Union of Concerned Scientists

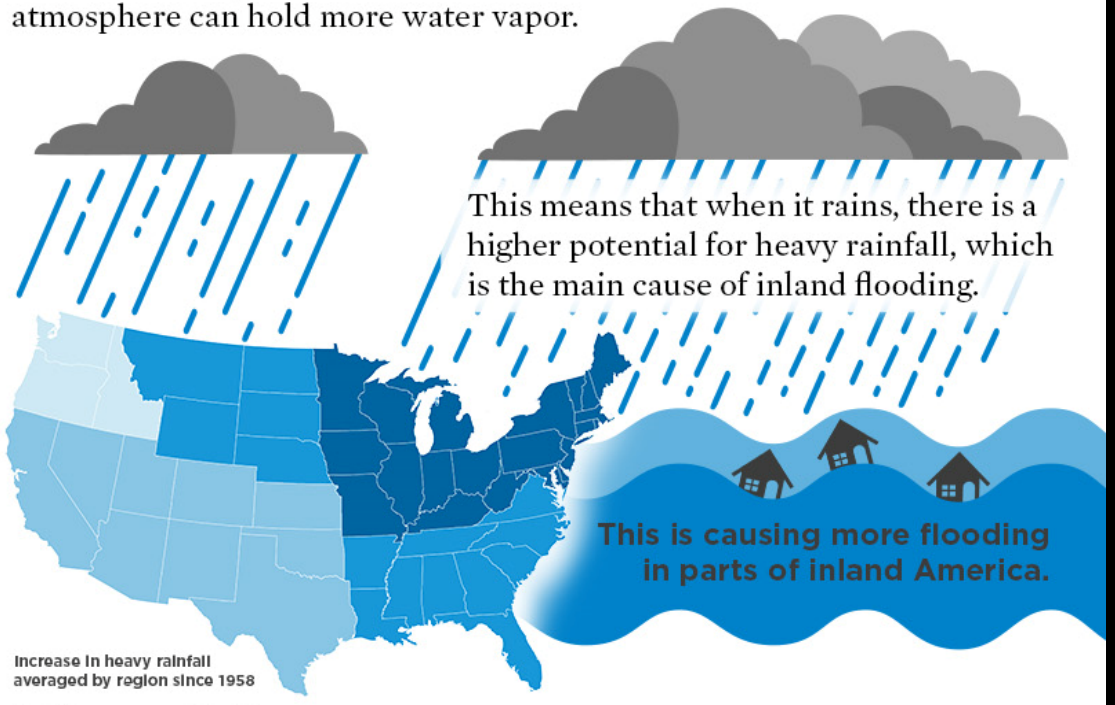
Astrid Caldas – Kresge CREWS Convening – 10/23/2018

Why Is Inland America

Flooding?

