

The emergence of climate change policy entrepreneurs in urban regions

Scott E. Kalafatis¹ · Maria Carmen Lemos²

Received: 26 July 2016 / Accepted: 26 March 2017 / Published online: 8 April 2017
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Abstract The development of climate change policy in cities has been closely tied to the efforts of particular individuals, policy entrepreneurs. However, there is still much we do not know about the conditions underlying the emergence and spread of policy entrepreneurship both generally and in support of climate change policies specifically. In this paper, we shed light on these issues using data from 371 mid-sized cities throughout the Great Lakes region of the USA. Building upon scholarship from the public choice literature, we explore the role that fragmentation, that is, the number of independent but connected governmental units both within the city itself as well as in the city's regional metropolitan or micropolitan area play in explaining the emergence of climate entrepreneurship. We show that not only does fragmentation at both of these levels help predict the emergence of climate change entrepreneurs in individual cities, but also exchanges between these levels could drive the rapid development of policy entrepreneurship and related policy innovations throughout urban systems.

Keywords Cities · Metropolitan/micropolitan regions · Policy entrepreneurs · Fragmentation · Policy innovation

Why do cities pioneer strategies to address potentially contentious policy issues like climate change? How will action in

Editor: Robbert Biesbroek.

✉ Scott E. Kalafatis
kalafat1@msu.edu

¹ Department of Earth and Environmental Sciences, Michigan State University, 288 Farm Lane, East Lansing, MI 48824, USA

² School of Natural Resources and the Environment, University of Michigan, 440 Church St, Ann Arbor, MI 48109, USA

one city spread through networks and proliferate into others? Empirical work has shown that the presence of policy entrepreneurs—those who recognize a potential unrealized opportunity around an issue in a public policy system and work to fulfill it using their own experience, connections, and persistence—is a key factor underlying public policy innovations (Mintrom 2000; Mintrom and Vergari 1996; Mintrom 1997). Many case studies addressing urban climate change policy in particular have described that the presence of climate change policy entrepreneurs plays a crucial role in the emergence and development of these policies (e.g., Lambright et al. 1996; Collier and Löfstedt 1997; Bulkeley and Kern 2006; Mukheibir and Ziervogel 2007; Roberts 2008; Burch 2010; Carmin et al. 2012; Wejs 2014). Quantitative studies on urban climate change mitigation have also found that their presence is the most or one of the most important factors tested (Krause 2012a; Krause 2012b).

However, despite policy entrepreneurs' broadly observed significance, there has been far less attention to the factors that actually affect the emergence of policy entrepreneurship not only around climate change, but any other issue as well (Mintrom and Norman 2009). Existing explanations mostly focus on policy entrepreneurship as a pragmatic undertaking that occurs when conditions are favorable for action due to available resources, social disruptions, and a low likelihood of significant opposition emerging (Schneider et al. 1995). Still, there is still much we do not know about the ways in which the emergence of policy entrepreneurs in one policy setting affects the emergence of other policy entrepreneurs in their own policy setting or in others.

In this paper, we seek to address these gaps by drawing on survey responses from 371 cities to advance our understanding of the conditions that help predict the emergence of climate change policy entrepreneurs. In particular, we focus on the role of the level of fragmentation—the number of

independent (but interacting) governmental units—both within the city itself as well as in its metropolitan or micropolitan region. In the next sections, we review the literature that underlies our analysis and describes our study area, our methods, and our statistical model. We then discuss our results and summarize their implications in support of our argument, before advancing some concluding remarks and suggestions for further research.

