

China and US Case Studies: Preparing for Climate Change

Austin, TX: Preparing for Water Scarcity and Drought

Aaron Ray*

China-US Case Studies Project: This report is part of series of six case studies (<http://www.georgetownclimate.org/US-China-case-studies>) that explore ways that 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

Austin, Texas, has experienced significant environmental challenges that are likely to be exacerbated by climate change. These challenges include drought, heat waves, wildfires, and floods. Austin has responded to these challenges by adopting measures to prepare for future changes in the climate.

Austin has been experiencing a persistent drought since 2008.¹ The city has been operating under Stage 2 Drought Response Watering Restrictions, which limit outdoor watering to one day per week, nearly continuously since September 2011.² Increasing water demand due to population growth, coupled with seven years of severe drought, has lowered surface water storage in the Highland Lakes. The drought has become so severe that 240 counties in Texas, including Travis County, which includes Austin, have been

* Research contributed by Matthew Goetz and Kate Lee

¹ *What Austin needs to know about the drought*, AUSTIN WATER, http://www.austintexas.gov/sites/default/files/files/Water/Conservation/DroughtMailer_Sept2013.pdf (Last visited May 30, 2014).

² *Drought Update*, AUSTIN WATER, <http://www.austintexas.gov/department/drought-update> (Last visited May 30, 2014). Under Stage 2, watering is limited to one day per week, between set hours. Residential, commercial, and school units are assigned different days. Other provisions under Stage 2 include a ban on home car-washing, and restrictions on when restaurants can serve water, and when commercial properties can operate patio misters and fountains.

declared Primary Natural Disaster Areas by the United States Department of Agriculture.³ The worst year of the drought to-date was 2011, when inflows of water into the large upstream man-made reservoirs Lakes Travis and Buchanan reached only 10 percent of the historical average.⁴ As of April 27, 2014, the reservoirs had received lower inflows through the first quarter of the year than during the same period in 2011 and were at only 37 percent capacity.⁵ The Austin metropolitan area receives its primary water supplies from the Colorado River and stored water in Lake Travis and Lake Buchanan.⁶ The City of Austin owns water rights to waters from the Colorado River granted by the Texas Commission on Environmental Quality. Austin also has a contract with the Lower Colorado River Authority (LCRA) for additional water to supplement the City's run-of-river water rights.⁷ The combination of these water rights provides a total available supply that significantly exceeds Austin's recent municipal water use.⁸ However, the LCRA has noted that the basin is in a new critical period with inflows into the Highland Lakes lower during the period between 2008 to 2014 than the inflow during the worse seven years of the drought of record between 1947 to 1957.

Austin has already experienced impacts from extreme weather and natural hazards, which will be exacerbated by climate change. In 2011, Austin experienced a heat wave in which temperatures exceeded 100° F for more days than in any year since 1925.⁹ There were 90 days in which the maximum temperature exceeded 100° F in 2011.¹⁰ The first and third warmest years on record in Texas were 2011 and 2012.¹¹ The combination of drought and high temperatures created the conditions for a catastrophic wildfire in the region that destroyed almost 1,700 residential and commercial structures, resulted in the loss of two lives, and displaced at least 5,000 people in Bastrop County near Austin in 2011.¹² Wildfires threaten lives and property and divert city resources to fire suppression and management. They also create the conditions for erosion, run-off, and debris loading in local waterways, reducing water quality. In

³ *USDA Designates 240 Counties in Texas as Primary Natural Disaster Areas with Assistance to Producers in Surrounding Area*, U.S. DEPARTMENT OF AGRICULTURE, FARM SERVICE AGENCY, http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=edn&newstype=ednewsrel&type=detail&item=ed_20140423_rel_0069.html (Last visited April 23, 2014).

⁴ *Texas Drought*, Lower Colorado River Authority, <http://www.lcra.org/water/water-supply/droughtupdate/pages/default.aspx> (Last visited May 30, 2014).

⁵ Id.

⁶ Id.

