FLOOD RESILIENCE IN APPALACHIA

POLICY RECOMMENDATIONS

2024

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Platform Introduction

As the climate changes, rainfall events in Appalachia will increase in frequency and intensity. The National Climate Assessment projects this trend across several regions of the U.S., including the Southeast, Northeast, and Midwest. Appalachia is divided across these regions. The Southeast contains Kentucky, Tennessee, and Virginia, the Northeast includes West Virginia and Pennsylvania, and the Midwest includes Ohio. Across all regions, rainfall intensity will increase and thus flood risk is also projected to increase.[1]

The American Communities Project has stated that "Appalachia is ground zero for rainfall," the risk of increasingly extreme rainfall is particularly high for Kentucky, West Virginia, and Ohio.[2] New precipitation frequency modeling by researchers at First Street Foundation found that extreme events (e.g. 1-in-100 year flood events) are likely to occur much more frequently than every 100 years, especially for the Ohio River Basin.[3]

But rather than a futuristic scenario, these extreme rainfall and flooding events are already affecting our region. Over the last decade (2013 - 2023), there have been nearly 20 federally declared flooding disasters across Kentucky, Pennsylvania, Virginia, West Virginia, Tennessee and Ohio. The majority have occurred in Kentucky and West Virginia, often also affecting parts of Virginia. Total Federal Emergency Management Agency (FEMA) spending on these events totals nearly $1 billion[4] and at least 230 lives have been lost due to flash flooding.[5]

To address these issues, a broad coalition of groups have worked together to create the following priorities, or pillars, of issues that impact Appalachian communities and potential solutions. To ensure that the implementation of these policies best benefits Appalachian workers, all construction work or other work done to implement these policy priorities should include requirements for prevailing wages with strong protections for worker safety, use of registered apprenticeship programs and prioritize local hiring. When applicable, the materials and parts should be procured locally or regionally to support manufacturing job creation. Following an orientation to key terms used throughout the platform, each pillar is outlined in detail below.

[1] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.
[2] Pinkus, Ari. (2021, February 17). Mapping Climate Risks by County and Community. *American Communities Project.* www.americancommunities.org/mapping-climate-risks-by-county-and-community/.
[3] Kim, J., Shu, E., Lai, K., Amodeo, M., Porter, J., & Kearns, E. (2022). Assessment of the standard precipitation frequency estimates in the United States. *Journal of Hydrology: Regional Studies*. Volume 44, 2022, 101276. doi.org/10.1016/j.ejrh.2022.101276.
[4] Information on major disaster declarations can be found here: www.fema.gov/disaster/declarations.
[5] Information on flood fatality statistics can be found here: www.weather.gov/arx/usflood

Key Terms and Programs

Federal Emergency Management Agency (FEMA) programs and terms

Building Resilient Infrastructure and Communities Program (BRIC): competitive grant program that supports hazard mitigation projects led by states, communities, tribes and territories.

Disaster Case Management (DCM): awards to a state, tribal, or territorial government or non-governmental organization to assist disaster-impacted individuals and families through the recovery process. DCM is a partnership between a Disaster Case Manager and a disaster survivor.

Flood Insurance Rate Maps (FIRM): type of flood map used to determine requirements for flood insurance. Includes data on floodplains, historical flooding, hydrology, hydraulics, land use, and infrastructure.

Flood Mitigation Assistance (FMA): competitive grant program that supports projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. States, local governments, federally recognized Tribal governments, and U.S. territories are eligible recipients.

Hazard Mitigation Grant Program (HMGP): grants for state, local, Tribal, and territorial governments to develop and implement hazard mitigation plans; available after a Presidentially declared disaster. The maximum award is capped at 20 percent of the amount FEMA spends on Public Assistance (PA) and Individual Assistance (IA) for the particular disaster.

Individual Assistance (IA): grants to eligible individuals and households who have sustained losses as a direct result of a disaster that receives a Presidential disaster declaration. These funds can help pay for temporary housing, medical or funeral expenses, property losses, and more.

Individuals and Households Program (IHP): type of Individual Assistance; provides financial assistance and direct services to eligible individuals and households affected by a disaster to help meet immediate basic needs.

Public Assistance (PA): grants that reimburse state, county, and local governments for costs associated with debris removal, emergency protective measures, and public infrastructure repairs post-disaster. Eligible costs can include all labor, equipment,

materials, and contracted work necessary for recovery efforts, though work must be authorized by FEMA to be considered eligible. Within six months following the disaster, PA funding can be used for debris removal and emergency protective measures. Within 18 months, PA funding can be used for roads and bridges, water control facilities, public buildings and equipment, public utilities, and parks, recreational, and other facilities.

National Flood Insurance Program (NFIP): provides flood insurance to property owners, renters, and businesses. The program is administered by FEMA, and insurance policies are sold and serviced via a network of insurance companies.

U.S. Department of Agriculture (USDA) programs and terms

Emergency Watershed Protection Program (EWP): provides financial and technical assistance to local governments, federally recognized Tribes, and tribal organizations to help communities relieve imminent threats to life and property caused by natural disasters that impair a watershed. EWP is administered by the Natural Resources Conservation Service, which is an agency within USDA. It does not require a Presidential (or state) disaster declaration.

Limited Resource Areas (LRA): An area where housing values and income are less than a state's average and unemployment is at least twice the U.S. average. NRCS has calculated LRAs at the county level, however other areas may also meet the LRA criteria, as determined by NRCS.

Rural Disaster Home Repair Program: grants to very-low and low-income homeowners to repair owner-occupied homes damaged in calendar year 2022 Presidentially declared disaster areas.

Farm Bill Conservation Assistance programs: A number of popular and oversubscribed programs that provide technical and financial assistance to enable farmers, ranchers, and foresters to adopt practices that build soil health, improve water quality and quantity, sequester carbon, and more. These include the Conservation Stewardship Program (CSP) and the Environmental Quality Incentives Program (EQIP).

Sustainable Agriculture Research and Education (SARE) Program: competitive grant program that supports research and outreach to advance sustainable agricultural practices in the U.S. Farmers and ranchers, researchers, and extension agents and other educators are all eligible recipients.

Housing and Urban Development Agency (HUD) programs

Community Development Block Grant Disaster Recovery program (CDBG-DR): grants for states, counties, local governments, Tribes, and territories to rebuild disaster-impacted areas and assist with long-term recovery process. These funds must be appropriated by Congress after a Presidentially declared disaster.

U.S. Army Corps of Engineers (USACE) programs

Planning Assistance to States (PAS): provides states, local governments, other non-federal entities (like nonprofits), and eligible Tribes assistance in preparing comprehensive plans for the development, utilization, and conservation of water and related land resources. PAS covers planning only, and does not provide any details on potential project construction.

Pillar I: Increase local and state capacity to respond and recover

Pillar I: The Problem

Local governments are intended to be the first responders when disasters strike, however, many small towns in Appalachia do not have the funding or staff to adequately respond to flooding. Access to federal funds for disaster response and recovery requires local resources — both human and financial — and these are in short supply as local budgets in coal communities have been in steady and dramatic decline.

Pillar I: The Policy Landscape

Flood disaster relief begins with locally appointed and funded Local Disaster Recovery Managers (LDRM), often referred to as local emergency managers. LDRMs collaborate with state and federal officials and key stakeholders (such as the private sector) on recovery management and mitigation plans. In a pre-disaster phase, these LDRMs set long- and short-term risk reduction priorities, evaluate risk vulnerabilities, integrate mitigation and recovery goals in their local plans, and establish priorities for resilience. Governors assist LDRMs by declaring territorial or state-level emergencies, which requires notification from local authorities who have evaluated the actual/potential damage, and then may declare state emergencies.

If the emergency is significant enough, governors may institute the Stafford Act, which requests the President to declare a federal emergency. Once the Stafford Act Emergency or Major Declaration Disaster is announced, FEMA is activated to provide assistance in accordance with the purview of the Governor's request. Other federal agencies are activated as well: U.S. Army Corps of Engineers (USACE) supports flood control, the General Services Administration allows recipients to purchase goods/services using contracting mechanisms for rapid procurement of supplies, and the U.S. Department of Agriculture (USDA) supports emergency watershed protection and control measures. FEMA also provides assistance for publicly owned facilities that are immediately impacted by the disaster.

