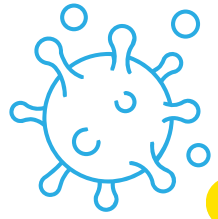


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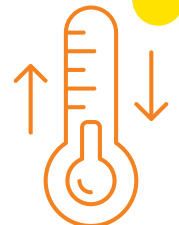
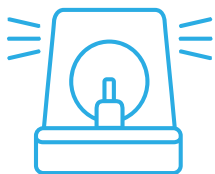


Building a

Resilient Future:

Climate Solutions to Protect Our Health and Planet

Caetano de Campos Lopes, Katie Ebinger, and Sydney O'Connell



COMMUNITY CLIMATE
COLLABORATIVE

Introduction

The health effects of climate change are ubiquitous. These effects are sometimes obvious when it comes to severe weather events, pollution hanging over cities, or rising sea levels. However, climate change also causes many health effects that are less immediately visible. These can be direct – the inhalation of chemicals from fossil fuel combustion, for example – or more inconspicuous, such as the impact of climate displacement on mental health. These consequences of climate change are disproportionately experienced by historically marginalized communities, where centuries of health inequities and climate injustices coalesce.

Fortunately, where there is an overlap in the issues of climate change, equity, and health, there is also an overlap in their solutions. This report seeks to discuss the health effects of climate change and shed light on equitable climate solutions that benefit both the people and the planet.

1 Global Warming and Extreme Weather

1.1 Extreme Heat

As global warming worsens, instances of extreme heat are expected to rise drastically in communities around Virginia. For example, in a “high-emission scenario,” Charlottesville could experience 20 days per year with a heat index over 105°F within the next 30 years. Currently, there is just one day per year over 105°F. Additionally, by 2100, average daily maximum temperatures in Charlottesville would increase from 70°F to 78°F.¹ Urban dwellers face greater risks of extreme heat due to the urban heat island effect, when city infrastructure absorbs and re-emits heat more than natural landscapes.^{2,3}

Extreme heat contributes to numerous adverse health effects, ranging from discomfort and confusion to death.^{4,5} Minimizing the urban heat effect with vegetation, heat-smart infrastructure, and subsidized cooling systems for homes and other buildings can all help to mitigate both global warming and the health effects of extreme heat.⁶

According to Charlottesville Gov.:⁸

- Plant/conserve trees.
- Build green spaces, green roofs.
- Weatherize and insulate buildings.

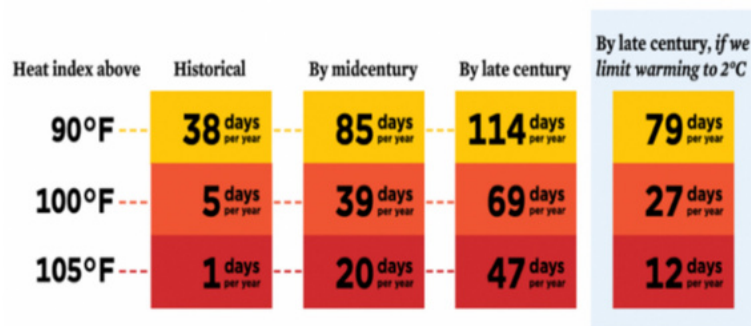


Figure 2. Predicted Annual Days of Extreme Heat Per Year in Virginia's 5th District.

From C3's "Local Effects of Climate Change" report: Predicted Annual Days of Extreme Heat Per Year in Virginia's 5th District.

1.2 Flooding and Drought

Extreme precipitation is another health hazard caused by climate change. Droughts will also increase with climate change, creating dangerous water scarcity and the perfect conditions for flooding.⁹ Some studies predict that in the next 30 years, the US will face a 26% increase in flood risk.¹⁰ Drowning is one of the most immediate risks of extreme flooding. There are additional risks associated with disease exposure because flood waters can contaminate drinking and recreational water sources. Floodwater may also carry sewage and chemicals in addition to parasites and viruses. After a flood, there is also a risk of mold growth inside homes and other buildings, leading to respiratory issues once inhaled.¹¹



2020 flooding in Darden Towe Park in Charlottesville.

