

Review of the Federal Emergency Management Agency's Community Rating System Program

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Abstract: This study presents the first systematic literature review of academic research on the FEMA Community Rating System (CRS) program. The CRS is a voluntary program created in 1990 as a means to incentivize communities in the United States to implement floodplain management activities that surpass those required under the National Flood Insurance Program. As participating communities adopt additional flood mitigation measures, flood insurance policyholders in those communities receive reductions in their flood insurance premiums. To identify studies for inclusion, the authors searched three academic databases using the keywords “Community Rating System” and “Federal Emergency Management Agency” and “Community Rating System” and “FEMA.” The search uncovered 44 studies that met the selection criteria (e.g., peer-reviewed, focus on CRS, and empirical) and are included in the review. The findings provide significant insights into the current state of research on the CRS. This paper concludes by providing some recommendations to policymakers aiming to enhance communities’ resilience to floods and by outlining a future research agenda for the academic and practitioner communities. **DOI:** 10.1061/(ASCE)NH.1527-6996.0000320. © 2019 American Society of Civil Engineers.

Introduction

In the United States, floods cause the most significant economic damage and affect more individuals annually than any other natural hazard (Cigler 2017; Michel-Kerjan et al. 2016). In fact, from 2000 to 2017, the United States experienced 49 significant flood events—a flood event that results in 1,500 or more paid losses, with 17 of the events exceeding more than \$1 billion in damage (FEMA 2018; NOAA 2018a). In addition, NOAA (2018b) notes that the 30-year flood loss average is \$7.96 billion in damage per year and 82 fatalities per year. The mounting costs of floods in recent years stem from a number of interrelated factors, including persistent development along the nation’s coastlines and floodplains and changes in the climate that has resulted in increased precipitation and rising sea levels (Bouwer 2011; Brody et al. 2010; Melillo et al. 2014).

Amid rising flood costs and forecasts suggesting that the number and severity of flood events will surge in the coming years (IPCC 2013), scholars have examined more closely how communities can better manage their flood risks. For example, researchers

have explored why some communities are more vulnerable to floods than others (Consoer and Milman 2018; Zahran et al. 2008), the flood planning process (Bailey 2017; Kang 2009), and the effectiveness of a variety of community-level flood mitigation strategies (Brody et al. 2007a, b, 2014; Brody and Highfield 2013). Furthermore, one area of research under the community flood risk management umbrella that has received substantial empirical attention in recent years is FEMA’s Community Rating System (CRS) program. The CRS is a voluntary program that was created in 1990 as a means to incentivize communities to implement floodplain management activities that surpass those required under the National Flood Insurance Program (NFIP) (FEMA 2017a). Specifically, under the CRS program, communities are rewarded for engaging in flood management activities that go beyond the NFIP’s purpose of regulating the construction of new homes and buildings to national standards (FEMA 2017a). As participating communities adopt additional flood mitigation measures, flood insurance policyholders in those communities receive reductions in their flood insurance premiums.

Scholars have examined various aspects of the CRS program over the past two decades, including the determinants of participation (Asche 2013; Landry and Li 2011; Li 2012; Li and Landry 2018; Paille et al. 2016; Sadiq and Noonan 2015a, b) the CRS activities that result in the greatest reduction in flood losses (Highfield and Brody 2013), and the CRS activities that are valued the most (Fan and Davlasheridze 2014). Moreover, studies have assessed the effects the CRS program has on insured flood losses (Highfield and Brody 2017), residential choice location (Fan and Davlasheridze 2014), and poverty and income inequality (Noonan and Sadiq 2018). The steady increase in the number of studies on the CRS is likely attributable to the perceived benefits of participation (i.e., reduced flood risks and lower flood insurance premiums), the minimal number of communities that participate in the program, and the need for more effective community flood risk management (FEMA 2017a; Highfield and Brody 2017; Sadiq and Noonan 2015a, b).

Given the substantial body of research on the CRS program, there is a need to establish the current state of knowledge, synthesize extant research findings, and identify directions for future

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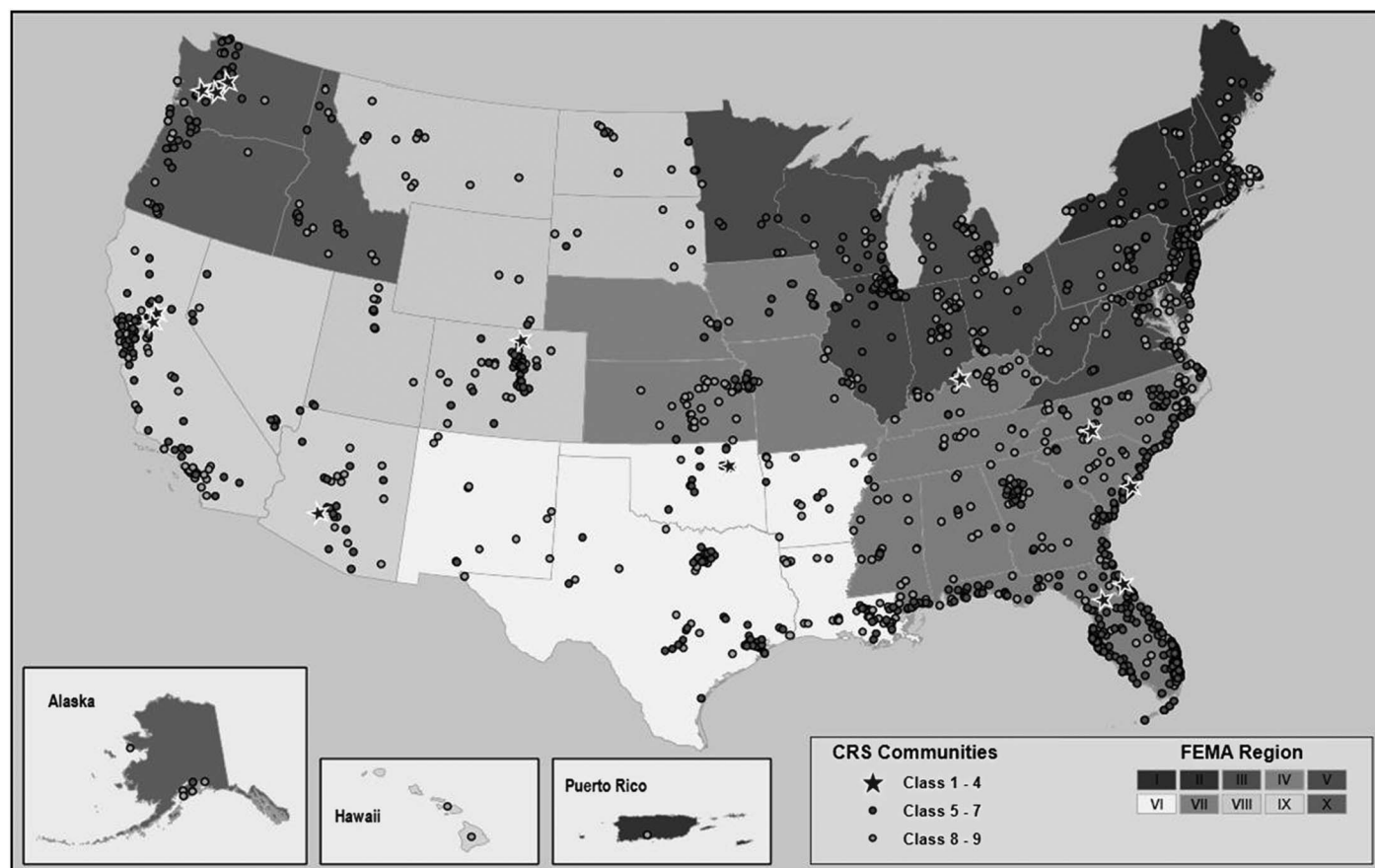


Fig. 1. Map of CRS participating communities organized by class (as of October 2017). (Reprinted from [CRS Resources 2018](#).)

research. The present study addresses this need by conducting the first systematic literature review of academic research on the CRS program. The findings provide significant insights into the current state of research on the CRS. The paper concludes by providing some recommendations to policymakers aiming to strengthen participation in the CRS program and reduce the impacts of floods on communities and by outlining a future research agenda for the academic and practitioner communities.

