MULTI-LEVEL AND REGIONAL GOVERNANCE MODELS FOR URBAN CLIMATE ACTION: A CASE STUDY OF THE PHILADELPHIA METROPOLITAN AREA

Melissa Oberon Tier
Student ID: 1144431
Kellogg College

MSc in Sustainable Urban Development
Department for Continuing Education

University of Oxford

September 2019

Word count: 15,017
(counting p. 8–81, and excluding figures and footnotes)



Abstract

Climate change and urbanisation are the paramount processes of the modern age, and research and praxis on each can no longer be fully realised without the context of the other. The present research explores models of urban practice in order to identify how they can better prioritise sustainable systems, given the urgency and severity of anthropogenic climate change. Two well-established urban studies models, “urban governance” and “regime theory”, are considered – as well as three models from other disciplines: ecology’s distinct version of “regime theory”, and “multi-level climate governance” and “emissions linkages” that have emerged from the field of international climate relations. Using a case study of the Philadelphia Metropolitan Area, I argue that updated models are needed that address the complex reality of urban sustainability governance. New urban governance models and innovative interdisciplinary research must incorporate concepts of agonistic practice among government and non-governmental stakeholders, as well as persistent coordination among various levels of regional jurisdictions. Climate change – a catastrophic planetary transformation that is, for better or worse, deeply intertwined with global urbanisation – demands such research if global society is to stem the tide of this existential crisis.

Acknowledgements

Thank you to all those who have made this dissertation, and this postgraduate degree, possible. In particular, I would like to thank my fiancé and my parents for their unending support, Dr. Debbie Hopkins for her guidance during the writing process, Dr. Vlad Mykhnenko for his tutelage during the proposal stage, my colleagues in the Office of Sustainability at Swarthmore College for holding down the fort on my work responsibilities while I travelled, and all of my interview participants for their incredible insights.

Table of Contents

Abstract **p. 1**

Acknowledgements **p. 2**

Table of Contents **p. 3**

List of Abbreviations & Acronyms **p. 4**

List of Tables & Figures **p. 5**

Chapter 1: Introduction **p. 8**

Chapter 2: Literature Review **p. 10**

Section 2.1: Urban Governance Models 10
Section 2.2: Regime Theory Models 13
Section 2.3: Multi-Level Governance Models Post-Paris 16
Section 2.4: Interlinking Research Threads 21

Chapter 3: Methods **p. 23**

Section 3.1: Methodological Framework 23
Section 3.2: Survey Structure & Goals 25
Section 3.3: Participants 26
Section 3.4: Data Analysis 28
Section 3.5: Constraints 30

Chapter 4: Case Study Context **p. 33**

Section 4.1: About the Delaware Valley 33
Section 4.2: About Philadelphia 36
Section 4.3: About Delaware County 37

Chapter 5: Results & Discussion **p. 40**

Section 5.1: Participant Demographics 40
Section 5.2: Quantitative Comparison Between Locations 42
Section 5.3: Qualitative Comparison Between Locations 59
Section 5.4: Case Study Implications 73

Chapter 6: Conclusion **p. 77**

References **p. 82**

Appendix I: Semi-Structured Interview Full Script **p. 90**

Appendix II: Detailed Statistical Data **p. 106**

List of Abbreviations & Acronyms

C40 Cities Climate Leadership Group	C40
Delaware County	DelCo
Delaware Valley Regional Planning Commission	DVRPC
Intended Nationally Determined Contributions	INDCs
Intergovernmental Panel on Climate Change	IPCC
IPCC Special Report on Global Warming of 1.5°C	SR15
Local Governments for Sustainability (formerly International Council for Local Environmental Initiatives)	ICLEI
Mean of a sample population	$\bar{x}$
New Urban Agenda	NUA
Office of Sustainability	OOS
P-value from a statistical test	p
Pennsylvania	PA
Pennsylvania Department of Conservation and Natural Resources	DCNR
Pennsylvania Department of Environmental Protection	DEP
Philadelphia	Philly
Philadelphia Metropolitan Area	PMA
Sample population size	n
Sustainable Development Goals	SDGs
Sustainable Development Solutions Network	SDSN
United Nations	UN
United States	US

List of Tables & Figures

Chapter 3: Methods

Table 3.1a	Participant Categories for Delaware County	p. 27
Table 3.1b	Participant Categories for Philadelphia	p. 27
Table 3.2	Contextual Reports	p. 29–30

Chapter 4: Case Study Context

Figure 4.1	Map of the Delaware Valley Featuring the Delaware River	p. 34

Chapter 5: Results & Discussion

Figure 5.1	Participants by Category & Location	p. 41
Figure 5.2	Frequency of Additional Hazards by Location	p. 44
Figure 5.3a	Importance of Hazards According to Professional Judgement (DelCo)	p. 46
Figure 5.3b	Importance of Hazards According to Professional Judgement (Philly)	p. 47
Figure 5.4a	Importance of Hazards According to Impressions of County Priorities (DelCo)	p. 48
Figure 5.4b	Importance of Hazards According to Impressions of City Priorities (Philly)	p. 49
Figure 5.5a	Effect of Climate Change on Hazards According to Professional Judgement (DelCo)	p. 50
Figure 5.5b	Effect of Climate Change on Hazards According to Professional Judgement (Philly)	p. 51
Figure 5.6a	Effect of Climate Change on Hazards According to Impression of County Recognition (DelCo)	p. 53

Figure 5.6b	Effect of Climate Change on Hazards According to Impression of City Recognition (Philly)	p. 53
Figure 5.7	Dominant Risk Management Approach by Location	p. 55
Figure 5.8	Emerging Risk Management Approach by Location	p. 56
Figure 5.9	Adequacy of Management Approach if Natural Hazards Worsen (by Location)	p. 57
Figure 5.10	Likelihood of Natural Hazards Worsening (by Location)	p. 58
Figure 5.11	Level of Climate Success by Location	p. 59
Figure 5.12	Frequency of Key Climate Policy Actors by Location	p. 61
Figure 5.13	Frequency of Key Climate Policy Barriers by Location	p. 62
Figure 5.14a	Importance of Climate Policy at Different Government Scales on County Action (DelCo)	p. 69
Figure 5.14b	Importance of Climate Policy at Different Government Scales on City Action (Philly)	p. 69

Appendix II: Detailed Statistical Data

Figure II.1	Participants by Years in Current Job & Location	p. 109
Figure II.2	Participants by Years of Relevant Work Expertise & Location	p. 110
Figure II.3a	Risk Management Approach by Hazard (DelCo)	p. 112
Figure II.3b	Risk Management Approach by Hazard (Philly)	p. 112
Figure II.4a	Importance of Different Actors (DelCo)	p. 114
Figure II.4b	Importance of Different Actors (Philly)	p. 114
Figure II.5a	Importance of Different Factors (DelCo)	p. 115

Figure II.5b	Importance of Different Factors (Philly)	p. 116
Figure II.6	Changes in Risk Management Approach? (By Location)	p. 117
Figure II.7a	Management of Potential Future Risk Scenarios (DelCo)	p. 118
Figure II.7b	Management of Potential Future Risk Scenarios (Philly)	p. 119
Figure II.8a	Likelihood of Potential Future Risk Scenarios (DelCo)	p. 120
Figure II.8b	Likelihood of Potential Future Risk Scenarios (Philly)	p. 120
Figure II.9	Level of Participant Familiarity with Climate Policies by Location	p. 123

Chapter 1: Introduction

In October 2018, the Intergovernmental Panel on Climate Change (IPCC) stunned global societies by announcing that we had just twelve years to reduce planetary greenhouse gas emissions by 45 percent by 2030 in order to avoid the most catastrophic damages from climate change (Allen et al., 2018). The situation remains dire: many anthropogenic changes to the Earth are already locked-in (Bazaz et al., 2018) – and a year after the IPCC's report, countries are not sufficiently on the path toward deep decarbonisation[1] (Coalition for Urban Transitions, 2019).

Although the Paris Agreement was ratified by UN member countries in 2015, newly elected President Trump vowed in 2016 to pull the US out of the Agreement. In light of this, many sub-national actors in the US reaffirmed their emissions reduction commitments. The "We Are Still In" campaign, for example, consists of municipal jurisdictions, tribes, businesses, universities, etc. declaring that they "will continue to support climate action to meet the Paris Agreement" (We Are Still In, 2019). This sub-national US effort, plus a proliferation of trans-national city networks sharing best practice on climate action (Rapoport et al., 2019), indicates that novel governance structures are actively being explored to cope with the threat of climate change.

After providing further evidence that urbanisation is indeed a global phenomenon, I then investigate existing models of urban governance to theorise which would be most appropriate – and how they might need to be updated – in a world with a rapidly changing physical climate and, consequently, rapidly changing societal structures. A restructuring of professions and disciplinary

[1] Carbon dioxide is the most concerning of the greenhouse gases because of the sheer quantity that humans emit (primarily through fossil fuel combustion) and because of the length of time that it remains in the atmosphere (United States Environmental Protection Agency, 2019). Throughout this dissertation, as is common in the literature, I use "*carbon* emissions" and "de*carbon*isation" as a shorthand for all greenhouse gases.

frameworks, too, is inevitable – as Raworth (2017) writes in her book germanely subtitled "Seven Ways to Think like a 21st-Century Economist". She argues that a reshaping of economics should be harnessed as effectively as possible in the hopes of humanity surviving the greatest existential crisis it has ever faced.

Urban practitioners and scholars, like economists, must evolve for the 21st-century. As populations continue to consolidate into increasingly dense urban areas, urban planners and local government officials must negotiate the challenges of sustainable development – and, conversely, those working directly on climate policies at any governmental level must address urban processes if their policies are to succeed. The urban case study presented here, which explores the climate-disaster preparedness of two counties within the Philadelphia Metropolitan Area, is a contribution to solutions for the crisis at hand. Though other recent research has explored the risk management approaches of cities globally, none has so explicitly questioned local stakeholders about their region's approach to climate change – and there has been minimal research on coordinated risk management efforts within one greater metropolitan area. Inclusion of these elements allows for the development of new urban governance models for sustainability, as well as identification of crucial areas for further exploration. Although the Philadelphia Metropolitan Area is not (yet) a global star of climate action, the present research shows that there is potential stirring among stakeholders for truly innovative governance models built proactively to address climate risk head-on.

Chapter 2: Literature Review

There are three research threads that contribute to the present study on urban governance for sustainability. The first is the urban governance literature coming from urban studies. The second is research on regime states that grew largely out of ecology's concepts of resilience, as well as a parallel concept born out of urban studies. The final thread is recent work to meaningfully account for sub-national actors within the broader research on international climate policymaking. Though these research threads have different disciplinary origins, there has been some overlapping work in recent years. The present study adds to a young but burgeoning area of research that deliberately unites these threads to identify new models of urban practice that prioritise sustainable systems in the face of climate change.

Section 2.1: Urban Governance Models

The increasing importance of urban environments has attracted the attention of scholars and policymakers alike. Many have noted the proliferation of urban areas across the globe and referenced the now well-known prediction that around two-thirds of the world's population will come to live in those areas in just the next few decades (e.g., Bazaz et al., 2018; High-Level Political Forum on Sustainable Development, 2018; Habitat III, 2017). Definitions and legislative boundaries of an urban area or city vary widely (Coalition for Urban Transitions, 2019). However, there is general consensus that the modern urban form, particularly in the Global North, is often characterised by agglomerated economies, high population density, devolution of power from national to sub-national authorities, and integration with globalised economic systems; and such

systems are, on the whole, both fervently capitalistic and steeped in colonial histories (Rapoport et al., 2019; DiGaetano & Strom, 2003; Jessop, 2002). The urban studies discipline tends to ardently oppose such neoliberal tendencies – seeing them as: "Eurocentric," "masculinist," "heteronormative," "hubristic," and "neocolonial" (Brenner, 2018: p. 2; see also Robinson & Roy, 2015). Despite this critique of urban practice, Roy (2015) writes that the urban studies discipline itself is still steeped in research methodologies that try to universalise the European trajectory of development, and that scholars must continue to strive for a truly post-colonial approach.

With this in mind, Brenner and Schmid (2015) put forth a nuanced understanding of urbanism – one that sees the "urban" as a diverse but nevertheless global process. This planetary, "urban fabric" is not just represented by bounded cities, but in fact much more accurately by all regions (including rural or hinterland areas) because all have been touched by interconnected, global urbanisation processes. These processes manifest themselves differently in different parts of the world, and trends in uneven economic, infrastructural, and spatial development are becoming apparent[2]. Still, Brenner and Schmid's urban fabric concept is criticised by some as an overzealous attempt to universalise, and thereby simplify, the urban form (Brenner, 2018; Robinson & Roy, 2015). Roy (2015) also warns against describing rural or Global South communities only in relation to and/or outside of the urban – as well as cautions against telling their contemporary stories as inherently urban/European-influenced. Nonetheless, the urban fabric is an important articulation of some process that is definitely happening, for better or worse, in innumerable parts of the world – albeit a process with a plurality of manifestations and uneven outcomes for people's lived experience (Brenner, 2018).

[2] For example, "new centers of agglomeration… may emerge within zones that previously served mainly as operational hinterland" (Brenner & Schmid, 2015: p. 169) while others lag behind in terms of modern industrialisation.

Brenner and Schmid's conceptualisation of the urban process helps contextualise theories of governance for the modern age. Many scholars have differentiated "government" (policymaking bodies with jurisdiction over a particular area) from "governance" (a process of decision-making that includes, but extends far beyond, government) (see Rapoport et al., 2019). Pierre (2011; 1999), for example, identifies four dominant types of urban "governance" (though also acknowledges that in practice cities are governed by multifaceted, sometimes contradictory principles). The first is "managerial governance" (sometimes called "new public management"), in which efficiency is prioritised and community members are seen as customers. "Corporatist governance" fosters participation from non-governmental organisations, making use of their resources but also tying itself to these organisations' interests. "Progrowth governance" is singularly focused on achieving economic growth, while in "welfare governance" redistributive policies are paramount.

Patterson et al. (2017) ask whether governance might be harnessed to foster societal transformation toward sustainability, an approach they call "earth system" governance. Because "the city now looms large on the international climate change agenda" (Bulkeley & Betsill, 2013: 136) due to globalised urbanisation processes, urban governance research is a major theoretical concern – and specifically governance for transformation. Much as Brenner (2018) calls for a recognition of urban plurality, Patterson et al. (2017) call for a recognition that transformations toward a sustainable world will occur via intersectional and sometimes conflictual approaches. Albrechts (2015) refers to a process that actively fosters dialogue among such varied approaches as 'agonistic' – i.e., not an outright antagonistic one, but instead one that encourages debate even when consensus may seem impossible. Remembering Pierre's recognition that local contexts

typically embody multiple approaches at once, agonism may be a pragmatic method for managing the complex reality of urban governance.

Section 2.2: Regime Theory Models

Urban studies scholars have distinguished the "urban governance" approach from urban "regime theory". Clarence Stone is often credited with first applying the concept of "regimes" to urban environments (Jochim & May, 2010; Mossberger & Stoker, 2001). Stone writes that an analysis of urban regimes should include two components: how current "governing arrangements" are structured and how that particular structure (i.e., regime) came into being (Stone, 2005). Regime theory scholars focus on the coalition building efforts of various stakeholders, whether governmental or non-governmental (DiGaetano & Strom, 2003). A given regime is also relatively stable and pursues an identifiable agenda (Mossberger & Stoker, 2001). A key difference between regime theory and urban governance models is that where regime theories prioritise coalition-building, urban governance models prefer that local governments focus on coordination over decision-making; "*authority* – the formal right to make decisions – and *agency* – the execution of those decisions – can and should be separated" (Pierre, 2014: 874, my emphasis). Despite this, there is a "close kinship between urban regime theory and theories of urban governance" within urban studies (Pierre, 2005: 449).

Interestingly, another discipline independently developed a remarkably similar "regime theory" approach. Ecology's regime theory[3] first emerged in the 1970s to describe periods of

[3] Also sometimes referred to as panarchy theory ("panarchy" being a technical term within the framework) or resilience theory (Allen et al., 2014).

stability and change within ecological systems[4] (Folke et al., 2010; Holling, 1973). In these systems, resilience is defined as the "capacity of a system to absorb disturbance" and to incorporate change without fundamentally changing core identities of a system (Folke et al., 2010: 4). Resilient systems undergo periodic phases in order to adapt to change (Folke et al., 2010). Sometimes, change is great enough that it forces transformation, leading to a "regime shift" (Allen et al., 2014). It is precisely these regime shifts that are of interest to sustainability management: given that radical transformations are necessary, how can they best be facilitated?

More recently, the ecological concept of regime states has been further integrated with social systems (Brown et al., 2013), bringing it closer in line with the urban studies version of regime theory. Mossberger and Stoker (2001) warn against "concept stretching" regime theory – but on the other hand, Folke et al. (2010) write that the ecosystems model on its own is dangerously incomplete without incorporating social systems, given anthropogenic impacts at all ecological scales.

The resilience concept within regime theory is also disputed. One criticism is that it has high potential to lend itself to neoliberalism; resilience is sometimes seen as a quintessentially conservative, pull-yourself-up-by-your-bootstraps point of view that favors the status quo over regime shift change (Kaika, 2017; Mykhnenko, 2016; Olsson et al., 2015). Nevertheless, a 2016 bibliometric analysis found that resilience was *not* "some sort of a Trojan horse of neoliberals used to advance their causes" because the concept is wholly unused in neoliberal publications (Mykhnenko, 2016: 11). A second criticism comes from Kaika (2017), though, who argues that labelling communities as resilient sets them up to "take more suffering, deprivation or

[4] Olsson et al. (2015) note that the use of "resilience" in psychology actually predates its related usage in ecology (in psychology, referring to the capacity of a person or community to weather adversity). Nevertheless, the research thread discussed here really begins with Holling's (1973) seminal work on regimes and resilience.

environmental degradation in the future" (p. 95). Going forward, theorists would do well to see resilience as pluralistic (Olsson et al., 2015) and community-driven (Kaika, 2017).

Of significance to the present research is a 2016 *Journal of Extreme Events* series of comparative studies that used regime theory to evaluate urban governance for disaster risk management. Parallel methodology was initially used in five cities across the planet: Kolkata, Lagos, London, New York, and Tokyo (respectively: Parasuram et al., 2016; Ajibade et al., 2016; Pelling et al., 2016; Solecki et al., 2016; Nishi et al., 2016), with some follow-up in more recent years (García Sánchez et al., 2018; Solecki et al., 2017a; Solecki et al., 2017b). Using stakeholder interviews, these studies aimed to determine: the currently dominant disaster risk management regime state for each city, whether a different regime state might be emerging, and factors that contributed to or limited change potential. The various researchers explore four regime state types: resistant (in which systems are reluctant to incorporate change); resilient (in which adaptive cycles readily incorporate incremental change but do not fundamentally change); transformative (in which fundamental change is regularly welcomed); and collapse (in which coordination throughout a system does not occur) (see Pelling et al., 2016). Solecki et al. (2017b) write that a transformative regime "is open to the need for significant change in fundamental development trends in order to avoid unacceptable risk and future loss" (p. 2). Status quo approaches to climate change certainly suggest unacceptable risk and significant loss (Allen et al., 2018); thus, modelling transformative urban change is imperative.

Section 2.3: Multi-Level Governance Models Post-Paris

The final of the three crucial research threads derives from recent developments in international climate policymaking. Since 2015, there has been a plethora of international

conferences, agreements, and reports to shift the global agenda toward addressing the urgency of the climate crisis. There has been significant international alignment around the 2015 Paris Agreement, as well as the 2030 Agenda and its associated Sustainable Development Goals (SDGs) from the same year[5]. The 2018 Special Report on Global Warming of 1.5°C (SR15) from the Intergovernmental Panel on Climate Change (IPCC)[6] appears to be further galvanising global action with its calls for "societal transformation" to achieve a "climate-resilient world" (Connors & Pidcock, 2018: 24; see also: Bazaz et al., 2018). More specifically, the SR15 makes an impassioned – while also rigorously scientific – case for limiting global temperature change to no more than a 1.5°C increase (as compared to a 1850-1900 baseline); anything higher would be catastrophic (Connors & Pidcock, 2018). It also emphasises that the current total sum of national carbon reduction commitments does not meet the 1.5°C goal, so there is urgent work to be done to more radically transform countries' emissions projections.

The 2017 New Urban Agenda (NUA) took a significant step in connecting the SDGs[7] with global urbanisation processes, as well as in recognising the particular threat that climate change-induced disasters pose to urban environments (Habitat III, 2017). The NUA calls for urban governance to be inclusive (of multiple levels of government, as well as of citizenry, academia, and civil society), contextual, accountable, efficient, technologically advanced, and socially just. Although the NUA matches many of the ideals espoused in the urban governance literature cited

[5] The Paris Agreement hosts the commitments made by individual countries to reduce their national emissions; each member country has its own Intended Nationally Determined Contribution (INDC) to reducing global emissions (Mehling et al., 2017). The SDGs, on the other hand, consist of 17 principles for social and environmental sustainability that member countries signed on to support (United Nations [UN], 2018).

[6] The IPCC is the world's leading scientific body on climate change, comprised of hundreds of researchers from all member countries of the UN (IPCC, 2018).

[7] In particular, the so-called "urban SDG": "Goal 11: Make cities and human settlements inclusive, safe, resilience and sustainable" (UN, 2018: 9). That said, the NUA recognises that the SDGs are intended as a unified package – no one SDG should be considered in isolation from the others (Habitat III, 2017).

above, it has also been criticised for a lack of specificity (Cohen & Habron, 2018) and for leaving some issues, such as government corruption, unaddressed (Rapoport et al., 2019). Furthermore, Kaika (2017) argues that the NUA overemphasises technological solutions to climate change, which would exacerbate global inequities by favoring wealthier cities and continuing to extract resources from historically colonised regions. She sees an approach focused on achieving indicators, moreover, as an overly-managerial governance style. Instead, she advocates for "dissensus" governance practices – reminiscent of Albrechts' (2015) call for agonistic dialogue in decision-making processes.

Nonetheless, action is urgently needed. Already, cities emit 70 percent or more of the world's emissions (Sustainable Development Solutions Network [SDSN], 2019; Fong et al., 2014). Global urbanisation processes mean that this number will increase unless significant emissions reduction strategies are undertaken (Coalition for Urban Transitions, 2019). Incongruously, commitments to the Paris Agreement are made only at the national level; cities and other "sub-national actors" do not have direct membership to the UN (Coalition for Urban Transitions, 2019; Mehling et al., 2017). The "global climate governance landscape" has been changing, however, with more bottom-up approaches developing that are distinct from (though typically referential to) the UN (Betsill et al., 2015; see also: Jordan et al., 2015; Bulkeley & Betsill, 2013). As a case in point, cities have increasingly put forth their own Paris Agreement-style commitments (Mehling et al., 2017), such as the Philadelphia *Greenworks* plan that is discussed in **Chapter 4: Case Study Context**.

There is thus an increasing recognition within the climate policy literature (although Kaika would almost certainly disapprove) of the need to link sub-national commitments with national

indicators (Chan et al., 2018; Mehling et al., 2017). The term "linkage" often has a technical definition – narrowly referring to accounting mechanisms for emissions reductions that allow countries to officially register actions being taken internally by their sub-national actors. These types of linkages are logistically complicated, and much work remains to be done in the international climate policy field to design and implement them.

Taking the linkage concept beyond carbon accounting mechanisms, however, suggests that other lines of enquiry are also needed to develop urban governance models that integrate various levels of government and governance stakeholders (Valencia et al., 2019). To this point, Fuhr et al. (2018) find that despite inherent limitations in the roles that cities can take on (for example, they are often largely dependent on national financial support), there are opportunities for innovative synergies. Fuhr et al. (2018) introduce the concept of "embedded upscaling", whereby governance intentionally incorporates the sharing of best practice among: cities and their parent countries[8], cities and international bodies, and cities participating in trans-national networks. The time appears to be ripe for new governance models that address these relationships. In fact, Lee and Koski (2015) pronounce that "climate change is *the* quintessential multi-level governance problem" and that "future climate policy would do well to *plan* for multi-level climate governance" (p. 1512-1513, original emphasis).

The growth in trans-national city networks has already lead to developments in urban governance (Rapoport et al., 2019). Trends, particularly in the Global North, of increased urbanisation and devolution, as well as frustration with straggling national climate policy action has increased cities' participation in sustainability-focused organisations such as C40 and ICLEI

[8] Ehnert et al. (2017) refer to this specific relationship as "compensatory federalism", whereby a system of checks and balances creates an equilibrium between local and national governments.

(Rapoport et al., 2019; Davidson & Gleeson, 2015). To date, cities' involvement in such networks has "demonstrated a clear appetite to bypass their national executives", instead of (on the part of both local and national governments) to intentionally design new forms of multi-level governance (Rapoport et al., 2019: 51). Furthermore, and in line with Kaika's (2017) criticism of both the NUA and resilience concepts, participation in C40 is seen by some as a perpetuation of neoliberal governance trends because of its focus on public-private partnerships, indicator measurement and reporting, and achieving "green" economic development (Davidson & Gleeson, 2015).

Moss et al. (2019), in the context of the US, recommend a novel "climate consortium" to include not just state and local governments, but also indigenous nations, community-based organisations, foundations, businesses, universities, and more – with the goal of creating a comprehensive system for managing and communicating climate risk throughout the country. Even more recently, a report released just before the late-September Climate Action Summit at the UN recommends a reorientation of national governments toward "urban transitions" in the face of "climate catastrophe", claiming that "the scale and urgency of these global challenges demands collaborative, ambitious action across all tiers of government" (Coalition for Urban Transitions, 2019: p. 24). One can only imagine that such consortia and multi-level collaborative actions would need to successfully harness dissensus and agnostic practices in order to make meaningful headway.

A final consideration for the future of urban governance models is the study of greater metropolitan areas – as opposed to limiting analyses to cities' strict jurisdictional boundaries (Rapoport et al., 2019). The effects of climate change and other environmental hazards do not limit themselves to governmental borders; thus, "it might be more conducive to consider functional areas

that better take into account the actual territorial extent within which different processes take place" (Valencia et al., 2019: 8). Furthermore, "metropolitan governance structures" have some proven benefits already, including higher per capita GDP and increased economic growth (of course, not seen as a positive by all), better coordination of regional public transportation, and reduced urban sprawl (Rapoport et al., 2019).

Högström et al. (2018) and Ehnert et al. (2017) both explore the wider urban region of Stockholm, finding that more alignment among regional municipalities would result in better achievement of sustainability goals. Also, in an analysis of nearly 1500 municipalities, Homsy & Warner (2015) find that American suburbs are typically less proactive in their sustainability efforts than their regional urban counterparts – but that more multi-level governance methods increase local action in neighbouring suburban and urban regions. Early attempts within research on material flows and "urban metabolism" have also begun to incorporate greater metropolitan areas in their quantifications of consumption (see for example: Athanassiadis et al., 2018; Kennedy et al., 2011; Barles, 2009) because cities rely on regions outside of their jurisdictional boundaries (suburbs, hinterlands, etc.) for resources. Finally, very recently the US's first joint municipal climate action plan was co-released by two cities in the state of Florida (Oakland Park & Wilton Manors, 2019), although other similar examples exist in the US between universities and their home municipalities[9].