If the estimated cost of assistance exceeds certain thresholds, FEMA provides Public Assistance (PA) funds during and after emergencies to aid local and state governments' in disaster recovery.[6] PA grants reimburse state, county, and local governments for costs

[6] There are two ways FEMA calculates cost thresholds: whether estimated disaster costs exceed $1 million across a state or territory (or $250,000 across a tribe), and whether costs exceed annually adjusted per capita thresholds across the county and the state or territory in need. In FY2023, the per capita threshold across a state or territory requesting PA is $1.77, and across a county is $4.44. However, these thresholds are somewhat fluid. FEMA can adjust PA funding based on other factors. These include: 1) providing PA in cases of severe, concentrated damages, even when the statewide per capita threshold is not met, 2) reducing the cost of PA based on the actual or required insurance coverage for PA-eligible work, and 3) providing PA when mitigation measures may have reduced the cumulative value of damages,

Rural Capacity Index Map

Headwater Economics, an independent nonprofit research group focused on improving community development and land management decisions, has created the **Rural Capacity Index map** which is used to "help identify communities where investments in staffing and expertise are needed to support infrastructure and climate resilience projects."

The index measures 12 variable functions for community capacity including local staff and expertise, education, economic opportunity, and institutional capacity and presents some startling features about the surveyed region. The combined 268 Appalachian counties in our six states, as defined by the Appalachian Regional Commission, had a Rural Capacity Index (RCI) score of 65 (out of 100) with 57% of counties nationwide having higher capacity scores.

However, when broken down by state, the Appalachian counties of Kentucky (55 RCI), West Virginia (62 RCI), Virginia (66 RCI), and Tennessee (67 RCI) ranked lowest on RCI when compared to Ohio (71 RCI) and Pennsylvania (74 RCI). Additionally, the percentage of low-capacity counties are highest in the Appalachian counties of Kentucky (70%), West Virginia (54.5%), Tennessee (41.2%) when compared to Virginia (29%), Ohio (15.6%), and Pennsylvania (9.6%).

associated with debris removal, emergency protective measures, and public infrastructure repairs. PA grants cover at least 75 percent of eligible costs; the state, county or local governments must cover the remaining 25 percent.

After the disaster, the federal government provides additional types of support for recovery and flood resilience. FEMA's Hazard Mitigation Grant Program (HMGP) provides funding to the affected state. These funds can be used to prevent structures and homes from future floods (e.g., home buyouts, flood proofing homes, slope stabilization) and planning and enforcement for preventing future impacts of disasters. Other competitive grant programs that FEMA administers to support community resilience are the Flood Mitigation Assistance (FMA) and Building Resilient Infrastructure and Communities (BRIC) programs. The U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) program also provides much-needed funding to help meet remaining unmet housing, infrastructure, and community and economic development needs.

Though not structured as a flood recovery program, the USACE's Planning Assistance to States (PAS) can also provide support for communities looking to better manage their long-term flood risk. Funds can encompass planning for a wide array of flood-related issues,

even when estimated damages do not meet the per capita thresholds. FEMA also considers the effects of recent disasters within the disaster-affected jurisdiction to assess need, and whether other federal assistance may be more appropriate. For more detail on PA, see crsreports.congress.gov/product/pdf/IF/IF11529.

including flood damage reduction, wetlands restoration, erosion, integrating hydrologic or economic data into state water resources plans, and more.

However, access to each of these programs comes with challenges and limitations. HMGP requires a 25 percent local match.[7] PAS requires a 50 percent local match (though the Corps does have the ability to waive the cost of technical assistance to "economically disadvantaged communities," at the discretion of the Secretary).[8] FMA is limited to properties with flood insurance, and many of the buildings impacted in recent Appalachian flood events were not insured.[9] BRIC is competitive, oversubscribed, and also requires a local match of 10-25 percent. During the FY 2022 grant cycle, FEMA had $2.3 billion available for BRIC but received over 800 applications requesting more than $4.6 billion in funding. Further challenging the effective impact of these funds is the timing of these awards. These funds typically are not awarded for several months to over a year after a disaster and in the aftermath of a disaster. The timeline for the availability of CDBG-DR funds following a disaster are highly variable and on average are allocated 318 days following a disaster.[10]

Appalachian states have made attempts to mitigate flood risks and support local communities in recovery efforts in recent years, but the results have been mixed. West Virginia's State Resilience Office (SRO), started after the large-scale flooding disaster of 2016, has yet to receive any financial allocation since two separate trust funds were established in 2023. The SRO is tasked with updating the 2004 state flood plan, but will be relying heavily on commissioners, conservation districts, and floodplain managers for assistance. Virginia relied on their annual RGGI funds to support the Community Flood Preparedness Fund (CFPF) as a grant and loan system to assist regions reduce impact of flooding, and was the only state to use RGGI funds in this manner. However, Governor Youngkin withdrew Virginia from RGGI in the summer of 2023 through the State Air Pollution Control Board, reducing funds available to the CFPF. Kentucky relied on a special session relief package of $212.6 million to help with

[7] There is an ongoing effort to reduce local match requirements for FEMA's Hazard Mitigation Assistance programs, which include HMGP, BRIC,and FMA. In certain cases, FEMA can provide up to 90 or 100 percent cost-share. For example: rural, economically disadvantaged communities qualify for a 90 percent cost share for BRIC. FEMA defines these communities as those with a population of 3,000 or fewer, where the average per capita income does not exceed 80 percent of the national average and the local unemployment rate exceeds the most recently reported national yearly average by at least one percentage point. More details on FEMA cost-share requirements are available here: www.fema.gov/fact-sheet/summary-fema-hazard-mitigation-assistance-hma-programs. PA cost-share amounts can also be reduced at the discretion of the President, for spending related to a particular disaster or during a particular time frame (e.g., as was done for all major disaster and emergency declarations in 2020 and 2021, see: www.fema.gov/press-release/20220318/fema-announces-9010-cost-share-adjustment).

[8] USACE uses the federal Climate and Economic Justice Screening Tool to identify "economically disadvantaged communities," per its final interim guidance for implementing environmental justice and Justice40. See: api.army.mil/e2/c/downloads/2022/03/22/6ab6eb44/final-interim-implementation-guidance-on-environmental-justice-1.pdf.

[9] Dixon, E. & Shelton, R. (2023). *Housing Damage from the 2022 Kentucky Flood*. Ohio River Valley Institute and Appalachian Citizens' Law Center. ohiorivervalleyinstitute.org/housing-damage-2022-ky-flood/.

[10] Gimont, Stan. (2022, March 28). CDBG-DR Program's Lack of a Permanent Authorization Has Unintended Consequences for Recent Allocations. *Bipartisan Policy Center*. bipartisanpolicy.org/blog/cdbg-dr-programs-lack-of-a-permanent-authorization-has-unintended-consequences-for-recent-allocations/.

emergency costs for local governments, schools, and infrastructure hit by the 2022 floods. The fund also supported local communities' abilities to provide funding for local match amounts needed to access federal dollars and was a pool of funding that localities could draw upon to pay costs up front since FEMA PA money is provided only through reimbursements.

Silver Jackets

Silver Jackets can be another useful resource for communities striving to reduce flood risk. These are state-specific, interagency teams that facilitate collaborative solutions to reduce state flood risk. Federal participants include representatives from USACE, FEMA, and USGS, though agencies such as the Environmental Protection Agency and the National Weather Service can also participate. State agencies typically include those working on hazard mitigation, floodplain management, and natural resources conservation. Local and Tribal government agencies can also participate. The makeup and focal area of each Silver Jackets team is unique to the state. Teams can help with information-sharing, including immediately post-disaster: Kentucky's Silver Jackets team, for example, coordinated data collection and response efforts via regular meetings after the 2022 Eastern Kentucky floods. Resources for Silver Jackets come through the individual programs of each participating agency, within the constraints of available budgets.

Across Appalachia, local revenues have been declining for years and rural capacity is generally low. Coal production fell by 65 percent between 2005 and 2020.[11] As the Congressional Research Service reported in November 2023, "The decline in tax revenues and public services in coal communities may compound economic and workforce development challenges…"[12] Coal-reliant communities depend heavily on this declining industry where, in some cases, coal-related revenues make up over a third of county budgets.[13] The ability for Appalachian states to mitigate, respond, and recover on their own is becoming increasingly more challenging. Without appropriate, timely federal assistance to these states prior to a disaster, financial burdens on federal agencies will rise.

Pillar I: Recommendations

- FEMA PA funds should be structured differently for disadvantaged communities. It should not be managed as a reimbursing fund, but granted once need is established and a quote for a project is obtained. The 25 percent local match requirement should also be eliminated or reduced for economically disadvantaged communities.