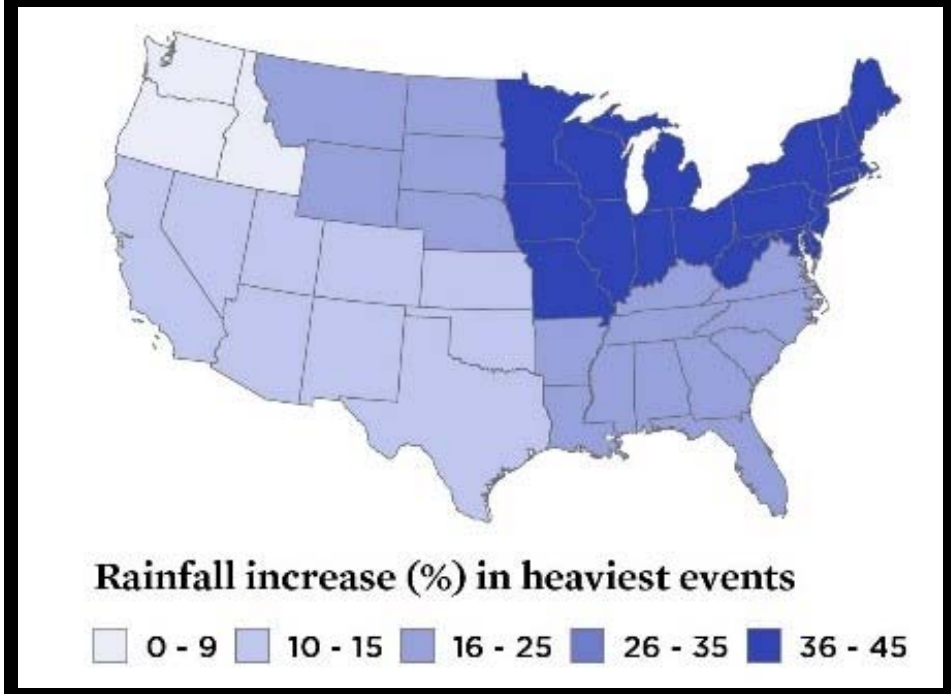
More Frequent, Heavier Rainfall

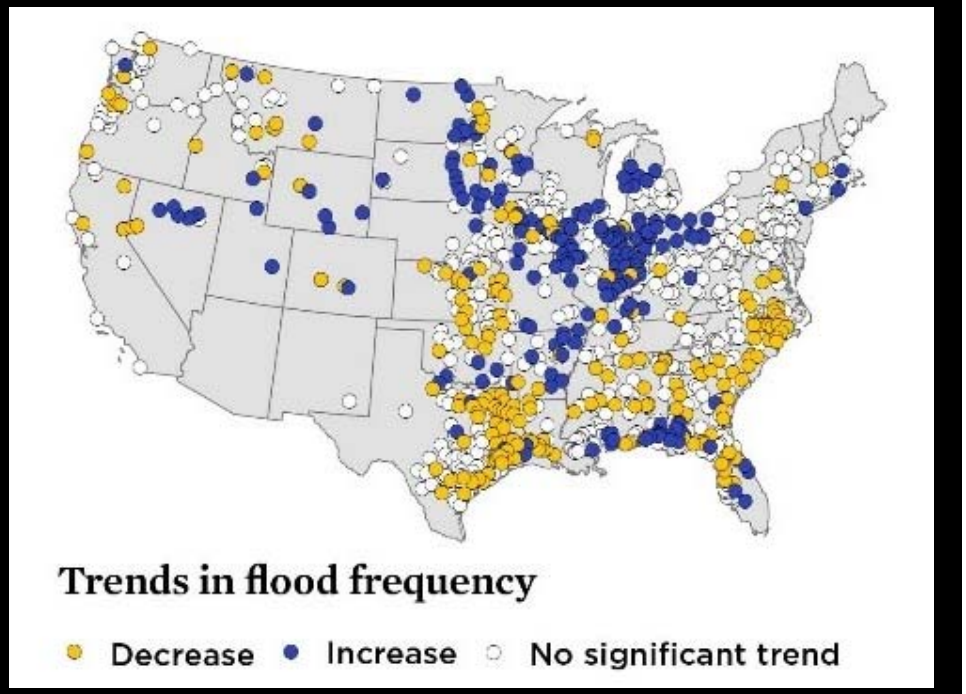
With rising global temperatures due to increased heat-trapping emissions, more water evaporates from the land and oceans. The warmer atmosphere can hold more water vapor.



Source: Climate Science Special Report 2017

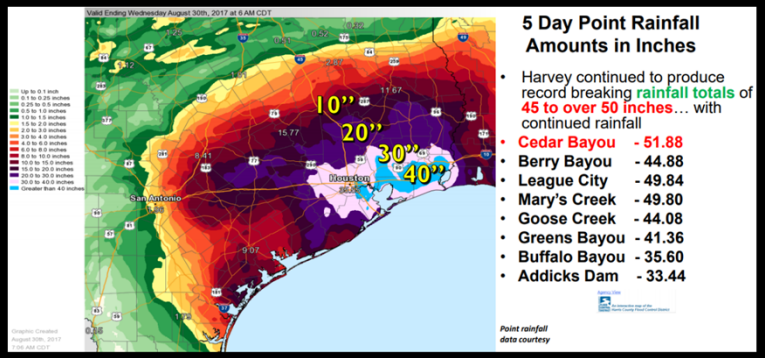
Heavy Rainfall and Flooding Trends in the U.S.





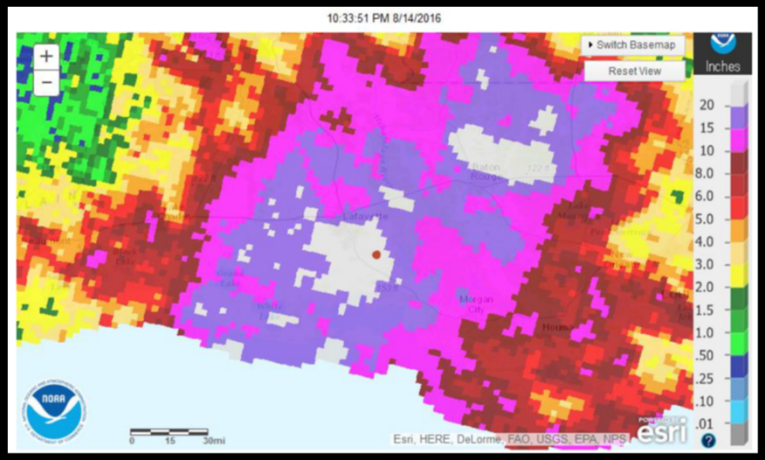
Data Sources: (Left) Climate Science Special Report (CSSR), Easterling et al. 2017. (Right) Slater and Villarini 2016. Provided by Slater.

