



# Resilience in U.S. cities

A survey of policies & programs

*This report is dedicated to Dr. Kent Portney (1951-2020), a great friend and scholar. Dr. Portney was a professor at Texas A&M University's Bush School of Government and Public Service and Director of the Institute for Science, Technology, and Public Policy. Through his work on public administration of environmental issues, Dr. Portney taught us how government can be a positive force for change.*

## RECOMMENDED CITATION

Sierra C. Woodruff, Ann Bowman, Richard Feiock, Bryce Hannibal, Ki eun Kang, Jeongmin Oh, Garrett Sansom. 2020. Resilience in U.S. Cities: A survey of policies and programs. 101 Resilient Cities Policies and Programs Project.

## CONTACT

The project lead: [swoodruff@tamu.edu](mailto:swoodruff@tamu.edu)

## ACKNOWLEDGMENTS

This material is based upon work supported by the Texas A&M Triads for Transformation. We would like to thank Salonee Mehta and Smruti Parab for their assistance with this report and the many students that helped with data collection.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of Texas A&M University, Florida State University, or University of Southern California.



To understand how U.S. cities are operationalizing resilience, we surveyed 58 of the largest cities in the U.S. in 2019. The survey included questions about how cities define resilience, who is engaged in resilience efforts, and the policies and programs cities are adopting to build resilience. We complemented the survey with a web-based analysis of adoption and implementation of 109 different resilience policies and programs.

We found:

- *Most cities do not have a resilience plan or indicator system.*
- *City officials' understanding of resilience is multi-faceted and includes a broad set of attributes.*
- *One-quarter of cities (24%) have not received any external funding for resilience. Federal agencies were the most common source of funding for cities that did receive funding for resilience projects.*
- *Resilience efforts are highly collaborative. In most cities, a large number of city agencies are engaged in resilience efforts and cities commonly coordinate with outside organizations.*
- *City sustainability, emergency management, planning, and public works departments appear to be the most important actors in resilience efforts.*
- *There is large variation in adoption of resilience policies across cities. The most prevalent policies align with the traditional sustainability agenda.*
- *Although cities consider reducing social vulnerability as a key attribute of resilience, policies to reduce social vulnerability are not widely adopted.*
- *Policies to harden critical infrastructure and plan for the impacts of climate change are relatively uncommon across the 101 largest cities in the U.S.*

---

# TABLE OF CONTENTS

06

---

INTRODUCTION

08

---

AN EMERGING AGENDA

09

---

WHAT IS RESILIENCE ?

13

---

WHO IS ENGAGED ?

19

---

POLICIES & PROGRAMS

22

---

WEB BASED ANALYSIS

25

---

CONCLUSION

26

---

APPENDIX

- Figure 1: Sample Cities. Web data collected for the 101 largest cities in the United States. Survey data from 58 of those cities.
- Figure 2: Percent of cities with an official resilience plan.
- Figure 3: Leaders in Resilience.
- Figure 4: Percent of cities with an established definition of resilience.
- Figure 5: Critical attributes of a resilient city.
- Figure 6: Hazard threats.
- Figure 7: City facilities that have experienced flooding in the last five years.
- Figure 8: Groups or agencies that played a major role in initiating resilience efforts in the city.
- Figure 9: External funding sources for resilience projects.
- Figure 10: City departments involved in resilience.
- Figure 11: Coordination among city departments on resilience.
- Figure 12: City coordination with external agencies.
- Figure 13: Collaborative actions.
- Figure 14: City policies and programs.
- Figure 15: Distribution of city policies and programs.
- Figure 16: City government engagement activities.
- Figure 17: Distribution of number of policies across cities.
- Figure 18: Most commonly adopted policies.
- Figure 19: Most uncommon policies.

Resilience has rapidly risen in prominence to become an important concept in urban governance, as well as in academic discourse. Large, high-profile funding opportunities for cities, such as the U.S. Housing and Urban Development (HUD) \$1 billion National Disaster Resilience Competition and the Rockefeller Foundation's 100 Resilient Cities, demonstrate the support and interest in resilience at the city scale. Yet, there are still many questions about how resilience is translated into practice: How do cities define resilience? Who is engaged in municipal resilience efforts? What policies do cities adopt to build resilience?

The 101 Resilient Cities Policies and Programs Project (RC3P) aimed to address these questions. In 2019 we conducted a survey of the 101 largest cities in the U.S. to understand how they are operationalizing resilience. In each city, we sent surveys to a high level official who would be familiar with their city's resilience efforts. We targeted chief resilience officers and sustainability directors. In cities that did not have these positions or if we did not receive a response, a survey was sent to planning and emergency management directors or city executives.

Of the 101 largest cities, we received responses from 58 cities shown in Figure 1. A plurality of survey respondents work in city resilience, sustainability, or planning offices. We also received responses from departments of emergency management, environment, and city executives. 86% of the survey respondents indicated that they work in an agency, department or office that directly deals with resiliency. Respondents' titles include chief resilience officers, planning directors, city managers, and sustainability coordinators. Since participants are in senior level positions within offices that address resilience, we expect that they are familiar with their city's efforts to build resilience. To further understand which policies and programs cities are implementing to build resilience, we complemented the survey of city officials with a web-based analysis of policy adoption.

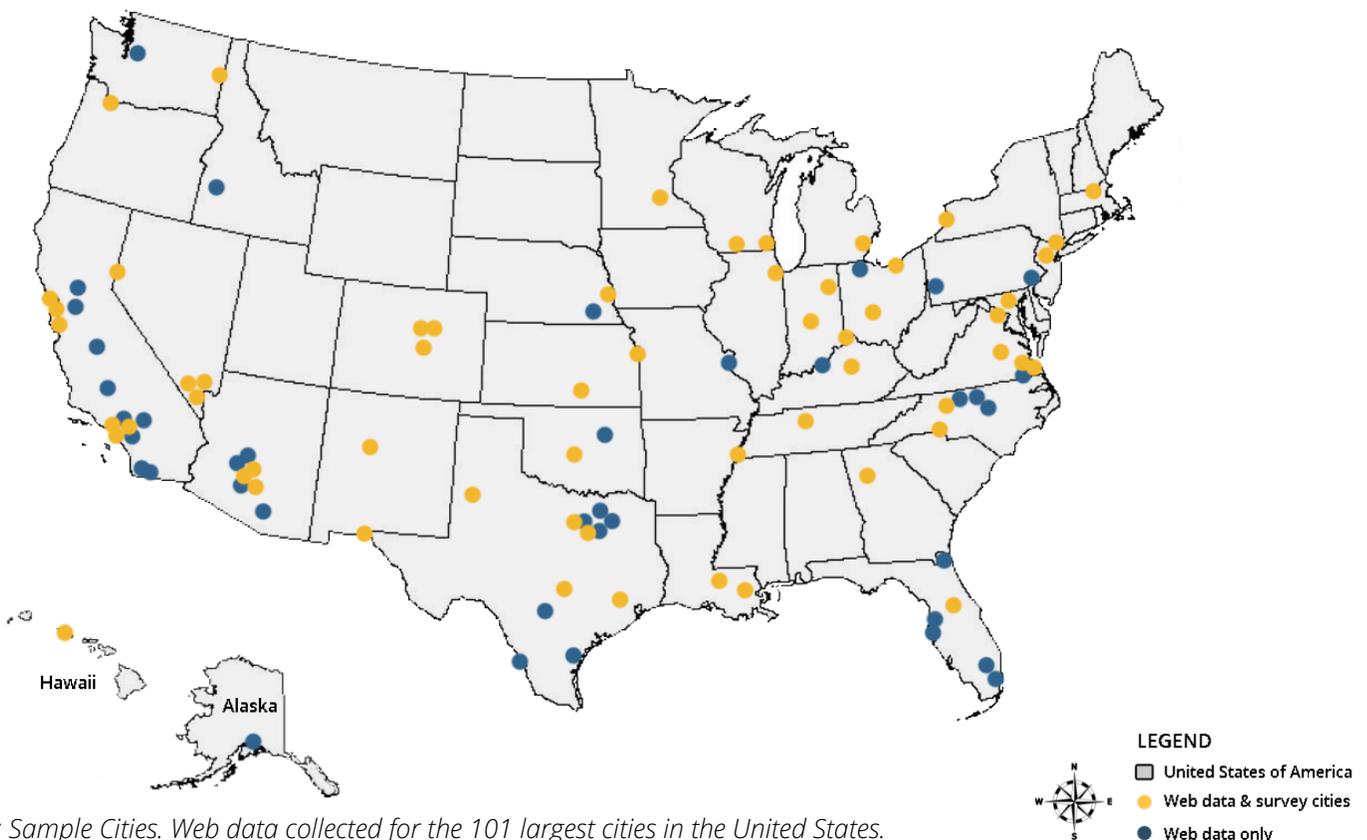


Fig 1: Sample Cities. Web data collected for the 101 largest cities in the United States. Survey data from 58 of those cities.

To better understand the policies and programs the 101 largest U.S. cities are implementing to build resilience, we complemented the survey of city officials with a web-based analysis of policy adoption. We searched government websites and online materials for evidence of implementation of 109 different resilience policies. We consider a broad range of policies – hardening critical infrastructure, locally sourced food, lead paint abatement - to capture different interpretations and understandings of resilience. A full list of policies included in the study is available in Appendix A. For each policy, we searched government websites and online materials for evidence of policy adoption and implementation.

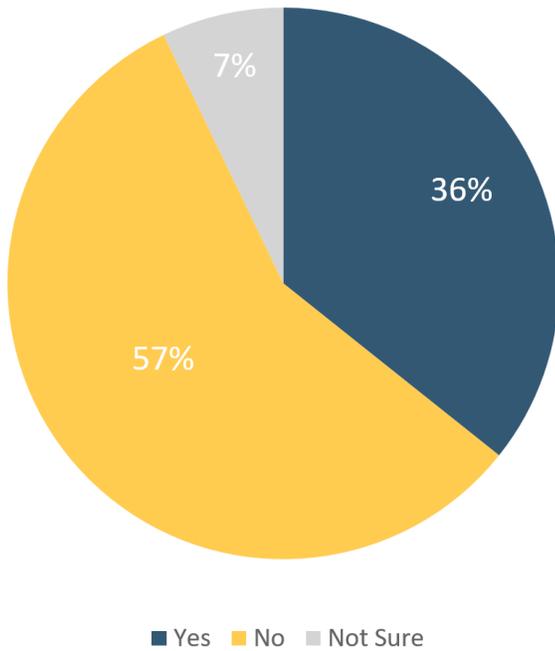
The web-based analysis uses a binary approach, determining whether a city has a policy or does not. For most policies and programs to be coded as present they must: (1) fulfill the description of the policy; (2) have sufficient evidence that the policy is in effect or the program is being implemented; and (3) be a city policy – either the city authorized, funded, or implemented the policy or program.

It is important to note that there is wide variation in what may qualify for each policy. In other words, there might be a number of different ways that a city could be given credit for having a policy or program. For example, a city that has a single green infrastructure demonstration program and a city that is using a variety of tools to promote green infrastructure would both qualify as having a green infrastructure program. Coding for presence of policies does not capture city context and depth, but is necessary to compare a larger sample of cities. Conversely, having a policy coded as absent may mean that either the city does not have the specific policy or that the policy is not documented online.



# AN EMERGING AGENDA

While resilience has rapidly risen in prominence, our results suggest that it is still an emerging policy agenda that has not been formalized in many cities. *Figure 2* demonstrates that only around 36% of the surveyed cities have an official resilience plan. In contrast, 62% of respondents indicate that their city has a sustainability plan. Even fewer cities, just 29%, currently have a resiliency indicator system or project to measure or track resilience outcomes.



“ We are starting to really focus on this issue.”

“ We recently embarked on the process of developing a resilience strategy.”

