2024

Priority Climate Action Plan (PCAP)

Southwestern Pennsylvania Regional Climate Pollution Reduction Plan

Southwestern Pennsylvania Commission

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Priority Climate Action Plan (PCAP)

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Disclaimer and Acknowledgements

The **Southwestern Pennsylvania Commission** (SPC), in partnership with our member governments, has developed this *Priority Climate Action Plan for Southwestern Pennsylvania*, to meet the requirements of the US Environmental Protection Agency's (EPA) Climate Pollution Reduction Program (CPRG). The purpose of the CPRG grant program is to implement greenhouse gas (GHG) emissions-reduction programs, projects, policies, and measures (collectively referred to as "GHG reduction measures," or "measures") identified in a Priority Climate Action Plan (PCAP) as developed under a CPRG planning grant, of which SPC is a recipient.

The PCAP for Southwestern Pennsylvania recommends many preliminary GHG reduction measures. These recommended measures are not necessarily endorsed by any or all of SPC's member governments. Furthermore, examples of measures contained within this plan are not meant to be exhaustive. Our region is diverse, innovative, and resourceful, and our plan is intended to serve as a starting point for collaboration and innovation.

SPC would like to thank our many partner agencies who provided their ideas, interest and support during the development of this PCAP. SPC's PCAP was coordinated by SPC staff; developed with consultant support from HDR Engineering, Inc. and E Holdings, Inc., and has been informed by input from our planning partners, regional stakeholders, and members of the public.

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1: Climate Pollution Reduction Grant Program Background

The Priority Climate Action Plan (PCAP) is a pre-requisite for competing in the second phase of the United States Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) program, which will provide competitively-awarded Implementation Grants (CPRG-IG) of $4.6 billion for projects and programs that reduce climate pollution. To compete for implementation funding, a project needs to be associated with a quantified greenhouse gas (GHG) emissions-reduction measure in the PCAP. The PCAP also may include additional measures that will not be part of an implementation grant application.

The Southwestern Pennsylvania Commission (SPC) comprises a 10-county region in Southwestern Pennsylvania. The Commission is the federally-certified Metropolitan Planning Organization (MPO), Economic Development District (EDD), and Local Development District (LDD) for the region that is comprised of the counties of Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington, and Westmoreland, plus the City of Pittsburgh. Their mission is to help direct the use of funds allocated to the region by working closely with counties, municipalities, and townships to access funding and support their planning needs.

The CPRG implementation grants build on $250 million in planning funds that the EPA awarded to organizations across the country. Our organization received a $1 million-dollar CPRG planning grant for the 8-county Pittsburgh Metropolitan Statistical Area, plus the adjacent counties of Greene and Indiana, to create a Regional Climate Pollution Reduction Plan. Our planning process is currently underway, and will cover the 10-county planning region within Southwestern Pennsylvania, including the City of Pittsburgh.

2: GHG Inventory

According to the 2020 Census, the 10-county region under the SPC's jurisdiction is home to 2.6 million people, or about 20% of the entire population of Pennsylvania. The region occupies about 15% of the Pennsylvania's land area and contributes to 21% of the state's Gross Domestic Product. This inventory process summarizes all greenhouse gas emissions sources from various activities within the SPC region.

2.1 Methodology

The Greenhouse Gas inventory was assembled for each of the 10 counties under SPC's jurisdiction for the year 2020. The base year of 2020 was chosen as the most commonly-available data year across data sets, and therefore was the most recent standardized "planning year" available in the EPA's National Emissions Inventory[1] (NEI), US Census, and other relevant datasets.

The analysis framework of the inventory process is consistent with EPA's Local Greenhouse Gas Inventory Tool[2] (LGGIT). The LGGIT model categorizes greenhouse gas emissions from sources including mobile, electric power consumption, solid waste, stationary, agriculture and land management, wastewater treatment, and urban forestry. This GHG inventory focuses on activities that happen within the SPC region (Scope 1 and 2 emissions). Scope 1 emissions stem from sources within the SPC boundary, while Scope 2 emissions result from grid-supplied electricity within the SPC boundary. Scope 3 encompasses all other GHG emissions occurring outside the SPC boundary due to activities within it. Scope 3 emissions were not calculated for this inventory.

Mobile source emissions cover transportation-related emissions on road and other nonroad fossil fuel engines such as lawn mowers, excavators, and generators. Greenhouse gas emissions from electric power consumption within each county are calculated by the proportion of the county's area that falls within the Emissions & Generation Resource Integrated Database[3] (eGRID) regions, specifically the RFC East (RCRE) or RFC West (RCRW) subregions. Solid waste emissions are associated with landfill operations. Stationary source emissions are from fossil fuel usage from industrial and commercial facilities. Emissions from agriculture and land management involve livestock, crop production, and prescribed burns. Wastewater treatment emissions are compiled from regional sewer systems. Lastly, sequestration from forested areas in residential, commercial, and industrial land uses is considered for its role in carbon absorption and land use impacts. The full methodology of the GHG inventory for SPC's PCAP is found in Appendix A - *Greenhouse Gas Inventory Technical Document*. Table 1 summarizes the data source from the emissions.

[1] United States Environmental Protection Agency (EPA) (2023, May 26). *National Emissions Inventory (NEI)*. Air Emissions Inventories. Retrieved March 1, 2024, from https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei

[2] United States Environmental Protection Agency (EPA) (2024, February 5). *Local Greenhouse Gas Inventory Tool*. Energy Resources for State and Local Governments. Retrieved March 1, 2024, from https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool

[3] United States Environmental Protection Agency (EPA) (2024, January 30). *Emissions & Generation Resource Integrated Database (eGRID)*. Retrieved March 1, 2024, from https://www.epa.gov/egrid

Table 1. Data Sources of GHG Inventory

Description	Data Source
Mobile Source GHG Emissions	• 2020 National Emissions Inventory (NEI) County-level Estimates.[4] • Federal Aviation Administration's Traffic Flow Management System Counts (TFMSC)[5] • 2023 Climate Registry[6]
Electric Power Consumption GHG Emissions (Electricity and Natural Gas Data)	• DOE's State and Local Planning for Energy (SLOPE) Platform[7]
Solid Waste GHG Emissions	• EPA's Landfill Methane Outreach Program (LMOP) [8] • 2020 National Emissions Inventory (NEI) Data for Landfills[9]
Stationary Source GHG Emissions	• 2020 National Emissions Inventory (NEI) Facility Emissions[10]
Agriculture and Land Management GHG Emissions (Livestock, Cropland Acreage, Prescribed Burns)	• USDA 2017 Census of Agriculture [11] • 2020 National Emissions Inventory (NEI) Data for Prescribed Burn[12]
Wastewater Treatment (SPC Regional Sewer Inventory of 2019)	• SPC Water Resource Center[13]

[4] United States Environmental Protection Agency (EPA) (2023, May 26). *National Emissions Inventory (NEI)*. Air Emissions Inventories. Retrieved February 7, 2024, from https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei
[5] Federal Aviation Administration (n.d.). *Traffic Flow Management System Counts (TFMSC)*. Traffic Flow Management System Counts. Retrieved March 1, 2024, from https://aspm.faa.gov/tfms/sys/main.asp
[6] The Climate Registry (TCR) (2023, June). *2023 Default Emission Factors.* Retrieved February 7, 2024 from https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
[7] National Renewable Energy Laboratory (NREL) (n.d.). *Plan Your Energy Future*. SLOPE: State and Local Planning for Energy. Retrieved February 7, 2024, from https://maps.nrel.gov/slope/
[8] United States Environmental Protection Agency (EPA) (2024, February 1). *Landfill Methane Outreach Program (LMOP)*. Retrieved March 1, 2024, from https://www.epa.gov/egrid
[9] Ibid.
[10] Ibid.
[11] United State Department of Agriculture (USDA) (2019, March 22). *Census of Agriculture*. National Agricultural Statistics Service. Retrieved February 7, 2024, from https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Pennsylvania/index.php
[12] Ibid.
[13] Southwestern Pennsylvania Commission (SPC) (n.d.). *Home*. SPC Water Resource Center. Retrieved March 1, 2024, from https://spcwater.org/

Description	Data Source
	• An Examination of Failing Private Septic Systems in Pennsylvania[14] (for septic tank assumption)
Urban Forestry Resources (National Land Cover and Land Use Land Cover Data)	• Nation Land Cover Database 2019[15] (for forest coverage) • SPC's Land Use/Land Cover Database 2016[16] (for land use information)

[14] Day, R. L., PhD, Bruce, S., & Franklin, A. (2008, September 1). *An Examination of Failing Private Septic Systems in Pennsylvania*. Penn State University with a Grant from the Center for Rural Pennsylvania, a Legislative Agency of the Pennsylvania General Assembly. Retrieved March 1, 2024, from https://www.rural.pa.gov/getfile.cfm?file=Resources/reports/assets/172/septic_systems2008.pdf&view=true
[15] United State Geographical Survey (USGS) (2018, September 11). *National Land Cover Database*. Retrieved March 1, 2024, from https://www.usgs.gov/centers/eros/science/national-land-cover-database
[16] Southwestern Pennsylvania Commission (SPC) Water Resource Center (2020, February 1). *Land Use/Land Cover in the SPC Region*. Retrieved March 1, 2024, from https://spcwater.org/wp-content/uploads/2020/02/LULC_Feb2020.pdf

2.2 GHG Inventory Results

Using the LGGIT Tool and the aforementioned input datasets, the region's current total GHG emissions are calculated at approximately 53.5 million Metric Ton of Carbon Dioxide Equivalent ($MTCO_2e$) without accounting for sequestration from urban forestry. Accounting for urban forestry sequestration, the net total GHG emissions are reduced to 52.3 million Metric Tons of Carbon Dioxide Equivalent. The calculated emissions in the SPC region are approximately 22% of the State's total emissions as per the to 2023 *Pennsylvania Greenhouse Gas Inventory Report*[17], which inventoried the baseline greenhouse gas emissions for Pennsylvania for the 2020 data year.

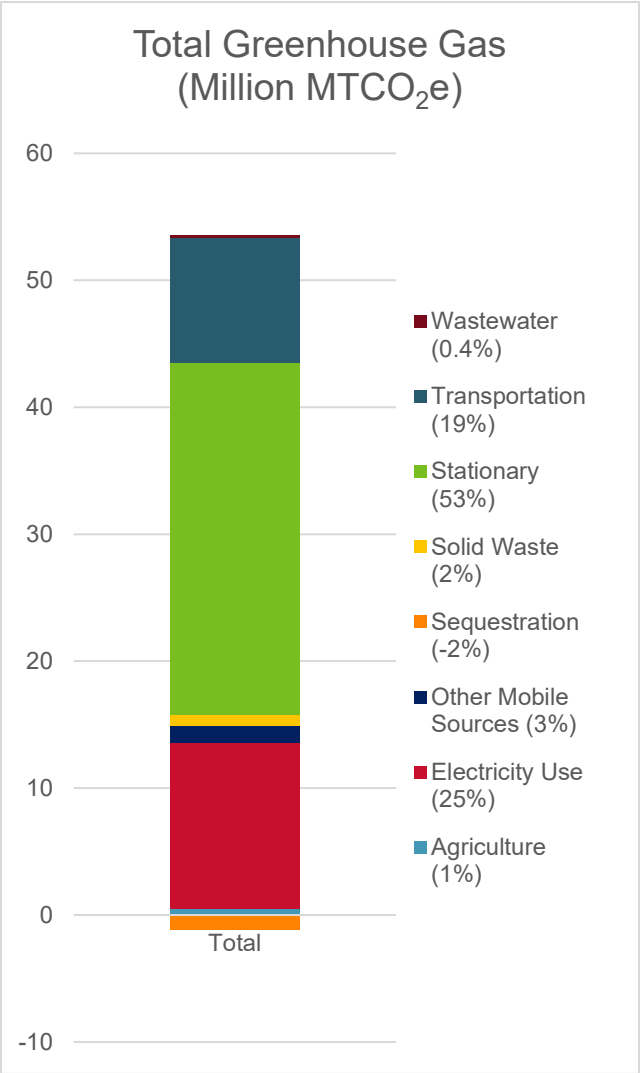


Figure 1 SPC Total Greenhouse Gas Emissions ($MTCO_2e$)

Among all GHG emissions within the SPC region, carbon dioxide emissions account for 79% of the total greenhouse gas emissions, follow by methane emissions at 20%. All emissions are reported in Metric Ton of Carbon Dioxide Equivalent ($MTCO_2e$) to be consistent with EPA's reporting standard and the unit used in the LGGIT tool.

The industrial sector contributes over 25 million $MTCO_2e$ to the atmosphere, which accounts for about 47% of the total greenhouse gas emissions within the SPC region. The commercial/institutional and residential sectors which each contribute around 13 million $MTCO_2e$, or about 25% of the total greenhouse gas emissions. Table 2 summarizes the total emissions for each sector.

[17] Pennsylvania Department of Environmental Protection, *Pennsylvania Greenhouse Gas Inventory Report 2023,* FINAL_2023_GHG_Inventory_Report_2.27.24.pdf (state.pa.us)

Table 2. Greenhouse Gas ($MTCO_2e$) per Sector

Sector	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Commercial/Institutional	13,610,750	25.43%
Energy Generation[18]	1,192,600	2.23%
Industrial	25,305,605	47.28%
Residential	13,410,077	25.06%
Grand Total	53,519,033	100.00%

The highest emission source within the SPC region based on activity category is from stationary sources, accounting for about 52% of total emissions. Electricity use follows as the next major contributor, accounting for about 24% of emissions. Transportation activities are also responsible for 18% of the greenhouse gas emissions. Table 3 summarizes the greenhouse gas emission contribution based on economic activities.

Table 3. Greenhouse Gas ($MTCO_2e$) per Activity Category

Activity Category	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Agriculture	492,394	0.92%
Electricity Use	13,046,828	24.38%
Other Mobile Sources	1,327,556	2.48%
Solid Waste	940,160	1.76%
Stationary	27,704,109	51.76%
Transportation	9,794,260	18.30%
Wastewater	213,725	0.40%
Grand Total	53,519,033	100.00%

[18] All emission sources are also categorized into residential, commercial or institutional, industrial, and energy generation activities. Emissions related to fossil fuel usage to generate electricity were not included in the energy generation category. The accounting of electricity usage and its associated emissions take place at the point of consumption within residential, commercial, and industrial sectors.

Table 4. Greenhouse Gas ($MTCO_2e$) per County

County	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Allegheny	21,360,281	39.91%
Armstrong	1,220,306	2.28%
Beaver	2,548,953	4.76%
Butler	4,042,504	7.55%
Fayette	1,506,053	2.81%
Greene	7,546,399	14.10%
Indiana	1,881,783	3.52%
Lawrence	1,365,573	2.55%
Washington	7,152,311	13.36%
Westmoreland	4,894,870	9.15%
Grand Total	53,519,033	100.00%

The GHG inventory aimed to identify major emission sources in the SPC region, using mostly public databases listed in Table 1 above. It is probable that the inventory overlooked emissions stemming from land use alterations and other minor sources such as home heating oil or propane. Inaccuracies or missing data issues will be addressed during development of the Comprehensive Climate Action Plan (CCAP).

For more details of the inventory process, refer to Appendix A – *Greenhouse Gas Inventory Technical Document*.

3: Quantified GHG Reduction Measures

In November 2023, the Southwestern Pennsylvania Commission (SPC) issued a formal invitation for implementation-ready project proposals to numerous stakeholders across the region. The solicitation specified the submission of concise project descriptions and the inclusion of the project's emissions-reduction measures and strategies from the following sectors: Transportation, Electric Power, Industrial, Residential & Commercial Buildings, Waste, Water and Materials Management, and Agricultural and Carbon Removal. In response, the SPC received a nearly 100 email responses from interested community members, encompassing over 40 unique project recommendations spanning these diverse sectors. Stakeholder feedback from organizations throughout the region was compiled as the basis for the PCAP's quantified GHG reduction measures, where both authority to implement and momentum for implementation is well established. The spectrum of proposed projects was broad, ranging from infrastructure-scale capital projects to tree plantings.

SPC fostered clear communication by offering virtual and in-person meetings with stakeholders with project-related inquiries and to discuss regional priority projects that should be included in the PCAP. In mid-January 2024, the SPC organized and hosted a workshop tailored for project sponsors. This forum served as an invaluable opportunity for sponsors to pose questions openly, seeking greater clarity on various aspects of their project submissions. This workshop was followed by four focused workshops organized around workforce development and community benefits, building-based systems, mobility and transportation systems, and regional waste and materials management and natural lands systems.

In parallel with the aforementioned endeavors, the project team has undertaken additional initiatives to enhance the efficiency and efficacy of the project evaluation process. Specifically, SPC's project team created a Project Candidate Intake Form for potential project sponsors to provide detailed information about potential projects they are interested in developing and over 70 responses were received via this method. The envisaged outcome is a streamlined process that identifies well-developed and compelling project candidates within the region.

Table 5 represents the projects that were received and their associated sectors. Projects are categorized into two groups: those with quantified greenhouse gas (GHG) measures provided by sponsors and those whose GHG measures are yet to be quantified. The sector-specific projects showcased in Table 6 through Table 11 exclusively feature projects with quantified GHG measures. SPC will provide technical assistance for proposed projects whose sponsors have not yet fully-quantified their GHG reductions. The PCAP does not show projects that did not provide quantification estimates in order to better align with the CPRG's goal to quantify short-term and long-term greenhouse gas emission reductions. However, these potential projects will continue to be addressed during development of the CCAP.

Table 5. Number of Projects from Project Candidate Intake Form by Sector

Sector	Quantified GHG Reduction Measures	Not Quantified GHG Reduction Measures
Electric Power	10	0
Transportation	13	4
Buildings	20	9
Industrial	4	3
Carbon Removal	2	1
Agricultural	1	0
Waste, Water, and Sustainable Materials Management	2	1
Total	52	18

The sections below represent quantified priority GHG Reduction measures and projects that were identified with quantified GHG measures. Project information was provided to the Southwestern Pennsylvania Commission (SPC) with preliminary cost estimates and potential GHG reduction quantities, which were estimated by project sponsors.

3.1 Transportation Sector

The transportation sector accounts for approximately 10 million $MTCO_2e$, or 19% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to project initiatives that achieve the following policy goals:

- Programs to increase the share of electric light-, medium-, and heavy-duty vehicles, and to expand electric vehicle charging infrastructure
- Electrification requirements for state, municipal, territorial, and tribal vehicle, transit, or equipment fleets
- Introduce a microtransit platform that uses app technology to offer flexible routes and scheduling
- Transportation pricing programs that reduce vehicle miles traveled (VMT), especially during peak hours, such as parking pricing, and congestion and road pricing
- Policies to support transportation management-incentive programs to reduce vehicle trips or travel and expand transit use, such as van-pool programs, ridesharing, transit fare subsidies, and bicycle facilities
- New or expanded transportation infrastructure projects to facilitate public transit, micro-mobility, car sharing, bicycle, and pedestrian modes
- Incentive programs to purchase zero-emission vehicles and equipment to replace older heavy-duty diesel vehicles and equipment
- Programs to increase efficiency and reduce GHG emissions at ports and freight terminals, such as vehicle or equipment idle reduction, vessel-speed reduction, equipment electrification, and shore power
- Updating of building and zoning codes to encourage walkable, bikeable, and transit-oriented development
- Encourage mode shift, especially during peak hours, from private vehicles to walking, biking, and public transportation (e.g., complete streets, bike share programs, bike storage facilities, low-speed electric bicycle subsidies, public transit subsidies)

These are the projects, greenhouse gas emissions reduction estimates and authority to implement, from the Project Candidate Intake Form in the Transportation Sector:

Table 6. Examples of Quantified GHG Reduction Projects in Transportation

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Fleet Conversion to Electric	Convert a portion of the current vehicle fleet to electric, including shuttles buses, transport vans, facilities vehicles, and public safety vehicles.	291	1,164	Local Governments, Government Agencies, Community Groups, Businesses
Alternate Modes of Mobility Project	Support electric vehicles, give benefits for using e-bikes and other alternative transport like tuk-tuks, and create bike parking and hubs through infrastructure, policies, and user involvement programs.	7,250	29,000	Local Governments, Government Agencies, Community Groups, Businesses
EV Charging Station Project	Add fast electric vehicle (EV) charging stations at selected stores in Southwestern Pennsylvania in poor air quality areas.	3,500	29,445	Local Governments, Government Agencies, Community Groups, Businesses
Vehicle Retrofit Project	Replacement of selected diesel terminal trucks with new zero emissions vehicles.	11,443	45,773	Local Governments, Government Agencies, Businesses

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Vehicle Retrofit Project	Purchase of nearly 80 fleet vehicles powered by the cutting-edge Cummins ISX12N compressed natural gas engine.	14,818	29,123	Local Governments, Government Agencies, Businesses
Innovative Vessel Propulsion CO_2 Reduction Demonstration	Upgrade an existing Tier 1 diesel-engine vessel with new engine technology to eliminate emissions and continue a green and sustainable operation model, reducing CO_2 from a vessel operating on inland waterways.	235	980	Local Governments, Government Agencies, Businesses
Smart LED Street Light Installation	Deploy smart LED streetlight technology to optimize the energy use of municipal streetlights.	74,500	298,000	Local Governments, Government Agencies, Community Groups, Businesses

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Brownfield Restoration and Shoreline Management Project	A series of brownfield restoration and shoreline management initiatives, including the addition of tree canopy, native plants, and non-motorized transportation infrastructure.	161	416	Local Governments, Government Agencies, Community Groups, Redevelopment Authorities
Convert Transit Revenue Fleet to Zero-Emissions Vehicles	Transitioning an entire transit Revenue Fleet (buses) to zero-emission technologies with the goal of net zero emissions by 2045.	21,000	1,220,000	Public Transit Agencies
Non-Revenue Fleet Transition Plan and EV Pilot	Begin to transition the non-revenue generating fleet of sedans, trucks, and other vehicles to zero-emission technologies	45	32,460	Local Governments, Government Agencies, Businesses
Expanding Electric Micromobility	Expand a bikeshare system into neighboring municipalities over a two-year period.	1,431	5,723	Local Governments, Government Agencies, Community Groups
Adoption of Electric Vehicles	Facilitate large-scale EV adoption at a water utility to provide ratepayer and community benefits through reduced operating costs and reduced non-point source pollution connected to vehicles.	246	246	Local Governments, Government Agencies, Businesses

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Equitable Residential Electric Vehicles Charging Access	Design, Implement and Maintain 24/7 Public and Equitable Access to Electric Vehicle (EV) Charging infrastructures for a wide variety of community types.	0	1,312,254	Local Governments, Government Agencies, Community Groups, Individuals
Total Emission Reduction Range[19]		67 – 270 thousand $MTCO_2e$	1486 - 5944 thousand $MTCO_2e$	

[19] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.2 Electric Power Sector

The electric power sector accounts for approximately 13 million $MTCO_2e$, or 25% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to projects and initiatives that address the source and carbon content of the electricity that serves the SPC region. A range of ideas for addressing the electric power sector were discussed, including:

- Renewable portfolio standards and/or clean electricity standards
- Energy efficiency portfolio standards
- Emissions-trading systems (e.g., cap-and-trade programs) and carbon pricing measures
- GHG performance standards for electric generating units
- Installation of renewable energy and energy storage systems on municipal facilities
- Programs to support smart-grid and/or behind-the-meter technologies to reduce power losses, reduce peak demand, and enable consumer participation in distributed generation
- Targeted incentives for installation of renewable energy and energy storage systems on commercial, institutional or, residential buildings, such as net metering, tax credits, rebates, and streamlined interconnection standards
- Policies and measures to streamline permitting for renewable energy projects
- Development of distributed or community-scale renewable energy generation, microgrids, or vehicle-to-grid infrastructure in disadvantaged communities, including remote and rural regions
- Policies/commitments to decarbonize the utility-supplied electricity grid

Specific proposed projects, and greenhouse gas emissions reduction estimates, and authority to implement identified through the Project Candidate Intake Form in the Electric Power Sector, include:

Table 7. Examples of Quantified GHG Reduction Projects in Electric Power

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Solar Rooftop Array	Install a 200-kW solar PV array on the O&M building at a wastewater facility campus.	700	2,800	Local Governments, Government Agencies
County-wide Solar PV Initiatives	Install solar PV projects at multiple sites in multiple municipalities.	7,862	172,958	Local Governments, Government Agencies
Solar Projects	Establish a regionwide Solar Program to streamline the process and mitigate risk for organizations and communities installing solar PV systems, while also educating school and municipal leaders on the benefits of solar.	43,000	164,473	Local Governments, Government Agencies, Businesses, Schools, Individuals
Solar Project – Countywide 1	Establish a countywide solar program to educate school and municipal leaders on the benefits of solar energy.	4,224	95,047	Local Governments, Government Agencies, Schools
Solar Project – Countywide 2	Establish a countywide solar program to educate school and municipal leaders on the benefits of solar energy.	196	72,650	Local Governments, Government Agencies, Schools
Solar Installations	Install solar PV and related building infrastructure upgrade projects at three facilities.	630	4,200	Local Governments, Government Agencies, Businesses, Schools, Individuals

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Solar Project	Install photovoltaic solar array at a metal recycling center.	13,134	52,536	Local Governments, Government Agencies, Businesses, Individuals
Solar Project	Provides onsite, BTM solar generation at 7 public school locations.	11,288	45,153	Local Governments, Government Agencies, Businesses, Individuals
Decarbonize & Clean Energy	Incorporate solar generation capacity in a facility.	11,446	57,890	Local Governments, Government Agencies, Businesses, Individuals
Total Emission Reduction Range[20]		49 - 195 thousand $MTCO_2e$	343 - 1373 thousand $MTCO_2e$	

[20] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.3 Buildings Sector

Buildings produce Scope 1 and 2[21] GHG emissions from consumption of operational energy, including electricity, natural gas, steam, or diesel. Specifically, natural gas usage, for applications such as space heating and domestic water heating, accounts for 10 million $MTCO_2e$, or 19% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to projects and initiatives that focus on energy efficient equipment and systems and electrification/fuel switching. Conceptual and programmatic approaches to decarbonize the buildings sector were communicated, such as:

- Adoption and implementation of the most up-to-date building energy codes or "stretch" codes for new commercial and residential buildings
- Implementation of a clean heat standard
- Incentive programs for implementation of end-use energy efficiency measures in existing government-owned, commercial, and residential buildings
- Incentive programs for the purchase of certified energy-efficient appliances, heating and cooling equipment, lighting, and building products to replace inefficient products
- Programs and policies to promote electrification of government-owned, commercial, and residential buildings, including funding or green bank-type of financial support.
- Programs and policies to accelerate the incorporation of efficient electric technologies and electric vehicle charging at new single-family, multi-unit, or affordable residential buildings and commercial buildings, including building codes related to electric vehicle charging
- Implementation of a building energy performance management program for government-owned buildings
- Implementation of a new benchmarking and building performance standards, and/or energy benchmarking and disclosure requirements for existing buildings that meet predefined minimum criteria.
- Carbon trading (i.e., cap-and-trade) program for commercial building owners establishes emission caps and puts a price valuation on carbon.

Specific projects in the Buildings sector, including a project description, projected greenhouse gas reduction estimates, and authority to implement were identified through the Project Candidate Intake Form in the Building Sector:

[21] Scope 1 emissions stem from sources within the SPC boundary, while Scope 2 emissions result from grid-supplied electricity within the SPC boundary

Table 8. Examples of Quantified GHG Reductions in Building Projects

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Garage Upgrade	LED lighting and controls retrofit and electrical service upgrade for all interior, exterior and life safety lighting at a garage facility.	223	446	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Hospital Upgrade	Energy efficiency upgrades at a local hospital, including an LED lighting retrofit and additional energy conservation measures discovered through retro-commissioning and energy auditing.	12,500	50,000	Hospitals
Building Sustainable, Resilient, and Thriving Communities (by Sector)	Establish a program to fund deep carbon retrofit projects, including energy efficiency and renewable energy projects, based on market sector.	250,000	1,000,000	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Building Sustainable, Resilient, and Thriving Communities (Geographic Cluster)	Establish a program to fund deep carbon retrofit projects, including energy efficiency and renewable energy projects, based on geographic clusters, with an emphasis on underserved communities.	1,000,000	4,000,000	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
School District HVAC Upgrades	HVAC and controls upgrades to 10 school buildings and one administrative building.	6,000	40,000	Schools

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Capturing the Reuse Potential in the C&D Waste Stream	Conduct an analysis of the building construction and demolition waste stream to understand the potential GHG impacts and market opportunities from a circular economy through material salvaging and reuse.	6,326	31,631	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Comprehensive Energy Efficiency Upgrade	Implement a comprehensive set of energy efficiency upgrades, based on recommendations from a previously completed study.	0	27,240	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Retrofit HVAC and LED lighting project	LED lighting and controls retrofit and HVAC sensor replacement at a major conference center.	975	3,900	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Strengthening Climate Action	Electrify and decarbonize the heating systems by replacing gas-fired steam boilers with solar powered ground source heat pump systems.	6,000	13,500	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Decarbonizing Public Housing and Implementing Neighborhood Scale Green Zones	Implement a range of decarbonization projects throughout public housing facilities serving low-income residents	14,993	65,015	Public Housing Authorities
Expanding Buildings Upgrade program	Expand the funding available to an existing energy efficiency program, which accelerates equitable, widespread	6,042	120,840	Local Governments, Government Agencies, Businesses, Community Groups, Individuals

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
	energy efficiency and efficient electrification upgrade projects.			
Roof Replacement Project	Roof replacement and insulation upgrade for a building that houses a local nonprofit organization.	156	520	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Lighting Upgrades at Apartments	LED lighting upgrades at multiple apartment buildings.	50	200	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Building Decarbonization Projects	Implement decarbonization projects throughout a citywide portfolio of buildings, based on projects identified through previous studies.	7,500	50,000	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Energy Master Plan	Develop a decarbonized energy master plan .	307,500	5,000,000	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
School District HVAC and Building Envelope Upgrades	HVAC and controls upgrades to 3 school buildings and one field house building in the school district.	5,200	26,000	Schools
Theater Decarbonization	Electrify and decarbonize the domestic hot water and space heating systems and other energy efficiency upgrades at an historic theater.	345	1,380	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Whole-Home Repairs + Decarbonization	Implement efficiency and decarbonization whole-home repair projects.	8,316	33,264	Local Governments, Government Agencies, Businesses,

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
				Community Groups, Individuals
Medical Center Decarbonization	Install energy efficient, all electric equipment that will allow for decarbonization at a medical center in an underserved community, which is currently in the planning phase.	560	2,230	Local Governments, Government Agencies, Businesses, Community Groups, Individuals
Downtown Office to Residential Conversion Program	Convert underutilized office buildings into affordable and workforce housing and improve the energy efficiency of the building	16,031	106,870	Local Governments, Government Agencies, Businesses, Community Groups, Individuals, Redevelopment Authorities
Total Emission Reduction Range[22]		824 - 3297 thousand $MTCO_2e$	5287 - 21146 thousand $MTCO_2e$	

[22] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.4 Industrial Sector

Industrial point source emissions account for approximately 16 million $MTCO_2e$, or 29% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to project initiatives that achieve the following policy goals:

- Standards addressing GHG emissions from industrial facilities and from energy production sectors, including emissions from industrial process heat and industrial processes
- Programs to support or incentivize implementation of energy efficiency measures in industry, including energy audits, strategic energy management, equipment upgrades, and waste heat utilization
- Programs to support or incentivize GHG reductions in industrial energy use and industrial processes, including use of low/no carbon fuels, electrification, renewable energy, and process improvements
- Programs to develop, expand, and support markets for low-embodied carbon materials and products, such as cement and steel.
- Programs to promote recovery and destruction of high-global warming potential (GWP) hydrofluorocarbons (HFCs) used in existing appliances, air conditioning systems, and commercial / industrial chillers
- Restoration of degraded lands (e.g., brownfields, mine reclamation) and forested lands to enhance carbon sequestration

These are the projects, greenhouse gas emissions reduction estimate, and authority to implement from the Project Candidate Intake Form in the Industrial Sector:

Table 9. Examples of Quantified GHG Reductions Projects in Industrial

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Waste Methane Capture	Capture waste methane from regional mine facilities to address methane emissions, support Justice40 priorities through job creation, and produce alternative fuels with zero carbon intensity.	0	TBD	Local Governments, Government Agencies, Businesses

New Industrial Scale Refrigerants Project	Changing old HFC refrigerants (using 404R22) to new CO_2 refrigerants in multiple supermarkets and convenience stores. This will reduce greenhouse gases and save 15% annual energy per store, removing an estimated 4,000 lbs. of old refrigerant each.	71,663	2,568,513	Businesses
New Industrial Scale Generator Project	Install electric hook-ups at multiple stores and warehouses to stop using diesel generators in their refrigerator trailers. This could save an estimated 186,600 gallons of diesel fuel	9,416	188	Businesses
Pennsylvania Clean Energy Manufacturing Initiative	Create a guide with practical steps for clean energy manufacturing. The goal is to make southwestern Pennsylvania's economy strong, fair, and environmentally-friendly.	128,750	250,000	Local Governments, Government Agencies, Businesses
Total Emission Reduction Range[23]		105 - 420 thousand $MTCO_2e$	1409 - 5637 thousand $MTCO_2e$	

[23] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.5 Waste, Water, and Sustainable Materials Management Sector

Methane is large source from landfills and wastewater. The emissions from landfills and wastewater account for approximately 1 million $MTCO_2e$, or 2% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to project initiatives that achieve the following policy goals:

- Standards and incentives to reduce methane emissions from landfills and wastewater treatment facilities, including through collection for use or destruction.
- Programs and incentives to reduce or divert waste (including food and/or yard waste) through improved production practices, improved collection services, and increased reuse or recycling rates
- Programs and incentives to reduce GHG emissions associated with industrial materials production, use, and waste management
- Programs to expand composting and bio-digestion infrastructure to reduce GHG emissions and increase beneficial use of organic waste
- Policies and programs to reduce construction and demolition waste through building reuse, deconstruction, and material diversion and reuse
- Installation of renewable energy and energy efficiency measures at wastewater treatment facilities
- Programs that encourage waste diversion and reuse

These are the projects, and greenhouse gas emissions reduction estimate, and authority to implement from the Project Candidate Intake Form in the Waste, Water, and Sustainable Material Management Sector:

Table 10. Examples of Quantified GHG Reductions Projects in Waste, Water, and Sustainable Materials Management

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Recycling Convenience Center	Develop a county recycling convenience center to better serve municipal and county constituents, with reliable material management and disposal options.	4,159	33,268	Local Governments, Government Agencies, Businesses
Reducing Greenhouse Gases through Workforce Development & Urban Wood Reuse	Aims to divert wood waste, engaging residents in product development, and producing biochar for soil remediation.	3,878	49,477	Local Governments, Government Agencies, Businesses
Total Emission Reduction Range[24]		4 – 16 thousand $MTCO_2e$	41 – 165 thousand $MTCO_2e$	

[24] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.6 Agricultural Sector

The agricultural sector account for approximately 0.5 million MTCO2e, or 1% of total greenhouse gas emissions in the SPC region in 2020. To reduce greenhouse gas emissions from this sector, SPC is looking to apply CPRG funding to project initiatives that achieve the following policy goals:

- Incentive programs to fund electric agricultural equipment technologies
- Incentives for technologies and techniques that reduce nitrous oxide emissions from fertilizer application
- Incentives to promote anaerobic digesters to capture methane and generate renewable energy or produce renewable fuel

These are the projects, greenhouse gas emissions reduction estimate, and authority to implement from the Project Candidate Intake Form in the Agricultural Sector:

Table 11. Examples of Quantified GHG Reductions Projects in Agricultural Sector

Project Title	Description	$MTCO_2e$ saved 2025 to 2030	$MTCO_2e$ saved 2030 to 2050	Authority to Implement
Agrovoltaics	Agrovoltaic project within agricultural fields.	2270	11352	Local Governments, Government Agencies, Businesses, Universities
Total Emission Reduction Range[25]		1 - 5 thousand $MTCO_2e$	6 - 23 thousand $MTCO_2e$	

[25] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.7 Carbon Removal Measures

The carbon removal sector emerges as a crucial avenue for mitigating atmospheric greenhouse gas concentrations. Through innovative technologies and nature-based solutions, this sector focuses on actively removing carbon dioxide from the atmosphere, thereby offsetting emissions and contributing to overall climate stability. From afforestation and reforestation projects to direct air capture and carbon sequestration initiatives, a diverse array of strategies is employed to achieve significant carbon removal. Below are some of the goals, SPC aims to achieve:

- Policies to promote improved forest management to enhance carbon stocks on forested land
- Urban afforestation and green infrastructure programs and projects
- Restoration of degraded lands (e.g., brownfields, mine reclamation) and forested lands to enhance carbon sequestration
- Policies to enhance carbon stocks in coastal estuaries, such as wetlands and mangroves.

