City of Charlottesville Climate Change Vulnerability Assessment: Survey Analysis

Introduction

The City of Charlottesville's Climate Change Vulnerability Assessment Survey (open 4/20/2022 - 5/20/2022) asked respondents to evaluate risk levels across 3 climate hazards — extreme heat, increased intensity of precipitation and flooding, and changing seasonal conditions — in combination with the community systems previously identified as most relevant: Agriculture & Food Supply, Energy Supply & Delivery, Forestry & Ecological Function, Public Health & Wellness, Housing, Public Safety, and Transportation.

Extreme Heat	Increased Intensity of Precipitation and Flooding	Changing Seasonal Conditions
Agriculture & Food Supply	Agriculture & Food Supply	Agriculture & Food Supply
Energy Supply, Access & Delivery	Energy Supply, Access & Delivery	Forestry and Ecological Function
Forestry and Ecological Function	Housing	Public Health and Wellness
Public Health and Wellness	Public Health and Wellness	
	Public Safety	
	Transportation	

Each community system was further disaggregated into between 5 and 8 specific asset categories. For example, the Agriculture & Food Supply system provided specific asset categories that included "food banks" and "regional orchards, vineyards, and other community crops"; the Energy Supply, Access & Delivery system was broken down into asset categories that included "households with high energy bills" and "people without access to back-up power generators". Please see Appendix 1 for a full listing by Climate Hazard, Community System, and Asset Category.

For each hazard-category pairing, respondents were asked to rank: 1) the impact of the hazard on each asset category (using a 1-5 scale, with 5 being the greatest impact) and 2) the ability of the asset to adapt/respond (1-5 scale, with 5 being the greatest ability to adapt/respond). For 2), respondents were encouraged to think about the ability to adapt/respond from the perspective of individual residents and Charlottesville as a community. Responses were averaged for each hazard-category pair and the final results were plotted to create a risk prioritization matrix.[1] In this matrix view, hazard-category pairings considered to experience high

[1] The risk prioritization matrix methodology is modeled after Temperate.io's "adaptive need" matrix. Matrix design is based on the visualizations developed for the Town of Blacksburg's 2020 Climate Vulnerability Assessment.

potential impact and exhibiting low adaptive capacity are higher priority, while pairings considered to experience low potential impact and characterized by high adaptive capacity are shown as lower priority. Risk prioritization matrices help the City identify places, population groups, infrastructure, ecosystems, and other assets in Charlottesville with the greatest need for adaptation.

The survey also gave respondents the chance to write in "other aspects of this system not listed above that [they] are concerned about". These inputs are listed at the end of each hazard section and are labeled as "Additional Survey Input".

Connected to the survey, respondents were given access to an online GIS-based map and the opportunity to add points marking Locations of Climate Vulnerability Concern. See Appendix 2 for the map visual and information provided for the marked locations.

Who Are the Respondents?

