Linking Mitigation and Adaptation in Local Climate Change Planning: The Opportunity Facing Somerville, Massachusetts

by

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ABSTRACT

As climate change impacts are beginning to be felt and scientists project unavoidable levels of future change—cities are beginning to adapt. Simultaneously, they are expanding their commitment to mitigate carbon emissions, knowing that unless emissions are reduced significantly it may not be possible to continue adapting to future impacts. With increasingly constrained resources, cities are seemingly pushed in two different directions. In this report, I argue that instead of pursuing mitigation and adaptation as independent planning processes, cities should better integrate these goals in order to achieve important political, community, and sustainability impacts.

I consider the challenge of integrated climate change planning in the case of Somerville, Massachusetts, where city planners intend to link mitigation and adaptation in developing the city's first climate change plan. In doing so, I argue that Somerville can advance a more transformative approach to climate action that engages wider community interests, increases the urgency of mitigation, strengthens the link between climate policy, social equity, and sustainable development, and gains political support for actions that achieve multiple co-benefits.

Through interviews with North American planners, domestic and international climate policy experts, decision-makers within the City of Somerville, and local community organizations, I identify distinct approaches for acting on mitigation and adaptation integration. I then propose recommendations for how Somerville can pursue a not only integrated but transformative approach to its climate change planning.

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INTRODUCTION

As people and places are beginning to experience climate change impacts such as extreme weather events, increased temperatures and precipitation, and sea level rise—and scientists project unavoidable levels of future change—cities are beginning to take action. Climate adaptation planning is gaining momentum as cities take on the responsibility of reducing their residents' physical, social, and economic vulnerability to climate change. Simultaneously, U.S. cities are continuing and expanding their commitment to mitigate carbon emissions, knowing that unless emissions are reduced significantly it may not be possible to adapt to future climate impacts.

Because cities, operating under increasing financial constraints, are simultaneously taking on both mitigation and adaptation and must advance on both fronts in the coming decades to meaningfully reduce climate change impacts, some forward-thinking planners are trying to connect and integrate local mitigation and adaptation planning rather than pursuing them as independent planning processes. They are looking for compelling and practical strategies that broaden and sustain community engagement on climate change and can attract political support and funding by achieving multiple benefits. By effectively linking mitigation and adaptation, planners hope to identify and maximize co-benefits that can result from initiatives that are consistent with both goals and can potentially advance a comprehensive and effective approach to sustainable development.

In this report, I consider the challenge of integrated climate change planning in the case of Somerville, Massachusetts, where city planners intend to link climate mitigation and adaptation in developing the city's first climate action plan. Somerville is a city of 4.2 square miles and almost 80,000 residents, making it the most densely populated municipality in New England. It has not yet developed a climate mitigation or adaptation plan, and is seeking to pursue an integrated and innovative approach to its planning. I argue that by adopting a municipal climate change framework and planning process that intentionally links mitigation and adaptation, Somerville can advance a more transformative approach to climate action for several reasons. Linking mitigation and adaptation can enable more efficient use of limited staff resources, increase the urgency of mitigation action, and ensure adaptation is advanced through green rather than grey infrastructure strategies. Most important, it can increase the community development and social equity focus of local climate policy, thereby broadening the range of stakeholders engaged in climate action and increasing investment return on and political support for projects prescribed by the plan. By taking a comprehensive approach, Somerville can eschew traditional mitigation-adaptation siloes in favor of a more critical focus on developmental and economic drivers of both carbon emissions and climate vulnerability.

I base this argument on data gathered from an extensive literature review, as well as an analysis of the experience of North American sustainability planners and the current planning efforts and goals of the City of Somerville. I conducted interviews with planners in ten North American cities to assess the extent to which they had tried to integrate climate mitigation and adaptation strategies and how their efforts to link those goals influenced planning. I identified these cities by scanning municipal climate action plans to detect their emphasis on linking adaptation and mitigation strategies, taking into account the diversity of approaches to doing so that they represent. I also interviewed international and domestic climate policy experts from the academic, nonprofit, and public sectors, in addition to decision makers across the departments in the City of Somerville that are engaged in sustainability implementation (transportation and infrastructure, planning and zoning, sustainability and environment, capital projects, housing, communications and community engagement, and the mayor's office). Interviews with local organizations actively engaged in sustainability and climate efforts provided information on community priorities. In addition to conducting interviews, I analyzed city documents—including capital and master plans, budgets, departmental presentations, and planning documents—to assess the city's climate action priorities.

I regard Somerville as a potential model for advancing an integrated approach to climate change planning. Because Somerville does not have a formal mitigation or adaptation plan, it is in the unusual position of being able to link both goals from the beginning; the city's office of sustainability and environment is explicitly seeking to use its limited resources more efficiently by linking mitigation and adaptation planning. There is also broad and deep mayoral and staff support for innovative climate change planning: Somerville's mayor recently announced a goal of reaching carbon neutrality by 2050 and is the chair of the Boston-area Metro Mayor's Coalition, which will be convening regional climate adaptation efforts. Within the city, there are key opportunities for climate change goals to influence comprehensive mobility, zoning, and affordable housing planning, recently spurred by a $1 billion federal funding commitment towards the expansion of the MBTA Green Line. In addition, the city's aging housing stock and stormwater infrastructure, lack of green space, intensive anticipated transit-oriented development, and desire for local community development present clear climate action focus areas in which mitigation and adaptation may overlap.

My recommendations focus on how Somerville can ensure that its climate change planning fulfills its transformative potential by: 1) linking mitigation and adaptation under a resilience framework that centers on social equity, community development and empowerment, and public health and safety; 2) positioning climate action to influence citywide planning; 3) focusing on issues that have direct mitigation and adaptation overlap; and 4) engaging stakeholders that are traditionally involved and new to climate action.

THE SOMERVILLE CHALLENGE

The leadership and culture of innovation in Somerville present an opportunity for the city to advance practice on integrated and transformative climate action planning. Somerville is carrying out major zoning, housing, and transit-oriented development planning, spurred by the future extension of transit lines throughout the city. Several departments are advancing climate-related activities as part of these efforts, though the city lacks a climate plan that makes these actions explicit, unifies them, and provides additional rationale and political support. Strong political support from the mayor and the Office of Sustainability and Environment, in addition to active community groups organizing around sustainability and climate issues, provide the foundation for innovative action.

