

The Nature Conservancy Comments
on
FEMA PROPOSED POLICY: Hazard Mitigation Assistance: Building Resilient
Infrastructure and Communities

Introduction

Thank you for the opportunity to comment on the proposed policy for Federal Emergency Management Agency's (FEMA) implementation of the Building Resilient Infrastructure and Communities (BRIC). The Nature Conservancy (TNC) considers this program to be of paramount importance as it is one of the few sources of federal investment for hazard risk reduction before disaster strikes. We are pleased that Congress codified this program, resulting in enhanced resources dedicated for investment in pre-disaster mitigation.

TNC is a global conservation organization dedicated to conserving the lands and waters on which all life depends. Guided by science, we create innovative, on-the-ground solutions to the world's toughest challenges so that nature and people can thrive together. We are tackling climate change, conserving lands, waters and oceans at unprecedented scale, providing food and water sustainably and helping make cities more sustainable. Working in all 50 states and 72 countries, we use a collaborative approach that engages local communities, governments, the private sector and other partners, including farmers, ranchers and other landowners.

TNC engages and invests in conservation and restoration projects in varied ecosystems throughout the United States that results in risk reduction to a host of threats such as flooding, drought and wildfire. We offer the following comments drawing on our extensive project experience and expertise carrying out this work.

- **Encouraged investment in natural infrastructure projects should be explicitly cited in BRIC's principles.**

Natural infrastructure has been shown to reduce disaster risk and benefit communities and the environment. Just as support for the adoption and enforcement of building codes is included in the principles section of the policy, support for the use of natural infrastructure projects where feasible and effective should be included in this section of the policy because this action contributes to risk reduction and enhanced resilience, is cost-effective, produces multiple societal, economic and environmental benefits, and is sustainable over time. See Appendix A for additional information on what types of natural infrastructure in the coastal, river and urban setting contribute to risk reduction and associated studies that document the effectiveness and cost effectiveness of this work.

- **More detailed and updated guidance on investment in various types of natural infrastructure should be in the Notice of Funding Availability and in the Hazard Mitigation Assistance (HMA) guidance manual.**

We urge FEMA to conduct a thorough review and update of the detailed rules and HMA guidance to accompany the formulation of this new program and ensure that public review and comment are afforded.

We recognize that FEMA has allowed Pre-Disaster Mitigation funds to be used on natural infrastructure type projects, and we applaud the prior recognition of the risk reduction benefit of these investments. We

also recognize that this proposed policy is not an articulation of the more detailed guidance that FEMA will issue in association with the creation of this new BRIC program. Having worked with several communities that are interested in investing in nature-based mitigation work, we have documented the continued challenges with the rules and guidance for applying mitigation funding to natural infrastructure work. We have included in Appendix B further details on these challenges and recommendations on how to address these challenges to more effectively allow for and ensure investment in effective natural infrastructure projects.

➤ **FEMA should fund and prioritize strategic buyouts that incorporate nature-based solutions under BRIC.**

BRIC should continue to fund strategic buyouts targeted in the highest risk areas in a way that will maximize risk reduction and deliver additional environmental benefits.

FEMA has long funded strategic buyouts through its mitigation grant programs and BRIC should continue to fund that work. The buyout work should also be paired with restoration of the underlying land to maximize the risk reduction and suite of co-benefits that are provided. Targeted, strategic buyouts are an essential tool to help ensure that people who want to move to a less vulnerable place have a means to do so. They have been a vital and successful part of federally and locally funded disaster preparedness and recovery efforts and should be continued.

Moreover, general restoration of all lands – coastal, riverine or forestlands – should include permanently removing structures and investing in the underlying ecological system. These kinds of investments provide benefits not just to the individuals who were moved out of harm’s way, but also restore the disaster reduction benefits, and additional suite of benefits, that healthy, intact natural systems provide to their neighboring communities. These added benefits must be accounted for in some manner in order to properly value this work. Combining strategic buyouts and natural infrastructure restoration presents one of the most effective strategies for improving overall community resilience.

