Title:

Sustainability and Disaster Planning: What are the Connections?

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Abstract

In this paper, we examine the connections between resiliency and sustainability by asking: can disaster planning lead to more sustainability actions? In a survey we conducted of 1,899 cities, towns, and counties across the United States in 2015, we found that disaster plans are three times more common than sustainability plans. Our regression models find both types of plans lead to sustainability action as does regional collaboration across the rural-urban interface. However, we find that hazard mitigation planning may be done without including sustainability staff, citizens, and other officials. After controlling for motivations, capacity, and cooperation, we find rural communities are more likely to have sustainability plans than suburbs, though their level of sustainability action is lower due to capacity constraints. Our models of multilevel governance find local motivations balance sustainability's concept of environment, economic development, and social equity – and are more important drivers of action than grassroots or higher level government funding and policy. This bodes well in a context where federal government leadership on sustainability is absent.

Keywords: sustainability, disaster planning, local government

Introduction

Rural America is at the intersection of many sustainability and resiliency challenges. Non-metropolitan communities face a range of long-term concerns around climate change, food

security, energy production, and ecosystem protection. At the same time, these places face immediate threats due to local and regional disasters, such as floods, snowstorms, and wildfires. Local governments have come to be seen as important players in both sustainability and disaster resilience. The overriding question we seek to answer in this paper is whether the two concepts are related in terms of how local jurisdictions plan for and act on issues of sustainability.

Local governments play a key role in both sustainability and resiliency. Cities and towns, including rural ones, are appropriate places to promote sustainability because, among other things, they create and enforce land use regulations, building codes, transportation policies, and other protocols that impact a community's long-term sustainability. They can also green their own operations by updating government buildings or improving vehicle fleets. In terms of resiliency, local government responders are usually first on the scene and last to leave after a calamity. Community leaders build the foundation for an effective response by collaborating with neighboring jurisdictions, the state, and private partners (Cutter et al. 2008; FEMA 2008). Many of these resiliency efforts are tied to the Disaster Mitigation Act of 2000, which motivated large numbers of local governments to create a hazard mitigation plan (Horney et al. 2017).

The concepts of sustainability and resilience are related. But they are different. Resilience is the descriptive quality of a system that allows it to maintain functions and recover from disturbances; while sustainability describes the desired state of a system (van der Heijden 2014). Sustainability is a broad concept that encompasses environmental protection, economic development, and social equity. Its complexity requires working across geographical and administrative silos (Fiorino 2006; Kettl 2002). Actions undertaken to make a community more resilient should be designed to make it more sustainable by reducing its ecological footprint while improving quality of life (Newman, Beatley, and Boyer 2009). However, much of the literature on urban resiliency focuses on design challenges to harden a community and its infrastructure against disaster, especially with regard to the impacts of climate change (Bosher et al. 2007). Recovery policies often fail to integrate environmental sustainability (Abrahams 2014; Song et al. 2017) and some disaster plans aimed at mitigating threats actually increase the risk to already vulnerable areas (Berke et al. 2018).

Given the potential and important connections between sustainability and resiliency, a major unexplored question is the manner in which the two concepts are connected. While theoretical connections between the two are described (Asprone and Manfredi 2015; Bosher et

al. 2007) or explored within case studies (Brundiers and Eakin 2018; Ismail, Halog, and Smith 2017; Song et al. 2017), broad, generalizable studies that connect the two concepts are missing, especially from a governance and planning perspective. Sustainable development does not guarantee resiliency and reduced community risk, but the two may be able to reinforce each other.

In this paper, we empirically link the two concepts and examine whether an emphasis on resiliency and disaster planning can translate into sustainability planning and action. This is especially important as disaster planning, but not sustainability planning, is supported by the federal government. Using a national survey of local governments, we examine the theoretical connections between sustainability, natural hazard mitigation planning, and a community's disaster experience. We also examine the predictors of sustainability policy action and illuminate the way those drivers differ among urban, suburban, and rural places. We examine these along the rural-urban interface as well as within the context of a community's various types of social, political and financial capital. Finally, we investigate whether local governments are starting to break down the administrative and jurisdictional silos necessary to tackle sustainability's most potent challenges.

After we examine the literature around sustainability and resiliency in the next section, we present the methodology behind our three models that examine the drivers of disaster planning, sustainability planning, and sustainability policy actions. From these models, we find that a community's experience with disaster does drive its creation of a disaster plan and sustainability actions, but not creation of a sustainability plan. The presence of a disaster plan or a sustainability plan predicts higher rates of sustainability policy adoption. We conclude hazard mitigation planning is a good first step towards sustainability in the absence of national efforts to encourage sustainability planning, but it is not based on the broader coalitions and actions necessary for long term region wide sustainability.

