

Improving FEMA's Community Rating System to encourage investment in coastal natural infrastructure to reduce storm damages

By

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ABSTRACT

The Federal Emergency Management Agency's Community Rating System (CRS) is an effective but not well-known program that provides real flood risk reduction returns to communities that participate and to their citizens that carry flood insurance. CRS communities realize lowered flood impacts and lowered insurance premiums. Given the increased frequency of severe flooding events, improving aspects of CRS could expand community participation and reduce the impacts (and therefore the costs) of flood disasters. Environmental Defense Fund (EDF), in collaboration with the Graham Institute of Sustainability at the University of Michigan, sought to explore with experts working on community investment in flood mitigation and familiar with the CRS what research might lead to more communities participating in CRS and doing so at higher, more meaningful levels. EDF in particular was interested in whether better reflection of the hazard reducing roles of natural infrastructure in the CRS would advance inclusion of these measures in community plans. Through a facilitated workshop, experts concluded that compelling data can and should be generated to increase the number of coastal communities taking actions to mitigate flood hazards and improve their resilience to climate change aggravated flooding. Because smaller and less flood-prone communities have historically been less likely to participate in CRS, experts suggested that improvements to CRS be complemented with other means to measure, encourage, and reward their flood hazard mitigation actions.

ADDITIONAL KEYWORDS: Flood insurance, hazard mitigation, nature-based features.

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According to the National Centers for Environmental Information (2018), 2017's historic hurricane season resulted in \$265 billion in losses, making it the most expensive year on record. Approximately 1.5 million people were still without power more than two months after Hurricanes Irma and Maria devastated the Florida Keys, Puerto Rico, and other parts of the Caribbean, causing the longest electrical blackout ever in American history. These disasters starkly demonstrate how far we need to go to proactively lessen the devastation caused by storms and flooding, and that, without concerted pre-storm investments aimed at lessening the impacts of storms, the continued adverse effects of climate change will worsen an already bad situation.

One mechanism that exists to encourage communities to take advance actions that lessen the loss of life, economic disruption, and adverse environmental effects of flood damage is Federal Emergency Management Agency's (FEMA) Community Rating System (CRS). The

CRS program is effective in that its returns to participating communities are real:

- Communities that engage in hazard mitigation activities are less prone to flood hazards and recover faster from disaster than those communities that do not (Landry and Li 2011, citing NOAA 2010).
- When communities increase their CRS rating, flood damages decrease by 15 percent (Brody *et al.* 2007).

However, the program is not widely recognized, and the number of participating communities — particularly those that are mid- to small sized or that have proportionately smaller flood-prone areas — could be increased. Even among those communities that do participate in CRS, most have only a Class 9 or 8 (FEMA 2012) indicating that they could do more to lessen the impacts of flood disasters.

Simplified procedures might broaden community participation in CRS. To help communities overcome inertia and the

daunting 641-page CRS manual, several organizations are encouraging communities to reduce flood impacts by providing tools and guides.¹ Several of these guides demonstrate how actions communities are already taking or contemplating, such as preserving open space in floodplains, can be credited in CRS. Simplifying and revising CRS might help unlock public support for investing in actions to get ahead of disasters, reduce flood losses, and advance restoration of coastal natural infrastructure like wide beaches with healthy dunes.

For smaller coastal towns, several factors may influence decisions to invest in flood hazard mitigation and participate in CRS. One reason may be limited capacity. Capacity may be limited by a lack of professional expertise in risk mapping or hazard mitigation. In some cases, the expertise may exist, but staff are expected fulfill multiple responsibilities. Sometimes these issues are rooted in the nature of political leadership; when faced with limited budgets and election cycles, political leaders tend to address short-term needs, deferring investment in actions that reduce the impacts of potential storm waves and winds and floods.

1) Especially noteworthy tools include the Community Rating System Explorer prepared by The Nature Conservancy (<http://coastalresilience.org/project/community-rating-system-explorer/>); Surging Seas CRS Guide developed by Climate Central (<http://sealevel.climatecentral.org/crs/>); and the CRS Green Guide compiled by the Association of State Floodplain Managers, Coastal States Organization, and others (<https://www.flood-sciencecenter.org/products/crs-community-resilience/>).