SPC has received projects to improve urban forest management to help sequester CO_2:

Table 1112. Examples of Quantified GHG Reductions Projects in Carbon Removal

Project Title	Description	MTCO2e saved 2025 to 2030	MTCO2e saved 2030 to 2050	Authority to Implement
Addressing Climate Pollution in Southwestern Pennsylvania through Community Forestry Initiatives	Increasing equitable access to tree canopies.	4,963	19,852	Local Governments, Government Agencies, Businesses, Community Groups, Land Trusts
Land Conservation Project	Conserve existing forested and meadow properties throughout the county to prevent land conversion and enhance natural forest sequestration.	155,173	965,413	Local Governments, Government Agencies, Businesses, Community Groups, Land Trusts
Total Emission Reduction Range[26]		80 - 320 thousand $MTCO_2e$	493 - 1971 thousand $MTCO_2e$	

[26] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

3.8 Implementation of GHG Reduction Measures

As demonstrated in the Priority GHG inventory, emissions come from varied activities in all sectors and as demonstrated by the Quantified GHG Reduction Measures, projects to reduce emissions can come in many forms. In order to best enable the region to maximize climate pollution reductions across the region in ways that are equitable and scalable across the entire region, SPC should establish a program for evaluating projects and awarding funding to highly impactful projects. The program would be established to implement projects in the Southwestern Pennsylvania region that employ measures outlined in the PCAP. Quantification of benefits and cost effectiveness would be key criteria, along with benefits to workforce development, and low income and disadvantaged communities. Table 12 below summarizes the projected range of CO_2e reduction for projects within each sector.

A significant initial investment in a regional fund would set in motion measures across all sectors and in all counties. SPC would monitor project outcomes and make investments that both maximize climate pollution reductions while enabling new technologies and infrastructure to be scaled for regional benefit. This program will be a first step in a long-term regional funding strategy, comprehensively focused on workforce benefits and economic development, through the lens of climate pollution reduction projects and programs.

Table 1213. Projected carbon reduction per sector in the SPC region[27]

Sector	2025-2030 **Reduction** (in thousand MT**CO_2e**)	2030-2050 **CO_2e Reduction** (in thousand MT**CO_2e**)
Electric Power	49 - 195	343 - 1373
Transportation	67 - 270	1486 - 5944
Buildings	824 - 3297	5287 - 21146
Industrial	105 - 420	1409 - 5637
Carbon Removal	80 - 320	493 - 1971
Agricultural	1 - 5	6 - 23
Waste, Water, and Sustainable Materials Management	4 - 16	41 - 165
Total	1131 - 4523	9065 – 36260

[27] The total emission reduction is provided as a range. Given that projects are currently in planning stages at various levels of development, we anticipate that actual emissions reduction could be 50% lower than estimated or 100% higher. This reflects a 10% conceptual design level of certainty.

4: Benefits Analysis

4.1 Low-income and Disadvantaged Communities Benefits Analysis

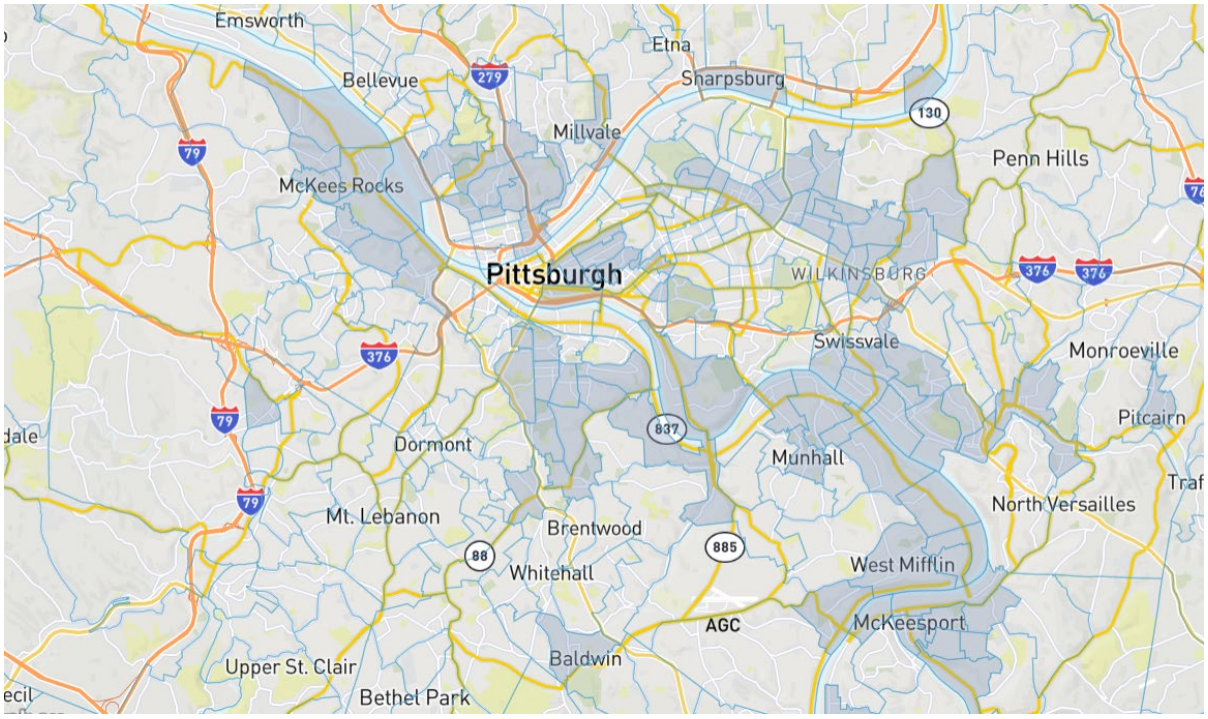
A preliminary analysis was conducted to identify low-income and disadvantaged communities (LIDACs) that will be affected by the GHG reduction measures in the PCAP. The United States Council on Environmental Quality's Climate and Economic Justice Screening Tool[28] (CEJST Tool) was used to support this analysis in determining the relevant census tracts impacted by the projects in the PCAP. The CEJST Tool provides an interactive map indicating burdens in 8 categories – climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development – using percentiles to assess communities against the national average. To qualify as disadvantaged, one of the burdens must be above the 90th percentile.

Within the larger SPC region, there are 201 census tracts that qualify as disadvantaged. These tracts are distributed across 10 counties and are home to more than 500,000 people. On average, these tracts exceed 2.9 of the burden categories, meaning that many of these communities are disadvantaged in several areas, not just the one burden required to qualify as a LIDAC.

Below is a snapshot of the CEJST Tool illustrating the census tracts that qualify as a LIDAC in the Pittsburgh metro area, where most of the LIDACs are in Allegheny County.

[28] United States Council on Environmental Quality (n.d.). *Climate and Economic Justice Screening Tool*. Explore the Map - Climate & Economic Justice Screening Tool. Retrieved February 29, 2024, from https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

Figure 2. Snapshot of CEJST Tool for the Pittsburgh Metro Area



Explore the map - Climate & Economic Justice Screening Tool (geoplatform.gov)

The LIDACs in Allegheny County have a total population nearly 50 percent of the total population living in LIDACs in the larger SPC region. The other nine counties consist of the other half of the total population. To compare the LIDACs to the general population, Allegheny County recorded a total population of 1,223,583 people in 2010 (when the LIDAC population totals were recorded for the CEJST Tool), implying that about 20 percent of individuals in Allegheny County are living in a LIDAC. The table below represents a summary of all counties included in the LIDAC analysis, displaying both LIDAC and total census tracts and population statistics.

Table 13 LIDACs and Population within SPC region

County	LIDACs	Total Census Tracts[29]	% of Total Census Tracts	LIDAC Population	County Population [30]	% of Total Population
Allegheny	107	394	27.2	249,326	1,223,583	20.4
Armstrong	7	19	36.8	22,353	68,839	32.5
Beaver	12	53	22.6	33,943	170,567	19.9
Butler	4	47	8.5	11,467	184,059	6.2
Fayette	23	36	63.9	81,540	136,466	59.8
Greene	1	10	10.0	4,204	38,686	10.9
Indiana	4	24	16.7	15,787	88,847	17.8
Lawrence	10	28	35.7	25,824	90,968	28.4
Washington	13	62	21.0	28,947	207,875	13.9
Westmoreland	20	113	17.7	47,060	365,012	12.9
Total	**201**	**786**		**520,451**	**2,574,902**	

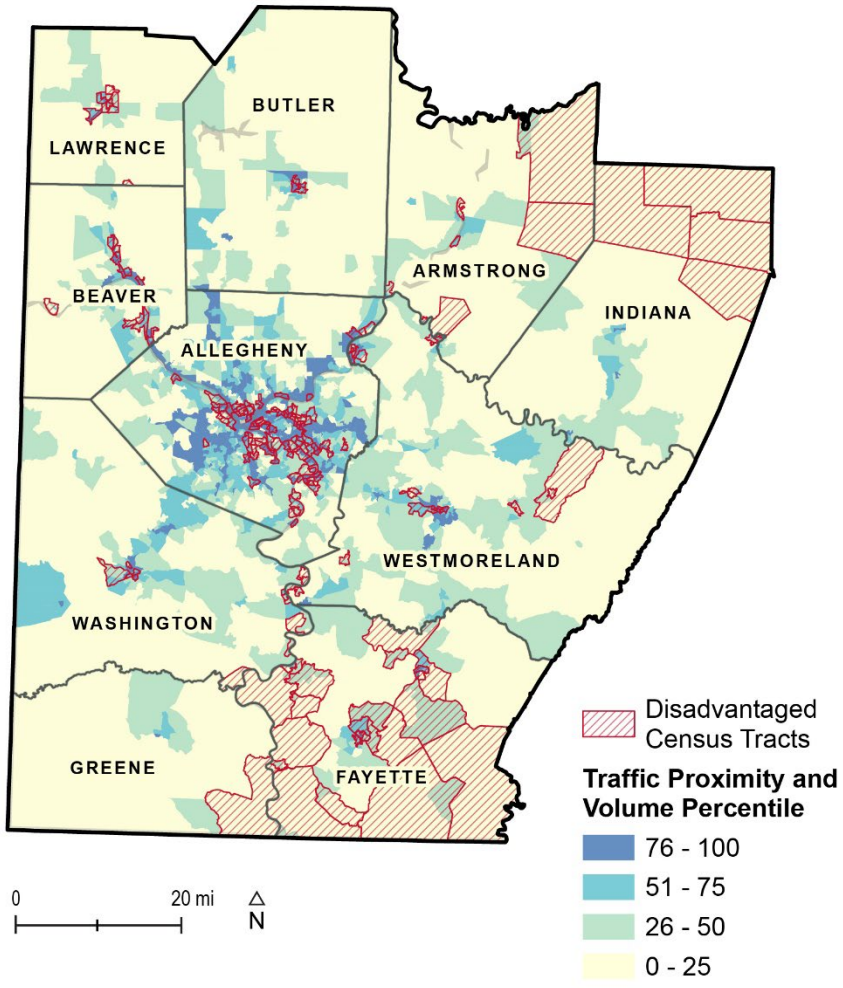
Summary of LIDACs identified by the CEJST Tool

- Income: More than 97% of the census tracts are considered low income, including 100 percent of the LIDACs in all the ten counties except for Allegheny and Washington. More than 80% of individuals living in these low-income census tracts are below the 200 percent Federal Poverty Line.
- Housing: In Allegheny County, 17 census tracts reached the 90th percentile threshold for housing burden, including 65 reaching the threshold for the pre-1960s housing lead paint indicator. In Indiana County, an average of nine percent of homes in the LIDACs did not have an indoor kitchen or indoor plumbing, which may represent homes belonging to members of the Amish or Mennonite communities.
- Climate: Inland flooding is a widespread issue across this region. 24 of the 107 LIDAC census tracts in Allegheny County reached the 90th percentile threshold for the share of properties at risk of flooding in 30 years. Other less densely populated areas in the region, such as Armstrong County, have 4 of the 7 LIDACs at or above this flooding threshold.
- Traffic / Transportation: In Allegheny County, five census tracts reached the 90th percentile for heavy traffic, and one of the tracts reached the threshold for barriers to travel and/or access to transit. Most of the LIDAC census tracts lacking access to transit or facing barriers to transportation are in Fayette County, where 8 of the 23 LIDACs reached the 90th percentile. In

[29] U.S. Census Bureau. “2020 Census – Census Tract Reference Map”.
[30] U.S. Census Bureau. "ACS DEMOGRAPHIC AND HOUSING ESTIMATES." American Community Survey, ACS 1-Year Estimates Data Profiles, Table DP05, 2010, https://data.census.gov/table/ACSDP1Y2010.DP05?q=population in Allegheny county in 2010&t=Age and Sex:Housing:Race and Ethnicity&g=050XX00US42005,42007,42019,42051,42063,42073,42125,42129. Accessed on January 21, 2024.

addition to the CEJST Tool, a high-level traffic congestion analysis was conducted by geospatially overlaying the traffic proximity and volume percentiles with identified LIDACs to show the relationship between traffic congestion and disadvantaged communities. This analysis is shown in the figure below, indicating high levels of traffic volume in Allegheny County, especially around the Pittsburgh metro area. This figure shows a clear overlap between traffic congestion and LIDACs, indicating that in areas where traffic volume is already relatively high, those living within LIDACs suffer the most. This relationship appears to extend to the surrounding counties, especially prevalent in Lawrence, Beaver, Washington, Butler, and Westmoreland.

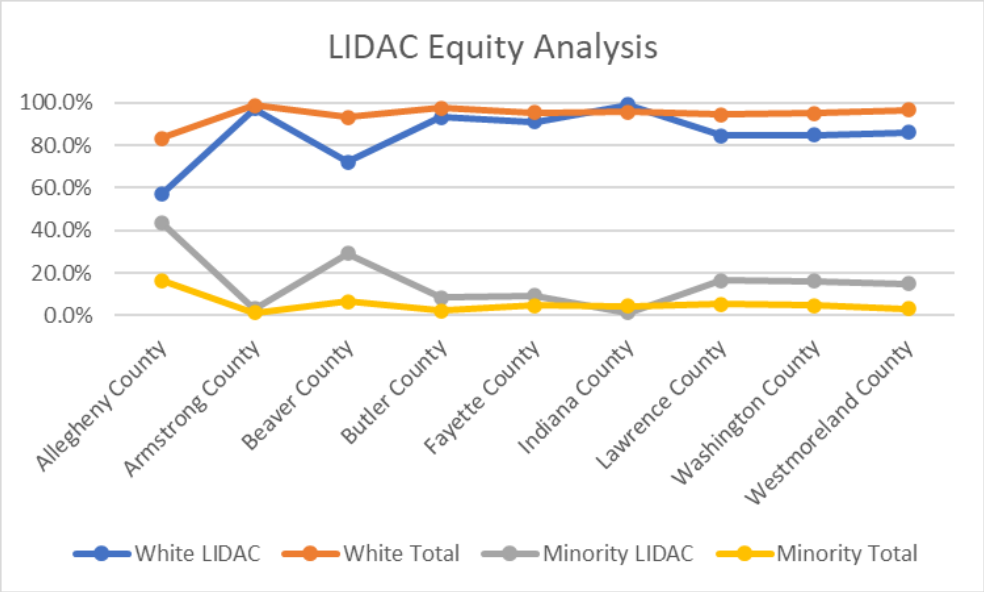
Figure 3. Map of Regional Traffic Volume and Disadvantaged Census Tracts



- Emissions: Although none of the census tracts in this region reached the 90 percent threshold for exposure to PM2.5, census tracts in Allegheny County are in the 85th percentile, on average. In our region, the topography and developmental history of the region has led to development patterns where LIDACs, urban centers, and major roadways are collocated within valleys.

- Energy: In total, 100 of the 201 LIDAC census tracts reached the 90th percentile threshold for energy burden. This includes 9 out of 12 LIDACs in Beaver County, 15 of 23 LIDACs in Fayette County, and 9 out of 10 LIDACs in Lawrence County.
- Hazardous Waste / Facilities: In Allegheny County, five census tracts reached the 90th percentile threshold for proximity to hazardous waste sites, three for proximity to Superfund sites, and four for proximity to Risk Management Plan facilities. In Washington County, 8 of the 13 LIDAC census tracts reached the 90th percentile threshold for proximity to Risk Management Plan facilities. In Fayette County, 10 of the 23 LIDAC census tracts have at least one abandoned mine, with 22 census tracts in the greater SPC region.
- Health: The average life expectancy in the LIDACs included in this analysis is 73.5 years. Conditions such as asthma, diabetes, and heart disease contribute to a lower life expectancy compared to the 2010 state and national average of 78.6[31] and 78.5[32], respectively. More specifically, 66 of the LIDAC counties in Allegheny County reached the 90th percentile threshold for asthma, 36 for diabetes, and 29 for heart disease. In Beaver County, 10 of the 12 LIDAC counties reached the threshold for asthma, 2 for diabetes, and 6 for heart disease.
- Racial demographics: These communities have a disproportionate percentage of minority individuals who live in LIDACs, compared to the total region. As seen in the figure below, eight of the nine counties within the region have a greater percentage of minorities and a lower percentage of white people in LIDACs, compared to the total population of the region.

Figure 4. Racial Disparities in LIDACs



Source: U.S. Census Bureau. "ACS DEMOGRAPHIC AND HOUSING ESTIMATES." American Community Survey, ACS 1-Year Estimates Data Profiles, Table DP05, 2010, https://data.census.gov/table/ACSDP1Y2010.DP05?q=population in Allegheny county in

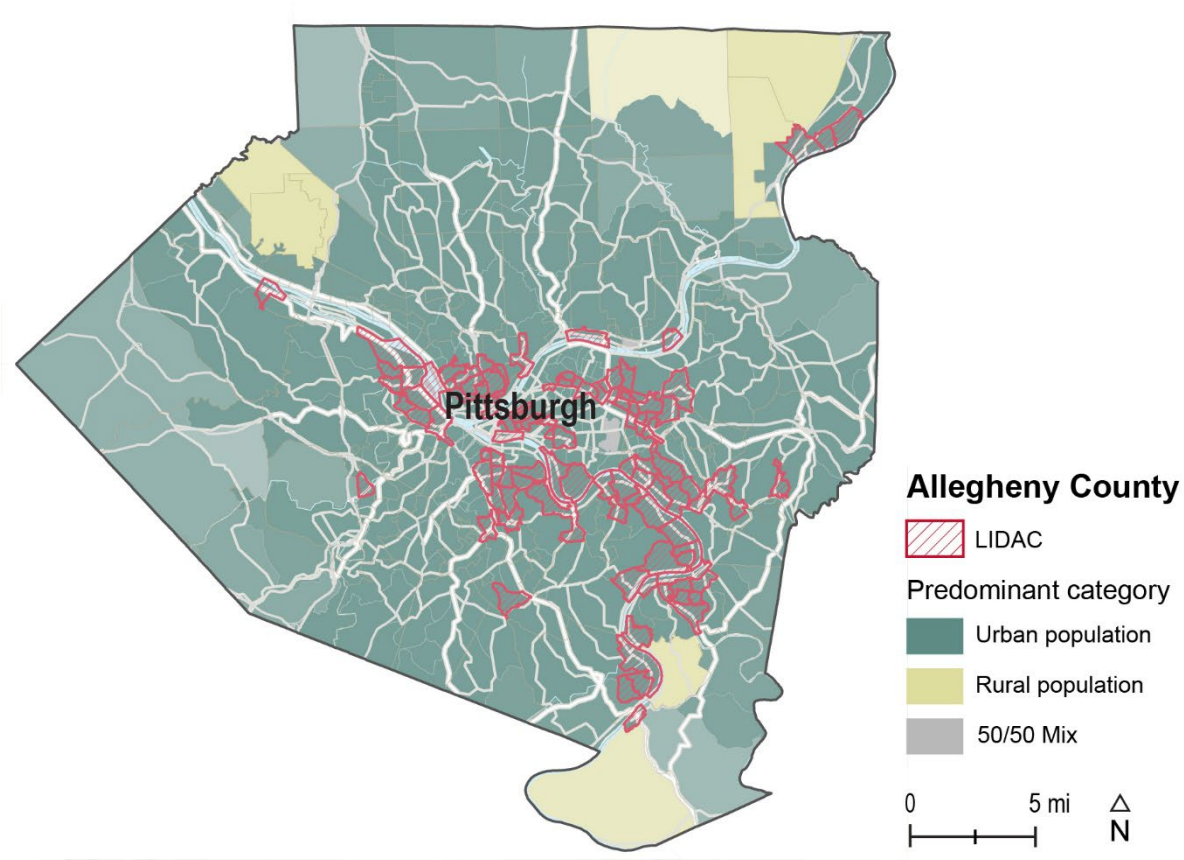
[31] CDC Data Visualization Gallery, Life Expectancy at Birth for U.S. States and Census Tracts, 2010-2015. Life Expectancy Data Viz (cdc.gov)
[32] Macrotrends: U.S. Life Expectancy 1950-2024. U.S. Life Expectancy 1950-2024 | MacroTrends

2010&t=Age and Sex:Housing:Race and Ethnicity&g=050XX00US42005,42007,42019,42051,42063,42073,42125,42129. Accessed on January 21, 2024.

4.2 LIDAC: Urban vs. Rural

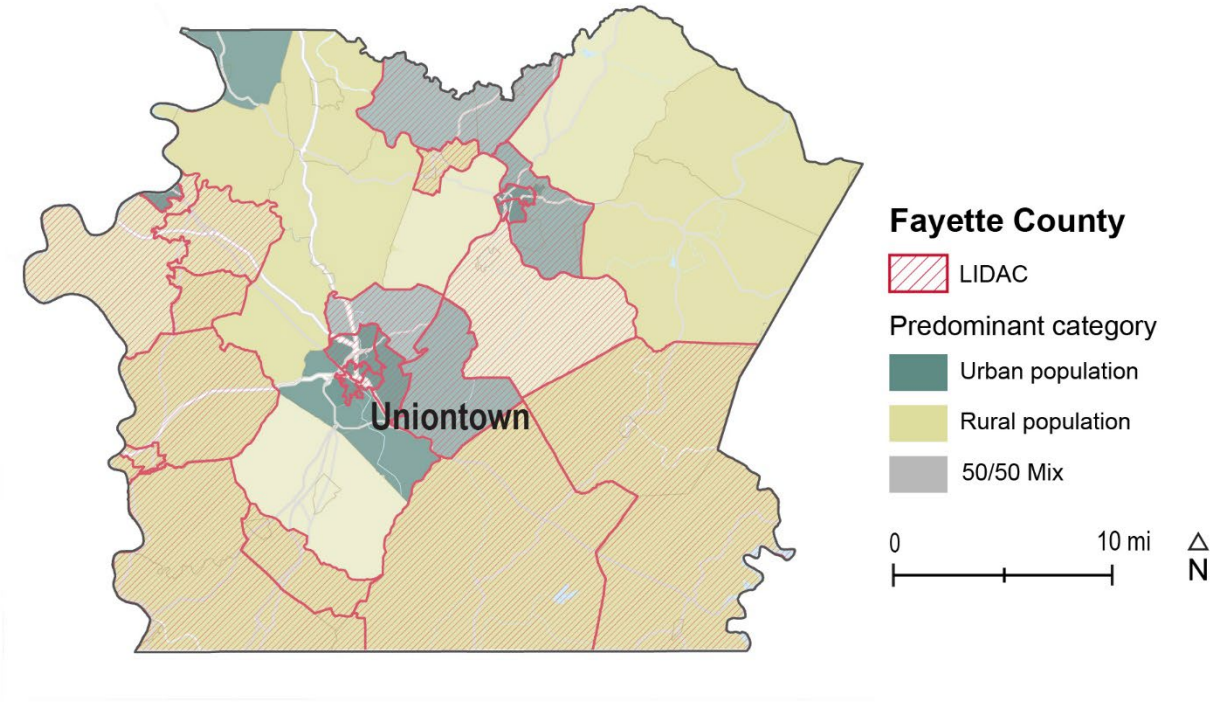
Using the 2020 U.S. census urban vs. rural population classification dataset, each of the ten counties in the larger SPC region were analyzed to develop a deeper understanding of population and land use types within the LIDACs. The analysis for Allegheny County is shown in the figure below. The population type in Allegheny County is predominantly urban, with some rural areas on the outskirts of the county. All the LIDACs in Allegheny County are in predominantly urban areas, mostly clustered around the Pittsburgh metro area.

Figure 5. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Allegheny County



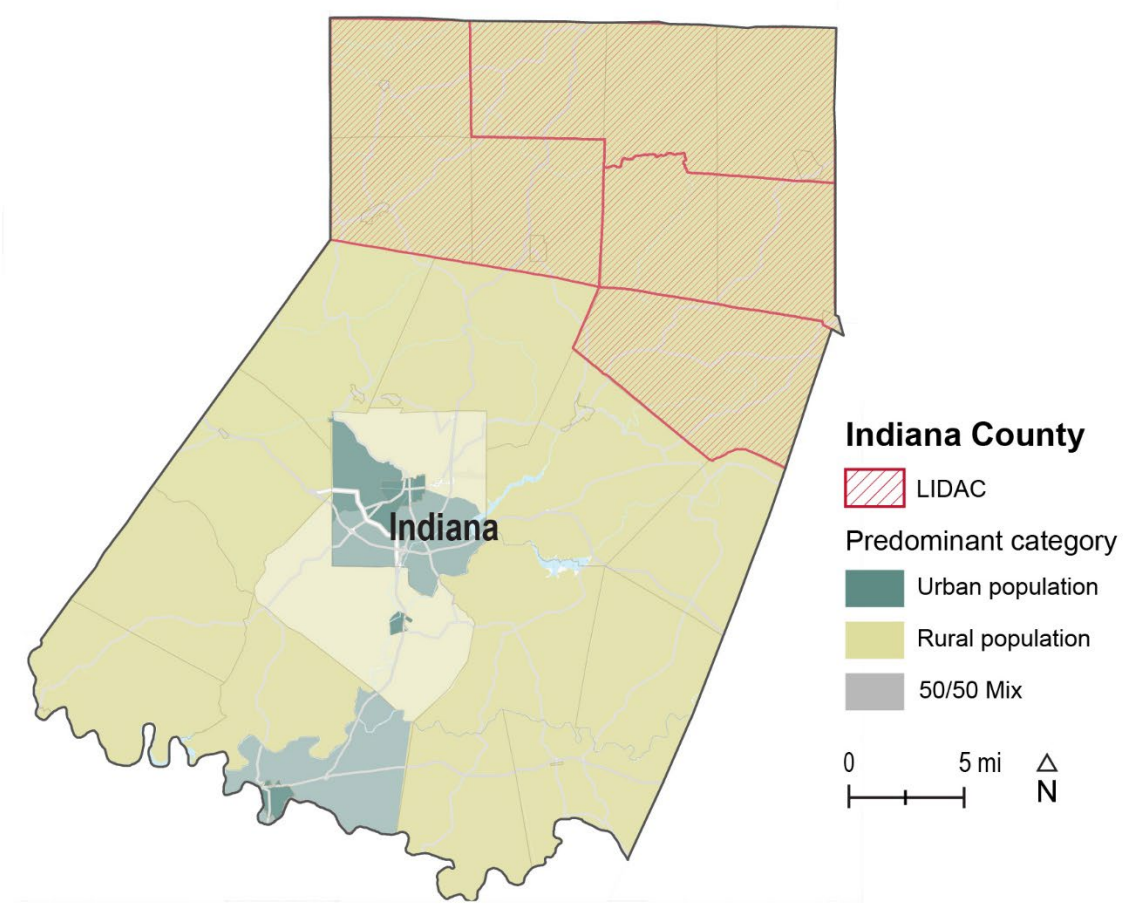
The correlation between LIDACs and urban vs. rural population types varies throughout the larger SPC region. Like Allegheny County, the LIDACs in Butler, Lawrence, and Westmoreland counties are in predominantly urban areas. The LIDACs in Beaver and Washington counties are also mostly urban areas, but there are some rural areas mixed in. In Armstrong and Fayette counties, the LIDACs are split between urban and rural population types. The analysis for Fayette County is shown in the figure below.