➤ **Recognize and ensure consideration of climate change and future growth and development impacts.**

FEMA must require that climate change impacts be considered when designing and investing in mitigation actions. This must be called out as a basic principle of the program and also as a required activity of project eligibility.

Over the last 50 years, Americans have seen a 20% increase in the heaviest downpours. In addition, newly published research demonstrates that the proportion of category 4-5 hurricanes has doubled from 20% to 40% in 35 years (Holland and Bruyere, 2012). Coastal storm surge and storm impacts will intensify as sea levels continue to rise the predicted 0.95 to 3.61 feet globally by the end of this century¹. The [Fourth National Climate Assessment](#) stresses that fires are already increasing in intensity, duration and frequency, and by mid-century, the western US is expected to have two to six times more damaging wildfires.

To not require grantees to consider and design for these increased impacts, would be making investments in infrastructure that will fail more frequently. Considering these impacts will ensure enhanced resilience of investments in the face of climate change.

¹ <https://www.ipcc.ch/srocc/>

Also, well documented and critical to account for is the impact of future growth and development. The study commissioned by FEMA and conducted by AECOM, documents the projected growth in special flood hazard area due to increased development and climate change.² Growth and development have a measurable effect on the scale of future damage to property and infrastructure. Often development is occurring in high risk areas with higher probability of damage. Avoiding this impact by accounting for likely patterns of future growth and development must be a priority.

In keeping with this consideration, FEMA should adopt a requirement similar to the one advanced in Section 280 of the National Defense Authorization Act of FY2019 for use of any BRIC funds. The DRRA provision bill calls for the Secretary of Defense to require mitigation actions when the Defense Department is making a major or minor military construction project, to assess if the project is occurring in a FEMA designated 100-yr. floodplain, and if so, to take the following mitigation actions:

“(4) MINIMUM FLOOD MITIGATION REQUIREMENTS.—When mitigating the flood risk of a major or minor military construction project within or partially within the 100-year floodplain, the Secretary concerned shall require any mitigation plan to assume an additional—
(A) 2 feet above the base flood elevation for non-mission critical buildings, as determined by the Secretary; and
(B) 3 feet above the base flood elevation for mission critical buildings, as determined by the Secretary.”

➤ **TNC urges FEMA’s commitment to allocate the full 6% allocation of Disaster Relief Funds**

FEMA continues to state it “may” set aside 6% of Sections 403, 406, 407, 408, 410, and 428 of DRF for BRIC funding. FEMA should commit to allocating the full 6%. Given the documented return on investment of mitigation work, it is only prudent to dedicate the maximum amount possible to the BRIC program.

➤ **TNC applauds the flexibility of the cost share provision.**

TNC appreciates the flexibility in how to account for cost share including the ability to count in-kind services. The flexibility in cost share match will aid communities who don’t have the funding to make a cash match. It also allows private entities to provide necessary services associated with the mitigation activities to count toward match.

➤ **TNC urges FEMA to consider making non-profits eligible sub applicants under BRIC.**

We urge FEMA to make non-profit organizations eligible sub applicants for BRIC funding as is currently allowed under the Hazard Mitigation Grant Program (HMGP). Doing this will allow for greater private investment to better leverage FEMA’s public funding, and opportunity for larger-scale projects that are less bound by geopolitical boundaries. As an organization that regularly develops nature-based solutions that reduce disaster risks, we are well suited to submit sub applications to FEMA to foster preparedness and resilience.

² https://aecom.com/content/wp-content/uploads/2016/06/Climate_Change_Report_AECOM_2013-06-11.pdf

➤ **TNC appreciates support for technical assistance.**

TNC appreciates that FEMA will provide non-financial technical assistance. Aside from lack of resources, lack of technical assistance is also a significant challenge for communities advancing risk reduction strategies and work. It is an even greater challenge for smaller communities, especially small lower income communities. FEMA should place an emphasis on providing technical assistance for these communities.

