigation	Qualitative Description
Recreation	$63 per acre per year (lower bound)
Wildlife Habitat	Qualitative Description
Combined Buffer Services	$14/Household/Year

Extrapolating the rate of riparian land development observed in the Delaware River Basin between 2001 and 2011, and applying ecosystem service values monetized at a per acre scale, the net present value of future losses will be in the tens of millions of dollars (Table 26). Looking at only the narrower of the two buffer widths considered (100 foot width) the discounted benefit over the next ten years of avoiding additional loss of riparian buffer would likely be worth greater than $25 million.

[85] Bergstrom, J.C. and Ready, R.C., 2009. What have we learned from over 20 years of farmland amenity valuation research in North America?. *Applied Economic Perspectives and Policy*, *31*(1), pp.21-49.

Table 26. Summary of Projected Ecosystem Service Losses, by State, 2018-2028

Source: ECONorthwest with data from a number of sources (see report)

Note: Net Present Value calculations apply a 3 percent discount rate.

Water pollution refers only to nitrogen and phosphorus effects, and does not include sediment benefits; see Table 9, Section 1.

Carbon storage effects are detailed in Table 17, Section 2

Air pollution effects are detailed in Table 18, Section 3

Recreation effects are detailed in Table 22, Section 7.

State		Delaware	New Jersey	New York	Pennsylvania	Basin Total
Net Loss of Natural Land Cover	Annual	-9	-53	-13	-92	-167
(100-ft buffer, acres)	Decadal	-93	-531	-126	-924	-1,674
NPV 2018-2028						
Water Pollution Removal	Low	-$388,436	-$2,222,600	-$527,409	-$3,867,640	-$7,006,084
	High	-$691,441	-$3,956,372	-$938,822	-$6,884,650	-$12,471,285
Carbon Storage	Low	-$126,992	-$726,636	-$172,426	-$1,264,450	-$2,290,503
	High	-$602,932	-$3,449,930	-$818,646	-$6,003,368	-$10,874,876
Air Pollutant Removal	Low	-$1,371	-$7,843	-$1,861	-$13,648	-$24,723
	High	-$56,477	-$323,155	-$76,683	-$562,336	-$1,018,651
Outdoor Recreation	-	-$26,910	-$153,975	-$36,537	-$267,938	-$485,359
Total Quantified Services	**Low**	**-$543,708**	**-$3,111,053**	**-$738,233**	**-$5,413,675**	**-$9,806,669**
	High	**-$1,377,759**	**-$7,883,432**	**-$1,870,688**	**-$13,718,293**	**-$24,850,172**
Annualized Value						
Water Pollution Removal	Low	-$38,844	-$222,260	-$52,741	-$386,764	-$700,608
	High	-$69,144	-$395,637	-$93,882	-$688,465	-$1,247,128
Carbon Storage	Low	-$12,699	-$72,664	-$17,243	-$126,445	-$229,050
	High	-$60,293	-$344,993	-$81,865	-$600,337	-$1,087,488
Air Pollutant Removal	Low	-$137	-$784	-$186	-$1,365	-$2,472
	High	-$5,648	-$32,316	-$7,668	-$56,234	-$101,865
Outdoor Recreation	-	-$2,691	-$15,397	-$3,654	-$26,794	-$48,536
Total Quantified Services	**Low**	**-$54,371**	**-$311,105**	**-$73,823**	**-$541,368**	**-$980,667**
	High	**-$137,776**	**-$788,343**	**-$187,069**	**-$1,371,829**	**-$2,485,017**

Implementing Protection and Restoration of Riparian Areas

Providing these economic benefits of riparian buffers is not a particularly costly endeavor. Per-acre, agricultural land costs $8,400 in Delaware, $12,800 in New Jersey, $2,980 in New York, and $5,500 in Pennsylvania.[86] The price of an easement is generally 60 to 80 percent of the land price.[87] These prices suggest that the one-time burden of riparian buffer costs in areas not yet urbanized would generally be less than the annual benefit. Prices in urban and suburban areas are much higher. For example, in 2016 urban land in Philadelphia cost $52,187 per acre.[88] Retrofitting riparian buffers back into urbanized areas can be particularly costly. These figures establish a clear urgency for protecting the Basin's remaining riparian forests. See the Appendix Maps for more information on this issue.

