OVERVIEW OF DOD CLIMATE ASSESSMENT TOOL (DCAT)

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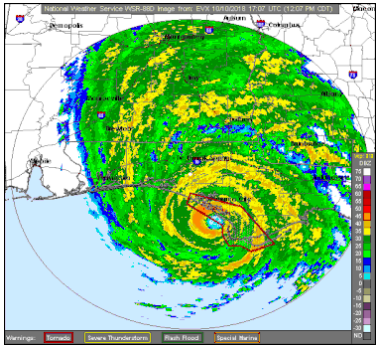
Two Responses to Climate: Adaptation & Mitigation

DEPARTMENT RESPONSES

1 ADAPTATION



Manage unavoidable climate impacts
by adapting, changing mission, and/or relocating where appropriate

2 MITIGATION

Avoid unmanageable impacts
through rapid greenhouse gas (GHG) reduction

Manage Unavoidable Climate Impacts

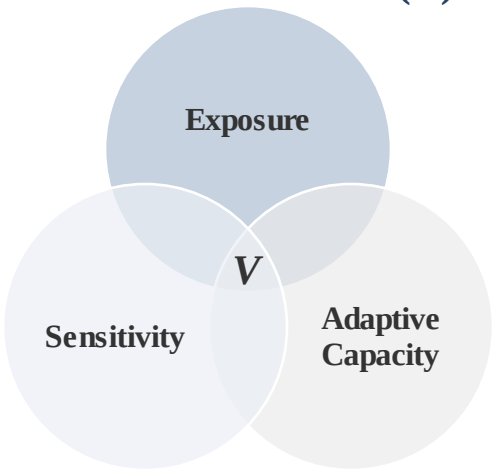
…by adapting, changing mission, and/or relocating to:

Reduce **Exposure**	Drive Down **Sensitivity**	Improve **Adaptive Capacity**
Missions and people	Sustain Mission Assurance	Prioritize actions and resources
Facilities and supply chains	Infrastructure integrity	Institutional capacity building
Critical infrastructure outside fenceline	Reliable performance of mission functions	Improve all-hazards resilience

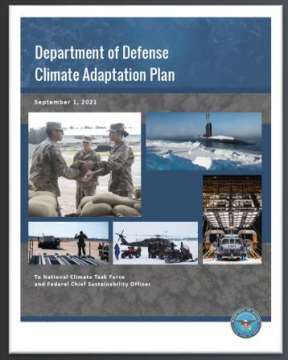
Coming FY24-25 *Coming FY24-25*

Is there a problem? ***Does it matter?*** ***Do we have resources to adapt?***

VULNERABILITY (V):



DCAT: Screening-Level Exposure Assessment



DoD Climate Assessment Tool (DCAT) currently addresses one aspect of Vulnerability**: Exposure**.

Reduce **Exposure**	Drive Down **Sensitivity**	Improve **Adaptive Capacity**
	Coming FY24-25	*Coming FY24-25*

Vulnerability

The DCAT helps achieve the Department's **Climate Adaptation Plan (CAP) End State**:

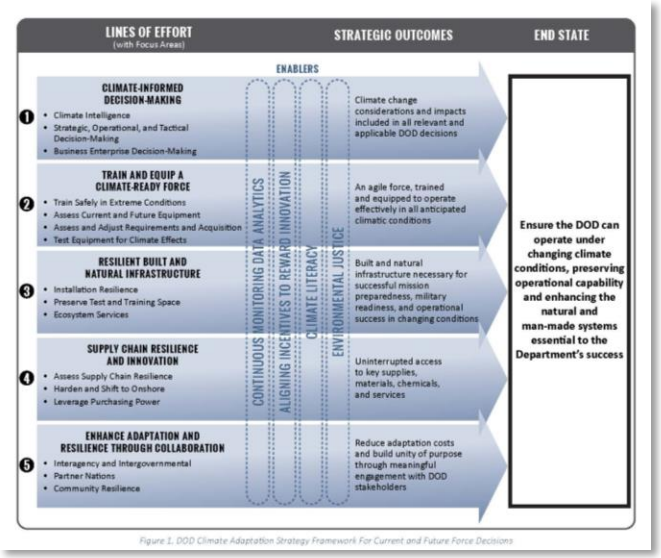


Figure 1. DOD Climate Adaptation Strategy Framework For Current and Future Force Decisions

"Ensure the DoD can operate under changing climate conditions, preserving operational capability and enhancing the natural and man-made systems essential to the Department's success."

- DoD CAP Strategic Framework

DoD Climate Assessment Tool

2011 — USACE Civil Works Vulnerability Assessment Tool

2014 — DoD Climate Change Adaptation Roadmap

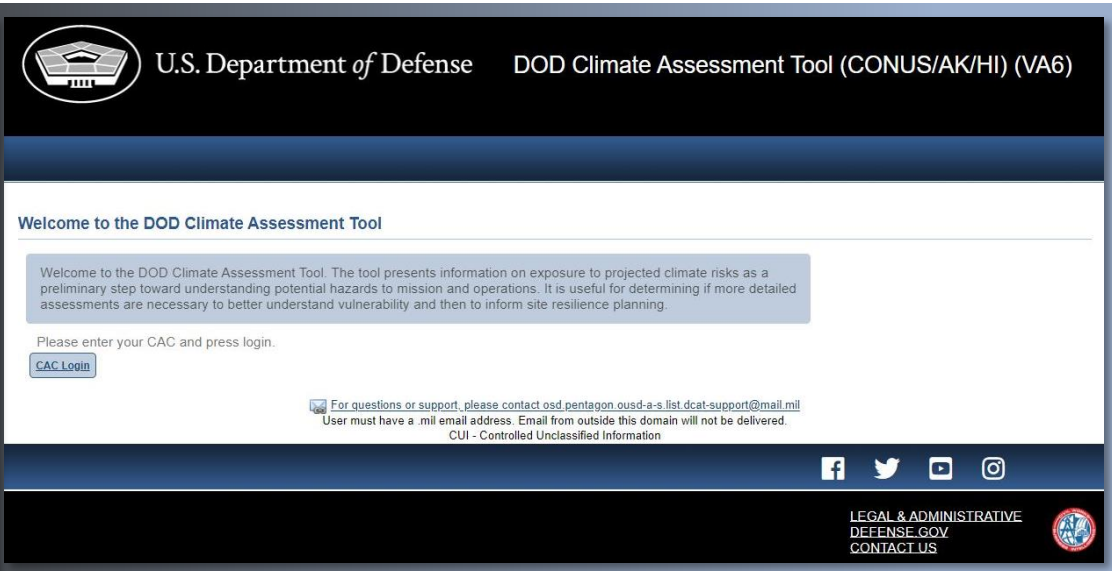
2016 — FY16 NDAA: DoD Screening Level Vulnerability Assessment

2018 — Army Climate Assessment Tool (ACAT)

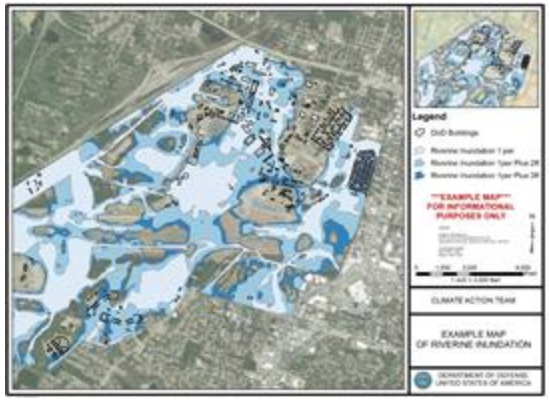
2020 — FY20 NDAA mandates DoD Screening Level Vulnerability Assessment Tool

