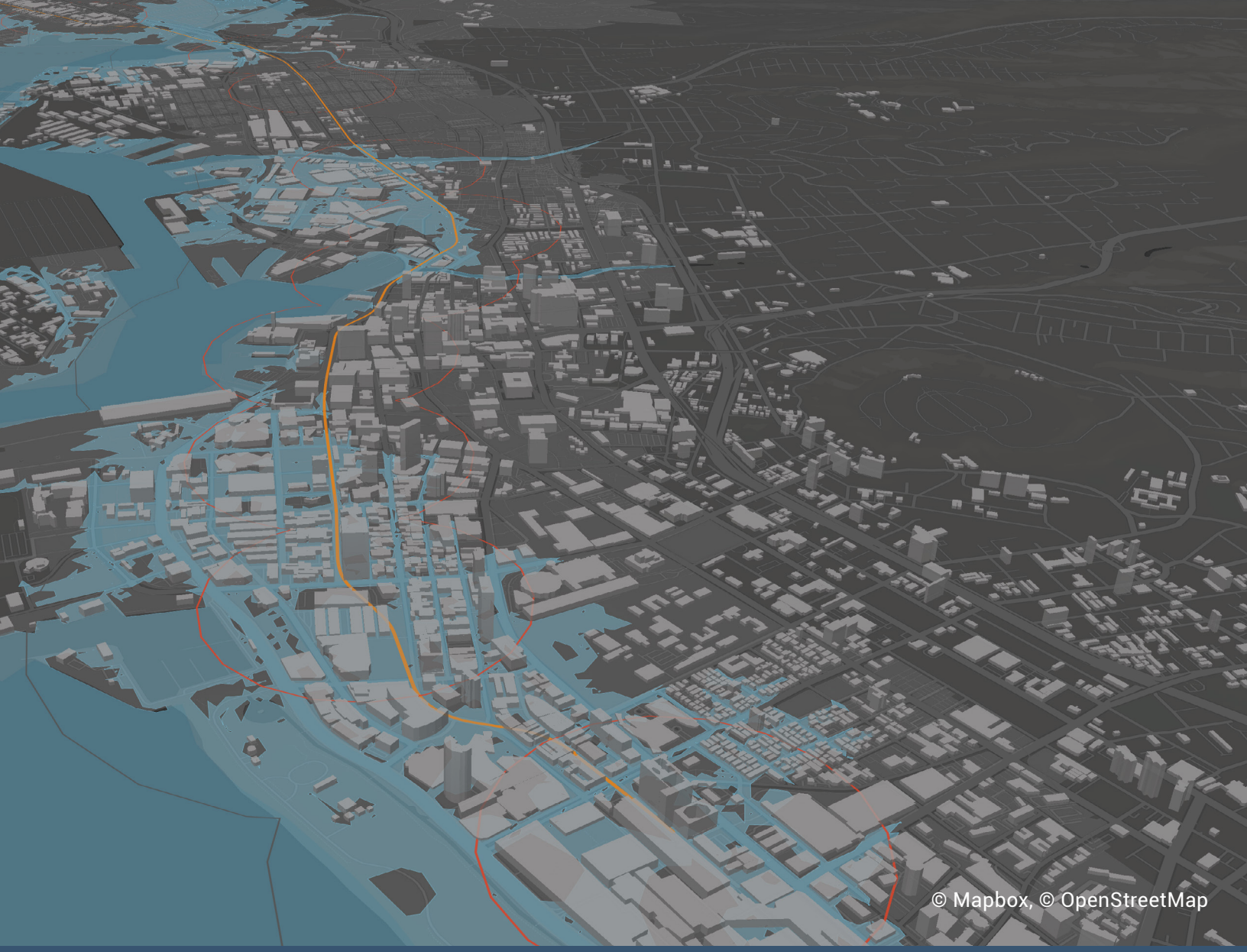


Data Driven Planning for **City Resilience, Climate Adaptation, and Recovery**

URBAN FOOTPRINT

Table of Contents

Sustainable cities will play a critical role in securing a resilient future.

To Our Fellow Planners,

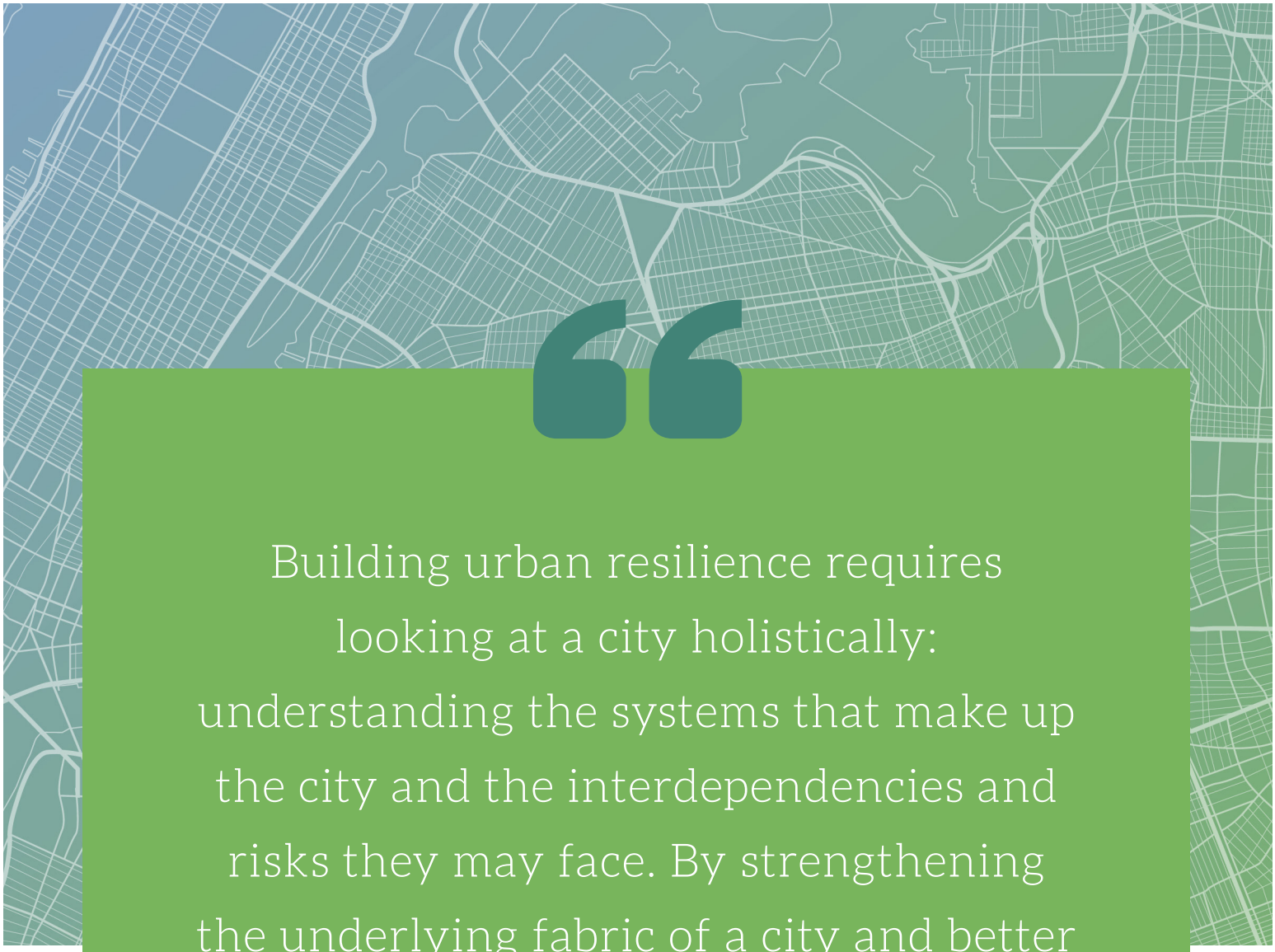
Scientists agree: If we are to curb the effects of climate change, we need to reduce global emissions to just 80 percent of 1990 levels by 2050. Today over half the world's population lives in urban areas, and by 2050, 70% of global citizens are expected to be urban dwellers. Urban areas will be responsible for the majority of resource consumption and emissions production. This places cities at the center of our society's greatest challenges and most promising opportunities.

At the same time we shape cities to reduce carbon emissions we must protect them. While no single weather event can be solely attributed to climate change, many scientists contend climate change already plays a role in increasing the intensity and frequency of extreme weather events. In addition to the ongoing and incredibly important work of planning for sustainable, equitable, and economically strong communities, planners must now simultaneously tackle the imminent ramifications of climate change to ensure the design of safe, resilient cities.

In response, UrbanFootprint's new Risk and Resilience Module is designed to help planners and communities better prepare for the projected impacts of sea level rise, flooding, fire hazard, and more. Planners need to be armed with the tools and information they need to quantify and illustrate the potential impacts of these natural hazards on populations, job centers, residential areas, and beyond. It's our hope data-driven conversations and strategies backed by analytics that make outcomes clear will accelerate the adoption of essential community resilience and climate adaptation plans. Let's work together to secure a resilient future for both people and planet.

Peter Calthorpe and Joe DiStefano, UrbanFootprint Co-Founders

> “At the same time that we’re solving for climate change, we’re going to be building cities for 3 billion people... If we don’t get that right, I’m not sure all the climate solutions in the world will save mankind.”
>
> **PETER CALTHORPE**
> *UrbanFootprint Co-Founder, TED2017*



> Building urban resilience requires looking at a city holistically: understanding the systems that make up the city and the interdependencies and risks they may face. By strengthening the underlying fabric of a city and better understanding the potential shocks and stresses it may face, a city can improve its development trajectory and the well-being of its citizens."

100RC

What is Urban Resilience?

Data-driven resilience planning supports sustainable, equitable, and economically strong communities.

In the United States, 53% of greenhouse gas emissions are dependent upon the nature of our buildings and our transportation.[1] Both sit squarely in the realm of urbanism. As we prepare for the coming urban transformation, our land use choices will play a critical role in not only our ability to curtail emissions and mitigate the impacts of climate change, but also our success in fostering equitable, sustainable, and economically strong communities.

Urban planners are uniquely positioned to forge a sustainable path forward, and yet they face a nearly insurmountable challenge: Shaping the future of our urbanizing world and leading the charge against climate change with antiquated tools and technology.

UrbanFootprint is designed to address this technological gap. Cities produce more data than ever before, and yet it's never been tougher to distill this information into meaningful, actionable insights. Traditionally, resilience planning datasets like FEMA flood hazard zones, NOAA sea level rise, or CALFIRE fire hazard zones effectively identify areas of potential hazard but stop short of analyzing who and exactly what is vulnerable.

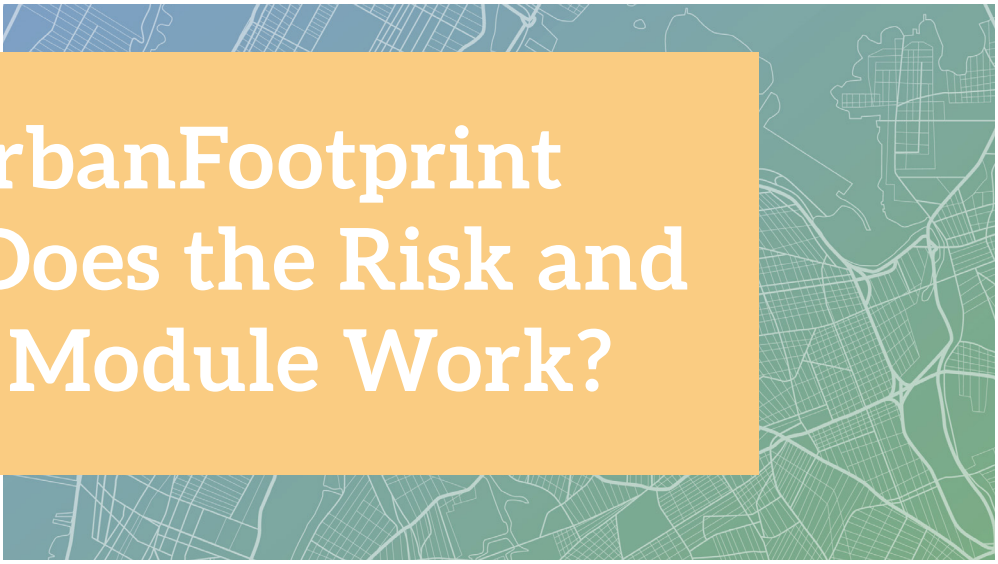
UrbanFootprint's Risk and Resilience Module helps planners build smart resilience, recovery, and climate adaptation plans with the ability to quickly evaluate the impacts of climate change and natural hazards on current and future land use scenarios. Plus, as it's not enough for planners to evaluate this information in a silo, UrbanFootprint's suite of analytics allows planners to get a holistic view of potential outcomes by evaluating risk and resilience within the context of key planning metrics like transportation, walk and transit accessibility, emissions, household costs, and more.

In this eBook, we'll share how UrbanFootprint's Risk and Resilience Module works and walk through three example case studies of data-driven planning for sea level rise, flood hazard, and fire hazard.

> “The great green city of the future is ecologically and economically resilient; it’s made up of healthy, livable neighborhoods where the benefits of nature are available to all people.”
>
> **PASCAL MITTERMAIER**
>
> *Global Managing Director, Cities, The Nature Conservancy*

1 Peter Calthorpe, Urbanism in the Era of Climate Change, page 8.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?



UrbanFootprint streamlines each stage of the planning process: From exploring and visualizing existing conditions, to creating new plan scenarios, to analyzing current and future plan impacts, UrbanFootprint serves as the data and mapping platform for sustainable community planning.

The Risk and Resilience Module is one of ten analysis modules currently available in UrbanFootprint:

- Emissions
- Transportation
- Transit Accessibility
- Land Consumption
- Household Costs
- Conservation
- Water Use
- Walk Accessibility
- Risk and Resilience
- Energy Use

These modules make it easy to visualize and measure the current and future impacts of land use and planning decisions. The Risk and Resilience Module evaluates the impacts of sea level rise, flood inundation, and fire hazard.

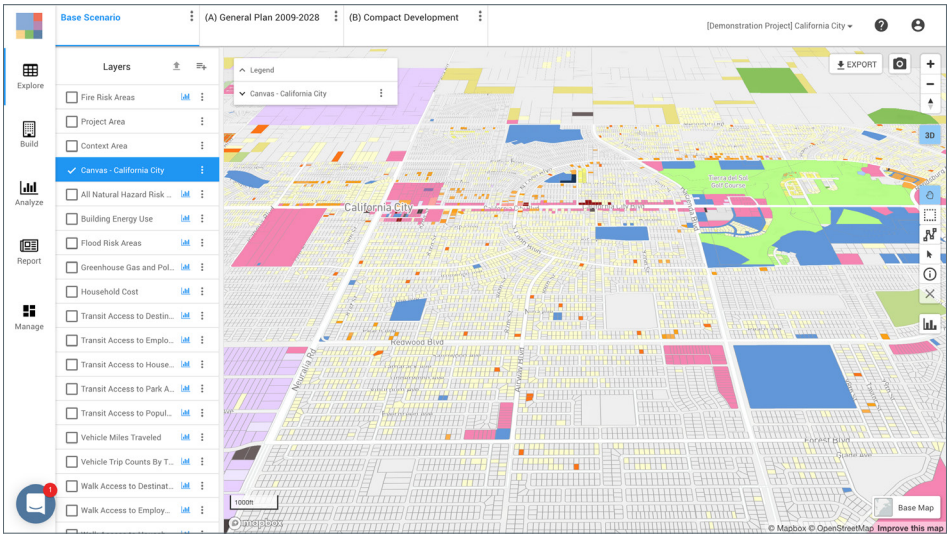
By spatially joining the number of parcels, acreage, population, dwelling units, and jobs within areas that are at risk for each type of natural disaster, UrbanFootprint is able to quickly summarize the impacts of potential natural hazards now and in the future.

Below we'll quickly walk through how to use the Risk and Resilience Module in each step of the planning process, from general plan and design projects, to more focused resilience, climate adaptation, or recovery plans.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Understanding Existing Conditions and Potential Risk

UrbanFootprint's extensive data library allows planners to access pre-built land use maps at the parcel level for nearly all U.S. locations. In UrbanFootprint, we call this the "Base Canvas".



UrbanFootprint displays the pre-built land use or "Base Canvas" for California City, California.

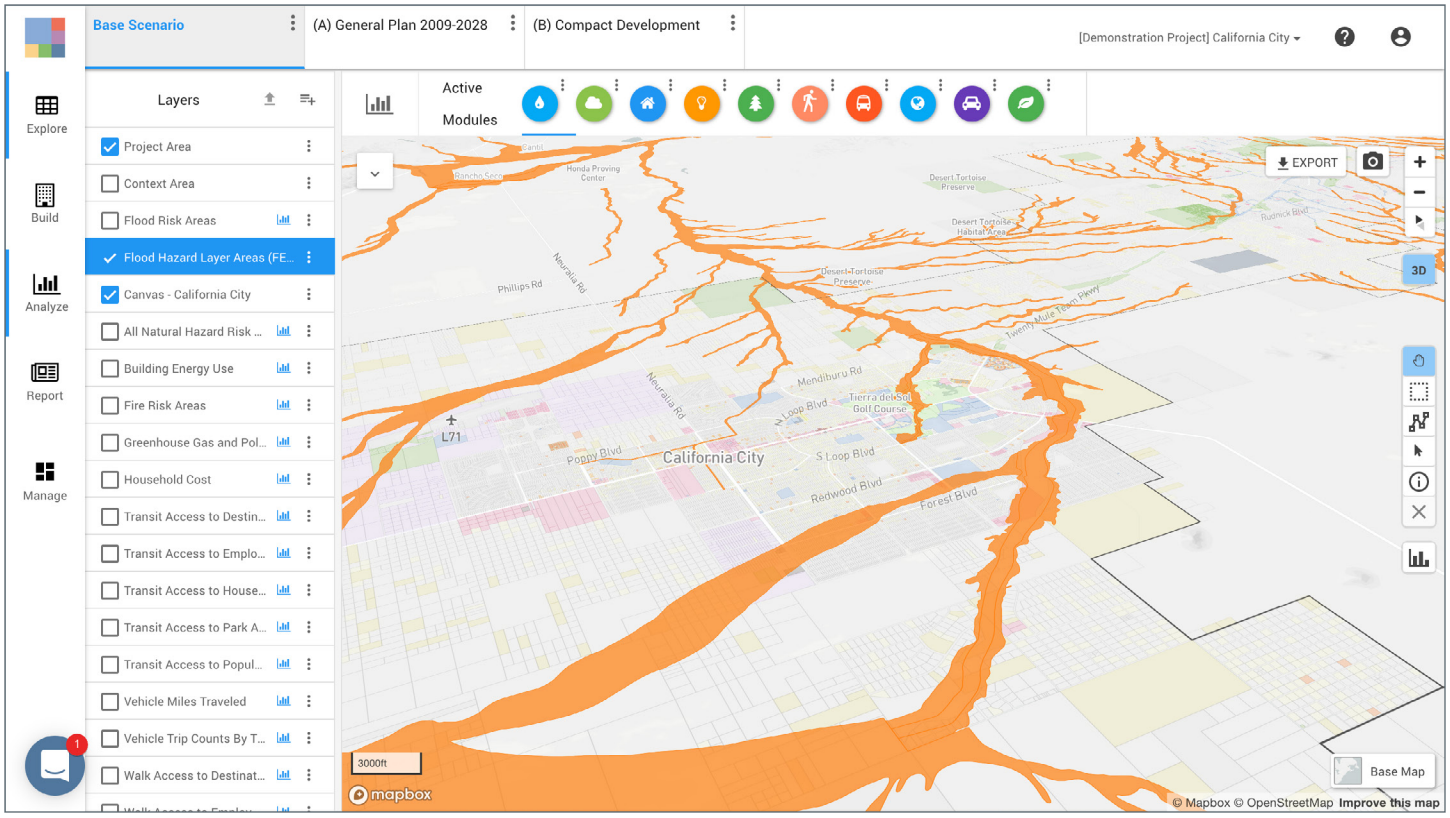
The image above displays the Base Canvas for California City, California.