⁷ CITY OF AUSTIN, LAW DEPARTMENT, <https://www.austintexas.gov/faq/does-city-austin-have-its-own-water-rights-or-does-it-purchase-its-water>. (Last visited April 10, 2015).

⁸ *City of Austin Municipal Water Supply Overview*, CITY OF AUSTIN, http://www.tceq.state.tx.us/assets/public/permitting/watersupply/water_rights/eflows/20101028clbbasc_coawat_ersupply.pdf (Last visited April 10, 2015).

⁹ *Austin plagued by record heat wave*, NPR (2011), available at <http://www.npr.org/2011/08/24/139923595/austin-plagued-by-heat-wave>

¹⁰ Data available from WeatherUnderground.com

¹¹ *2012 was record-warm year in contiguous US, Texas, many Texas cities*, THE SACRAMENTO BEE. (2011), available at <http://blogs.sacbee.com/photos/2011/09/wildfire-destroys-nearly-500-h.html>

¹² *Wildfire destroys over 1500 homes in Texas*, TEXAS CLIMATE NEWS JOURNAL (DECEMBER 8, 2011), available at <http://texasclimateneeds.org/wp/?p=6315>; see also Bastrop Complex Wildfire Case Study available at <http://www.co.bastrop.tx.us/bcdisaster/index.php/wildfire-case-study>

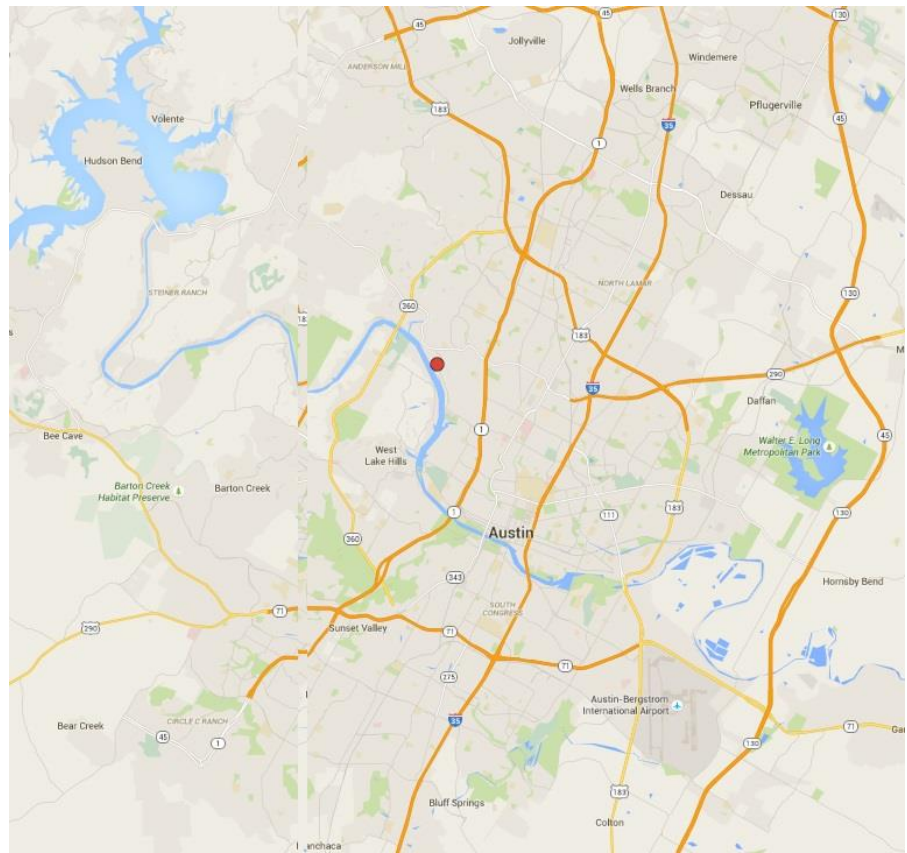
addition to drought, heat, and wildfires, Austin has been subject to damaging floods, including one that damaged more than 1,200 homes and killed four people in 2013.¹³

Background

Austin's climate is characterized by hot summers and mild winters.¹⁴ The city is situated geographically at the junction of two climactic zones, with the Texas Hill Country to the north and west and the Blackland Prairies to the east.¹⁵ Austin is located along the Colorado River and has three man-made lakes within the city limits that provide the city's main source of drinking water.¹⁶ The metropolitan area has elevations between 400 and 1000 feet above sea level.