Protection vs. Restoration

Buffer rules offer the opportunity to keep existing riparian forests in place. Protecting forests will protect water bodies from further declines and could avert much larger costs to fix the Basin's impaired habitats and waters in the future. Restoration is much more expensive than protection. In work we have completed in the Puget Sound Basin reviewing habitat restoration and conservation projects, restoration projects tended to cost at least ten times more than equivalent conservation projects.[89]

Furthermore, restoration can be challenging, and success rates are well below 100 percent. A review of wetland mitigation projects in Washington State found less than a 50 percent success rate.[90] Programs based on restoration have often had a difficult time meeting restoration goals.[91] For example, the Chesapeake Bay program has consistently failed to meet planting objectives: *"A goal of 900 miles/year was a goal first set by the states in 2007. Since that time, this goal has never been reached. … Average annual mileage [*between 2012 and 2014*] was 220 miles. In a 10-year period, from 2001-2010, average annual mileage was 650 miles."*[92] The report cites a variety of barriers that have slowed progress.

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[86] USDA National Agricultural Statistics Service. 2016. Land Values 2016 Summary.

[87] New Jersey Transfer of Development Rights Program. 1999. Appraisal Guidelines For Determining Development Potential.

[88] Lincoln Institute of Land Policy. 2016. Land and Property Values in the U.S. - Land Prices for 46 Metro Areas.

[89] See, for example ECONorthwest. 2008. Puget Sound Partnership Action Agenda: Financing Strategy Task 1: Cost Analysis.

[90] Washington State Department of Ecology. 2000. Washington State Wetland Mitigation Evaluation Study.

[91] Chesapeake Bay Program. Track the Progress – Planting Forest Buffers. Online at: http://www.chesapeakebay.net/indicators/indicator/planting_forest_buffers

[92] Chesapeake Bay Program. 2015. Riparian Forest Buffer Outcome Management Strategy 2015–2025, v.1

Restoration not only costs more than protection, but also provides lower service levels during recovery. For example, when planted, a riparian forest buffer composed of saplings will not be very effective in reducing nutrient runoff, but its effectiveness will increase as the trees mature. A recent study of riparian buffer age and its effects on stream aquatic function supports the idea that restoration may require significantly longer time periods to display restored ecological functions and values. Orzetti et. al. (2010):

> *"…collected data on water quality, habitat, and macroinvertebrates from 30 Piedmont streams with buffers ranging from zero to greater than 50 years of age in the Chesapeake Bay watershed. Overall, buffer age was positively related to improved stream habitat, water quality, and a suite of macroinvertebrate metrics. The data collected showed marked improvements occurring within 5–10 years postrestoration, with conditions approaching those of streams with long established buffers within 10–15 years postrestoration".*[93]

Urbanization

Riparian buffers are "*uniquely capable of producing high levels of multiple ecosystem services in otherwise nonforested landscapes*".[94] For example, in a model assessing the impacts of urbanization on Chesapeake Bay water quality between 2000 and 2030, researchers demonstrated that, if implemented throughout the Basin, riparian buffers could reduce overall nitrogen and phosphorus loads even as urban point sources increase.[95]

Federal and state policies have traditionally prioritized agricultural properties for technical and financial support and participation in incentivized riparian buffer programs, such as the U.S. Department of Agriculture's Conservation Reserve Enhancement Program (CREP). In contrast, part-time farmers (and/or amenity owners) and residential landowners have received much less programmatic attention (information and incentives) for buffer implementation. Based on the increase in urban cover in the riparian zone and the decline in forest and agricultural cover throughout the Basin, federal and state policy might shift from its present agricultural emphasis to better address residential riparian conditions and loss. Urbanization is projected to increase throughout the Basin in the coming decades (Figure 15).