[Connecting extreme precipitation to climate change



Hurricane Harvey (August 2017)

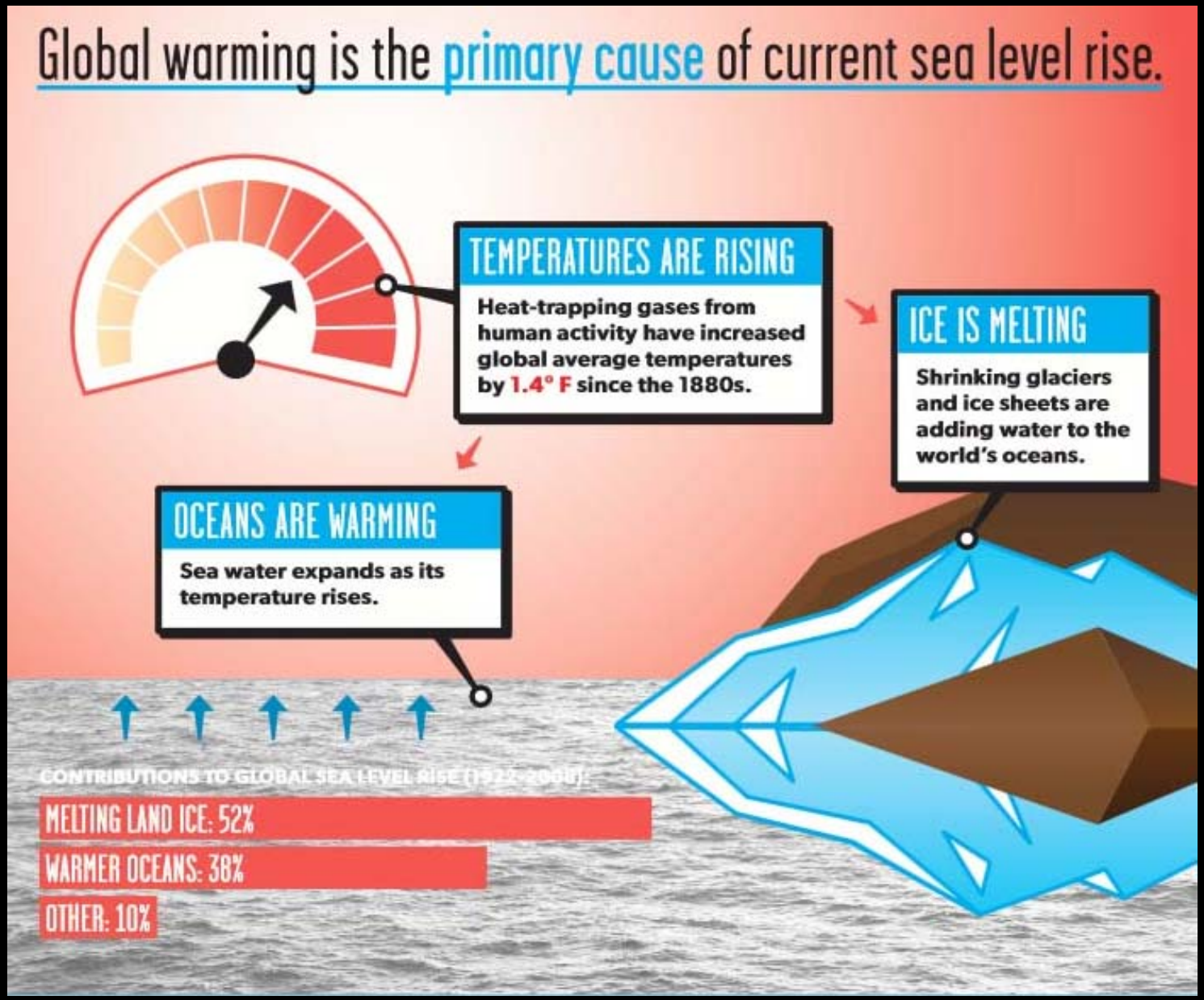
Human-caused climate change made the record rainfall that hit Houston during Hurricane Harvey **~3 x more likely & 15% more intense**



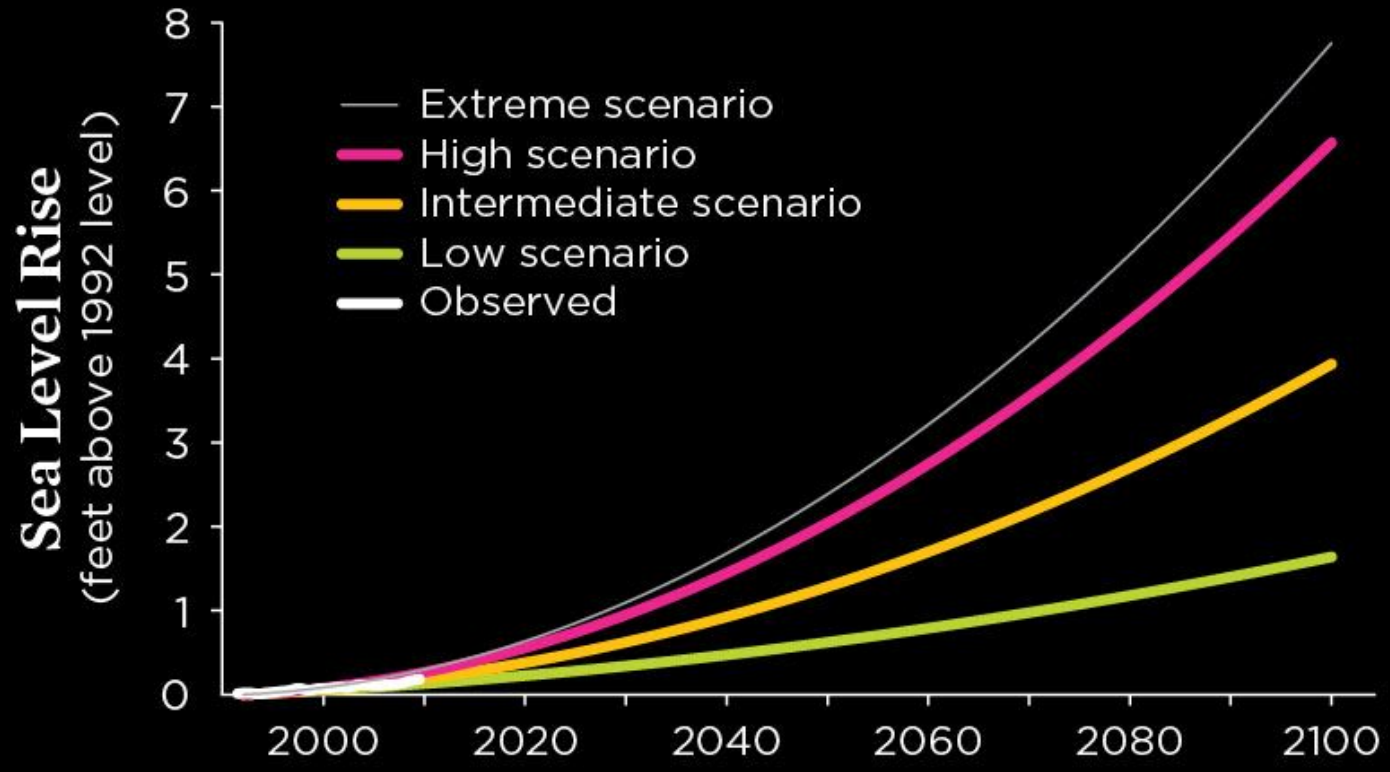
Louisiana Floods (August 2016)