A Note on California City

California City is a real city in California. It was founded in 1958 when a real estate developer bought 80,000 acres in the Mojave Desert with the aim of master planning California's next great city, one that would some day rival Los Angeles in size. Growth fell well short of his expectations, so we took it upon ourselves to create an UrbanFootprint scenario, "General Plan, 2009-2028" that builds out California City to its founder's vision. In addition, we built an alternative, more compact scenario, "Compact Development", so we could compare plan performance across a range of key factors, including risk and resilience.You can check out these scenarios in more detail in UrbanFootprint, where California City is set up as a demonstration project in the free trial.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

From here, users can easily layer additional datasets, or reference layers, over the Base Canvas. For example, if we select the Federal Emergency Management Agency's (FEMA) "Flood Hazard Layer Area" from the reference layers, we can quickly see which areas may be at risk of inundation in a flood event.



UrbanFootprint displays FEMA Special Flood Hazard Areas for California City, California in orange.

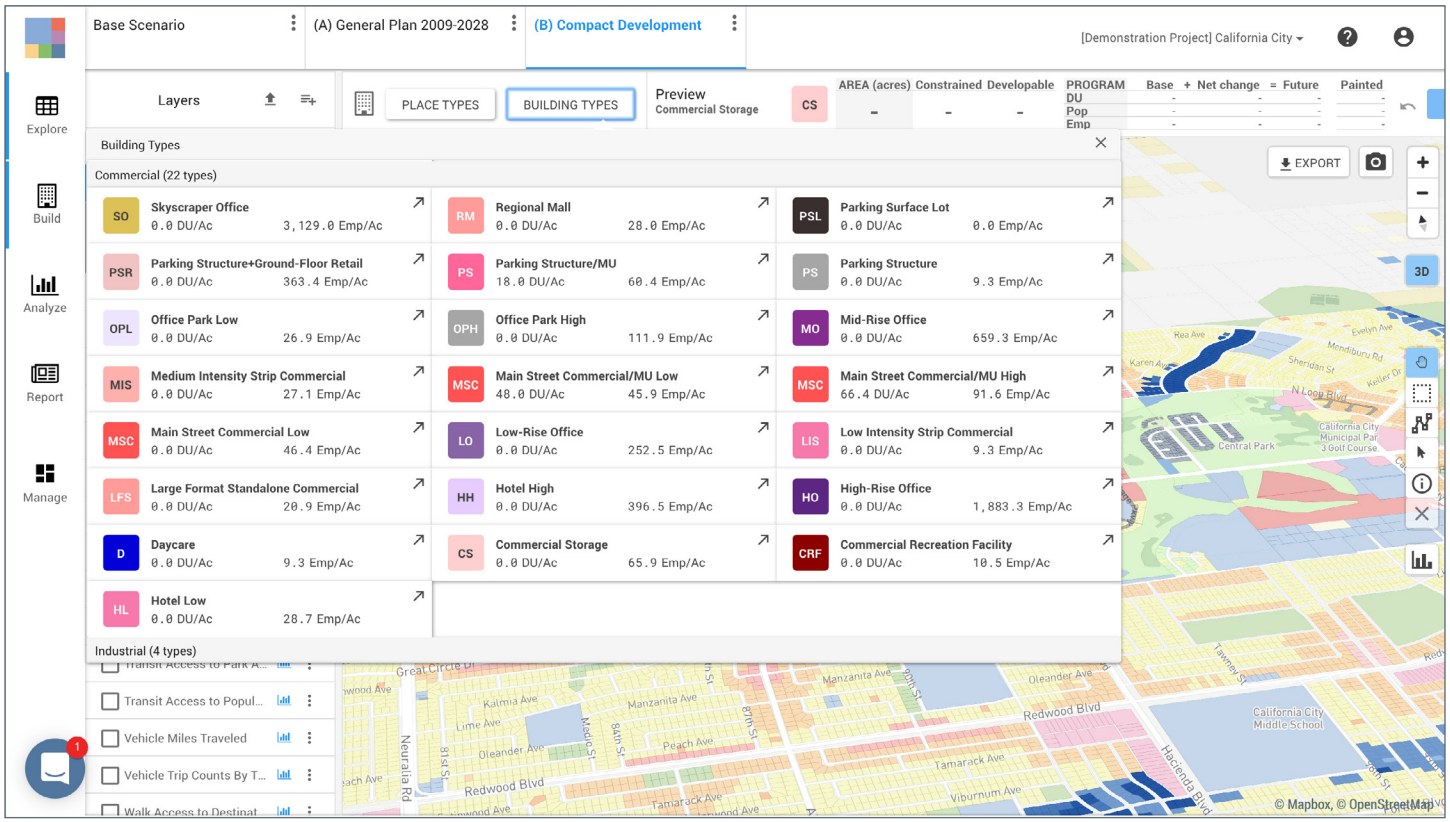
UrbanFootprint's built-in data library includes hundreds of reference datasets that allow planners to get quick answers to critical planning and resilience questions in a matter of minutes, rather than days or weeks.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Scenario Planning for Future Resilience and Recovery

Of course, it's not enough to look at potential risks for current land use conditions. UrbanFootprint's scenario planning capabilities make it easy to build new scenarios to explore the risk and resilience impacts of the proposed plans or future land use policies.

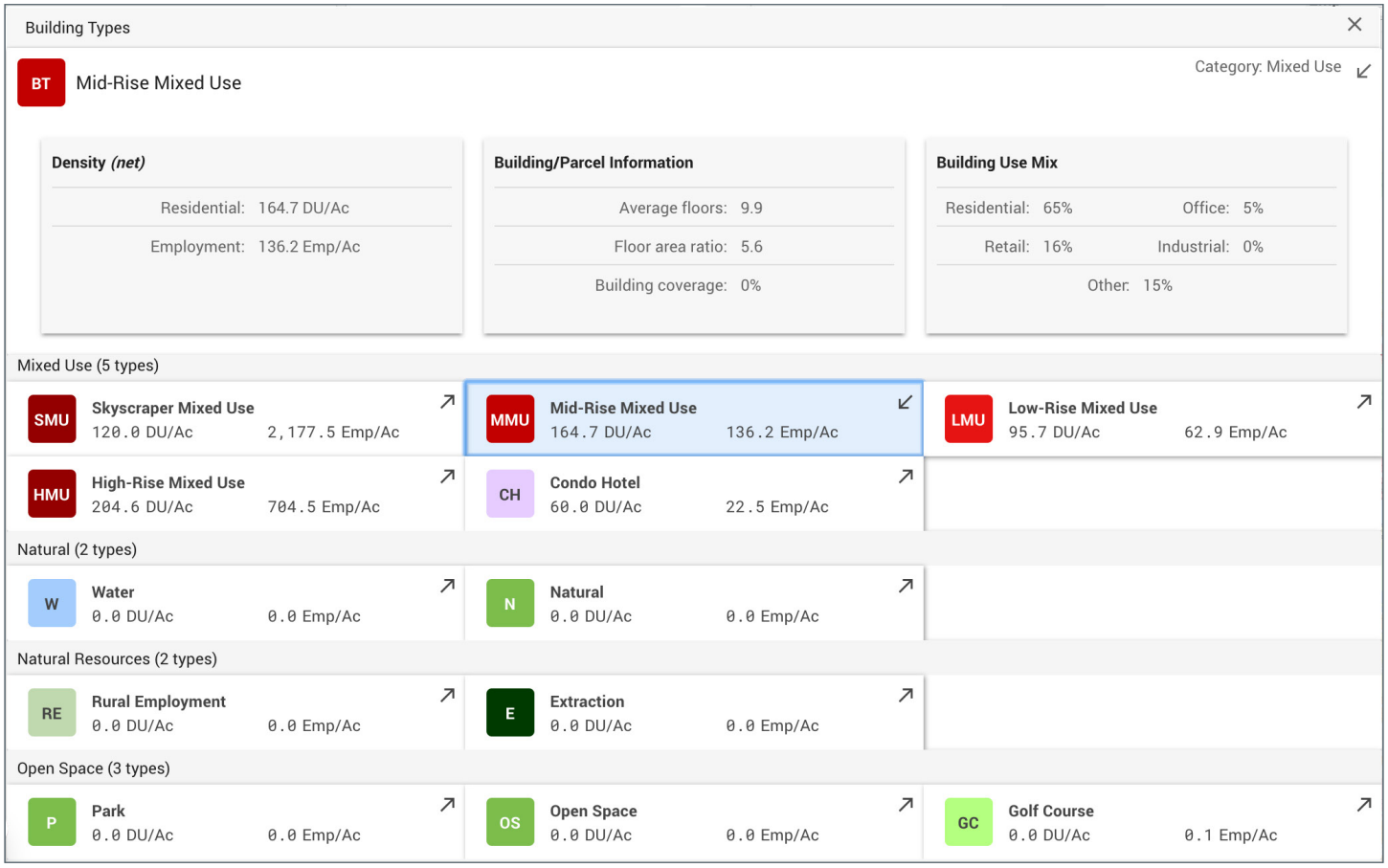
To get started, UrbanFootprint users can simply copy the current land use conditions for their project or community to create a new scenario and begin making changes by modifying land use on select parcels or blocks. UrbanFootprint's out-of-the-box Building and Place Type catalog expedites this process with a comprehensive library of land use codes and districts.



UrbanFootprint's Building Type library.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Each Building or Place Type comes preset with assumed density, land use, residential, and employment mix for each parcel or block. Users can edit these types or create new types to match local conditions or project needs.

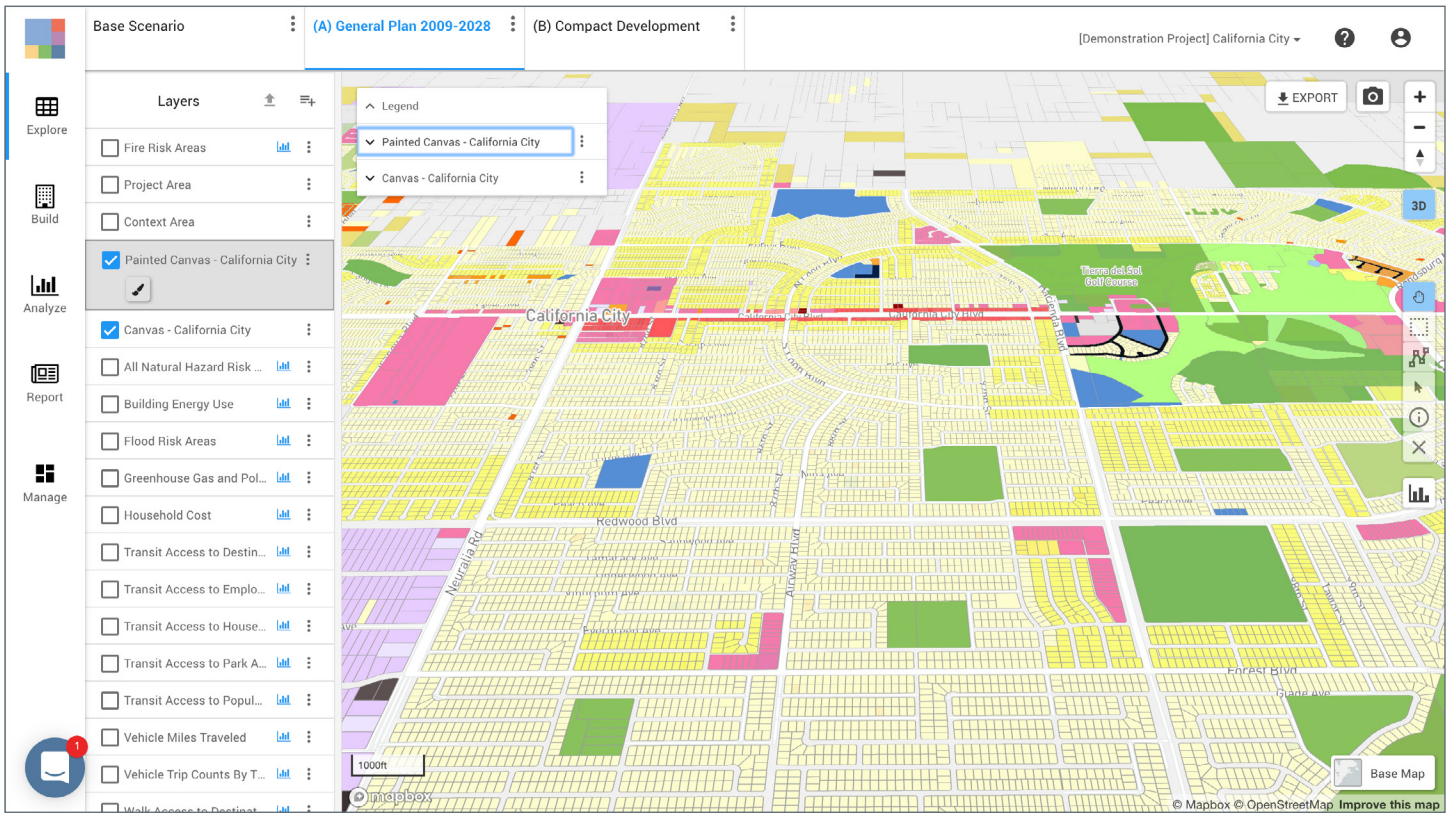


UrbanFootprint's Building Type library.

This streamlines the process of measuring basic planning metrics as you make changes to the land use in real-time. For example, let's say we wanted to explore the potential impacts of California City's General Plan versus a higher-density, compact infill plan.

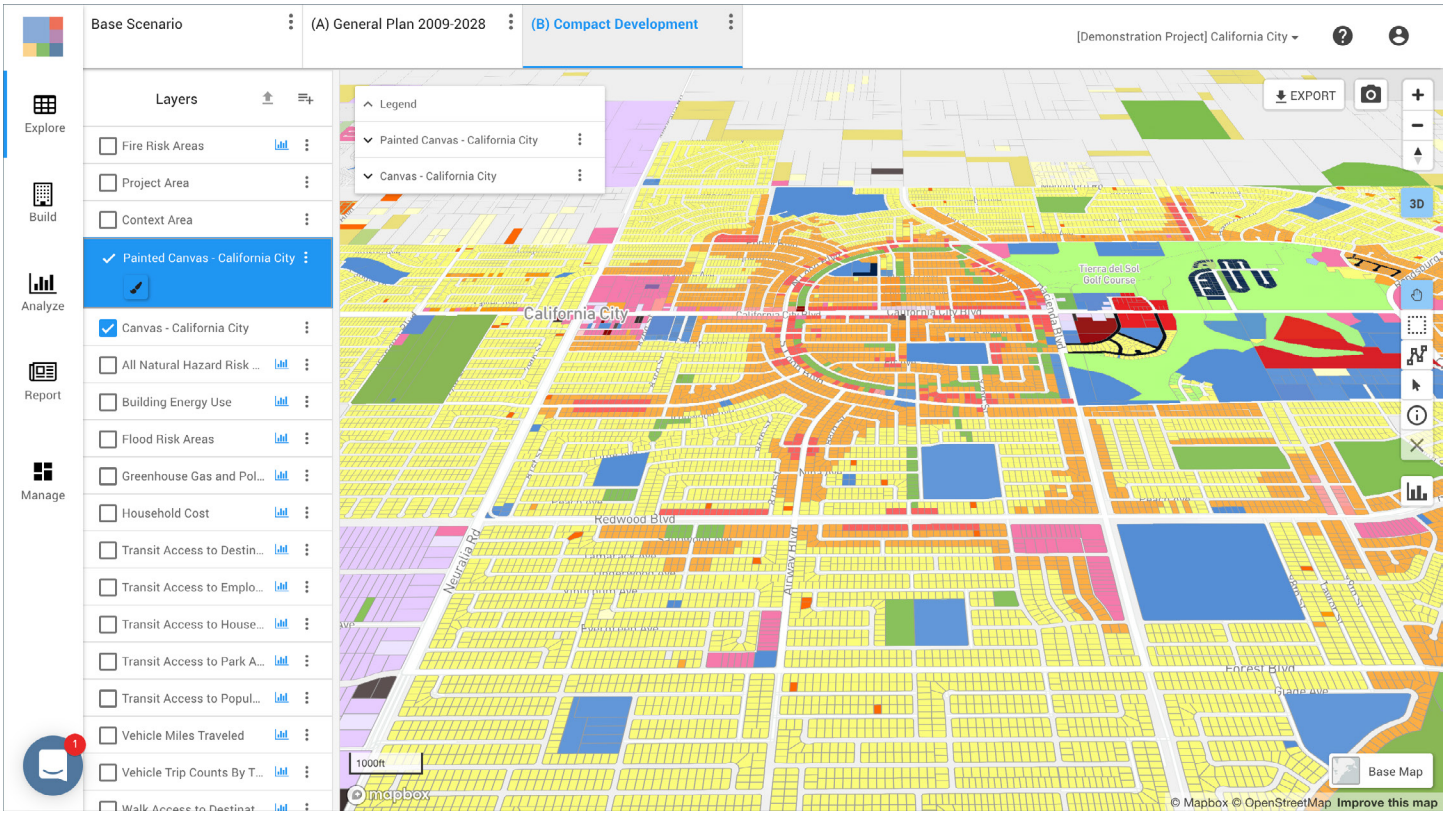
What is UrbanFootprint and How Does the Risk and Resilience Module Work?

We can quickly map new scenarios in UrbanFootprint by selecting the parcels we'd like to update and choosing what Building (parcel-scale) or Place Type (block-scale) we'd like to change the current land use designation to. Below, we've created two new scenarios: "General Plan 2009-2028" and "Compact Development".



California City scenario,"General Plan 2009-2028".

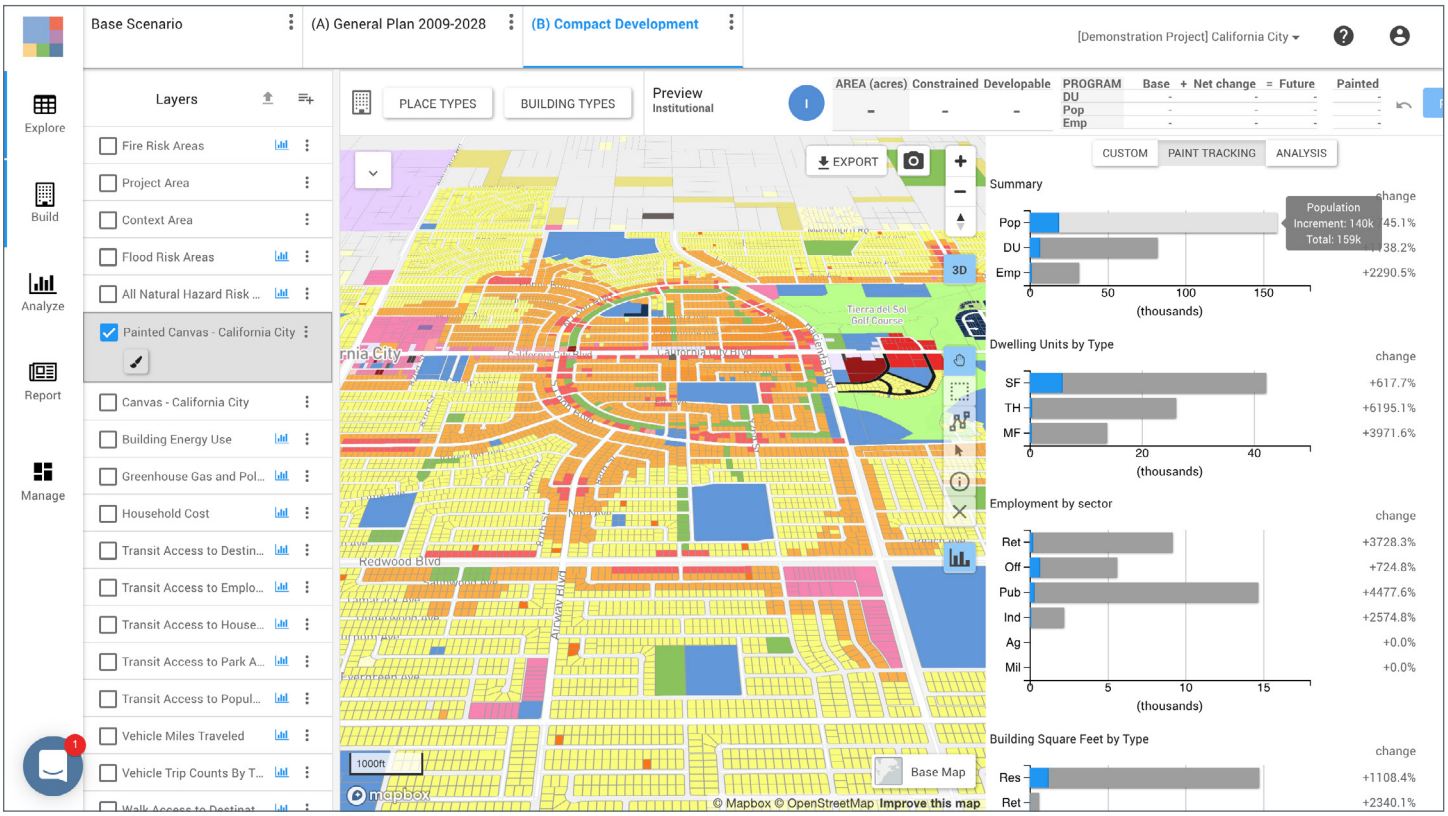
What is UrbanFootprint and How Does the Risk and Resilience Module Work?