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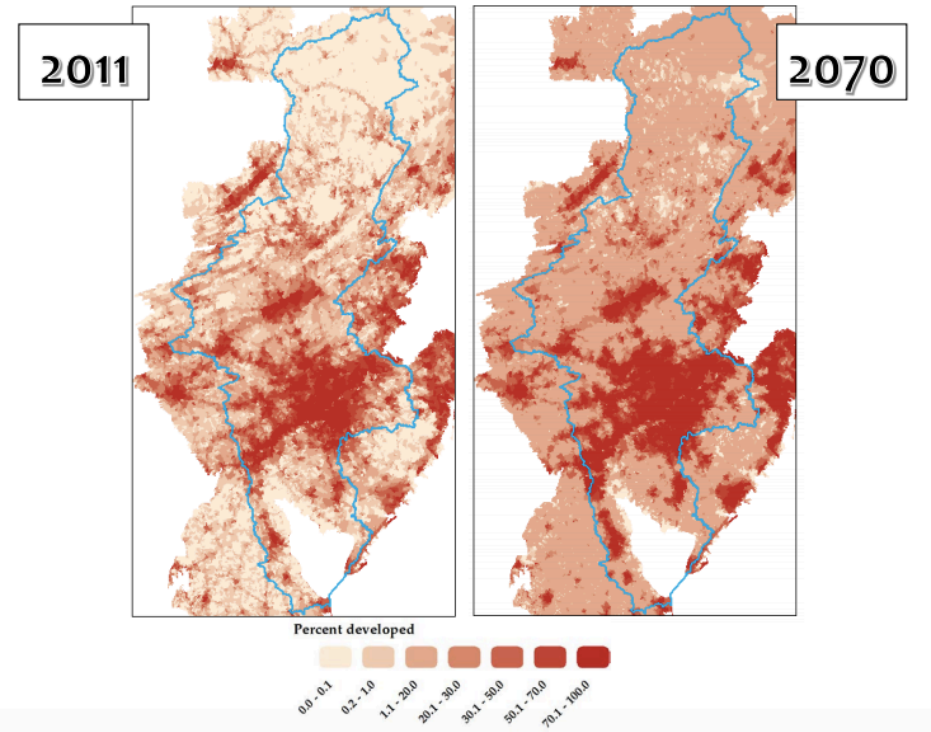
[93] Orzetti LL, Jones RC, Murphy RF (2010) Stream condition in Piedmont streams with restored riparian buffers in the Chesapeake Bay watershed. J Am Water Resour Assoc 46:473–485

[94] Stanturf, J., Lamb, D. and Madsen, P. eds., 2012. *Forest landscape restoration: Integrating natural and social sciences* (Vol. 15). Springer Science & Business Media.

[95] Roberts, A.D., and S.D. Prince. (2010). Effects of urban and non-urban land cover on nitrogen and phosphorus runoff to Chesapeake Bay. Ecological Indicators 10: 459-474

Figure 15. Urban Development Projections, 2011-2070

Source: The Delaware River Basin Project, Presentation by Dr. Jantz, Shippensburg University



Researchers studying riparian buffer implementation in urban environments observed "that residential landowners without buffers often were not familiar with riparian functions or conservation organizations; nor did they find the practices promoted by buffer programs applicable for their backyards".[96] They concluded that:

> *"Residential riparian landowners are dramatically less willing to implement buffers on their property than agricultural landowners … In the eyes of residential riparian landowners, the current size and demands of buffers are not acceptable; however, neighborhood cohesion may play an encouraging or discouraging role depending on the prevailing normative standards. As buffers become more common on residential properties, potentially through experimentation and education that emphasizes local outcomes, backyard buffers may more effectively adhere to aesthetic and property management norms"*[97]

Social Barriers and Constituencies

The Technical Advisory Committee for Pennsylvania's Riparian Buffer Initiative Implementation Plan issued a comprehensive report based on the input of more than 100

[96] Armstrong, A. and Stedman, R.C., 2012. Landowner willingness to implement riparian buffers in a transitioning watershed. *Landscape and Urban Planning, 105*(3), pp.211-220.

[97] Armstrong, A. and Stedman, R.C., 2012. Riparian landowner efficacy in an urbanizing watershed. *Society & Natural Resources, 25*(11), pp.1193-1203.

individuals and representatives of Pennsylvania groups that represented a range of interests in the Chesapeake Bay watershed.[98] The report identified six categories of barriers to riparian forest buffers in Pennsylvania:[99]

- **Economic barriers** include the need for farmers to maximize production, the fact that smaller farms may suffer more than larger farms from loss of riparian land from production, and the costs of planting and maintenance.
- **Education and awareness**: fear of government control, failure to consider buffers in site designs, and failure to understand the need for or function of buffers.
- **Marketing**: landowners may not know where to go for help.
- **Policy, planning and legislative** barriers: engineered flood control projects do not take buffers into account; transportation, utility, and other corridors are often located along streams; landowners lack incentives, and; Pennsylvania has no driving legislation.
- **Physical, chemical, or biological barriers**: Lack of space in urban areas and the use of streamside lands for active recreation.
- **Attitudes**: landowners think that buffers harbor invasive plants or undesirable wildlife; a desire for access to streams; the value of tidiness; the importance of traditional appearances and habits; lack time to establish or manage riparian forests; interference with viewsheds; and landowner-rights issues.