[11] Bowen, E., Christiadi, Deskins, J. & Lego, B. (2020). *An Overview of Coal and the Economy in Appalachia: Fourth Quarter 2020 Update.* Appalachian Regional Commission. www.arc.gov/wp-content/uploads/2021/04/Coal-and-the-Economy-in-Appalachia_Q4_2020-Update.pdf.
[12] Lawhorn, J.M., Levin, A.G., Larson, L.N., & Collins, B. (2023). *Federal Economic Assistance for Coal Communities.* Congressional Research Service. crsreports.congress.gov/product/pdf/R/R47831.
[13] Morris A., Kaufman, N., & Dosh, S. (2020). *Revenue at Risk in Coal-Reliant Communities.* National Bureau of Economic Research Working Paper. www.nber.org/system/files/working_papers/w27307/w27307.pdf.

- Appropriate additional funding for FMA and BRIC, which provide essential support for flood recovery and resilience, including for nature-based hazard mitigation, but are both highly oversubscribed.

- Increase state and local planning and proactive mitigation activities by passing the *Championing Local Efforts to Advance Resilience (CLEAR) Act*, which would provide federal grant funding for states to establish or maintain a resilience office and begin implementing resilience and recovery programming efforts. For example, these state resilience offices could provide technical assistance and support for local governments to develop public works projects and maintenance that are more resilient to disasters. State and local agencies should also participate in and utilize their Silver Jackets team, to coordinate in the wake of flood disasters and to collaborate on long-term flood resiliency.

- Establish a pilot program through FEMA that can provide funding directly to local governments to help them increase or maintain the number of trained emergency managers, with a focus on developing and implementing local mitigation plans, and increasing knowledge and uptake of nature-based hazard mitigation. This would be similar to FEMA's *Staffing for Adequate Fire and Emergency Response (SAFER)* grant program, which provided 177 awards totaling more than $360 million in Fiscal Year (FY) 2022.

- Enable more expedient disaster response by passing the *Making Access to Cleanup Happen (MATCH) Act*, which would allow communities to begin pre-approved watershed rehabilitation activities immediately following disasters without eliminating eligibility for federal aid, speeding up the process for disaster recovery at the local level.

- Permanently authorize CDBG-DR so that funds are available more rapidly following a disaster by passing the *Reforming Disaster Recovery Act*.

- In collaboration with the Appalachian Regional Commission, FEMA and USACE should design a training program for local elected officials and other local community members involved in disaster response and recovery that provides education about FEMA aid processes, debris removal processes, local capacity building for disaster response and mitigation, nature-based hazard mitigation, and floodplain and watershed management.

- Appropriate additional funding for USACE's Planning Assistance to States; the Corps should also work to ensure this support helps advance nature-based hazard mitigation projects.

Pillar II: Relieve the recovery and mitigation burden for low-income households

Pillar II: The Problem

The cost to low-income communities during disaster recovery efforts are straining household budgets. In Appalachia, the annual median household income is $48,964, more than $20,000 less than the national median of $70,622.[14] The average poverty rate is 16.3 percent, compared to a national average of 14.6 percent.[15] While homeownership rates in Appalachian states are relatively high compared to the national average,[16] rural Appalachian individuals are more likely to have poor credit scores, face increased cost of credit, have higher rates of denial for mortgage applications, and have higher debt burden than the national average.[17] U.S. Census Bureau's Household Pulse Survey reported in 2023 that over one-third of Americans impacted by disasters had to rely on loans or increase credit card spending to meet household needs which, for Appalachians, may be particularly challenging. In addition, lower income households typically receive lower individual assistance awards from FEMA, making recovery particularly difficult for those who have the fewest resources.[18] Inability to recover after a natural disaster may lead to displacement, further exacerbating issues of population decline in Appalachian communities.[19]

Pillar II: The Policy Landscape

Flood-related disasters in Appalachia exacerbate many existing challenges in the region, including poverty rates, out-migration, and lack of affordable, quality housing. Flood-related disasters have direct impacts in the rise in poverty rates for local communities. Natural disasters can decrease U.S. household incomes by up to 21.5 percent post-disaster, and can increase poverty rates by upwards of 2.5 percent in impacted areas.[20] In Greenbrier County, WV, the poverty level was 18.4 percent in 2016, the year that a federally-declared flood

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[14] Liu, M., Luce,C., Orevba, M., Sebastian, S., & Shupe, C. (2022). *Consumer Finances in Rural Appalachia*. Consumer Financial Protection Bureau. files.consumerfinance.gov/f/documents/cfpb_consumer-finances-in-rural-appalachia_report_2022-09.pdf.

[15] Appalachian Regional Commission. n.d. *Poverty Rates in Appalachia, 2013-2017*. Appalachian Regional Commission. www.arc.gov/map/poverty-rates-in-appalachia-2013-2017/.

[16] West Virginia (78.6 percent), Kentucky (71.4 percent), Pennsylvania (70.7 percent), Virginia (67.4 percent), and Ohio (66 percent) all have higher rates of homeownership when compared to the national average (65.9 percent).

[17] Op cit. 14

[18] Op cit. 8; Hersher, R., Kellman, R. (2021, June 29). Why FEMA Aid Is Unavailable To Many Who Need It The Most. *NPR*. www.npr.org/2021/06/29/1004347023/why-fema-aid-is-unavailable-to-many-who-need-it-the-most.

[19] An analysis of United States Postal Service Vacancy Data in counties hit hardest by the July 2022 flooding in Eastern Kentucky shows that residential vacancies increased by 19 percent from the third to the fourth quarter in 2022. This is in addition to an average population decline of 600 people per year going back to 1984. Fewer residents mean fewer people available to fill jobs. See: www.clevelandfed.org/publications/cd-reports/2023/20230927-resilience-and-recovery.

[20] Ney, J. (2023, March 8). Natural Disasters cause havoc for low-income Americans. *American Inequality*. americaninequality.substack.com/p/natural-disasters-cause-havoc-for.

disaster struck the region. In 2017, a year after the flood, the poverty level was 19.6 percent.[21] Multiple factors lead to a rise in poverty rates post-flood, such as a disruption of public services, shuttered businesses, supply chain interruptions, loss of homes, and damaged infrastructure. Flood-related disasters in Appalachia may also exacerbate population decline in the region. If a county experiences two consecutive natural disasters, out-migration increases by 1 percent.[22] Higher-income residents, who often have advanced degrees, have greater financial abilities to leave flood-prone areas and seek employment elsewhere than lower-income residents, suggesting that those who remain are the least equipped to recover.[23] Further reduction in the availability of affordable housing in Appalachia is also a primary concern following disasters. If a household spends more than 30 percent of their income on housing, they are considered cost-burdened. A 2023 study completed by researchers with the Virginia Center for Housing Research at Virginia Tech and the West Virginia University Extension office found that the percentage of renter households in Appalachian Kentucky, Tennessee, Virginia, and West Virginia that are cost-burdened ranged from 47.8-51 percent, while for owner households it was 15.7-21.1 percent.[24]

After a federally-declared disaster, there are several federal programs that might be made available to provide funding for household damages and individual property losses, but the primary program implemented by FEMA is the Individual Assistance (IA) program. There are several IA programs, but the Individuals and Households Program (IHP) provides funding and resources directly to disaster-affected households. The program is not designed to compensate survivors for all losses but to help meet immediate basic needs. IA funds granted to homeowners, for example, are meant to make primary living spaces of the home habitable, not repair all the damages. As of October 2023, the maximum amount of assistance that can be granted to an individual or household is $42,500, even if one's home is completely destroyed, and to qualify the home must be a household's primary residence.[25]

Another household repair program for homeowners that provides grant funding directly to households is administered by the United States Department of Agriculture (USDA). Through the USDA's Rural Disaster Home Repair Program, a program made available for those who suffered housing damages in a Presidentially declared disaster area from 2022, low-income households could receive an additional $40,675 for home repairs.[26] Funding is currently