The remainder of this paper is organized as follows. The next section provides background on the CRS program. The third section outlines the methods used to identify studies for inclusion as well the selection criteria. The fourth section presents the results from the review and identifies recommendations to strengthen the CRS program. Finally, this paper concludes with a discussion of study findings and directions for future research on the CRS program.

Background on CRS

Since the inception of the NFIP in 1968, its purpose has been to reduce the impact of flooding on public and private infrastructures, promote the development of flood protection activities in communities, and provide affordable insurance to property owners ([FEMA 2017a](#)). However, to acquire flood insurance through the NFIP, the property must be located in a community that participates in the NFIP. Participating NFIP communities are required to adopt and enforce floodplain ordinances that regulate development in flood risk areas. As of 2017, over 22,200 communities in the United States and its territories participate in the NFIP ([FEMA 2017a](#)).

To further the mission of the NFIP, FEMA implemented the CRS in 1990 as a voluntary program to incentivize communities

to surpass the expectations of the NFIP. Indeed, under the CRS, communities are rewarded for engaging in flood management activities that go beyond the NFIP's purpose of regulating the construction of new homes and buildings to national standards ([FEMA 2017a](#)). The three goals of the CRS are to reduce flood damage to insurable property, strengthen and support the insurance aspects of the NFIP, and foster comprehensive floodplain management ([FEMA 2017a](#)). When communities develop flood management activities that reflect these three goals, they receive varying levels of discounts in flood insurance premiums based on their CRS class and on whether or not they are located in a Special Flood Hazard Area (SFHA)—an area with a 1% chance of flooding in any given year. However, despite the benefit of flood insurance premium reductions, as of 2017, only 1,444 (6.5%) of communities that participate in the NFIP also participate in the CRS ([FEMA 2017a](#)). Nevertheless, over 69% of flood insurance policies are in CRS communities ([FEMA 2017b](#)). Fig. 1 shows the location of CRS participating communities.

Communities participating in the CRS are organized into 10 classes based on their credit points ([FEMA 2017a](#)). These rankings are based on the number of credit points a community has earned in 500-point increments such that a community can range from 0–499 (a Class 10 community) to 4,500 and over (a Class 1 community). Class 10 represents communities that do not participate or do not possess the minimum number of credit points to enter the program; flood insurance policyholders in these communities receive no discount in flood insurance premiums. Class 1 represents communities with exceptional floodplain management activities; flood insurance policyholders residing in Class 1 communities experience a 45% discount in their flood insurance premiums (if they are located

Table 1. CRS classes, credit points, and premium discounts based on location in or outside an SFHA

CRS class	Credit points	Premium reduction	
		In SFHA (%)	Outside SFHA (%)
1	4,500+	45	10
2	4,000–4,499	40	10
3	3,500–3,999	35	10
4	3,000–3,499	30	10
5	2,500–2,999	25	10
6	2,000–2,499	20	10
7	1,500–1,999	15	5
8	1,000–1,499	10	5
9	500–999	5	5
10	0–499	0	0

Source: Data from FEMA (2017a).

in a SFHA) (Table 1). The intermediate classes receive discounted flood insurance premiums in increments of 5%. In other words, flood insurance policyholders residing in a Class 9 community receive a 5% discount, flood insurance policyholders residing in a Class 8 community receives a 10% discount, and so forth. A vast majority of communities participating in the CRS program fall in the class range of 8 and 9 (56%) and 5 through 7 (44%) (CRS Resources 2012). Only 7 of the nearly 1,500 communities participating have obtained the Class 1 ranking (FEMA 2017a).

Communities accumulate credit points as they adopt any of the 19 creditable activities that advance the CRS's goals and span across 1 of the 4 categories: public information, mapping and regulations, flood damage reduction, and warning and response (Table 2) (FEMA 2017a). Activities that promote public information include advising individuals about flood hazards and encouraging property owners to purchase flood insurance. Mapping and regulation activities center on preserving open spaces, protecting natural floodplain measures, enforcing standards, and managing stormwater. FEMA also awards credit points to communities that endorse flood damage reduction activities, such as creating a comprehensive floodplain management plan, relocating or retrofitting structures, and maintaining drainage systems, which help prevent repetitive losses (Landry and Li 2011). Lastly, communities receive points for implementing measures that protect life and property in the event of a flood disaster through warning and response programs. The amount of credit points given to communities varies by the mitigation activity in each category. Furthermore, although the CRS attempts to draw up a comprehensive list of credited activities, it recognizes that communities might engage in activities that are not specified as a creditable activity. An Insurance Services Office (ISO) specialist reviews these instances on a case-by-case basis. The ISO also administers the day-to-day operations of the CRS program on behalf of FEMA and is responsible for assisting communities with the CRS application process.

To participate in the CRS program, a community must be in full compliance with the rules and regulations of the NFIP for at least 1 year (FEMA 2017a). The application process begins with the community submitting a letter of interest and proof that its flood protection activities would credit more than 499 points to their state's ISO specialist. The request is then forwarded to the regional FEMA office, which assesses the community's request based on its NFIP compliance and additional actions taken to reduce the impact of flood disasters. If FEMA approves the request, the ISO specialist schedules a community verification visit to determine the community's class by assessing the number of flood protection activities deserving of credit. ISO then submits the findings to FEMA, who will verify the ISO specialist's findings and notify the requesting community of its

Table 2. Credit points awarded for CRS activities

Activity	Maximum possible points	Percentage of communities credited
300 Public Information		
310 Elevation Certificates	116	96
320 Map Information Service	90	85
330 Outreach Projects	350	93
340 Hazard Disclosure	80	84
350 Flood Protection Information	125	87
360 Flood Protection Assistance	110	41
370 Flood Insurance Promotion	110	4
400 Mapping & Regulations		
410 Floodplain Mapping	802	55
420 Open Space Preservation	2,020	89
430 Higher Regulatory Standards	2,042	100
440 Flood Data Maintenance	222	95
450 Stormwater Management	755	87
500 Flood Damage Reduction		
510 Floodplain Management Planning	622	64
520 Acquisition and Relocation	2,250	28
530 Flood Protection	1,600	13
540 Drainage System Maintenance	570	43
600 Flood Preparedness		
610 Flood Warning and Response	395	20
620 Levees	235	0.5
630 Dams	160	35

Source: Data from FEMA (2017a).

initial classification in the CRS. To ensure communities continue to implement flood protection activities, the CRS requires communities to recertify every year. Based on this recertification, communities who are adding additional credited activities can advance to a higher ranking. However, communities that do not implement credited activities properly or fully may receive a lesser ranking.