Figure 6. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Fayette County



In Greene and Indiana counties, the LIDACs are in predominantly rural areas. Like the other counties in the larger SPC region, Greene and Indiana counties consist of denser urban areas in the center of their respective areas, although unlike the other counties, none of these more urban population tracts in Greene and Indiana are LIDACs. Instead, the rural areas on the outskirts of the county are LIDACs. The analysis for Indiana County is shown in the figure below.

Figure 7. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Indiana County



This analysis provides insight into the variety of populations that live in LIDACs within the larger SPC region. The mix of urban and rural populations presents a unique opportunity to consider climate mitigation and GHG reduction strategies that address the diverse challenges and risks faced by all population types.

4.3 Summary of Climate Risks

The CEJST Tool provided some details on climate burdens to these communities, although more research was conducted to provide a more comprehensive analysis. According to a study by the American Communities Project[33], areas in the greater SPC region are specifically vulnerable to climate impacts such as hurricanes and extreme rainfall. The SPC region often experiences the high winds on the outer edge of the storm path, though is not typically directly within the path of such storms.

Another climate burden this region faces is the risk of tornadoes and severe thunderstorms. In March of 2023, a tornado outbreak, with 145 confirmed tornadoes, and widespread severe weather across the eastern U.S., resulted in $5.6 billion in damage across the multiple states to homes, businesses, vehicles, agriculture, and other infrastructure, with 33 deaths across Pennsylvania, Illinois, Indiana, Ohio, Missouri, Arkansas, and Tennessee. In fact, within the 376 weather and climate disasters since 1980 in which overall damages/costs reached or exceeded $1 billion, Pennsylvania was listed 17 times, of which 10 were for damages from severe thunderstorms or tornadoes[34]. It is expected that most of these storms would have occurred in the western portion of the state, with a higher prevalence for strong storms and tornadoes in the Mid-West region of the U.S. According to the CEJST Tool, wildfires are not considered a widespread issue among the LIDACs in this area. Lastly, concerning fire risk, the average census tract that qualified as a LIDAC was in the 33rd percentile for the share of properties at risk of fire in 30 years.

[33] American Communities Project (n.d.). *American Communities Project - Socioeconomic, Culture, Politics*. Retrieved March 1, 2024, from https://www.americancommunities.org/

[34] NOAA National Centers for Environmental Information, U.S. Billion-Dollar Weather & Climate Disasters 1980-2023. https://www.ncei.noaa.gov/access/billions/events.pdf.

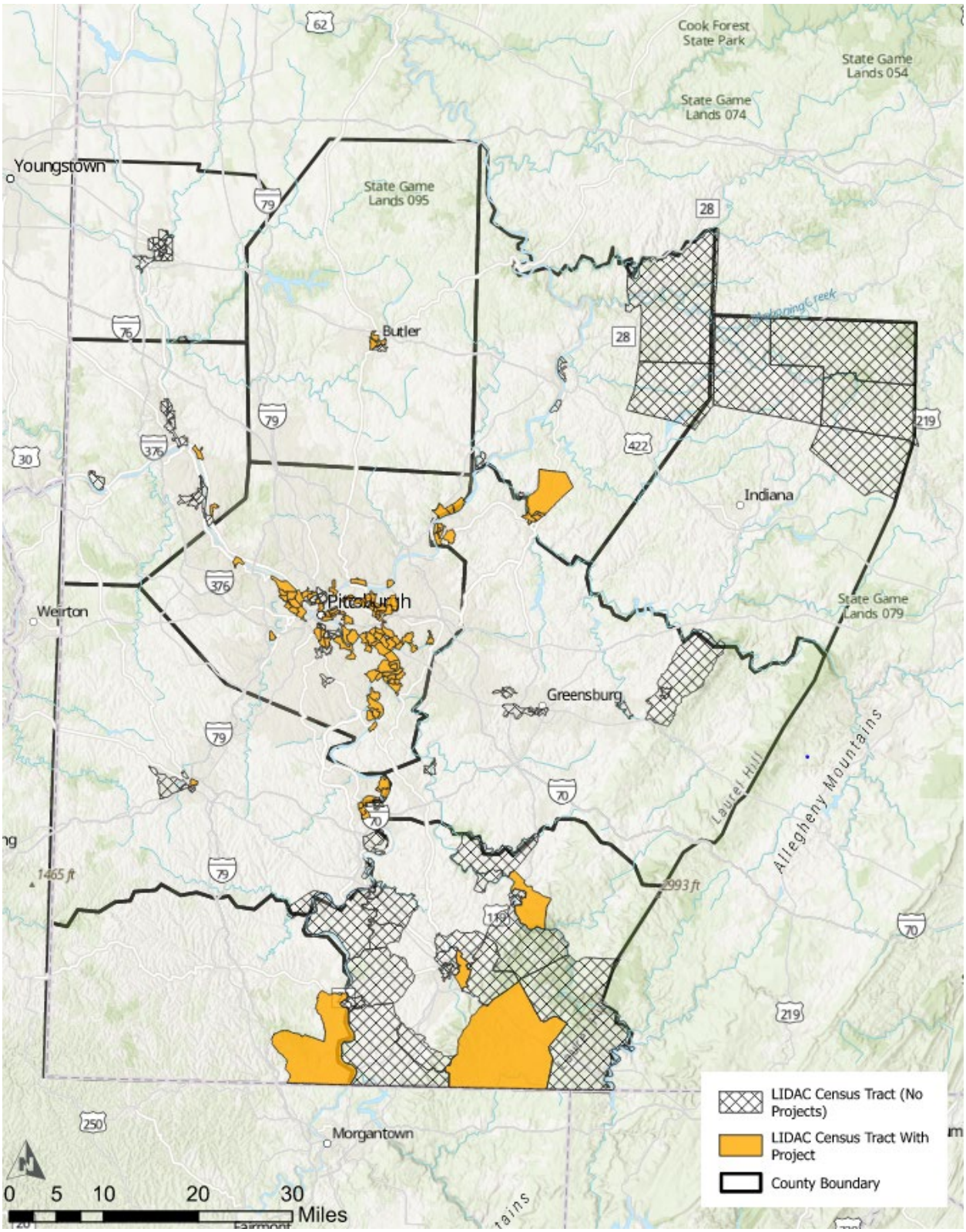
4.4 Benefits to LIDACs

GHG reduction measures included in the PCAP such as expanding access and system capacity for non-motorized travel, energy efficiency measures, and improved waste management will result in improved public health, decreased energy demand and costs, and expanded access to transportation alternatives. These improvements will have significant benefits on the LIDACs in the greater SPC region, especially those in Allegheny County. The LIDACs in Allegheny County, mostly centered around the Pittsburgh metro area, suffer the hardest from poor health, traffic proximity and volume, and harmful emission exposure. Upgrading cycling and pedestrian access will offer another mode of transportation and reduce traffic congestion on city streets. Reduced congestion will contribute to a lower rate of transportation emissions and lead to improved public health for an area already suffering disproportionately from asthma, diabetes, and heart disease.

Furthermore, increasing energy efficiency and decreasing dependence on fossil fuels will lead to decreased energy costs, improved energy security, and more resilient energy sources. These impacts would benefit the LIDACs suffering from an energy burden. Out of the 201 LIDACs in the region, 100 census tracts reached the 90th percentile threshold for energy burden. This signifies a significant need for upgrading energy efficiency and becoming more resilient to the changing climate.

Fifteen proposed implementation projects are distributed across 115 out of the 201 LIDAC tract in the SPC region. The sectors targeted by these projects include Transportation, Industrial, Buildings, Carbon Removal, and Electric Power. The primary objective of these project is to implement measures that will effectively reduce greenhouse gas emissions. Figure 8 provides a visual representation of the distribution and extent of project coverage among the LIDACs in the SPC region. Refer to Appendix C, *Project Presence in Low-Income Disadvantaged Community Census Tracts*, for additional details.

Figure 8. Map of Low Income and Disadvantaged Community Census Tracts and Proposed Project Location inside those Tracts



4.5 Regional Benefits Analysis

A preliminary regional analysis was conducted using a Community Risk and Resiliency Report to evaluate climate and natural hazard risk factors within the SPC region. This analysis is considered preliminary and will be finalized in the CCAP phase of the planning.

Community Risk and Resiliency Reports[35] were generated for each of the 10 counties in the larger SPC region, along with an 11th report that provides a regional overview of the larger SPC region. These reports offer detailed insight on existing and forecasted climate risks and vulnerabilities. The reports reference data from the Federal Emergency Management Agency's (FEMA) National Risk Index for Natural Hazards[36] (NRI), which includes a Social Vulnerability Score (0-100), a Community Resilience Score (0-100), and an Expected Annual Loss (in US dollars) resulting from natural hazards.

The National Risk Index for the larger SPC region is 15, which is relatively low compared to the rest of Pennsylvania with a value of 28. The Social Vulnerability score is 36, which is 2 lower than the statewide value of 38. Social Vulnerability considers the social, economic, and housing characteristics of a community that influences its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards. Like the Social Vulnerability score, the Community Resilience score is defined as the ability for a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community. The larger SPC region earned a score of 73, which is 9 higher than the statewide value of 64.

The geography of this region is sheltered from direct impacts from events like coastal flooding and hurricanes that the eastern part of the state experiences more acutely. This results in a lower Expected Annual Loss[37] caused from natural hazards than the more densely-populated Philadelphia metro area in the eastern side of the state. The report identifies that landslides, wildfires, cold fronts, lightning, and riverine flooding are the most prevalent natural hazard risks within the larger SPC region, with each of these risk factors above the 60th percentile. Landslides appear to be the greatest risk being above the 80th percentile for risk factor. As expected, coastal flooding did not receive a score because it doesn't prevent a risk for these counties. Although this region can avoid coastal flooding, inland flooding still presents a significant issue.

[35] See Appendix B: *Community Risk and Resiliency Reports*.
[36] Federal Emergency Management Agency (FEMA) (2023, August 30). *National Risk Index for Natural Hazards*. Retrieved February 29, 2024, from https://www.fema.gov/flood-maps/products-tools/national-risk-index
[37] Federal Emergency Management Agency (FEMA) (n.d.). *Expected Annual Loss*. National Risk Index. Retrieved March 1, 2024, from https://hazards.fema.gov/nri/expected-annual-loss

Based on historical climate events, existing conditions, and forecasted probabilities, the expected annual loss for the larger SPC region resulting from natural hazards is over $70 million per year[38]. This value quantifies the economic loss for relevant consequence types (i.e., buildings, population, or agriculture). It is expected that projects identified in the PCAP will promote community resiliency, sustainable development, and mitigate existing and forecasted climate and natural hazard risks to ensure quality of life and economic success for future generations.

[38] Federal Emergency Management Agency (FEMA) (2023, August 30). *National Risk Index for Natural Hazards*. Retrieved February 29, 2024, from https://www.fema.gov/flood-maps/products-tools/national-risk-index

5: Review of Authority to Implement

All proposed individual projects with quantified GHG reduction measures identified for the PCAP are fully within the sponsor organization's, and SPC's, authority to implement. As such, SPC and the partner organizations have existing statutory and/or regulatory authority to implement the measure and no further legislative approvals from key entities would need to be obtained.

Implementation of a regional fund administered by SPC requires authorization from SPC's board of commissioners. On Monday, 26 February 2024, SPC's commissioners passed Resolution 1-24 granting the SPC authorization to apply for implementation funding in order to establish a proposed regional fund, which will support projects aligned with the regional Priority Climate Action Plan (PCAP). Thus, in addition to individual projects being within the authority to implement of sponsor organizations and SPC, the SPC also has the authority to implement the creation of a regional fund for climate pollution reduction projects.

Appendix A: Southwestern Pennsylvania Commission 2020 Greenhouse Gas Emission Inventory Technical Support Document

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1 Southwestern Pennsylvania (SPC) Commission Greenhouse Gas Inventory

This appendix presents the results discussion and methodology employed in quantifying emissions from large emitting sources within SPC's geographic area, laying the groundwork for climate action planning. Referred to as the GHG inventory, this assessment provides a preliminary estimate primarily focusing on significant emission sources, serving as a vital starting point for understanding the magnitude and distribution of emissions.

1.1 Introduction: Inventory Scope and Purpose

In 2023, the Southwestern Pennsylvania Commission received a planning grant[1] from the U.S. Environmental Protection Agency (EPA) under the EPA's Climate Pollution Reduction Grant (CPRG) program to create a Regional Climate Pollution Reduction Plan for Southwestern Pennsylvania, including the Pittsburgh Metropolitan Statistical Area, plus the adjacent counties of Greene and Indiana within the 10-county SPC region. As part of the CPRG program's initial phase, a Priority Climate Action Plan (PCAP) with an accompanying greenhouse gas (GHG) inventory is mandated.

The GHG inventory presented here plays a pivotal role within the PCAP, addressing the pressing need for emission reduction initiatives within SPC's jurisdiction. Conducted expediently, this inventory offers estimates of emissions from major sources, acknowledging the presence of data gaps and incompleteness. Despite these challenges, the primary objective was to pinpoint significant emission sources and comprehend GHG emissions across the SPC region.

This initial GHG inventory facilitated the identification of data gaps and emission sources, guiding subsequent efforts to gather comprehensive data for the development of the CCAP. By highlighting areas of uncertainty and emphasizing data collection and refinement, this preliminary inventory serves as a crucial foundation for understanding emissions profiles and devising effective mitigation strategies. Through ongoing refinement and collaborative endeavors, we strive to improve the accuracy and efficacy of our climate action initiatives, ensuring a sustainable and resilient future for our community.

2 Principal Conclusion

According to 2020 Census, the 10-county region under the SPC's jurisdiction is home for 2.58 million people, or about 20% of the entire population of Pennsylvania. The region occupies about 15% of Pennsylvania's land area and contributes 21% of the state's Gross Domestic Product. This inventory process summarizes all greenhouse gas emissions sources from various activities within the SPC region.

The Greenhouse Gas inventory was assembled for each of the 10 counties under SPC jurisdiction for the data year of 2020. The year 2020 was chosen because the 2020 inventory was conducted in the 2023 National Emissions Inventory (NEI), which provided the most comprehensive dataset available at the time of this report's appendix preparation.

The analysis framework of the inventory process is consistent with EPA's Local Greenhouse Gas Inventory Tool (LGGIT). The LGGIT model categorizes greenhouse gas emissions from sources including mobile,

[1] EPA Assistance Agreement #95318101

electric power consumption, solid waste, stationary, agriculture and land management, wastewater treatment, and urban forestry. This GHG inventory focuses activities that happen within the SPC region (Scope 1 and 2 emissions). Scope 1 emissions stem from sources within the SPC boundary, while Scope 2 emissions result from grid-supplied electricity within the SPC boundary. Scope 3 encompasses all other GHG emissions occurring outside the SPC boundary due to activities within it. Scope 3 emissions were not calculated for this inventory.

Mobile source emissions cover transportation-related emissions on road and other nonroad fossil fuel engines such as lawn mowers, excavators and generators. Greenhouse gas emissions from electric power consumption within each county are calculated by the proportion of the county's area that falls within the Emissions & Generation Resource Integrated Database (eGRID) regions, specifically the RFC East (RCRE) or RFC West (RCRW) subregions. Solid waste emissions are associated with landfill operations. Stationary source emissions are from fossil fuel usage from industrial and commercial facilities. Emissions from agriculture and land management involve livestock, crop production, and prescribed burns. Wastewater treatment emissions are compiled from regional sewer systems. Lastly, sequestration from forested areas in residential, commercial and industrial land uses are considered for their role in carbon absorption and land use impacts. Table 1 summarize the data source from the emissions:

Table 1. Data Sources

Description	Data Source
Mobile Source GHG Emissions	• 2020 National Emissions Inventory County-level Estimates. • Federal Aviation Administration's Traffic Flow Management System Counts (TFMSC) • 2023 Climate Registry
Electric Power Consumption GHG Emissions (Electricity and Natural Gas Data)	• DOE's State and Local Planning for Energy (SLOPE) Platform
Solid Waste GHG Emissions	• EPA's Landfill Methane Outreach Program • 2020 National Emissions Inventory Data for Landfills
Stationary Source GHG Emissions	• 2020 National Emissions Inventory Facility Emissions
Agriculture and Land Management GHG Emissions (Livestock, Cropland Acreage, Prescribed Burns)	• USDA 2017 Census • 2020 National Emissions Inventory Data for prescribed burn
Wastewater Treatment (Regional Sewer Inventory of 2019)	• SPC Water Resource Center • An Examination of Failing Private Septic Systems in Pennsylvania (for septic tank assumption)
Urban Forestry Resources (National Land Cover and Land Use Land Cover Data)	• Nation Land Cover Database 2019 (for forest coverage) • SPC's Land Use Land Cover Database 2016 (for land use information)

The total greenhouse gas emissions are approximately 53.5 million Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$) without accounting for sequestration from urban forestry. The emissions in the SPC region are approximately 22% of the State's total emissions according to 2023 Pennsylvania Greenhouse Gas Inventory Report, which inventoried the greenhouse gas emissions for the entire state of Pennsylvania in 2020.

Among all GHG emissions within the SPC region, carbon dioxide (CO_2) emissions account for 79% of the total greenhouse gas emissions, follow by methane emissions at 20%. All emissions are reported in Metric Tons of Carbon Dioxide Equivalent ($MTCO_2e$).

The industrial sector contributes over 25 million $MTCO_2e$ to the atmosphere, which accounts for about 47% of the total greenhouse gas emissions within the SPC region. The commercial/institutional and residential sectors each contribute around 13 million $MTCO_2e$, or about 25% of the total greenhouse gas emissions. Table 2 summarizes the emission for each sector.

Table 2. Greenhouse Gas ($MTCO_2e$) per Sector

Sector	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Commercial/Institutional	13,610,750	25.43%
Energy Generation[2]	1,192,600	2.23%
Industrial	25,305,605	47.28%
Residential	13,410,077	25.06%
Grand Total	**53,519,033**	**100.00%**

The highest emission source within the SPC region based on activity category is from stationary sources, accounting for about 52% of total emissions. Electricity use follows as the next major contributor, accounting for about 24% of emissions. Transportation activities are also responsible for 18% of the greenhouse gas emissions. Table 3 summarizes the greenhouse gas emission contribution based on economic activities.

Table 3. Greenhouse Gas ($MTCO_2e$) per Activity Category

Activity Category	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Agriculture	492,394	0.92%
Electricity Use	13,046,828	24.38%
Other Mobile Sources	1,327,556	2.48%
Solid Waste	940,160	1.76%
Stationary	27,704,109	51.76%
Transportation	9,794,260	18.30%
Wastewater	213,725	0.40%
Grand Total	**53,519,033**	**100.00%**

[2] All emission sources are also categorized into residential, commercial or institutional, industrial, and energy generation activities. Emissions related to fossil fuel usage to generate electricity were not included in the energy generation category. The accounting of electricity usage and its associated emissions take place at the point of consumption within residential, commercial, and industrial sectors.

Table 4. Greenhouse Gas ($MTCO_2e$) per County

County	Greenhouse Gas Emissions ($MTCO_2e$)	% Total Greenhouse Gas Emission
Allegheny	21,360,281	39.91%
Armstrong	1,220,306	2.28%
Beaver	2,548,953	4.76%
Butler	4,042,504	7.55%
Fayette	1,506,053	2.81%
Greene	7,546,399	14.10%
Indiana	1,881,783	3.52%
Lawrence	1,365,573	2.55%
Washington	7,152,311	13.36%
Westmoreland	4,894,870	9.15%
Grand Total	**53,519,033**	**100.00%**

The GHG inventory aimed to identify major emission sources in the SPC region, using mostly public databases listed in Table 1 above. Inaccuracies or missing data issues were unresolvable due to no readily-available validation options during the shorter-term PCAP process. This initial inventory has likely missed emissions from land use changes and minor sources like home heating oil or propane, for example. Moreover, SF_6 (sulphur hexafluoride) is a significant source of emissions in the electricity transmission and distribution sectors, and it is not reported in the NEI or Facility Level Information on Green House Gases Tool (FLIGHT) data. As such, those emissions will be inventoried in the CCAP process.

3 Methodology

The following presents the methodology used to create the GHG inventory. The inventory was built for each county within SPC's governing area, through EPA's Local Greenhouse Gas Inventory Tool (LGGIT). The LGGIT is a Microsoft Excel-based tool designed to help communities evaluate their GHG emissions. The tool is pre-programmed with default emission factors and system assumptions needed to calculate emissions. The results from using this tool can be used to create an emissions baseline, track emissions trends, assess the relative contributions of emissions sources, communicate with stakeholders, partner with other municipalities to create a regional inventory, and develop mitigation strategies and policies. The tool is intended for governments interested in compiling a relatively quick and simple GHG inventory.

The GHG inventory was chosen as a 2020 baseline as this data-year had the most complete dataset needed for input into the LGGIT tool. Data sources mostly came from publicly-available data that could be evaluated quickly. The main GHGs evaluated were carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Sulfur hexafluoride (SF_6) and Perfluorocarbons (PFCs) were only evaluated for stationary sources reported in EPA's Facility Level Information on Green House gases Tool (FLIGHT). It is noted that SF_6 is a significant source of emissions in the electricity transmission and distribution sector. As such, it should be inventoried in the CCAP process, as noted previously. Per EPA's guidance, the Global Warming Potential (GWP) conversion factors for greenhouse gases, as outlined in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), provide a standardized method for comparing their impact on global warming (Table 5). These factors allow the emissions of different gases to be

converted into a common metric (CO_2e) for a consistent assessment of their contributions to global warming. CO_2 has a GWP conversion factor of 1 and serves as the baseline for comparison. CH_4 is 28 times more potent than CO_2 and N_2O is 265 times more effective at trapping heat in the atmosphere, with respective GWP conversion factors to CO_2e of 28 and 265. SF_6 has a GWP of 23,500. Stationary sources emitting PFCs were identified using FLIGHT data. However, the specific type of PFC emitted could not be confirmed. Since FLIGHT data relies on Global Warming Potentials (GWP) from the IPCC Fourth Assessment Report (AR4), the emissions were quantified in terms of CO2e based on the values from AR4.

Table 5. Global Warming Potential

Global Warming Potential			
CO_2	CH_4	N_2O	SF_6
1	28	265	23,500

Global warming potentials are from the IPCC AR5 Fifth Assessment Report for 100-year GWP.

The emissions were categorized by activity and sub-activity, selected to encompass the major sources of GHG emissions in the area. The GHG inventory addresses the largest sources of emissions across six categories: transportation, agriculture, wastewater, solid waste, stationary sources, and electric power consumption. Each activity was calculated and estimated to be one economic sector. The LGGIT tool separates the emissions into four different sectors:

- Residential
- Industrial
- Commercial/Institutional
- Energy Generation

The tool was compiled for each county within the SPC governing area. The following details the approach for each sector.

3.1 Data Sources

The following is a list of the public data sources that were used in the analysis:

- US National Emissions Inventory (NEI) (National Emissions Inventory (NEI) | US EPA)
- Facility Level Information on Greenhouse Gases (FLIGHT) (EPA Facility Level GHG Emissions Data)
- Landfill Methane Outreach Program (LMOP) (Landfill Methane Outreach Program (LMOP) | US EPA)
- State and Local Planning for Energy (SLOPE) Platform (State and Local Planning for Energy (nrel.gov))
- Federal Aviation Administration's Traffic Flow Management System Counts (Federal Aviation Administration (faa.gov))
- June 2023 Climate Registry Emission Factors (The Climate Registry)
- US EPA State Inventory and Projection Tool (State Inventory and Projection Tool | US EPA)
- United States Department of Agriculture (USDA) 2017 Census of Agriculture (2017 Census by State | 2017 Census of Agriculture | USDA/NASS)
- USGS National Land Cover Database (National Land Cover Database | U.S. Geological Survey (usgs.gov))

3.2 Local Inventory of Mobile Source GHG Emissions

The GHG inventory of mobile sources followed the Guidance for Accessing NEI Transportation Data as a guide for obtaining transportation greenhouse gas emissions data at the county level within SPC's jurisdiction. The guide details the process of using the NEI Data Retrieval Tool to acquire county-level transportation emissions data from the 2020 National Emissions Inventory (NEI). These data include emissions for various mobile sources such as on-road and non-road vehicles and equipment. It provides steps for accessing the tool, selecting specific counties or tribes, filtering for GHG pollutants, viewing county level data, and exporting the data for use. The following NEI Data categories were included in the GHG inventory:

- Mobile – On-Road Diesel Heavy Duty Vehicles
- Mobile – On-Road non-Diesel Heavy Duty Vehicles
- Mobile – On-Road Diesel Light Duty Vehicles
- Mobile – On-Road non-Diesel Light Duty Vehicles
- Mobile – Non-Road Equipment – Gasoline
- Mobile – Non-Road Equipment – Diesel
- Mobile – Non-Road Equipment – Other
- Mobile – Commercial Marine Vessels
- Mobile – Locomotives

On-road vehicles' classification are distributed into Residential, Commercial/Institutional on-road vehicles, and classifications are distributed into the Residential, Commercial/Institutional, and Industrial sectors LGGIT uses.

1. 100% of motor homes and motorcycles are residential use
2. 100% of refuse trucks, transit, intercity, and school buses are exclusively for commercial and institutional use.
3. Combination and single unit trucks are split between commercial/institutional (90%) and industrial (10%) uses
4. Light commercial trucks are divided equally between commercial/institutional (50%) and industrial (50%) uses
5. Passenger cars and trucks are predominantly residential (80%) with minor commercial and industrial use (10% each)

All nonroad (off-highway vehicle, equipment) emission sources are separated into residential, commercial/institutional, industrial off-highway vehicle, equipment) emission sources are separated into residential, commercial/institutional, industrial, and construction uses. Construction uses are considered commercial/institutional in the LGGIT.

The aviation GHG inventory is compiled through a Landing Take Off (LTO) cycles analysis and airport operations data from the NEI database. Emission factors for LTO are determined for each aircraft type as outlined in the 2023 Climate Registry. The 2020 LTO data required for all public airports within the SPC Jurisdiction are sourced from the Federal Aviation Administration's Traffic Flow Management System Counts (TFMSC).

Per NEI's Guidance for Accessing NEI Transportation Data, all emission inventory from NEI data in short tons of CO_2, CH_4, and N_2O must be converted to Metric Tons of Carbon Dioxide Equivalence ($MTCO_2e$). Emissions were input to the "Additional Emission Sources" sheet in the LGGIT: Community Module. The converted NEI transportation data in $MTCO_2e$ was input into the LGGIT.

Assumptions for mobile sources:

- NEI data includes all mobile sources within the SPC governing region.
- Refrigerants were not included.

3.3 Local Inventory of Electric Power Consumption GHG Emissions

The inventory of electric power consumption followed EPA's "Guidance for County and Regional Inventories Energy Sector Data Sources," which outlined procedures for obtaining energy activity data at the county level (Appendix to Local Greenhouse Gas Inventory Tool: Community Module (epa.gov)). This data was sourced from the State and Local Planning for Energy (SLOPE) Data Viewer for the year 2020, which provided estimated energy consumption data in terms of natural gas and electricity usage across residential, commercial, and industrial sectors. The SLOPE data are developed from a 2016 baseline and provide estimated energy consumption data in the form of natural gas and electricity usage for residential, commercial, and industrial sectors. More information about the SLOPE projected data may be found here: State and Local Planning for Energy (nrel.gov). The data obtained from SLOPE was calculated to the correct units to be implemented in the LGGIT.

Using the location-based method, the LGGIT uses the Emissions & Generation Resource Integrated Database (eGRID) regions to calculate the electricity emissions. The eGRID system categorizes areas based on their electric power grids and related environmental attributes. By associating each county with a specific eGRID subregion, the LGGIT can incorporate regional differences in power generation and distribution, which is vital for accurate and location-specific analysis. However, many counties are within two different eGRID regions and therefore, a blend of the different eGRID regions was performed. The following table represents the percentage of the county in each eGRID region. The percent in each grid was performed using GIS.

Table 6. eGRID Coverage per County

County	% Area served by RFCE eGRID subregion	% Area served by RFCW eGRID subregion
Allegheny	12%	88%
Armstrong	93%	7%
Beaver	1%	99%
Butler	97%	3%
Fayette	30%	70%
Greene	0%	100%
Indiana	100%	0%
Lawrence	38%	62%
Washington	0%	100%
Westmoreland	42%	58%

The percentage of area served by each subregion was multiplied by corresponding emission factors and added together to create a blended emissions factor. The electricity usage was calculated within LGGIT using the blended emission factors.

Assumptions:

- SLOPE data projects the electricity usage in 2020.
- Electricity generation created in SPC region but not used in the SPC region is not included within the SLOPE data.
- No renewable energy / REC assumed, outside of what is assumed within the eGRID emission factors.

3.4 Local Inventory of Stationary Source GHG Emissions

Large emitting stationary sources were identified to be included in the GHG inventory such as mining, large manufacturing, chemical plants and other large, permitted facilities. The data was obtained from the 2020 NEI. The NEI compiles greenhouse gas emissions data from various large facilities, transportation, infrastructure, and agriculture. For stationary sources, only source that are considered point sources were included. Further precaution was taken to avoid double-counting emissions already considered in the electricity and natural gas combustion data from SLOPE and landfill emission emissions computed in the solid waste emissions. Therefore, North American Industrial Classification System (NAICS) codes indicating combustion related to electric power for grid electricity and landfill combustion were excluded from the data.

The EPA's FLIGHT database provided supplementary information on emissions of facilities not captured by NEI. The FLIGHT data also includes a more comprehensive list of greenhouse gas pollutants, such as PFCs, SF_6, and hydrofluorocarbons from large facilities not covered by NEI. Upon comparing the FLIGHT facility data against the NEI data, 26 additional sites were incorporated into the GHG inventory from FLIGHT. The FLIGHT data uses IPCC AR4 GWPs, therefore, CO_2, CH_4, N_2O and SF_6 emissions were recalculated using IPCC AR5 GWPs. However, due to insufficient information regarding the specific types of PFCs emitted, their emissions could not be recalculated using AR5 GWPs and were retained in AR4 GWPs for reporting metric tons of CO_2e.

The SLOPE dataset provides estimates of natural gas usage across residential sector. These data, properly formatted with the correct units, were incorporated into the LGGIT to calculate emissions stemming from natural gas usage. The following equation was used to calculate the SLOPE data into *mcf* to be input into the LGGIT tool:

$$1{,}000 \text{ MMBTU natural gas} \times 0.9643 = 964.3 \text{ mcf}$$

In the GHG inventory compilation process, we compared the NEI Wagon Wheel natural gas usage data, FLIGHT and the SLOPE natural gas data to evaluate their representation of natural gas consumption in the SPC region. The analysis identified shortcomings from all NEI, FLIGHT, and SLOPE data. When comparing the SLOPE data against the NEI and FLIGHT data, we determine that the SLOPE data underestimated natural gas usage in the region, particularly industrial and commercial sectors. On the other hand, the NEI and FLIGHT data did not account for residential and other smaller natural gas combustion, including activities like heating and cooking. Approximately 50% of households in Pennsylvania rely on natural gas for heating (Pennsylvania Profile (eia.gov)).

To address these shortcomings from each data source, we augmented SLOPE natural gas data for the residential GHG inventory and summed all the natural gas usage from SLOPE, NEI, and FLIGHT data to account for the commercial and industrial sector. By utilizing SLOPE, NEI and FLIGHT emissions data, we aim to encompass the full spectrum of natural gas usage within the area, ensuring comprehensive coverage of emissions from heating and other relevant activities.

All emissions data obtained were converted from short tons of CO_2, CH_4, N_2O, PFCs, and SF_6 to $MTCO_2e$. These aggregated emissions were entered into the "Additional Emission Sources" tab within LGGIT, with appropriate sector designations assigned.

Assumptions:

- NEI and FLIGHT data includes all large point source emitters.
- SLOPE data projects natural gas usage in 2020 for residential, commercial/institutional, and industrial sectors. The NEI and FLIGHT natural gas usage data for large sources were added to the SLOPE natural gas usage data for the commercial/institutional, and industrial sectors.
- There may be possible double counting of natural gas related GHG emissions if SLOPE data were reported within NEI and/or FLIGHT.
- Calculations were reported correctly from each facility in NEI and FLIGHT.
- Fuel oil/propane used for heating in residential and smaller commercial industrial facilities is not included.
- IPCC AR4 GWP for PFCs are used instead of AR5

3.5 Local Inventory of Solid Waste GHG Emissions

Landfills are significant sources of greenhouse gases, particularly methane, resulting from the anaerobic decomposition of organic waste. When municipal solid waste (MSW) is deposited in landfills, methane-producing bacteria break down the waste, emitting methane in the process.