The environmental challenges the city has faced are likely to become more severe as a result of climate change. Austin, located in Central Texas, was part of the 2014 National Climate Assessment's (NCA)¹⁷ Great Plains region, which stretches from Texas in the south to North Dakota in the north. The NCA projected a range of climate impacts for the Great Plains region through 2070,¹⁸ including:

- More frequent days in which maximum temperatures exceed 100° F;
- An increase in the number of nights with minimum temperatures higher than 80° F;
- Longer dry spells; and



Map of Austin
Source: Google maps

¹³ *Historic flash flood leaves devastation in Austin*, USA TODAY. (2013), available at <http://www.usatoday.com/story/news/nation/2013/11/07/flash-flood-austin-residents-killed-displaced/3459181/>

¹⁴ *Austin Climate Summary*, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, <http://www.srh.noaa.gov/images/ewx/aus/ausclisum.pdf> (Last visited May 30, 2014).

¹⁵ *Id.*

¹⁶ *Id.*

¹⁷ The National Climate Assessment uses climate models to make projections of the impacts of climate change on particular regions of the United States.

¹⁸ Mark Shafer et al., *Chapter 19: Great Plains*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 441-461 (J. M. Melillo et al. eds., U.S. Global Change Research Program 2014)

- More overwintering insect populations.

Projections for the state suggest that Texas is likely to see an increase in mean temperature of nearly 4° F by 2059.¹⁹ Water systems are projected to experience increased stress from higher temperatures, increased evaporation and evapotranspiration, possible decreases in precipitation, and an increase in water demand.²⁰ These projections suggest that Austin's water system and public health systems, among others, are likely to experience increased stress as a result of the impacts of climate change.

Austin's demographic and economic profile contributes to the city's vulnerability to climate change. Austin is the capital of Texas, the county seat of Travis County, and the 11th largest city in the US. Austin has experienced significant population and economic growth in recent years, both of which are projected to continue. The Austin metropolitan area had a population of 1.8 million in 2012,²¹ and Forbes projects the population to grow 2.8 percent through 2016.²² The city itself has a population of nearly 860,000 residents and is expected to exceed 1 million residents by 2025.²³ The combination of population growth and potential decreases in precipitation are likely to further stress the city's constrained water supplies.

Local Adaptation Activities

City agencies play a key role in Austin's climate initiatives. The city is served by a publicly owned electric utility (Austin Energy) and a public water and wastewater utility (Austin Water), and has an Office of Sustainability that coordinates department activities related to energy, waste management, and water and resource conservation.

In addition to adopting policies to reduce the city's GHG emissions, Austin has actively pursued measures to prepare the city for the impacts of climate change. On November 21, 2013, the City Council passed Resolution 20131121-060 directing the city manager to analyze climate change projections, determine how departmental planning efforts integrate future impacts of climate change, and identify a process for performing departmental vulnerability assessments.²⁴ The resolution identified the following sectors and city agencies to be included in the scope of the assessment: transportation, the electric utility, the water utility, drainage infrastructure, community health and wellness efforts, and disaster preparedness and emergency response management.

With the adoption of Resolution 20131121-060, city agencies have been exploring measures to improve resilience in a number of policy areas. The Office of Sustainability has worked closely with department stakeholders to fulfill the requirements of the resolution. The city hired ATMOS Research, led by Dr. Katharine Hayhoe from Texas Tech University, to conduct climate modeling for the Austin area and to

¹⁹ John Nielson-Gammon, *Chapter 2: The Changing Climate of Texas*, in *THE IMPACT OF GLOBAL WARMING ON TEXAS* (J. Schmandt et al. eds., University of Texas Press: Austin 2011)

²⁰ Id.

