

William & Mary Environmental Law and Policy Review

Volume 44 (2019-2020)
Issue 3 Symposium Issue: *Climate Change: It
Takes Everyone*

Article 4

March 2020

Reflections on Rural Resilience: As the Climate Changes, Will Rural Areas Become the Urban Backyard?

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REFLECTIONS ON RURAL RESILIENCE: AS THE CLIMATE CHANGES, WILL RURAL AREAS BECOME THE URBAN BACKYARD?

ELIZABETH A. ANDREWS* & JESSE REIBLICH**

This Article discusses the impacts of climate change on rural communities, including how they can exacerbate current economic and environmental challenges there, such as increasing absentee landownership and nonexistent or failing septic systems. It focuses on the accompanying policy challenges in addressing these issues with an emphasis on efforts to address the needs of socially vulnerable communities. Additionally, it proposes key policy recommendations, including funding, planning for sea level rise, public education and communication, and addressing rural needs in the Chesapeake Bay Total Maximum Daily Load (“TMDL”) process.

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INTRODUCTION

Rural communities today face many challenges. Their agricultural population is aging, with fewer young people pursuing farming as an occupation.¹ Furthermore, in many rural areas the overall population is decreasing as young people move away for jobs and educational opportunities.² This trend has stripped resources from rural communities, resulting in less tax revenue, fewer shops and restaurants, and fewer local jobs.³

Climate change threatens to contribute to these stressors by altering the landscape and character of coastal rural regions. For instance, higher temperatures are expected to cause rising seas as glacial ice melts and the volume of water in the oceans expands.⁴ Higher temperatures also decrease crop yields.⁵ More frequent and intense storms are also

¹ Nicole Pierron-Rasule, *U.S. Facing an Aging Farm Population and Lower Entry Rates for Beginning Farmers*, CFAES (Dec. 22, 2015), <https://cfaes.osu.edu/news/articles/us-facing-aging-farm-population-and-lower-entry-rates-for-beginning-farmers> [<https://perma.cc/4NMR-4KA7>]; Andrea Stone, *American Farmers are Growing Old, with Spiraling Costs Keeping Out Young*, NAT'L GEOGRAPHIC (Sept. 19, 2014), <https://www.nationalgeographic.com/news/2014/9/140919-aging-american-farmers-agriculture-photos-ngfood/#close> [<https://perma.cc/7WLA-M64Y>].

² Dipak Kumar, *Rural America Is Losing Young People—Consequences and Solutions*, WHARTON PUB. POL'Y INITIATIVE (Mar. 23, 2018), <https://publicpolicy.wharton.upenn.edu/live/news/2393-rural-america-is-losing-young-people> [<https://perma.cc/RB6P-U2R2>].

³ Amy Glasmeier & Priscilla Salant, *Low-Skill Workers in Rural America Face Permanent Job Loss*, 2 CARSEY INST. POL'Y BRIEF 1, <https://scholars.unh.edu/cgi/viewcontent.cgi?article=1005&context=carsey> [<https://perma.cc/9CMY-59QJ>]; Kumar, *supra* note 2; April Simpson, *As Rural Groceries Fade Away, Lawmakers Wonder Whether to Act*, PEW CHARITABLE TR. (Oct. 2, 2019), <https://www.pewtrusts.org/en/research-and-analysis/blogs/state-line/2019/10/02/as-rural-groceries-fade-away-lawmakers-wonder-whether-to-act> [<https://perma.cc/RLY6-4RCE>]; David Swenson, *Opinion: Dwindling Population and Disappearing Jobs is the Fate that Awaits Much of Rural America*, MARKETWATCH (May 24, 2019), <https://www.marketwatch.com/story/much-of-rural-america-is-fated-to-just-keep-dwindling-2019-05-07> [<https://perma.cc/978Q-6SBL>].

⁴ See *Sea Level Rise Viewer Tool*, OFF. FOR COASTAL MGMT., NAT'L OCEANIC & ATMOSPHERIC ADMIN., <https://coast.noaa.gov/digitalcoast/tools/slr.html> [<https://perma.cc/FJP9-9V35>] (last visited Mar. 9, 2020); WILLIAM SWEET ET AL., NAT'L OCEANIC & ATMOSPHERIC ADMIN., 2018 STATE OF U.S. HIGH TIDE FLOODING WITH A 2019 OUTLOOK (2019), https://tidesandcurrents.noaa.gov/publications/Techrpt_090_2018_State_of_US_HighTideFlooding_with_a_2019_Outlook_Final.pdf [<https://perma.cc/54RJ-7CSN>]; WILLIAM SWEET ET AL., NAT'L OCEANIC & ATMOSPHERIC ADMIN., GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES (2017), https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf [<https://perma.cc/TA4W-936F>]; see also John D. Boon & Molly Mitchell, *Nonlinear Change in Sea Level Observed at North American Tide Stations*, 31 J. COASTAL RES. 1295 (2015).

⁵ *Crop Yields Decline under Higher Temperatures*, U.S. GLOBAL CHANGE RES. PROGRAM,

expected to cause increased precipitation and storm surges.⁶ Rising seas can, in turn, cause saltwater intrusion into wells and increased flooding that blocks roads, threatens coastal wetlands and forests, and inundates septic systems.⁷ Land subsidence can exacerbate the effects of rising seas in some areas.⁸ As sea level rises, communities will need to decide whether to spend large sums of money—which many rural communities do not have—for resilience measures or plan for managed retreat from recurrently flooding areas. This is an extremely difficult discussion to have and an existential choice that many communities will have to make.

Additionally, in the Chesapeake Bay region, many localities are already allocating significant resources to water quality protection measures as part of the Chesapeake Bay restoration efforts.⁹ In the face of increasing demands on limited resources and proliferating impacts from climate change, the concept of rural resilience deserves more scrutiny. But what does it mean for a community to be “resilient” in a rural setting, particularly where there are declining population levels? How does a rural coastal community, with limited resources and staff, plan for emergency services, water quality protection, and flooding resilience as the sea level rises? Will rural localities become the receiving communities for climate change refugees retreating from flooding urban areas? Will they find a way to thrive and grow, or will their populations continue to dwindle until they essentially become the recreational and agricultural “backyard” or potential waste disposal sites¹⁰ for urbanized areas? These

<https://nca2014.globalchange.gov/highlights/report-findings/agriculture/graphics/crop-yields-decline-under-higher-temperatures> [<https://perma.cc/243D-AHRF>] (last visited Mar. 9, 2020).

⁶ *Extreme weather gets a boost from climate change*, ENVTL. DEF. FUND, <https://www.edf.org/climate/climate-change-and-extreme-weather> [<https://perma.cc/3JAZ-CLDV>] (last visited Mar. 9, 2020); *Extreme Weather*, NAT'L CLIMATE ASSESSMENT, <https://nca2014.globalchange.gov/highlights/report-findings/extreme-weather> [<https://perma.cc/S666-6C94>] (last visited Mar. 9, 2020).

⁷ John P. Masterson et al., *Effects of Sea-Level Rise on Barrier Island Groundwater System Dynamics—Ecohydrological Implications*, 7 *ECOHYDROLOGY* 1064 (2014).

⁸ See JACK EGGLESTON & JASON POPE, U.S. GEOLOGICAL SURVEY, *LAND SUBSIDENCE AND RELATIVE SEA-LEVEL RISE IN THE SOUTHERN CHESAPEAKE BAY REGION* (2013), <https://pubs.usgs.gov/circ/1392/pdf/circ1392.pdf> [<https://perma.cc/945C-W3HJ>].

⁹ See *Water Quality*, CHESAPEAKE BAY PROGRAM, https://www.chesapeakebay.net/what/goals/water_quality [<https://perma.cc/9GN7-VKR9>] (last visited Mar. 9, 2020).

¹⁰ See UN-WATER DECADE PROGRAMME ON ADVOCACY & COMMUN., *CITIES AND THEIR RURAL SURROUNDINGS. THE URBAN-RURAL INTERFACE 1* (2010), https://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/04_cities_and_rural_surroundings.pdf [<https://perma.cc/9LGW-LCEK>] (“On many city borders, peri-urban and urban agriculture, industry and transport compete for water resources. Furthermore, the rural-urban interface

questions are becoming increasingly important as the climate changes, bringing an accompanying need to plan for rising sea levels and temperature changes. This Article discusses these challenges and questions and proposes potential policy and technological solutions.

I. PROBLEMS AFFECTING RURAL COMMUNITIES

As part of its assessment of current and predicted effects of climate change, the Intergovernmental Panel on Climate Change (“IPCC”) considered the distinctive characteristics of rural areas that make them uniquely vulnerable to climate change impacts.¹¹ A working group of the IPCC noted that dependence on agriculture and natural resources makes such areas highly sensitive to climate variability, extreme climate events, and climate change.¹² It also found that “existing vulnerabilities caused by poverty, lower levels of education, isolation, and neglect by policymakers can all aggravate climate change impacts in many ways.”¹³

These factors set aside rural areas as particularly in danger of not having the necessary resilience to face predicted climate change impacts. When discussing the concept of community “resilience,” a common theme is the ability of a community to not just survive catastrophic events but to rebound, adapt, and be better than they were before.¹⁴ Such an ability

can become the “backyard” for urban waste disposal, imposing severe impacts on the health of ecosystems and human populations.”).

¹¹ Purnamita Dasgupta et al., *Rural Areas*, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY. PART A: GLOBAL AND SECTORAL ASPECTS. CONTRIBUTION OF WORKING GROUP II TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 613, 618, https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap9_FINAL.pdf [<https://perma.cc/FG6A-6GD5>]; see also DAVID W. FAHEY & KATHERINE HAYHOE, U.S. GLOB. CHANGE RESEARCH PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 393 (D.R. Reidmiller et al. eds., 2018), https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf [<https://perma.cc/J8WQ-UKJP>] (“Climate change has the potential to adversely impact agricultural productivity at local, regional, and continental scales through alterations in rainfall patterns, more frequent occurrences of climate extremes (including high temperatures or drought), and altered patterns of pest pressure.”).

¹² Dasgupta et al., *supra* note 11, at 618.

¹³ *Id.*

¹⁴ See, e.g., *What is Urban Resilience?*, 100 RESILIENT CITIES, <http://100resilientcities.org/resources/#section-1> [<https://perma.cc/RJ8V-LV47>] (last visited Mar. 9, 2020) (the definition of “urban resilience” used by the Rockefeller Foundation’s 100 Resilient Cities program is as follows: “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, *adapt*, and *grow* no matter what kinds of chronic stresses and acute shocks they experience”) (emphasis added); see also Wim Heijman et

to rebound is important in rural communities in America today, as they already face a number of economic and environmental challenges that will be amplified by climate change and further affect their ability to recover from emergencies. A few of those key challenges are discussed below.

A. *Demographic Shifts and Economic Impacts*

A significant contributing factor to changes in rural communities is the demographic shift that many of them are experiencing. The average age of farmers in the United States is now over fifty-seven years old,¹⁵ and many rural areas are experiencing steadily declining populations even as urban areas are growing.¹⁶ Many young people are leaving

al., *Rural Resilience as a New Development Concept*, in DEVELOPMENT OF AGRICULTURE AND RURAL AREAS IN CENTRAL AND EASTERN EUROPE 383, 383 (Danilo Tomić & Miladin M. Ševarlić eds., 2007) (“Rural resilience may be defined as the capacity of a rural region to *adapt* to changing external circumstances in such a way that a satisfactory standard of living is maintained.”) (emphasis added); *What Is Resilience?*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., <https://www.noaa.gov/resilience-101-science-helps-america-withstand-wild-weather> [<https://perma.cc/4RUY-2ZM4>] (last visited Mar. 9, 2020) (“Resilience is the ability to prepare and plan for, absorb, recover from, *and more successfully adapt* to adverse events, as defined by the National Academies of Science.”) (emphasis added).