Sustainability, Resiliency, and Rural Local Governments

Rural jurisdictions struggle with a range of sustainability issues (Morrison, Lane, and Hibbard 2015), and rural communities across the US are less likely to adopt sustainability policies than more urban places (Homsy and Warner 2012). While a majority of farmers believe the climate is changing, they consider the changes to be part of a natural cycle and remain

skeptical of humans as the cause (Takahashi et al. 2016; Yung et al. 2015). Rural planners also face local leaders who question the effectiveness of local action and who lack peer communities from which to learn about greenhouse gas reduction strategies (Carter and Culp 2010). Rural places often struggle to bring together the sometimes conflicting demands of resource extraction, commodity production, property rights, and environmental protection without the necessary technical capacity or structural, fiscal, and political resources (Wolf 2011). At the same time, rural officials perceive their communities as more vulnerable to disasters than urban areas (Horney et al. 2017).

Natural Hazards Planning and Disaster Experience

Municipal action around climate change adaptation and the building of resilient communities is tied to local experience with extreme events across various political contexts (Butler, Deyle, and Mutnansky 2016; Flyen et al. 2018). Passage of disaster planning measures may only become politically feasible following an incident (Næss et al. 2005), and many disaster plans remain unimplemented (Lyles, Berke, and Smith 2016). In rural areas, personal experience with weather extremes, such as drought, wildfires, changes in length of growing season and flooding, are important drivers of perceptions, but may not shift opinions enough to act on topics such as climate change (Chatrchyan et al. 2017; Millar, Boon, and King 2015; Takahashi et al. 2016), especially when the rural discourse emphasizes a balance between economy and environment as well as questioning the impact of local action (Kessler, Parkins, and Huddart Kennedy 2016). Most communities that do take climate adaptation action only adopt policies that have an immediate benefit in other ways (Abunnasr, Hamin, and Brabec 2015). Such a co-benefits approach reframes actions so as to increase effectiveness and broaden constituencies (Homsy 2018b).

Local governments often focus on resisting hazards rather than becoming more resilient, which can increase the severity of incidents (Liao 2012). In many instances, officials do not learn from past challenges and, therefore, do not make communities more sustainable and more capable of weathering natural disasters. For example, coastal Mississippi communities failed to adapt following both Hurricane Camille and Hurricane Katrina due to their desire to speed recovery to pre-disaster conditions and focus on hardening buildings to withstand future events rather than engaging in longer-term planning for sustainable land use (Smith 2014).

Rural-Urban Interface

The binary view of rural as distinct from urban has given way to consideration of the rural-urban interface where flows of capital, labor, information, ideas, and goods cross a permeable rural-urban boundary (Lichter and Ziliak 2017). The resulting urbanization of rural spaces, growing rural populations of minority residents, and increased income inequality in rural communities bring greater expectations and greater challenges. Rural communities are integral to regional success (Harrison and Heley 2015) and these non-metropolitan areas have more agency than in previous urban-dominated times (Lichter and Brown 2014). However, they also face increased conflict which can undercut the political and social capital needed to move forward on important issues, such as sustainable land use planning and regulation (Libby and Sharp 2003). Regional governance remains fragmented, which compounds resiliency and sustainability challenges, as municipalities fail to engage with the extensive social, political, and economic relationships sitting in the rural-urban interface (Brown and Shucksmith 2017).

Although not as well-discussed as economic matters, sustainability at the rural-urban interface presents interesting concerns, which have been expressed mainly through land use planning. Rural residents describe the intersection of rural and urban in terms of environmental degradation, biodiversity and habitat loss, and water quality, as well as the loss of a sense of place and community identity with accompanying decreases in social cohesion (Slemp et al. 2012). Still, there are examples, where regions are managing to contemplate planning and smart growth issues at the intersection of urban and rural areas (such as the New York City Watershed and the Walworth County, Wisconsin described by Brown and Shucksmith (2017)).

Motivations and Multilevel Governance

Environmental protection, in particular, and sustainability, more generally, represent complex commons challenges, which are often handled by a central government (Fiorino 2006). The central government is similarly important to successful climate change resiliency and hazard mitigation planning. The United States government requires that counties and states seeking hazard mitigation grants from the Federal Emergency Management Agency (FEMA) prepare disaster plans (Horney et al. 2017). Federal and state money following major disasters speeds the implementation of infrastructure improvements around resiliency (Næss et al. 2005). However,

in the United States, absent a national policy on adaptation, local governments have failed to engage in more long-term thinking about the future of their communities (Smith 2014). Differences in policy implementation can be seen from state to state with some places, such as Florida and Texas, focusing on specific municipal projects, while others, such as North Carolina, require that local governments take a more comprehensive approach (Lyles et al. 2016). Many municipalities cannot determine which potential consequences of climate change should be prioritized in their adaptation plans without additional national guidance (Amundsen, Berglund, and Westskog 2010). A multilevel governance framework can help communities address broader sustainability issues (Homsy et al 2018).

