

MAY 2023

# Climate Resilience in Central Appalachia: Impacts and Opportunities

An analysis of projected climate crisis impacts and its implications for community and economic development in the Central Appalachian region

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## **Executive Summary**

Across the country, Americans are beginning to feel the direct impacts of the climate crisis on their lives, work, health, and property. This has led many from “bellwether” regions like the Gulf Coast, parts of California, and the Pacific Northwest to reconsider the long-term viability of these geographies to sustainably support large populations and functional economies. While adaptation efforts in the most climate-impacted regions are worthy and important, these residents are increasingly seeking alternate locations perceived to be better suited to withstand and adapt to the increasing frequency and severity of climate shocks. Appalachia also finds itself facing the immediate effects of the climate crisis, especially with the increased regularity and unprecedented intensity of flooding across the region (USGCRP, 2018), including recent historic rainfall events in Eastern Kentucky, West Virginia, and Western North Carolina. Despite increased rates of severe flooding and other climate related challenges, the Appalachian region is relatively well-poised for climate change-linked in-migration in the coming decades.

Analysis of available data and literature reveals that climate change concerns are already influencing where many Americans are choosing to live (Allen, 2022). Significantly, much of the available data and information point toward Central Appalachia as a likely important hub for in-migration and climate-adaptive development. However, there is a noticeable lack of region-specific research in this field, especially concerning the role of geographies in greater Appalachia. We recommend development of extensive and publicly available research from federal agencies, as well as academic and private institutions on the topic of internal US migration as a consequence of climate change, with specific attention paid to states and communities inside Appalachia as possible climate receiver places.

To date, popular and academic discourse on the topic has focused heavily on the Great Lakes region and the post-industrial cities of the ‘Rust Belt’ as prospective havens for climate migration. Much of the existing literature also reflects an urban-centric analysis for where and how climate migration will occur. However, anecdotal and quantitative data of migratory trends during the COVID-19 pandemic challenge a solely urban centric analysis (Riordan, 2022). Rural areas seem to represent stability in the popular consciousness, and real estate professionals in Appalachia report that buyers from outside the area have begun seeking properties in the region as a hedge against climate disruptions even before the COVID-19 pandemic began (Walton, 2020). Meanwhile, the geostrategic importance of the region’s natural and ecological assets in the face of the climate crisis present significant and complex opportunities for future generations. Invest Appalachia (IA) and its regional partners believe that Central Appalachia—and the rest of the 13-state Appalachian region—has a vital role to play in national climate adaptation and mitigation efforts.

With this report, Invest Appalachia aims to shed light on the key role the region can and must play in safeguarding American economic development, safety, and security through climate adaptation and mitigation, while seeking to re-center rural communities as viable and necessary hubs for forward-looking investment in this era of climate crisis.

Furthermore, this report seeks to establish a baseline analysis of a climate-impacted future for the region that can be broadly shared and understood, so that we can collectively develop the forward-looking tools and resources we need in the present in order to build equitable markets, increase resilience, and safeguard our future.

Given its elevation, mild warm-season temperatures, ecological diversity, mountainous terrain, water resources, and proximity to regions at severe risk of climate disruptions, Central Appalachia is relatively well-positioned geographically to act as a “climate receiver place,” defined as those communities expected to see a net gain in population due to climate change-related migration. This represents extraordinary opportunity for the region in the form of expanded investment and economic growth. At the same time, there exists the possibility of exacerbating longstanding socioeconomic disparities and even creating new challenges such as sharply rising home prices, land access, and cost of living increases linked to rural gentrification. It is the aim of this paper, and of Invest Appalachia generally, to identify the most important and impactful areas for investment and growth while simultaneously seeking to safeguard existing ecosystems and communities that are in many cases currently striving towards greater socioeconomic inclusion, sustainability, and economic parity with the rest of the country.

The physical properties of a geography are only part of what makes a place resilient, economically sustainable and viable in terms of climate change adaptability. Also relevant are issues of equity and justice, affordability, opportunity, good governance, housing and food access, and education, to name just a few. Invest Appalachia is focused on addressing the aforementioned issues through community-aligned, strategic deployment of catalytic and investment capital to facilitate community development. The goal is to nurture sustainable and autonomous economic systems in the region that are able to withstand the shocks and pressures associated with the climate crisis to the greatest possible extent. Invest Appalachia has identified several areas in which climate change is likely to affect community development and resilience across the region’s economy, including IA’s four key impact sectors: Community Health, Clean Energy, Food and Agriculture, and Creative Placemaking. This paper explores how forward-looking planning, strategy, and investment across these and other sectors can help to position the region to adapt and thrive in a climate-impacted future.

## Introduction

Invest Appalachia is designed to accelerate both the flow of financial resources to the region's underserved communities, as well as the intangibles of capacity, shared analysis, and collaboration. By incentivizing climate resilience and sustainable development practices within IA's own investment priorities, we hope regional and national partners will join us in enabling rural communities to build resilience from the ground up. Central Appalachia is a complex region consisting of six states (KY, WV, TN, OH, VA, and NC) within the larger Appalachian region spanning from Maine to Alabama. In analyzing the predicted impacts of the climate crisis, empirical evidence, though limited to date, indicates that Appalachia as a region is relatively well positioned geographically to adapt to climate related challenges (PLACE Initiative, 2022). As a result, it will likely see an influx of migrants from other regions within the United States. While we advocate for more publicly-available future research into the topic, we need to begin planning and preparing our communities for that reality now. This effort presents unprecedented challenges and opportunities for innovation and impact in the fields of community economic development, economic justice, sustainable development, and impact investment. The geostrategic position of the region and its resources, being within five hours driving range from most metropolitan areas East of the Mississippi, presents varying conflict and security implications vis-a-vis migration in the decades to come.

**A shared understanding of this climate-impacted future is essential to securing livelihoods in the near term and preparing the region to be a likely destination for in-migration as the country, particularly the east coast and southern region, is projected to face more frequent and severe climate shocks. Here, we aim to outline the challenges and opportunities Central Appalachia will encounter related to community and economic development through a climate lens. Specifically, we must understand the opportunity to mitigate the impacts of climate shocks on already vulnerable rural communities. This baseline analysis will be critical to advancing long-term climate resilience, as well as environmental and economic justice in the region.**

The extraction of Appalachia's natural resources has fueled economic growth of the United States for generations, while the industries associated with this extraction contributed directly to the climate crisis itself. All the while, working families in rural Appalachian communities received little benefit from this extraction and bore the brunt of the economic, environmental, health, and social costs of this country's extraction-based energy economy (Crosson, 2021) (Zipper & Skousen, 2021). In fact, economic and environmentally motivated migration are central facets of the region's past, present, and future. As we look forward, it is clear that Appalachia will become increasingly relevant nationally and internationally in the

coming decades due to its role as a natural carbon sink and as a globally-significant site of ecological diversity that is juxtaposed by defaced mountains, fouled waterways, and other legacy impacts of fossil fuel extraction (The Nature Conservancy, 2022).

Invest Appalachia is committed to building more equitable and sustainable economic markets within our region. Necessary to achieving that objective is the recognition that the climate crisis will challenge and exacerbate existing inequalities (and is doing so already). Doing this work in a region with existing economic challenges requires the assembly of collaborative infrastructure to move tailored and targeted resources to the ground, in support of a climate resilient future.



## About Invest Appalachia

As a new platform for the deployment of aligned philanthropic and investment capital, Invest Appalachia (IA) uses impact investing to create equitable and resilient communities in Central Appalachia. IA works within the region's community development and investment system to develop strategies and resources that enable transformative investment to reach the hills, hollers, and rural communities that need it most.

Founded in 2019, IA is a regional social investment fund built by and for the people of Central Appalachia. IA provides integrated investment and philanthropic capital to strengthen businesses, build local wealth, advance critical sectors, and increase quality jobs and quality of life in Central Appalachia. Invest Appalachia deploys philanthropic and/or investment capital into projects related to clean energy, food and agriculture, community health, and creative placemaking, as well as other impact-aligned projects in the Appalachian counties of KY, NC, TN, OH, VA, and WV.

IA is committed to building equitable and sustainable communities for future generations of all of Appalachia's people. IA approaches this work with a Just Transition lens, referring to concepts and frameworks including the Just Transition Fund, which outlines its Just Transition framework as a set of "place-based economic development strategies that support local entrepreneurs and build on community assets" in coal impacted communities, as well as the Climate Justice Alliance, which defines Just Transition as "a vision-led, unifying and place-based set of principles, processes, and practices that build economic and political power to shift from an extractive economy to a regenerative economy."