Understanding policy entrepreneurship in urban areas

Policy entrepreneurs combine experience, connections, and persistence to bring particular issues to broader attention in a policy context (Kingdon 1984). Similar to entrepreneurs in the private sector, policy entrepreneurs recognize a potential unrealized opportunity in a public policy system and work to fulfill it (Schneider and Teske 1992; Schneider et al. 1995). In the course of their work, policy entrepreneurs communicate with others who affect policy to build awareness about their issue of interest, craft strategies and locate resources to address it, identify connections between their issue and other issues people care about, and engage with the political environment to identify political opportunities (Kingdon 1984). They also build teams (Mintrom and Norman 2009; Mintrom 2000; Roberts and King 1996) as well as leverage experiences and relationships previously developed around other issues (Mintrom and Vergari 1996; True and Mintrom 2001) to support their efforts.

In their study on the emergence of entrepreneurs around economic development in cities, Schneider et al. (1995) use *public choice* concepts and theories derived from economics to predict entrepreneur emergence. Public choice scholars argue that cities compete with other nearby cities to attract desired residents and investment (Tiebout 1956; Ostrom et al. 1961). In this conceptualization, cities and those working within them operate as pragmatic entities with a “fiscal imperative” (Wolman and Spitzley 1996) to discover the most cost-effective balance between providing attractive services and limiting their own level of taxation. One consequence of this imperative is that cities continuously observe other cities and adjust their behavior to appear competitive in terms of innovating and keeping up with other cities (Ostrom et al. 1961; Schneider 1989). Schneider et al. (1995) argue that policy entrepreneurs are similarly pragmatic and will tend to emerge when certain conditions are favorable, including availability of excess discretionary funds and of positions through which they can easily influence collective action, the occurrence of a social disruption that they can help address, and low probability that sustained opposition will emerge.

However, while Schneider et al. (1995) successfully drew upon the public choice perspective, they did not focus their attention on a factor that is very closely associated with that literature, namely fragmentation. From the very beginning, insights from the public choice literature have shown that the proliferation of other governmental units in a city’s metropolitan area will enhance the competitive pressure that the city faces (Tiebout 1956; Ostrom et al. 1961; Hendrick and Shi 2015). Hence, from a public choice perspective, the more independent (but interacting) governmental units there are in an urban system, that is, the more fragmentation there is, the more likely it is that cities within this system will stimulate policy innovation (Strumpf 2002; Schneider 1989).

This prediction is echoed in recent advances in urban studies research focusing on “urban scaling.” This scholarship finds that as urban populations grow and the webs of social connections within cities become more and more dense, per capita rates of “social quantities”—such as innovations in the form of patents—rise (Bettencourt et al. 2007; Bettencourt et al. 2010; Bettencourt 2013; Batty 2013; Schläpfer et al. 2014). However, despite the similarities between discussions about fragmentation and urban scaling, these two branches of the literature focus on different aspects of urban governance. On the one hand, fragmentation scholars examine how overlapping local governmental units (i.e., cities, special districts, counties) (Berry 2008) and centralized or decentralized authority between cities and higher levels of government (Basolo 2003, Musso 1998) affect financial efficiency. On the other hand, urban scaling scholars explore how fragmentation at different levels enhances the innovative potential of social systems as similar, but differentiated social activities are replicated and transferred across different levels. In doing so, urban scaling scholars deem such systems as having a “fractal quality” (Batty and Longley 1994; Salingaros 2004). In this article, we build upon this perspective to explore the relationship between fragmentation and policy innovation in the form of climate change policy entrepreneurship at two interrelated levels: within the city itself and within the city’s larger urban system.

Methods

Study area

The Great Lakes Region of the USA (here defined as the eight US states bordering the Great Lakes: Illinois, Indiana, Michigan, Minnesota, Ohio, Pennsylvania, New York, and Wisconsin) is a particularly fertile area for researching cities’ responses to global change. Many of the cities in this region are within the US’ “Rust Belt”—a once prosperous multistate industrial region whose manufacturing base eroded during the second half of the twentieth century (High 2003). National

and global social changes have driven widespread declines in both economic conditions and population throughout the region, imposing a challenging identity crisis for many cities (Longworth 2009; High 2003). At the same time, the region lacks a clear, overwhelming climate-change-based threat such as sea-level rise or glacial retreat, meaning that responses to climate change in the Great Lakes region might be more generally applicable to other areas. Furthermore, in this study, we focus on mid-sized cities (population 5000–500,000) in this region to shed light on common or ordinary forces in cities not already recognized as leading examples of climate policy innovation. Due to our interest in examining interconnected urban areas, we also restricted our potential sample of cities to those in Metropolitan or Micropolitan Statistical Areas as defined by the U.S. Census, resulting in a final research population of 776 cities.