Section 2.4: Interlinking Research Threads

Three key conclusions arise from interlinking these urban research models. First, because urbanism is a contemporary planetary process (albeit one with myriad local variations and uneven

[9] As just one example, Oberlin College and the city of Oberlin designed their sustainability commitments in close partnership (Oberlin, 2011).

outcomes), international climate policymaking must grapple with urbanism if it is to identify "socially equitable, democratically managed and environmentally sane" societies (Brenner & Schmid, 2015: p.178). All communities are now embedded in a global fabric of urbanism; at present, no assessment of or planning for environmentally-sound and socially-just societies would be complete without a robust understanding of the characteristics and consequences of these urban processes.

Second, the urgency of the climate crisis and other intertwined environmental disasters endemic to the Anthropocene necessitates an unprecedented level of academic interdisciplinarity in order to model successful pathways for societal transformation. An initial step offered in this study is to compare and contrast the literature on urban governance models and local government regime states, and to link both to sustainable transformations. Future research from other disciplines such as social psychology, feminist and queer theory, public economics, and many more will have distinct but important insights into how societal transformations might be intentionally fostered, who the key governance players are, and how best practices will necessarily differ among locations throughout the world.

Third, the need for more detailed research on linkages of greenhouse gas reductions has implications beyond the technicalities of emissions accounting: this gap also implies a critical need for cities to engage more with local communities outside of their own jurisdictional boundaries. Multi-level and regional governance models that incorporate greater metropolitan areas need to be developed and assessed.

These developments in theory and praxis will need to be both pluralistic and postcolonial to encourage productive dialogue among stakeholders (Brenner, 2018); agonistic to ensure inclusion

of different points of view within governance approaches (Albrechts, 2015) and moreover to ensure that processes are community-led (Kaika, 2017); and reflexive to allow for redirection toward innovative methods that are currently unknown (Patterson et al., 2017). Together, these takeaways form the theoretical backdrop to motivate the present research: a case study of urban sustainability governance that considers the greater Philadelphia Metropolitan Area.

Chapter 3: Methods

To explore the burgeoning field of urban sustainability governance, the present research asks three questions about the case study: is there a difference between the climate readiness of the two locations within the Philadelphia Metropolitan area; what are the trends in each location; and what implications does this case study have on urban governance models? The details below describe how the study was structured in order to answer these questions.

Section 3.1: Methodological Framework

The three research questions necessitated different types of answers and therefore different types of data collection. I utilised a "mixed methods" framework, which both allowed for the needed variation in data types as well as encapsulated the interdisciplinarity that I believe is necessary in the modern age.

Put simply, a mixed methods framework is a social science research paradigm that uses a mixture of qualitative and quantitative approaches (Creswell, 2003). Qualitative approaches see research as a subjective practice in which the positionality of the researchers cannot be removed from their work (Johnson & Onwuegbuzie, 2004). Quantitative approaches, on the other hand, build off of the physical sciences to prioritise positivism (Johnson & Onwuegbuzie, 2004). Quantitative scholars criticise qualitative ones for a lack of interest in empirical data, while qualitative scholars criticise quantitative ones for believing that objectivity is possible (Smith, 1983).

Drawing from both ends of this epistemological spectrum, mixed methods research is pragmatic in its pluralistic and agnostic approach (Johnson & Onwuegbuzie, 2004). Mixed methods scholars generally argue that both qualitative and quantitative approaches have merit, both have weaknesses, and by using both a research endeavor can better avoid methodological pitfalls. Moreover, mixed methods help to "triangulate" conclusions drawn from the data by demonstrating that different data types signal similar results (Johnson et al., 2007).

Data for the present study were collected via stakeholder interviews, which incorporated both qualitative and quantitative aspects simultaneously. The methodologies were separated somewhat at the point of data analysis – with the first research question primarily answered by analysing answers to Likert-type scale interview questions[10]; the second, descriptive research question informed most by participant responses to open-ended interview questions; and the final, most exploratory research question extrapolated from all of the data.

The interviews were conducted using a semi-structured format. Semi-structured interviews match the mixed methods approach by falling on a spectrum between structured interviews (where all questions are predetermined and interviewer deviation from a script is disallowed) and unstructured interviews (which are open, flexible conversations led by the participant) (Longhurst, 2010). My interview script, research proposal, and risk assessment were all approved by the University of Oxford's Research Ethics Committee.

[10] According to Boone & Boone (2012), the most common form of Likert-type scales has participants answer a series of questionnaire items on a five-point scale from strongly disagree to strongly agree, though slight variations are common; I opted for a four-point scale.

Section 3.2: Survey Structure & Goals

The interview questions drew on a series of five studies on urban risk management regimes published in the *Journal of Extreme Events* in 2016 (Parasuram et al., 2016; Ajibade et al., 2016; Pelling et al., 2016; Solecki et al., 2016; Nishi et al., 2016). The present research expands on that work by integrating climate risk explicitly into the stakeholder interviews, and by comparing multiple counties of one greater metropolitan area[11] for the first time.

The present questionnaire contained four main sections. The first assessed the stakeholders' views on the importance of various hazards and how they believed their local governments were prioritising risks. The seven hazards provided to participants were selected through a combination of comparing the hazards used in previous studies and reviewing regional reports (see **Table 3.2** below) to understand common risks in the case study area.

The second section had participants identify the local government's current risk management approach out of four described types[12]. Looking toward the future, the third section identified any emerging directions of change in the local government's approach and assessed participants' views on the likelihood of future scenarios that could make risk management more challenging. The final section refocused risk management questions in the context of climate change explicitly, and assessed perceptions of future climate risk in the region. Participants were also asked to describe the key actors (e.g., elected officials, media, local businesses, etc.) and barriers (e.g., political infighting, lack of financial resources, lack of public interest, etc.) that have influenced their government's climate action planning to date.

[11] Solecki et al. (2017b) come close in a follow-up paper, with a very brief comparison of Staten Island and Jamaica Bay following Hurricane Sandy in New York City.

[12] These matched the four regime types from Solecki et al. (2017b): collapse, resistance, resilience, and transformation. See **Chapter 2: Literature Review.**

Section 3.3: Participants

32 participants were interviewed in total, with 16 participants from Delaware County and 13 distinct participants from Philadelphia. The two locations had similar distributions of stakeholders, each with the most from government, as well as several from academia, the private sector, and civil society. (See **Table 3.1a & 3.1b** for a full breakdown of participant categories.) Participants were selected based on relevant work or volunteer activity, as well as by snowball sampling of those who were interviewed earlier on – a common practice with semi-structured interviews (Longhurst, 2010). Interviews were concluded when clear themes repeatedly emerged from participants' commentary (though the timing was also bounded by the dissertation deadline). Participants were contacted with an initial interview request by email; once they expressed interest in being interviewed they were emailed a detailed information sheet.

Consent was obtained at the beginning of the interview, before recording began. The semi-structured interviews took place both in person and via Zoom videoconferencing[13], and took between 45 to 60 minutes to complete. All interviews were recorded with Otter Voice Meeting Notes, which created computer-generated transcripts that I subsequently edited.

[13] Because I work full-time, and because the participants generally preferred to be interviewed during standard work hours, it was often not feasible for me to travel to meet with individual participants in person.

Table 3.1a Participant Categories for Delaware County. n=16.		
Categories	**Sub-Categories**	**Specialisations**
Government or quasi-government (6)	State (1)	Elected office (1)
	Regional (1)	Environmental planning (1)
	County (3)	Elected office (2)
		Emergency management (1)
	Municipal (1)	Municipal oversight (1)
Academia (4)	University faculty (1)	Geography (1)
	University staff (3)	Institutional environmental sustainability (3)
Private sector (1)	Local business (1)	Waste management (1)
Civil society (5)	Volunteer group (1)	Environmental and/or climate work (5)
	Non-profit organisation (4)	

Table 3.1b Participant Categories for Philadelphia. n=13.		
Categories	**Sub-Categories**	**Specialisations**
Government or quasi-government (5)	Regional (1)	Environmental planning (1)
	City (4)	Environmental planning (2)
		Parks and recreation (1)
		Waste management (1)
Academia (3)	University faculty (1)	Economics (1)
	University staff (2)	Institutional environmental sustainability (2)
Private sector (1)	Local business (1)	Law (1)
Civil society (4)	Non-profit organisation (4)	Environmental and/or climate work (1)
		Local businesses (1)
		Media (1)
		Waste management (1)

Section 3.4: Data Analysis

Quantitative comparisons of the scaled questions between the two locations were analysed using Fisher's Exact Tests in R[14]. This test is a particularly good match for these data: with a categorical, two-level independent variable[15] and a relatively low sample size (Agresti, 2001). Descriptive statistical methods were also used for explorations of trends within and between the two locations; descriptive statistics and associated figures were completed using Google Sheets.

Qualitative responses provided substantial depth to scaled responses, and more directly informed the analysis of trends in each location. For this analysis, quotes were pulled from the transcript and anonymised. Coding was also done for three qualitative questions (see **Figures 5.2, 5.12** and **5.13** in **Chapter 5: Results & Discussion**) in order to assess the frequency of various open-ended responses.

Finally, numerous relevant government, quasi-governmental, and NGO reports were reviewed to provide context for the references, constraints, and opportunities mentioned by participants. Though no direct data analysis was conducted on these documents (and most, but not all, are directly cited in-text), they all provided essential background context; for this reason, they have been listed below (see **Table 3.2**) in addition to within the **References**.

[14] The confidence level was the standard 95% (Agresti, 2001). Thus, the *p*-value was considered significant if less than or equal to 0.05.

[15] The independent variable was participants' location, with the two levels being Delaware County or Philadelphia.

Table 3.2 Contextual Reports.

Report Title	**Scale of Assessment**	**Publishing Body**	**(Author, Year)**
Climate Emergency, Urban Opportunity: How National Governments Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities	International	Coalition for Urban Transitions	(Coalition for Urban Transitions, 2019)
Climate Change Impacts in the United States: Northeast	National	National Climate Assessment	(Horton et al., 2014)
Confronting Climate Change in the U.S. Northeast	National	Northeast Climate Impacts Assessment	(Frumhoff et al., 2007)
Leaving No U.S. City Behind: The U.S. Cities SDGs Index	National	SDSN	(Espey et al., 2018)
US Cities Sustainable Development Report	National	SDSN	(SDSN, 2019)
PA Climate Action Plan	State	PA DEP	(ICF, 2018)
Connections: The Regional Plan for a Sustainable Future	Regional	DVRPC	(DVRPC, 2009)
Beat the Heat: Hunting Park. A Community Heat Relief Plan	County (Philly)	Philadelphia	(Philly OOS, 2019a)
Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control	County (Philly)	Philadelphia	(Philly Water, 2011)
Greenworks: A Vision for a Sustainable Philadelphia	County (Philly)	Philadelphia	(Philly OOS, 2016)
Greenworks Review	County (Philly)	Philadelphia	(Philly OOS, 2019b)
Growing Stronger: Toward A Climate Ready Philadelphia	County (Philly)	Philadelphia	(Philly OOS, 2015)
Options for Achieving Deep Reductions in Carbon Emissions in Philadelphia by 2050	County (Philly)	Drexel University	(Drexel, 2015)
Philadelphia: The State of the City	County (Philly)	Pew Charitable Trusts	(Pew, 2019)
Powering Our Future: A Clean Energy Vision for Philadelphia	County (Philly)	Philadelphia	(Philly OOS, 2018)
Zero Waste Litter Cabinet Action Plan	County (Philly)	Philadelphia	(Philly, 2017)
Delaware County 2035: Implementation Metrics Report	County (DelCo)	Delaware County	(DelCo, 2017)

Report Title	**Scale of Assessment**	**Publishing Body**	**(Author, Year)**
Delaware County Hazard Mitigation Plan	County (DelCo)	Delaware County	(DCPD, 2016)
Land Use Policy Framework Plan	County (DelCo)	Delaware County	(DelCo, 2013)
Swarthmore Area Greenhouse Gas Emissions Inventory and Action Plan Project	Municipality (DelCo)	Temple University	(Temple, 2010)
The City of Chester Vision 2020: Climate Adaptation Planning Elements	Municipality (DelCo)	Chester	(Chester, 2014)
Township of Haverford Climate Change Action Plan	Municipality (DelCo)	ICLEI	(ICLEI, 2008)
Bryn Mawr College Climate Action Plan	University (DelCo)	Bryn Mawr College	(Bryn Mawr, 2010)
Haverford Climate Action Plan	University (DelCo)	Haverford College	(Haverford, 2012)
Swarthmore College Climate Action Plan	University (DelCo)	Swarthmore College	(Swarthmore, 2013)
The Villanova University Climate Action Plan	University (DelCo)	Villanova University	(Villanova, 2010)

Section 3.5: Constraints

Sampling

Although the participants represented a wide variety of stakeholder professions and sectors, there is potential for bias among the participant sample as a whole. Participants were selected for their regional expertise with local hazard management or climate risk policy. In the United States, engagement with pro-environmental professions and/or civil society networks is closely aligned with the Democratic Party (one of two political parties in an almost exclusively two-party system that permeates both the local and national scales) (Leiserowitz et al., 2019). While participants'

political alignment was not asked[16], many participants were elected officials (thus, their party affiliation is public knowledge) or very clearly expressed their affiliation during the interview. It is therefore probable that Republicans were severely underrepresented in the interviews. This concern is likely stronger for Philadelphia, where political affiliation is more homogenous, than for Delaware County, where supporters of both parties are well represented in the population (Wolf & Cortés, 2017). Nevertheless, attempts were made to contact and interview a wide-range of stakeholders, as well as to make the questionnaire as apolitical as possible so as to minimise perceptions of the interviewer's own affiliations.

Another sampling restraint was the accessibility of various types of potential participants. The intention was to have more equal representation from the four sectors: government, academia, civil society, and the private sector. It proved difficult, however, to identify willing participants. Individuals who were contacted for an interview often shared that they felt they had too little policy awareness to productively participate and so declined the invitation. This is a common difficulty with stakeholder interviews and focus groups, however, especially when "cold-calling" is involved (Longhurst, 2010). Nevertheless, as shown in **Chapter 5: Results & Discussions**, differences between the two locations still became apparent with the data that were obtained.

Interview Questions

While the interviews asked the same questions of all participants, it is possible that terms were interpreted differently. No terms were outright defined, and the semi-structured nature of the interviews allowed for some participants to ask clarifying questions while others did not.

[16] Given the highly fractured state of American politics, it can be inappropriate to directly ask a person's party affiliation in a formal setting. Moreover, asking for party affiliation could colour participants' responses by leading them to over-interpret the "agenda" of the questionnaire.

Participants may have also internalised the scaled questions differently, leading to mismatched responses. These interpretative differences were minimised by using a clearly articulated interview script, presenting visual cards to help participants respond to scaled questions, and interviewing enough participants to obtain representative results.

Finally, critiques of regime theory (for example that it lends itself to neoliberal preferences for smaller local government, less inclusive governance practices, prioritisation of hyper-capitalism, etc.) might suggest that the interview questions pointed participants toward conservative thinking. However, given the almost certain Democratic-affiliations held by the majority of the participants, it is much more likely that these same questions made liberal ideas more salient.

Chapter 4: Case Study Context

Between the increasing urbanisation of populations globally and the reality of obstructed climate policy in the US and other countries today, it is imperative that urban efforts to respond to climate change become better understood. The Delaware Valley is a prime example of the successes as well as the limitations of an American greater metropolitan area in addressing this crisis.

Section 4.1: About the Delaware Valley

The study area took place in the US state of Pennsylvania (PA). PA is one of 50 American states, located about a third of the way down the country's eastern coast – although the eastern edge of PA is around 80 kilometers from the Atlantic Ocean (Google, 2019). Because the Delaware River spans PA's eastern border, the region is known as the Delaware Valley – or, alternatively, the Philadelphia Metropolitan Area because Philadelphia is the biggest city along the river. See **Figure 4.1**.



Figure 4.1. Map of the Delaware Valley Featuring the Delaware River (Wikipedia, 2019).

A 2018 PA Climate Action Plan created by the state's Department of Environmental Protection finds that the state is at risk for more frequent and more severe storms, droughts, heatwaves, snowfalls, and general precipitation (Inner City Fund [ICF], 2018: 12). Increased air pollution is also a major concern (ICF, 2018). Additionally, the Delaware Valley is at particular risk of riparian flooding due to sea level rise (ICF, 2018). These findings are well in line with general projections for the US Northeast (Horton et al., 2014). What was once a "pronounced seasonal cycle" with "snowy winters, verdant springs, humid summers, and brilliant autumns" (Frumhoff, et al., 2007: ix) has already begun to drastically change due to anthropogenic emissions. Global warming, and its associated effects (e.g., more hot days, more rain and snow, more flooding, etc.), will change the "character and economy of the Northeast" (Frumhoff, et al., 2007: ix). Despite these dire predictions, the 2018 Sustainable Development Report of the US ranks PA as only 30th in the total list of American states' progress toward the SDGs (Sachs et al., 2018).

The question for the present study is how individual communities of PA (i.e., two within the Delaware Valley) are responding to these changes, as well as whether and how they are ramping up their efforts given the urgency of the crisis. The federalist system of the US allows for immense variation among states in how they govern. States are comprised of counties, which are further comprised of municipalities that themselves vary greatly in terms of resources and priorities. The Delaware Valley contains nine counties, which are located in both PA and New Jersey and include the two study areas – Delaware and Philadelphia Counties (Delaware Valley Regional Planning Commission [DVRPC], 2009).

Section 4.2: About Philadelphia

By population, Philadelphia (commonly called Philly) is the largest city in the Delaware Valley, the sixth largest city in the US, and the eighth largest in the US in terms of greater metropolitan area[17] (United States Census Bureau [Census], 2018a). It is a major economic powerhouse located about equidistant between New York City to the north and Washington, DC to the south. Philadelphia had significant historical importance in the US colonies and served as the young country's capital for a decade. Philadelphia incorporated its surrounding counties in the mid-19th century, at which time it consolidated the county and city governments (Heath, 2013). Like many regions of the US, the city is governed by three branches: executive (with an elected mayor that appoints boards and commissions), legislative (a ten-person city council), and judicial (with a series of hierarchical courts) (Schnader et al., 1951).

In 2008, former Mayor Michael Nutter established the Office of Sustainability (OOS), which began to identify emissions reductions and other environmental targets (Drexel, 2015). The OOS's *Greenworks* vision, first published in 2009, is an overarching plan to establish targets, showcase success, and organise subsidiary city plans (such as the 2011 *Green City, Clean Waters*; 2017 *Zero Waste & Litter Cabinet Action Plan*; 2018 *Powering Our Future*; and 2019 *Beat the Heat: Hunting Park*, to name a few). Annual *Greenworks* updates have since been published, as well as an updated sustainability plan in 2016. The 2016 plan contains 8 "visions" that are reminiscent (albeit localised to the Philadelphian context) of the 17 SDGs from 2015 (Philly OOS, 2016). Much like the research on the US Northeast and on PA, the OOS has found that

[17] The city population is 1.5 million (Census, 2018c), while the PMA population is 6 million (Census, 2018a).

Philadelphia is increasingly vulnerable to hotter and wetter weather, more extreme weather events, and sea level rise – with consequential social impacts also loosely predicted (Philly OOS, 2016).

Philadelphia has received some recognition among urban sustainable development organisations for its actions to date. For example, the city was selected by Bloomberg Philanthropies in 2018 for its American Cities Climate Challenge (Philly OOS, 2019b). Philadelphia also participates in transnational networks such as C40 and ICLEI. That said, Philadelphia continues to rank middle-of-the-road in assessments of its sustainability progress as compared to other cities both domestically and internationally – although there are signs that implementation of the *Greenworks* vision is having a positive effect. For example, the Philadelphia Metropolitan Area was ranked 59 out of 100 American cities by the Sustainable Development Solutions Network (SDSN) in 2018 in terms of achievement of the SDGs (Espey et al., 2018), while in 2019 it was ranked 40 out of 105 cities[18] (SDSN, 2019). Similarly, Rosenzweig & Solecki (2018) scored six international cities on five pathways for sustainable transformation and found that Philadelphia had middling success. However, the pathways mirror visions laid out in the *Greenworks* plans – so it is likely too early in the *Greenworks* implementation stages to fully assess its success.

Section 4.3: About Delaware County

Delaware County (commonly called DelCo) contains 49 distinct municipalities (Delaware County Planning Department [DCPD], 2016). It "is a primarily urban county, with rings of development radiating from the border of Philadelphia" (DCPD, 2016: 5). The total population of

[18] The analysis of the PMA in this case included the following nearby cities: Philadelphia, Camden, and Wilmington. It appears to be the case that suburban areas of each of these cities within the Delaware Valley were not included in the assessment.

the county is about a third of the size of Philadelphia, at 5.6 thousand as of a 2018 estimate (Census, 2018b). The county is primarily governed by a County Council, which oversees managerial departments, as well as by a handful of other elected officials (DelCo, 2019). Substantial governing authority is left to the municipalities; that said, the county is primarily responsible for departments and activities such as: emergency services, distribution of federal money, the county prison and courthouse, and public libraries.

Despite Delaware County's proximity to Philadelphia, major political differences are worth noting. While Philadelphia is a dominantly Democratic-voting population (about 77% registered as Democrats as of 2016) with most elected officials being Democrats (Wolf & Cortés, 2017), DelCo is more mixed. As of 2016, almost 46% of the voting population in Delaware County were registered as Democrats while almost 42% were registered as Republicans (Wolf & Cortés, 2017). Importantly, Delaware County has for many decades had single-party Republic rule (McLarnon, 2003) – but a recent upset in 2017 saw the first two Democrats elected to the five-person County Council since the 1970s.

Delaware County does not have an OOS or other department devoted to environmental issues[19]. Two critical planning documents, however, highlight the county's current orientation toward climate mitigation and adaptation. First, the 2013 *Land Use Policy Framework Plan* of the umbrella *Delaware County 2035 Vision* is a strategic plan that repeatedly calls for "sustainable communities," "sustainable living," and "sustainable development" (DelCo, 2013). Some recognition of smart growth models and one reference to greenhouse gas emissions are also

[19] It also does not have a health department, which was noted repeatedly by DelCo participants in interviews.

included in this report[20] (DelCo, 2013). Second, the 2016 *Hazard Mitigation Plan* identifies the 22 most significant hazards[21] to the county (DCPD, 2016). For each hazard, an assessment was made of its current frequency as well as projected future occurrence. The worsening of some hazards due to climate change is lightly recognised in relation to two hazards: sea level rise threatening riparian flooding and an increase in types of viruses due to temperature change. The 2016 plan also notes that a "County Climate Adaptation Component Plan" is forthcoming in three years that will "identify opportunities to improve resiliency" (DCPD, 2016: 212 & 260) – but as of late 2019 such a document has not yet been publicly published. Finally, the plan recognises that certain municipalities have modelled climate adaptation plans and highlights work done by its subsidiary municipality of Chester.

[20] None of the words "sustainable," "smart growth," or "emissions" were included in a 2017 progress report, however, and no further progress reports are publically available (DelCo, 2017).

[21] The 22 are, in brief: Droughts, earthquakes, extreme temperatures, floods, hailstorms, hurricanes, landslides, lightning, pandemics, radon exposure, sinkholes, windstorms, wildfires, winter storms, civil disturbances, dam failures, hazardous material releases, levee failures, terrorism, transportation accidents, fires, and utility interruptions.

Chapter 5: Results & Discussion

This chapter synthesises key results from the stakeholder interviews in the form of both qualitative and quantitative analyses. Three research questions permeate the data analysis:

> ***Research Question 1:*** Is there a difference between the climate readiness of the Delaware County government and the Philadelphia city government?
>
> ***Research Question 2:*** What are the trends in each location, and how are they causing differences or contributing to similarities between the two locations?
>
> ***Research Question 3:*** What implications does this case study have for urban governance models?

For a detailed summary of the interview questions and all statistical analyses conducted, see **Appendices I & II**, respectively.

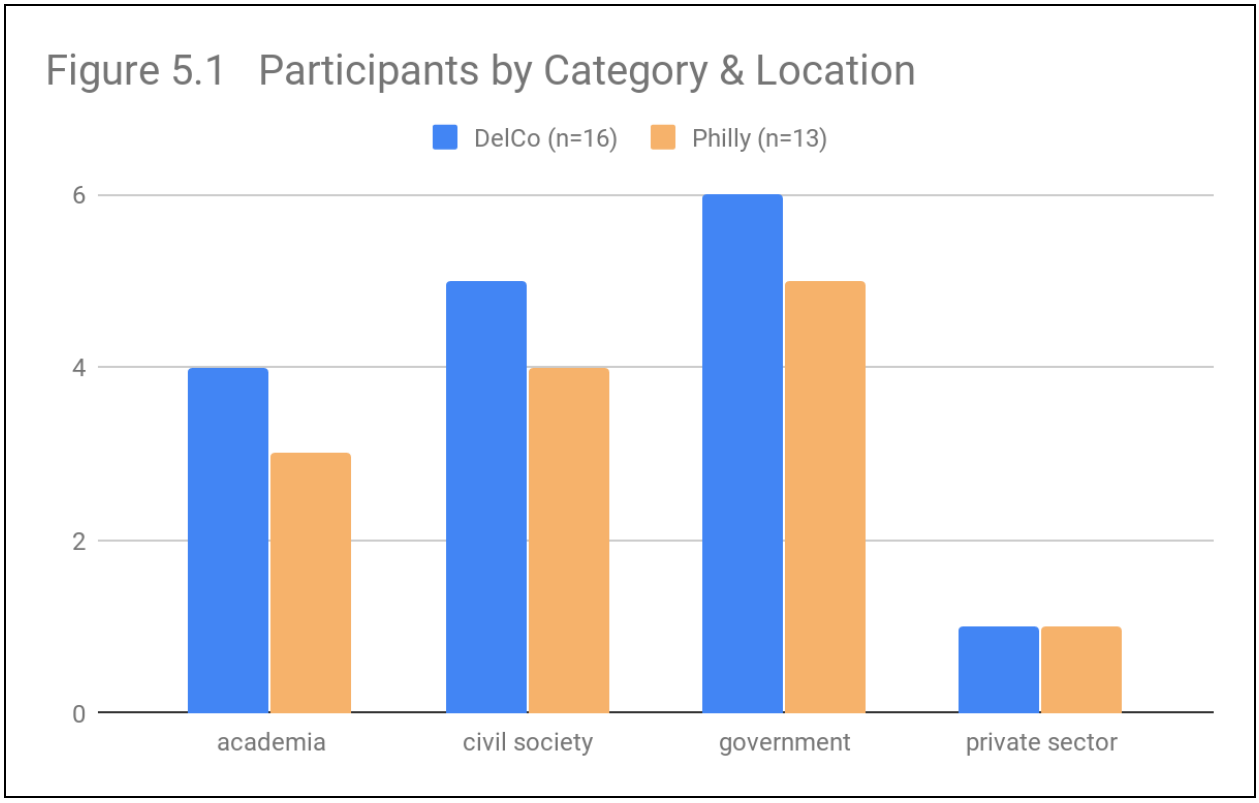
After establishing important demographic characteristics about the sample populations, I turn to answering this study's motivating research questions. To answer **Research Question 1**, I review results mostly from quantitative, scaled questions. For **Research Question 2**, I look for context and trends by delving deeply into participants' qualitative responses. Finally, turning to **Research Question 3**, I return to urban governance models to theorise about the implications of this case study.