Public data on landfill emissions was collected from the EPA's Landfill Methane Outreach Program (LMOP), which monitors landfill gas (LFG) energy projects and MSW landfills across the United States. The LMOP Database contains information on 36 MSW landfills in the SPC Region and their associated projects, including those in various stages such as planning, construction, operational, and shutdown.

The LMOP Database provides state-specific Excel files detailing landfill and project information, including counts of operational projects, candidate landfills, and all landfills by state, as of July 2023. For landfills equipped with LFG collection systems, data was entered into the LGGIT tool under the assumption that LFG capture was comprehensive.

While several landfills in the LMOP Database were closed, only those with available data on the amount of waste disposed were included in the emissions calculation. For these closed landfills, emissions were estimated using the California Air Resources Board (CARB) Landfill Emissions Tools. It is important to note that closed landfills without recorded data were excluded from the inventory analysis. Additionally, for landfills without recorded opening dates, it was assumed that all waste was placed in the closing year.

The LMOP data base was crossed reference with the NEI emissions from landfills. It was found that one landfill was not accounted for with the LMOP database. That landfill was added into the inventory using

the emissions calculated with the NEI database. Prior to integration into the LGGIT model, the NEI emissions were converted to Metric Tons of Carbon Dioxide Equivalence ($MTCO_2e$).

Assumptions:

- Closed landfills without data in the LMOP database were not included.
- Closed landfills with only a closed date, all waste placed was assumed to be on the closed year.
- Open landfills with the LFG collection system are assumed to be comprehensive.
- NEI calculations are correct.

3.6 Local Inventory of Wastewater Treatment

Wastewater emissions were determined using the LGGIT methodology. In 2019, SPC conducted a survey to collect data from local wastewater treatment plants, including details about their treatment plans. However, the response rate varied across counties, with some providing ample data while others did not fully participate. To ensure comprehensive coverage of the entire SPC region, the total population of each county was incorporated into the wastewater GHG emission calculation.

The collected survey data was then integrated into the LGGIT framework to calculate CH_4 and N_2O emissions. The LGGIT model estimates emissions based on the total population served by each treatment process, attributing CH_4 emissions to anaerobic, aerobic, and septic systems, while N_2O emissions arise from nitrification/denitrification processes. The total population of each county was categorized based on survey data and expert input.

Methane Emissions:

- Population served by Aerobic Treatment Facilities
- Population served by Anaerobic Treatment Facilities
- Population served by Septic Systems

Nitrous Oxide Emissions:

- Population served by facilities with Nitrification/Denitrification
- Population served by facilities without Nitrification/Denitrification

Site-specific data was not incorporated into the LLGIT, and therefore, the total nitrogen load is not included. The amount of people served by septic systems in the SPC jurisdiction is unknown at the time of the PCAP. Referencing a Center for Rural Pennsylvania study completed in 2008, *An Examination of Failing Private Septic Systems in Pennsylvania*, it is estimated that 25% of the population in Pennsylvania uses septic systems. Therefore, for each county an estimated 25% of the population is assumed to use septic systems.

Assumptions:

- 25% of the population on each county is on septic systems.
- Industrial nitrogen load was not included.
- Anaerobic vs aerobic was based on survey data on “Treatment type”.
- The total population of each county was used, and any portion of the population that did not cover in the survey was assumed to us aerobic treatment facilities and nitrification.

3.7 Local Inventory of Agriculture and Land Management

Agriculture and land management included four main sources of GHGs, livestock enteric fermentation, livestock manure management, fertilizer use and prescribed burns.

Data on agriculture were sourced from the United States Department of Agriculture's National Agricultural Statistics Service, and respective county agriculture profiles, particularly the Census of Agriculture - 2017 Census Publications - State and County Profiles - Pennsylvania. The most recent agricultural census in 2017 was assumed to represent the year 2020 for this GHG inventory.

Emissions from fertilizer use were downscaled from state-level data to county-level data using the Guidance for County and Regional Inventories Agriculture and Land Management. State-level fertilizer consumption data were obtained from the State Inventory Tool (SIT) Agriculture Module and converted to calendar year consumption. Consumption estimates for each fertilizer type were then derived by proportionally scaling down the state-level data to the county level, considering the respective cropland acreage. The amount of fertilizer use then was input into the LGGIT to calculate the associated GHG emissions.

To address livestock-related emissions, livestock inventory data were gathered from the 2017 Census of Agriculture county profiles, assuming this data represented the year 2020. Emission factors for CH_4 and N_2O emissions from livestock were obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the State Inventory Tool (SIT) Agriculture Module.

Additionally, emissions from prescribed burns were included based on data from the 2020 National Emissions Inventory (NEI) for each county. This data was converted to Metric Tons of Carbon Dioxide Equivalence ($MTCO_2e$) and input into the LGGIT tool under the industrial sector.

Assumptions

- USDA census data was assumed to be representative of 2020.
- Statewide break down of livestock and manure management were assumed to be representative of each county's breakdown.
- Mobile sources of agricultural were included in "Other mobile sources."
- Soil management practices such as tillage practices were not included.
- Land use change was no accounted for.

3.8 Local Inventory of Urban Forestry Resources

Carbon sequestration techniques are being applied specifically to urban areas, with a focus on anthropogenic spaces found within residential, industrial, and commercial zones. This approach is tailored to account solely for human-made environments and activities, excluding untouched lands or natural ecosystems. This focused approach addresses the specific challenges and opportunities presented by urban landscapes, leveraging carbon sequestration initiatives to enhance environmental sustainability and resilience in densely populated areas.

To estimate the impact of urban forestry on greenhouse gas emissions, the 2021 National Land Cover Database (NLCD) dataset was utilized. This involved determining the percentage of tree coverage for each sector per county based on SPC's Land Use Land Cover data, categorizing sectors into residential, commercial/institutional, and industrial. Total area in square kilometers (km2) for each sector was

calculated, and the NLCD dataset was used to determine the percentage of area with tree cover. This calculation was based on NLCD classes 41, 42, and 43 (Deciduous Forest, Evergreen Forest, and Mixed Forest). Subsequently, data entry was conducted in the Local Greenhouse Gas Inventory Tool (LGGIT), where total area and weighted percent tree cover were entered for each sector on the "Urban Forestry" worksheet. LGGIT uses a factor of 2.23 metric ton C/hectare/year value.

Other carbon sequestration of natural sources was not included in the inventory. Things like grass lands, marshes, carbon mineralization reactions, fungi, soils, and crops. The agricultural sector only accounts for emitted GHG from large sources and does not account for any offset due to carbon sequestration of crops.

Assumptions:

- Only anthropogenic land use was included. Those sectors included commercial, residential, and industrial.

3.9 Quality Control

As part of the quality control measures, a thorough statistical analysis was conducted to ensure the accuracy and reliability of the emissions data. The emissions analysis methodology employed across counties and categories involved several steps aimed at facilitating precise comparisons and identifying outliers. Emissions from each county and category were normalized per capita, per land area, and per Gross Domestic Product (GDP) per capita, respectively (table 7). Following normalization, a *z*-score was calculated for each emission subcategory as illustrated in Table 8, utilizing the mean emissions across the category and sample standard deviation. The *z*-score was calculated based on the following formula:

$$Z\ score = \frac{x - \bar{x}}{\sigma}$$

Where

$$x = normalized\ emissions\ per\ capita, per\ land\ area\ or\ per\ GDP\ per\ capita$$

$$\bar{x} = sample\ mean\ of\ the\ normalized\ emission$$

$$\bar{\sigma} = sample\ standard\ deviation\ of\ the\ normalized\ emission$$

Table 7. Population, Area and GDP per County

County	2020 Census Population [a]	Area [b]	GDP [c]
		km²	Thousands of 2020 US Dollars
Allegheny	1,250,578	1,891	103,265,012
Armstrong	65,558	1,715	2,132,535
Beaver	168,215	1,162	7,340,302
Butler	193,763	2,056	10,634,063
Fayette	128,804	2,069	4,384,933
Greene	35,954	1,509	2,507,437
Indiana	83,246	2,218	3,848,966
Lawrence	86,070	937	3,303,582
Washington	209,349	2,243	12,324,629
Westmoreland	354,663	2,680	14,910,190

[a] From 2020 Census April 2020
[b] From SPC Land Use Land Cover Data
[c] from BEA (BEA Interactive Data Application)
[d] from Pennsylvania Greenhouse Gas Inventory Report 2023

Categories with a *z*-score greater than 2 or less than -2 were considered potential outliers and were subjected to further investigation.

Other quality control measure included conducting expert interviews, visualization of data, and inventory comparison to the Pennsylvania emission inventory. These steps helped identify potential gaps and ensure comprehensive coverage of significant emissions sources. The 2023 Pennsylvania GHG inventory can be found online: GHG Inventory (pa.gov).

3.10 Other Considerations

This GHG inventory focused on capturing the major emission sources within the SPC region. While most of the data was sourced from public databases, the inability to verify some of this data underscores challenges regarding the accuracy and reliability. Any inaccuracies or omissions in the data could not be rectified due to the lack of validation mechanisms. Additionally, it's important to note that the inventory may not fully account for emissions from land use changes, as well as smaller sources such as heating oil or propane used in homes, which were not adequately captured. These factors underscore the complexity and challenges inherent in compiling comprehensive GHG inventories, emphasizing the need for robust data verification processes and consideration of all relevant emission sources. These considerations will be considered for the Comprehensive Climate Action Plan and moving forward with future inventories.

4 Results Discussion

SPC has developed their inaugural inventory to identify the primary GHG sources in the area, relying on predominantly publicly available data supplemented by internally-collected data. EPA's Local Greenhouse Gas Inventory Tool (LGGIT) was used to analyze and organize the data. SPC opted for 2020 as the base emission inventory year due to the most comprehensive dataset.

It's important to acknowledge the significant impact of the COVID-19 pandemic in the year 2020, which resulted in widespread disruptions to human activities globally. This unprecedented event may have influenced the data captured in this greenhouse gas inventory, reflecting changes in emissions patterns due to shifts in economic activities, transportation, and energy usage. Regardless, the inventory may still provide valuable insights into the regions GHG emissions.

The GHG inventory covers the largest sources of GHG in the area including six categories: transportation, agriculture, wastewater, solid waste, stationary sources, and electric power consumption. To encompass the net total, SPC has complied data on CO_2 sequestrations from urban trees. The analysis focused on large emitting sources of CO_2, CH_4, and N_2O. Other gases that were included from stationary sources were SF_6 and PFCs. All gases (but PFCs) were calculated to metric tons of CO_2e using the Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report (AR5) for comparison. For PFCs, the IPCC's Fourth Assessment Report (AR4) was used. More information may be found in the Methodology section.

In 2020, the SPC region generated approximately 53.5 million metric tons of CO_2e. Urban trees sequestered for a total of 1,170,000 metric tons, making a net total for the SPC area 52.3 million metric tons of CO_2e.

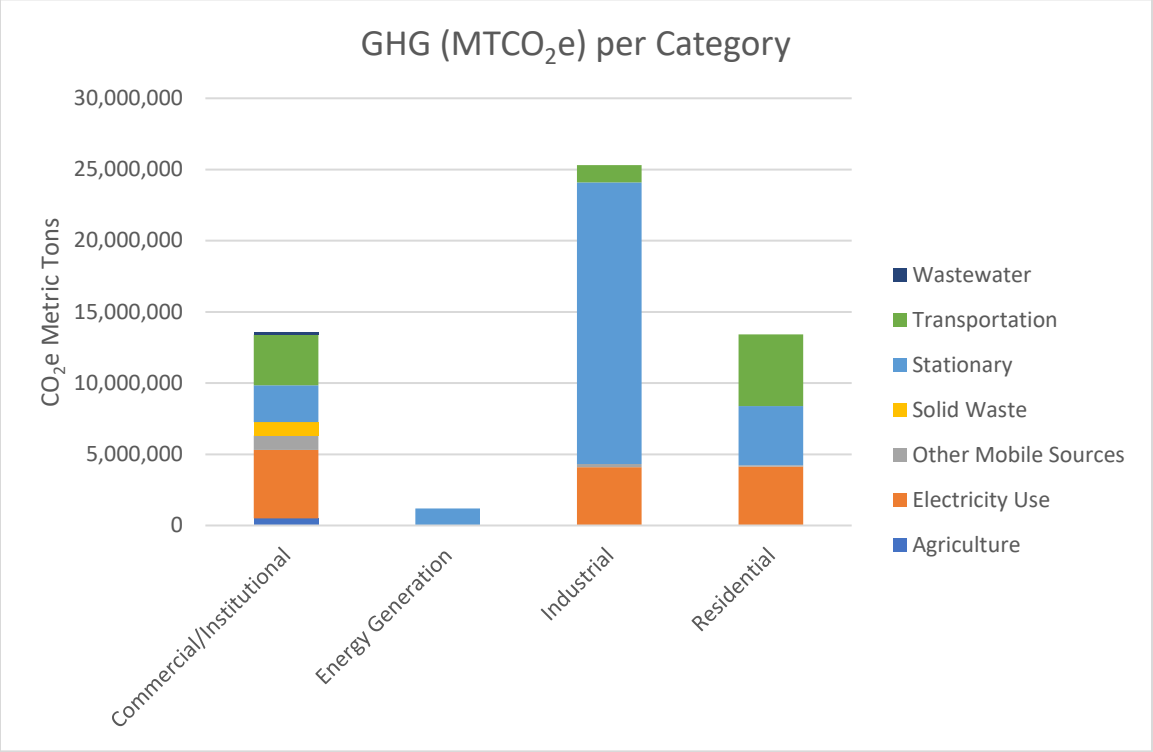
4.1 Greenhous Gas Emissions

4.1.1 Sector Results

The GHG inventory was divided into four sectors following the LGGIT model: residential, commercial/institutional, industrial, and energy generation. In this analysis, the classification of grid electricity use within the residential, commercial/institutional, and industrial sectors was determined by electricity usage. Any other fuel combustion and fugitive emissions associated with energy generation, excluding combustion for grid electricity, were categorized under energy generation. This classification aims to represent potential efficiencies utilized within these sectors.

The industrial sector accounted for the highest proportion of GHG emissions, constituting 47% of the total emitted emissions, followed by commercial/institutional at 25% and residential at 25%. Figure 1 illustrates the sectors color-coded by their respective GHG emission categories. Electricity use was included in the residential, commercial/institutional, and industrial sectors. Therefore, emissions from grid electricity were not included in the energy generation. The energy generation sector accounts for emissions from oil and natural gas extraction that may be used for electricity but does not account for the power plant itself. Energy Generation accounted for 2% of the total emitted emissions.

Figure 1. Greenhouse Gas ($MTCO_2e$) per Sector



4.1.2 Category Results

The breakdown of emissions into categories aimed to provide a comprehensive representation of emissions resulting from various activities and sectors within the region. Table 1 and Figure 2 display

these categories. This breakdown allows for a more detailed understanding of the sources contributing to greenhouse gas emissions and enables targeted mitigation strategies tailored to each category.

Figure 2. Greenhouse Gas ($MTCO_2e$) per Category

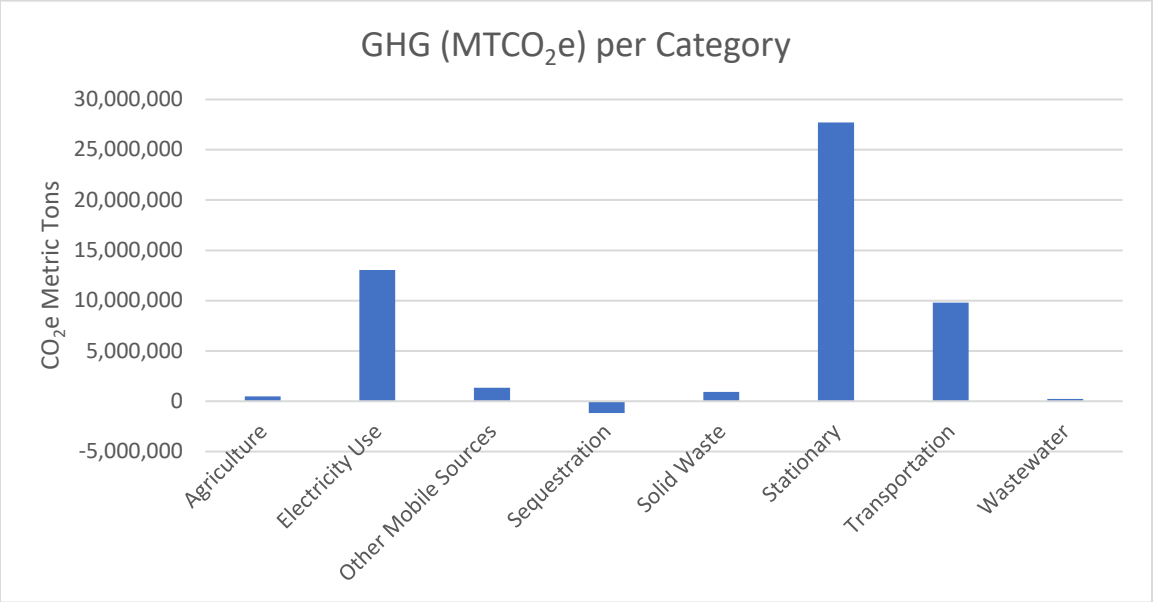


Table 8. Greenhouse Gas (MTCO2e) total emissions in SPC region per category. All emissions reported in Metric Tons of CO_2e.

Category	Sum of CO_2	Sum of CH_4	Sum of N_2O	Sum of PFCs	Sum of SF_6	Sum of Total (CO_2e)
Agriculture	**183,792**	**288,931**	**19,671**			**492,394**
Enteric Fermentation		234,479				234,479
Fertilizer Application	123,800	10				123,811
Manure Management		48,353	19,671			68,024
Prescribed Burns	59,991	6,089				66,080
Electricity Use	**12,976,485**	**30,435**	**39,908**			**13,046,828**
Electricity - Slope	12,976,485	30,435	39,908			13,046,828
Other Mobile Sources	**1,318,655**	**8,902**				**1,327,556**
Commercial Nonroad	369,711	5,027				374,738
Construction Nonroad	632,107	585				632,692
Industrial Nonroad	226,030	1,092				227,122
Residential Nonroad	90,807	2,197				93,004
Solid Waste	**127**	**940,014**	**19**			**940,160**
Landfill - Closed		40,780				40,780
Landfill - LFG		891,669				891,669
Landfill- NEI	127	7,565	19			7,711
Stationary	**18,221,015**	**9,416,551**	**9,276**	**131**	**57,136**	**27,704,109**
Commercial/Institutional Point	409,180	269	625			410,073
Energy Generation Point	1,042,485	149,597	519			1,192,600
Industrial Point	6,481,872	9,241,095	2,980	131	57,136	15,783,214

Category	Sum of CO_2	Sum of CH_4	Sum of N_2O	Sum of PFCs	Sum of SF_6	Sum of Total (CO_2e)
Natural Gas - Commercial/ Institutional	2,170,720	5,400	1,087			2,177,207
Natural Gas - Industrial	3,969,753	9,875	1,988			3,981,617
Natural Gas - Residential	4,147,005	10,316	2,077			4,159,398
Transportation	**9,716,766**	**20,851**	**56,643**			**9,794,260**
Aviation	237,610	283	1,064			238,957
Marine	71,383	860				72,243
Onroad	9,113,963	19,060	53,598			9,186,621
Railroad	293,810	648	1,981			296,439
Wastewater		**185,175**	**28,550**			**213,725**
Total		185,175	28,550			213,725
Emitted Total	**42,416,839**	**10,890,859**	**154,069**	**131**	**57,136**	**53,519,033**
Sequestration	**-1,170,559**					**-1,170,559**
Urban Forestry	-1,170,559					-1,170,559
Net Total	**41,246,279**	**10,890,859**	**154,069**	**131**	**57,136**	**52,348,473**

4.1.2.1 Transportation

Transportation was the third largest source and accounted for 18% of the total emitted emissions. Transportation was composed of four different subcategories, including aviation, marine, on-road and railroad. On-road includes light duty vehicles, light duty trucks, heavy duty trucks and long haulers. Aviation included landing and takes off in airports within SPC region. The fuel type used for all on-road vehicles includes Compressed Natural Gas (CNG), Diesel, Ethanol (E-85) and Gasoline.

Figure 3. Transportation Electricity Greenhouse Gas ($MTCO_2e$)

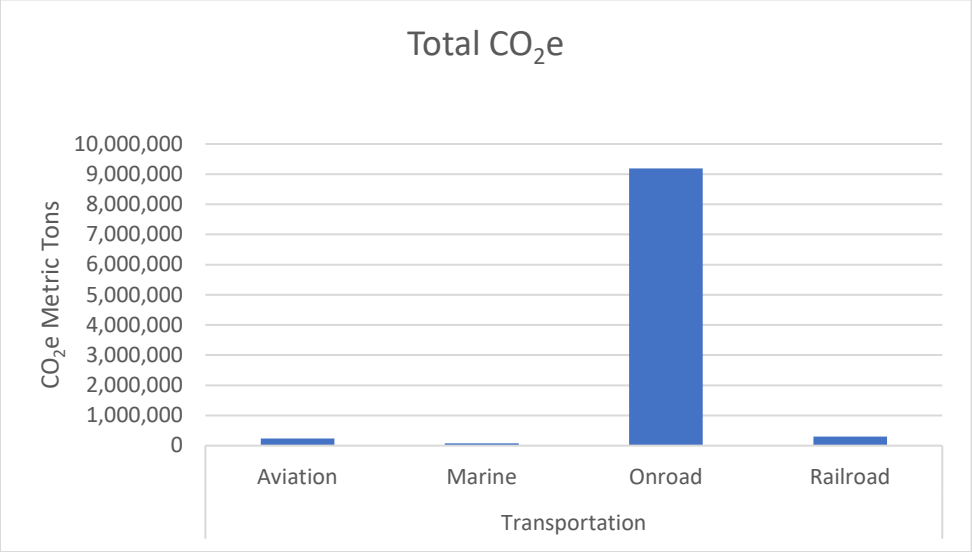


Table 9. Transportation Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)				
	Transportation			
County	Aviation	Marine	Onroad	Railroad
Allegheny	176,163	22,425	3,474,674	82,402
Armstrong	272	5,766	253,292	3,080
Beaver	11,393	14,243	547,825	49,326
Butler	11,203	3,400	859,973	4,147
Fayette	4,994	8,073	482,429	27,727
Greene	1,196	2,077	277,205	11,595
Indiana	3,237	2,550	343,383	13,646
Lawrence	3,942	1,275	341,161	14,562
Washington	11,297	3,934	1,118,020	16,554
Westmoreland	15,259	8,500	1,488,659	73,400
Total	**238,957**	**72,243**	**9,186,621**	**296,439**

4.1.2.2 Electricity Use

Electricity use was second highest emitted, accounting for 24% of the total emitted GHG emissions. The electricity was based on SLOPE data and is a representative of projected electricity usage for the area.

Figure 4. Electricity Usage Greenhouse Gas ($MTCO_2e$)

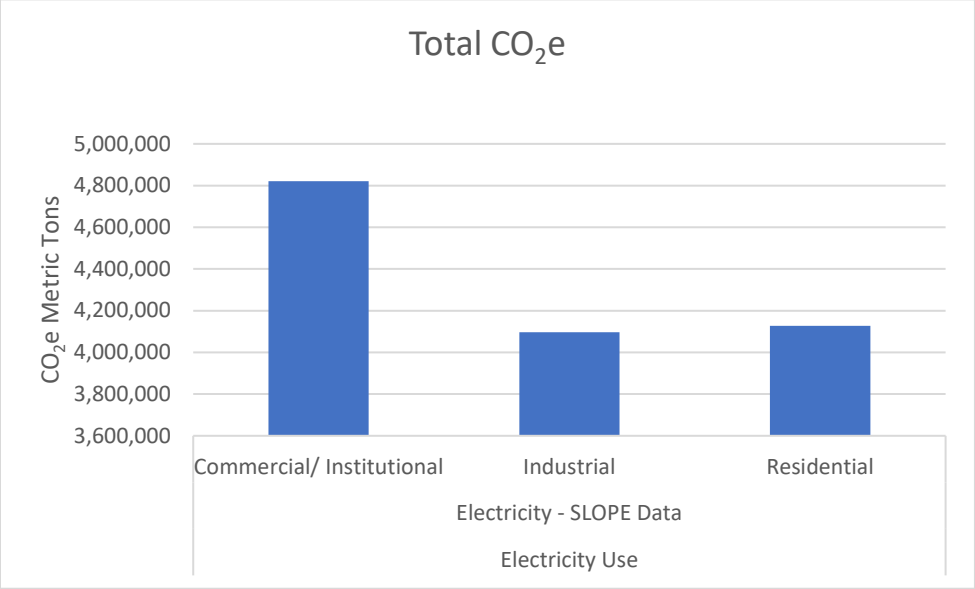


Table 10. Electricity Use Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)	
Category	**Electricity Use**
County	**Electricity - Slope**
Allegheny	6,039,067
Armstrong	475,955
Beaver	906,786
Butler	877,960
Fayette	521,886
Greene	329,583
Indiana	423,995
Lawrence	454,420
Washington	1,526,061
Westmoreland	1,491,114
Total	**13,046,828**

4.1.2.3 Stationary Sources

Stationary sources was the largest category and accounted for 52% of the total emitted emissions. Stationary sources include large point sources and natural gas consumption within the residential, industrial, and commercial sectors. The natural gas projections include residential and commercial heating. The largest section was stationary sources from point sources for the industrial sector. Table 11 summarize the total stationary greenhouse gas emissions for each county. Table 12-22 presents the emissions based on the North American Industrial Classification System (NAICS) codes for the entire SPC region and for each county.

Table 11. Stationary Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)						
Category	**Stationary**					
County	**Commercial/ Institutional Point**	**Energy Generation Point**	**Industrial Point**	**Natural Gas - Commercial/ Institutional**	**Natural Gas - Industrial**	**Natural Gas - Residential**
Allegheny	241,978	17,868	5,091,756	1,522,168	1,057,298	2,460,445
Armstrong	0	53,213	200	35,922	210,307	99,431
Beaver	67,617	903	302,338	48,187	258,238	236,298
Butler	10,586	309,291	507,065	37,190	875,026	264,782
Fayette	10,290	17,589	6,403	77,548	61,027	121,143
Greene	0	252,334	6,370,218	17,728	157,780	38,647
Indiana	19,301	71,800	446,332	22,914	309,226	85,667
Lawrence	24,986	0	146,699	84,974	113,117	95,807
Washington	3,628	376,673	2,567,193	191,016	701,269	275,722
Westmoreland	31,688	92,930	345,010	139,560	238,328	481,455
Total	**410,073**	**1,192,600**	**15,783,214**	**2,177,207**	**3,981,617**	**4,159,398**

Figure 5. Stationary Greenhouse Gas ($MTCO_2e$)

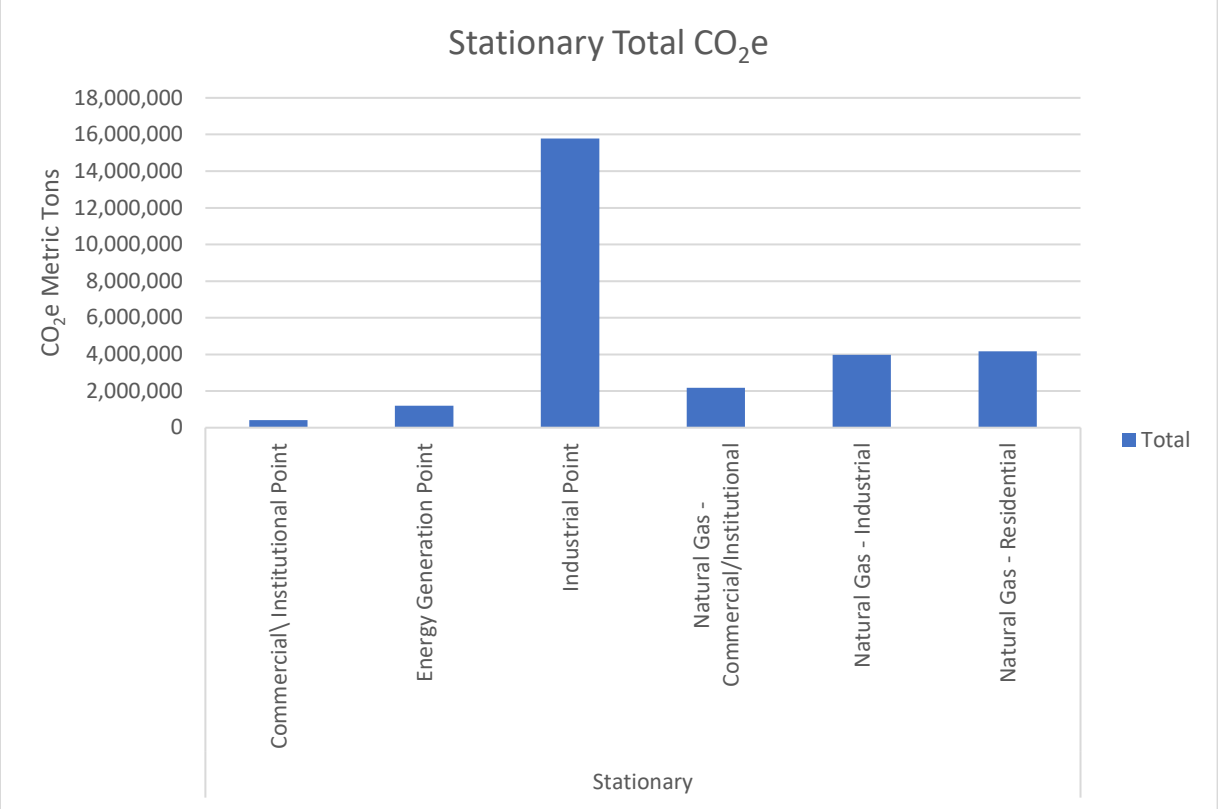


Table 12. SPC Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**410,073**
Administrative Management and General Management Consulting Services	6,047
All Other Pipeline Transportation	272
Breweries	5,854
Colleges, Universities, and Professional Schools	107,605
Commercial Printing (except Screen and Books)	2,453
Dry, Condensed, and Evaporated Dairy Product Manufacturing	24,115
General Medical and Surgical Hospitals	79,791
Hazardous Waste Treatment and Disposal	1,368
Industrial Launderers	1,557
Other Services Related to Advertising	590
Other Support Activities for Road Transportation	1
Petroleum Bulk Stations and Terminals	5,060
Pipeline Transportation of Refined Petroleum Products	921
Psychiatric and Substance Abuse Hospitals	6,885
Recyclable Material Merchant Wholesalers	194
Specialty (except Psychiatric and Substance Abuse) Hospitals	5,464

NAICS	Emissions ($MTCO_2e$)
Steam and Air-Conditioning Supply	125,788
Support Activities for Rail Transportation	25,262
Testing Laboratories and Services	10,833
Wired Telecommunications Carriers	13
Energy Generation	**1,192,600**
Natural Gas Distribution	12,687
Natural Gas Extraction	315,771
Natural gas transmission	105,039
Nuclear Electric Power Generation	523
Petroleum Bulk Stations and Terminals	25,481
Pipeline Transportation of Crude Oil	29,762
Pipeline Transportation of Natural Gas	331,665
Support Activities for Oil and Gas Operations	371,673
Industrial	**15,783,083**
Air and Gas Compressor Manufacturing	16,130
All Other Basic Organic Chemical Manufacturing	2,915
All Other Miscellaneous Chemical Product and Preparation Manufacturing	3,203
All Other Miscellaneous General Purpose Machinery Manufacturing	2,979
All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	2,278
All Other Petroleum and Coal Products Manufacturing	153,293
All Other Plastics Product Manufacturing	923
All Other Rubber Product Manufacturing	1,988
Anthracite Mining	1,819,640
Asphalt Paving Mixture and Block Manufacturing	42,104
Cement Manufacturing	183,929
Clay Building Material and Refractories Manufacturing	12,673
Commercial and Service Industry Machinery Manufacturing	39,873
Copper Rolling, Drawing, Extruding, and Alloying	21,884
Crushed and Broken Limestone Mining and Quarrying	768
Cutting Tool and Machine Tool Accessory Manufacturing	180
Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	1
Drilling Oil and Gas Wells	2,385
Elevator and Moving Stairway Manufacturing	31,417
Gypsum Product Manufacturing	130,657
Industrial Mold Manufacturing	46
Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	11,362
Iron and Steel Forging	81,385
Iron and Steel Mills and Ferroalloy Manufacturing	5,123,361
Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	11,823
Iron Foundries	4,137
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	38,280
Metal Window and Door Manufacturing	5,799

