Georgia Tech

Climate Vulnerability Assessment

CP 6055

2023

Scope, Introduction, and Purpose of Project

CP 6055 is a studio-practicum for students in their second year of the Master's program in city and regional planning (MCRP).

With the threat posed by climate change imminent, the goal of this studio was to **assess the vulnerability of Georgia Tech's campus, operations, and surrounding community to a wide array of hazards** expected to get worse as the planet warms, using a combination of literature and research reviews, firsthand interviews with staff and key stakeholders, and geospatial analyses of key campus features.

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Sustainable Development Goals (SDGs)

The United Nations' 2030 Agenda for Sustainable Development introduced the SDGs in 2015 to make "an **urgent call for action** in a **global partnership**."

The 17 SDGs provide **specific goals** with **measurable outcomes** concerning the three pillars of sustainability, and their prevalence at the global level.

(United Nations, 2020)

At the core of this class and Vulnerability Assessment are the 17 SDGs.

Georgia Tech is integrating the SDGs across the institution

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Class Roadmap

September

Background research:

- *What is sustainability?*
- *What does a climate action plan specify?*
- *What are the UN SDGs?*
- *Which hazards are expected to get worse due to climate change?*

October

Hazard-specific research and analyses to determine campus exposure and adaptation capacity

Focus on *critical infrastructure* (utilities, building, transportation) and *social infrastructure* (community, public health and safety, food systems, emergency response)

November

Finalizing analyses and recommendations on actions Georgia Tech can take to better prepare for climate change

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Georgia Tech Infrastructure Vulnerability

	Heat	Drought	Floods	Winds	Diseases	Air
Utilities	High	High	High	High	Low	Low
Buildings	High	High	High	High	Low	Medium
Transportation	Medium	Low	Medium	Medium	Low	High
Health	High	Low	Low	Low	High	High
Safety	Low	Low	Low	Low	High	Medium
Food Systems	Low	Low	Low	Low	Low	Low
Emergency Resp.	Low	Low	Low	Medium	Low	Medium
Community	High	Medium	Medium	Low	Medium	High

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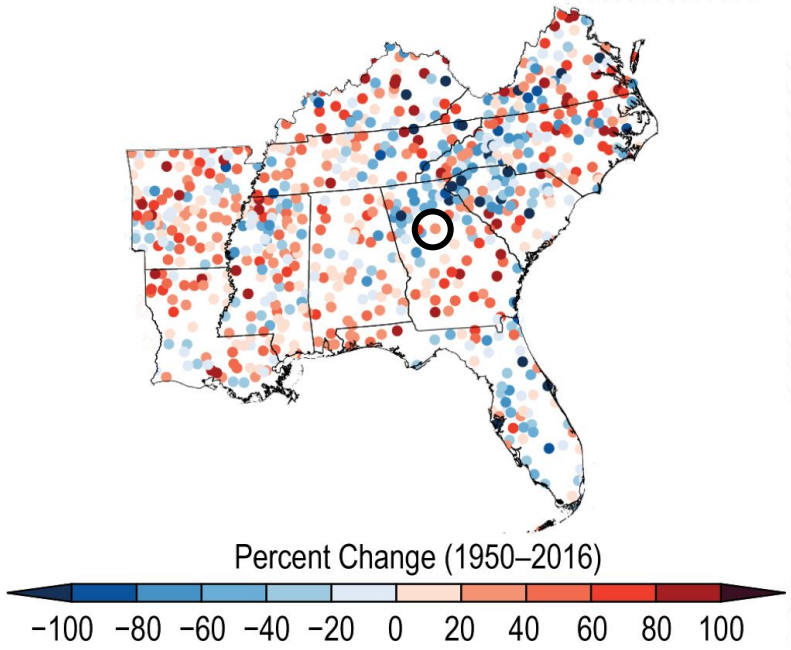
Floods: Introduction

Two main types of inland floods: (SCOR, 2022)