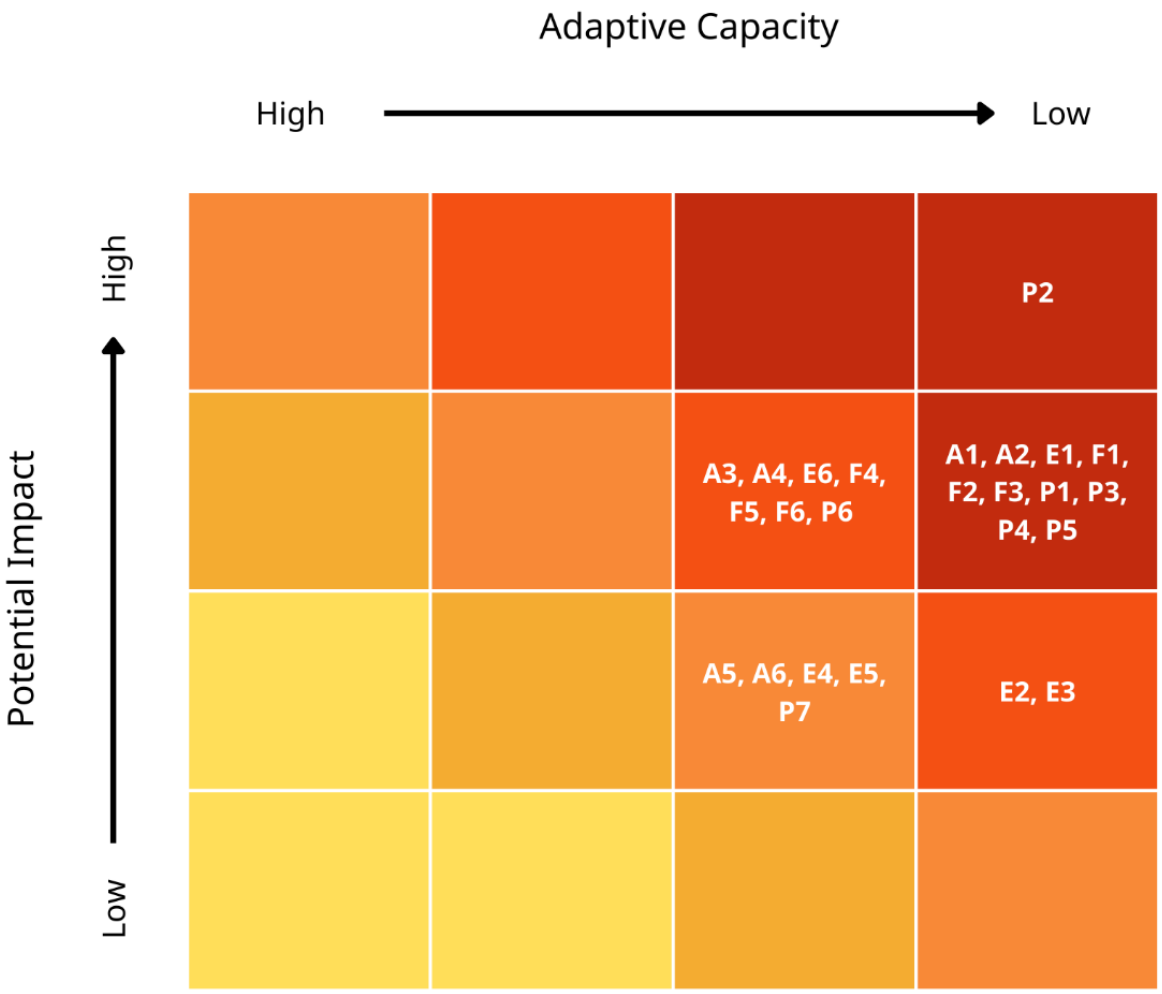
- 41 people responded in total
- 85% are residents of the City of Charlottesville; these respondents live in the:
    - NE of the City of Charlottesville: 10%
    - SE of the City of Charlottesville: 17%
    - NW of the City of Charlottesville: 7%
    - SW of the City of Charlottesville: 34%
    - Center area of the City of Charlottesville: 17%
- 10% of respondents reside in Albemarle County; 5% reside elsewhere
- 80% own their own residence
- The majority of respondents (56%) had lived in Charlottesville for 15 years or more.

Extreme Heat

Key Findings

- Public Health & Wellness stood out as being a community system of high concern for extreme heat, with 5 out of 6 hazard-category pairings considered high risk.
- "Natural"/living categories under both Agriculture & Food Supply and Forestry & Ecological Function generally had higher risk than non-natural categories (e.g., grocery stores).

Risk Prioritization Matrix



Additional Survey Input

The items below are survey responses to the question of "Are there other aspects of this system not listed above that you are concerned about? If so, please list them here." This open response question was asked for each hazard-community system pairing. The free-form responses are organized under sub-headings below.

New Categories Suggested:
Responses listed here are suggestions of asset categories that were not asked about in the survey.

- Impact of increased heat on infrastructure/our water system
- Many invasive species are likely to be more successful under future climates - could be considered separately or as an impact on the items already listed.

Adaptation Ideas:
Responses listed here include ideas for adaptation strategies. These ideas will be included in future steps of this process as part of an initial list of adaptation ideas.

- Build cooling centers now; Subsidize heat pumps and HVAC for low income households by cutting the police budget
- Health of our green spaces: landscaping in city parks & homes could mitigate impacts of extreme heat on our communities.. The city can incentivize ecological landscaping (fewer lawns & asphalt, more trees/native plants).
- people rely on amenities like splash parks and other water features to cool off; city should invest in providing more of those resources and making sure they are resilient
- Yes: I worry about the impact of increased climate stress on our sense of community. Perhaps the city could help train volunteers to aid vulnerable residents during states of climate emergency.
- Our food systems depend on our the health of our ecological systems. Promoting ecological use of landscapes in and out of the city can only increase resilience in our local food systems/urban agriculture sites
- The truth is we don't know how these ecosystems will adapt or not to climate change. The city can incentivize landscaping companies/home owners to use better landscaping practices (let's encourage less fertilizer use/fewer gas powered leaf blowers etc)

Additional Details/Other Comments:
Responses listed here include suggestions of specific assets, comments on what the survey was asking, and other ideas that do not fit into any of the sub-headings.