¹⁵ NAT’L AGRIC. STATISTICS SERV., USDA, AC-17-A-51, 2017 CENSUS OF AGRICULTURE 62 (2019).

¹⁶ For example, the University of Virginia’s Weldon Cooper Center for Public Service projects that, of Virginia’s 133 cities and counties, fifty-three (most of them in south, southwest, and western Virginia) will lose population by 2040, and by 2020, more than 30 percent of the residents in rural counties are expected to be over sixty-five, double the statewide proportion of people over sixty-five. Capital News Service, *What’s causing rural Virginia’s population to drastically shrink*, WTVR.COM (Sept. 19, 2019), <https://wtvr.com/2019/09/19/rural-virginia-population-cns/> [<https://perma.cc/3WWA-L4YW>]; *Virginia Population Projections*, U. VA. WELDON COOPER CTR. FOR PUB. SERV., <https://demographics.coopercenter.org/virginia-population-projections/> [<https://perma.cc/566P-QM57>] (last visited Mar. 9, 2020); see also Shonel Sen, *Population Projections show that Virginia is aging and growing more slowly*, U. VA. WELDON COOPER CTR. FOR PUB. SERV. (July 1, 2019), <http://statchatva.org/2019/07/01/population-projections-show-that-virginia-is-aging-and-growing-more-slowly/> [<https://perma.cc/KLL6-RP6R>]; *Around 2.5 billion more people will be living in cities by 2050, projects new UN report*, UN NEWS (May 16, 2018), <https://www.un.org/development/desa/en/news/population/2018-world-urbanization-prospects.html> [<https://perma.cc/G53W-9HL3>] (noting that, by 2050, two out of every three people are likely to be living in cities or other urban centers, according to a new United Nations report); *New Census Data Show Differences Between Urban and Rural Populations*, CENSUS.GOV (Dec. 8, 2016), <https://www.census.gov/newsroom/press-releases/2016/cb16-210.html> [<https://perma.cc/9JDV-A866>] (“Rural areas cover 97 percent of the nation’s land area but contain 19.3 percent of the population (about 60 million people),” Census Bureau Director John H. Thompson said.”).

rural areas for college or employment in more urbanized areas and are not coming back to live in their home communities due to a lack of opportunities.¹⁷ In general, rural communities have lagged behind urban and suburban areas in recovering from recent economic downturns,¹⁸ and rural poverty has exceeded urban poverty in the United States.¹⁹ Perhaps the most problematic issue is that jobs are moving out of rural areas, and new employers are not moving in for a number of reasons, including the lack of an educated or skilled workforce.²⁰ Accordingly, Virginia is becoming

¹⁷ See Tim Henderson, *Rural States Try to Stop Population Exodus*, GOVERNING (Aug. 20, 2015), <https://www.governing.com/topics/mgmt/states-try-to-counter-rural-flight.html> [<https://perma.cc/GEX2-68DE>]; Michael Pope, *New Data Shows Several Shrinking Localities Across Virginia*, WVTF.ORG (July 15, 2019), <https://www.wvtf.org/post/new-data-shows-several-shrinking-localities-across-virginia#stream/0> [<https://perma.cc/X3R9-GN YD>] (“[P]eople aren’t moving in [to rural areas] because of the lack of jobs, and businesses aren’t locating there.”).

¹⁸ Eduardo Porter, *The Hard Truths of Trying to ‘Save’ the Rural Economy*, N.Y. TIMES (Dec. 14, 2014), <https://www.nytimes.com/interactive/2018/12/14/opinion/rural-america-trump-decline.html> [<https://perma.cc/HP2C-E6K7>] (“In the first four years of the recovery after the 2008 recession, counties with fewer than 100,000 people lost 17,500 businesses, according to the Economic Innovation Group. By contrast, counties with more than 1 million residents added, altogether, 99,000 firms.”).

¹⁹ According to the 2017 American Community Survey (“ACS”), the higher incidence of non-metro poverty relative to metro poverty has existed since the 1960s, when poverty rates were first officially recorded. The nonmetro poverty rate was 16.4 percent in 2017, compared with 12.9 percent for metro areas; and nonmetro poverty fell two percentage points in 2017 from 2013, when it reached its thirty-year peak of 18.4 percent. *Rural Poverty & Well-Being*, ECON. RES. SERV., USDA, <https://www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being/#historic> [<https://perma.cc/W8RP-VXP8>] (last visited Mar. 9, 2020).

²⁰ See, e.g., *Student Debt Has A Unique Impact on Rural America*, ROANOKE TIMES (Apr. 29, 2019), https://www.roanoke.com/opinion/editorials/editorial-student-debt-has-a-unique-impact-on-rural-america/article_9a04e4ba-2aba-550c-8d0f-c5e27955bdab.html [<https://perma.cc/F6AC-Z8HL>] (“Virtually every discussion of rural economic development—indeed, economic development anywhere—deals with the need to create a better-skilled workforce. The GO Virginia economic development council issued a series of detailed reports in 2017 for each region of Virginia. Each one talked about how there’s a mismatch between the skills the local workforce has and the skills that the economy is demanding. . . . This is a particular challenge in rural Virginia: In Falls Church, 74.4% of adults have a college degree. In most counties in Southwest and Southside Virginia, that figure is under 20%. . . . That speaks directly to the need to lower tuition somehow—either through more state funding, or more local fund-raising campaigns for scholarships, or both. That’s why the push to make community college free has come largely from states with lots of rural areas—such as Tennessee. They don’t see a giveaway; they see workforce development.”); Candice Williams et al., *Why Amazon didn’t pick Detroit*, DETROIT NEWS (Jan. 18, 2018), <https://www.detroitnews.com/story/news/local/detroit-city/2018/01/18/amazon-passes-over-detroit-2nd-hq/1043515001/> [<https://perma.cc/N8NV-ACYV>] (“A lack of mass transit and a questionable ability to attract talent doomed Detroit’s bid to host Amazon’s second North American headquarters, regional leaders say.”); see also Gerald Baliles, *Restating the Case*

more urban and less suburban—a phenomenon that mirrors this trend nationally and internationally.²¹ Rural incomes also lag behind urban incomes, another feature of this divide.²² The lack of broadband internet service in many rural areas also can contribute to younger residents' and businesses' hesitation to locate in rural areas²³ since without reliable, high-speed internet access, one cannot operate a home-based business or telecommute from home.

for *Higher Education—Defining New Roles for SCHEV and Presidents*, ROANOKE TIMES (Sept. 30, 2018), https://www.roanoke.com/opinion/commentary/baliles-restating-the-case-for-higher-education-defining-new-roles/article_5be0ccb0-21c3-5fd1-b96d-dde7415d2151.html [<https://perma.cc/UM9R-WHVV>] (“[I]f the ‘rural horseshoe’ region [of Virginia] were considered a separate state, it would be tied for dead last with Mississippi and West Virginia for educational attainment levels—dead last for citizens with high school diplomas; dead last for citizens with college degrees.”); Kaya Yurieff, *Everything we know about Amazon’s HQ2 search*, CNN (Nov. 5, 2018), <https://www.cnn.com/2018/11/05/tech/amazon-hq2-update/index.html> [<https://perma.cc/6C64-ZFAJ>] (explaining the criteria for selecting Amazon’s second headquarters: “. . . proximity to a major airport and the ability to attract technical talent. It must be a suburban or urban area with more than 1 million people. Amazon also said it was looking for communities that offer a ‘stable and business-friendly’ environment and access to mass transit.”).

²¹ *Urbanization in Virginia*, VA. MUSEUM HIST. & CULTURE, <https://www.virginiahistory.org/collections-and-resources/virginia-history-explorer/urbanization-virginia> [<https://perma.cc/FK2T-3TCT>] (last visited Mar. 9, 2020).

²² Pankaj Lal et al., *Socioeconomic Impacts of Climate Change on Rural Communities in the United States*, in EFFECTS OF CLIMATE CHANGE ON NATURAL RESOURCES AND COMMUNITIES: A COMPENDIUM OF BRIEFING PAPERS 819, 824 (“The rural-urban income gap is associated with lower costs of living in rural areas, lower educational attainment, less competition for workers among employers, and fewer highly skilled jobs in the rural occupational mix.”).

²³ VA. ST. UNIV. & VA. TECH, MOVING RURAL VIRGINIA FORWARD: IDEAS FOR ACTION AND INVESTMENT 2 (2018), <https://rga.lis.virginia.gov/Published/2018/RD374/PDF> [<https://perma.cc/5PKY-GMY6>] (explaining that “[o]n balance, Virginia’s rural localities trail their metropolitan-area counterparts on key measures of community well-being, including . . . broadband access . . .”); see also Christopher Ingraham, *Americans say there’s not much appeal to big-city living. Why do so many of us live there?*, WASH. POST (Dec. 18, 2018), <https://www.washingtonpost.com/business/2018/12/18/americans-say-theres-not-much-appeal-big-city-living-why-do-so-many-us-live-there/> [<https://perma.cc/REN4-53YK>] (“Roughly 80 percent of Americans live in urban areas, according to the U.S. Census Bureau. But new data from Gallup suggests many of them aren’t doing so by choice. Asked what kind of community they’d live in if they could move anywhere they wished, Americans overall said their No. 1 choice would be in a rural area. . . . The differences between where people actually live and where they’d like to live are telling. Just 15 percent said they live in a rural area, while 40 percent said they live in either a big or small city. . . . So why do they stay put? Quite simply, big metro areas tend to be where the jobs and opportunities are. . . . Labor markets work as a positive feedback loop: Job opportunities attract talented employees, and talented employees attract firms looking to hire. At the extreme end of this cycle you end up with superstar firms and cities gobbling up an ever larger share of the economic pie.”).

Residents moving away from a community results in a decreased tax base and thus less revenue for the locality to invest in public services and infrastructure improvements.²⁴ This shift diminishes the ability of rural communities to maintain levels of service or to become more resilient, and it makes them more vulnerable to climate change impacts.²⁵ Relatedly, the lack of adequate funds to address climate change issues, such as rising seas and recurrent flooding, can negatively impact these communities' credit ratings,²⁶ which in turn can make it harder for them to access the capital necessary to finance the infrastructure projects needed to address these impacts. And in some rural communities, due to a lack of significant local employment beyond farming, the residents who do remain commute to work, shop, and eat outside of the community, thus taking their sales tax proceeds and local business revenue elsewhere and further upholding the commercial divide between rural and urbanized areas.²⁷

Furthermore, the National Flood Insurance Program ("NFIP") unintentionally has incentivized rebuilding in hazardous areas, while simultaneously keeping housing markets at an inflated level where no such market would exist without the NFIP insuring these precarious areas.²⁸

²⁴ DAVID L. BROWN & KAI A. SCHAFFT, *RURAL PEOPLE AND COMMUNITIES IN THE 21ST CENTURY* 56 (2011) ("While organizations are important across all types of communities, large and small, urban and rural, they bear particular examination in the rural context not only because in rural areas local institutions (such as schools) play such an important role in community life, identity and civic participation, but also because of the equity challenges facing rural communities as they contend with ensuring appropriate service provision in the context of limited resources and small economies of scale.").