➤ **TNC applaud support for public private partnerships.**

We appreciate the specified support for partnership building and agree that this is a key activity. Often small, rural communities most at risk from wildfire, drought and flooding have limited to no resources to address these vulnerabilities. Residents, tribes, NGO's and local governments in many places are actively mitigating their fire, flood and drought risk, but they aren't necessarily working together in a coordinated fashion. They also lack adequate funding to administer and coordinate mitigation efforts. Funding for local partnership building and mitigation coordination would help ensure the efficient and effective use of existing local resources and enable communities to use FEMA and other funding wisely and in ways that catalyze sustainable mitigation outcomes. We are hopeful that these communities will be able to tap into BRIC's Capability- and Capacity-Building funding to support necessary coordination and planning work. Strong partnerships are central to planning, gaining buy in and successfully implementing mitigation work.

➤ **Funding support should also be allowed for a range of pre-project activities. To further support this, TNC urges FEMA to considering ensuring “advanced assistance” and 5% initiative studies are included under BRIC.**

In addition to technical assistance support, TNC believes that building capacity will be key to achieving the intent of the BRIC program. This can be achieved through ensuring funding support for a range pre-project activities. In addition to supporting technical assistance, BRIC funds should be explicitly allowed for planning, regional mitigation assessments, prefeasibility project scoping and development.

Some communities, especially smaller communities lack the funding and capacity to plan for, conceive of, design and advance projects that will most effectively reduce risk. These all need to be funded activities under BRIC to ensure equity in advancing mitigation actions for all communities of varying size, wealth, and demographic makeups.

Yet the funding shouldn't be merely for these communities coming together to develop Hazard Mitigation Plans. This is important but so is studying, assessing and developing plans and strategies that identify and determine the most cost-effective risk reduction actions communities should take. GIS-based analysis that combines many data layers can be a powerful tool to identify where and what projects will be most effective in reducing risk. These plans informed by the assessments must be developed with full community engagement to ensure community buy in which will in turn result in greater acceptance of the investments and thus ultimately more success in advancing these risk reduction actions. Smaller, less well-resourced communities need technical support to conduct this analysis, to organize and execute engagement strategies that gain the necessary community support and buy in. All this work must be supported through BRIC funding.

A tool for further supporting these activities is Advance Assistance and Planning funding and the use of this should be explicitly allowed under BRIC. Use of these funds has supported critical resources that

communities need to better understand their hazard vulnerabilities and develop cost-effective and innovative solutions to address them.

Additionally, the HMGP 5% Initiative fund which has supported some of the activities, should be replicated in BRIC. It is important to be able to access these funds to support activities for which a benefit cost analysis is difficult or impossible to complete.

➤ **Extra credits should be afforded project applications that deliver added environmental and societal benefits.**

It is challenging to quantify a host of environmental and societal benefits produced through investments in natural infrastructure. As we noted above and further explain in appendix A, these projects often deliver a host of benefits such as water quality improvements, natural habitat for plants, animals and fish, air quality improvements, carbon emission reductions, recreational and enhanced community aesthetics. We urge FEMA to consider including these added benefits in the project review process and award such projects added points in project scoring to increase likelihood for these being awarded funding when added benefits are well documented.

➤ **FEMA should ensure funding is not unduly invested in large grey infrastructure projects; especially those typically funded by other federal entities**

We do not think that the promotion of “large-scale public infrastructure” should be cited and called out in the Principles of this Draft Policy. We are concerned that in doing so, funding will be dedicated to a limited number of more traditional grey infrastructure projects and the total amount of risk reduction will be less than if the funding is invested in a larger number of projects.

Large scale grey infrastructure projects often result in a myriad of impacts over time and have a limited design life, eventually failing or having to be rebuilt. Often these costs are not factored into the BCA when accounting for this work.

