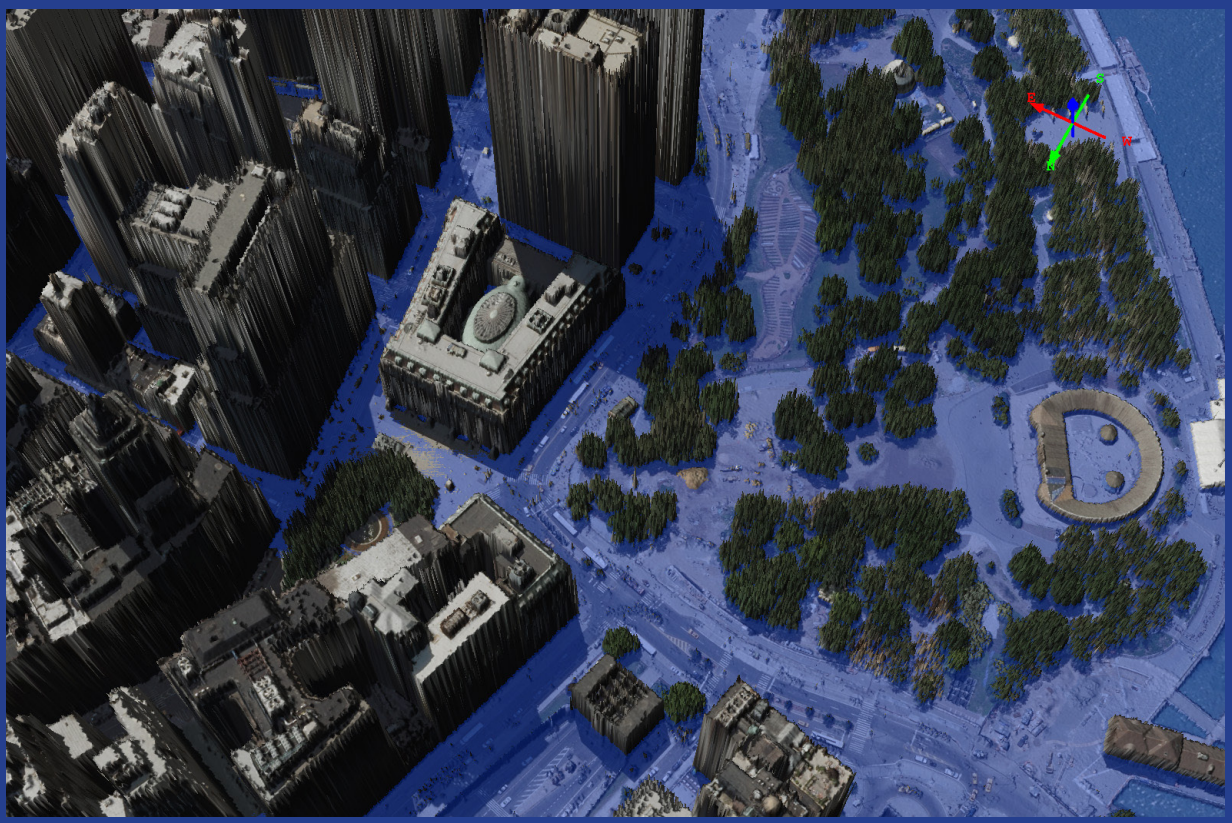
Climate Change Adaptation Plan

Phase 1 + 2 Executive Summary: Smithsonian Facilities in Washington, D.C., New York, Maryland, and Florida

2018



Smithsonian Institution

This document summarizes the findings of Phases 1 and 2 of the Smithsonian's Climate Change Adapation Plan (CCAP) research, conducted between summer 2015 and spring 2017. The research focused on how flood risks to Smithsonian facilities will evolve over time as a result of three climate change-related effects: (1) intensification of precipitation; (2) increased storm surge from coastal storms; and (3) sea level rise. The latter two influences are compounding; rising seas mean the flooding from a storm surge of any given magnitude will be higher and more extensive.