Initiated through the Appalachia Funders Network and developed by regional leaders representing CDFIs, public and private philanthropic entities, community organizations, and universities, IA is designed to accelerate inclusive market development in the region. IA does this by employing a blended capital approach which combines concessionary Fund investment alongside philanthropic resources ("Catalytic Capital") in order to provide patient, non-extractive resources to absorb risk and leverage additional investment to advance impact-forward projects. IA deploys these financial resources in coordination with the critical social capital of the region's existing ecosystem to ensure community accountability, support, and success.

**Investment Capital:** The Invest Appalachia Fund, LLC provides patient, flexible, and often subordinated loan capital to underserved communities for community development projects, including real estate and facilities, businesses, infrastructure, non-profits, and financial intermediaries.

## About Invest Appalachia

The IA Fund coordinates with locally-focused and sector-focused partners, making loans alongside and into existing regional financial intermediaries, thereby leveraging existing capital and capacity to accelerate the overall flow of capital to Appalachian communities.

**Catalytic (Philanthropic) Capital:** Invest Appalachia provides hyper-flexible grant funding in investment-like forms in order to strengthen the regional community investment ecosystem, develop an inclusive investment pipeline, and increase “investability” of high-impact projects in underserved markets. These dollars are also used to incentivize climate resilience within projects seeking investment and to leverage repayable investment into climate-focused projects. Financial products are purpose-built to support pre-development capacity and technical assistance, as well as to provide high-leverage credit enhancement tools (e.g., guarantees, loan loss reserves, conditional repayment grants) to secure additional investment. Catalytic Capital targets gaps in the current philanthropic ecosystem, complementing federal funding flows and aligned grantmaking by 60+ members of Appalachia Funders Network.

IA’s catalytic capital is managed in various sub-pools based on geography, sector, and issue area. One priority is a sub-pool of capital to infuse and incentivize climate resilience across the entirety of IA’s portfolio. We utilize these dollars to support a wide variety of projects to explore and ensure that investment dollars are being used not only to catalyze climate-smart economic development but also to help our communities adapt their built and natural environments to better withstand climate shocks and recover after disaster.

**Social Capital:** Invest Appalachia supports the region’s overall investment ecosystem, working across the region’s robust network of organizations, peer networks, and place-based grassroots capacity (Center for Community Investment & Invest Appalachia, 2021). A comprehensive framework for this approach can be [found here](#). IA’s partnership-based pipeline integrates opportunities from partners, coordinates strategies, leverages community and technical capacity, and accelerates existing place-based industry sector clusters. IA’s Community Advisory Council, a diverse group of regionally representative grassroots stakeholders, defines sector priorities and impact goals as “mission steward,” a built-in community accountability mechanism for IA. To support ecosystem capacity, IA provides training and field-building tools, as well as coordinated impact data collection, storytelling, and support for regionally defined narratives.



## About Invest Appalachia

Table 1. Invest Appalachia Entities and Deployment

Target Fund Size	<b>IA Catalytic Capital Pool</b>		<b>Invest Appalachia Fund, LLC</b>		
	\$17,000,000 (over 7 years)		\$40,000,000 (7 year investment period)		
Tools	<b>TA &amp; Targeted Coordination Grants</b>	<b>Credit Enhancements &amp; Non-Extractive Financing</b>	<b>Direct Project-Level Loans</b>	<b>Loan Participations</b>	<b>Loans to Intermediaries</b>
Examples	Targeted grants for ecosystem support; TA for projects or clusters; pipeline developments	Enhancements such as loan guarantees, loan loss reserves, or collateral supports; non-extractive repayment models	<ul style="list-style-type: none"> <li>Real Estate [e.g., construction, renovation, mini-perm financing]</li> <li>Business [including non-profits &amp; social enterprises e.g., working capital, equipment]</li> </ul>	Loans to CDFIs and other regional financial intermediary institutions	
Governance	Priorities and guidance set by Community Advisory Council of grassroots stakeholders; deployment approved by IA Board of Directors.		Pipeline and underwriting managed by IA staff and LOCUS Capital; loans reviewed and approved by multi-stakeholder Investment Committee.		

Table 1 provides an overview of IA’s categories of financial resources.

Given the increased frequency and severity of climate impacts such as flooding in our region, we see a need for collaborative and innovative solutions at local and regional levels. IA is committed to helping build the necessary resources for rural communities to prepare and implement their own strategies for climate-resilient development and adaptation.

## Part 1: Assessing Climate Impact: Themes and Observations

This section of the paper provides a summary of a broad-scope literature review which establishes that climate change concerns will increasingly drive internal US migration, identifies Central Appalachia as possible important site of in-migration at the national scale, and begins to elucidate some of the challenges and opportunities for the region represented by these changing demographics and climate change impacts.

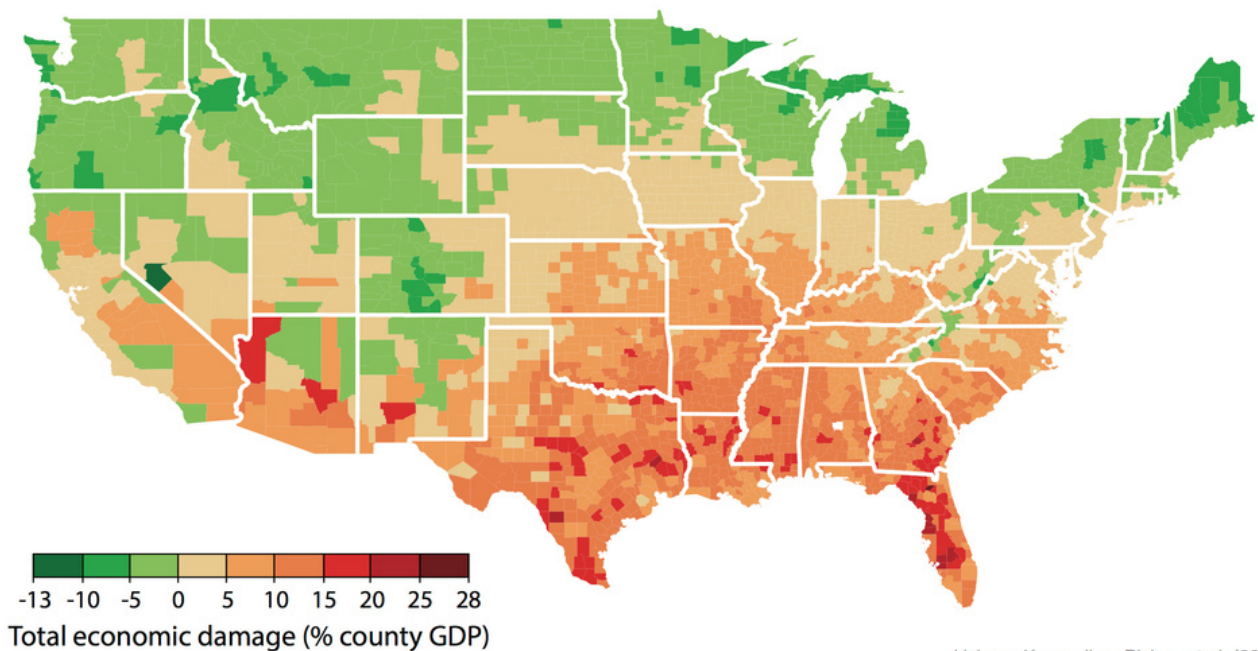
As the direct impacts of climate change become more dire and begin to compound, more attention is being paid to which communities and regions of the United States may be relatively more resilient with regard to climate change and the ability to adapt. Several factors suggest that Central Appalachia could play an outsized role in the United States' national climate adaptation in the coming years.

Centrally located along the eastern seaboard, yet far enough inland to protect against major Atlantic storms, Central Appalachia boasts a temperate climate buffered against extreme heat by elevation and plentiful rainfall, a burgeoning sustainable agriculture sector, and available property at prices lower than the more heavily populated coasts—factors that make the region an attractive place for investment as a hedge against looming climate shocks. However, to date, the area most commonly-identified as an ideal location within the US for in-migration and overall resilience to climate change is the Great Lakes region. Without question, the post-industrial cities of the Great Lakes region represent opportunities for more rapid urbanization in the decades to come given the large-scale infrastructure already in place in addition to geophysical considerations, such as abundant fresh water and comparatively mild summer temperatures. While much popular and academic literature omits Appalachia as a site for in-migration, this analysis makes the case that it should be not only considered, but made a priority for investment.