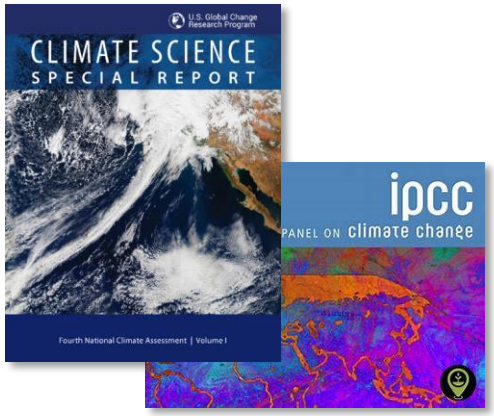
2021-22 — DoD CAP release ACAT → DCAT Major upgrades

2022-23+ — Expand DCAT to Partner Nations plus VESAC



Screening-level assessment of **exposure** to climate and extreme weather events…





…based on the **best available, authoritative, and actionable science.**

Users include…

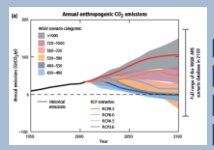
DCAT: Climate Data Pipeline

SCIENCE

Climate Science

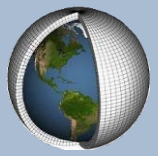
SERDP DOD • EPA • DOE
ESTCP

Research

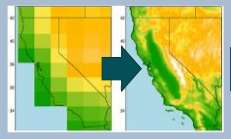


Emissions Scenarios

Using scenarios accounts for uncertainty in the data

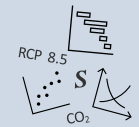


Global Climate Models

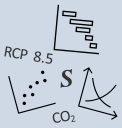


Downscaled Output

AGGREGATE & INTEGRATE



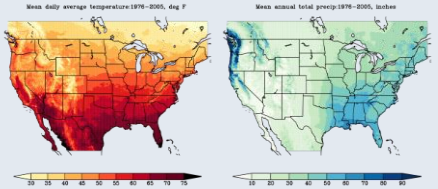
Climate Data and Information



Hydrological Model

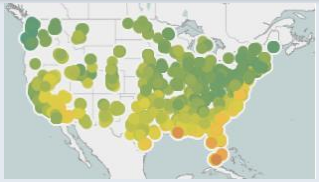
TRANSLATE

Projected Meteorological Information (Temperature, Rainfall)



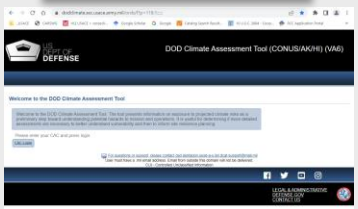
Projected Hydrological Information (Routed Runoff, Streamflow)

Hazards and Indicators



ACTIONABLE INFORMATION

DCAT



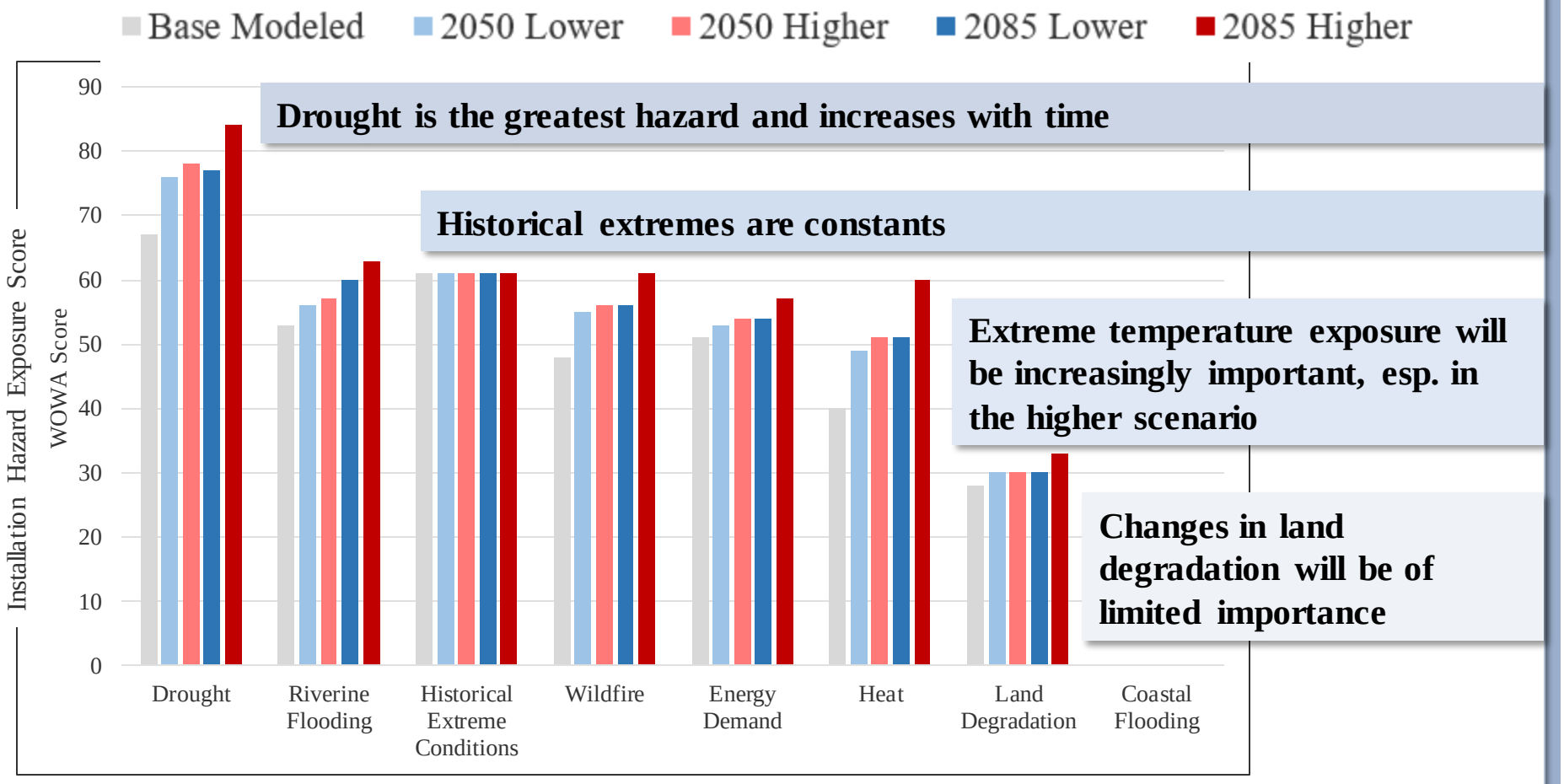
DCAT Data Features:

- **Place-Based**
- HUC8 sub-basin + point data
- Two 30-year projected epochs
- Two GHG Emission Scenarios