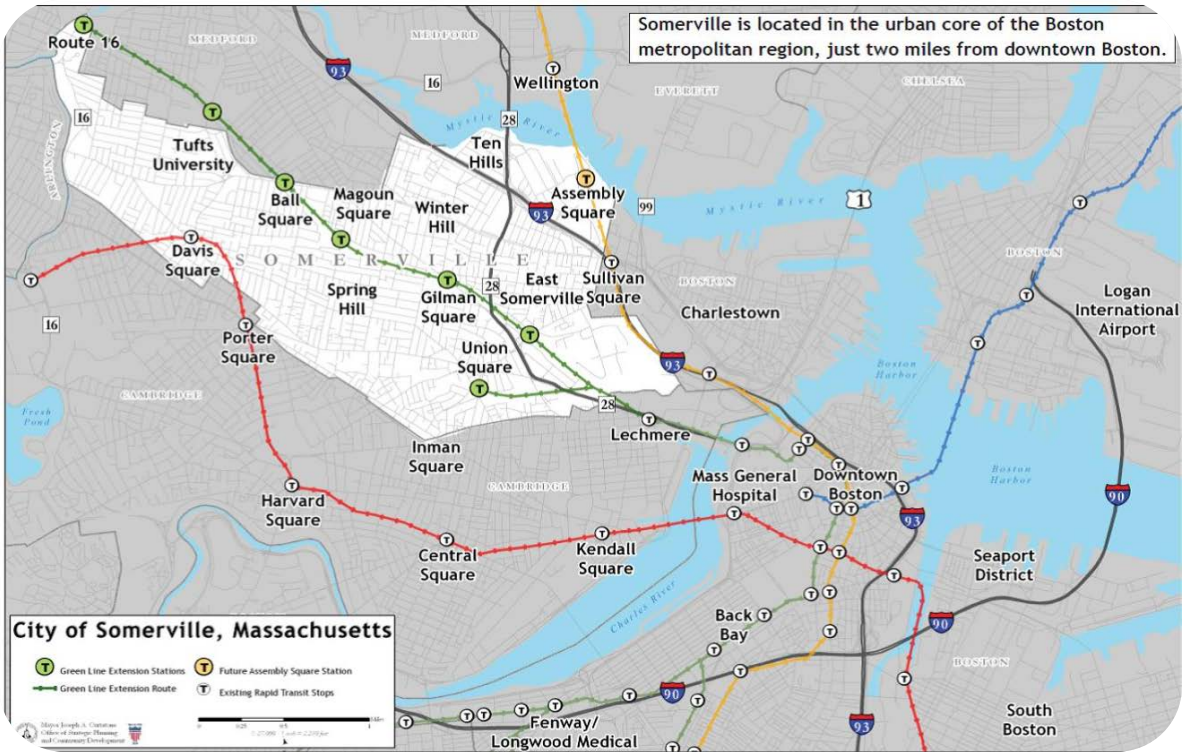
Somerville Today

Somerville is a dense, relatively young city where strong resident activism is matched by the popularity of a strong mayor. Somerville is located two miles northwest of Boston and is home to nearly 80,000 residents in 4.2 square miles. With a population density of 18,404 people per square mile, and a housing unit density of 7,909 per square mile, it is the most densely populated municipality in New England. Somerville has historically been known as an immigrant city; currently one-third of residents speak a language other than English at home and 27 percent of the population is foreign-born. Where immigrants to Somerville once came primarily from Europe, the city now attracts predominantly Brazilian, Haitian, and Latin American immigrants. Somerville is also home to a significant student and young professional population, and two-thirds of residents are renters (Ostrander 2013).

Somerville has a strong mayor system, and its current mayor, Joe Curtatone, has served for over a decade. Known for his energy, leadership, and commitment to innovation, the mayor has worked with diverse stakeholder groups in the city to make Somerville "a great place to live, work, play, and raise a family." The city was named "best run in Massachusetts" by the *Boston Globe* in 2006 (Ostrander 2013). But Somerville has experienced significant development and gentrification since the 1980s due to rising housing prices in nearby Cambridge and Boston, and the extension of public transit lines through the city. These patterns are on track to continue into this decade with the recent pledge of $1 billion in federal funding to extend seven new subway stations into Somerville, enabling 85 percent of residents (up from 15 percent) to live within a half-mile of a station (see figure 1) (Howe et al. 2013). Increased density and development have affected the city in many ways: open space has been reduced, with current levels at less than two acres of public space per 1,000 residents (the smallest amount in the state). Additionally, with three major highways running across the city, Somerville is one of the sites of greatest exposure to air pollution in Massachusetts (Al-Chalabi 2008).[1]

[1] 5.37% of Somerville's land is public space, though only 45% is owned by the city; the rest is owned and managed by the state DCR; MBTA; Middlesex County, and Tufts University.

Figure 1: Somerville's Location Northwest of Boston, and Proposed Green Line Subway Extension



Source: City of Somerville, 2012

Sustainability and Climate Action in Somerville

Sustainability and climate action have been driven in Somerville over the past 15 years by the mayor, key city staff and advisors, and an active and informed community. It has recently gained additional political attention with the mayor's citywide net zero goal, and regional climate adaptation planning. Efforts initiated in 2000 through the establishment of a municipal clean air task force and the resident-driven Somerville Climate Action group. In 2001 the city completed a municipal greenhouse gas inventory and in 2002 passed a resolution to reduce city emissions 10 percent below 1990 levels by 2015. Mayor Curtatone's strong commitment to climate and sustainability can be traced to this time, when he introduced legislation to form the Commission on Energy Use and Climate Change (CEUCC) while still an alderman in 2002. CEUCC is now an appointed body that advises the mayor on climate and clean energy initiatives. The group developed a 2003 climate action plan that primarily targeted energy efficiency across municipal, residential, and commercial sectors (Commission on Energy Use and Climate Change 2003).

In 2006 the mayor created the Office of Sustainability and Environment (OSE) to spearhead municipal sustainability initiatives and integrate sustainability across city operations. The director of this office reports to the mayor. In 2011 the mayor also supported efforts to designate Somerville a "green community," by participating in a state program that requires municipalities to allow as-of-right siting for clean energy

generation, develop a plan to reduce energy use by 20 percent in five years, purchase fuel efficient vehicles, and adopt a stretch code to minimize energy costs from new construction (Lusardi 2011). The Green Communities program awarded the city $362,175 in grant funding for clean energy initiatives, which has currently been allocated to LED streetlights and indoor lighting, electric vehicle charging stations, and digital temperature control in the high school (Sellers-Garcia 2014).[2]

Somerville's climate action leadership was propelled forward in 2014 when the mayor announced a commitment to achieve net zero energy use in the city by 2050. CEUCC members involved in the announcement attributed the mayor's decision to strong political instincts about how to generate local enthusiasm needed to support aggressive action. He understood that setting carbon neutrality as Somerville's target would demonstrate the city's clear commitment to climate leadership, and would motivate more community support than a lesser goal (such as a 50 percent or 80 percent reduction in greenhouse gas emissions) could achieve. Though the pathways towards the carbon neutrality goal remain undefined, city and community stakeholders understand the mayor's support of bold climate action as a "game changer". Following this announcement, Somerville has completed an updated municipal energy analysis, which attributes a majority of emissions to building electricity and heat oil use, most notably in schools and fire stations.[3] The city will release an RFP for a community-wide emissions inventory in 2015 whose results will support a forthcoming climate change planning process.

Very recently, climate adaptation has gained attention in Somerville as dramatic events such as 2012 super-storm Sandy and record-breaking snow levels convince residents and policy-makers that climate impacts are beginning to be felt locally. Though the city has yet to complete a climate vulnerability assessment, it is assumed that its vulnerabilities include extreme heat, increased precipitation and storms, and dependence on the resilience of Boston and regional infrastructure systems for employment, transportation, goods, and services. While municipal climate preparedness efforts are yet to be taken, Somerville's mayor chairs the Metropolitan Area Planning Commission's Metro Mayors Coalition, which in 2015 will convene local municipalities and regional and state agencies to advance regional climate preparedness.

Community groups in Somerville have also historically played an active role in planning processes, and focus efforts on issues of affordability, accessibility, equity, and participation. To be locally relevant and engage broader community interests, climate change planning must also address these goals. In 2009 several community groups aligned under the Community Corridor Planning initiative (CCP), organized by the

[2] Somerville has also developed a 20-year energy service contract with Honeywell, an energy service company, to advance municipal energy efficiency by evaluating and implementing energy and cost savings opportunities.
[3] Current GHG inventory data is inputted into the MassEnergy Insight portal and includes vehicle fuel for the city fleet but not employee transportation, and cannot be reasonably subdivided by departments who often overlap in building use space. Data is monthly and cannot be broken in shorter timeframes.

Somerville Community Corporation, to ensure community participation in “planning for a livable, equitable Somerville” and emphasis on displacement and affordable housing issues along the proposed green line corridor. The coalition, which was unique in its targeting and attraction of low-income, minority, and immigrant communities, emphasized core principles of protecting local jobs, businesses, affordability and diversity, environmental improvement through green space and pollution reduction, increased alternative transit opportunities and access, and community involvement (Ostrander 2013).

Additional organizations organize specifically on climate and sustainability issues such as increasing green space through depaving, green jobs training, food access and local food, pollution and waste reduction, energy efficiency and community solar, and climate change education. Several groups expressed a need for greater local awareness on climate issues (especially adaptation), and an increase in city outreach and initiative. Interviews revealed that while city staff encouraged targeting progressive parents and young professionals on these issues, community groups pushed for broader engagement of underserved communities that are most impacted by environmental justice, higher utility costs, and projected heat and flooding impacts. Community stakeholders were adamant for a participatory process focused on resident needs and priorities, with concrete participation outcomes and messaging centered on tangible and near-term quality of life improvements.