Extreme precipitation is expected to be the top climate-related hazard for Virginian communities like Richmond and Charlottesville, increasing substantially by 2050.^{12,13} It has already increased; from 1995 to 2015, Charlottesville and Albemarle County had 98 floods, costing them \$1.15 million and resulting in one fatality.¹⁴

Tips from the **CDC**:^{7,17}

- Cover your skin with long clothing.
- Use 0.5% permethrin on clothes/gear.
- Avoid brush outside.
- Prevent ticks on your pets.
- Check for ticks and shower as soon as you get inside.
- Use screens on your windows.
- To prevent mosquitoes from laying eggs, don't leave standing water around.

1.3 Vector-Borne Illnesses

The rising temperatures will also increase the length of the season during which vector-borne illnesses can be spread. The area in which vectors can survive is also expanded due to rising temperatures. West Nile virus and Lyme disease are two examples of these diseases which are increasing in prevalence and spread.¹⁵ Virginia has already seen the impact of this; between 1989 and 2006, the length of Charlottesville's mosquito season increased by 19%, reaching 114 days.¹⁶

2 Transportation

2.1 Active Transportation

Lack of physical activity is one of the primary causes of obesity in the US.¹⁸ Active transportation can address this health issue alongside mitigating climate change. Walking or biking to work provides an opportunity to exercise, and increasing walking and bike paths can facilitate less sedentary lifestyles throughout the community. Reducing motorized transportation can also contribute to a healthier community by reducing air pollutants, noise emissions, and traffic-related injuries.¹⁹

Focusing on active transportation in Virginia cities such as Charlottesville would be both beneficial and well-received. One extensive Charlottesville survey by Move2Health Equity reported that while most respondents drive themselves, 79% said they would prefer to walk, bike, or use public transit if it weren't for barriers including a lack of sidewalks and bike lanes.²⁰

2.2 Public Transportation

Public transportation can also provide opportunities for physical activity, since it is often multi-modal, involving walking to and from bus stops.²¹ In fact, in a study conducted by C3, the top suggestion by current riders for improving Charlottesville Area Transit's system in Charlottesville was to make bus stops more accessible via bike and pedestrian infrastructure.²²



Improving public transportation would help reduce wear on roads, which in turn reduces emissions and runoff from paving or construction.²³ It would also reduce traffic-related greenhouse gas (GHG) emissions, which contribute significantly to Virginia's total GHG emissions. In 2018, transportation alone accounted for an estimated 52% of all GHG emissions in Albemarle County and 31% in Richmond.^{24,25} These emissions add to air pollution, which contains particulate matter and other harmful gases, such as nitrogen dioxide (NO₂).²⁶ Studies have shown that this traffic-related air pollution is associated with dementia,²⁷ asthma, heart problems, strokes, lung cancer, and premature death.²⁸ Air pollution and its health effects also disproportionately impact communities of color; one nationwide study found that majority-nonwhite neighborhoods had NO₂ levels 2.7 times higher than majority-white neighborhoods, causing an estimated 5,000 premature deaths.²⁹ Making public transportation more accessible, equitable, and clean could both reduce global warming-causing emissions and work toward preventing these adverse health effects.

2.3 Electric Vehicles

The shift toward electric vehicles is necessary to achieve cleaner air. An American Lung Association report found that a national shift by 2040 to selling only zero-emission passenger vehicles could help avoid up to 110,000 premature deaths, 3 million asthma attacks, and 13 million lost workdays.³⁰

Recently, California has adopted policies to begin this process, and other states have followed suit. The "Advanced Clean Cars II" (ACC II) standard states that by 2035, only zero-emission new passenger vehicles may be sold.³¹ Virginia's 2021 adoption of the ACC II is expected to reduce carbon pollution by 76 million tons and prevent almost 3,000 asthma attacks, 5,000 instances of respiratory illness, and over 160 premature deaths by 2050 in Virginia.³²

As one of the leading states in the adoption of ACC II, it is also important for Virginia to recognize the gap in the adoption of zero-emissions standards and their associated health benefits in "environmental justice communities of concern", or EJCOG.³³ Targeted policies to address this gap are imperative for advancing health equity alongside climate justice.³⁴



A 2020 photo from Marina Bay Park in Richmond showing a solar-powered electric-vehicle charging station.