We need to understand what constrains communities and what information and incentives might better influence them to take actions to lower their vulnerability, reduce the impacts of flood disasters, and adapt to rising seas and more extreme weather. Understanding this could help improve the design and marketing of CRS to encourage communities to participate in CRS and participate in more meaningful ways.

THE COMMUNITY RATING SYSTEM: A BRIEF PRIMER

FEMA created the CRS as a means to recognize and incentivize community floodplain management activities that exceed the minimum National Flood Insurance Program (NFIP) requirements. Communities may voluntarily participate in the NFIP so that property owners in their jurisdictions can purchase insurance to protect against flood losses. By participating in NFIP communities agree to implement and enforce state and community floodplain management regulations intended to prevent loss of life, reduce flood damages and associated economic and social impacts, and reduce taxpayer costs for disaster relief.

CRS is also voluntary and has three goals:

- Reduce flood damage to insurable property,
- Strengthen and support the insurance aspects of the NFIP, and
- Encourage a comprehensive approach to floodplain management.

Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join CRS. FEMA awards participating CRS communities with flood insurance premium rate discounts reflective of the reduced flood risk expected from those actions. The discounts are intended to be reflective of FEMA's expected savings from reduced flood insurance claims. FEMA uses formulas and adjustment factors to calculate credit points for each activity and uses the current CRS Coordinator's Manual (FEMA 2017a) and a verification process to provide a CRS class rating. FEMA audits communities to ensure actions are being taken.

As of 1 May 2017, 1,466 communities participated in the CRS. This represents about 6% of the 22,000 communities

participating in NFIP and eligible to participate in CRS. While CRS represents more than 69 percent of all flood insurance policies (FEMA 2017b), it's important to realize that only about half of the homes in the most vulnerable Special Flood Hazard Areas have flood insurance (Dixon et al. 2006). There are some communities that do not participate in CRS despite having a high number of policy holders—for example, approximately 120 communities in coastal states have policy counts of over 1,000 but do not participate in CRS (Molly O'Toole, pers. comm., 10 October 2017). Clearly there is room for improvement in both market penetration of insurance and community adoption of CRS.

Communities not participating may have concluded that the CRS discount for a small number of policy holders does not justify the cost of participating in CRS or may have NFIP compliance problems (Molly O'Toole, pers. comm., 10 October 2017). But research shows that most communities stay in the program once they've joined, and these communities also tend to increase their number of risk reduction activities over time (Michel-Kerjan et al. 2016). On occasion communities' ratings may decrease.

CRS's class scale runs from 10 to 1. Communities receiving a 10 realize no reduction in their citizens' flood insurance premiums, while communities demonstrating superior hazard mitigation and a 1 rating received the highest possible flood insurance premium discount of 45% for their citizens. As a community accrues more points, it improves its CRS class rating and receives increasingly higher discounts — 5% with each level of CRS rating improvement. Therefore, a rating of Class 9 yields a 5% premium discount for a community's citizens holding NFIP policies in the Special Flood Hazard Area.

There are, however, a few notable exceptions. FEMA caps discounts on policies issued on properties in the X- or C-Zones and thus property owners can never secure the potential 45% discount. (The X-Zone is defined as the area of moderate flood hazard between the limits of the base flood and a flood with a 0.2% annual chance — the "500-year flood." The C-Zone is the area of minimal flood hazard — the areas outside the Special Flood Hazard Area and higher than

the elevation of the 0.2% annual chance flood.) Additionally, in some cases, state policies can have the effect of capping coastal communities' CRS ratings, such as where state governments limit establishment of locally relevant (i.e. flood hazard informed) building codes. For example, Massachusetts' building code did not allow localities to adopt higher standards for wind restriction levels in new construction, so in turn, localities have been unable to achieve a high enough Building Code Effectiveness Grading Schedule rating to advance beyond a CRS Class 7^{2,3}. Similarly, North Carolina and Texas have had building standards or prohibitions from adopting local building codes that restricted communities to at best a Class 7 or 8⁴. In Florida, bills were recently enacted that limited nationally approved changes to the base building code used in Florida; the effect of which will cause Florida's CRS communities rated at or above Class 6 to retrograde to a Class 7⁵.