Identifying policy entrepreneurs in cities

In order to identify in which cities in this region climate change policy entrepreneurs had emerged, we distributed an online survey to a staff member in the 776 cities in our research population in October 2014. City council clerks (from 679 cities) were the primary targets of this survey because they are charged with objectively documenting the activities within the government and are expected to be aware of policy deliberations (Schneider et al. 1995). However, whenever clerks were not available, other administrators—City Administrators (51 cities), other staff in the administration (38 cities), or City Managers (8 cities)—were contacted instead. The survey itself was designed to take less than 5 min and was administered using three contacts by email (Dillman et al. 2009), resulting in 371 cities providing responses concerning climate change entrepreneurs (response rate 48%). To document the presence of a climate change policy entrepreneur, participants were asked to identify any individual in the last 5 years (inside or outside government) who had advocated for their community to make changes based on concerns about climate change/global warming or its possible impacts in the community. Besides climate change entrepreneurs, the survey also asked respondents to identify sustainability and economic development entrepreneurs. A summary of the results of this survey is provided in Table 1.

Following Schneider et al. (1995), our first survey was conducted with the premise that if a city staff person generally aware of policy deliberations taking place in city council associated a particular individual with an issue, then it was a good indication that this individual had already achieved a fair amount of visibility around that issue in the city. However, Schneider et al. (1995) and other prominent quantitative research on policy entrepreneurs (e.g., Mintrom 2000) have sought some verification that the individuals identified in their initial survey were actually acting as policy entrepreneurs.

Table 1 Summary of survey results

	Count	%
Cities with a policy entrepreneur		
Economic development	229	62
Sustainability	196	53
Climate change	45	12
Policy entrepreneurs per city		
Zero	99	27
One	103	28
Two	140	38
Three	29	8

Therefore, if the respondent answered that an individual was associated with a particular issue, we attempted to follow up with those individuals. The October 2014 survey included a prompt to provide the name and affiliation of the issue advocate and searching these names and affiliations online produced viable email contacts for 280 of the advocates identified across the three issues. We followed up with 111 of these individuals and confirmed that our survey had indeed identified those who were acting as policy entrepreneurs.

Modeling the presence of climate change policy entrepreneurs in cities

We developed a binary logistic regression model to predict the emergence of climate change entrepreneurs in the cities sampled. We used our survey responses to populate our dependent variable describing the presence (1) or not (0) of a climate change policy entrepreneur. We then regressed it against 15 independent variables representing fragmentation, other policy entrepreneurship drivers, or climate change policy drivers. A summary of these variables is provided in Table 2. We also included a factor variable in our model to control for differences between states since their small number (eight) would make it impractical to include state-level variables in the regression.

Fragmentation independent variables

Based on the literature discussed above, we hypothesized that political fragmentation in terms of the proliferation of governmental units can help predict the emergence of climate change entrepreneurship in cities. Inspired by discussion about urban scaling and social innovation, we also hypothesized that fragmentation at multiple levels of governing activity would enhance the likelihood of climate change policy entrepreneurship emerging. To test the role of fragmentation at two different levels of governing activity, we included two different measures. The first was a measure of the degree of

Table 2 Summary of independent variables used in the equation for the presence of a climate change policy entrepreneur in a city