Fig 2: Percent of cities with an official resilience plan.

To understand which cities are looked to by other cities regarding resilience, we asked: “Which cities do you consider to be leaders in resilience?” As shown in *figure 3*, New York was identified as a leader by the most cities, with 11 out of 55. Other cities that topped the chart are Boston with 7 votes, San Francisco with 5 votes, and New Orleans, Norfolk, and Atlanta each with 3 votes. It is notable that all these cities are members of 100 Resilient Cities.

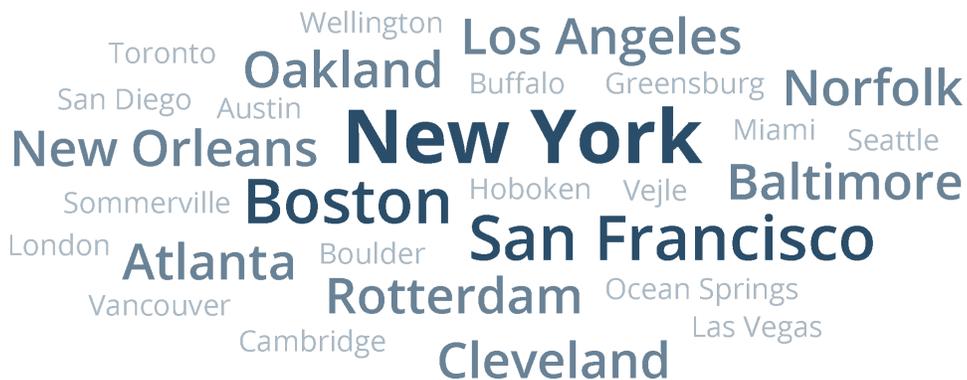


Fig 3: Leaders in Resilience.

# WHAT IS RESILIENCE ?

Resilience is a fuzzy concept with multiple definitions. Meerow, Newell, and Stults (2016) conducted an extensive literature review to document at least 25 definitions of resilience that expose competing concepts. At times resilience is understood as resisting change while at other times it is adapting to change; resilience is discussed as both an outcome and a process. The numerous definitions of resilience make it difficult to translate the concepts into specific policies and programs. As *figure 4* shows, an equal number of cities (46%) do and do not have a formal definition of resilience

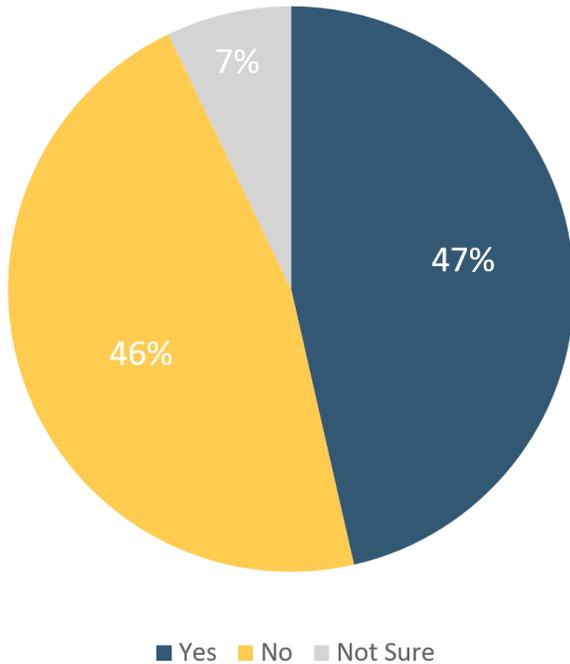


Fig 4 : Percent of cities with an established definition of resilience.

To understand how cities define resilience, we asked, “As a general rule, what do you consider to be the critical attributes of a resilient city?” and provided a list of 12 attributes that are commonly discussed in the literature. *Figure 5* shows the percentage of respondents that selected each attribute of a resilient city.

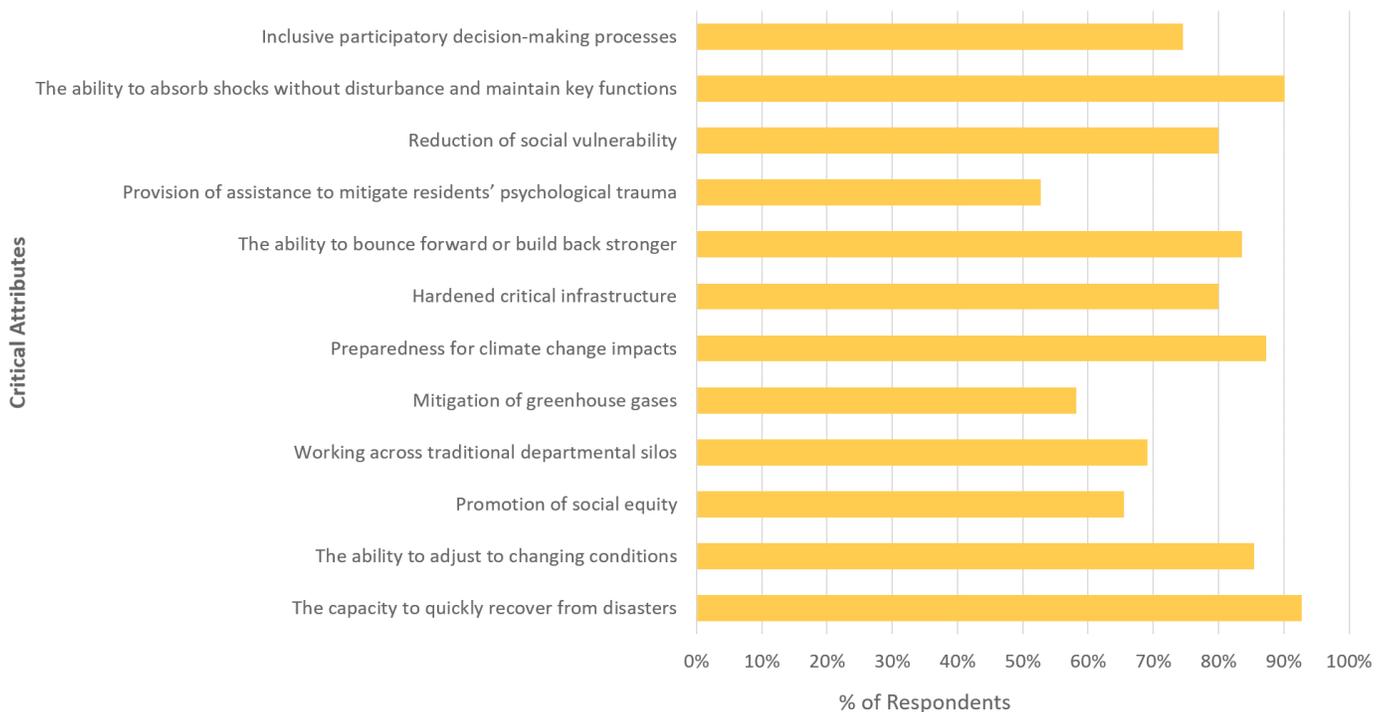


Fig 5 : Critical attributes of a resilient city.

---

# WHAT IS RESILIENCE ?

According to the survey respondents, the most crucial element for resilience is the ability to adjust to changing conditions which was selected by 98% of the respondents. The next most important attribute, chosen by 90% of the city officials, is the ability to absorb shocks without disturbance and maintain critical functions. It is closely followed by preparedness for climate change impacts with 87% and the ability to bounce forward or build back stronger with 84%. Reduction of social vulnerability and hardened critical infrastructure were both selected by 80% of the participants. About three-fourths (75%) of the respondents chose inclusive participatory decision-making processes as a critical attribute of a resilient city. The next most commonly selected attributes are working across traditional departmental silos and promotion of social equity, both with 69% of the total responses. The three least chosen attributes are the capacity to recover quickly from disasters (65%), mitigation of greenhouse gases (58%), and provision of assistance to mitigate resident's psychological trauma (53%).

The results illustrate that resilience remains a fuzzy concept that encompasses a broad set of attributes. Of 55 respondents to the question, 40% selected all the attributes in the list. More than 90% of the respondents picked five or more attributes from the checklist. This demonstrates that city officials' understanding of resilience is multi-faceted and potentially includes conflicting goals.

The most commonly selected attributes align with disaster resilience, demonstrating the prevalence of disaster resilience in city resilience efforts. Disaster resilience focuses on the ability to moderate the harm of disasters through hazard mitigation, response, and recovery. It is notable that the idea of quickly recovering from disasters, which aligns with engineering resilience and the idea of returning to a stable state following crisis, is not as commonly selected.

More cities selected reduction of social vulnerability than promotion of social equity, demonstrating that a broader concept of resilience that includes addressing underlying causes of social vulnerability is not as widely adopted.

*“ We are completing our first sustainability plan, which is inclusive of both climate mitigation and resilience activities. ”*

*“ Resilience has been focused on hazard response and economic vibrancy. The term has been challenging to validate beyond just another buzzword like, 'sustainability'. ”*

# WHAT IS RESILIENCE ?

Resilience is frequently defined in relation to hazards, so we asked participants to indicate whether different hazards pose a threat to their cities. *Figure 6* illustrates the extent to which 14 different hazards pose a threat to a responding city. Flooding and extreme heat are the most prevalent high-threat-hazards. 73% cities view flooding as a high threat to their city. Nearly every city identified flooding, extreme heat, environmental pollution, threats to cyber security, and acts of terror as a threat. Most cities also view epidemics and industrial accidents as a threat, although few consider them a high threat. Mudslides, hurricanes, earthquakes, wildfires, and tornadoes are not considered a threat in many cities illustrating the geographic specificity of these hazards. Actions to build resilience to these hazards may require different policies.

Many cities identify multiple hazards as a high threat demonstrating that resilience is intended to address multiple, inter-related hazards. About 40% of the cities identify 12 or more of the 14 hazards as a threat.