DRSL

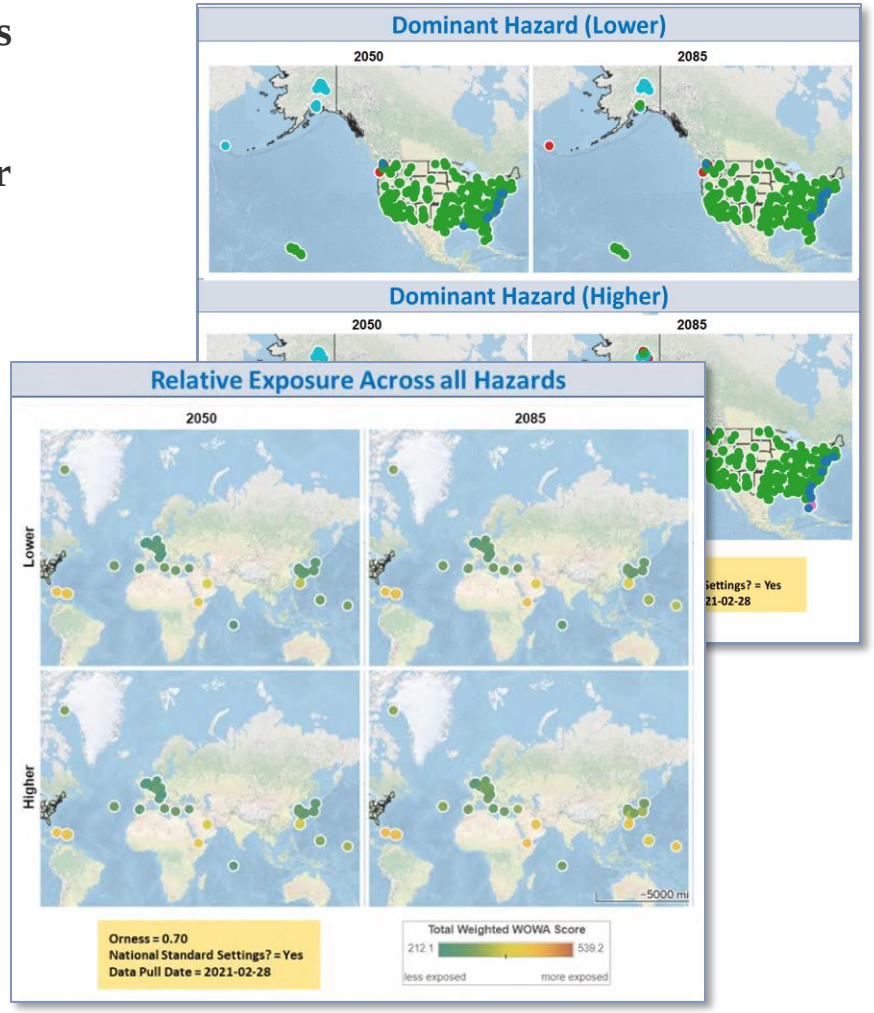
How Hazards are Assessed in the DCAT

Across eight hazards and five epoch-scenarios…



DCAT Findings

- Climate hazards increase over time; **drought is the dominant hazard**
- Exposure is greater for the **late century higher emission scenario**
- Hazards directly tied to **temperature** (e.g., heat index) are **increasing fastest in intensity and frequency**
- Near-term **adaptation planning and investments** expected to be **similar regardless of emissions scenario through 2050**
- **Additional climate adaptation may be needed after 2050** – further analysis and planning could necessitate different strategies



Climate Exposure Summary: SE Sentinel Landscapes

- The DoD Climate Assessment Tool (DCAT) identified drought as the top future climate exposure hazard for the key military installations within the Southeastern U.S. Sentinel Landscapes.
  - Additional top hazards varying across SLs include: historical extreme conditions, coastal flooding, riverine flooding energy demand, and extreme temperature

- The 1% Annual Exceedance Probability (AEP) riverine flood map footprint currently intersects with:
  - 32.2% of the Eastern North Carolina SL
  - 48% of the South Carolina Low Country SL
  - 31.7% of the Georgia SL
  - 49% of the Avon Park SL
  - 35.7% of the Northwest Florida SL
  - 50.9% of the Middle Chesapeake SL

- Energy demand and Extreme temperature are top climate exposure hazards ***(GA; SCLC)***

- Wildfire is also a top climate exposure hazard ***(ENC; NWF; AP; GA)***

- Coastal Flooding is a top hazard for some installations within each SL ***(MC; SCLC; NWF)***

Southeast DCAT Regional Climate Key Messages

Southeast Key Message 1: Urban Infrastructure and Health Risks

Many southeastern cities are particularly vulnerable to climate change compared to cities in other regions, with expected impacts to infrastructure and human health. The vibrancy and viability of these metropolitan areas, including the people and critical regional resources located in them, are increasingly at risk due to heat, flooding, and vector-borne disease brought about by a changing climate. Many of these urban areas are rapidly growing and offer opportunities to adopt effective adaptation efforts to prevent future negative impacts of climate change.

Southeast Key Message 2: Increasing Flood Risks in Coastal and Low-Lying Regions

The Southeast's coastal plain and inland low-lying regions support a rapidly growing population, a tourism economy, critical industries, and important cultural resources that are highly vulnerable to climate change impacts. The combined effects of changing extreme rainfall events and sea level rise are already increasing flood frequencies, which impacts property values and infrastructure viability, particularly in coastal cities. Without significant adaptation measures, these regions are projected to experience daily high tide flooding by the end of the century.

Southeast Key Message 3: Natural Ecosystems will be Transformed

The Southeast's diverse natural systems, which provide many benefits to society, will be transformed by climate change. Changing winter temperature extremes, wildfire patterns, sea levels, hurricanes, floods, droughts, and warming ocean temperatures are expected to redistribute species and greatly modify ecosystems. As a result, the ecological resources that people depend on for livelihood, protection, and well-being are increasingly at risk, and future generations can expect to experience and interact with natural systems that are much different than those that we see today.

Southeast Key Message 4: Economic and Health Risks for Rural Communities

Rural communities are integral to the Southeast's cultural heritage and to the strong agricultural and forest products industries across the region. More frequent extreme heat episodes and changing seasonal climates are projected to increase exposure-linked health impacts and economic vulnerabilities in the agricultural, timber, and manufacturing sectors. By the end of the century, over one-half billion labor hours could be lost from extreme heat-related impacts. Such changes would negatively impact the region's labor-intensive agricultural industry and compound existing social stresses in rural areas related to limited local community capabilities and associated with rural demography, occupations, earnings, literacy, and poverty incidence. Reduction of existing stresses can increase resilience.

Georgia Key Messages

Georgia State Climate Summary Key Message 1:

Temperatures in Georgia have risen by 0.8°F, about half of the warming for the contiguous United States, since the beginning of the 20th century, but the warmest consecutive 5-year interval was 2016–2020. However, under a higher emissions pathway, historically unprecedented warming is projected during this century, including increases in heat wave intensity and decreases in cold wave intensity.

Georgia State Climate Summary Key Message 2:

Higher temperatures will increase the rate of soil moisture loss during dry spells, which could lead to more intense droughts and increased competition for the state's water resources.