- ***Fluvial*** is caused by rivers or other bodies of water **overflowing their banks**
- ***Pluvial*** is caused by **rainfall exceeding the absorption capacity of soil**

Climate change is expected to increase both the **frequency *and* intensity of rainfall** in Atlanta, leading to more of both types of floods (USGCRP, Ch 19, 2018)



National Climate Assessment indicates that Atlanta (circled, black) has seen a significant increase in “heavy precipitation” (days with >3in of rain) from 1950 to 2016, which is expected to continue. *USGCRP (2018)*

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Floods: Risks

Floods can cause damage in three main ways:

Direct

Floods can **corrode or otherwise damage** above and below-ground infrastructure, such as roads, bridges, buildings, power stations, and power and internet cables

(SCOR, 2022)
(USGCRP, Ch 19, 2018)
(USGCRP, Ch 11, 2018)

Indirect

Floods **prevent mobility**, hampering supply chains and emergency response, and can **spread diseases** by contaminating water supplies, while also **impacting mental health**

(SCOR, 2022)
(USGCRP, Ch 19, 2018)

Synergistic

Floods can increase the harms from *other* climate risks: killing plants can **worsen droughts** and future floods, and stagnant pool **provide breeding grounds** for vector-borne diseases

(USGCRP, Ch 19, 2018)

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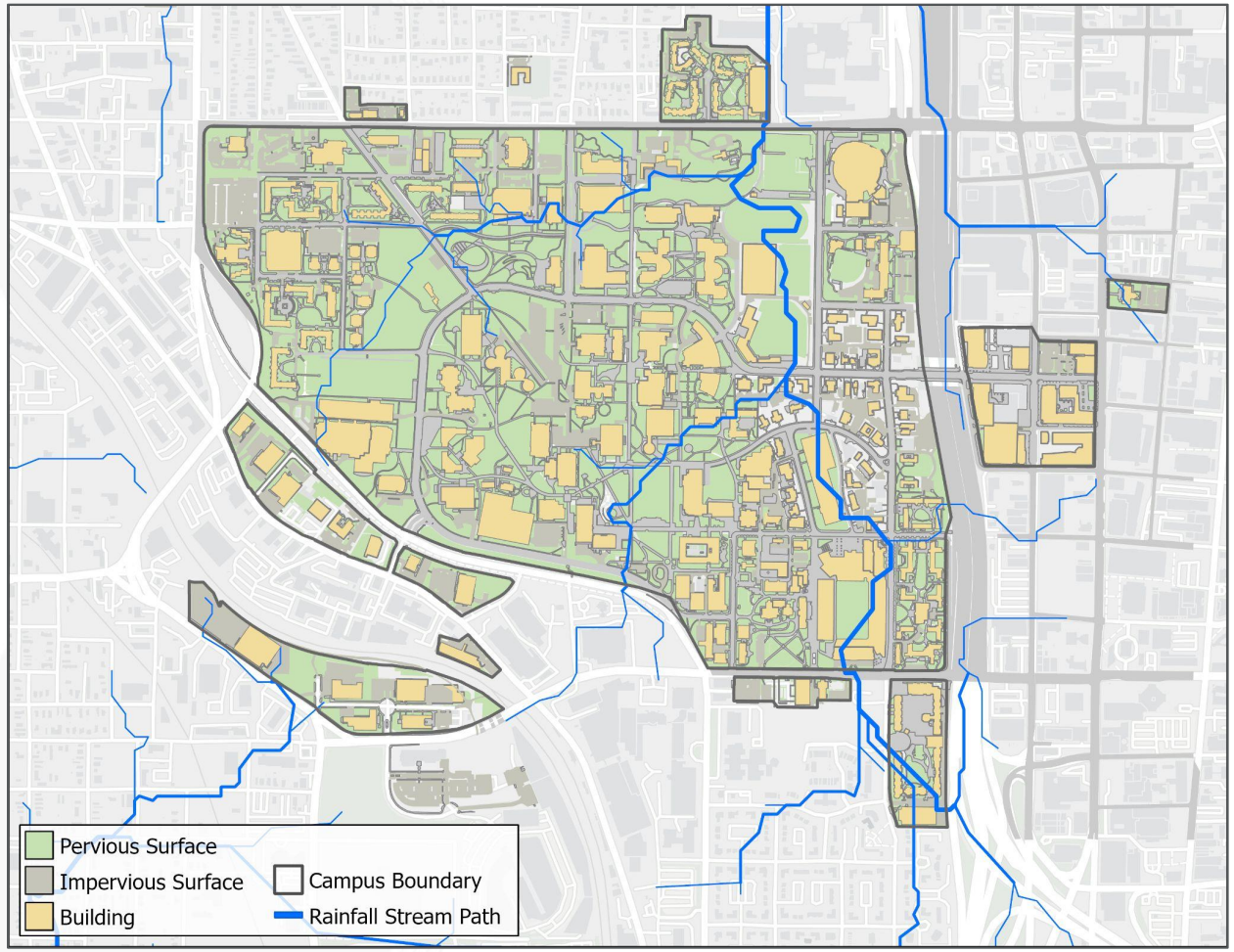
Floods: Vulnerability to Stormwater Runoff