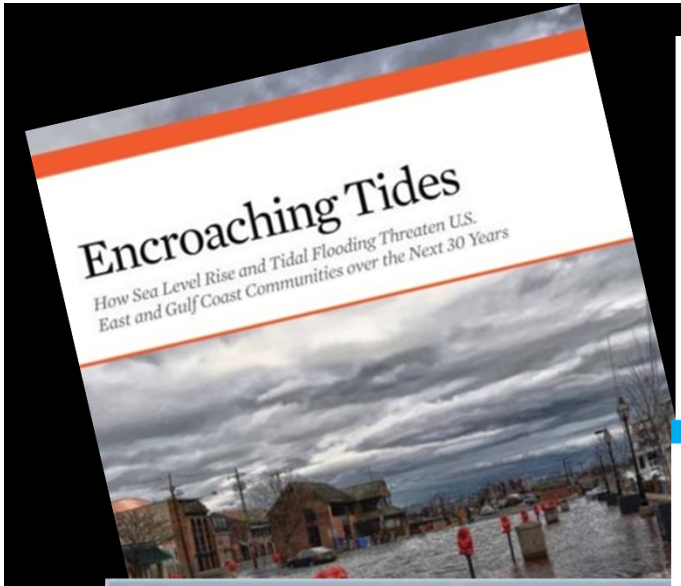
Human-caused climate change **increased the likelihood of this extreme rain event by at least 40%**

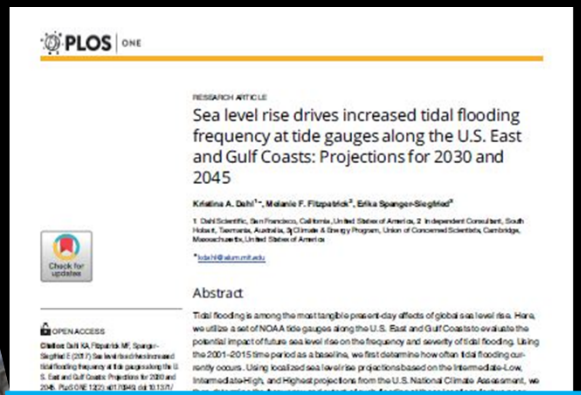
(van Oldenborgh et al. 2017a; van Oldenborgh et al. 2018).


Global warming is the primary cause of current sea level rise.
TEMPERATURES ARE RISING
Heat-trapping gases from human activity have increased global average temperatures by 1.4° F since the 1880s.
ICE IS MELTING
Shrinking glaciers and ice sheets are adding water to the world's oceans.
OCEANS ARE WARMING
Sea water expands as its temperature rises.
CONTRIBUTIONS TO GLOBAL SEA LEVEL RISE (1972-2008):
MELTING LAND ICE: 52%
WARMER OCEANS: 38%
OTHER: 10%

Sea Level Rise Projections & Our Choices






PLOS ONE

RESEARCH ARTICLE

Sea level rise drives increased tidal flooding frequency at tide gauges along the U.S. East and Gulf Coasts: Projections for 2030 and 2045

Kristina A. Dahl[1]*, Melanie F. Fitzpatrick[2], Erika Spanger-Siegfried[3]

1 Dahl Scientific, San Francisco, California, United States of America, 2 Independent Consultant, South Hobart, Tasmania, Australia, 3 Climate & Energy Program, Union of Concerned Scientists, Cambridge, Massachusetts, United States of America

*kdahl@alum.mit.edu

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Abstract

Tidal flooding is among the most tangible present-day effects of global sea level rise. Here, we utilize a set of NOAA tide gauges along the U.S. East and Gulf Coasts to evaluate the potential impact of future sea level rise on the frequency and severity of tidal flooding. Using the 2001–2015 time period as a baseline, we first determine how often tidal flooding currently occurs. Using localized sea level rise projections based on the Intermediate-Low, Intermediate-High, and Highest projections from the U.S. National Climate Assessment, we


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EXECUTIVE SUMMARY

The US Military on the Front Lines of Rising Seas

Growing Exposure to Coastal Flooding at East and Gulf Coast Military Bases

HIGHLIGHTS

The US Armed Forces depend on safe and functional bases to carry out their stated mission: to provide the military forces needed to deter war and to protect the security of this country.