California City scenario,"General Plan 2009-2028".

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

As we explore new land use scenarios, we can view the summarized changes in population, housing units, and employment.



UrbanFootprint summarizes the impacts of land use changes in population, housing units, jobs, and more in real-time as new scenarios are created.

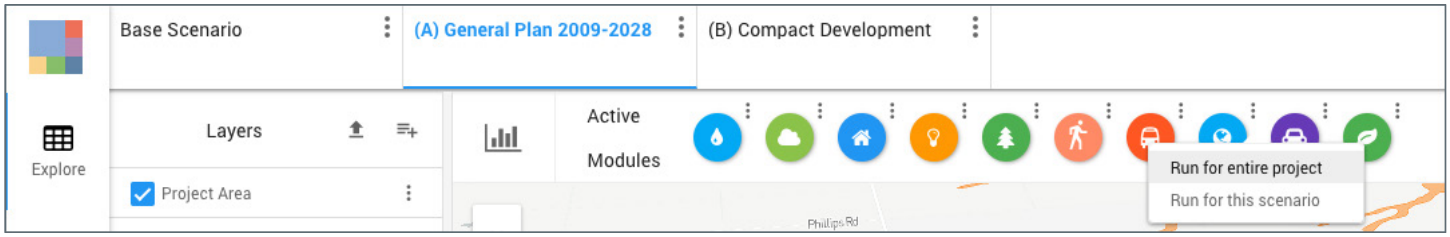
We can also easily use additional reference layers, to guide our updates to the built environment. For example, we could use flood hazard zones as building constraints while using the parks and open space reference layer to focus growth around green space and thus increase walk access to parks and recreation areas.

But how do these land use changes impact fire or flood hazard? How do the scenarios compare in terms of vehicle miles traveled or household costs? In this next step, we'll discuss how to take it a step further than map creation or alternatives development and compare each scenario's impact on key risk and resilience factors.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Creating a Holistic Analysis of Resilience Plan Impacts

To evaluate how each new scenario impacts sea level rise, flooding, and fire hazard, we run the Risk and Resilience Module in UrbanFootprint.

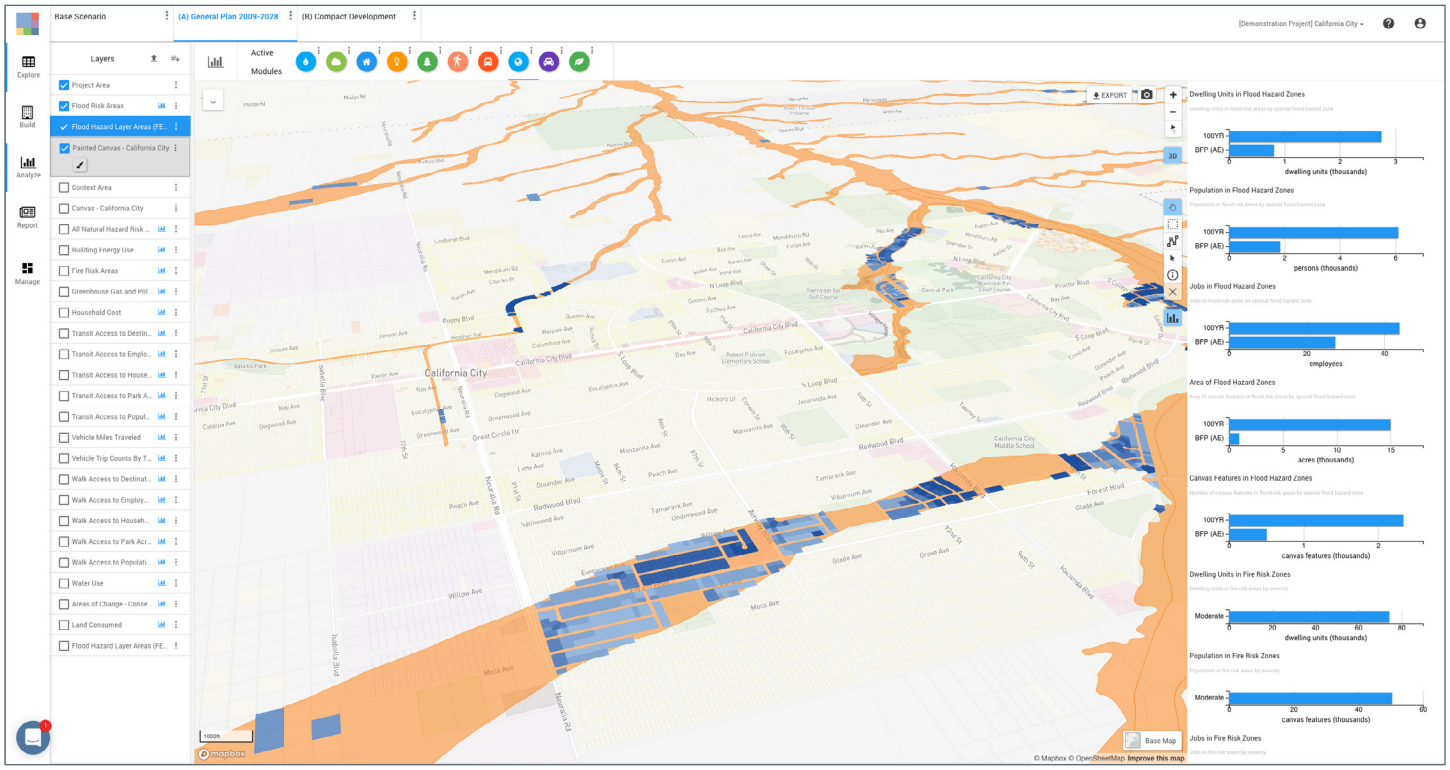


We click to run the Risk and Resilience Analysis Module in UrbanFootprint.

After the module runs, we're now able to view and compare the number of blocks or parcels, acreage, population, dwelling units, and jobs that lie within a hazard area for fire, flood, and sea level rise for each scenario. We can visualize the results in map form and compare the numbers in charts and tables for easy reporting.

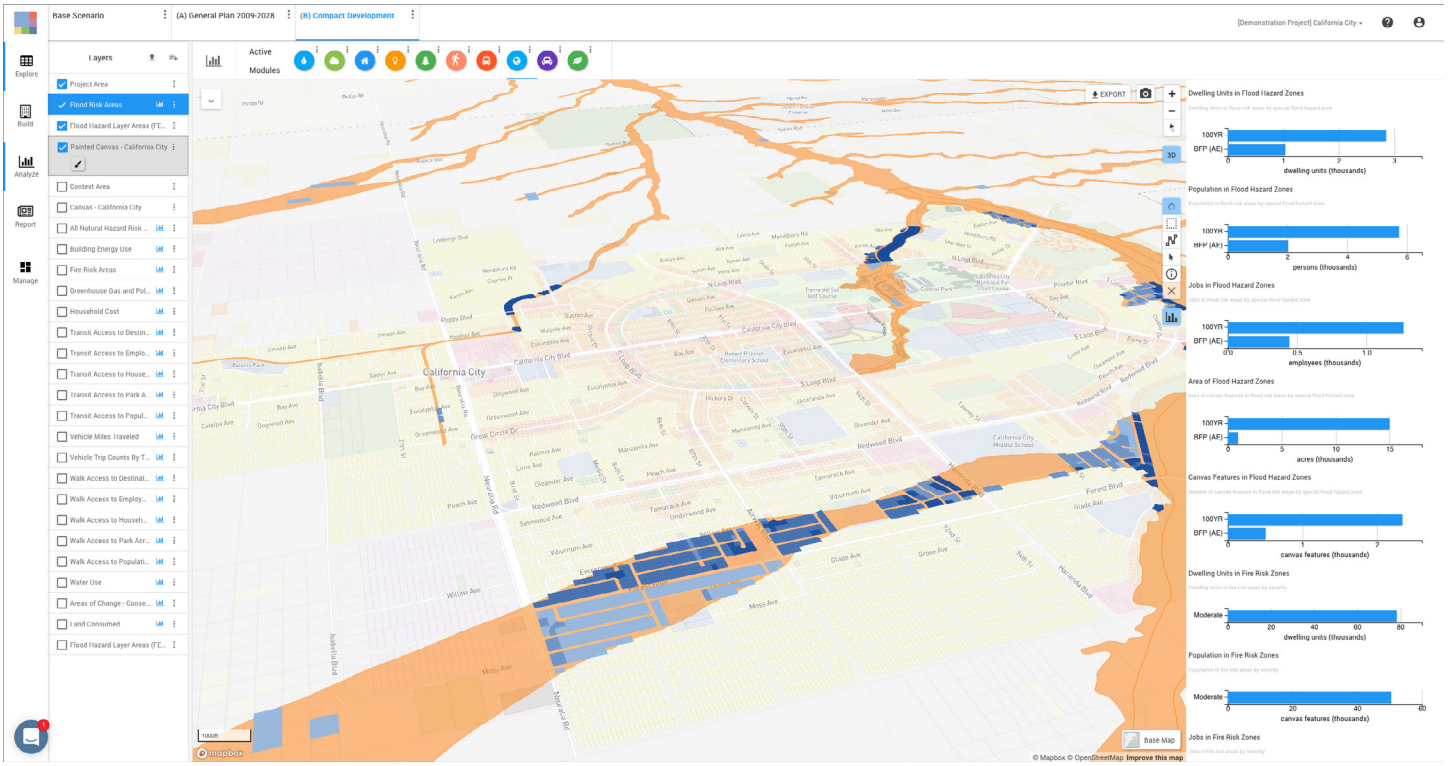
What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Following our demonstrative California City project, below we map impacted area and analyze the the number of people, housing units, and jobs in a flood hazard zone for each scenario.



Flood hazard zone analysis for the California City "General Plan 2009-2028" Scenario.

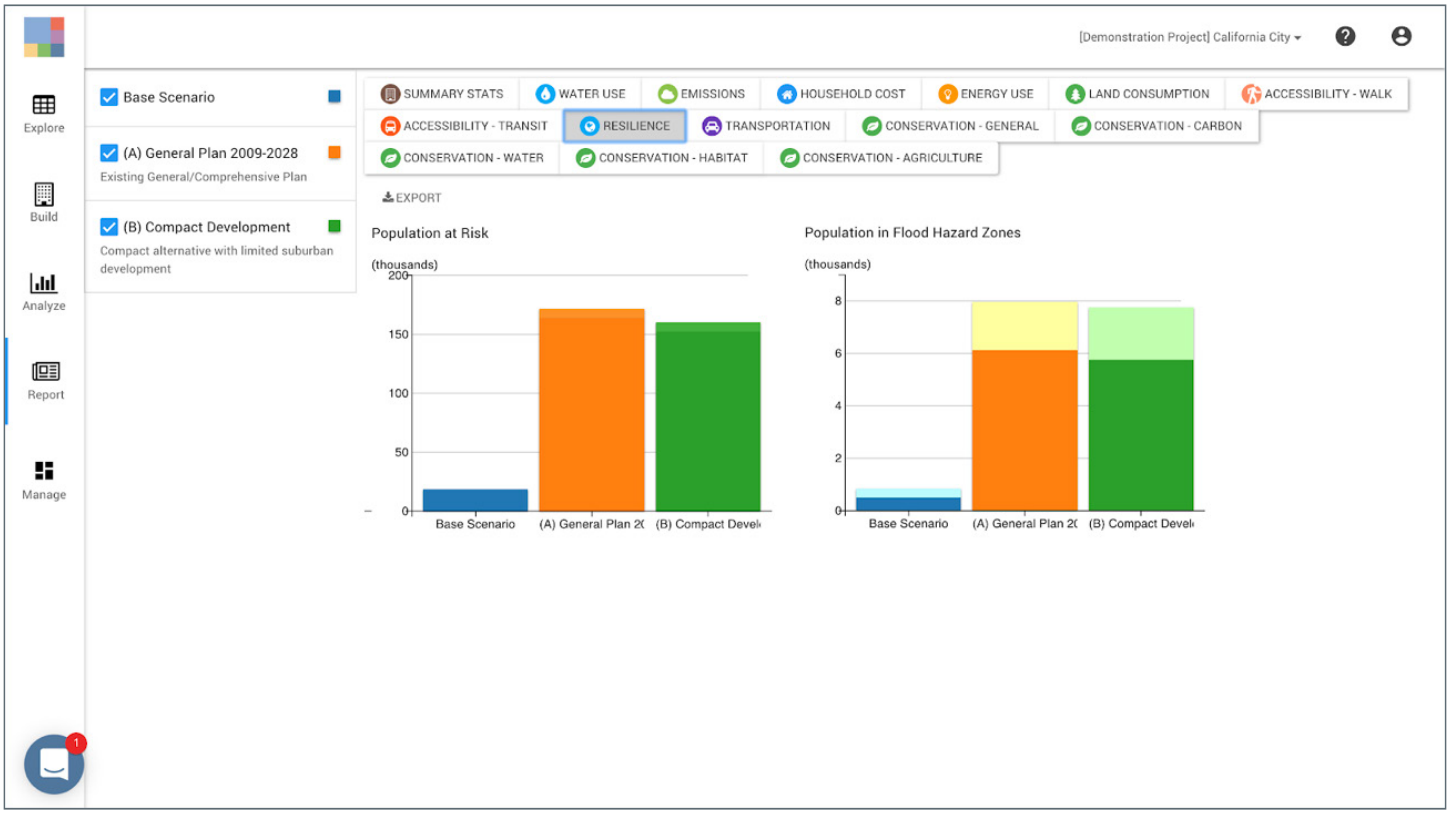
What is UrbanFootprint and How Does the Risk and Resilience Module Work?



Number of people in a flood hazard area for the California City "Compact Development" Scenario. Darker shades of blue indicate a higher number of people in a flood hazard area. Orange represents FEMA's Special Flood Hazard Area.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

We can also quickly view the results in comparative bar charts for easy-to-understand reporting.



The top left bar chart compares the population in a fire or flood hazard area for each California City scenario. The chart on the right displays population in a flood hazard zone for each scenario.

What is UrbanFootprint and How Does the Risk and Resilience Module Work?

Beyond the risk and potential impacts of fire, flood, and sea level rise, we can also evaluate a wide breadth of factors by running each of the ten analytics modules.

The top left bar chart compares the total annual vehicle-miles traveled for each scenario.

For example, we can now see that the “Compact Development" scenario reduces the number of people in a flood hazard area and the number of annual automobile vehicle-miles traveled when compared to the “General Plan" scenario. This type of analysis allows planners to efficiently evaluate the costs and benefits of proposed plans at every stage of the planning process.

Now that we've covered the basics of how UrbanFootprint works to evaluate risk and recovery efforts for current and future land use scenarios, we'll walk through three detailed case studies on how to use the Risk and Resilience Module for resilience and recovery planning.

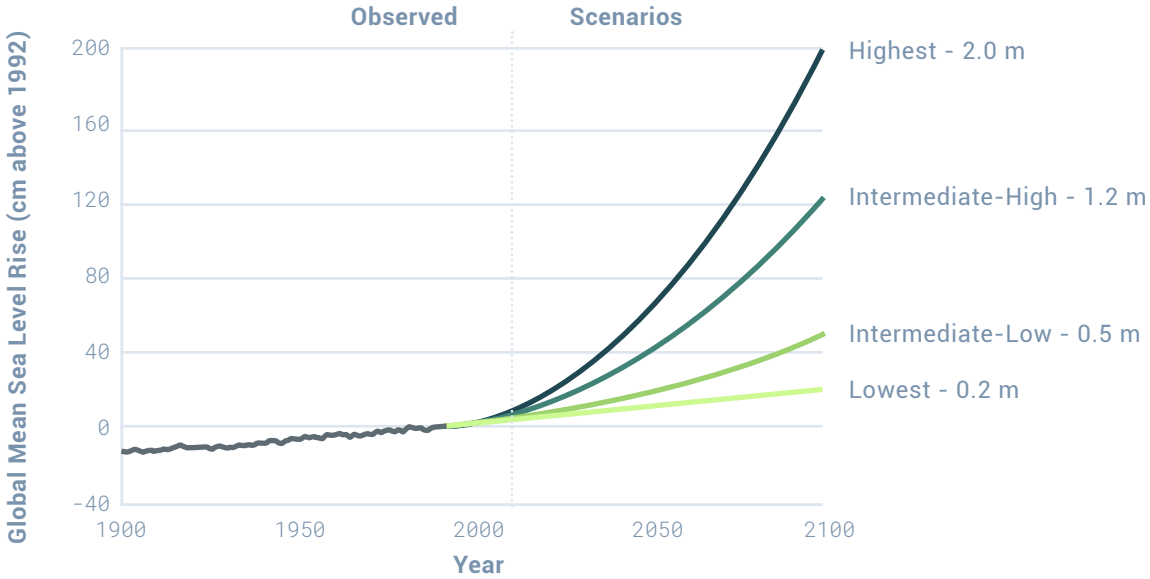
Case Study **Planning for Sea Level Rise**

Perhaps the most common topic of the climate resilience discussion, both for those who reside in cities and for those who plan for them, is sea level rise and its impacts on cities and communities along our coastlines. The New York Times reported 2017 to be the most expensive year for insurers, who are paying for liabilities attributed to natural hazards caused by anthropogenic climate change or otherwise. Local and regional governments increasingly view these threats as contingencies that should be integral to the urban planning process, especially those that spur changes to land use or the introduction of infrastructure that's essential to the safety and economic livelihood of residents.

In this case study, we'll use the UrbanFootprint's Resilience Module to evaluate and illustrate the projected outcomes of sea level rise on coastal city populations, job centers, and housing infrastructure.

Analyzing Sea Level Rise in Honolulu, Tampa, and Charleston

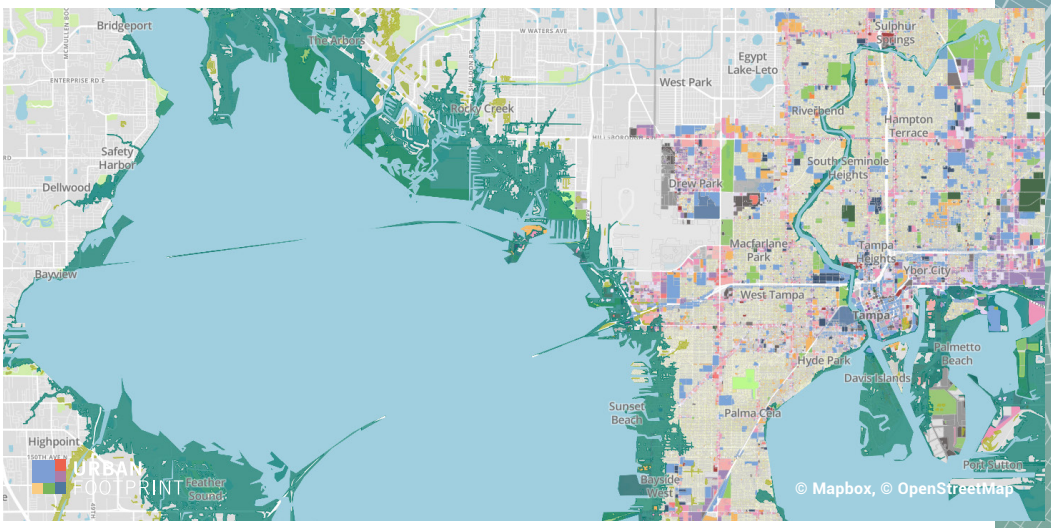
We used UrbanFootprint to evaluate the impacts of sea level rise on three coastal cities: Honolulu (HI), Tampa (FL), and Charleston (SC). We started by using UrbanFootprint's built-in data to map the likely progression from existing conditions to the National Oceanic and Atmospheric Administration's (NOAA) estimate for an anticipated six-foot sea level rise by 2100.