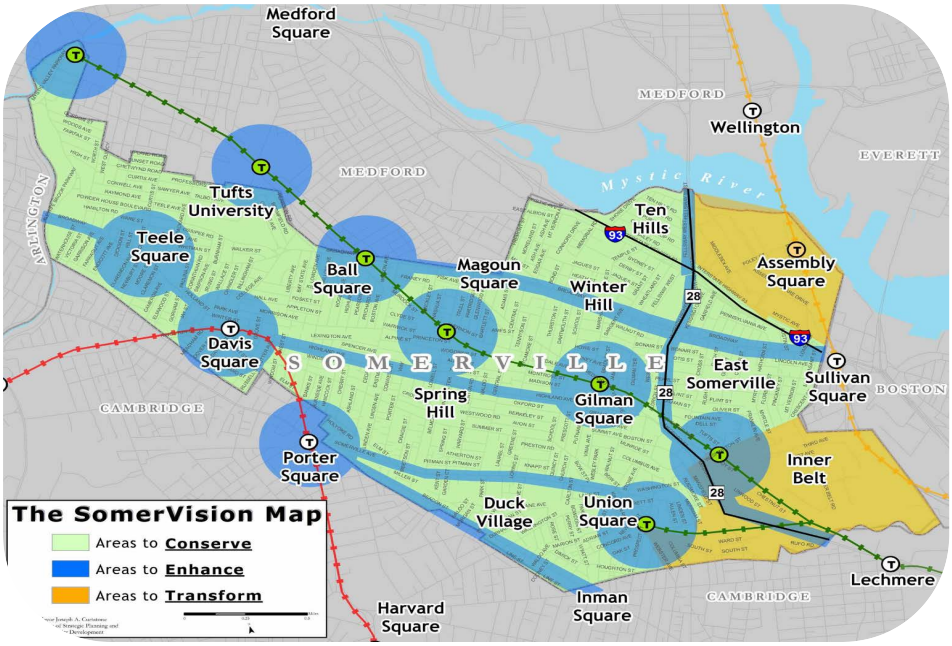
In 2014 city and community stakeholders including the Somerville Net Zero Design Team developed a climate systems mapping report for the city to identify intersections between local carbon emissions reduction and climate adaptation. It was the first effort to prioritize local climate action and attempt to strategically link mitigation and adaptation. In 2015 Somerville will be embarking on its first community-wide climate change planning process. Lacking a formal climate mitigation or adaptation plan and seeking to address both issues, the OSE has put forward the challenge to link these two goals in one planning framework. In doing so, the OSE can potentially utilize its limited resources more efficiently across issue areas, identify implementation strategies that advance both goals simultaneously, and attract greater buy-in for initiatives that achieve multiple community benefits.

Current Citywide Planning

Apart from the city's more explicit sustainability and climate action, several departments are implicitly advancing these goals through mobility and smart growth planning. Transit-oriented development in Somerville has propelled these major planning processes, as city and community stakeholders work to align projected future growth with equally significant improvements in local quality of life, sustainability, and equity (see figure 2). However, the lack of citywide climate goals and tracking mechanisms hinders the expansion of currently implicit climate action. An integrated climate action plan could support a variety of citywide efforts.

Within the Office of Strategic Planning and Community Development (OSPCD), the housing department is executing the mayor's 2014 Sustainable Neighborhoods Plan, a comprehensive affordable housing strategy that calls for the creation of 9,000 new housing units by 2030, 35 percent of which are affordable (Anon. 2014). This goal conflicts with residents' simultaneous desire for increased open space, and will place additional stress on the city's aging sewer and stormwater infrastructure system. The department also runs heating assistance and lead abatement programs for residents, and is thus a natural partner for expanding residential climate change programs. Further, a recent study funded by the Kresge Foundation in Somerville identified health hazards to residents living in housing near highways, and recommended mitigation through green infrastructure design solutions. Climate goals could bring further attention to the relationship between green infrastructure and public health (along with stormwater management and carbon sequestration), and lead to housing development standards that incorporate green infrastructure.

Figure 2: Projected Transit-Oriented Development along the Green Line Subway Expansion



Source: City of Somerville, 2012

The division of planning and zoning recently led an overhaul of the city's zoning code to promote transit-oriented development and smart growth yet lacks the specialized expertise to determine which climate solutions to focus its resources on. The division promotes development that balances open space conservation with growth and that does not simply push sprawl or carbon emissions onto neighboring communities. It supports neighborhood expansion near subway stations to increase transit use and reduced car trips, and seeks to minimize parking requirements in new buildings. Planning and zoning also implements an impervious surface ordinance and wants to promote on-site stormwater management more aggressively. Though the updated zoning code and current building standards do not address climate issues explicitly, according to the division director a forthcoming sustainability amendment could institute provisions such as the stretch code, development bonuses for LEED buildings and renewable energy, on-site stormwater management, and distributed generation. According to the director, better understanding of which strategies result in significant climate impact would improve the division's strategic directions, whereas currently he asks, "Should we focus on building systems or energy generation? How much of a density bonus should we give and for what? What can a homeowner or a developer do better? What is the most impactful retrofit?" (Proakis 2015).

The transportation and infrastructure department also advances climate goals implicitly through efforts to reduce car use and increase open space, yet because this work is not linked to citywide goals, misses an opportunity for greater political support and visibility. The department is primarily focused on mode-shift and increasing public transit, pedestrian, and cycling infrastructure, and will be developing the city's first comprehensive mobility plan. This plan will serve to implement the 2014 Complete Streets Ordinance, which encourages public health through walking, biking, and public transit, and a reduction in automobile dependence and congestion (Nosnik 2014). Somerville is the first city in the state to enact such an ordinance. The department also works to advance a citywide effort to increase open space by 125 acres in 20 years, though this target remains unrelated to emissions reduction or urban heat island targets. According to the department director, while the city holds significant control over relevant issues of water quality, stormwater management, and depaving, and climate and resiliency concerns are taken into account in planning, the department has never set explicit goals or tracking mechanisms.

Outside of the OSPCD, the city's capital projects and planning department holds responsibility for infrastructure repair and construction but does not yet connect its efforts to broader climate or sustainability goals. Aware of the absence of a municipal energy policy, the department is creating a new position in preventive maintenance that will be coupled with energy management responsibilities. Flooding is a major concern, as 75 percent of the city's combined sewer overflow system flows through Union Square, and planning for this aging system is based on current conditions and capacities (with no account yet for future climate and demographic projections). The department supports the mayor's net zero goals given community support and a clearer understanding of the

goal itself. As the director explained, “We want to do it all and have great projects. I need the buy-in and community support to pay for the more expensive ones. Knowing what net zero means, how quickly we need to get there, and if we’re willing to pay for it will let me do my job. If it’s the goal of the community, then that’s what we have to do” (King 2015).

Finally, Somerville employs a performance management system called SomerStat that tracks implementation across agencies, and could be used to hold departments accountable to climate action goals and inform capital planning, budgeting, and climate policy. According to a city manager, “It’s now common for capital planning to operate on a rot and replace basis; showing the climate costs will enable us to do more preventative work” (Hadley 2015).

INTEGRATED CLIMATE CHANGE PLANNING

In designing its climate change planning process, Somerville can learn from other cities that have linked mitigation and adaptation through either targeted initiatives or comprehensive planning. Somerville can also better understand its opportunity for municipal leadership by learning how ideas on effectively advancing these goals have evolved in research and practice.

Project-level Examples

Somerville's biggest sustainability challenges, including an aging and inefficient housing stock, lack of green space, and congestion, present an opportunity to integrate mitigation and adaptation. Mitigation-adaptation overlaps exist wherever a reduction in energy use (and therefore carbon emissions) coincides with decreased demand and dependence on centralized infrastructure systems, which are vulnerable in the face of a changing climate (Udvary and Winkelman 2014). Therefore, cities that want to better integrate mitigation and adaptation should focus on energy efficiency, alternative energy and distributed generation, green stormwater infrastructure, green building policies, urban forestry and open space, water efficiency and conservation, and local food system and community development. In theory, by pursuing strategies that advance both mitigation and adaptation, cities can achieve social, economic, and environmental co-benefits, enhance climate benefits of resiliency investments, increase the relevancy of mitigation action, and augment funding sources (Udvary and Winkelman 2014; Ayers and Huq 2008).