Phase 1: National Mall, Washington, D.C.

The Mall is exposed to flood risks from both heavy precipitation (it lies at a local topological low point) and the combined effects of sea level rise and storm surge (this part of the Potomac River is tidally influenced). These risks will grow over time, but more research is needed to understand how exactly they will evolve. The new Potomac Park Levee system will provide some protection from the River, but not from runoff flooding.

- The **National Museum of American History (NMAH)** and **National Museum of Natural History (NMNH)** are the most vulnerable facilities. They are highly exposed to flooding from both the Potomac and precipitation runoff, and have extensive critical spaces that house collections and building systems on lower levels.
- The **National Museum of the American Indian (NMAI)** and **National Air and Space Museum (NASM)** are somewhat vulnerable, but less so than NMAH or NMNH; they are less exposed and have fewer critical spaces on lower levels.
- The **National Museum of African American History and Culture (NMAAHC)** is highly exposed and has significant critical spaces below grade, but flood protection measures are an integral part of its design. Its vulnerability will grow over time, however, especially to Potomac flooding.
- Other Mall properties are not generally vulnerable. The risks they face are largely confined to site-specific flooding from severe precipitation events.

Phase 1: National Zoo, Washington, D.C.

The National Zoo's Rock Creek campus is not subject to storm surge flooding or sea level rise, but intensified precipitation will increase runoff and riverine flood risks to low-lying Zoo properties. The magnitude of this increase is unknown; more research is needed. However, major vulnerabilities already exist, particularly at the Boiler Plant. Even a relatively modest flood event along Rock Creek could surmount current barriers at this site and put important building systems at risk. Other properties in high risk areas include the General Services Building (GSB), Propagation Building, Amazonia, and, to a lesser extent, the Lower Bear Exhibit and Main Barn.

Vulnerability Matrix: National Mall

Climate Change Variable	Consequence	Time Frame	Hirshhorn	NASM	NMAAHC	NMAH	NMAI	NMNH	Other Mall Properties
Precipitation	Interior Drainage (Runoff) Flooding	Current	●	●	●	●	●	●	●
		2020s	●	●	●	●	●	●	●
		2080s	●	●	●	●	●	●	●
Coastal Storms and Sea Level Rise	Storm Surge Flooding	Current - 2020s	●	●	●	●	●	●	○
		2050s	●	●	●	●	●	●	○
		2100s	●	●	●	●	●	●	○

Vulnerability	
Very High	●
High	●
Moderate	●
Low	●
Minimal	○
Unknown	*

Phase 2: New York City

Of the New York area Smithsonian facilities, only one—the **National Museum of the American Indian's Gustav Heye Center (NMAI-NY)**—is at risk from storm surge flooding and sea level rise. Its current exposure is modest (although it almost flooded during Hurricane Sandy in 2012), but will grow substantially over time. For other New York facilities, flood risks are confined to minor local runoff issues and to the indirect threat of power loss from inundataed utility facilities.

Phase 2: Florida

The **Smithsonian Marine Station (SMS)** at Fort Pierce is on an island with sandy, porous soil, so it is at little risk from runoff flooding regardless of how climate change may affect precipitation. However, all SMS facilities are currently exposed to storm surge risk, and will become much more vulnerable as a result of sea level rise. Smithsonian- and community-level adaptations may mitigate the threat to some extent, but there is no guarantee that SMS could be effectively protected from flooding in a powerful storm. Given the unit's coastal research focus, some exposure to coastal storm events is unavoidable. But in the long run, relocation of some facilities to less-exposed sites may be advisable.