Based on landowner surveys, Dutcher et. al. (2004) report that these barriers must be addressed in order for successful policy implementation:

> *"An effective approach to conserving and maintaining riparian forests needs to emphasize the role of riparian forests, respect concerns and dignity of individual landowners, and use credible advisors who understand landowner needs. Initially, it might be more effective for planners and policy makers to encourage riparian landowners to develop and execute personal management plans that incorporate landowner interests than to expect landowners to buy into abstract, arbitrary goals for buffer widths and stream reaches. … To be successful, any effort to create and maintain riparian forests on private lands should address landowner concerns about flooding, the reluctance of many landowners to abandon the ordered landscapes to which they are accustomed, and the economic interests of farmers. Centrally administered, coercive regulations will not be well received, although a broad, flexible regulatory framework that accounts for the interests of individual landowners may be acceptable once*

[98] Dutcher, D.D., Finley, J.C., Luloff, A.E. and Johnson, J., 2004. Landowner perceptions of protecting and establishing riparian forests: a qualitative analysis. *Society and Natural Resources*, *17*(4), pp.319-332.

[99] Pennsylvania Department of Environmental Protection. 1998. *Pennsylvania Riparian Buffer Initiative Implementation Plan, Report of the Technical Advisory Committees, Final Draft.*

more democratic approaches have been tried and landowners have learned more about the importance of streamside reforestation".[100]

Residential and commercial landowners are more likely to approve of riparian buffers when their ecosystem services are recognized.[101] Similarly, agricultural landowners are more likely to support riparian conservation if they believe that these areas are important for the community.[102]

Constituencies that will benefit from protecting riparian areas include angling and boating groups, hunters, outdoor recreationists, commercial fishermen, public water utilities, dam operators, tourism bureaus, businesses needing clean water, and local landowners. Buffer management policies must be designed to address the concerns of groups who may perceive losses, including agriculture, industry, residential owners, utilities, realtors, homebuilders, and landowner associations.

In a paper reviewing the implications of climate change and other large-scale trends in the Basin, researchers at the Pinchot Institute highlighted the importance of buffers and the role of local governments:

> *"In considering the findings of the risk assessments, analysis and prioritization, it is clear that risks to the region could be reduced significantly through implementing land use policies that maintain existing forest cover, reduce forest fragmentation, maintain impervious cover at reasonable levels (e.g., < 10 percent), and take full advantage of the ecosystem services provided by floodplains and riparian corridors. Local governments have primary responsibility for the land use decisions that can ultimately make communities less vulnerable and more economically resilient to environmental changes. Although it is a challenge to coordinate land use policy in a region that includes three states, seven counties and hundreds of municipalities, it has great potential for far-reaching climate resiliency benefits"*[103]

[100] Dutcher, D.D., Finley, J.C., Luloff, A.E. and Johnson, J., 2004. Landowner perceptions of protecting and establishing riparian forests: a qualitative analysis. *Society and Natural Resources*, *17*(4), pp.319-332.

[101] Wagner, M.M., 2008. Acceptance by knowing? The social context of urban riparian buffers as a stormwater best management practice. *Society and Natural Resources*, *21*(10), pp.908-920.

[102] Schrader C (1995) Rural greenway planning: the role of streamland perception in landowner acceptance of land management strategies. Landsc Urban Plan 33:375–390

[103] Price, W. and Beecher, S., 2014. Climate change effects on forests, water resources, and communities of the Delaware River Basin.

Table 27. Distribution of Benefits and Costs from Buffer Policies

Source: Huron River Watershed Council[104]

Entity	Costs	Benefits
Local Governments	Staff time Staff Training Technical Assistance to Developers and landowners Public education efforts	Increased property values Reduced water treatment costs Stormwater management Reductions in flood damage Habitat preservation and increased wildlife populations
Developers and Property Owners	Technical surveys and reports Buffer delineation Loss of developable land Buffer restoration Buffer protection during construction	Increased property values Stormwater management Bank stabilization and erosion control Increased diversity of wildlife Recreation opportunites Potential economic uses of buffer (e.g., logging)

Programs must be designed carefully to avoid unintended consequences that work against the objectives of riparian buffer protection efforts. For example, farmers and other landowners might preemptively reduce riparian areas in natural vegetation on their property with potential limits under consideration. The North Carolina Environmental Management Commission introduced North Carolina's buffer rule as an immediate rule in July 1997 to minimize such activity.