Several North American cities work at this nexus. Energy initiatives provide opportunities for mitigation-adaptation synergy: a focus on efficiency, alternative energy, and distributed generation can reduce energy use and carbon emissions, decrease demand on an overburdened electricity grid, and enhance grid resilience. An example is Surrey, British Columbia, where planners are focusing on downtown development and energy use. In 2012 Surrey passed the City Centre District Energy System Bylaw, which required that all new buildings in the downtown core have the capacity to connect to a district energy system in order to reduce energy use and emissions and build resilience to extreme heat or storm events and energy price fluctuations (see figure 3) (Burch 2014).[4] Similarly, Vancouver employs a density bonus for developers who connect buildings to a district energy system and has seen a 100 percent uptake by developers for this policy (Shaw et al. 2014). Washington D.C. is setting a target for all new buildings and infrastructure projects to undergo a climate change impact analysis by 2032. This analysis could enable the city to incorporate both mitigation and adaptation metrics in its green building regulations. D.C. is also focusing simultaneously on the efficiency and resiliency of its energy infrastructure through a citywide smart meter and smart grid infrastructure initiative and expanding local energy generation.

[4] The city owns and operates its own utility, Surrey City Energy.

Figure 3: Surrey, Baltimore, and D.C.'s Integrated Project Examples

Source: City of Surrey 2015, City of Baltimore 2015, Sustainable DC 2015

Baltimore provides another example of integrated mitigation and adaptation action. Though the city developed separate climate action, sustainability, and hazard mitigation plans, its "whole block approach" intentionally links these goals at the neighborhood level. Rather than implementing independent mitigation or adaptation strategies, the whole block approach targets energy and other greening retrofits, such as green and cool roofs, weatherization, green stormwater infrastructure, trees and vegetation, solar energy, and energy education. Residents benefit from a reduction in building heat gain and utility bills while also becoming more resilient to heat, flood, and storm impacts. In addition to advancing both mitigation and adaptation, Baltimore's whole block approach enhances social equity and community development (Udvary and Winkelman 2014).

Green stormwater infrastructure, such as green and cool roofs, tree planting, vegetation, bioswales, green walls, and pervious surfaces, are a particularly instructive example of the potential for climate co-benefits; these strategies have been demonstrated to decrease energy use and have carbon sequestration benefits (mitigation) while also retaining stormwater and reducing the building's indoor air temperature to combat the urban heat island effect (adaptation). Green building policies can be integrated to address both energy use and storm and heat resilience (Rosenzweig et al. 2006; Nowak and Crane 2002). For example, D.C. is planning for 75 percent of its landscape (both public and private) to be used for stormwater management and retention through 2 million square feet of green roofs, an expanded tree canopy (covering 40 percent of the district), pervious surface minimums by zoning district, and a 50 percent increase in wetland acreage along its rivers. Although primarily intended to absorb the impact of rainier weather, these initiatives will also reduce the city's carbon emissions by sequestering (small amounts of) carbon. Chicago's focus on heat as a primary climate impact has led to the city's reliance on green infrastructure to combat both the urban heat island effect and reduce building energy demands and use. The city's green roof, green alley, green streets, and sustainable streetscape programs have resulted in close to 600,000 tree plantings, an increase in thousands of acres of impervious surface, and over 4 million square feet of green roofs (see figure 4) (Office of Wetlands, Oceans and Watersheds 2010).

Similarly, water-use efficiency and conservation lead to energy use and emissions reduction benefits while making water systems more robust in the event of declining water supplies and drought. Broward County, Florida is threatened by a vulnerable water supply and decided to invest in water conservation initiatives (such as rebates for high-efficiency toilets and plumbing, mobile irrigation, and stormwater capture and redistribution to existing well fields) that are significantly less costly and energy intensive than alternative, grey solutions. According to an author of its regional climate action plan, "The energy-water nexus is a prominent example of where we actively addressed mitigation and adaptation concurrently…We didn't want to see mitigation strategies being overwhelmed by energy demand required for adaptation, and there was thoughtful consideration of the least energy intensive adaptation measures" (Jurado 2015).

The city of Boulder, Colorado also took an integrated approach to addressing flood vulnerability alongside emissions reduction. Utilizing climate adaptation funding, the city built a bike path system that, during a flood event, "transform into rivers, directing the flood waters safely through the city and to the other side" (Doig 2014). Under normal conditions, the bike paths facilitate the city's high percentage of bicycle commuters, thereby reducing dependence on cars and car-related emissions.

Figure 4: Broward County, Boulder, and Chicago's Integrated Project Examples

Source: Broward.org 2015, Next City 2014, Chicago Green Alley Handbook 2010

While the kinds of integrated approaches described above can yield co-benefits, mitigation and adaptation strategies may also be at odds. For example, on a large scale, increased density—a critical driver of emissions reductions—can lead to a reduction in green space that increases vulnerability by exacerbating the urban heat island effect and risk of flooding. More narrowly, the increase in air conditioners as a means to reduce heat impacts (or a city's requirement for all new buildings to include air conditioning) is an adaptation strategy that leads to an increase in energy use and carbon emissions (Laukkonen et al 2009). By taking an integrated approach, cities can ensure adaptation initiatives do not have negative impacts for mitigation (and vice versa), and work to mainstream both into broader planning and development processes (ICLEI 2008; Swart and Raes 2007).

Both scholars and practitioners identify additional benefits to initiatives that advance both mitigation and adaptation. Planners in Vancouver, Washington DC, and Cambridge emphasized that these efforts achieve multiple co-benefits and are therefore more politically compelling, garner more support, and may be implemented more quickly. Stakeholders are less likely to support adaptation responses that only provide future climate benefits and instead prefer solutions that achieve multiple community benefits now and "no matter what". In Seattle, planners said that the "climate question" (or how both emissions and vulnerability are affected) is asked for each strategy, and that additional justification exists to advance strategies that achieve both mitigation and adaptation. In addition, some policy experts expressed that government and foundation funders are pushing communities to identify creative solutions that both reduce their carbon footprint and are resilient, and those that can demonstrate such critical thinking may be better positioned for additional funding sources.

Integration in Local Climate Action Planning

Some cities have moved beyond targeted and project-level integration and link mitigation and adaptation more comprehensively in climate action planning. This is relatively new for North American cities, because national climate policy discourse evolved in a way that prioritized mitigation, and only recently began to see adaptation as a critical and complementary strategy. Previously, cities' climate planning efforts focused almost entirely on mitigation. Adaptation was seen by planners as counterproductive to mitigation efforts, defeatist, and likely to draw valuable attention and resources away from mitigation (Swart and Raes 2007). Recently however, dramatic events like super-storm Sandy have convinced many planners that the aim of both mitigation and adaptation is to reduce risks of negative and unavoidable climate impacts, and that even aggressive mitigation action won't prevent historical emissions or near-term climate impacts (Wilbanks 2003; Pielke 2007). One climate policy expert expects that linking these goals is "what we're all going to be doing by 2017. They need to be put back together again" (Adams 2014).

Cities are increasingly recognizing their responsibility for taking on both mitigation and adaptation in climate change planning, and the potential sustainability, community engagement, and political benefits for doing so. The following cities provide examples of plans that explicitly integrate these goals. Eugene, Oregon's 2010 "Climate and Energy Action Plan" is divided into six action areas (buildings and energy, food and agriculture, land use and transportation, consumption and waste, health and social services, urban natural resources), each of which asks "How is this sector contributing to GHG emissions?" and "How can we prepare this sector for climate change?" (see figure 5) (Anon. 2010). Integration was also prioritized in the city's vulnerability assessment, which addressed climate and natural hazards and energy use as regional vulnerabilities. The integrative structure was mandated by the city council; planners said this support and direction was key to guiding the longer-term planning process. Whereas some city staff

were hesitant to take on the strongly integrative approach, since it required a difficult balance between multiple and often competing goals, planners credited the approach with enabling more efficient use of limited financial resources and preventing maladaptive strategies (McRae 2014).