Source: NOAA. "Figure 6. The GMSL rise scenarios of Parris et al. (2012)." Tides and Currents, NOAA, January 2017, https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf.

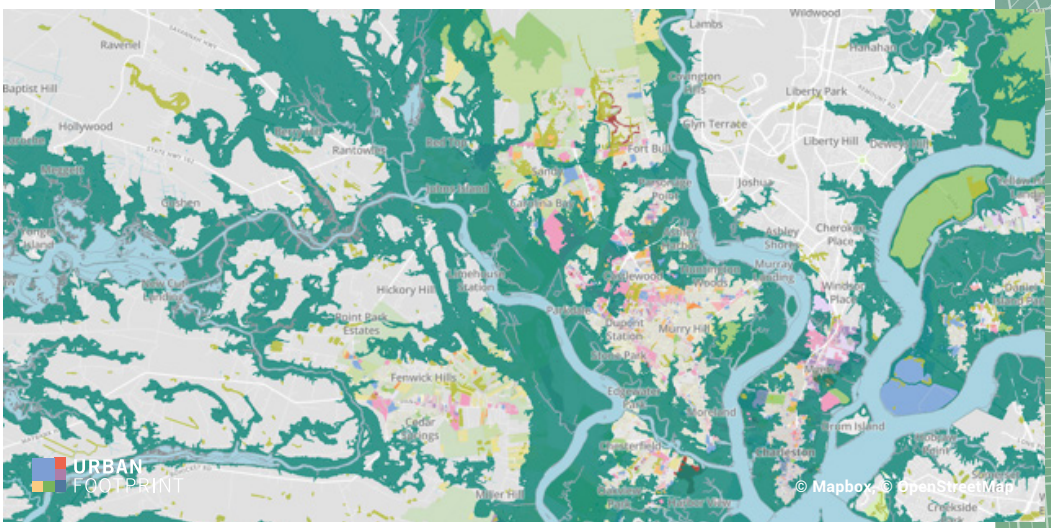
Case Study **Planning for Sea Level Rise**

Below, we see the effects of a six-foot sea level rise in on Tampa, Florida.



Mapping the projected impacts of a six-foot sea level rise in Tampa, Florida.

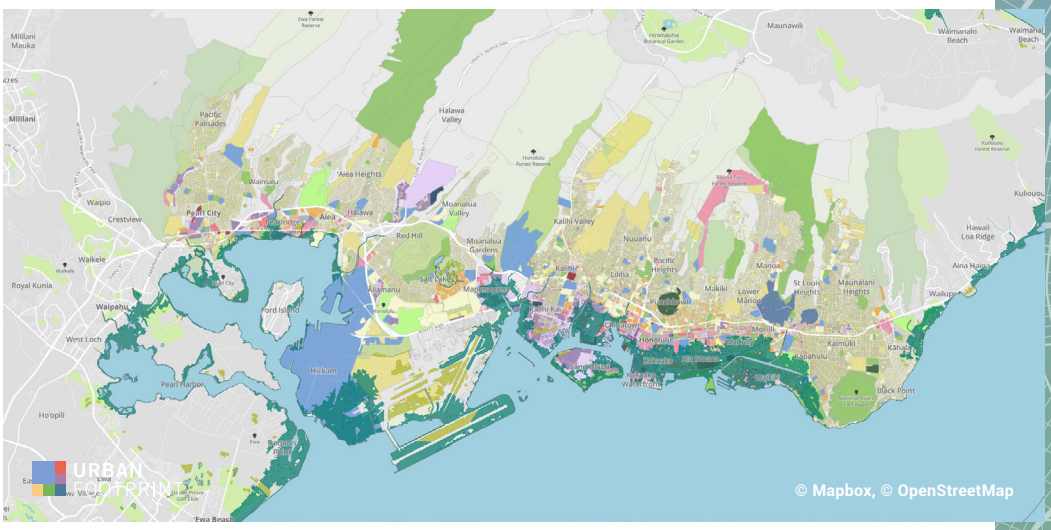
And the projected impacts on Charleston, South Carolina.



Mapping the projected impacts of six-foot sea level rise in Charleston, South Carolina.

Case Study **Planning for Sea Level Rise**

And finally, the estimated outcomes of sea level rise in the central Primary Urban Center (PUC) of Honolulu, Hawaii.

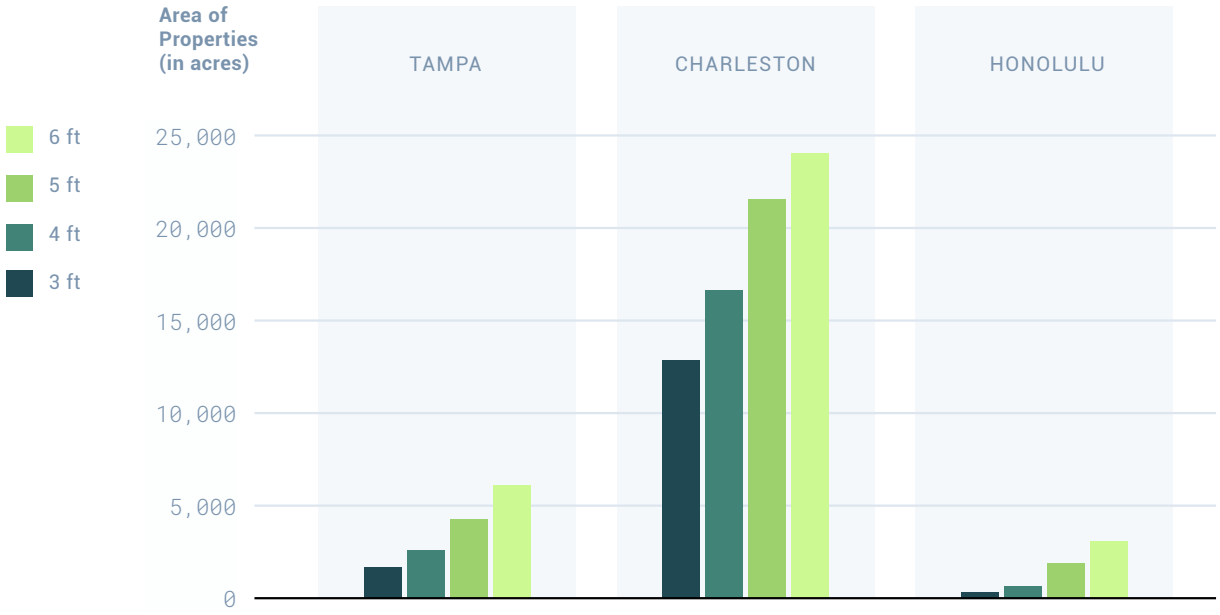


Mapping the projected impacts of sea level rise in Honolulu, Hawaii.

While these maps present dramatic impacts, we wanted to further evaluate the outcomes of sea rise in these communities. We used UrbanFootprint's built-in data and Resilience Module to quantify the population, employment, and property impacts of these sea rise scenarios.

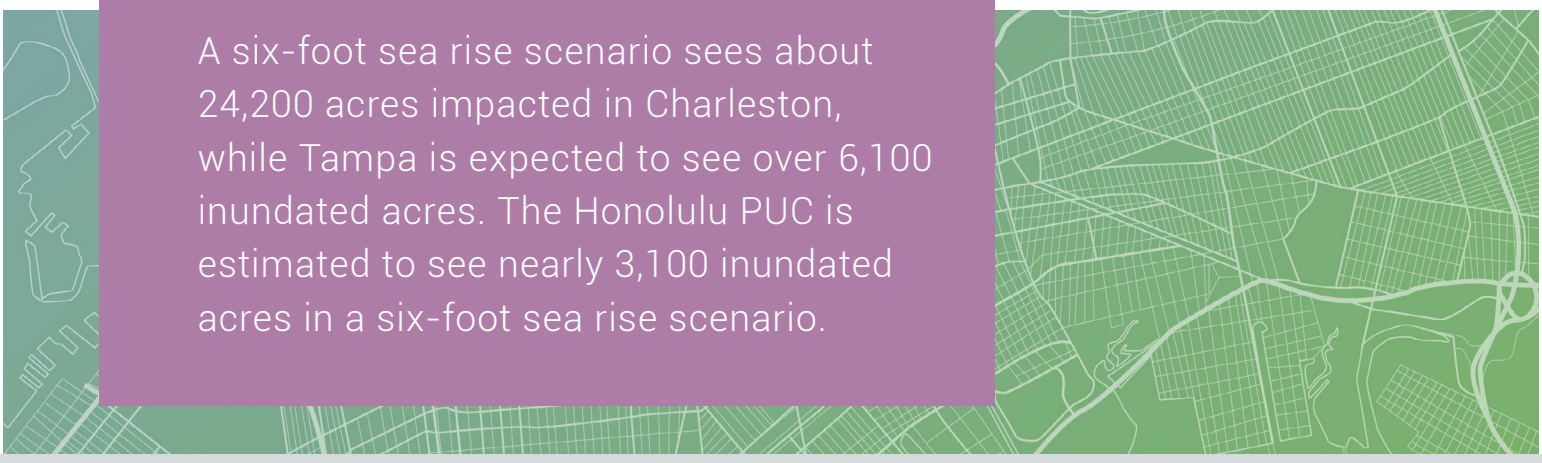
Case Study **Planning for Sea Level Rise**

Total Parcel Land Area at Risk of Sea Level Rise



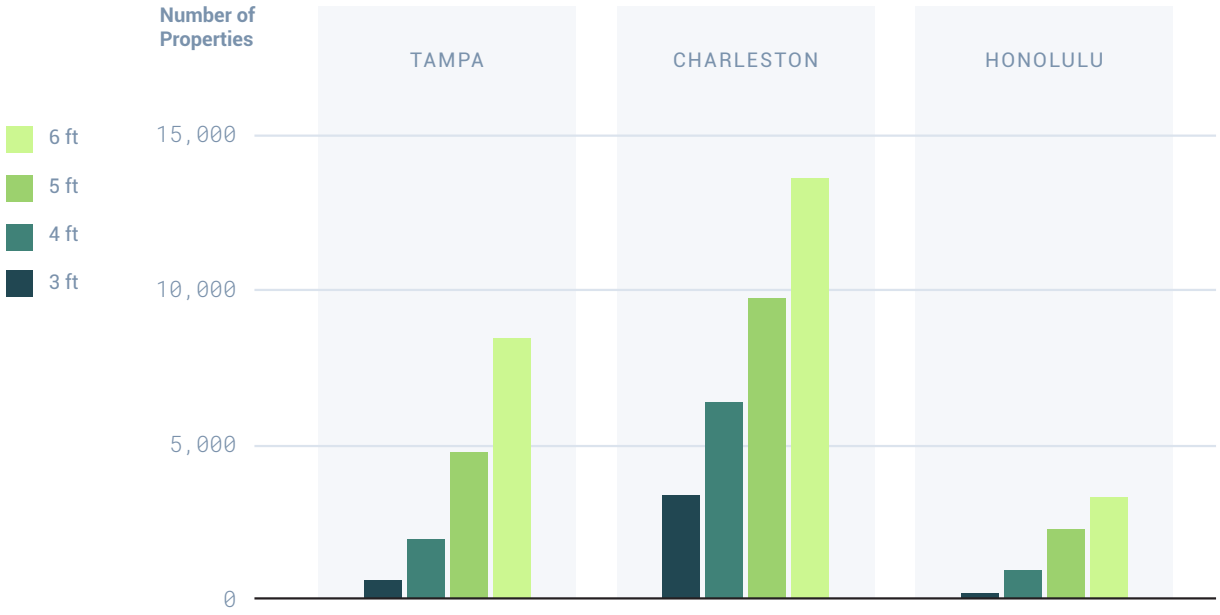
Total parcel land area at risk in the three-to-six-feet sea level rise scenarios for Tampa (FL), Charleston (SC), and Honolulu PUC (HI).

A six-foot sea rise scenario sees about 24,200 acres impacted in Charleston, while Tampa is expected to see over 6,100 inundated acres. The Honolulu PUC is estimated to see nearly 3,100 inundated acres in a six-foot sea rise scenario.



Case Study **Planning for Sea Level Rise**

Total Number of Properties at Risk of Sea Level Rise

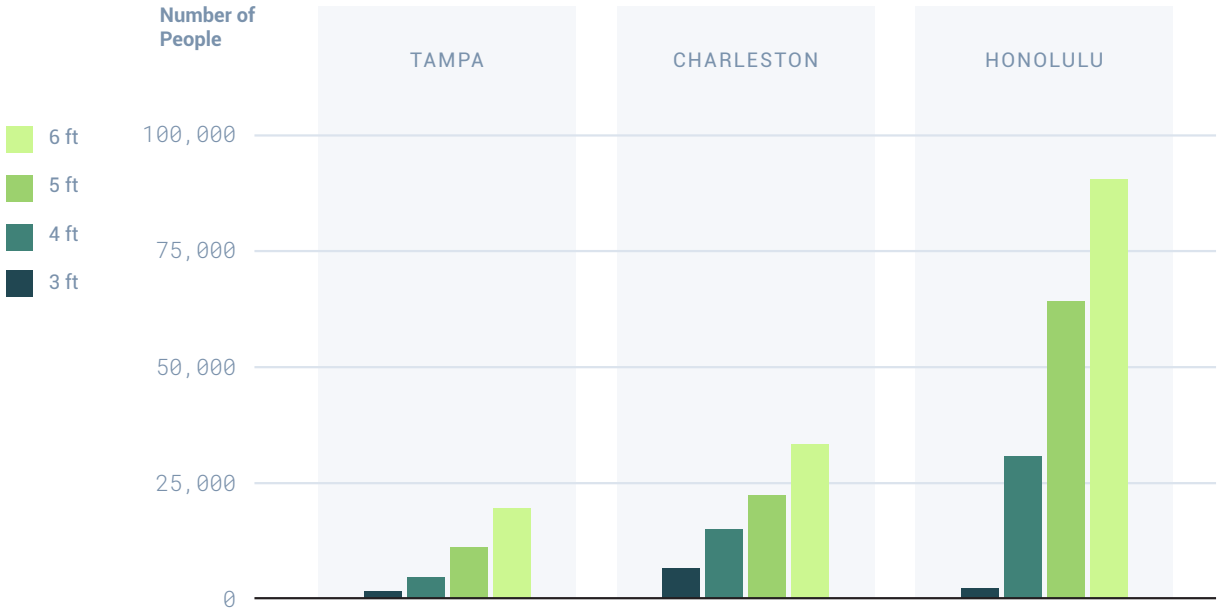


Number of properties at risk across three-to-six-feet sea level rise scenarios for the cities of Tampa (FL), Charleston (SC), and Honolulu PUC (HI).

More than 13,600 properties in Charleston are at risk in a six-foot sea level rise scenario, with over 8,400 and 3,300 parcels at risk in Tampa and Honolulu, respectively.

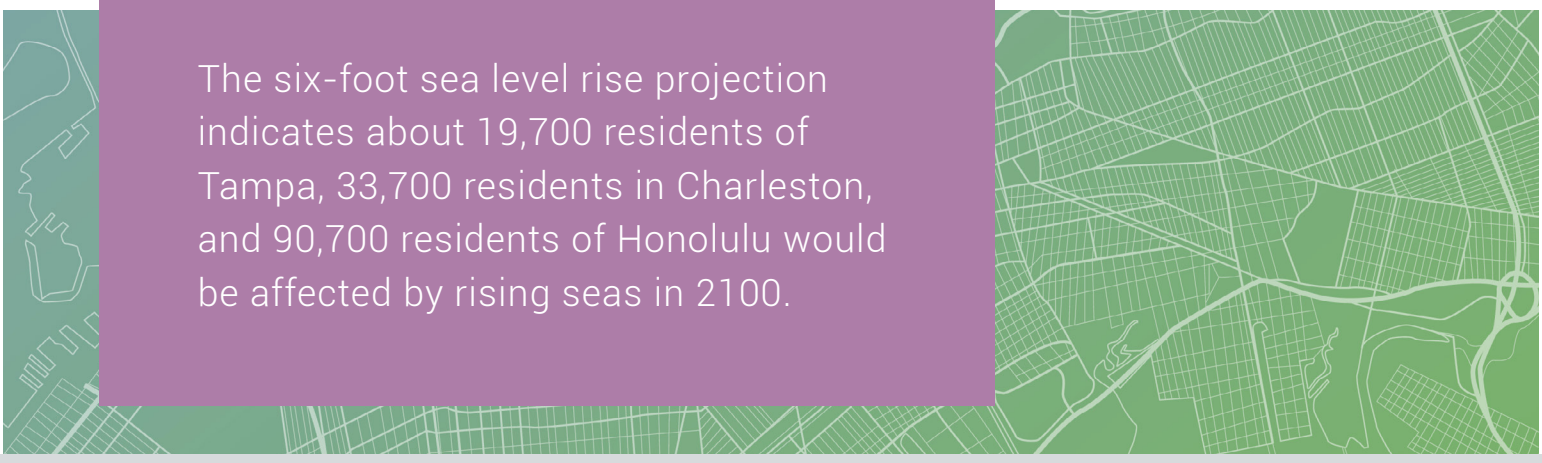
Case Study **Planning for Sea Level Rise**

People Impacted by Sea Level Rise



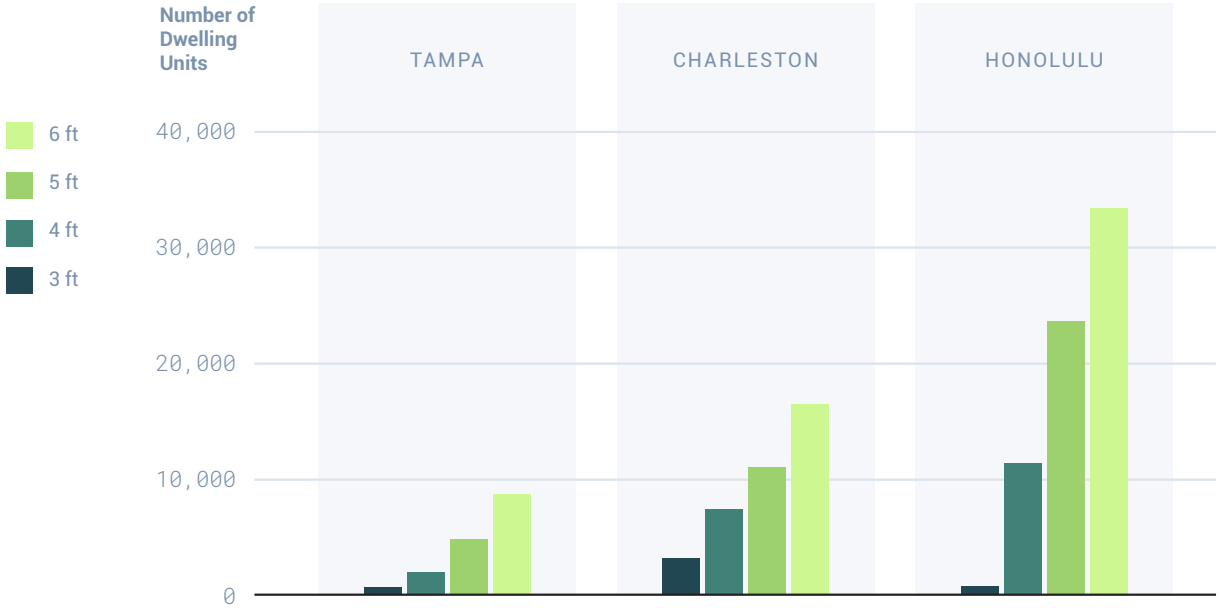
Number of residents estimated to be affected by three-to-six feet sea level rise scenario in Tampa (FL), Charleston (SC), and Honolulu PUC (HI).

The six-foot sea level rise projection indicates about 19,700 residents of Tampa, 33,700 residents in Charleston, and 90,700 residents of Honolulu would be affected by rising seas in 2100.