²⁵ See, e.g., Debbie Truong, *When 'the heartbeat' stops: Rural schools close as opportunity and residents flee*, WASH. POST (Oct. 20, 2018), https://www.washingtonpost.com/local/education/when-the-heartbeat-stops-rural-schools-close-as-opportunity-and-residents-flee/2018/10/20/bfc2d06a-b52f-11e8-a2c5-3187f427e253_story.html [<https://perma.cc/MSW4-ELNA>] (explaining the phenomenon of closing rural schools, noting that "[i]n 2015–2016, the latest school year for which data is available, 27,145 schools were in rural areas, nearly 2,700 fewer than a decade earlier, according to the National Center for Education Statistics.").

²⁶ Katie Walsh, *Moody's warns cities to prepare for climate change. Here's why it matters*, CDP (Dec. 20, 2017), <https://www.cdp.net/en/articles/cities/moodys-warns-cities-to-prepare-for-climate-change-heres-why-it-matters> [<https://perma.cc/YY2U-6GF3>].

²⁷ See, e.g., Tamara Dietrich, *Rural coastal residents overlooked in SLR impacts, solutions*, DAILY PRESS (Feb. 22, 2019), <https://www.dailypress.com/news/dp-nws-rural-coast-sea-level-rise-20190221-story.html> [<https://perma.cc/H3UM-82XB>] ("Every day, said [Lewie] Lawrence[, Executive Director of the Middle Peninsula Planning District Commission], 72 percent of the Middle Peninsula's workforce—more than 34,000 workers—drives out of the area to get to their jobs in Hampton Roads, Richmond, Fredericksburg or Northern Virginia."). For Virginia localities' community profiles, including outcommuting statistics, see *Community Profiles*, VA. EMP. COMMISSION, <https://virginiaworks.com/community-profiles> [<https://perma.cc/G4S8-VY8L>] (last visited Mar. 9, 2020).

²⁸ *National Flood Insurance Program*, U.S. GOV'T ACCOUNTABILITY OFF., <https://www.gao.gov>

This subsidization of the housing market can encourage homeowners in both rural and urban areas to remain in flooding areas longer than they would otherwise, thus reducing community resiliency.²⁹ Globalization and changing consumer consumption patterns—exemplified by the dominance of Amazon and Walmart in the rural marketplace—also have contributed to economic impacts on rural communities.³⁰ While retailers like Amazon have increased access to retail shopping that rural communities previously lacked,³¹ such consolidated retailers have also caused brick and mortar competitors to shutter their businesses,³² further changing the rural

/key_issues/disaster_assistance/national-flood-insurance-program [https://perma.cc/J69G-TF3G] (last visited Mar. 9, 2020) (“Flood insurance through the National Flood Insurance Program (NFIP) is a key component of the federal government’s efforts to improve resilience to flood damage. However, we’ve found that the program has experienced significant challenges because FEMA is tasked with pursuing competing goals—keeping flood insurance affordable and keeping the program fiscally solvent. Emphasizing affordability has led to premium rates that in many cases do not reflect the full risk of loss and produce insufficient premiums to pay for claims. In turn, this has transferred some of the financial burden of flood risk from individual property owners to taxpayers as a whole.”); see also Christine A. Klein, *The National Flood Insurance Program at Fifty: How the Fifth Amendment Takings Doctrine Skews Federal Flood Policy*, 31 GEO. ENVTL. L. REV. 285 (2019).²⁹ J.R. Ball, ‘Our Drainage System Is Blocked Up’: Experts Say Flooding Made Worse By Focus On Growth, TIMES-PICAYUNE, Sept. 29, 2016, 2016 WLNR 29741731 (“When Congress approved the Disaster Relief Act of 1950, enabling the federal government to provide relief and recovery funds, [Craig] Colten[, LSU Geography professor,] said, it gave the region a false sense of security and a willingness to allow development in higher risk areas. Making the risk even more tolerable is the National Flood Insurance Program, created in 1968 after Hurricane Betsy flooded New Orleans three years earlier. The intent of the insurance program was to provide affordable, government-subsidized flood coverage for homes already at risk of flooding. In exchange, local communities are supposed to prevent new development in high-risk areas. Not only have local governments largely ignored their role, but also local officials routinely threaten lawsuits whenever FEMA attempts to expand the 100-year flood zone, where homeowners must carry private flood insurance. Most of the houses damaged in the Louisiana Flood of 2016 did not carry flood insurance because they were located outside FEMA’s high-risk zone. And instead of limiting development, the flood insurance program has opened the door for more expensive homes, constructed on concrete slabs, to be built in areas likely to flood. ‘It’s been 50 years of unintended consequences,’ said [Edward] Richards, the LSU law professor. ‘A program designed to help has made the problem worse.’”).

³⁰ Kyle Emory, *Walmart’s Rural Dominance: A Brick & Mortar Advantage in an eCommerce Battle*, HARV. BUS. SCHOOL (Nov. 15, 2017), <https://digital.hbs.edu/platform-rectom/submission/walmarts-rural-dominance-a-brick-mortar-advantage-in-an-ecommerce-battle/> [https://perma.cc/TQ99-Z8DU].

³¹ Kaleigh Rogers, *Amazon Prime Is a Blessing and a Curse For Remote Towns*, VICE (July 13, 2017), https://www.vice.com/en_us/article/xwz4dz/amazon-prime-is-a-blessing-and-a-curse-for-remote-towns [https://perma.cc/2UDX-QPX6].

³² See OLIVIA LEVECCHIA & STACY MITCHELL, INST. FOR LOCAL SELF-RELIANCE, AMAZON’S

economy and sometimes triggering the loss of long-standing commercial pillars of the community.

B. Loss of Character and Sense of Place

One of the most poignant changes in Virginia's rural communities over the past few decades has been a loss of character and potentially unique sense of place. This is problematic because many of those seeking to remain in rural communities, or indeed to move to them, do so because of the traditional character of these areas. As residents age or leave and population declines, local shops and restaurants often close.³³ There also is the danger of a loss of traditional knowledge, as farmers who have experience with their local landscapes and elderly residents with memories of medicinal uses of local native flora and fauna pass away without the ability to pass on their knowledge to a younger generation living nearby.

Another contributing factor is that increasing acres of farmland are being converted to solar farms.³⁴ Although solar farms play an important role in America's renewable energy portfolio and provide guaranteed rental income for landowners, the long-term leases being used for them means that this conversion can trigger displeasure within the community because it changes the area's bucolic appearance and removes land from row crop or livestock farming for years to come.³⁵

STRANGLEHOLD: HOW THE COMPANY'S TIGHTENING GRIP IS STIFLING COMPETITION, ERODING JOBS, AND THREATENING COMMUNITIES 54 (2016), https://ilsr.org/wp-content/uploads/2016/11/ILSR_AmazonReport_final.pdf [<https://perma.cc/A96A-N684>] (estimating that "by the end of 2015, Amazon's growth had displaced enough sales at brick-and-mortar stores to cause about 135 million square feet of retail vacancy.").

³³ Jarred Schenke, *National Retailers Are Abandoning Small Town, USA*, BISNOW (Apr. 18, 2017), <https://www.bisnow.com/national/news/retail/the-decimation-of-rural-retail-how-store-closings-are-affecting-small-town-usa-73383> [<https://perma.cc/846R-JCEU>].

³⁴ See Pamela D'Angelo, *Solar surge brings optimism, concern and uncertainty to Virginia*, FREE LANCE-STAR (Apr. 7, 2019), https://www.fredericksburg.com/news/local/solar-surge-brings-optimism-concern-and-uncertainty-to-virginia/article_05356f05-5ee7-5597-a74a-dec189f0215a.html [<https://perma.cc/7JM5-3JXK>] (noting that, in Virginia, Community Energy Solar has a solar farm on 965 acres on forty-four different parcels of Accomack County farmland; a 500-megawatt farm has been proposed by the Sustainable Power Group on a 6,300-acre site in Spotsylvania County; and Charles City County approved another solar power permit application for a 340-megawatt solar farm on 1,400 acres). In the last decade, the solar industry has experienced an average annual growth rate of 50 percent. *Solar Industry Research Data*, SOLAR ENERGY INDUSTRIES ASS'N, <https://www.seia.org/solar-industry-research-data> [<https://perma.cc/LQK7-RATL>] (last visited Mar. 9, 2020).

³⁵ See, e.g., D'Angelo, *supra* note 34 (discussing the backlash in Accomack County against the use of agricultural land for solar farms and the board of supervisors' decision in 2017

Changing land uses also contribute to this loss of sense of place. For instance, in Accomack County on Virginia's Eastern Shore, chicken houses now dot the countryside that was once populated by small family farms.³⁶ These industrial farms have also impacted the area by withdrawing a great deal of water from the Eastern Shore's single source groundwater aquifer, triggering the state Department of Environmental Quality to investigate and require groundwater withdrawal permits in a number of cases.³⁷ The increase in the number of chicken houses also has spurred surrounding farms to shift from growing produce to growing feed for this now dominant industry.³⁸ These changes have been avoided in the Eastern Shore's other county, Northampton, where zoning changes have limited the proliferation of chicken houses.³⁹

Coinciding with the increasing average age of farmers and the lack of young farmers to replace them is a concern that absentee land ownership—whether due to farms being sold to owners outside of the community, decedents' properties being divided among non-local heirs, or conversion of farms to subdivisions or vacation homes—will increase.⁴⁰

to remove large-scale solar farms as a conditional use on agricultural-zoned land and limit them to industrial areas in the county); Jacob Fenston, *A Battle Is Raging Over The Largest Solar Farm East Of The Rockies*, NPR (Mar. 25, 2019), <https://www.npr.org/2019/03/25/706546214/a-battle-is-raging-over-the-largest-solar-farm-east-of-the-rockies> [<https://perma.cc/87LF-6P79>] (discussing a proposed solar farm that would stretch across ten square miles in Spotsylvania County, Virginia).

³⁶ Dave Mayfield, *On the quiet Eastern Shore of Virginia, residents think they have a chicken problem*, VIRGINIAN-PILOT (Feb. 9, 2018), https://www.pilotonline.com/news/environment/article_d381623b-7865-5131-abcb-be1cea6d976d.html [<https://perma.cc/U4RE-H4X6>].

³⁷ Whitney Pipkin, *Groundwater: the next frontier of concern on Virginia's Eastern Shore*, BAY J. (Apr. 12, 2018), https://www.bayjournal.com/article/groundwater_the_next_frontier_of_concern_on_virginias_eastern_shore [<https://perma.cc/BR23-7SN4>] (“Groundwater resources are among the top concerns raised at public meetings about the poultry industry's growth, where citizens have asked if too many water-intensive facilities could cause wells to run dry or backfill with saltwater. . . . Fueled largely by the expansion of Tyson's processing facility in Temperanceville, Accomack County is on pace to nearly double the number of chicken houses within its borders in the coming years . . .”).

³⁸ See *Facts About Virginia's Meat Chicken Industry*, DELMARVA POULTRY INDUSTRY, INC. (May 2018), <https://www.dpichicken.org/facts/docs/factsva2017.pdf> [<https://perma.cc/CM S9-HX2A>].

³⁹ Mayfield, *supra* note 36 (explaining that you will not find chicken houses “in Accomack's neighbor to the south, Northampton County, which adopted zoning guidelines that have discouraged poultry development”).

⁴⁰ See U.S. DEPT OF AGRIC., ACH 12-27, FARMLAND OWNERSHIP AND TENURE: RESULTS FROM THE 2014 TENURE, OWNERSHIP, AND TRANSITION OF AGRICULTURAL LAND SURVEY 1–3 (2015), https://www.nass.usda.gov/Publications/Highlights/2015/TOTAL_Highlights.pdf [<https://perma.cc/58MM-LAWR>] (noting that “[i]n 2014, more than 2 million landowners

An absentee owner means an owner who may not be geographically near enough to participate in the local community's social or governance structure, nor shop locally, nor keep a close eye on the condition of the farm's natural resources such as its waterways and riparian buffers.