NAICS	Emissions ($MTCO_2e$)
Natural Gas Distribution	9,240
Office Supplies (except Paper) Manufacturing	4,344
Ornamental and Architectural Metal Work Manufacturing	9,776
Other Basic Inorganic Chemical Manufacturing	11,035
Other Chemical and Allied Products Merchant Wholesalers	30,039
Other Millwork (including Flooring)	7,481
Other Miscellaneous Durable Goods Merchant Wholesalers	59,297
Other Nonferrous Metal Foundries (except Die-Casting)	759
Other Pressed and Blown Glass and Glassware Manufacturing	67,648
Paint and Coating Manufacturing	13,622
Plastics Material and Resin Manufacturing	76,909
Polystyrene Foam Product Manufacturing	987
Primary Metal Manufacturing	160,930
Rolled Steel Shape Manufacturing	70,189
Secondary Smelting and Alloying of Aluminum	51,503
Steel Foundries (except Investment)	12,112
Surface Coal Mining	148,188
Tire Manufacturing (except Retreading)	7,789
Turbine and Turbine Generator Set Units Manufacturing	14,525
Underground Coal Mining	7,267,534
Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	6,874
Unlaminated Plastics Profile Shape Manufacturing	5,583
Urethane and Other Foam Product (except Polystyrene) Manufacturing	1,109
Wood Kitchen Cabinet and Countertop Manufacturing	200
Grand Total	**17,385,757**

Table 13. Allegheny Stationary Point Sources Greenhouse Gas (MTCO2e) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**241,978**
Administrative Management and General Management Consulting Services	6,047
Colleges, Universities, and Professional Schools	74,424
Commercial Printing (except Screen and Books)	37
General Medical and Surgical Hospitals	28,839
Petroleum Bulk Stations and Terminals	4,863
Pipeline Transportation of Refined Petroleum Products	921
Recyclable Material Merchant Wholesalers	194
Specialty (except Psychiatric and Substance Abuse) Hospitals	5,464
Steam and Air-Conditioning Supply	120,366
Support Activities for Rail Transportation	810
Wired Telecommunications Carriers	13
Energy Generation	**17,868**
Natural Gas Distribution	7,959

NAICS	Emissions ($MTCO_2e$)
Pipeline Transportation of Natural Gas	9,908
Industrial	**5,091,756**
All Other Basic Organic Chemical Manufacturing	2,915
All Other Miscellaneous General Purpose Machinery Manufacturing	2,979
Asphalt Paving Mixture and Block Manufacturing	18,807
Clay Building Material and Refractories Manufacturing	8,581
Copper Rolling, Drawing, Extruding, and Alloying	21,884
Elevator and Moving Stairway Manufacturing	31,417
Iron and Steel Forging	25,920
Iron and Steel Mills and Ferroalloy Manufacturing	4,736,414
Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	<1
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	37,767
Other Basic Inorganic Chemical Manufacturing	3,438
Other Chemical and Allied Products Merchant Wholesalers	30,039
Other Nonferrous Metal Foundries (except Die-Casting)	759
Paint and Coating Manufacturing	12,048
Plastics Material and Resin Manufacturing	30,918
Primary Metal Manufacturing	120,281
Secondary Smelting and Alloying of Aluminum	1,769
Steel Foundries (except Investment)	5,819
Grand Total	**5,351,602**

Table 14. Armstrong Stationary Point Sources Greenhouse Gas (MTCO2e) per NAICS

NAICS	Emissions ($MTCO_2e$)
Energy Generation	**53,213**
Natural Gas Distribution	2,414
Pipeline Transportation of Natural Gas	50,799
Industrial	**200**
Wood Kitchen Cabinet and Countertop Manufacturing	200
Grand Total	**53,413**

Table 15. Beaver Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**67,617**
General Medical and Surgical Hospitals	43,537
General Warehousing and Storage	<1
Hazardous Waste Treatment and Disposal	1,368
Other Support Activities for Road Transportation	1
Support Activities for Rail Transportation	22,710
Energy Generation	**903**
Nuclear Electric Power Generation	523

NAICS	Emissions ($MTCO_2e$)
Pipeline Transportation of Natural Gas	380
Industrial	**302,338**
All Other Miscellaneous Chemical Product and Preparation Manufacturing	3,203
Asphalt Paving Mixture and Block Manufacturing	4,716
Commercial and Service Industry Machinery Manufacturing	39,873
Gypsum Product Manufacturing	130,657
Iron and Steel Mills and Ferroalloy Manufacturing	26,568
Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	11,457
Other Pressed and Blown Glass and Glassware Manufacturing	39,873
Plastics Material and Resin Manufacturing	45,991
Grand Total	**370,858**

Table 16. Butler Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**10,586**
Colleges, Universities, and Professional Schools	10,213
Commercial Printing (except Screen and Books)	374
Energy Generation	**309,291**
Natural Gas Extraction	139,792
Support Activities for Oil and Gas Operations	169,499
Industrial	**507,065**
All Other Petroleum and Coal Products Manufacturing	90,883
All Other Plastics Product Manufacturing	782
Asphalt Paving Mixture and Block Manufacturing	5,551
Cement Manufacturing	183,929
Clay Building Material and Refractories Manufacturing	924
Cutting Tool and Machine Tool Accessory Manufacturing	180
Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	1
Iron and Steel Mills and Ferroalloy Manufacturing	209,240
Metal Window and Door Manufacturing	5,799
Ornamental and Architectural Metal Work Manufacturing	9,776
Grand Total	**826,942**

Table 17. Fayette Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**10,290**
General Medical and Surgical Hospitals	4,059
Steam and Air-Conditioning Supply	5,360
Support Activities for Rail Transportation	871
Energy Generation	**17,589**
Pipeline Transportation of Natural Gas	17,589
Industrial	**6,403**
Asphalt Paving Mixture and Block Manufacturing	4
Crushed and Broken Limestone Mining and Quarrying	629
Polystyrene Foam Product Manufacturing	970
Unlaminated Plastics Profile Shape Manufacturing	4,799
Grand Total	**34,282**

Table 18. Greene Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Energy Generation	**252,334**
Natural Gas Extraction	4,806
Natural gas transmission	105,039
Petroleum Bulk Stations and Terminals	25,481
Pipeline Transportation of Natural Gas	117,009
Industrial	**6,370,218**
Anthracite Mining	1,819,640
Surface Coal Mining	148,188
Underground Coal Mining	4,402,390
Grand Total	**6,622,552**

Table 19. Indiana Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**19,301**
Colleges, Universities, and Professional Schools	17,258
Commercial Printing (except Screen and Books)	2,042
Energy Generation	**71,800**
Pipeline Transportation of Crude Oil	29,762
Pipeline Transportation of Natural Gas	42,038
Industrial	**446,332**
All Other Plastics Product Manufacturing	141
Tire Manufacturing (except Retreading)	7,789
Underground Coal Mining	438,402
Grand Total	**537,432**

Table 20. Lawrence Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**24,986**
Dry, Condensed, and Evaporated Dairy Product Manufacturing	24,115
Support Activities for Rail Transportation	871
Industrial	**146,699**
Asphalt Paving Mixture and Block Manufacturing	5,888
Clay Building Material and Refractories Manufacturing	3,168
Iron and Steel Forging	55,465
Iron and Steel Mills and Ferroalloy Manufacturing	32,445
Secondary Smelting and Alloying of Aluminum	49,734
Grand Total	**171,685**

Table 21. Washington Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**3,628**
All Other Pipeline Transportation	272
General Medical and Surgical Hospitals	3,356
Energy Generation	**376,673**
Natural Gas Distribution	2,314
Natural Gas Extraction	171,172
Pipeline Transportation of Natural Gas	1,012
Support Activities for Oil and Gas Operations	202,174
Industrial	**2,567,062**
All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	2,278
Asphalt Paving Mixture and Block Manufacturing	5,009
Drilling Oil and Gas Wells	2,385
Iron and Steel Mills and Ferroalloy Manufacturing	41,972
Natural Gas Distribution	9,240
Other Basic Inorganic Chemical Manufacturing	7,598
Other Pressed and Blown Glass and Glassware Manufacturing	27,775
Rolled Steel Shape Manufacturing	29,540
Turbine and Turbine Generator Set Units Manufacturing	14,525
Underground Coal Mining	2,426,742
Grand Total	**2,947,363**

Table 22. Westmoreland Stationary Point Sources Greenhouse Gas ($MTCO_2e$) per NAICS

NAICS	Emissions ($MTCO_2e$)
Commercial/Institutional	**31,688**
Breweries	5,854
Colleges, Universities, and Professional Schools	5,710
Industrial Launderers	1,557

NAICS	Emissions ($MTCO_2e$)
Other Services Related to Advertising	590
Petroleum Bulk Stations and Terminals	197
Psychiatric and Substance Abuse Hospitals	6,885
Steam and Air-Conditioning Supply	61
Testing Laboratories and Services	10,833
Energy Generation	**92,930**
Pipeline Transportation of Natural Gas	92,930
Industrial	**345,010**
Air and Gas Compressor Manufacturing	16,130
All Other Petroleum and Coal Products Manufacturing	62,410
All Other Rubber Product Manufacturing	1,988
Asphalt Paving Mixture and Block Manufacturing	2,129
Crushed and Broken Limestone Mining and Quarrying	138
Industrial Mold Manufacturing	46
Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	11,362
Iron and Steel Mills and Ferroalloy Manufacturing	76,722
Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	365
Iron Foundries	4,137
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	513
Office Supplies (except Paper) Manufacturing	4,344
Other Millwork (including Flooring)	7,481
Other Miscellaneous Durable Goods Merchant Wholesalers	59,297
Paint and Coating Manufacturing	1,573
Polystyrene Foam Product Manufacturing	17
Primary Metal Manufacturing	40,649
Rolled Steel Shape Manufacturing	40,649
Steel Foundries (except Investment)	6,293
Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	6,874
Unlaminated Plastics Profile Shape Manufacturing	783
Urethane and Other Foam Product (except Polystyrene) Manufacturing	1,109
Grand Total	**469,628**

4.1.2.4 Wastewater

Wastewater was about 0.4% of the total emitted GHG emissions. Emissions from wastewater included CH_4 and N_2O emissions from estimated treatment type and nitrification process. However, due to insufficient data, industrial nitrogen load was not included in the GHG inventory.

Table 23. Wastewater Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)	
Category	**Wastewater**
County	**Total**
Allegheny	94,256

GHG Emissions ($MTCO_2e$)	
Category	**Wastewater**
County	**Total**
Armstrong	4,941
Beaver	17,477
Butler	14,604
Fayette	9,708
Greene	2,710
Indiana	6,274
Lawrence	6,487
Washington	18,744
Westmoreland	38,523
Total	**213,725**

4.1.2.5 Agriculture

Agriculture accounted for 1% of the emitted GHG in the SPC area. Agriculture had three main emissions sources included in the GHG inventory: animal enteric fermentation, manure management and fertilizer use. Mobile emissions from agriculture, such as tractors, are included within "Other mobile sources". The Figure 6 represents the breakdown of emissions from each subsector.

Figure 6. Agriculture Greenhouse Gas ($MTCO_2e$)

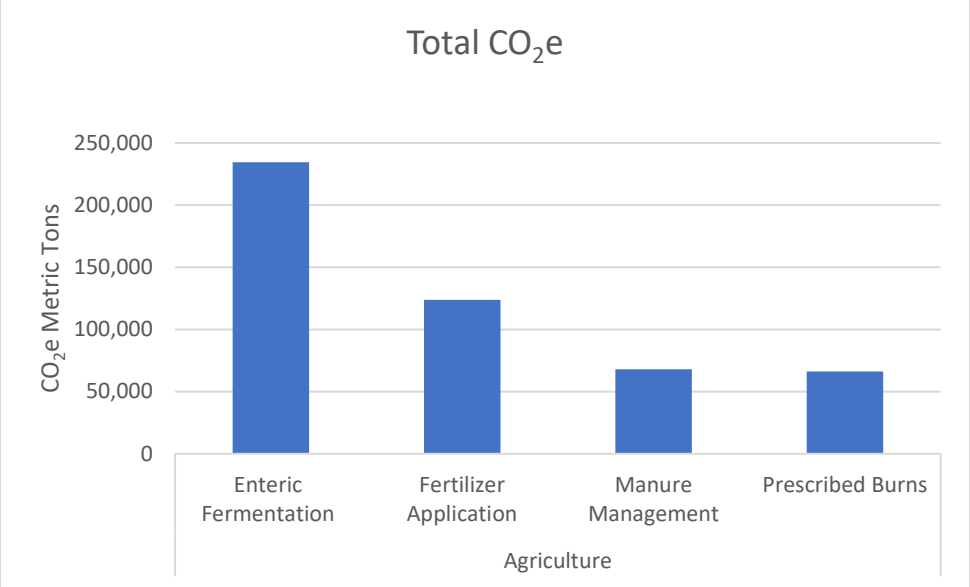


Table 24. Agriculture Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)				
Category	**Agriculture**			
County	**Enteric Fermentation**	**Fertilizer Application**	**Manure Management**	**Prescribed Burns**
Allegheny	2,965	3,015	445	3,957
Armstrong	25,450	14,322	8,174	4,500

GHG Emissions ($MTCO_2e$)				
Category	**Agriculture**			
County	**Enteric Fermentation**	**Fertilizer Application**	**Manure Management**	**Prescribed Burns**
Beaver	12,040	5,850	4,436	2,455
Butler	26,146	16,768	7,595	5,015
Fayette	24,164	11,495	6,564	16,855
Greene	16,858	7,295	3,037	10,259
Indiana	39,012	18,506	14,197	4,089
Lawrence	20,205	10,721	7,796	1,043
Washington	32,437	17,684	5,392	10,135
Westmoreland	35,202	18,155	10,389	7,773
Total	**234,479**	**123,811**	**68,024**	**66,080**

4.1.2.6 Other Mobile Sources

Other mobile source accounting for 2% of the total emitted GHG emissions. Other mobile sources include nonroad (off highway vehicle, equipment) fossil fuel engine that is not associated with transportation. These mobile sources are used for recreational, construction, industrial, agricultural, and lawn and garden, etc. All nonroad emissions sources are separated into residential, commercial/institutional, industrial off-highway vehicle, equipment, and construction uses. Construction uses are considered commercial/institutional in the LGGIT.

Figure 7. Other Mobile Sources Greenhouse Gas ($MTCO_2e$)

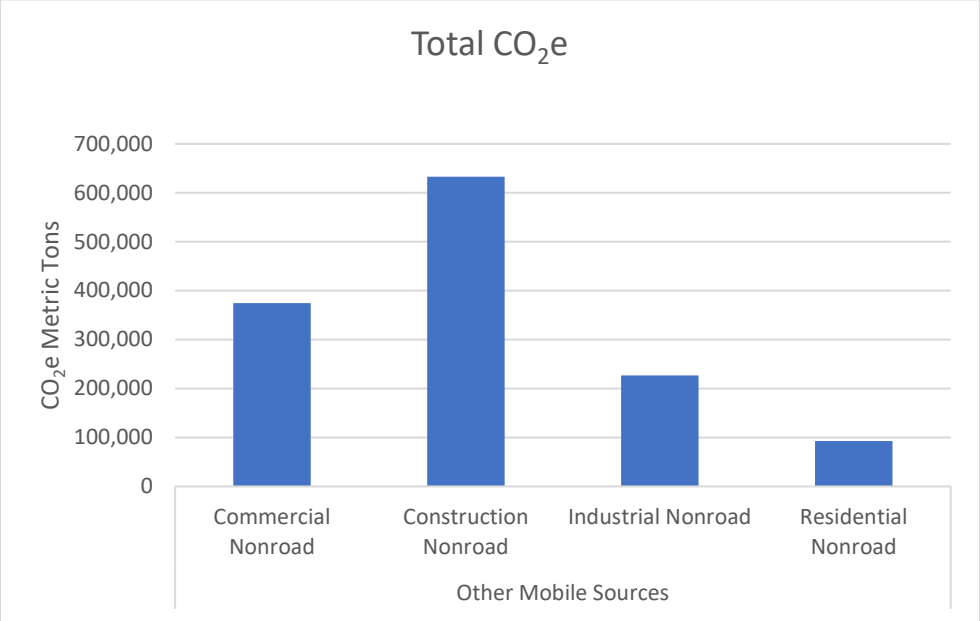


Table 25. Other Mobile Sources Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)				
Category	**Other Mobile Sources**			
County	**Commercial Nonroad**	**Construction Nonroad**	**Industrial Nonroad**	**Residential Nonroad**
Allegheny	143,143	364,907	93,341	37,623
Armstrong	13,936	2,009	5,546	3,988
Beaver	13,065	11,317	17,691	6,320
Butler	28,466	38,377	23,757	8,210
Fayette	14,263	17,689	7,641	6,547
Greene	39,221	5,965	1,604	1,087
Indiana	17,698	6,875	7,223	3,469
Lawrence	11,702	12,548	9,231	4,897
Washington	34,707	133,009	20,836	6,972
Westmoreland	58,536	39,996	40,252	13,889
Total	**374,738**	**632,692**	**227,122**	**93,004**

4.1.2.7 Solid Waste

Solid waste emissions accounting for 2% of the total emitted GHG emissions. Solid waste emissions primarily consist of CH_4. This category comprises three subcategories: landfills with landfill gas collection (LFG) systems, closed landfills, and landfill emissions sourced from NEI data. Using the LGGIT methodology detailed in Section 3.5, methane emissions were calculated for landfills participating in the EPA's Landfill Methane Outreach Program (LMOP). Emissions from landfills persist even after closure. However, due to limited data availability, only closed landfills with reported tonnage of waste deposited were included in this GHG inventory. Furthermore, large landfills are encompassed within the emissions data provided by the NEI. Therefore, any landfill not covered by the LMOP database but included in the NEI was accounted for in this analysis. For further details, please consult Section 3.5 of the methodology.

Figure 8. Solid Waste Greenhouse Gas ($MTCO_2e$)

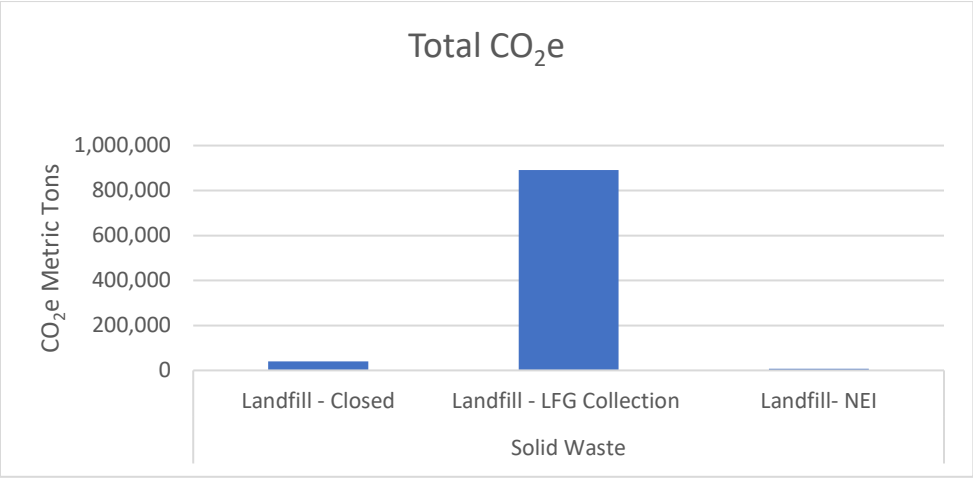


Table 26. Solid Waste Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)			
Category	**Solid Waste**		
County	**Landfill - Closed**	**Landfill - LFG**	**Landfill- NEI**
Allegheny	27,479	402,905	
Armstrong			
Beaver		15,148	
Butler		112,943	
Fayette		52,018	
Greene			
Indiana		22,389	
Lawrence			
Washington		73,316	7,711
Westmoreland	13,301	212,950	
Total	**40,780**	**891,669**	**7,711**

4.1.2.8 Sequestration

Urban sequestration accounted for 2% of the net total CO_2e emissions of the SPC region. Urban sequestration here is classified as trees located on anthropogenic lands that fall into the residential, commercial/institutional, and industrial land usage categories. Land that does not fall into these categories was assumed to be not urban forestry.

Table 27. Sequestration Greenhouse Gas ($MTCO_2e$) per County

GHG Emissions ($MTCO_2e$)	
Category	**Sequestration**
County	**Urban Forestry**
Allegheny	-121,166
Armstrong	-165,718
Beaver	-89,520
Butler	-195,752
Fayette	-144,815
Greene	-43,986
Indiana	-209,247
Lawrence	-80,799
Washington	-98,921
Westmoreland	-20,635
Total	**-1,170,559**

4.1.3 Breakdown of Gas Types

The GHG inventory primarily focused on the most prevalent greenhouse gases, namely CO_2, CH_4, and N_2O. However, certain sources also contributed emissions of SF_6 and PFCs. Figure 9 below illustrates the distribution of these gases. In the breakdown provided, the percentage represents the contribution to CO_2e emissions to the emitted total, which encompasses all greenhouse gases expressed in terms of

their carbon dioxide equivalence. CO_2 accounted for the majority of emissions (79%), followed by CH_4 (20%). N_2O made a smaller contribution of 0.3%. SF_6 and PFCs had the least impact, contributing only 0.11% and 0.0003%, respectively. Stationary sources were the largest contributors to CO_2 emissions, followed by electricity use and transportation. For methane emissions, stationary sources were again predominant, followed by solid waste and agriculture.

Figure 9. Distribution of Greenhouse Gas Type

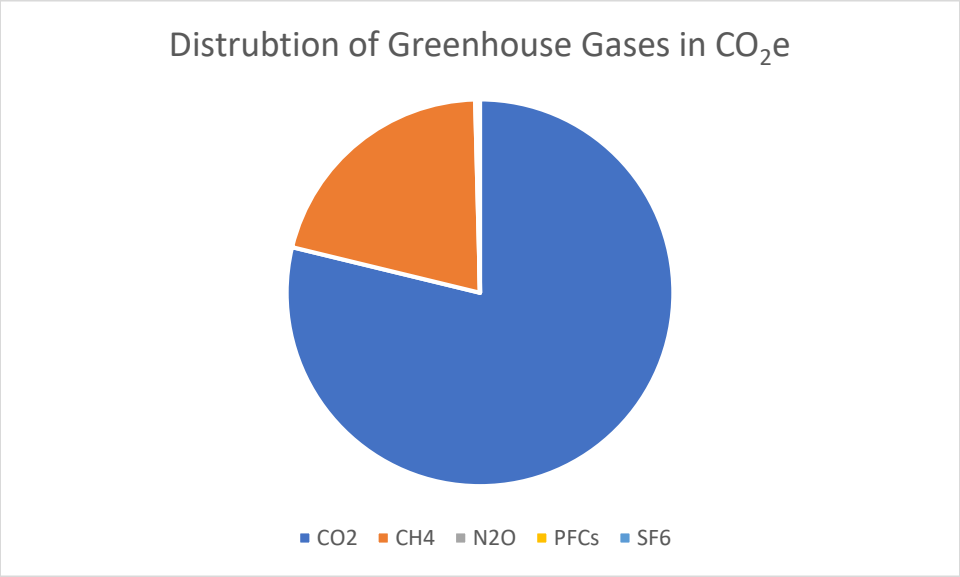


Table 28. Distribution of Greenhouse Gas type ($MTCO_2e$)

Gas	CO_2e	Percent of Total
CO_2	42,416,839	79%
CH_4	10,890,859	20%
N_2O	154,069	0.29%
PFCs	131	0.0002%
SF_6	57,136	0.11%
Emitted Total	53,519,033	100.00%

4.2 Quality Control Discussion

As discussed in section 3.9 above, all emissions were categorized in separate activity category and subcategory as illustrated in Table 29 below.

Table 29. Emission Category and Subcategory

Category	Subcategory
Agriculture	Enteric Fermentation
	Fertilizer Application
	Manure Management
	Prescribed Burns
Electricity Use	Electricity - Slope
Other Mobile Sources	Commercial_Nonroad

Category	Subcategory
	Construction_Nonroad
	Industrial_Nonroad
	Residential_Nonroad
Sequestration	Urban Forestry
Solid Waste	Landfill - Closed
	Landfill - LFG
	Landfill- NEI
Stationary	Commercial/ Institutional Point
	Energy Generation Point
	Industrial Point
	Natural Gas - Commercial/Institutional
	Natural Gas - Industrial
	Natural Gas - Residential
Transportation	Aviation
	Marine
	Onroad
	Railroad
Wastewater	Total Wastewater

A total of 301 inventoried subcategories were included in GHG inventory within the SPC region. Each inventoried greenhouse gas was normalized against population, land area, and GDP. The normalization process aimed to identify outliers by calculating *z*-scores for each data point. Out of the 301 data points, 40 had *z*-scores that exceeded the threshold of 2 or were less than -2. These 40 outliers across the subcategories were then subjected to further investigation to understand the underlying reasons for their variance, and the findings were compiled into the table 30 below. All 40 potential outliers were deemed to have legitimate reason. As such, those data points are included as part of the inventory.

Table 30. Potential Outlier Investigation

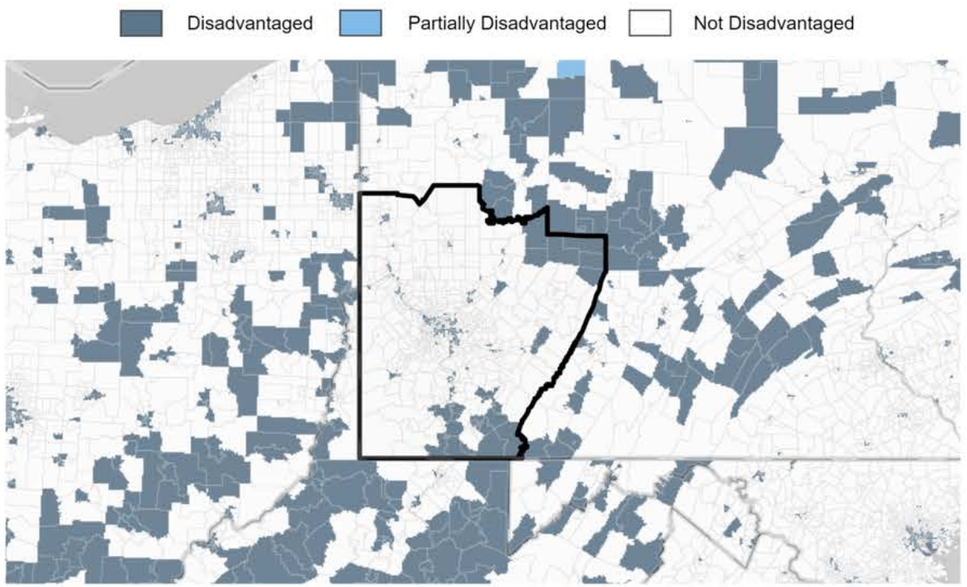
County	Category	Subcategory	Emission per Capita	Population Z-score	Emission per Area	Area Z-score	Emission per GDP	GDP Z-score	Investigation
Allegheny	Transportation	Onroad	1.62	(1.23)	1,069.78	2.74	0.0196	(2.28)	Densely Populated Area with high GDP contributed to the perceived outlier
Allegheny	Transportation	Onroad	0.79	(1.09)	522.96	2.61	0.0096	(2.18)	Densely Populated Area with high GDP contributed to the perceived outlier
Allegheny	Transportation	Onroad	0.37	(1.01)	245.21	2.71	0.0045	(2.31)	Densely Populated Area with high GDP contributed to the perceived outlier
Greene	Transportation	Onroad	3.59	2.48	85.44	(0.62)	0.0514	0.26	Small population in Greene county, assume vehicle travel through
Greene	Transportation	Onroad	3.06	2.39	72.93	(0.59)	0.0439	1.29	Small population in Greene county, assume vehicle travel through
Greene	Transportation	Onroad	1.06	2.48	25.33	(0.58)	0.0152	1.03	Small population in Greene county, assume vehicle travel through
Armstrong	Transportation	Marine	0.09	2.61	3.34	0.85	0.0027	2.68	The Allegheny River traverse through Armstrong County.
Allegheny	Transportation	Aviation	0.14	2.50	93.18	2.83	0.0017	1.52	Pittsburgh Intl Airport is a major regional and international airport
Allegheny	Other Mobile Sources	Residential_Nonroad	0.03	(1.14)	19.90	2.72	0.0004	(1.21)	Densely Populated Area with high residential concentration
Allegheny	Other Mobile Sources	Commercial_Nonroad	0.11	(0.43)	75.72	2.72	0.0014	(0.78)	Densely Populated Area with small area
Greene	Other Mobile Sources	Commercial_Nonroad	1.09	2.82	25.99	0.29	0.0156	2.66	Underground Mining Equipment contribute to the emissions (lots of mining in Greene)
Allegheny	Other Mobile Sources	Industrial_Nonroad	0.07	(0.61)	49.37	2.65	0.0009	(1.43)	Densely Populated Area with small area
Allegheny	Other Mobile Sources	Construction_Nonroad	0.29	0.60	193.02	2.73	0.0035	0.01	Densely Populated Area with small area
Washington	Other Mobile Sources	Construction_Nonroad	0.64	2.58	59.29	0.45	0.0108	2.63	NEI data non road contains a lot of diesel emissions of diesel construction equipment
Allegheny	Electricity Use (Residential)	Electricity – Slope	1.48	(0.66)	980.43	2.74	0.0179	(1.32)	Highly populated
Allegheny	Electricity Use (Commercial)	Electricity – Slope	2.56	2.30	1,691.14	2.82	0.0310	0.49	Highly populated, likely more commercial
Allegheny	Electricity Use (Industrial)	Electricity – Slope	0.79	(1.08)	522.84	2.18	0.0096	(1.28)	Highly populated
Armstrong	Electricity Use (Industrial)	Electricity - Slope	4.49	1.00	171.64	(0.38)	0.1381	2.20	Armstrong county has the lowest GDP of all counties
Greene	Electricity Use	Electricity - Slope	6.38	2.07	151.92	(0.52)	0.0914	0.93	Sparsely populated in Greene County
Allegheny	Agriculture	Enteric Fermentation	0.00	(1.32)	1.57	(2.18)	0.0000	(1.28)	More city development, less agricultural footprint
Indiana	Agriculture	Manure Management	0.17	2.01	6.40	1.12	0.0037	1.61	Significantly more animals in Indiana County compare to others
Fayette	Agriculture	Prescribed Burns	0.13	0.76	8.15	2.03	0.0038	1.67	Speculated more burns in Fayette County
Greene	Agriculture	Prescribed Burns	0.29	2.56	6.80	1.44	0.0041	1.83	Small population, assume larger agricultural footprint
Armstrong	Agriculture	Fertilizer Application	0.22	1.36	8.35	0.58	0.0067	2.08	Armstrong county has the lowest GDP of all counties in SPC region
Allegheny	Wastewater	Total Wastewater	0.08	(0.58)	49.86	2.70	0.0009	(1.53)	Large population density in small area contribute to this outlier
Armstrong	Sequestration	Urban Forestry	(0.53)	(1.58)	(20.26)	0.04	-0.0163	(2.04)	Armstrong county has the lowest GDP of all counties in SPC region
Armstrong	Sequestration	Urban Forestry	(1.96)	(1.70)	(74.75)	(1.27)	-0.0601	(2.18)	Armstrong county has the lowest GDP of all counties in SPC region
Indiana	Sequestration	Urban Forestry	(0.05)	(2.03)	(2.06)	(1.39)	-0.0012	(1.61)	More forested in industrial district in Indiana County
Allegheny	Solid Waste	Landfill - LFG	0.18	(0.14)	120.35	2.87	0.0022	(0.58)	yes, correct based on LGGIT calculations & LMOP data
Fayette	Solid Waste	Landfill - LFG	0.40	1.44	25.15	(0.26)	0.0119	2.24	yes, correct based on LGGIT calculations & LMOP data
Washington	Solid Waste	Landfill- NEI	0.04	#DIV/0!	3.44	#DIV/0!	0.0006	#DIV/0!	This is for the only Landfill that is not capture in LMOP. This one data point is not normalized against NEI.
Allegheny	Stationary	Commercial\ Institutional Point	0.19	0.32	128.00	2.41	0.0023	(0.31)	Densely Populated Area with small area
Allegheny	Stationary	Industrial Point	3.93	(0.28)	2,597.19	2.16	0.0475	(0.31)	Densely Populated Area with small area
Greene	Stationary	Energy Generation Point	3.39	2.06	80.72	0.99	0.0486	1.94	One compression station contributed to over 50% of emission.
Allegheny	Stationary	Natural Gas - Residential	1.97	2.21	1,301.47	2.81	0.0238	(0.46)	Highly dense area, large amount of natural gas
Allegheny	Stationary	Natural Gas - Commercial/Institutional	1.22	1.83	805.16	2.83	0.0147	0.35	Highly dense area, large amount of natural gas
Allegheny	Stationary	Natural Gas - Industrial	0.85	(0.98)	559.26	2.05	0.0102	(1.22)	Highly dense area, large amount of natural gas