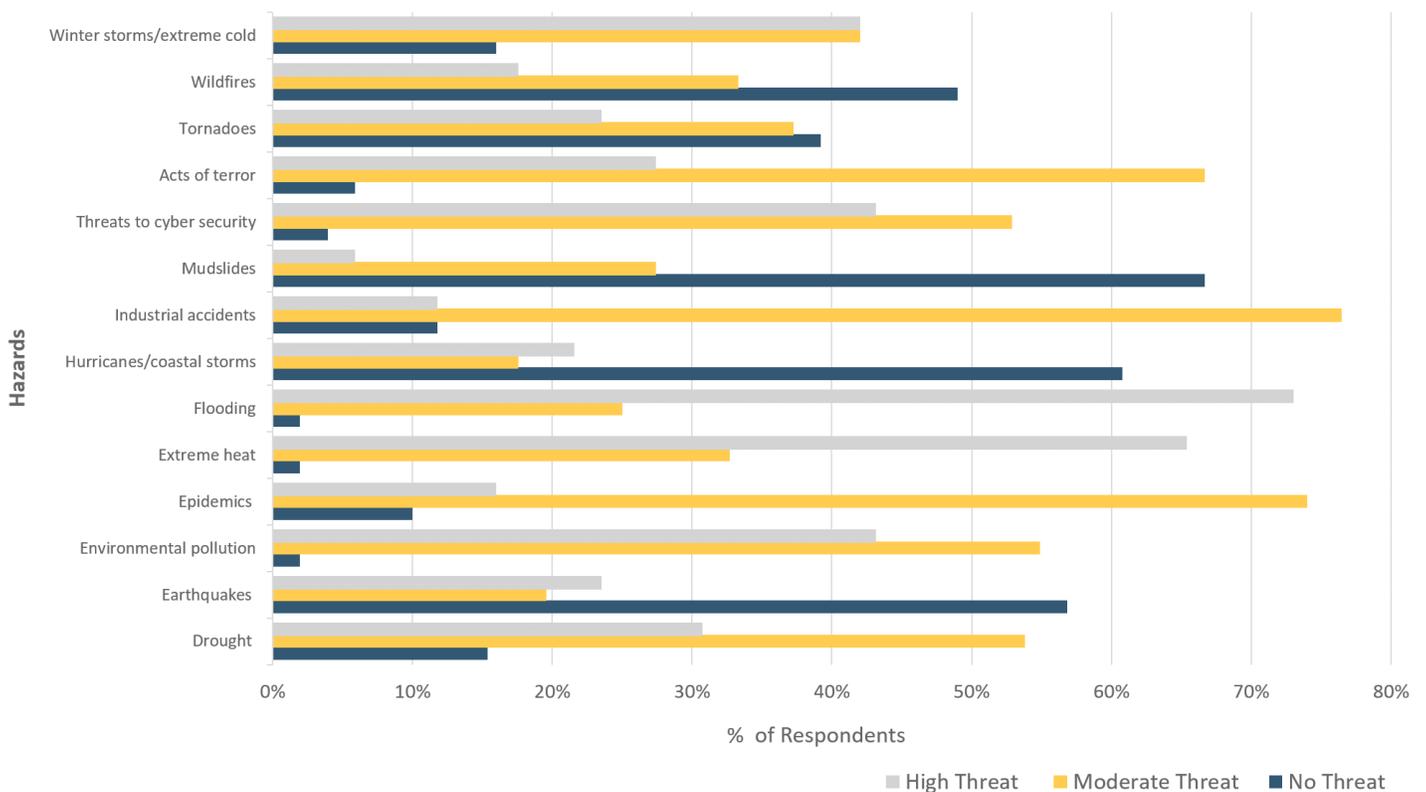


Fig 6 : Hazard threats. Percent of respondents that rated hazard as high, moderate, and no threat.

**“ When our office talks about ‘resilience’, we mean specifically climate resilience, or resilience to the impacts of climate change that the city is facing and will face: extreme heat, extreme precipitation, and to a lesser extent sea level rise. ”**

# WHAT IS RESILIENCE ?

To better understand the resilience challenges that cities are confronting, we asked specifically about their experience with flooding in the past five years: “What areas or what kind of facilities in your city have experienced any flooding over the last five years?” We then provided a list of different areas and facilities such as critical infrastructure (hospitals, schools, wastewater treatment plants, etc.) and areas with socially vulnerable populations.

According to the survey responses, shown in *Figure 7*, 73% cities have experienced flooding on major local roadways. The next highly flooded areas include neighborhoods with a higher concentration of socially vulnerable populations (62%), areas with older or historical development (60%), and outlying business or commercial areas (53%).

The prevalence of cities that selected areas with a higher concentration of socially vulnerable populations, demonstrates that social vulnerability is an issue in many cities. Only about half of the cities, however, indicates that minorities have been affected by flooding.

Most cities indicate that flooding has not affected critical infrastructure. The areas that experienced the least flooding in the past five years are hazardous chemical/waste sites (4%), electric generating facilities (16%), and hospitals (16%).

About 13% of cities indicated that they experienced extensive flooding selecting more than 10 of the 15 areas in the city. On the contrary, about 29% of the cities responded that they experienced more localized flooding selecting 5 or fewer of the areas. Four cities indicated that they have not had any flooded areas in the past five years.

Although 28 out of 45 cities specified that they experienced flooding in areas with higher concentration of socially vulnerable populations, only 22 out of those cities selected reducing social vulnerability as an attribute of a resilient city.

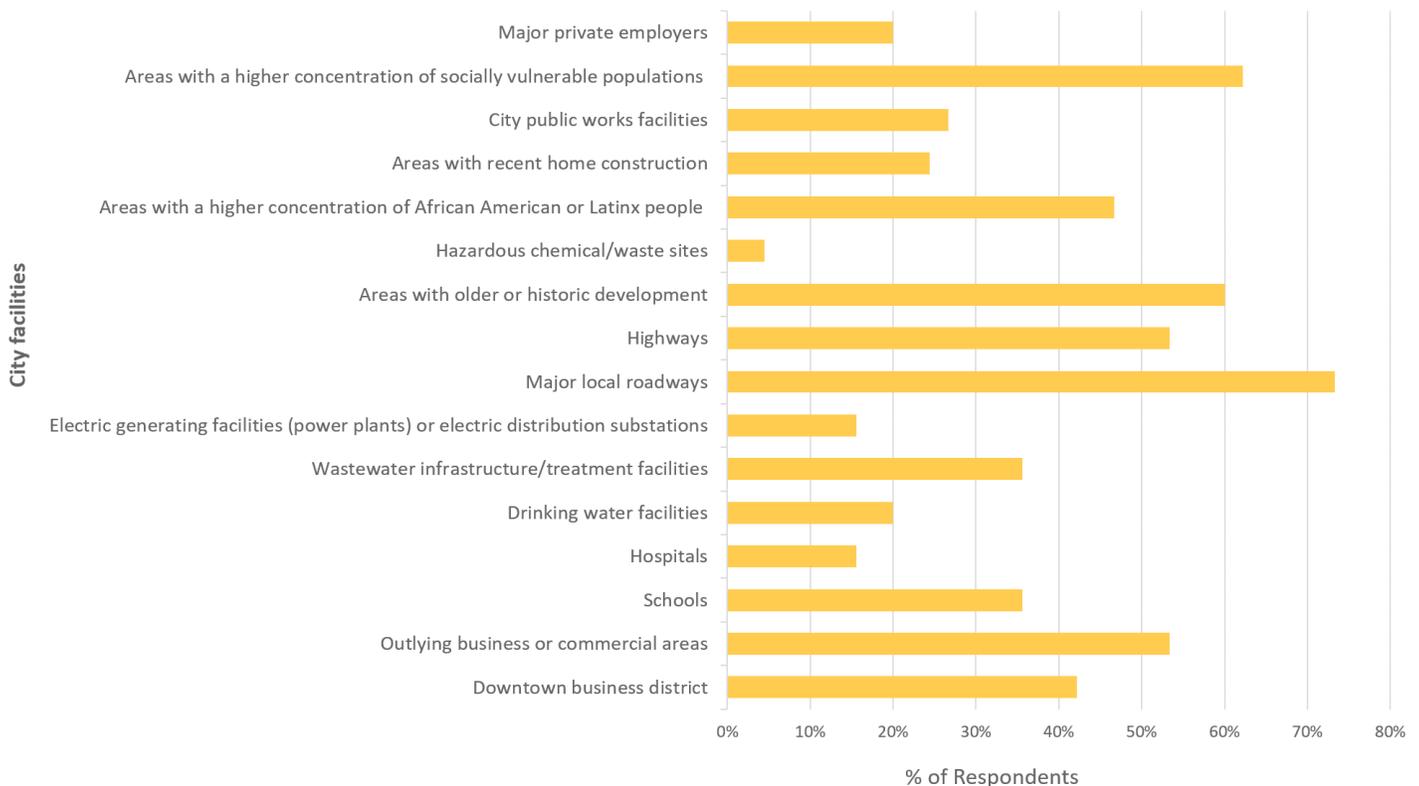


Fig 7 : City Facilities that have experienced flooding over the last five years.

# WHO IS ENGAGED ?

To better understand who is leading resilience efforts in cities, we asked “Which groups or agencies played a major role in initiating resilience efforts in your city. Please check all that apply” and provided a list of five groups and an opportunity to write in others. As shown in Figure 7, about three-fourth (76%) of the respondents said that community groups played a significant role in initiating resilience efforts. Mayors were the second most frequent initiators, identified as playing an important role in initiating resilience in 65% of the cities. In comparison, state agencies (37%) were the least common initiators of city resilience efforts followed by the business community. Three out of 55 cities (i.e. 5%) selected all organizations from the list

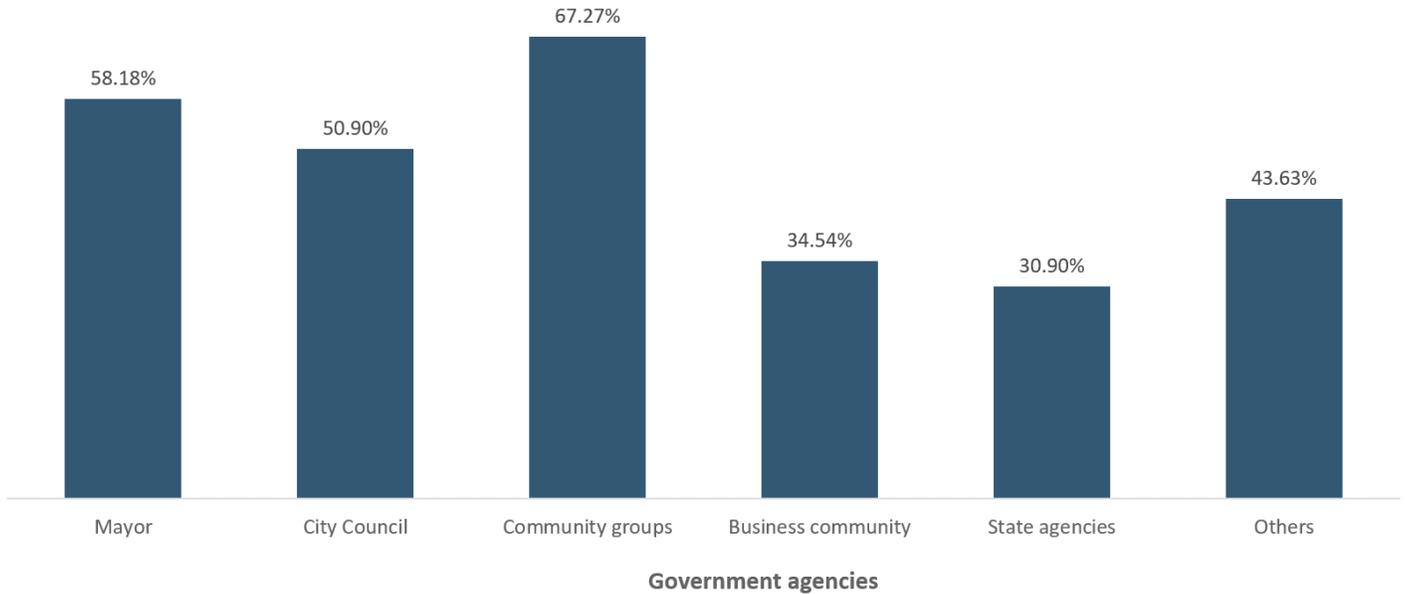


Fig 8 : Groups or agencies that played a major role in initiating resilience efforts in the city.

In cities where state agencies were important in initiating resilience efforts, respondents identified state emergency management, energy, transportation, and environment departments as important. The cities also mentioned a few other groups that played a major role in initiating resilience such as specific government departments, public utilities, universities, and foundations.

**“ We were selected as one of the 100 Rockefeller Resilient Cities in 2017 but had to place the project on hold last year because of Mayoral transition. The hope is to re-invigorate the project after the next mayoral election. ”**

# WHO IS ENGAGED ?

**“ In our city, we utilized FEMA Mitigation grant funds to purchase repetitive loss locations to limit the effects of flooding in the future. An example would be from the 2010 Tropical Storm Hermine, Rush Creek flooded a condominium community. After using the funds to purchase the property, the city turned the area into a green space and dog park for community use. ”**

Figure 9 displays the percentage of cities that received external funding from different sources in the past two years. It is notable that about one quarter of cities (24%) have not received any external funding for resilience. Cities that did receive funding, most frequently (43%) received funds from federal agencies (i.e. HUD, FEMA, NOAA). Local non-profit organizations or foundations were the second most common source of funding, providing funding to about 35% of cities. About a third of the cities received funding from national or international non-governmental organizations (33%) and state agencies (33%). Funding from other local governments (19%), private companies (13%), and other sources (11%) is less common.

