



Case Study:

Climate Change Adaptation in the City of Irvine, CA

ND-GAIN Urban Adaptation Assessment

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Gracie Georgi is a junior at the University of Notre Dame studying Political Science, German, and Energy. What has drawn her to this diverse combination of studies is her passion for the environment, international relations, U.S. foreign policy, and German history and she hopes to combine these interests and translate them into positive action. Upon learning about ND-GAIN's Country Index and their mission to "enhance the world's understanding of the importance of adaptation and facilitate private and public investments in vulnerable communities," Gracie was inspired to get involved and applied to become an Urban Ambassador for the Urban Adaptation Assessment. Through this experience, she researched adaptation efforts locally in Irvine, California and developed a greater understanding of ND-GAIN's work.

Abstract

Inspired and influenced by ND-GAIN's climate change adaptation research, this case study focuses on adaptation efforts in the City of Irvine, California. Utilizing a gamut of resources, this study provides a basis for understanding climate change needs throughout California, the Southwest, and in Irvine. Specifically, this study assesses key climate change risks within Irvine and outlines potential adaptation strategies for the city. Lastly, these findings showcase the advantages and of the ND-GAIN Urban Adaptation Assessment and demonstrate its universal applicability and necessity.

Objective:

The primary objective of this case study is an investigation into the City of Irvine's climate change adaptation plans. The following questions will serve as a roadmap for the investigation:

1. Does Irvine currently have climate change adaptation plans?
2. If there are no existing adaptation plans, does the city plan to implement any? How so?
3. What are Irvine's climate change adaptation needs?

Overview:**1. Irvine, California**

Located in the heart of Orange County, Irvine is an affluent, well-run, master-planned community spanning an area of 66 square miles and with an ethnically diverse population of 266,122 people.¹ It is the largest city in Orange County in terms of area and the third largest in terms of population. Geographically, Irvine is located twelve miles inland from the coast and most of the city is flat valley, although there are also several hills, plateaus, and canyons. As with most of Southern California, Irvine's climate is relatively mild to hot, with an average annual temperature of 74 degrees and relatively low precipitation levels.²

2. California

California is a national and global leader in efforts to combat, mitigate, and adapt to climate change. The state does so through ambitious greenhouse gas emission reduction targets and renewable energy integration goals, tough restrictions on destructive super pollutants, and the implementation of rigorous building and appliance efficiency standards. In addition to these measures, the state provides extensive tools and resources to local governments for mitigating, assessing, preparing for, and adapting to climate change-related risks.

3. Southwest

The Southwest is the hottest and driest region in the United States, where the availability of water is a defining feature of its development. Currently, water resources are scarce, strained, and over-utilized in many areas, with climate changes threatening to exasperate these conditions as the region gets hotter and, in its southern half, significantly drier. Present and projected climate changes include: higher temperatures, increased precipitation, and more frequent and intense storms. These changes will have an adverse effect on ecosystems and wildlife, snowpack and streamflow, coastal regions, public health, and the urban heat island-effect, among other things.³

¹ United States Census Bureau, 2016.

² Guide to Irvine, 2017.

³ Adapting to Climate Change, Southwest; EPA, 2016.

IRVINE

Current Climate Change Adaptation Status

The City of Irvine does not currently have an adopted Climate Action Plan; however, the city is the process of updating their General Plan, which will include a California state climate action plan requirements in the update. The city's General Plan is a blueprint for decision-making and represents the community's view for the future. It was initially adopted in 1972 and last updated in 1999, prior to the implementation of California's Global Warming Solutions Act of 2006 (AB 32), which called for local governments to help meet state-wide greenhouse gas emissions reductions targets through climate action planning. The 2012 California Adaptation Planning Guide (APG), designed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change, states, "Climate adaptation strategies can be implemented in a variety of ways from a freestanding adaptation plan to incorporation in existing plans and programs." Existing plans and programs suggested for incorporation include: coastal plans, local hazard mitigation plans, climate action plans, and general plans. According to the City of Irvine's webpage, the updated General Plan will be presented to City decision-makers in 2017.