In addition, with fewer residents in a rural area, there are fewer people to join churches and participate in volunteer community organizations,⁴¹ which can contribute to the breakdown of traditional community support networks and social safeguards. These organizations traditionally play a prominent role in rural society, both socially and as a means to share important information. For instance, when an unnamed storm event dropped twenty to thirty inches of rain in rural communities in southeast Louisiana and southwest Mississippi in August 2016, overwhelming the stormwater infrastructure and swelling the local rivers until they overtopped their banks,⁴² local residents used boats and canoes to rescue residents stranded by flooding.⁴³ The much-lauded "Cajun Navy" drew media coverage for their heroic and quick reactions to the flood before many resources could get there to assist them.⁴⁴ When asked how they knew who to rescue, a local citizen who took part in the efforts in

rented out 353.8 million acres for agricultural purposes[, which is] 39 percent of the . . . farmland in [twenty-five] surveyed states Of these landowners, . . . 87 percent were landlords who do not operate a farm); *see also* Tyler Harris, *Managing leases with absentee landowners*, NEB. FARMER (Nov. 14, 2018), <https://www.farmprogress.com/land-management/managing-leases-absentee-landowners> [<https://perma.cc/YL5H-BJVB>] (asserting that with farmers' increasing age comes "a massive transition of ag land assets in the years to come" and "landowners that are farming are trending toward larger farms, and there's a higher portion of beginning farmers that are renting land than better-established producers with more equity.").

⁴¹ *See, e.g.*, Caleb Ayers, *Volunteer Fire Departments See Decline in Firefighters*, U.S. NEWS & WORLD REP. (Nov. 24, 2019), <https://www.usnews.com/news/best-states/virginia/articles/2019-11-24/volunteer-fire-departments-see-decline-in-firefighters> [<https://perma.cc/NM9R-QP7Q>]; Taya Flores, *Fraternal groups battle obsolescence*, J. & COURIER (Oct. 11, 2014), <https://www.jconline.com/story/news/2014/10/11/fraternal-service-groups-battle-declining-membership/16874977/> [<https://perma.cc/GFD7-FWTH>] (noting that fraternal organizations are having a hard time attracting new members).

⁴² *August 2016 Record Flooding*, NAT'L WEATHER SERV., <https://www.weather.gov/lix/August2016flood> [<https://perma.cc/DQ9L-A6BR>] (last visited Mar. 9, 2020).

⁴³ Bryn Stole, *Citizen-sailors, or 'Cajun Navy,' vital to rescue efforts in sunken Baton Rouge*, ADVOCATE (Aug. 19, 2016), https://www.theadvocate.com/louisiana_flood_2016/article_bbf5263e-6646-11e6-a775-ebda9d5c17ae.html#13 [<https://perma.cc/9EC8-LP7E>].

⁴⁴ *Id.* The Cajun Navy actually evolved into a 501(c)(3) nonprofit organization, the Cajun Navy Relief, Inc. *See About the Cajun Navy Relief*, CAJUN NAVY RELIEF & RESCUE, <https://www.cajunnavyrelief.com/about-us-2/> [<https://perma.cc/A4KS-CCFG>] (last visited Mar. 9, 2020).

Central, Louisiana, said they received lists of elderly and disabled residents from the local churches.⁴⁵

C. *Historic Resources at Risk*

Another risk posed by sea level rise in our coastal rural areas is the potential inundation of historic sites. For example, rural Virginia is perhaps unique because of its long history of settlement and the many historic and culturally significant resources at risk to rising seas in the area, which is one of the most vulnerable regions to sea level rise in the country.⁴⁶ The area boasts Indian tribal lands; Revolutionary War and Civil War battlefields; colonial settlements; and many historic birthplaces, homes, places of worship, and national parks. The site of the colonial settlement at Jamestown on the James River serves as a warning concerning the risks posed by sea level rise to historic sites in this region: the James River's level is four feet higher than what it was during the colonial era,⁴⁷ and Jamestown's elevation is only three to seven feet above sea level.⁴⁸ Hurricane Isabel in 2003 flooded nearly one million artifacts at the site,⁴⁹ and the impact of future flooding looks to be even worse.⁵⁰ Rising sea levels and increased possibilities of flooding have encouraged archaeologists to dig up artifacts at Jamestown that they otherwise would not because they may shortly be under water.⁵¹ The problem of rising tides is worse for

⁴⁵ Interview on file with author.

⁴⁶ *Report: Rising sea level threatens Virginia's historic sites*, ASSOCIATED PRESS (May 3, 2017), <https://wtop.com/virginia/2017/05/report-rising-sea-level-threatens-virginias-historic-sites/> [<https://perma.cc/Q2FM-D6TS>] ("The Department of Historic Resources said . . . that 527 state-owned historic areas are threatened by climate change, including 24 historic properties and 237 archaeological sites."); see also *Compare Report Card Values*, VA. INST. MARINE SCI., <https://www.vims.edu/research/products/slrc/compare/index.php> [<https://perma.cc/52AJ-5BBC>] (last visited Mar. 9, 2020).

⁴⁷ Rex Springston, *Jamestown faces a future of rising tides*, RICHMOND TIMES-DISPATCH (Mar. 10, 2013), https://www.richmond.com/news/virginia/jamestown-faces-a-future-of-rising-tides/article_7c6e60c7-11fc-5bba-82a2-530f7c7b0385.html [<https://perma.cc/D6Q2-3D85>] ("Water has long chewed away at Jamestown. The surrounding river level is about 4 feet higher than when the settlement was founded."); see also ADAPTVA, <http://adaptva.com/> [<https://perma.cc/GC7B-BKE4>] (last visited Mar. 9, 2020).

⁴⁸ Christopher Joyce, *With Rising Seas, America's Birthplace Could Disappear*, NPR (May 14, 2013), <https://www.npr.org/2013/05/14/178809495/with-rising-seas-americas-birthplace-could-disappear> [<https://perma.cc/8LQN-9ZSZ>].

⁴⁹ Michelle R. Smith, *Drowning history: Sea level rise threatens US historic sites*, SAN DIEGO UNION TRIB. (Apr. 10, 2016), <https://www.sandiegouniontribune.com/sdut-drowning-history-sea-level-rise-threatens-us-2016apr10-story.html> [<https://perma.cc/2SNW-2JHV>].

⁵⁰ Springston, *supra* note 47.

⁵¹ Joyce, *supra* note 48.

Jamestown because it continues to settle into the ground, and the waters around it are rising at more than twice the global average⁵²—facts that are true for many coastal areas in Virginia that are rich in historic artifacts.⁵³ The flooding and erosion of Indian tribal lands risks cultural losses in these communities as well.⁵⁴

In addition to the prospective loss of historic sites to inundation, there already has been a loss of numerous historic homes in the countryside due to factors such as fires, a declining population contributing to vacant housing, and a lack of resources for expensive maintenance.⁵⁵ Furthermore, dilapidated, uninhabited homes are a liability to farmers working the fields around them, occupying space that could be tilled, and absentee landowners who do not wish to live on their farms lack a financial incentive to maintain them as residences.⁵⁶ The decay or destruction of familiar old homes in a rural area can contribute to the sense of loss of community, which will only be exacerbated by flooding triggered by climate change.

Another factor that could contribute to an additional loss of historic homes in rural coastal areas is that older buildings constructed before the effective date of a community's first NFIP Flood Insurance Rate Map ("FIRM") that are located in high-risk flood zones have flood

⁵² Springston, *supra* note 47; see also Jack Jacobs, *Officials weigh how to address the effects of climate change at Jamestown*, VA. GAZETTE (July 6, 2018), <https://www.daily-press.com/viriniagazette/news/va-vg-jamestown-sea-level-rise-0704-story.html> [<https://perma.cc/D4N2-3JDK>].

⁵³ See, e.g., Peter Coutu, *As sea levels rise, archaeological sites throughout Virginia Beach are at risk, experts say*, VIRGINIAN-PILOT (Dec. 2, 2019), <http://www.pilotonline.com/news/environment/vp-nw-fz-sea-level-rise-archaeological-sites-20191202-p2qguyasfraltfx77sltqcnz3a-story.html> [<https://perma.cc/67B4-QXD2>].

⁵⁴ *Climate Change, Coastal Tribes and Indigenous Communities*, U.S. GEOLOGICAL SURV. (Mar. 11, 2015), <https://www.usgs.gov/news/climate-change-coastal-tribes-and-indigenous-communities> [<https://perma.cc/S26E-FBZM>]; see also Whitney Pipkin, *Gone with the waves: storms, rising waters threaten pieces of past*, BAY J. (Nov. 19, 2018), https://www.bayjournal.com/article/gone_with_the_waves_storms_rising_waters_threaten_pieces_of_past [<https://perma.cc/C9KP-R5CG>].

⁵⁵ See JACK WATTS, NAT'L TR. FOR HISTORIC PRES., FIRE SAFETY IN HISTORIC BUILDINGS 1 (2008), <https://intoorg.org/wp-content/uploads/2015/09/2B27.FireSafetyInHistBldgs.pdf> [<https://perma.cc/BL8B-N4L2>]; Patrice Frey, *Why Historic Preservation Needs a New Approach*, CITYLAB (Feb. 8, 2019), <https://www.citylab.com/perspective/2019/02/tax-credit-historic-preservation-old-town-main-street/581989/> [<https://perma.cc/5P2H-LEE4>].

⁵⁶ For instance, Hurricane Isabel damaged a historic home on Route 617 in Surry County, Virginia that was owned by Winston Weaver Co. Inc. (formerly Weaver Fertilizer Co.). Rather than repair or replace the roof and continue to incur the expense of maintaining the vacant home, the company razed the structure and left the home site empty, surrounded by actively farmed fields.

insurance policies with subsidized rates.⁵⁷ However, the Federal Emergency Management Agency is in the process of implementing reforms required by the Homeowner Flood Insurance Affordability Act of 2014 that will increase the flood insurance rates to eventually eliminate the subsidy for such homes, with the increase taking place more quickly for non-primary residences.⁵⁸ This could provide an additional incentive to raze an older home in a coastal area rather than maintain and preserve it, an issue that will be exacerbated as areas requiring flood insurance expand due to increased flooding. This could be very helpful in incentivizing residents of flooding areas to eventually move to safer ground, but it also could contribute to an expedited loss of historic homes in those areas.

D. *Public Health Issues*

Changes in rural areas also have caused or exacerbated public health concerns.⁵⁹ In addition to a potential reduction in the number of volunteer paramedics and firefighters,⁶⁰ the shuttering of rural hospitals⁶¹ and a shortage of primary care physicians⁶² cause concerns about access

⁵⁷ NAT'L FLOOD INS. PROGRAM, FEMA, HOW RECENT LEGISLATIVE CHANGES AFFECT FLOOD INSURANCE 1–2, https://www.fema.gov/media-library-data/1402589850648-b39ea7ae38c86378e4c3e977d25cf942/HFIAA-Fact_Sheet_061114.pdf [<https://perma.cc/C58T-QZ3Q>].

⁵⁸ *Id.*

⁵⁹ See generally Nick Boykin, *Virginia law aims to save people thousands in costs for emergency medical attention*, WTKR (Nov. 27, 2018), <https://wtkr.com/2018/11/27/virginia-law-aims-to-save-people-thousands-in-cost-for-emergency-medical-attention/> [<https://perma.cc/LJ9M-PAH8>] (“Growing gaps in available care make getting quick medical attention difficult. About 46.7 million Americans don’t have access to a Level I or II trauma center within an hour’s drive from their home, a 2005 JAMA study showed. Since 2005, more than 120 rural hospitals have gone out of business, and more emergency departments have closed in the community hospitals that remain. Both of these trends are predicted to increase. That means more patients will need air ambulances.”).