About 33% of the cities received funding from two or more sources. Five out of 54 cities (9%) have received funding from all three levels of government - federal, state, and local - in the past two years. Four cities received funding from five or more sources.

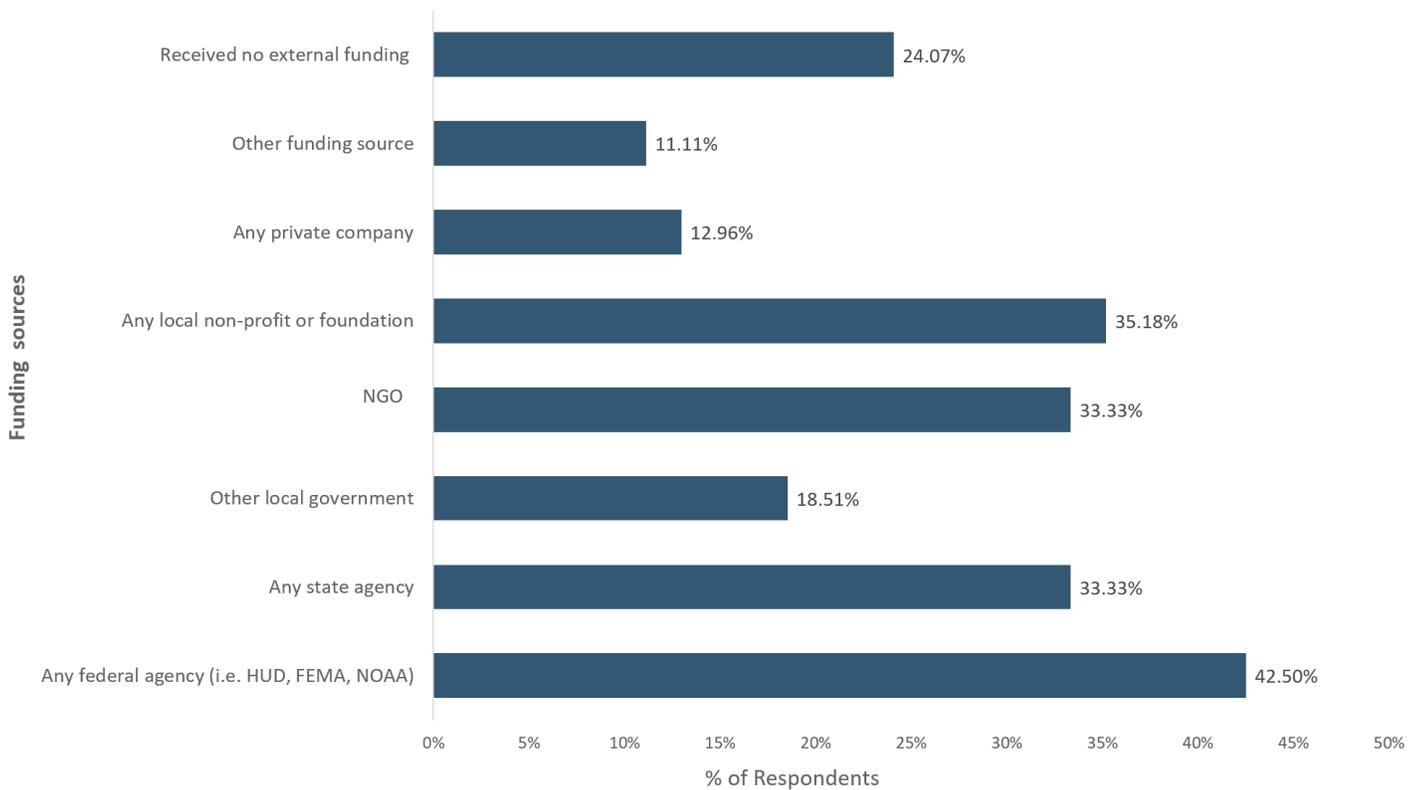


Fig 9 : External funding sources for resilience projects.

# WHO IS ENGAGED ?

We asked which city government departments and city organizations have been involved in resilience efforts. The survey provided a list of 19 city government offices and respondents checked all that were involved. The results, shown in *figure 10*, demonstrate that in most cities resilience reaches across traditional sectors and silos. Of the respondents, approximately 15% indicated that all departments and offices are involved in resilience efforts. An additional 19% reported 18 of the 19 offices were involved in resilience efforts in their city.

The agencies that are most frequently reported as involved in city resilience efforts are emergency management (83%), planning (81%), and public works (81%). Resilience offices are less commonly involved (48%), likely because many cities do not have a resilience office. However, based on our data, we cannot determine how many cities do and do not have each department. Local businesses (48%), city council (54%), economic development (54%) and local foundations (56%) are not as widely involved

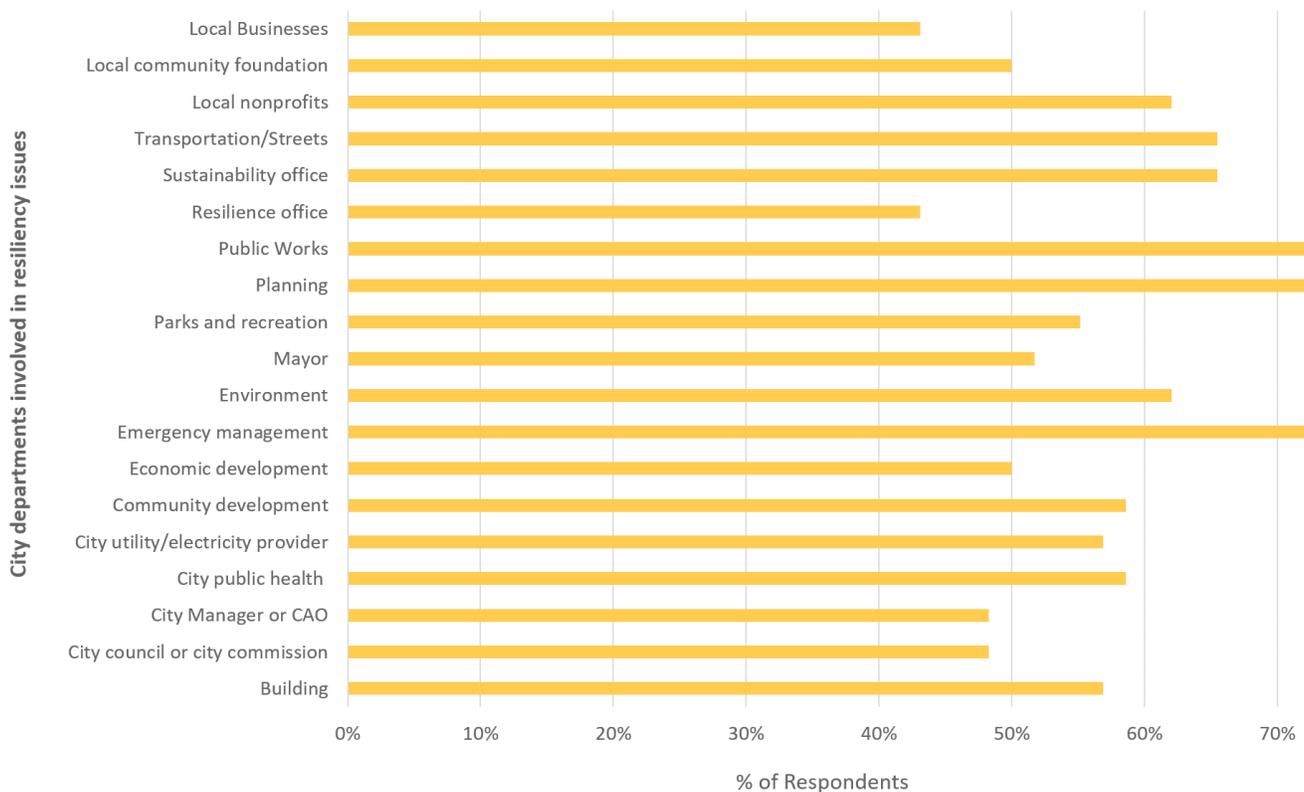


Fig 10 : City departments involved in resilience.

Figure 11 shows how frequently the responding agency coordinates with other city departments (or equivalent units) to address problems or issues related to resilience. We corrected for cities that do not have the departments of interest, so values should be interpreted as collaboration of cities with the given department. The results demonstrate that in most cities resilience is a highly collaborative endeavor. Eight of the respondents indicated that they were occasionally or frequently involved with all other city departments. Over 50% of the respondents coordinate with 13 or more of the 15 departments listed.

# WHO IS ENGAGED ?

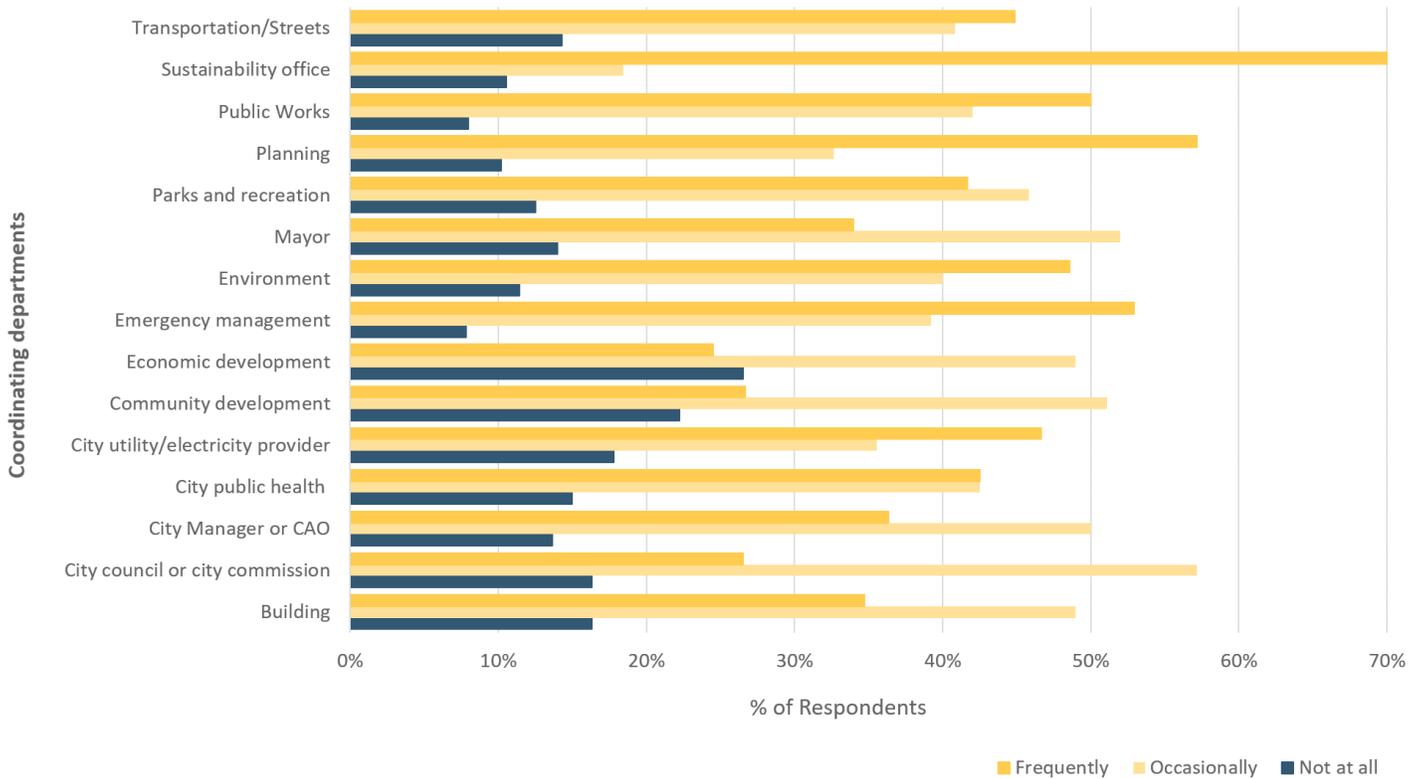


Fig 11 : Coordination among city departments on resilience.