Irvine's Changing Climate

Cal-Adapt is a website designed to provide data and information that offer a view of how climate change might affect California at the local level. Cal-Adapt's development is a key recommendation of the 2009 California Climate Adaptation Strategy,⁴ which was updated in 2014⁵ and again in 2017⁶ as the Safeguarding California Plan. According to the original Adaptation Strategy, the primary goal of the Cal-Adapt website is to synthesize existing California climate change scenarios and climate impact research and to encourage its use in a way that is beneficial for local decision-makers.

For the City of Irvine, I looked at annual average projected changes in the following:

1. Maximum Temperature (+)
2. Minimum Temperature (+)
3. Total Precipitation (-)
4. Number of Extreme Heat Days (+)

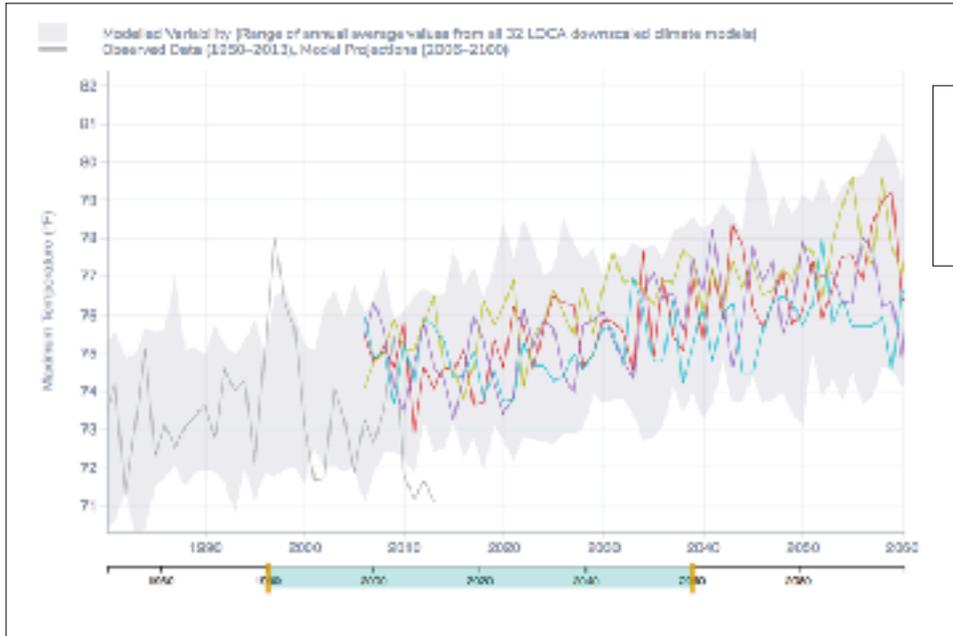
⁴ California Statewide Climate Adaptation Strategy (CAS), 2009. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf

⁵ Safeguarding California Plan, 2014. http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf

⁶ Safeguarding California Plan, 2017. <http://resources.ca.gov/wp-content/uploads/2017/05/DRAFT-Safeguarding-California-Plan-2017-Update.pdf>