County	Category	Subcategory	Emission per Capita	Population Z-score	Emission per Area	Area Z-score	Emission per GDP	GDP Z-score	Investigation
Armstrong	Stationary	Natural Gas - Residential	1.52	0.70	57.96	(0.43)	0.0466	2.26	Armstrong county has the lowest GDP of all counties in SPC region
Greene	Stationary	Energy Generation Point	3.63	2.26	86.49	1.15	0.0521	2.15	Large amount of Compressor stations in Greene County
Greene	Stationary	Industrial Point	122.45	3.41	2,917.31	2.50	1.7557	3.40	There are multiple coal mines in Greene counties in FLIGHT data. So, the outlier is accepted

Community Risk and Resiliency Report

SWPC

Justice40 Disadvantaged Census Tracts



National Risk Index

15 ↓

This is 13 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

36 ↓

This is 2 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

73 ↑

This is 9 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$70,858,391

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

771
Total Tracts in Study Area

201
Tracts in Study Area identified as Disadvantaged

26.07%
Percent of Tracts in Study Area that are Disadvantaged

503,582
Population in Disadvantaged Tracts in Study Area

52
Legacy Pollution Disadvantaged Tracts

41
Climate Change Disadvantaged Tracts

78
Workforce Development Disadvantaged Tracts

145
Housing Disadvantaged Tracts

132
Health Disadvantaged Tracts

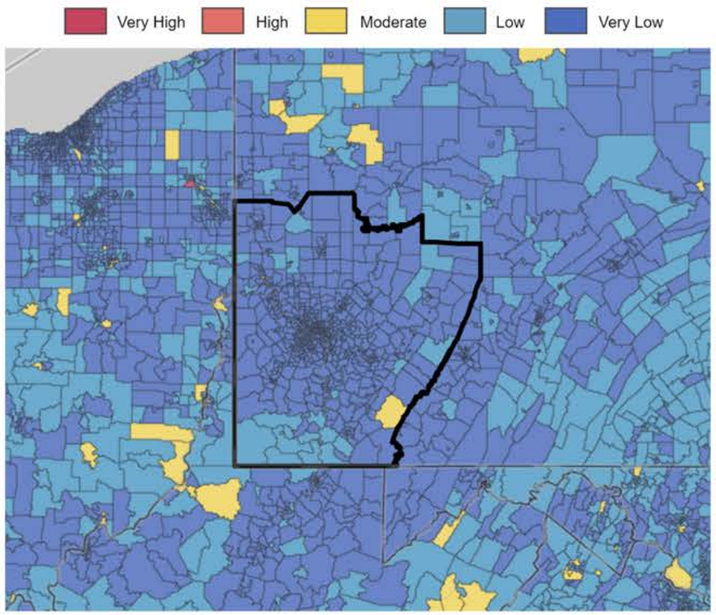
100
Energy Disadvantaged Tracts

15
Water and Wastewater Disadvantaged Tracts

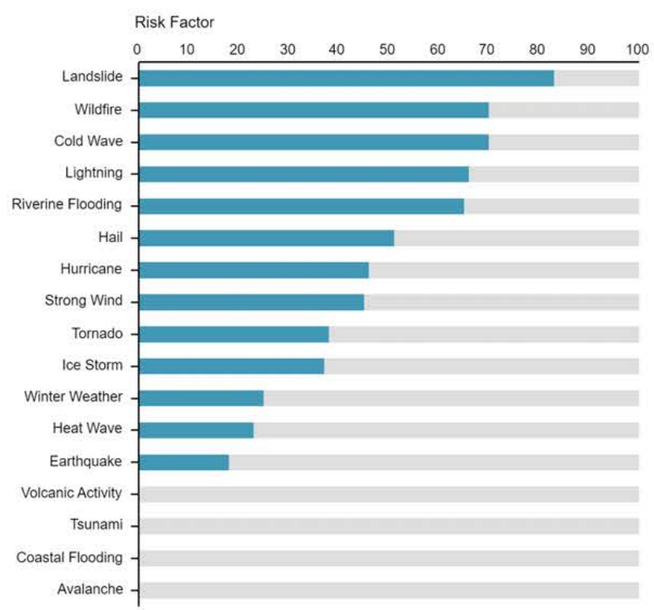
23
Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



Natural Hazard Risk Factors

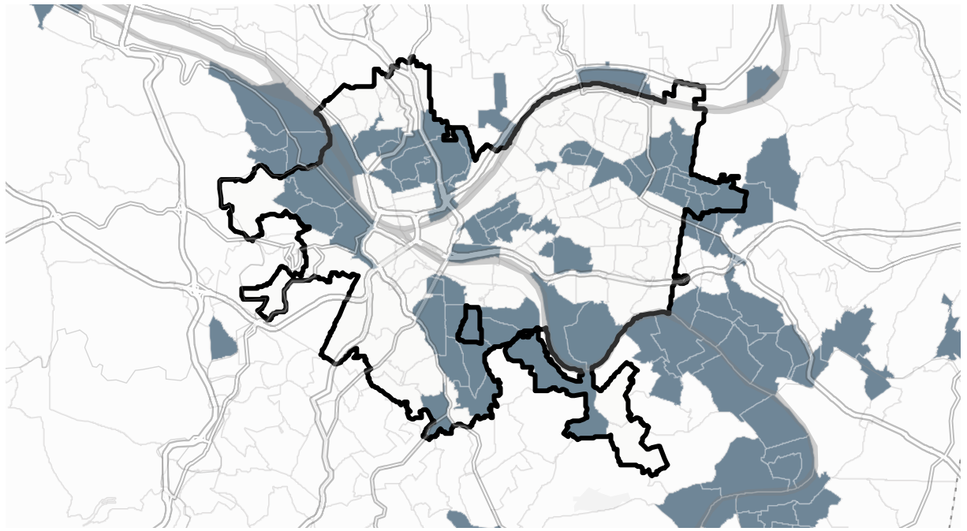


Community Risk and Resiliency Report

City of Pittsburgh, PA

Justice40 Disadvantaged Census Tracts

Disadvantaged | Partially Disadvantaged | Not Disadvantaged



National Risk Index

1 ↓

This is 2 lower than **Allegheny County**. **Allegheny County** has a value of **3**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

47 ↑

This is 22 higher than **Allegheny County**. **Allegheny County** has a value of **25**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

89 ↑

This is 0 lower than **Allegheny County**. **Allegheny County** has a value of **89**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$4,422,550

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

137
Total Tracts in Study Area

51
Tracts in Study Area identified as Disadvantaged

37.23%
Percent of Tracts in Study Area that are Disadvantaged

102,957
Population in Disadvantaged Tracts in Study Area

6
Legacy Pollution Disadvantaged Tracts

4
Climate Change Disadvantaged Tracts

23
Workforce Development Disadvantaged Tracts

42
Housing Disadvantaged Tracts

38
Health Disadvantaged Tracts

25
Energy Disadvantaged Tracts

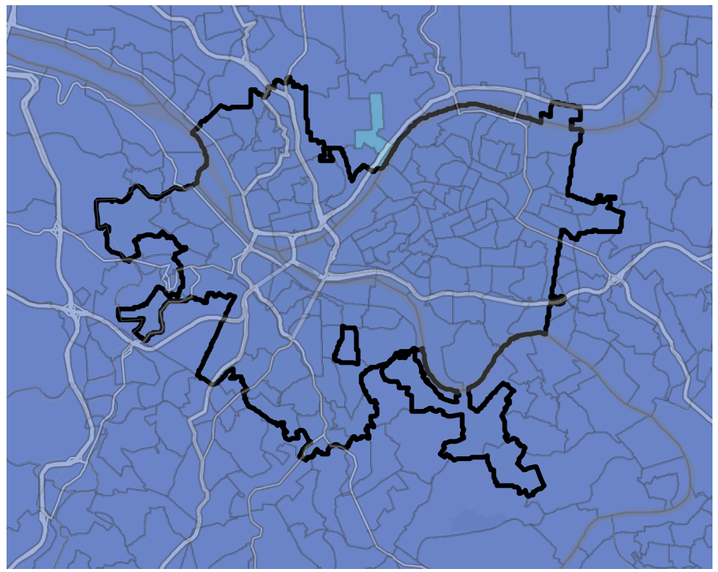
3
Water and Wastewater Disadvantaged Tracts

4
Transportation Disadvantaged Tracts

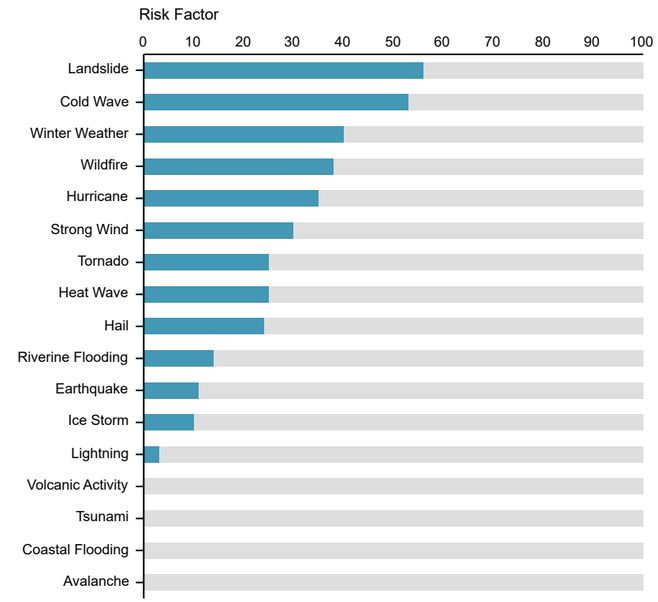
Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index

Very High | High | Moderate | Low | Very Low



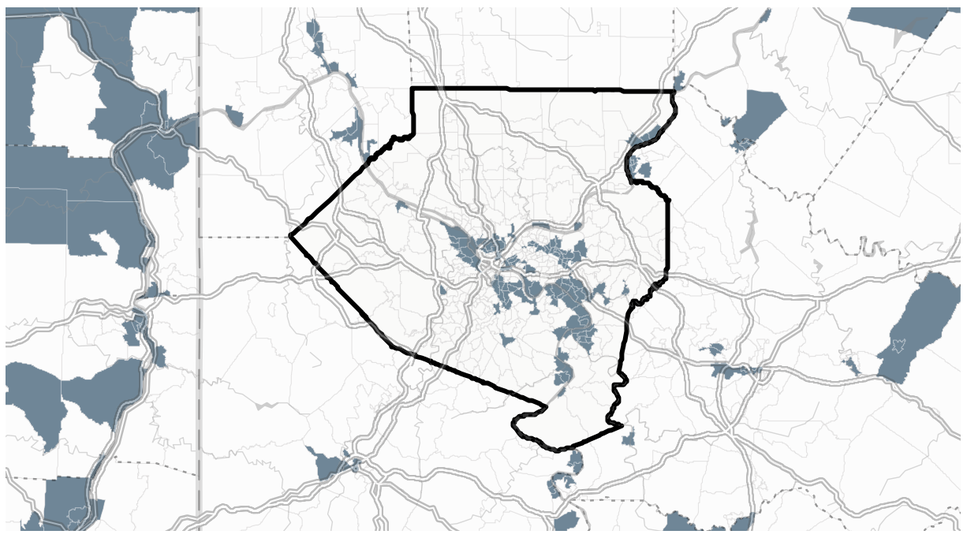
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Allegheny County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

3 ↓

This is 25 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

25 ↓

This is 13 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

89 ↑

This is 25 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$19,228,213

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

402 Total Tracts in Study Area

107 Tracts in Study Area identified as Disadvantaged

26.62% Percent of Tracts in Study Area that are Disadvantaged

242,709 Population in Disadvantaged Tracts in Study Area

14 Legacy Pollution Disadvantaged Tracts

24 Climate Change Disadvantaged Tracts

44 Workforce Development Disadvantaged Tracts

91 Housing Disadvantaged Tracts

78 Health Disadvantaged Tracts

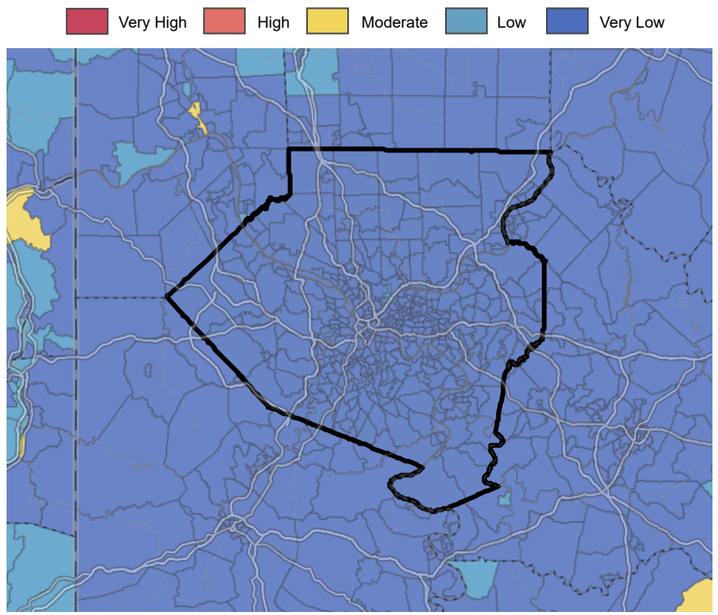
53 Energy Disadvantaged Tracts

9 Water and Wastewater Disadvantaged Tracts

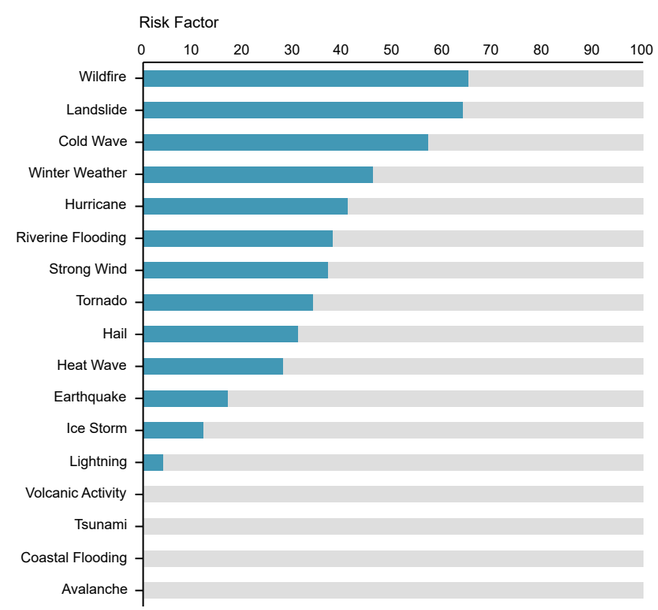
6 Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



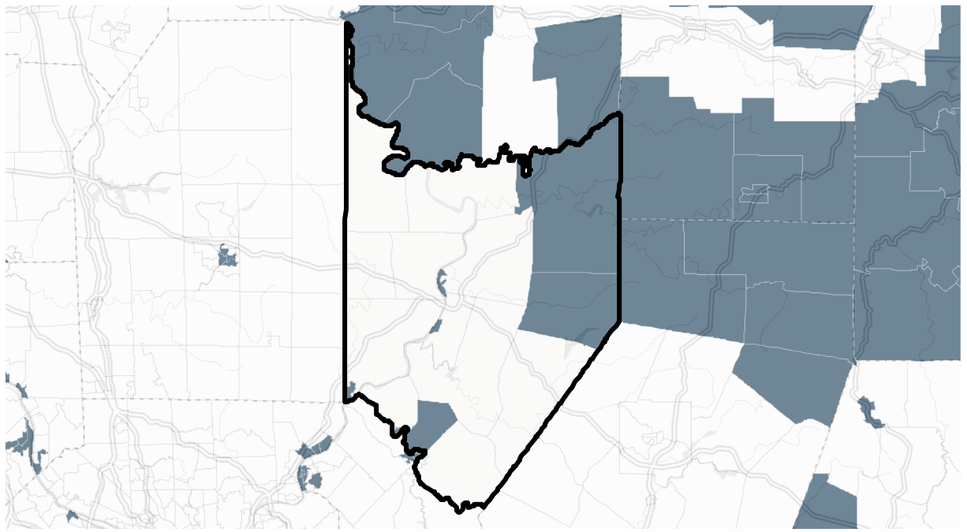
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Armstrong County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

8 ↓

This is 20 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

42 ↑

This is 4 higher than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

75 ↑

This is 11 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$2,126,187

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

19
Total Tracts in Study Area

7
Tracts in Study Area identified as Disadvantaged

36.84%
Percent of Tracts in Study Area that are Disadvantaged

21,594
Population in Disadvantaged Tracts in Study Area

3
Legacy Pollution Disadvantaged Tracts

4
Climate Change Disadvantaged Tracts

1
Workforce Development Disadvantaged Tracts

5
Housing Disadvantaged Tracts

2
Health Disadvantaged Tracts

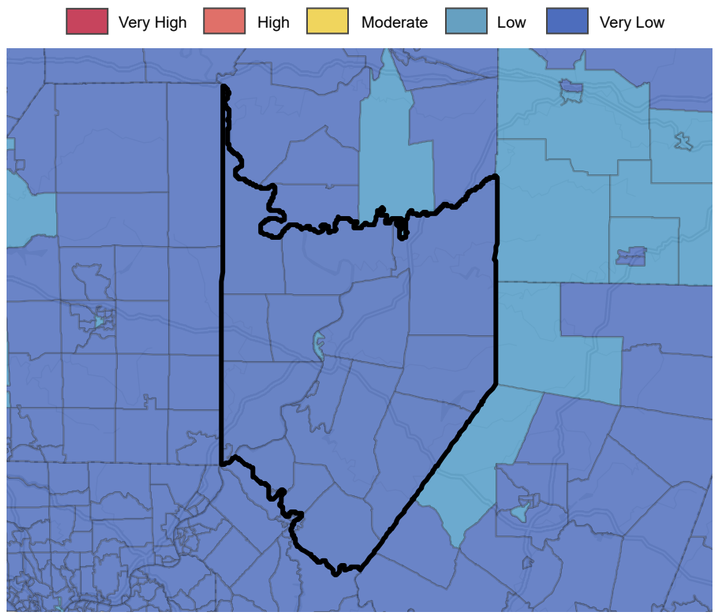
0
Energy Disadvantaged Tracts

0
Water and Wastewater Disadvantaged Tracts

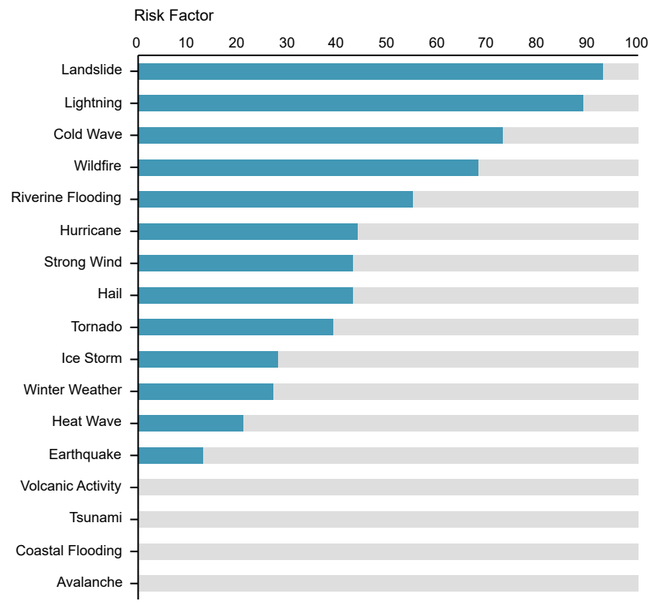
3
Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



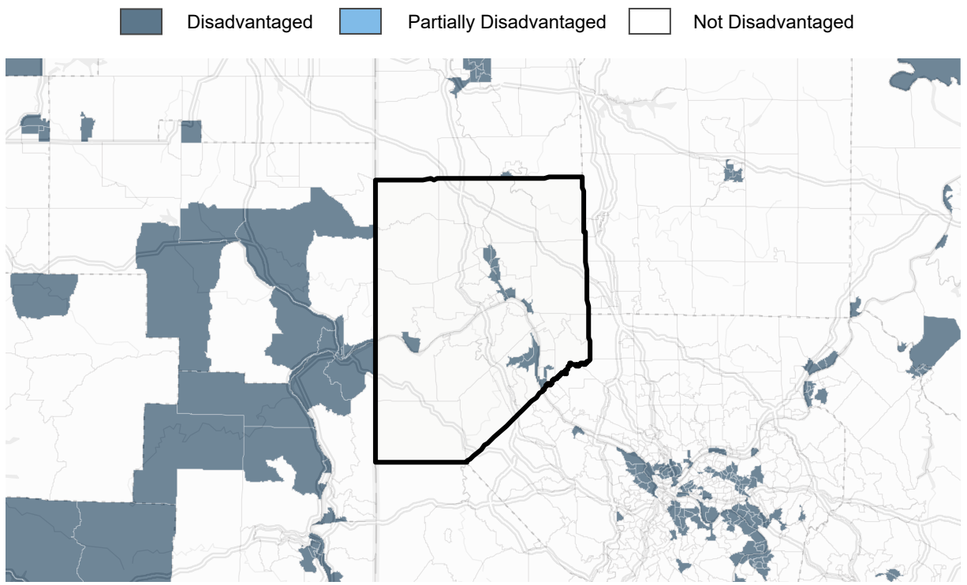
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Beaver County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

11 ↓

This is 17 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

26 ↓

This is 12 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

89 ↑

This is 25 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$7,247,299

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

51
Total Tracts in Study Area

12
Tracts in Study Area identified as Disadvantaged

23.53%
Percent of Tracts in Study Area that are Disadvantaged

33,271
Population in Disadvantaged Tracts in Study Area

0
Legacy Pollution Disadvantaged Tracts

1
Climate Change Disadvantaged Tracts

5
Workforce Development Disadvantaged Tracts

9
Housing Disadvantaged Tracts

10
Health Disadvantaged Tracts

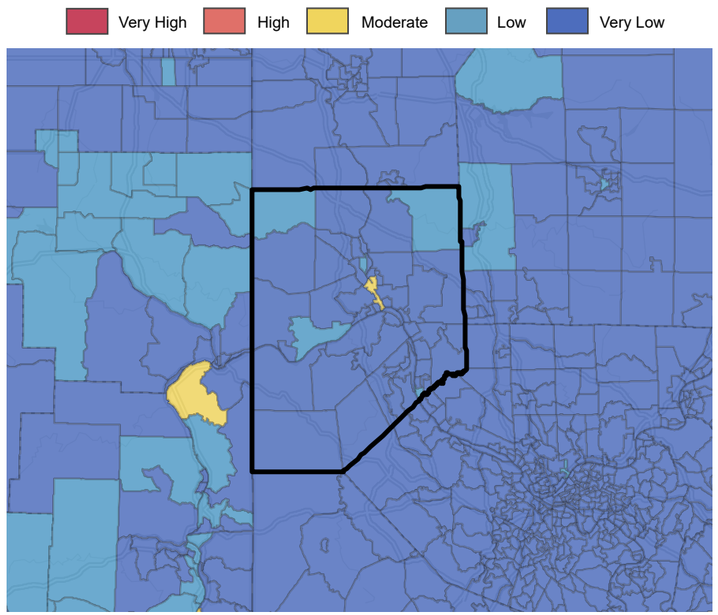
9
Energy Disadvantaged Tracts

1
Water and Wastewater Disadvantaged Tracts

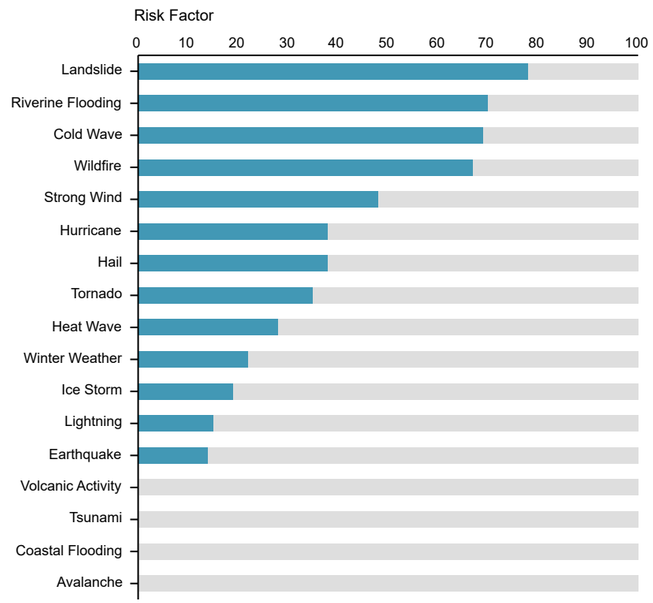
0
Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



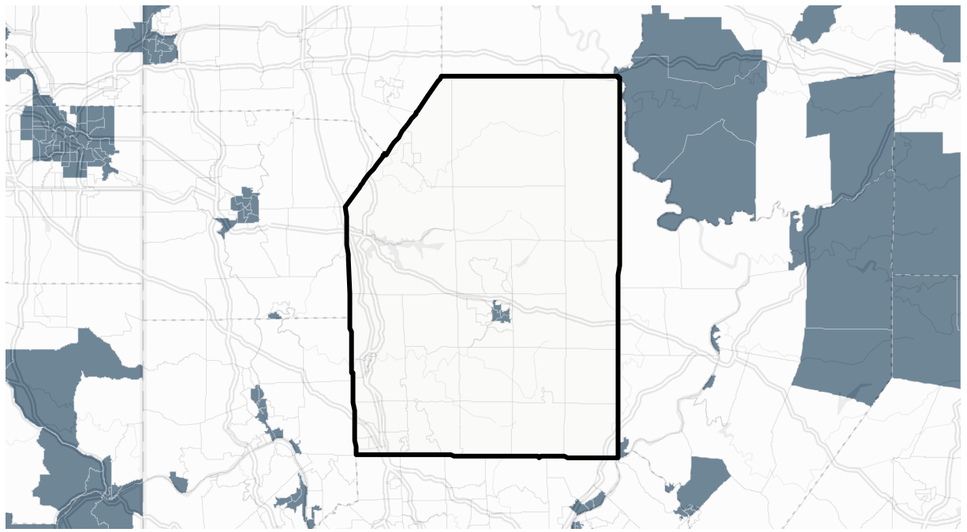
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Butler County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

14 ↓

This is 14 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

31 ↓

This is 7 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

83 ↑

This is 19 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$7,041,239

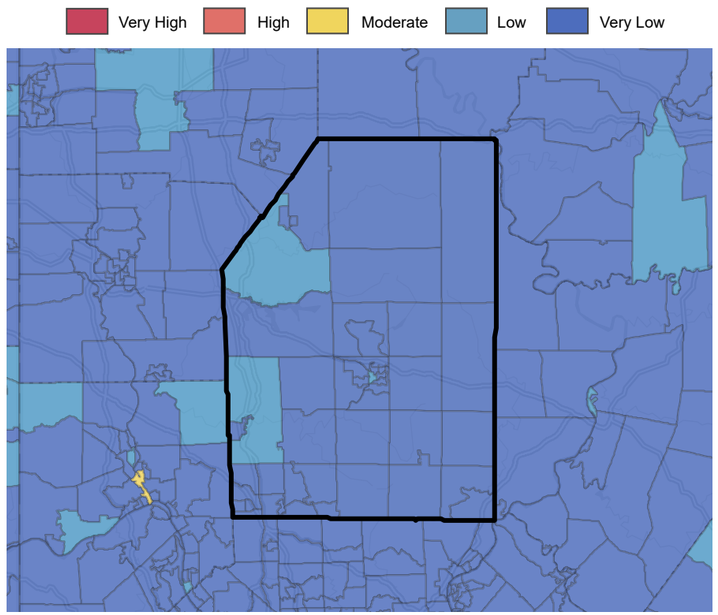
The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

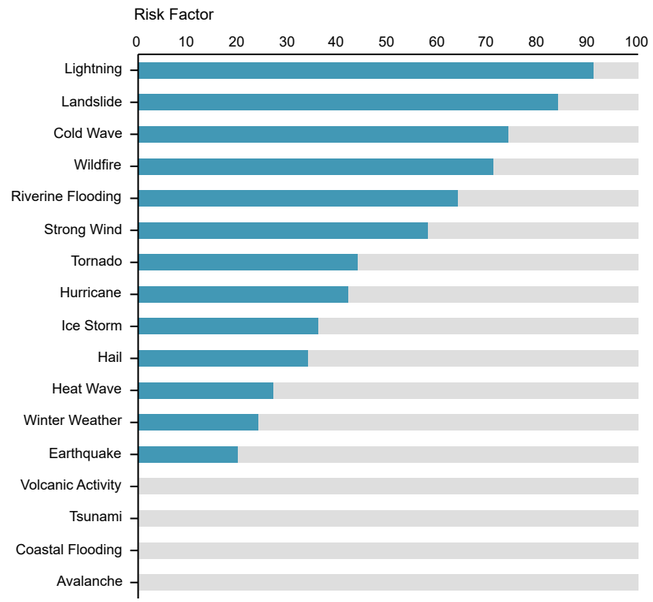
44	Total Tracts in Study Area
4	Tracts in Study Area identified as Disadvantaged
9.09%	Percent of Tracts in Study Area that are Disadvantaged
10,960	Population in Disadvantaged Tracts in Study Area
4	Legacy Pollution Disadvantaged Tracts
2	Climate Change Disadvantaged Tracts
2	Workforce Development Disadvantaged Tracts
3	Housing Disadvantaged Tracts
2	Health Disadvantaged Tracts
0	Energy Disadvantaged Tracts
0	Water and Wastewater Disadvantaged Tracts
0	Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



Natural Hazard Risk Factors

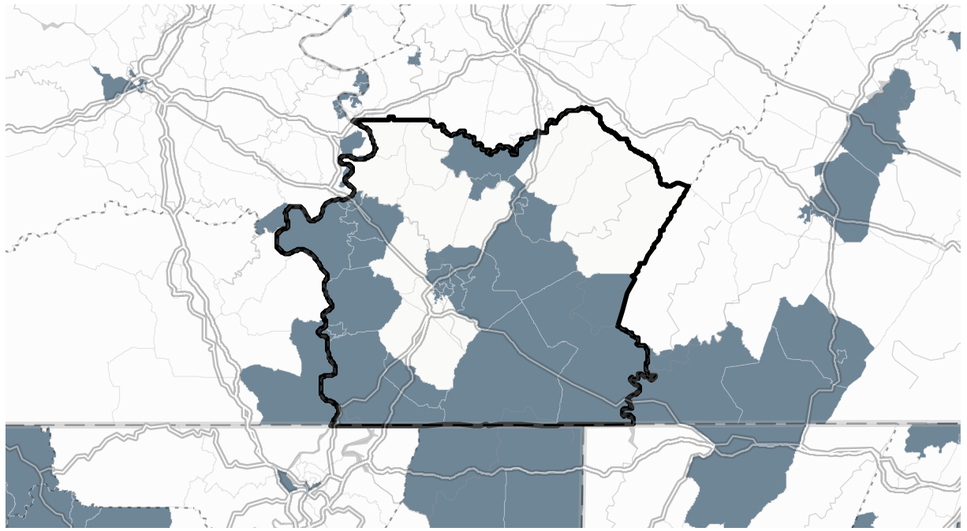


Community Risk and Resiliency Report

Fayette County, PA

Justice40 Disadvantaged Census Tracts

Disadvantaged | Partially Disadvantaged | Not Disadvantaged



National Risk Index

23 ↓

This is 5 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

50 ↑

This is 12 higher than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

48 ↓

This is 16 lower than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$6,461,302