Considering frequent and occasional coordination together, respondents most commonly collaborate with the emergency management and public works departments. They coordinate least with economic development departments, about a quarter of respondents indicate they do not coordinate with these departments at all. Focusing on frequent coordination, the most prevalent collaborator is the sustainability department. Of the cities with a sustainability department, 71% of respondents indicating that they frequently coordinate with the sustainability department. However, it is important to note that eleven cities report not having a sustainability department. The sustainability department is closely followed by the planning (57%), emergency management (53%), and public works (50%) departments as frequent collaborators. While mayoral offices, city council, and building departments are widely reported as collaborators, most respondents indicate that they occasionally (as opposed to frequently) coordinate with these offices. Even in cities where the mayor and city council are viewed as initiators of the resilience agenda, they are not commonly engaged in the day-to-day resilience efforts.

To better understand how much cities collaborate with organizations outside city government, we asked: “How frequently does your city coordinate with the following organizations to address problems or issues related to resilience?” and provided a list of 9 organizations such as county government, state agencies, and college and universities. *Figure 12* shows that coordination with outside organizations on resilience is ubiquitous. Half of the cities report that they coordinate (either frequently or occasionally) with every type of organization in their region. Taking frequent and occasional coordination together, cities most commonly coordinate with community nonprofit organizations, metropolitan planning organizations (MPOs), counties, and colleges or universities. Cities coordinate least with councils of governments, mostly because about a quarter of cities are not members of a council of governments.

# WHO IS ENGAGED ?

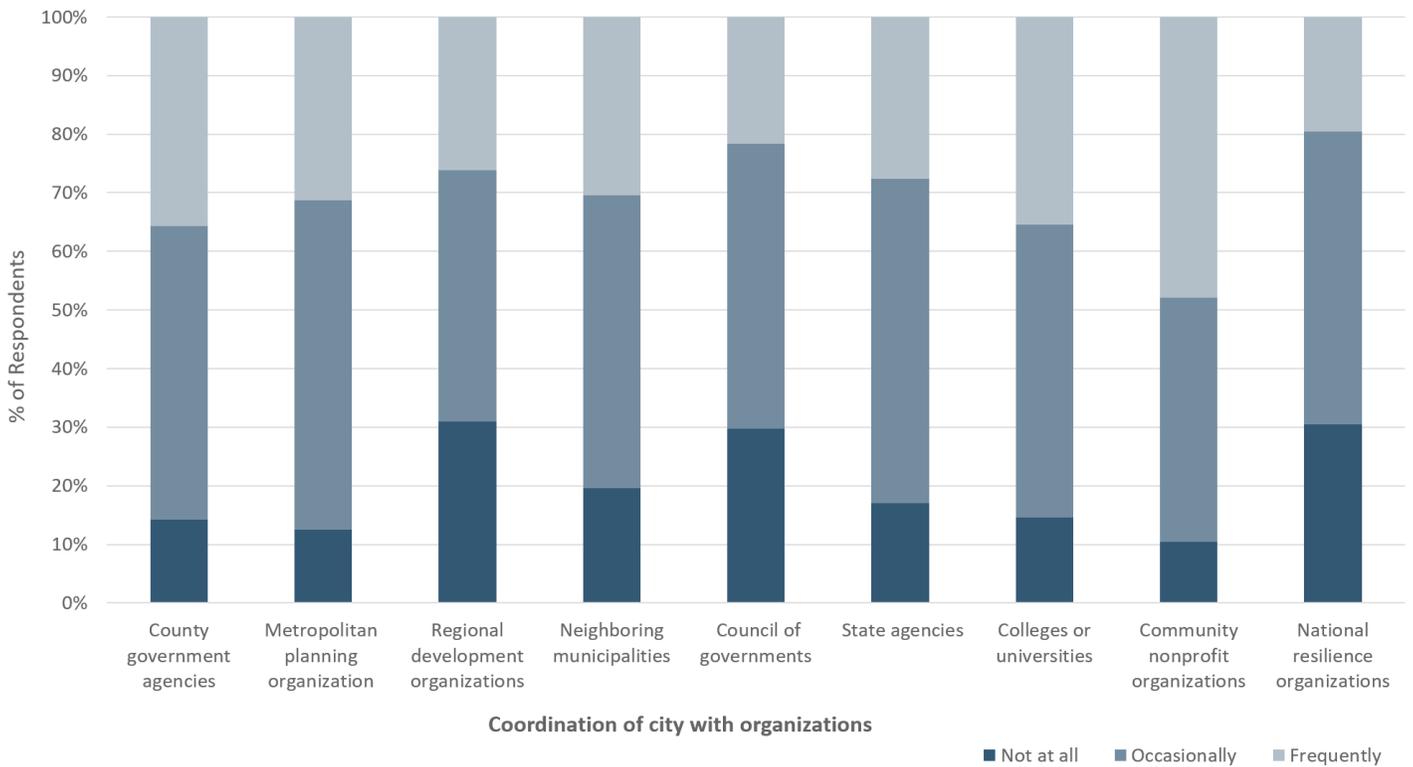


Fig 12 : City coordination with external agencies.

While collaboration with outside organizations is prevalent, cities tend to occasionally – as opposed to frequently - coordinate with outside partners. Focusing on frequent collaboration, cities most commonly coordinate with community nonprofit organizations. This is the only group for which more cities report frequent coordination than occasional coordination. Nonprofit organizations (48%) are followed by county government (36%), colleges or universities (35%), and metropolitan planning organizations (31%).

In terms of organizations that cities do not coordinate with, cities coordinate least with regional development organizations, closely followed by national resilience organizations and council of governments.

**“ The public works department factors resilience into capital project improvements and into maintenance practices where possible. ”**

**“ The metropolitan sewer district worked with many municipalities to create a resilience plan for the region. ”**

To further explore how cities collaborate with outside organizations, we asked if they engaged in different collaborative activities related to resilience. The results are shown in figure 13. The majority of the cities, about 60%, have participated in joint resilience planning with regional, state, or federal government agencies. About half the cities have made changes to city comprehensive or other plans based on regional planning efforts (50%), but no other collaborative activities were taken by a majority of cities. The rarest form of collaboration was joint purchasing with other local or county governments, selected by only 30% of the cities.

# WHO IS ENGAGED ?

Only one city reported engaging in all the collaborative activities. On the other hand, 25% of the cities said that they engaged in one or none. This suggests that there is opportunity to increase regional collaboration on resilience efforts.

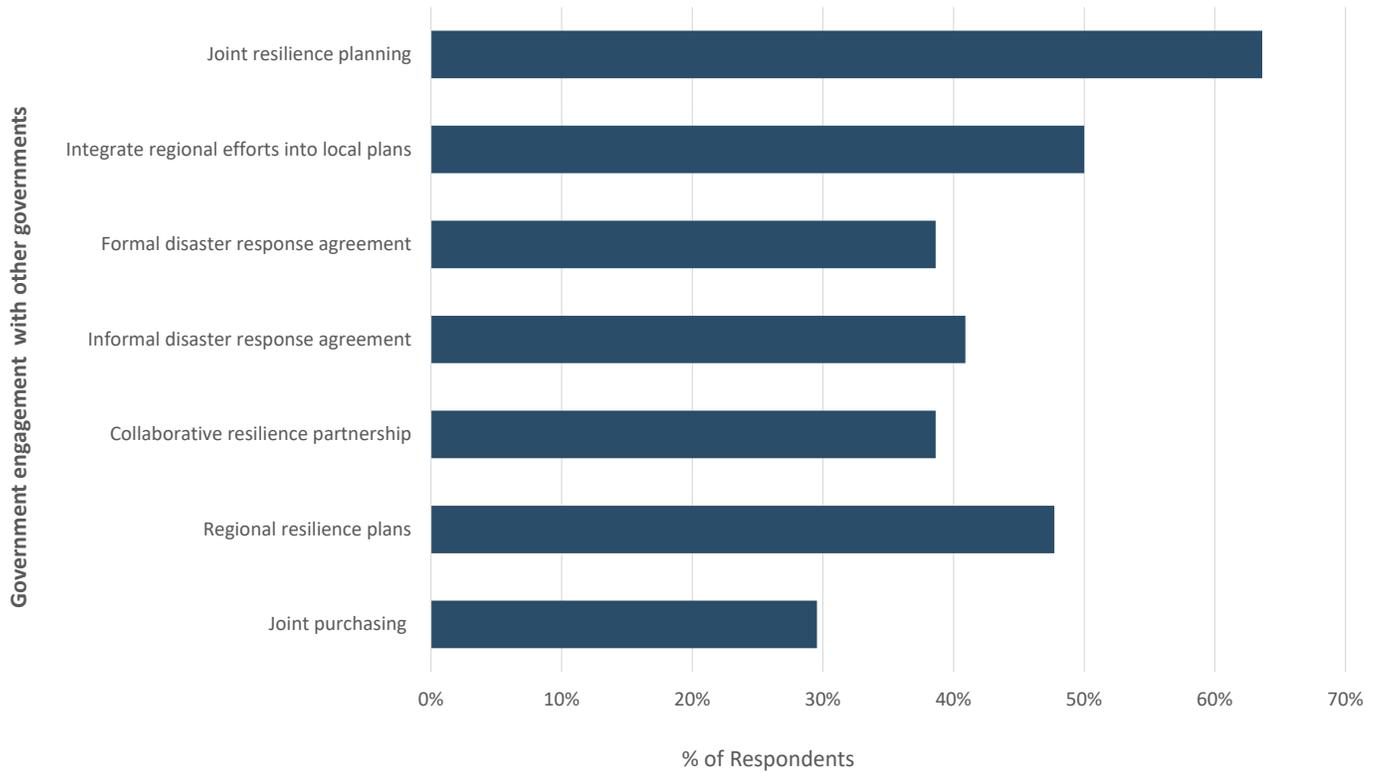


Fig 13 : Collaborative actions. Percent respondents that have engaged in collaborative actions with other governments.

“ We will be creating a resilience plan after a regional effort is completed (18 months). ”

“ The city adopted a resolution supporting community resilience jointly with a local university. Resilience is also a guiding principle of the City's 2050 Master Plan, which is currently under development. ”

“ Our city has addressed issues of resilience primarily from an emergency services and preparedness standpoint in the past, but has partnered on regional projects that address climate change resilience more holistically, and as such, is in the process of developing an integrated sustainability and resilience strategy to guide the City's action on climate change. ”

# POLICIES AND PROGRAMS

To understand which resilience-related policies and programs cities are implementing, we provided a list of 26 different policies that a city could have adopted. Policies captured the range of different concepts of resilience from policies to reduce greenhouse gas emissions to policies that advance social equity to policies that help avoid disaster impacts.

Figure 14 shows the percentage of cities that have adopted the different policies and programs. About 80% of the cities indicate that they have policies and programs related to complete streets, and increasing the energy efficiency of local government operations. These are closely followed by replacing fleet vehicles and buses with alternatively fueled vehicles (78%) and providing assistance on affordable housing application (73%). Some of the least common policies chosen by the respondents include support business' creation of business recovery plans (13%), city investment checklist to ensure equality and/or resilience in public investments (22%), subsidy or rebate system to assist low-income residents with the purchase of air conditioning/heating (25%), and evacuation plan to assist vulnerable populations.