Since 2000, many have speculated that local governments would lead the way on important sustainability issues (Kousky and Schneider 2003). Municipalities have a lot of power to shape building codes, land use, and transportation patterns. Nagendra and Ostrom (2012) argue that local action on complex issues is preferred because such policies can fit the particulars of a local circumstance. However, local governments still enact few sustainability policies (Svara 2011), especially in small and rural communities (Homsy and Warner 2012). Local action also carries the concern of commons problems that result in negative externalities, regional inequities, and spillover effects (Feiock 2013; Pastor, Lester, and Scoggins 2009). Citizen activism is also expected to drive local governments to more sustainable policies (Portney and Berry 2016). Citizens can be effective actors when they are engaged on an officially constituted committee or task force, especially in smaller cities (Homsy and Warner 2015). The social and political capital in rural communities is one key to explaining differences in the level and willingness of communities to act (Flora and Flora 2013). Trust in resiliency information is higher when it comes from local agencies than from the federal government (Sadiq, Tharp, and Graham 2016) and, similarly, local volunteer responders are perceived as more prepared for disasters, despite their lack of resources and expertise (Singh-Peterson et al. 2015).

Community Capital, Capacity, and Coordination

Any action requires a certain level of investment by a community. Complex policies require greater local government capacity to undertake (Honadle 2001), something that often inhibits sustainability action in rural places (Kapucu, Hawkins, and Rivera 2013; Rumbach

2016). For example, policy data from 169 Connecticut communities found that small towns rely on regional planning organizations for much of their natural hazard and climate adaptation planning, though these regional agencies also have limited financial resources (Boyer, Meinzer, and Bilich 2017).

Flora and Flora (2013) outline a typology of seven capitals that a community can use to promote sustainability. These are: cultural capital (a population's world view); human capital (education, skills, health, etc.); social capital (mutual trust, reciprocity, etc.); political capital (ability to create and enforce rules and regulations); financial capital (income, assets); built capital (infrastructure and technology) and natural capital (the natural resource base). These capitals interact to produce healthy ecosystems, vibrant economies, and social equity. Some of these have been tested within the context of sustainability. For example, political capital (measured by the presence of city managers, who tend to be more innovative) is positively associated to increased sustainability policymaking by local governments (Svara, Watt, and Jang 2013). Similarly, cultural capital and fiscal capital are positively correlated to action on climate change mitigation (Homsy 2018a). A balance between these capitals has been shown to be critical to effective environmental management (González Rivas et al. 2014). Resiliency is enhanced through the social capital networks that emerge among emergency managers from different municipalities within a region (Zurita et al. 2018).

Sustainability and environmental protection require more innovative problem solving configurations that break down administrative and jurisdictional silos (Fiorino 2006). For example, environmental policy is increasingly handled through intergovernmental partnerships (Rabe 2004), and planners report that the inability to coordinate across jurisdictions undercuts sustainable development efforts (Filion et al. 2015). Similarly, disaster resilience planning benefits from regional collaboration (Flyen et al. 2018), but such efforts are relatively rare due to challenges coordinating agencies from different jurisdictions (Lyles et al. 2016).

Resiliency research has found similar administrative disconnects because disaster planning and response involve various agencies, which normally work independently. Since each has its own processes and information flows, coordination can be difficult (Bharosa, Lee, and Janssen 2010). These problems are magnified during emergencies (Allen, Karanasios, and Norman 2014), and integrating non-governmental actors, important to successful emergency management (ICMA 2006; Waugh and Streib 2006), adds to the complexity of resiliency plans.

The coordination of disaster plans tends to be stronger when headed by an emergency management agency rather than other agencies (Lyles et al. 2016).

Building upon this theoretical base, we explore the links between disaster and sustainability planning and sustainability action giving special attention to differences by community size and location. We provide an empirical test of the links between resilience and sustainability and do so in a multilevel governance framework. See Figure 1. We also examine the role of multilevel factors, regional coordination, and community capitals.

[Figure 1 about here]

Methods

Our empirical data are drawn from the 2015 Local Government Sustainability Practices Survey we conducted with the International City/County Management Association. The survey measures the presence of a sustainability plan, disaster response/natural hazard mitigation plan, and the adoption of different sustainability actions. It also includes a range of questions on motivators for sustainability action and inter-departmental and inter-governmental collaboration. For a descriptive summary of survey results see (Homsy, Warner, and Liao 2016).[1] The sample frame consisted of all counties, all municipalities and townships over 25,000 in population, and a one in 2.5 sample of municipalities and townships with between 2,500 and 24,999 people. The survey was mailed to the chief administrative officer of all 8,562 local governments in this universe and we had a response rate of 22.2 percent for a sample size of 1,899 counties and municipalities. By population, a chi-square test indicates that the largest municipalities in the sample (100,000 or more) and the smallest (under 25,000) are slightly overrepresented while the communities between 25,000 and 99,999 are underrepresented. Also, urban and suburban jurisdictions are somewhat overrepresented and rural underrepresented.

Dependent variables

In order to explore the relationship between disaster response/natural hazard mitigation planning, sustainability planning and sustainability actions, we generated three dependent variables for use in each of the models. The first, disaster plan adoption, is a binomial variable that measures whether the locality reported adopting a hazard mitigation or emergency evacuation/relocation plan. The second dependent variable, sustainability plan adoption,

measures whether the locality has adopted a sustainability plan or not. The third dependent variable, total sustainability actions, is a count of sustainability actions taken in each jurisdiction. The survey included 79 sustainability actions across 11 issue areas. See Table 1 for a summary of the actions that make up this dependent variable.

[Insert Table 1 about here.]