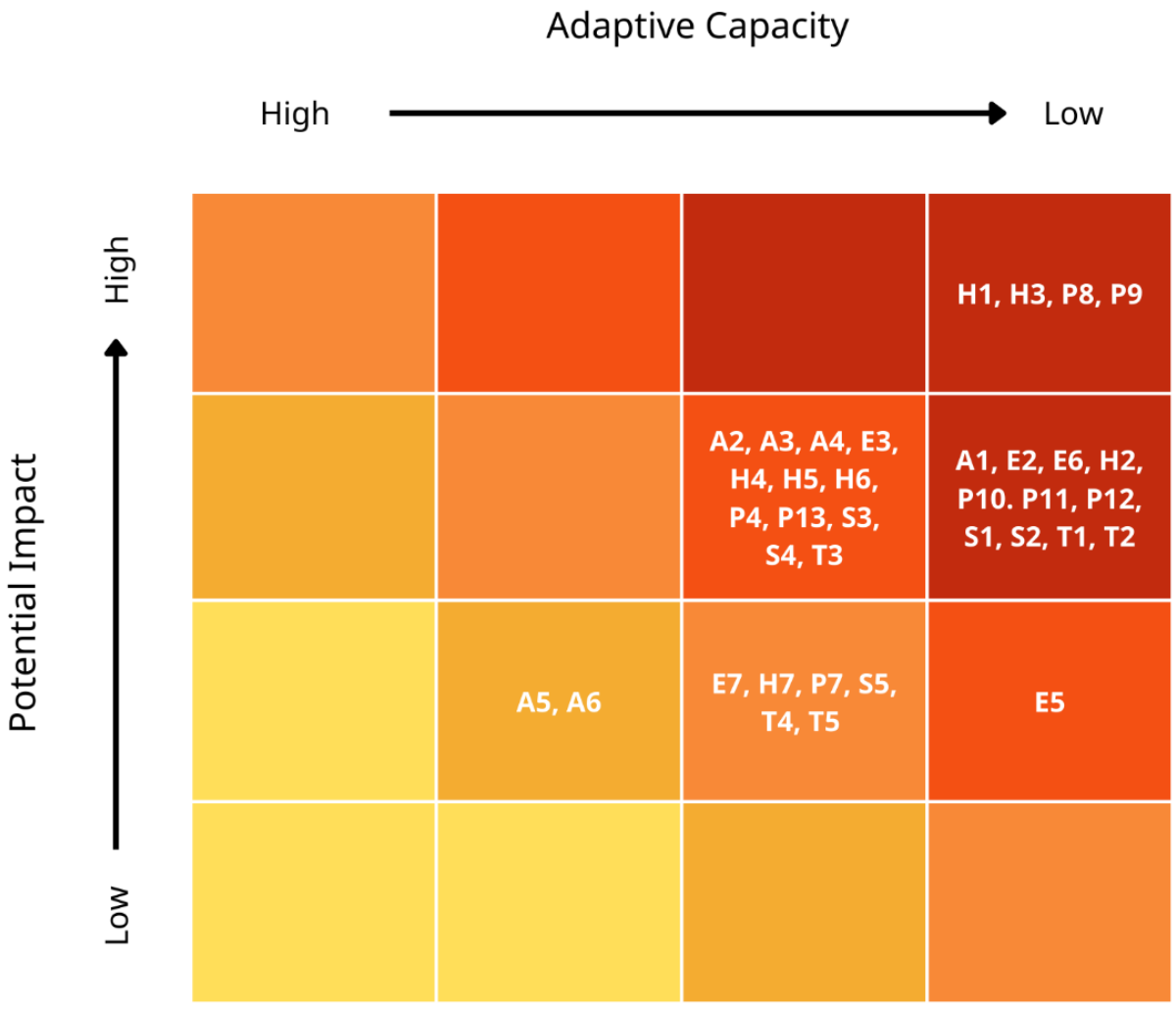
- children being willing to play outside and their parents and school administrators being willing to let them
- I am especially concerned for people who do not have a home/reliable shelter, as well as people living in neighborhoods with a disproportionately low level of shade.
- Impact on trees and plantings
- Low income people with no AC.
- Nonprofits such as churches that will be spending more of their revenue on cooling and less on helping people

Increased Intensity of Precipitation and Flooding

Key Findings

- Public health stands out as being higher risk, with 5 out of the 8 hazard-category pairs being ranked high risk.
- For categories across all hazard-system pairings, there is noticeable clustering in the squares of highest risk.

Risk Prioritization Matrix



Detailed Results

Increased Intensity of Precipitation and Flooding					
Agriculture & Food Supply (A)	**Energy Supply, Access & Delivery (E)**	**Housing (H)**	**Public Health (P)**	**Public Safety (S)**	**Transportation (T)**
A1) Regional orchards, vineyards, and other regional crops	E2) Medical equipment/services reliant on power	H1) Housing in floodplain	P4) Outdoor work and workers	S1) Homes and businesses in valleys and other low lying areas	T1) Roadway safety
A2) Regional livestock	E3) Food suppliers reliant on power (such as for refrigerated or frozen foods)	H2) Homes with infiltration issues	P7) Tourism or participation in outdoor activities	S2) People without access to vehicle to evacuate	T2) Transportation infrastructure (roads, highways, traffic lights, etc)
A3) Local fresh produce programs (CSA Boxes, Farmer's Markets, etc)	E5) Critical/essential services reliant on energy during a power outage (hospitals, emergency response, etc.)	H3) Low-income/affordable housing	P8) People without access to shelter	S3) People reliant on internet and cellular connectivity for emergency information	T3) Ability to commute or travel (for part or for the entire trip) by foot, bike, or bus - including school buses
A4) Urban agriculture sites (such as backyard or community gardens)	E6) People without access to back-up power generators (in the event of a power outage)	H4) Housing with basements	P9) People living or working in structures in floodplains or drainage issues	S4) People living or working in structures near old/unhealthy trees	T4) Delivery of goods and services
A5) Food banks	E7) Above-ground electricity lines	H5) Sump pumps	P10) People living or working in structures with water infiltration issues	S5) Understaffed hospitals	T5) General connectivity
A6) Grocery stores		H6) Public housing	P11) Water quality in reservoirs and		