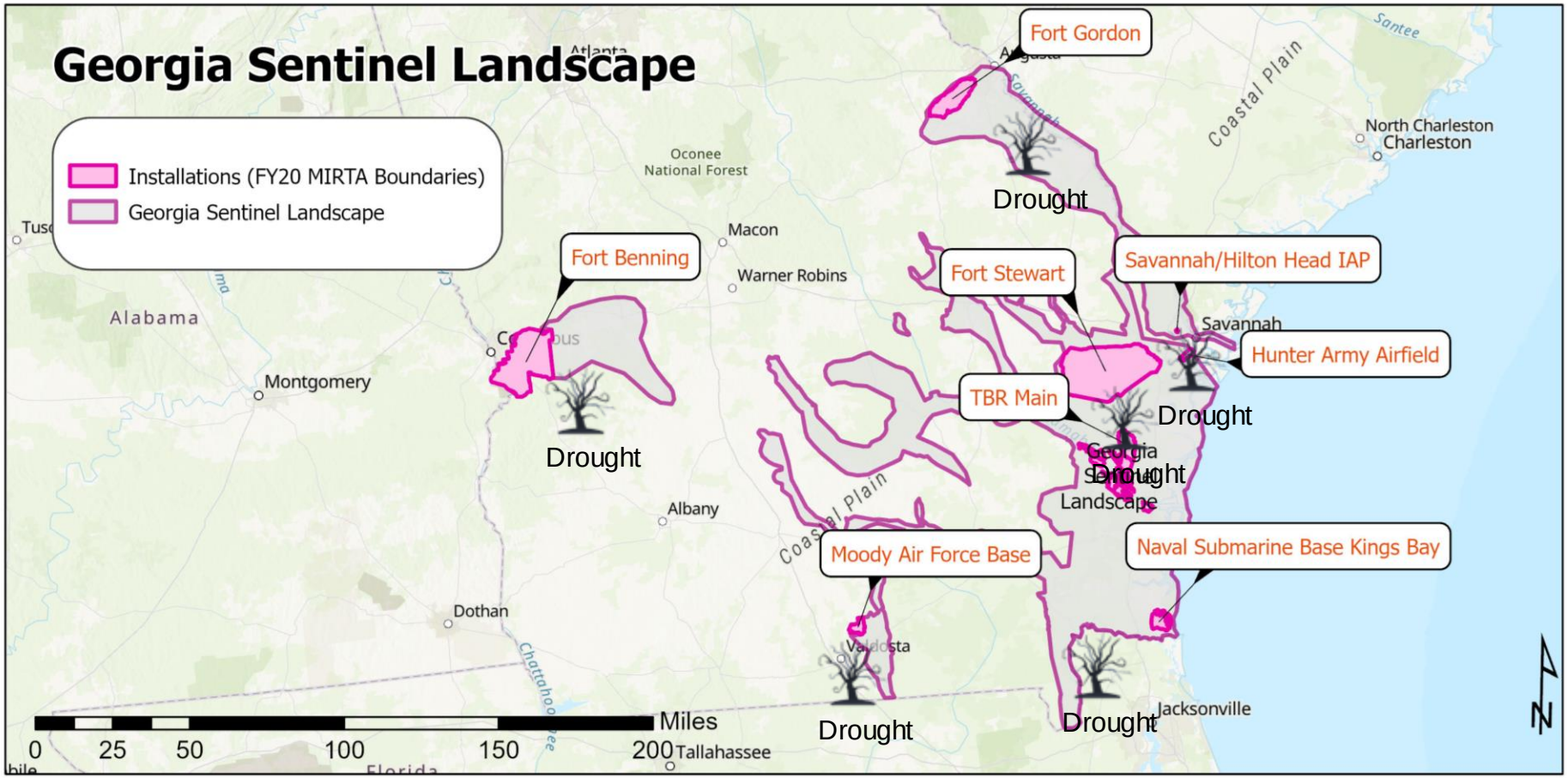
Georgia State Climate Summary Key Message 3:

Global sea level has risen by about 7 to 8 inches since 1900 and is projected to rise another 1 to 4 feet by 2100. Sea level rise will increase the frequency, extent, and severity of coastal flooding, posing a grave risk to developments along Georgia's coastline.

Source: NOAA State Climate Summaries 2022:
https://statesummaries.ncics.org/chapter/ga/

GSL Installations Top Exposure Hazard 2050 Epochs

- Drought is the top ranked exposure hazard for all installations in the GSL across both 2050 modeled scenarios



SCLCSL Storm Damages

Total SCLCSL Damages 2000-2021

Damage Category	Property Damage Estimate ($)	Total Deaths
Hurricanes, Typhoons and Tropical Storms	67,200,000	0
Riverine and Lakeshore Flooding	51,959,230	0
Ice Storms, Freezing Fog and Sleet	28,270,000	0
Wildfire	12,000,000	0
Tornadoes and Waterspouts	10,072,500	8
Wind Damage	9,470,460	4
Snowstorms	1,720,000	0
Hail	1,144,770	0
Heavy Rain	13,500	0
Heat and Heat Waves	-	1
Drought	-	0
Cold Temperature Extremes	-	1
Coastal Flood	-	0
Grand Total	**181,850,460**	**14**

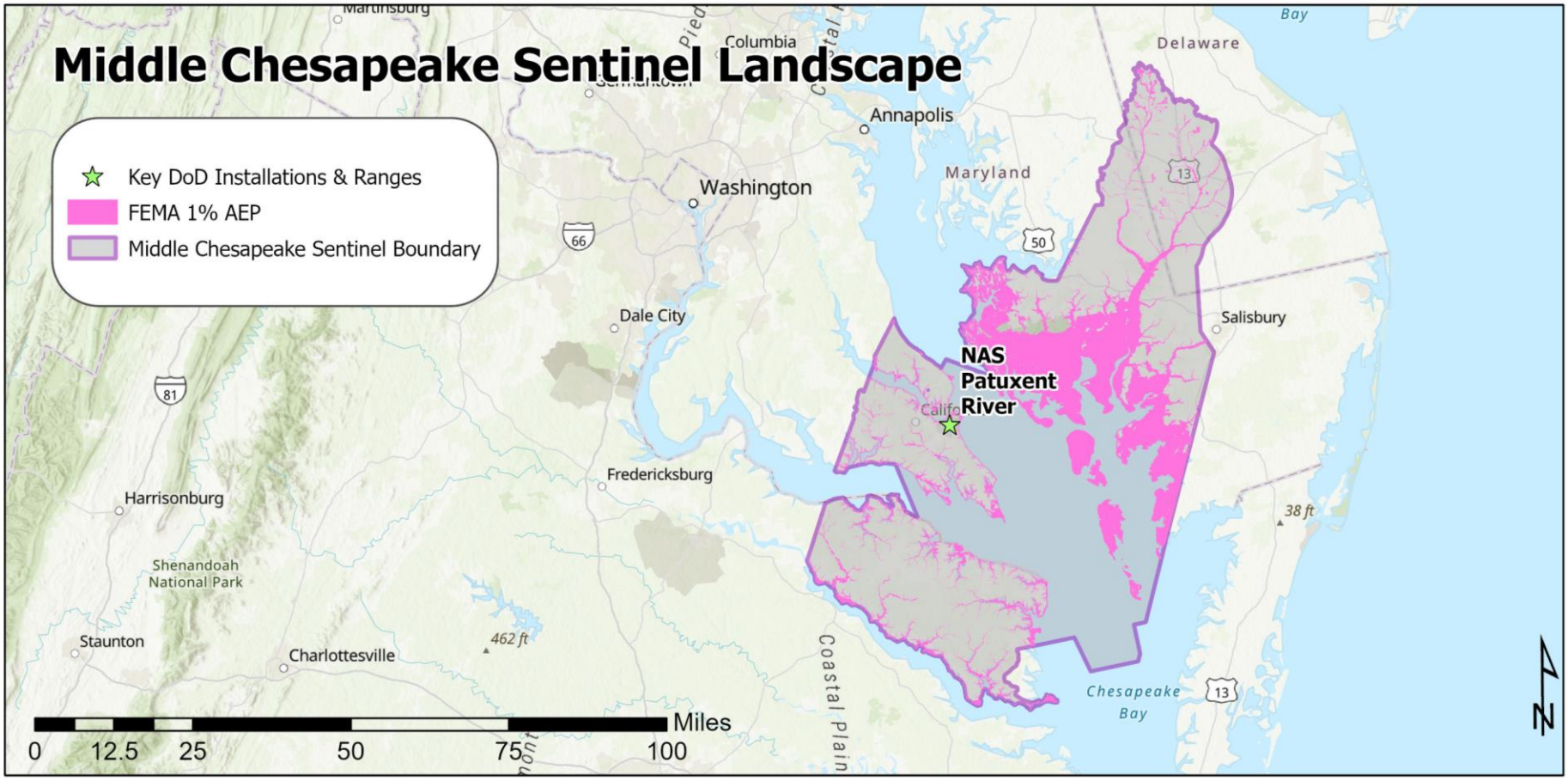
Source: NOAA Storm Damages
https://www.ncei.noaa.gov/pub/data/swdi/stormevents/csvfiles/