Section 5.1: Participant Demographics

The total number of participants from Delaware County (DelCo) was 16, while the total number from Philadelphia (Philly) was 13. As can be seen throughout the quantitative data analysis, individual questions were sometimes skipped, leading to different *n* responses for any given question. Participants sometimes felt that they did not have the relevant expertise to answer a

particular question and could always opt out. DelCo participants were more likely to skip questions than Philly participants throughout, so respondent numbers often turned out similarly despite the higher total number of participants from DelCo.

I categorised each participant into one of four main categories: academia, civil society, government, or the private sector. **Figure 5.1** below shows the breakdown of participants by category and location (See **Tables 3.1a-b** in **Chapter 3: Methods** for a detailed breakdown of participant categories by location). Overall, the breakdown by category was very similar in both locations.



Participants from both locations were also similar in terms of their average number of years in their current work positions, their average total years of relevant work experience, and their familiarity with international climate policies (both groups, on average, ranked themselves as

moderately familiar). On the whole, then, the participant pools from both locations were quite similar to each other, which reduces the possibility that any differences were caused by different types of participants.

Section 5.2: Quantitative Comparison Between Locations

> ***Research Question 1:*** Is there a difference between the climate readiness of the Delaware County government and the Philadelphia city government?

The first research question was quantitative in nature: can it be shown empirically that there was a difference in responses between the two locations? Four core interview questions were designed to answer this question, all of which explored various aspects of seven hazards that were identified before any interviewing began. The core questions were, in brief (see **Appendix I** for the full interview script):

> ***Core Interview Question A:*** How important do you think each hazard is?
>
> ***Core Interview Question B:*** How important does your government think each hazard is?
>
> ***Core Interview Question C:*** How affected do you think each hazard will be by climate change?
>
> ***Core Interview Question D:*** How affected does your government think each hazard will be by climate change?

Each of the four core questions was answered for each hazard (blizzards, coastal flooding, rainfall flooding, heatwaves, fires, gun violence, and terrorism) on a Likert-type scale from not important/affected to extremely important/affected. Participants were also allowed to add between 1-3 hazards after answering ***Core Interview Question A***. If they opted to add a hazard, then that hazard was included in all subsequent questions. Although added hazards could not be compared

across participants, their inclusion was extremely informative for understanding stakeholders' primary risk concerns. Three additional quantitative question sets (exploring: government risk management approach, the adequacy of that approach if hazards worsen, and a ranking of government climate action success) gave more depth to participants' responses to the core questions.

In order to answer **Research Question 1**, in this section I will: first briefly review data confirming the validity of the provided hazards, then examine the additional hazards that participants provided, and then finally analyse the quantitative interview questions described above. **Section 5.3** explores **Research Question 2.**

Validation of Provided Hazards

Many participants corroborated the utility of the provided list of seven hazards. One participant agreed that:

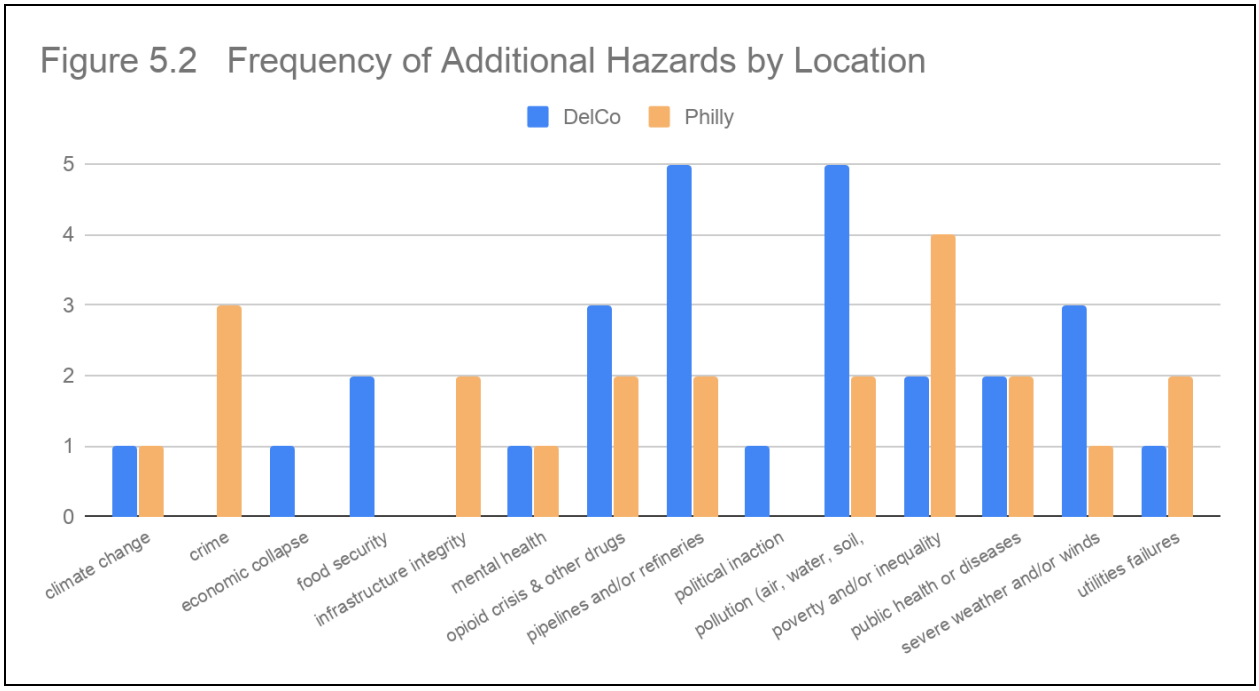
> We have the localised flooding, we have the water problem, we have really bad urban heat island effect. We have definitely some heatwaves and some cold snaps that are affecting vulnerable communities the worst. *(Civil society participant 3 from Philly.)*

Some feedback about the wording of the hazards is worth noting, however. With blizzards, coastal flooding, and fires, several participants commented that there could be variation within the sample population in terms of slightly different interpretations in meaning. For example, more than one DelCo participant expressed confusion about the word "coastal" because no part of the county is on the coast (however, the southern edge of the county is along the Delaware River and faces high risk of riparian flooding due to sea level rise). This might in part explain why, as will be shown later on, participants from DelCo placed slightly less importance on coastal flooding than

did those from Philly. Despite some minor interpretative differences with regard to the hazards themselves, however, meaningful patterns from the two locations became apparent throughout the interviews.

Frequency of Additional Hazards

Figure 5.2 shows the other hazards that participants opted to list and the frequency with which each hazard was named. Some consolidation was done for hazards that were very similar (e.g., "high winds" and "wind damage") or to group together some hazards (e.g., various types of pollution).



Poverty and crime were notably listed more by Philly respondents, whereas many more DelCo participants named pipelines and/or refineries and various types of pollution as additional key hazards for their region. (See ***Theme 2*** within **Section 5.3** below for analysis on why these hazards were commonly added.) DelCo participants also named severe weather and/or winds with

some frequency due to the unusual number of heavy thunderstorms (and a rare tornado threat) that had recently occurred.

Core Interview Questions

Having confirmed that the provided list of seven hazards was generally appropriate for both locations, I will now move on to the main quantitative analysis.

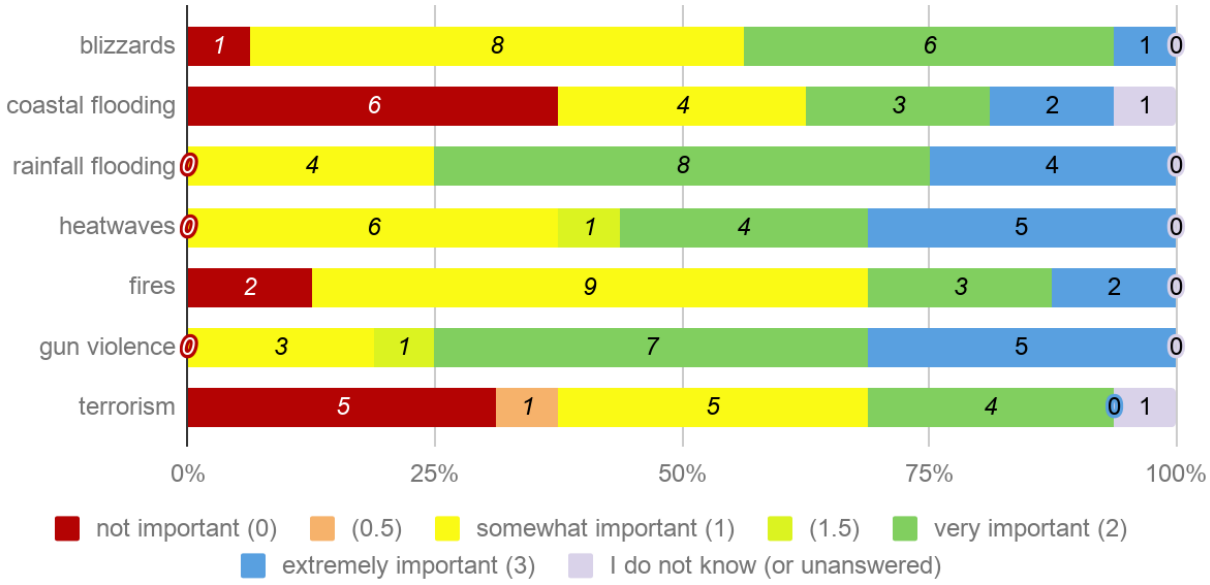
Core Interview Question A: *How important do you think each hazard is?*

The first core interview question set the stage for comparisons between the two locations, as well as for later comparisons between participants' views and their perception of their governments' approach. **Figures 5.3a & 5.3b** show the breakdown of how much importance participants placed on each hazard by location. Here, as with all other interview questions, participants could opt out of answering a question or say "I don't know". Some participants also insisted on using half points on the scale.

Participants from both DelCo and Philly ranked rainfall flooding and gun violence highest, with heatwaves close behind. Philly participants' ranking of the importance of gun violence was statistically significantly higher than the response from DelCo participants ($p=0.05$). Blizzards, coastal flooding, and fires were ranked in the middle of the pack for both locations. Participants from neither location thought that terrorism was particularly important. Thus, with the exception of gun violence, quantitative responses did not meaningfully differ between the two locations: participants across the board held similar views about the varying importance of the seven hazards.

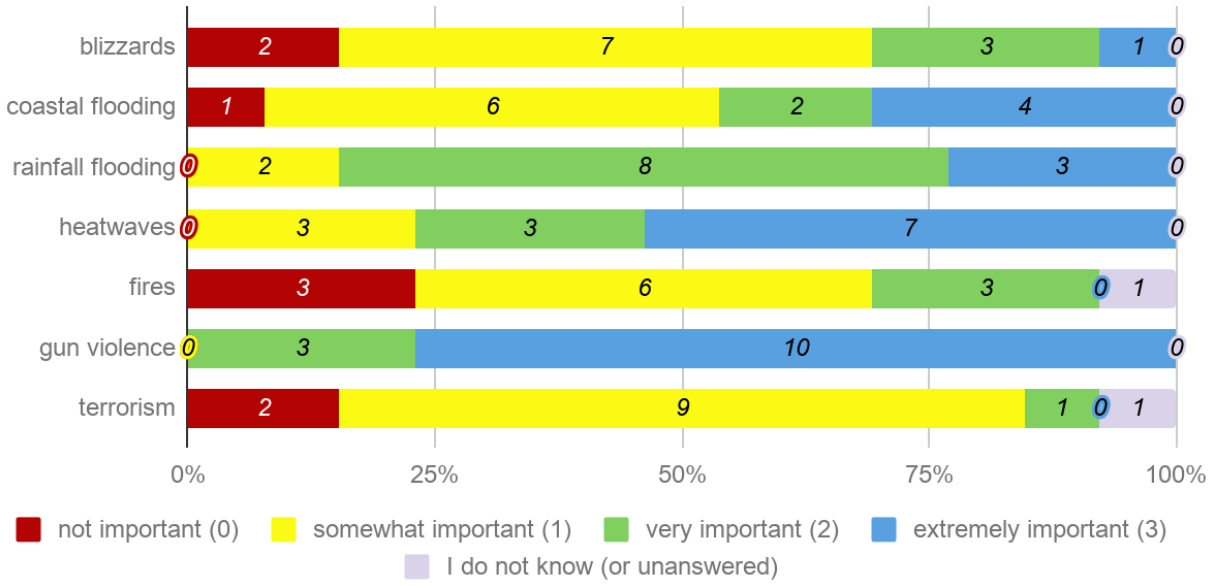
Both locations have significant amounts of gun violence[22], although in DelCo there are notable differences among municipalities. (See ***Theme 3*** within **Section 5.3** for more on municipalities and gun violence.) Perceptions of gun violence and favorability toward increased gun restriction policies have also been highly politicised in the US (Bacon, 2009), which likely explains some of the difference between the strongly Democratic Philadelphia and the more politically mixed Delaware County.

Figure 5.3a Importance of Hazards According to Professional Judgement (DelCo)



[22] One 2017 article describes gun violence as a local public health crisis, citing examples in both Philly and DelCo's City of Chester (Lozano, 2017).

Figure 5.3b Importance of Hazards According to Professional Judgement (Philly)



Core Interview Question B: *How important does your government think each hazard is?*

The second core interview question was designed in contrast to the first – now asking participants' sense of their *governments'* prioritisation as opposed to their personal points of view. **Figures 5.4a & 5.4b** show the breakdown of how much importance participants felt their governments placed on each hazard by location.

As with their answers to **Core Interview Question A**, Philly participants ranked rainfall flooding and gun violence very highly – although DelCo participants only ranked these two hazards as moderately important to their governments. For gun violence again, the difference between responses from the two locations was statistically significant ($p<0.01$). Participants from both locations felt that their governments thought that blizzards, heatwaves, fires, and terrorism

were all moderately important. Philly participants ranked coastal flooding as moderately important to their government, which was statistically significantly higher than DelCo participants' low ranking (p=0.05). As mentioned before, some DelCo participants figured that their government was not thinking about coastal issues – which perhaps affected the data. At the same time, quite a few participants from Philly referenced the city's *Green City, Clean Waters* plan – demonstrating that such documents can raise the salience of issues among the general public.

Figure 5.4a Importance of Hazards According to Impressions of County Priorities (DelCo)

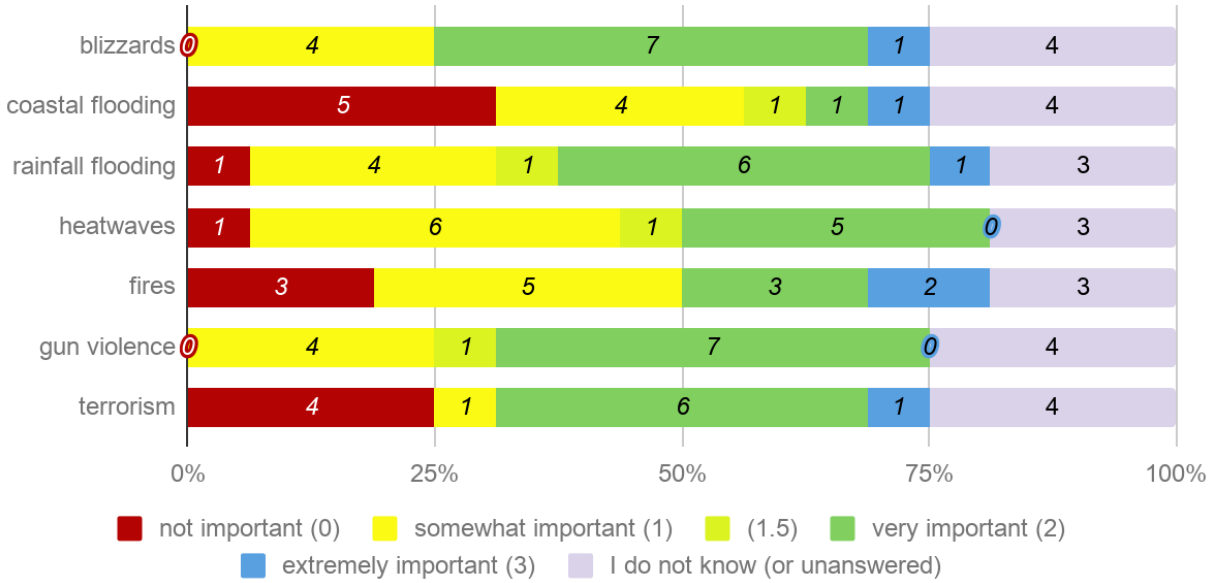
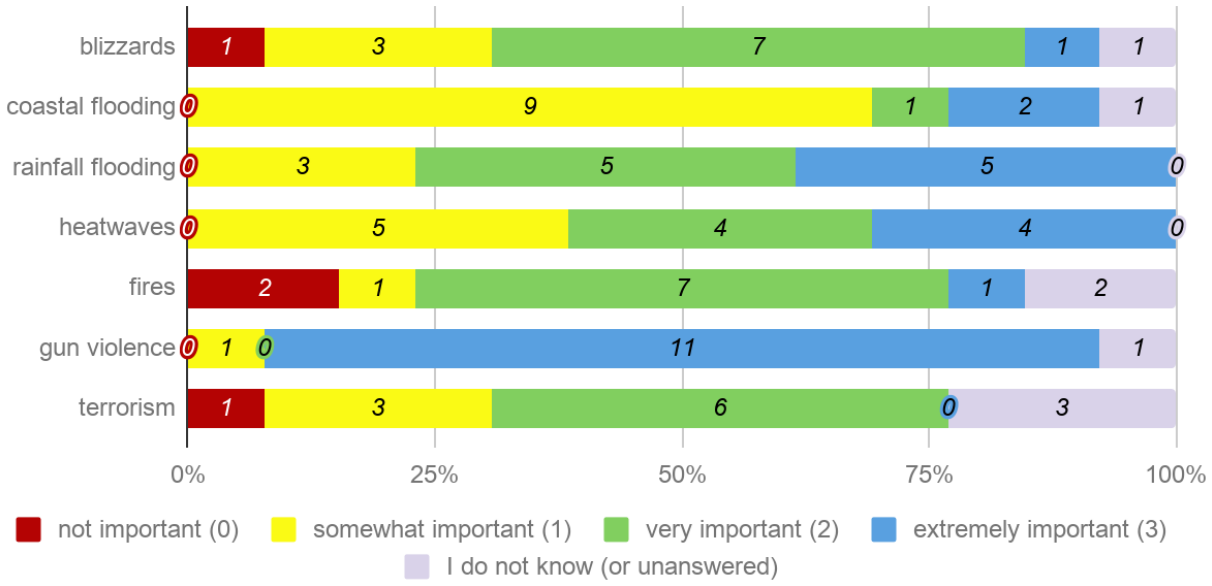


Figure 5.4b Importance of Hazards According to Impressions of City Priorities (Philly)



Core Interview Question C: *How affected do you think each hazard will be by climate change?*

The next core interview question transitioned to considering climate change explicitly. **Figures 5.5a & 5.5b** show the breakdown of how affected participants thought each hazard would be by climate change in their location over the next 20 years.

Participants from both locations ranked blizzards, rainfall flooding, and heatwaves as highly likely to be affected by climate change. Philly participants also ranked coastal flooding very highly, while DelCo participants only expected it to be moderately affected – however, the difference was not statistically significant. Both locations expected fires and gun violence to be moderately affected by climate change, and terrorism to be minimally affected. However, the difference in responses for terrorism was statistically significant (p=0.05), with DelCo participants

ranking it meaninfully higher. DelCo participants on the whole mentioned terrorism more often in the interviews. (See ***Theme 3*** in **Section 5.3** for more on terrorism.)

Here, as with the other core interview questions so far, participants from both locations had overall similar responses despite some minor differences. This validates that the hazard risks for these two regions of the Philadelphia Metropolitan Area are similar, and that stakeholders in both locations are somewhat aware of the expected increase in risks due to climate change.

Figure 5.5a Effect of Climate Change on Hazards According to Professional Judgement (DelCo)

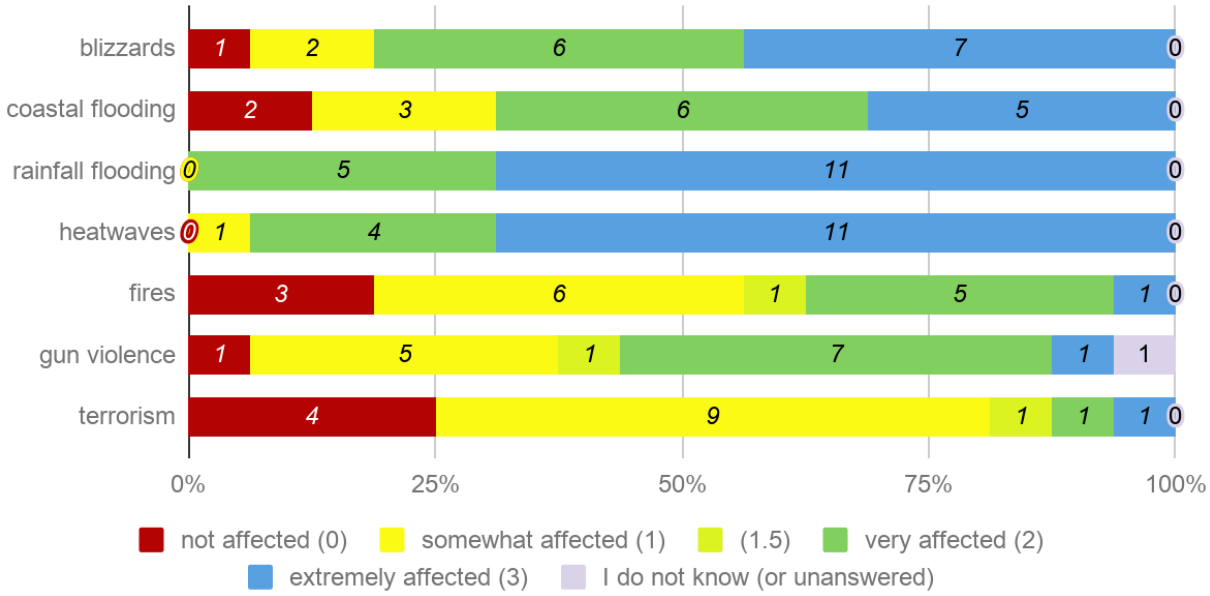
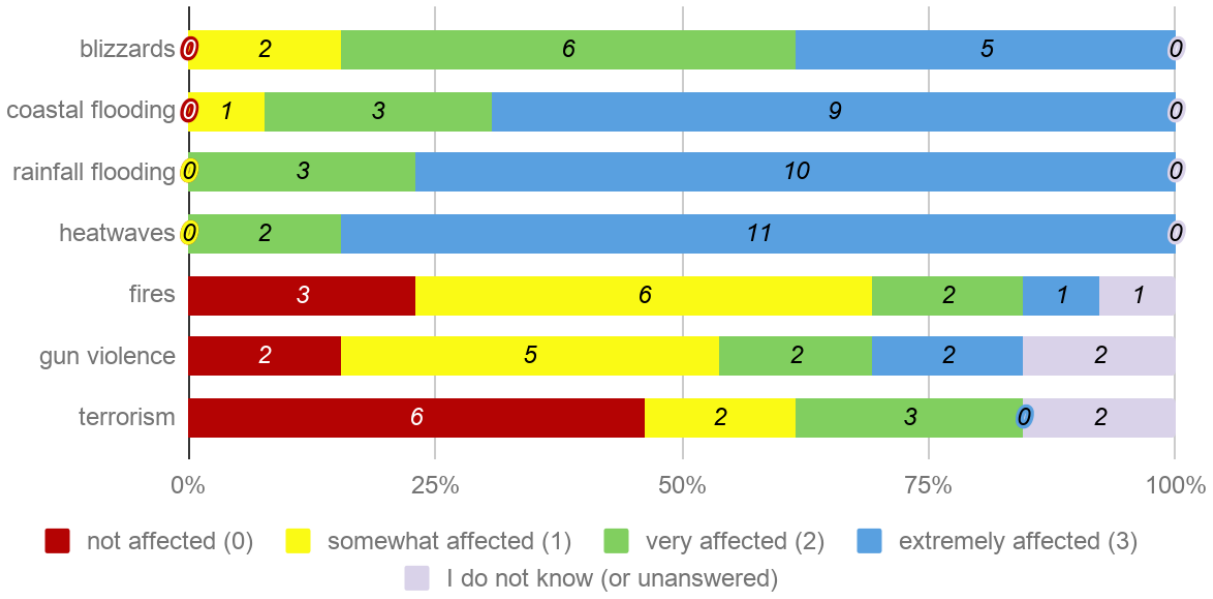


Figure 5.5b Effect of Climate Change on Hazards According to Professional Judgement (Philly)



Core Interview Question D: *How affected does your government think each hazard will be by climate change?*

The final interview question differentiates participants' views on their *governments'* approach to climate risk from their personal sense of climate risk. **Figures 5.6a & 5.6b** show the breakdown of how affected participants felt their government thought each hazard would be by climate change in their location over the next 20 years.

By far the largest differences between DelCo and Philly participants became apparent with this question. To begin with, DelCo participants did not rank any hazard very highly. Philly participants, on the other hand, ranked both rainfall flooding and heatwaves very highly. (In addition to the city's *Green City, Clean Waters* plan, Philly also recently released a *Beat the Heat* plan that has received a lot of local attention.) In comparison, DelCo participants perceived their

government to expect rainfall flooding to be moderately affected by climate change, whereas heatwaves only minimally affected. The difference in responses between locations for both rainfall flooding and heatwaves was statistically significant ($p<0.01$ for both hazards).

Participants from Philly ranked blizzards and coastal flooding as moderately affected; DelCo participants ranked them as minimally affected (again, according to their perception of their governments' recognition). The difference in responses for coastal flooding was statistically significant ($p<0.01$). Participants from both locations ranked fires, gun violence, and terrorism as minimally affected. For fires, the difference was statistically significant ($p=0.01$), with DelCo's ranking being much lower.

In sum, responses to almost all of the hazards with **Core Interview Question D** varied between the locations. DelCo participants clearly indicated that their county government was not meaningfully considering the impacts of climate change, a result which is highly corroborated by the qualitative analysis in **Section 5.3**.