Independent variables

Based on our theoretical framework, the drivers of local sustainability policymaking fall into four primary groups. Table 2 contains descriptive statistics of all variables.

[Insert Table 2 about here.]

Planning and disaster assistance variables. The first group of variables investigates the connection between disasters, disaster planning, sustainability planning, and sustainability actions. Disaster experience is a dichotomous variable based on the survey question: "Has your local government had to respond to a major disaster in the past 15 years?" We also use the dependent variable, presence of a disaster plan, as an independent variable in models two and three. The dependent variable, presence of a sustainability plan, becomes an independent variable in model three.

Rural-urban interface variables. First, we develop a measure of regional collaboration. The survey asked respondents if they collaborated with other municipalities across the region in 12 different areas (economic development, land use, environmental protection, seeking funding and grants, storm water management, affordable housing, hazard mitigation/evacuation planning, climate change mitigation, climate change adaptation, open space / farmland preservation, watershed management, and roads / transportation) and the regional variable represents a count of the number of such collaborations. A second regional variable is whether or not the local government is a county, as counties represent a higher level of government that could help coordinate across a region (Lobao and Kraybill 2005). Also, we differentiate communities by metro core, suburb, and rural places. Core cities are those designated by the US Census as principal cities (U.S. Census Bureau 2013) and core counties contain those cities. Suburbs are

jurisdictions that lie outside of the borders of the principal city but still within metropolitan counties. Rural communities include all municipalities and counties outside of metropolitan areas.

Motivation / multilevel governance variables. The survey asked respondents to assess the significance of 13 factors in motivating sustainability efforts by their local governments according to a 4-point Likert scale, with 1 indicating "not significant" and 4 indicating "very significant." As shown in Table 3, factor analysis found these elements loaded along three dimensions - motivation from higher level government (funding and policy), motivation from local government (leadership, staff interest) around the three E's of sustainability (economic development, environment and equity), and motivation from the grassroots (residents, advocates, business). We generated an additive index from the mean score of all indicators in each factor.

[Insert Table 3 about here.]

Coordination and community capital variables. Sustainability and resiliency require breaking down administrative silos within local government. This requires building bridging ties across agencies within the jurisdiction (Homsy and Warner 2013). The survey asked respondents about the level of collaboration among agencies within their jurisdiction in 11 different areas (economic development, land use, environmental protection, seeking funding and grants, storm water management, energy planning, affordable housing, hazard mitigation/evacuation planning, climate change mitigation, climate change adaptation, and open space / farmland preservation) and this variable measures the number of such collaborations.

We also capture the community capitals in our measures of capacity: civic, fiscal, and managerial/administrative, which have been shown to be important to sustainability (Flora and Flora 2013). For civic capacity and social capital, we use a survey question which indicates the presence of a resident committee, commission, and/or task force in sustainability planning. For financial capital, we use the fiscal health of the local government by measuring total government revenue per capita. For local political capital we measure the administrative capacity of a jurisdiction through the presence of professional managers or professional sustainability staff, who often drive the adoption of sustainability policies (Pasquini and Shearing 2014). We also

control for population, population density, per capita income, and homeownership, as well as geographic region.

Results

Table 4 shows the results of our three regression models. Models 1 and 2, which assess the adoption of disaster and sustainability plans respectively, are logistic regressions with the results presented as odds ratios. The first dependent variable, disaster plan, is used as an independent variable in models 2 and 3, and the second dependent variable, sustainability plan, is used as an independent variable in model 3. Model 3, total sustainability actions, uses a Poisson regression, and the results are in the form of incidence rate ratios. To maintain sample size, we used a multiple imputation approach (Rubin 1996). The multiple imputation approach adds a random error component to the imputed data values, and thus produces more reasonable standard errors than the traditional approach of imputing missing data. We also use a state level fixed effect model to account for the variances generated from unobserved characteristics resulting from municipalities clustered within states.

[Insert Table 4 about here.]

Our models indicate that both disaster and sustainability plans are positively associated with the adoption of sustainability policies as expected. Having a hazard mitigation plan increases the predicted number of sustainability policies by 18.5 percent (Model 3). Similarly, having a sustainability plan is associated with a 19.8 percent higher rate of sustainability policy adoption. Not surprisingly, experience with a disaster also correlates with 47.0 percent higher odds of having a hazard mitigation plan and predicts a 6.9 percent higher rate of sustainability policy adoption, but does not increase the likelihood of having a sustainability plan.

Local government motivations increase the likelihood of having a sustainability plan and raise the predicted rate of sustainability actions, but higher-level government motivations have no effect, and grassroots pressure reduces the level of sustainability actions. Our results show local governments are motivated by a range of sustainability factors beyond just environmental protection. Note that four of the six components of the internal government motivators variable are: concern over the environment, the potential for fiscal savings and for attraction of

development projects, and the desire to promote social equity. These represent the "Three E's" (environmental protection, economic development, and social equity) of sustainability and are embedded at the local level and motivate both sustainability planning and sustainability actions.