			rivers		
		H7) Future development	P12) Mosquitos or other water-related pests		
			P13) Potable water supply		

Additional Survey Input

The items below are survey responses to the question of "Are there other aspects of this system not listed above that you are concerned about? If so, please list them here." This open response question was asked for each hazard-community system pairing. The free-form responses are organized under sub-headings below.

New Categories Suggested:
Responses listed here are suggestions of asset categories that were not asked about in the survey.

- [None]

Adaptation Ideas:
Responses listed here include ideas for adaptation strategies. These ideas will be included in future steps of this process as part of an initial list of adaptation ideas on the initial list of adaptation ideas presented for discussion in the second set of stakeholder workshops.

- Considering very few CAT bus stops have benches or rain shelters, I'd rank this among the more urgent (yet easily addressable) needs.
- While transportation facilities need to be resilient to flooding impacts, emphasis should also be placed on making sure these facilities are placed in natural resilience areas--such as floodplains and wetlands--that would help to absorb precipitation.
- Future housing shouldn't be sited in areas prone to flooding or in places that would destroy natural resilience features.

Additional Details/Other Comments:
Responses listed here include suggestions of specific assets, comments on what the survey was asking, and other ideas that do not fit into any of the sub-headings.

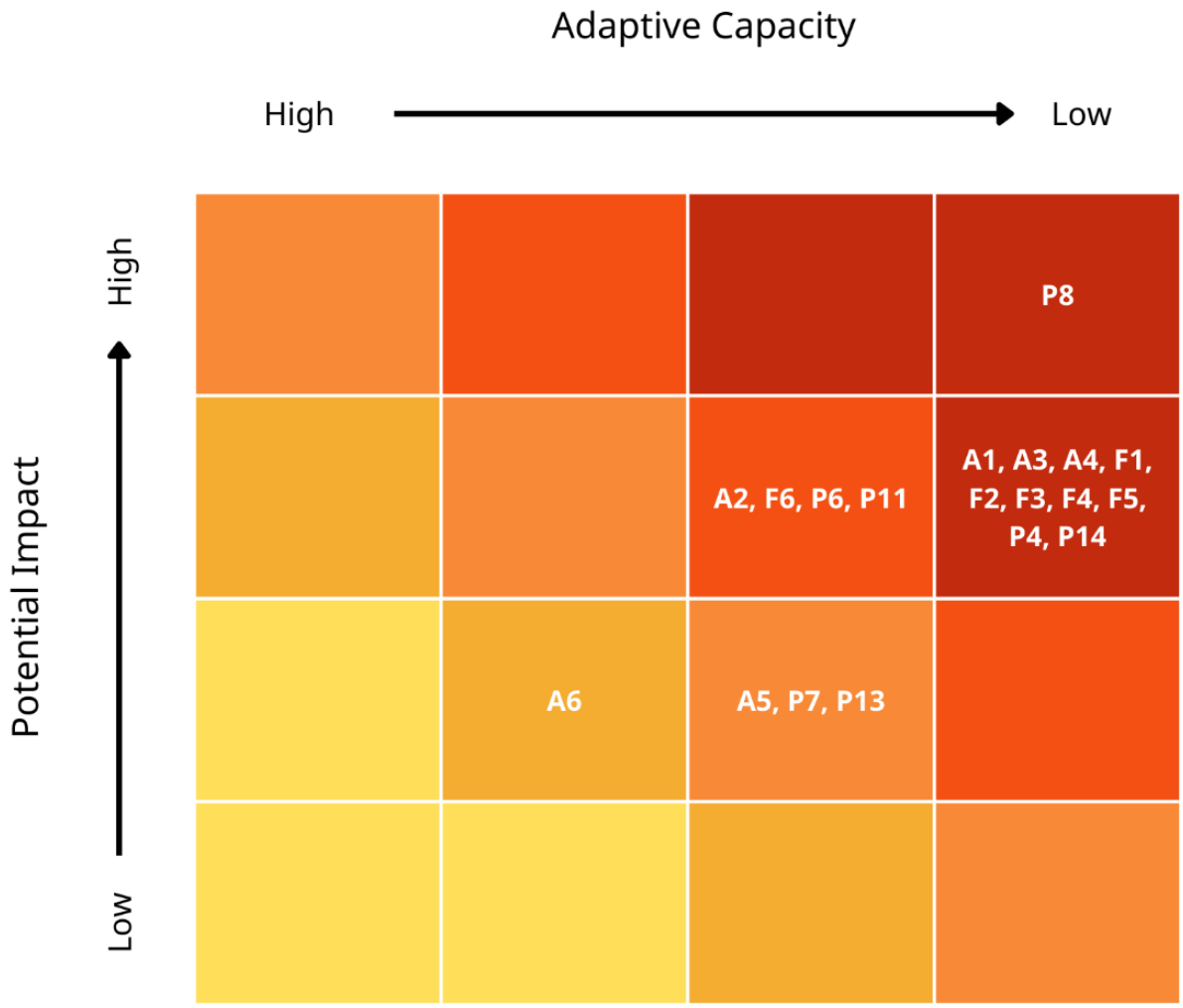
- Concerned about rise in housing costs due to insurance companies having to raise rates.
- I think the same: higher costs of transportation (due to costs of managing this infrastructure in the new climate reality)
- About the adaptability of mosquitoes/water-associated pests: I wasn't sure what you were asking here; whether the mosquitoes, etc., would be adaptable, or whether our capacity to handle them was adaptable.