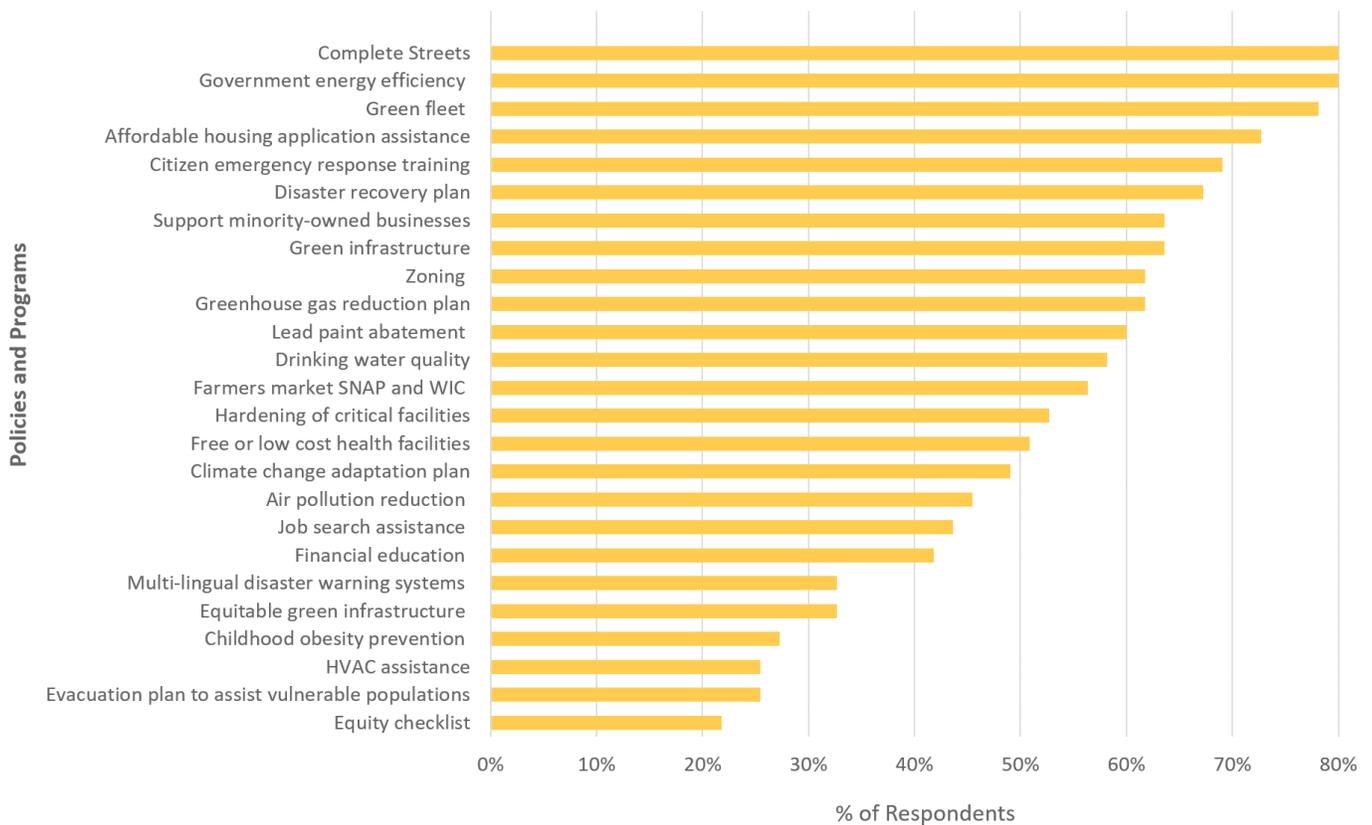


Fig 14 : Percent cities that have adopted resilience policies and programs.

# POLICIES AND PROGRAMS

Many of the most commonly adopted policies - such as complete streets, government energy efficiency, green fleet, and green infrastructure - are traditional sustainability policies. Programs and policies to address social vulnerability are not widely adopted, e.g., checklist to advance equity in city investments, assisting low-income residents with the purchase of air conditioning/heating, prioritizing green infrastructure in neighborhoods with greatest need.

The lack of policies to address social vulnerability demonstrates an implementation gap. Of the 44 cities that state addressing social vulnerability is a key attribute of resilience, only 16 have disaster warnings in multiple languages and 13 have plans to help evacuate vulnerable populations.

Figure 15 shows the distribution of policies adopted by cities. On average, cities have adopted half of the policies we asked about but there is large variation across cities. At the higher end, four cities form the 55 (7%) respondents selected more than 80% of the listed policies, while an equal number of cities selected less than 20% of the given policies.

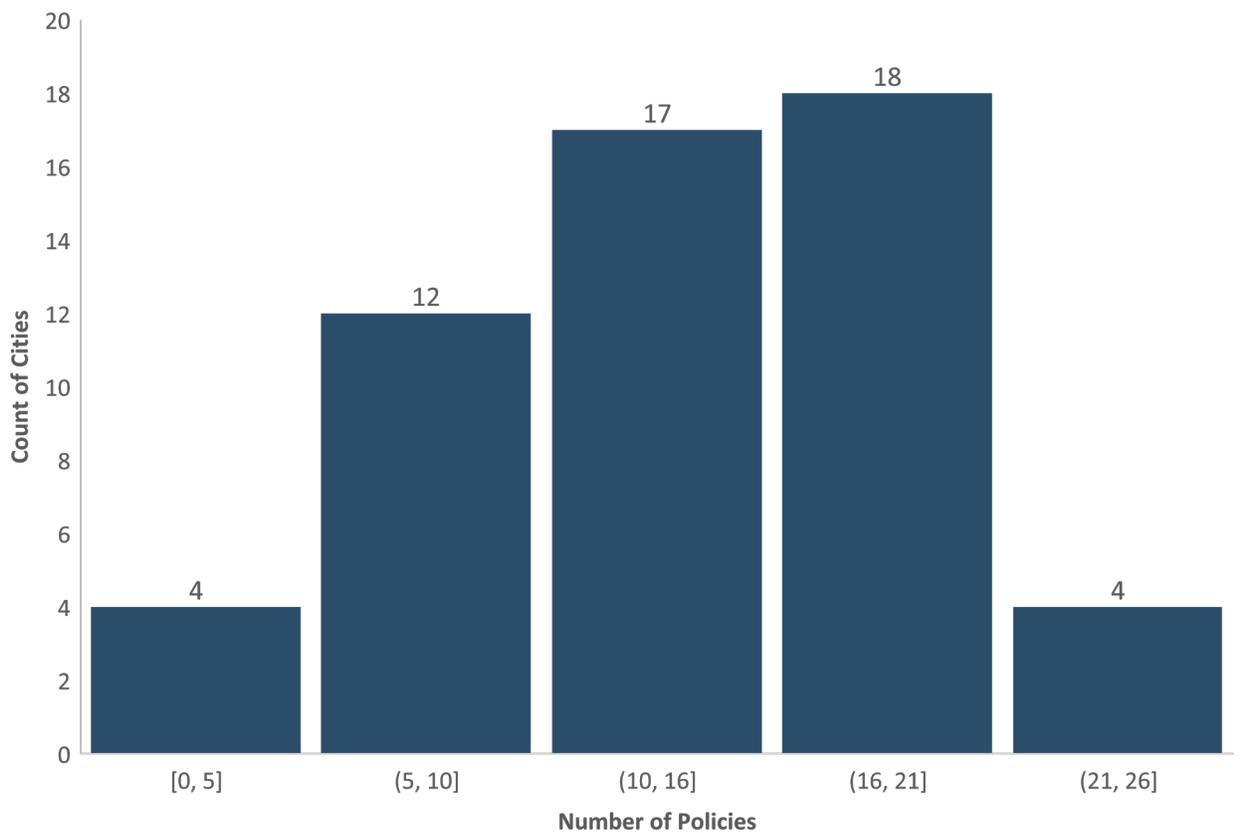


Fig 15 : Distribution of city policies and programs.

**“ Why we are not currently implementing Climate Action and Climate Adaptation plans, we are in the process of creating them-- and equity and vulnerable populations will greatly figure into these plans . ”**

# POLICIES AND PROGRAMS

Figure 16 displays the different engagement activities that city governments conducted in the past two years. More than three-quarters (78%) of the cities conducted disaster simulation exercises. Incorporating resilience into strategic planning was the next most engaging activity selected by 68% of the cities. Only about half of the cities engaged in activities such as sponsoring stakeholder engagement workshops on resilience (56%), reaching out to low-income, disadvantaged, or diverse communities on resilience issues (52%), holding public hearings or information sessions on resilience issues (50%), and conducting a community vulnerability assessment (48%). Out of the cities that engaged in outreach to low-income, disadvantaged communities on resilience issues, about 46% indicated reduction of social vulnerability as a critical attribute of a resilient city.