### Domestic Climate Migration: Refuge and Resilience

First, it is necessary to establish that climate change concerns will become a primary driver of where Americans choose to live. It is widely recognized that globally poor and rural populations face the brunt of climate impacts currently and will continue to do so. Yet, it can be difficult to see the influence of concerns over climate change impacts on internal US migration today. In fact, the opposite appears to be true at the macro level, as many of the nation's fastest-growing cities are located within areas at the greatest risk of climate change impacts (Clark et al., 2022). The "Sunbelt" region of the United States, including the desert Southwest, Texas, and the Gulf Coast region, has accounted for a staggering 75% of

US population growth in the last decade, according to real estate research group Clarion Partners. The Sunbelt's in-migration has been driven by economic opportunity and favorable climate conditions, but climate change impacts threaten both of these. The impacts of climate change on economic growth for the Sunbelt region are projected to be severely damaging due to a confluence of factors, including increased mortality, property damages, lost productivity, higher energy costs, and lower agricultural yields (Hsiang et al., 2017). These economic damages are visualized in the map found in **Figure 1**. In contrast, the Appalachian region aligns with much of the Northern US in its likelihood to experience economic growth as a result of climate change-related impacts. That economic growth is tied largely to shifting demographics and in migration, including more businesses relocating to regions that are comparatively better suited to withstand and adapt to our changing climate, as well as changes to energy costs and agriculture yields (Hsiang et al., 2017).



**Figure 1.** Projected economic damages at the county level as percent of GDP in the US from 2080–2099 (Hsiang et al., 2017). Reprinted with permission from AAAS.

It is reasonable to expect then that the current trend of mass migration into the Sunbelt will at some point cease and then reverse. This could happen rather abruptly given that real estate markets are subject to runs and panics. Beyond that, comprehensive homeowner's insurance coverage for flooding and other climate shocks can be incredibly expensive and are increasingly being denied for climate disaster-prone areas. This is in large part because insurance policies are increasingly incongruous with the nature of climate shocks across the country. For example, in Eastern Kentucky, the overwhelming majority of homes impacted by the flooding were not in historic flood plains, but are adjacent to small creeks where

intensive flash flooding occurred.

Moreover, data from government and independent nonprofit organizations show that the majority of flood-impacted homes in several recent disasters, such as Hurricane Harvey and Superstorm Sandy, sit outside historic floodplains. Traditional federal flood risk maps are made using historical climate records, and do not account for climate change projections including increasingly severe and frequent extreme rainfall events (Kuta, 2022). First Street Foundation, a non-profit research and technology group, in collaboration with several major academic research institutions, has built a comprehensive, peer-reviewed property level flood risk model of the United States that includes climate change forecasting in their models. This granular flood risk data, as well as similar modeling data of wildfire and extreme heat risks, is available to the public through the Risk Factor online tool at [riskfactor.com](https://riskfactor.com) (First Street Foundation, 2023).

Additionally, the same low taxes and lack of government involvement that has attracted so many businesses and migrants to the Sunbelt in the first place may contribute to a lack of resilient infrastructure, which could prove extremely costly as the impacts of climate change accelerate and compound. It is crucial that Appalachian communities not follow the same laissez faire approach of government towards the impending effects of climate change. Instead, adaptation must be intentional and proactive to develop resilience before it is needed, not after the damage is done. The relatively favorable geophysical properties of the region alone will not suffice to protect against increasingly disruptive climate impacts.

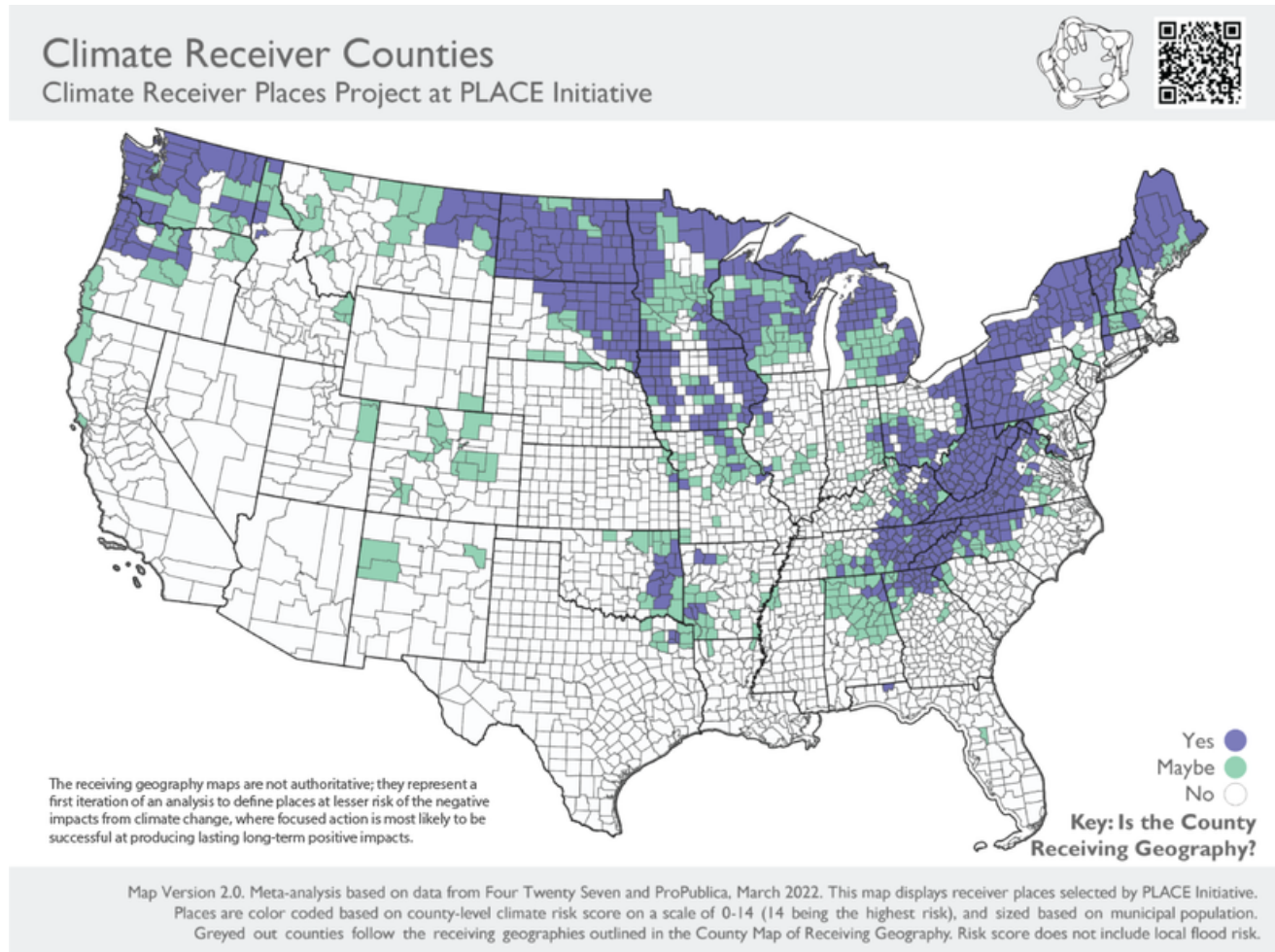
While the macro level trend suggests that climate change has not yet fundamentally altered internal migration patterns in the United States, a closer look at individual markets reveals there is already concern among real estate investors. To date, the largest and most frequently cited study of the effects of climate change concerns on property values is one conducted by online real estate market company Zillow. That study compared the selling prices of similar homes at slightly different elevations, and therefore with differing levels of vulnerability to sea level rise, within given neighborhoods of the Miami-Dade County (MDC) market. The study found a positive correlation between elevation and selling prices for similar properties, signaling that the effect on the market is already detectable in the data, which supports abundant anecdotal evidence (Rao, 2017). More recently, a national survey conducted by Forbes Home found that nearly a third of American respondents who moved homes in 2022 cited climate change as a reason for their move (Allen, 2022).