Figure 5.6a Effect of Climate Change on Hazards According to Impression of County Recognition (DelCo)

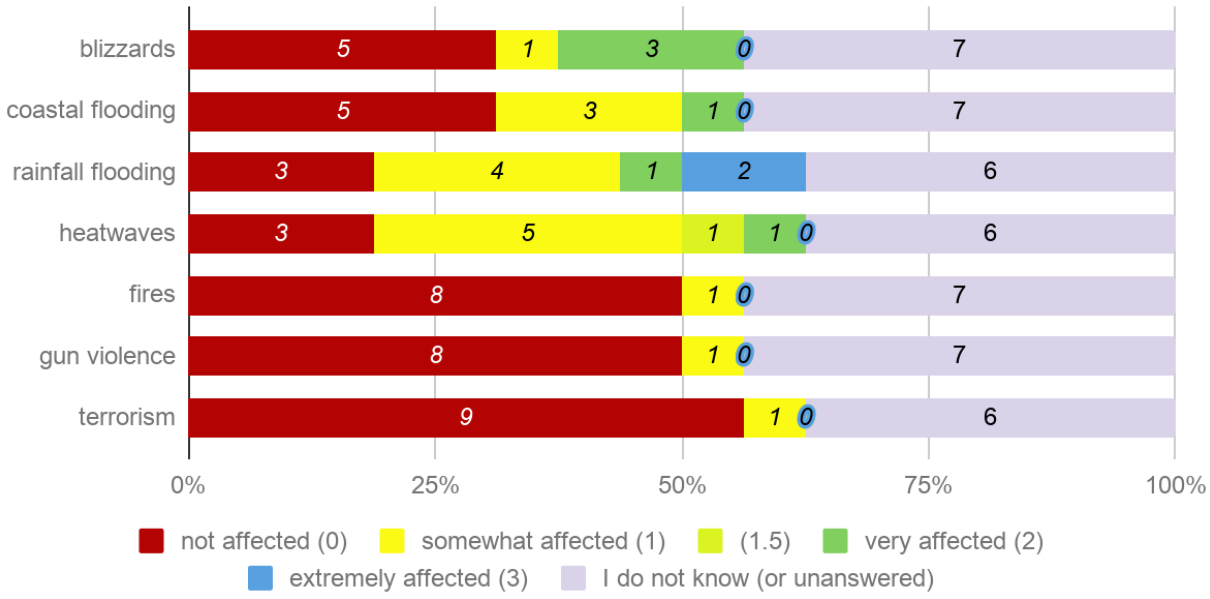
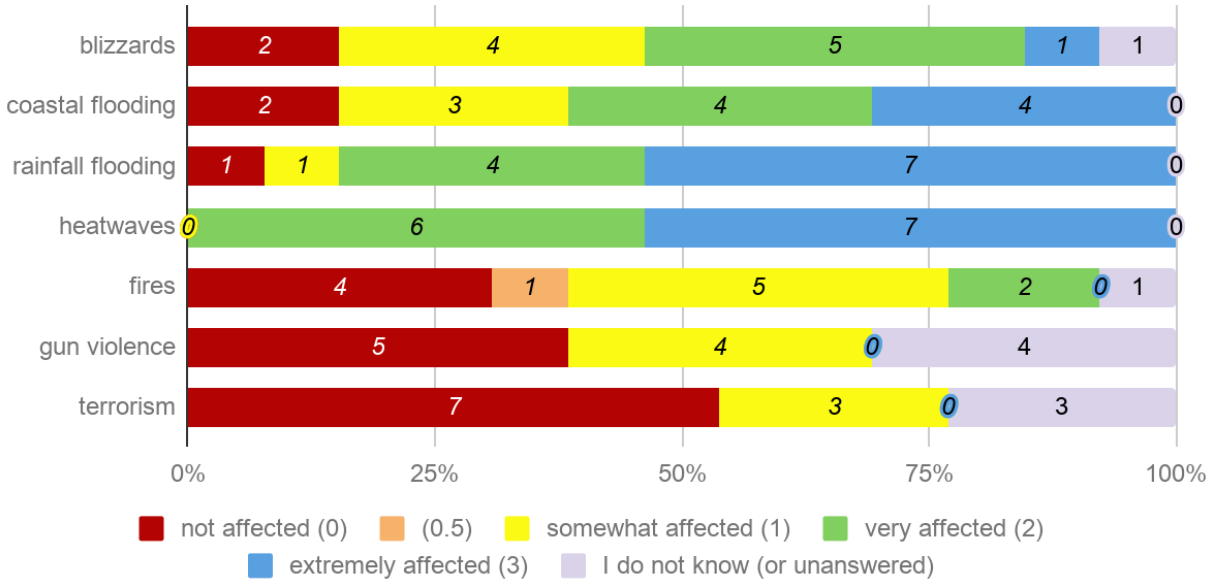


Figure 5.6b Effect of Climate Change on Hazards According to Impression of City Recognition (Philly)



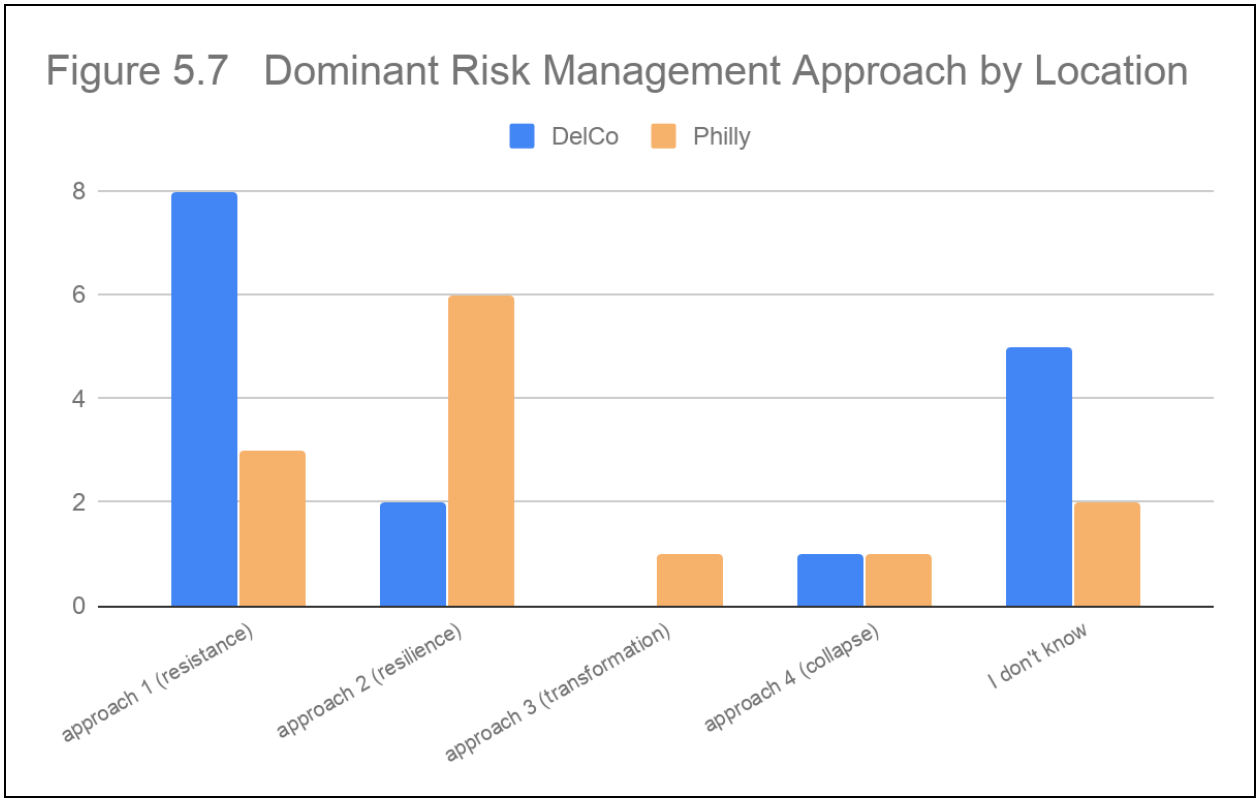
Risk Management Approach

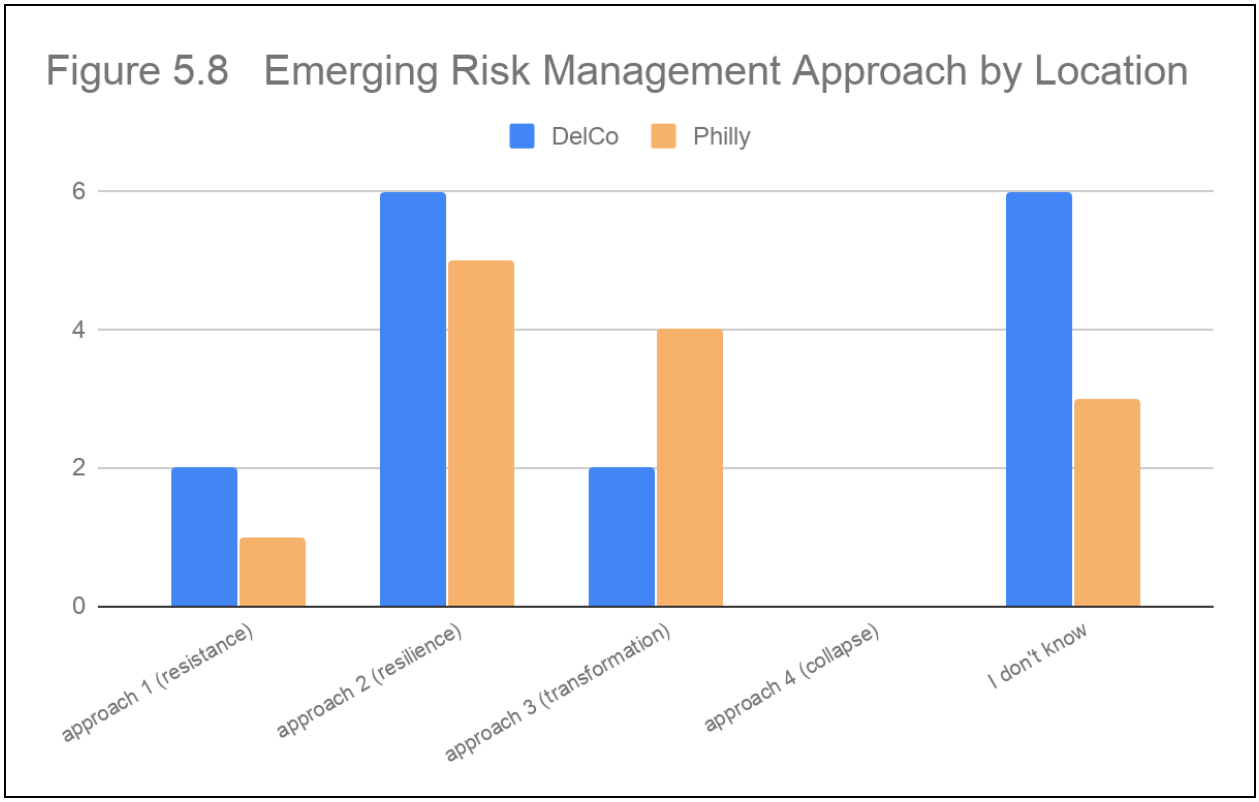
Before moving on to the qualitative analysis, I will briefly review three other question sets that demonstrate similar results to those of **Core Interview Question D.** These additional quantitative data strengthen the claim that there is a significant difference between the DelCo government and the Philly city government in terms of climate risk preparedness.

One set of questions pursued a line of enquiry about dominant versus emerging risk management approaches for each government. Participants were given four hazard management approaches that their government might be taking and asked which one represented the currently dominant government approach, and which represented an emerging direction of change for their government. The four management approaches each represented one of the four urban management regime states reviewed in **Chapter 2: Literature Review** (see also Solecki et al., 2017b). In the present study: *Approach 1* = resistance; *Approach 2* = resilience; *Approach 3* = transformation; and *Approach 4* = collapse (see **Appendix I** for the full text of the four approaches). The regime states were not named for participants; participants were just asked to match the descriptions to their perceptions of their governments' approach.

Participants were first asked to choose the dominant approach taken by their respective governments across all hazards. Although the difference between locations was not statistically significant, DelCo participants most commonly chose *Approach 1* (resistant) while Philly participants most commonly chose *Approach 2* (resilient) – see **Figure 5.7**. Participants were then asked if any of the four hazard management approaches represented an emerging approach (as opposed to the currently dominant one) – see **Figure 5.8.** Here, the most commonly selected emerging approach across all hazards for both DelCo and Philly was *Approach 2*; the difference

between responses was not statistically significant. These results suggest that while DelCo may be transitioning from a resistant regime state to a resilient one, Philly may not yet be transitioning beyond resilience toward transformation. Importantly, though, not a single participant selected *Approach 4* (collapse) as the emerging trend for their government.



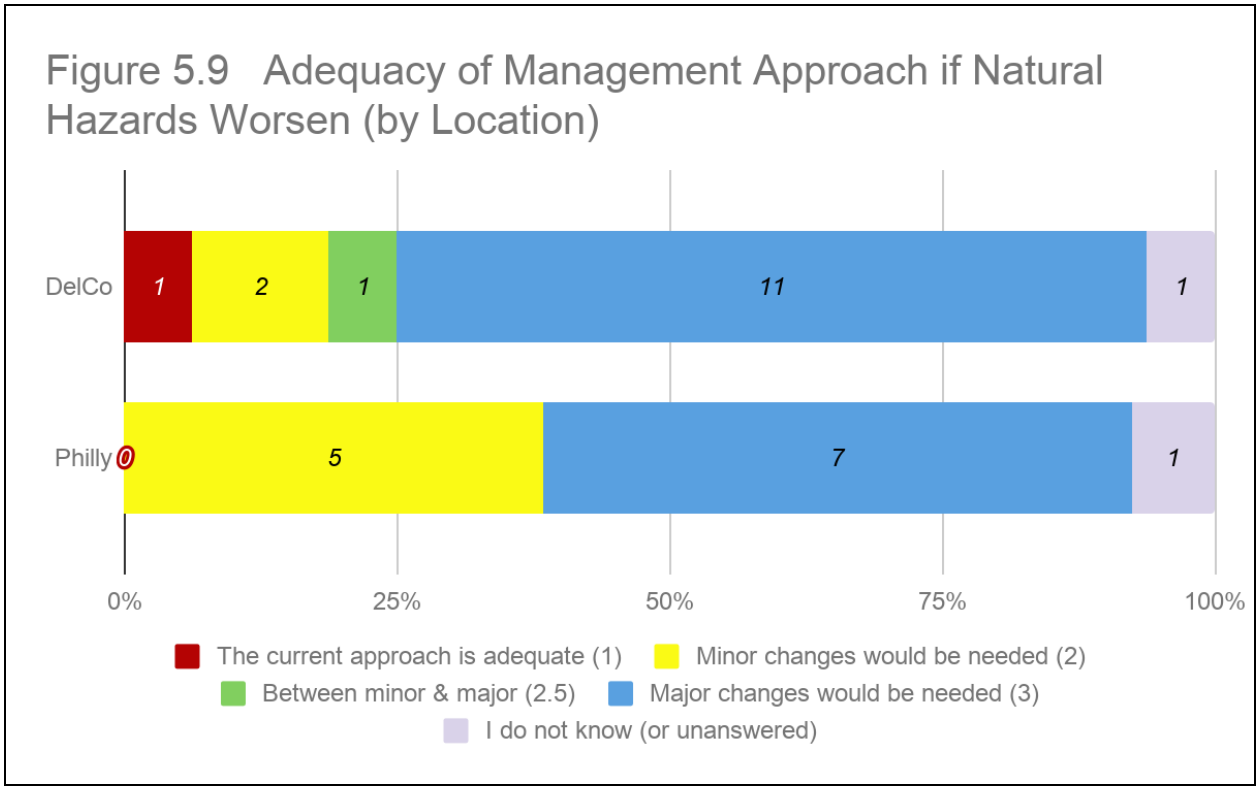


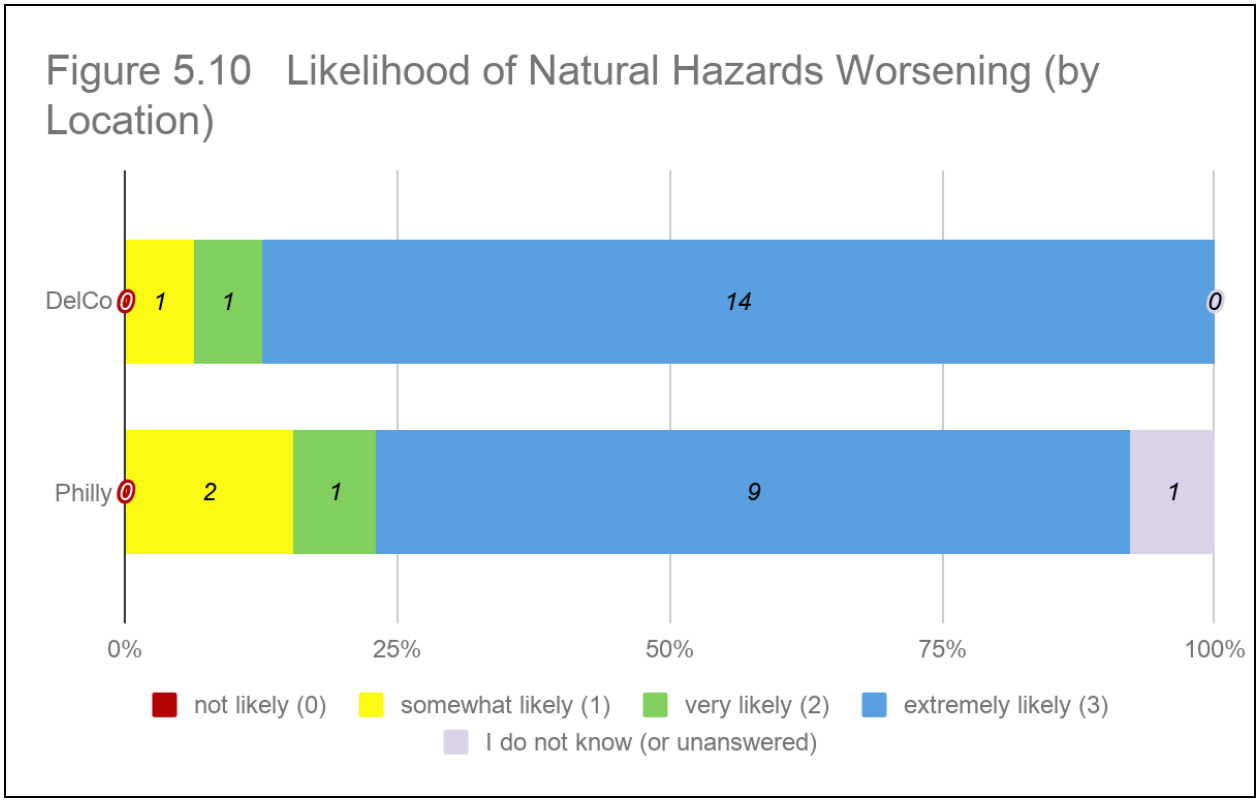
Adequacy of Current Approach if Natural Hazards Worsen

Participants were also asked to consider potential future risks facing each location. They were given several risk scenarios, and asked for each whether current management approaches would be adequate to handle the added risk of this scenario, or whether instead minor versus major changes in government approach would be needed. Participants were also asked how likely each risk scenario was for their location over the next 20 years on a scale from not likely to extremely likely.

Participants in both locations, on average, said that increased severity and frequency of natural hazards would necessitate between minor and major changes to their government's risk management approach (see **Figure 5.9**), and that increased severity and frequency of natural hazards is very to extremely likely in their area in the next two decades (see **Figure 5.10**). Neither

differences among responses for the two questions were statistically significant. As with the government risk management approach question, these data show that while Philly participants see their government as doing more for climate preparedness than DelCo participants do, they still believe that the Philly government will need to take more drastic action. In the face of the climate crisis, a "resilient" approach may just not be enough.

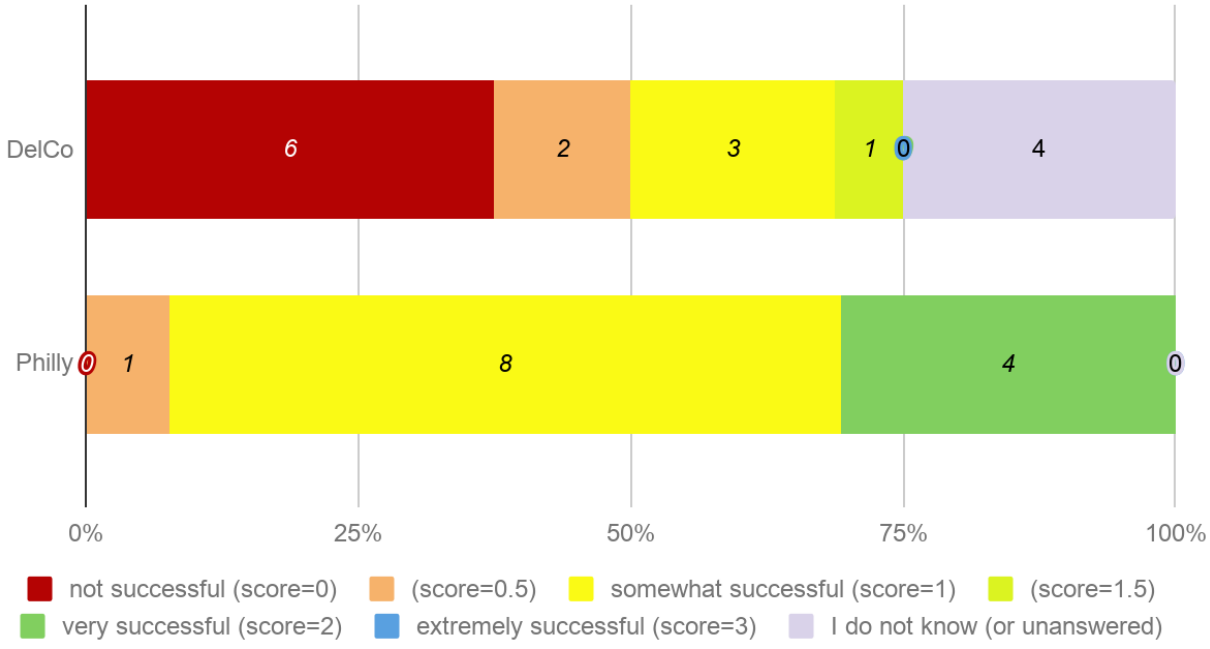




Government Climate Action Success

Finally, participants were asked explicitly how successful they felt their government had been to date in terms of climate action and mitigation (see **Figure 5.11**). There was a strong indication here that DelCo participants were disappointed in their county government's climate action, rating them as not or minimally successful. Philly participants were somewhat more positive (and the difference in responses was statistically significant at $p<0.01$), but did not rank their city government as particularly successful.

Figure 5.11 Level of Climate Success by Location



Section 5.3: Qualitative Comparison Between Locations

On the whole, then, the quantitative results demonstrate that Philly was seen by participants to be more prepared on climate risk preparedness than DelCo – but nevertheless did not meet high standards of success. This section aims to answer why this difference between the locations became apparent, and why neither location is achieving high levels of success, by analysing current and future trends in each location.

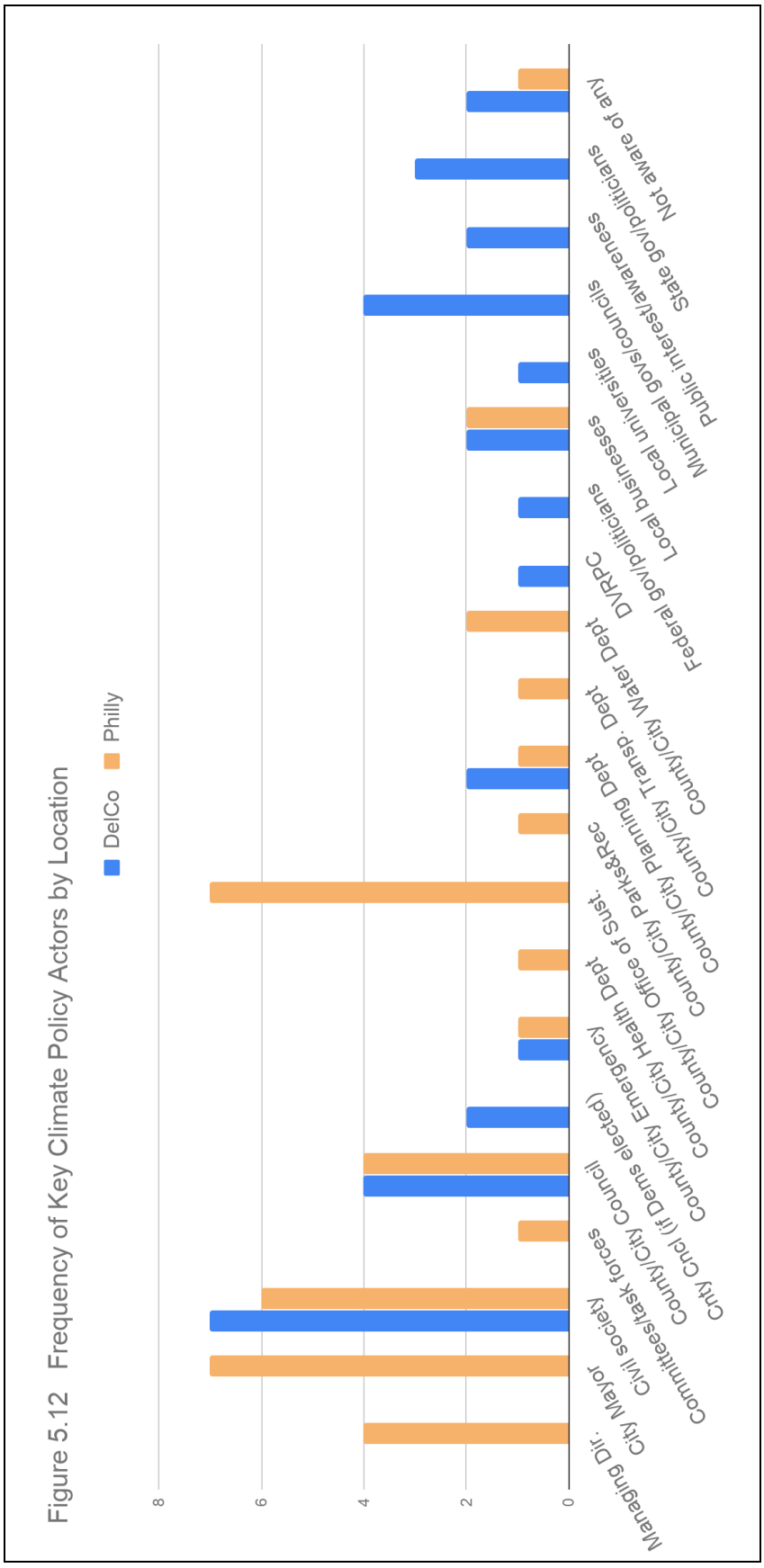
> ***Research Question 2:*** What are the trends in each location, and how are they causing differences or contributing to similarities between the two locations?

