

China and US Case Studies: Preparing for Climate Change

Washington, DC: Targeting Urban Heat Islands

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China-US Case Studies Project: This report is part of a series of six case studies (<http://www.georgetownclimate.org/US-China-case-studies>) that explore how subnational actors (municipalities, states, and special administrative regions) in the United States and China are building resilience to natural hazards, extreme weather, and climate change. These case studies examine efforts to adapt to impacts in three U.S. and three Chinese jurisdictions, including efforts to prepare for: (i) increasing coastal flooding due to more frequent and intense coastal storms and rising sea levels in coastal Louisiana and Shanghai; (ii) increasing water scarcity in Austin, TX, and Beijing; and (iii) increasing heat waves and urban heat islands in Washington, DC, and Hong Kong. These case studies are oriented toward building resilience to the weather and climate related impacts being experienced in each jurisdictions; these actions are not always explicitly linked to climate change, and we do not evaluate the effectiveness or appropriateness of the specific activities undertaken by each jurisdiction.

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Introduction

On March 15, 2012, the District of Columbia (DC) hit a record high temperature of 82 °F, compared to the normal daily maximum temperature of 56 °F.¹ The average temperature in DC in March that same year was 10 degrees warmer than historical averages for the month.² Several months later, in July 2012, the District experienced the second hottest month on record (behind July 2011), it broke the record for most days over 95 °F (16 days) and over 100 degrees °F (7 days).³ As climate change causes the earth to get hotter, cities like DC find themselves increasingly susceptible to serious public health and

¹ NOAA, Daily normal and records for the month of March for Washington DC, NOAA Eastern Region Headquarters, available at <http://www.erh.noaa.gov/lwx/climate/dca/Dcamar.txt>.

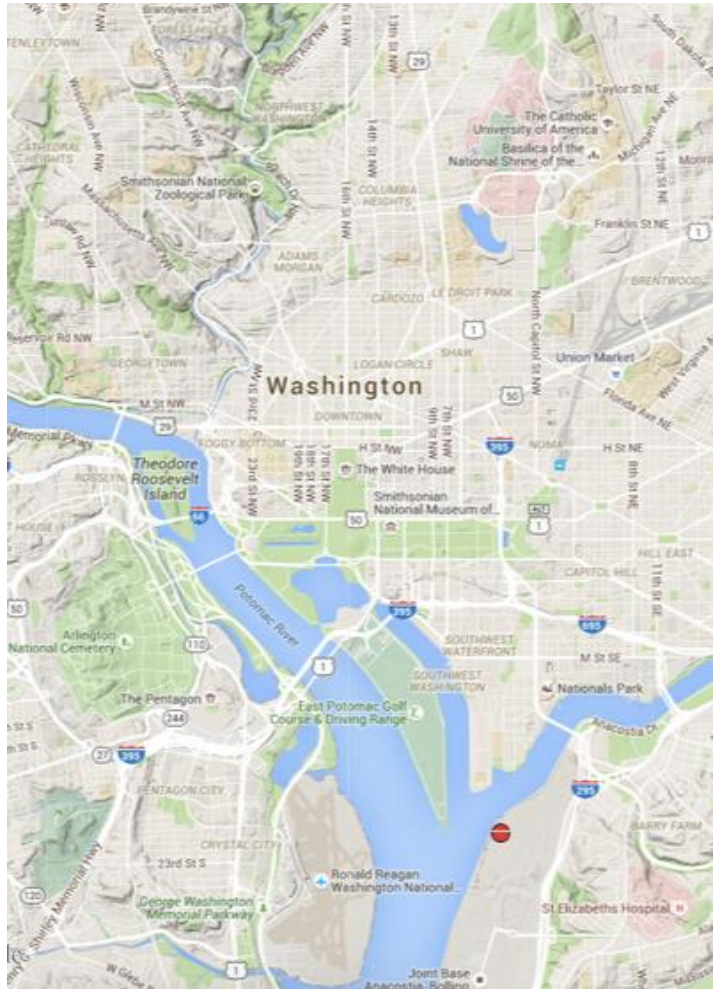
² Matt Rogers, *March 2012: Warmest on record in Washington, D.C.; 6th driest (tie)*, Washington Post, Apr. 2, 2012, http://www.washingtonpost.com/blogs/capital-weather-gang/post/march-2012-warmest-on-record-in-washington-dc-6th-driest/2012/04/02/gIQAHwPrqS_blog.html.