Regardless of a community's ranking, the benefits of the CRS can be enticing for communities that are especially vulnerable to flood disasters. The most compelling benefit of participating in the CRS is the reduction in flood insurance premiums. However, participation can also yield nonmonetary benefits (FEMA 2017a). For example, the implementation of robust flood mitigation measures that can reduce property and infrastructure damage, as well as minimize economic disruptions and reduce human suffering is arguably the most significant long-term benefit of participating in the CRS (Noonan and Sadiq 2018). An additional benefit of participation in the CRS is the ability to join CRS user groups. These groups provide a mechanism of support for communities as they implement their flood protection activities. Furthermore, CRS program managers provide training and technical assistance to participating communities to design dynamic flood protection measures at no cost. For additional information regarding the benefits of the CRS, see Stiff (2017).

However, despite the aforementioned benefits of participating in the CRS, some scholars have expressed concern over the potential negative consequences and fairness of the CRS program. Dixon et al. (2006), for example, argue that CRS activities designed to improve structural flood mitigation might also reduce a community's perceived risk, thereby negating the effects of decreased insurance rates and public education. Moreover, Zahran et al. (2010) question the fairness of the program in terms of the classes and the associated discounts in flood insurance premiums. Specifically, these authors disagree with the idea that a community possessing 1,501 credit points receives the same discount in flood insurance premiums as a community with 1,999 points who has spent more

time, money, and effort in reducing flood disasters. Furthermore, the discounts are offset by all policyholders in both participating and nonparticipating communities. Finally, Noonan and Sadiq (2018) consider some of the unintended consequences of CRS participation and find evidence that participation in the CRS promotes income inequality. Considered together, these concerns call for a greater understanding of the effectiveness of the CRS program, the benefits of participating in the program, and some of the unintended consequences of participation.

Methods

Search Strategy

To identify studies that examined the CRS program, the authors adopted a three-stage approach. The first stage involved searching three academic databases—Google Scholar, Science Direct, and Web of Science—for relevant studies (Bubeck et al. 2012; Thompson et al. 2017). This search began in April 2018 using the keywords “Community Rating System” and “FEMA.” This keyword search yielded 988 documents. Of these 988 documents, 36 studies met the selection criteria (discussed subsequently), 909 studies did not meet the selection criteria, and 43 studies were found multiple times within the same database or in a different database (i.e., study was indexed in both Google Scholar and Web of Science). The three databases were also searched using the keywords “Community Rating System” and “Federal Emergency Management Agency.” This keyword search generated 895 documents, with the majority ($N = 773$) of the studies having been identified in the first keyword search. Nonetheless, this keyword search led to the identification of six new studies that met the selection criteria. Although the keyword searches were completed in early May, Google Scholar alerts were used to receive any recently published studies that contained any of the keyword searches. As of July 11, 2018, Google Scholar alerts yielded an additional 11 studies, none of which matched the selection criteria. In sum, at the end of the first stage, 1,883 studies had been screened, 1,067 studies reviewed, and 42 identified that met the selection criteria.

In the second stage, a backward citation search of all 42 studies found in Stage 1 was carried out. By backward citation search, we mean reviewing the the references of each study to determine whether any relevant studies were not identified during the keyword searches. Through this process, two additional studies that met the selection criteria were identified. At the end of Stage 2, the number of studies included in the review had increased to 44.

The third and final stage consisted of sending the 44 studies found in the previous 2 stages to 6 scholars who are experts on the CRS program. These experts come from a variety of disciplines (e.g., urban and regional planning, economics, and sociology) and have extensively investigated various aspects of the CRS program as well as other topics related to community flood risk management. Of the six experts contacted, three responded. These 3 experts were asked to review the initial 44 studies to confirm that they met the selection criteria and to offer any additional studies that might not have been included in the original keyword searches or that were forthcoming in a peer-reviewed journal. The 3 experts validated the initial 44 studies and could not identify any additional studies. At the conclusion of this final stage, 44 studies had been identified that met the selection criteria, and they are included in the review.

Selection Criteria

Studies were selected for inclusion as long as they met the following criteria: (1) written in English; (2) peer-reviewed journal article,

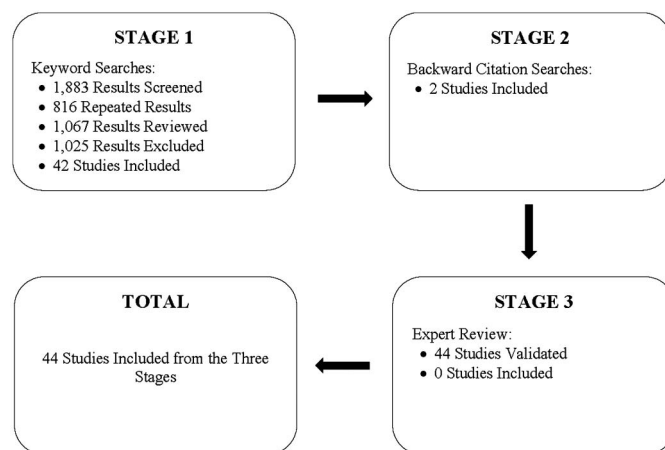


Fig. 2. Search strategy and selection process utilizing the three-stage approach.

conference paper, conference proceeding, or dissertation; (3) focus on the CRS program (e.g., include the CRS program as a dependent, independent, or control variable); and (4) empirical, thus relying on experience or observations (studies might use primary or secondary data as well as quantitative or qualitative data). For organizational purposes, a spreadsheet was developed to track studies that met and did not meet the specified selection criteria. Specifically, for every study generated by each keyword search, one of the authors reviewed the full-text version of the study to determine whether it met the criteria for inclusion. If this author determined that the study did in fact meet the selection criteria, it was listed in a spreadsheet for coding purposes. If the researcher determined the study did not meet the criteria, this author listed the study in a separate spreadsheet and coded the reason for exclusion, such as not written in English, is not a peer-reviewed journal article, conference paper, conference proceeding, or dissertation, does not focus on the CRS program, or is not empirical. Of the 1,067 studies reviewed, 23 were excluded for not being written in English; 700 were excluded for not being a peer-reviewed journal article, conference paper, conference proceeding, or dissertation; 278 were excluded for not focusing on the CRS program; and 24 were excluded for not being empirical. Fig. 2 illustrates the search strategy and the selection process used for this study.

Article Review Strategy

Two of the authors reviewed the 44 studies included in the review and identified the purpose, methodological qualities, and major findings of each study. To maintain intercoder reliability, these 2 individuals separately reviewed and coded 10 randomly selected articles. After reviewing and coding the 10 articles, these 2 individuals compared their codes and discovered only 1 discrepancy in the codes, which was resolved by consensus. The authors evenly distributed the remaining studies, reviewed them, coded them individually, and found no additional issues.