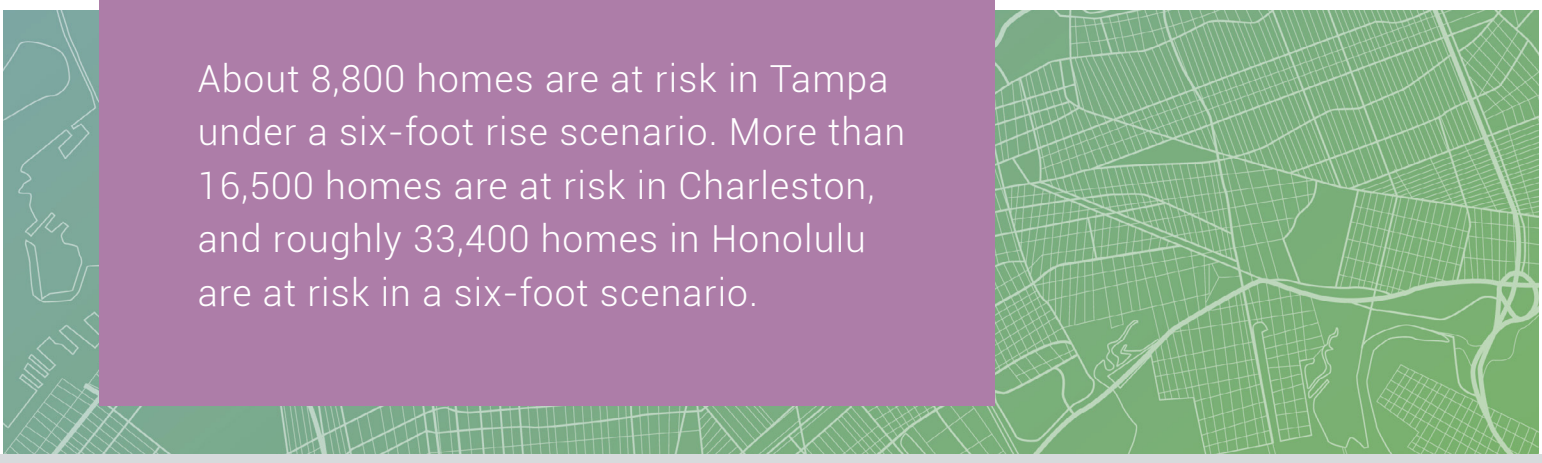
Case Study **Planning for Sea Level Rise**

Dwelling Units at Risk due to Sea Level Rise



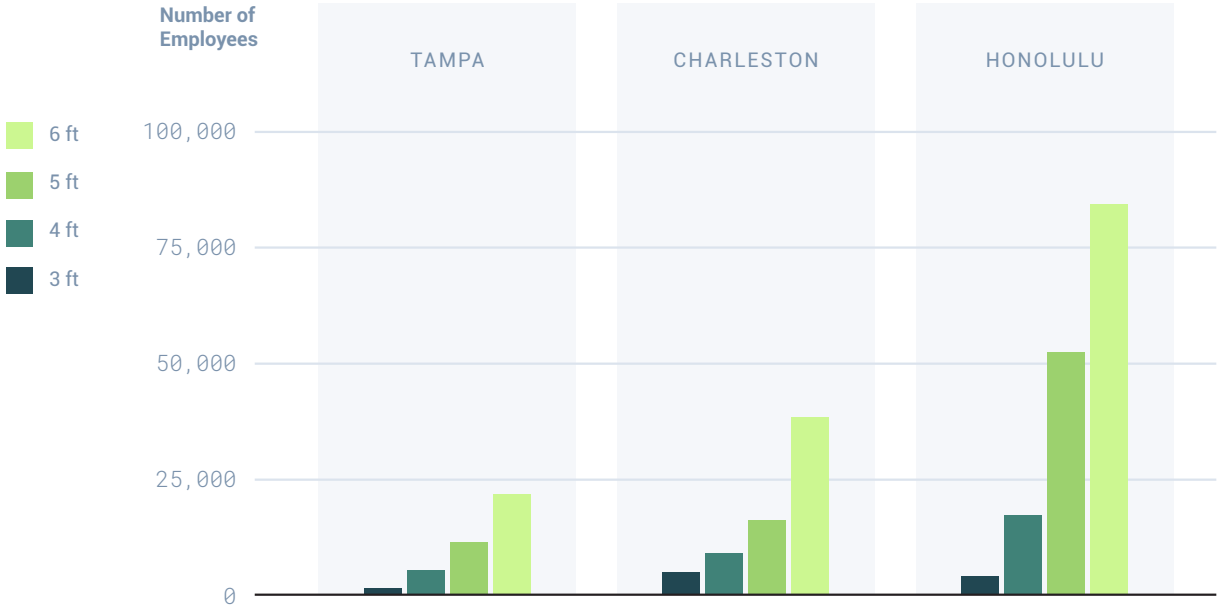
Number of dwelling units at flood risk from the three-to-six feet sea level rise scenarios in Tampa (FL), Charleston (SC), and Honolulu PUC (HI).

About 8,800 homes are at risk in Tampa under a six-foot rise scenario. More than 16,500 homes are at risk in Charleston, and roughly 33,400 homes in Honolulu are at risk in a six-foot scenario.



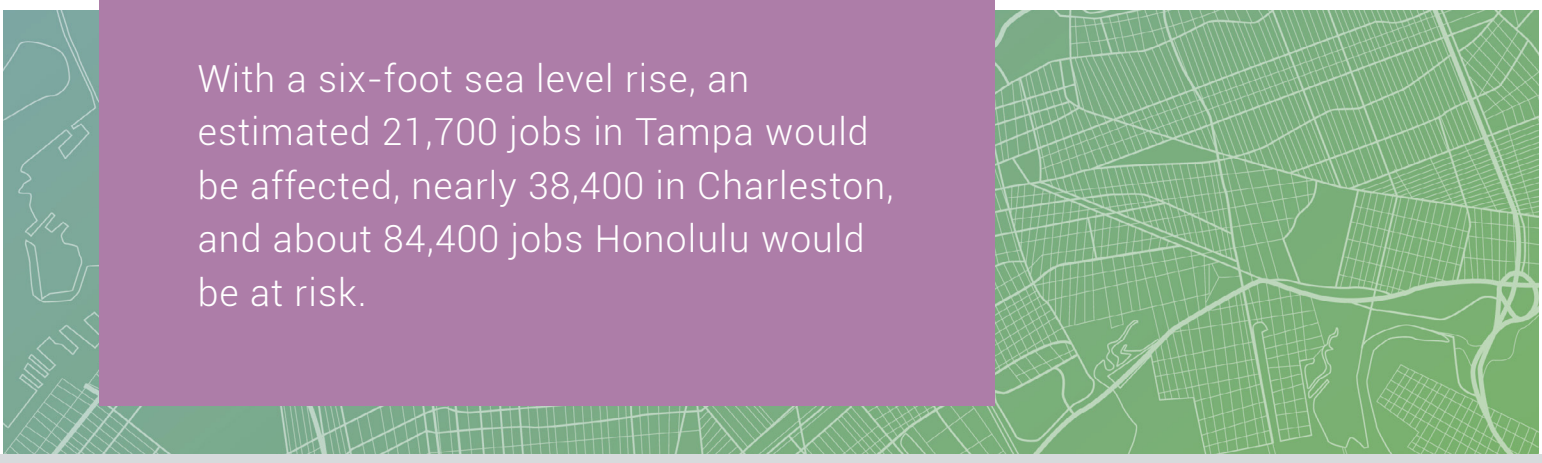
Case Study **Planning for Sea Level Rise**

Jobs Impacted by Sea Level Rise



Number of jobs impacted by the three-to-six feet sea level rise scenarios in Tampa (FL), Charleston (SC), and Honolulu PUC (HI).

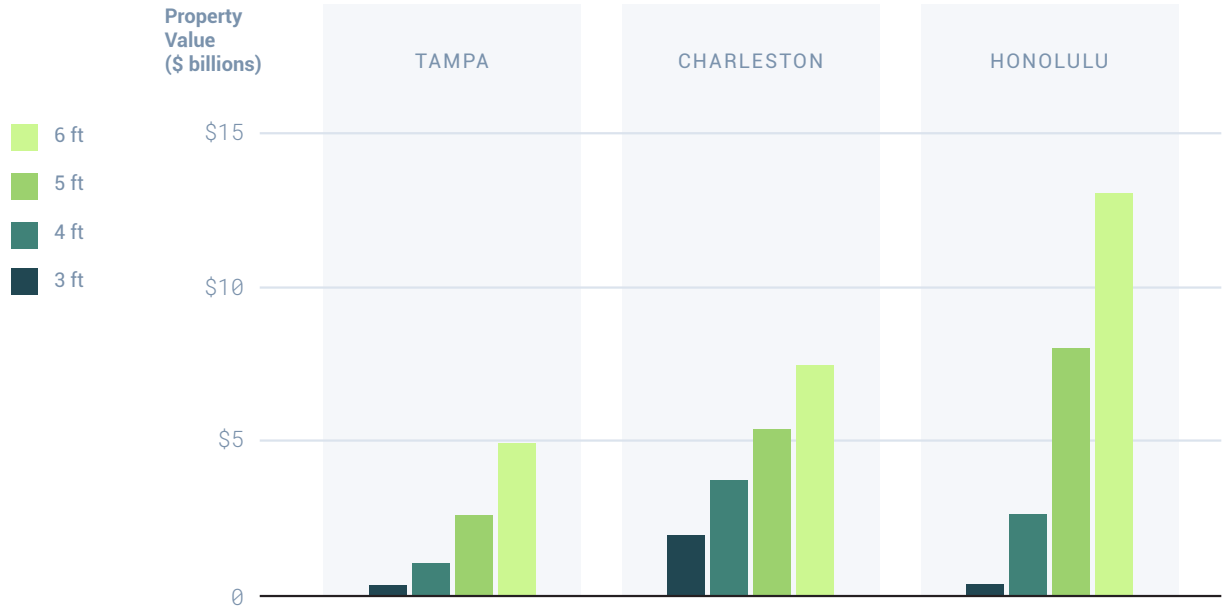
With a six-foot sea level rise, an estimated 21,700 jobs in Tampa would be affected, nearly 38,400 in Charleston, and about 84,400 jobs Honolulu would be at risk.



Case Study **Planning for Sea Level Rise**

When we compare the market value, encompassing land and improvement value of inundated properties, all three cities surpass $1 billion in total property value at risk with a four-foot sea level rise scenario. At six-feet, Honolulu sees major increases in property value at risk with more than $13 billion of potential impact in a six-foot rise scenario.

Total Value of Properties at Risk of Sea Level Rise



Value of residential properties estimated to be affected by three-to-six feet sea level rise scenarios in Tampa (FL), Charleston (SC), and Honolulu PUC (HI). The property values reported are the closest estimations to their 2016 market values for use in assessments by county or local tax authorities. It is collected and curated by CoreLogic.

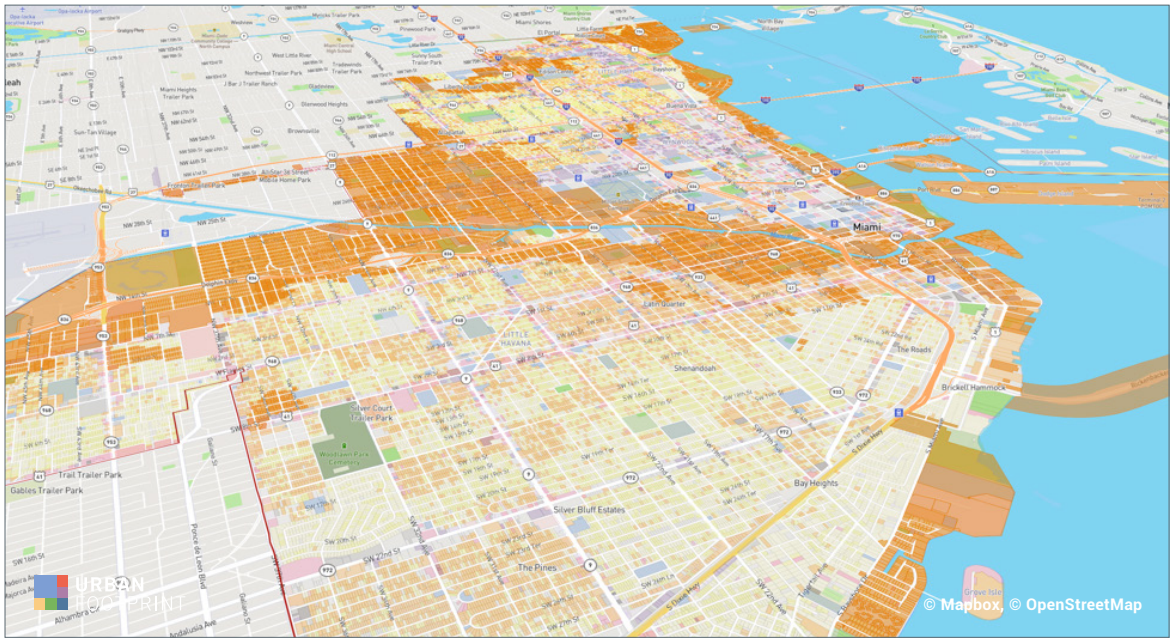
Note that, for the purposes of this case study, this analysis only accounts for the impacts of NOAA's anticipated sea level rise scenarios on present land use conditions. It does not account for potential changes to future land use or a projected increase or decrease in development. UrbanFootprint can be used to build and analyze the impact of future land use scenarios, but the impacts on current conditions already demonstrate the need for proactive planning to address climate resilience. The ability to illuminate this challenge and clearly convey the numbers behind this threat can facilitate informed discussions within the community and a smarter path forward to a prosperous future.

Case Study **Planning for Flood Hazard**

In the U.S., the Federal Emergency Management Agency (FEMA) creates nationwide flood risk maps. FEMA's Risk Mapping, Assessment and Planning (MAP) program partners with states and communities to provide flood hazard and risk data, including the National Flood Hazard Layer (NFHL). The NFHL identifies Special Flood Hazard Areas (SFHA) that are subject to inundation by a 100-year flood, or in other words, a flood with a 1-percent chance of occurrence in any given year. Over the course of a 30-year mortgage, that means there is a 26 percent chance of having at least one flood.

FEMA maps provide a useful national standard for evaluating flood risk, yet for planners the real challenge often lies in quickly analyzing and communicating the potential impacts of flooding on current and future land use. The datasets to run these critical numbers are typically siloed and difficult to clean and curate into meaningful insights. Below we'll walk through how UrbanFootprint's Risk and Resilience Module helps to visualize and understand how SFHAs may affect community resiliency by quantifying the projected population, homes, and jobs impacted.

Visualizing and Analyzing Flood Hazard



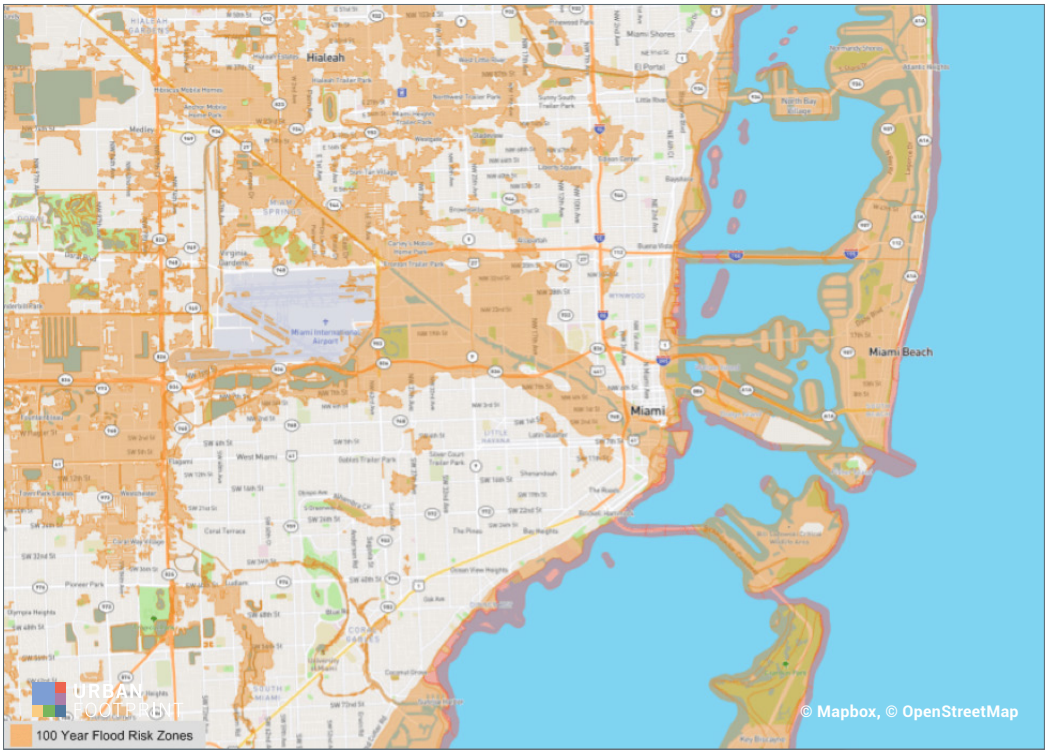
UrbanFootprint identifies parcels within Special Flood Hazard Areas in Miami, Florida. Dark orange indicates parcels within the Special Flood Hazard Areas

Case Study **Planning for Flood Hazard**

In UrbanFootprint, FEMA flood risk maps are provided as a reference dataset that can be easily added to current land use maps or future scenarios to provide context, build exhibits, and further analyze planning outcomes. FEMA data is also used by the built-in Risk and Resilience Module to measure the impacts of flood risk on population, homes, and jobs. Below, we'll use the module to analyze flood risk in three U.S. cities especially prone to heavy rains and flooding: Miami, Sacramento, and Topeka.

Miami, Florida

As a coastal city that also faces hurricanes, Miami is vulnerable to flooding from both sea level rise and heavy rains. Using UrbanFootprint's Risk and Resilience Module, we can get insights about both sea level rise scenarios and flood risk concurrently. For this study, we will focus solely on flood risk.

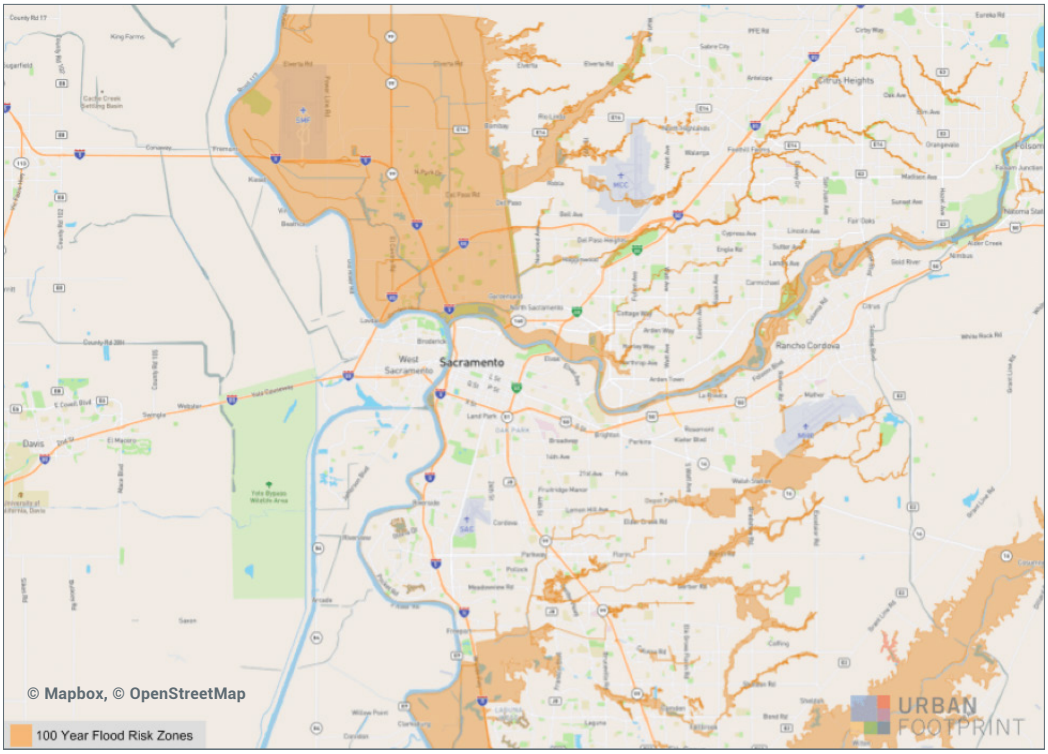


Special Flood Hazard Areas in Miami, Florida shown in orange.

Case Study **Planning for Flood Hazard**

Sacramento, California

Over the past few decades, Sacramento has experienced significant, sometimes devastating, flooding, most notably in 1986, 1995, 1997, 2006, and 2017. The Sacramento Area Flood Control Agency identifies Sacramento as having the nation's greatest metropolitan flood risk.