[21] American Community Survey, Income & Poverty Statistics, Greenbrier County, WV, 2016-2017.
[22] Ney, J. (2023, March 8). Natural Disasters cause havoc for low-income Americans. *American Inequality*. americaninequality.substack.com/p/natural-disasters-cause-havoc-for.
[23] Op cit. 20
[24] Jones, M., Choi, S., & Eades, D.. (2023). *Housing Needs and Trends in Central Appalachia and Appalachian Alabama*. The Virginia Center for Housing Research at Virginia Tech and the West Virginia University Extension Office. fahe.org/wp-content/uploads/2024/03/2023-Housing-Needs-and-Trends-in-Central-Appalachia-and-Appalachian-Alabama-072023.pdf
[25] More information about FEMA's individual assistance programs can be found here: crsreports.congress.gov/product/pdf/R/R46014/8.
[26] The USDA program and NRCS buyout program were new programs deployed following the July 2022 flooding event in Eastern Kentucky (FEMA disaster 4663). The Rural Disaster Home Repair Program assisted Kentucky homeowners from the 2022 floods. As of February 2024, the program has obligated $1.8M in funding to Kentuckians.

ongoing but, without further Congressional appropriations, is limited. CDBG-DR funding can also be used to build and repair housing, subsidizing rebuilding costs for homeowners. Even in combination, these resources are often insufficient to restore properties to pre-flood conditions. A challenge specific to Appalachian communities, where many homeowners live near streams and rivers, is the cost not only of repairing and rebuilding one's home but repairing and rebuilding private bridges. Numerous individuals involved in the recovery process after the July 2022 Eastern Kentucky flooding referred to private bridge repair and rebuilding as an ongoing challenge for which no federal resources were made available. In WV, over 300 private bridges were destroyed by floods in 2015. The WV Voluntary Organizations in Active Disaster established a volunteer and donations based program to help rebuild private bridges as no public funds were available.[27]

In addition to the challenge that available resources are often inadequate to fully repair damages, they are also challenging to access, especially for low-income households. Case managers and legal assistance are necessary to provide many households with the support they need. Application requirements can be burdensome; often individuals need assistance to obtain home ownership and residency documentation or support in completing forms such that they receive the maximum amount of aid for which they are eligible. In rural areas, there is limited legal and case management capacity to support application submissions and appeals. Those legal and other institutions that are available to support individuals may fall behind on filing deadlines, especially those for appeals. FEMA's IA program does include Disaster Case Management funding, which provides case managers to help individual households navigate the recovery process. Having case managers immediately available post-disaster can help expedite an individual's recovery process; however, it can take months for case managers to be on the ground and helping households. In FEMA disaster 4663, the 2022 flooding in Eastern Kentucky, case managers were available much earlier than is typical, indicating that a more expedited timeline for availability is feasible. In addition, DCM funding is typically only available for up to 24 months. Though this may seem sufficient, some disaster recovery funds, such as CDBG-DR, do not become available for a long time after disasters. For example, in disaster 4663, CDBG-DR funds are not expected to be available for distribution until two years post-disaster, in the summer of 2024.

Once households receive IA, an additional burden is that they must obtain flood insurance or else they, and/or the future owners of the property, will not be eligible for IA in any future disasters. Maintaining and affording flood insurance is a significant challenge for low-income households. The average annual cost of NFIP for households in Kentucky, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia ranges from $1,077 to $3,074. Kentucky (9th), Pennsylvania (15th), and West Virginia (2nd) all rank in the top 15 most expensive states and territories for flood insurance rates with average annual costs higher than the average annual

[27] For more information about this program visit: www.wvvoad.org/bridge-home-program

cost of insurance.[28] In addition, NFIP flood insurance premiums must be paid in one lump sum annually, further exacerbating the challenge of budgeting for this cost.

In 2021, FEMA released Risk Rating 2.0, a new methodology to determine NFIP premium rates. The methodology calculates premiums by accounting for specific features of individual properties, such as flood frequency, structure foundation type, prior claims, replacement cost value, type of flooding, and distance from water. Overall, the new methodology better aligns premiums with the actual, individual flood risk of a specific property. It accounts for more sources of flooding (including from rainfall) and is the first update to FEMA's insurance premium methodology since the 1970s.[29] But it has also led to an increase in insurance premium rates for many policyholders. According to FEMA, average national annual costs rose from $888 to $1,808 after implementation. Some states in Appalachia have seen particularly large increases: the median cost for policyholders in West Virginia and Kentucky has risen by 34 percent or more.[30] A recent GAO report provides a number of recommendations to improve Risk Rating 2.0, citing affordability concerns. Key among them is creation of a means-based assistance program, which is especially crucial for low- and fixed-income residents, to ensure they can continue to access flood insurance. Improving the affordability of NFIP premium rates would also help ensure that flood-prone communities are aware of property flood risk and so that they can take proactive steps to alleviate risk through mitigation activities.

When home repairs and/or obtaining flood insurance is untenable, there are federally funded buyout programs, primarily administered through FEMA and USDA, to help families relocate. Following a disaster, funding from FEMA for buyouts comes primarily through HMGP.[31] Homeowners are generally offered the pre-disaster fair market value for the property. USDA administers a voluntary floodplain buyout program through the Emergency Watershed Protection Program (EWP), which provides project sponsors (state or local governments) up to 75 percent of the fair market value of a property, relocation costs, and site restoration costs. Homeowners are offered the pre-disaster fair market value for the property. The Bipartisan Infrastructure Law (BIL) provided an additional pool of funds for the EWP within eligible, flood-prone Limited Resource Areas (LRA). This program offers full fair market value to buyout participants, as well as funding for relocation and restoration costs of the buyout. Eligibility for the LRA buyout is roughly the same as the standard EWP, but also includes property that was damaged by flooding at least once in the previous year or at least twice in

[28] FEMA's National Flood Insurance Program provides data on policies and claims here: nfipservices.floodsmart.gov/reports-flood-insurance-data.
[29] Puente Cackley, A., & Todisco, A. (2023). *FEMA's New RateSetting Methodology Improves Actuarial Soundness but Highlights Need for Broader Program Reform*. Government Accountability Office. www.gao.gov/assets/gao-23-105977.pdf.
[30] Ibid. More information about the cost of flood insurance, including breakdowns by state and zip code under the legacy methodology and Risk Rating 2.0, is available from FEMA here: www.fema.gov/flood-insurance/work-with-nfip/risk-rating/single-family-home. By law, NFIP rates cannot increase by more than 18 percent each year.
[31] FMA and BRIC funding can also be used for buyouts.

the previous ten years. Land that may be impacted by a dam breach, or land adjacent to eligible flood-damaged lands, are also eligible under the LRA.

When used as a recovery tool immediately following a disaster, buyout programs are often plagued with challenges. In post-disaster situations, when local governments are in crisis mode, there may not be adequate capacity to smoothly coordinate these programs.[32] Often, the buyout process is not completed expediently, leaving families in limbo without adequate housing.[33] A 2019 study by the Natural Resources Defense Council found that the median time frame for the completion of a buy-out through FEMA was over five years.[34] Once the buyout is completed, there may be a lack of homes available to rent or buy in the local area, requiring families to move further away from their community. It can also be difficult to find affordable housing after the disaster as the housing market in the unimpacted surrounding region may become unaffordable due to increased demand.[35] Researchers have also found that those who accept buyouts develop a weaker attachment to place and live with lower levels of social capital than those who rebuilt in place or rebuilt adjacent to their original community.[36]

Though homeownership rates in Appalachian states are relatively high, those who do rent tend to have lower incomes and higher housing cost burdens.[37] FEMA IA programs and Small Business Administration programs can provide assistance for renters with property damage and FEMA may provide up to two months of rental assistance. FEMA's temporary Housing Assistance program can also provide temporary housing for up to 18 months.[38] However, landlords may struggle to repair rental properties as FEMA IHP assistance is only granted to individuals whose owned, primary residence is affected. With landlords struggling to repair their own homes, rental properties are likely to be lower priority and take longer to repair or landlords may choose to participate in buyout opportunities. Finding pathways to make more

[32] Lightbody, L., Sanders, M., Tompkins, F., & Watts, B. (2022). *Property Buyouts Can Be an Effective Solution for FloodProne Communities*. The Pew Charitable Trusts. www.pewtrusts.org/en/research-and-analysis/reports/2022/04/property-buyouts-can-be-an-effective-solution-for-flood-prone-communities.