³ Matt Rogers, *2nd hottest July on record in Washington, D.C.; warmest year-to-date on record, 5th driest*, Washington Post, Aug. 1, 2012, http://www.washingtonpost.com/blogs/capital-weather-gang/post/2nd-hottest-july-on-record-in-washington-dc-warmest-year-to-date-on-record-5th-driest/2012/08/01/gJQAFaJGPX_blog.html.

environmental effects from heat waves, due to the urban heat island effect.⁴ Urban heat islands are areas that are hotter because natural vegetation has been replaced with impervious surfaces and other infrastructure, particularly buildings and streets.⁵ They contribute to a variety of other environmental and health-related problems, such as increased pollution and incidence of asthma.

In addition to heat, the District can expect to experience sea-level rise along the Anacostia and Potomac Rivers, both of which are tidally influenced.⁶ The District is expected to see more intense precipitation events and more frequent and serious flooding.⁷ More severe storms and accompanying storm surges will also increase threats to people and property in the district from flooding, winds, and power outages.⁸

This case study focuses on the steps that the District has taken to adapt to these impending climate threats, with a particular focus on actions taken or that could be taken to reduce the District's heat island. The District has many populations that are particularly vulnerable to heat, including low-income communities of color, the homeless, and very young and elderly residents. Many of the steps the District has taken are focused on the government's own operations and the strategic use of resources to reduce heat, protect public health, and lower greenhouse gas emissions.



Map of the District of Columbia

Source: Google maps

The District has so far taken a multifaceted approach to preparing for increased heat. Some efforts have focused on the physical urban environment—planting more trees, constructing more cool and green roofs, and reducing impervious surfaces. Many of these efforts also reduce energy use and therefore help to mitigate climate change as well as adapt to its effects. Other efforts have focused on community

⁴ U.S. EPA, *Heat Island Impacts*, Heat Island Effect, <http://www.epa.gov/hiri/impacts/index.htm>.

⁵ U.S. EPA, *Basic Information: What is an Urban Heat Island?*, Heat Island Effect, <http://www.epa.gov/hiri/about/index.htm>.

⁶ METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS, SUMMARY OF POTENTIAL CLIMATE CHANGE IMPACTS, VULNERABILITIES, AND ADAPTATION STRATEGIES IN THE METROPOLITAN WASHINGTON REGION (hereinafter MWCOG SUMMARY), 6 (June 2013); available at <http://www.mwco.org/uploads/pub-documents/pl5cXls20130701111432.pdf>.

⁷ MWCOG SUMMARY at 5 and 7.

⁸ MWCOG SUMMARY at 11.

engagement and building neighborhood-level resilience to climate impacts and other potential threats to communities. Still others have focused on quantifying the effect that interventions will have or identifying priority areas for those interventions.

Adaptation Activities

The DC government has been tackling its climate problem in several stages over the past few years, beginning with mitigating greenhouse gas emissions. Climate adaptation was a relatively small topic within DC's initial planning process—the DC Climate Action Plan issued in 2010. The plan only briefly discussed the adaptation co-benefits of some of the mitigation recommendations, but did not address impacts or strategies for adapting to those impacts in depth. In 2011, however, Mayor Vincent Gray broadened the city's climate focus by calling for the Sustainable DC planning process. Envisioned by Mayor Gray and led by the DC Office of Planning (DCOP) and the District Department of the Environment (DDOE), this year-long process engaged residents, business owners, and government officials from around the District in a visioning process for making DC the “greenest, healthiest, and most livable city in the nation.”⁹

From 2011-2012, nine working groups met on nine different topics including climate, food, waste, transportation, buildings, and others.¹⁰ Each working group assessed potential challenges in its topic area, generated solutions, and created specific action items and measurable targets to guide progress in the next few years. The Sustainable DC Plan,¹¹ with climate mitigation and adaptation embedded throughout, was released to the public in 2013. The Plan called for implementation of heat adaptation strategies such as requiring “all new building and major infrastructure projects to undergo climate change impact assessment as part of the regulatory planning process”¹² The Plan also calls for adoption of a city-wide climate adaptation plan (more below). Sustainable DC has since served as an “umbrella plan” for the District's environmental and climate-focused programs to integrate with one another in one broad framework. Authority to undertaken environmental and climate activities are spread through many agencies throughout the District government, from urban forestry at the District Department of Transportation (DDOT) to government buildings at the Department of General Services (DGS) and public health surveillance at the Department of Health. Sustainable DC is now a critical coordinator of goals and programs to ensure that agencies are working toward common goals and metrics, and are coordinating activities.