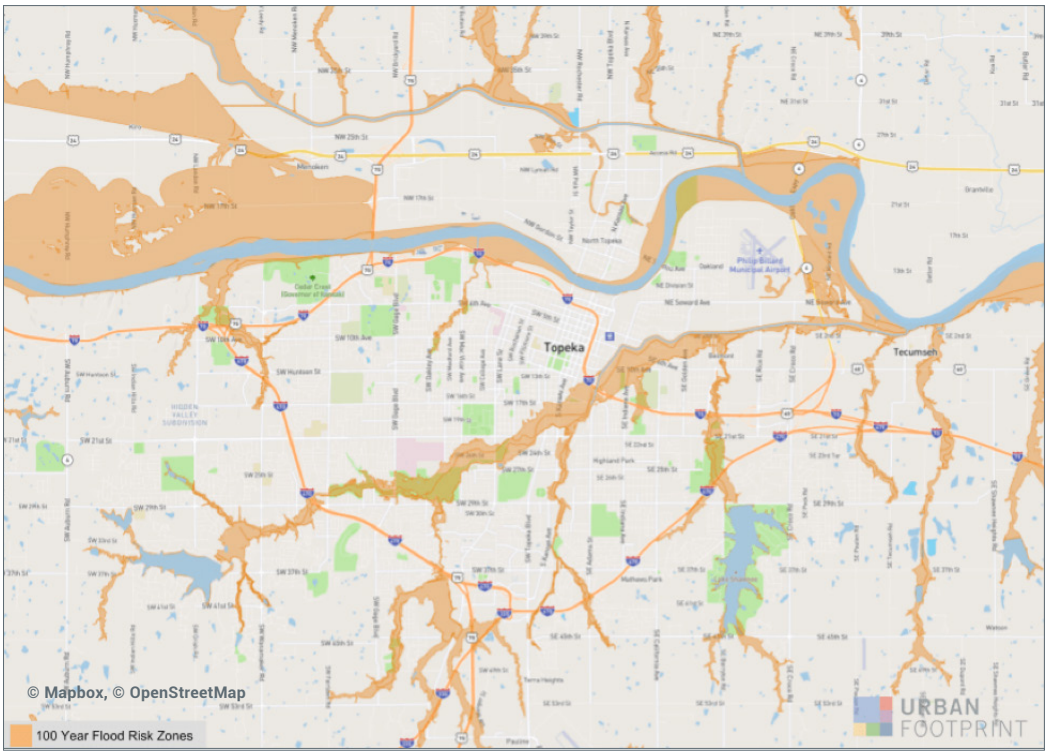


Special Flood Hazard Areas in Sacramento, California is shown in orange.

Case Study **Planning for Flood Hazard**

Topeka, Kansas

Like many midwestern cities, Topeka is prone to flooding by nearby rivers. The Kansas River flows through Topeka and during heavy downpours risks causing significant damage to homes, businesses, and city infrastructure.

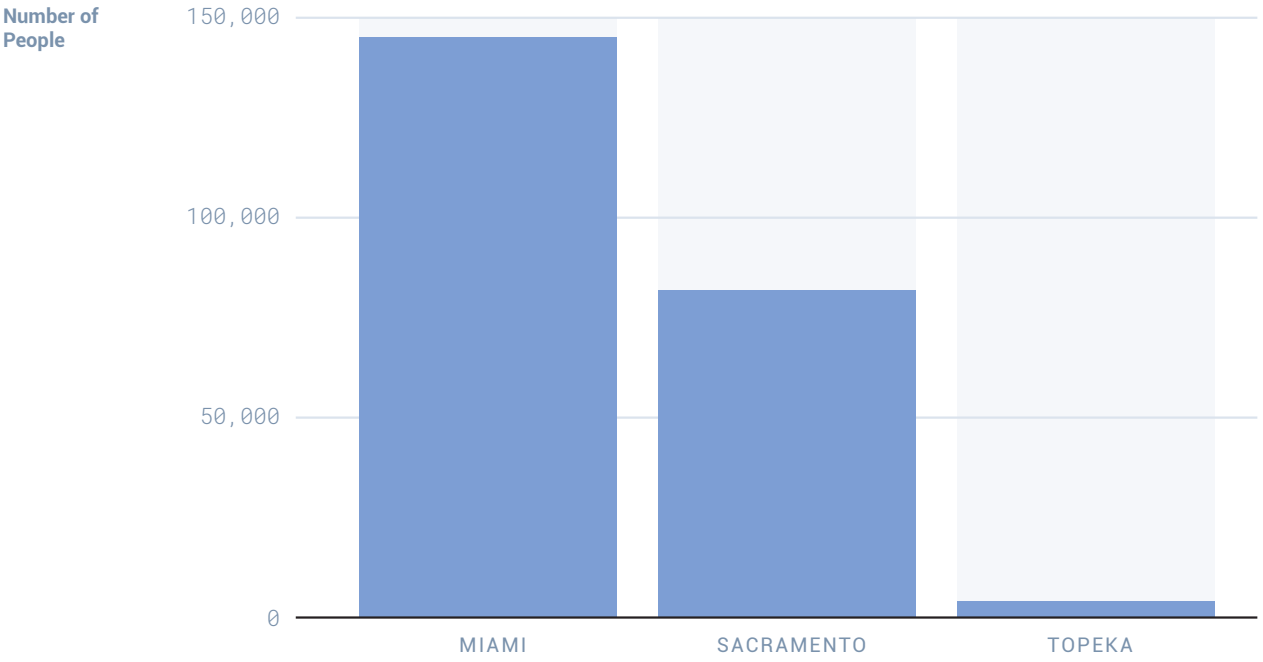


Special Flood Hazard Areas in Topeka, Kansas is shown in orange.

Case Study **Planning for Flood Hazard**

The following charts compare the potential impacts of flood risk on these three cities by the number of parcels, land area, population, dwelling units, and jobs.

Population at Risk of 100-Year Flood Impact

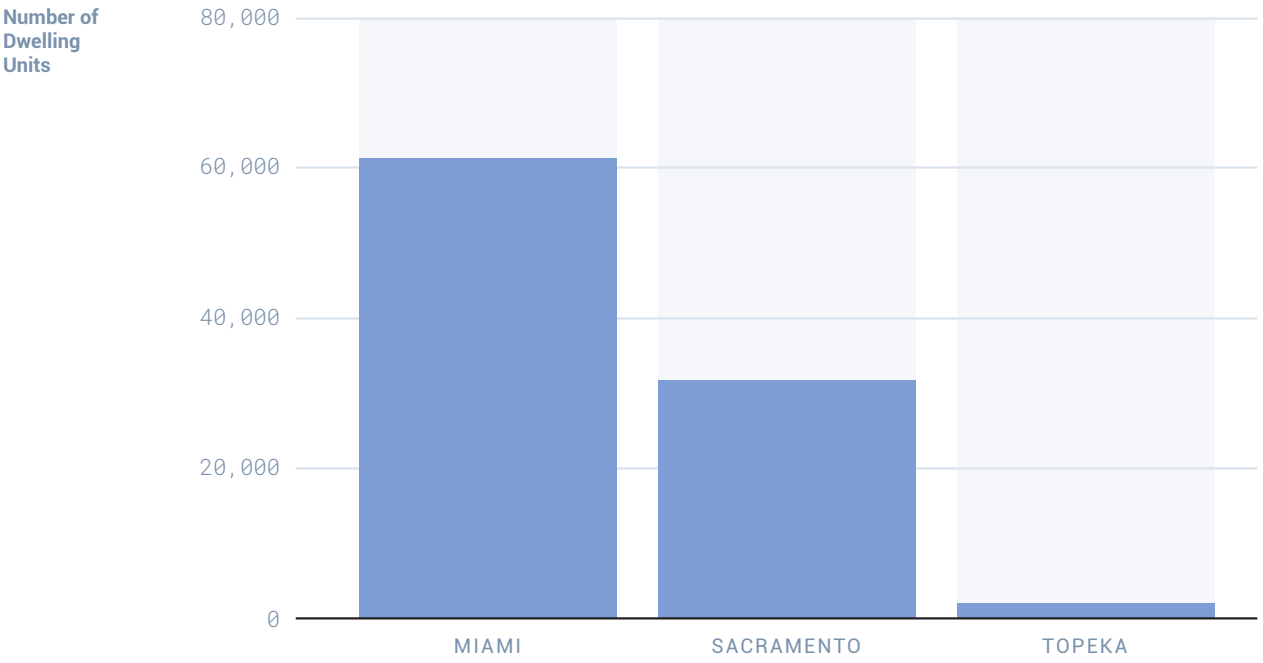


Our analysis shows that over 145,000 people, about a third of Miami's current population, are at risk of a 100-year flood. Around 82,000 people in Sacramento and 4,800 in Topeka are at risk.

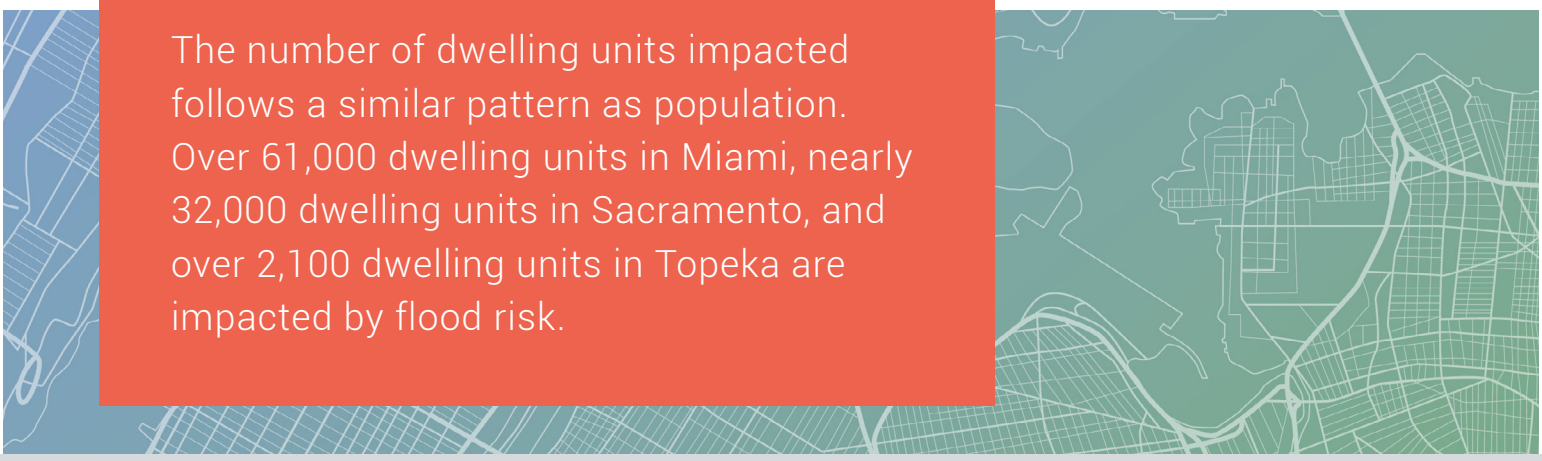
The Risk and Resilience Module also measures risk by FEMA's subclassifications of Special Flood Hazard Areas. For example, in Sacramento, of the 82,000 people who are at risk, nearly all (97%) fall into FEMA's SFHA "A99" classification. A99 areas are at risk from a 100-year flood but will ultimately be protected upon completion of an under-construction federal flood protection system, such as dams, dikes, or levees.

Case Study **Planning for Flood Hazard**

Dwelling Units at Risk of 100-Year Flood Impact

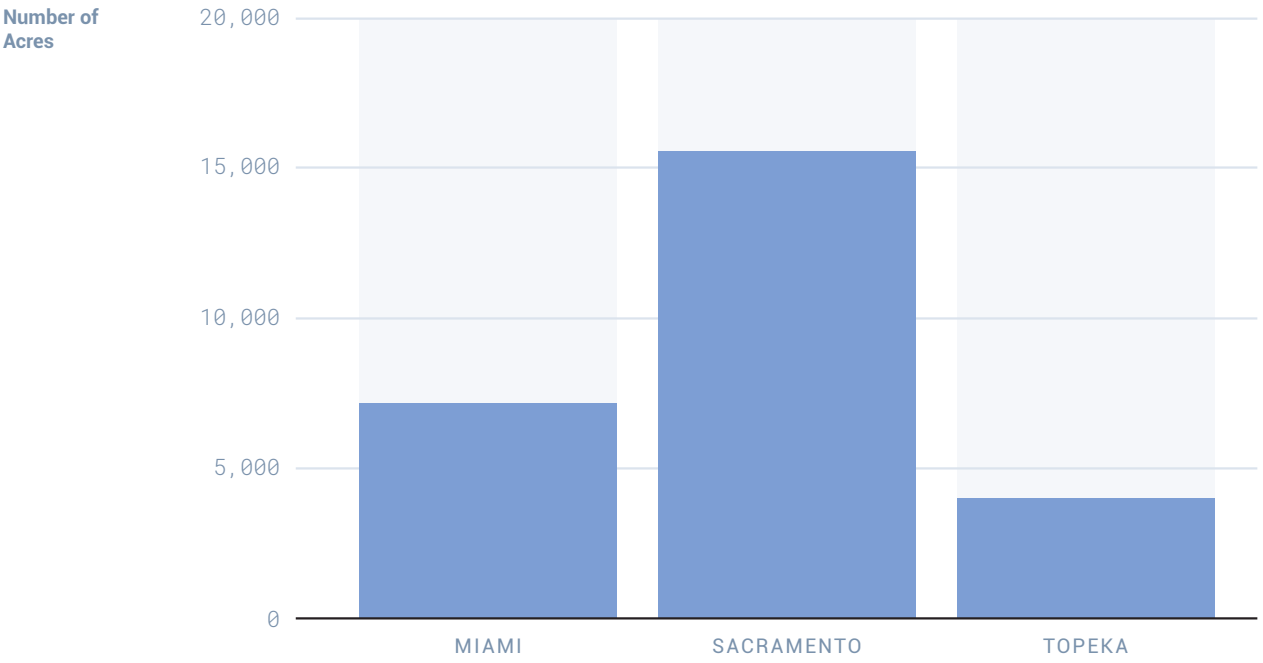


The number of dwelling units impacted follows a similar pattern as population. Over 61,000 dwelling units in Miami, nearly 32,000 dwelling units in Sacramento, and over 2,100 dwelling units in Topeka are impacted by flood risk.



Case Study **Planning for Flood Hazard**

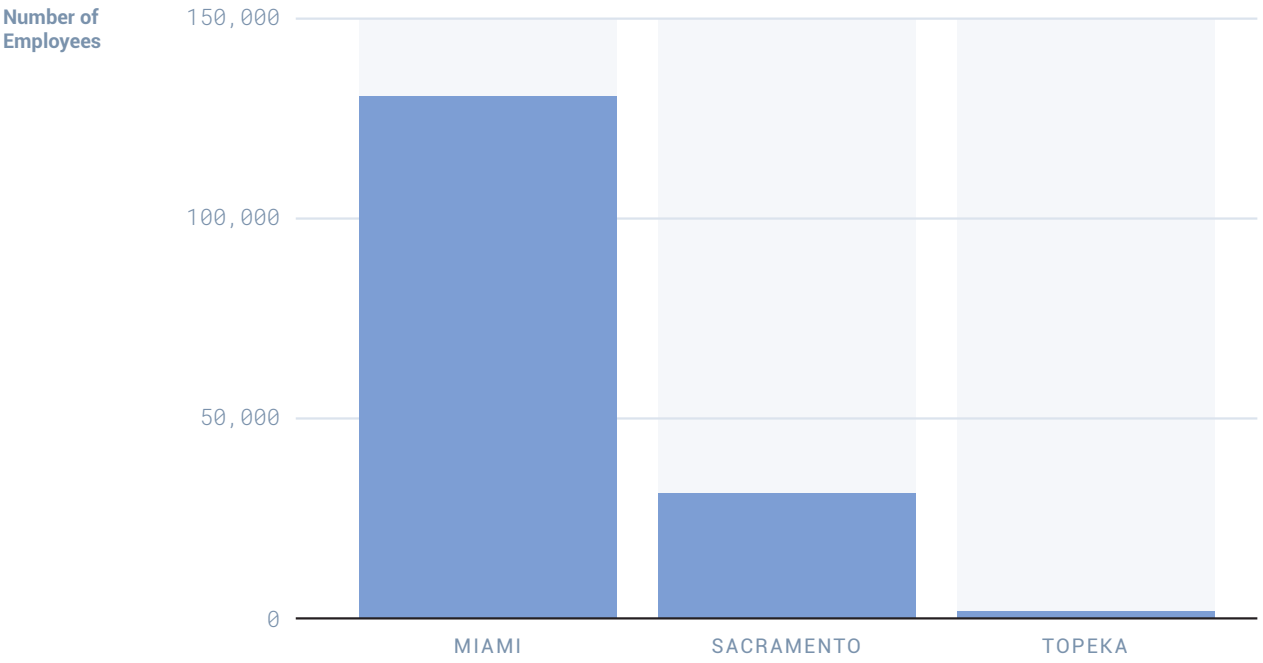
Land Area at Risk of 100-Year Flood Impact



The land area at risk tells an interesting story as well. Even though the area of at-risk parcels is lesser in Miami than in Sacramento, about 7,200 acres compared to 15,600 acres, respectively, the at-risk population is much higher in Miami. This indicates a much higher population density in flood risk areas in Miami compared to Sacramento. A small increase in flood risk area in Miami impacts substantially more people and dwelling units than in Sacramento.

Case Study **Planning for Flood Hazard**

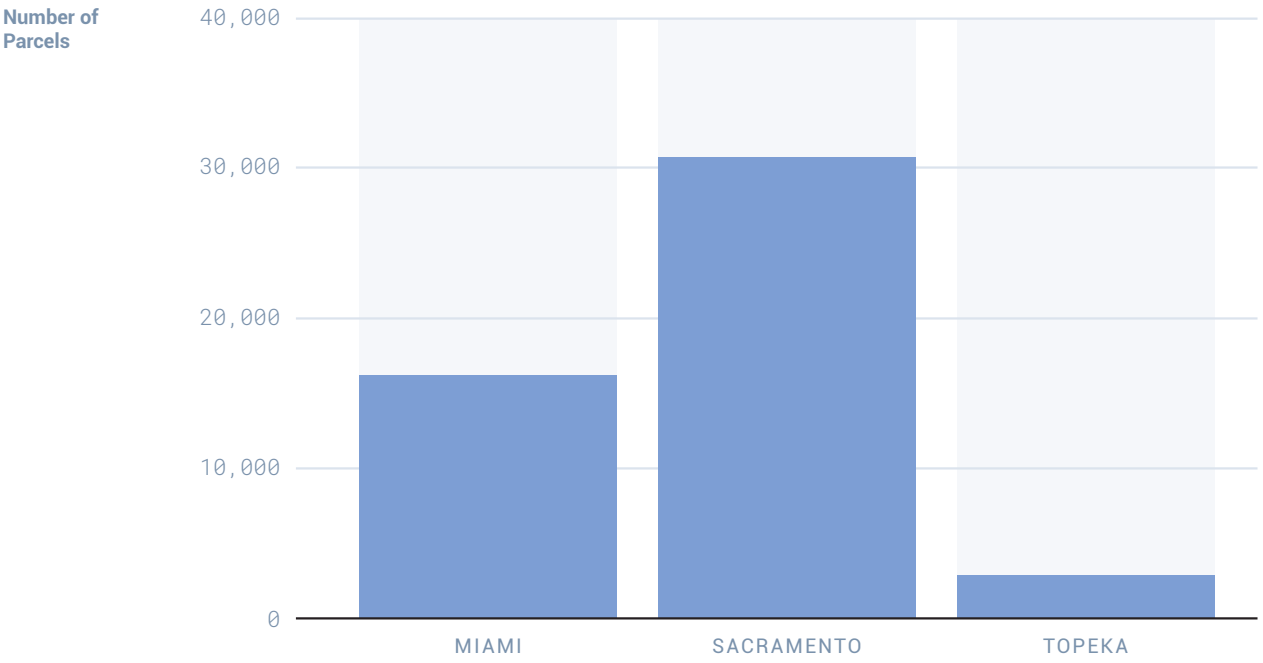
Jobs at Risk of 100-Year Flood Impact



About 130,700 jobs in Miami, 31,000 jobs in Sacramento and 1,300 jobs in Topeka are impacted by flood risk.