Results

Methodological Qualities

Table 3 provides an overview of the methodological qualities coded for the 44 studies included in this review. The first methodological quality that was coded for was the research objective. Research

Table 3. Summary of study qualities, descriptions, and results

Study quality	Description	Result
Research objectives	Research question(s) or the primary purpose of each study are organized into five objectives.	CRS ($N = 16$), Effective community flood risk management ($N = 17$), flood insurance policies and claims ($N = 5$), enhancing disaster resilience ($N = 3$), planning for floods ($N = 3$)
Geographical focus	This is measured as whether a study focused on a coastal area, inland area, or both.	Inland ($N = 0$), coastal ($N = 17$), both ($N = 26$), not reported ($N = 1$).
Study location	This is the specific state(s) studied (excludes $N = 9$ studies that focused on all 50 states).	Florida ($N = 11$), Texas ($N = 10$), Mississippi ($N = 7$), Louisiana ($N = 7$), North Carolina ($N = 5$), Alabama ($N = 3$), Georgia ($N = 3$), Arkansas ($N = 2$), Illinois ($N = 2$), Iowa ($N = 2$), Kentucky ($N = 2$), Missouri ($N = 2$), New Jersey ($N = 2$), Tennessee ($N = 2$), Wisconsin ($N = 2$), California ($N = 1$), Colorado ($N = 1$), Connecticut ($N = 1$), Delaware ($N = 1$), Kansas ($N = 1$), Maine ($N = 1$), Maryland ($N = 1$), Massachusetts ($N = 1$), Minnesota ($N = 1$), Montana ($N = 1$), Nebraska ($N = 1$), New Hampshire ($N = 1$), New York ($N = 1$), North Dakota ($N = 1$), Oklahoma ($N = 1$), Pennsylvania ($N = 1$), Rhode Island ($N = 1$), South Dakota ($N = 1$), Virginia ($N = 1$), West Virginia ($N = 1$)
Type of study	Measured as whether a study conducted quantitative analysis, qualitative analysis, or both.	Quantitative ($N = 42$), qualitative ($N = 0$), both ($N = 2$)
Length of study	Measured as whether the study employs cross-sectional or panel data.	Cross-sectional ($N = 15$), panel ($N = 28$), not reported ($N = 1$)
Data type	Measured as whether a study utilized primary data, secondary data, or both.	Primary ($N = 1$), secondary ($N = 37$), both ($N = 6$)
Response rate	Response rate reported by a study.	Only 6 of the 44 studies reported a response rate; highest and lowest response rates are 97% and 17%, respectively, with average response rate being 48.9%
Variable type	Measured as whether the CRS was used in a study as a dependent, independent, or control variable.	Dependent ($N = 13$), independent ($N = 26$), control ($N = 2$); three studies were descriptive in nature and did not include variables
Analytical approach	Analytical approaches are organized into seven groups—univariate/bivariate analysis, regression analysis, multiple-equation models, spatial analysis, any combination of the previous four groups, qualitative analysis, and a combination of any of the first four groups and qualitative analysis.	Univariate/bivariate analysis ($N = 2$), regression ($N = 24$), multiple equation model ($N = 3$), spatial analysis ($N = 1$), any combination of the previous four groups ($N = 9$), a combination of any of the first four groups and qualitative analysis ($N = 5$)
Author discipline	Measured as discipline of highest degree obtained by each author.	Social sciences ($N = 99$), natural sciences ($N = 8$), engineering ($N = 1$), medical ($N = 2$)

objectives were organized based on each study's research question(s) or purpose. Of the 44 studies included in the review, a large number focused on effective community flood risk management in general ($N = 17$) or the CRS program in particular ($N = 16$). Additional studies examine flood insurance policies and claims ($N = 5$), enhancing disaster resilience ($N = 3$), and planning for floods ($N = 3$). In addition, the geographical focus (e.g., coastal, inland, or both) and the location of each study were identified. In terms of geographical focus, a large number of studies examined coastal communities ($N = 17$) or a combination of both coastal and inland communities ($N = 26$); no study examined solely inland communities. Furthermore, the majority of studies were conducted, at least in part, in Florida ($N = 11$) or Texas ($N = 10$). Other coastal states, including Mississippi ($N = 7$) and Louisiana ($N = 7$), also received empirical attention. Furthermore, coding was based on whether a study used quantitative or qualitative methodologies and cross-sectional or panel data and relied on primary or secondary data. Upon reviewing the 44 studies, it was found that the vast majority of studies included in this review used quantitative methodologies ($N = 42$), used panel data ($N = 28$), and relied on secondary data ($N = 37$). It was also found that the average response rate of the six studies that reported a response rate was 48.9% (the highest and lowest response rates were 97% and 17%, respectively). In addition, just over half of the studies ($N = 26$) used the CRS as an independent variable, and the researchers generally relied on a variety of analytical approaches to examine their data, though the most prominent was regression ($N = 24$). Finally, the

authors' discipline was recorded for each study to determine which disciplines study the CRS. Author discipline is the discipline of the highest degree obtained by each author, and it was found that social scientists ($N = 99$) make up the vast majority of scholars studying the CRS.

Study Findings

Table 4 displays the findings related to the CRS for the 44 studies included in this review. Findings are organized based on eight themes: (1) factors enhancing and inhibiting CRS participation; (2) planning for floods under the CRS; (3) effectiveness of the CRS at reducing flood losses; (4) flood insurance policies; (5) impact of CRS on disaster recovery outcomes; (6) value of CRS activities; (7) predictors of CRS points/ratings/scores; and (8) perverse incentives and unintended consequences of the CRS. The findings included under these themes are discussed in subsequent sections. However, before this is done, it is important to note that a handful of scholars used the same data for similar publication purposes ($N = 6$) and, as result, produced similar findings. Generally, this was a result of a dissertation or conference paper being turned into a published journal article. It is also important to recognize that while 44 studies met the selection criteria and are included in the review, only 41 studies explicitly reported findings regarding the CRS. Hence, Table 4 only includes the findings related to the CRS for 41 studies.

Table 4. Major CRS findings from each study ($N = 41$)