In conclusion, efforts to protect existing riparian buffers can provide benefits well in excess of the costs associated with protecting such remaining areas. And policy should be designed and implemented with expediency as a primary objective.

Policy Implications

The key findings relevant to policy from this study are:

1. Benefits of well-functioning riparian buffers in the Delaware River Basin are high in economic value, particularly in comparison to typical costs.
2. Investments should prioritize protection of existing buffers. Preservation is generally much more cost-effective than restoration.
3. Beneficiaries of riparian buffers are numerous, widespread and geographically diffuse.

The widespread distribution of benefits suggests that individual private investment alone will generally lead to underinvestment in riparian buffers. Benefits to others will typically play a negligible role in individual private investment decisions. Even when riparian landowners recognize their benefits from riparian buffers, it will be most advantageous, all else equal, to free-ride on buffers provided by others upstream and downstream. The free-riding approach leads to little private investment overall, with a heavy reliance on public contributions where feasible.

The benefits of riparian buffers in the Basin compared to the costs are particularly favorable, to an extent rarely observed in the scope of potential public investments. Opportunities to invest

[104] Huron River Watershed Council. 2008. Riparian Corridor Protection in the Huron River Watershed.

thousands of dollars per acre to see that return or more every subsequent year are uncommon. The challenge is that the costs are not well-aligned with a narrow set of beneficiaries, but rather a diverse set of upstream and downstream beneficiaries, and society at large.

Collectively these results dictate that government involvement is needed to coordinate and maintain investment in riparian buffers for the Delaware River Basin. By requiring protection and in some cases restoration of riparian buffers, those who benefit also contribute, while the society as a whole experiences the broader benefits. There is a fairness to this approach as well, in that riparian landowners have disproportionately benefitted from society-wide investments to improve water quality and aquatic habitat conditions in the Basin.

Appendix Maps

Maps in Figure A-16 and Figure A-17 show land coverage and changes in land coverage by type from 2001 to 2011. Of particular note are the declines in agricultural lands and corresponding increases in urban lands. Urban land generally has higher prices than agricultural land, suggesting that the sooner riparian buffer protections can be established, the less costly they will be. Furthermore, urban areas have more people to benefit from the presence of riparian buffers, so the value of riparian buffers will increase over time as well.