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

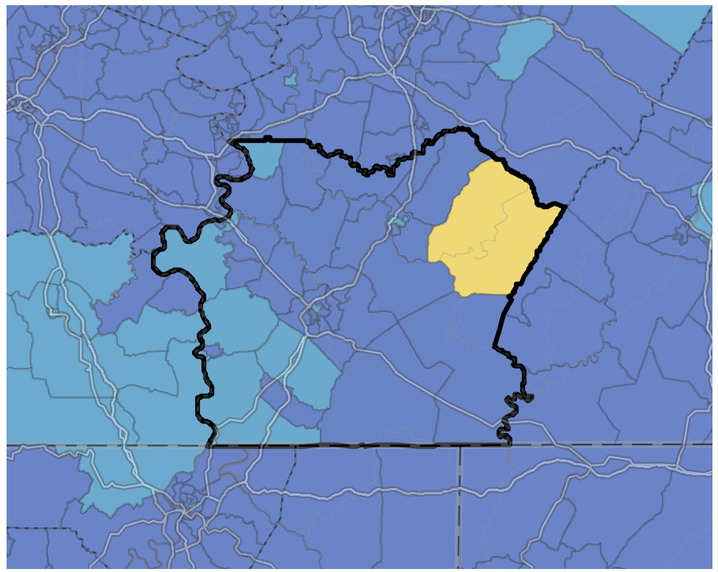
Justice40 Disadvantaged Tracts Breakdown

36	Total Tracts in Study Area
23	Tracts in Study Area identified as Disadvantaged
63.89%	Percent of Tracts in Study Area that are Disadvantaged
78,352	Population in Disadvantaged Tracts in Study Area
11	Legacy Pollution Disadvantaged Tracts
2	Climate Change Disadvantaged Tracts
8	Workforce Development Disadvantaged Tracts
6	Housing Disadvantaged Tracts
9	Health Disadvantaged Tracts
15	Energy Disadvantaged Tracts
0	Water and Wastewater Disadvantaged Tracts
8	Transportation Disadvantaged Tracts

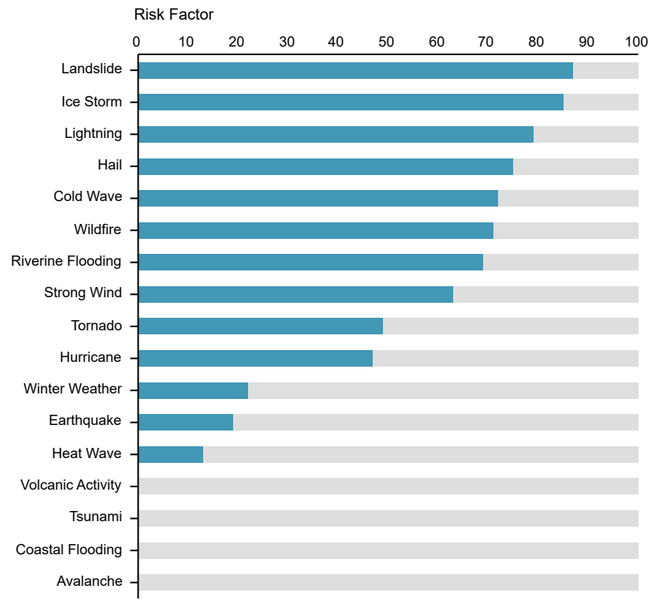
Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index

Very High | High | Moderate | Low | Very Low



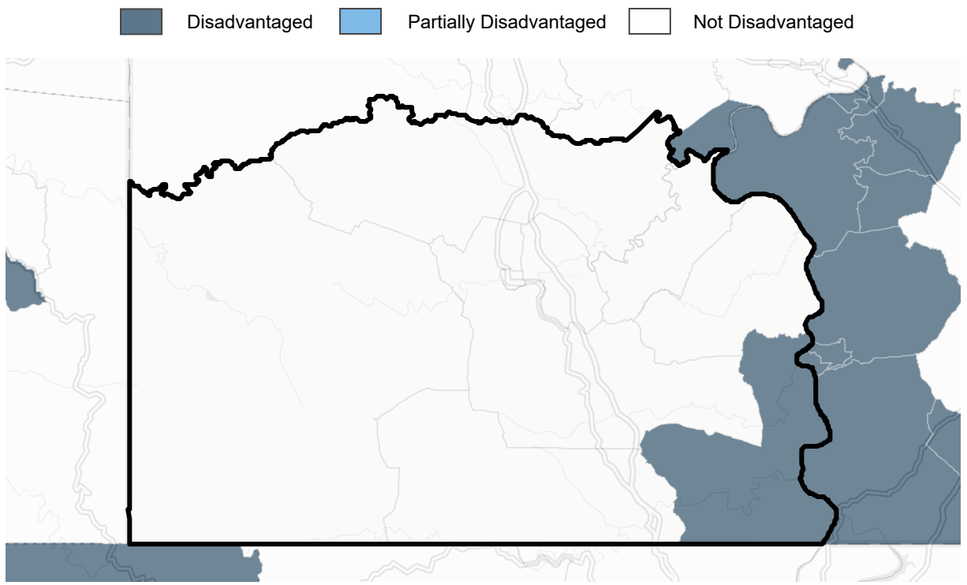
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Greene County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

44 ↑

This is 16 higher than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

40 ↑

This is 2 higher than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

42 ↓

This is 22 lower than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$3,490,451

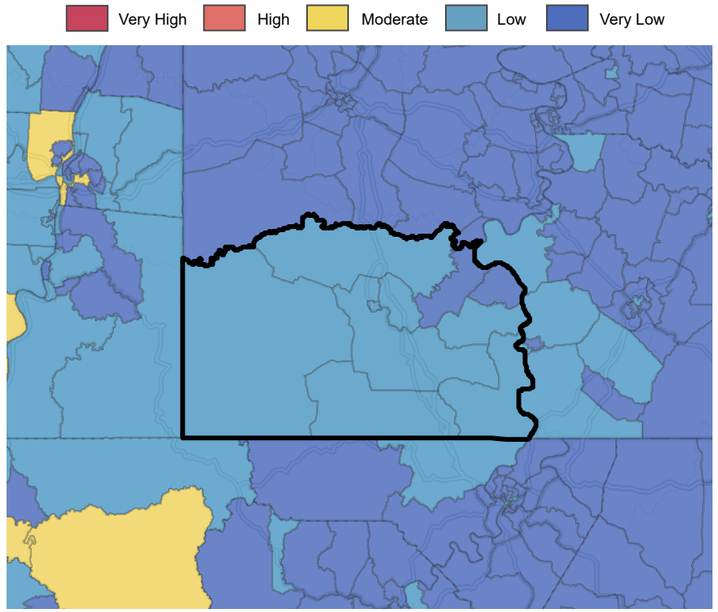
The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

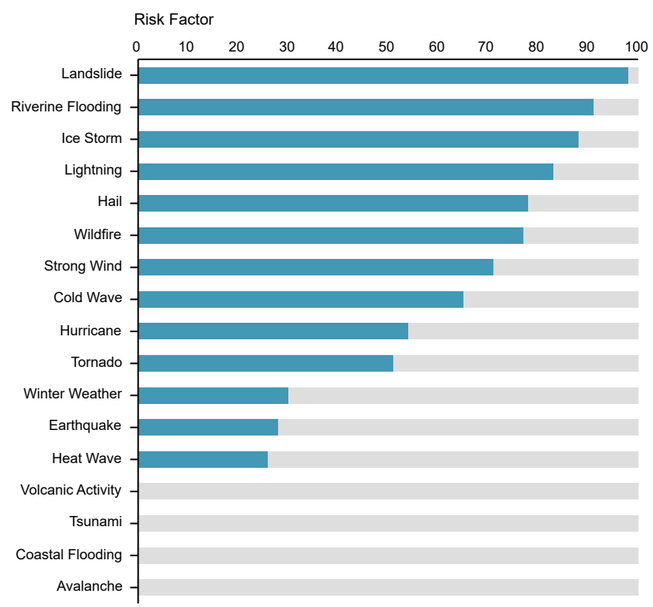
9	1	11.11%	4,217
Total Tracts in Study Area	Tracts in Study Area identified as Disadvantaged	Percent of Tracts in Study Area that are Disadvantaged	Population in Disadvantaged Tracts in Study Area
0	0	0	0
Legacy Pollution Disadvantaged Tracts	Climate Change Disadvantaged Tracts	Workforce Development Disadvantaged Tracts	Housing Disadvantaged Tracts
0	0	0	1
Health Disadvantaged Tracts	Energy Disadvantaged Tracts	Water and Wastewater Disadvantaged Tracts	Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



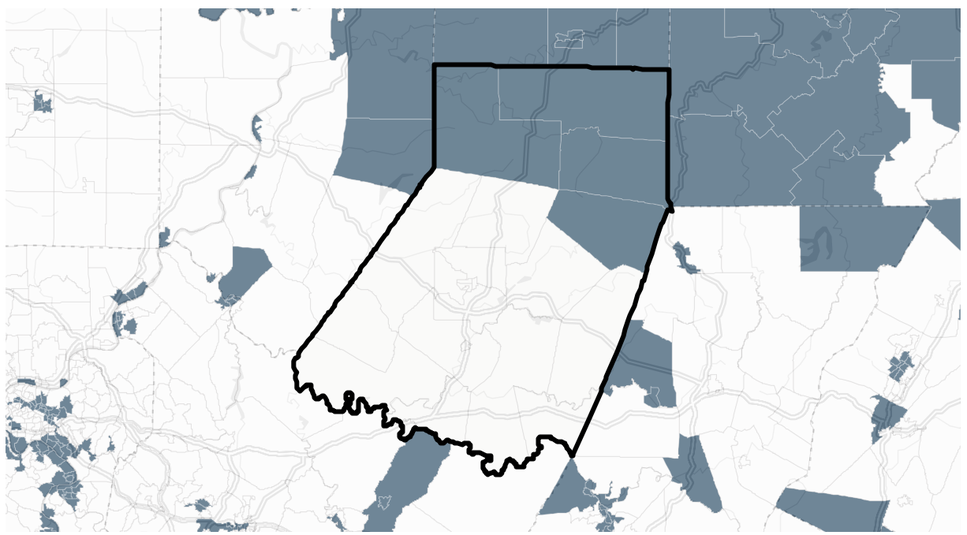
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Indiana County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

18 ↓

This is 10 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

53 ↑

This is 15 higher than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

56 ↓

This is 8 lower than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$3,759,278

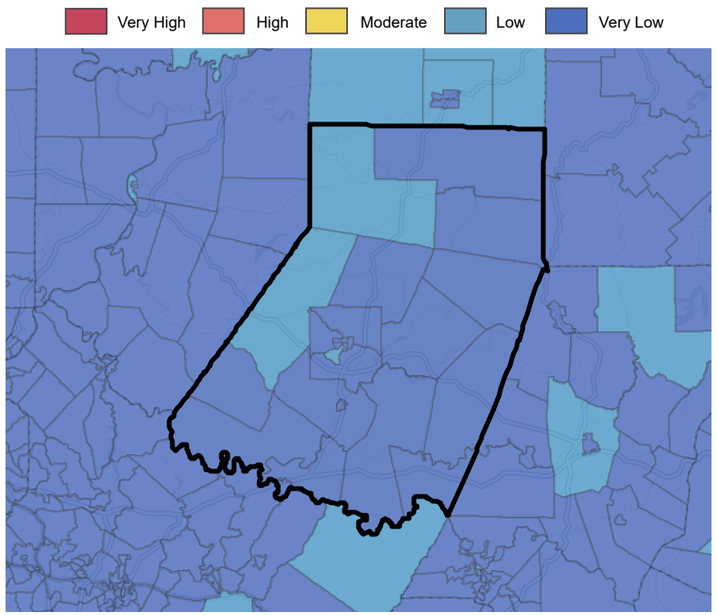
The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

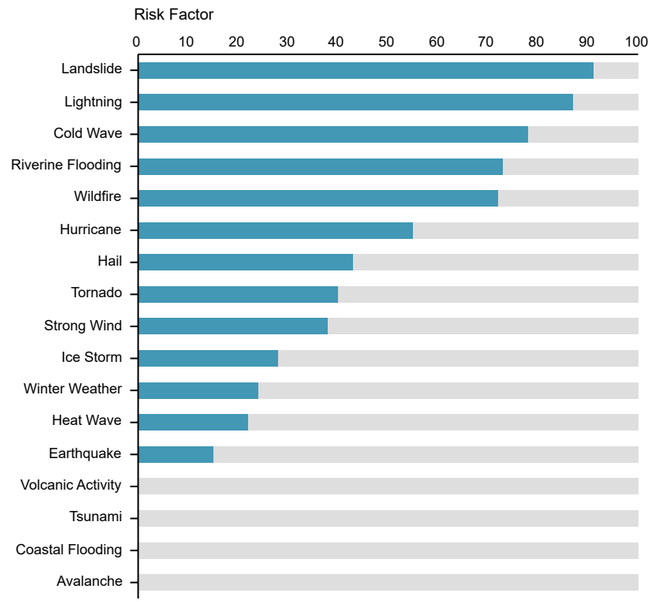
23	Total Tracts in Study Area
4	Tracts in Study Area identified as Disadvantaged
17.39%	Percent of Tracts in Study Area that are Disadvantaged
15,519	Population in Disadvantaged Tracts in Study Area
4	Legacy Pollution Disadvantaged Tracts
0	Climate Change Disadvantaged Tracts
1	Workforce Development Disadvantaged Tracts
4	Housing Disadvantaged Tracts
2	Health Disadvantaged Tracts
2	Energy Disadvantaged Tracts
0	Water and Wastewater Disadvantaged Tracts
3	Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



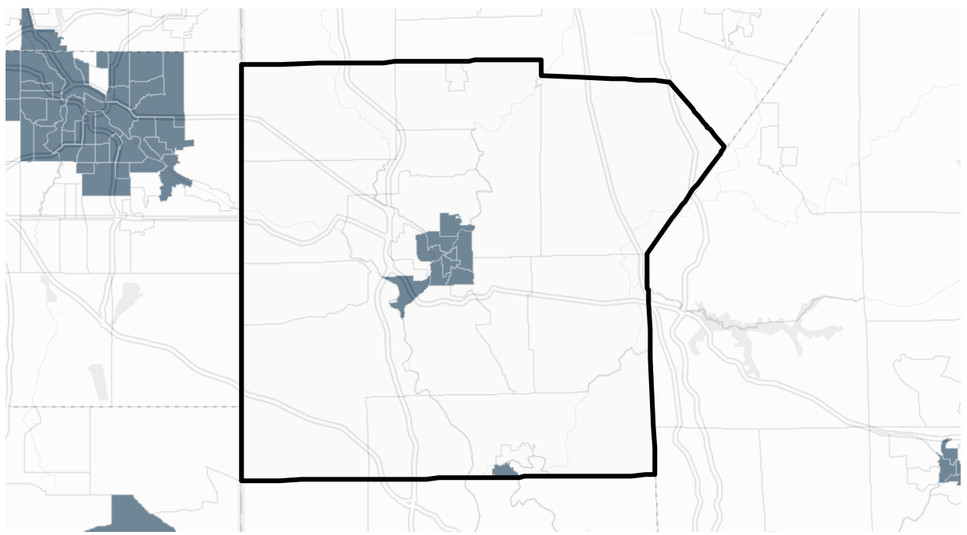
Natural Hazard Risk Factors



Community Risk and Resiliency Report

Lawrence County, PA

Justice40 Disadvantaged Census Tracts



National Risk Index

9 ↓

This is 19 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

39 ↑

This is 1 higher than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

58 ↓

This is 6 lower than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$3,038,436

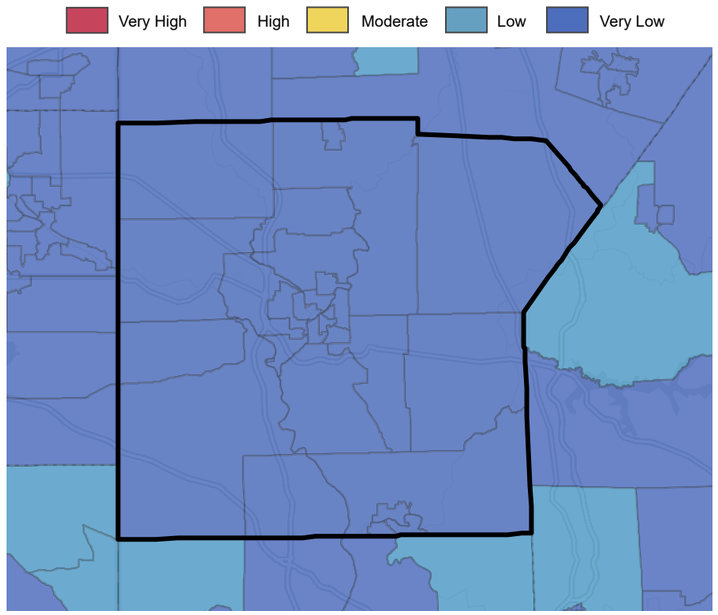
The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

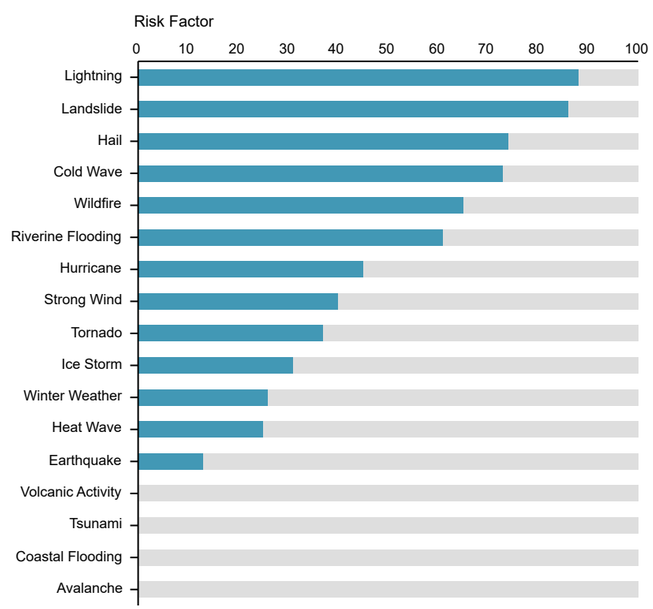
28 Total Tracts in Study Area	10 Tracts in Study Area identified as Disadvantaged	35.71% Percent of Tracts in Study Area that are Disadvantaged	24,442 Population in Disadvantaged Tracts in Study Area
1 Legacy Pollution Disadvantaged Tracts	0 Climate Change Disadvantaged Tracts	6 Workforce Development Disadvantaged Tracts	8 Housing Disadvantaged Tracts
9 Health Disadvantaged Tracts	9 Energy Disadvantaged Tracts	1 Water and Wastewater Disadvantaged Tracts	0 Transportation Disadvantaged Tracts

Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index



Natural Hazard Risk Factors

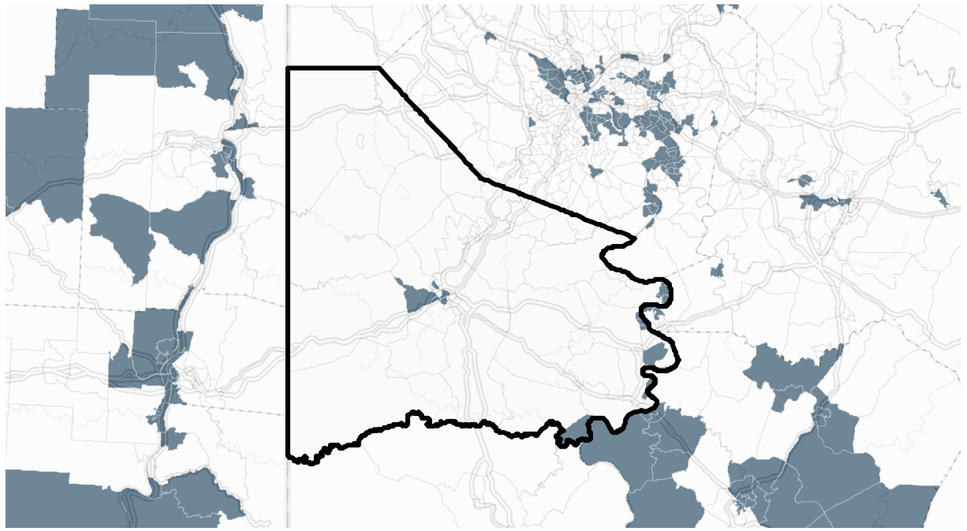


Community Risk and Resiliency Report

Washington County, PA

Justice40 Disadvantaged Census Tracts

Disadvantaged | Partially Disadvantaged | Not Disadvantaged



National Risk Index

6 ↓

This is 22 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

29 ↓

This is 9 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

83 ↑

This is 19 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$5,617,333

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

Justice40 Disadvantaged Tracts Breakdown

59
Total Tracts in Study Area

13
Tracts in Study Area identified as Disadvantaged

22.03%
Percent of Tracts in Study Area that are Disadvantaged

27,620
Population in Disadvantaged Tracts in Study Area

10
Legacy Pollution Disadvantaged Tracts

3
Climate Change Disadvantaged Tracts

5
Workforce Development Disadvantaged Tracts

8
Housing Disadvantaged Tracts

8
Health Disadvantaged Tracts

5
Energy Disadvantaged Tracts

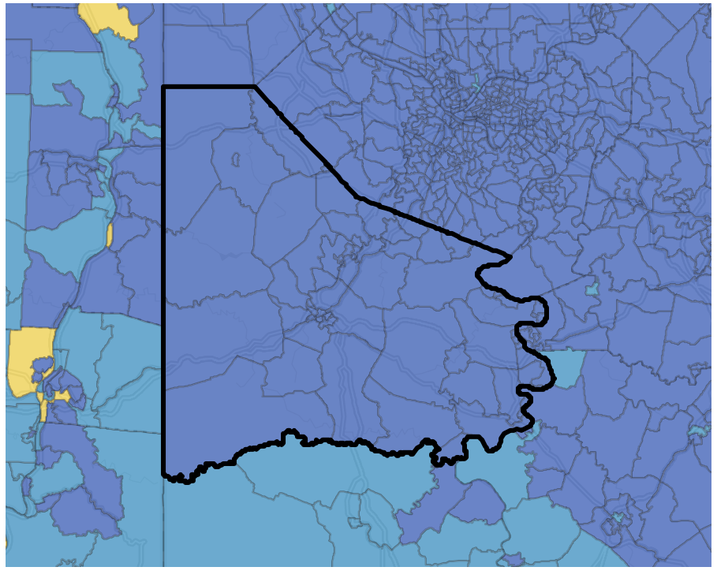
2
Water and Wastewater Disadvantaged Tracts

1
Transportation Disadvantaged Tracts

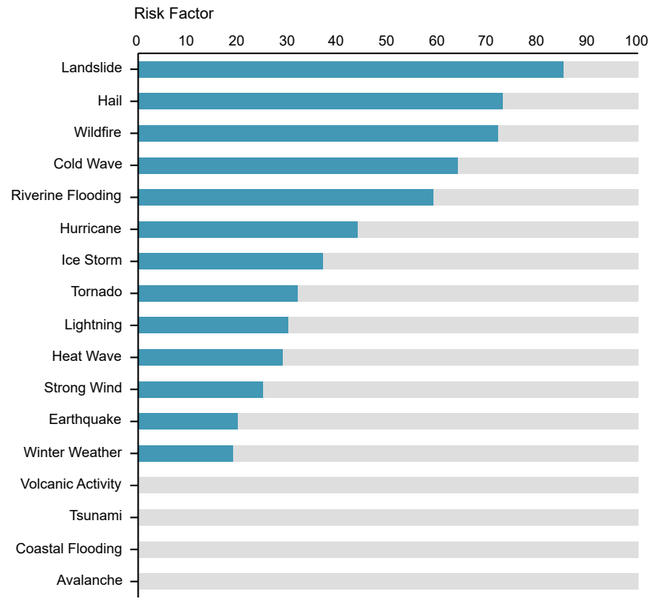
Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index

Very High | High | Moderate | Low | Very Low



Natural Hazard Risk Factors

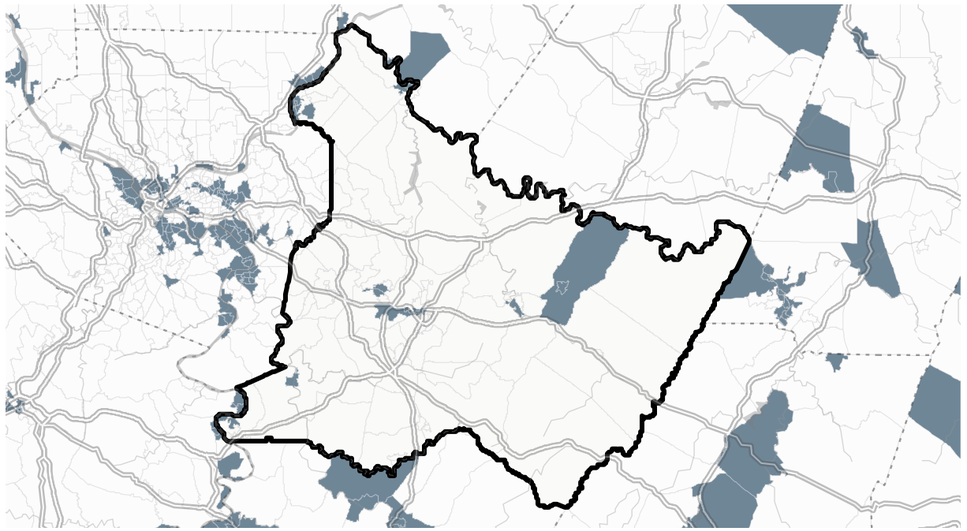


Community Risk and Resiliency Report

Westmoreland County, PA

Justice40 Disadvantaged Census Tracts

Disadvantaged | Partially Disadvantaged | Not Disadvantaged



National Risk Index

13 ↓

This is 15 lower than **Pennsylvania**. **Pennsylvania** has a value of **28**.

The Risk Index score is based on three components: Social Vulnerability, Community Resilience, and EAL. The higher the score, the more significant the risk.

Social Vulnerability

29 ↓

This is 9 lower than **Pennsylvania**. **Pennsylvania** has a value of **38**.

Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

Community Resilience

89 ↑

This is 25 higher than **Pennsylvania**. **Pennsylvania** has a value of **64**.

Community Resilience is defined as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The higher the score, the more resilient the community.

Expected Annual Loss

$12,848,291

The EAL is the average economic loss in dollars resulting from natural hazards each year. EAL is computed for each hazard type and only quantifies loss for relevant consequence types (i.e., buildings, population, or agriculture).

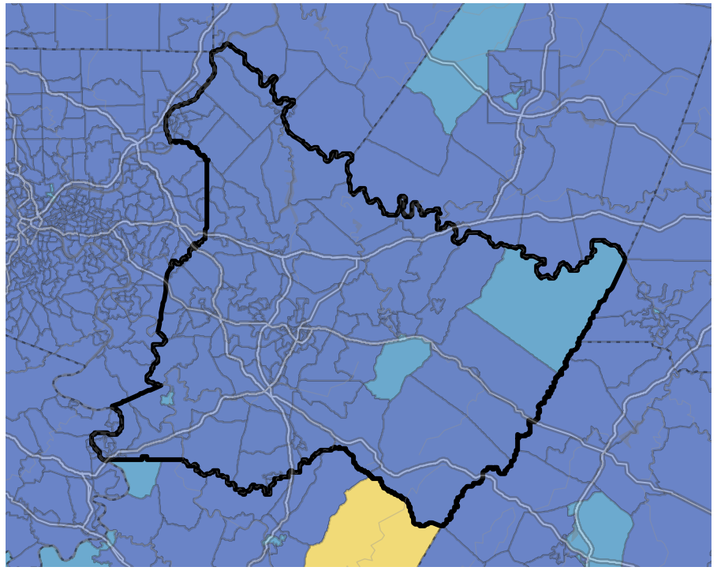
Justice40 Disadvantaged Tracts Breakdown

100	Total Tracts in Study Area
20	Tracts in Study Area identified as Disadvantaged
20.00%	Percent of Tracts in Study Area that are Disadvantaged
44,894	Population in Disadvantaged Tracts in Study Area
5	Legacy Pollution Disadvantaged Tracts
5	Climate Change Disadvantaged Tracts
6	Workforce Development Disadvantaged Tracts
11	Housing Disadvantaged Tracts
12	Health Disadvantaged Tracts
7	Energy Disadvantaged Tracts
2	Water and Wastewater Disadvantaged Tracts
1	Transportation Disadvantaged Tracts

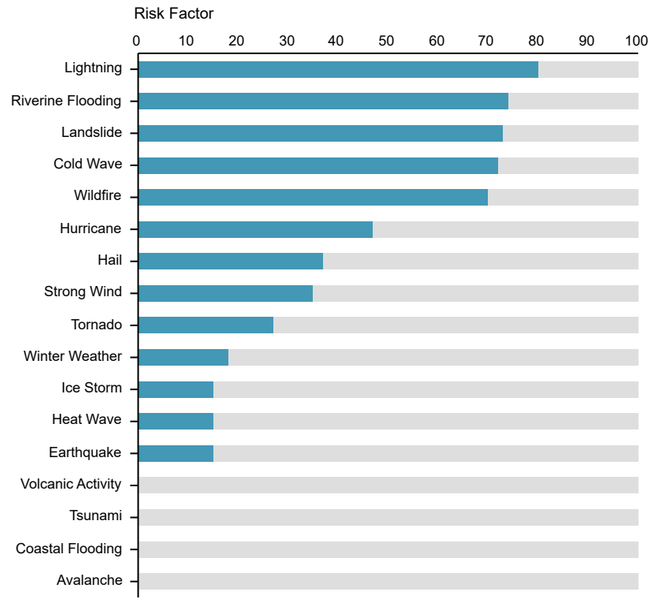
Data Sources: FEMA's National Risk Index for Natural Disasters and Justice40 disadvantaged tracts (November 2022).