Damages By County 2000-2021

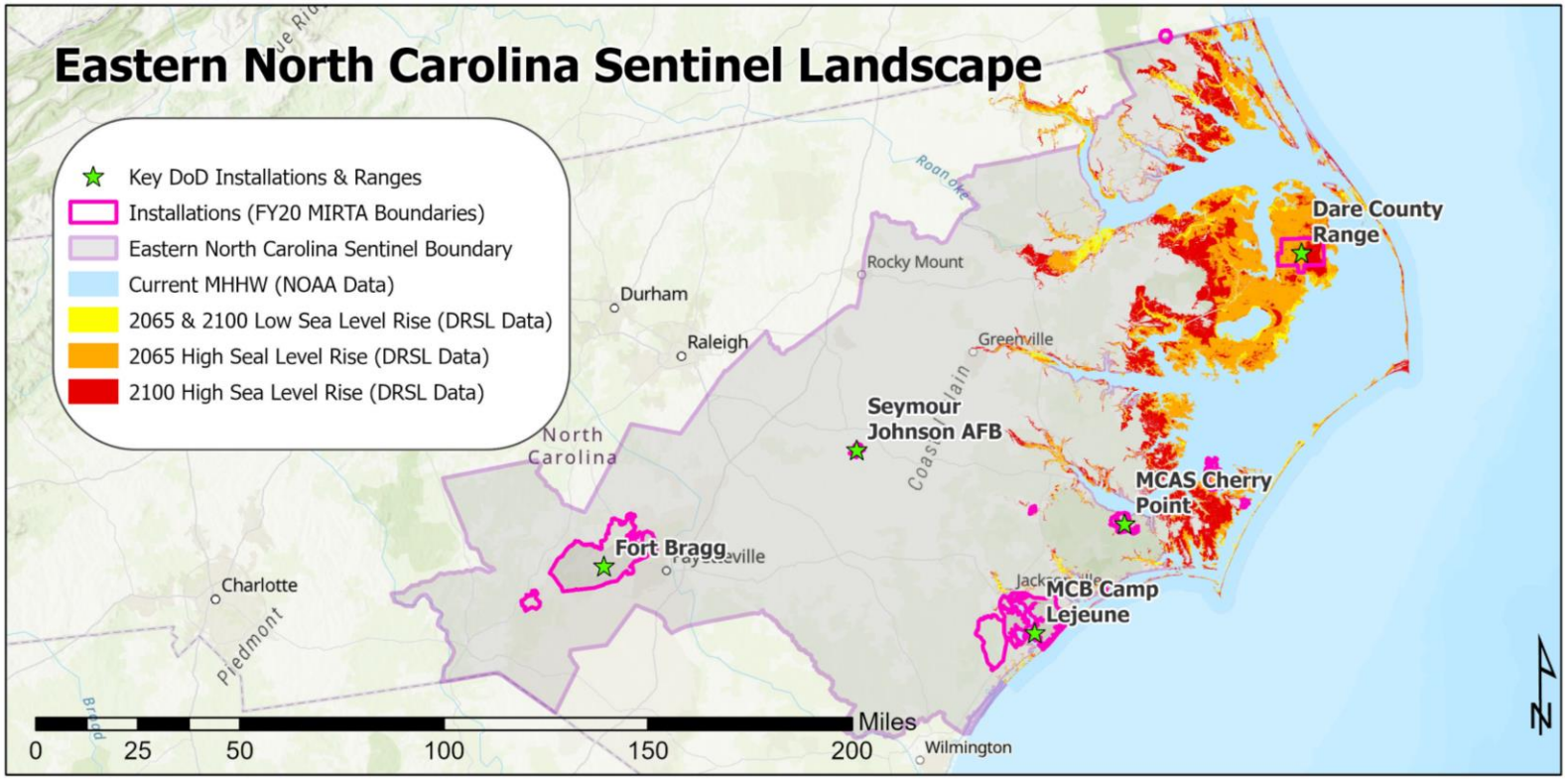
County	Total Damages ($)	Total Deaths
Jasper	79,732,500	0
Charleston	28,593,850	1
Orangeburg	23,110,650	4
Allendale	13,796,500	2
Bamberg	13,738,500	1
Beaufort	10,556,650	0
Dorchester	7,670,800	0
Colleton	4,320,160	1
Hampton	330,850	5
Grand Total	**181,850,460**	**14**

MCSL Riverine Flooding Overview

50.9% of the Middle Chesapeake Sentinel Landscape land area falls within the 1% FEMA Riverine Floodplain.