Figure A-16. Percent Cover in Riparian Zone, 2011

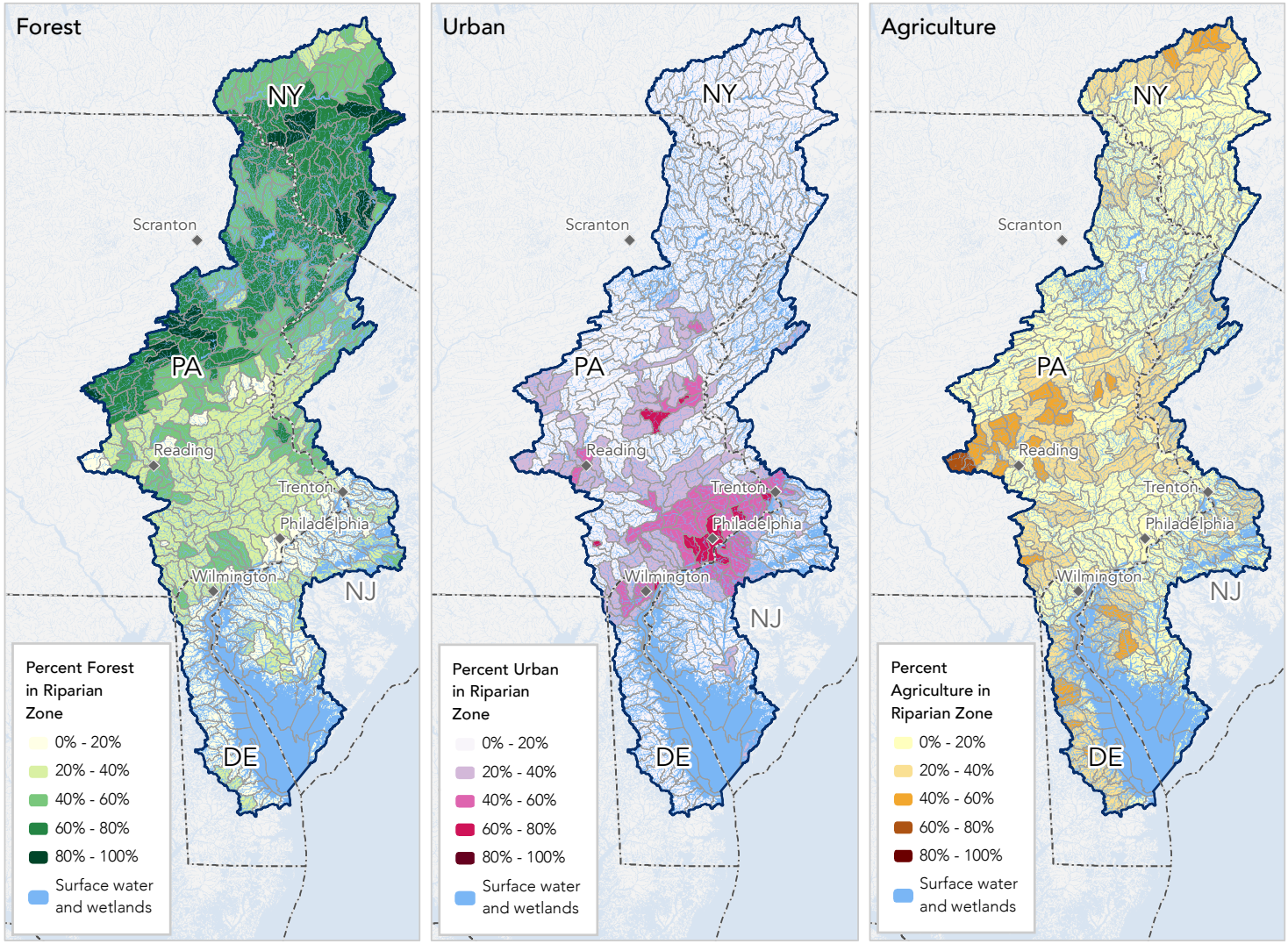
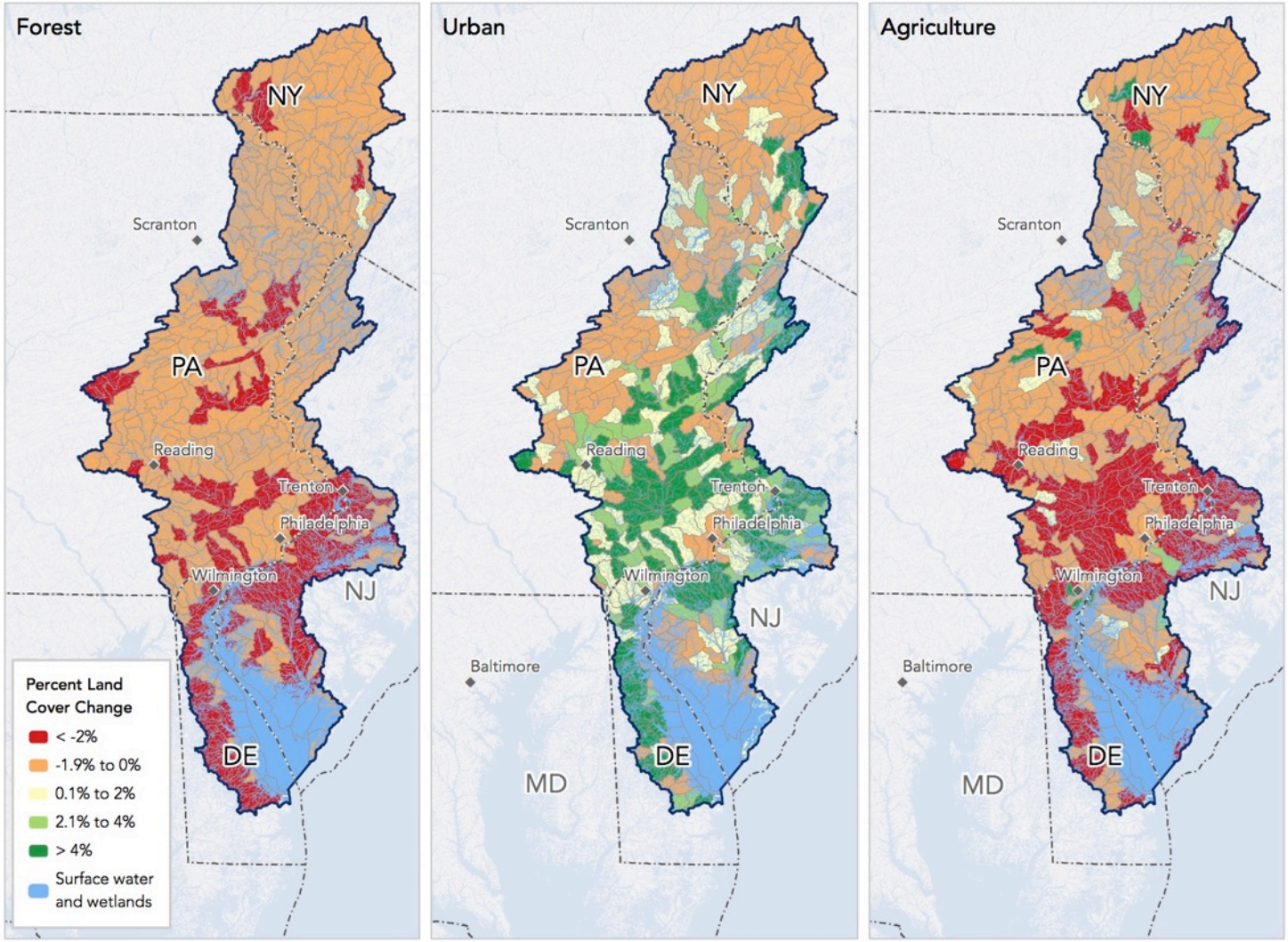