²¹ *Austin-Round Rock-San Marcos, TX Metro Area. ACS Profiles*, MISSOURI CENSUS DATA CENTER. <http://mcdc.missouri.edu/acs/profiles.php> (Last visited May 30, 2014)

²² Daniel Fisher, *America's Fastest-Growing Cities*, FORBES.COM (April 18, 2012), <http://www.forbes.com/sites/danielfisher/2012/04/18/americas-fastest-growing-cities/>

²³ *Demographics*, CITY OF AUSTIN, PLANNING AND DEVELOPMENT REVIEW DEPARTMENT, <http://www.austintexas.gov/demographics> (Last visited May 30, 2014).

²⁴ *Resolution No. 20131121-060*, CITY OF AUSTIN, http://www.austintexas.gov/sites/default/files/files/Sustainability/Climate/2013-11-21_Climate_Adaptation_Resolution.pdf (Last visited June 2, 2014).

develop climate change projections through 2100.²⁵ City staff used this information to identify potential future environmental, economic, and social impacts to operations, asset management, and long-term planning efforts. On May 1, 2014, city agencies released a report titled *Toward a Climate-Resilient Austin* which responds to the reporting requirement of the Resolution 20131121-060 and identifies potential steps city agencies could take to improve resilience.²⁶

City agencies are exploring a number of responses to climate impacts. Increasing temperatures present significant public health challenges, spurring city officials to consider urban heat mitigation measures. The Department of Parks and Recreation identified six strategies to combat the urban heat island effect, including cool roofs, green roofs, cool pavements, green walls, tree planting, and the development of structures to provide shade.²⁷ The Department highlighted opportunities to address urban heat while conserving water by planting drought tolerant species on green roofs and choosing drought tolerant trees. In addition, the damaging wildfires and floods of 2011 led the Austin water utility to consider measures to better manage the water quality impacts of wildfire. These floods have pushed city officials to embark on a buyout program as well as other floodplain management approaches. In response to recent flooding, the city spent almost \$100 million to purchase more than 350 flood-prone homes.²⁸ In addition, the city's comprehensive plan, *Imagine Austin*,²⁹ includes a number of priority programs that contribute to climate resilience. In particular, the plan calls for the use of green infrastructure to protect environmentally sensitive areas and promote the sustainable management of the city's water resources.³⁰

Austin is also taking immediate steps to address its vulnerability to climate impacts on the city's water supply. On April 10, 2014, the City Council adopted Resolution 20140410-033.³¹ That resolution created the Austin Water Resource Planning Task Force to evaluate the city's water needs and make recommendations to augment the city's future water supply.³² The Task Force's final report was released on July 10, 2014.³³ That report includes recommendations to increase water conservation, explore commercial and industrial water reuse and rainwater capture, and develop an Integrated Water Resource Plan (IWRP). Other recent City Council measures have included adoption of Resolutions 20140807-090

²⁵ *Climate Program*, CITY OF AUSTIN, OFFICE OF SUSTAINABILITY, <http://austintexas.gov/department/austinclimate-protection-program> (Last visited May 30, 2014).

²⁶ *Toward a Climate-Resilient Austin*, CITY OF AUSTIN, http://www.austintexas.gov/sites/default/files/files/Sustainability/Climate/Toward_a_Climate_Resilient_Austin.pdf (Last visited June 2, 2014).

²⁷ *The Heat Island Effect: Cooling Strategies*, CITY OF AUSTIN, DEPARTMENT OF PARKS AND RECREATION, <http://austintexas.gov/coolspaces> (Last visited August 11, 2014).

²⁸ *Toward a Climate-Resilient Austin*, CITY OF AUSTIN, http://www.austintexas.gov/sites/default/files/files/Sustainability/Climate/Toward_a_Climate_Resilient_Austin.pdf (Last visited June 2, 2014).

²⁹ *Id.*

³⁰ *Id.* at 19.