Changing Seasonal Conditions

Key Findings

- Forestry & Ecological Function stood out as being relatively high risk, with 5 out of 6 hazard-category pairings falling in the high-risk area.

Risk Prioritization Matrix



Detailed Results

Changing Seasonal Conditions		
Agriculture & Food Supply (A)	**Forestry & Ecological Function (F)**	**Public Health & Wellness (P)**
A1) Regional orchards, vineyards, and other regional crops	F1) Stream and river ecosystems	P4) Outdoor work and workers
A2) Regional livestock	F2) Pollinators	P6) Ability to commute or travel (for part or for the entire trip) by foot, bike, or bus
A3) Local fresh produce programs (CSA Boxes, Farmer's Markets, etc)	F3) Ecosystems/ Habitats, in general	P7) Tourism or participation in outdoor activities
A4) Urban agriculture sites (such as backyard or community gardens)	F4) Plants, in general	P8) People without access to shelter
A5) Food banks	F5) Trees	P11) Water quality in reservoirs and rivers
A6) Grocery stores	F6) Wildlife corridors	P13) Potable water supply
		P14) Exposure to mosquitos and ticks

Additional Survey Input

The items below are survey responses to the question of "Are there other aspects of this system not listed above that you are concerned about? If so, please list them here." This open response question was asked for each hazard-community system pairing. The free-form responses are organized under sub-headings below.

New Categories Suggested:
Responses listed here are suggestions of asset categories that were not asked about in the survey.

- [None]

Adaptation Ideas:
Responses listed here include ideas for adaptation strategies. These ideas will be included in future steps of this process as part of an initial list of adaptation ideas on the initial list of adaptation ideas presented for discussion in the second set of stakeholder workshops.

- One huge driver of ecosystem harm is invasive species & subsequent harm to biodiversity in plants/ecosystems. The city could allocate more resources to manage invasive plants in our community and encourage the use of native trees/plants.

Additional Details/Other Comments:

Responses listed here include suggestions of specific assets, comments on what the survey was asking, and other ideas that do not fit into any of the sub-headings.

- Migratory patterns and emergence times for various kinds of wildlife have coevolved to coincide with longstanding bloom times. As these react to climate change, the food sources for many types of fauna will be thrown out of sync with their arrival.
- viability of our trees & native plants. More trees will die or become diminished by disease & lack of water. Invasive weeds & vines will take over our yards, open spaces, & parks. & parksk of water.

Appendix 1: Climate Hazards, Community Systems, Asset Categories

Climate Hazard	Community System	Asset Categories
Extreme Heat	Agriculture & Food Supply	Food banks
		Grocery stores
		Local fresh produce programs (CSA Boxes, Farmer's Markets, etc)
		Regional livestock
		Regional orchards, vineyards, and other regional crops
		Urban agriculture sites (such as backyard or community gardens)
	Energy Supply, Access & Delivery	Critical/essential services reliant on energy during a power outage (hospitals, emergency response, etc.)
		Electric grid reliability (i.e. the ability to avoid power outages)
		Food suppliers reliant on power (such as for refrigerated or frozen foods)
		Households with high energy bills
		Medical equipment/services reliant on power
		People without access to back-up power generators (in the event of a power outage)
	Forestry and Ecological Function	Ecosystems/ Habitats, in general
		Plants, in general
		Pollinators
		Stream and river ecosystems
		Trees
		Wildlife corridors
	Public Health and Wellness	Ability to commute or travel (for part or for the entire trip) by foot, bike, or bus
		Charlottesville's General Public Health & Wellness
		Households without access to reliable air conditioning & adequate insulation
		Outdoor work and workers