After establishing that climate change impacts will increasingly drive migration patterns in the United States, the relevant next question is, “Where will people go?” In the available literature, both popular and academic, the most common answer by far is the Great Lakes

region of the Upper Midwest and Northeast. Broadly speaking, this is due to natural factors such as availability of freshwater, mild warm-season temperatures, and distance from the rising seas and tropical cyclones, as well as ample physical and social infrastructure already in place dating from the height of the industrial manufacturing era. Cities such as Buffalo, NY, and Detroit, MI, are well positioned to accept a relatively large increase in population. When associate professor of real estate at Tulane University Jesse Keenan recently provided financial news outlet CNBC with a list of the top 10 “climate haven” cities in the United States, nine of them were in the Great Lakes area... The one notable outlier being Asheville, NC. Keenan’s inclusion of a mountain city points to the important fact that Appalachian cities and towns will become increasingly relevant to the nation’s adaptation to climate change. This is especially true given the region’s geographic proximity to the Gulf Coast and Deep South states, which consistently rank among the most at-risk to climate change-related negative impacts. In addition to Asheville, one may also expect to hear cities such as Knoxville, TN, Morgantown, WV, and many other localities of Central Appalachia discussed as ideal places to relocate for those seeking areas more resilient to climate disruptions. [A recent article from the Yale School of the Environment](#) includes Appalachia in the shortlist of increasingly popular climate destinations: “As wildfires worsen and sea levels rise, a small but growing number of Americans are choosing to move to places such as New England or the Appalachian Mountains that are seen as safe havens from climate change. Researchers say this phenomenon will intensify in the coming decades” (Hurdle, 2023).

While no place is immune to damaging climate change impacts and related societal challenges, the fact remains that the direct geophysical impacts of climate change are unevenly distributed. Further, the ability of cities and communities to adapt to those impacts also varies widely. Stated simply, when it comes to the impacts of climate change, some places are better positioned than others. The term “receiver places” was coined by urbanist theorists to describe cities and towns, communities, and neighborhoods of various scales that may expect in-migration related to climate change. To begin to empirically identify receiver geographies, PLACE Initiative in collaboration with ProPublica and Four Twenty Seven created a weighted meta-analysis using a set of nine climate risk factors to determine a county-level risk score (PLACE Initiative, 2022). Only those counties assigned a score of 0-2, or the lowest climate risk, are considered to be receiving geographies and are depicted in blue on the map of the contiguous United States found in **Figure 2** below. Those counties with a score of 3 are considered marginal “receiving geographies” and are depicted in green. All other counties, or those receiving scores of 4 or higher, are considered “sending geographies,” meaning that they are considered by the analysis to be at a high enough level of climate risk that they may expect to lose population due to the impacts of climate change. When looking at the PLACE Initiative map, the Appalachian

region clearly stands out. Very broadly speaking, the receiving geographies fall into one of two categories, one of those being counties in states that border Canada and/or in the Great Lakes region, and the other category being the counties of Central and Northern Appalachia.



**Figure 2.** Map of US counties identified as “receiving geographies,” which are projected to gain population as a result of climate change (PLACE Initiative, 2022).

### Climate Gentrification in Small Towns and Rural Places

As Americans begin to migrate from more heavily impacted regions across the Southeastern US and coastal regions, they’re likely to travel towards northern, inland states, or to the much closer Central Appalachian region. A great many are likely to opt for the latter. This prospect raises the emerging issue of “climate gentrification” (Nathan, 2019), a phenomenon in which individuals of higher socio-economic status site their primary

residences or investment properties in areas that are perceived to be in less danger from direct climate change impacts, in turn driving up property values and taxes in those areas while impacting the existing social and cultural makeup (Payne, 2019). A fast-growing remote worker population and the COVID-19 pandemic have added to ex-urbanization and amenity migration to create a situation where certain regions, including parts of Appalachia, are experiencing growth rates unseen since the coal and industrial booms of the mid-twentieth century. Given the added pressure of climate migration on top of these circumstances, **how well or poorly communities in Appalachia adapt to the challenges and opportunities presented by in-migration in the present and near future may well define the region for a generation or more.**

One important factor that could exacerbate the effects of climate gentrification is the simple fact that the mountainous terrain of the region makes construction of all kinds relatively difficult compared to the Sun Belt and other fast growing housing markets in the US. This includes new housing construction and other physical infrastructure build out to support a growing population. One practical consequence could be a housing supply that is quickly and increasingly exceeded by demand, causing sharp rises in rent prices, home selling prices, and property taxes. Marginalized individuals and communities could be unable to afford rent or be coerced into selling as their previously inexpensive housing becomes increasingly desirable, forcing those previous inhabitants into the new margins—i.e., areas that are at higher risk of negative climate impacts.

### **Assessing Risks and Opportunities in the Mountain South**

The emerging consensus that Central Appalachia is relatively well positioned geographically with regard to climate change impacts is broadly backed up by climate science. This research largely uses Western North Carolina (WNC) as a proxy for the broader Central Appalachia region. The 2020 North Carolina Climate Science Report (NCCSR) found that, while there has been a general trend of warming temperatures in Western North Carolina in recent years, particularly an increase in the number of warm nights, these trends have been notably less severe than in the United States as a whole, and are relatively mild compared to projections for the Deep South and Gulf States. This is not to say that the region is in any way immune to climate change: An observed warming trend in recent decades is projected to continue into the future, and of particular concern is the frequency and intensity of extreme precipitation events that the region may expect to experience (Kunkel et al., 2020).

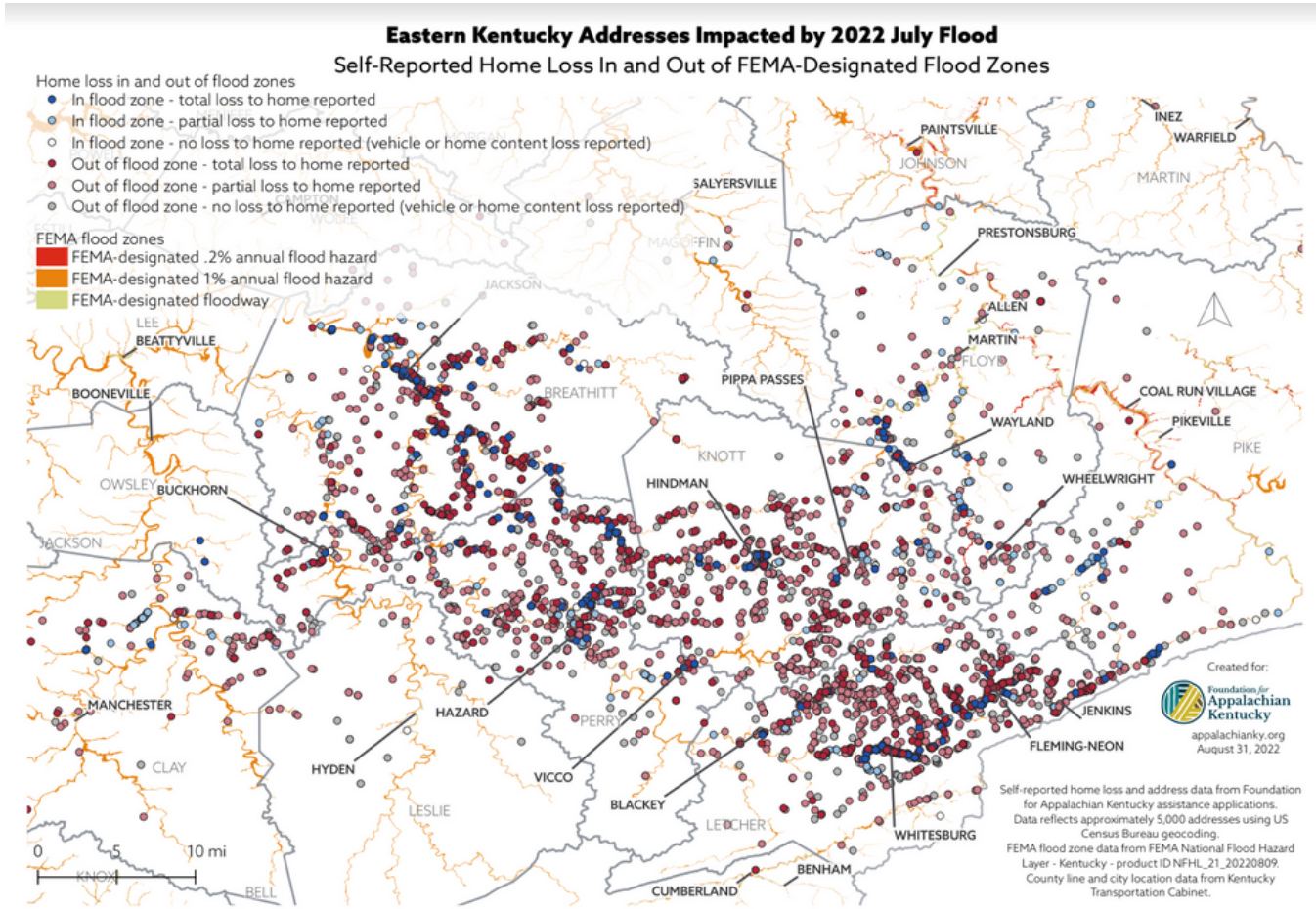
While changes to the hydrologic cycle and precipitation patterns over the mountains are particularly difficult to model and project, the simple fact that a warmer atmosphere holds more moisture means that it is very likely that the region will experience increased

frequency of extreme precipitation events as warming increases. Changes to precipitation patterns are not entirely unipolar, instead manifesting as more frequent extremes in both rainfall and drought. Along with more flooding events, wildfires too are increasing in severity, frequency, duration, and range across the nation, with the change strongly correlated to climate change. This is also true in Central and Southern Appalachia. Modeling done by the USDA Forest Service projects a 236% increase in median area burned by lightning-caused wildfires in the region by 2060 compared to 2020, highlighting the need for proactive land and fire management practices (James et al., 2020). In addition to localized fire hazard risks, smoke from very large fires is affecting vast territories and negatively impacting public health in myriad ways.