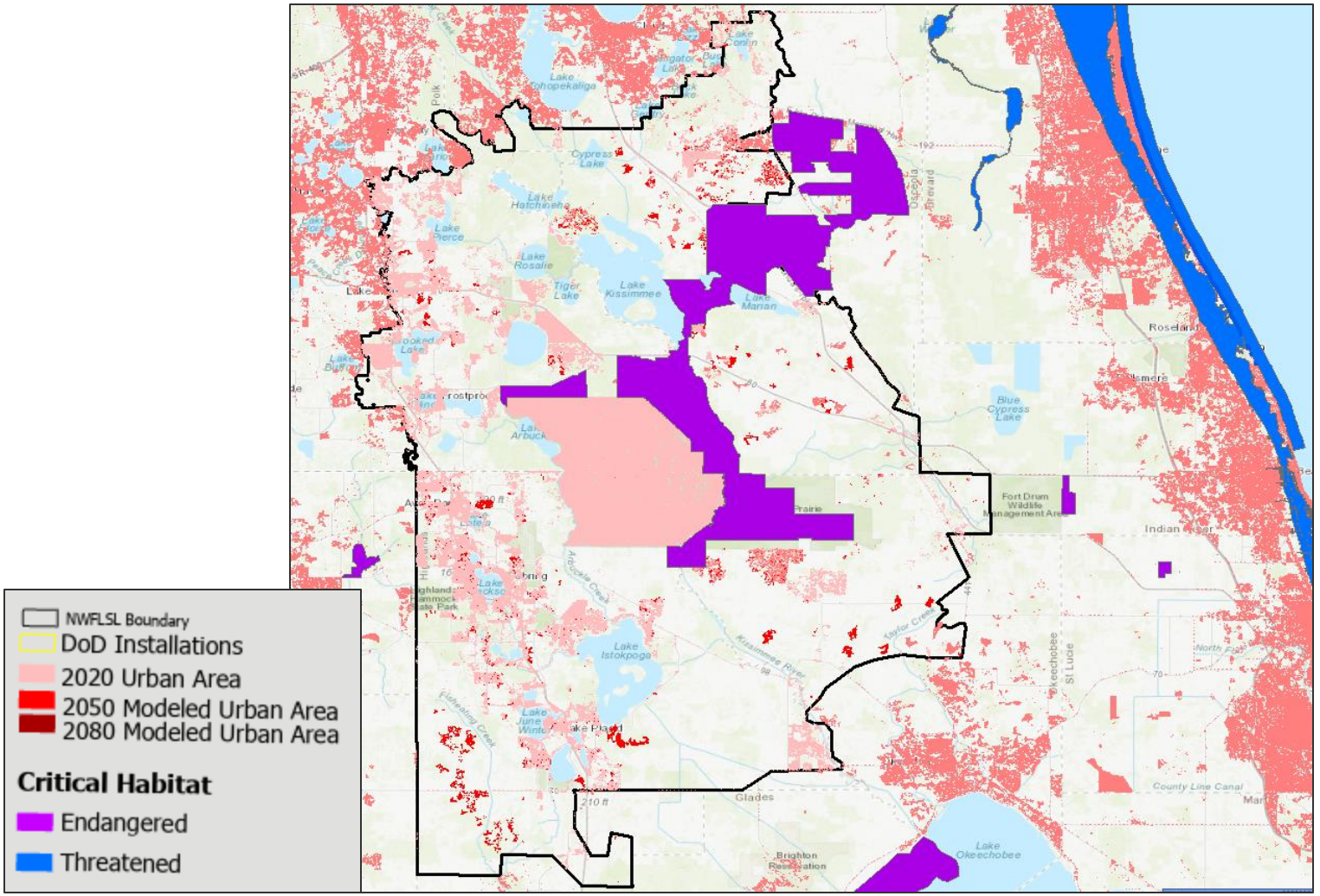
ENCSL Coastal Flooding



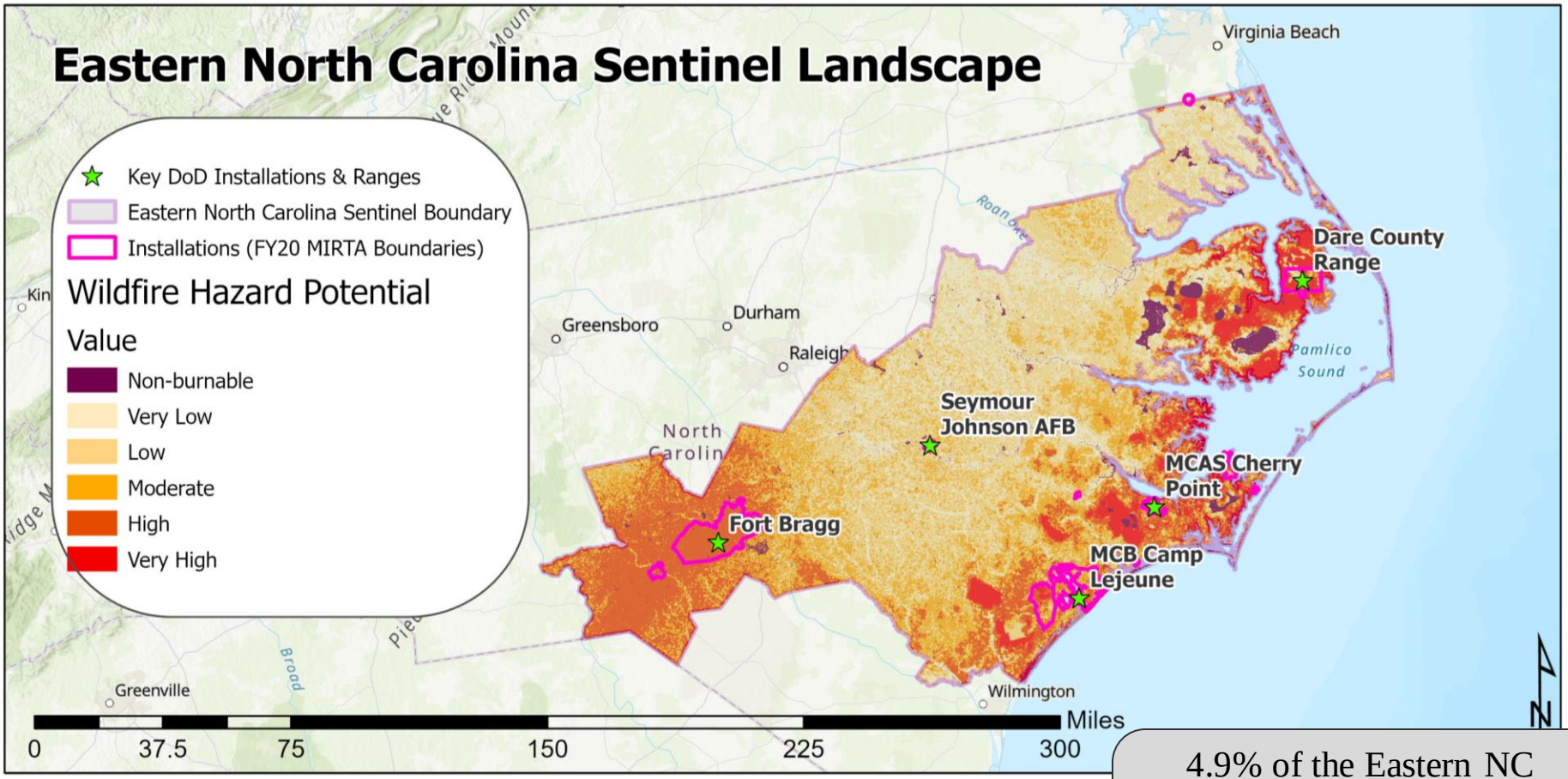
Important Note: This sea-level rise analysis is an average at low resolution. These are rough estimates calculated from DCAT information at the installation. A more in-depth analysis is needed for more quantifiable results.

Sea-level rise (SLR) results are from two sources. DRSL was used to determine the projected SLR in respect to the Global Mean Sea Level (referenced to the 1983-2001 tidal datum). The rises shown in the map are from the NOAA Sea Level Rise viewer which are measured from MHHW and only available in 1-foot increments. In the case of the ENCSL, MHHW was not as high as so more SLRs could be shown, opposed to those for many of the other Sentinel Landscapes. The 2100 High SLR shown is the ~8 ft rise determined in DRSL shown with the 8 ft NOAA data based on a different datum (elevation over MHHW). It was assumed that MHHW in DRSL and NOAA are equivalent.

APSL Critical Habitat and Urban Encroachment



ENCSL Wildfire Hazard Potential



4.9% of the Eastern NC Sentinel Landscape has High or Very High Wildfire Hazard Potential

Fort Benning Temperatures

Average daily maximum temperatures for Chattahoochee County, GA are expected to increase by about 5-10°F by the end of the century. Days >95°F will increase from a historic average of 15 days/year (1961-1990) to 16-185 days/year at the end of the century, depending on scenario and model.

Days Per Year with Temperatures Above 95°F

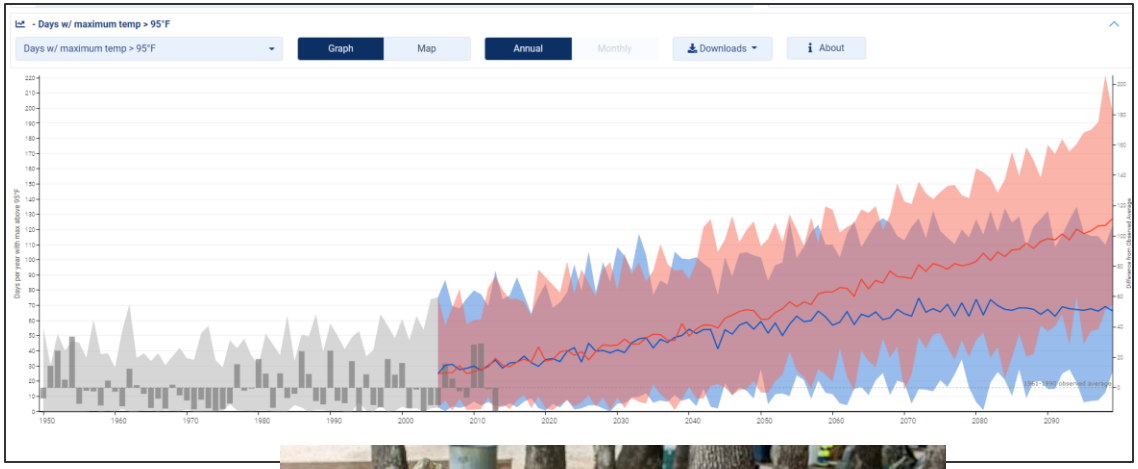


TABLE 2. Heat injury events[a], by location of diagnosis/report (with at least 100 cases during the period), active component, U.S. Armed Forces, 2016–2020