Points are awarded for engaging in any of 19 creditable activities, which are organized under four categories:

- Public information
- Mapping and regulations
- Flood damage reduction, and
- Warning and response.

Communities choose which activities

2) 1 December 2015 letter to Massachusetts Board of Building Regulations and Standards signed by Shannon Jarbeau, Certified Floodplain Manager, and William Clark, CRS and Floodplain Coordinator Executive Director, Cape Code Cooperative Extension, Barnstable County, Massachusetts.

3) Recent legislation may have resolved this issue for Massachusetts.

4) Dave Carlton, Certified Floodplain Manager, DKCarlton & Associates, pers. comm. 5 April 2018.

5) 28 February 2017 letter of the Florida Floodplain Managers Association to Members of the Committee on Community Affairs.

6) More detailed information on the CRS program can be obtained from the 2017 CRS Coordinator's Manual (https://www.fema.gov/media-library-data/1493905477815-d794671adeed5beab6a6304d8ba0b207/633300_2017_CRS_Coordinators_Manual_508.pdf), FEMA's CRS website (<https://www.fema.gov/national-flood-insurance-program-community-rating-system>), and the CRS resources website (<http://crsresources.org>).

they wish to pursue to receive credits towards their CRS class, although two activities must be included: Activity 310, Elevation Certificates and Activity 510 (Sections 501-504), Repetitive Loss⁶. CRS's current point allocation is based on evidence that protection of open space, development limitations, and removal of repetitively flood-damaged buildings significantly reduce flood hazards. Floodplain open space—whether its parkland, agricultural fields, forests, or wetlands—means that homes and other buildings are not in harm's way. These areas also allow floodwaters to spread, taking the peak off the flood height and slowing damaging flood waters. Preservation of natural infrastructure can be counted toward CRS open space preservation, and many communities under-identify these points (Highfield and Brody 2017). The savings associated with a one-class increase, via CRS open space preservation, saves on average \$3,532 per community per year through reduced flood losses (Highfield and Brody 2013).

Restoration of natural infrastructure can also be counted in other CRS activity areas (e.g. flood protection and storm-water management), and some actions under CRS can be credited more than once. For example, CRS credits property acquisition and relocation activities, and because such activities can create new open space, the action can receive two sets of credits. Less clear is whether credits for natural floodplain features (such as wetlands or dunes) that are restored on that open space are also possible. Unfortunately, few communities take credit for protecting natural functions and improving the value of floodplains; for example, only 17 communities currently get natural shorelines CRS points (Bill Lesser, pers. comm., 9 Aug 2017.)

CRS WORKSHOP

In August 2017, Environmental Defense Fund (EDF), in collaboration with the Graham Institute of Sustainability at the University of Michigan, brought together experts working on community investment in flood mitigation and familiar with CRS. EDF's primary goal for the workshop was to explore whether expanding and improving CRS would be an effective means for reducing flood disaster impacts and expanding protection and restoration of natural infrastructure. Other objectives included:

Table 1. Workshop participants

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- Dr. Philip Berke, Director of the Institute for Sustainable Coastal Communities, Texas A&M University at College Station.
 - Dr. Brian Boutin, Director, Albemarle-Pamlico Sounds Program, The Nature Conservancy.
 - Dr. Sam Brody, Department of Marine Sciences and Director for the Center for Texas Beaches and Shores; Texas A&M University Galveston.
 - Steve Cochran, Campaign Director, Restore the Mississippi River Delta, and Associate Vice President of Coastal Protection, Environmental Defense Fund. (Non-voting participant)
 - Shannon Cunniff, Director, Coastal Resilience, Environmental Defense Fund. (Non-voting participant)
 - Dr. Jeffrey Czajkowski, Managing Director of the Wharton Risk Management and Decision Process Center at the University of Pennsylvania.
 - Dr. Doria Gordon, Lead Senior Scientist, Office of the Chief Scientist, Environmental Defense Fund. (Non-voting participant)
 - Dr. Diego Herrera, High Meadows Post-Doc Fellow, Environmental Economist, Environmental Defense Fund. (Non-voting participant)
 - Dr. Wesley Highfield, Associate Director for Research at the Center for Texas Beaches and Shores; Texas A&M University Galveston.
 - Bill Lesser, CFM, National CRS Coordinator, Mitigation Directorate, Floodplain Management Division, FEMA Federal Insurance and Mitigation Administration.
 - Will McDow, Director of Habitat Markets, Environmental Defense Fund. (Non-voting participant)
 - Tom Morey, State NFIP Coordinator, Kansas Department of Agriculture; also representing the Association of State Floodplain Managers.
 - Sarah Murdock, Director, U.S. Climate Resilience and Water Policy, The Nature Conservancy.
 - Dr. Doug Noonan, School of Public and Environmental Affairs at Indiana University-Purdue University Indianapolis.
 - Dr. Richard Norton, J.D., Urban and Regional Planning, Taubman College of Architecture and Urban Planning, College of Literature, Science, and the Arts' Program in the Environment, University of Michigan.
 - Molly O'Toole, PE, CFM, DWRE, MASCE, is a lead consultant to FEMA's CRS program.
 - Dr. Rainer Romero, Senior Social Scientist, Environmental Defense Fund. (Non-voting participant)
 - Dr. Abdul Akeem Sadiq, School of Public Administration, University of Central Florida.
 - Dr. David Salvesen, Director, Sustainable Triangle Field Site, Research Associate, University of North Carolina at Chapel Hill Institute for the Environment.
 - Dr. David A. Stroud, CFM, Emergency and Hazard Mitigation Lead, AMEC Foster Wheeler Environment and Infrastructure.
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- Assessing whether other innovative means of expanding investment in protection and restoration of natural infrastructure to reduce flood disaster impacts exist if flood insurance is further privatized in the future; and
- Launching development of a unifying, efficient research roadmap to identify the factors influencing the rate and level of participation in flood hazard mitigation.

Participants in the workshop (Table 1) presented research or experiential findings pertinent to CRS to aid informed discussion around key questions:

- What do we know about how CRS works and in what ways is it effective? How is its effectiveness measured?
- What information is needed to better encourage communities to join and improve their level of participation? Is certain information especially transformative or critical to success?
- What strategic and tactical changes could be made to the program itself to make it more effective?
- Should and how could preservation and restoration of natural infrastructure be more explicitly reflected in CRS?
- What strategic locations/communities might EDF target to enhance risk reduction and restoration of natural floodplain features, functions, and values? What other means could be used to encourage implementation of hazard mitigation that includes natural defenses?

Throughout the discussions, research questions were captured and organized. After thorough discussion, to get a sense of the full group, attendees multi-voted, distributing their four votes in any manner. Two assignments were given to voting attendees (identified in Table 1): They were to demarcate the best research ideas and identify where answering a research question could be “transformative” in terms of improving investment in hazard mitigation.

The following day, the researchers, along with an EDF facilitator, revisited the attendees’ impressions from the first day, provided additional thoughts related to the workshop objectives, and discussed how to further develop a unified research

roadmap based on strategic research questions identified. After the workshop, research ideas were organized, combining similar concepts, and results tallied.

KEY WORKSHOP FINDINGS

Overall, participants agreed that a stronger body of evidence on the effectiveness of CRS, from which compelling messages could be created, would improve CRS participation and progress on reducing flood impacts. Key evidence is needed to demonstrate definitively the costs and cost-effectiveness of CRS in lowering risk, reducing damages, and providing other *community-wide* benefits (as opposed to benefits solely enjoyed by NFIP policy holders).