Both warmer temperatures and more extreme rainfall pose challenges for communities' infrastructure. Warmer nights and more hot days mean that a region that has historically not relied heavily on air conditioning will increasingly need to do so. This will require expensive structural retrofits to better handle the heat, leading to increased energy demands on the electric grid to run more air conditioners. Additionally, heat stress has serious negative impacts on public health, including exacerbating air quality issues. Extreme rainfall also requires communities to strengthen infrastructure to account for more severe and frequent flooding, including in areas not previously considered to be at high flood risk (Harvey, 2022). This includes the expansion of green and blue infrastructure (utilizing natural features such as floodplains, wetlands, and existing streams in water management strategies) along with updates to planning, zoning, and building codes. Additionally, the mountainous Appalachian region must prepare for increased landslide risks.

The map below outlines self-reported damage to homes from the July 2022 flooding in Eastern Kentucky, which was caused by 11 inches of rain that fell in under 6 hours causing unprecedented flooding. This data shows that the majority of flood damage occurred in low lying areas outside of historic flood zones. This not only shows the evolving nature of climate shocks in the region, but also outlines the pressing need to revise a variety of public policy, community engagement, and investment priorities to advance climate resilience efforts moving forward. Simply put, the rules as we know them don't fully apply anymore.





**Figure 3.** Self-reported damages to homes from 2022 flooding in Eastern Kentucky outline how the majority of flood damages are not located in federal flood zones (Foundation for Appalachian Kentucky, 2022).

In addition to adaptation, the region offers important opportunities for climate mitigation, as the region is currently estimated to store more than half of the eastern region's above ground carbon. The Nature Conservancy has identified the preservation of Appalachian forests and habitats as crucial to protecting biodiversity. As a great number of species of flora and fauna are beginning to shift their ranges poleward as a result of rising temperatures, the higher elevation of the Appalachian range acts as a "virtual superhighway for nature" (The Nature Conservancy, 2022).

## Part 2: Sector-Based Analysis of Climate Impacts and Opportunities

Invest Appalachia's priorities and strategies were developed with the purpose of addressing key capacity and resource gaps in the regional ecosystem that limit the ability of communities to not only grow, but to thrive. IA's analysis and that of our partners is centered around developing the necessary infrastructure, resources, and capacities to support the development of our four priority sectors (clean energy, community health, food and agriculture, and creative placemaking) and industries that support inclusive prosperity. This analysis was developed in concert with CDFIs, foundations, non-governmental organizations, public agencies, academic institutions, and grassroots stakeholders, to support a just economic transition away from historic dependencies on the extraction of fossil fuels.

These targeted sectors represent a starting point for prioritizing community economic development within the framework of just transition, while acknowledging additional economic challenges and opportunities that will emerge from the impacts of the climate crisis. **The overall goal of a systems-level approach to community economic development is to create the circumstances for all of Appalachia's people to have the opportunities to exist equitably and sustainably in their place of choice.**

A great deal of the popular discourse regarding climate adaptation and resilience, as well as a significant amount of investment dollars, currently focuses on emerging high tech solutions and 'green' startup companies. However, for the millions of Americans whose daily lives are increasingly impacted by climate change, building resilience and adapting to climate impacts also requires a much less flashy approach to resilience and adaptation – attention to the basic industries, amenities, and infrastructure that allow people to live and thrive in the face of a transforming climate. While affordable clean energy is important, issues such as community-oriented health systems, robust infrastructure and built environments, thriving local economies, and a diverse regionalized food system are also part of the foundation on which to build a climate-resilient Central Appalachia. This section identifies sectors that we believe are critical to overall climate resilience and which require proactive investment and market development strategies.

Sector	Investment Themes
<i>Community Health</i>	Workforce and affordable housing, community health facilities, health care provider access, addiction treatment & recovery, built environment, childcare and early childhood education
<i>Clean Energy</i>	Renewable energy, energy efficiency, green buildings, clean manufacturing, climate adaptation, mine land reclamation/redevelopment, workforce development, community ownership
<i>Food &amp; Agriculture</i>	Family farms/farmer livelihoods, local retail, healthy food access, craft food & beverage aggregation/distribution infrastructure, value-added processing, agroforestry & forest farming, working lands conservation
<i>Creative Placemaking</i>	Asset-based tourism, outdoor recreation, downtown revitalization, commercial real estate, small business development, community amenities, arts and culture enterprises
<i>Other</i>	Other projects that meet the impact criteria in section III and advance our impact goals of Equity & Economic Justice, Community Wealth Building & Quality Jobs, and Sustainability and Climate Resilience

**Figure 4.** Invest Appalachia focuses on sectors that are driving community development and inclusive prosperity.

These four sectors were identified as essential to the region’s economic diversification, building community wealth, improving social determinants of health, and quality of life in the region longitudinally. Viewed through a climate lens, the development of each of our priority sectors contributes to increasing the investment readiness and entrepreneurial opportunities of the region’s various economies. Across many economic and public health indicators, Appalachia is striving towards economic parity with much of the rest of the country. As we grapple with a just transition in the coming years, we’re focused on longitudinal community resilience and exploring pilot adaptation projects that can be replicated throughout the region. An experimental approach to financial products is necessary to enable the region to test strategies and deploy resources in each sector in a way that incentivizes climate adaptation throughout our entire investment approach.

Within each sector-focused investment theme below, we offer some initial analysis of how climate change will create new challenges, needs, or opportunities related to the priority strategies or core issues within each sector.

## Food and Agriculture Systems

**Market Development** – Climate-related disruptions are creating greater demand for strong

regional food systems. Warming trends are leading to longer growing seasons and greater crop variety, plus new challenges such as increased pest and disease pressure, heat damage, drought, and flood loss, including soil erosion. These challenges are likely to be most severe in the Great Plains, Central Valley of California, Desert Southwest, and western Gulf of Mexico regions, placing pressure on Central Appalachia for expansion of the agricultural sector (Union of Concerned Scientists, 2019). As the COVID-19 pandemic has illustrated, long-distance supply chains are particularly vulnerable to disruption, while the shorter, more direct supply chains of regionalized food systems should allow for more resilience to system shocks. At the same time, a strong regionalized food system helps build food sovereignty and allows for localized control of food production and distribution, creating both food security and local jobs. The USDA designates such local and regional producers, cooperatives, supply networks, food hubs, and retailers that constitute regional smallholder food systems as ‘mid-tier value chains,’ and has identified them for special funding status (USDA, 2022).

**Healthy Food Access** – National and international supply chain disruptions and food price volatility is likely to become increasingly turbulent; thus putting greater demand on regional food systems. (Davis et al., 2020). A robust infrastructure for regional food production that emphasizes smallholder farms and the production of diverse crop varieties would help build resilience into the food system and prove better able to adapt to unpredictable climate change impacts than the dominant monocultural practices of industrial farming. While mainstream food assistance networks rely on shelf-stable products, warehousing, and long-distance distribution channels, there is an emerging recognition that fresh, local food products can provide improved nutritional options as well as reducing dependence on long supply chains that are vulnerable to economic and weather shocks.