Figure A-17. Percent Change in Land Cover, 2001-2011



KEEA
KEYSTONE ENERGY EFFICIENCY ALLIANCE

September 14, 2020

Good Afternoon, thank you for the opportunity to address the House Democratic Policy Committee.

My name is Erin Cosgrove and I represent the Keystone Energy Efficiency Alliance. Today I will be talking about the benefits of ambitious energy efficiency policy and steps that Pennsylvania can take to grow energy efficiency and transition to a thriving clean energy economy.

The Keystone Energy Efficiency Alliance (KEEA) is Pennsylvania's trade association for the energy efficiency industry. Our membership, comprised of seventy companies, ranges from small, local firms to large, multinational corporations. These businesses engage in a diverse range of professions—from contractors and manufacturers to engineers, architects, and software developers—and represent a local workforce that cannot be outsourced. The policy we promote at the state and local level expands the market for energy efficiency and sets the stage for the transition to a clean energy economy.

Prior to the economic downturn, energy efficiency was leading the nation (and state) in job growth in the energy sector. In 2019, energy efficiency accounted for 71,000 jobs in Pennsylvania with 44 percent of these jobs outside the Pittsburgh and Philadelphia metro areas and construction and manufacturing making up a majority of the workforce.

Energy efficiency is not only a job creation tool, but it is the least cost energy resource available for Pennsylvania to meet clean energy goals. As we say in the industry "A kilowatt saved is always cheaper than a kilowatt generated." Well implemented energy efficiency programs lower rates for consumers directly and across the Commonwealth, by decreasing utility system costs for all ratepayers. These savings expand beyond the number on a bill. Families have money back in their pocket to spend more on local goods and services and businesses put more towards payroll or capital investments. Further, these energy savings lower GHG emissions, and provide a host of non-energy benefits from growing the local workforce to improving health, home comfort, and reducing indoor and outdoor air pollutants.

Finally, energy efficiency can be a corner stone of Pennsylvania's economic recovery. After the Lehman Brothers triggered the Great Recession in 2009, electricity demand collapsed, and economic activity stagnated. Despite this challenging environment, energy efficiency was a bright spot in the recovery, creating tens of thousands of jobs, driving rapid innovation with LED lighting technology, and delivering $4 billion in benefits to Pennsylvania electric customers through Phase I of Act 129, PA's flagship energy efficiency law.