Particularly, participant voting revealed strong agreement on one topic, which also was deemed to have the greatest transformative potential: Building better understanding of the costs and perceptions of costs associated with CRS participation. Elements of this research would involve determining a fuller assessment of the incremental or separable administrative and implementation costs to a community over and above the costs of participating in the NFIP. Assessing community costs would ideally include assessing increased staffing needs, time invested in training, time to get to full capacity (i.e. learning curves), changes in staff turnover rates, and increased record keeping. Additional data to help understand and inform decision making would include the per capita costs of participation, and, if possible, costs broken out by CRS class level. Another research topic would be an assessment of how perceptions of costs serve as barriers to decisions about buyouts, establishment of freeboard for building designs and zoning decisions, etc. Research to establish a rank ordering of the economic effectiveness of CRS activities could influence decision-making at community level.

CRS recognizes risk reduction benefits from open space in floodplains and some natural infrastructure. Participants also determined that expanding participation in FEMA’s CRS program would be an effective means for reducing flood disaster impacts *and* expanding protection and restoration of natural infrastructure if:

- The numbers of communities participating in the CRS were expanded and doing so at higher levels.

- The CRS was revised to provide points crediting the preservation and restoration of ecosystem services provided by natural defenses, such as floodplains and coastal features that reduce flood and erosion impacts.

One of the shortcomings of CRS is its jurisdictional, rather than watershed, focus. If some aspect of CRS would reward watershed approaches, it would allow better identification of the reasons for flooding and improve opportunities to address flood risks by restoring natural infrastructure. To improve planning and progress measurement, experts suggested that means be developed to integrate resilience scorecards and Disaster Mitigation Act plans within the CRS scoring scheme.

If flood insurance is further privatized in the future, expanding investment in protection and restoration of natural infrastructure to reduce flood disaster impacts could occur if:

- Insurance companies recognized the incremental risk reduction benefits of natural infrastructure, and/or
- Private insurers, states, or FEMA created a simpler CRS “gateway” or “on-ramp” program designed to attract and recognize the accomplishments of communities that are smaller, less flood-prone, or have fewer NFIP policy holders

Further details on the ideas and voting results from the workshop can be found in Cunniff (2017).

DISCUSSION

Given the increase in flood disasters and their costs there is a real need to scale up investment in flood hazard mitigation measures. The CRS program may be our best barometer for measuring the flood resilience of communities and the nation. The relatively low numbers of NFIP communities participating in CRS, and the fact that the majority of those participating communities are Class 8, 9, or 10 (the poorest ratings), demonstrate the opportunity for improvement.

The CRS program can be leveraged to advance the number of coastal communities taking actions that equitably reduce flood hazards, improve quality of life, and increase habitat quantity and value. CRS could also be complemented with other means to measure, encourage,

and recognize flood hazard mitigation actions by smaller and less flood-prone communities. Creation of state-level CRS ratings could also be explored.

Communities can start building resilience by reviewing their existing plans, such as community development, transportation, natural resources, and emergency management plans, as each likely directly and indirectly addresses factors relevant to hazards and risk reduction (Berke *et al.* 2015). These plans need to be de-conflicted, and ideally, integrated, to align the decision-making power necessary to realize significant reductions in vulnerability to floods and other hazards. If CRS informs this review, communities may uncover additional measures and credits to receive under CRS.

By developing far more compelling information about the impacts of floods on the economy, the variety of means to reduce these negative impacts, and the value of building resilience we can encourage appropriate investments that lessen the economic, social, and other impacts of flood disasters. With data we can provide more convincing stories about the benefits derived by communities, as well as by each citizen.

Communities may be more likely to encourage and support investments in hazard mitigation if they perceive or experience near-term positive outcomes from such actions. When restoration of natural infrastructure is used to mitigate storm and flood hazards, it generates fairly immediate rewards because these features provide other beneficial functions, such as recreational space, improved water quality, and wildlife habitat. Each of these outputs improves the quality of life for coastal residents and attracts tourism. Therefore, broader public support for hazard mitigation investment may be realized by including natural infrastructure that complements traditional flood loss measures such as building codes, zoning, retention basins, and other structural measures.