Name	Description	Source	Mean	SD
Fragmentation				
Directly elected districts	Number of wards/precincts/districts that directly elect council members	City websites	2.89	2.99
Number of municipalities	Number of municipalities in metropolitan or micropolitan CBSA (log-transformed)	2012 Census of Governments	3.87	1.35
Other policy entrepreneur drivers				
Population	City population (in 10,000 s)	2010 Decennial Census	2.27	2.90
Budget surplus/shortfall	City's total revenue divided by total expenditures from 2006 to 2010	State auditor databases	1.03	0.09
Debt burden	Percentage of city revenue devoted to servicing existing debt from 2006 to 2010	State auditor databases	8.39	8.47
Intergovernmental dependence	Percentage of city revenue from intergovernmental transfers from 2006 to 2010	State Auditor databases	17.79	8.47
Household income	Median household income (in 10,000 s)	ACS 2005–2009 5-year estimate	5.07	1.90
Strong mayor	Mayoral power to appoint without council consent (binary)	City websites and charters	0.31	0.46
Population change	Change in city population from 2000 to 2010 (as a percentage of 2000 population)	2000 and 2010 Decennial Censuses	7.81	23.10
Climate change policy drivers				
Politics	Share of city vote for Democratic versus Republican candidate for president in 2012	State Secretary of State databases	4.37	25.77
Economic development PE	Economic development policy entrepreneur present (binary)	Survey	0.61	0.49
Sustainability PE	Sustainability policy entrepreneur present (binary)	Survey	0.57	0.50
Environmental organizations	Number of environmental organizations in county	2012 Economic Census	7.50	12.28
Sustainability network	Membership in a sustainability network (binary)	Network websites	0.06	0.27
Disasters	Number of weather-based federal disaster declarations (by county) from 2000 to 2014	FEMA disaster declaration database	3.53	2.23

fragmentation within the city itself—the number of districts in the city government that directly elect city council members. The second was a measure of the degree of fragmentation in the city's larger urban system—the number of municipalities in the city's metropolitan or micropolitan area.

Other policy entrepreneurship drivers

We included seven variables in our model that represented conditions that might encourage the emergence of climate change policy entrepreneurs. The first is simply the population of the city under the basic supposition that the more people there are in the city, the more likely it is that someone might emerge as a policy entrepreneur.

Based on the public choice literature's focus on cities' fiscal imperative and using each city's financial audits from 2006 to 2010, a budget surplus may be a resource that could encourage entrepreneurship around a new issue like climate change. In contrast, a potential entrepreneur might be less inclined to emerge if a city's responsibility for servicing past investments makes it less amenable to taking on new policy challenges, that is, if a city has a higher existing debt burden. We also included a variable ("intergovernmental dependence") that described the percentage of the city's revenue that

came from higher levels of government, assuming that potential policy entrepreneurs will have less incentive to become active if the city's policy decisions are shaped by higher levels of government rather than more local debates. Finally, we included a measure of the city's median household income assuming that higher income will result in a higher tax base to finance new policy efforts.

Based on Schneider et al.'s (1995) study on the emergence of policy entrepreneurs in cities, which found that the existence of positions of authority and disruptive social changes encouraged individuals to act as policy entrepreneurs, we included a binary variable describing whether or not a city had a "strong mayor" position. We defined this variable as a mayor having the authority to appoint administration officials without council approval based on its City Charter. To account for social change, we added population change from 2000 to 2010, a measure that is particularly relevant to the Rust Belt cities.

Climate change policy drivers

Making the assumption that the emergence of climate change policy entrepreneurs might be connected with other factors that have been found to influence the pursuit of climate change policy in cities, we also derived six independent

variables from the urban climate change policy literature. The first is a measure of how much the electorate of the city leans towards the US' Democratic Party versus the US' Republican Party—measured here by the relative share of the vote Barack Obama (D) received compared to Mitt Romney (R) in precincts within the city in the 2012 presidential election. In the USA, public opinion research has found that being either a Democrat/liberal or Republican/conservative is the most important predictor of public perceptions about climate change in the USA (Marquart-Pyatt et al. 2014; Hamilton 2011; McCright and Dunlap 2011). In her study of the emergence of climate mitigation actions in cities, Krause (2012a, 2012b) found that voting partisanship is an important demographic characteristic to consider when assessing climate change action in cities (Krause 2012a, 2012b). The presence of a more Democratic Party-leaning electorate would therefore presumably make policy entrepreneurship around climate change a more attractive undertaking because it would make sustained opposition against such actions less likely.