Stormwater runoff analysis performed using digital elevation models acquired from USGS. *Streams* pictured here in blue, are paths where runoff would collect together as it flows downhill, before eventually running into the Chattahoochee River. (USGS, 2023)

Stormwater runoff analysis based on the area's elevation profile revealed **numerous streams bisecting the main campus**, which **could create conflict points** at key roads and buildings if not properly managed through soil management and drainage.

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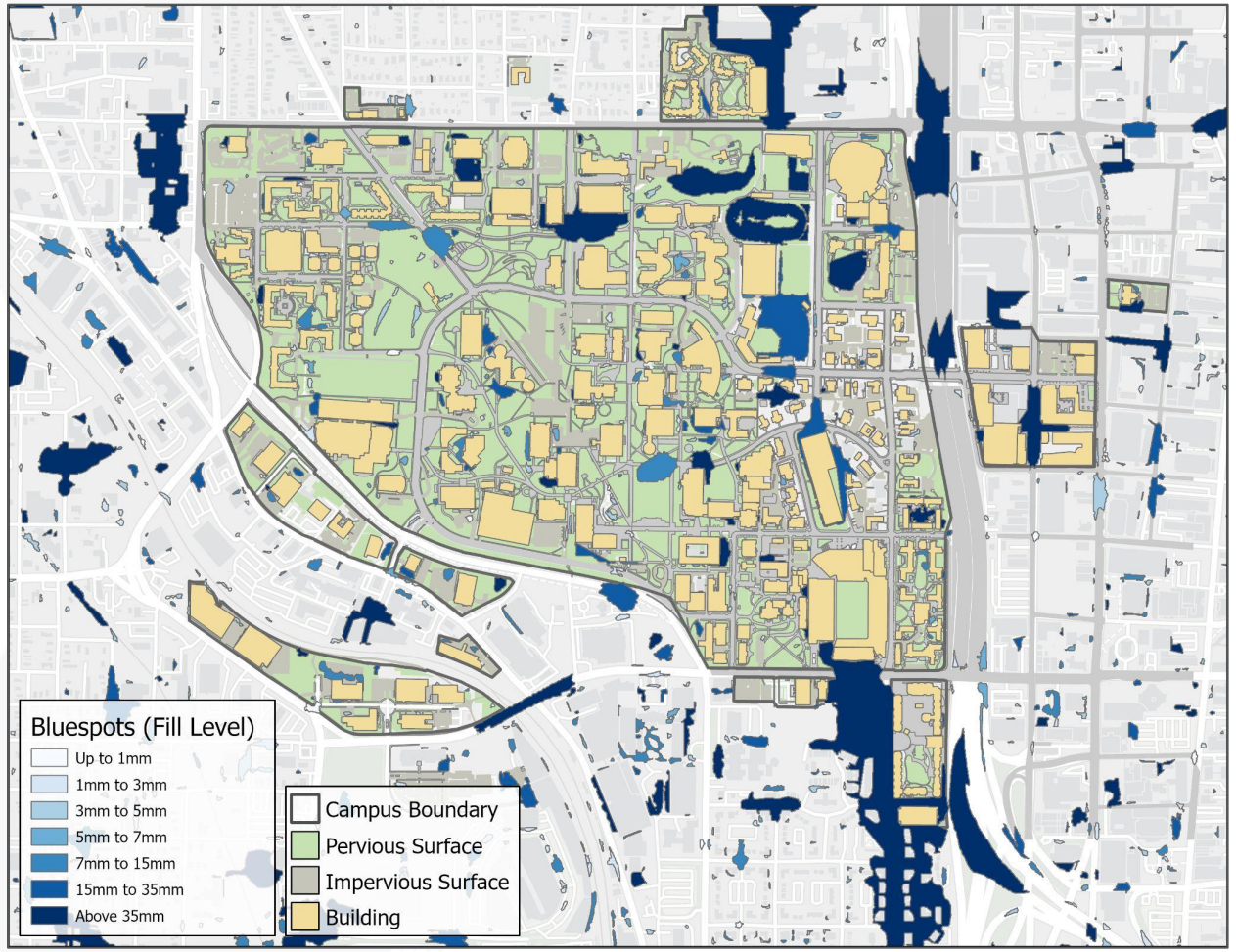
Floods: Vulnerability to Bluespots