Surrey, British Columbia, a municipality in the metro Vancouver region, intentionally linked mitigation and adaptation in its Community Climate Action Strategy, whose purpose is to "reduce emissions and adapt to climate change". Sustainability planners had developed separate mitigation and adaptation plans, and decided to bring the two together in the integrated strategy. The city identified critical overlaps between mitigation and adaptation in four key areas: ecosystem protection, hazard avoidance, and compact land use; ecosystem health and carbon sequestration; heat management and passive solar; and community-based energy systems and self-sufficiency. In each category, the plan identified mitigation strategies with adaptation benefits, and adaptation strategies with mitigation benefits. In evaluating its adaptation strategies, Surrey prioritized mitigation co-benefits, followed by cost, urgency, window of opportunity, political acceptability, funding, and capacity. Sustainability planners understand a part of their role as bringing an integrated lens to mitigation and adaptation planning in framing climate action to the city council and broader community (Anon. 2013; Mathewson 2015).

Philadelphia, Pennsylvania incorporated mitigation and later adaptation into the city's sustainability plan, Greenworks, which was developed as a response to public pressure to increase urban quality of life. In 2009 climate action framing did not resonate with the public, and the plan was structured under the broader categories of energy, environment, equity, economy, and engagement. Though adaptation was only explicitly included in Greenworks in the 2012 update, planners said that strategies had always addressed both mitigation and adaptation, and specifically mentioned that these goals were linked through energy efficiency, district energy, building retrofits, and green infrastructure planning. Within the plan, mitigation-adaptation overlaps are explicitly emphasized and visualized. Planners also took an integrated approach to focus climate communication on livability, public health, green space, and slowing carbon emissions and reducing stormwater. They expected these messages would engage and educate residents, gain long-term buy-in for initiatives, and better address citywide sustainable development objectives (Wu 2014; Dews and Wu 2012). Planners were clear that this framing is a more powerful way to engage residents than using "adaptation and mitigation" terminology (whose distinction is not always clear or useful on the local level), and is a progressive example of where the urban sustainability and climate action field is moving.

Figure 5: Eugene, Surrey, and Philadelphia's Climate Action Planning Examples

Source: City of Eugene 2010, City of Surrey 2013, City of Philadelphia, 2012

An integrated climate framework provides additional benefits, including more entry points to the climate conversation beyond emission reductions that can engage broader community interests. Increased participation and collaboration across city agencies can lead to greater operationalization of climate action, and increased embeddedness in city practices and stability in the face of political change. As one planner explained, "If they are not linked, one has the chance of falling to the wayside as political interests change…Integrated approaches with co-benefits will harden the argument and ensure greater capacity for continuation of shared interests and investments, and multiple champions" (Jurado 2015). Planners also acknowledge that integrated climate action planning can enable limited financial and human resources to address more comprehensive climate issues, as these goals are often tied to similar resource bases, city staff, and stakeholders.

There is another benefit of integrated climate action planning that is only beginning to be understood. Some scholars have begun to argue that adaptation planning and investment—which moves climate change from an abstract and future concern to a tangible and real-time challenge—has the potential to advance action on mitigation at the local level. The idea is rooted in the social psychological principle of "loss aversion," according to which if people perceive their reference point as one of "losses" they act in a more risk-seeking manner in an effort to re-stabilize their reference point. Translated to climate action, if people believe their city will face impending climate impacts caused by past emissions, they may be more inclined to support intensive emissions reduction measures to mitigate such impacts (Abassi 2006). King County executive Ron Sims observed this in Seattle, in noting increased support for a city mitigation strategy following proposed investments in adaptation infrastructure. The link between perceived climate impacts and a desire to reduce future harm presents a potentially important opportunity for increasing civic engagement and support for climate mitigation by explicit integration with adaptation action (Center for Science in the Earth System 2007).

This finding, however, is contrasted in Miami, a city with extreme climate vulnerability. With federal stimulus funding for energy efficiency exhausted and the realization of inevitable regional climate impacts, one sustainability planner expressed that the focus locally has shifted from mitigation to adaptation. “While mitigation remains an important concern, given limited available resources, our efforts may be better spent focusing more on adaptation, especially keeping in mind that the nature of our peninsular geography makes mitigation arguably less effective than in more continental locations. Moreover, our vulnerability to extreme weather events increases the urgency to adapt to the expected impacts of climate change” (Stewart 2015). Though a unique example, Miami highlights challenges to integrated climate action planning. Planners in this region identified the need to continue considering adaptation solutions that did not have mitigation benefits, such as flood barriers or raising the construction level of buildings, and a liability (unlike with mitigation) for not elevating the adaptation conversation (Jurado 2015). Other cities such as Seattle also recognized challenges in aligning implementation, since adaptation is often seen as more location-specific than mitigation.

Additional challenges to pursuing a more integrated approach could also include longer plans covering more issues, an increase in their scope of work, and the fact that some stakeholders do not care equally about both issues. Critics in the academic literature are concerned about focusing on mitigation-adaptation synergies because of the different temporal and spatial scales, costs, and actors traditionally involved in the separate policy arenas. Despite potential synergies, these critics argue that decision-making remains siloed across agencies, and initiatives that aim to combine mitigation and adaptation may be costly, difficult to implement, and produce insufficient climate benefits (Swart and Raes 2007; Klein 2005).

Broader Alignment with Sustainable Development

Beyond targeted implementation measures and integrated climate change planning, some cities are taking a deeper approach by aligning their climate policy with broader sustainable development. In Copenhagen, Denmark and Malmo, Sweden, planners attempt to identify underlying drivers of both emissions and vulnerability, and position climate action to influence spatial and economic development. These cities provide a more advanced example of integrated planning because of this framing, and the plan implementation that has ensued. Copenhagen's adaptation plan is a green growth and sustainability strategy to improve livability, attract businesses and residents, and increase green space, recreational opportunities, green jobs, and environmental protection. The city's integrated approach is captured in its motto, "A Greener Copenhagen is a Climate-Proof Copenhagen". From Copenhagen's perspective, mitigation is preventive adaptation, and adaptation is an opportunity to advance both short- and long-term sustainable development. In particular, the plan identifies the adoption of green stormwater infrastructure (GSI)—such as preserving and connecting green space, green roofs, walls, and rainwater gardens, pocket parks, and concentration of new development around transit nodes—as a critical adaptation strategy that provides benefits in terms of heat and flood resilience, recreation and livability, energy use reduction, and carbon sequestration. GSI strategies support Copenhagen's efforts to become carbon neutral by 2025 (see figure 6) (Anon. 2011).

Malmo, Sweden integrates its mitigation and adaptation goals under the banner of "Climate Smart Malmo". To both reduce carbon emissions and support local economic development through adaptation, Malmo focuses on energy, transportation, and sustainable consumption strategies that combine mitigation and adaptation objectives. Solar, urban wind energy, biogas, renewable energy districts, and strict energy efficiency targets advance local renewable energy generation and distribution goals. Public transit travelers benefit from priority bus and bicycle lanes and expanded bicycle infrastructure, and the city promotes mode-shift educational campaigns (such as "No ridiculous car trips!") and fuel-efficient driving training programs for city employees and large companies. Sustainable consumption, which reduces carbon emissions and builds local resilience, is advanced through local food purchasing in the school system, a sustainability checklist as part of the events permitting process, and a "Fair Trade City" designation that promotes and regulates local and ethical procurement (Anon. 2009). These strategies aim to reduce carbon emissions while stimulating local economic development, aligning municipal resources more effectively, and improving the city's green profile (Lenhart 2015).

This level of integration can broaden the scope of both the mitigation and adaptation conversations. These cities understand that there is a risk of cities working at cross purposes if the two goals are not intentionally coordinated, and an opportunity to strengthen climate policy when they are. Research is also showing that integrated approaches that advance broader sustainability goals may be more effective than a singular focus on mitigation, and that how these two goals interact may determine larger urban sustainability and resiliency outcomes (Ayers and Huq 2008; Shaw et al 2014).