The rural/urban interface variables showed mixed results. Regional coordination among local governments was only significant in predicting a small increase in the rate of sustainability policy adoption, and was not significant in either the disaster or sustainability plan models. County governments were much more likely to engage in disaster planning, as expected since they often help coordinate disaster response. But counties are associated with lower levels of sustainability action; and are not significant in the sustainability plan model. Thus counties are not yet playing a leading role in sustainability planning and action. The only metropolitan status variable that is significant shows rural communities have a 7.7 percent lower likelihood of adopting sustainability plans.

The coordination and community capital variables had significant impacts on sustainability planning and action, but not disaster planning. Coordination across departments within the local government had a consistently positive correlation to planning and action. However, social capital, measured by the presence of a sustainability task force, increases the odds of having a sustainability plan; in this case the citizen task force raised the likelihood of having a sustainability plan by about 2.9 times, and increased the predicted rate of sustainability action by 13.5 percent. However, citizen task forces were insignificant in the disaster plan model. Regarding financial capital, total government revenue per capita was only significant in predicting an increased rate of sustainability actions because actions cost money. Planning is also costly but federal funds for disaster planning subsidize the process. Regarding human and political capital, the presence of sustainability staff increases the odds of having a sustainability plan about 2.78 times and is associated with eight percent more sustainability actions. However, it is associated with a much lower the likelihood of having a disaster plan. Having a council-manager has mixed results. Council manager governments reported a higher number of sustainability actions (9 percent), but lower odds of having a sustainability plan (30 percent), and no impact on disaster planning. Larger and richer localities are more likely to implement more sustainability actions. Even after controlling for state level effects, sustainability actions are lower in the South and higher in the West as compared to the North Central region.

Discussion

Planning for Disasters and Planning for Sustainability

The results show the importance of planning – having either a hazard mitigation plan or a sustainability plan is associated with an increased likelihood of adopting more sustainability actions. The federal government funds municipalities to create hazard mitigation plans, but it does not fund the creation of sustainability plans. Our results point to the possibility that localities may leverage the hazard mitigation process to increase a community's sustainability.

Motivations and Multilevel Governance

Our model results show that local level motivations drive sustainability planning and action. Higher-level government motivations have no effect, and grassroots pressure actually reduces the level of sustainability actions. Previous studies have found that higher levels of government are important drivers of sustainability actions due to capacity provision or regulation (Andreen 2003; Homsy, Liu, and Warner 2018). However, this study is one of the first to use a multilevel governance framework, with measures that distinguishes local government from higher level government motivation. The respondents report that at the local level, they are motivated by a range of sustainability factors beyond just environmental protection. Our results support recent research that also finds communities consider both environmental sustainability and economic development as compatible local government goals. This mirrors results from a previous national survey of US local governments that found places with sustainability goals undertake more community-oriented economic development actions than those without (Zhang, Warner, and Homsy 2017). Interestingly, although previous research has found that local governments and volunteers are perceived to be more directly responsibility for resiliency (Sadiq et al. 2016; Singh-Peterson et al. 2015); our study found that such local motivations played no significant role in disaster planning.

Coordination and Community Capitals

A balance across community capitals is critical for sustainability (Flora and Flora 2013). We see that interdepartmental coordination is associated with both disaster and sustainability planning and with a higher number of sustainability actions. Hazard mitigation planning requires the involvement of numerous public safety departments – police, fire, ambulance – who respond

in the immediate aftermath of a disaster. Previously, in case studies, researchers have found that emergency managers are disconnected from those who plan all other aspects of communities (Bosher et al. 2007). Our research suggests that city managers, sustainability staff, and citizens may not be sufficiently involved in hazard mitigation planning efforts. Sustainability staff have a strongly negative association with the presence of a disaster plan while the presence of a citizen task force and a city manager are not significant. These groups represent knowledge and practice more broadly linked to issues of sustainability. The lack of involvement of these groups may be a factor in the generally poor quality of disaster plans found by researchers (Stults and Woodruff 2016). By contrast our models indicate that a broader range of people are involved in sustainability planning: sustainability staff, citizen task force, and a professional city manager. These players have a more long-range perspective; they do not just focus on bouncing back from the next disaster, but look for ways to be more consistently sustainable. While the presence of either plan is a strong predictor of sustainability actions, the factors associated with creating these plans indicate that sustainability planning is a more comprehensive exercise.

Sustainability Along the Rural-Urban Interface

Sustainability also requires coordination across the rural - urban interface (Brown and Shucksmith 2017; Lichter and Ziliak 2017; Slemp et al. 2012). We can see some evidence of this in our results, as localities reporting more areas of regional coordination exhibit higher levels of sustainability actions. Such intermunicipal collaboration helps eliminate commons challenges, such as externalities, spillovers, and free riding that urban theory predicts would make environmental protection unachievable.

When we break down the variables by metropolitan status, as shown in Table 5, the subgroup means indicate that rural governments do not lag far behind metro core and suburban communities in terms of planning. The presence of a disaster plan in all three kinds of communities is very high, over 80 percent, probably due to federal incentives. With sustainability plans, metro core governments have a much higher adoption rate than suburban and rural places, as expected. However, rural places do not differ from suburbs in their adoption of such plans. While suburbs might free ride on the plans made by their neighboring big cities, rural communities cannot, and thus must make their own sustainability plans.