Reference	Findings related to CRS
<i>Theme 1. Factors enhancing and inhibiting CRS participation</i>	
Asche (2013)	Population size, income, amount of owner occupied housing, and historical flood risk positively influence participation in the CRS at the county level.
Bailey (2017)	Participation in CRS program is not popular within the study sample. In fact, only 9 out of the 108 counties included in the sample participate in the CRS program. Furthermore, the nine counties that do participate in the program have low classifications.
Fan and Davlasheridze (2014)	Communities with higher levels of educational attainment are more likely to participate in the CRS.
Husein (2012)	Approximately 65% of local jurisdictions in coastal Texas participate in the NFIP a great deal, whereas approximately 19% participate in the NFIP somewhat. Furthermore, approximately 37% of eligible NFIP communities participate in the CRS very actively, 23% participate in the CRS somewhat, and 11% participate in the CRS to a small extent.
Mayunga (2009)	Counties in the state of Florida maintain higher CRS scores, indicating that most counties have implemented the required flood management measures under the NFIP.
Landry and Li (2011)	Participation in the CRS is greater in counties with higher tax revenues, educational attainment levels, and proportions of senior citizens. Furthermore, counties are more likely to engage in flood mitigation activities when a greater number of nested municipalities participate in the CRS. Finally, results indicate that windows of opportunity immediately following disasters influence counties' decision to participate in the CRS.
Li (2012)	Counties with higher educational attainment levels and proportions of senior citizens are significantly more likely to participate in the CRS. In addition, counties are more likely to engage in flood mitigation activities when a greater number of nested municipalities participate in the CRS.
Li and Landry (2018)	Communities are more likely to participate in the CRS when they have higher tax revenues and lower crime and unemployment levels.
Posey (2008)	Communities with higher average incomes and education levels are more likely to participate in the CRS. In addition, communities with higher numbers of persons living in poverty and larger concentrations of minorities are less likely to participate in the CRS.
Posey (2009)	Communities with high income populations are more likely to participate in the CRS, whereas communities with moderate-income populations and higher minority populations are less likely to participate in the CRS. Furthermore, results indicate that communities with a higher flood risk are significantly more likely to participate in the CRS. Interestingly, findings were not affected by the form of government observed or budgetary factors.
Sadiq and Noonan (2015b)	Local capacity, flood risk, socioeconomic characteristics, and political economy factors are significant predictors of CRS participation.
<i>Theme 2. Planning for floods under the CRS</i>	
Bailey (2017)	State mitigation plans generally focus on addressing repetitive loss properties as well as promoting both the NFIP and the CRS. In fact, of the 10 states included in the study, only 1 did not mention the CRS when discussing nonstructural mitigation measures in their state mitigation plan.
Berke et al. (2014a)	CRS participation does not have a significant impact on five of the six recovery plan quality principles. Indeed, the CRS only influences the public participation principle, indicating that CRS participating communities are more likely to include public participatory processes in their recovery plans. Enrollment in the CRS only influenced the public participation principle but does not affect the remaining principles.
Berke et al. (2014b)	Unexpectedly, the authors found that the CRS program's incentive scheme does not encourage local governments to support more preventive land-use actions in the policy element of mitigation plans.
<i>Theme 3. Effectiveness of CRS in reducing flood losses</i>	
Asche (2013)	Communities with higher flood risks that participate in the CRS experience higher insured losses. However, the interaction between a community's flood risk and CRS score is a significant, negative predictor of flood losses. This indicates that the CRS is effective at achieving its goal of reducing flood losses in communities with high flood risks. It also suggests that if flood risks increase throughout the United States, the benefits associated with participating in the CRS will become more apparent.
Brody et al. (2012)	Participation in the CRS does not have a significant effect on flood losses.
Brody et al. (2007a)	Counties with higher CRS scores experience less flood damage. In fact, an increase in CRS class corresponds to a \$38,989 reduction in average costs per flood. Furthermore, findings indicate that CRS participation leads to a greater reduction in flood damage than dams, which are more expensive for communities to implement.
Brody et al. (2007b)	Nonstructural mitigation activities measured by CRS class are twice as effective at reducing flood damage as dams. In fact, a one-unit increase in CRS rating leads to a \$303,525 reduction in the average amount of flood damage. This suggests that nonstructural mitigation activities and implementing local land-use policies reduce property damage incurred from floods. This is likely due to the movement away from vulnerable areas. However, despite the benefits of the CRS, wetlands appear to reduce property loss from floods more so than dams and CRS class.
Davlasheridze (2013)	On average, counties with a CRS class of seven or better will experience \$2.02 million less in property damage in any given year. Results indicate that this is attributable to effective code enforcement. Results also suggest that activities worth 500 credit points—leading to a better CRS class—lead to average savings in property losses of \$1.6 million. In addition, counties with more CRS credit points are more resilient to local labor market shocks. Finally, results indicate that counties that are less dependent on external assistance and better equipped to manage disaster with their own resources are also better equipped to implement a sustainable hazard mitigation approach, as evident from the CRS program.
Deegan (2007)	The CRS policy mix, which refers to a policy mix that included all four activities in the community rating system: public information, mapping and regulations, flood damage reduction, and flood preparedness represented the most effective policy in terms of managing flood damage and vulnerability.

Table 4. (Continued.)

Reference	Findings related to CRS
Highfield and Brody (2017)	Participation in the CRS significantly reduces the amount of insured flood losses incurred by communities. In fact, on average, participating CRS communities experience a 41.6% reduction in flood claims compared to communities that do not participate in the CRS.
Highfield et al. (2014)	Participation in the CRS significantly reduces flood losses at the parcel level. Specifically, results indicate that CRS participating communities experience an 88% reduction in mean flood damage compared to communities that do not participate in the program. Furthermore, for every point increase in a community's total number of CRS points, there is a 0.06% reduction in property damage at the parcel level.
Kim (2015)	Participation in the CRS coupled, adopting building regulations, and implementing structural hazard mitigation measures are negatively associated with disaster losses, indicating that these measures are effective at reducing losses.
Li (2012)	The CRS is effective at reducing average property damage incurred from flood events.
Kousky and Michel-Kerjan (2017)	Communities that participate in the CRS at a Class 9 and Class 8 experience approximately 13.5% fewer individual flood claims when compared to communities that do not participate in the CRS. This suggests that communities implementing a minimal number of mitigation activities under the CRS still see reductions in individual flood claim amounts. Furthermore, results indicate that a 100-point increase in CRS class reduces flood claims by approximately 2.5%.
Michel-Kerjan and Kousky (2010)	Participation in the CRS program can lead to reduced individual flood claim amounts, yet results indicate that the most significant reductions in flood claim amounts occur in communities that participate in the CRS at a Class 5 level or better.
Petrolia et al. (2013)	Implementing activities included under the CRS results in lower prices of flood insurance and reduced likelihood or magnitude of loss.
Zahran et al. (2008)	Participation in the CRS significantly lowers the risk that a community will experience a flood-related casualty.
<i>Theme 4. Flood insurance policies</i>	
Brody et al. (2017a)	Individuals residing in communities with higher CRS scores are significantly more likely to purchase flood insurance under the NFIP. In fact, respondents are 2.3 times more likely to have a flood insurance policy if they reside in a better CRS class.
Brody et al. (2017b)	Individuals residing in jurisdictions with higher CRS scores are significantly more likely to have adopted a range of information-based flood adjustments, including the decision to purchase flood insurance.
Petrolia et al. (2013)	Individuals residing in communities with a better CRS class are significantly more likely to purchase flood insurance. In fact, a one-unit increase in CRS class increases the likelihood that community members will hold a flood insurance policy by 3%. However, this is not the case in Florida, where better CRS classes are associated with lower levels of flood insurance purchase.
Zahran et al. (2009)	Counties with higher CRS scores also contain higher numbers of flood insurance policyholders. In fact, a 1% increase in CRS points earned (from the mean) results in an increase of 0.13% to 0.23% in the number of NFIP policies per 100 households.
<i>Theme 5. Impact of CRS on disaster recovery outcomes</i>	
Burton (2012)	The presence of a mitigation plan and participation in the NFIP, CRS, and Citizen Corps may lead to a more positive recovery. In fact, with regard to the CRS, there is a positive and significant relationship between CRS participation and the odds of moving from one recovery category to the next.
Burton (2015)	Communities participating in the CRS experienced significantly better disaster recovery outcomes 1, 3, and 5 years after Hurricane Katrina.
<i>Theme 6. Value of CRS activities</i>	
Brody and Highfield (2013)	Open space protection is an effective strategy for reducing flood losses. Indeed, a point increase in the open space protection activity under the CRS significantly reduces insured flood damage in floodplain areas. Findings also indicate that other mitigation activities under the CRS, for example, warning programs, housing relocation, and drainage maintenance, lead to reductions in flood damage.
Brody et al. (2009)	Communities participating in the CRS appear to favor activities under CRS Series 300 (Public Information) and 400 (Mapping and Regulations).
Fan and Davlasheridze (2014)	People tend to place the highest value on CRS activities aimed at reducing repetitive flood losses. Public information disclosure about a community's flood risks is the second highest activity valued under the CRS. Results also indicate that retirees and college graduates value CRS activities related to flood damage reduction and public information. Finally, results suggest that the CRS program influences individuals' location choices.
Fan and Davlasheridze (2016)	In general, households are willing to pay a significant amount of money to improve community flood risk management. In fact, the marginal willingness to pay per additional credit point is \$25 for CRS series 300 (Public Information), \$169 for CRS 400 (Mapping and Regulations), and \$129 for CRS 500 (Flood Damage Reduction). Furthermore, people place a higher value on activities related to public information and flood damage reduction. Furthermore, more educated individuals tend to value the CRS program more than less educated individuals. Finally, results indicate that the long-term benefits of CRS participation could be greater than the immediate benefits (e.g., insurance premium discounts). This indicates that individuals prefer communal flood protection in addition to discounts in flood insurance premiums.
Highfield and Brody (2013)	The adoption of three CRS activities—freeboard requirements, open space protection, and flood protection—leads to significant reductions in flood damage.
Highfield et al. (2014)	Activities included under CRS Series 300 (Public Information), 400 (Mapping and Regulations), and 500 (Flood Damage Reduction) lead to significant reductions in property damage. Yet, findings indicate that activity 430 (Higher Regulatory Standards), which includes development restrictions in floodplains, implementation of freeboard requirements, and increased requirements for V-zone properties, generates the highest savings.
Li and Landry (2018)	Communities tend to persistently invest in activities under CRS Series 400 (Mapping and Regulations) and 500 (Flood Damage Reduction) more than activities under CRS Series 300 (Public Information) and 600 (Flood Preparedness).
Petrolia et al. (2013)	Structural flood mitigation activities under the CRS are more effective at increasing the number of NFIP flood insurance policyholders, while information-based activities under the CRS are not.