³¹ *Resolution No. 20140410-033*, CITY OF AUSTIN, http://austintexas.gov/sites/default/files/files/Water/Resolution_20140410-033_Austin_Water_Resource_Planning_Task_Force.pdf (Last visited June 2, 2014).

³² *Austin Water Resource Planning Task Force*, AUSTIN WATER, <http://austintexas.gov/page/austin-water-resource-planning-task-force> (Last visited August 11, 2014).

³³ *Austin Water Resource Planning Task Force Recommendations, Revised Report*, CITY OF AUSTIN, http://austintexas.gov/sites/default/files/files/Water/AustinWaterResourcePlanningTaskForce_ReportToCityCouncil.pdf (Last visited August 11, 2014).

and 20141211-119 further addressing demand and supply side drought measures and the development of the IWRP in a stakeholder process involving several city departments.³⁴

The city is also involved in a number of regional planning efforts. Staff from the city's Climate Program were part of a team including members of the Capital Metropolitan Planning Organization (CAMPO),³⁵ which received a grant from the Federal Highway Administration (FHWA) to fund a Central Texas Climate Change and Extreme Weather Vulnerability Assessment for Transportation Infrastructure.³⁶ The \$152,000 grant will be used to study projected climate impacts on roadways, bridges, rail, airports, and other transportation infrastructure. The goal of the project is to incorporate climate considerations into the region's long-range transportation plan, CAMPO 2040, and into the City of Austin's transportation and emergency response planning. CAMPO released the draft 2040 Regional Transportation Plan for public comment on March 2, 2015.³⁷ The draft plan includes a number of findings related to the projected impacts of climate change on regional transportation infrastructure. Clay soils in the region shrink and swell with changes in soil moisture, causing premature pavement cracking and buckling, soils shifting in the roadbed, and damage to underground utilities. Climate projections indicate that the region can expect a 4 percent to 10 percent decrease in soil moisture by 2040, intensifying the shrink/swell effect of the clay soil and associated road damage. Road maintenance in the eastern part of the region may be more frequent and more costly in the future, necessitating adaptive techniques for building and maintaining roads.

Climate projections also indicate that future conditions will be more conducive to wildfires. The peak burn period for wildfires, often in late afternoon, coincides with peak traffic volume. The 2040 plan highlighted the need to evaluate the transportation system to determine whether it is adequate for wildfire and flood evacuations, identify opportunities to increase redundancy and alternate routes, and advance best practices in addressing drought related impacts to the transportation system. In addition to the 2040 Plan, CAMPO adopted a policy in November 2014 that required the minimization of impacts from the transportation system to floodplains and other environmentally sensitive areas like aquifer recharge zones.³⁸

In addition to city-led planning initiatives, Austin's academic and non-governmental organizations (NGOs) are actively promoting climate adaptation. On October 4, 2013, the University of Texas (UT) at Austin's LBJ School of Public Affairs hosted a Climate Resilience and Adaptation Strategies Symposium.³⁹ The symposium brought together researchers and practitioners to discuss Austin's

³⁴ Resolution No. 20140807-090, CITY OF AUSTIN, <http://www.austintexas.gov/edims/document.cfm?id=214617>; Resolution No. 20141211-119, CITY OF AUSTIN, <http://www.austintexas.gov/edims/document.cfm?id=223726>

³⁵ Capital Metropolitan Planning Organization (CAMPO) is the Metropolitan Planning Organization (MPO) serving the counties of Bastrop, Burnet, Caldwell, Hayes, Travis, and Williamson in Central Texas. CAMPO, <http://www.campotexas.org/> (Last visited January 21, 2015).

³⁶ Federal Grant for Pilot Program on Climate Change and Extreme Weather Vulnerability, CITY OF AUSTIN, <http://www.austintexas.gov/edims/pio/document.cfm?id=185602> (Last visited June 2, 2014).

³⁷ The plan development was led by two planning bodies: the CAMPO Transportation Policy Board and Technical Advisory Committee. CAMPO 2040 Plan, CAMPO, <http://www.campotexas.org/plans-programs/campo-plan-2040/> (Last visited March 23, 2015).