This planning strength of rural areas, does not extend to action. Cities and suburbs still outpace rural areas with regards to sustainability policy adoption. The regression models show rural places are predicted to have only 92.3 percent the rate of sustainability policy adoption as metro core local governments. The models indicate that the reason for this difference may lie in a lack of technical and fiscal capacity. While planning can be done with staff and citizen support, as shown in model two, action requires more resources. As model three demonstrates, coordination across a region allows the opportunity for horizontal integration and support. Ours is among the first study to empirically measure the extent to which municipalities are starting to break down regional silos on sustainability. As the social and economic integration of rural and urban continues, future research can assess whether rural and urban areas will show increased signs of cooperation across regional issues (Brown and Shucksmith 2017).

[Insert Table 5 about here.]

Conclusion

Our analysis has broken new ground by empirically linking resiliency and sustainability – two complex and often intertwined concepts that have developed different bodies of literature. We have established a direct link between having a disaster plan and the increase in sustainability actions undertaken by a local government. Although the presence of a disaster plan does not predict the presence of a sustainability plan, sustainability actions are the important policy outcomes. However, there are important differences between communities with sustainability plans and those without. Communities committed to a sustainability plan appear to have a longer-term outlook. So, while a federally-funded hazard mitigation plan appears to be a pathway to sustainability, it may only be a first step.

Still, this bridge between hazard mitigation and sustainability offers practitioners an attractive "back door" to sustainability. In our analysis, we can see the practical connection, that hazard mitigation planning leads to sustainability actions. Resiliency is more immediate and local; it is about protecting the community today and bouncing back. Sustainability, on the other hand, considers spatially and temporally distant impacts, which require attention to the flows across the rural-urban interface. Although the two concepts should work hand-in-hand,

sustainability and resiliency are separate concepts that are not adequately connected in practice or in the research literature. Our study has started to address that gap.

Endnotes

[1] A report summarizing the raw data can be found at: https://icma.org/sites/default/files/308135_2015%20Sustainability%20Survey%20Report%20Final.pdf

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Figure 1 – Conceptual model linking disaster and sustainability planning with sustainability actions

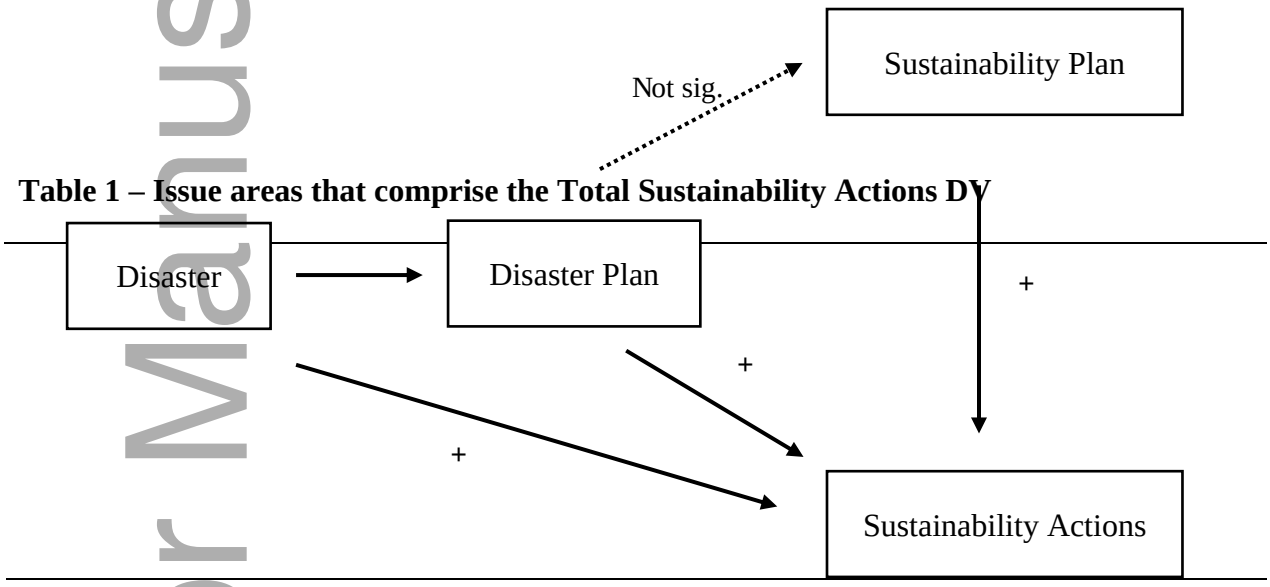


Table 1 – Issue areas that comprise the Total Sustainability Actions DV

- General Sustainability Actions (8 indicators): governments budgeted specifically for sustainability, adopted a climate mitigation plan, conducted a greenhouse inventory of local government operations or in the community, etc.