[33] Moore, R. (2020, January 23). As Climate Risks Worsen, U.S. Flood Buyouts Fail to Meet the Need. *Yale Environment 360*. e360.yale.edu/features/as-climate-risks-worsen-u.s.-flood-buyouts-fail-to-meet-the-need; Cole del Charco, C., (2018, October 29). When It Comes To Flooding Preparation, Charlotte Appears To Be The Model. *WFAE*. www.wfae.org/local-news/2018-10-29/when-it-comes-to-flooding-preparation-charlotte-appears-to-be-the-model#stream/0; Weber, A., (2019, September 26). Blueprint of a Buyout: Blue Acres Program, New Jersey. *Natural Resources Defense Council*. www.nrdc.org/bio/anna-weber/blueprint-buyout-blue-acres-program-nj

[34] Weber, A. & Moore, R. (2019). *Going Under: Long Wait Times for Post-Flood Buyouts Leave Homeowners Underwater*. Natural Resources Defense Council. www.nrdc.org/sites/default/files/going-under-post-flood-buyouts-report.pdf.

[35] Binder, S., & Greer, A. (2016). "The Devil Is in the Details: Linking Home Buyout Policy, Practice, and Experience After Hurricane Sandy." *Politics and Governance*, *4*(4), 97-106.doi.org/10.17645/pag.v4i4.738.

[36] Binder, S. B., Barile, J. P., Baker, C. K., & Kulp, B. (2019). "Home buyouts and household recovery: neighborhood differences three years after Hurricane Sandy." *Environmental Hazards*, *18*(2), 127–145. doi.org/10.1080/17477891.2018.1511404.

[37] Mather, M. (2004). *Housing and Commuting Patterns in Appalachia*. Appalachian Regional Commission. www.arc.gov/wp-content/uploads/2020/06/HousingandCommutingPatternsinAppalachia.pdf; Zahalak, T. (2018). *Multifamily Opportunities and Challenges in Middle Appalachia*. Fannie Mae. www.fanniemae.com/media/23401/display.

[38] For more information on IA programs see: crsreports.congress.gov/product/pdf/R/R46014/8.

housing available sooner after the disaster will support renters as well as those participating in buyouts.

Pillar II: Recommendations

- As FEMA IHP and USDA repairs program funding streams are often not sufficient for low-income households to fully repair their homes, it is important to 1) permanently authorize CDBG-DR so that funds are available more rapidly following a disaster 2) permanently authorize and increase the grant limit for the USDA Rural Disaster Home Repair Program.
- Expand federal disaster recovery programs to explicitly include funding for private bridge repair and rebuilding these bridges to higher flood resilience standards; this should include expanding funding for USDA's Rural Disaster Home Repair Program.
- FEMA IHP assistance, especially that related to the provision of temporary housing, should not be strictly tied to an 18 month time limit but rather should be available at least until CDBG-DR funding is dispersed.
- Disaster Case Management funding needs to be available sooner after a disaster and the period of performance for the program should be extended to 36 months following a disaster declaration or the 24 month time period should commence on the date that the funding is awarded rather than the date of the disaster.
- Within NFIP, create a means-tested affordability framework to improve flood insurance access for low- and fixed-income residents.
- FEMA should increase awareness of and participation in its Community Rating System (CRS), particularly for under-resourced and rural communities. CRS provides discounted flood insurance premium rates to homeowners within communities that invest in floodplain management activities, and flood mitigation-related training and technical assistance to those communities. FEMA should streamline the process to join CRS, and consider providing additional incentives to local governments to join. Local governments bear the burden of participation (e.g., staff time, the cost of implementing flood management activities) while CRS benefits are accrued by individual NFIP policyholders. This can be a barrier to participation. FEMA could allow a percentage of the CRS benefits to be awarded directly to a CRS community, which could support flood mitigation activities and/or staff time for local floodplain management officials.
- To support better outcomes from buyouts: 1) provide buyout funding and resources for planning prior to disaster. This can be achieved by appropriating additional funding into the FEMA FMA and BRIC programs and by passing the *CLEAR Act* to support local and state-level planning efforts 2) permanently authorize the CDBG-DR program so that funds are available more rapidly following a disaster and support construction of new homes that those who participate in buyouts can purchase to remain in or close to their communities.

- Post-disaster, when assessing homeowners for buyouts and when funding is limited, prioritize applicants based on financial need.
- To increase the availability of housing for renters following a disaster, again, it would be helpful to permanently authorize the CDBG-DR program as this program can support the construction of new multi-family housing units. In addition, FEMA should make available an IA program that provides funding to landlords to repair rental properties. Granting of funds could be made contingent upon the landlord providing subsidized rent for a number of months or years following the disaster.
- Improve property disclosures: when selling a home, require that homeowners disclose whether a property has ever had a flooding problem, whether the property is located in a special flood hazard area, and whether or not the property is mandated to be covered by flood insurance due to the receipt of previous federal aid. Requiring this information will help assure that low-income homeowners do not purchase a property that is then ineligible for federal aid in future disasters.[39]

[39] In April 2023, the Department of Homeland Security submitted a series of legislative proposals to Congress to reform NFIP, including one to require the Disclosure of Flood Risk Information Prior to Real Estate Transactions. This would provide clarity and uniformity on all NFIP-participating communities to establish minimum flood risk requirements when engaged in residential property transactions. See the full proposal here: www.fema.gov/sites/default/files/documents/fema_NFIP-risk-analysis-communications-item-5-disclosure-flood-risk-information-prior-real-estate-transaction.pdf. Many states already require these types of disclosures; this resource from the Natural Resources Defense Council allows users to explore flood disclosure policies in different states: www.nrdc.org/resources/how-states-stack-flood-disclosure.

Pillar III: Improve flood mapping and data inputs

Pillar III: The Problem

Federal investments in flood mapping have not kept pace with the need or with increasing climate impacts; thousands of U.S. communities lack maps, and about 15 percent of community flood maps are over 15 years old. More expansive and accurate maps – that account for climate change, and incorporate community views – are needed, particularly in rural Appalachian communities, as historically mapping efforts have targeted higher population areas.[40]

Pillar III: The Policy Landscape

FEMA is responsible for developing, in coordination with communities, flood hazard maps. There are two categories: regulatory maps, and non-regulatory maps. The former are formally known as Flood Insurance Rate Maps (FIRMs), and are used to determine requirements for flood insurance. Non-regulatory maps include additional flood hazard information, and are meant to provide a more user-friendly analysis of the flood risks of different communities. The National Flood Insurance Program (NFIP), which FEMA runs, requires the agency to update and maintain flood maps with respect to all populated areas and areas of possible population growth within 100-year and 500-year floodplains. FEMA collects some of the data for flood maps, and relies on data from other agencies, namely:

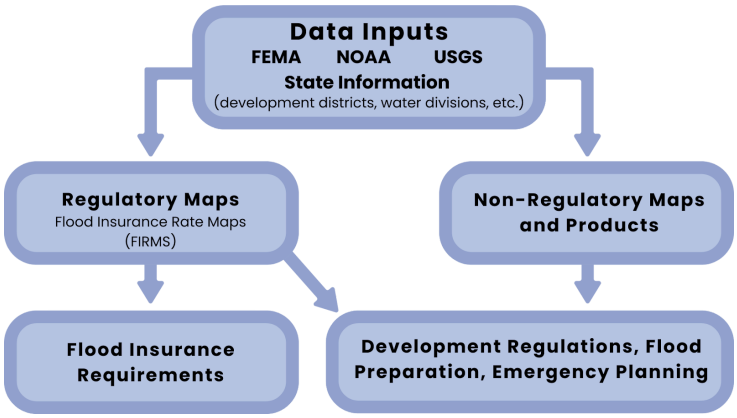
- The U.S. Geological Survey (USGS), which maintains the National Hydrography Dataset and Watershed Boundary Dataset. These map the U.S. drainage network and surface water areas, and monitor streamflow (via USGS streamgages).
- NOAA, which maps shorelines and precipitation frequency data. The latter is collected in the NOAA Atlas. The 2021 *Infrastructure Investment and Jobs Act* included dedicated funding to update the current version of the Atlas, NOAA Atlas 14, to account for climate change, and to develop precipitation frequency estimates for the entire U.S. and its territories. Final version of this, Atlas 15, will not be ready until 2026.
- State agencies, including local development districts and water districts.

Along with FEMA's non-regulatory mapping products, FIRMs inform development regulations, and flood preparation, evacuation, and response planning.

Flood hazard mapping and risk analysis is funded through the NFIP by two methods: direct annual appropriations from Congress, and a Federal Policy Fee collected on receipts from

[40] Association of State Floodplain Managers. (2020). *Flood Mapping for the Nation: A Cost Analysis for Completing and Maintaining the Nation's NFIP Flood Map Inventory*. Association of State Floodplain Managers. asfpm-library.s3-us-west-2.amazonaws.com/FSC/MapNation/ASFPM_MaptheNation_Report_2020.pdf.

premiums of flood insurance policies. FY 2022 appropriations for FEMA flood mapping were about $400 million; studies have estimated that the needs are far greater. A 2020 analysis by the Association of State Floodplain Managers estimates that the cost to complete updated flood mapping for the entire nation falls between $3.2 billion and $11.8 billion, with an annual maintenance cost ranging from $107 million and $480 million.