⁶⁰ See Ayers, *supra* note 41; see also sources cited *infra* note 66.

⁶¹ Eli Saslow, *Who’s going to take care of these people?*, WASH. POST (May 11, 2019), <https://www.washingtonpost.com/news/national/wp/2019/05/11/feature/whos-going-to-take-care-of-these-people/> [<https://perma.cc/W7QF-K3G7>]; see also Ayla Ellison, *State-by-state breakdown of 102 rural hospital closures*, BECKER’S HOSPITAL CFO REP. (Mar. 20, 2019), <https://www.beckershospitalreview.com/finance/state-by-state-breakdown-of-102-rural-hospital-closures.html> [<https://perma.cc/RH2T-YJVL>]; *161 Rural Hospital Closures: January 2005–Present (121 since 2010)*, U.N.C. CECIL G. SHEPS CTR. FOR HEALTH SERVS. RES., <https://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/> [<https://perma.cc/L7G8-WHEJ>] (last visited Mar. 9, 2020) (reporting 121 rural hospitals closed since 2010).

⁶² AUGUST WALLMEYER, *THE EXTREMES OF VIRGINIA* 26–27 (2016) (explaining that many rural communities lack access to health care).

to medical treatment for rural residents.⁶³ These issues are expected to continue and even intensify for the foreseeable future.⁶⁴ Furthermore, lack of preventative medical treatment is one reason those who live in rural areas are more likely to die prematurely from disease, cancer, unintentional injury, chronic lower respiratory disease, or stroke.⁶⁵

Fewer young people living in rural areas also can impact the provision of emergency services to the community by volunteer fire and rescue squads. For example, a Civil Information Management Exercise conducted in the town of Cape Charles on the rural Eastern Shore of Virginia in 2018 assessed the town's emergency response capabilities and concluded that a decrease in volunteerism created a gap in their services.⁶⁶

Climate change, bringing increased flooding due to sea level rise, will make access to medical care in rural areas more problematic as residents must traverse long distances on roads that will increasingly flood and be closed. In addition, the repeated inundation of septic systems can make those systems stop working,⁶⁷ potentially spreading illness through

⁶³ Onyi Lam et al., *How far Americans live from the closest hospital differs by community type*, PEW RES. CTR. (Dec. 12, 2018), <https://www.pewresearch.org/fact-tank/2018/12/12/how-far-americans-live-from-the-closest-hospital-differs-by-community-type/> [<https://perma.cc/38YB-5WT2>] (last visited Mar. 9, 2020) (explaining that “[r]ural Americans live an average of 10.5 miles from the nearest hospital.”).

⁶⁴ See, e.g., *Hospital Closings Likely to Increase*, U.S. HEALTH RESOURCES & SERVS. ADMIN., <https://www.hrsa.gov/enews/past-issues/2017/october-19/hospitals-closing-increase.html> [<https://perma.cc/B6LK-DZFM>] (last updated Oct. 2017) (noting that “[m]ore than 120 rural hospitals have gone out of business since 2005, and the trend has been accelerating since 2010.”).

⁶⁵ *Telehealth in Rural Communities*, CDC, <https://www.cdc.gov/chronicdisease/resources/publications/factsheets/telehealth-in-rural-communities.htm> [<https://perma.cc/GJ43-H5QK>] (last updated May 31, 2019); Robin Warshaw, *Health Disparities Affect Millions in Rural Communities*, ASS'N AM. MED. CS. (Oct. 31, 2017), <https://www.aamc.org/news-in-sights/health-disparities-affect-millions-rural-us-communities> [<https://perma.cc/Y5G5-8ZLF>].

⁶⁶ Civil Affairs Battalion, 82d Airborne Division, Civil Information Management Exercise (July 2018). The then-Town Manager of Cape Charles, Larry DiRe, noted, “From discussion with the (volunteer) fire company and rescue squad the team determined overall trends of members being older, reduction in youth interested in serving, and physical distance of members from town able to answer as many calls.” Email from Larry DiRe, Cape Charles Town Manager, to author (July 31, 2018) (on file with author); see also *Rescue squads scramble for volunteers*, NEWS ON NECK (Mar. 28, 2018), https://www.newsontheneck.com/news/local/rescue-squads-scramble-for-volunteers/article_e5028d97-4243-5d16-9c24-1135d4747dc5.html [<https://perma.cc/24M4-ZRA7>].

⁶⁷ See Sarah Vogelsong, *Septic system failures expected to increase in coastal Virginia*, BAY J. (July 29, 2019), https://www.bayjournal.com/article/septic_system_failures_expected_to_increase_in_coastal_va [<https://perma.cc/3PHT-RPJU>] (explaining that septic failures are increasing as seas rise and contribute to health and environmental problems); see also Alex Harris, *A \$3 billion problem: Miami-Dade's septic tanks are already failing due*

contaminated flood water and causing shellfish bed closures due to exposure to bacteria such as *E. coli*.⁶⁸ Furthermore, as the problems facing rural communities compound, including climate change, extreme weather events, and trade wars, farmer suicides have increased.⁶⁹ This mounting despair is the ultimate public health risk for this community.

E. Technological Barriers

There are also several technological issues that highlight the divide between rural and urban areas, and that exacerbate the challenges that come with climate change. As discussed above, one of the most obvious deficiencies is the lack of broadband internet access for rural communities and the resultant disincentive to locate businesses or telecommute from there.⁷⁰ Additionally, the lack of public mass transportation in these communities also highlights the economic divide between them and other, more prosperous regions. A smaller population means there are not sufficient resources to fund public transit, so rural residents must rely upon individual car ownership and often are forced to drive over many miles of country roads to access jobs, shopping, and medical care, and the dwindling number of young people returning to rural areas means fewer drivers to take elderly family members on errands.⁷¹ This can result in isolation

to sea rise, MIAMI HERALD (Jan. 10, 2019), <https://www.miamiherald.com/news/local/environment/article224132115.html> [<https://perma.cc/88AW-GGNZ>] (describing the inundation of Miami-Dade County's septic systems due to sea level rise); *Septic Systems—What to Do after the Flood*, EPA, <https://www.epa.gov/ground-water-and-drinking-water/septic-systems-what-do-after-flood> [<https://perma.cc/89W7-SVKN>] (last updated July 12, 2017) (detailing many of the issues for homeowners associated with flooded septic systems).

⁶⁸ See, e.g., *Portion of James River closed to shellfish harvesting due to river flooding*, WTKR (Feb. 26, 2019), <https://wtkr.com/2019/02/26/portion-of-james-river-closed-to-shell-fish-harvesting-due-to-river-flooding/> [<https://perma.cc/Q7TV-CBER>].

⁶⁹ Annie Gowen, *I'm gonna lose everything*, WASH. POST (Nov. 9, 2019), <https://www.washingtonpost.com/nation/2019/11/09/im-gonna-lose-everything/?arc404=true> [<https://perma.cc/WB3W-PKXS>] ("In farm country, mental health experts say they're seeing more suicides as families endure the worst period for U.S. agriculture in decades. Farm bankruptcies and loan delinquencies are rising, calamitous weather events are ruining crops, and profits are vanishing during Trump's global trade disputes."); see also Wendy Ringgenberg et al., *Trends and Characteristics of Occupational Suicide and Homicide in Farmers and Agriculture Workers, 1992–2010*, 34 J. RURAL HEALTH 246, 247 (2018) (finding that, when compared to rates of all workers, suicide rates were higher among farm operators/workers).

⁷⁰ VA. ST. UNIV. & VA. TECH, *supra* note 23.

⁷¹ TODD LITMAN, CMTY. TRANSP. ASS'N OF AMERICA, PUBLIC TRANSPORTATION'S IMPACT ON RURAL AND SMALL TOWNS: A VITAL MOBILITY LINK 7–9, 21 (2017), <https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Rural-Transit-2017.pdf> [<https://perma.cc/M2RB-G4RW>].

of physically vulnerable populations, such as the elderly and disabled, who may not be able to drive. It also can result in those residents being less resilient and less able to evacuate quickly during a storm or flooding event.

F. Environmental Impacts

Environmental issues also impact the resilience of Virginia's rural communities. Some of these issues are intertwined with previously noted problems. For instance, the passing of older farmers and the relocation of their children out of the rural communities they have stewarded for years, if not generations, means a loss of not only institutional environmental knowledge about the soils, plants, and animals of the community, but also of some of the most stalwart environmental champions of these regions.

Some of the environmental issues rural coastal communities already face will be exacerbated by climate change impacts. For instance, saltwater intrusion due to sea level rise will jeopardize some domestic wells, including water that is pumped to irrigate crops.⁷² Rising seawater also threatens to convert some coastal forests to saltwater marshes as the trees die.⁷³ Additionally, over time, encroaching saltwater may force farmers to switch to growing saltwater-resistant crops that might not yield similar profits and that might require new equipment to grow or harvest. This is an important issue in coastal agricultural states because it could prompt existing farmers to retire and inhibit new farmers from replacing them because they cannot afford the new equipment that is required.

Another concern is that rural coastal communities are experiencing increasingly overwhelmed ditches that are meant to drain roadways and agricultural fields but that often cannot drain adequately in low-lying, flat areas and thus sometimes contain stagnant, polluted water.⁷⁴

⁷² See, e.g., Christian D. Langevin & Michael Zygnerski, *Effect of Sea-Level Rise on Salt Water Intrusion Near a Coastal Well Field in Southeastern Florida*, 51 GROUNDWATER 781, 781, 783 (2013) (finding that historical sea-level rise exacerbated the extent of salt water intrusion by a shallow coastal aquifer system near a municipal supply well field, and that "when sea-level rise is included in the simulations, drinking water standards are exceeded 10 to 21 years earlier, depending on the specified rate of sea-level rise."); John P. Masterson et al., *Effects of Sea-Level Rise on Barrier Island Groundwater System Dynamics—Ecohydrological Implications*, 7 ECOHYDROLOGY 1064, 1064 (2014) (finding that a sea-level rise of just twenty centimeters "leads to substantial changes in the depth of the water table and the extent and depth of saltwater intrusion" in a barrier island groundwater system).

⁷³ Matthew L. Kirwan & Keryn B. Gedan, *Sea-Level Driven Land Conversion and the Formation of Ghost Forests*, 9 NATURE CLIMATE CHANGE 450, 452 (2019).

⁷⁴ JOHN S. MORRIS III, MIDDLE PENINSULA PLANNING DIST. COMM'N, ROADSIDE AND

These ditches may extend for long stretches in undeveloped areas with the underlying land ownership often unclear, so there is uncertainty about who is responsible for maintaining them. There currently is no economic incentive for the private sector or localities to attempt to acquire control over the water in the ditches and clean it for reuse or to generate nutrient credits. The Chesapeake Bay restoration effort imposed by the U.S. Environmental Protection Agency has triggered a variety of requirements to protect water quality,⁷⁵ and those who hold pollutant discharge permits issued pursuant to the federal Clean Water Act sometimes purchase nutrient credits to assist them in meeting their pollutant reduction requirements.⁷⁶ These purchases must be from sources within a limited hydrologic range,⁷⁷ so there is no demand for permittees to purchase credits generated by restoring rural waters in remote areas that are not in sufficient hydrological proximity to meet the nutrient credit use requirements. Many ditches in coastal rural areas thus remain often inundated with their water quality issues unaddressed.⁷⁸

Furthermore, restrictions on development within riparian buffer areas adjacent to waterways in the Chesapeake Bay watershed have proven to be important protectors of water quality in the Bay.⁷⁹ These restrictions may be an impediment, however, to undertaking resilience

OUTFALL DRAINAGE DITCHES 4, 8 (2013), https://www.mppdc.com/articles/reports/Final%20Report%20%20Exhibits_131118_RED.pdf [<https://perma.cc/BXV7-5K62>].