- Reducing energy use in transportation and exterior lighting (15 indicators): local governments took actions such as established a fuel efficiency target for government vehicles, increased the purchase of fuel efficient vehicles, installed high efficiency streetlights, etc.
- Reducing energy use in buildings (10 indicators): municipalities conducted for themselves or in the community, energy audits, weatherization campaigns, or heating/air conditioning upgrades etc.
- Supporting energy conservation programs targeted at marginalized groups (4 indicators): programs included helping low-income residents, seniors, small businesses, and non-profit organizations.
- Regulating buildings and land-use (8 indicators): local governments promoted higher density development near public transit nodes, mixed use development, clustered (conservation) subdivision design etc.
- Reducing water usage (4 indicators): reuse of grey or reclaimed water in government buildings, public parks, or public facilities as well as using water price structure to encourage water conservation, etc.
- Improving social equity (7 indicators): government provides financial support/incentives for affordable housing, subsidies for weatherization, protection for low income residents from water shut off, etc.
- Promoting transportation alternatives (8 indicators): municipalities had policies to encourage the use of mass transit, carpools, bicycling, or walking to work, provided bike lines, sidewalks or transit.
- Managing recycling and waste (10 indicators): communities had a recycling program for government offices, required recycled content in office paper, provided for recycling of household hazardous waste, curbside recycling, etc.
- Other sustainability actions (5 indicators): community extended internet access to all, had local air quality regulations, required developers to pay impact fees, supported community gardens, etc.

Table 2 – Summary Statistics of Model Variables

Variable	Mean[1]	S.D.	Min	Max	n
Dependent					
Disaster plan (1=yes, percent yes) [a]	82.5	NA	0	1	1899
Sustainability plan (1=yes, percent yes) [a]	30.9	NA	0	1	1899
Total sustainability actions (1-79) [a]	16.89	12.12	0	66	1899
Independent					
Planning & Disaster Experience	74.5	NA	0	1	1899
Disaster experience (1=yes, percent yes) [a]					
Rural / Urban Interface					
Coordination across the region [a]	6.58	3.44	0	12	1899
County (1=county,0=city) [a]	22.3	NA	0	1	1899
Metro Core [a]	15.2	NA	0	1	289
Suburb [a]	54.5	NA	0	1	1034
Rural [a]	30.3	NA	0	1	576
Motivations & Multilevel Governance					
Higher government (0-3) [a]	1.81	0.80	0	3	1599
Local government / three E's (0-6) [a]	1.84	0.66	0	3	1585
Grassroots (0-4) [a]	1.22	0.71	0	3	1566
Coordination & Community Capitals					
Coordination across departments (0-11) [a]	6.08	2.62	0	11	1899
Presence of sustainability task force (1=yes)	38.0	NA	0	1	1899
Total govt. revenue per capita ($1,000)[b]	1.76	1.48	0.01	18.2	1898
Presence of sustainability staff (1=yes) [a]	23.1	NA	0	1	1899
Council-manager form of govt (1=yes) [a]	54.6	NA	0	1	1899
Controls					
Population [c]	61,033	278,931	641	9,818,605	1899
Population Density (per sq. mile) [c]	1,645	1991.57	0.07	20,518	1899
Per capita income [d]	28,795	12,183	5,235	152,128	1898
Homeownership rate [c]	0.68	0.13	0.14	0.99	1899
Geographical regions					
North-central	18.3	NA	0	1	348
Northeast	34.3	NA	0	1	652
South	28.3	NA	0	1	537

West	19.1	NA	0	1	362

For dichotomous variables, percent with a value of 1 is presented.

[a] Source: ICMA Sustainability Survey, 2015.

[b] Source: 2012 Census of Government.

[c] Source: 2010 U.S. Census of Population and Housing.

[d] Source: 2010-2014 American Community Survey (ACS).

Table 3 – Factor Loading for Motivation Variables

Elements	Factor 1 Local Govt. Three E's	Factor 2 Grassroots	Factor 3 Higher Govt.	Cronbach's alpha
Federal or state policies	0.241	0.219	0.740	0.840
Federal/state funding opportunities	0.358	0.162	0.721	
Leadership regional/state officials	0.450	0.202	0.548	
Leadership of local elected officials	0.623	0.200	0.312	0.848
Potential for fiscal savings	0.624	0.172	0.331	
Potential to attract develop. project	0.541	0.229	0.326	
Concern over the environment	0.648	0.268	0.188	
Desire to promote social equity	0.541	0.404	0.215	
Desire/expertise of municipal staff	0.543	0.356	0.140	
Pressure from residents	0.367	0.733	0.128	0.817
Pressure from advocacy groups	0.385	0.685	0.114	
Pressure from business / industry	0.311	0.717	0.200	
Threat of Lawsuits	0.019	0.459	0.309	