Table 4. (Continued.)

Reference	Findings related to CRS
Zahran et al. (2008)	Communities that engage in public information, mapping and regulation, and flood damage reduction CRS activities experience significantly lower levels of flood-related casualties.
<i>Theme 7. Predictors of CRS scores/ratings/points</i>	
Blessing et al. (2017)	Flood claims located within 100-year floodplains had significantly more CRS points.
Brody et al. (2017b)	Higher CRS scores are significantly correlated with longer household tenure, more flood experience, and being located within a 100-year floodplain.
Brody et al. (2009)	Flood history significantly increases communities' overall CRS scores. This suggests that communities react to hazard events. Furthermore, results indicate that moving from zero land area in a floodplain to 100% overlap decreases the overall CRS score by 4.65%.
Li and Landry (2018)	Communities with higher median household incomes and higher population densities also have more CRS points.
Paille et al. (2016)	Communities with higher median housing values also have higher CRS scores. Furthermore, higher CRS scores are found in counties that have more local communities that participate in the CRS program. However, the number of floods in the past 5 years and the revenue base of the county does not appear to affect the CRS score.
Sadiq and Noonan (2015b)	Communities' property values appear to reduce CRS scores. Furthermore, flood risk does not appear to be a significant predictor of CRS scores.
<i>Theme 8. Perverse incentives and unintended consequences of the CRS</i>	
Brody et al. (2009)	Communities that participate in the CRS appear to be pursuing a "low-hanging-fruit" strategy when it comes to accumulated credit points. Indeed, CRS participating communities appear to participate in activities under CRS Series 300 (Public Information) and 400 (Mapping and Regulations), which are generally less expensive in comparison to activities under CRS Series 500 (Flood Damage Reduction) and 600 (Warning and Response). Furthermore, results indicate that the factors influencing CRS policy learning differ by activity series. For example, results indicate that increases in overall CRS scores are stunted for communities with a quarter of land area in a floodplain.
Brody et al. (2007b)	The CRS offers a perverse incentive for individuals to reside in high-flood-risk areas. Specifically, the discounts in flood insurance premiums make it less expensive for individuals to reside in a 100-year floodplain. Hence, it could be argued that the CRS system might actually encourage development in areas that are most vulnerable to flooding. This makes sense given that the findings from this study indicate that the CRS is not as effective at reducing high-damage floods when compared to wetlands.
Noonan and Sadiq (2018)	The CRS appears to attract poor residents but relocates them out of floodplains. Furthermore, the CRS tends to attract top earners, including in floodplains. These findings suggest that the CRS encourages income inequality outside floodplains but discourages income inequality inside floodplains.
Sadiq and Noonan (2015a)	Communities that react to the CRS program's nonlinear, tiered incentives are different from communities that do not. Specifically, CRS participating communities that engage in less flood mitigation generally have lower flood risks, property values, government payrolls, and population densities. Furthermore, results indicate that at lower levels of CRS participation, communities tend to adopt more passive or nonstructural mitigation measures.
Schechtman (2016)	Communities are less likely to be motivated by the incentives associated with the CRS when it comes to taking actions to protect against climate change. Yet, in a few towns, respondents reported that the CRS is the key adaptation tool and has significant support among elected officials.
Zahran et al. (2010)	Communities appear to behave strategically and are driven by the nonlinear, tiered incentive design of the CRS program. In addition, communities seem to be motivated by the easy gains embedded in the CRS program.

Factors Enhancing and Inhibiting CRS Participation

Of the 44 studies included in this review, 11 provide evidence of the factors enhancing and inhibiting CRS participation. Considered together, results indicate that participation in the CRS is greater in places with higher flood risks, population sizes, incomes, owner-occupied housing, educational attainment levels, and proportions of senior citizens (Asche 2013; Fan and Davlasheridze 2014; Landry and Li 2011; Li 2012; Li and Landry 2018; Posey 2008, 2009; Sadiq and Noonan 2015b). Furthermore, studies suggest that places are more likely to engage in more flood mitigation activities when a greater number of nested municipalities participate in the CRS (Landry and Li 2012; Li 2012). Results also demonstrate that CRS participation is lower in places with higher unemployment, poverty, crime rates, and minority populations (Landry and Li 2012; Li and Landry 2018; Li 2012; Posey 2008, 2009). A few studies, however, found conflicting results with regard to the determinants of CRS participation. For example, some scholars (e.g., Sadiq and Noonan 2015b) found a significantly negative relationship between property tax revenues and CRS participation, while other scholars found a significantly positive relationship (Landry and Li 2011; Li 2012; Li and Landry 2018). A possible explanation for these divergent findings is that Sadiq and Noonan (2015b) used Census places (cities,

towns, or townships) as their unit of analysis, whereas Li (2012) and his colleague (Li and Landry 2018) analyze counties. Finally, a few studies revealed that, while CRS participation remains rather low (Bailey 2017), communities in Texas and Florida make up a large proportion of the communities that participate in the program (Husein 2012; Mayunga 2009). Perhaps this is because Texas has the highest flood-related fatalities in the United States (Zahran et al. 2008) and Florida is routinely affected by major hurricanes that lead to substantial flooding (Brody et al. 2007a).

Planning for Floods under the CRS

Three studies included in this review demonstrate the impact the CRS has on the quality of mitigation and recovery plans. Although one study included in this review indicates that state mitigation plans generally focus on the CRS (Bailey 2017), other studies suggest that the CRS program does not significantly improve the quality of mitigation and recovery plans (Berke et al. 2014a, b). For example, Berke et al. (2014b) find that the CRS program's incentive scheme does not encourage local governments to support more preventive land-use actions in the policy element of mitigation plans. Furthermore, Berke et al. (2014a) find that CRS participation only had a significant impact on one plan quality principle—public

participation. This suggests that CRS participating communities are more likely to include public participatory processes in their recovery plans.