**Working Lands Conservation and Sustainability** – Access to arable land for sustainable farming operations may be hindered by price competition due to climate change-linked in-migration. Land identified as important for conservation may similarly be threatened by development. Policy and protection status are likely crucial mechanisms to secure land access and management. There is great potential for carbon sequestration in intentional agriculture practices and land management strategies more broadly, including agroforestry, regenerative agriculture, and restoration of riparian zones. Sites of mountaintop removal and other lands damaged by extractive activities could especially benefit from restorative land management practices. For example, analysis from the Ohio River Valley Institute reveals that if just one-quarter of Abandoned Mine Lands (AMLs) were reforested, the resulting carbon sequestration would equal the annual emissions of approximately 40,000 homes (Dixon, 2021).

**Green Infrastructure for Food Hubs (Processing, Aggregation, and Distribution)** – While global corporate supply chains have been an early and appropriate focus for increasing sustainability through operational efficiencies such as waste reduction and green transport, similar opportunities for resilience apply to local and regional food systems. Specifically, a robust regional food system requires hard infrastructure in the form of facilities, equipment, and transportation. Solar powered buildings (ideally with storage), energy efficient cold storage and processing equipment, electric vehicles, and waste stream management are all opportunities to simultaneously reduce carbon footprint and increase the resilience of the regional food system in the face of climate shocks and economic disruptions.

**Sustainable Production Practices and Carbon Offsets** – One policy area for robust consideration is creating or participating in carbon credit/offset markets, which could represent an important revenue stream for land owners and agriculture operators while incentivizing best practices that promote soil ecology health. In addition to drawing down and storing carbon, these practices protect waterways from contamination by runoff of excess agricultural inputs, including industrial chemicals found in fertilizers, pesticides, and fungicides. Even in their current state regionalized sustainable agriculture practices require substantially less fossil fuel-reliant inputs in the production of crops. Not only is there less reliance on heavy machinery, significantly less industrial chemicals are used as inputs and amendments, which are often themselves derived from fossil fuel products.

## Community Health

**Public Health Outcomes** – Climate change poses risks for public health across the US, especially in the form of air quality issues and extreme heat exacerbating both acute and chronic respiratory and cardiovascular problems. Supporting the development of the region’s community health infrastructure is vital to create healthy communities as population increases alongside growth of other key economic sectors. Utilizing the social determinants of health framework, some immediate strategies for creating more climate resilient communities include:

- Identification of neighborhoods, people, and resources most at risk; developing or adapting protocols for delivery of mental health services during and after extreme weather events.
- Public and municipal awareness, outreach, and training for local disaster preparedness and recovery efforts within local and county governments, including other public health challenges related to climate like air quality, by utilizing existing resources like EPA’s Air Quality Index tool at [Airnow.gov](https://www.airnow.gov).
- Heat island cooling strategies such as increased tree and vegetation cover in public

places, green or reflective roofs, and the creation of community cooling centers for extreme heat events, including transportation plans for elderly and disabled people.

***Housing and Affordable Housing*** – Climate-related in-migration, especially “climate gentrification,” is likely to place great pressure on housing affordability in Central Appalachia as the region becomes increasingly desirable at the national scale. Expanding floodplains and the consequential rate increases for homeowners and flood insurance may also exacerbate affordability issues nationally. As noted earlier, it is increasingly evident that insurance providers and regulatory bodies are in structural misalignment with the evolving realities of the climate crisis. Affordable housing is currently and will continue to be a central issue as it relates to community health and safety in the generations to come. Entire communities will inevitably have to adopt intensive climate adaptation measures or relocate altogether.

## **Clean Energy**

***Green Buildings and Energy Efficiency*** – As the region warms above historic baselines due to climate change, green buildings and energy efficiency take on even greater significance. This is especially true as many homes and other buildings that historically have not required air conditioning will become too hot to comfortably or safely inhabit without it. This will create greater energy demand, straining rural energy grids and driving up prices, causing affordability and reliability issues. While there are long term benefits, the difficulty and expense of retrofitting manufactured homes and older structures including aging municipal buildings is high, making it unrealistic for many families and rural municipalities and businesses without outside assistance, particularly state and federal funding and favorable policy. Updated governmental policy with regards to energy suppliers and utility providers is also a critical component of ensuring expanded access to the environmental and economic benefits of renewable energy technology.

***Renewable Energy Economy*** – Central Appalachia represents a significant growth market for renewable energy in both solar and on-shore wind, leading the nation in projected economic benefit of solar and wind buildout from 2021–2030 (Topsado et al., 2021). The former mining workforce is well positioned to transition to a renewable energy economy. For example, small-to-medium-scale commercial and institutional solar (churches, school systems, municipal buildings, grocery stores) provides employment opportunities in addition to resilience and climate benefits – an analysis which grounds the Appalachian Solar Finance Fund’s approach ([solarfinancefund.org](http://solarfinancefund.org)). There is also great potential for community solar, micro-grids, cooperatives, and other democratic approaches to the

energy economy (see next paragraph). Demand-side support for clean energy development is critical, however, as market forces will skew new renewable energy development towards areas of wealthy and/or dense population where developers have more and larger projects to build a business around. Demand-side support needs include public education, local policy change, predevelopment support for the planning and feasibility stages of projects, workforce development and training, flexible bridge financing tools, and creative large scale investment. Invest Appalachia is interested in supporting clean energy projects of all sizes that are informed by sustainable climate adaptation practices.

**Energy Democracy** – Renewable energy, especially solar, represents an opportunity for greater individual and community energy democracy and a move away from utility monopolies. This is an important issue as energy markets that rely heavily on fossil fuels become increasingly volatile through their ties to the global market. With the support of creative financing products like what Invest Appalachia offers, rural communities can begin to increase their energy efficiency and localize energy generation with a blend of on- and off-grid infrastructure. However, restrictive policy and regulatory contexts heavily constrain these possibilities currently. For this reason, it is misguided to focus entirely on the technical possibilities of renewable energy technologies as the answer to climate adaptation, since they may not be feasible in many jurisdictions. Instead, we advocate for a pragmatic approach that puts resources and energy into technologies and resources that can actually be deployed in the current policy and economic context, and done so in a way that benefits rural and other underserved communities. A democratic and equitable energy transition is not a technical problem, it is a problem of political will and appropriate resources.

### **Creative Placemaking**

Creative placemaking is best considered a broad framework for place-based community development rather than an industry or sector. It proposes an asset-based, place-centric frame for development and investment decisions that we believe is critical for prosperity, resilience, and inclusivity. In Central Appalachia, creative placemaking includes such strategies as downtown revitalization, asset-based tourism, small business development, arts and culture based development, and leveraging the power of the creative economy. All of these strategies, especially when taken together, help to foster diversity, inclusivity, and community engagement and can ensure overall quality of life and a sense of togetherness in the face of climate disasters and other challenges.

**Downtown Revitalization and Community Livability** – Downtowns are critical to a future of increasing population in Appalachia's small towns and cities, the likely scenario discussed in

the first section of this paper. A focus on dense mixed-use (commercial and residential) development intentionally centered around existing downtowns, vs the sprawling development that currently characterizes rural gentrification, has major advantages for an expanding population. This intentional downtown-centric focus on redevelopment helps to support community vibrancy, cultural inclusion, enhanced walkability/bikeability and public transportation options (which have implications for both public health and emissions).

Special attention must be paid to the fact that many of the region's historic downtowns are in low lying valleys and floodplains relative to the surrounding mountains, and recent analysis from First Street Foundation (2020) has revealed that a great many locations in Appalachia are at higher flood risk than previously understood. With the increasing frequency and intensity of extreme precipitation events, adapting the historic hearts of Appalachian communities to be flood-resistant is vital to the long-term preservation of creative placemaking and community safety. Historic buildings or existing structures undergoing redevelopment can incorporate climate-adaptive design considerations including energy efficiency, sustainable construction materials, and much more. Every brick and mortar project is an opportunity to increase the resilience of local infrastructure, preparing communities to adapt our built environments to better withstand the impacts of climate shocks and recovery more quickly. This stance grounds Invest Appalachia's consideration of every investment and should do the same for partner funders and investors.

In fact, adaptive reuse—renovation and retrofitting of existing buildings—is a major climate mitigation strategy in and of itself. Existing research shows that “reusing our existing building stock can help us avoid significant environmentally-costly new emissions, while also providing opportunities to reduce building operating emissions through energy upgrades. It's estimated that reusing and retrofitting existing buildings can save between 50–75% of the carbon that would be expended by constructing a similar building” (Frey & Martinez, 2023). The lion's share of building-related emissions are from the operations of existing buildings (27%), which underscores the importance of energy efficient and green buildings as discussed in the previous section on green energy. However, with new construction accounting for 13% of the building sector's emissions, focusing on adaptive reuse of existing buildings makes an important difference in short and long-term CO2 emission reduction.