Location of diagnosis	No.	% total
Fort Benning, GA	1,849	14.8
MCB Camp Lejeune/Cherry Point, NC	1,050	8.4
Fort Bragg, NC	971	7.8
Fort Campbell, KY	756	6.1
Fort Polk, LA	674	5.4
MCRD Parris Island/Beaufort, SC	576	4.6
NMC San Diego, CA	531	4.3
MCB Camp Pendleton, CA	467	3.7
Fort Hood, TX	365	2.9
Okinawa, Japan	315	2.5
JBSA-Lackland, TX	290	2.3

https://crt-climate-explorer.nemac.org/ *Note, may be small differences in days above 95 degrees due to the way DCAT/NOAA calculates these values

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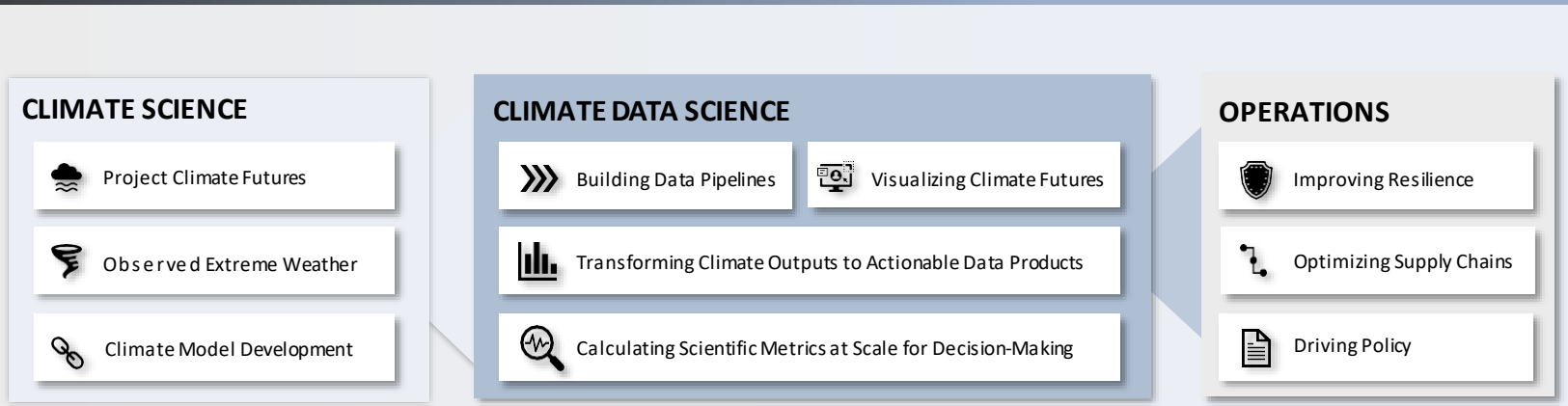
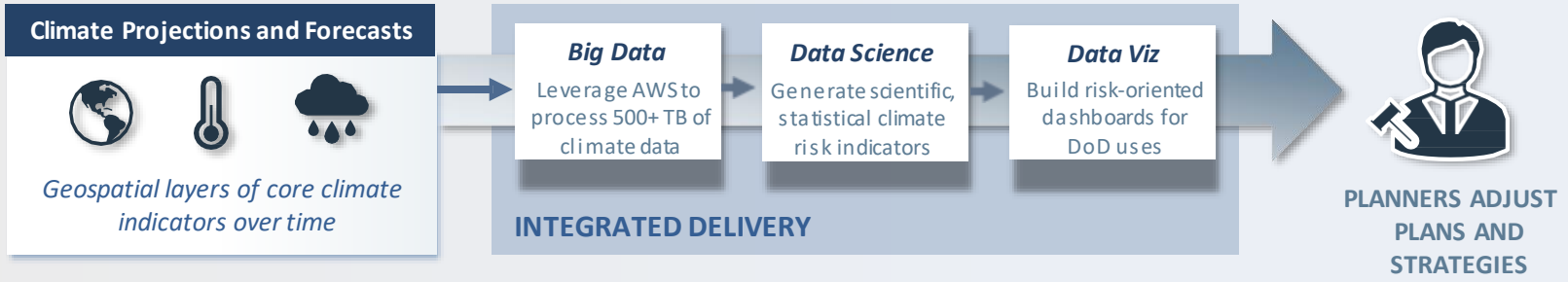
Climate Science and Decision-Making



Active Delivery Example

Climate Wargaming Sub-Working Group evaluating validated and actionable climate data and models for inclusion in DoD wargames.



DCAT: Screening-Level Exposure Assessment

Spiral development of DCAT will leverage the **Paint the Nations** work, which is the watershed-based precursor to **Paint the World** (i.e., not installation-based)

CURRENT:

1 Exposure

CONUS | AK | HI

COMING APRIL 2023

2 Paint the Nations

International DCAT + 6 NATIONS
(IT, AU, UK, DE, KR, & JP)

UP NEXT:

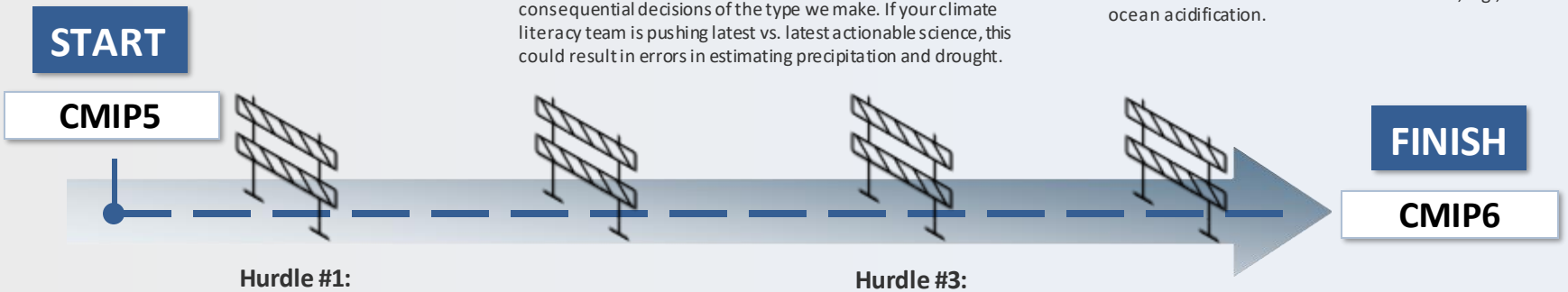
3 + Sensitivity & Adaptive Capacity

4 Paint the World

spiral development is favored for complex projects

Getting from CMIP5 to CMIP6

Planning tools provide well-tested information that is refined over time as new information is aggregated, integrated, and translated into actionable information, with updates at a time scale consistent with decision horizon.



Hurdle #1:
Vertical Land Movement

Our interagency sea level rise working group has identified issues with the vertical land movement portion of the CMIP6 models, impacting sea level rise projections, making these a poor choice for consequential decision-making. If your climate literacy team is pushing latest vs. latest actionable science, this could result in errors estimating water surface over the land.