The US military and defense budget in fiscal year 2015 was just under $600 billion. Of that total, about one-third was earmarked for the maintenance and operation of bases, many of which are in the United States. Given growing exposure to rising seas and storm surge, this analysis finds, the military is at risk of losing land where vital infrastructure, training and testing grounds, and housing for thousands of its personnel currently exist.

The Department of Defense (DOD) maintains more than 1,000 military installations in the United States—sites where the military tests weaponry, conducts training exercises, builds and launches ships, completes intelligence, develops new technology, and houses critical military command (Hall et al. 2016). Many of these sites are also where officers, enlisted men and women, and their families live.

Given their central role in national security, such installations have historically been well protected. But sea level rise, increased tidal flooding, and heightened storm surges do not stop for checkpoints. These climate-driven trends are already complicating operations at certain coastal installations (NAS 2011). A roughly three-foot increase in sea level would threaten 128 coastal DOD installations in the United States (4.3 percent of which are naval installations, valued at roughly $100 billion) and the livelihoods of the people—both military personnel and civilians—who depend on them (NAS 2011).

To enable decision makers to better understand these threats, how they may unfold this century, and where and when they could become acute, the Union of Concerned Scientists (UCS) has performed a new analysis of 11 military installations along the East and Gulf coasts. We selected these sites for their strategic importance to the armed forces, for their potential exposure to the effects of sea level rise, and because they represent coastal installations nationwide in terms of size, geographic distribution, and service branch. By analyzing their changing


When Rising Seas Hit Home

Hard Choices Ahead for Hundreds of US Coastal Communities

Union of Concerned Scientists


Underwater

Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate

PRICE REDUCED WATERFRONT

Union of Concerned Scientists


ELEMENTA

Dahl, KA, et al. 2017 Effective inundation of continental United States communities with 21st century sea level rise. Elem Sci Anth, 5: 37, DOI: https://doi.org/10.1525/elementa.234

RESEARCH ARTICLE

Effective inundation of continental United States communities with 21st century sea level rise

Kristina A. Dahl*, Erika Spanger-Siegfried†, Astrid Caldas† and Shana Udvardy‡

Recurrent, tidally driven coastal flooding is one of the most visible signs of sea level rise. Recent studies have shown that such flooding will become more frequent and extensive as sea level continues to rise, potentially altering the landscape and livability of coastal communities decades before sea level rise causes coastal land to be permanently inundated. In this study, we identify US communities that will face effective inundation—defined as having 10% or more of livable land area flooded at least 26 times per year—with three localized sea level rise scenarios based on projections for the 3rd US National Climate Assessment. We present these results in a new, online interactive tool that allows users to explore when and how effective inundation will impact their communities. In addition, we identify communities facing effective inundation within the next 30 years that contain areas of high socioeconomic vulnerability today using a previously published vulnerability index. With the Intermediate-High and Highest sea level rise scenarios, 489 and 668 communities, respectively, would face effective inundation by the year 2100. With these two scenarios, more than half of communities facing effective inundation by 2045 contain areas of current high socioeconomic vulnerability. These results highlight the timeframes that US coastal communities have to respond to disruptive future inundation. The results also underscore the importance of limiting future warming and sea level rise: under the Intermediate-Low scenario, used as a proxy for sea level rise under the Paris Climate Agreement, 199 fewer communities would be effectively inundated by 2100.

Keywords: climate change; sea level rise; coastal resilience; socioeconomic vulnerability; United States

1. Introduction

Sea level rise as a consequence of ongoing climate change poses a threat to millions of people worldwide (Hinkel et al. 2014). In the United States alone, the combination of global sea level rise, population growth and land use change is projected to expose between 4 and 13 million people to inundation by the year 2100 (Hauer et al. 2016). Left unabated, rising seas could affect upwards of 20 million US residents through the end of this century and beyond (Strauss et al. 2015).

While the number of people and communities affected by future inundation depends on the pace and magnitude of sea level rise, recurrent tidal flooding is already emerging as one of the most visible and quantifiable present-day signs of climate change. The East and Gulf Coasts of the US experienced some of the world's fastest rates of sea level rise during the 20th century (National Oceanic and Atmospheric Administration 2013a; Dangendorf et al. 2017). These rising seas have caused tidal flooding—coastal flooding that is driven in large part by routine tidal fluctuations rather than precipitation or storm surge—to become an increasingly frequent occurrence in US coastal communities. Whereas minor coastal flooding along the East, Gulf, and West coasts of the US occurred just once every one to five years in the 1950s, it was occurring about once every three months by 2012 (Sweet et al. 2014).