Case Study **Planning for Flood Hazard**

Parcels at Risk of 100-Year Flood Impact



About 16,100 parcels are impacted in Miami while around 30,600 parcels are impacted in Sacramento and 2,600 parcels are impacted in Topeka.

One important aspect to note is while the Risk and Resilience Module currently runs on FEMA data, the module is designed to adapt and can use new datasets as they become available.

Also, while we will stick with visualizing flood impacts for current land use conditions for the scope of this case study, demonstrating the potential future impacts of flooding is also a key component of resilience planning.

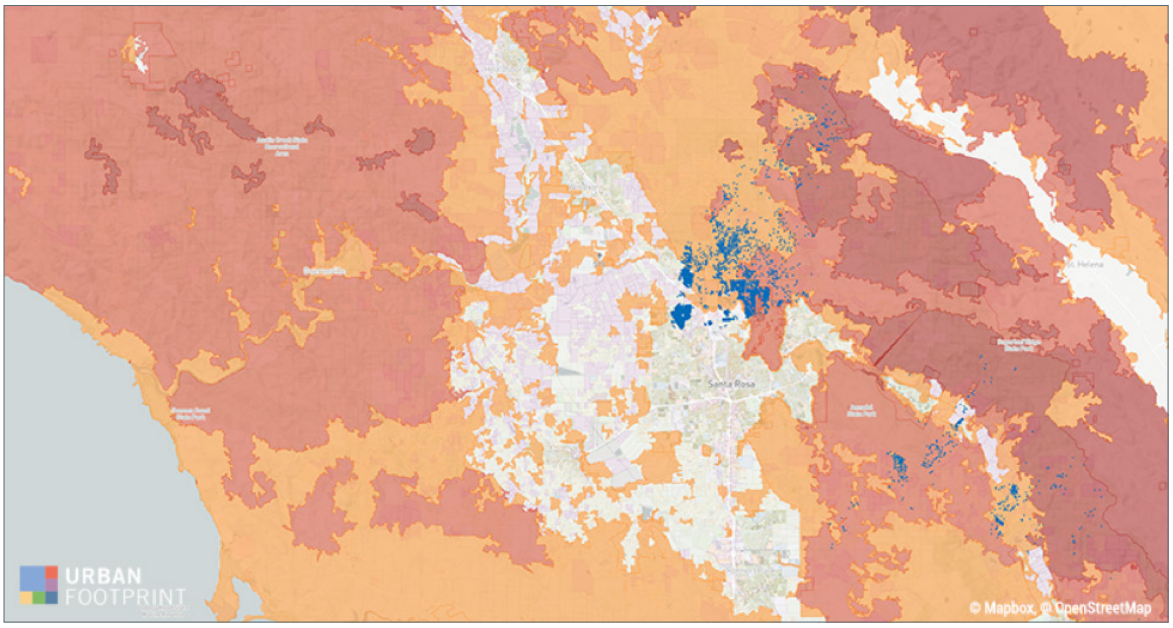
UrbanFootprint's scenario planning capabilities can support planners in their efforts to clearly communicate and effectively engage the public in exploring the costs and benefits of proposed plans or policies and why land use planning plays an important role in mitigating potential flood hazard in addition to other resilience planning factors like sea level rise or fire hazard.

In our next case study, we'll take a close look at how Sonoma County is using UrbanFootprint for their own resilience planning efforts, including an exploratory scenario planning example.

Case Study **Planning for Wildfire Resilience and Recovery**

In the State of California, the California Department of Forestry and Fire Protection, CALFIRE, maps Fire Hazard Severity Zones based on fuels, terrain, weather, and other relevant factors. These areas are classified into three zones: Moderate, High, and Very High. While CALFIRE data provide an essential baseline for assessing and mapping fire hazard zones, the real challenge for planners is often aligning this information with current and future land use data to estimate fire risk. Beyond mapping fire hazard levels, planners must be able to evaluate who and what is most vulnerable, including population, housing, employment areas, and more.

The UrbanFootprint map below displays CALFIRE's Fire Hazard Severity Zones for Sonoma County, a jurisdiction of nine cities in Northern California and tragically the site of some of the most destructive and deadly wildfires in California history last year. The map also shows the homes destroyed in the wildfires last October in blue.



CALFIRE Fire Hazard Severity Zones mapped for Sonoma County in UrbanFootprint. Light orange displays "Moderate" fire hazard, dark orange maps "High" fire hazard, and red indicates "Very High" fire hazard. Blue represents the homes destroyed in the 2017 wildfires.

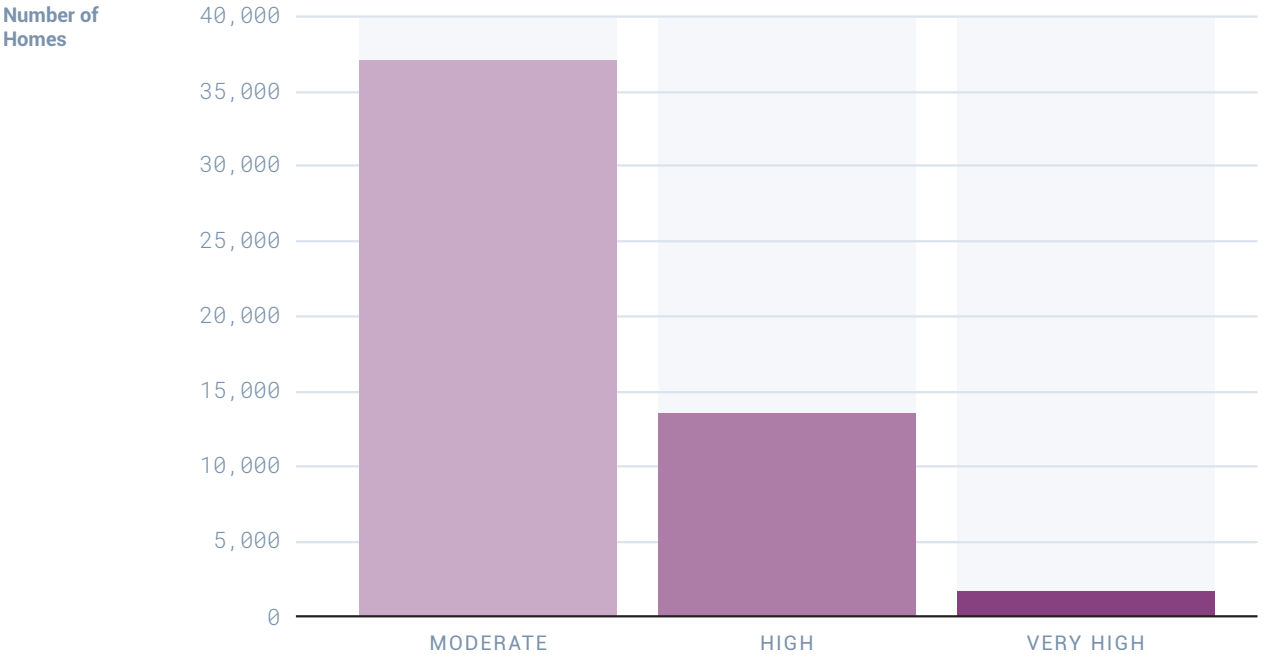
Case Study **Planning for Wildfire Resilience and Recovery**

As Chris Barney, Senior Transportation Planner at the Sonoma County Transportation Authority notes: “As we can see here, a lot of the housing that was lost was already in high fire hazard areas. As we plan for the future, it will be critical to use this information to guide our recovery efforts."

Using Data to Guide Community Recovery

With easily accessible fire hazard data and the ability to align this with key planning datasets, we can better understand which communities are most at risk and clearly communicate the potential impacts of land use choices. For example the UrbanFootprint chart below displays the number of Sonoma County homes currently in the moderate, high, or very high fire hazard zones.

Number of Sonoma County Homes Currently in a Fire Hazard Area



The number of Sonoma County homes currently in a moderate, high, or very high fire hazard zone.

Case Study **Planning for Wildfire Resilience and Recovery**

Of course, fire risk has long been a factor of living in the American West and modeling fire hazards cannot fully eliminate this risk, yet it can provide planners and community stakeholders with better directional information to more accurately weigh and mitigate the risk as much as possible.

A key part of the Sonoma County resilience planning efforts will include planning for new housing to both support community recovery and to address the ongoing housing shortage in California. Just an hour's drive north of the San Francisco Bay Area, Sonoma County has not been exempt from the impacts of soaring job growth and sluggish housing development. In an effort to tackle the acute housing shortage, further exacerbated by last year's wildfires, Sonoma County has set a goal to build 30,000 new housing units in the next five years - 25,000 more than the 5,000 homes lost in the fires.

As Barney notes, "This is an ambitious goal and there are a lot of questions surrounding how we will achieve and implement it. As we evaluate different ways to approach this critical issue, we're using UrbanFootprint to help us dig into the key impacts of our housing development choices, such as household travel costs, accessibility, vehicle miles traveled, emissions, water use, and more. In addition, we are of course considering all of this through the lens of mitigating fire risk and planning for community recovery, as well."

Choosing the location and development pattern of 30,000 new housing units is no small feat and stands to greatly impact the Sonoma County community. How can Sonoma County best address the housing crisis while working toward its goals of reduced greenhouse gas emissions, increased transit accessibility, and enhanced community resiliency?

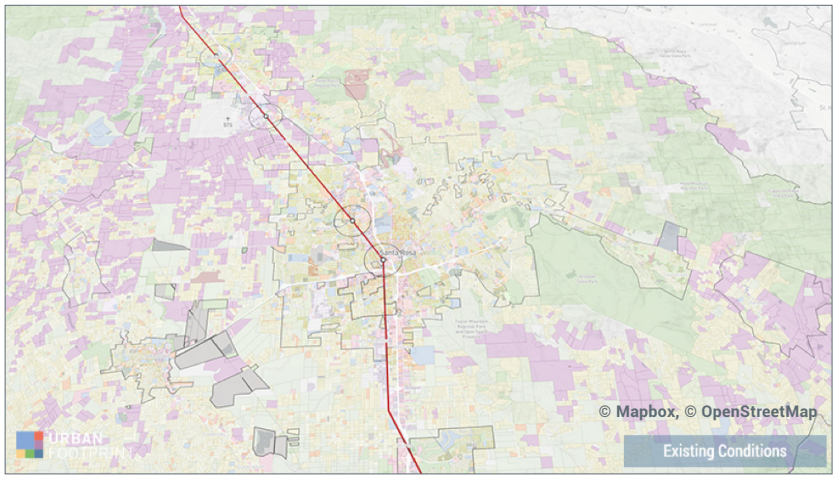
Projecting Plan Impacts with Advanced Scenario Planning

UrbanFootprint was first used in Sonoma County in 2015 to analyze the transit and environmental impacts of five development and housing scenarios to accommodate for projected growth by 2040. Scenarios ranged from lower density suburban growth patterns (Scenario One) to higher density housing options with an emphasis on infill development opportunities near new Sonoma-Marin Area Rail Transit (SMART) commuter rail stations (Scenario Five).

The UrbanFootprint graphic below maps and compares fire hazard potential to the aforementioned scenarios, including existing conditions on the ground today. Note that while Sonoma County is currently analyzing housing growth options with a particular focus on mitigating fire risk and alleviating soaring housing costs, the maps below are solely for an illustrative resilience and recovery planning example.

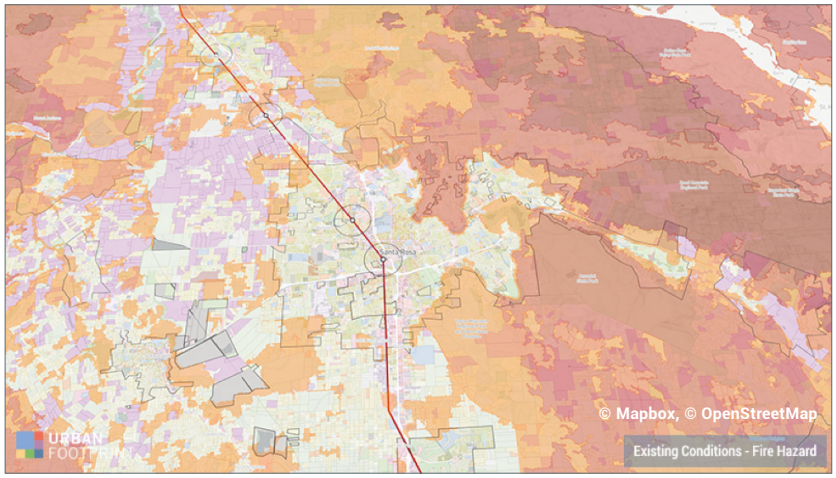
Case Study **Planning for Wildfire Resilience and Recovery**

In the exhibit below, UrbanFootprint's built-in Base Canvas layer first displays a current land use map of Santa Rosa parcels. Additional reference layers highlight the SMART line and a half mile buffer around each SMART station.

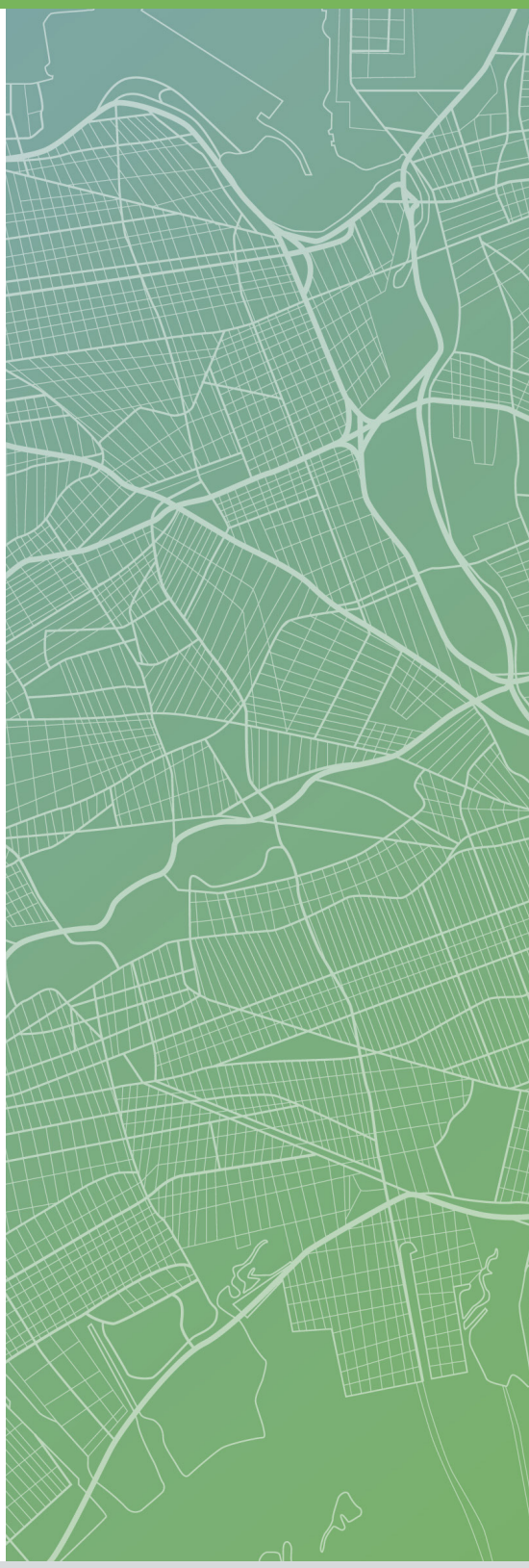


UrbanFootprint maps displays existing land use for Sonoma County.

Next, the Risk and Resilience Module maps CALFIRE Fire Hazard Severity Zones for existing conditions in Santa Rosa.

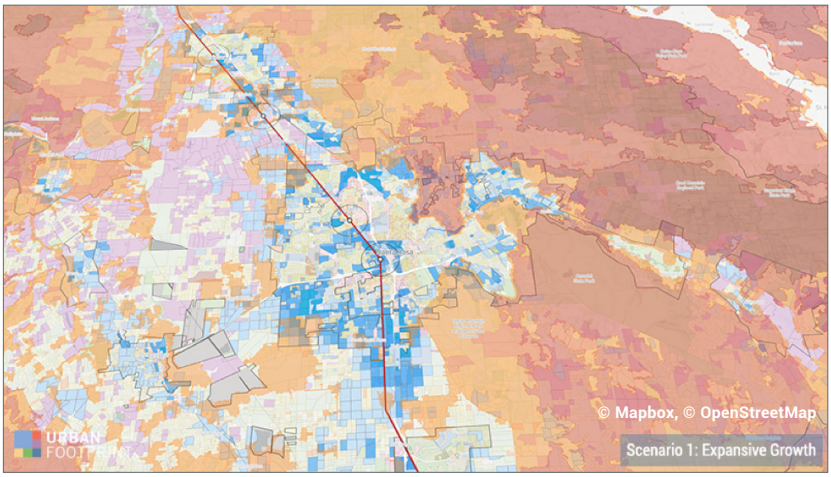


UrbanFootprint maps fire hazard zones over existing land use in Sonoma County.



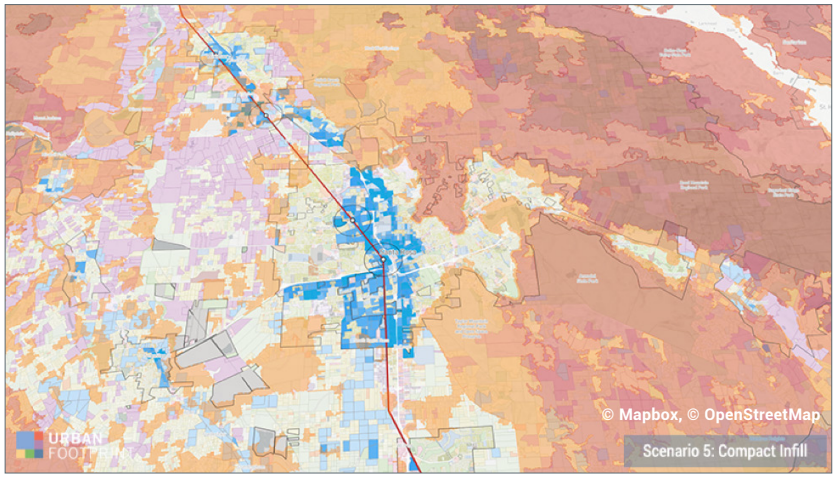
Case Study **Planning for Wildfire Resilience and Recovery**

Here we observe Scenario One's lower-density development pattern, where blue indicates the placement of new housing units.

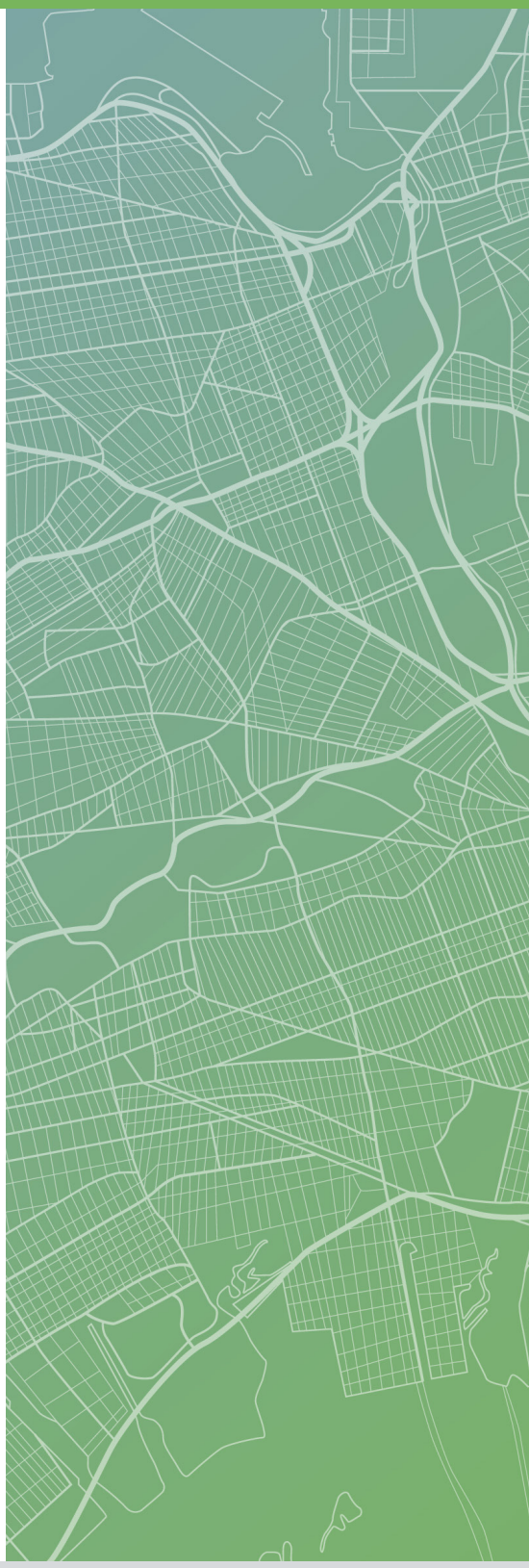


Blue indicates the placement of new housing units in the expansive growth scenario.