While FEMA has long recognized the natural and beneficial functions of floodplains and incorporated means to encourage retention and restoration of these values into its programs, much more is needed to deepen and broaden understanding of the values that natural infrastructure brings to communities —

benefits that pay daily dividends, not just during a flood event. FEMA programs have recently begun to more overtly recognize the contributions of green infrastructure and natural infrastructure toward reducing flood and erosion hazards. It is critical we continue to evaluate and document the effectiveness of natural infrastructure solutions to act as buffers to absorb the energy of waves, flood waters, and wind in lieu of and along with traditional engineering solutions. And in considering those benefits, we need to also calculate natural infrastructure's other benefits for biodiversity, tourism, recreation and fishing, as well as for carbon capture and storage.

Several organizations are developing guidance on the design of natural infrastructure. The U.S. Army Corps of Engineers, Partnership for Ecosystem-based Disaster Risk Reduction, and the World Bank have each organized collaborative efforts to develop guidelines and evaluate projects to scale up adoption of natural infrastructure features into flood and storm risk reduction plans. As natural floodplain functions and values are more explicitly recognized for their defensive nature, and as metrics for resiliency to floods are created, these features will be integrated into communities' plans and hopefully credited by FEMA under CRS or by private insurers.

CONCLUSION

The rising costs of flood disasters make it clear that changes to our current tactics for managing flood risks and the costs of flood disasters are needed. The growing economic impacts and social costs of devastating floods are not acceptable. Coastal communities are on the front line of climate change, increased storms, and hazardous flooding.

Political and business leaders, faced with mounting evidence in the form of more frequent high tide flooding, eroding coast lines, and unprecedented precipitation and flooding, are realizing that that climate change is having an adverse effect on their coastal communities. Motivated by experiencing the disruptions and costs associated with these events, communities are getting more serious about hazard mitigation in all its forms.

We need to stimulate wiser risk-informed land use planning, building codes, and resource protection to realize a

more secure and vibrant future. Programs like CRS can reward such leadership and should encourage others to act similarly.

Through a subsequent series of calls and meetings, the group organized by EDF and the Graham Institute plans to develop a seminal paper presenting a research roadmap capable of leading to transformation of CRS to expand community participation in meaningful planning and flood hazard mitigation activities.

A research road map informed by floodplain management experts and community leaders, would provide a vital link between government officials and the research community. The road map would guide researchers from multiple disciplines to provide more compelling evidence of the costs and benefits of investing in mitigating flood hazards. It would facilitate addressing other critical questions necessary to build broad sustained support for building community resilience.

Others wishing to participate in or be informed about the research road map as this effort continues, should contact Shannon Cunniff, EDF, or Dr. Richard Norton, University of Michigan.

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Editorial

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lution levels, and the ecological footprint of humans.

"Changing Energy: The Transition to a Sustainable Future," by John Perkins, (University of California Press) outlines the transitions we have gone through to get to our current energy economy and argues that we are now poised for a fourth energy transition. Perkins discusses climate change and geopolitical instability as the main imperatives for this change in energy. He finishes the book with criteria for acceptable new energy sources, and the benefits from and challenges to making these changes.

Finally, no *Shore & Beach* book review would be complete without a book by Gary Griggs. In "Coasts in Crisis: A Global Challenge" (University of California Press), Gary asks whether coastal regions

can adapt to natural hazards. Part One of "Coasts in Crisis" is an introduction to humans and the coast. Part Two addresses natural processes and hazards that affect the coast, things like earthquakes around the Ring of Fire, cyclones, storms, and climate change. Part Three discusses some of the Impacts of Human Activities on the Coast, including overfishing, pollution, coastal energy facilities, invasive species, ocean acidification, and finally sand, dams, and beaches. Each of these sections cover the current status of the resource or problem and finish with a discussion on "where do we go from here" that offers challenges and opportunities for beneficial change. Each section is written with Gary's attention to the science, ability to distill complex situations, and to use site-specific situations to draw broader trends and conclusions.