Sea level rise is expected to make recurrent tidal flooding both more frequent and more extensive (Sweet & Park 2014; Moftakhari et al. 2015; Dahl et al. 2017; Kulp & Strauss 2017). While the tidal datums associated with the mean higher high water (MHHW) mark could be revised upward as sea level rises, the water level at which a community begins to flood will not change, thus leading to an increase in flood frequency. With this increase, many areas will flood with such frequency—potentially facing dozens to hundreds of minor coastal floods per year by mid-century—that, in the absence of protective measures, they could be rendered unusable before they actually fall at or below the present day MHHW level.

The definition of an area permanently inundated by the ocean is conceptually and functionally straightforward. Any area that is under water at high tide would be considered permanently inundated. Sea level rise is projected to permanently inundate many coastal areas in the US this century (e.g. NOAA, 2017). Many communities, however, are already facing disruptive, even transformative flooding

* Dahl Scientific, San Francisco, CA, US
† Union of Concerned Scientists, Cambridge, MA, US
‡ Union of Concerned Scientists, Washington, DC, US
Corresponding author: Kristina A. Dahl (kdahl@alum.mit.edu)

Implications of Chronic Inundation:
worse for low-income and minority communities

DIRECT:

- People & infrastructure in flooded areas
- Loss of history, culture, sense of place
- Emotional stress of losses, uncertainty

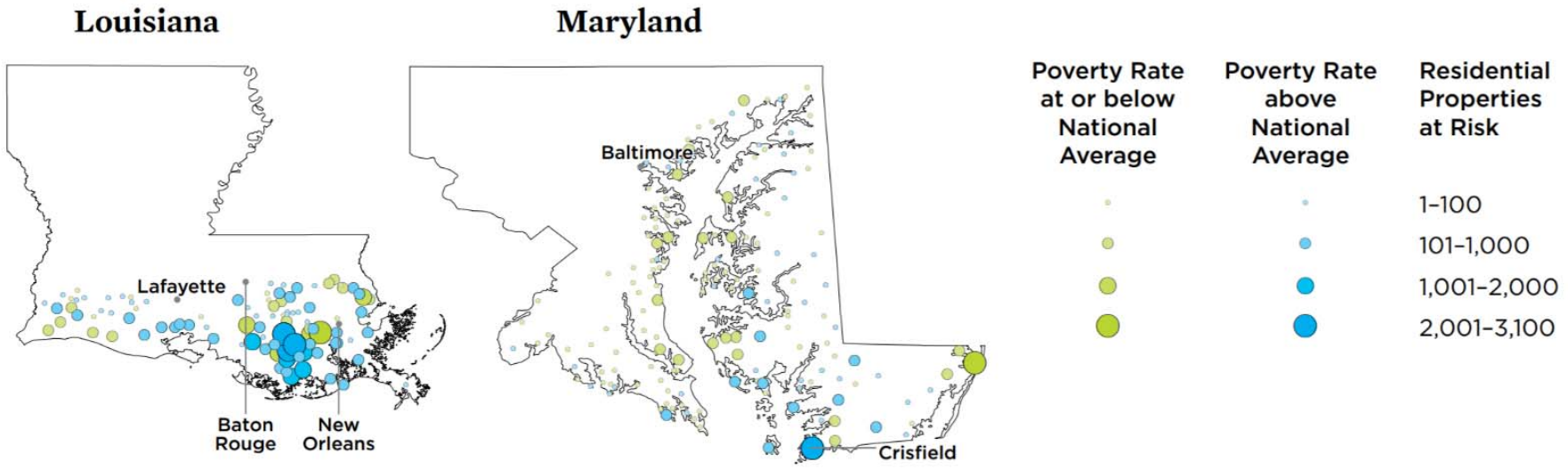
INDIRECT:

- Flooding may not affect your home, but livelihood, place of work, school, services
- Local tax base can decline (that fund schools, infrastructure, and services)
- Relocation can drive gentrification and push lower-income residents out
- 2035: over 50% of CI communities have *at least one* Census tract with high SoVI score today