***Place-based Tourism and Outdoor Recreation*** – Tourism, particularly eco-tourism in Central Appalachia is a growing sector throughout IA's geographic territory. The natural beauty of the region is home to destinations like Asheville, NC, Gatlinburg, TN, Red River Gorge, KY, the New River Gorge National Park in WV and countless other destinations. In fact,



the Great Smoky Mountains National Park is already the most visited national park site in the nation, and the Blue Ridge Parkway is the second most visited annually (National Parks Service, 2022). With the COVID-19 pandemic even the region's most rural areas have seen an influx of tourism as people sought to leave cities temporarily and in many cases permanently. With increased investment in tourism infrastructure and promotion over the last decade it is projected that larger flows of tourists will be coming to the region. As the impact of the climate crisis intensifies, those numbers will increase as people seek to enjoy the relatively mild warm seasonal temperatures compared to areas at lower elevations and latitudes. This expanded outdoor tourism and recreation represents an opportunity to create a sustainable business and lifestyle sector that generates positive economic activity in the region. It is also an opportunity to promote public awareness and education opportunities around the region's vital environmental assets, and incentivize resource conservation and land management best practices.

**Arts, Culture, and Identity** – As discussed, climate change is likely to bring increased in-migration from across the nation, leading to challenges of integration and cultural identity. The threat of cultural erasure, intentional or otherwise, is especially high in scenarios of gentrification. Relatively affluent new arrivals have access not only to greater economic capital, but often greater social and political capital as well. To help guard against cultural loss of identity, a robust creative economy plays a vital role in cultural preservation and identity for current and future residents. The ability to exchange cultural traditions, tell stories, and forge new ways of expressing identity is critical to facilitating community integration and cohesion, generated through collective community action (Burke et al., 2020). Cultural and creative expression are key to understanding, retaining, and shaping cultural identity in any place, especially when that place is changing and incorporating new histories, identities, and cultures. While economic investment in other sectors will shape and secure the built and natural environment of the region, empowering creative voices to shape narratives and tell the story of a place as it is changing is also fundamental to the lived experience of present and future populations, and an imperative strategy for shaping broader public discourse in a healthy and inclusive direction.

## Appalachian Climate Resilience in Action

### Community-Oriented Solar Development

The [Appalachian Solar Finance Fund](#) is helping public school systems in the coalfields install solar, lowering costs, increasing energy resilience, and developing a local workforce.

### Coal Mining Byproducts and Value-Added Processing

Social enterprises like [True Pigments Paints](#) are turning harmful mining byproducts and legacy impacts into sustainable development opportunities. Research and product development at academic institutions like Ohio University are also leading the way to create economic growth at the intersection of environmental remediation and value-added products.

### Climate Resilient Housing

Housing developers like [Housing Development Alliance](#) and [HOMES Inc.](#) are helping move flood-impacted E. Kentucky residents into homes built in less vulnerable areas. Ohio River Valley Institute (ORVI) [estimates](#) that the cost of this approach is twice that of rebuilding in flood-prone areas, but saves money and lives in the long term.

### Greening Food Hub Infrastructure

Regional food system intermediaries like [Appalachian Sustainable Development](#), [Coalfield Development](#), and [ACEnet](#) are working to “green” regional aggregation and distribution infrastructure through solar power, energy efficiency, and electric vehicle transportation.

### Reforestation and Agroforestry

Organizations like [Green Forests Work](#) are replanting native trees on reclaimed mine lands, while [Rural Action](#) and others support sustainable forest management and non-timber forest product opportunities for small landowners.

### Downtown Revitalization and Sustainable Design

[Studio Appalachia](#), a partnership between the UK College of Design and local partners, has used a community-led, collaborative design process to plan for climate resilience and sustainability in downtown Hazard, KY.

### Infrastructure for Collaborative

Networks such as the [Central Appalachian Network](#) and the [Appalachia Funders Network](#) have formed Climate Resilience Working Groups to share strategies around the intersection of community economic development and climate.

## Appalachian Climate Resilience in Action

### Coalition Building

In 2022, **The Appalachian Climate Technologies (ACT) Now Coalition** received a \$62.8 million investment from the U.S. Economic Development Administration, matched by \$28 million in funds from philanthropy. This historic investment is not only a major federal commitment to West Virginia and Central Appalachia, it also represents a community-first focus on climate resilience. The coalition represents a bold new approach to partnership, with municipalities, higher education, economic revitalization organizations, and others collaborating to address a multifaceted challenge. The coalition includes many of West Virginia's most innovative non-profit organizations, as well as its two largest universities, and more than 50 private companies. Regional partners like Invest Appalachia and the Appalachian Solar Finance Fund also participate in the coalition. Their goal is to prepare rural and economically-distressed communities across Southern West Virginia to advance long-term community and economic development strategies in the face of climate change.

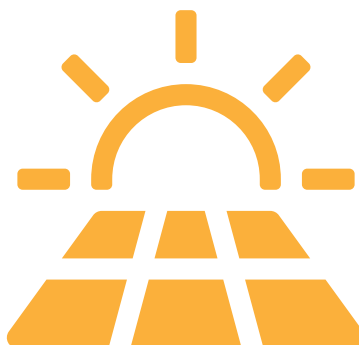
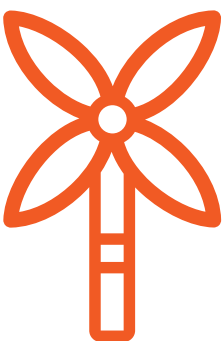
The scale and ambition of the ACT Now Coalition is possible thanks to the region's existing trust-based networks, which allow this type of collaboration to mobilize and execute on large-scale opportunities and challenges. The coalition focuses on key leverage points for long-term climate resilience, such as infrastructure, business development, community planning, and economic diversification. The coalition brings together projects like the development and construction of green manufacturing hubs, revitalization of local business districts, workforce development, clean energy development, and economic resilience planning to drive a 360-degree approach to actualizing climate resilience for communities. The coalition recognizes the need for proactive strategies on multiple fronts to prepare Appalachian communities to meet the needs of future generations.

The ACT Now Coalition is an example of the large-scale, collaborative approaches that this report identifies as necessary to create a climate resilient Appalachian region.

## Global Context from COP27 Sharm El-Sheik

During the latest UN IPCC global conference, COP27 in Sharm El-Sheik, Egypt, several topics that formed the focus of the meeting also have relevance to communities in the United States including Central Appalachia. These topics include the need to replace fossil fuel, especially coal, with clean energy as quickly as possible. Within the US, it is vital that capital, government policy, and public education are aligned to facilitate the rapid transition to renewable sources of energy. One of the many positive aspects of the clean energy transition and climate adaptation overall is the fact that operations and therefore jobs are largely localized and place specific. This is especially important as Central Appalachia grapples with its history of fossil fuel exploitation and the loss of coal jobs due to automation of the industry and competitive nature of other fossil fuels like natural gas. It is worth noting that coal industry jobs are largely already gone, and far more Americans are currently employed in still expanding renewable energy markets than the coal industry (NASEO & EFI, 2019). The transition to renewable energy sources requires many different jobs across various sectors which may contribute to economic diversification for many areas.

Another key topic at COP27 was the establishment of a 'loss and damage' fund to help the most vulnerable nations adapt to the ongoing climate related disasters they are facing, acknowledging that many of the peoples experiencing the most direct harms of climate change are also the least able to respond. This is true within the United States as well, where there must be a similar commitment to materially supporting particularly vulnerable communities in adaptation. Cost-benefit calculations must include social and environmental factors, and great care must be taken to account for place and culture.



## Part 3: Recommendations for Proactive Climate Resilience in Appalachia

In the decades to come, the world will be transformed by the effects of climate change, which will be mitigated or exacerbated depending on how society responds. That response includes forward-looking actions that must be taken today to be effective. The same is true in Appalachia; the region's economy and residents will be shaped by a variety of climate driven externalities and patterns that are already emerging, creating an entirely new calculus for community development efforts, and for life and livelihoods in general. Simply put, there is no option of "business as usual." There are myriad challenges that will face the region as a result of climate change, and many of them we cannot fully understand or predict at this point. However, the known challenges identified in this paper must be taken into full consideration in development, policy, and capital investment strategies, with the recognition that the climate crisis will inevitably present unknown and compounding challenges at our feet.