Figure 6: Copenhagen and Malmo's Comprehensive Planning Examples

Source: Inhabitat 2012, Malmo stad 2009

Transformational Resilience

However, despite a growing number of climate action plans, carbon emissions continue to rise, and vulnerable communities are beginning to feel climate impacts. And while climate policy has been dichotomized between mitigation and adaptation, it has avoided addressing root drivers of both emissions and vulnerability, such as economic inequality and high levels of consumption, as central climate action strategies. A separate approach to climate change planning is emerging out of dissatisfaction with these outcomes. It moves away from a technical focus on emissions reduction and flood management towards a socially driven "transformational resilience" that emphasizes the potential for climate action to address root causes of poverty and unsustainable development, as well as the need for aggressive carbon mitigation.

Transformational resilience contrasts a more traditional incremental approach, which seeks to "bounce back" or maintain existing systems, by "bouncing forward," or actively improve city services and infrastructure, and address social inequalities that maintain vulnerability as a critical climate policy objective (Pelling 2011; Bahadur and Tanner 2014). The scope of transformational resilience includes food security for low-income residents, affordable housing, basic service provision, environmental justice, and resilient and carbon neutral water, energy, and transit infrastructure. These initiatives should also promote equity, inclusiveness, community agency, and innovation (Revi et al 2014; Kresge Foundation 2015).

Done in a serious way, then, linking mitigation and adaptation can refocus climate change planning to the developmental and economic drivers that increase both carbon emissions and vulnerability, and on the need to advance sustainable development through policies that also strengthen community voice and empowerment, improve public health, reduce demand on ecological systems, reduce consumption, and increase resource use efficiency. It aims for more substantial integration with development decision-making (such as economic, land use, transportation, and energy) and social equity objectives, and is evaluated by indicators beyond carbon emissions (Shaw et al 2014; Burch et al 2014).

There are limited examples of cities that have taken on a transformational resilience approach to date, though this work is beginning at the community level. Through the Kresge Foundation in 2014, for example, $1.7 million went to support 16 community-based organizations across the U.S. engaged in climate resiliency planning that addresses socioeconomic disparity and directly benefits low-income communities. In 2015 the NAACP's Climate Justice Initiative guided government agencies towards a more transformational approach by developing a list of indicators of equity in resiliency planning. These included local job creation, community benefits agreements for development, household food security, residential displacement, and inclusive stakeholder engagement (Patterson 2015). Norfolk, VA, recognized in 2013 in the first cohort of Rockefeller Foundation's "100 Resilient Cities", is beginning its climate resiliency planning through a focus on "…slowing the growth in economic and health disparities" (Armstrong 2014). Cities should follow the lead of these progressive non-profit networks, foundations, and community-based organizations that are pushing alternative and transformational definitions of climate resilience that move beyond adaptation and mitigation (Movement Strategy Center 2015).

RECOMMENDATIONS FOR SOMERVILLE

Somerville faces an unusual opportunity to link mitigation and adaptation goals from the inception of the city's climate change planning and pursue a more transformative approach to climate action. Somerville can learn from and go beyond the examples set by other cities by positioning climate change as a more comprehensive planning issue whose overarching framework and urgency can serve to advance livability, environmental, public health, and community development concerns. Specific interest by leadership in addressing both goals in one planning framework, overlap of mitigation and adaptation benefits across local climate challenges, and broad support across city and community stakeholders provide the foundation to advance in this strategic direction. Based on my research, I recommend the following steps to help city staff conceptualize and operationalize integrated climate change planning:

- *Link mitigation and adaptation under a broader resilience framework*: An integrated planning framework that places issues of social equity, community development and empowerment, and public health and safety at its center will engage a broader segment of stakeholders and steer implementation towards efforts that achieve multiple benefits and garner broad political support. Planners can increase the effectiveness of communication by using concrete examples of climate impacts, links with resident concerns, and immediate actions the city can take.

- *Position climate action to influence citywide planning*: Setting citywide climate goals can tie together, draw attention and exert pressure to existing climate efforts across departments, and fill gaps where responsibilities do not yet exist. Somerville can act on its goals through legislation, influencing ongoing zoning, mobility, and affordable housing planning, and holding departments accountable for improving their own performance.

- *Focus on issues that have direct mitigation and adaptation overlaps*: Issues such as energy, green space, mode-shift, and local community development advance both mitigation and adaptation. Emphasis here can lead to carbon emission reductions, increased resilience, reduced demand and dependence on the energy grid, cost savings, air pollution reduction, and green job creation.

- *Engage stakeholders that are both traditionally involved and new to climate action*: City agencies and community-based organizations are key to strategy development and implementation and must be engaged from the beginning. The city must also strengthen the voice of vulnerable communities that will be most impacted by climate change and create conditions that sustain a diversity of participation.

Link Mitigation and Adaptation under a Broader Resilience Framework

This recommendation focuses on how Somerville should think about local climate change planning at a high level in order to expand its community engagement and achieve meaningful social and environmental impact. By linking mitigation and adaptation under a climate resilience framework, Somerville can follow the example of progressive non-profit networks and foundations and lead city governments in broadening climate change planning from a more narrow focus on energy and disaster preparedness to a more transformative approach to building local resilience. This can be advanced through explicit links with climate change, social equity, and community development issues (such as mode-shift, affordable housing, living wage advocacy, and job creation). Somerville should assert that climate change planning will prioritize strategies that don't merely "bounce back" to the status quo but "bounce forward" to advance progressive livability, accessibility, and public health objectives (Pathways to Resilience 2015).

An integrated climate resilience framework will push Somerville to ask how to take action that both reduces carbon emissions *and* demand on central infrastructure systems *while* improving local community development objectives. It is a tool for assessing priorities, driving increased political support from city and community stakeholders, creating stronger partnerships between the Office of Sustainability and Environment, Office of Strategic Planning and Community Development, and Capital Planning, and positioning climate change as a more comprehensive planning issue moving forward. It can also enable Somerville to address multiple issues more efficiently, ensure adaptation is not furthered through energy intensive strategies, increase the equity focus of local climate policy, and increase support for efforts that achieve multiple co-benefits (Shaw et al 2014). It is important because according to one interviewee, "Multi-benefit investments are important for cities no matter what the goal....The same questions of what, where, and how you build are the same for adaptation and mitigation. What is needed are compelling and practical solutions that will actually get implemented" (Winkelman 2015).

Communication with stakeholders should therefore be centered on climate resilience, that more accurately describes the broader municipal concerns of energy security, public health and safety, community development, and social equity that climate change planning aims to address. Many even noted that the distinction between "mitigation" and "adaptation" can be unclear and confusing to residents in the first place. As advised by interviewed sustainability planners, climate change plans that are communicated in such equity and community development frameworks are more powerful tools to engage and educate residents, gain support, align with city sustainable development objectives, and are reflective of the direction the urban sustainability and climate action field is moving.

Local stakeholders were also clear that effective climate communication includes concrete examples of how climate change is real for Somerville residents now (such as higher food prices, increase in heat alert days, rising utility bills and cost of living, health impacts, and flooding), and should help residents set targets and report on suggested actions that take into account differences in income, homeownership status, and commitment levels. The city should not emphasize methodology or intangible "future quality of life" improvements. Instead, focus on how both mitigation and adaptation can lead to improvements in the city's livability now, and show community members what is known and ask, "what does this mean to you?"[5]

Position Climate Action to Impact Citywide Planning

The following three recommendations apply to how Somerville can act on the climate resilience framework described above. Though Somerville's potential impact on global emission reductions and climate vulnerability will be limited, the city can advance climate leadership by serving as an example of a small, diverse city that has chosen to integrate its climate mitigation and adaptation goals under a resilience framework. Through plan implementation, Somerville can provide examples of visible projects that link mitigation and adaptation to equity and sustainable development, and in doing so better position the city for funding and engage a broader range of stakeholders. These examples can be replicated across cities, and provide the state with justification for expanding its own funding of local climate change efforts.