Poverty, race, & tides create hotspots of risk

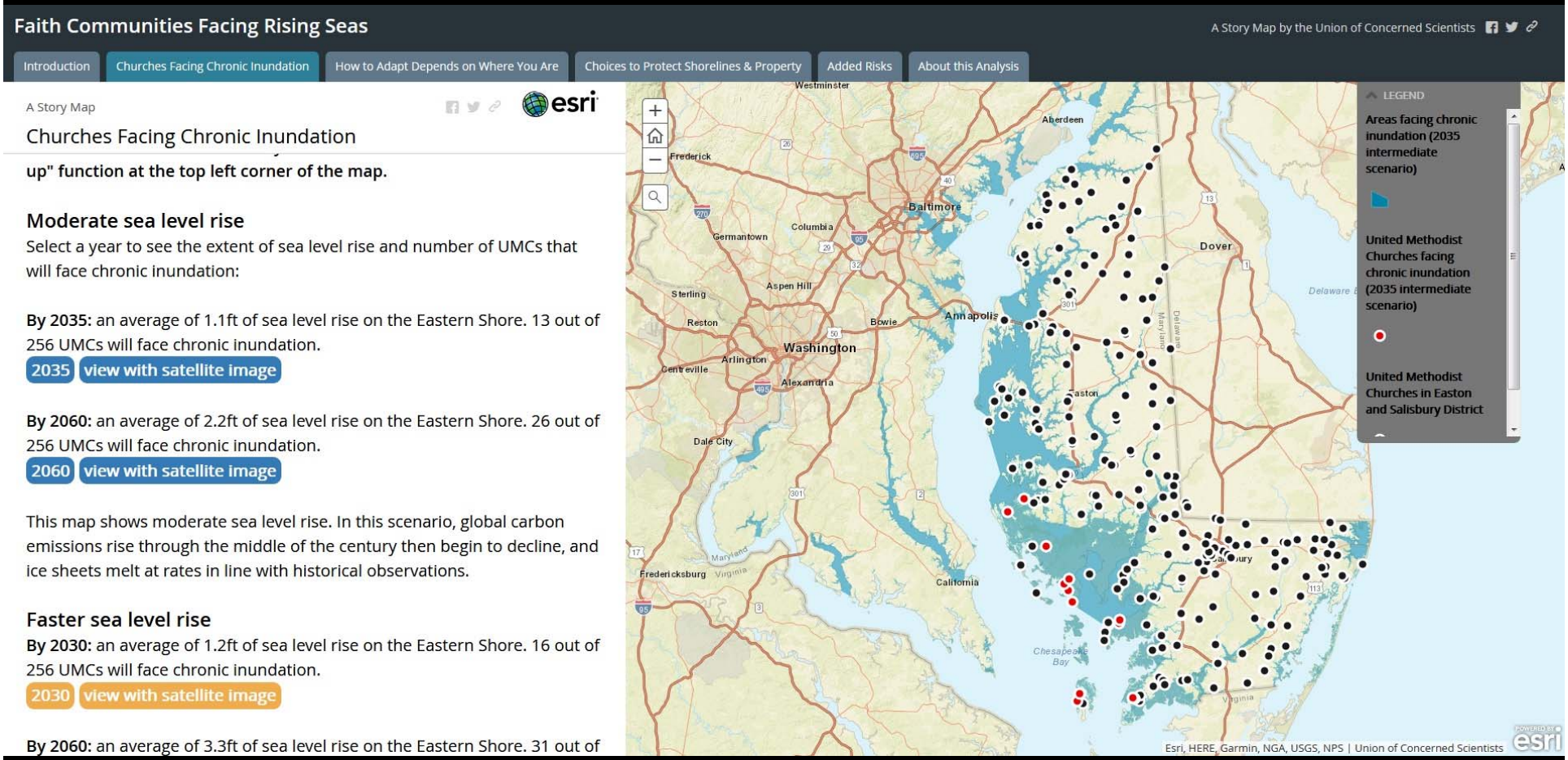
Nationwide, in 2045, approx. 175 communities could see 10% or > of housing stock at risk & ~40% are low-income communities w/ poverty levels above the national average.

[Snapshot of the chronic flooding and poverty intersection (2045)



Data provided by third parties through the Zillow Transaction and Assessment Dataset (ZTRAX). More information on accessing the data can be found at https://www.zillow.com/ztrax.

[Chronically Inundated Communities with High Socioeconomic Vulnerability in Maryland