FEMA flood maps don't always reflect best available climate science or current climate impacts, including extreme rainfall seen increasingly in Appalachia. According to FEMA, nearly a third of flood damage occurs outside of FEMA designated flood zones.[41] Maps are focused on riverine and coastal flooding, and prioritize areas of greatest population and flood insurance policies. A 2020 report from First Street Foundation identified around 1.7 times the number of properties as having substantial risk (defined by First Street as a 100 Year flood) compared to the FEMA 1-in-100 Special Flood Hazard Area (SFHA) designation. This means that nearly 6 million properties and property owners are currently unaware of, or underestimating, their flood risk. The First Street model represents flooding from multiple risks (fluvial/riverine, pluvial/rainfall, and coastal sources) plus current and future environmental considerations. The inclusion of pluvial flood risk, sea level rise, and ungauged streams are responsible for most of the additional risk First Street identified. According to First Street, 45 percent of the parcels in the four counties that were most impacted by the July 2022 flooding disaster in Eastern Kentucky had a very high risk of flooding, but only 22 percent of those parcels were in a FEMA designated flood zone.[42]

Local concerns about updating flood maps

In the process of developing this platform, several local officials expressed concerns that updated maps would increase the areas included in floodplains and negatively impact residents through increases in flood insurance costs, decreased property values, increased mitigation costs, and a general lack of awareness that their property was now designated as located in the floodplain. These concerns are valid and make the recommendations included within other pillars vital companions to updated maps. It is also essential that all map be verified locally to ensure alignment with local topography.

[41] Hersher, R., & Kellman, R. (2020, October 20). Living In Harm's Way: Why Most Flood Risk Is Not Disclosed. *NPR*. www.npr.org/2020/10/20/921132721/living-in-harms-way-why-most-flood-risk-is-not-disclosed.
[42] Klesta, M. (2023). *Resilience and Recovery: Insights from the July 2022 Eastern Kentucky Flood*. Federal Reserve Bank of Cleveland. www.clevelandfed.org/publications/cd-reports/2023/20230927-resilience-and-recovery.

Pillar III: Recommendations

- Improve data on precipitation, stream flow patterns, and flood events by deploying more streamgages in Appalachia. To foster this deployment, provide additional funding for the U.S. Geological Survey's (USGS) Federal Priority Streamgages network and the agency's Cooperative Matching Funds Program, which supports the National Streamflow Network. These networks track, in near real-time, streamflows across the U.S. Increasing funding would enable USGS to continue operating about 3,800 streamgages, support improvements to the overall resiliency of streamgages in the network, and deploy additional flood-hardened streamgages.

- Eliminate the local match requirement for streamgages in the National Streamflow Network. Currently, these streamgages are funded via a 50/50 cost-share between USGS and tribal, regional, state, or local partners. Increasing funding for this program would allow USGS to eliminate the local match requirement for the installment and maintenance of USGS streamgages in disadvantaged communities. This aligns with President Biden's Justice40 Initiative, and would enable more expansive data on precipitation, stream flow patterns, and flood events in Appalachia. Also, eliminate the local match requirement for flood inundation mapping based on these streamgages.

- Increase funding for FEMA to expeditiously generate updated and modern floodplain maps through the use of best-available technology to provide communities with an accurate understanding of present and future flood risk. Updated maps should account for anticipated climate impacts, and incorporate mapping of existing natural floodplain areas to understand where protective natural features exist and where they have been lost.

Pillar IV: Invest in Nature-Based Hazard Mitigation

Pillar IV: The Problem

Appalachia's landscape, and its history of extraction, have made its communities uniquely vulnerable to climate-induced flooding. Human activity on the landscape – especially from coal mining, logging, and road and home construction – has impacted the region in disparate ways. The land's topography, with its rolling hills and mountains, means people often live adjacent to rivers or streams, where limited flat land is located. Logging and mining have reduced the land's capacity to retain rainfall, especially where land has not been properly restored. Restoring and protecting the landscape, including via investments in nature-based solutions, are needed to better protect Appalachian communities, and to build long-term climate resilience.

Pillar IV: The Policy Landscape

Mining: Appalachia's history of surface mining has altered the region's hydrology and left a need for extensive land reclamation. The Surface Mining Control and Reclamation Act (SMRCA) requires reclamation of mine sites, to restore land to its original contours and to revegetate the land to restore its productivity levels. The Office of Surface Mining Reclamation and Enforcement (OSMRE) oversees SMCRA implementation. However, mined lands, even after reclamation, disrupt the hydrology of Appalachia. Conventional reclamation has repeatedly been shown to be ineffective at returning mined lands to their pre-mining hydrologic and ecological functionality.[43] Often reclamation involves a semipermanent conversion of forested land to a pasture/grassland condition. Federal regulations allow reclamation operations to substitute the original topsoil, if the substitute is "best available in the permit area to support revegetation" or is "more suitable for sustaining vegetation."[44] Reclaimed soils are often thinner and finer-grained to suit this purpose, lacking the necessary strength to maintain stability, reducing its infiltration rates and water storage capacities.[45] As a result of soil and revegetation choices, computer model results have shown that reclamation can result in an almost "impervious" surface similar to those found in urban environments.[46]

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[43] Williamson, T. & Barton, C. (2020). Hydrologic modeling to examine the influence of the forestry reclamation approach and climate change on mineland hydrology. *Science of The Total Environment*. DOI: 10.1016.

[44] 30 CFR § 817.22 - Topsoil and subsoil.

[45] Reed, M. & Kite, S. (2020). Peripheral gully and landslide erosion on an extreme anthropogenic landscape produced by mountaintop removal coal mining. *Earth Surface Processes and Landforms*. DOI: 10.1002/esp.4867. drive.google.com/file/d/1mw-c6LYIKFIFYuS0LHgNCy91_v1pst2J/view.

[46] Ferrari, J. R., Lookingbill, T.R., McCormick, B., Townsend, P.A. & Eshleman, K.N. (2009). Surface mining and reclamation effects on flood response of watersheds in the central Appalachian Plateau region. *Water Resources Research*. 45, W04407, doi:10.1029/2008WR007109. drive.google.com/file/d/1yZwGV3HTnpRpRt1kz49508S_bErW56Zw/view.

In the early 2000s, researchers proposed and established the Forestry Reclamation Approach (FRA), an approach to reclamation that returns mined lands to a hardwood ecosystem more closely resembling the original site's ecology. FRA reduces compaction and creates conditions that support the redevelopment of soils more similar to those that were there before mining. The diverse species mix also helps to reduce erosion on the site. Recent studies also suggest that the use of the FRA can aid in restoring natural hydrologic functions on mined sites.[47] With the emerging insights from the FRA, OSMRE established the Appalachian Regional Reforestation Initiative (ARRI). ARRI is a cooperative effort between OSMRE, state agencies, and scientists that facilitates cooperation between nonprofits, landowners, the coal industry, and other groups to develop reforestation projects on mined lands. ARRI has never had dedicated program funding but has proceeded by pulling together a patchwork of private and public dollars. A dedicated pool of public funding could help expand and expedite the important work of this program.