Next, we included two binary variables addressing the presence of economic development or sustainability policy entrepreneurship in the city based on our survey. Our assumption was that the presence of policy entrepreneurship associated with these other issues might encourage the emergence of a climate change policy entrepreneur because of the opportunity to connect climate change with other issues. Indeed, the urban climate change policy literature argues that associating climate change action with economic development and sustainability enhances its likelihood of success (Carmin et al. 2012; Heinrichs et al. 2013; Aggarwal 2013; Anguelovski and Carmin 2011).

We also included the number of environmental nonprofit organizations as a proxy for local civic capacity associated with the emergence of commitments to address climate change (Zahran et al. 2008). A city's participation in sustainability networks can represent commitments that might encourage climate change-related activities or offer multinational sources of guidance promoting climate change-related action (Krause 2012a), so we included a binary "Sustainability Network" variable describing participation in at least one of three city sustainability networks: a large, multinational one (ICLEI), a binational regional one (the Great Lakes St. Lawrence Cities Initiative), or a binational professional one (USDN). Lastly, we considered the influence of natural disasters that could act as "focusing events" (Kingdon 1984) encouraging action by including the number of federal disaster declarations made from 2000 to 2014 (county-level), excluding winter storm events that might be less easily associated with "global warming."

Results

Table 3 summarizes the results of our logistic regression model assessing the relationship between our independent

Table 3 Summary and coefficients of the equation for the presence of a climate change policy entrepreneur in a city

Adjusted R ²		LR
0.243		48.93**
	<i>B</i>	SE
Fragmentation		
	Directly elected districts	0.176* (0.084)
	Number of municipalities	0.387* (0.197)
Other PE Drivers		
	Population	-0.096 (0.069)
	Budget surplus/shortfall	3.099 (2.396)
	Debt burden	0.025 (0.025)
	Intergovernmental dependence	-0.043 (0.028)
	Household income	0.017 (0.134)
	Strong mayor	-0.653 (0.568)
	Population change	-0.018 (0.012)
Climate change policy drivers		
	Politics	0.013 (0.009)
	Economic development PE	0.636 (0.453)
	Sustainability PE	0.935* (0.430)
	Environmental organizations	-0.006 (0.016)
	Sustainability network	0.355 (0.695)
	Disasters	-0.226 (0.132)
	Population change	-0.018 (0.012)
States		
	Illinois (reference category)	
	Indiana	1.139 (1.034)
	Michigan	-0.604 (0.838)
	Minnesota	1.051 (0.779)
	New York	2.370* (1.048)
	Ohio	0.652 (0.851)
	Pennsylvania	-14.319 (935.029)
	Wisconsin	-0.143 (0.984)

Standard errors in parentheses. $n = 329$

DV climate change policy entrepreneur present

Levels of significance: ** $p < .01$; * $p < .05$

variables and the presence of a climate change policy entrepreneur in a city (1) or not (0). Overall, the model explained just over 24% of the observed variance in whether or not a climate change policy entrepreneur was present in the city or not. The two fragmentation variables had a statistically significant association with the presence of a climate change policy entrepreneur at the $p < 0.05$ level: the number of city council districts in the city that directly elect council members and the number of municipalities a city has in its metropolitan or micropolitan area. The presence of a sustainability policy entrepreneur—one of the climate change policy drivers variables—also had a statistically significant association with the presence of a

climate change policy entrepreneur at the $p < 0.05$ level. We performed a variance inflation factor test to assess lingering multicollinearity in our model and found no indication of significant inflation taking place.