3 Land-use and Zoning



"A look at a draft of Charlottesville's new zoning map, which proposes increasing housing density throughout the city. Screenshot from Charlottesville Plans Together" from February 2023.

3.1 Zoning

Zoning is a historically contentious topic. Zoning density, which refers to the number of dwelling units that are legally allowed on a lot,³⁵ is a population density control method with public health origins. For example, it has been used to regulate the distance between toxic industrial buildings and residential units. However, for many, zoning density regulations are exclusionary. Low-density residential zoning makes multifamily housing unaffordable, and studies have shown that this has resulted in increased racial and income segregation. These restrictions on the built environment can have a significant impact on both the climate and human health.³⁶

3.2 Location Efficiency

Low-density zoning pushes low-income households into areas with low location efficiency.³⁷ These areas are not only inaccessible by public transit, but they also lack the infrastructure to promote physical activity.³⁸ As people are pushed further from wealthier urban neighborhoods, their transportation emissions and cost burdens will increase as they are forced to use individual vehicles, resulting in less active transportation and more polluted air.^{39,40} Additionally, people may be forced into food deserts, where there are reduced options for purchasing nutritious, healthy foods.

3.3 Displacement and Extreme Weather Risks

Zoning is one of many reasons that historically marginalized communities tend to be co-located with undesirable environmental conditions. Density restrictions may push housing developments into deserts where temperatures and wildfire risk are extreme.⁴¹ In other cases, low-density zoning may push these housing developments into areas at higher risk for flooding.⁴² (Please see Section 6.3: Disproportional Mental Health Impacts for more information on how climate displacement affects mental health).

3.4 Historic Racial Injustices

Studies have shown that historic legacies of “redlining” or Jim Crow policies created neighborhoods that today tend to be more susceptible to extreme heat due to a lack of urban tree canopy cover. Correspondingly, the EPA has found that in the case of a 2°C warming, “Black and African American people were 40% more likely to live in areas that will experience the highest increases in extreme heat deaths.”⁴³ Nationally, Black neighborhoods are also most at risk for extreme flooding,⁴⁴ compound- ing existing racial injustices.⁴⁵

3.5 Efforts to Update Zoning in Charlottesville and Richmond

Since 2013, Charlottesville has been abiding by low-density residential zoning, meaning that affordable housing has been pushed toward these fewer desirable areas.⁴⁶ In 2022, work began on a new rezoning project in Charlottesville to reduce low-density housing restrictions and thus increase affordable housing.⁴⁷ Focusing on higher-density zoning is an important step to remediating social injustices and mitigating the health effects of climate change.

As Richmond grows, its city council also faces zoning decisions that have residents concerned. While some residents worry about the changes that high-density zoning regulations would bring, others claim that without this change, affordable housing options will be even further reduced.⁴⁸

A 2022 rezoning resolution by the council showed promise for increasing the number of residential units in Richmond, although some council members have raised concerns about the affordability and location efficiency (see Section 3.2: Location Efficiency) of these new areas.⁴⁹

4 Reducing Fossil Fuel Dependency

4.1 Building and Transportation Electrification

Natural gas accounts for a substantial share of emissions from stationary energy use (building energy use). In Charlottesville, this number is approximately 26.8% of emissions.⁵⁰ While Charlottesville is exploring options to move away from natural gas, approximately 51.5% of its households are supplied by the city's gas utility.⁵¹ There are many new concerns surrounding the use of natural gas in homes, as it may result in adverse health effects.⁵² Gas stoves in particular can leak natural gas into homes, which has been linked to asthma, cancers, and other negative health effects.^{53, 54}

Natural gas is largely made up of methane, a potent greenhouse gas with approximately 25 times more global warming potential than carbon dioxide.^{55, 56} Natural gas also releases volatile organic compounds (VOCs), which are precursors to the creation of ground-level ozone (smog), a gas that can cause a range of health effects from

respiratory issues to premature death.⁵⁷ VOCs are also emitted through the combustion of fossil fuels used in the transportation sector (more information in Section 2.3: Electric Vehicles).⁵⁸