⁷⁵ EPA, CHESAPEAKE BAY TMDL EXECUTIVE SUMMARY ES-1 (2010), https://www.epa.gov/sites/production/files/2014-12/documents/bay_tmdl_executive_summary_final_12.29.10_final_1.pdf [<https://perma.cc/3FG5-ZSRQ>].

⁷⁶ See *Basics for the Chesapeake Bay Watershed*, CHESAPEAKE BAY FOUND., <https://www.cbf.org/issues/water-quality-trading/> [<https://perma.cc/6G8R-PWYP>] (last visited Mar. 9, 2020).

⁷⁷ For example, in Virginia, municipal separate storm sewer system (MS4) permittees are only authorized to acquire nutrient credits generated in the same locality or tributary. VA. CODE ANN. § 62.1-44.19:21 (West 2013). Land disturbers subject to the General Virginia Stormwater Management Program Permit for Discharges of Stormwater from Construction Activities or a Construction Individual Permit can only acquire offsite credits generated in the same or adjacent U.S. Geological Survey eight-digit hydrologic unit code as the permitted site. VA. CODE ANN. §§ 62.1-44.19:21, 62.1-44.15:35 (West 2013).

⁷⁸ For further information on the challenges in addressing water quality in flooding ditches in rural Virginia, see COMMONWEALTH CTR. FOR RECURRENT FLOODING RESILIENCY, REPORT TO THE GOVERNOR AND THE CHAIRMEN OF THE HOUSE COMMITTEE ON AGRICULTURE, CHESAPEAKE AND NATURAL RESOURCES AND THE SENATE COMMITTEE ON AGRICULTURE, CONSERVATION AND NATURAL RESOURCES PURSUANT TO HOUSE BILL 1774 iv–v (2017), <https://rga.lis.virginia.gov/Published/2017/RD540/PDF> [<https://perma.cc/AA3N-8PY2>].

⁷⁹ See, e.g., MD. CODE ANN., NAT. RES. § 8-1801 (West 2020); VA. CODE ANN. § 62.1-44.15:67 (West 2019).

measures within those buffer areas to reduce flooding. This creates another challenge for rural localities that cannot afford to install seawalls, jetties, or other large-scale measures to protect their shorelines and thus have roads, residences, and businesses that are vulnerable to flooding from sea level rise. These communities must find a way to meet the important goal of protecting water quality while also improving their resilience and protecting their residents from harm.

II. POTENTIAL SOLUTIONS

In light of these challenges, what does “rural resilience” mean, and what can rural communities do to make themselves more resilient in the face of potentially severe climate change impacts? These communities clearly are already resilient in the sense that they have survived for decades in the face of economic downturns, severe weather events, and minimal public infrastructure and resources. In fact, research indicates that rural businesses are, on average, more resilient than their metropolitan counterparts, with 71.6 percent of businesses surviving for at least five years in rural areas with populations of fewer than 2,500 people not near urbanized areas, while metropolitan areas with a population of one million or more have an average five-year business survival rate of 66.5 percent.⁸⁰ When it comes to climate change impacts specifically, resilience in these communities should not only encompass the clear imperatives of reducing risks to physical infrastructure and having adequate programs in place for disaster response and recovery, but they also must have policies in place to address and reduce social vulnerability within the community, such as ensuring the long-term provision of adequate public health services and affordable housing.⁸¹

⁸⁰ Brian Thiede et al., *The Divide Between Urban and Rural America in 6 Charts*, U.S. NEWS & WORLD REP. (Mar. 20, 2017), <https://www.usnews.com/news/national-news/articles/2017-03-20/6-charts-that-illustrate-the-divide-between-rural-and-urban-america> [<https://perma.cc/9PQQ-JNTP>].

⁸¹ See, e.g., BOS. GREEN RIBBON COMM'N, CARBON FREE BOSTON: SOCIAL EQUALITY REPORT 2019, at 7, 13–14 (2019), <https://www.greenribboncommission.org/document/carbon-free-boston-social-equity-report/> [<https://perma.cc/LKU3-NU8K>]; see also Alejandra Martinez, *Miami Expert On How Climate Change Accelerates Gentrification: “It’s A Double Whammy”*, INVADING SEA (Aug. 23, 2018), <https://www.theinvadingsea.com/2018/08/23/miami-expert-on-how-climate-change-accelerates-gentrification-its-a-double-whammy/> [<https://perma.cc/LY9R-6NH7>]; Kirk Semple, *After a Caribbean Hurricane, the Battle Is Where, or Even Whether, to Rebuild*, N.Y. TIMES (Oct. 7, 2019), https://www.nytimes.com/2019/10/07/world/americas/hurricane-irma-saint-martin.html?te=1&nl=climate-fwd:&emc=edit_clim_2019

Some work is already underway to study these issues. For instance, Virginia universities have begun proactively studying the rural-urban divide and how to address rural challenges.⁸² Additionally, commentators have pointed to certain paths forward for rural communities seeking to increase their resilience.⁸³ The following are some suggestions for policies and approaches that can be used by rural localities to help them plan ahead and keep their residents safe.

A. *Public Education and Community Discussion*

Because so much of the coastline and agricultural lands are privately owned, it is crucial that coastal states and local governments engage in public education and community discussion about the looming risk of flooding and saltwater inundation. Private property owners should be fully informed about the predicted levels of sea level rise and temperature changes and the possible pathways to make their properties and communities more resilient. It is increasingly important for localities to engage members of the public in discussions about the risks and the choices for addressing them—namely, adapt to climate change impacts, mitigate the risks, or leave. The first two choices are expensive, and the last is heart-wrenching. None is simple or easy. Only by having the best and fullest information before them can residents of coastal areas determine how they wish to proceed in the face of these existential threats, and informed voters are more likely to support elected officials' efforts to adequately plan and fund resilience measures.

1009?campaign_id%3D54&instance_id=12959&segment_id=17722&user_id=42066b3b26dbdcb20cbb337038b0955f@i_id=82197780&smid=nytcore-ios-share [https://perma.cc/AGK6-JUKD].

⁸² Jennifer Morgan, *Rural Virginia Initiative seeks solutions to Virginia's growing urban-rural divide*, VA. TECH DAILY (Apr. 11, 2019), <https://vtnews.vt.edu/articles/2019/04/rural-virginia.html> [https://perma.cc/S9WG-79GS] (announcing a new initiative that will bring together Virginia Tech, University of Virginia at Wise, Virginia State University and representatives from government and the private sector in a collaborative project to analyze problems and propose recommendations to address Virginia's growing urban-rural divide).

⁸³ See, e.g., Laurie Ristino, *Surviving Climate Change in America: Toward a Rural Resilience Framework*, 41 W. NEW ENG. L. REV. 521, 521 (2019) (proposing using resilience as the foundation of a framework to guide social investments and policy efforts to better address our economic and environmental sustainability challenges in rural areas); Mark Haggerty, *Getting Real About Rural Resilience*, HEADWATERS ECON. (Apr. 2019), <https://headwaters.economics.org/economic-development/getting-real-about-rural-resilience/> [https://perma.cc/W5LR-ACZ6] (advocating a three-step "Transition, Revenue and Investment" process to help build rural community resilience to economic disruptions).

Researchers at three Virginia universities have proposed a collaborative solution to educate communities about these issues and help them determine steps to increase their resilience. The Resilience Adaptation Feasibility Tool (“RAFT”) is a program that assists coastal localities in Virginia with assessing their vulnerabilities and developing a checklist of community actions to become more resilient.⁸⁴ The RAFT consists of three components: a scorecard that assesses a locality’s plans, ordinances, and policies for resilience; a community workshop at which local leaders develop a Resilience Action Checklist of measures that can be undertaken over the span of a year to improve resilience; and a year-long assistance phase, during which the universities provide research, legal and policy analysis, mapping tools, information about grant opportunities, and other support to the community.⁸⁵ This approach provides a baseline of knowledge for a community-wide discussion about climate change impacts and the opportunity to develop consensus about the steps that will be taken to increase community resilience.

B. *Technological Advances*

There are several technological advances that, if adopted by rural communities, could increase their resilience as they face the effects of climate change and narrow the prosperity gap between urban and rural areas. For instance, in the future, autonomous cars could provide the opportunity for those who cannot drive to access distant medical care, shopping, and jobs, and may even provide the ability for car owners to earn extra income from leasing the car to others for ride-sharing.⁸⁶ They also could be used to evacuate the car owners during the onset of a flooding event, without the dangerous delay of waiting for rescue and without endangering emergency rescue personnel or fellow citizens, such as the members of the “Cajun Navy.” Funding for adaptation of many miles of

⁸⁴ *The Resilience Adaptation Feasibility Tool (The RAFT)*, U. VA., <https://ien.virginia.edu/raft> [<https://perma.cc/JU6T-RNKK>] (last visited Mar. 9, 2020).

⁸⁵ The three RAFT institutions are the University of Virginia’s Institute for Engagement & Negotiation, William & Mary Law School’s Virginia Coastal Policy Center, and Old Dominion University’s Resilience Collaborative. *Id.*

⁸⁶ Jigar Shah, *The Car You Just Bought Might Be The Last One You’ll Own*, LINKEDIN (Dec. 13, 2018), <https://www.linkedin.com/pulse/car-you-just-bought-might-last-one-youll-own-jigar-shah/> [<https://perma.cc/6TTN-L4YD>]; see also *Forget autonomous cars—rural Japan is betting on self-driving buses*, APOLITICAL (Sept. 25, 2018), https://apolitical.com/en/solution_article/forget-autonomous-cars-rural-japan-is-betting-on-self-driving-buses/ [<https://perma.cc/H3JT-YJUT>] (stating that autonomous buses are also a possibility).

rural roadways for use by autonomous cars will be a significant hurdle, but rural localities can discuss and assess their policies today in order to position themselves to be early adopters of autonomous vehicle technology tomorrow.

Additionally, the emerging technology known as “telemedicine”—or “telehealth”—can help bridge the gap created by closing hospitals and disappearing local medical services in rural areas. This technology allows a patient to speak to a doctor or other healthcare professional through mobile phones or computers.⁸⁷ These services can provide better access to disease prevention measures and management of chronic medical issues for rural residents.⁸⁸ Federal grants have started to fund these programs.⁸⁹ The availability of telemedicine requires reliable internet coverage, however, which can be lacking in rural areas.

Therefore, another essential need in rural areas is funding for broadband internet services. Public-private partnerships (“PPPs”) can help to address this, as demonstrated by Bedford County, Virginia. In addition to using grant funds, the rural county has proposed entering into an agreement with a private company, Blue Ridge Towers, for an estimated \$3 million project to construct a system that would provide broadband coverage to approximately 95 percent of residences in the county by mid-2020.⁹⁰ Other state and federal grant programs and initiatives also aim to address this gap.⁹¹

⁸⁷ *Telehealth in Rural Communities*, NAT'L CTR. FOR CHRONIC DISEASE PREVENTION & HEALTH PROMOTION, CDC, <https://www.cdc.gov/chronicdisease/resources/publications/factsheets/telehealth-in-rural-communities.htm> [<https://perma.cc/28RV-47HY>] (last updated May 31, 2019).