These jobs were a direct result of smart, ambitious, environment, and clean energy policy goals. The same kind of leadership that is needed today. This is why I would like to highlight three key

opportunities in Pennsylvania that can invest in energy efficiency and provide community-based, reliable jobs for a thriving clean energy economy. Through RGGI, Act 129, and spurring already available private investment with C-PACE and a Green Fund.

1. **Support the implementation of the Regional Greenhouse Gas Initiative and the investment of the auction proceeds into energy efficiency and clean energy programs.**

RGGI is a cap-and-invest program that seeks to regulate pollution without the traditional command-and-control regulatory style. Proceeds from the RGGI auction are invested into forward-looking industries that grow quickly, reliably, and locally, such as energy efficiency programs for residents and businesses, clean energy technologies, and electric vehicle infrastructure.

Currently, states participating in RGGI invest over 50% of RGGI proceeds towards energy efficiency, which have generated over $4 billion in net economic benefits. Investing in energy efficiency reduces the costs for customers to join RGGI through lowering electricity costs and providing local jobs. In Pennsylvania, the value of RGGI proceeds could reach $300 million or more annually. This represents a significant resource to deploy toward distributed clean energy, launch new and bolster existing energy-saving programs, and strengthen the resilience of our power grid.

2. **Remove the cost cap on Act 129 to allow utilities to investment substantially more in energy efficiency programs and enable Pennsylvania to join the numerous other Northeast and mid-Atlantic states that have committed to ambitious energy reduction goals.**

Act 129 is Pennsylvania's flagship energy efficiency law. It requires each of Pennsylvania's seven major electric utilities to reduce energy use within their service territories. In the first seven years of the law, energy efficiency programs delivered $6.4 billion in benefits to all customer classes and reduced carbon pollution by 7 million tons. These programs had a benefit-to-cost ratio of 2-to-1, meaning every dollar invested has returned two dollars back.

But PA's spending on energy efficiency is lagging behind peer states such as Illinois, Minnesota, and Michigan. In large part due to the uniquely restrictive cap for Act 129. This cap limits utility investment in EE to 2% of 2006 utility revenues. This artificially restricts the level of energy efficiency investment that utility can make to eliminate energy waste. KEEA has long been advocating for a legislative fix to remove this cap as such an action could lead to greater success and more investment for energy efficiency programs. In a report from ACEEE, researchers found that removing the spending cap on Act 129 could create 30,000 more jobs and likely grow carbon savings.

Finally, removing the cap can allow for energy efficiency to become a core part of the utility business model. Compared to investments in substations, transmission, and powers plants, energy efficiency is the least-cost alternative to meet electric demands. Allowing for more investment in energy efficiency and regulating it properly, is the first step in changing the utility

business model structure so that they no longer are concerned with volumes of electric sales but with efficiency and performance.

3. **Create programs that attract additional private capital to help grow energy efficiency, through implementing a multifamily C-PACE program and creating a state Green Fund.**

Commercial Property Assessed Clean Energy (C-PACE) is a financing tool for local governments to help facilitate energy efficiency and clean energy loans. In Pennsylvania, energy efficiency and water conservation programs in C-PACE create good-paying jobs, generate local economic investment, and improve health, comfort, and affordability for tenants. The current law does not allow for multifamily mix use properties to take advantage of this income source. Changing C-Pace to allow for multifamily can provide a competitive source of clean energy financing and reduce utility costs for tenants and help increase the number of projects able to be completed under the program.

A Green Fund operates as a bank, but is dedicated to funding energy efficiency, renewable energy, and/or sustainability projects that generate cost savings. These programs use limited public dollars to tap into millions of private capital looking to invest in clean energy. In Connecticut, the Green Fund programs have funded successful low-income programs that include deep energy efficiency retrofits with energy and health improvements and the installation of solar panels. The program is done at the same cost to consumers as their current energy bill so there is no noticeable difference in payment. For businesses, Green Funds can encourage and spearhead specific clean energy projects through completing first-of-their kind transactions for businesses, removing administrative and financial barriers.

Conclusion

Strong energy efficiency policy leads to a strong clean energy economy that can support well-paying jobs for thousands of Pennsylvania's residents, while lowering energy costs for consumers and establishing a local, reliable energy workforce.

Thank you for this opportunity and please contact me for any further information. I will follow up with a written version of my testimony as well.

Sincerely,

Erin Cosgrove, esq.
Director of Regulatory Affairs
Keystone Energy Efficiency Alliance