Climate Hazard	Community System	Asset Categories
Increased Intensity of Precipitation and Flooding	Agriculture & Food Supply	Food banks
		Grocery stores
		Local fresh produce programs (CSA Boxes, Farmer's Markets, etc)
		Regional livestock
		Regional orchards, vineyards, and other regional crops
		Urban agriculture sites (such as backyard or community gardens)
	Energy Supply, Access & Delivery	Above-ground electricity lines
		Critical/essential services reliant on energy during a power outage (hospitals, emergency response, etc.)
		Food suppliers reliant on power (such as for refrigerated or frozen foods)
		Medical equipment/services reliant on power
		People without access to back-up power generators (in the event of a power outage)
	Housing	Future development
		Homes with infiltration issues
		Housing in floodplain
		Housing with basements
		Low-income/affordable housing
		Public housing
		Sump pumps
	Public Health and Wellness	Mosquitos or other water-related pests
		Outdoor work and workers
		People living or working in structures in floodplains or drainage issues
		People living or working in structures with water infiltration issues
		People without access to shelter
		Potable water supply
		Tourism or participation in outdoor activities
		Water quality in reservoirs and rivers
	Public Safety	Homes and businesses in valleys and other low lying areas
		People living or working in structures near old/unhealthy trees
		People reliant on internet and cellular connectivity for emergency information
		People without access to vehicle to evacuate
		Understaffed hospitals
	Transportation	Ability to commute or travel (for part or for the entire trip) by foot, bike, or bus - including school buses
		Delivery of goods and services
		General connectivity
		Roadway safety
		Transportation infrastructure (roads, highways, traffic lights, etc.)

Climate Hazard	Community System	Asset Categories
Changing Seasonal Conditions	Agriculture & Food Supply	Food banks
		Grocery stores
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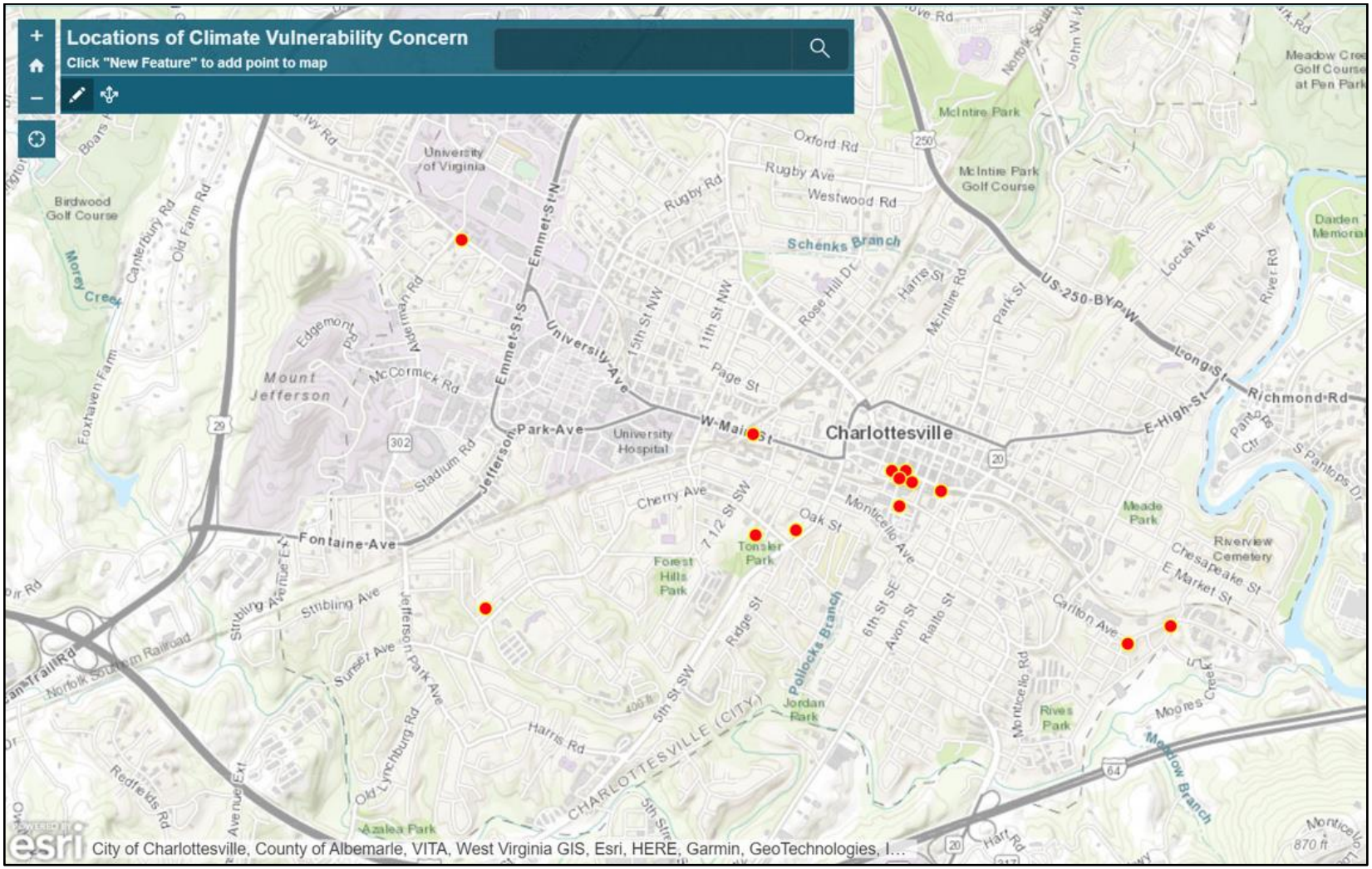
		Urban agriculture sites (such as backyard or community gardens)
	Forestry and Ecological Function	Ecosystems/ Habitats, in general
		Plants, in general
		Pollinators
		Stream and river ecosystems
		Trees
		Wildlife corridors
	Public Health and Wellness	Ability to commute or travel (for part or for the entire trip) by foot, bike, or bus
		Exposure to mosquitos and ticks
		Outdoor work and workers
		People without access to shelter
		Potable water supply
		Tourism or participation in outdoor activities
		Water quality in reservoirs and rivers