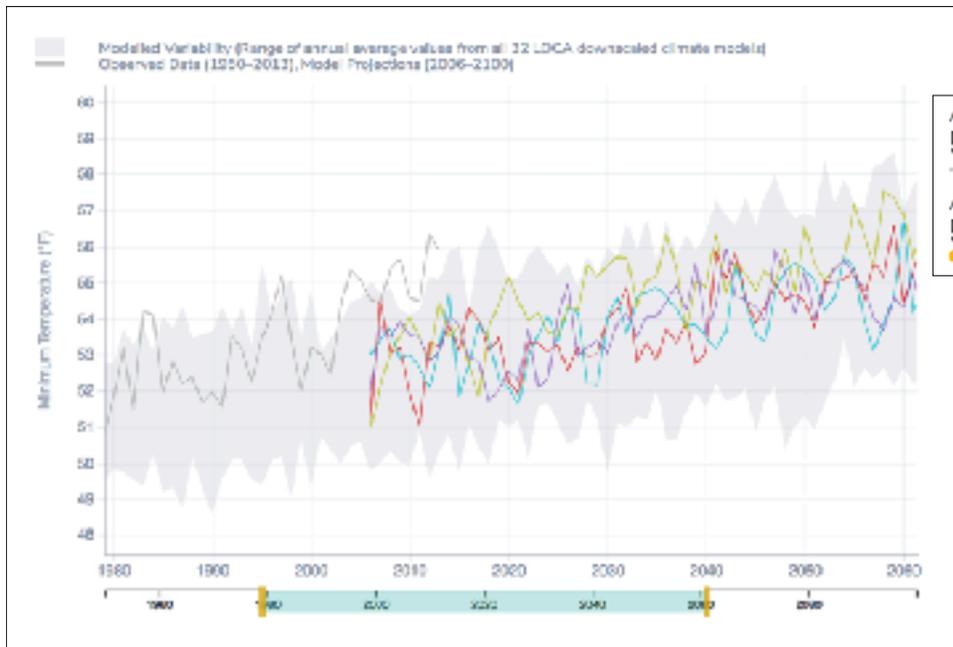
For consistency, each chart is adjusted to a timeframe of 1980 to 1960 and under the RCP 4.5 scenario (emissions peak around 2040 and then decline). The red, yellow, blue, and purple lines represent the results of various climate models, which are averaged under “annual mean” in the corresponding box. Charts 1–4 are observed data and model projections for the specific Irvine area.

1. Annual Average Maximum Temperature (Decrease)



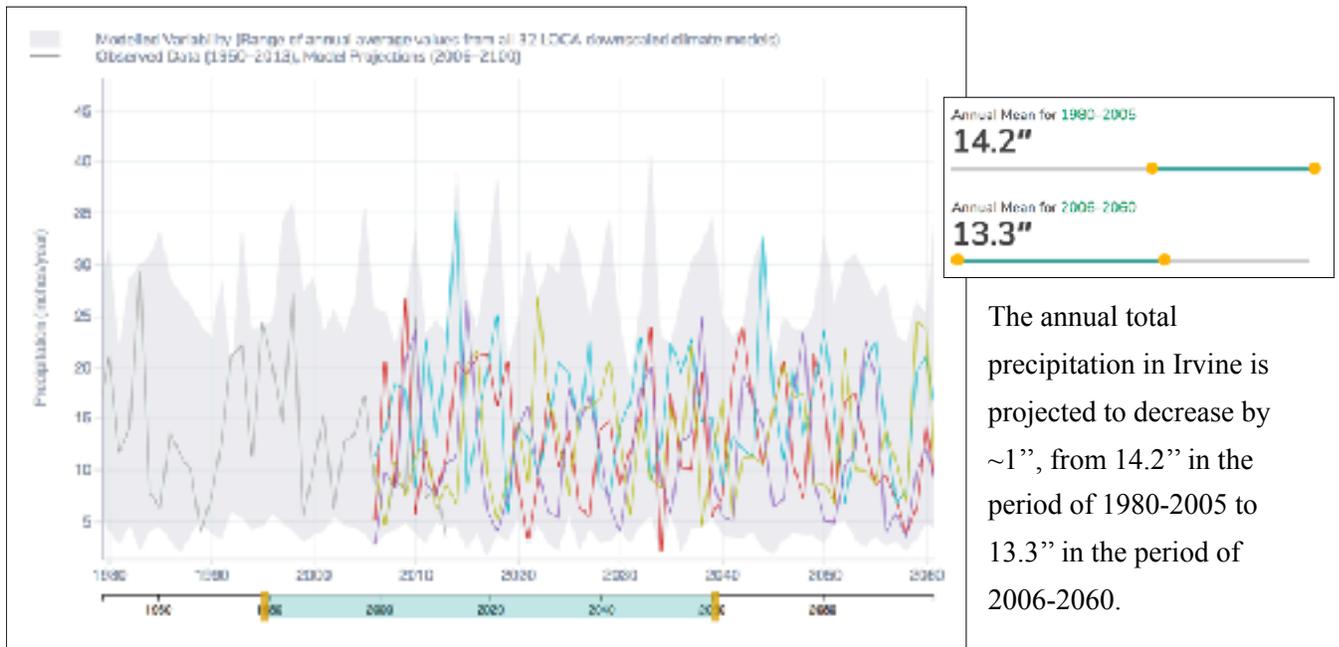
The annual average maximum temperature in Irvine is projected to rise by 2.3°F, from 73.6°F in the period of 1980-2005 to 75.9°F in the period of 2006-2060.