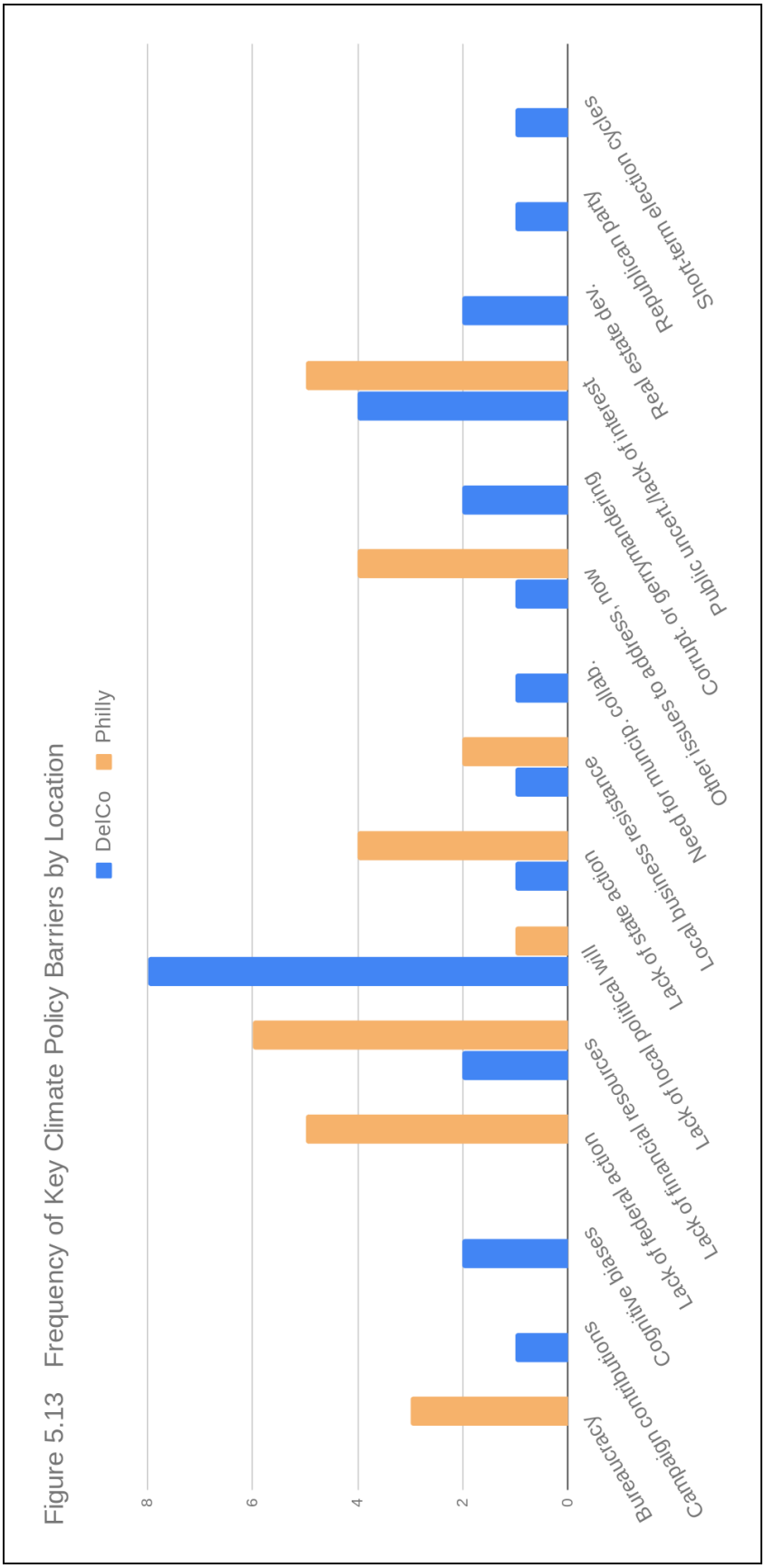
This section identifies three substantial themes from the interviews, and compares and contrasts the input about these themes from the two locations. Some of the qualitative responses below help to explain the quantitative results found above, while others illuminate additional

important themes. I begin first, though, with a brief review of the climate actors and barriers that participants listed as key, since these same actors/barriers emerge throughout the qualitative analysis.

Key Climate Actors and Barriers

Participants were asked to list any key actors shaping climate policymaking in their location (**Figure 5.12**), as well as key barriers and limitations (**Figure 5.13**). In terms of key climate actors, both locations named their County/City Council and civil society groups (activists, NGOs, etc.) with high frequency. DelCo participants also pointed to the role of municipal and state governments, while Philly participants saw the Office of Sustainability, Mayor, and City Managing Director as very important. In terms of key climate barriers, both locations were fairly concerned with a lack of public interest. DelCo participants also listed lack of local political will with extremely high frequency, while Philly participants named a range of other issues: lack of state/federal action, lack of financial resources, and other pressing issues needing attention today. These actors/barriers permeate the themes described below.


Figure 5.12 Frequency of Key Climate Policy Actors by Location
DelCo
Philly
0
2
4
6
8
Managing Dir.
City Mayor
Civil society
Committees/task forces
Cnty Cncl (if Dems elected)
County/City Council
County/City Emergency
County/City Health Dept
County/City Office of Sust.
County/City Parks&Rec
County/City Planning Dept
County/City Transp. Dept
County/City Water Dept
DVRPC
Federal gov/politicians
Local businesses
Local universities
Municipal govs/councils
Public interest/awareness
State gov/politicians
Not aware of any


Figure 5.13 Frequency of Key Climate Policy Barriers by Location
DelCo
Philly
0
2
4
6
8
Bureaucracy
Campaign contributions
Cognitive biases
Lack of federal action
Lack of financial resources
Lack of local political will
Lack of state action
Local business resistance
Need for munic. collab.
Other issues to address, now
Corrupt. or gerrymandering
Public uncert./lack of interest
Real estate dev.
Republican party
Short-term election cycles

Theme 1: *Participants in each location had consistent views about their own government's climate action to date.*

There was a high amount of internal consistency in opinions among participants from each location. For example, DelCo participants were very clear about their county government's current lack of interest in taking climate action, as shown in a number of examples:

> I don't I think that the majority of our County Council members take climate change seriously. And there haven't been any substantive efforts at the county level to address it or even to explore it. *(Government participant 6 from DelCo.)*

> I think there have been times where we have seen catastrophic weather events, and there has been perhaps some implied acknowledgement that perhaps climate change is responsible for some of that, but we've never made any sort of official comment or taken any official action that would recognise there being a linkage. *(Government participant 3 from DelCo.)*

> The environment is just not a variable in the equation and it's a shame because it will cost us more than anything else will down the line. It's going to be the most expensive mistake. *(Private sector participant 1 from DelCo.)*

Additionally, nearly all DelCo participants tied this inaction to long-standing Republican rule in the county, often calling the party's dominance a "political machine". In fact, many participants discussed Republican rule of County Council in particular, as well as the importance of an upcoming council election. For example:

> There's a very important election here in November. There are three open seats. Delaware County government has been under Republican control since the Civil War. The Democrats need to win one of three seats to flip control, which changes all of county government, and I think that is likely to happen in November. *(Government participant 6 from DelCo.)*

> Everyone seems to expect that there'll be more [Democrats] added [to County Council] so that they will get the majority of the five seats. So things are going to change. We'll see how it shakes out. *(Civil society participant 2 from DelCo.)*

The expected turnover may well have significant implications for the county's climate action, but one respondent was worried about the coming political change:

> Are we going to have a period of inactivity because of this potential change? … I'm actually worried too that the Democrats will work way too fast. Which kind of pains me to say. *(Government respondent 5 from DelCo.)*

Only time will tell whether new Democrats, if elected, were able to successfully make change in DelCo. But they would do well to start their terms in office by recognising the gravity of climate change and by acting swiftly despite political divisiveness; at this point in time, fast action on climate change is truly of the essence. Moreover, the period of transition from resistance to resilience, or from resilience to transformative regime types, is a "central pivot point for planning pathways to sustainable and equitable development" (Solecki et al., 2017b: p. 4).

Philly participants were also quite consistent: they felt that their city government was doing some proactive work with regard to hazard management – but their comments also contained significant criticisms. For example:

> The bottom third of the city is projected to be underwater in some capacity in the next 30 to 50 years. That's the airport. That's the Navy Yard[23]. That's an entire neighbourhood. Like, that's the rail line. What's being done to plan for the protection, if not relocation of that infrastructure? I don't know. I don't get the sense that that's happening. So yeah, I think that we're doing something but I think that a lot more can and should be done. *(Civil society participant 3 from Philly.)*

> It's the frog in the boiling water thing, like "things are changing a bit, we can adapt a bit." But that's actually more costly and inefficient than having a comprehensive strategy up front. *(Academia participant 2 from Philly.)*

[23] The Navy Yard is a recently redeveloped, campus-like neighbourhood on the southern edge of Philly. It was previously the city's naval shipyard.

These responses align well with participants' identification of the Philly government as being "resilient" but not "transformative", and that substantial changes to the government's hazard management approach would be needed in the face of worsening natural hazards.

Many saw the stability of the political systems in Philly as important to the hazard management approach that it has taken to date, as well as leadership from the Mayor and key city departments. For example:

> I'm thinking, for example, about the *Green City, Clean Water* initiative of the Philadelphia Water Department. That's an initiative that has spanned mayoral administrations… I think the overall approach endured. And so, even though some of the structures changed, I think there was an ongoing stability that maintained a sense of responsibility for risk management. *(Academia participant 1 from Philly.)*

Former Mayor Nutter also aunched the city's Office of Sustainability (OOS), whose existence was noted repeatedly by Philly participants:

> 20 years ago, there wasn't an Office of Sustainability… The city's thinking, particularly around climate change, has evolved significantly. And how we've looked at all those individual risk factors [i.e., the present study's hazard list] has evolved as well. *(Government participant 4 from Philly.)*

> If there is someone [i.e., the OOS] who's willing to work with you, and help with funding – provided that you're thinking sustainably about your project, or that your project is incorporating something like community resiliency, or reductions in energy or waste – then it really pushes you to start to align over time with some of the goals of the *Greenworks*. So that is one really big positive change that I think I can see. *(Government participant 5 from Philly.)*

The role of a sustainability department thus should not be understated: it creates a set of city employees whose primary responsibility is to think about environmental policy, it ensures at least some allocation of financial resources to those policies, and it signals to the public that such issues are important. Perhaps, though, such departments need to be further empowered as facilitators of *climate* action and mitigation more specifically.

Importantly, Philly may have been able to create the OOS in large part because of a recently improved financial situation in the city:

> We were on the verge of bankruptcy in the ’90s… We used to be managing decline and now we're managing growth. We're in a very different paradigm right now… We actually have a rainy day fund again and are reinvesting in things. *(Government participant 1 from Philly.)*

Despite this, many felt that Philly continues to struggle with financial resources, leading to an overpriotisation of short-term issues and a lack of preparedness for how climate change will exacerbate existing challenges:

> Sometimes we have trouble looking at the long game of investment when you're trying to solve really drastic, immediate needs. Gun violence, poverty, crumbling infrastructure: we're trying to deal with this now. *(Government participant 1 from Philly.)*

> They're already strained. They're the poorest large city [in the US]. *(Private sector participant 1 from Philly.)*

Philly (and other regions) may not be able to take transformative action on climate change without substantial outside financing – which, as explored below, could be sourced from the private sector as well as other levels of government.

Theme 2: *Participants in both locations noted important roles of non-governmental actors.*

As noted previously (see **Figure 5.2**), DelCo participants repeatedly named pipelines and/or refineries as additional hazards. Participants from both locations also commonly referenced the role of local activists and civil society; for example, DelCo participants commonly named the Middletown Coalition for Community Safety in DelCo against the proposed Mariner East II natural gas pipeline:

> I think it's citizen activism, I think that's where the most energy is right now… County Council finally passed a resolution around safety in the last month or so, but that was after years of citizen advocacy. So I think [advocacy is] primarily around pipeline issues. *(Government participant 6 from DelCo.)*

There was little talk, though, in DelCo of direct collaboration between the government and activists. In fact, one participant had a strongly negative view of activists:

> We will have NGOs that are our partners. So what they're saying is much more important to us than what an activist is saying. Activists, even if we gave them what they wanted they still wouldn't be happy. *(Government respondent 4 from DelCo.)*

To some, an important first step in better integrating the county government with non-governmental actors would be the government making the public more aware of its work. For example:

> [Information] is not always just readily available unless you get interested in it. *(Academic participant 2 from DelCo.)*

> I'm disappointed in the Delaware County climate action plan and policy, because I don't know about it… They haven't stuck it in my face. That's on them. *(Academic participant 4 from DelCo.)*

> I think [it] doesn't maybe occur to folks to make the public aware, which, even as I say that aloud, that seems silly. Like, of course we would want the public to be aware of how we're preparing for hazards. *(Government participant 3 from DelCo.)*

DelCo is clearly not yet embracing the governance approach recommended by contemporary urban theorists. Perhaps with a restructured County Council in place soon, some shifting can occur. Trust between governments and non-governmental actors will need to be developed slowly, though, starting first with improving transparency and building up to agonistic and dissensus practices.

Among Philly participants, the role of the business community and of the increasing need for private funding to manage worsening hazards was a common theme, tying back to the sense of the city's financial challenges. For example:

> I think that there's a trend that we're seeing where the city is beginning to understand that they can't, and shouldn't, ignore the business community. But I think that their core significant percentage of the business community is also quite resistant, and it's quite traditional. *(Civil society participant 3 from Philly.)*

> Public safety, meaning like police, fire and emergency has come to sort of dominate our budget… But it has kind of led to a scenario where there are very few public dollars for us to spend on anything outside of that. What that in effect does is [it] pushes us to… we are going to have to start engaging the private world more to engage some of these other things like resilience. *(Government participant 5 from Philly.)*

Unlocking such resources is clearly important for local communities, but at the same time – as hinted at by one participant above – there is a concern about becoming increasingly beholden to private interests. Governments will need to adeptly navigate how to invite the private sector more robustly into a holistic governance approach, while also avoiding detrimentally transitioning into "progrowth" or "managerial" governance types (that are extremely unlikely to achieve "transformational" regimes).

Theme 3: *Participant comments reveal important implications for multi-level governance approaches.*

Participants in both locations felt strongly about the relative importance of other government scales on their own government's climate action. For example, participants were asked whether further climate policymaking at the regional, state, and federal scales would influence their local government's climate action (rated from not important to extremely important). See **Figures 5.14a & 5.14b.**

Figure 5.14a Importance of Climate Policy at Different Government Scales on County Action (DelCo)

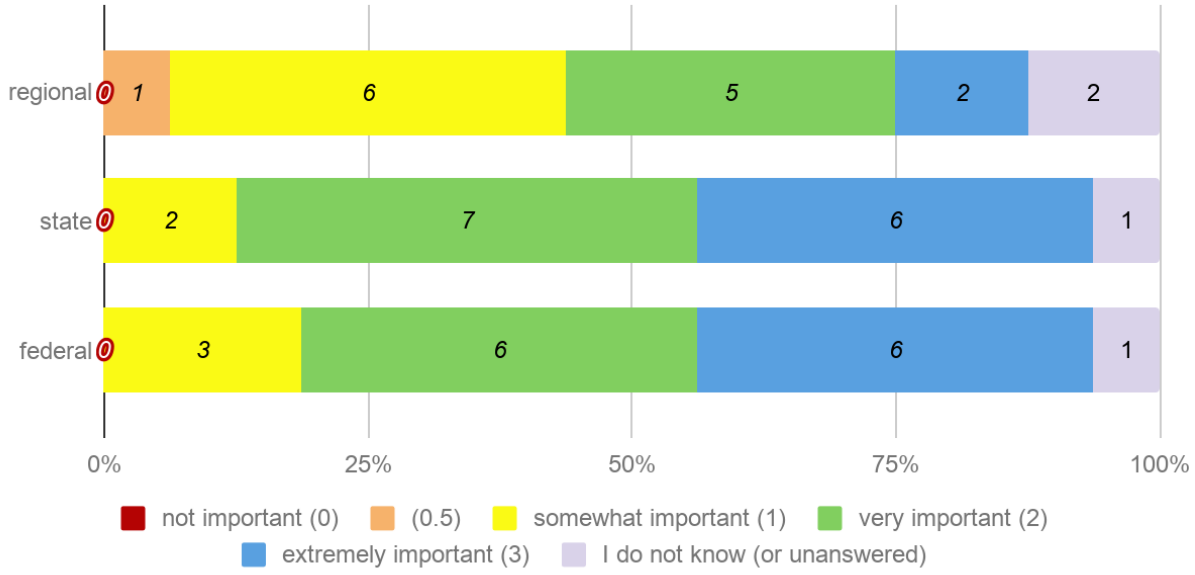
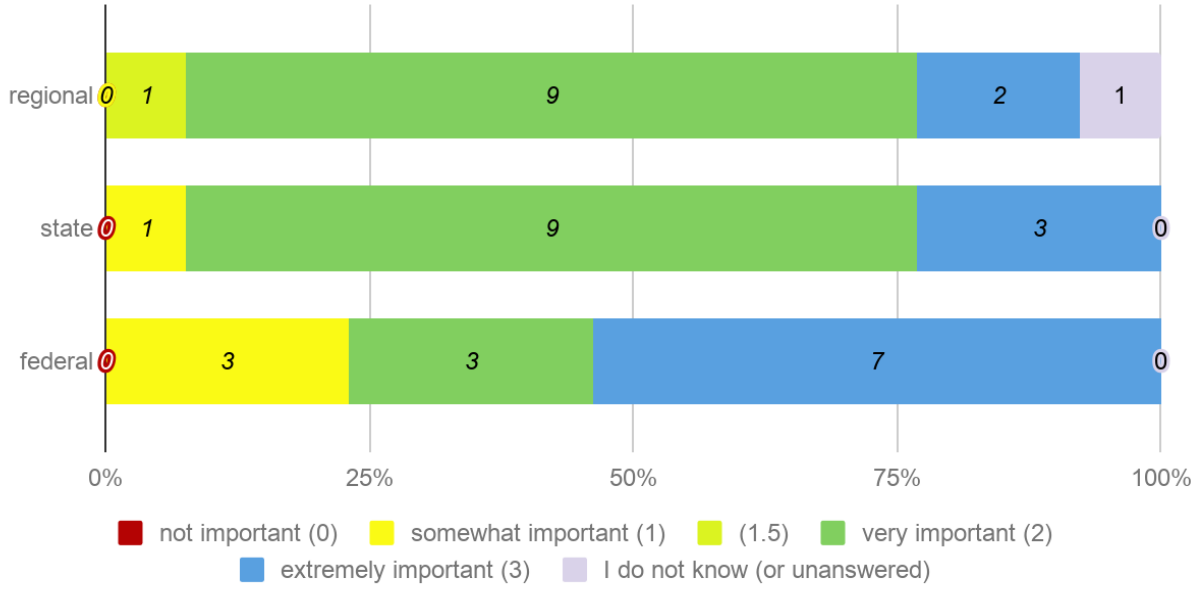


Figure 5.14b Importance of Climate Policy at Different Government Scales on City Action (Philly)



On average, participants in both locations ranked state and federal climate action as highly important to further action being taken in their county/city. The reasoning in both locations was also similar: higher levels of government both offer funding and enforce regulations, so are impactful. As one individual put it:

> With a lot of these, state and federal dollars often follow. So I think they have more of an impact… So when policy changes happen [at the] state or federal level, that results in an increase or decrease in funding that's available to counties. *(Government participant 1 from DelCo.)*

On the other hand, the difference between the locations' responses for the importance of regional climate action action was statistically significant (p=0.04). Philly respondents, on average, ranked the regional scale as very to extremely important, whereas DelCo respondents, on average, ranked it as somewhat to very important. DelCo respondents seemed to be more wary of the role of a quasi-governmental agency such as the Delaware Valley Regional Planning Commission (DVRPC)[24]:

> If [DVRPC] had policies out it wouldn't be enforceable, it would just be recommendations for strategies and actions. Unless it came with money. *(Government participant 2 from DelCo.)*

Tied to participants' reactions to the value of climate action at different government scales is their acknowledgement of the cultural influence of nationally salient hazard issues. The most salient hazard was different for the two locations, however. In Philly, the predominant concern was with hurricanes – likely because of the experience of nearby New York City:

> I think things like Hurricane Sandy, even though Philadelphia itself was not significantly impacted by it, a nearby peer municipality was and I think that has created a greater sense of urgency. *(Academia participant 1 from Philly.)*

[24] The DVRPC is a federally mandated metropolitan planning organisation that coordinates among both counties and municipalities in Pennsylvania and New Jersey (DVRPC, 2009). The DVRPC offers research, tools, and some funding opportunities in domains such as smart growth, transit development, coastal management, climate change resiliency, and more (DVRPC, 2019).

> Even like Hurricane Sandy or Hurricane Harvey, which didn't really hit Philadelphia. But it drove a lot of conversation and it really makes us think about risk management. *(Government participant 2 from Philly.)*

Conversely, participants in DelCo felt that national terrorism was more salient, likely because of political divides in the US[25]:

> I think things that make national news tend to get over-prioritised. You know, the idea that Delaware County is going to be a hot button target for terrorism feels somewhat like fear mongering. *(Government participant 1 from DelCo.)*

> Dealing with things that have come along in the last, you know, really since 2001, with September 11. A greater emphasis has been placed on terrorism, especially with gun violence. And I think of schools and mass shootings and those things. *(Academia participant 2 from DelCo.)*

In addition to the influence of state/federal policies and culture, sub-jurisdictions within DelCo play a critical role. The city of Philadelphia is coterminous with its county, so any city subdivisions report directly to the city government. In DelCo, on the other hand, municipalities have significant independence (and variation in resources):

> I think there are things the county can do, but it's also somewhat limited based on its authority… Municipalities have a lot of the control. And the municipalities, like I said earlier, can vary as far as the resources they have available to them. A lot of the communities that probably have the greatest need, don't necessarily have the resources. *(Government participant 2 from DelCo.)*

> Gun violence is an issue that's isolated somewhat to certain parts of the county – that I think have been underrepresented and under-attended to by county government, particularly in Chester and southeastern Delaware County and Upper Darby[26]. *(Government respondent 1 from DelCo.)*

Despite historical levels of independence, one participant suggested that the county government could do significantly more to coordinate among municipalities:

[25] A very recent Gallup poll, for example, shows a persistent political divide in opinions on the War in Afghanistan, which began after the 9/11 terrorist attacks; Republicans tend to be more in favor of the war (Reinhart, 2019).

[26] Chester and Upper Darby are municipalities within Delaware County.

> There's not a lot of coordination between the communities as far as like, we need you to have your storm water where you are, where it falls, so it doesn't end up in our backyard, our streets, all that… Potentially, there's more that can be done to foster that collaboration. Or even though the county can't necessarily build all the stormwater basins, they could help make that possible in different communities… Could also be the county applying to DCNR[27] for funding to help prepare plans together. *(Government participant 2 from DelCo.)*

And one could imagine that it would not just be state agencies that the DelCo government could help municipalities to coordinate with – though these are certainly key. In addition, supporting coordination with agencies such as the regional DVRPC and federal Environmental Protection Agency could also be high priority.

One final aspect of multi-level governance that was brought up by DelCo participants was the influence that Philly has on DelCo, as stated in two quotes from the same participant:

> Philly the city is doing well [on climate action]. But Philly is a unique animal. It's a city. It's not suburbs. So what they do, and what DelCo, or any other urban-suburban area, can do are a little different... While [Philly has] – one would argue maybe not the greatest but – a large public transportation infrastructure, DelCo benefits from some of that. *(see below)*

> When Philly passed the stormwater bill, that pushed other municipalities to do the same. It helps that [municipalities were] like, "Oh, we can bring in revenue. Let's do this." Whereas, when Philly passed the building metering policy, you didn't see as many suburban counties go for that. Because that's ultimately a costly program. *(Academic participant 3 from DelCo.)*

DelCo is reliant on Philly to some extent for the maintenance of a multi-county public transportation system and other infrastructure, as well as for piloting innovative policies such as the *Green City, Clean Waters* plan. Notably, a converse relationship was not noted at all by Philly participants. Though DelCo participants referenced Philly often, Philly participants did not mention DelCo. This divide is explored further in **Section 5.4** below.

[27] The PA Department of Conservation and Natural Resources (DCNR); in other words, a state agency.

Research Question 2: Summary

Whereas the analysis of ***Research Question 1*** demonstrates quantitative differences between Philly and DelCo in terms of government climate action and risk management approaches, the more heavily qualitative analysis of ***Research Question 2*** explores the themes that animate those differences – as well as a few parallel trends in the two locations.

DelCo participants saw their government as most interested in maintaining the status quo, while Philly participants had consistently mixed assessments of their government. In both locations, government approach to hazards and climate change alike are deeply influenced by local politics as well as financial resources. The role of other key actors besides the Philly city government or the DelCo county government also came to the fore. Finally, many participants spoke to the relevance of other government scales on their local government. For both locations, the state and federal governments were seen as more influential than informal regional bodies because of the former's financial resources, legal authority, and cultural influence. DelCo participants also noted the cultural influence of Philly on their location, but not vice versa. In DelCo, the question of the authority of municipalities versus county government was often raised.

Section 5.4: Case Study Implications

> ***Research Question 3:*** What implications does this case study have for urban governance models?

Returning to the three literature review research threads – 1) urbanism is a planetary process, therefore global climate change should be addressed with an urban lens; 2) more theory development is needed on urban governance to facilitate societal transformations for sustainability; 3) the theory and practice of city governing will need to begin operating with a novel

understanding of jurisdictional boundaries in order to better account for greater metropolitan areas – the question now at hand is how the present data inform these threads.

Participants certainly noted the expansive risk impacts of climate change as well as the desire for changes in government approach, especially in the context of worsening natural hazards. Several participants also spoke extensively about the broad interconnections of climate change with other social issues, as this participant did when asked to think about climate policy:

> How can every decision that we're making…try to connect as many of those dots as possible? If we only try to solve this problem over here with this band aid, and we're not thinking about how that could…contribute solutions to these other things, then I think we're going to continue to find ourselves in the sort of position that we're in, which is a bit of whack-a-mole versus a comprehensive, unified, holistic strategy. *(Civil society participant 3 from Philly.)*

Additionally, the Philadelphia Metropolitan Area (PMA) is an intensely urbanised area, and the fact that DelCo participants often commented about Philly as their nearby city suggests that they identify as a suburban neighbourhood of Philly. Thus, the case study locations exemplify both urban processes of the modern age and common threats of climate change to densely urban areas. Moreover, DelCo and Philly precisely follow the pattern described by Homsy and Warner (2015) (see **Chapter 2: Literature Review**): suburban neighbourhoods in the US tend to be slower to implement sustainable policies than their adjacent cities.

The characteristics identified in the present research about the PMA also are remarkably similar to results from multiple studies on the New York Metropolitan Area. Though cross-national comparisons of regime theory studies may be challenging because of inconsistencies in definitions (Mykhnenko, 2016; Olsson et al., 2015) and a historical overemphasis throughout urban studies on the Global North (Robinson & Roy, 2015), comparisons within the US at the very least are fruitful – especially of adjacent US cities. In the New York Metropolitan Area, as in the PMA:

non-governmental actors desire more information and better coordination with governments (Solecki et al., 2017a); there is jurisdictional confusion among levels of government leading to stymied action (García Sánchez et al., 2018); and the dominant governance regime state fluctuates between resistance and resilience (Solecki et al., 2017b; Solecki et al., 2016). The PMA is thus in line with research to date – but how does the present study add to the conversation on furthering local and regional climate policymaking?

The context of hazard management in Philly and DelCo has implications for concepts of urban governance. Not only do various levels of government play a role in local decision-making, but also non-governmental actors – such as businesses and activists – are essential. Pierre's (1999) types of urban governance further elucidate the status quo in the case study locations. Philly most closely aligns with the "progrowth governance" type, as is the case in many US cities (Pierre, 1999), with its focus on economic growth, local development, and infrastructure projects, as well as the importance afforded to both senior officials and the private sector. DelCo is closer to the "managerial governance" type, with its greater emphasis on career professionals in government, use of standards and methods from private industry, and desire for efficiency.