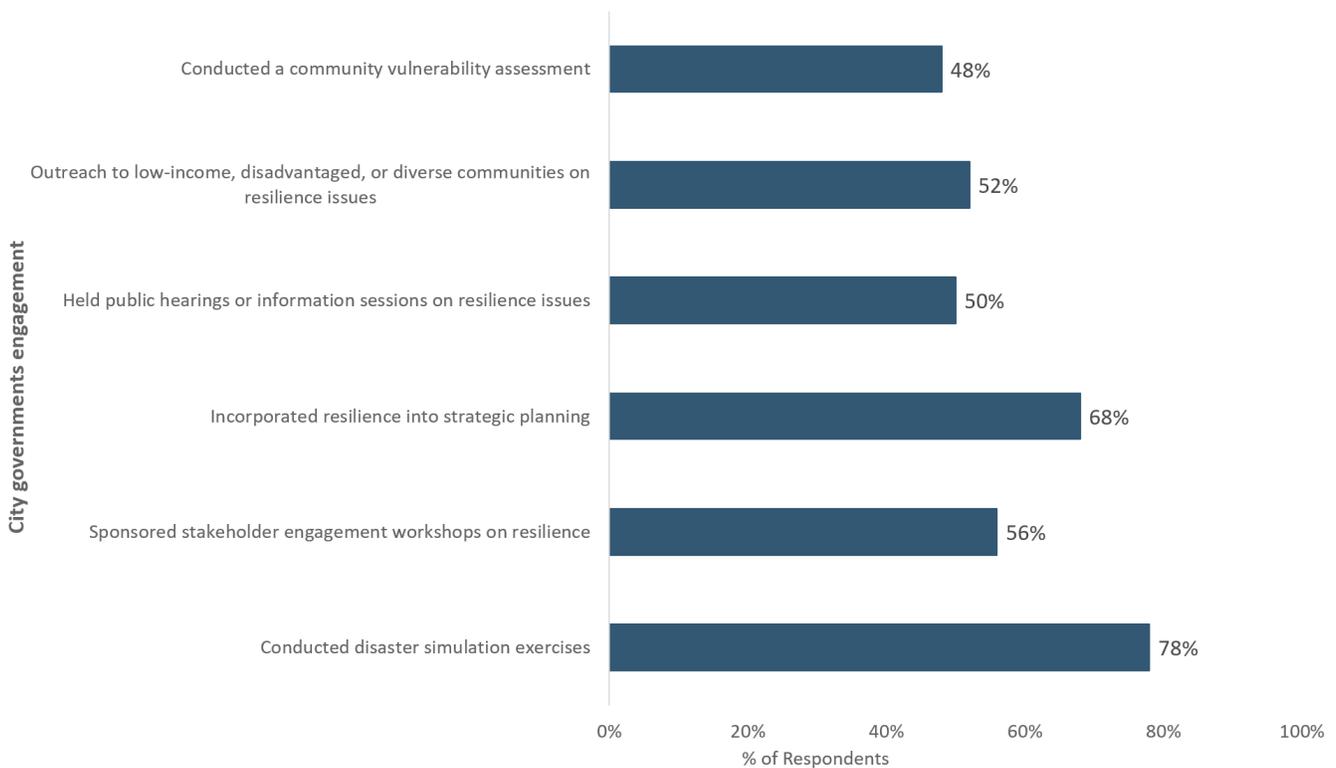
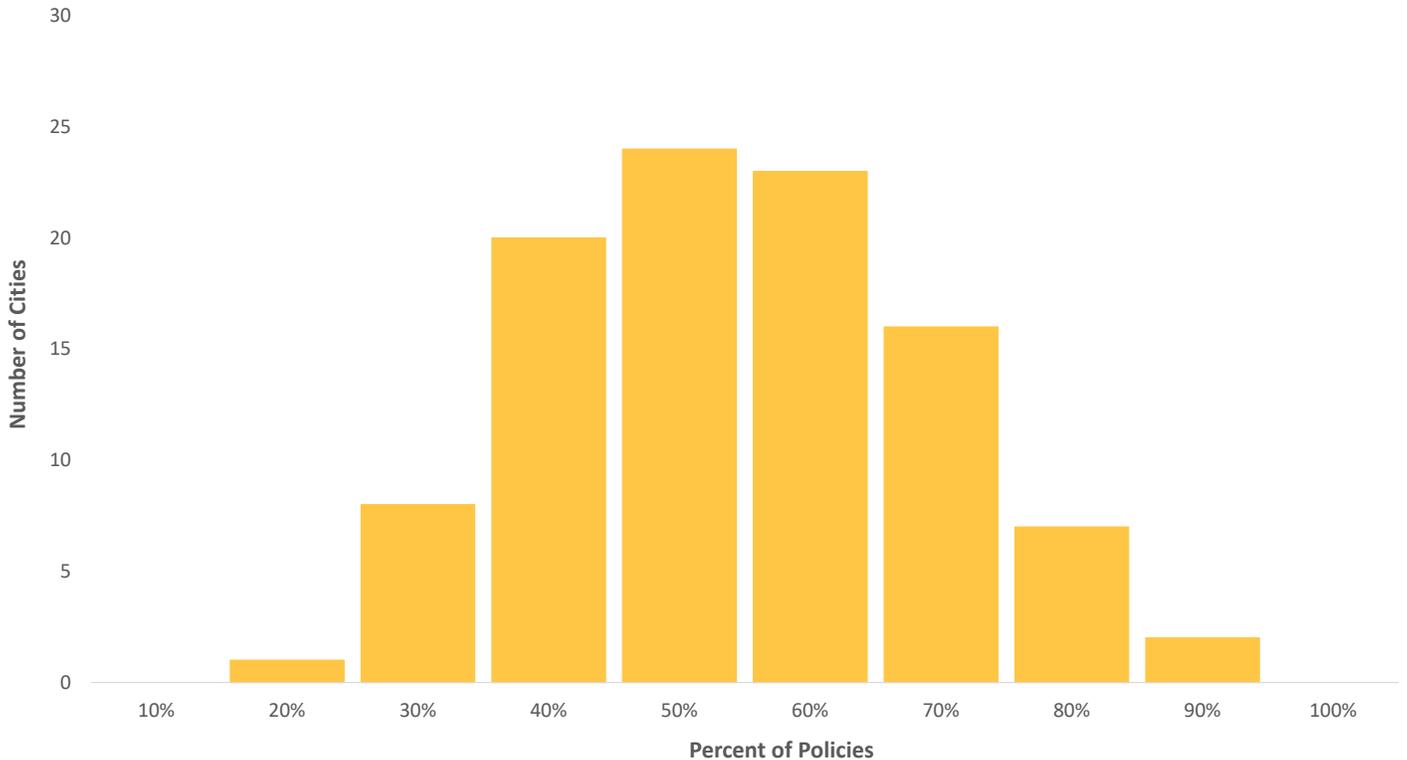


Fig 16 : City government engagement activities.

To further understand which policies and programs the 101 largest U.S. cities are implementing to build resilience, we complemented the survey of city officials with a web-based analysis of policy adoption. We searched government websites and online materials for evidence of implementation of 109 resilience policies. Appendix A provides a full list of policies included in the analysis and the percent of cities that have adopted each policy. On average, cities have adopted 54 of the 109 resilience policies and programs included in the analysis. There is large variation in adoption of policies across cities (from a low of 21 to a high of 97 policies) and across policies (3 to 98 cities). *Figure 17* shows the distribution of policies adopted by cities.



*Fig 17 : Distribution of number of policies across cities.*

New York, NY has adopted the most policies with 97 of the 109 included in our study. They are followed by San Francisco, CA (96 policies); Austin, TX (87 policies); Seattle, Washington (82 policies); Washington DC (82 policies); and Los Angeles, CA (81 policies).

The cities that score lowest on our index are San Bernardino, CA (21 policies); Lubbock, TX (24 policies); Bakersfield, CA (24 policies); Laredo, TX (29 policies); St. Petersburg, FL (29 policies); and Newark, NJ (29 policies).

The most prevalent policy is household solid waste recycling, 98 of the 101 largest cities offer recycling. More than 90 cities have also adopted programs to promote biking (96 cities), green infrastructure (96 cities), zoning to protect environmental areas (94 cities), combating homelessness (93 cities), improving storm drainage (92 cities), and comprehensive planning (91 cities). *Figure 18* shows the most prevalent policies.

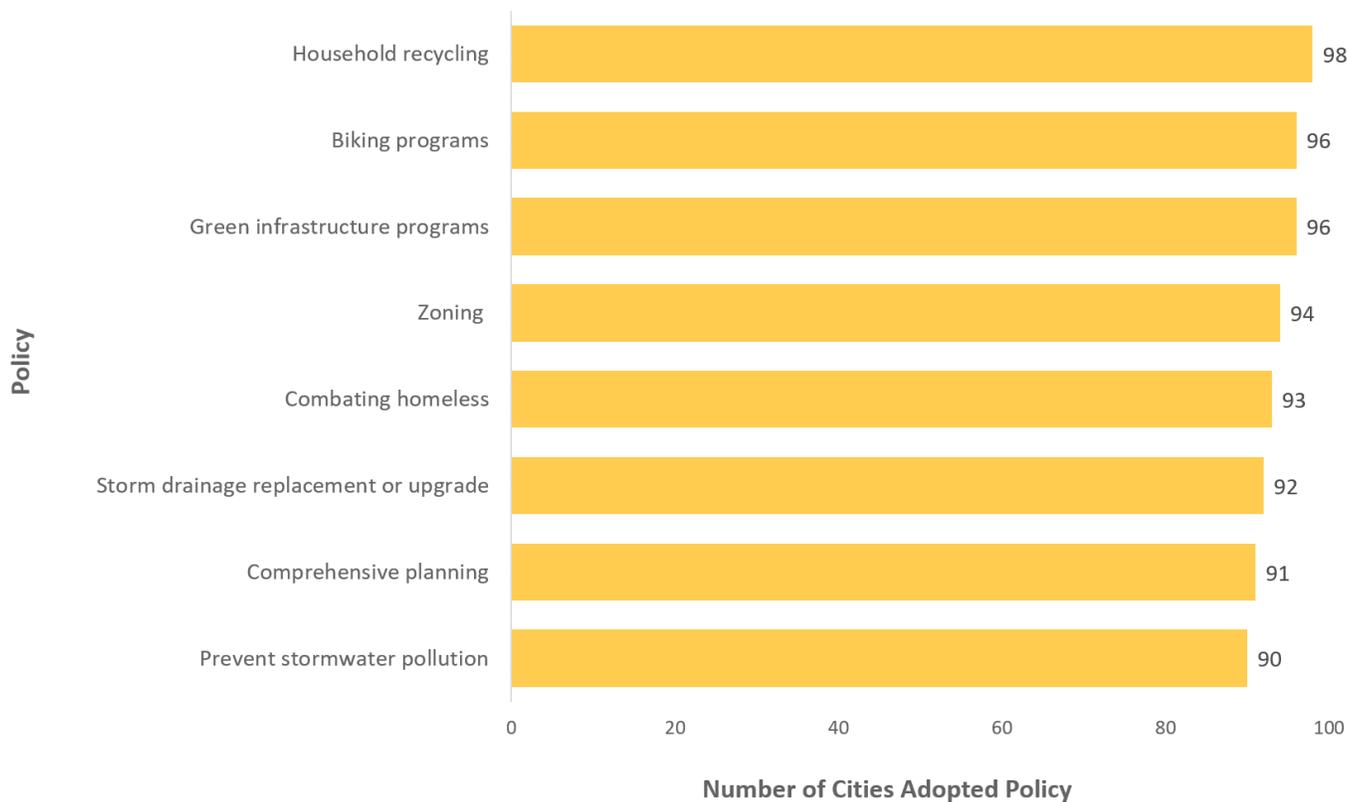


Fig 18 : Most commonly adopted policies.

Conversely, *figure 19* reports the least prevalent policies. Policies to harden critical infrastructure are among the least common policies. Hardening electric generation plants is the least common policy, adopted by only 3 cities, followed by hardening schools (4 cities) and redundant gasoline distribution systems (7 cities). Hardening drinking water treatment plants or distribution (11 cities), transportation infrastructure (14 cities), electric distribution (15 cities), and wastewater treatment plants (18 cities) are also uncommon. This may reflect a limitation of our methods: this information may be difficult to find on government websites and documents. The absence of information, however, does not necessarily mean that cities have not taken this action. Cities may not share this information due to security concerns. The limited hardening of critical infrastructure may also reflect the fact that complex governance arrangements are involved in providing these services and cities may not have direct authority over this infrastructure. Generation of electricity is generally a private industry.

The critical need for electricity, however, has spurred some cities to work collaboratively with power companies to create these policies. Following Superstorm Sandy in 2012, New York City worked with a wide array of stakeholders, including local utility providers and nonprofit organizations to fashion a long-term set of policies and programs to enhance the city's resilience. This collaboration helped shape Con-Edison's \$1 billion investment plan to protect their systems from severe weather (CONED 2013 8; 14).

Climate change mitigation and adaptation is also relatively uncommon with 31 cities having no climate change policies. In particular, climate change adaptation is rare. Only 33 cities have conducted a climate change vulnerability study and 28 have adopted an adaptation plan.

Across policy issues, policies to address social equity are less common than other policy actions. For example, while 96 cities have a green infrastructure program, only 18 have an explicit policy to prioritize green infrastructure in neighborhoods with greatest need. Seventy-eight cities have green building programs, only 38 have programs to create green affordable housing. Energy conservation efforts are present in 73 cities, but only 56 have energy conservation programs targeted for low-income households. Early warning emergency systems are found in 79 cities, but only 32 provide warnings in multiple languages. Of the 33 cities with a climate change vulnerability assessment, only 19 address social vulnerability. Moreover, we found evidence of only 14 cities pro actively engaging disadvantaged communities in resilience efforts.