Effectiveness of CRS at Reducing Flood Losses

Of the 44 studies, 14 produced findings related to the effectiveness of the CRS in terms of reducing flood losses. The majority of these studies indicate that participation in the CRS program does indeed lead to significant reductions in flood losses, measured as less property damage (Brody et al. 2007a, b; Davlasheridze 2013; Highfield et al. 2014; Li 2012), property and crop damage (Kim 2015), flood claims (Asche 2013; Highfield and Brody 2017; Kousky and Michel-Kerjan 2017; Michel-Kerjan and Kousky 2010), and flood casualties (Zahran et al. 2008). Furthermore, Asche (2013) finds that the interaction between a community's flood risk and CRS score is a significant, negative predictor of flood losses. This indicates that the CRS is effective at achieving its goal of reducing flood losses in communities with high flood risks. It is important to note, however, that until flood maps, floodplain regulations, and compliance with NFIP and CRS require that increased rainfall, sea level rise, and factors like subsidence and residual risk from levees and dams be accounted for at the local level, CRS credits need to be significantly reduced. Some CRS credits address the impact of future conditions, but not all. While risks will be increasing, communities will be receiving credit for actions that are not effective at reducing future flood risks. It is also important to recognize that one study (e.g., Brody et al. 2012) included in this review finds that participation in the CRS has no significant effect on reducing flood losses. Brody et al. (2012), for example, do, however, recognize this inconsistent finding and maintain that the CRS is generally effective at reducing flood losses.

Flood Insurance Policies

Four studies provide evidence on the relationship between the CRS and flood insurance policies. The results from these studies suggest that individuals residing in communities with higher CRS scores or in better CRS classes are significantly more likely to be flood insurance policyholders (Brody et al. 2017a, b; Petrolia et al. 2013; Zahran et al. 2009). However, interestingly, Petrolia et al. (2013) found that this is not the case for residents in Florida, where better CRS classes are not associated with higher levels of flood insurance purchases. This suggests that residents in Florida might not be motivated by reductions in flood insurance premiums (Petrolia et al. 2013).

Impact of CRS on Disaster Recovery Outcomes

Only two studies included in this review explore the impact the CRS has on disaster recovery outcomes. Nonetheless, both of these studies provide evidence that participation in the CRS program leads to positive recovery outcomes (Burton 2012, 2015). Indeed, when examining recovery following Hurricane Katrina, Burton (2012, 2015) found that CRS participating communities were significantly more likely to experience better recovery outcomes (measured as the reconstruction of the built environment) 1, 3, and 5 years after the storm. This suggests that communities who put more forethought into flood risk management are better equipped to experience positive recovery outcomes.

Value of CRS Activities

Nine studies provide evidence on the value of CRS activities (Fan and Davlasheridze 2014, 2016), the activities that result in the greatest reduction in flood damage (Brody and Highfield 2013; Highfield and Brody 2013; Highfield et al. 2014) and flood casualties (Zahran et al. 2008), the activities communities tend to persistently invest in (Li and Landry 2018), and the activities that lead

to increases in the number of NFIP flood insurance policyholders (Petrolia et al. 2013). Concerning the CRS activities individuals value most, Fan and Davlasheridze (2014) find that people in general tend to place the highest value on CRS activities aimed at reducing repetitive flood losses. Public information disclosure about a community's flood risks is the second highest activity valued under the CRS (Fan and Davlasheridze 2014). These authors also find that retirees and college graduates value CRS activities related to flood damage reduction and public information (Fan and Davlasheridze 2014, 2016). Furthermore, results indicate that a variety of CRS activities, including open space protection, free-board requirements, and flood protection (Brody and Highfield 2013; Highfield and Brody 2013), as well as additional activities included under CRS Series 300 (Public Information), 400 (Mapping and Regulations), and 500 (Flood Damage Reduction) (Highfield et al. 2014), result in significant reductions in flood losses. Relatedly, Li and Landry (2018) find evidence to suggest that communities tend to persistently invest in activities under CRS Series 400 (Mapping and Regulation) and 500 (Flood Damage Reduction) more than activities under CRS Series 300 (Public Information) and 600 (Flood Preparedness). This finding is interesting because it runs contrary to those of other studies that find CRS communities tend to invest in "low-hanging fruit" (Brody et al. 2009; Sadiq and Noonan 2015a). Indeed, Brody et al. (2009) find a reduced pursuit of Series 500 and 600 activities and higher pursuit of Series 300 and 400 activities. Finally, in terms of the number of NFIP flood insurance policyholders, Petrolia et al. (2013) find that structural flood mitigation activities under the CRS are more effective at increasing the number of NFIP flood insurance policyholders, while information-based activities under the CRS are not.

Predictors of CRS Scores/Ratings/Points

Six of the 44 studies included in this review contribute to researchers' understanding of the predictors of CRS scores, ratings, and points. Interestingly, the majority of the studies are at odds with one another. For example, Brody et al. (2017) find that higher CRS scores are correlated with greater flood experience and being located within a 100-year floodplain as well as longer household tenures. Yet, Paille et al. (2016) and Sadiq and Noonan (2015b) find that flood risk does not appear to affect CRS scores. Furthermore, Brody et al. (2009) find that moving from zero land area in a floodplain to 100% overlap decreases CRS scores by 4.65%. Findings are also inconsistent with regard to the effect of property and housing values on CRS scores. For example, while Paille et al. (2016) find that communities with higher housing values tend to have higher CRS scores, Sadiq and Noonan (2015b) find that higher property values tend to reduce CRS scores.

Perverse Incentives and Unintended Consequences of CRS

Finally, six studies included in this review provide information on some of the perverse incentives and unintended consequences associated with the CRS. For example, concerning perverse incentives, Brody et al. (2007b) find that the CRS might encourage development in areas that are vulnerable to flooding. This is because the discounts in flood insurance premiums make it less expensive for individuals to reside in a 100-year floodplain. This result is supported by Noonan and Sadiq's (2018) finding that, in general, the CRS attracts both the poor and individuals in the highest income brackets. Noonan and Sadiq (2018) also find that the CRS promotes income inequality in general. In addition, results from other studies indicate that CRS participating communities behave strategically and are driven by the nonlinear incentive structure of the CRS program (Brody et al. 2009; Sadiq and Noonan 2015a; Zahran et al. 2010). For example, it appears that communities pursue a "low-hanging-fruit" strategy

when it comes to accumulating credit points. Indeed, CRS participating communities appear to engage more in activities under CRS Series 300 (Public Information) and 400 (Mapping and Regulation), which are generally less expensive than activities under CRS Series 500 (Flood Damage Reduction) and 600 (Warning and Response) (Brody et al. 2009). In addition, Sadiq and Noonan (2015a) find that CRS participating communities engaging in less flood mitigation generally have lower flood risks, property values, government payrolls, and population densities.

Discussion

Future Research Directions

This systematic and comprehensive review of the CRS literature presents an opportunity to develop a set of recommendations for future research. In the following sections, a few areas are discussed that would benefit from additional inquiries: (1) the determinants of CRS participation; (2) the predictors of CRS scores, ratings, and points; (3) the relationship between the CRS and disaster recovery; and (4) negative impacts associated with participation in the CRS.