Bluespot analysis performed using digital elevation models acquired from USGS. *Bluespots* are areas where water collects due to depressions in the Earth. Here, Bluespots are colored by the amount of rainfall needed to fill them completely, in millimeters. (USGS, 2023; Balstroem, 2022)

Bluespot analysis, using similar elevation profile data, **identified areas where water could pool and collect** if not diverted or drained, **many of which are located near buildings or on roads**. Prolonged pooling of these bluespots could lead to long-term damage through seepage or erosion.

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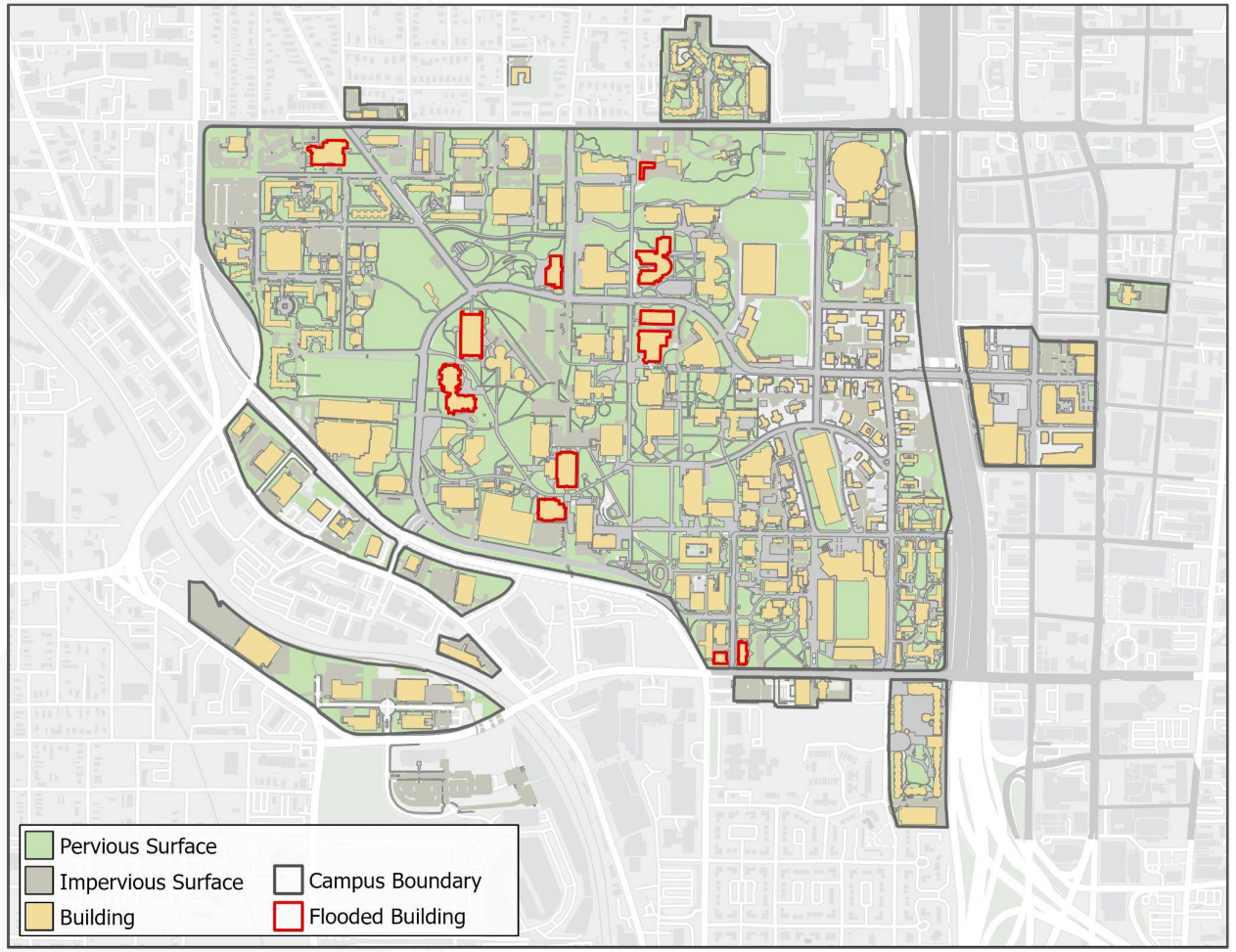
Floods: Damage to Campus