Multiple agencies within the District have been engaging on heat adaptation and climate resilience. DDOE used money from its Green Building Fund to award a grant to the Global Cool Cities Alliance to model how much the city could reduce heat-related mortality by increasing cool roofs in parts of the District.¹³ The study examined the effect of increasing light-colored and vegetated surfaces in the District on heat mortality over time. It found that increasing the reflectivity of DC surfaces by ten percent would reduce the number of deaths by six percent during heat events,¹⁴ and adding a ten percent increase in

⁹ District of Columbia, *About Sustainable DC*, <http://sustainable.dc.gov/page/about-sustainable-dc> (last visited Jun. 17, 2014).

¹⁰ *Id.*

¹¹ *Id.*

¹² SUSTAINABLE DC PLAN at 12.

¹³ Laurence S. Kalkstein, et al., *Assessing the Health Impacts of Urban Heat Island Reduction Strategies in the District of Columbia* (2013).

¹⁴ *Id.* at 4.

vegetated surfaces on top of that would reduce deaths by seven percent.¹⁵ Additionally, the study notes that not only deaths, but visits to the emergency room and hospital admissions, could be expected to decrease under these scenarios.¹⁶ DDOT has initiated several green alley pilot programs, which are intended to both help manage stormwater and also reduce temperatures locally.¹⁷

DGS, which is responsible for managing all of the District government's property, has similarly taken recent actions to meld climate into its mission. DGS's Smart Roof Initiative assessed all existing District-owned buildings (including municipal buildings and public schools) to determine which can be retrofitted with cool, green, or solar roofs.¹⁸ DGS has over 400 buildings under its jurisdiction covering 321 acres of roof area—which provides enormous potential for reducing heat throughout the District.¹⁹ With the help of a contractor, DGS has already identified 65 sites with potential for solar panels, and has obtained over \$2 million in grant money to install more green roofs on DGS buildings.²⁰ The new roofs will reduce ambient air temperatures in the area immediately surrounding them and will insulate the buildings themselves reducing heat and cooling costs.



Photo of green infrastructure project in Petworth neighborhood and the green roof of the American Society of Landscape Architects' building. Source: Photos by Jessica Grannis (right), American Society of Landscape Architects (left)

On a regulatory level, in 2014 the District adopted the International Green Construction Code (IgCC) and Building Energy Code.²¹ The new code requires buildings over 10,000 square feet to incorporate heat

¹⁵ Id.

¹⁶ Id.

¹⁷ DISTRICT DEP. OF TRANSP., *Green Alley Projects*, <http://ddot.dc.gov/node/469782> (last visited August 5, 2014).

¹⁸ SUSTAINABLE DC PLAN at 12.

¹⁹ Richard Rast, Bluefin LLC, Washington D.C. Smart Roof Program: Program Overview, (Presentation to Metropolitan Washington Council of Governments October 2013), available at <http://www.mwcog.org/uploads/committee-documents/Y11aWVpW20131018075322.pdf>.

²⁰ Id.

²¹ Vol 61 No. 14 - Part2 D.C. Reg. (March 28, 2014).

island mitigation strategies, such as cool roofs.²² The new code requirements, along with the District's Green Area Ratio in the zoning code,²³ ensure that new development is "heat friendly." The Green Area Ratio sets standards for new development or substantial renovations (with some exceptions) requiring development to manage stormwater, reduce temperatures, and improve air quality.²⁴

The District is also fortunate to be a target city for a University of Michigan project to create a heat vulnerability map, funded by the National Institute for Environmental Health Sciences (NIEHS).²⁵ A collaboration between the university's public health and urban planning schools, the project is using Geographic Information System (GIS) to overlay physical and demographic data to identify the areas of greatest heat vulnerability within the District. With this vulnerability map, DDOE and other agencies can prioritize urban heat interventions both in emergency response (e.g., ensuring that cooling centers are located where people are most likely to need them) and in the built environment (e.g., strategically choosing neighborhoods or even blocks for tree planting, cool roof initiatives, and cool pavement pilots). By literally mapping vulnerability, this project will help DDOE and other agencies to be strategic about getting the most adaptation impact for their money. The Georgetown Climate Center has also worked with DDOE to help map the legal authority of District agencies and to identify potential pathways for increasing the number of green roofs, cool pavements, and urban forestry.