Participants in both locations felt that their government's response to the looming climate crisis was inadequate, however. Thus, instead of a progrowth or managerial type governance, perhaps what both locations need is a transformative "earth system" governance, such as advocated by Patterson et al. (2017), to facilitate a shared prioritisation of sustainability above all else among the full range of governance actors. Moss et al.'s (2019) conceptualisation of a "climate consortium" – which "would bring together practitioners with scientists, professionals, and science intermediaries to evaluate how to use knowledge to adapt to and mitigate climate change" (p. 899)

– is one method for implementing earth system governance. Such consortia should aim not just to evaluate climate policies, however, but should actually introduce novel governance structures. As Pelling et al. (2016) write, "governing transformational change requires transformation of governance systems themselves" (p. 5).

An important step in developing earth system governance is to further "embedded upscaling" (Fuhr et al., 2018) – increasing coordination between cities and their federal governments (and their associated non-governmental actors). A report from the Coalition for Urban Transitions (2019) that was released just last week is of high relevance, as it calls for national governments to "coordinate and support local climate action in cities" (p. 120). This week, economist Nicholas Stern wrote, in an opinion piece about the report, that "for the good of their entire countries today and tomorrow, we need national leaders to seize the new urban opportunity" (Stern, 2019: online). Certainly federal governments have work to do to harness their urban centers for sustainability.

More intentional coordination among hierarchies of government is absolutely essential, but regionally located governments should also do more to collaborate. In the PMA, for example, slow water rise poses a significant flooding threat to portions of the Delaware River. This region includes substantial amounts of public transportation infrastructure, as well as the Philadelphia International Airport (which actually sits in both Delaware and Philadelphia Counties). It is in these counties' best interests to develop hazard management plans in unison, and with input from non-governmental community members. The recent *Climate Action Plan* released jointly by two cities in the state of Florida (see **Chapter 2: Literature Review**) is a fantastic early example of such an approach (Oakland Park & Wilton Manors, 2019).

Chapter 6: Conclusion

The present research on the Philadelphia Metropolitan Area (PMA) first demonstrates that there is a difference between the climate readiness of the Delaware County and Philadelphia city governments. Philadelphia has taken more action to date – but, according to stakeholders, not nearly enough. This evidence contributes to a growing body of literature researching hazard management approaches in cities globally, including Bilbao (García Sánchez et al., 2018), Kolkata (Parasuram et al., 2016), Lagos (Ajibade et al., 2016), London (Pelling et al., 2016), New York (García Sánchez et al., 2018; Solecki et al., 2017a; Solecki et al., 2017b; Solecki et al., 2016), and Tokyo[28] (Nishi et al., 2016). This study updates this existing line of enquiry, however, by comparing two distinct jurisdictions within a wider metropolitan area and by making the methodological interest in climate risk more explicit.

The second contribution of this case study is a synthesis of urban governance models, with the aim of more effectively prioritising sustainability. The qualitative analysis shows that each study location's political trends, financial resources, non-governmental actors, and relationships with other governments are key to their climate planning – and that there is a need for transformative change that incorporates these various actors and factors in innovative ways. Pierre's (2011; 1999) classification of common urban governance types does not fully capture experimental models currently in development that harness such new partnerships for climate action. But regime theory's transformative regime state is at this point more a prescription than a reality. Contemporary research

[28] Importantly, none of the case study cities listed above currently feature a predominantly "transformative" regime state.

must explore how metropolitan areas can better pursue transformational change, and which models both represent and encourage such changes.

The PMA would benefit from "earth system" urban governance (Patterson et al., 2017), perhaps via a "climate consortium" (Moss et al., 2019) – as, I suspect, would many greater metropolitan areas in the US, if not globally. The forms these governance structures take would certainly vary by metropolitan area. Still, I make three recommendations below for both scholars and practitioners, in the hopes that they benefit the PMA specifically as well as other regions looking toward transformative change. The focus of my recommendations is on local governments, because there are significant steps that they could take to better facilitate among a broad spectrum of actors. Rapoport et al. (2019) argue that city leaders "need to facilitate rather than direct" (p. 21). I contend that such inclusive facilitation is indispensable for achieving transformative regime change and urban governance models for sustainability.

> ***Recommendation 1:*** Local governments should facilitate coordination among non-governmental actors, while ceding more decision-making authority.

The results of the case study demonstrate that both locations could do substantially more to harness the power of all local stakeholders. Building up enough trust to productively engage a wide range of stakeholders, however, would require that local governments take the lead in modelling transparent and inclusive practices, and that all stakeholders learn to work with dissensus and agonistic dialogue (Kaika, 2017; Albrechts, 2015). Local governments would also need to be more willing to initiate such coordination, while at the same time learning to cede more decision-making authority to outsiders (Pierre, 2014). Activists or local businesses might demand a seat at the table with governments, and so might play an integral role in realising this governance

vision – but ultimately it must be local governments who allow for or, better yet, proactively build such systems. The establishment of a sustainability office/department, especially if empowered to take meaningful climate action, can go a long way in initiating this governance approach.

> ***Recommendation 2:*** Local governments should facilitate coordination among higher levels of government and quasi-governmental agencies (and vice versa).

Both case study locations could coordinate much more actively with state and federal environmental agencies – as well as with the Delaware Valley Regional Planning Commission [DVRPC], which already aims to support PMA counties and municipalities. The Delaware County government, in particular, could better harness its county-level role to organise multi-municipal efforts – in terms of DVRPC initiatives as well as state and federal grants. Other metropolitan areas should seek out parallel opportunities. Additionally, the federal government should take urban municipalities and counties more seriously, and coordinate directly with them. This may disrupt standard hierarchies of government jurisdictions, but will be necessary in order for cities to unlock resources and for countries to target essential emissions reductions in their metropolitan areas (Coalition for Urban Transitions, 2019).

County governments should also learn from their municipalities that are already modelling climate action, and encourage (if not require) others to follow their example. In Delaware County, the 2014 *City of Chester Vision 2020: Climate Adaptation Planning Elements* recognises the expected exacerbation of hazards in Chester due to climate change and then proposes a series of adaptation strategies and data collection needs (Chester, 2014). Haverford Township (Local Governments for Sustainability [ICLEI], 2008) and Swarthmore Borough (Temple, 2010) also both have *Climate Action Plans*, as do many universities in the county – including Haverford

College (Haverford, 2012), Swarthmore College (Swarthmore, 2013), Bryn Mawr College (Bryn Mawr, 2010), and Villanova University (Villanova, 2010). Such plans should be held up as exemplars by county governments.

> ***Recommendation 3:*** Local governments should facilitate coordination among metropolitan jurisdictions for innovative partnerships.

Finally, Delaware County and Philadelphia (in addition to the seven other PMA counties in Pennsylvania and New Jersey) would do well to recognise each other as regional partners, even though their jurisdictional boundaries only minimally overlap. In the coming decades, substantial theory developments and field experiments will need to explore unconventional multi-municipal partnerships that can better handle increasing threats posed by climate change. As with the changing relationship between federal and local urban governments, there is a growing need for multi-county and multi-municipal discussions that challenge orthodox understandings of jurisdictional authority. In the PMA, this could be achieved in part by empowering the DVRPC with more financial or legislative authority to support multi-municipal climate initiatives.

A "climate consortium" would allow for the various types of relationships described in these recommendations – among governments and non-governmental actors; among municipal, county, regional, state, and federal governments; and among the multiple jurisdictions of a greater metropolitan area – to coexist. Future research should build on these recommendations to further develop urban climate governance models in which governments' primary role is to facilitate such coordination, with the direct goal of achieving more sustainable systems. Such models would inherently vary locally; still, as more and more cities achieve transformative regime states, factors

will likely arise that tend to instigate transformation. Further work should also be done to explore a case study of entire metropolitan areas (e.g., the city of Philadelphia and all of the counties immediately surrounding it) – and to evaluate the impact of governance experiments with regional planning agencies like the DVRPC as well as national (as opposed to county) government facilitation of novel urban governance approaches (Coalition for Urban Transitions, 2019).

From the New Urban Agenda's prescription to engage broad networks of stakeholders for managing increasing disaster risk (Habitat III, 2017), to the cities taking the lead in US implementation of the international Paris Agreement (We Are Still In, 2019), to the Coalition for Urban Transitions' (2019) very recent call for national governments to better facilitate climate action in their cities domestically, it is clear that climate change has made the development of new urban governance models imperative. The coming years will no doubt see a proliferation of experimental collaborations and theoretical frameworks to meet this urgent demand. This case study of the PMA offers a powerful, early unification of urban studies and climate policy concepts that validates the viability of this interdisciplinary perspective.

References

Agresti, A. (2001). Exact inference for categorical data: Recent advances and continuing controversies. *Statistics in Medicine, 20*, 2709-2722.

Ajibade, I., Pelling, M., Agboola, J., & Garschagen, M. (2016). Sustainability transitions: Exploring risk management and the future of adaptation in the megacity of Lagos. *Journal of Extreme Events*, *3*(3), 1–5.

Albrechts, L. (2015). Ingredients for a more radical strategic spatial planning. *Environment and Planning B: Planning & Design*, *42*(3), 510–525.

Allen, C. R., Angeler, D. G., Garmestani, A. S., Gunderson, L. H., & Holling, C. S. (2014). Panarchy: Theory and application. *Ecosystems*, *17*(4), 578–589.

Allen, M., Babiker, M., Chen, Y., de Coninck, H., Connors, S., … Zickfeld, K. (2018). Summary for policymakers. In *Global Warming of 1.5°C: An IPCC Special Report.* Intergovernmental Panel on Climate Change.

Athanassiadis, A., Christis, M., Bouillard, P., Vercalsteren, A., Crawford, R. H., & Khan, A. Z. (2018). Comparing a territorial-based and a consumption-based approach to assess the local and global environmental performance of cities. *Journal of Cleaner Production*, *173*, 112–123.

Bacon, P., Jr. (2019). GOP politicians are much more resistant to gun control than GOP voters are. *FiveThirtyEight.* Retrieved from: https://fivethirtyeight.com/features/gop-politicians-are-much-more-resistant-to-gun-control-than-gop-voters/

Barles, S. (2009). Urban metabolism of Paris and its region. *Journal of Industrial Ecology*, *13*(6), 898–913.

Bazaz, A., Bertoldi, P., Buckeridge, M., Cartwright, A., de Coninck, H., … Waisman, H. (2018). *Summary for Urban Policymakers: What the IPCC Special Report on Global Warming of 1.5°C Means for Cities.* Intergovernmental Panel on Climate Change.

Betsill, M., Dubash, N. K., Paterson, M., van Asselt, H., Vihma, A., & Winkler, H. (2015). Building productive links between the UNFCCC and the broader global climate governance landscape. *Global Environmental Politics*, *15*(2), 1–10.

Boone, H. N., Jr. & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension*, *50*(2), 1–5.

Brenner, N. (2018). Debating planetary urbanization: For an engaged pluralism. *Environment and Planning D: Society & Space*, *36*(3), 570–590.

Brenner, N. & Schmid, C. (2015). Towards a new epistemology of the urban? *Cityscape, 19*(2-3), 151–182.

Brown, K., O'Neill, S., & Fabricius, C. (2013). Social science understandings of transformation. In UNESCO (Ed.), *World Social Science Report 2013: Changing Global Environments* (p. 100–107).

Bryn Mawr College [Bryn Mawr]. (2010). *Bryn Mawr College Climate Action Plan.*

Bulkeley, H. & Betsill, M. M. (2013). Revisiting the urban politics of climate change. *Environmental Politics, 22*(1), 136–154.

Chan, G., Stavins, R., & Ji, Z. (2018). International climate change policy. *Annual Review of Resource Economics, 10*(1), 335–360.

Chester. (2014). *The City of Chester Vision 2020: Climate Adaptation Planning Elements.*

Coalition for Urban Transitions. (2019). *Climate Emergency, Urban Opportunity: How National Governments Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities.* New Climate Economy, C40 Cities, & WRI Ross Center for Sustainable Cities.

Cohen, M. & Habron, G. (2018). How does the New Urban Agenda align with comprehensive planning in U.S. cities? A case study of Asheville, North Carolina. *Sustainability, 10*, 1–18.

Connors, S. & Pidcock, R. (Eds.). (2018). *Frequently Asked Questions: SR15.* Intergovernmental Panel on Climate Change.

Creswell, J. (2003). Research questions and hypotheses. In *Research Design: Qualitative, Quantitative and Mixed Methods* (p. 105–118). London, UK: SAGE Publications.

Davidson, K. & Gleeson, B. (2015). Interrogating urban climate leadership: Toward a political ecology of the C40 network. *Global Environmental Politics, 15*(4), 21–38.

Delaware County [DelCo]. (2019). *Elected Officials.* Retrieved from: https://www.delcopa.gov/electedofficials/index.html

Delaware County [DelCo]. (2017). *Delaware County 2035: Implementation Metrics Report.*

Delaware County [DelCo]. (2013). *Delaware County 2035: Land Use Policy Framework Plan.*

Delaware County Planning Department [DCPD]. (2016). *Delaware County Hazard Mitigation Plan.*

Delaware Valley Regional Planning Commission [DVRPC]. (2019). *About Us.* Retrieved from: https://dvrpc.org/About/

Delaware Valley Regional Planning Commission [DVRPC]. (2009). *Connections: The Regional Plan for a Sustainable Future*.

DiGaetano, A. & Strom, E. (2003). Comparative urban governance: An integrated approach. *Urban Affairs Review*, *38*(3), 356–395.

Drexel University Institute for Energy and the Environment [Drexel]. (2015). *Options for Achieving Deep Reductions in Carbon Emissions in Philadelphia by 2050.* City of Philadelphia Office of Sustainability.

Ehnert, F., Kern, F., Borgström, S., Gorissen, L., Maschmeyer, S., & Egermann, M. (2018). Urban sustainability transitions in a context of multi-level governance: A comparison of four European states. *Environmental Innovation and Societal Transitions*, 101–116.

Espey, J., Dahmm, H., & Manderino, L. (2018). *Leaving No U.S. City Behind: The U.S. Cities Sustainable Development Goals Index.* Sustainable Development Solutions Network.

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*(4), 1–9.

Fong, W. K., Sotos, M., Doust, M., Schultz, S., Marques, A., & Deng-Beck, C. (2014). *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities.* World Resources Institute, C40 Cities, & Local Governments for Sustainability.

Frumhoff, P. C., McCarthy, J. J., Melillo, J. M., Moser, S. C., & Wuebbles, D. J. (2007). *Confronting Climate Change in the US Northeast: Science, Impacts, and Solutions.* Northeast Climate Impacts Assessment. Cambridge, MA: Union of Concerned Scientists.

Fuhr, H., Hickmann, T., & Kern, K. (2018). The role of cities in multi-level climate governance: Local climate policies and the 1.5°C target. *Current Opinion in Environmental Sustainability*, *30*, 1–6.

García Sánchez, F., Solecki, W. D., & Ribalaygua Batalla, C. (2018). Climate change adaptation in Europe and the United States: A comparative approach to urban green spaces in Bilbao and New York City. *Land Use Policy*, *79*, 164–173.

Google. (2019). *Philadelphia, Pennsylvania.* Retrieved from: https://goo.gl/maps/Wfz7Q1xF5reTak8p7

Habitat III. (2017). *New Urban Agenda*. United Nations.

Haverford College [Haverford]. (2012). *Haverford College Climate Action Plan.*

Heath, A. (2013). Consolidation Act of 1854. *The Encyclopedia of Greater Philadelphia.* Retrieved from: https://philadelphiaencyclopedia.org/archive/consolidation-act-of-1854/

High-Level Political Forum on Sustainable Development. (2018). *2018 Review of SDGs Implementation: SDG 11*. United Nations.

Högström, J., Balfors, B., & Hammer, M. (2018). Planning for sustainability in expansive metropolitan regions: Exploring practices and planners' expectations in Stockholm, Sweden. *European Planning Studies*, *26*(3), 439–457.

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, *4*(1), 1–23.

Homsy, G. C. & Warner, M. E. (2015). Cities and sustainability: Polycentric action and multilevel governance. *Urban Affairs Review*, *51*(1), 46–73.

Horton, R., Yohe, G., Easterling, W., Kates, R., Ruth, M., … Wolfe, D. (2014). Ch. 16: Northeast. In J. M. Melillo, T. T. C. Richmond, & G. W. Yohe (Eds.), *Climate Change Impacts in the United States: The Third National Climate Assessment* (371-395). US Global Change Research Program.

Inner City Fund [ICF]. (2018). *Pennsylvania Climate Action Plan.* Pennsylvania Department of Environmental Protection.

Intergovernmental Panel on Climate Change [IPCC]. (2018). *IPCC Factsheet: What is the IPCC?* Retrieved from: https://www.ipcc.ch/site/assets/uploads/2018/02/FS_what_ipcc.pdf

Jessop, B. (2002). Liberalism, neoliberalism, and urban governance: A state-theoretical perspective. *Antipode*, *34*(3), 452–472.

Jochim, A. E. & May, P. J. (2010). Beyond subsystems: Policy regimes and governance. *Policy Studies Journal*, *38*(2), 303–327.

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14–26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112–133.

Jordan, A. J., Huitema, D., Hildén, M., van Asselt, H., Rayner, T. J., … Boasson, E. L. (2015). Emergence of polycentric climate governance and its future prospects. *Nature Climate Change*, *5*(11), 977–982.

Kaika, M. (2017). ‘Don’t call me resilient again!’: The New Urban Agenda as immunology … or … what happens when communities refuse to be vaccinated with ‘smart cities’ and indicators. *Environment and Urbanization*, *29*(1), 89–102.

Kennedy, C., Pincetl, S., & Bunje, P. (2011). The study of urban metabolism and its applications to urban planning and design. *Environmental Pollution*, *159*(8-9), 1965–1973.

Lee, T. & Koski, C. (2015). Multilevel governance and urban climate change mitigation. *Environment and Planning C: Government & Policy*, *33*(6), 1501–1517.

Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Ballew, M., … Bergquist, P. (2019). *Politics & Global Warming.* Yale Program on Climate Change Communication.

Local Governments for Sustainability [ICLEI]. (2008). *Township of Haverford Climate Change Action Plan.*

Longhurst, R. (2010). Semi-structured interviews and focus groups. In N. Clifford, S. French, & G. Valentine (Eds.), *Key Methods in Geography* (2nd ed, 103–115). London, UK: SAGE Publications.

Lozano, A. V. (2017). Pennsylvania attorney general: ‘We should not tolerate’ gun violence. *NBC Philadelphia.* Retrieved from: https://www.nbcphiladelphia.com/news/local/PA-Attorney-General-on-Gun-Violence-We-Should-Not-Tolerate-This-419477713.html

McLarnon, J. M., III. (2003). *Ruling Suburbia: John J. McClure and the Republican Machine in Delaware County, Pennsylvania.* Cranbury, NY: Associated University Presses.

Mehling, M. A., Metcalf, G. E., & Stavins, R. N. (2017). *Linking Heterogeneous Climate Policies (Consistent with the Paris Agreement).* Harvard Project on Climate Agreements.

Moss, R. H., Avery, S., Baja, K., Burkett, M., Chischilly, A. M., … Zimmerman, R. (2019). Evaluating knowledge to support climate action: A framework for sustained assessment. Report of an independent advisory committee on applied climate assessment. *Weather, Climate, and Society*, *11*(3), 465–487.

Mossberger, K. & Stoker, G. (2001). The evolution of urban regime theory: The challenge of conceptualization. *Urban Affairs Review*, *36*(6), 810–835.

Mykhnenko, V. (2016). Resilience: A right-wingers’ ploy? In S. Springer, K. Birch, & J. MacLeavy (Eds.), *Handbook of Neoliberalism* (190–206). New York, NY: Routledge.

Nishi, M., Pelling, M., Yamamuro, M., Solecki, W., & Kraines, S. (2016). Risk management regime and its scope for transition in Tokyo. *Journal of Extreme Events*, *3*(3), 1–29.

Oakland Park & Wilton Manors. (2019). *Two Cities, One Sustainable Future: Climate Action Plan.*

Oberlin. (2011). *Oberlin Climate Action Plan.* City of Oberlin & Oberlin College.

Olsson, L., Jerneck, A., Thoren, H., Persson, J., & O'Byrne, D. (2015). Why resilience is unappealing to social science: Theoretical and empirical investigations of the scientific use of resilience. *Science Advances, 1*(4), 1–11.

Parasuram, P., Narayanan, P., Pelling, M., Solecki, W., Ramachandran, P., & Ramachandran, R. (2016). Climate change adaptation pathways in Kolkata. *Journal of Extreme Events, 3*(3), 1–22.

Patterson, J., Schulz, K., Vervoort, J., van der Hel, S., Widerberg, O., … Barau, A. (2017). Exploring the governance and politics of transformations towards sustainability. *Environmental Innovation and Societal Transitions, 24*, 1–16.

Pelling, M., Abeling, T., & Garschagen, M. (2016). Emergence and transition in London's climate change adaptation rathways. *Journal of Extreme Events, 3*(3), 1–25.

Pew Charitable Trusts [Pew]. (2019). *Philadelphia 2019: The State of the City.*

Philadelphia [Philly]. (2017). *Zero Waste Litter Cabinet Action Plan.*

Philadelphia Office of Sustainability [Philly OOS]. (2019a). *Beat the Heat: Hunting Park. A Community Heat Relief Plan.*

Philadelphia Office of Sustainability [Philly OOS]. (2019b). *Greenworks Review.*

Philadelphia Office of Sustainability [Philly OOS]. (2018). *Powering Our Future: A Clean Energy Vision for Philadelphia.*

Philadelphia Office of Sustainability [Philly OOS]. (2016). *Greenworks: A Vision for a Sustainable Philadelphia.*

Philadelphia Office of Sustainability [Philly OOS]. (2015). *Growing Stronger: Toward A Climate Ready Philadelphia.*

Philadelphia Water Department [Philly Water]. (2011). *Green City, Clean Waters: The City of Philadelphia's Program for Combined Sewer Overflow Control.*

Pierre, J. (2014). Can urban regimes travel in time and space? Urban regime theory, urban governance theory, and comparative urban politics. *Urban Affairs Review, 50*(6), 864–889.

Pierre, J. (2011). *The Politics of Urban Governance.* New York, NY: Palgrave Macmillan.

Pierre, J. (2005). Comparative urban governance: Uncovering complex causalities. *Urban Affairs Review*, *40*(4), 446–462.

Pierre, J. (1999). Models of urban governance: The institutional dimension of urban politics. *Urban Affairs Review, 34*(3), 372–396.

Rapoport, E., Acuto, M., & Grcheva, L. (2019). *Leading Cities: A Global Review of City Leadership*. London, UK: UCL Press.

Raworth, K. (2017). *Doughnut Economics: Seven Ways to Think like a 21st Century Economist.* London, UK: Penguin Random House.

Reinhart, R. J. (2019). U.S. views mixed on war in Afghanistan. *Gallup News.* Retrieved from: https://news.gallup.com/poll/266546/views-mixed-war-afghanistan.aspx

Robinson, J. & Roy, A. (2015). Debate on global urbanisms and the nature of urban theory. *International Journal of Urban and Regional Research, 40*(1), 181–186.

Rosenzweig, C. & Solecki, W. (2018). Action pathways for transforming cities. *Nature Climate Change*, *8*(9), 756–759.

Roy, A. (2015). Who's afraid of postcolonial theory? *International Journal of Urban and Regional Research*, *40*(1), 200–209.

Sachs, J. D., Lynch, A., LoPresti, A., & Fox, C. (2018). *Sustainable Development Report of the United States 2018.* Sustainable Development Solutions Network.

Schnader, W. A., Freedman, A. L., McCracken, R. T., & Wolkin, P. A. (1951). *Philadelphia Home Rule Charter.* City of Philadelphia.

Smith, J. K. (1983). Quantitative versus qualitative research: An attempt to clarify the issue. *Educational Researcher, 12*(3), 6–13.

Solecki, W., Leichenko, R., & Eisenhauer, D. (2017a). Extreme climate events, household decision-making and transitions in the immediate aftermath of Hurricane Sandy. *Miscellanea Geographica: Regional Studies on Development*, *21*(4), 139–150.

Solecki, W., Link, H., & Garschagen, M. (2016). Risk management and adaptation transitions in New York City. *Journal of Extreme Events, 3*(3), 1–28.

Solecki, W., Pelling, M., & Garschagen, M. (2017b). Transitions between risk management regimes in cities. *Ecology and Society*, *22*(2), 1–14.

Stern, N. (2019). Meeting the challenge of climate change offers the urban development opportunity of our lifetimes. *Newsweek.* Retrieved from: https://www.newsweek.com/climate-change-urban-renaissance-nicholas-stern-1460805

Stone, C. N. (2005). Looking back to look forward: Reflections on urban regime analysis. *Urban Affairs Review, 40*(3), 309–341.

Sustainable Development Solutions Network [SDSN]. (2019). *The 2019 US Cities Sustainable Development Report.*

Swarthmore College [Swarthmore]. (2013). *Swarthmore College Action Plan.*

Temple University Center for Sustainable Communities [Temple]. (2010). *Swarthmore Area Greenhouse Gas Emissions Inventory and Action Plan Project.*

United Nations [UN]. (2018). *The Sustainable Development Goals Report 2018.*

United States Census Bureau [Census]. (2018a). *Annual Estimates of the Resident Population.* Retrieved from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml

United States Census Bureau [Census]. (2018b). *QuickFacts: Delaware County, Pennsylvania.* Retrieved from: https://www.census.gov/quickfacts/delawarecountypennsylvania

United States Census Bureau [Census]. (2018c). *QuickFacts: Philadelphia City, Pennsylvania.* Retrieved from: https://www.census.gov/quickfacts/philadelphiacitypennsylvania

United States Environmental Protection Agency. (2019). *Overview of Greenhouse Gases.* Retrieved from: https://www.epa.gov/ghgemissions/overview-greenhouse-gases

Valencia, S. C., Simon, D., Croese, S., Nordqvist, J., Oloko, M., … Versace, I. (2019). Adapting the Sustainable Development Goals and the New Urban Agenda to the city level: Initial reflections from a comparative research project. *International Journal of Urban Sustainable Development, 11*(1), 4–23.

Villanova University [Villanova]. (2010). *The Villanova University Climate Action Plan.*

We Are Still In. (2019). *"We Are Still In" Declaration.* Retrieved from: https://www.wearestillin.com/we-are-still-declaration

Wikipedia. (2019). *Delaware River Basin Map.* Retrieved from: https://en.wikipedia.org/wiki/Delaware_River#/media/File:Delaware_river_basin_map.png

Wolf, T. & Cortés, P. A. (2017). *The Administration of Voter Registration in Pennsylvania: 2016 Report to the General Assembly.* Pennsylvania Department of State.

Appendix I: Semi-Structured Interview Full Script

Participant ID: _____

Interviewee information.

Please confirm the following details about you and your work.

1. Job title: _____
2. Institution and department: _____
3. Years in your current position: _____
4. Years of related career service: _____
5. One sentence describing your main responsibilities:

Hazard management prioritisation.

These first questions focus on the current hazards facing [DelCo/Philly] and how they are prioritised.