We appreciate that D.1.b. of the Draft Policy calls out that funds “must not duplicate activities that another federal agency or program has more specific authority to conduct.” Larger scale infrastructure projects are funded by other agencies depending on their purpose. Water infrastructure is funded by Army Corps, Bureau of Reclamation and transportation infrastructure is funded by Department of Transportation; energy infrastructure is often funded by Department of Energy. These agencies should generally continue to fund these forms of infrastructure. BRIC should be used to fund work that is not typically funded by these other agencies.

➤ **FEMA should coordinate with other federal agencies to ensure that the best designed projects are selected for funding.**

In the articulation of the administration of the BRIC program, it is critical to cite FEMA’s intent to consult with other federal agencies to ensure proper professional expertise is afforded in reviewing project applications. We note this is especially needed for natural infrastructure type projects where FEMA staff does not typically have the training and expertise to sufficiently review the engineering and ecological related components of these projects. This is especially true for forest related investments as they are a new category of eligible activity for FEMA mitigation funding. Ideally, FEMA would establish cooperative work agreements with other agencies such as U.S. Army Corps of Engineers, U.S. Forest Service, National Oceanic and Atmospheric Administration, and Fish and Wildlife Agency to provide consultation services when needed during project review. The process to implement this practice should ensure that it does not add to the project review process or time.

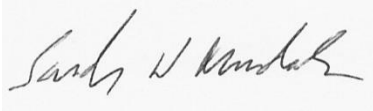
➤ **FEMA should streamline BRIC processes to make the program more accessible.**

FEMA should acknowledge the opportunity for BRIC to be more accessible and easier-to-navigate. Many towns, states, and organizations do not apply for federal funding because they do not have the resources or capacity to apply for or manage it. BRIC could be made more available to the communities that most need it if its processes are streamlined.

FEMA's project review process is extremely slow and drawn out. Questions of the applicants are not all bundled at once but sent in batches over a course of time. Replies from the agency are often very slow with long time lags between communications. FEMA often misses required response times with no repercussions and little leverage is afforded to communities to speed up the process. We understand that FEMA is working to address some of these issues. We recommend that processing of applications in a timely manner be a job performance metric for mitigation staff. This would ensure that sufficient importance is given to addressing this ongoing issue.

Thank you to FEMA for affording the opportunity to provide input as you are developing the rules for administering the new BRIC program. It is exciting that the need for much greater pre-disaster mitigation resources has been identified and that this new program is filling some of this national need.

Sincerely,



Sarah W. Murdock
Director, U.S. Climate Resilience and Water Policy
Smurdock@tnc.org

Appendix A

Natural Infrastructure Provides Cost Effective Risk Reduction Benefits.

In its essence, natural infrastructure is designed to protect, restore, or mimic the role that nature plays—the ecological processes that naturally manage the flow of water, sediment, and the like. Natural infrastructure uses vegetation, soil health, land protection, land management, and other elements and practices to protect, maintain, and restore the natural processes required to manage water and other natural processes, create healthier environments, and protect human communities.

When properly implemented, natural infrastructure provides a suite of benefits and can:

- Keep people and structures out of harm's way
- Reduce wave heights and storm surge
- Store and convey water
- Reduce threats of catastrophic fires

Natural infrastructure solutions can be applied on different scales: at the city, county or regional scale. By using nature, damages and impacts can be minimized and communities can recover more quickly from disasters and impacts. To illustrate examples of varied types of natural infrastructure projects, the Naturally Resilient Communities website (www.NRCsolutions.org) provides an overview of natural infrastructure and a host of case studies throughout the U.S. with varied types of projects. The Army Corps of Engineers, Engineering with Nature program also recently published an Atlas (<https://ewn.el.erdc.dren.mil/atlas.html>) that documents 56 infrastructure projects that use nature in some form.