2. Annual Average Minimum Temperature (Increase)

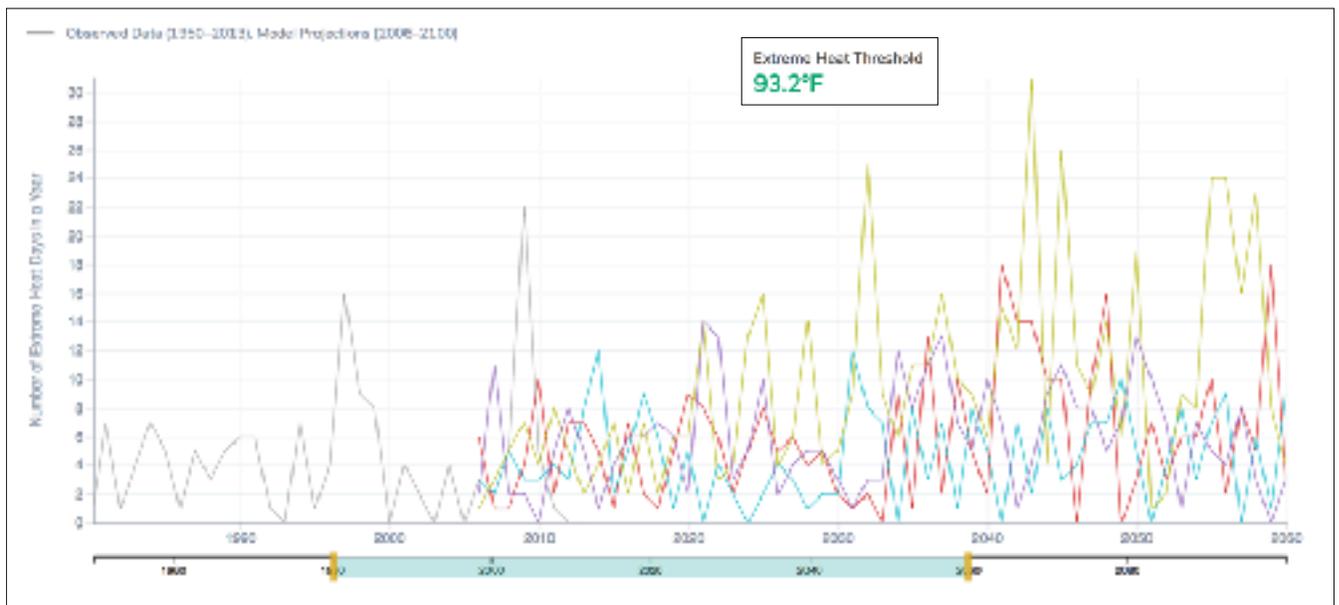


The annual average minimum temperature in Irvine is projected to rise by 1°F, from 53.1°F in the period of 1980-2005 to 54.1°F in the period of 2006-2060.

3. Annual Total Precipitation (Decrease)



4. Annual Number of Extreme Heat Days (Increase)



Given an extreme heat threshold of 93.2°F, the annual number of extreme heat days with a high above 93.2°F is projected to nearly double, from 4.1 days per year in the period of 1980-2005 to 7 days per year in the period of 2006-2060.

Irvine's Primary Climate Change Concerns

The following four risks are based on the Cal-Adapt⁷ data from above, southwest climate change adaptation recommendations,^{8 9} and information from the City of Irvine's webpage regarding water and utility resources. They are recommendations that I have come up with based on my research.