1. a) According to your own professional judgment, please identify the **importance of the following hazards** for human security in [DelCo/Philly]:

Hazard	Not important (0)	Somewhat important (1)	Very important (2)	Extremely important (3)	Do not know (na)
i. Blizzards					
ii. Coastal flooding					
iii. Rainfall flooding					
iv. Heatwaves					
v. Fires					
vi. Gun violence					
vii. Terrorism					
viii. Other _____					

1. b) Please identify in your personal view **how much importance** the [DelCo/Philly] government places on each hazard:

Hazard	Not important (0)	Somewhat important (1)	Very important (2)	Extremely important (3)	Do not know (na)
i. Blizzards					
ii. Coastal flooding					
iii. Rainfall flooding					
iv. Heatwaves					
v. Fires					
vi. Gun violence					
vii. Terrorism					
viii. Other _____					

1. c) Please briefly describe any similarities or differences between your professional judgment and your perception of current [DelCo/Philly] government priorities.

Current risk management approach.

These next questions explore the management approaches that [DelCo/Philly] employs to address risks. A [county/city]'s risk management approach involves how the [county/city] allocates resources and plans for hazards, and how the [county/city] prioritises hazard risk as compared to other concerns such as economic development.

I will read four approaches to risk management, and I want you to think about which one or ones seem relevant to [DelCo/Philly]. After I read the four approaches, I will ask you a few questions.

> **The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards.** For example, this approach would include an expansion of existing policies and operations to respond to flood risks in order to safeguard development.
>
> **The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses.** Shifts might include alterations in land-use zoning to better integrate nature-based features (e.g., urban forestry, wetlands for storm attenuation).
>
> **The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk.** Change can take place via legislation, regulations, administrative systems, financial institutions, and technological or biological systems.
>
> **Currently there is no strategic risk management policy for [DelCo/Philly].** There is no capacity for strategic planning and action. Any activity is highly fragmented and uncoordinated.

Now that you've considered each approach, I will ask you which approach best applies to each of the previously listed hazards (e.g., rainfall flooding).

1. a)

Hazard Approach to: Blizzards	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. b)

Hazard Approach to: Coastal flooding	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. c)

Hazard Approach to: Rainfall flooding	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. d)

Hazard Approach to: Heatwaves	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. e)

Hazard Approach to: Fires	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. f)

Hazard Approach to: Gun violence	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. g)

Hazard Approach to: Terrorism	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

1. h)

Hazard Approach to: Other _____ *(from B1a-b)*	The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards. (1)	The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses. (2)	The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk. (3)	Currently there is no strategic risk manage-ment policy for [DelCo/ Philly]. (4)	Do not know (na)
Explanation					

2. From your perspective, choose the statement that best represents the **dominant urban risk management approach** in your [county/city] across all hazard risks.

1) The current aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards.
2) The current aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses.
3) The current aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk.
4) Currently there is no strategic risk policy for [DelCo/Philly].

3. Which actors (individuals or groups) have been **most important in influencing the [county/city]'s current urban risk management approach**?

Actor	(0) Not important	(1) Somewhat important	(2) Very important	(3) Extremely important	(na) Do not know
a) A single leader (e.g., mayor)					
b) [County/ city] politicians or officials					
c) State politicians or officials					
d) National politicians or officials					
e) Regional government agencies					
f) Scientists & academics					
g) Media & press					
h) Civil society					

Actor	(0) Not important	(1) Somewhat important	(2) Very important	(3) Extremely important	(na) Do not know
i) Local businesses					
j) International organisations (e.g. aid or development agencies)					
k) Other _____					

4. Which *factors* have been **most important in influencing the [county/city]'s current risk management approach**?

Factor	(0) Not important	(1) Somewhat important	(2) Very important	(3) Extremely important	(na) Do not know
a) Stability of administrative structures					
b) Real estate development					
c) Economic change					
d) Extreme natural events					
e) Modernising science and technology					

Factor	(0) Not important	(1) Somewhat important	(2) Very important	(3) Extremely important	(na) Do not know
f) Shifting public values					
g) Political party leadership					
h) Demographic change					
i) Other _____					

5. Have there been **any major changes** in the way that risks have been managed in the [county/city] over the last 20 years or so?

1) Yes
2) No
3) Do not know

6. If yes, can you please briefly describe the changes that have occurred in the last 20 years?

7. Which of the following terms best describes the **speed of changes** in approaches to risk management?

1) Rapid (the shift seemed to emerge within a period of <12 months)
2) Medium (seemed to emerge during a period of 12-24 months)
3) Slow (seemed to emerge only after many years)

8. Were there **any specific events or pressures** that led to this change? Please list.

a) Specific event(s):

b) Pressure(s):

9. Earlier you described the current dominant approach for risk management policy in [DelCo/Philly] *[state previous choice from C2]*. Do you think there are conditions for changing this overall aim (e.g. growing interest, pressing need)? Please choose the statement that best describes the **emerging direction of [county/city] risk management**:

1. The emerging aim of [DelCo/Philly]'s risk management policy is to provide stability for planning and business so that development is not disrupted by hazards.
2. The emerging aim of [DelCo/Philly]'s risk management policy is to help planners and businesses shift toward accepting some impacts of hazard risk in order to avoid major losses.
3. The emerging aim of [DelCo/Philly]'s risk management policy is to work to significantly change standard planning and business practices because they are inadequate and are causes of risk.
4. There is no emerging strategic risk management policy for [DelCo/Philly].

10. Please explain your answer.

Future risks & risk management approaches.

The next questions examine future potential risk faced by the [county/city] and what management approaches could be employed.

I am interested in your opinion regarding how well placed [DelCo/Philly] is to prepare now for changes in risk that might emerge over the next 20 years (approximately 2040). I will present four possible scenarios and ask how you think the [county/city] risk management approach would need to be changed, if at all, to maintain an acceptable level of risk. For each scenario please choose the most appropriate answer.

1. a) **More frequent and more intense natural hazards** (e.g., blizzards, hurricanes, and heatwaves).

1. The current risk management approach is adequate to manage the risks in this scenario.
2. Minor changes to the risk management approach would be needed to handle these new risks.
3. Major changes to the risk management approach would be needed that probably cannot be achieved without significant effort.

1. b) If changes would be needed to reduce risk, what would these changes be and how could they be achieved?

2. a) **Increased income inequality** (e.g., significantly increased income inequality between the wealthiest and poorest).

1. The current risk management approach is adequate to manage the risks in this scenario.
2. Minor changes to the risk management approach would be needed to these handle new risks.
3. Major changes to the risk management approach would be needed that probably cannot be achieved without significant effort.

2. b) If changes would be needed to reduce risk, what would these changes be and how could they be achieved?

3. a) **An aging population** (e.g., significantly increased fraction of the [county/city] population being over the age of 65).

1. The current risk management approach is adequate to manage the risks in this scenario.
2. Minor changes to the risk management approach would be needed to handle these new risks.
3. Major changes to the risk management approach would be needed that probably cannot be achieved without significant effort.

3. b) If changes would be needed to reduce risk, what would these changes be and how could they be achieved?

4. a) **Smaller local government** (e.g., reduced administrative staff and decreased operational budget).

1. The current risk management approach is adequate to manage the risks in this scenario.
2. Minor changes to the risk management approach would be needed to handle these new risks.
3. Major changes to the risk management approach would be needed that probably cannot be achieved without significant effort.

4. b) If changes would be needed to reduce risk, what would these changes be and how could they be achieved?

5. How likely are each of these scenarios for your [county/city] in the next 20 years?

Scenario	Not likely (0)	Somewhat likely (1)	Very likely (2)	Extremely likely (3)	Do not know (na)
i. Increased natural hazards					
ii. Increased income inequality					
iii. Aging population					
iv. Smaller local government					

6. Are there any other emerging changes that you would include? Please list and explain.

Approach to climate risk.

This final set of questions examines climate risk more specifically. I will ask you a few of the same questions from previous sections - this time, please answer with climate change in mind.

1. a) Returning to our list of hazards, please tell me using your professional judgement **how much you expect** each of the following hazards to be **affected by climate change** in [DelCo/Philly]:

Hazard	Not affected (0)	Somewhat affected (1)	Very affected (2)	Extremely affected (3)	Do not know (na)
i. Blizzards					
ii. Coastal flooding					
iii. Rainfall flooding					
iv. Heatwaves					
v. Fires					
vi. Gun violence					
vii. Terrorism					

Hazard	Not affected (0)	Somewhat affected (1)	Very affected (2)	Extremely affected (3)	Do not know (na)
viii. Other _____ *(from B1a-b)*					

1. b) Please identify in your personal view **how much the [DelCo/Philly] government has officially stated** that it expects the following hazards to be **affected by climate change** within [DelCo/Philly]:

Hazard	Not affected (0)	Somewhat affected (1)	Very affected (2)	Extremely affected (3)	Do not know (na)
i. Blizzards					
ii. Coastal flooding					
iii. Rainfall flooding					
iv. Heatwaves					
v. Fires					
vi. Gun violence					
vii. Terrorism					
viii. Other _____ *(from B1a-b)*					

1. c) Please briefly describe any similarities or differences between your professional judgment and your perception of current [DelCo/Philly] government priorities.

2. a) Please rate the influence of climate action policy at different government scales on [DelCo/Philly]'s local decision-making. How important would more robust regional, state, or federal policy be for [DelCo/Philly]'s climate adaptation and mitigation efforts?

Climate Action Policy Scales	Not important (0)	Somewhat important (1)	Very important (2)	Extremely important (3)	Do not know (na)
i. Regional (DVRPC)					
ii. State (PA)					
iii. Federal (US)					

2. b) Please explain your answer.

3. Who do you consider to be the **most significant actors** shaping [DelCo/Philly]'s climate action planning? Please provide some examples.

4. What do you consider to be the **most significant barriers and limitations** that prevent [DelCo/Philly] from changing its approach to climate change? Please provide some examples.

5. Overall, how would you rate the implementation of [DelCo/Philly]'s strategic climate planning efforts?

Not successful (0)	Somewhat successful (1)	Very successful (2)	Extremely successful (3)	Do not know (na)

6. Would you consider yourself familiar with internationally-supported climate policies such as the Paris Agreement, Agenda 2030, or the Sustainable Development Goals?

Not familiar (0)	Somewhat familiar (1)	Very familiar (2)	Extremely familiar (3)	Do not know (na)

7. What are the best sources of **climate planning documentation** for the [DelCo/Philly]? (e.g., the Philadelphia Greenworks Plan, the New Urban Agenda)

Conclusions

1. Who else might you know that I should contact for an interview?

Name: _____
Affiliation: _____
Contact information: _____
Relevance: _____

Name: _____
Affiliation: _____
Contact information: _____
Relevance: _____

2. Are there any other questions that you think I should have asked that I did not? Briefly explain.

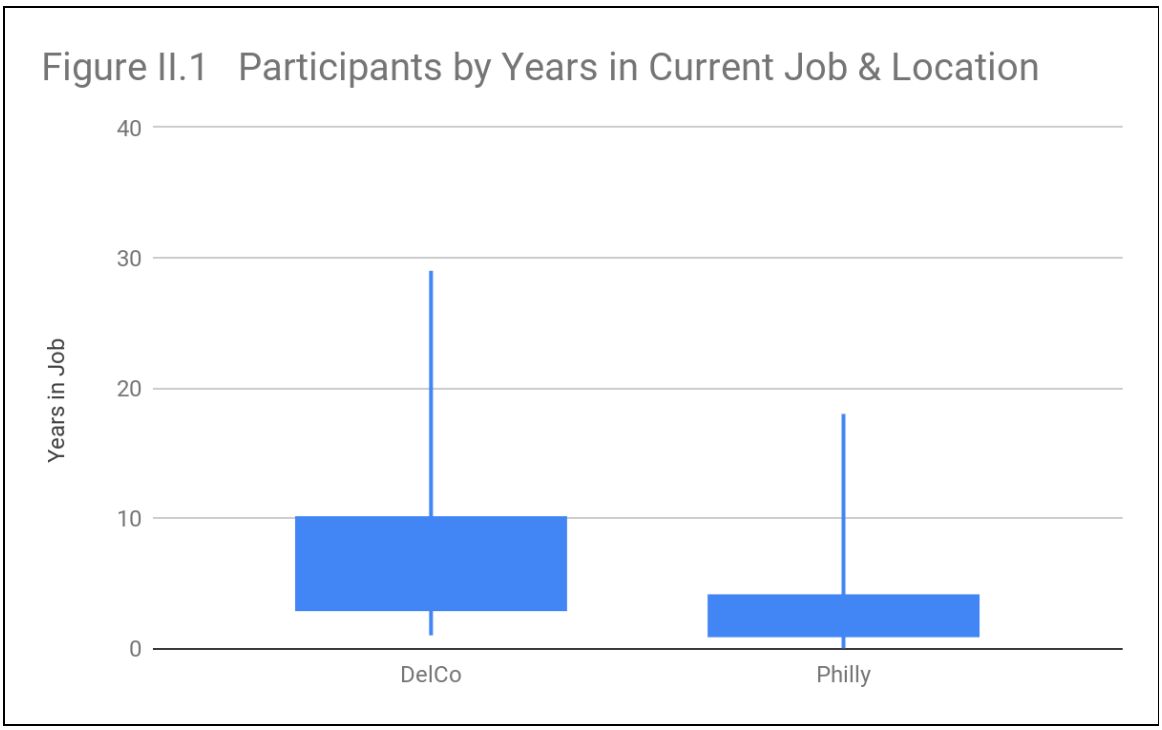
Appendix II: Detailed Statistical Data

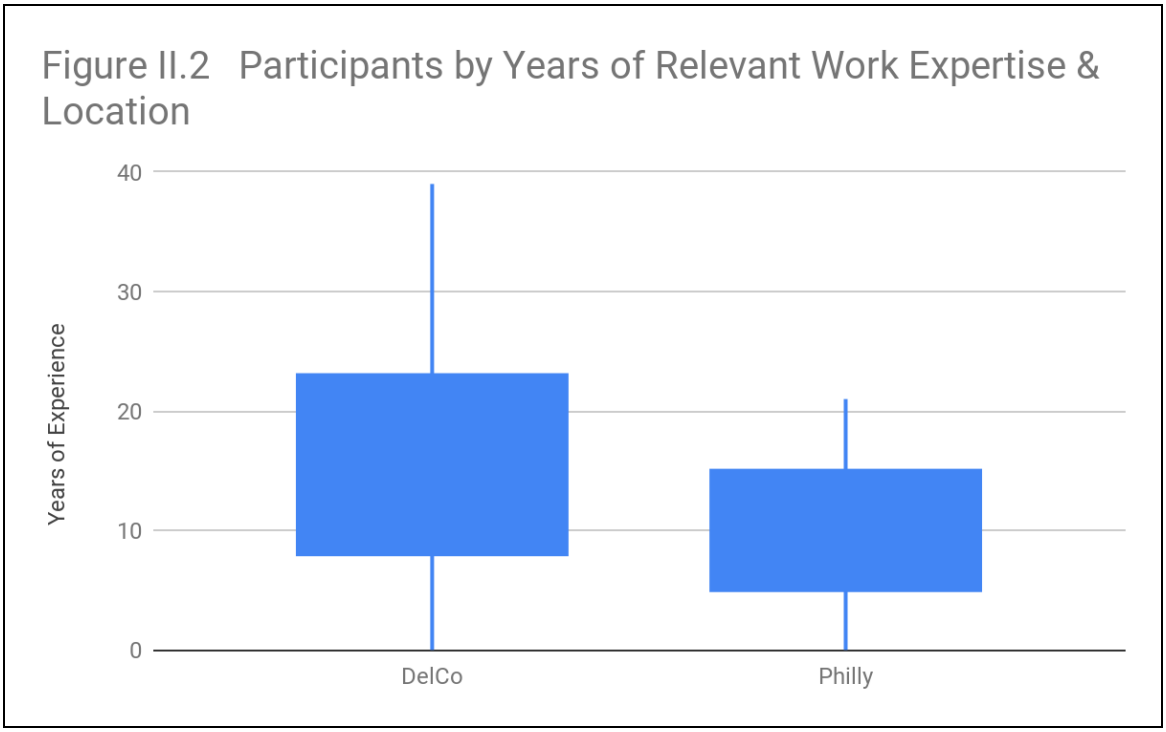
Interviewee information.

⇨ Total sample population: DelCo n=16; Philly n=13

⇨ Years in current position (**Figure II.1**): DelCo $\bar{x}$=8.22; Philly $\bar{x}$=4.46; p=0.77

⇨ Years of related career service (**Figure II.2**): DelCo $\bar{x}$=16.38; Philly $\bar{x}$=10.69; p=0.71





Hazard management prioritisation.

⇨ According to your own professional judgment, please identify the importance of the following hazards for human security in [DelCo/Philly]:

Blizzards: DelCo $\bar{x}$=1.44 (n=16); Philly $\bar{x}$=1.23 (n=13); p=0.82

Coastal flooding: DelCo $\bar{x}$=1.07 (n=15); Philly $\bar{x}$=1.69 (n=13); p=0.22

Rainfall flooding: DelCo $\bar{x}$=2.00 (n=16); Philly $\bar{x}$=2.08 (n=13); p=0.88

Heatwaves: DelCo $\bar{x}$=1.91 (n=16); Philly $\bar{x}$=2.31 (n=13); p=0.63

Fires: DelCo $\bar{x}$=1.31 (n=16); Philly $\bar{x}$=1.00 (n=12); p=0.66

Gun violence: DelCo $\bar{x}$=2.09 (n=16); Philly $\bar{x}$=2.77 (n=13); ***p*=0.05**

Terrorism: DelCo $\bar{x}$=0.90 (n=15); Philly $\bar{x}$=0.92 (n=12); p=0.30

See **Figures 5.3a & 5.3b** in **Chapter 5: Results & Discussion**.

⇨ Please identify in your personal view how much importance the [DelCo/Philly] government places on each hazard:

Blizzards: DelCo $\bar{x}$=1.75 (n=12); Philly $\bar{x}$=1.67 (n=12); p=0.73

Coastal flooding: DelCo $\bar{x}$=0.88 (*n*=12); Philly $\bar{x}$=1.42 (*n*=12); ***p*=0.05**

Rainfall flooding: DelCo $\bar{x}$=1.58 (*n*=13); Philly $\bar{x}$=2.15 (*n*=13); *p*=0.15

Heatwaves: DelCo $\bar{x}$=1.35 (*n*=13); Philly $\bar{x}$=1.92 (*n*=13); *p*=0.09

Fires: DelCo $\bar{x}$=1.31 (*n*=13); Philly $\bar{x}$=1.64 (*n*=11); *p*=0.36

Gun violence: DelCo $\bar{x}$=1.63 (*n*=12); Philly $\bar{x}$=2.83 (*n*=12); ***p*<0.01**

Terrorism: DelCo $\bar{x}$=1.33 (*n*=12); Philly $\bar{x}$=1.50 (*n*=10); *p*=0.48

See **Figures 5.4a & 5.4b** in **Chapter 5: Results & Discussion**.

Current risk management approach.

⇨ Which approach best applies to each of the previously listed hazards?

Blizzards: DelCo *mode*=Approach 1 (*n*=10); Philly *mode*=Approach 1 (*n*=11); *p*=0.68

Coastal flooding: DelCo *mode*=Approach 4 (*n*=8); Philly *mode*=Approach 2 (*n*=9); *p*=0.19

Rainfall flooding: DelCo *mode*=Approach 2 (*n*=10); Philly *mode*=Approach 3 (*n*=12); ***p*<0.01**

Heatwaves: DelCo *mode*=Approach 4 (*n*=9); Philly *mode*=Approach 2 (*n*=10); *p*=0.19

Fires: DelCo *mode*=Approach 1 (*n*=10); Philly *mode*=Approach 1 (*n*=10); *p*=0.88

Gun violence: DelCo *mode*=Approach 4 (*n*=7); Philly *mode*=Approach 2 (*n*=9); *p*=0.06

Terrorism: DelCo *mode*=Approach 1 (*n*=8); Philly *mode*=Approach 2 (*n*=8); *p*=0.42

See **Figures II.3a & II.3b** below.

Figure II.3a Risk Management Approach by Hazard (DelCo)

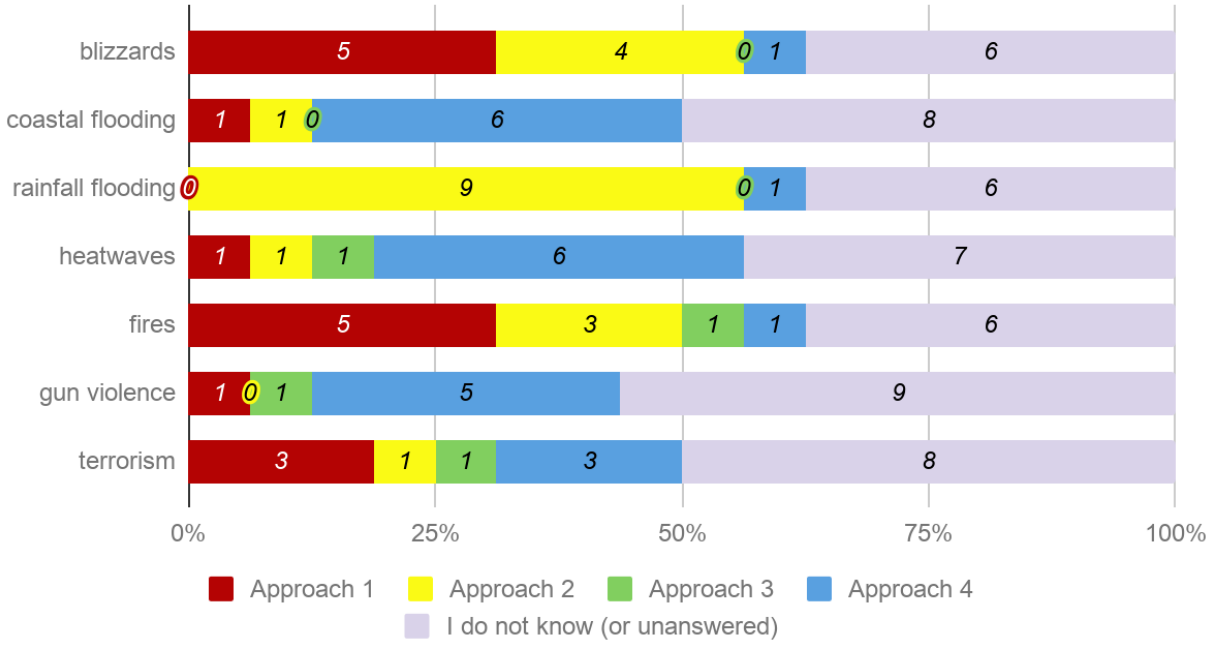
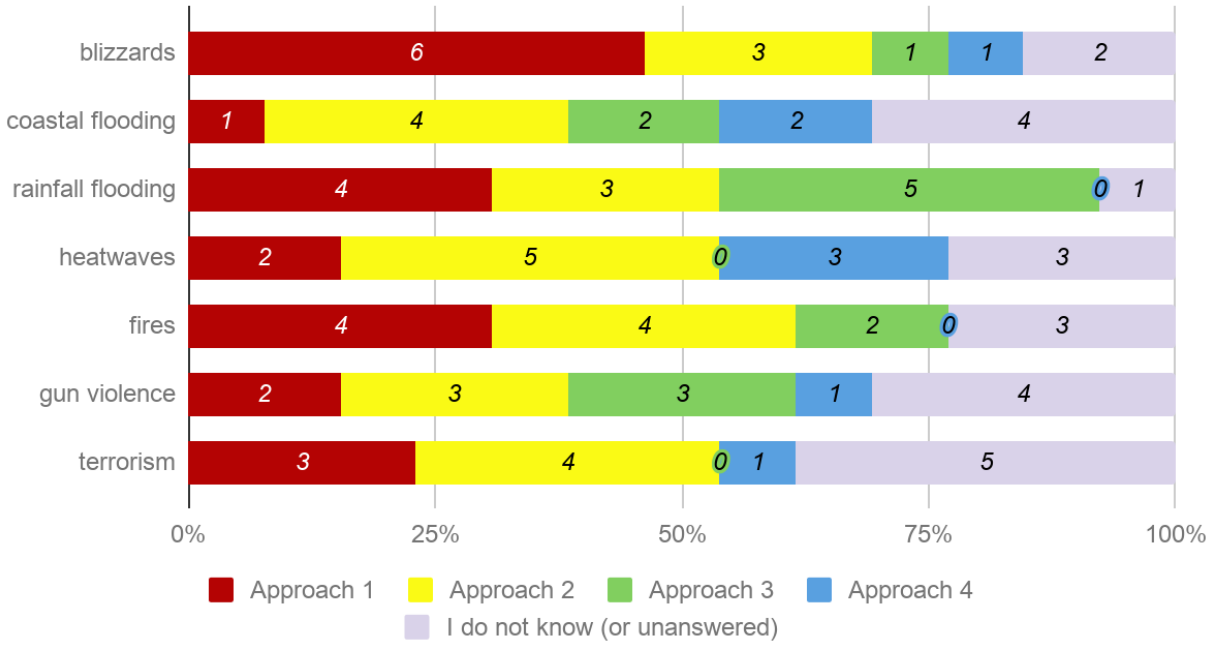


Figure II.3b Risk Management Approach by Hazard (Philly)



⇨ From your perspective, choose the statement that best represents the dominant urban risk management approach in your [county/city] across all hazard risks.

DelCo *mode*=Approach 1 (*n*=11); Philly *mode*=Approach 2 (*n*=11); *p*=0.15

See **Figure 5.7** in **Chapter 5: Results & Discussion.**

⇨ Which actors (individuals or groups) have been most important in influencing the [county/city]'s current urban risk management approach?

Mayors: DelCo $\bar{x}$=1.77 (*n*=13); Philly $\bar{x}$=2.00 (*n*=13); *p*=0.51

County/city politicians or officials: DelCo $\bar{x}$=1.87 (*n*=15); Philly $\bar{x}$=2.08 (*n*=13); *p*=0.68

State politicians or officials: DelCo $\bar{x}$=1.53 (*n*=15); Philly $\bar{x}$=1.50 (*n*=12); *p*=0.95

National politicians or officials: DelCo $\bar{x}$=1.03 (*n*=15); Philly $\bar{x}$=1.50 (*n*=12); *p*=0.90

Regional government agencies: DelCo $\bar{x}$=1.61 (*n*=14); Philly $\bar{x}$=1.85 (*n*=13); *p*=0.06

Scientists and academics: DelCo $\bar{x}$=1.27 (*n*=15); Philly $\bar{x}$=1.73 (*n*=13); *p*=0.15

Media and press: DelCo $\bar{x}$=1.79 (*n*=14); Philly $\bar{x}$=2.23 (*n*=13); *p*=0.62

Civil society: DelCo $\bar{x}$=1.57 (*n*=15); Philly $\bar{x}$=2.00 (*n*=13); ***p*=0.02**

Local businesses: DelCo $\bar{x}$=1.44 (*n*=16); Philly $\bar{x}$=1.58 (*n*=12); *p*=0.95

International organisations: DelCo $\bar{x}$=0.38 (*n*=16); Philly $\bar{x}$=0.50 (*n*=11); *p*=0.17

See **Figures II.4a & II.4b** below.