Coastal Natural Infrastructure Types

- Wetlands Restoration. Restoring and protecting coastal wetlands reduces impacts of storm surge by attenuating wave energy, helping to absorb flood waters and slowing erosion.
- Living Shorelines. Using plants or other natural elements, sometimes in combination with harder shoreline structures, can reduce shoreline erosion and, in some cases, reduce flood risk.
- Oyster Reef Restoration and Development. By rebuilding and/or restoring oyster reef habitat at intentionally sited locations, reefs attenuate wave energy, reducing shoreline erosion, and can reduce overall flood risk.

Evidence of Performance

A 2015 study of a wave tank experiment shows significant attenuation of wave energy (up to 67%) by oyster reefs combined with saltmarsh for boat wake waves. (https://www.researchgate.net/profile/Linda_Walters/publication/269096201_Wave_attenuation_experiments_over_living_shorelines_over_time_a_wave_tank_study_to_assess_recreational_boating_pressures/links/547f6a340cf250f1eddbc5d3.pdf)

In another 2005 study, shoreline retreat was significantly lower (by up to 33%) for experimental field sites with oyster reefs, compared to sites without oyster reefs. (<http://onlinelibrary.wiley.com/doi/10.1111/j.1526-100X.2005.00062.x/abstract>)

A study of barrier islands in Louisiana shows that healthy islands could reduce wave heights by 30% or more and delay the propagation of surges by up to two hours during hurricanes (Grzegorzewskiet al., 2011). Similarly, the Louisiana Coastal Master Plan finds that nature-based defenses can contribute to

regional risk reduction (Cobell et al., 2013; CPRA, 2017, 2012; Fischbach et al., 2012; Peyronnin et al., 2013).

Freshwater Natural Infrastructure Types

- Floodplain restoration through levee setback and habitat restoration reduces flood impacts by absorbing floodwaters as compared to funneling river flow downstream and improves water quality through absorption and filtration of water
- Floodplain restoration including wetlands and banks of waterways to restore a more natural hydrologic regime provide absorptive capacity for floodwaters, reduce erosion and protect infrastructure.
- Watershed headwater protection and restoration reduces flood impacts by absorbing floodwaters as compared to funneling river flow downstream and improves water quality through absorption and filtration of water
- Culvert upsizing allows more natural flow of a river and reduces risk of culvert failures during times of extreme flows
- Strategic obsolete dam removal allows more natural flow of a river and reduces risk of dam failures during times of extreme flows

A Cost-Effective Solution

A large-scale river restoration project was carried out on the Napa River, which runs through Napa City, CA. The project included:

- Improvements to 6 miles of the Napa River and 1 mile of Napa Creek
- Removal of 53 mobile homes, 16 other residences and 28 commercial buildings
- Creation of 400+ acres of emergent marsh and 150 acres of seasonal wetlands
- Replacement of 9 bridges

Prior to the restoration work, floods resulted in \$26 million in property damage annually throughout Napa County. The project significantly reduces, if not eliminates, flood damage within the city of Napa and downstream communities. The project resulted in the protection for 3,000 properties from the 1% risk of flood (that is, the 100-year flood event), translating into damage avoided amounting to \$1 billion.

Restoration work on the Puyallup river provides another good example. During a January storm in 2009, the Puyallup River in Washington was raging and crested at 16,900 cubic feet per second (cfs). Some 26,000 people were evacuated—one of the largest evacuations in the State's history. This year the Puyallup River again crested above 16,000 cfs on November 25th, 2014; yet only a handful of residents evacuated. By reconnecting side channels, moving 1.5 miles of the levee back to more than double the width of the river, and installing log jams that add river complexity and shoreline protection, the Calistoga Reach Floodplains by Design project has helped dramatically reduce flood risk for the City of Orting and surrounding community. This project also improves habitat for endangered salmon in the Puyallup River.