Appendix 2: Survey Map Entries

The image below shows the interactive GIS-based map platform and points that were added by survey respondents.



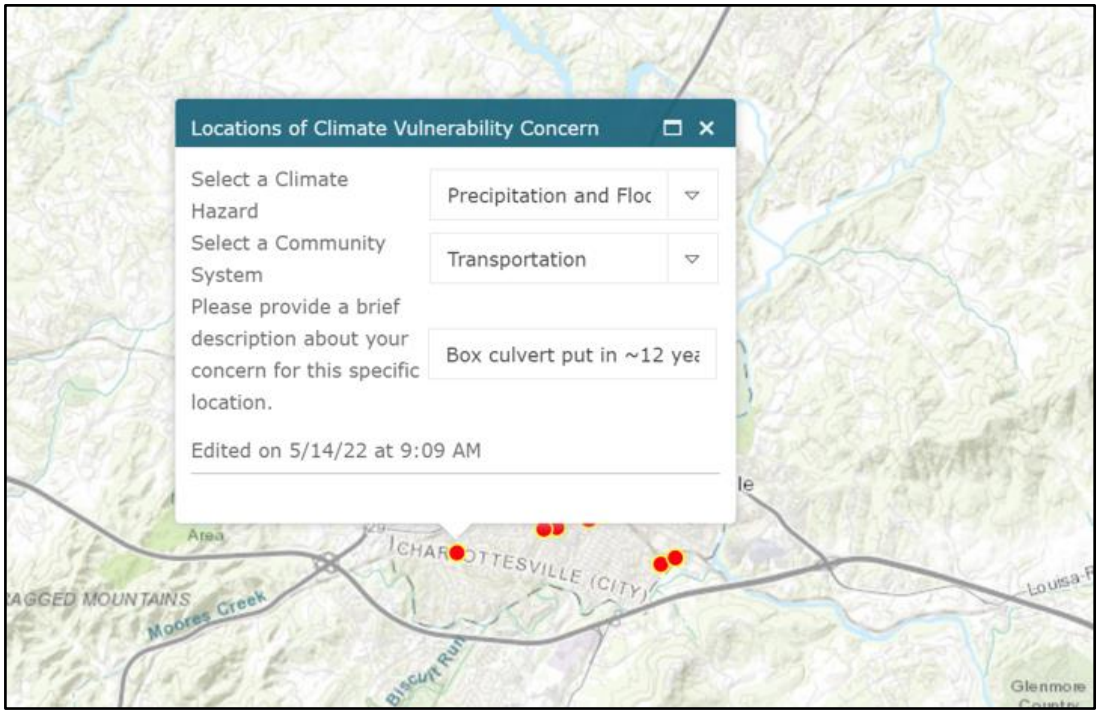
A total of 12 points were added to the map. Respondents provided information about 7 of the points. These 7 points are shown in the images below along with any text or information that was provided.

Point 1

Climate Hazard: Precipitation and Flooding

Community System Affected: Transportation

Specific Concern for this Location: Box culvert put in ~12 years ago is already overwhelmed 2-3 times/year.