The overarching framework for adaptation for DC agencies is currently in development. Building on both DC's strong history of mitigation work and on the Sustainable DC platform, DDOE has begun a city-wide adaptation planning process to assess the District's vulnerabilities and create solutions to address them. The plan will address heat as one of the major impacts to which the District will be vulnerable, particularly low-income communities of color and the city's sizeable homeless population. Just as the Sustainable DC plan provides a policy framework for directing the District's climate change and environmental policies and programs, the climate adaptation plan will provide the framework directing and refining the District's adaptation policies and practices already in place, as well as developing the next generation of actions.

In 2012, the DC Department of Health (DOH) initiated a program called Resilient DC in partnership with the RAND Corporation.²⁶ The effort is assessing and building community resilience in anticipation of natural or man-made disasters, including severe heat waves. Resilient DC is engaging faith-based groups, community groups, media, health-care organizations, and others to produce strategies to increase community resilience across all of these sectors. This increased resilience should support greater knowledge and ability to prepare for heat emergencies in many of the District's vulnerable communities.

Lessons Learned

While the District of Columbia is still in the initial stages of adapting to urban heat, it has made significant strides toward developing a strategic, innovative set of adaptation practices that could serve as examples for other places around the United States or even the world.

²² See, e.g., D.C. CODE MUN. REGS tit. 12 § 408k (2014).

²³ See D.C. CODE MUN. REGS tit. 11 § 3400 *et seq.* (2013).

²⁴ *Id.*

²⁵ Conlon, Kathryn, University of Michigan - School of Public Health, Employing Heat Vulnerability Mapping to Inform Weatherization programs in 3 US Cities, (Abstract for 2013 Conference of the International Society for Environmental Epidemiology), *available at* <http://ehp.niehs.nih.gov/isee/p-3-12-11/>

²⁶ DISTRICT DEP. OF HEALTH, *Resilient DC*, <http://doh.dc.gov/resilience> (last visited January 6, 2015).

First, the District is strategically using limited resources. The concept of targeting adaptation interventions based on GIS mapping is relatively new, as is the heat mortality study. While Toronto and a few other places have achieved similar mapping, very few jurisdictions have yet planned their built environment interventions based on detailed GIS maps. If the District government prioritizes its heat adaptation interventions based on these vulnerability maps, the model could be replicable in other cities. Vulnerability maps can be used to help a city deploy scarce resource to protect the most vulnerable residents, potentially save on health costs, and get the greatest health and environmental benefit for the investment of time, effort, and money.

Second, the District had integrated its multiple planning initiatives. The District is not unique in having multiple plans. Jurisdictions across the US have to contend with federal regulations such as stormwater permit requirements, hazard mitigation planning requirements, transportation planning requirements, and many others. Many of these jurisdictions have also chosen to plan for climate change mitigation and adaptation, adding perhaps two more plans. The District further has an all-hazards emergency preparedness plan and is developing a comprehensive energy plan, among others. The challenges of coordinating and effectively managing this many processes are steep. The District is attempting to manage this chaos with the umbrella plan provided by Sustainable DC. Sustainable DC provides a common framework for policy goals and a platform for engagement by a large number of agencies, the public, and local advocates and experts to reduce the confusion and entropy that so many plans might otherwise bring.

Third, the DC government is leading by example. The DC government is encouraging private behavior in many ways, including subsidizing green roofs. But it is also leading by example: DGS' Smart Roofs program, the green alley pilot programs at DDOT, and other efforts such as the heat mortality study show the power of using the government's own operations to have direct adaptation impacts and to normalize the practices the local government wants to see more of in the private sector.

Finally, the DC Department of Health is investing in community resilience. The DC DOH's community resilience engagement should pay dividends in any future disaster or emergency, whether climate-related or not. By engaging so strongly with communities who are all too often left out of planning processes and climate discussions, the DC government is raising the capacity of those communities to adapt and to be stronger even in non-disaster times. Other cities can take note of this important environmental justice approach and reach out to vulnerable communities well in advance of any emergency.

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