Georgia Tech buildings flooded in storms on September 14, 2023. Data on flooded buildings shared by Georgia Tech Facilities team. (Young, 2023)

Georgia Tech's vulnerability to floods is not just hypothetical: **a dozen buildings flooded** due to high intensity rain storms in September of this year, when only **20 millimeters of rain fell in one hour**, and these types of storms are expected to get more intense and frequent due to climate change.

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Floods: Mitigation & Equity

The best way to mitigate flood risk is through **green infrastructure**

What is it?

A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystems services.

Examples include green roofs, permeable pavements, planter boxes, tree canopy, and infiltration cells.

Benefits

Many surrounding communities depend on GA Tech to manage and retain water in order to avoid flooding in their areas due to the inequity of not having the resources accessible.

It helps reduce water contamination, mitigate erosion, promote urban cooling, improve air quality, and enhance habitat diversity.

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Floods: Campus Actions

The *EcoCommons* is an 80 acre parcel of Georgia Tech's main campus designed to help manage stormwater runoff from other areas of campus. Featuring native plants and underground infiltration cells, it can handle up to 500,000 gallons of stormwater runoff, and is the primary infrastructure built to help Georgia Tech reach its goal of reducing runoff by 50%.

(Brim, 2021; Young, 2023)

Georgia Tech is already managing flooding in accordance with its **Stormwater and Landscaping Master Plans**, which direct Tech to go further than city regulations in managing rain runoff.

However, these plans should be revised to **account for the increase in rainfall expected due to climate change**.

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Floods: Conclusion

Is GT Prepared?

Mostly: The facilities team has a **robust** stormwater and rainfall management plan in place, but it is **out of date**, and doesn't account for future increases in rainfall projected under climate change.

Future Flood Impact

According to NCA4, climate change is expected to **continue to increase** both the frequency and intensity of rainfall in Atlanta, which **will lead to increased risk** of pluvial flooding.

Recommendations

5 years: Implementation of **Green Infrastructure** throughout campus.

10 years: Completion of **EcoCommons 2.0**

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Floods: References

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