The issues and opportunities outlined in this analysis demand aggressive and proactive engagement on large-scale and comprehensive strategies. Unprecedented future challenges require unprecedented visioning, innovation, and action. The process for developing these responses should be thoughtful, collaborative, and dedicated, and we hope that this paper offers a starting point for a sustained and committed dialogue across the broad variety of institutions, organizations, and communities that have a stake in this future. We also want to offer a place to start, and ways to take action now.

These recommendations focus on concrete steps that can be taken right now to directly mitigate future climate impacts and begin the process of adapting our region to be as climate resilient as possible. The outline below includes a variety of capital investment, research, policy, and community engagement recommendations. Each of these provides some resource, capacity, policy, or infrastructure that can help empower Appalachian communities to chart their own path towards an equitable, inclusive, and sustainable future.

### Capital Investment Recommendations

- Establish a federally funded, regionally managed resource pool for funding climate resilience in tandem with other regional economic development projects similar to that of the National Coastal Resilience Fund. Specifically, exploring the potential allocation of resources such as the Greenhouse Gas Reduction Fund from the Inflation Reduction Act (IRA) to seed this necessary infrastructure. This model should be informed by and/or work in alignment with the utilization of the state-based Safeguarding Tomorrow

Revolving Loan Fund Program which provides low-interest capital for adaptation and hazard mitigation projects.

- Engage national philanthropy to encourage a place-based understanding of climate resilience, appropriate resources for bottom-up resilience, and locally/regionally-led strategies to bolster sustainable, inclusive, and equitable economic development. This recommendation is in contrast to the dominant trend in climate resilience and climate justice focused philanthropy and impact investment, which prioritizes top-down, technology-based, and nationally intermediated “climate solutions” that have little dialogue with or accountability to the “frontline communities” they purport to serve.

### Research Recommendations

- Develop additional research to better understand the likely impacts and implications of climate change in Central Appalachia. Potential partners in this effort include academic institutions, public agencies, think tanks, and other research-focused organizations.
- Pursue commitments from EDA, USDA, ARC, and other relevant agencies to utilize climate impact research to inform their own work and grantmaking strategies in the Appalachian region. This should include but not be limited to:
  - Regional asset and resource mapping focusing on hybrid strategies mitigating ongoing environmental degradation and value added product development. Notable opportunities include:
    - Responsible processing of rare earth metal in mine wastes including coal ash, acid mine drainage, and coal refuse for the development of semiconductors, technological hardware, and a plethora of value added products that are essential to advancing a just energy transition. With diminishing and increasingly restricted reserves of rare earths globally and projected exponential demand for these resources in the coming decades, this an area of particular interest for investment and community accountability. With the development of research and technology in this space, we encourage regional partners and policy makers to ensure associated tax revenue and other profits be overwhelmingly reinvested in communities from which the minerals were originally sourced.
    - Strategically and diligently utilizing coal ash and industrial by-products for infrastructure and construction materials like concrete, gypsum board, etc. Utilization of these by-products must be done in conjunction with health and safety regulations.
    - Creation of other products such as paint pigments from mine runoff (TruePigments, Southeast Ohio)
  - Development of climate informed guidance on the deployment of IRA, ARPA, and other large scale federal funding for infrastructure.

- Increasing regional agricultural production with collaborative partnerships cutting across local food systems and agri-tech partners to develop cropping techniques that are resistant to drought and excessive rainfall. Explore native species cultivation practices that are central to preserving the region's biodiversity.

## Public Policy

- Revise mapping of regional floodplains based on best available data which takes into account up to date climate change modeling projections as opposed to historical climatology alone. Flood maps which are inclusive of areas vulnerable to flash flooding are also needed in mountainous regions such as Central Appalachia.
- Continue and expand clean energy tax credits and other incentives, including flexible place-based deployment of Greenhouse Gas Reduction Fund resources, that facilitate the necessity to transition to a renewable energy system.
- Expand public investment and incentives for affordable housing, including retrofitting existing housing to accommodate extreme weather and rising sea levels. Consider mechanisms to buffer lower-income households against climate-driven rural gentrification that is likely to force economically distressed populations into the most at-risk areas.
- Encouraging the funding of the RECOMPETE Act that could support comprehensive community and economic development efforts in distressed communities.

## Community Engagement

- Support strategies for revitalization and protection of community centers, specifically historic downtowns, by incorporating climate-smart design in redevelopment and new development and building in disaster preparedness and emergency response resources and capabilities (e.g. backup energy sources, shelters, food/equipment storage).
- Create a Rural Resilience Corps to engage emerging leaders in rural communities to:
  - Train residents on how to prepare for and respond to climate shocks at the local level
  - Share strategies for adapting their built and natural environment through sustainable design practices. This should also include community engagement and accountability in the development of any large-scale energy and adaptation projects (hydroelectric projects specifically).
  - Adapt, expand, or establish workforce development program(s) to train and employ Appalachian residents in the resilience workforce as a means of embedding sector

expertise and leadership within the region, while providing necessary capacity to address disaster response and adaptation efforts nationally.

Invest Appalachia is committed to continued research and exploration into the four categories of recommendations above. Our deepest hope is that this analysis and these recommendations contribute to a regional response to the climate crisis that will sustain our region's land, people, culture, and economies for generations to come. We welcome any and all partners in this dialogue and this shared pursuit.

## **Appendix: Methodology**

This paper was produced by Invest Appalachia. The lead author is Nicholas Shanahan. The secondary author is Baylen Campbell. Andrew Crosson is a contributing writer and editor.

### **Background and Purpose**

This work began as a series of discussions between Master's of Climate Change and Society (North Carolina State University) graduate Nicholas Shanahan, and Invest Appalachia's Director of Community Impact Baylen Campbell and CEO Andrew Crosson. These discussions centered around the idea that Central Appalachian communities will likely be impacted by in-migration due to the climate crisis. We asked ourselves what challenges and opportunities such a scenario is likely to present to states and communities in the region, and how to best align Invest Appalachia's strategic vision for community development and social investment accordingly. We found that there was not an established analysis of climate changes' impacts on the greater Central Appalachian region, though many local jurisdictions or community organizations had some level of data or analysis about climate change's impacts on a particular industry or locality.

This recognition led us to pursue what we originally conceived as a simple internal "baseline" assessment of existing literature on climate impacts and migration related to Appalachia. However, the lack of existing summary analysis on the topic led us to conduct a broadscope review of available literature from scientific and academic institutions, as well as an examination of the discourse from major popular media outlets, in an effort to empirically establish if and to what extent climate change concerns are affecting where Americans choose to live, as well as what regions may be best suited for climate related in-migration with a focus on the Central Appalachia region. The available data does suggest that Central and Northern Appalachia are relatively well positioned to act as sites of climate change adaptation at the national scale and therefore may expect to gain population and relatedly could experience economic expansion as a result of climate change. However,



rigorous research into the subject of internal, voluntary climate change related migration in the United States has proven to be sparse, and is particularly lacking with regards to Appalachia. We strongly advocate for more publicly available research on the subject. Nevertheless, the authors and reviewers made their best effort to ground this paper's arguments and findings in the most relevant available evidence. Where it was necessary to extrapolate or hypothesize, we relied on expert reviewers to vet any assumptions or projections.

### **Peer Reviewers**

This document was submitted for two rounds of peer-review by a broad set of strategic stakeholders and subject matter experts. We are grateful to the following individuals and organizations for their review and feedback at various stages of this report development:

- Heidi Arnold – Federal Disaster Recovery Officer, FEMA
- Matthew Day – Tufts University Doctoral Candidate
- Eric Dixon – Senior Researcher, Ohio River Valley Institute
- Edward Ellis Jr. – FEMA, Emergency Management Specialist: Community Assistance Division (Local Government Administration Expert Specialist)
- Chris Estes – Co-Director, Aspen Institute Community Strategies Group
- Jim Fox – Senior Resilience Associate, Fernleaf+NEMAC
- Jeff Fugate – Associate Professor of Extension and Program Director of the Urban & Environmental Design Program, University of Kentucky School of Architecture
- Ann E. Kingsolver – Professor of Anthropology and Director of the Appalachian Studies Program, University of Kentucky
- Autumn Long – Director of Appalachian Solar Finance Fund, Appalachian Voices
- Paul Patton – Chief Innovation Officer, Rural Action
- Debbie Phillips – Chief Executive Officer, Rural Action
- Stephanie Randolph – Deputy Director, Cassiopeia Foundation
- Adam Stein – Senior Policy Advisor of Climate and Resilience, NOAA
- Hannah Vargason – Finance Research Fellow, Carsey School Center for Impact Finance, UNH
- Rachael Young – Director of Grantmaking, Just Transition Fund

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