Table 4 summarizes a series of predicted probabilities that illustrate how changes in these statistically significant independent variables translate into changes in the likelihood that a climate change policy entrepreneur is present in a city based on our model if all the other variables in our model are held at their average value. In general, the average probability of a climate change policy entrepreneur being present in a city we analyzed is 0.128. If the number of city council districts that directly elect council members in the city is 0 (the 25th percentile of those city's analyzed), then that probability drops to 0.088, while if it is 5 (the 75th percentile of those cities analyzed), the probability rises to 0.166. Similarly, the probability of a climate change entrepreneur being present varies from 0.088 to 0.170 when the number of other municipalities in the city's metropolitan or micropolitan area is at the 25th or 75th percentile of those cities studied (roughly 14 and 139 municipalities respectively). If both the number of districts and the number of municipalities are in 25th percentile, there is a 0.054 probability, while there is a 0.209 probability if both of those variables are in their 75th percentile.

If a sustainability policy entrepreneur is not present, then the probability of a climate change policy entrepreneur being present is 0.079, but if a sustainability entrepreneur is present, it is 0.162. Finally, if we consider all three of these independent variables at once, then the probability of a climate change entrepreneur being present is 0.030 when the number of council districts and municipalities is at their 25th percentile values and a sustainability policy entrepreneur is not present. The probability is 0.339 if the number of council districts and municipalities is at their 75th percentile values and a sustainability policy entrepreneur is present.

Table 4 Predicted probabilities of the equation for the presence of a climate change policy entrepreneur in a city

Fragmentation variables (percentiles)	25th	75th
Directly elected districts alone	0.088	0.166
Number of municipalities alone	0.088	0.170
Districts and municipalities combined	0.054	0.209
Sustainability PE present?	No	Yes
Alone	0.079	0.162
Combined with fragmentation variables	0.030	0.339