Figure II.4a Importance of Different Actors (DelCo)

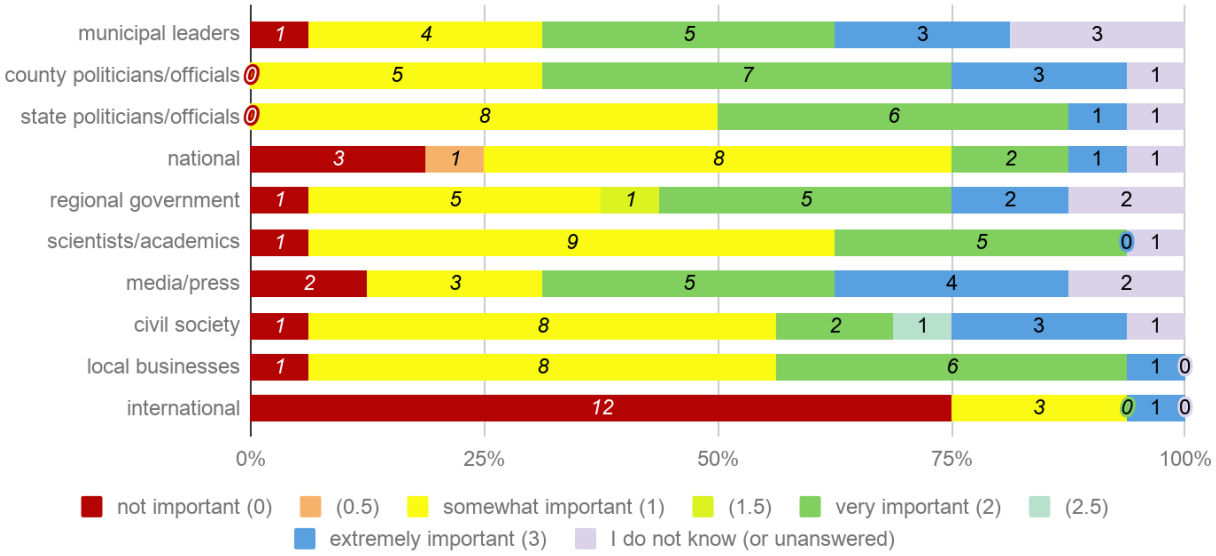
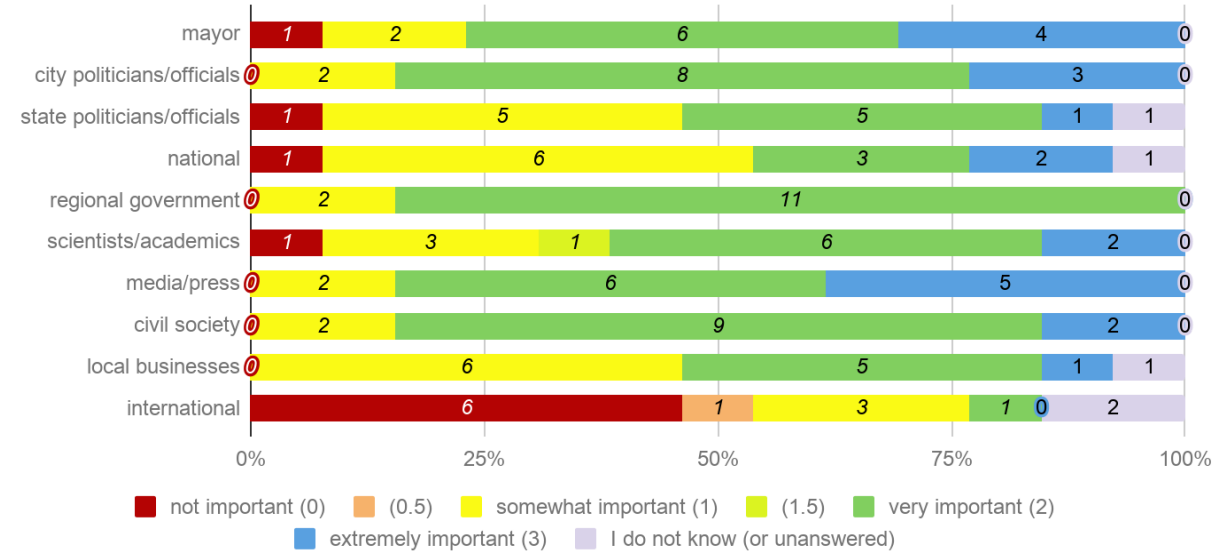


Figure II.4b Importance of Different Actors (Philly)



⇨ Which factors have been most important in influencing the [county/city]'s current risk management approach?

Stability of administrative structures: DelCo $\bar{x}$=1.70 (n=10); Philly $\bar{x}$=2.33 (n=12); ***p*=0.04**

Real estate development: DelCo $\bar{x}$=2.00 (n=13); Philly $\bar{x}$=1.90 (n=10); p=0.76

Economic change: DelCo $\bar{x}$=1.89 (n=14); Philly $\bar{x}$=2.00 (n=12); p=0.55

Extreme natural events: DelCo $\bar{x}$=2.12 (n=13); Philly $\bar{x}$=1.50 (n=13); p=0.12

Modernising science and technology: DelCo $\bar{x}$=1.18 (n=14); Philly $\bar{x}$=1.64 (n=11); p=0.47

Shifting public values: DelCo $\bar{x}$=1.77 (n=13); Philly $\bar{x}$=1.69 (n=13); p=0.46

Political party leadership: DelCo $\bar{x}$=1.92 (n=12); Philly $\bar{x}$=1.50 (n=12); p=0.11

Changing demographics: DelCo $\bar{x}$=1.38 (n=13); Philly $\bar{x}$=1.75 (n=12); p=0.49

See **Figures II.5a & II.5b** below.

Figure II.5a Importance of Different Factors (DelCo)

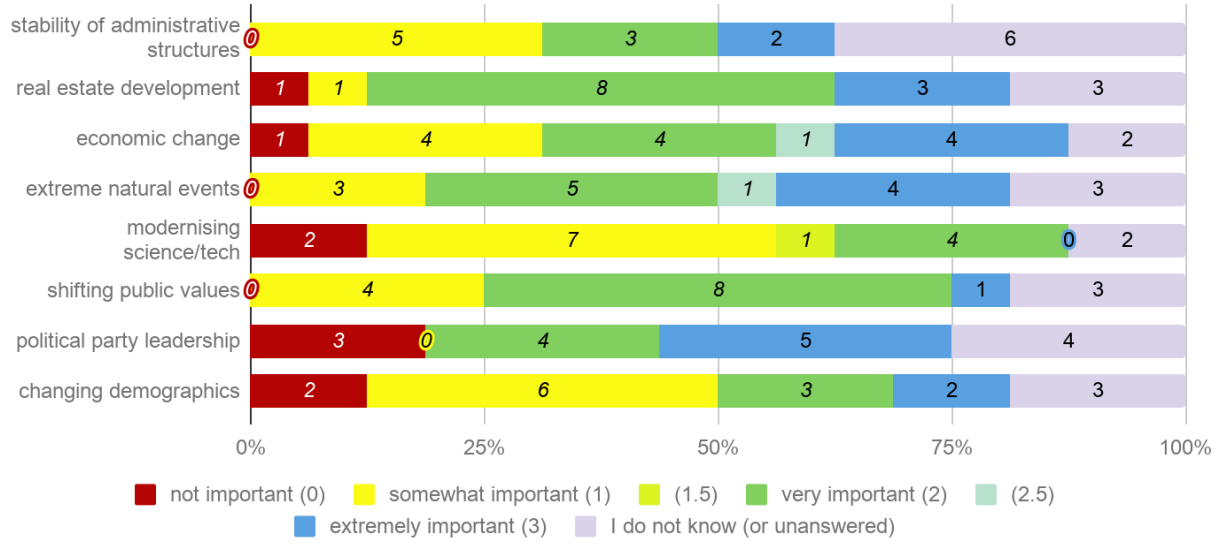
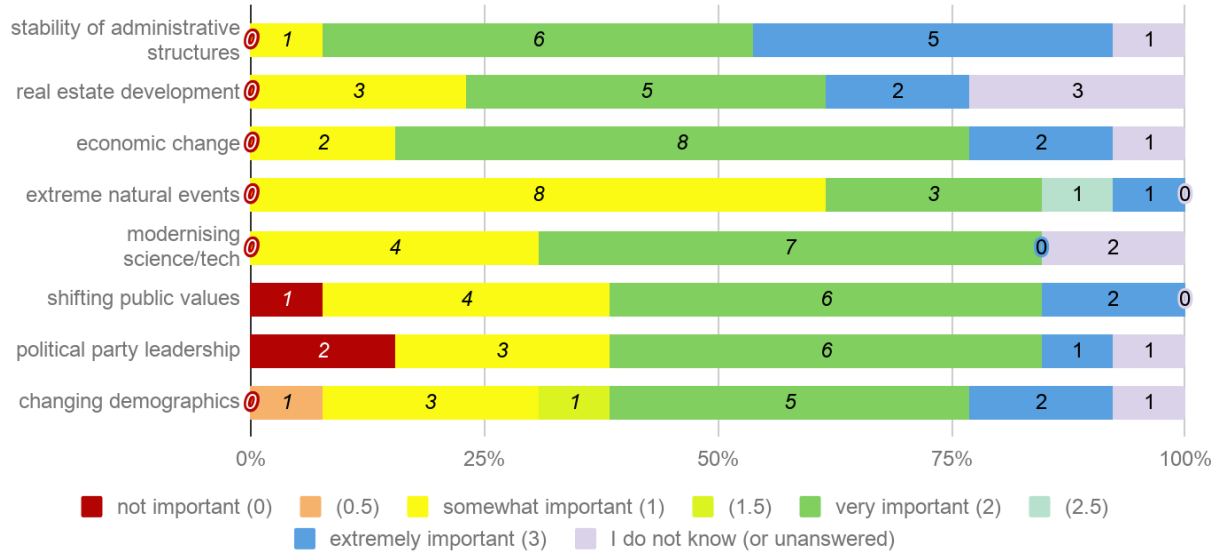


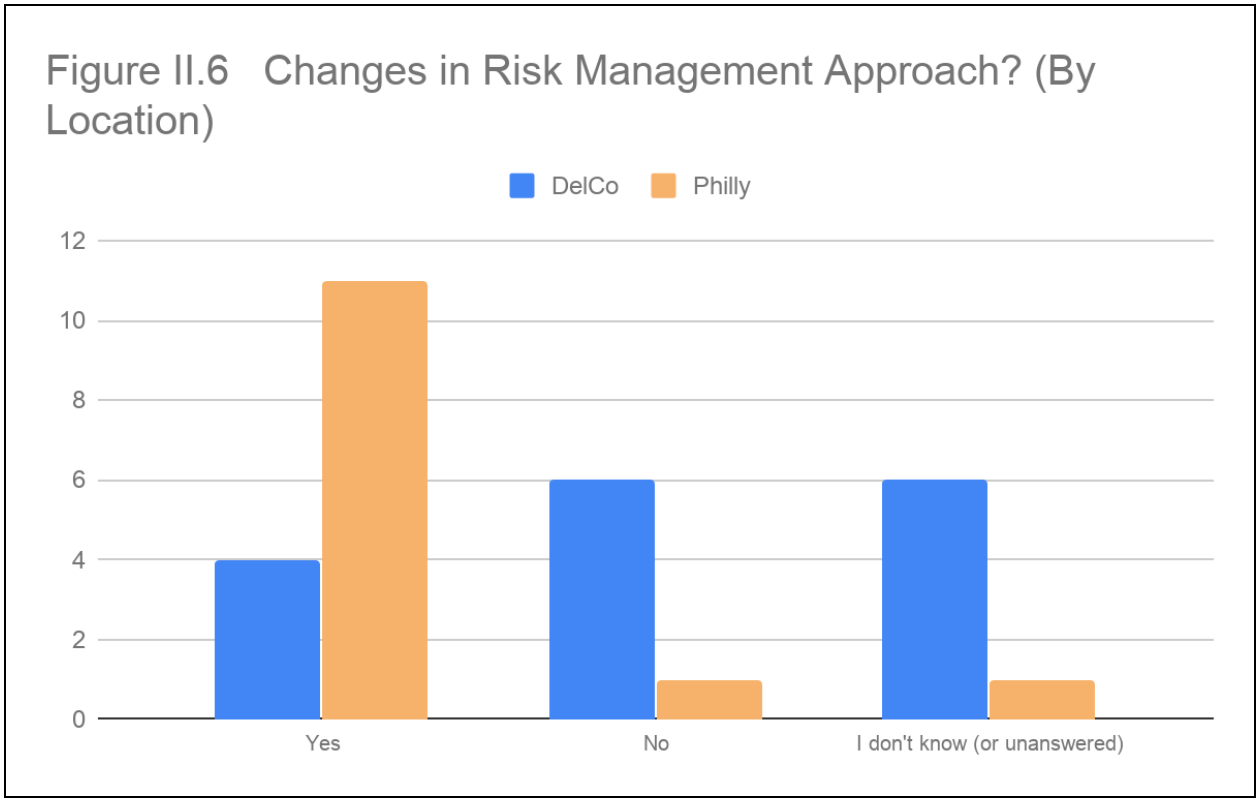
Figure II.5b Importance of Different Factors (Philly)



⇨ Have there been any major changes in the way that risks have been managed in the [county/city] over the last 20 years or so?

DelCo *mode*=No (*n*=10); Philly *mode*=Yes (*n*=12); ***p*<0.01**

See **Figure II.6** below.



⇨ Please choose the statement that best describes the emerging direction of [county/city] risk management:

DelCo *mode*=Approach 2 (*n*=10); Philly *mode*=Approach 2 (*n*=10); *p*=0.52

See **Figure 5.7** in **Chapter 5: Results & Discussion.**

Future risks & risk management approaches.

⇨ I will present four possible scenarios and ask how you think the [county/city] risk management approach would need to be changed, if at all, to maintain an acceptable level of risk.

More frequent and more intense natural hazards: DelCo $\bar{x}$=2.70 (*n*=15); Philly $\bar{x}$=2.58 (*n*=12); *p*=0.41

Increased income inequality: DelCo $\bar{x}$=2.73 (n=15); Philly $\bar{x}$=2.60 (n=10); p=0.33

An aging population: DelCo $\bar{x}$=1.92 (n=13); Philly $\bar{x}$=2.00 (n=10); p=0.80

Smaller local government: DelCo $\bar{x}$=2.50 (n=12); Philly $\bar{x}$=2.75 (n=12); p=0.42

See **Figures II.7a & II.7b** below.

Figure II.7a Management of Potential Future Risk Scenarios (DelCo)

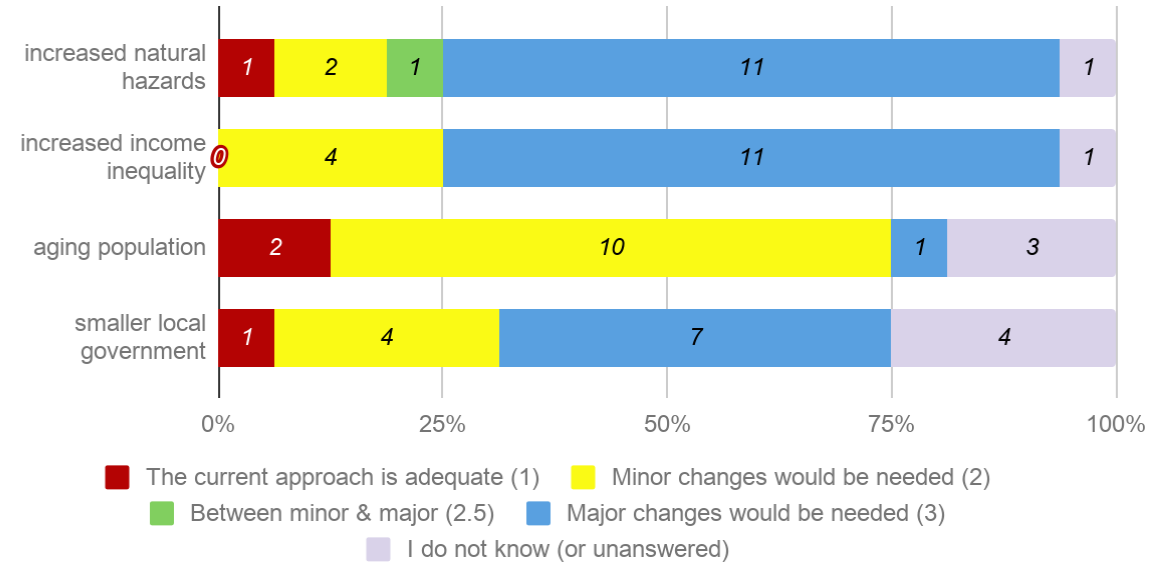
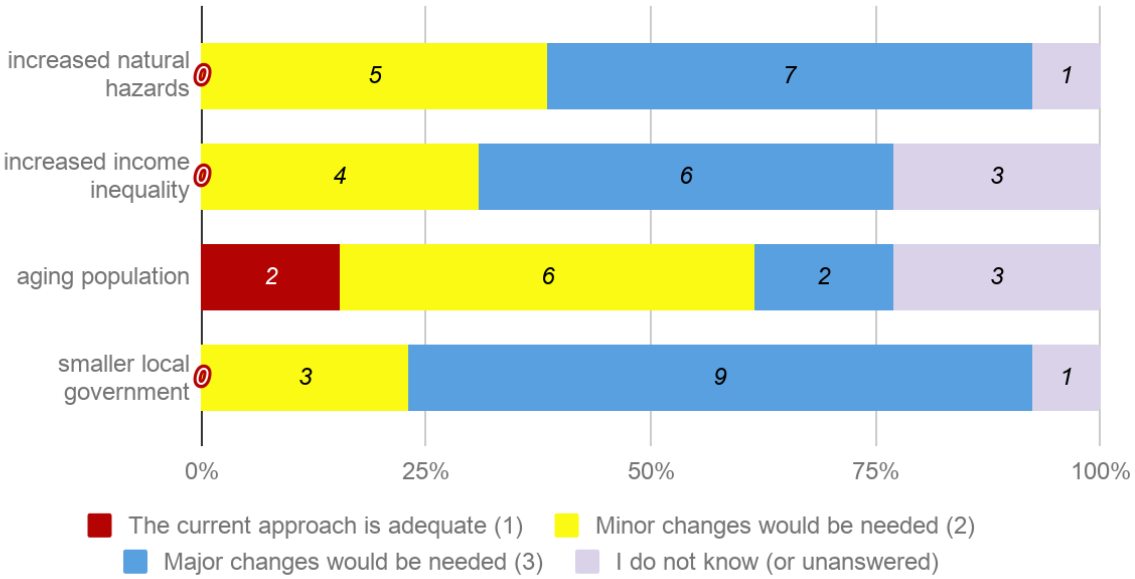


Figure II.7b Management of Potential Future Risk Scenarios (Philly)



⇨ How likely are each of these scenarios for your [county/city] in the next 20 years?

More frequent and more intense natural hazards: DelCo $\bar{x}$=2.81 (n=16); Philly $\bar{x}$=2.58 (n=12); p=0.68

Increased income inequality: DelCo $\bar{x}$=2.00 (n=15); Philly $\bar{x}$=1.83 (n=12); p=0.87

An aging population: DelCo $\bar{x}$=2.07 (n=15); Philly $\bar{x}$=1.91 (n=11); p=0.93

Smaller local government: DelCo $\bar{x}$=0.88 (n=13); Philly $\bar{x}$=0.95 (n=11); p=1

See **Figures II.8a & II.8b** below.

Figure II.8a Likelihood of Potential Future Risk Scenarios (DelCo)

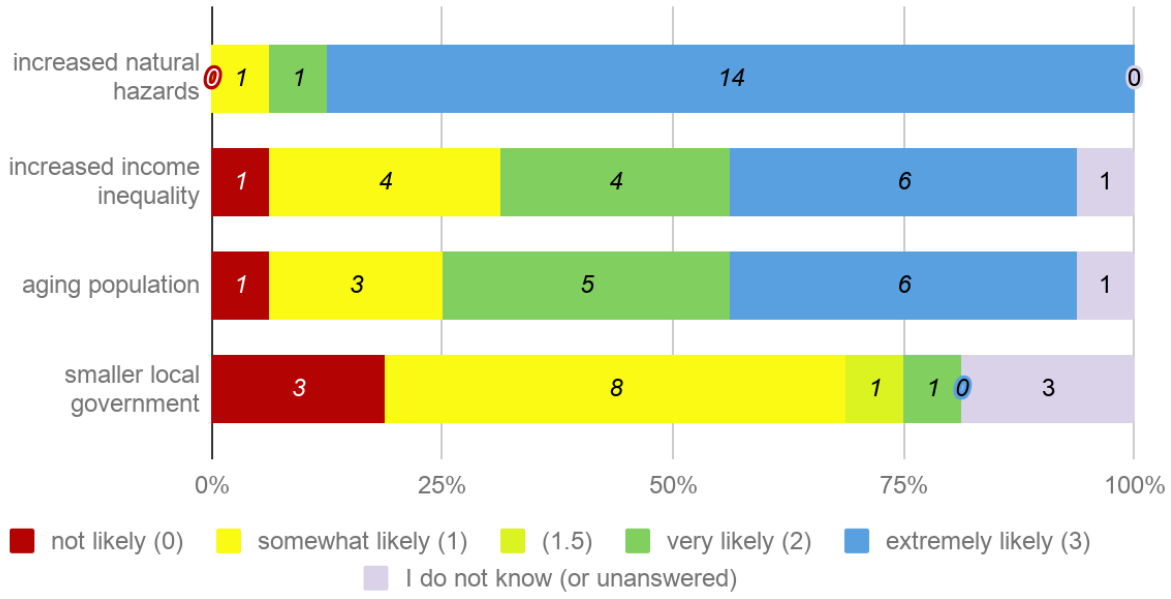
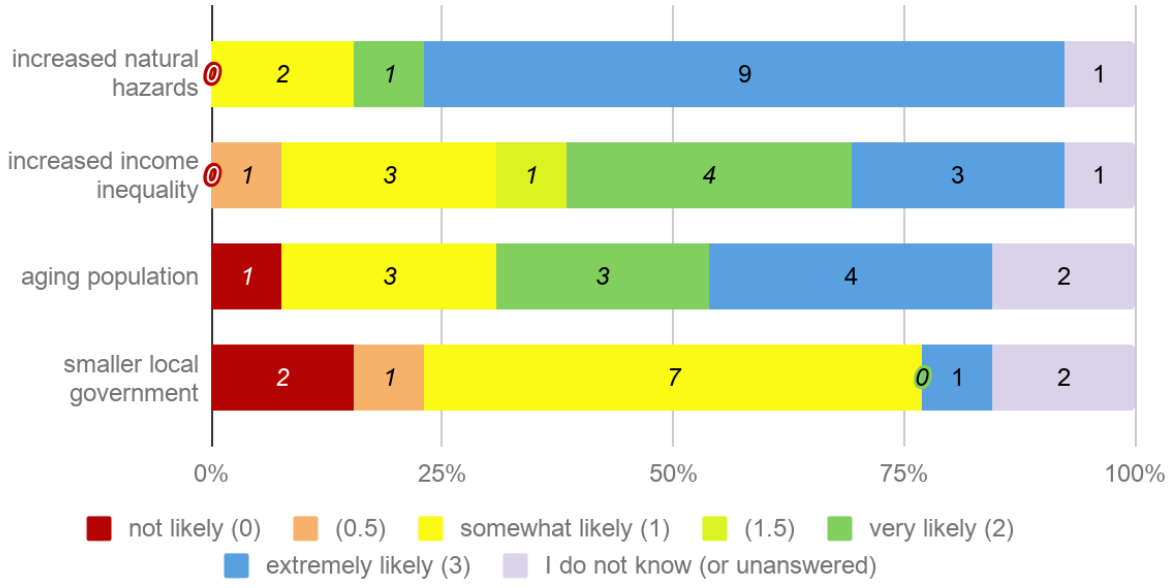


Figure II.8b Likelihood of Potential Future Risk Scenarios (Philly)



Approach to climate risk.

⇨ Returning to our list of hazards, please tell me using your professional judgement how much you expect each of the following hazards to be affected by climate change in [DelCo/Philly]:

Blizzards: DelCo $\bar{x}$=2.19 (n=16); Philly $\bar{x}$=2.23 (n=13); p=1

Coastal flooding: DelCo $\bar{x}$=1.88 (n=16); Philly $\bar{x}$=2.62 (n=13); p=0.20

Rainfall flooding: DelCo $\bar{x}$=2.69 (n=16); Philly $\bar{x}$=2.77 (n=13); p=0.70

Heatwaves: DelCo $\bar{x}$=2.63 (n=16); Philly $\bar{x}$=2.85 (n=13); p=0.81

Fires: DelCo $\bar{x}$=1.28 (n=16); Philly $\bar{x}$=1.08 (n=12); p=0.83

Gun violence: DelCo $\bar{x}$=1.57 (n=15); Philly $\bar{x}$=1.36 (n=11); p=0.55

Terrorism: DelCo $\bar{x}$=0.97 (n=16); Philly $\bar{x}$=0.73 (n=11); ***p*=0.05**

See **Figures 5.5a & 5.5b** in **Chapter 5: Results & Discussion.**

⇨ Please identify in your personal view how much the [DelCo/Philly] government has officially stated that it expects the following hazards to be affected by climate change within [DelCo/Philly]:

Blizzards: DelCo $\bar{x}$=0.78 (n=9); Philly $\bar{x}$=1.42 (n=12); p=0.06

Coastal flooding: DelCo $\bar{x}$=0.56 (n=9); Philly $\bar{x}$=1.77 (n=13); ***p*<0.01**

Rainfall flooding: DelCo $\bar{x}$=1.20 (n=10); Philly $\bar{x}$=2.31 (n=13); ***p*<0.01**

Heatwaves: DelCo $\bar{x}$=0.85 (n=10); Philly $\bar{x}$=2.54 (n=13); ***p*<0.01**

Fires: DelCo $\bar{x}$=0.11 (n=9); Philly $\bar{x}$=0.79 (n=12); ***p*=0.01**

Gun violence: DelCo $\bar{x}$=0.11 (n=9); Philly $\bar{x}$=0.44 (n=9); p=0.30

Terrorism: DelCo $\bar{x}$=0.10 (n=10); Philly $\bar{x}$=0.30 (n=10); p=0.45

See **Figures 5.6a & 5.6b** in **Chapter 5: Results & Discussion.**

⇨ How important would more robust regional, state, or federal policy be for [DelCo/Philly]'s climate adaptation and mitigation efforts?

Regional: DelCo $\bar{x}$=1.61 (n=14); Philly $\bar{x}$=2.13 (n=12); ***p*=0.04**

State: DelCo $\bar{x}$=2.27 (n=15); Philly $\bar{x}$=2.15 (n=13); p=0.51

Federal: DelCo $\bar{x}$=2.20 (n=15); Philly $\bar{x}$=2.31 (n=13); p=0.70

See **Figures 5.14a & 5.14b** in **Chapter 5: Results & Discussion.**

⇨ Overall, how would you rate the implementation of [DelCo/Philly]'s strategic climate planning efforts?

DelCo $\bar{x}$=0.46 (n=12); Philly $\bar{x}$=1.27 (n=13); ***p*<0.01**

See **Figure 5.11** in **Chapter 5: Results & Discussion.**

⇨ Would you consider yourself familiar with internationally-supported climate policies such as the Paris Agreement, Agenda 2030, or the Sustainable Development Goals?

DelCo $\bar{x}$=1.81 (n=16); Philly $\bar{x}$=1.62 (n=13); p=0.39

See **Figure II.9** below.

Figure II.9 Level of Participant Familiarity with Climate Policies by Location