Hurdle #2:
Warm Bias

Some CMIP6 models have a known warm bias. Our interagency groups have been assessing the output in order to determine if, how, and when, CMIP6 model output can be used in consequential decisions of the type we make. If your climate literacy team is pushing latest vs. latest actionable science, this could result in errors in estimating precipitation and drought.

Hurdle #3:
Lack of Downscaled CMIP6 Data on Global Scale

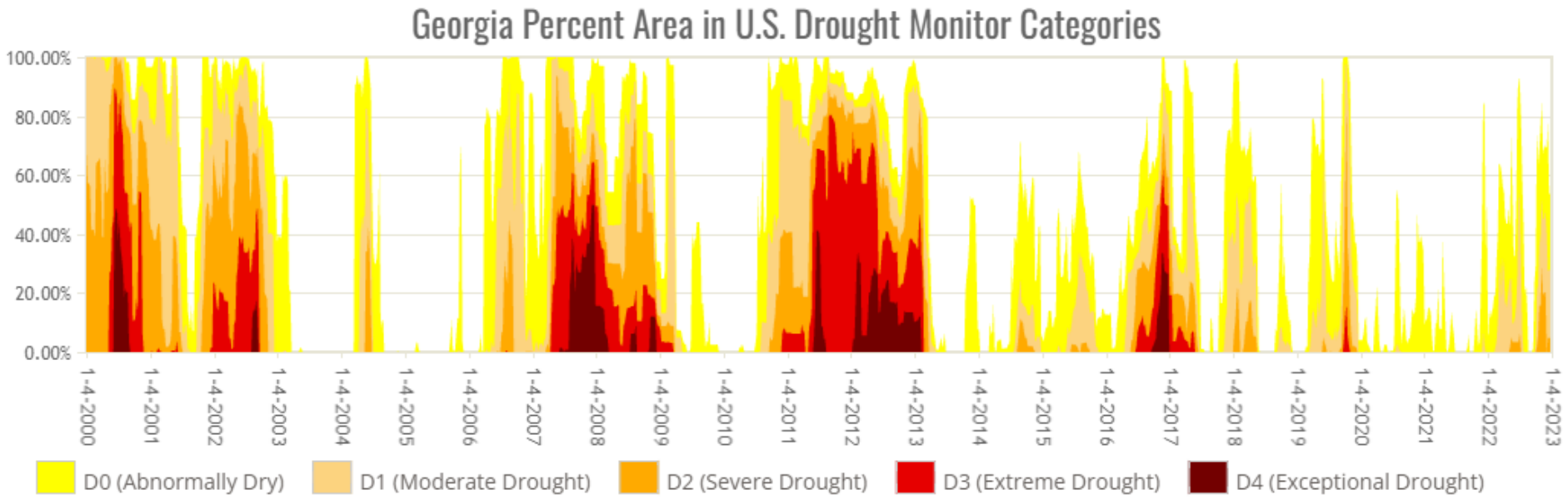
It takes time for modeling experts to downscale original low resolution climate projections to higher resolution scales that matter for installation or community level decisions. NCAR and other partners are making good progress on useful downscaled CMIP6 data, but only for the U.S. Future DCAT efforts like Paint the World will require global downscaled data

Hurdle #n:
TBD

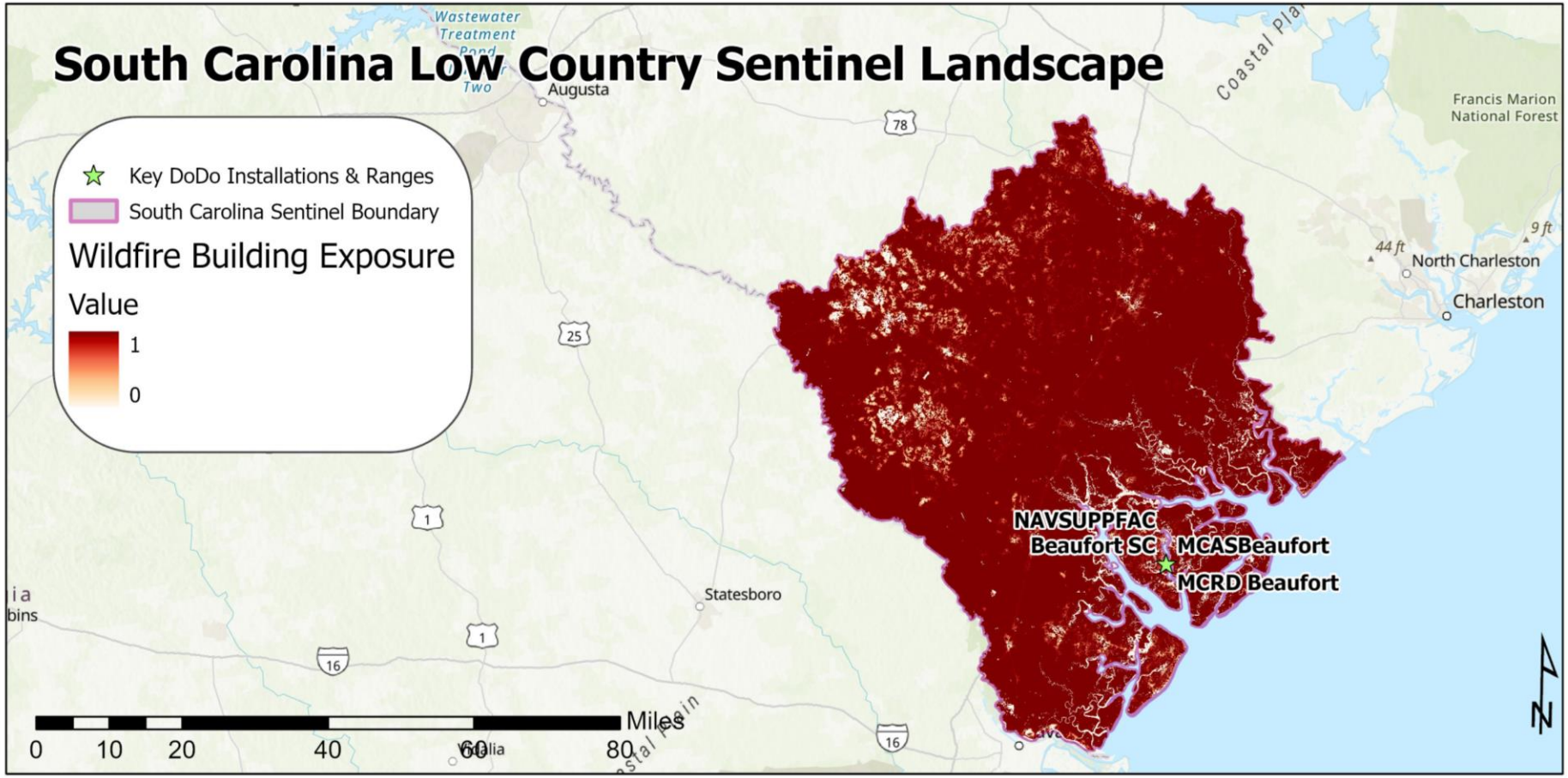
Further hurdles will develop as uncertainties are revealed during exploration of emerging science consensus and resolution of known hurdles., e.g., ocean acidification.

Drought in State of Georgia

The state of Georgia has experienced exceptional drought five times over the past 22 years in 2000, 2007, 2011, and 2012. The state has also been abnormally dry through much of that time.



SCLCSL Wildfire Building Exposure



Wildfire Building Exposure Type is a continuous ranking between 0 and 1 of how directly exposed a building would be to a wildfire. 1 is directly exposed, with close proximity to areas of burnable wildland vegetation, and 0 represents nonexposed.

The average building exposure type within the SCLCSL is 0.94