To position climate action to impact citywide planning, Somerville should consider the following key leverage points: climate change goals, SomerStat, legislative support, and current citywide planning. By launching a climate change planning process, the city can identify baselines on carbon emissions and vulnerabilities from which climate goals, timelines, and tracking mechanisms can be set. This will help guide and validate decision-making, prioritize efforts, draw attention and exert pressure on relevant work underway, increase departmental accountability, and assess the extent and focus of community support. Stakeholders emphasize that without knowledge of where the city currently stands and where it intends to go, climate action will be stymied. As a high-level city manager also said, "We hope a climate change plan will not just be aspirational, but actionable, adopted by the board, and a policy document on par with Somervision" (Hadley 2015).

[5] To explain the logic of addressing both mitigation and adaptation simultaneously, some stakeholders suggested the metaphor of a bathtub overflowing: "at some point we need to put down some towels, but we still need to fix the tap". Platforms such as the ResiStat newsletter, SomervilleMoms Yahoo group, Somerville Community Access Television, Welcome Project and Centro Presente, enhanced social media presence, and a website devoted to climate action and behavior tracking should be utilized to reach residents. Platforms should not only provide information, but facilitate a two-way dialogue on residents' solutions and priorities, with the needs of lower-income and vulnerable communities at the center.

With many departments such as Transportation and Infrastructure, Planning and Zoning, and Capital Projects advancing climate goals in some capacity, though not under this banner, climate change planning also provides value by linking this work to a larger city goal, providing urgency and a mayoral mandate for its expansion, and potentially additional grant funding. It is an opportunity for more coordinated planning and implementation across these departments' related efforts, something some city staff emphasize is currently limited. For example, climate change targets can provide the Transportation and Infrastructure department with a link between its mode-shift efforts and emission reductions and resiliency, and open space expansion with urban heat island reduction goals. Planning and Zoning will have a reason to codify climate action in zoning ordinances, and put resources towards clarifying current information gaps (such as energy standards for new development, impactful retrofits and building systems to encourage, and the inclusion of on-site stormwater management in development costs). Climate changing planning will push departments to take on long-range planning that considers regional climate projections. It can also bring awareness to--and fill--the gaps in climate responsibilities that currently exist across Somerville's departments. Most notably is a lack of energy efficiency and alternative energy management in the city, and widespread programs that support residents and landlords in retrofitting and purchasing renewable energy. Also missing is a focus in Planning and Development on energy and resilience targets and design standards for new and existing buildings, and the inclusion of such targets in budgeting and investment priorities.

These goals can then be translated into climate resiliency metrics that departments are held accountable to through SomerStat. This will enable the city to track cumulative effects of its actions, and demonstrate how climate change planning can guide longer-term development policy and capital planning decision-making. Somerville should look to the City of Surrey's "Sustainability Dashboard" as an example of comprehensive sustainability tracking beyond carbon emissions such as energy retrofits, water consumption, stormwater management, and community infrastructure investments ("Sustainability Dashboard" 2015).

Legislative support is another important lever for ensuring climate action longevity. By codifying its net zero energy goal (following the example of Eugene, OR that passed an ordinance requiring all city buildings and operations to be carbon neutral by 2020 (Anon. 2014)), Somerville will center climate policy as a legitimate city priority that can influence current and expected development. It would also increase its political immunity over time and establish a clear citywide goal to justify departmental action and investment. By seeking adoption of the climate change plan by the Board of Aldermen, the profile of climate action will be raised to the level of a policy document that guides development and decision-making on par with Somervision.

Three ongoing citywide planning efforts are also key opportunities for integrated climate change planning to directly influence Somerville's land use and redevelopment trajectories. The OSPCD has proposed a sustainability amendment to its 2015 zoning overhaul, which itself did not emphasize sustainability or climate concerns. The OSE should partner with the OSPCD to ensure this amendment advances mitigation and adaptation by eliminating barriers to residential alternative energy use or generation, creating density bonuses for LEED buildings, green roofs, distributed generation and affordable housing, requiring on-site GSI, introducing parking maximums, requiring a minimum density for transit-oriented development projects, and incentivizing tree preservation and planting, especially in lower-income neighborhoods (Duerkson 2010). Upcoming mobility planning to implement the 2014 Complete Streets Ordinance is another key opportunity. This ordinance will expand bike and pedestrian infrastructure, in addition to traffic calming and greening elements. GSI should be central to these efforts, and strategies should be assessed for their impact on emissions and vulnerability reduction.

Proposed housing development (to meet Somervision's goal of 9,000 new units by 2030) is the third critical area, and has particular importance for linking mitigation and adaptation. Increased strain on the city's already at-capacity wastewater management system raises flooding and adaptation challenges; mitigation is relevant because of the need for new development to align with the mayor's net zero energy goal. Citywide climate change goals would therefore influence new housing development (and any capital investment in the city) to meet net zero standards, not be sited in vulnerable locations, have the capacity to connect to a district energy system, require green stormwater infrastructure, minimize construction waste, and guarantee local living wage green jobs.

Focus Implementation on Issues with Direct Mitigation and Adaptation Overlap

By targeting issue areas that have direct mitigation and adaptation overlap, Somerville can pursue action that achieves multiple community benefits, aligns with the goals of its comprehensive plan, and advances practice on integrated planning. Cities such as Eugene, Surrey, and Philadelphia provide unique examples of plans where mitigation and adaptation are not isolated in separate chapters or plans but rather addressed as key components of broader urban sustainability issues. Somerville should apply a similar approach, identifying its key focus areas and then strategies that advance both mitigation and adaptation. A clear relationship with equity and community engagement should be identified across all topics. The plan should also advocate for the state's role in advancing regional climate action through large-scale distributed generation, utility restructuring, regional climate preparedness, and investment in public transportation infrastructure. Primary mitigation-adaptation overlaps in Somerville include:

- Energy: efficiency, alternative, and distributed: With the highest emissions coming from buildings, and a residential housing stock that is 50 percent of the city's land area and comprised of a majority of buildings built before 1910 (City of Somerville 2009), a focus on energy efficiency, renewable energy generation and purchasing, and green job creation is clear. Somerville should pursue efforts such as residential energy efficiency programs, community solar, solar and efficiency potential mapping, green building standards, partnership with green job training programs, and micro-grid development. District energy development could enhance the impact of energy efficiency initiatives, by further reducing energy use, emissions, and dependence on the grid. Baltimore's "whole block approach" provides a model of how multiple strategies can be integrated through neighborhood level planning. A partnership between the Office of Sustainability and Environment, Planning and Zoning, and Housing Department (that already coordinates home retrofit programs) to advance these efforts would be valuable.

- Green space: Highlighted as a priority among residents, increasing green space is particularly relevant and urgent give the city's rankings at the bottom of the state's open space and air pollution rankings. Through requirements and density bonuses for GSI (such as green alley programs, green roofs, bio swales, depaving, and pocket parks), on-site stormwater management standards, Complete Streets Ordinance implementation, green permitting programs, and increasing the tree canopy, the city can reduce both air pollution and building energy use (mitigation) in addition to reducing the urban heat island effect and improving stormwater management and livability (adaptation) (Mohareb and Kennedy 2012). To advance this goal, the OSE should provide input to the new zoning code's sustainability amendment, and work with the Housing Department on increasing green infrastructure in housing development to mitigate local health hazards.

- Mode shift: An increase in public transit, bike, and pedestrian infrastructure is a city priority as the Green Line is extended throughout Somerville, and advances both mitigation (reduced vehicle miles travelled) and adaptation (increased public transit accessibility) goals. As these efforts are already responsibilities of the OSPCD and supported through the Complete Streets Ordinance, what is missing is an explicit link to citywide climate goals that can further increase their relevance and urgency. Climate change planning should then serve to advance issues of equity and accessibility that are key to building resilience.