ARRI is just one example of the kind of nature-based hazard mitigation that can benefit Appalachia. Nature-based hazard mitigation consists of natural or nature-mimicking systems that help communities reduce the impacts of disasters, including floods. These systems can be entirely natural, like forests or floodplains, or can incorporate engineered features that use natural materials and are designed to emulate the functioning of natural ecosystems, like engineered stream stabilization. These approaches are considered nature-based solutions, an umbrella concept for a suite of approaches to infrastructure that rely on natural systems or processes to address societal challenges, and that provide benefits to both humans and biodiversity. These solutions are often more cost-effective than traditional, sometimes called gray, infrastructure, and provide numerous co-benefits, including climate mitigation (via carbon sequestration) and climate adaptation and resilience.[48]

Logging: The Appalachian Mountains have long been recognized as one of the most landslide-prone regions of the United States.[49] The relationship between logging and landslides has been well-established in the scientific literature. In a comprehensive modern review of landslides and their relationship to land use, Sidle and Ochiai (2006)[50] describe in detail the relationship between trees and landslides on forested slopes. They state that root strength and trees' ability to reduce soil wetness increases slope stability. Root strength is gradually lost in the years following logging as the roots decay. Studies that have directly

[47] Gerlitz, M., Agouridis, C. Williamson, T., and Barton, C. (2023). Evaluating the Influence of the Forestry Reclamation Approach on Throughfall Quantity in Eastern Kentucky. *Reclamation Sciences.* DOI: 10.21000/RCSC-202200009.
[48] Glick, P., E. Powell, S. Schlesinger, J. Ritter, B.A. Stein, and A. Fuller. (2020). *The Protective Value of Nature: A Review of the Effectiveness of Natural Infrastructure for Hazard Risk Reduction.* National Wildlife Federation.
[49] Radbruch-Hall, D.H., Colton, R.B., Davies, W.E., Lucchitta, I., Skipp, B.A. and Varnes, D.J., 1982. Landslide Overview Map of the Conterminous United States. US Geological Survey Professional Paper 1183.; Mirus, B.B., Jones, E.S., Baum, R.L., Godt, J.W., Slaughter, S., Crawford, M.M., Lancaster, J., Stanley, T., Kirschbaum, D.B., Burns, W.J., Schmitt, R.G., Lindsey, K.O., and McCoy, K.M, 2020. Landslides across the USA: occurrence, susceptibility, and data limitations. Landslides 17, 2271–2285, doi.org/10.1007/s10346-020-01424-4
[50] Sidle, R.C. and Ochiai, H., 2006, Landslides: Processes, Prediction, and Land Use. American Geophysical Union, Water Resources Monograph 18, 312 pp.

compared landsliding in logged versus non-logged areas have shown that landslides occur 3 to 9 times more in logged areas, that these landslides often occur from road fill failures and within harvest areas, and that landslides can be triggered by 24-hour rainfall events with recurrence intervals as small as 4 years.[51] In spite of this documented relationship between logging, landslides, and precipitation events, most states throughout Appalachia do not have Best Management Practices for logging to reduce landslides and the Federal Forest Service can take steps to strengthen landslide reduction practices on federal lands.

Agriculture: Sustainable agriculture practices are also a type of nature-based hazard mitigation. Nearly thirty percent of land in Appalachia is devoted to agriculture,[52] making this sector an important component of flood resiliency conversations. Flooding affects all members of a community, but farms take a double hit with crop losses and soil loss, plus other infrastructure damage. Small farms are particularly vulnerable to such climate related disruptions. Appalachia is characterized by small-scale farming; the average farm size in the region is 147 acres in contrast to the national average of 441 acres. Only eleven percent of Appalachian farmland is in farms 2,000 acres or larger – compared to over half of U.S. farmland in farms of that size.[53] Increasing organic matter in soils has been shown to play a significant role in absorbing floodwaters from small and medium sized storm events – it's estimated that every percent increase in soil organic matter helps soil hold an additional 20,000 gallons of rainfall per storm event.[54]

Several USDA programs provide financial and technical assistance to farmers for sustainable agriculture practices such as planting cover crops, reduced tillage, or shifting to pasture-based systems, including the Conservation Stewardship Program (CSP) and the Environmental Quality Incentives Program (EQIP). A USDA Sustainable Agriculture Research and Education (SARE) Program study found that 90 percent of the farmers who received cover crop incentives reported that they would definitely or probably continue planting cover crops after the payments ended because they saw the value of healthier soils for farm production and soil protection.[55] Sustainable agriculture practices are a cost-effective way to protect water quality, improve soil health, increase water retention and reduce the severity of flooding.

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[51] Montgomery, D.R., Schmidt, K.M., Greenberg, H.M. and Dietrich, W.E., 2000. Forest clearing and regional landsliding. Geology 28, 311-314, doi.org/10.1130/0091-7613(2000)28<311:FCARL>2.0.CO;2; Jakob, M., 2000. The impacts of logging on landslide activity at Clayoquot Sound, British Columbia. Catena 38, 279-300, doi.org/10.1016/S0341-8162(99)00078-8

[52] www.arc.gov/wp-content/uploads/2022/04/Agriculture-and-Local-Food-Economies-in-the-Appalachian-Region-April-2022.pdf

[53] See above

[54] Bryant, L. (2015). *Organic Matter Can Improve Your Soil's Water Holding Capacity*. Natural Resources Defense Council. www.nrdc.org/bio/lara-bryant/organic-matter-can-improve-your-soils-water-holding-capacity.

[55] Sustainable Agriculture Research and Education, Conservation Technology Information Center & American Seed Trade Association. (2023). *National Cover CropSurvey Report 2022-2023*. www.sare.org/wp-content/uploads/2022-2023-National-Cover-Crop-Survey-Report.pdf.

Nature-based Solutions: Many different federal agencies offer funding and technical assistance for nature-based solutions, including FEMA, NOAA, USACE, USDA, the Department of Transportation, and the Department of Interior. (See appendix for a list of relevant nature-based hazard mitigation resources, including technical documents and funding databases.) Many federal agencies, at the direction of the White House, have also made strides in recent years to expand the use of nature-based solutions.[56] One notable example: In November 2023, the Office of Management and Budget issued a memo guiding all executive branch agencies to encourage the use of nature-based solutions in any federal financial assistance program for infrastructure.

Ohio River Restoration

Much of central Appalachia lies in the basin of the Ohio River, which flows from Pittsburgh to Cairo, Illinois. The river and wetlands that feed it face serious threats from pollution, inadequate infrastructure, invasive species, and flooding. The Ohio River Basin Alliance is currently developing a plan to restore and protect the waters of the entire river basin. The plan is being written by the National Wildlife Federation (NWF) and the Ohio River Valley Water Sanitation Commission. Between June 2022 and May 2023, NWF hosted 31 listening sessions across the river basin, to hear from local residents about their priorities for Ohio River restoration. Flooding was a common concern: one of the key findings of the listening sessions was that residents want federal restoration actions to help them prevent climate impacts that are coming, such as increased flooding from heavier, more frequent rain events. The restoration plan is an opportunity to support reforestation, wetland restoration, and other nature-based hazard mitigation strategies that will mitigate flooding. Learn more about the effort at: https://www.nwf.org/ohioriver.

FEMA programs are of particular relevance for nature-based hazard mitigation; supporting these kinds of projects is possible through FEMA's PA, HMGP, and BRIC programs; FEMA has named nature-based solutions as a priority activity for BRIC. BRIC encourages large and innovative projects, allows flexibility when possible, promotes public-private partnerships that support capability and capacity-building, and offers a 90 percent federal cost-share for economically disadvantaged rural communities.[57] In FY 2022, BRIC awardees that used nature-based hazard mitigation solutions to combat flooding restored floodplains, improved stormwater infrastructure, naturalized streams and stabilized stream banks, and even turned

[56] The White House. 2023, December 9. *Biden-Harris Administration Expands Use of Nature-Based Solutions to Better Protect Communities from the Impacts of Climate Change.* [Press release]. www.whitehouse.gov/ostp/news-updates/2023/12/09/biden-harris-administration-expands-use-of-nature-based-solutions-to-better-protect-communities-from-the-impacts-of-climate-change/.

[57] An economically disadvantaged community is one that has a population of 3,000 or fewer individuals and where residents have an average per capita annual income that does not exceed 80 percent of the national per capita income.

vacant land into a stormwater park.[58] Protecting and acquiring open space, conserving or restoring wetlands and riparian areas, and stream restoration are all qualified uses of BRIC dollars – and are all nature-based hazard mitigation solutions highly relevant to Appalachian communities, which are often located within floodplains, or adjacent to rivers and streams, because that's where flat land is located.

USACE is charged with establishing pilot programs to evaluate opportunities to reduce flood, hurricane, and storm risks for economically disadvantaged and rural communities – studies carried out under these programs must incorporate natural or nature-based features to the maximum extent practical, and will have no cost-share requirement. These programs were authorized in the 2020 Water Resources Development Act; the Act, published about every two years, guides Corps policy and authorizes planning projects. USACE, however, has yet to publish guidance on these pilot programs.

Despite the steps taken by FEMA and other agencies, barriers remain to advancing the acceptance and working knowledge of nature-based solutions, on the whole, and to nature-based hazard mitigation in particular. Increasing familiarity with nature-based hazard mitigation at the state and local level, including via increasing opportunities for training and education (see Pillar I recommendations) and via boosted focus on nature-based hazard mitigation at FEMA, will help ensure Appalachian communities can truly benefit from these solutions.