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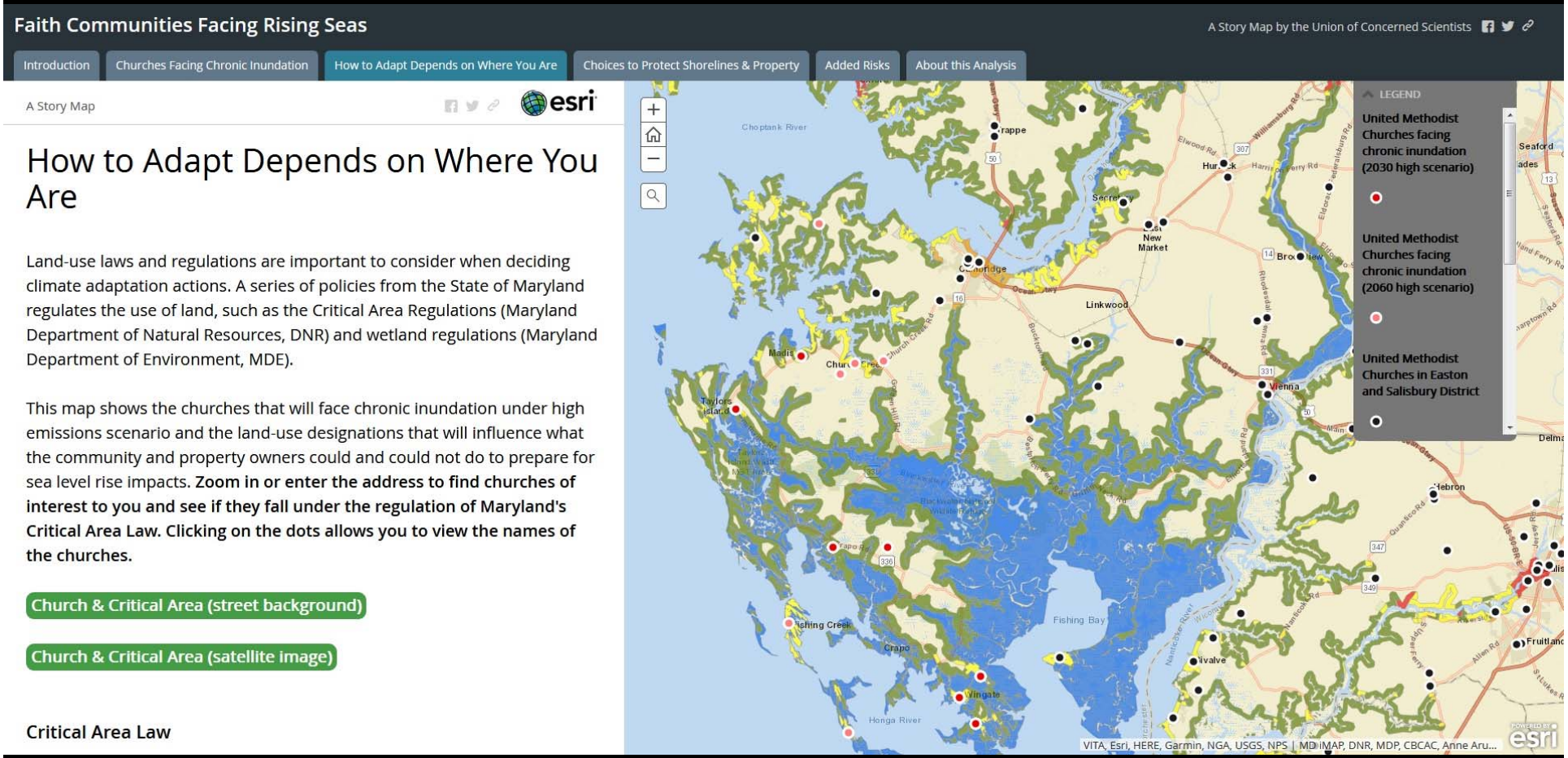


“Climate 101”

ClimateTown Hall

[Our Challenges and Choices

[Using “Response Time” Wisely

[Mapping, Mitigation, Insurance

NATIONAL FLOOD INSURANCE PROGRAM

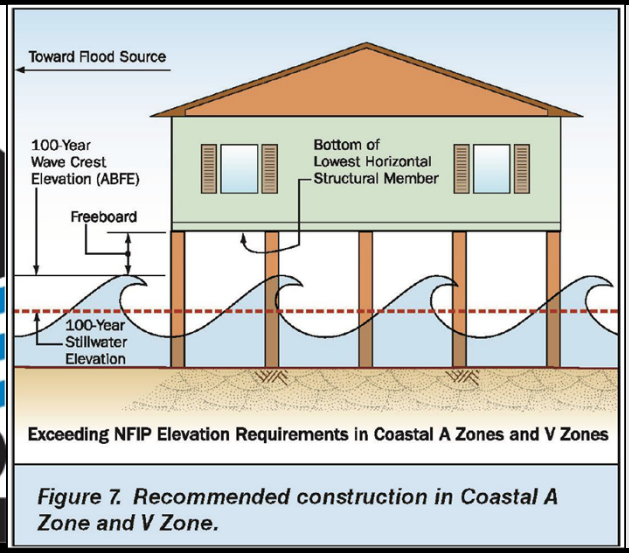
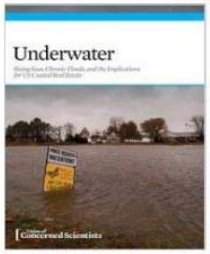


Figure 7. Recommended construction in Coastal A Zone and V Zone.

Educating Our Policymakers and Stakeholders

[Suite of Products: www.ucsusa.org/underwater

Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate (2018)



Hundreds of thousands of homes are at risk of chronic flooding due to sea level rise over the coming decades. The implications for coastal residents, communities, and the economy are profound.

[DOWNLOAD]

Full report >
Technical backgrounder >
Insights from market experts >
Complete data by state >
Complete data by community >
Complete data by ZIP Code >

Información disponible en español

If you or somebody you know is looking at coastal real estate, here are some smart questions to ask about tidal flooding. Read the brochure online or print it using this printer-friendly layout.

Explore interactive maps of the analysis

Interactive maps show how many homes are at risk by state, community, and ZIP Code. The maps also show the current property value, estimated population, and the property tax base at risk.

State-specific information (press releases)
California (English | Spanish) -- Delaware -- Florida (English | Spanish) -- Georgia -- Louisiana -- Maryland -- Massachusetts -- New Hampshire -- New Jersey (English | Spanish) -- New York (English | Spanish) -- North Carolina -- Pennsylvania -- South Carolina -- Texas (English | Spanish) -- Virginia -- Washington

Download data for all years and sea level rise scenarios included in this analysis (Excel)
By state -- By community -- By ZIP Code

4th NATIONAL ADAPTATION FORUM

APRIL 23-25, 2019 in Madison, WI

2019

ACTION TODAY for
a **BETTER TOMORROW**

Union of Concerned Scientists

t.com/pin/514325219919218393/

Questions?

acaldas@ucsusa.org