Predicted probabilities model average = 0.128

DV climate change policy entrepreneur present

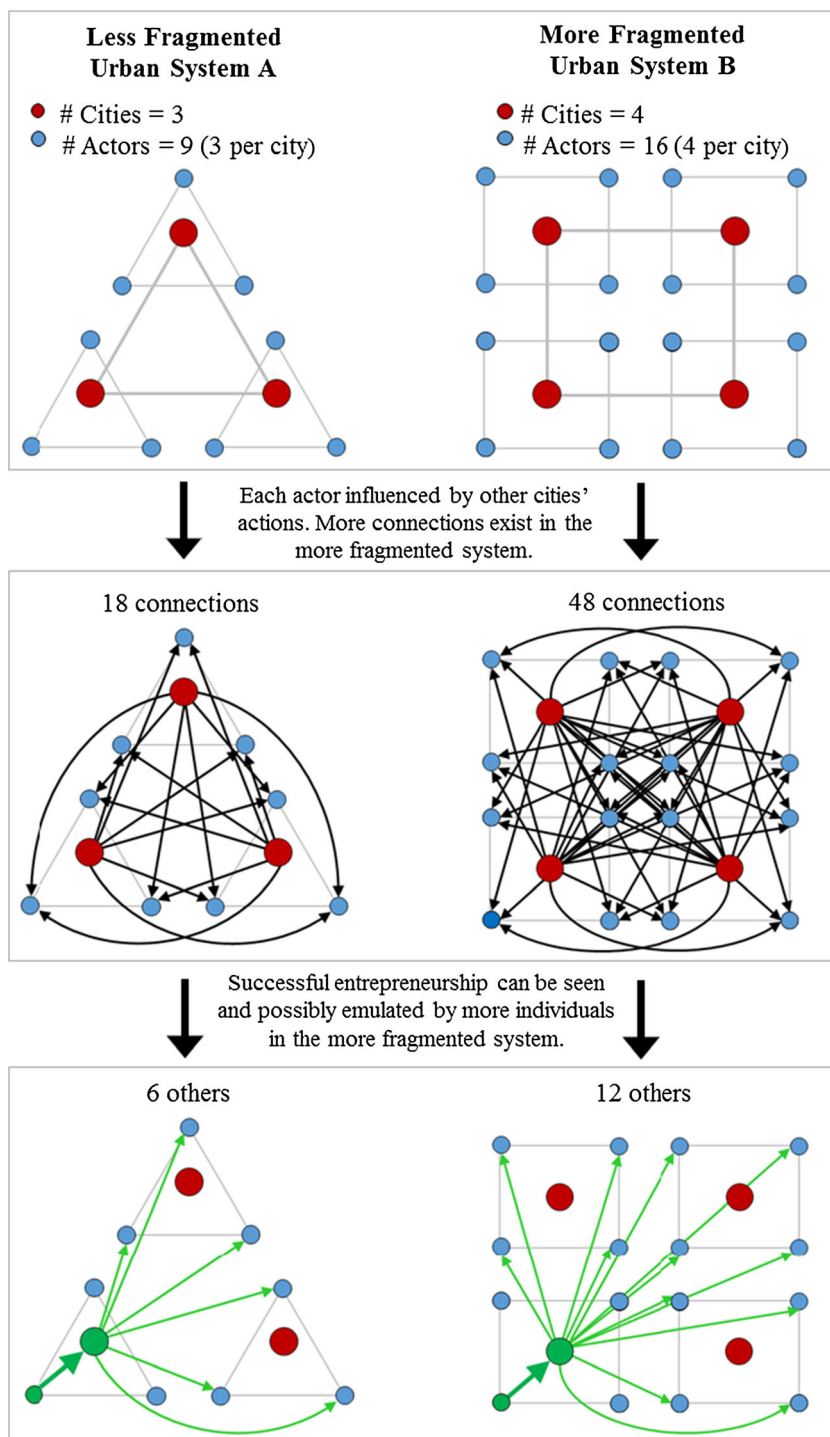
Understanding the emergence of climate change policy entrepreneurs

The results of our analysis provide some evidence that the fragmentation of urban systems might offer a means of understanding why climate change entrepreneurs emerge in some cities and not others. The two variables describing the multiplicity of independent but interconnected participants in the urban governance system were positively associated with the presence of a climate change entrepreneur in the city. One of these variables reflected fragmentation at the local level within an individual city, while the other reflected fragmentation at the metropolitan or micropolitan level. That one of these levels of activity is embedded within another, larger one, introduces the possibility for exchanges to take place between local and more regional levels. A city council is a smaller-scale system embedded within a larger-scale urban system. Council members respond to each other's actions but maintain independence from one another with ideas that reflect distinctions between the constituencies of their smaller council districts. While councils respond to actions throughout their regional urban system, council members' decisions will also influence decisions throughout the broader region.

Figure 1 compares two simplified models of an urban system (A and B) in order to help illustrate how the fragmentation at multiple levels reflected in these two variables might enhance the likelihood of policy entrepreneurship in the cities in that system. Urban System B on the right has a higher level of fragmentation at both levels than Urban System A on the left, and the opportunities and possible connections that might encourage policy entrepreneurship rise as the number of participants involved in the urban system rises. Decisions take place at both the city level and within the city level. Actors within cities monitor the other cities in their urban system and might respond to what they see by acting as policy entrepreneurs pushing their own city to emulate others. Consciously or unconsciously, the first climate change policy entrepreneur in such an urban region could initiate a significant disruption in ongoing regional policy activity. Their presence could create pressure for other cities to "keep up" with the latest form of policy intervention, opening an opportunity for a climate change policy entrepreneur to emerge in competing cities to resolve this competitive pressure. As policy entrepreneurs emerge in more and more cities, the policy landscape of the urban region could bend towards climate change interventions.