³⁸ CAMPO 2040 Plan policies as adopted by the CAMPO Transportation Policy Board November 2014, CAMPO, <http://www.campotexas.org/wp-content/uploads/2014/11/Policies-as-adopted-November-2014-Board.pdf> (Last visited January 21, 2015).

³⁹ Priscila Mosqueda, Conference: Climate Adaptation Crucial for Central Texas, TEXAS OBSERVER (October 7, 2013), <http://www.texasobserver.org/climate-change-conference-adaptation-crucial-saving-central-texas/>

vulnerabilities and opportunities for adaptation. Research presented at the conference demonstrated that some communities in Austin were more vulnerable than others to the environmental stresses associated with climate change. Conference organizer and climate adaptation researcher Stefan Wray⁴⁰ found that individuals in East Austin were most vulnerable to extreme heat events in 2011. Architect Adele Houghton highlighted the fact that many of Austin's LEED buildings were clustered west of the I-35 highway despite the relative vulnerability of those on the east side of the city to heat and flooding events. The Georgetown Climate Center (GCC) worked with the City of Austin and Austin Water to explore strategies for adapting to increasing drought in the region.

Lessons Learned

Austin's efforts to adapt to climate impacts present a number of lessons for other jurisdictions committed to reducing their vulnerability to climate change.

First, Austin benefits from the engagement of an active and concerned City Council. Strong leadership is a critical element of municipal action on climate change. Austin's City Council has enacted a series of resolutions that include specific direction to city agencies and aggressive time frames for implementation. These resolutions both require agency action and establish the importance of climate change on the public agenda. The Council's actions also clearly identify the need for distinct action on both mitigation and adaptation. In addition, the Council has engaged with specific issues related to climate adaptation, including managing the city's water supply and demand challenges.

Second, Austin's city agencies used the resources of academic and NGO experts and regional and federal entities to augment their own capabilities. In addition to working with UT and GCC, Austin has also pursued other collaborations with strategic partners. The Office of Sustainability engaged Texas Tech climate scientist Katherine Hayhoe to produce local climate projections. The city also partnered with CAMPO to pursue a grant from the FHWA. In addition, the Office of Sustainability supports staff involvement in national organizations like USDN and the C40 Cities Climate Leadership Group. These organizations allow Austin to leverage the experience and expertise of practitioners across the country and promote the city's position as a leader on climate issues. Many municipalities lack the resources or capacity to conduct the necessary analysis in order to pursue adaptation policies. Austin has successfully sought out outside resources and expertise to support its adaptation work.

Third, Austin has integrated its climate mitigation and adaptation work into a unified Climate Program⁴¹ in its Office of Sustainability. Coordinating these strategies allows Austin to pursue measures that both improve resilience and reduce GHG emissions. For example, adopting stringent household energy efficiency standards can both reduce household energy use and make those homes more comfortable during extreme heat events. Reducing GHG emissions and preparing for climate impacts are often complimentary yet distinct policy goals. Austin's integrated Climate Program allows for progress to be made on both fronts as part of a coordinated sustainability effort.

In addition to integrating adaptation and mitigation action, the city has pursued adaptation policies that bring together multiple city agencies. For example, the Austin Water Resource Planning Task Force's final report recommends the active participation of other City departments in the development and implementation of the city's Integrated Water Resource Plan, including the city's electric utility, Austin Energy, the city's Watershed Protection Department, and the Office of Sustainability. These kinds of

⁴⁰ Stefan Wray was then a graduate student at the University of Texas at Austin's Lyndon B. Johnson School of Public Affairs.

⁴¹ *Climate Program*, CITY OF AUSTIN, OFFICE OF SUSTAINABILITY, <http://austintexas.gov/department/austin-climate-protection-program>, (Last visited January 21, 2015).

cross agency collaborations are especially important when addressing the cross-sector impacts of climate change.

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Prepared by Aaron Ray. Please contact Jessica Grannis (grannis@law.georgetown.edu) with any questions.

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