1. Increased Frequency, Intensity, and Duration of Extreme Heat Events

This leads to increases in mortality due to heat-related illness and exacerbation of existing chronic health conditions. These impacts will primarily be felt by the most vulnerable members of society, such as the elderly, the chronically ill, infants, those who are socially or economically disadvantaged, and those who work outdoors.

2. Rising Sea Levels

Saltwater intrusion threatens to infiltrate the Orange County Groundwater Basin, accounting for 65% of Irvine's water resources. The remaining 35% of its water is imported from the Colorado River via the Colorado River Aqueduct; however, due to increased frequency and persistence of droughts, Colorado River flows are shrinking, threatening Irvine's water security.¹⁰

3. Rising Temperatures

Increases in air-conditioning usage will intensify electricity demands, placing added stress on the grid, which could potentially lead to blackouts and power outages. And, further complicating this issue, without new sources of "clean" electricity, higher demand will increase greenhouse gas emissions.

4. Decreased Precipitation

Reservoirs, rivers, water basins, and other critical water resources will not be replenished as precipitation levels continue to decline. This will exacerbate dry conditions and water scarcity in southern California .

⁷ Cal-Adapt, 2017. <http://beta.cal-adapt.org/>

⁸ Adapting to Climate Change, Southwest; EPA, 2016.

⁹ National Climate Assessment, Southwest, 2014. <http://nca2014.globalchange.gov/>

¹⁰ City of Irvine Community Development, Water Quality. <http://www.cityofirvine.org/community-development/water-quality>

Action and Adaptation

The 2012 California Adaptation Planning Guide (APG)¹¹ provides guidance and support for local governments and regional collaboratives to assess climate change vulnerability and to develop adaptation strategies. This resource is one among many provided by the state of California to enable adaptation planning at the local level. These resources aided me in developing potential adaptation strategies for Irvine based on the city's climate change needs and the key risks that I identified above.

A keystone element of Irvine's adaptation strategy should be community outreach and education. Long-term implementation of climate change adaptation requires community understanding and support.¹² A public outreach and community education program should seek to raise public awareness of the observed and potential threats of climate change and the benefits of taking action. For example, if community members are aware that climate change severely threatens Irvine's water security, they will be more inclined to adopt water conservation practices, such as watering your lawn less frequently and during cooler parts of the day or installing water-saving shower heads.

Further Adaptation Strategies Include:¹³

- The use of white-roofs, shade tree planting, and increased shading to combat more frequent and severe heat waves.
- The reduction of non-air-conditioning electricity demand through the use of energy efficient appliances in response to heat increases calling for more air-conditioning use and higher electricity demand.
- The application of smart-grid technologies, the installation of home solar panels, and the increased integration of renewable resources into the electrical grid to prevent stress on the grid and increased chances of brownouts and power outages.
- Increasing preparedness through the provision of cooling centers to accommodate vulnerable populations within the city, such as the elderly.

¹¹ California Adaptation Planning Guide, 2012. http://resources.ca.gov/docs/climate/01APG_Planning_for_Adaptive_Communities.pdf

¹² APG: Identifying Adaptation Strategies, 2012. http://resources.ca.gov/docs/climate/APG_Identifying_Adaptation_Strategies.pdf

¹³ Based on suggestions from the APG: Identifying Adaptation Strategies and the EPA's Adapting to Climate Change, Southwest.

ND-GAIN Urban Adaptation Assessment

Irvine is a top-tier city. Supporting over 17,000 businesses and 200,000 working people, and with a medium household income of \$92,000, Irvine is ranked first in wall street’s listing of best-run cities in America, ranked third in small American city of the future for economic potential, and ranked as one of the most livable cities in America. As “one of the greenest cities in America,” Irvine is an award winning sustainable community with a long-standing commitment to environmental stewardship, such as open space preservation, protecting the environment, and conserving natural resources. The city has developed a variety of environmental initiatives, ranging from green building to a 20-year energy plan designed to increase energy efficiency, increase renewables, and reduce greenhouse gas emissions through involving the whole community.¹⁴