- Water: quality, conservation, and management: Water conservation and efficiency strategies are key mitigation goals, and locally relevant given the city's aging sewer and stormwater infrastructure system. This is also an area the city has influence over, and flooding represents an existing challenge stakeholders are already seeking long-term planning solutions for. Support exists in the Capital Projects and Planning Department that seeks to minimize demand on the at-capacity stormwater management system that will be burdened by a substantial increase in housing. In the

short term, the city should explore green stormwater infrastructure strategies identified above in addition to water leak retrofits; in the long term, addressing the combined sewer system in light of existing constraints and expected population growth is a priority.

- Waste and sustainable consumption: Waste reduction can reduce municipal costs, carbon emissions, and pollution levels while building a more sustainable culture. To advance this goal, Somerville can undertake a curbside composting program, green procurement policies, and construction waste diversion requirements (especially important as the city advances significant transit-oriented development). Local food system support is also an element of sustainable consumption, and could be advanced through municipal procurement and an expanded partnership with Shape Up Somerville, the city's public health initiative.

- Local community development: The city should focus efforts on strengthening local economic and community development opportunities for low-income residents as a central climate change goal. An expanded local food system, green job training and opportunities, energy efficiency programs that reduce utility costs, affordable housing, and policies such as community benefits agreements and inclusionary zoning are issues that link directly to climate mitigation and adaptation priorities. As it expands, the OSE should see the Economic Development and Housing Departments as key city partners and stakeholders. Local resilience is strengthened, sprawl minimized, and emissions per capita reduced when residents can continue to live and work in Somerville, eat less environmentally impactful food, live in more energy efficient homes, and work living wage green jobs. This focus expands the rightful applicability and relevance of climate action to broader constituencies.

Engage Stakeholders that are Traditionally Involved and New to Climate Action

A climate resilient framework necessitates that the planning process actively supports the engagement and leadership of vulnerable communities most impacted by climate change. Interviewed sustainability planners agreed that having the "right people in the room" from the beginning is critical to more effective plan development and implementation. The OSE should put together a steering committee to guide planning and implementation that includes staff from:

- Office of Sustainability and Environment:
- Office of Strategic Planning and Community Development (Transportation and Infrastructure; Planning and Zoning; Housing; Economic Development)
- Capital Projects and Planning
- Department of Public Works
- SomerStat
- Communications and Community Engagement

Other agencies to include are Health and Human Services and the Council on Aging that are well positioned to support efforts to minimize climate health impacts to vulnerable populations. The School Department is also an important partner in reaching students and parents, and--with the most energy-intensive municipal buildings--engaging in efficiency programs.

Community-based organizations must be engaged throughout the planning process as they provide a more defined understanding of resident interests and priorities, and are better positioned to engage residents not traditionally involved in climate issues. Relevant organizations already engaged in sustainability and climate action within Somerville include:

- Somerville Climate Action
- Groundwork Somerville
- Somerville Transportation Equity Partnership (STEP)
- Fossil Free Somerville
- Mystic River Watershed Association
- Union Square Neighbors and Union United
- Somerville Community Health Agenda
- Somerville Community Corporation

Stakeholders within these organizations identified a number of other community-based organizations that are currently less engaged on climate issues, yet reach constituencies that are most vulnerable to climate impacts and therefore must be engaged in solution development:

- Local business community: Somerville Chamber of Commerce, Union Square Main Street, and Somerville Local First
- Immigrant Services Providers Group
- Massachusetts Alliance of Portuguese Speakers
- Haitian Coalition of Somerville
- Somerville-Cambridge Elder Services
- Local churches

To more meaningfully advance local climate resilience, climate change planning must amplify the voice of low-income and vulnerable populations, advance equity and social justice, and support community climate priorities and interests (Pathways to Resilience 2015). Community stakeholders emphasized that to effectively engage organizations and residents, the city should be clear as to what it is seeking from residents (whether this be opinions, support, and/or data) and to develop concrete outcomes and a finite timeline for an engagement process so stakeholders understand the value and purpose of their participation (e.g. all strategies will be included in a Climate Change Plan to be released in December; a percentage of the city budget will be devoted to climate action and we need to decide our priorities; this process will lead to a development of a community energy

efficiency program that will save you money and help improve your children's health). More targeted engagement and a focus on implementation rather than visioning will also separate this planning process from the Somervision comprehensive planning that many groups were recently engaged in.

Alternative engagement options beyond traditional town hall-style meetings are also valuable in increasing the quantity and quality of engagement. Though the process is slower and more costly, the city should commit to holding meetings with organizations and leaders who could reach more effectively into their own communities to identify how climate change is relevant to residents now; how climate action can connect with urgent resident concerns; and actions that residents can take to reduce costs, emissions, and vulnerability.

CONCLUSIONS

Though climate mitigation and adaptation have historically evolved on separate paths in both academic literature and the real world of planning and policy, integrating these two goals at the local level presents many opportunities for planners. Most significantly, it enables a broader conversation on climate change and its impacts that can engage wider community interests, increase the urgency and reality of mitigation, strengthen the link between climate policy, social equity, and sustainable development, and gain political support for actions that achieve multiple co-benefits.

While planners agree that mitigation and adaptation must both be advanced so that adaptation remains possible and to reduce unavoidable near-term climate impacts, many cities continue to pursue these goals separately. This is in large part due to the evolution of climate change discourse over the past decade that prioritized mitigation over adaptation. However, cities such as Copenhagen, Malmo, Surrey, Eugene, and Philadelphia are integrating these goals at the level of planning, communication, or implementation, and understand this integration to be a key element of future planning efforts.

These examples provide a context for Somerville, which is in the position to link its mitigation and adaptation planning in the city's first climate change planning process. To do so, Somerville needs to conceptualize its climate change planning differently. By linking mitigation and adaptation under a resilience framework, and communicating about social equity, community development and empowerment, and public health and safety, the city can orient climate change planning as a more comprehensive and transformative goal. It can then progress towards this goal by filling the current gaps in climate responsibility across city departments, aligning climate goals with influential zoning, mobility, and affordable housing planning, focusing on issues that overlap mitigation and adaptation (such as energy efficiency and alternative and distributed generation, green infrastructure, mode-shift, and local community development) and engaging city and community stakeholders that are traditionally involved and new to climate action. Following these recommendations will enable the city to broaden the climate conversation and employ the overarching framework and urgency of climate change towards advancing local sustainable development. Somerville can lead other municipalities in moving in this direction by making its efforts visible and accessible.

Though the recommendations I've made are specific to Somerville, elements are relevant more broadly to cities seeking more effective climate change strategies. For cities with limited sustainability planning resources or that are new to mitigation or adaptation planning (like Somerville), an integrated approach is a potentially more efficient use of resources and method for identifying priorities and building community and political support for action. For larger cities with existing planning efforts, mitigation-adaptation links are a critical lens for preventing maladaptive responses and strengthening the

relationship of mitigation with community development, and adaptation with root drivers of climate change (and not only emergency response). For any city, moving beyond siloed mitigation and adaptation strategies serves the broader need for climate change planning to more centrally and comprehensively address sustainable development and social equity in cities.

However, there are challenges to pursuing an integrated approach: it can be more complex to balance multiple and sometimes competing objectives, and often the siloes between mitigation and adaptation goals, staff, and resources are entrenched. But the need to move in this direction is clear. To date, there has been limited evidence that municipal climate action planning has been directly responsible for carbon emission reduction (Millard-Ball 2012). Cities are now struggling to take on both mitigation and adaptation with increasingly constrained resources and to sustain the engagement of diverse city and community stakeholders (Anguelovski and Carmin 2011). Planners seek more effective strategies that advance multiple goals, will be implemented, and more directly align with community priorities. In this report, I've laid out different approaches for conceptualizing integration—from project level examples and climate action planning to more transformative resilience frameworks. These are not steps to follow, but distinct opportunities to consider. All attempt to move cities away from siloed, narrow, and technical focuses on mitigation and adaptation towards community-centered climate resilience where the real root drivers of both emissions and vulnerability are addressed: fossil fuel use, economic inequality, and unsustainable development.

In Somerville, there is excitement and political support for doing things differently. With a strong mayor seeking climate action leadership and innovation, interest by city staff in an integrated planning approach, and an active local community demanding greater equity, accessibility, and participation, the city is well-positioned to advance practice in not only integrated but transformative climate change planning.

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