Culvert upsizing also presents an opportunity for significant savings. Nationally, a rough estimate is that 67% of culverts are not designed to allow for a 1% flood (100-yr. flood) and need upsizing. Assuming a quarter of those need immediate replacement, the savings over the life of the new culverts would be \$8 trillion. Upsizing culverts has been demonstrated to withstand flood events and thus avoid any damage to surrounding roads and infrastructure.

Looking at multiple sources, an average savings of around \$10,000 over the projected 100-year life of the culvert should be observed when installing culverts spanning a river width as compared to traditionally

designed culverts. The savings increases with flood risk and grows exponentially when emergency management is required due to road or bridge washout—none of the calculations account for the dramatic costs of catastrophic failure and emergency replacement.

Forest management as natural infrastructure

Taking a large-scale and ecologically based approach to forest management is essential. Destructive wildfires can be propagated in forest, shrubland and grassland habitats. Improving management of dry forest ecosystems, in particular, can provide a host of co-benefits, including improving community safety. As recent fires like the 2018 Camp fire have demonstrated, late season fires of that intensity driven by large fuel loads, dry weather, and high winds—conditions that will become more frequent in many parts of the country—can quickly move out of the wildlands and send embers flying miles to land on homes in the middle of densely populated communities. Instances like these are forcing the state to rethink how it maps fire hazard zones.

In some fire-prone forests, unmanaged forests where fire is excluded become unhealthy and prone to high-severity wildfire and drought. There is compelling evidence that ecological forestry—ecological thinning, prescribed burning, and managed wildfire—can reduce these risks and promote healthier, more resilient forest conditions. It is more cost-effective to invest in prevention than to pay for expenses associated with reacting to extreme wildfire events. For example, thinning one acre of dense forest in the critical Rio Grande and San Juan-Chama headwaters area costs \$700 on average, whereas the economic impact of one acre affected by damaging wildfire can be up to \$2,150 per acre. Even if just one large fire burns, the upfront investment in forest health saves money: forest thinning to boost fire resiliency is estimated to cost \$73 million to \$174 million, with damage estimates between \$104 million and \$1.3 billion.

This approach makes economic sense over the long-term. A recent study estimated the cost of damages from wildfires from 2009 to 2012 in New Mexico was \$1.5 billion. In contrast, the Rio Grande Water Fund estimates a total cost of \$420 million over 20 years to accelerate the pace and scale of forest treatments and restoration. Preserving and restoring these forests will help ensure the sustainability of New Mexico's water supply and increase social and economic benefits for local communities. A University of Oregon study from 2010 found that each \$1 million invested in forest or watershed restoration generates between 14.7 and 23.8 jobs, and between \$2.1 and \$2.6 million dollars for the local economy. The larger economic benefits of restoration—including work that protects our waters—is valued at \$25 billion and generates 220,000 jobs

(<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0128339>)

Appendix B

Additional Comments for to be considered for the Notice of Funding Availability (NOFA) and Mitigation Guidance

FEMA should develop and provide clear criteria for funding nature-based risk reduction in BRIC.

Application and funding processes need to be more applicant centric. The burden of applying, especially for lower-income and low-resource regions, is significant and often confusing. Steps are needed to make the processes clearer, affordable, and predictable through enhanced guidance and regulatory change.

Robust clarity would also facilitate review by state emergency management agencies, as a great deal of programmatic attention and time is consumed in communications between state agencies and FEMA on project approval processes. This is especially true for newer project types such as natural infrastructure projects.

FEMA should develop specific guidance on allowable wildfire mitigation actions and make clear that forest management is an allowable practice under BRIC.

A great deal of change has occurred since the last update of the Hazard Mitigation Assistance Guidance in 2015. In 2017 and 2018, deadly wildfires struck the state of California, tragically resulting in 159 deaths and over 32,000 structures destroyed. According to recent environmental assessments, fire seasons are increasing in length, putting more people and infrastructure at risk.