For these reasons, Irvine has enormous potential to become a leading city in climate change adaptation; just as California has taken the lead in combating climate change through mitigation and adaptation initiatives, Irvine can do the same. The Urban Adaptation Assessment could potentially facilitate this process in Irvine as well as in cities across the U.S. and around the world. While California provides a gamut of resources for local climate change adaptation planning, California is unique in this regard– the majority of states in the United States do not have an adaption plan and are not in the process of developing one. In fact, only 15 states have completed adaptation plans.¹⁵ In other words, cities are on their own in climate change adaptation efforts. While the EPA and the National Climate Assessment summarize the impacts of climate change throughout the United States, now and in the future, these assessments are restricted to the regional level, such as the southwest, northeast, and midwest, and cannot address the specific needs of individual states and cities. A tool such as the Urban Adaptation Assessment can bridge the gap between broader climate change assessments and local needs, allowing cities to identify their precise climate change risks and adaptation responses.

Allies and Aids

Irvine is not alone in creating an adaptation plan. Neighboring cities such as San Clemente¹⁶, Lake Forest, Laguna Beach, and Mission Viejo have developed climate action plans that city officials can reference in creating Irvine’s adaptation plan, especially because these cities have similar characteristics, and, therefore, similar climate change risks to Irvine. Additionally, the University of California Irvine has a climate action plan¹⁷ and could be a helpful ally in developing Irvine’s own plan.

¹⁴ Guide to Irvine, 2017.

¹⁵ Center for Climate and Energy Solutions, 2012. <https://www.c2es.org/us-states-regions/policy-maps/adaptation>

¹⁶ City of San Clemente Climate Action Plan, 2012. <http://www.san-clemente.org/home/showdocument?id=10036>

¹⁷ UCI Climate Action Plan, 2016. <http://sustain...ne2016CAP.pdf>

CALIFORNIA

Adaptation Resources and Legislation:

1. California Adaptation Planning Guide (2012)

Designed to provide guidance and support to local governments and regional collaboratives to address the unavoidable consequences of climate change.

- APG: Planning for Adaptive Communities
- APG: Defining Local and Regional Impacts
- APG: Understanding Regional Characteristics
- APG: Identifying Adaptation Strategies

2. California Statewide Climate Adaptation Strategy – CAS (2009)

A statewide adaptation strategy that assess climate change impacts across seven government sectors as a basis for providing guidance for establishing actions that prepare, prevent, and respond to the effects of climate change.

- 2014 Update: Safeguarding California: Reducing Climate Risk
- 2017 Update: DRAFT Safeguarding California

3. Climate Change Research Plan (2015)

Articulates near-term climate change research needs to ensure that the state stays on track to meet its climate goals.

4. Cal-Adapt (2017)

A web-based climate adaptation planning tool that allows the user to identify potential climate change risks in specific geographic areas throughout the state.

5. Assembly Bill 32 – California Global Warming Solutions Act of 2006

Requires a state-wide greenhouse gas emissions limit equivalent to the statewide greenhouse gas emissions levels in 1990 to be achieved by 2020– updated in 2016 to greenhouse gas reduction target of 40% below 1990 levels by 2030. Requires the Air Resources Board (ARB) to adopt regulations to require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with this program. Requires the development of a Scoping Plan which lays out California’s strategy for meeting these goals.

6. Executive Order B-30-15

Sets a greenhouse gas emissions target for 2030 at 40 percent below 1990 levels and explicitly addresses the need for climate adaptation and directs the state to: Incorporate climate change impacts into the state's five year infrastructure plan and update the Safeguarding California plan.

7. Executive Order S-13-08

Stipulates the completion of the complete the first California Sea Level Rise Assessment Report and calls for coordination between the Climate Action Team and local, regional, state and federal public and private entities to develop a state Climate Adaptation Strategy.

8. Executive Order S-3-05

Establishes greenhouse gas emission reduction targets, creates the Climate Action Team and directs the Secretary of Cal/EPA to coordinate efforts with meeting the targets with the heads of other state agencies. Calls for Mitigation and Adaptation Plans.