National Risk Index

Very High | High | Moderate | Low | Very Low



Natural Hazard Risk Factors



Appendix C: Project Presence in Low-Income Disadvantaged Community (LIDAC) Census Tracts

March 1, 2024

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Table 1. Project Presence in Low-Income Disadvantaged Community (LIDAC) Census Tracts

Census Tract	County Name	Proposed Project Within Tract
Census Tract 5604	Allegheny County	YES
Census Tract 5524	Allegheny County	YES
Census Tract 5523	Allegheny County	YES
Census Tract 5522	Allegheny County	YES
Census Tract 5521	Allegheny County	YES
Census Tract 511	Allegheny County	YES
Census Tract 510	Allegheny County	YES
Census Tract 509	Allegheny County	YES
Census Tract 5520	Allegheny County	YES
Census Tract 5519	Allegheny County	YES
Census Tract 5512	Allegheny County	YES
Census Tract 5509	Allegheny County	YES
Census Tract 501	Allegheny County	YES
Census Tract 406	Allegheny County	YES
Census Tract 9809	Allegheny County	YES
Census Tract 9805	Allegheny County	YES
Census Tract 5232	Allegheny County	YES
Census Tract 305	Allegheny County	YES
Census Tract 9822	Allegheny County	YES
Census Tract 5220	Allegheny County	YES
Census Tract 5170	Allegheny County	YES
Census Tract 103	Allegheny County	YES
Census Tract 5625	Allegheny County	YES
Census Tract 5623	Allegheny County	YES
Census Tract 5153	Allegheny County	YES
Census Tract 5151	Allegheny County	YES
Census Tract 5140	Allegheny County	YES
Census Tract 5138	Allegheny County	YES
Census Tract 4688	Allegheny County	YES
Census Tract 5128	Allegheny County	YES
Census Tract 5120	Allegheny County	YES
Census Tract 5100	Allegheny County	YES
Census Tract 4928	Allegheny County	YES
Census Tract 4927	Allegheny County	YES
Census Tract 4929	Allegheny County	YES
Census Tract 5094	Allegheny County	YES
Census Tract 5080	Allegheny County	YES
Census Tract 4270	Allegheny County	YES
Census Tract 4508	Allegheny County	YES
Census Tract 4994	Allegheny County	YES

Census Tract	County Name	Proposed Project Within Tract
Census Tract 4940	Allegheny County	YES
Census Tract 4240	Allegheny County	YES
Census Tract 4200	Allegheny County	YES
Census Tract 4870	Allegheny County	YES
Census Tract 4867	Allegheny County	YES
Census Tract 4868	Allegheny County	YES
Census Tract 4869	Allegheny County	YES
Census Tract 4838	Allegheny County	YES
Census Tract 4639	Allegheny County	YES
Census Tract 4626	Allegheny County	YES
Census Tract 4644	Allegheny County	YES
Census Tract 2022	Allegheny County	YES
Census Tract 1306	Allegheny County	YES
Census Tract 1304	Allegheny County	YES
Census Tract 1303	Allegheny County	YES
Census Tract 1302	Allegheny County	YES
Census Tract 4035	Allegheny County	YES
Census Tract 4020	Allegheny County	YES
Census Tract 2814	Allegheny County	YES
Census Tract 2902	Allegheny County	YES
Census Tract 2901	Allegheny County	YES
Census Tract 1301	Allegheny County	YES
Census Tract 1208	Allegheny County	YES
Census Tract 1204	Allegheny County	YES
Census Tract 1203	Allegheny County	YES
Census Tract 4012	Allegheny County	YES
Census Tract 2715	Allegheny County	YES
Census Tract 4843	Allegheny County	YES
Census Tract 4846	Allegheny County	YES
Census Tract 3001	Allegheny County	YES
Census Tract 1115	Allegheny County	YES
Census Tract 2615	Allegheny County	YES
Census Tract 4621	Allegheny County	YES
Census Tract 1017	Allegheny County	YES
Census Tract 1016	Allegheny County	YES
Census Tract 4882	Allegheny County	YES
Census Tract 4884	Allegheny County	YES
Census Tract 4850	Allegheny County	YES
Census Tract 903	Allegheny County	YES
Census Tract 2509	Allegheny County	YES
Census Tract 5629	Allegheny County	YES
Census Tract 5614	Allegheny County	YES

Census Tract	County Name	Proposed Project Within Tract
Census Tract 5612	Allegheny County	YES
Census Tract 5611	Allegheny County	YES
Census Tract 5610	Allegheny County	YES
Census Tract 5606	Allegheny County	YES
Census Tract 5624	Allegheny County	YES
Census Tract 5626	Allegheny County	YES
Census Tract 5619	Allegheny County	YES
Census Tract 5632	Allegheny County	YES
Census Tract 9708	Greene County	YES
Census Tract 2618	Fayette County	YES
Census Tract 2606	Fayette County	YES
Census Tract 2627.01	Fayette County	YES
Census Tract 8014	Westmoreland County	YES
Census Tract 8054	Westmoreland County	YES
Census Tract 8007	Westmoreland County	YES
Census Tract 8002	Westmoreland County	YES
Census Tract 8003	Westmoreland County	YES
Census Tract 8006	Westmoreland County	YES
Census Tract 4801.01	Allegheny County	
Census Tract 5616	Allegheny County	
Census Tract 5617	Allegheny County	
Census Tract 5129	Allegheny County	
Census Tract 2904	Allegheny County	
Census Tract 1207	Allegheny County	
Census Tract 4810	Allegheny County	
Census Tract 3207	Allegheny County	
Census Tract 1114	Allegheny County	
Census Tract 2620	Allegheny County	
Census Tract 1803	Allegheny County	
Census Tract 1807	Allegheny County	
Census Tract 2614	Allegheny County	
Census Tract 2609	Allegheny County	
Census Tract 2507	Allegheny County	
Census Tract 2503	Allegheny County	
Census Tract 2412	Allegheny County	
Census Tract 10	Lawrence County	
Census Tract 2626	Fayette County	
Census Tract 2632	Fayette County	
Census Tract 2629	Fayette County	
Census Tract 2630	Fayette County	
Census Tract 2631	Fayette County	
Census Tract 2616	Fayette County	

Census Tract	County Name	Proposed Project Within Tract
Census Tract 2617	Fayette County	
Census Tract 2625	Fayette County	
Census Tract 2612	Fayette County	
Census Tract 2613	Fayette County	
Census Tract 2607	Fayette County	
Census Tract 2608	Fayette County	
Census Tract 2603	Fayette County	
Census Tract 2622	Fayette County	
Census Tract 2623	Fayette County	
Census Tract 2619	Fayette County	
Census Tract 2633	Fayette County	
Census Tract 2614.02	Fayette County	
Census Tract 2627.02	Fayette County	
Census Tract 2614.01	Fayette County	
Census Tract 118	Lawrence County	
Census Tract 1	Lawrence County	
Census Tract 2	Lawrence County	
Census Tract 3	Lawrence County	
Census Tract 4	Lawrence County	
Census Tract 6	Lawrence County	
Census Tract 7	Lawrence County	
Census Tract 8	Lawrence County	
Census Tract 9	Lawrence County	
Census Tract 8052	Westmoreland County	
Census Tract 8060	Westmoreland County	
Census Tract 8041	Westmoreland County	
Census Tract 8028	Westmoreland County	
Census Tract 8009	Westmoreland County	YES
Census Tract 8016	Westmoreland County	YES
Census Tract 8001	Westmoreland County	YES
Census Tract 8015	Westmoreland County	YES
Census Tract 7753	Washington County	YES
Census Tract 7833	Washington County	YES
Census Tract 7827	Washington County	YES
Census Tract 7752	Washington County	YES
Census Tract 7832	Washington County	YES
Census Tract 7543	Washington County	YES
Census Tract 6040	Beaver County	YES
Census Tract 6035	Beaver County	YES
Census Tract 9514	Armstrong County	YES
Census Tract 9023	Butler County	YES
Census Tract 9024	Butler County	YES

Census Tract	County Name	Proposed Project Within Tract
Census Tract 8026	Westmoreland County	
Census Tract 8040	Westmoreland County	
Census Tract 8048.01	Westmoreland County	
Census Tract 8081	Westmoreland County	
Census Tract 8082	Westmoreland County	
Census Tract 8076	Westmoreland County	
Census Tract 7957	Washington County	
Census Tract 7512	Washington County	
Census Tract 7922	Washington County	
Census Tract 7544	Washington County	
Census Tract 6041	Beaver County	
Census Tract 6045	Beaver County	
Census Tract 6046	Beaver County	
Census Tract 7041	Washington County	
Census Tract 7546	Washington County	
Census Tract 7910	Washington County	
Census Tract 6012	Beaver County	
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Census Tract 6028	Beaver County	
Census Tract 6014	Beaver County	
Census Tract 6021	Beaver County	
Census Tract 6054	Beaver County	
Census Tract 6057	Beaver County	
Census Tract 9510	Armstrong County	
Census Tract 9519	Armstrong County	
Census Tract 9518	Armstrong County	
Census Tract 9511	Armstrong County	
Census Tract 9604	Indiana County	
Census Tract 9601	Indiana County	
Census Tract 9602	Indiana County	
Census Tract 9603	Indiana County	
Census Tract 9507	Armstrong County	
Census Tract 9501	Armstrong County	
Census Tract 9022	Butler County	
Census Tract 9025	Butler County	

Figure 1. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Allegheny County

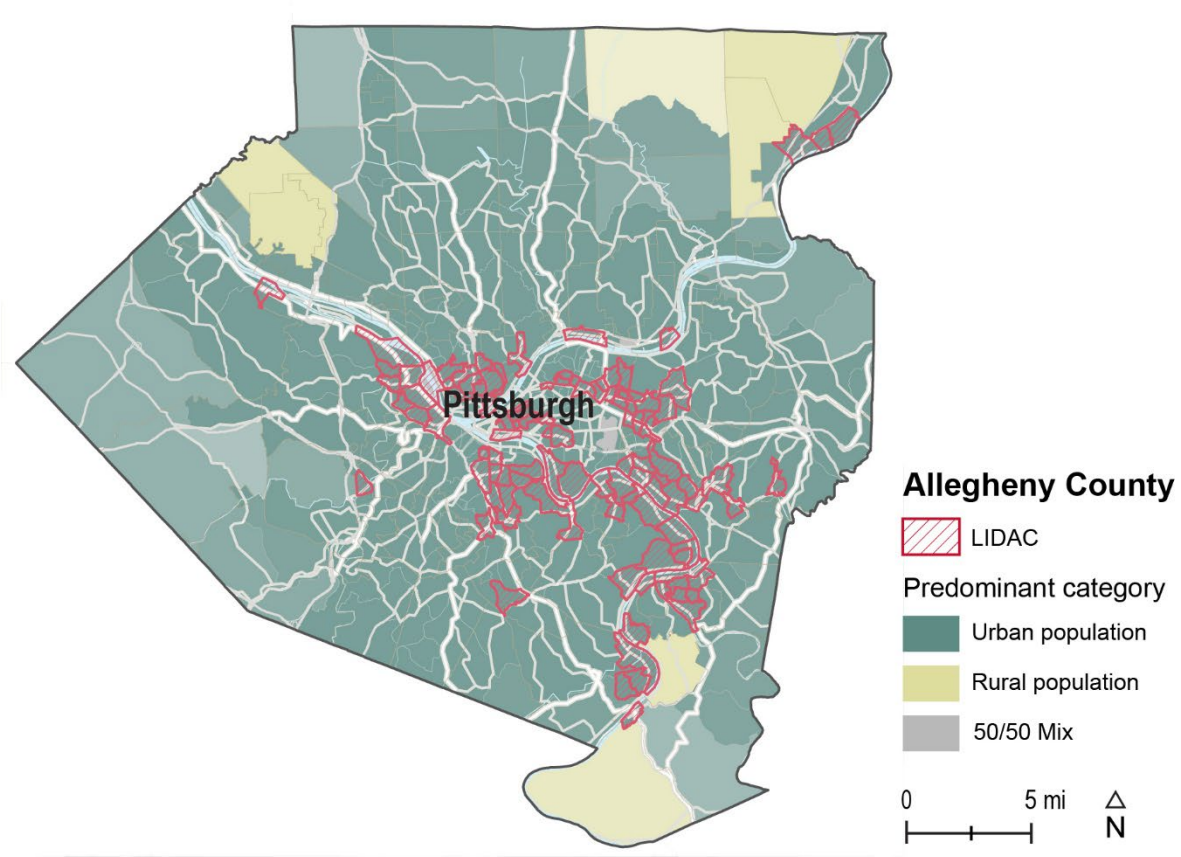

Figure 2. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Armstrong County

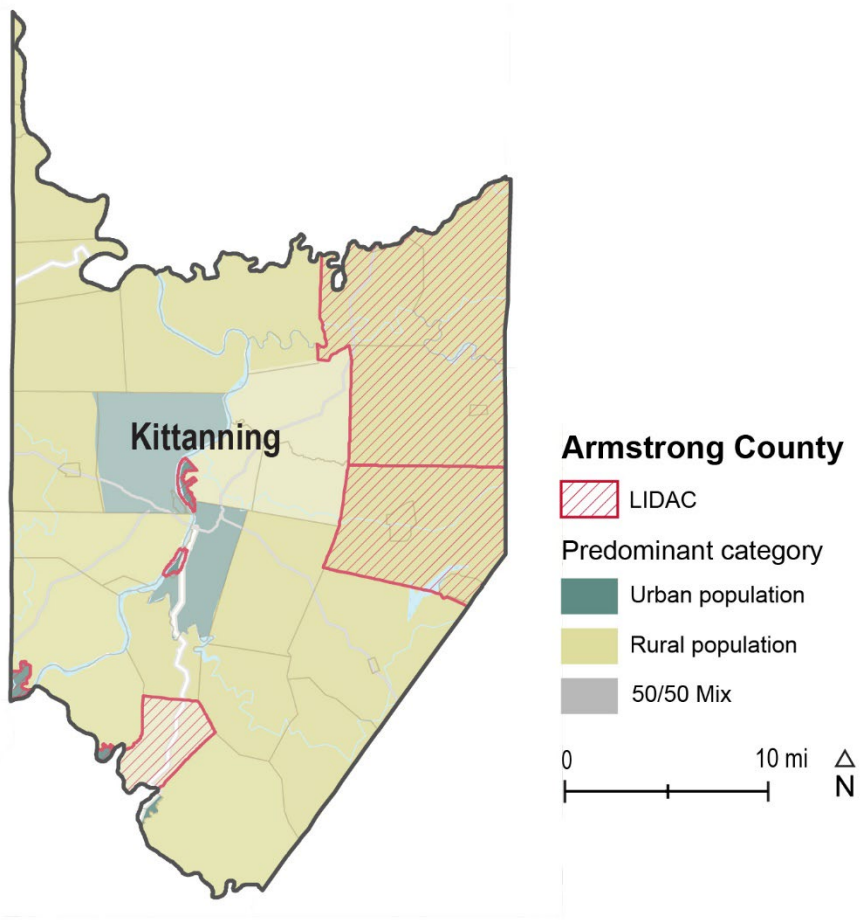

Figure 3. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Beaver County

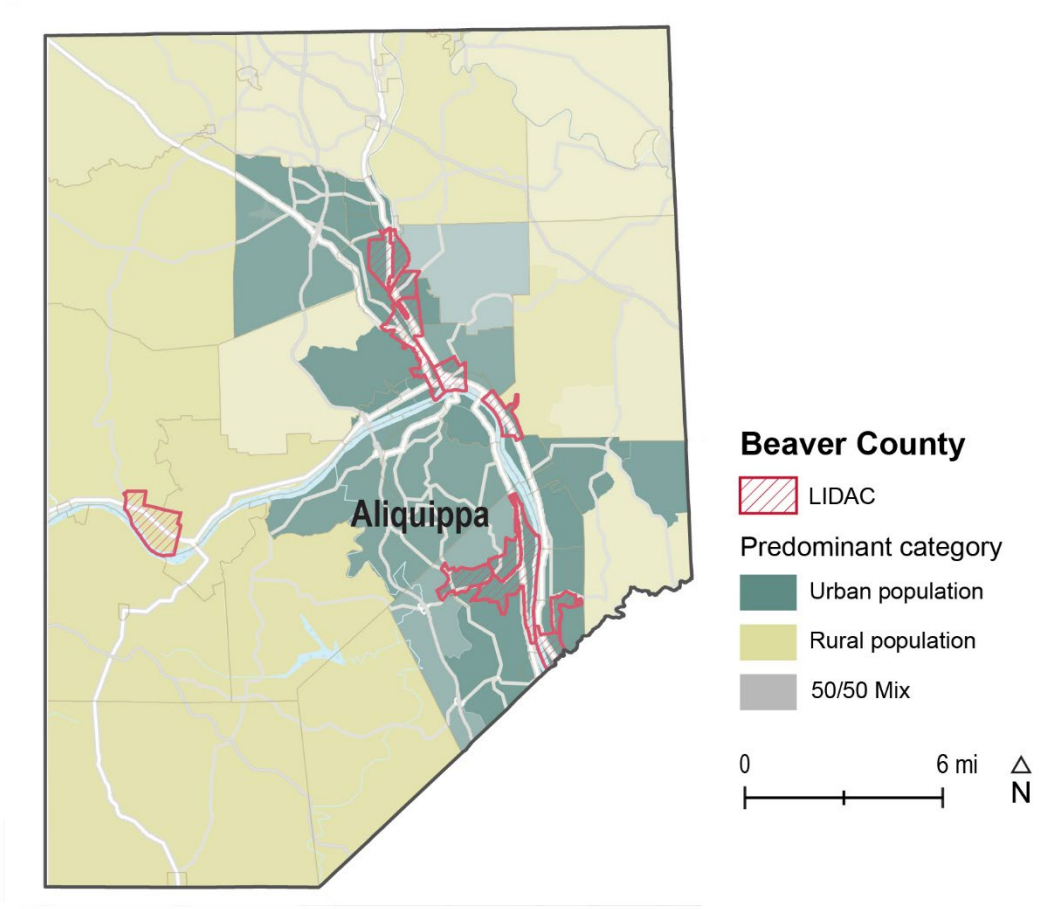

Figure 4. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Butler County

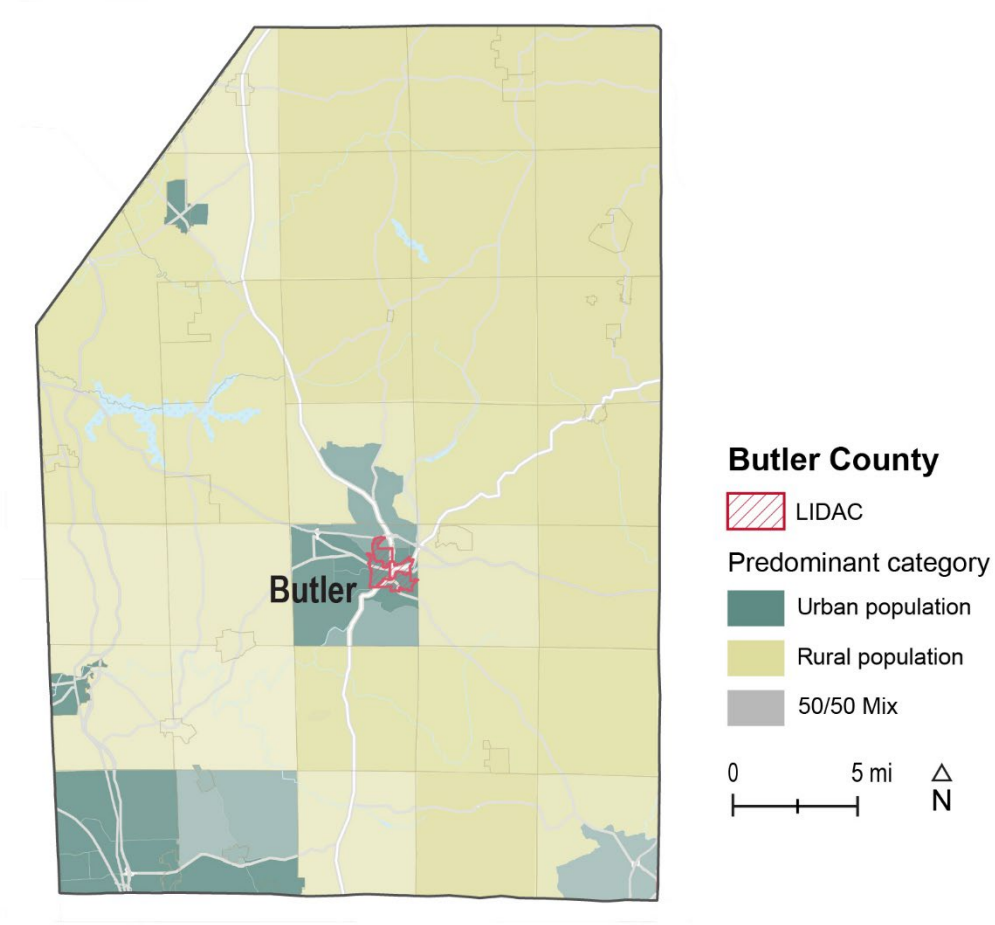

Figure 5. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Fayette County

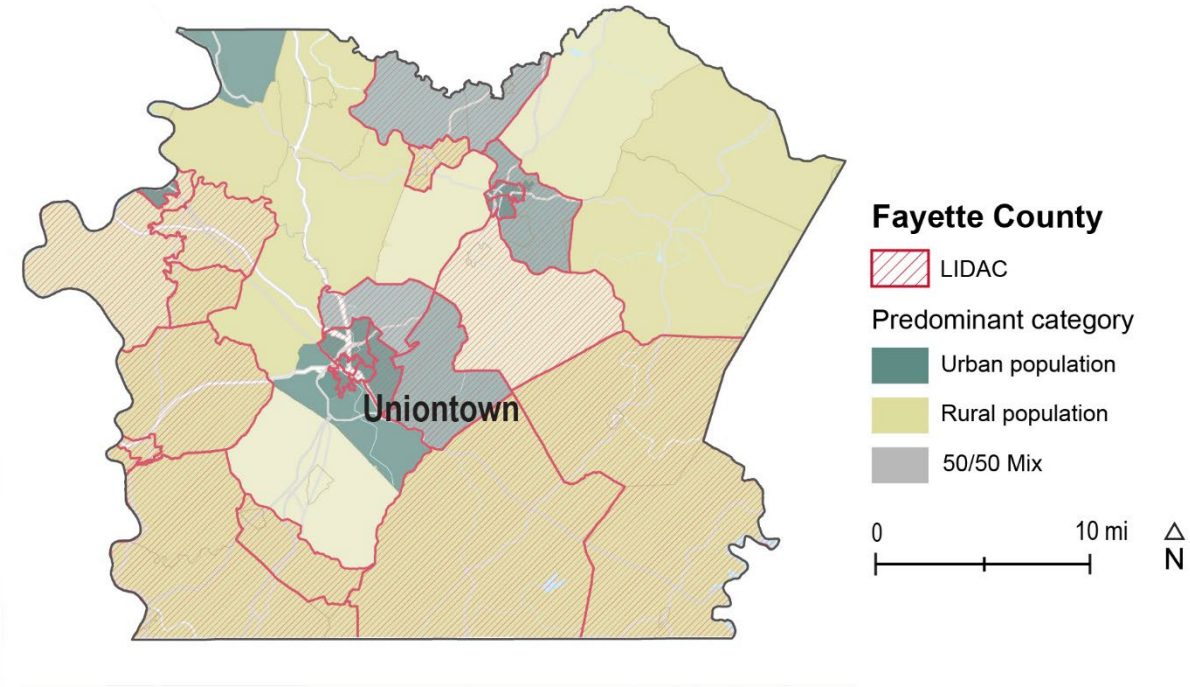

Figure 6. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Greene County

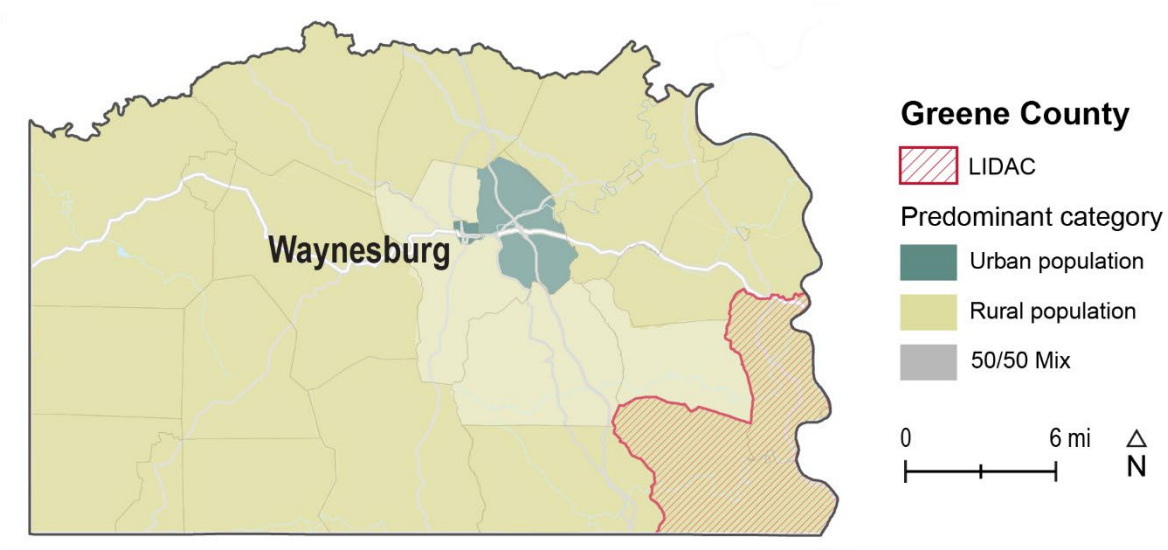

Figure 7. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Indiana County

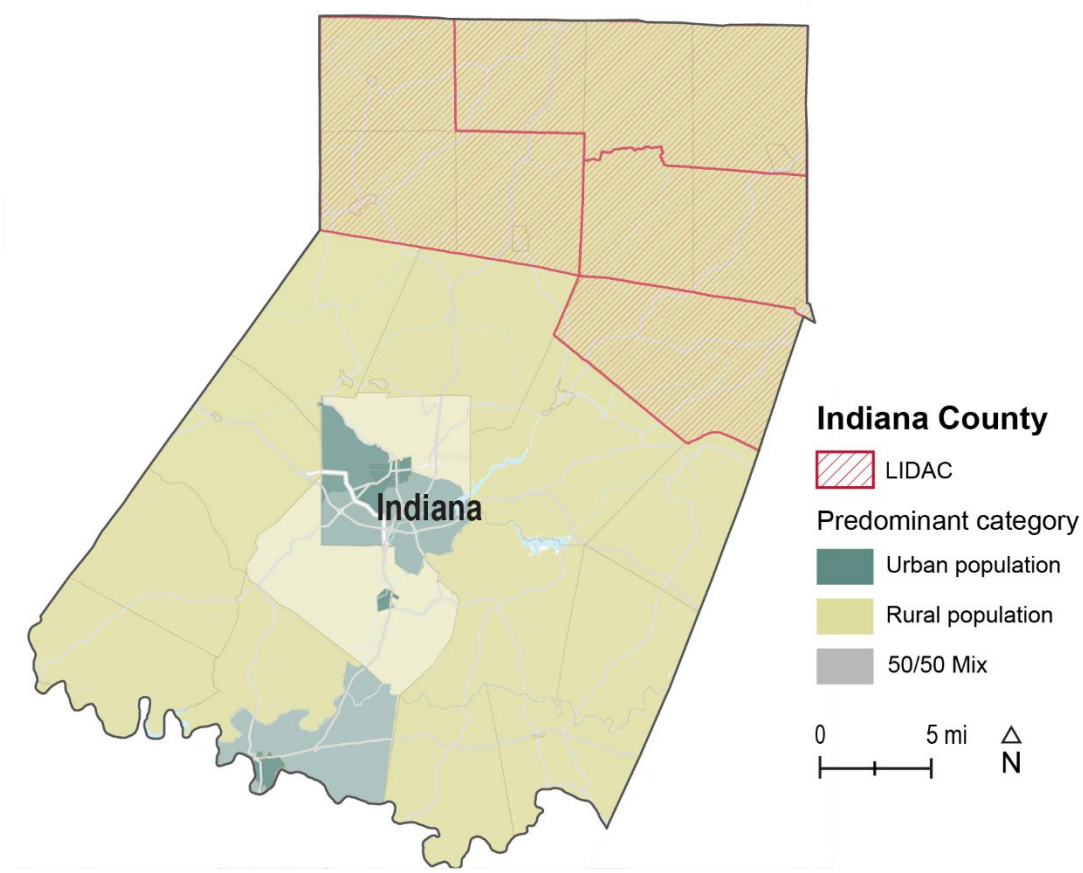

Figure 8. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Lawrence County

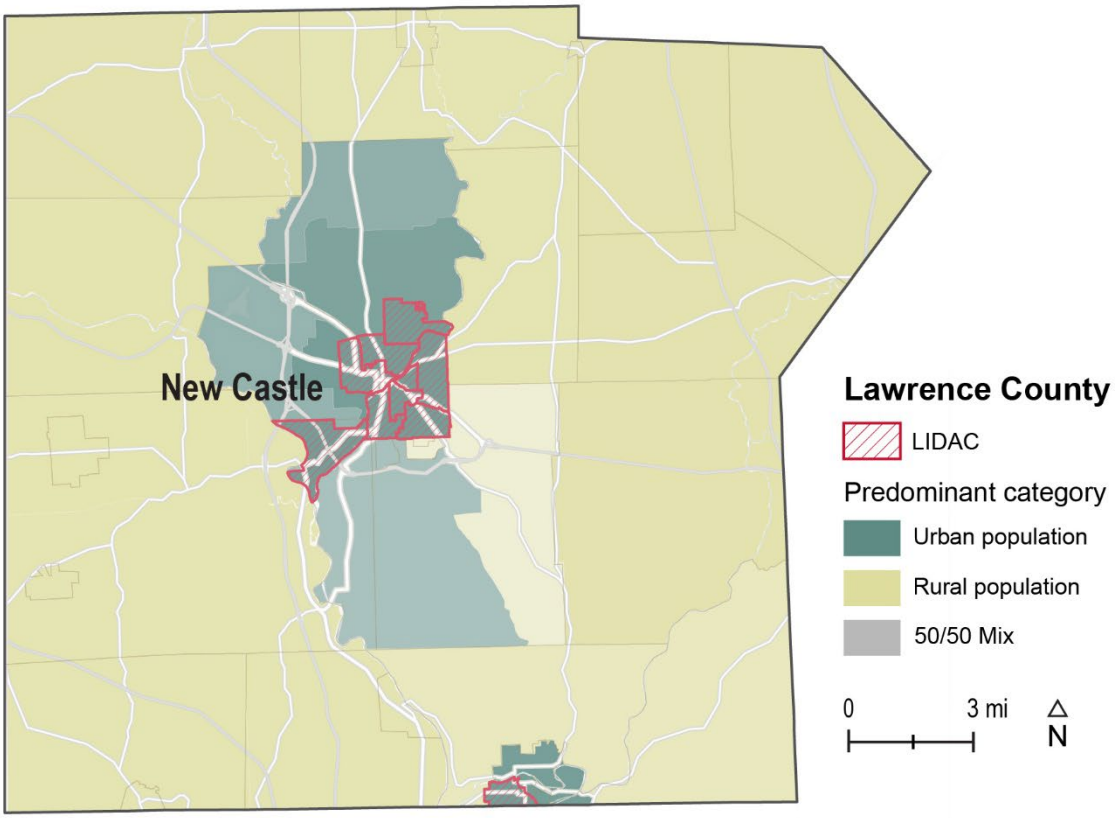

Figure 9. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Washington County

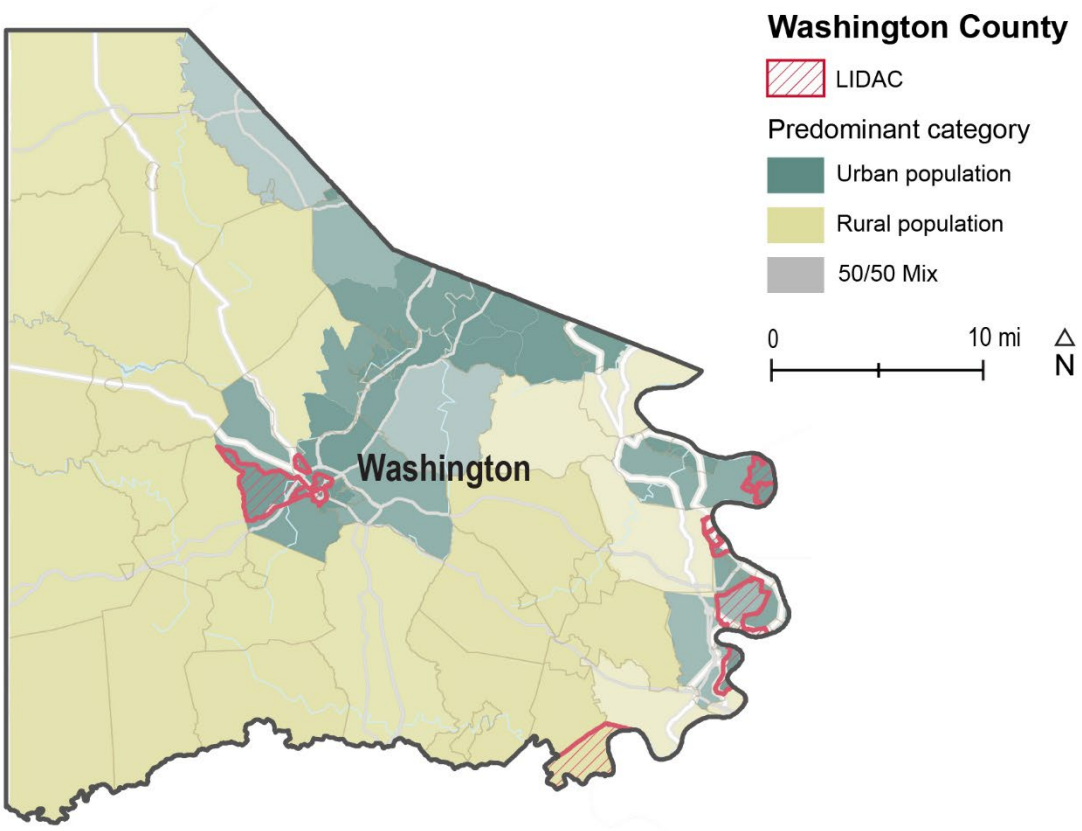

Figure 10. Map of Low Income and Disadvantaged Community Census Tracts and Urban and Rural Areas in Westmoreland County