Determinants of CRS Participation

The recommendation for future work on the determinants of CRS participation is not due to a lack of attention to the topic. In fact, 11 of the 44 studies included in this review provide insights on the factors facilitating and inhibiting CRS participation [the Association of State Floodplain Managers (2016) has also aimed to understand the predictors of CRS participation in a recent report]. These studies, however, relied on quantitative methodologies and primarily used secondary data to determine the relationship between CRS participation and a variety of community-level variables (e.g., population size, median household income, and tax revenues). Although these studies have helped in understanding the determinants of CRS participation, they do not provide insights into the decision-making process regarding why communities decide to initially and continue to participate in the CRS. Furthermore, they do not reveal the obstacles that hinder participation in the CRS. For example, it is likely that communities choose not to participate in the CRS because of the large amount of paperwork and evidence it takes to document that the community is engaging in any of the 19 creditable activities. Similarly, it is plausible that communities that do not have the funds to hire a full-time floodplain manager or that are unable to contract an outside agency to manage the documentation required will be less likely to participate in the program. In addition to the management of the CRS program, it is likely that the commitment of local flood management decision makers will influence CRS participation. For instance, it is plausible that communities with floodplain managers, community development directors, and emergency managers that are more motivated and committed to reducing flood risks will be more likely to participate in the CRS. Furthermore, there is evidence to suggest that communities participating in the CRS tend to cluster together (Landry and Li 2011; Li and Landry 2018). However, scholars have yet to determine whether this clustering is a function of a similar community composition, flood risks, or policy learning. Hence, to better ascertain why communities do or do not participate in the CRS, the extent to which local capacity and commitment influences CRS participation, and whether clusters of CRS participating communities is a function of community composition, flood risk, or policy learning, in-depth interviews are needed. Specifically, scholars should conduct intensive interviews with CRS coordinators in CRS participating communities and floodplain managers,

community development directors, or emergency managers in non-CRS participating communities. It would also be worthwhile for scholars to interview NFIP state coordinators. These coordinators are typically the ones who conduct community assessment visits, help communities apply for participation in the NFIP or CRS, provide training to local floodplain managers and elected officials, advise them on permits or violations, and so forth.

Predictors of CRS Scores, Ratings, and Points

Similar to the need for additional scholarship on the determinants of CRS participation, there is a need for more research on the predictors of CRS scores, ratings, and points because the extant research contains mixed findings. For example, some studies have found that a community's flood risk affects its CRS score (Brody et al. 2017), while others have found no such relationship (Paille et al. 2016; Sadiq and Noonan 2015b). Findings are also inconsistent with regard to the effect of property and housing values on CRS scores, with some finding that communities with higher housing values tend to have higher CRS scores (Paille et al. 2016) and others finding that higher property values tend to reduce CRS scores (Sadiq and Noonan 2015b). These mixed results warrant additional studies to better understand the predictors of CRS scores, ratings, and points.

An additional area included under this theme that would benefit from more research relates to the "low-hanging-fruit" hypothesis. Recall that this hypothesis suggests that CRS participating communities generally engage in less expensive flood mitigation activities (i.e., those under CRS Series 300 and 400) (Brody et al. 2009). The question that arises is what factors are responsible for communities' decision to engage in "low-hanging fruit" as opposed to "high-hanging fruit." Sadiq and Noonan (2015a) provide some insights into the question, finding that CRS participating communities engaging in less flood mitigation generally have lower flood risks, property values, government payrolls, and population densities. Although this is insightful, more research is needed to better understand communities' decision to engage in a "low-hanging-fruit" strategy and the consequences of that decision. One consequence could be that those communities participating in the CRS at lower levels (e.g., Classes 9 through 6) and through less costly flood mitigation activities may not reap the same benefits as CRS communities participating at higher levels (e.g., Class 5 through 1) or engaging in costlier flood mitigation activities. The findings associated with planning for flood events provide some evidence to support this assumption. For example, Berke et al. (2014a) find that the CRS program's incentive scheme does not encourage local government to support more preventive land-use actions in the policy element of mitigation plans. In sum, more scholarship is needed to better understand communities' decision to go after "low-hanging fruit" as opposed to "high-hanging fruit" and the consequences associated with that decision.

CRS and Disaster Recovery

Understanding the relationship between the CRS and disaster recovery represents another area that would benefit from more scholarship. Only two studies included in this review provide some indication of this relationship. Perhaps the lack of research on this topic is due to the inherent assumption that communities engaging in additional flood mitigation and preparedness measures as determined by the CRS will naturally experience fewer disaster impacts and therefore a quicker recovery. A recent report by Tyler (2018) provides some evidence to support this claim. For example, using data gathered from 19 interviews with businesses affected by Hurricane Irma, the author finds that businesses located in higher CRS participating communities suffered less impact and recovered faster than businesses located in lower CRS participating

communities. However, given the small sample size and the limited number of studies, more research is needed to understand the extent to which CRS participating communities experience better recovery outcomes in comparison to non-CRS participating communities. Scholars should also examine which of the 19 CRS activities facilitate a quicker recovery. It would be interesting to know whether the same CRS activities that result in significant reductions in disaster losses are the same ones that facilitate a speedy recovery.

Negative Impacts Associated with CRS Participation

Although a handful of studies assessed some of the perverse and unintended consequences related to the CRS, more research is needed to better understand a few of the negative impacts associated with CRS participation. One area that deserves significant attention relates to Brody et al.'s (2007) study that found the CRS might be encouraging development in high-flood-hazard areas by subsidizing insurance premiums. This is because the discounts in flood insurance premiums make it less expensive for individuals to reside in a 100-year floodplain. Other scholars have expressed similar concerns. Dixon et al. (2006), for example, argue that CRS activities designed to provide structural flood mitigation may also reduce a community's perceived risk, thereby negating the effects of decreased insurance rates and public education. These concerns and findings suggest that more scholarship is needed to better understand some of the negative impacts associated with participating in the CRS.

Policy Recommendations

Based on the present review of the CRS literature, three policy recommendations are proposed. First, there is a need for policymakers to take a critical look at the unintended consequences of the CRS such as the extent to which it promotes development in hazardous areas as well as its effect on poverty and income inequality. In doing so, the CRS is likely to be more successful at achieving its intended programmatic goals without leading to unintended problems.

Second, there needs to be more emphasis on the importance of the CRS in reducing flood losses. Policymakers should collaborate with the academic community to more effectively communicate the significance of participating in the CRS. Such a collaboration could be in the form of an outreach-based partnership that would be responsible for disseminating academic findings on the CRS, including case studies of CRS success stories, with non-CRS communities. Such outreach efforts could target non-CRS communities with high unemployment rates, poverty rates, crime rates, or minority populations. It is important to note that the authors are not suggesting that every participating NFIP community should also be participating in the CRS. Indeed, prior to participation, communities should consider the extent to which participation will help communities minimize their flood risks while simultaneously addressing social equity and environmental concerns both now and in the future. Communities should also take a critical look at whether they will be capable of continuing to perform the CRS activities they are receiving credit for in the CRS in the future.

Third, policymakers should provide more information on the costs, benefits, and potential for perverse or unintended consequences associated with each of the 19 creditable activities. In doing so, communities considering joining the CRS and current participants can make better-informed decisions about joining or increasing participation levels, respectively. This recommendation is particularly relevant in the light of FEMA's advice to communities to consider the costs and benefits of participating in the CRS prior to joining.

Conclusion

The purpose of this study is to conduct the first systematic literature review of academic research on the CRS program. Specifically, this study establishes the current state of knowledge on the CRS, identifies research gaps and recommends future research areas, and outlines a set of policy recommendations for emergency and floodplain managers as well as policymakers aiming to strengthen and increase participation in the CRS program. The findings from this review provide a comprehensive understanding of the determinants of participation, the predictors of CRS scores, ratings, and points, the relationship between the CRS and disaster recovery, and the perverse and unintended consequences associated with CRS participation.

A limitation of this study is that its comprehensive search approach may have missed other eligible studies. This limitation notwithstanding, the study represents a first step toward understanding where the research on the CRS program is and where it ought to be. Researchers are urged to build on this review by exploring the areas identified in the foregoing discussion that are in need of additional investigation. Doing so would lead to a better understanding of the effectiveness of the CRS as well as the impacts it has on reducing flood losses. Similarly, the authors hope that practitioners and policymakers will consider these recommendations with a view toward improving the design and implementation of the CRS program and reducing the impacts of floods on communities.

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