Source: Author Analysis, ICMA Sustainability Survey, 2015

Table 4 – Model Results

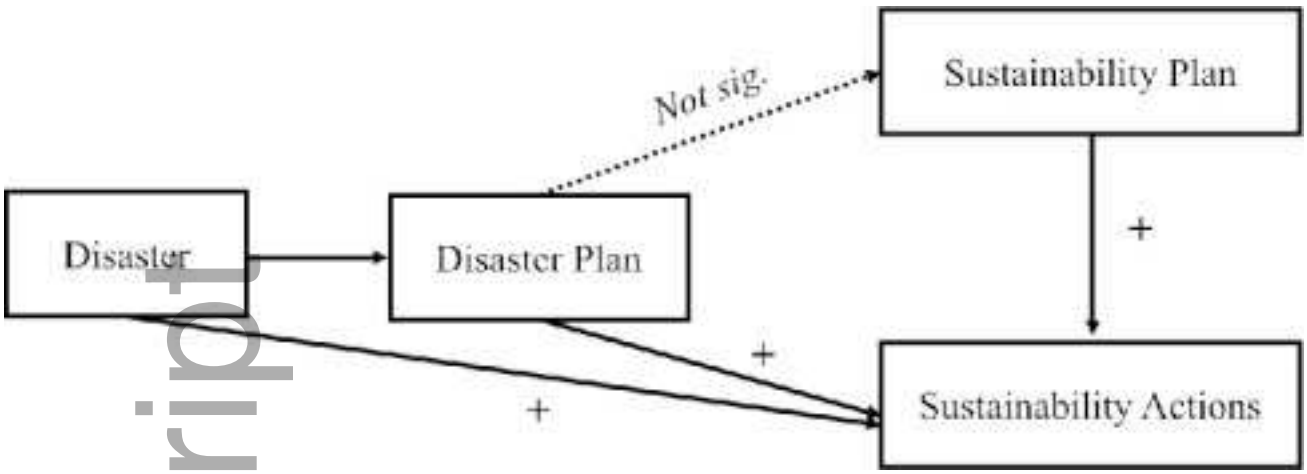
	Model 1 Disaster Plan (n=1,818)	Model 2 Sustainability Plan (n=1,895)	Model 3 Sustain. Actions (n=1,899)
	Logistic regression (presented as odds ratios)		Poisson regression (incidence rate ratios)
Planning & Disaster Experience			
Disaster experience (1=yes)	1.470*	0.883	1.069***
Disaster Plan (1=yes)		0.918	1.185***
Sustainability Plan (1=yes)			1.198***
Rural / Urban Interface			
Coordination across the region	1.000	1.019	1.010***
County (1=county,0=city)	5.036***	1.310	0.865***
Metro status (urban core is reference)			
Suburb	0.918	0.770	0.975
Rural	1.299	1.338	0.923**
Motivations & Multilevel Governance			
Higher government	1.025	0.994	0.991
Local government / Three Es	1.155	1.538**	1.119***
Grassroots	1.038	1.001	0.958**
Coordination & Community Capitals			
Coordination across departments	1.439***	1.089*	1.078***
Presence of sustain. task force (1=yes)	1.386	2.882***	1.135***
Total government revenue / capita ($)	0.987	0.942	1.048***
Presence sustain. staff (1=yes)	0.652*	2.783***	1.080***
Council manager govt. (1=yes)	1.094	0.702*	1.090***
Control Variables			
Population (log)	0.845	1.043	1.116***
Population density (log)	1.547*	1.068	1.120***
Per capita income (log)	0.975	1.904**	1.079***
Homeownership (percent)	1.000	0.993	0.998***
Geographical Regions (North Central is reference)			
Northeast	0.905	1.644	1.068
South	1.754	0.453	0.722***
West	1.049	0.320	1.224*

* < 0.05, ** < 0.01, *** < 0.001

Table 5 – Variable means by metro status

	Rural	Metro Core	Suburb
Dependent			
Disaster plan (1=yes, percent yes)	82[2]	89[1]	81[2]
Sustainability plan (1=yes, percent yes)	28[2]	47[1]	28[2]
Total sustainability actions (1-79)	11[3]	28[1]	17[2]
Independent			
Planning & Disaster Experience			
Disaster experience (1=yes, percent yes)	75[2]	83[1]	72[2]
Rural / Urban Interface			
Coordination across the region	5.5[3]	7.7[1]	6.9[2]
County (1=county,0=city)	41.5[1]	29.8[2]	9.6[3]
Motivations & Multilevel Governance			
Higher government	1.76[2]	1.92[1]	1.81[2]
Local government / Three Es	1.71[3]	2.06[1]	1.85[2]
Grassroots	1.16[3]	1.38[1]	1.20[2]
Coordination & Community Capitals			
Coordination across departments	5.1[3]	7.6[1]	6.2[2]
Presence of sustain. task force (1=yes)	30[3]	50[1]	38[2]
Total government revenue / capita ($)	1.88[1]	2.12[1]	1.59[2]
Presence sustain. staff (1=yes)	21[2]	42[1]	19[2]
Council manager govt. (1=yes)	40[3]	76[1]	57[2]
Control Variables			
Population (log)	15,422[3]	256,320[2]	31,859[1]
Population density (log)	654[2]	2,181[1]	2,048[1]
Per capita income (log)	23,264[3]	27,687[2]	32,184[1]
Homeownership (percent)	68[2]	58[3]	71[1]

Superscript numerals 1, 2 and 3 represent ordered differences in metro status means using Scheffe's method at the 0.05 significance level. When no significant difference in order is found, the superscripts are the same.



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