Although FEMA has vastly more experience and history providing recovery, relief and mitigation for flooding, FEMA has obligated about \$2 billion in housing, debris removal, and other assistance following fire-related disasters over the interval from 2009-2018. However, a small fraction of the total expenditure has been spent on mitigation (see Figure 1, below). Indeed, the 2015 HMA Guidance lists only three eligible fire mitigation activities: home hardening, defensible space, and fuels management. There is clearly a need to encourage more innovation and community-scale activity in the fire mitigation space.

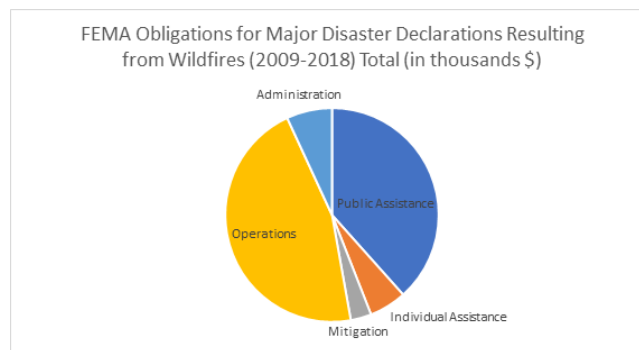


Figure 1: FEMA Obligations for Major Disaster Declarations Resulting from Wildfire (2009-2018).

For example, TNC is working with the Paradise Recreation and Parks District in Paradise, CA to explore whether buy-outs following the catastrophic Camp Fire could be aggregated to form parks that could play a part in long-term community resilience in the face of future wildfires. Science-based, innovative strategies such as this could lead to community resilience, open-space and habitat, and economic benefits in Paradise and other fire-prone communities in the future.

Conservation of undeveloped land should be allowed as a mitigation project under BRIC.

FEMA has typically only funded projects that directly address damaged or vulnerable structures. In an effort to truly build resilient infrastructure and communities, TNC strongly recommends that conservation of undeveloped land be considered an eligible project under BRIC if modelling can prove that the conservation will reduce risk to downstream or surrounding communities. Our forests, wetlands, floodplains, and sea marshes all act as natural barriers between hazards and our built environment. Acquiring and deed-restricting these undeveloped natural resources is not only an investment in reduction of future development-based risk, but also reduces the vulnerability of our existing development, through improved defensible space for wildfires or protection of a floodplain for floodwater storage. Added prioritization for these investments could be placed on lands at greater risk of development such as lands near existing communities, amenities, or infrastructure. Studies by TNC scientists and others document the cost effectiveness of protecting floodplains to reduce flood risk.³ A study published in Nature Sustainability, identified special flood hazard areas roughly the size of Colorado where conservation would generate \$5 in avoided flood damages for every \$1 invested.

FEMA does recognize the benefit of conserving certain lands in its National Flood Insurance Community Rating System program by granting points for preservation of open space. Given this, it is also important to incent this action in BRIC and other mitigation programs with regards to flood risk reduction as well as wildfire risk reduction.

FEMA should conduct regular updates to pre-calculated benefits in the cost benefit tool and consider aggregate applications.

The pre-calculated benefits for acquisition and elevation projects have been an invaluable tool for getting these critical projects accomplished. However, the national review was completed in the early 2010s, and as U.S. home values have typically risen by at least 3.8% annually during last decade, the current pre-calculated benefits threshold (\$276,000) needs to be reevaluated to make sure we can invest in these permanent risk-reduction projects.

Further, TNC recommends that aggregating projects to the neighborhood scale be considered for improved economic and natural outcomes. For example, consider a neighborhood of 50 homes that is located near a river, but only contains 46 houses that are technically within the Special Flood Hazard Area. If a community is able to group those additional 4 homes into the project, it can remove all of the roadway infrastructure and impervious surfaces. This would improve floodplain function and restoration benefits, promoting further protections in adjacent neighborhoods/communities, instead of creating patchwork development that still require infrastructure maintenance and repair during flood events.

³ <https://www.nature.com/articles/s41893-019-0437-5>