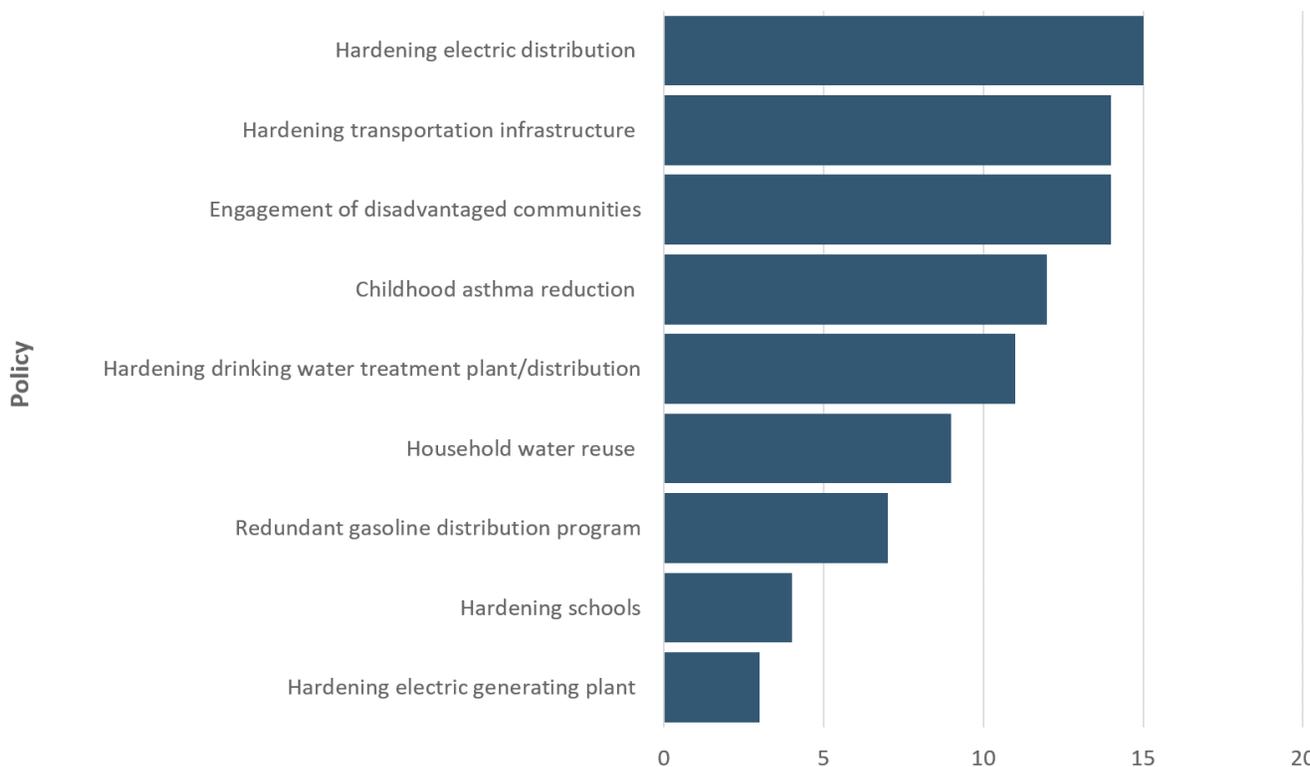


Fig 19 : Most uncommon policies.

City adoption of public health, housing, and economic policies that can advance social equity goals is also mixed. Among the public health policies included in our analysis, urban gardening (80 cities) and locally-sourced food programs (68 cities) are relatively common but others are relatively rare. We found only 12 cities had childhood asthma reduction programs and 35 had childhood obesity prevention programs. Adoption of housing programs is similarly uneven – 93 cities have programs to address homelessness but only 33 have anti-displacement policies. These findings demonstrate clear opportunities to further advance social equity.

Complex governance arrangements exist around many of the types of services and programs assessed in this project. Many of the public health programs – childhood asthma and obesity prevention, vaccination programs, and health facilities – tend to be led by county public health departments. Private companies are often key actors in hardening critical infrastructure. It is surprising that relatively few cities have explicit resilience collaborations with county government (38 cities), metropolitan planning organizations (24), the business community (34), and non-profits (43).

Resilience has been promoted as a new way to approach the complex, inter-related challenges that our cities are confronting – racial inequality, climate change, poverty, aging infrastructure, and more. The resilience platform is broad and ambitious, but poorly defined. What does resilience actually mean in the context of U.S. cities? The goal of this study was to better understand how resilience is operationalized and advanced in the largest 101 U.S. cities. To address how cities define resilience, who is engaged in resilience, and what policies are adopted to build resilience, we conducted a survey of senior city officials. We complemented the survey with a web-based analysis of city adoption of 109 different resilience policies and programs.

We found that resilience is still an emerging platform. Most cities do not have a resilience plan or indicator systems.

City officials' understanding of resilience is multi-faceted and includes a broad set of attributes. The attributes most commonly selected by survey respondents as critical for a resilient city align with disaster resilience. More cities selected reduction of social vulnerability than promotion of social equity, demonstrating that a broader concept of resilience that includes addressing underlying causes of social vulnerability is not as widely adopted.

One-quarter of cities (24%) have not received any external funding for resilience. For cities that did receive funding for resilience projects, federal agencies were the most common source of funding.

Resilience efforts are highly collaborative. In most cities, a large number of city agencies are engaged in resilience efforts and cities commonly coordinate with outside organizations. This suggests that resilience efforts are breaking down traditional silos. City sustainability, emergency management, planning, and public works departments appear to be the most important actors in resilience efforts.

There is large variation in adoption of resilience policies across cities. The most prevalent policies align with the traditional sustainability agenda. Policies to harden critical infrastructure and plan for the impacts of climate change are relatively uncommon. Although cities consider reducing social vulnerability as a key attribute of resilience, policies to reduce social vulnerability are not widely adopted. Greater attention must be dedicated to designing and adopting policies that benefit populations that have difficulty preparing, responding, and recovering from shocks.



| <b>Policy</b>  | <b>% Of cities with policy</b> |
|--|--------------------------------|
| Household solid waste recycling  | 97                             |
| Programs to promote biking   | 95                             |
| Green infrastructure program   | 95                             |
| Zoning used to delineate environmentally sensitive growth areas (including floodplains)  | 93                             |
| Increase access to permanent housing for homeless  | 92                             |
| Storm drainage replacement or upgrade  | 91                             |
| Comprehensive land use plan that includes environmental issues   | 90                             |
| Stormwater quality program or pollution prevention   | 89                             |
| Urban infill   | 86                             |
| Alternatively fueled city vehicle (green fleet) program  | 86                             |
| Mutual Assistance Agreements with neighboring jurisdictions  | 86                             |
| Operation or sponsorship of public transit (buses and/or trains)   | 84                             |
| Building code to address hazards such as building elevation in floodplains   | 83                             |
| Transit-oriented development   | 82                             |
| Data collection, use, and accessibility to public to provide transparency  | 82                             |
| Complete streets (walkability program)   | 81                             |
| Composting and mulching, food waste or yard waste  | 81                             |
| Small business support program   | 81                             |
| Community grant programs   | 80                             |
| Urban garden/sustainable food system or agriculture program (i.e. reduce legal and zoning restrictions on food production, allow repurposing of vacant properties for food production) | 79                             |
| Water conservation   | 78                             |
| Early warning systems  | 78                             |
| Household hazardous waste disposal/recycling program   | 77                             |
| Green building program   | 77                             |
| Brownfield redevelopment (project or pilot project)  | 76                             |
| Participate in the Community Rating System   | 75                             |
| Renewable energy use by city government  | 74                             |
| Energy conservation effort (other than Green building program) including building retrofits, consumer rebates  | 72                             |
| Job training or work force development programs  | 72                             |
| Citizen emergency response programs  | 71                             |
| Small business support program for historically under served or under represented populations  | 70                             |
| Stormwater utility fee   | 67                             |
| Locally-sourced food initiative  | 67                             |
| Government purchasing and contracting to support local businesses  | 67                             |
| Investment in green industry or green economic development   | 66                             |
| Lead paint abatement program   | 64                             |
| Use of SNAP and WIC benefits at community farmers markets  | 62                             |
| Industrial recycling   | 62                             |

|   |    |
|---|----|
| Equitable access to parks   | 60 |
| Reduce barriers to banking for low income populations and under served areas. Financial education programs. | 60 |
| GHG reduction target goals  | 59 |
| Direct financial assistance for utility bill payments for low income residents                              | 59 |
| Mayor or chief executive officer support of resilience (executive order, mention in state of city speech)   | 57 |
| Energy conservation effort for low income (i.e. weatherization and energy efficiency programs)              | 55 |
| Recycled product purchasing by city government  | 53 |
| Drinking water quality protection program   | 52 |
| Measurement of GHGs from community sources (i.e. households, transportation, and business)                  | 51 |
| Wastewater reuse program  | 50 |
| Disaster exercises in the last five years   | 50 |
| Business incubators   | 50 |
| Access to free or low cost vaccination program  | 48 |
| Redundant emergency communications program  | 47 |
| Pesticide reduction program (including Integrated Pest Management – on public parks)                        | 45 |
| Measurement of GHGs from government sources   | 45 |
| Indicators project active in last five years  | 43 |
| Evacuation route or plan  | 43 |
| City council support of resilience measures (ratification of policy)  | 43 |
| Collaboration with Non-profit organization  | 42 |
| Public participation (public hearings, visioning process, Neighborhood groups or associations, etc.)        | 42 |
| Air pollution reduction program beyond city government operations (i.e. VOC reduction)                      | 41 |
| Access to free or low cost health facilities  | 41 |
| City diversity hiring program   | 40 |
| Green affordable housing program  | 37 |
| Solar panel assistance programs   | 37 |
| Indicators progress report in last five years   | 37 |
| Collaboration with county government agency   | 37 |
| Job search assistance for low-income individuals  | 37 |
| Replacement of lead or PVC pipes  | 36 |
| Greenhouse gas reduction plan in last five years  | 36 |
| GHG reduction progress report in last five years  | 36 |
| Alternative energy offered to consumers (solar, wind, biogas, etc.)   | 36 |
| Car pool lanes (HOV or diamond lanes) on city streets   | 35 |
| Childhood obesity prevention program  | 34 |
| Resilience as an explicit part of a citywide comprehensive/general plan                                     | 34 |
| Involvement of the business community (e.g. Chamber of Commerce, Sustainable Business organization)         | 33 |
| Tax or incentives for environmentally friendly development  | 32 |
| Disaster recovery plan  | 32 |

|  |    |
|--|----|
| Climate change vulnerability study   | 32 |
| Dedicated office or staff position for resilience (i.e. chief resilience officer)  | 32 |
| Anti-displacement legislative package (i.e. Rent control and just-cause eviction laws)   | 32 |
| Warning system available in multiple languages   | 31 |
| Creation of city investment checklist or capital improvements plan to ensure equity and/or resilience in public investments            | 30 |
| Backup electric supply for critical infrastructure   | 29 |
| Climate change adaptation plan (may be embedded in Climate Action Plan, Sustainability Plan, Hazard Mitigation, or Comprehensive Plan) | 27 |
| Program encouraging residents to purchase National Flood Insurance   | 26 |
| Evacuation plan to assist vulnerable populations (i.e. provide transportation for households without cars)                             | 26 |
| Redundant water distribution program   | 25 |
| Subsidy or rebate system to assist lower-income residents to purchase and install air conditioning/heating                             | 25 |
| Collaboration with metropolitan planning council   | 23 |
| Assistance for affordable housing application  | 20 |
| Does indicators project include “action plan” of policies/programs? Contingency for not meeting plans                                  | 18 |
| Social vulnerability study for climate change  | 18 |
| Collaboration with Council of Governments (COG)  | 18 |
| Support business creation of business recovery plans   | 18 |
| Prioritization to build green infrastructure in neighborhoods with greatest need   | 17 |
| Hardening wastewater treatment plant (including elevating)   | 17 |
| Alternative food distribution program  | 16 |
| Asbestos abatement program   | 15 |
| Resilience Hubs  | 15 |
| Superfund (non-brownfield) site remediation  | 14 |
| Hardening electric distribution (including elevating and undergrounding)   | 14 |
| Hardening transportation infrastructure (including elevating)  | 13 |
| Engagement of disadvantaged communities in resilience  | 13 |
| Childhood asthma reduction program   | 11 |
| Hardening drinking water treatment plant or distribution (including elevating)   | 10 |
| Subsidy or rebate systems to assist residents to purchase and install grey water reuse systems   | 8  |
| Redundant gasoline distribution program  | 6  |
| Hardening schools (including elevating or tornado safe rooms)  | 3  |
| Hardening electric generating plant (including elevating)  | 2  |