Map of coverage by City of Charlottesville's gas utility

4.2 Upstream Pollution

When considering the health impacts of natural gas, there are important upstream factors to note. Exposure to air pollutants caused by natural gas leaks can lead to respiratory symptoms, cancer, and cardiovascular disease.⁶⁰ People living close to oil and gas wells experience higher rates of these symptoms, in addition to poor pregnancy outcomes such as birth defects, premature births, or fetal fatalities.⁶¹ Children living with high pollution levels are also more likely to have lower academic skills.⁶² Charlottesville is currently working to mitigate some of these health effects by reducing emissions from natural gas leaks, as the city recently received a federal grant to upgrade and reinforce existing natural gas pipes.⁶³

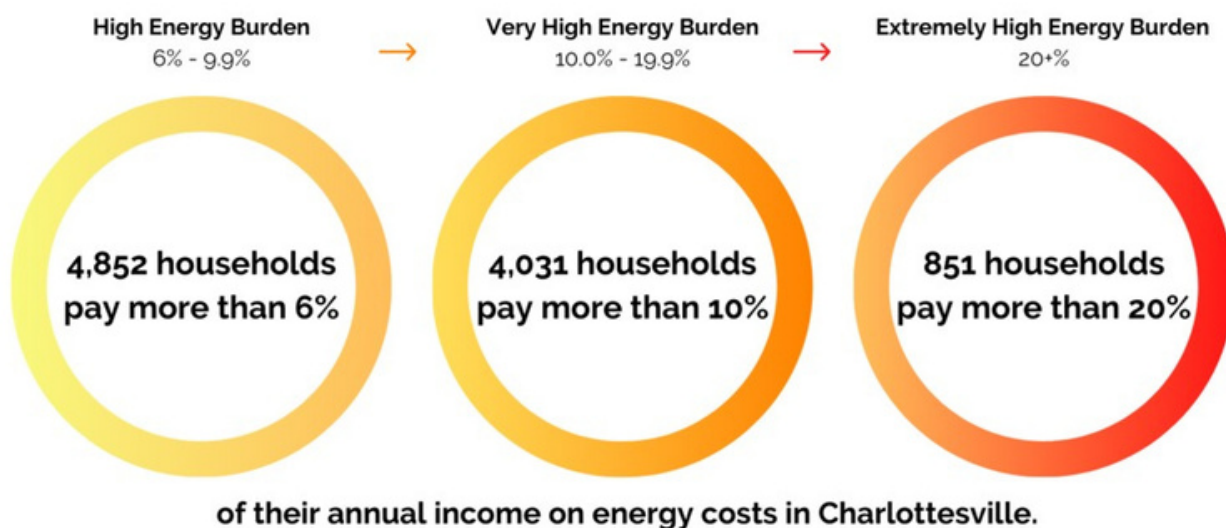
These adverse health effects are not shared in an equitable way. Communities of color are more likely to be exposed to air pollutants such as smog and fine particulate matter due to historic

redlining and systemic racism. For instance, “Latinos are 165% more likely to live in counties with unhealthy levels of particulate matter pollution,” states one report from Latino Advocacy Week.⁶⁴

Hydraulic fracturing (fracking), a common practice used to collect oil and gas, can also lead to many adverse health effects, causing small earthquakes and contaminating nearby drinking water with chemicals.⁶⁵ Communities of color are also among the most likely to face these effects, as they live disproportionately closer to fracking wells.⁶⁶

5 Energy

Energy usage – both in its source and its efficiency level – can have major impacts on the environment and human health. As discussed in Section 4: Reducing Fossil Fuel Dependency, GHG and the resulting air pollutants of hydrocarbon fuels both exacerbate the climate crisis and cause adverse health effects.



A graphic from C3's 2020 Uncovering Energy Inequity report showing Charlottesville energy burdens

5.1 Clean Energy Sources

Solar energy is the most abundant source of energy in the world, becoming more common and affordable over the years. However, low- and moderate-income households are often unable to be a part of this solution. Not only is it less affordable and accessible for them, but these income groups are more likely to rent, meaning that they are unable to install solar panels on their rooftops.⁶⁷ The Community Climate Collaborative's Uncovering Energy Inequity report discusses solutions to this problem, including government subsidization of either community solar energy or residential installation of solar panels.⁶⁸