⁸⁸ *Id.*

⁸⁹ Amanda Williams, *UVA receives nearly \$400,000 to implement the Virginia Telemedicine Network*, NBC29 (Nov. 21, 2019), <https://www.nbc29.com/2019/11/21/uva-receives-nearly-implement-virginia-telemedicine-network/> [<https://perma.cc/WT3Q-HSZE>]; see also Press Release, Tim Kaine, U.S. Senator from Virginia, Warner & Kaine Announce Nearly \$500,000 to Expand Telemedicine for Southwest Virginia and Eastern Shore Rural Communities (Oct. 31, 2018), <https://www.kaine.senate.gov/press-releases/warner-and-kaine-announce-nearly-500000-to-expand-telemedicine-for-southwest-virginia-and-eastern-shore-rural-communities> [<https://perma.cc/2LYM-93NV>].

⁹⁰ Shannon Keith, *Gov. Northam pushes broadband access at Bedford County event*, NEWS & ADVANCE (Dec. 14, 2018), https://www.newsadvance.com/news/local/gov-northam-pushes-broadband-access-at-bedford-county-event/article_363e0732-d643-572b-875d-dfe94ab3bb8e.html [<https://perma.cc/WZ5T-DNJY>].

⁹¹ *Broadband Development*, NORTHERNNECK.US, <http://www.northernneck.us/broadband/> [<https://perma.cc/GE22-32S3>] (last visited Mar. 9, 2020) (explaining that “[i]n FY 2020, The Virginia Telecommunications Initiative (VATI) is awarding \$19 million to eligible applicants throughout the state to provide last-mile services to unserved areas.”); see

Incentivizing the use of private sector funds as well as public funds can help expedite provision of vital internet access to rural localities. Such access would enable entrepreneurs to locate within rural communities and strengthen the local economy, as well as facilitate communication with citizens during disasters and weather emergencies. Furthermore, technological advancements might even provide a job creation boon for rural communities. Specifically, Amazon is betting that there is opportunity for rural areas to add hundreds of thousands of jobs and billions of dollars to the economy by adopting digital tools.⁹² And once a rural community invests in installation of broadband, it can build business or industrial parks that have high-speed internet capacity on much less expensive real estate than is available in urban areas, and its residents can more easily take advantage of online courses to obtain degrees and certifications economically without the expense of relocating from their home communities.⁹³ Additional skills, training, and education are key to rural communities' ability to lure new businesses and thrive in the future.

C. *Funding and Economic Solutions*

While simply throwing money at these problems will not solve them, prioritizing funding sources for these regions can help rural communities better address their mounting challenges. The federal government funds rural infrastructure projects through the U.S. Department of Agriculture ("USDA") Rural Infrastructure Opportunity Fund⁹⁴ and provides loans to low and moderate income homeowners through the USDA Single

COMMONWEALTH BROADBAND CHIEF ADVISOR, REPORT ON COMMONWEALTH CONNECT: GOVERNOR NORTHAM'S PLAN TO CONNECT VIRGINIA (2019), <https://rga.lis.virginia.gov/Published/2019/RD109/PDF> [<https://perma.cc/CTU6-TCQK>]; see also *Broadband Grants*, NAT'L TELECOMMUNICATION & INFO. ADMIN., U.S. DEP'T COM., <https://www.ntia.doc.gov/grants-combined> [<https://perma.cc/L5FF-6HCQ>] (last visited Mar. 9, 2020).

⁹² *Improved Digital Access Means Big Opportunities for Rural American Businesses*, U.S. CHAMBER COM., <https://www.uschamber.com/co/good-company/launch-pad/digital-key-rural-american-economic-growth-amazon> [<https://perma.cc/D39Q-LPZ4>] (last visited Mar. 9, 2020) ("Better adoption of online tools and digital services by businesses outside metropolitan areas could create 360,000 new full-time jobs in rural areas and add more than \$140 billion to the U.S. economy over the next three years, according to the findings of a newly released report conducted by the U.S. Chamber of Commerce's Technology Engagement Center (C_TEC) in partnership with Amazon.").

⁹³ See *id.*

⁹⁴ See Press Release, USDA Announces First Private Sector Investments through U.S. Rural Infrastructure Opportunity Fund (July 28, 2015), <https://www.usda.gov/media/press-releases/2015/07/28/usda-announces-first-private-sector-investments-through-us-rural> [<https://perma.cc/FQ2C-WRLC>].

Family Housing Guaranteed Loan Program for home purchase or repair, including for the establishment of escrow accounts for hazard and flood insurance premiums.⁹⁵ These important funding programs should be continued. Additionally, states can leverage their credit ratings and generate revenue to issue loans or grants to local governments that otherwise would not be able to access needed funding for resilience measures. These loans and grants could be used for physical or economic resilience projects. For example, one interesting funding option that a state could pursue is to pay farmers to provide environmental services, such as planting cover crops and using no-till practices to store carbon in the soil or converting poor soil areas to forests or wetlands to sequester carbon and buffer flood waters.⁹⁶

Innovative financial tools can also help pay for climate change adaptation and mitigation projects and take pressure off of localities that rely primarily upon revenue from their real property tax base and thus hesitate to plan for retreat from flooding areas. Again, PPPs can provide funding for projects for which public entities cannot foot the bill alone, and Community Development Financial Institutions (“CDFI”)⁹⁷ also can help to fund resilience investments in low and moderate income communities. Additionally, parametric insurance—which pays out when certain measurable parameters are met,⁹⁸ such as wind speed or flood water

⁹⁵ See *Single Family Housing Guaranteed Loan Program*, USDA, <https://www.rd.usda.gov/programs-services/single-family-housing-guaranteed-loan-program> [https://perma.cc/RZD3-623J] (last visited Mar. 9, 2020).

⁹⁶ See, e.g., Stefano Pagiola, *Payments for Environmental Services in Costa Rica*, 65 *ECOLOGICAL ECON.* 712, 712 (2008); see also Robert Leonard & Matt Russell, ‘*Our Small Towns Are Toppling Like Dominoes: Why We Should Cut Some Farmers a Check*, N.Y. TIMES (June 24, 2019), <https://www.nytimes.com/2019/06/24/opinion/farmers-climate-change-government-global-warming.html?smid=nytcore-ios-share> [https://perma.cc/M9QS-E998].

⁹⁷ CDFIs are private financial institutions that provide lending and financial services to expand economic opportunity for low-income people and communities. See James Chen, *Community Development Financial Institution (CDFI)*, INVESTOPEDIA, <https://www.investopedia.com/terms/c/cdfi.asp> [https://perma.cc/DJ8E-LL35] (last updated June 25, 2019); *What is a CDFI?*, OPPORTUNITY FIN. NETWORK, <https://ofn.org/what-cdfi> [https://perma.cc/KR7G-NBQT] (last visited Mar. 9, 2020); *Community Development Finance*, FED. RES., <https://www.federalreserve.gov/consumerscommunities/cdf.htm> [https://perma.cc/P7DE-PGT6] (last updated June 11, 2019); see also *Community Development Financial Institution (CDFI) and Community Development (CD) Bank Resource Directory*, OFF. COMPTROLLER CURRENCY, U.S. DEP’T TREASURY, <https://www.occ.gov/topics/consumers-and-communities/community-affairs/resource-directories/cdfi-and-cd-bank/index-cdfi-and-cd-bank-resource-directory.html> [https://perma.cc/AW94-XEF4] (last visited Mar. 9, 2020).

⁹⁸ See Tom Markovic & Steve Harry, *Parametric Insurance: A Tool to Increase Climate Resilience*, MARSH & MCLENNAN COMPANIES, <https://www.mmc.com/insights/publications/2018/dec/parametric-insurance-tool-to-increase-climate-resilience.html> [https://perma.cc/9A6Q-VKH2] (last visited Mar. 9, 2020).

depth—and catastrophe bonds—which pay out if catastrophic events occur, with higher interest rates paid to investors for taking on the higher risk⁹⁹—are examples of innovative products. Another pioneering financial tool is resilience bonds, which link insurance coverage and investments in resilience projects; they enable communities to monetize the physical and financial losses that they avoided by implementing resilience measures via an insurance rebate.¹⁰⁰ These tools provide opportunities and incentives for rural communities without many financial resources to increase their resilience.

A locality's tax policies also can be used to help steer a community toward economic and physical resilience. For example, a group of young businessmen have purchased buildings in Pulaski, Virginia, that needed renovation and are revitalizing them for their homes and businesses.¹⁰¹ They have created a template for stacking aggregate capital to gain access to historic tax credits and want to use it in other towns throughout southwest Virginia and in other states to show that there is an economically feasible way to use such tax credits.¹⁰²

Another example of the use of tax policy to increase resilience is the creation of agricultural and forestal districts, which enable landowners to be eligible for a reduced use value assessment and taxation if they engage in those pursuits, thus helping to bolster farming activities.¹⁰³ This tool will not work in an extremely rural area, however, where there are limited taxpayers and not much commercial tax base so the community cannot afford to reduce its tax revenues by creation of such a special assessment. In that circumstance, a more effective tool might be the

⁹⁹ Mark A. Perelman, *Bonds Move Disaster Finance from Recovery to Resilience*, CONSERVATION FIN. NETWORK (Aug. 23, 2017), <https://www.conservationfinancenetwork.org/2017/08/23/bonds-move-disaster-finance-from-recovery-to-resilience> [https://perma.cc/4MSG-J3M6].

¹⁰⁰ See JAMES RHODES & SHALINI VAJJHALA, RE.BOUND, A GUIDE FOR PUBLIC SECTOR RESILIENCE BOND SPONSORSHIP (Sept. 2017), <http://www.refocuspartners.com/wp-content/uploads/pdf/RE.bound-Program-Report-September-2017.pdf> [https://perma.cc/Y6TZ-2PHD]; *Resilience Funding Forum*, WM. & MARY L. SCH., <https://law.wm.edu/academics/programs/jd/electives/clinics/vacoastal/conferences/resiliencefundingforum/index.php> [https://perma.cc/EU6G-KJ2N] (last visited Mar. 9, 2020) (further information about innovative funding tools for resilience measures); Shalini Vajjhala, *Financing infrastructure through resilience bonds*, BROOKINGS INST. (Dec. 16, 2015), <https://www.brookings.edu/blog/the-avenue/2015/12/16/financing-infrastructure-through-resilience-bonds/> [https://perma.cc/L7DA-SMJD].

¹⁰¹ See Melinda Williams, *Kaine hopes more millennials revitalize towns*, SOUTHWEST TIMES (Apr. 30, 2019), <https://www.southwesttimes.com/2019/04/kaine-hopes-more-millennials-revitalize-towns/> [https://perma.cc/9GN5-ZEFK].

¹⁰² *Id.*

¹⁰³ See, e.g., VA. CODE ANN. § 58.1-3231 (2019).

provision of a real property tax credit for the creation of a conservation easement¹⁰⁴ or a tax exemption for property owners who install resilience measures such as riparian buffers, wetlands, and living shorelines on their properties.¹⁰⁵

D. Environmental Policy Recommendations

Certain environmental policy changes can also help address some of the identified problems in rural areas. Rural areas can play a significant role in the restoration of water quality in the Chesapeake Bay watershed, particularly in addressing agricultural impacts, if sufficient funding or economic incentive is found.¹⁰⁶ As discussed above, non-MS4, rural localities that are not subject to Clean Water Act discharge permits frequently do not experience economic demand for cleaning up their waterways, nor are they forced to do so by permit requirements, yet they often have stagnant or overflowing ditches adjacent to roadways and agricultural fields that need to be addressed. Pursuing nutrient and sediment reductions in rural ditch water as an accredited best management practice as part of the Chesapeake Bay restoration effort while judiciously expanding the potential users of such credits within the Bay watershed when permittees are not located nearby could be a cost effective way to improve water quality in these ditches as well as the Bay overall. A recent project demonstrated that ditch retrofits can be accomplished but at significant cost that is beyond the means of most rural localities. In order to improve the water quality of the Indian River and Broad Creek tributaries of the Eastern Branch of the Elizabeth River, the Elizabeth River Project (“ERP”) conducted ditch retrofits as a method of stormwater treatment.¹⁰⁷ ERP staff noted that they selected urban ditch retrofits because they improve nitrogen and phosphorus reductions, provide an option in areas with high water tables, and work well in areas with little space, and TMDL credit is available for Ditch Treatments and Ditch Retrofits.¹⁰⁸

¹⁰⁴ See, e.g., VA. CODE ANN. §§ 10.1-1009, 10.1-1011 (1998).