Phase 2: Maryland

Although the Maryland coast will be strongly affected by sea level rise, the most mission-critical concentration of facilities at the **Smithsonian Environmental Research Center (SERC)** in Edgewater—those surrounding the Mathias Laboratory—is far from the water, well elevated, and not subject to coastal flooding. Only two SERC buildings are at significant risk from such flooding, even over the long term. However, coastal experiments and infrastructure, and much of the shoreline itself, are threatened by climate change-related sea level rise, storm surge, and erosion. Some SERC properties also face a modest risk of flooding from runoff, particularly

Vulnerability Matrix: National Zoo

Climate Change Variable	Consequence	Time Frame	Amazonia	(Lower) Bears Exhibit	Boiler Plant	General Services Building (GSB)	Main Barn	Propagation Building
Local Precipitation	Interior Drainage (Runoff) Flooding	Current	●	●	●	●	●	●
		Future	✳	✳	✳	✳	✳	✳
Regional Precipitation	Riverine Flooding	Current	●	●	●	●	●	●
		Future	✳	✳	✳	✳	✳	✳

Vulnerability Matrix: New York

Climate Change Variable	Consequence	Time Frame	NMAI-NY	Cooper-Hewitt Main	Cooper-Hewitt Collections	Other Facilities
Precipitation	Interior Drainage (Runoff) Flooding	Current	●	●	●	○
		Future	✳	✳	✳	✳
Coastal Storms and Sea Level Rise	Storm Surge Flooding	Current -2020s	●	○	○	○
		2050s	●	○	○	○
		2100s	●	○	○	○

Vulnerability	
Very High	●
High	●
Moderate	●
Low	●
Minimal	○
Unknown	✳

the Reed Education Center. This risk may rise over time as a result of climate change-related intensification of precipitation, but problems with runoff can probably be managed as part of ongoing maintenance activities and projects. As with SMS, the proximity of SERC facilities to the water is essential, so some exposure to coastal storms is unavoidable.

Cross-Cutting Issues

With some exceptions, flood protection measures at D.C. and New York properties are "active" rather than "passive," meaning they require deployment by staff when flooding threatens. More intense and erratic precipitation events will increase the challenge of deploying these measures before damage occurs.

In addition to their own vulnerabilities, Smithsonian facilities are at risk from flood-related utility outages. Disruption to utility services can result in closure of Smithsonian facilities and loss of environmental controls that puts collections at risk. At all sites, it is critical to maintain reliable emergency power generation capacity in zones that contain valuable assets.

Likewise, even if Smithsonian properties emerge unscathed in a major flood event, transportation disruptions could impact operations by preventing personnel from reaching their workplaces.

Facility ownership is a significant issue for some Phase 2 facilities. In Florida and New York, valuable Smithsonian assets are located in buildings owned, and to some extent managed, by other organizations. Lease and occupancy terms can be complicated, and can lead to confusion about organizational responsibilities for flood protection, preparation, and recovery.

Vulnerability Matrix: SMS

Climate Change Variable	Consequence	Time Frame	Phase 1 Lab	Tyson House	Storage Building	Wet Lab	St. LucieCounty Aquarium	Indian River Marine Science Center
Precipitation	Interior Drainage (Runoff) Flooding	Current	○	○	○	○	○	○
		Future	✳	✳	✳	✳	✳	✳
Coastal Storms and Sea Level Rise	Storm Surge Flooding	Current - 2020s	●	○	●	●	●	●
		2050s	●	●	●	●	●	●
		2100s	●	●	●	●	●	●

Vulnerability Matrix: SERC

Climate Change Variable	Consequence	Time Frame	Core Campus (Mathias Lab)	Reed Center/ Main Dock	Contee Mansion Area	GCReW Area
Precipitation	Interior Drainage (Runoff) Flooding	Current	●	●	○	○
		Future	✳	✳	✳	✳
Coastal Storms and Sea Level Rise	Storm Surge Flooding	Current -2020s	○	●	○	●
		2050s	○	●	○	●
		2100s	○	●	○	●

Vulnerability	
○	Minimal/None
●	Low
●	Moderate
●	High
●	Very High
✳	Unknown