5.2 Energy Efficiency

Increasing energy efficiency levels in buildings can help reduce the amount of energy used, reduce our impact on the climate, and improve human health. According to the International Energy Agency, increasing energy efficiency may help to boost mental health, which suffers when “chronic thermal discomfort” is experienced (more information about the mental health impacts of climate change can be found in Section 6: Mental Health). Improving energy efficiency can also result in “reduced symptoms of respiratory and cardiovascular conditions, rheumatism, arthritis, and allergies,” as well as protection from extreme hot or cold temperatures.⁶⁹

Often, households with low energy efficiency also experience higher energy-cost burdens in addition to climate injustices. The higher energy-cost burdens of these households are determined by a combination of structural energy efficiency, appliance energy efficiency, and household size, among other things.⁷⁰ Research has shown that low-income households are more likely to reside in houses that are older and in need of energy efficiency upgrades. Historical discrimination against communities of color and lower-income demographics has forced many people into low energy efficiency housing, causing them to experience energy inequity.^{71,72}

6 Mental Health

6.1 Climate Anxiety

The mental health effects of climate change can manifest in long-term anxieties. According to a recent study, climate anxiety impacts 64% of Americans. Feelings of uncertainty, fear, and inevitability associated with the magnitude of climate change can all contribute to this anxiety.

6.2 Long-term Mental-Health Impacts

Acute events, such as floods or wildfires, can have lasting mental health impacts such as post-traumatic stress disorder or those resulting from the financial and emotional toll of property loss. Climate disasters, ranging from heat exposure to intense storms and wildfires, are detrimental to mental health and contribute to higher instances of psychological distress and suicide in populations with existing mental health conditions.⁷⁴



A graphic on climate anxiety data from Yale.

6.3 Disproportional Mental Health Impacts

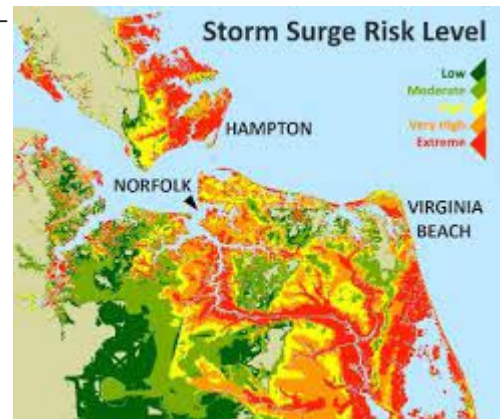
These mental health impacts are not shared equally. Over centuries of colonialism, ecological disasters have been imposed upon Indigenous people across the globe. Generational trauma has followed land loss, displacement, and disaster exposure – all of which are effects of both climate change and colonialism. With this understanding, it becomes clear that Indigenous communities are the key to building climate resilience, as they hold valuable insights into solutions for the climate crisis.⁷⁵

Climate displacement – when people are forced to move due to climate-related events – can have adverse effects as well, especially relating to mental health.⁷⁶ Climate displacement also disproportionately impacts historically marginalized communities. For instance, women make up an estimated 80% of climate refugees, according to the United Nations. Not only are women more likely to experience poverty than men and thus be vulnerable to climate disasters, but also their typical role of caretaker makes it harder for them to recover afterward.⁷⁷ Additionally, climate displacement increases the risk of gender-based violence.⁷⁸

As mentioned in previous sections, historically marginalized communities disproportionately experience the health effects of climate change due to discriminatory policies of the past. Their mental health is likely to be impacted as well since they carry the physical, emotional, and financial burden of climate change more than others. And as mentioned above, the climate-related extreme weather events to which they are more vulnerable can have severe health consequences.

Tips from **EcoAmerica, the APA, and Climate for Health:**⁷⁹

- Have an emergency plan to feel more prepared.
- Learn resilience interventions to feel more in control.
- Engage in physical activity.
- Build and maintain a social support network.
- Take preventative action against climate change within your community.



A storm surge risk level graph of the Chesapeake area in Virginia. This could lead to climate displacement as well.

Conclusion

The health effects of climate change are serious, widespread, and intensifying. As global warming worsens, so will the health outcomes outlined above. But the practices which cause climate change don't have to continue. If we treat climate change like the global health crisis that it is, then climate mitigation strategies can advance human health while also protecting the planet. And it is only by targeting these root causes that we can also begin to remediate the extensive climate and health injustices that hinder our ability to build equitable climate resilience.

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