And finally, we conclude with Scenario Five's higher density housing options focused around SMART.



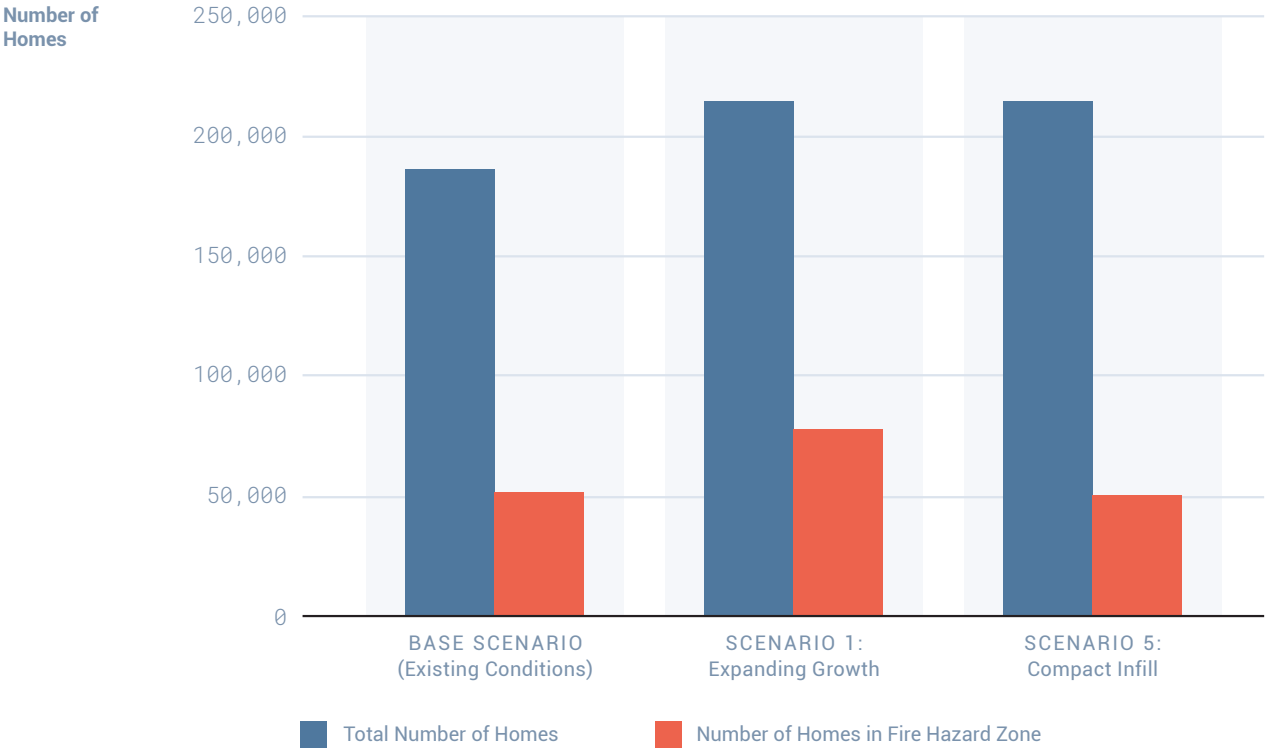
Blue indicates the placement of new housing units in compact infill scenario.



Case Study **Planning for Wildfire Resilience and Recovery**

The comparative fire hazard results below speak for themselves. The lower density development pattern of Scenario One places over 26,000 additional housing units in a fire hazard area compared to Scenario Five.

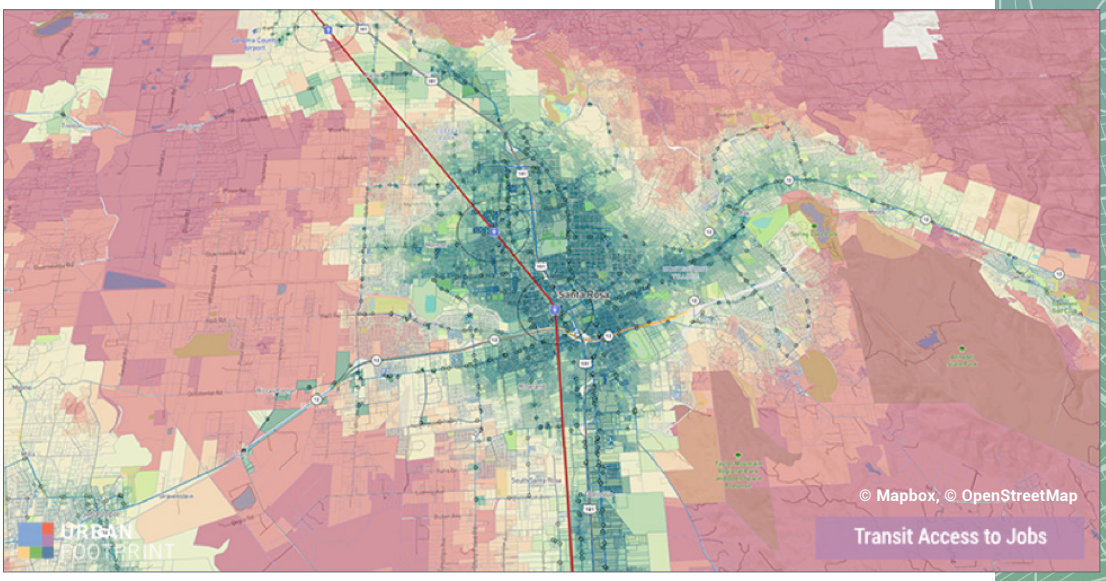
Numbers of Homes in a Fire Hazard Area for Sonoma County Scenarios



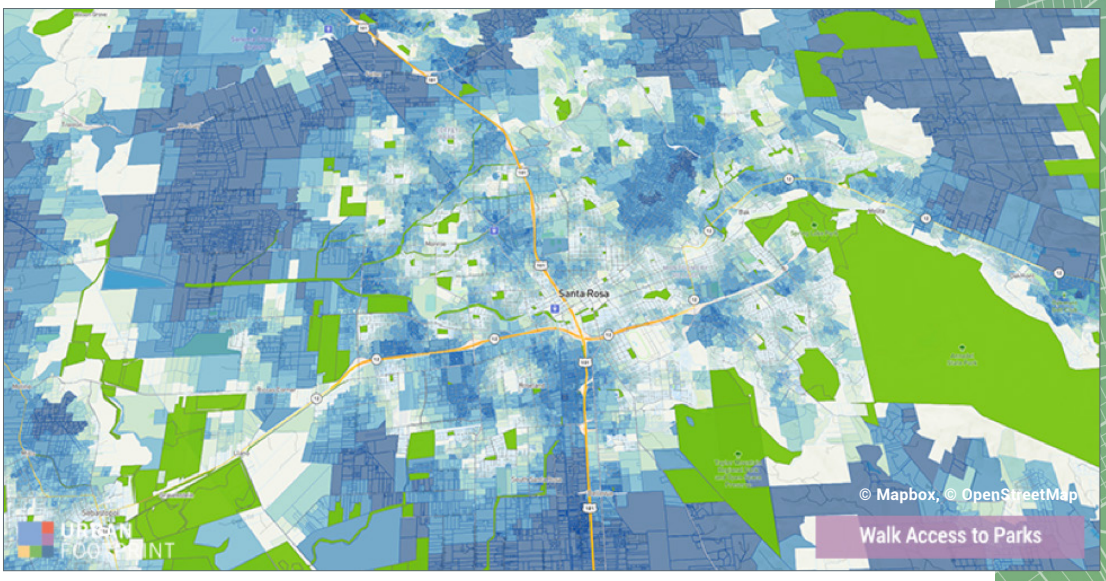
Blue indicates the total number of Sonoma County homes in each scenario. Red indicates the number of homes in a fire hazard zone in each scenario

Clearly, how and where new housing is built has the potential to greatly impact the safety and resilience of the community. And beyond fire risk, land use policy and future development patterns influence an array of factors that contribute to the long-term health, sustainability, and equity of our communities, including water use, walk access to parks, transit access to jobs, and beyond.

Case Study **Planning for Wildfire Resilience and Recovery**

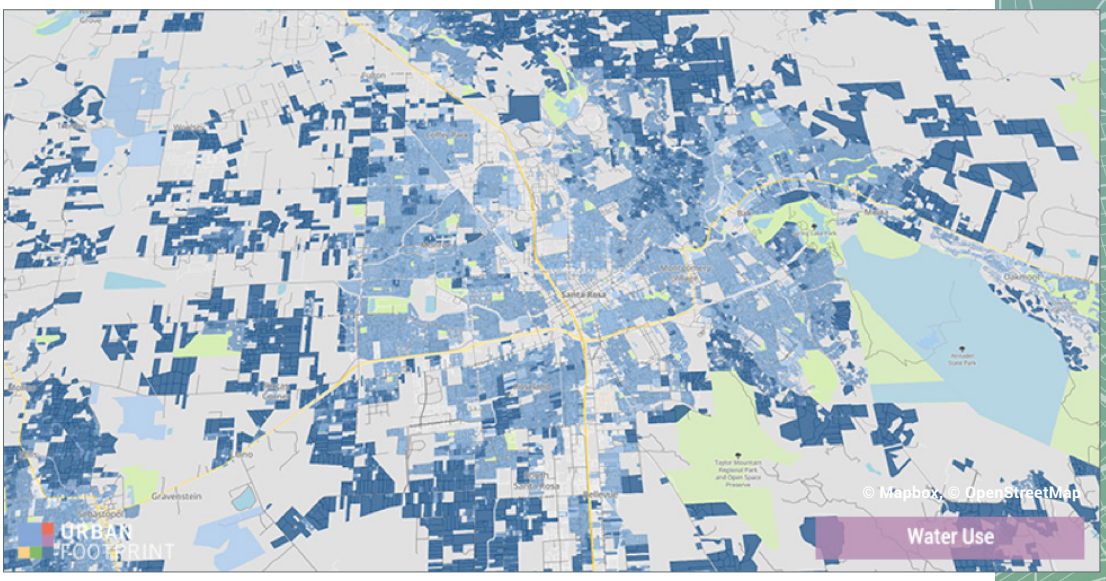


UrbanFootprint displays transit access to jobs for Sonoma County Scenario Five.



UrbanFootprint displays walk access to parks for Sonoma County Scenario Five.

Case Study **Planning for Wildfire Resilience and Recovery**



UrbanFootprint displays water use impacts for Sonoma County Scenario Five.

While this study is solely serving as an example to demonstrate the importance of data-driven resilience planning, Sonoma County is actively examining options to support new housing. As Barney shares, “We're going to be using UrbanFootprint's new Risk & Resilience Module, to evaluate fire hazard, flood risk, and sea level rise risk in relation to our current and future housing stock and employment areas. As we look to the future, we can better understand how we best mitigate these natural hazards and support a safe, strong, and resilient community."

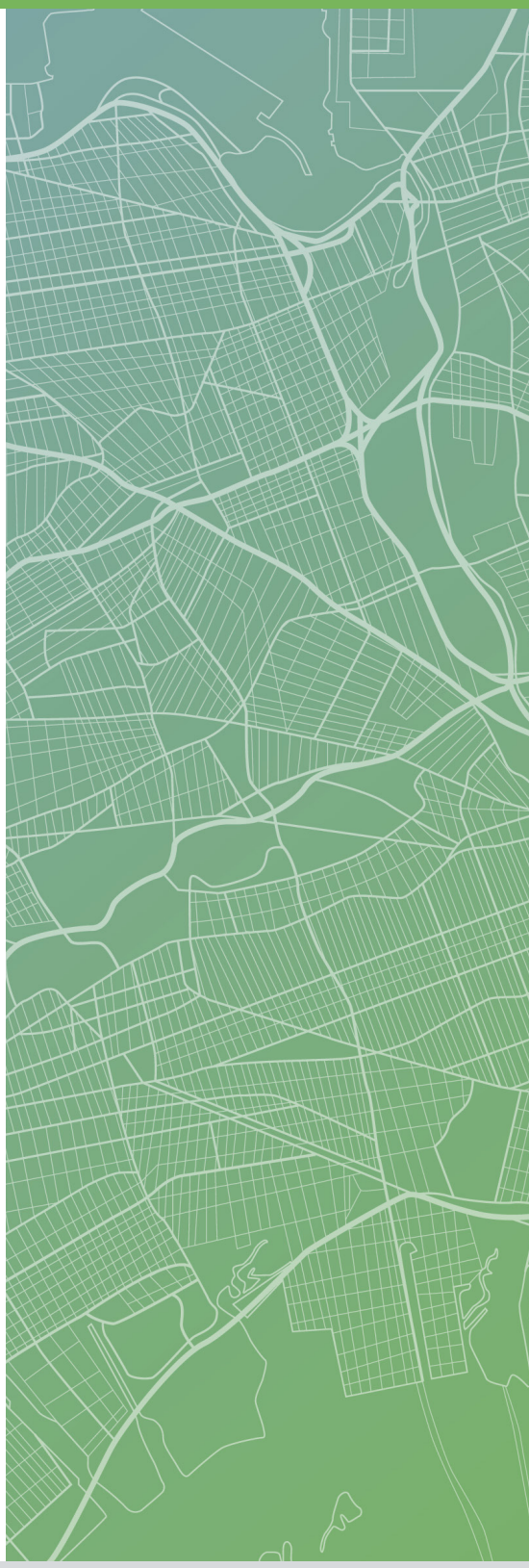
Case Study **Planning for Wildfire Resilience and Recovery**

Scenario Planning for a Sustainable, Resilient Future

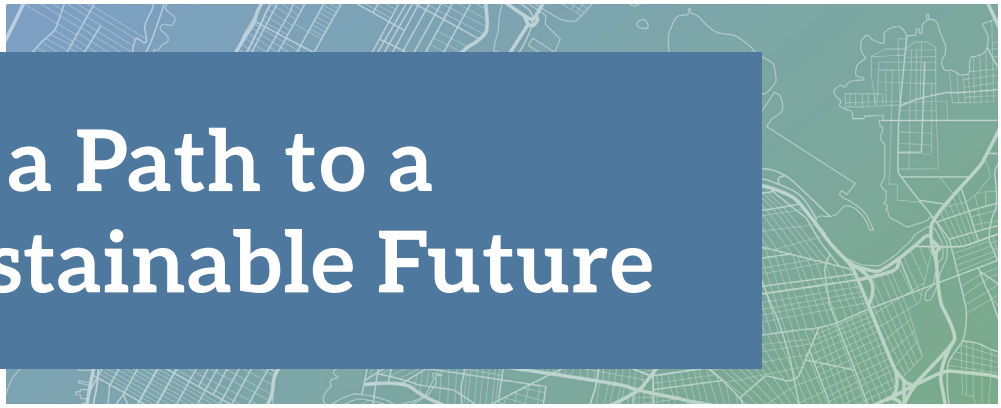
Scenario planning plays a pivotal role in smart resilience and recovery planning. By drafting alternative land use scenarios and measuring the impacts from all angles, planners and communities can quantify the costs and benefits of each proposed plan and support more informed policy conversations.

As Sonoma County prepares to accommodate 30,000 new housing units, the ability to build safe, resilient communities while supporting sustainable, equitable growth, requires analyzing each new housing scenario for a multitude of factors including fire hazard, transit accessibility to jobs, water use, and beyond. Running analyses like these often requires days, weeks, and even months of curating vast and disparate datasets to understand the combined impacts. UrbanFootprint's preloaded data library and built-in analytics modules are designed to support thoughtful, informed policies and to greatly reduce the time and costs generally incurred with iterative scenario planning for resilience.

While increasing fire risk currently is a stark reality for much of the American West, planners can take measured steps to mitigate fire risk and ensure a safe, strong, and resilient future for our communities.



Designing a Path to a Strong, Sustainable Future



So much depends on how we shape our cities, including our environmental sustainability, economic vitality, social well-being, and our sense of community. Fundamentally, the way we shape cities is a reflection of the kind of humanity we bring to bear.

As planners are tasked with solving some of the toughest challenges of our time, the Risk and Resilience Module is designed to improve and accelerate the resilience planning process. Easy access to clean data and advanced scenario planning capabilities frees planners and communities from a typically arduous and costly analysis process. This allows planners to perform in-depth analyses earlier on in the planning process and in turn supports data-driven policy conversations, better outcomes for the community, and serves to mitigate the risk of unintended consequences.

In order for our communities to survive and thrive, they must be sustainably designed to yield strong, resilient, and equitable places. A new paradigm of green urbanism is the foundation of our future.

Ready to build your own risk and resilience analysis?

Book a demo with our team today to get started. We'll walk through how to evaluate the potential impacts of sea level rise, flooding, and fire hazard for your next project.

Book a demo

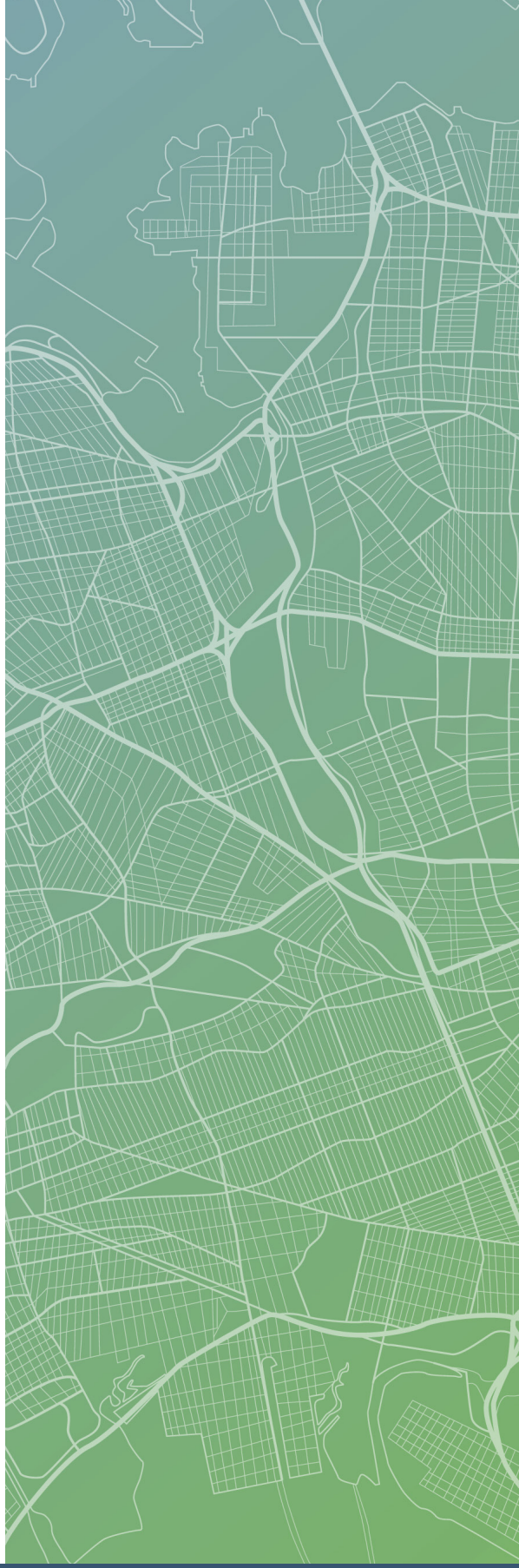
Stay tuned!

We plan to add earthquake and hurricane hazards to the Risk and Resilience Module in the near future.

About UrbanFootprint

UrbanFootprint is cloud-based software designed to help planners build more sustainable, resilient, and equitable cities. Founded by Peter Calthorpe and Joe DiStefano, UrbanFootprint's capabilities are rooted in 30 years of leadership and expertise in sustainable planning and analysis. With an extensive data library, advanced scenario planning, and a full suite of built-in analytics, UrbanFootprint allows planners to get projects done faster and requires no GIS experience.

Visit UrbanFootprint.com to book a demo with our team.



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