¹⁰⁵ See, e.g., VA. CODE ANN. § 58.1-3666 (2016).

¹⁰⁶ See EPA, STRATEGY FOR PROTECTING AND RESTORING THE CHESAPEAKE BAY WATERSHED EXECUTIVE SUMMARY 21–22 (2010), https://www.chesapeakebay.net/documents/Strategy_for_Protecting_and_Restoring_the_Chesapeake_Bay_Watershed.pdf [<https://perma.cc/E6EV-YUPR>].

¹⁰⁷ See *Water Quality Technical Workgroup*, HAMPTON ROADS PLAN. DISTRICT COMMISSION (Dec. 5, 2019), <https://www.hrpdcva.gov/events/details/864/water-quality-technical-workgroup/> [<https://perma.cc/483N-LTFC>].

¹⁰⁸ See GRACE SAUNDERS, WATER QUALITY TECHNICAL WORK GROUP, HAMPTON ROADS PLANNING DIST. COMM’N, ADVANCING THE SCIENCE OF URBAN DITCH “RE-PLUMBING” IN

E. Long-Term Planning and Adaptation Measures

While it is impossible to plan for every possibility, better planning and recognition of the immediate and long-term impacts of climate change can help rural communities confront these mounting issues. For instance, a locality's comprehensive planning process can be used to identify locations where marshes can migrate upland as the sea level rises. These corridors can then be prioritized for purchase or as potential donations for conservation purposes. Additionally, planning policies could be adopted to dissuade hard armoring of the shoreline and land uses that would inhibit such marsh migration so the water filtration and flood buffering benefits of these areas are not lost.¹⁰⁹ And areas that are predicted to become inundated by sea level rise also could be designated during a community's comprehensive planning process as working waterfronts, including allowance of aquaculture operations. A thriving aquaculture industry can help to strengthen and diversify a rural coastal economy.

Another aspect of pursuing rural resilience is identifying adaptation measures that increase the resilience of rural communities. These measures could run the gamut from substituting salt-tolerant crops in areas where saltwater intrusion has affected the yields in these locations to converting parcels that sometimes flood to new uses such as hunting grounds or areas for recreational access to waterways.¹¹⁰ For example, recognizing the threat posed by saltwater flooding in low-lying agricultural areas, the Dutch are researching saltwater-resistant potato crops.¹¹¹

THE ELIZABETH RIVER WATERSHED (Dec. 5, 2019), https://www.hrpdcva.gov/uploads/docs/SaundersHRPDC_DitchRetrofits_Dec52019_GS_JR.pdf [<https://perma.cc/9MML-GJAA>] (Their noted lessons learned include: ditch retrofits are expensive; maintenance of surrounding ditch elevations is needed for a project to be effective; the Chesapeake Bay Program has yet to approve TMDL credits for two-staged ditches, bioreactors, and phosphorus absorbing substrates; and with increased rainfall intensity, ditch retrofit designs will need to be modified).

¹⁰⁹ See, e.g., Jesse Reiblich et al., *Enabling and Limiting Conditions of Coastal Adaptation: Local Governments, Land Uses, and Legal Challenges*, 22 OCEAN & COASTAL L.J. 156, 163, 170, 174–75 (2017) (explaining that “the coastal habitats that buffer against rising sea levels could be prioritized for protection and restoration as part of a holistic, multi-benefit coastal adaptation strategy over other single-benefit strategies”).

¹¹⁰ Kirwan & Gedan, *supra* note 73, at 455.

¹¹¹ Maude Brulard, *Dutch saltwater potatoes offer hope for world's hungry*, PHYS.ORG (Apr. 29, 2015), <https://phys.org/news/2015-04-dutch-saltwater-potatoes-world-hungry.html> [<https://perma.cc/62LP-3Y7A>] (“While today much research is focused on improving the yield of crops, the Dutch team has taken the opposite approach: trying to grow crops on land previously considered unusable. [Dutch farmer Mark van Rijsselberghe] jokes

Another way to address encroaching saltwater is to plan on harvesting susceptible timber as saltwater intrudes into forest land.

Since funding is limited, communities increasingly will need to obtain multiple benefits from their investments. For example, living shorelines designed to provide erosion control, habitat, stormwater management, pollutant filtration, and flooding resilience would provide multiple returns on a locality's or landowner's investment. Similarly, areas in median strips of highways could be used for stormwater management, flood control, habitat, and even the growing of food crops.¹¹²

In some instances, as a last resort, adaptation will involve managed retreat from recurrently flooding areas and relocation to higher ground.¹¹³ That choice will require extensive planning, considerable funding, and political courage.¹¹⁴ Importantly, these decisions should be made with an eye toward providing adequate affordable housing for socially and physically vulnerable communities to ensure that they are not priced out of the market in safe, elevated areas.¹¹⁵

that in a country where much of the land lies below sea level, 'we are so afraid of the sea that until 10 years ago we didn't dare to do anything with sea water and growing plants.' The world loses around 2,000 hectares (just under 5,000 acres) of agricultural land a day to salt-induced degradation in 75 countries, caused by bad or absent irrigation, according to the UN's Institute for Water, Environment and Health.”)

¹¹² See Jeremy Cox, *Roundabouts, vegetable plots transform once-clogged traffic arteries*, BAY J. (Dec. 5, 2019), https://www.bayjournal.com/article/roundabouts_vegetable_plots_transform_once_clogged_traffic_arteries [<https://perma.cc/EPF3-VKA9>]. An example of this approach is Piedmont Environmental Council's use of the space between traffic circles in Loudoun County, Virginia as a farm to grow vegetables for a local food bank, which also kept the land out of development as urbanization approached. *Id.* Rural communities at the edge of urbanizing areas could follow suit, with appropriate funding.

¹¹³ See generally ANNE SIDERS, COLUM. CTR. FOR CLIMATE CHANGE LAW, COLUM. L. SCH., *MANAGED COASTAL RETREAT: A LEGAL HANDBOOK ON SHIFTING DEVELOPMENT AWAY FROM VULNERABLE AREAS* (Oct. 2013), <https://climate.law.columbia.edu/sites/default/files/content/docs/others/Siders-2013-10-Managed-Coastal-Retreat.pdf> [<https://perma.cc/EQ7X-EXTF>].

¹¹⁴ See, e.g., *Tribal Resettlement*, ISLE DE JEAN CHARLES, <http://www.isledejeancharles.com/our-resettlement> [<https://perma.cc/SJJ4-JVKZ>] (last visited Mar. 9, 2020) (highlighting the discussion of the high cost and extensive planning for the relocation of the Isle de Jean Charles community in Louisiana).

¹¹⁵ HOUS. VA., *MEETING HOUSING NEEDS IN RURAL VIRGINIA: TRENDS, NEEDS, GAPS, SOLUTIONS 16* (2016) (“Besides the limited availability of funding available, participants cited a lack of affordable financing, lack of infrastructure (public transportation, water/sewer, broadband/cellular access, etc.), and limited capacity of housing providers as the three most urgent gaps in each of their service areas. A number of respondents also pointed out a lack of community support as another gap that needs to be addressed.”). These gaps can increase as areas become flooded and communities have additional demands on their limited resources. *See id.*

F. Acceptance of a Changing Reality

In order to survive and thrive in the face of economic shifts and a changing climate, rural communities will need to reimagine themselves in some ways. They will need to be smart about attracting new residents, perhaps through advertising wide open spaces and cheaper land prices than in cities, incentivizing tourism opportunities such as farm vacation rentals and hunting grounds, and tapping into the “locavore” movement¹¹⁶ and the desire to eat fresh food grown nearby. If they are sufficiently elevated, they can become receiving communities for climate change refugees relocating from flooding communities. And they can strengthen their economic and social ties to nearby urban areas, fostering relationships with them for the benefit of all.¹¹⁷

Solutions may require some “out of the box” thinking. For example, could funding be pursued at the federal level, similar to the Rural Electrification Act of 1936,¹¹⁸ for installation of broadband internet services in isolated rural areas? Or could shrinking small towns in rural communities become the new home for senior citizens who can no longer live alone, with older buildings revitalized as senior centers in the midst of rural beauty and featuring on-site advanced medical care, plenty of room for gardens, and organized hikes through the countryside for good health? Such an approach potentially could reduce medical delivery costs, improve senior care and diets, increase social connection, and address isolation-triggered depression among our senior population. The IPCC has noted that rural people throughout the world have adapted to climate variability over time through farming practices, use of indigenous knowledge of natural resources, diversification of livelihoods, and informal means of risk-sharing and risk management.¹¹⁹ By thinking creatively, tapping into local

¹¹⁶ Dr. Veronica Anderson, *5 Reasons to Join the Locavore Movement*, HUFFINGTON POST (July 6, 2015), https://www.huffpost.com/entry/locavore_b_7483218?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAEWWr1PFJ5sb4S1rfoemrRS9dU0PsEMVPBXAsZoEnjAkwtlmGIDz4dOPR2FPx5GcwSVAbT aCmFYF9vIPDK6mY4bp_U5ShlBJeQRcQ400-0jIP5Z0gQUzyF_vXlk2HWCdwtxfG2bR3KYm2N01SuLQ1I4KF8dOeBrMJZB4D6Lk4DxT [https://perma.cc/977U-ZUMZ] (“Locavores are people who eat only locally-grown produce and, when possible, rely on meat, eggs, and other food products from local sources.”).

¹¹⁷ Nathan Arnosti & Amy Liu, *Why rural America needs cities*, BROOKINGS INST. (Nov. 30, 2018), <https://www.brookings.edu/research/why-rural-america-needs-cities/> [https://perma.cc/TRS8-WS2G] (arguing that “one of the best ways to help rural America may involve helping cities: supporting a distributed network of economically vibrant small and mid-sized cities across the United States.”).

¹¹⁸ 7 U.S.C. § 901 *et seq.* (2018); Pub. L. No. 74-605 (1936).

¹¹⁹ See Dasgupta et al., *supra* note 11, at 618.

knowledge, and adapting their policies, hopefully today's rural communities also can cope successfully with climate change impacts over time.

CONCLUSION

The quest for resilience will be a long-term one for rural communities. Yet there are measures that can be undertaken today to help ensure that they are prepared for the increasing challenges and risks posed by climate change. With sufficient community discussion and education, adequate planning and funding, and careful attention to the needs of socially vulnerable residents, rural coastal communities can face the existential threat posed by a changed climate. By following the approach of the Great Law of Peace of the Iroquois Nations—live for the next seven generations¹²⁰—we can help to ensure that today's decisions will lead to sustainable communities for generations to come.

¹²⁰ See, e.g., Terri Hansen, *How the Iroquois Great Law of Peace Shaped U.S. Democracy*, PBS NATIVE VOICES (Dec. 13, 2018), <https://www.pbs.org/native-america/blogs/native-voices/how-the-iroquois-great-law-of-peace-shaped-us-democracy/> [<https://perma.cc/8GYP-6WKS>].