Pillar IV: Recommendations

- Ensure adequate and expedient reclamation on SMCRA title V modern mine lands (e.g., improve reclamation bond requirements, establish a federal fund to provide additional money for reclamation projects, and improve the enforceability of SMCRA's requirements for timely reclamation.).[59]
- Provide dedicated funding for the Appalachian Regional Reforestation Initiative.[60]
- The Forest Service—by virtue of its national expertise and perspective—should be a land stewardship leader by adopting landslide-reduction Best Management Practices (BMPs) that at least meet and, in many cases exceed, state BMPs related to landslides, sedimentation, and watershed protection. National forests should incorporate the below, or regionally-adapted, slope stability/landslide related BMPs into Forest Plans:
    - BMP 1: Forest landslide susceptibility and other slope stability investigations should be performed by qualified and experienced geologists and/or geotechnical engineers.

[58] See list of all BRIC awardees for FY22 here: www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities/after-apply/fy22-status.
[59] For more information about specific policies, see the policy platform released on www.zombiemines.org.
[60] Our policy ask over the last year was to provide $5 million in FY24 appropriations. We have not yet been successful but have made progress in socializing and promoting the program and ask.

- BMP 2: Timber harvest planning should begin with production of a slope steepness map using the best and most current topographic data available for the watershed in which logging is anticipated.
- BMP 3: For individual harvest units or road corridors in which more than 10% of the area has a ground surface slope greater than 20% (11°),[61] a qualified professional with experience in steep forested watershed geomorphology and landslide mapping should perform an office review and site visit with a written summary report to identify areas that show evidence of past, current, or potential future landslide activity.
- BMP 4: Within harvest units or road corridors in which more than 10% of the area has a ground surface slope greater than 20% (11°), areas susceptible or highly susceptible to landsliding should be delineated.
- BMP 5: Take steps to minimize the likelihood of sediment delivery to streams—or other undesirable consequences such as road or structural damage, oil or gas pipeline rupture, or habitat loss—from landslides triggered by logging activities in susceptible or highly susceptible areas.
    - Within susceptible areas, regeneration harvests should be avoided and at least 50% of the basal area should be left uncut. In highly susceptible areas, 100% of the basal area should be left uncut.
    - Cutting, filling, and other earth moving for roads, landings, or other aspects of logging operations should be avoided entirely in highly susceptible areas.
- BMP 6: Implement a plan for long-term monitoring of susceptible and highly susceptible areas that intersect harvest units through the period of post-logging root strength loss and recovery, which may be on the order of a decade or more.

- The US Forest Service should prioritize allocation of funds, material resources, and people to revitalize its landslide-related expertise ranging from peer-reviewed applied research at its regional forest experiment stations to regional engineering geologic expertise that is easily accessible for on-the-ground application of robust best management practices to reduce logging-related landslide risks at the forest, watershed, and individual timber harvest unit scale.

[61] The 20% (11°) threshold is a limiting value calculated using an infinite slope factor of safety equation with a typical Appalachian sedimentary rock colluvium residual friction angle of 22°, no cohesive strength, slope parallel seepage, and a phreatic surface coincident with the ground surface. Landslides are unlikely to occur on slopes less than the threshold even if the ground is completely saturated and root strength eliminated. These values may be modified based on local experience if the BMPs are adopted in other states.

- Create meaningful incentives in FEMA's BRIC program that enable communities to pursue large-scale natural hazard mitigation projects. This could be done via a 15 percent set-aside of the BRIC national competition funding to specifically support nature-based hazard risk reduction projects.
- USACE should prioritize swift and effective implementation of Sec. 118 of the 2020 Water Resources Development Act (Pilot programs on the formulation of Corps of Engineers projects in rural communities and economically disadvantaged communities).
- Increase funding for popular, oversubscribed USDA conservation programs such as CSP and the EQIP, as well as sustainable agriculture programs such as SARE. These should be expanded to meet demand, and to ensure all farmers have the opportunity to adopt conservation practices that increase soil health and farm productivity while reducing flood impacts.
- Better integrate nature-based solutions into state hazard mitigation plans. These plans are required for projects to qualify for FEMA HMA funding. Many states include some nature-based goals in their plans, but there are numerous opportunities to expand on these, including via inclusion of detailed, specific nature-based hazard mitigation actions.[62] Congress could require future state hazard mitigation plans to consider nature-based solutions as a potential mitigation technique.

[62] Kihslinger, R., Li, A., Luedke, H. (2021). *Nature-Based Mitigation Goals and Actions in State and Tribal Hazard Mitigation Plans*. Environmental Law Institute. www.eli.org/sites/default/files/eli-pubs/nature-based-mitigation-goals-and-actions-final.pdf.

Appendix: Nature-based hazard mitigation resources

Title	Description	Author	Link
Nature-based Solutions Funding Database	Interactive database for communities interested in pursuing federal funding and/or technical assistance for nature-based solutions, including nature-based flood mitigation. Regularly updated; users can filter to find funding or technical assistance that best fits their needs	NWF	fundingnaturebasedsolutions.nwf.org/
Federal Nature-Based Resources For Coastal Communities, States, Tribes, And Territories	Summary of federal resources and guidance on coastal green infrastructure, nature-based solutions, and habitat restoration that are available to assist coastal communities, states, tribes, and territories in evaluating, enabling, and investing in nature-based adaptation strategies. Includes resources from FEMA, NOAA, USACE, USDA, and more.	U.S. government	noaa.gov/sites/default/files/2022-04/Nature-based-Solutions-Compendium.pdf
The Protective Value of Nature	Report summarizing the latest science on the effectiveness of natural infrastructure in lowering the risks to communities from weather- and climate-related hazards, including flooding.	NWF	nwf.org/protective-value-of-nature
Federal Flood Risk Management Resources Web Tool	Web tool that includes information about federal programs, services, data and tools available to support flood risk management activities (including nature-based solutions). Users can search for resources using filters to narrow their search by user type, flood risk lifecycle phase, assistance type and federal agency.	USACE	
Naturally Resilient Communities database	Guide of nature-based solutions and case studies of successful projects from across the US and Europe. Includes solutions and case studies about riverine flooding and erosion, and urban stormwater flooding.	Naturally Resilient Communities partnership	nrcsolutions.org/
Department of Interior Nature-base Solutions Roadmap	Developed for DOI staff to have consistent and credible information about nature-based solutions, though likely applicable to any practitioner engaged in planning or implementing nature-based hazard mitigation projects. Includes information on floodplain reconnection, riparian buffer restoration, and stream restoration.	DOI	doi.gov/sites/doi.gov/files/doi-nbs-roadmap.pdf

Promoting Nature-Based Hazard Mitigation Through FEMA Mitigation Grants	Guidance document intended for stakeholders pursuing FEMA HMA grants for nature-based solutions to mitigate risks associated with flooding (riverine and coastal) and wildfire; Includes an overview of selecting appropriate NBS for a given hazard and location, FEMA HMA requirements, and how to maximize benefits for a given project	TNC, AECOM	nature.org/content/dam/tnc/nature/en/documents/TNC_NBS_Guidebook-04-30-2021_LR.pdf
Guidance for Stream Restoration	Bibliographic repository of information available to assist professionals with the process of planning, analyzing, and designing a stream restoration or rehabilitation project; structured as a series of short literature reviews followed by a hyperlinked reference list	USFS	fs.usda.gov/biology/nsaec/assets/yochumreynolds_2020_tn-102-5_guidancestreamrestoration-508.pdf

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The authors would like to thank the following individuals for their contributions, edits, and review of the platform: Eric Dixon (Ohio River Valley Institute), Emily Donahoe (National Wildlife Federation), Bill Haneburg (Kentucky Geological Survey), Ross Griffin (National Wildlife Federation), Gabi Kenny and others at Wetlands Watch, Amethyst Muncy (Appalachian Citizens' Law Center), Sara Nicholas (PASA Sustainable Agriculture), Lindsey Shapiro (PASA Sustainable Agriculture), Erin Savage (Appalachian Voices), Sionainn Rudek (ReImagine Appalachia), Kevin Zedack (American Flood Coalition), Jim Garrett (KY VOAD)

The authors would also like to thank the many Appalachian residents, local elected officials, certified floodplain managers, and others with experience in disaster recovery who took our surveys and provided input on the platform's content and policy recommendations.

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