Fragmentation variables like those we used here can therefore provide a means of describing urban scaling dynamics when investigating policy innovations in urban areas. However, our study was not designed to directly test whether the number of municipalities in a metropolitan or micropolitan area is a better predictor of entrepreneurship than the population size of these urban areas variable highlighted by urban

Fig. 1 How greater fragmentation in urban systems might make policy entrepreneurship in cities more likely



scaling studies (Bettencourt et al. 2007; Bettencourt et al. 2010). In our data, the correlation between the number of municipalities variable and the presence of a climate change policy entrepreneur in a city was higher (0.119, $p = 0.022$) than it was for the metropolitan or micropolitan area population (0.092, $p = 0.075$). On the other hand, the performance of our overall model was only slightly better using the number of municipalities ($R^2 = 0.243$) variable versus replacing it with a

comparable one for metropolitan or micropolitan population ($R^2 = 0.237$). Further research would be required to understand whether the number of municipalities is a better predictor of social innovations related to public policy like the emergence of policy entrepreneurs than urban area population size.

Another limitation of this research is that it has primarily focused on the multiplicity of participants in an urban system and given less attention to nature of their interactions with one

another. This analysis has assumed that the way in which cities or those working within them interact with and influence each other is the same for all of those involved. Future research can address this limitation and forge a stronger connection between these findings and efforts to scale up public policy innovation through exchanges between local and regional levels (Kalafatis et al. 2015). In particular, urban climate change policy scholars investigating the role of local and regional networks (Woodruff and Stults 2016) can use our findings as an empirical starting point for future research.

This discussion regarding fragmentation suggests one way in which the emergence of policy entrepreneurs might affect the emergence of additional policy entrepreneurs in interconnected systems, while our finding that sustainability policy entrepreneurs were associated with the emergence of climate change ones suggests another. These findings are particularly notable given the need for more research on the influence of policy entrepreneurs on the emergence of other entrepreneurs (Mintrom and Norman 2009). In the case of sustainability and climate change policy entrepreneurship at least, it appears that the presence of entrepreneurship around sustainability might help “soften up” (Kingdon 1984) the policy context in ways that encourage the emergence of climate change policy entrepreneurship. However, our research study was not designed to specifically test the timing of entrepreneur emergence, therefore, we cannot establish evidence of a direct causal link between sustainability entrepreneurship and climate change entrepreneurship at this time. Still, the potential complementarity at least of these two activities might also be of particular interest to those studying the relationship between the emergence of climate change alongside other potentially related issues such as economic development and sustainability policy (Denton et al. 2014; Fenton et al. 2014; Measham et al. 2011).

Conclusion

While many studies have pointed to the influential role of climate change policy entrepreneurs in the development of climate change policy in cities, this study addressed what factors might underlie the emergence of climate change policy entrepreneurs in these cities in the first place.

We found evidence that the degree of fragmentation in an urban system—the number of independent (but interacting) governmental units—can help predict the emergence of climate change policy entrepreneurs in cities. Furthermore, we connected these findings to recent work on urban scaling by showing that fragmentation at multiple levels of governing activity can simultaneously contribute to a higher likelihood of entrepreneurship. These findings not only demonstrate that fragmentation both within a city and in regional metropolitan and micropolitan areas can help predict innovative activities in cities but also provide some indication of processes of

exchange between local and regional levels that could lead to climate change policy entrepreneurship spreading rapidly between cities.

Acknowledgements This research was supported in part by the National Oceanic and Atmospheric Administration’s Regional Integrated Sciences and Assessments Program (Grant NA10OAR4310213/Great Lakes Integrated Sciences + Assessments). We thank all of our survey respondents throughout the region who were willing to share their knowledge with us. We would also especially like to thank Yun-Jia Lo for her essential feedback on the quantitative analysis in this paper as well as Scott Campbell and Sara Hughes for their comments on a previous version. Finally, we are grateful for the guidance we received from our two anonymous reviewers.

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