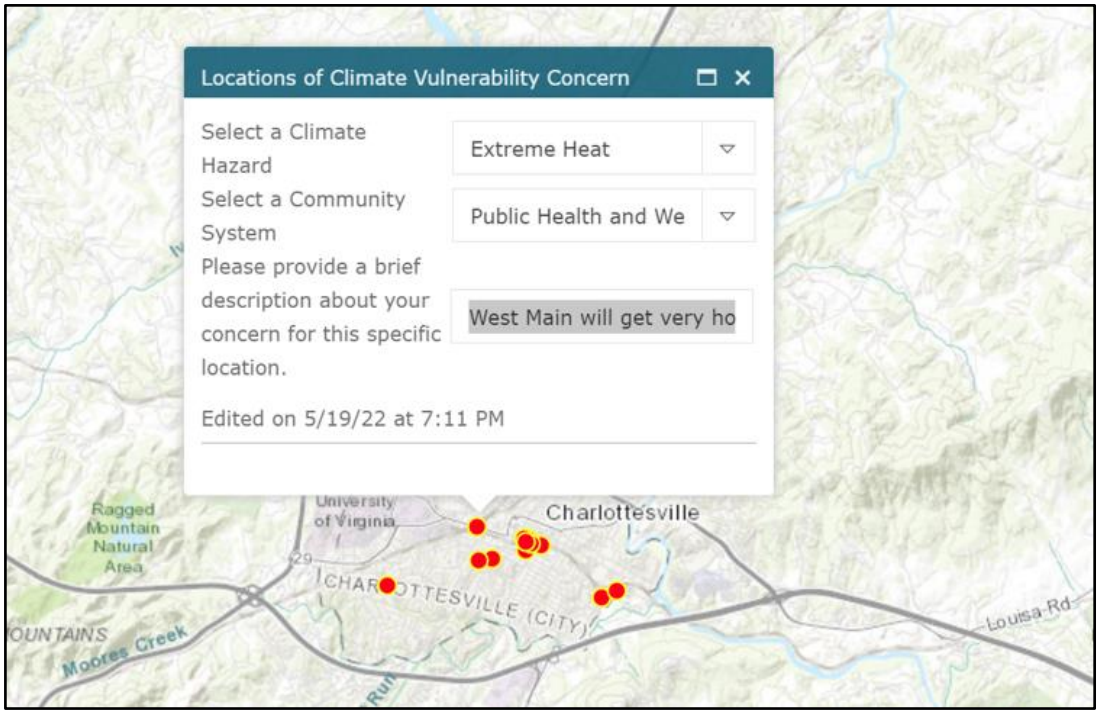


Point 2

Climate Hazard: Extreme Heat

Community System Affected: Public Health and Wellness

Specific Concern for this Location: West Main will get very hot if the city abandons both the existing trees and the streetscape project. Walking, biking, scooting, wheeling, or waiting for the bus will become even more unpleasant than they are now.

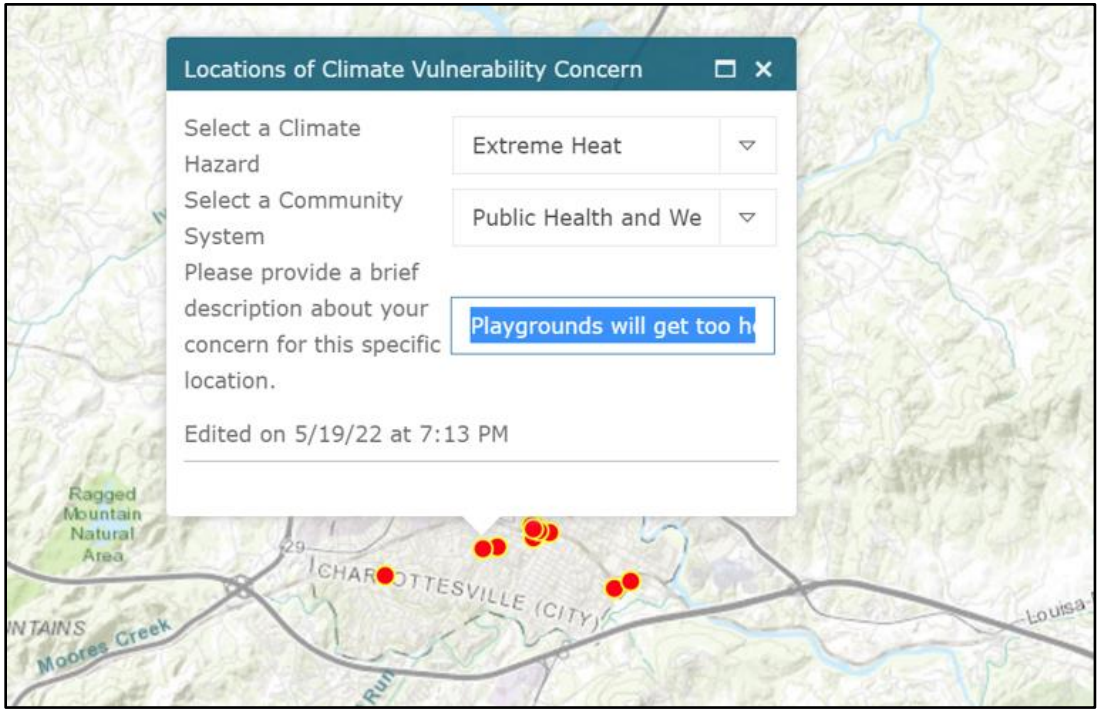


Point 3

Climate Hazard: Extreme Heat

Community System Affected: Public Health and Wellness

Specific Concern for this Location: Playgrounds will get too hot without added trees or shade structures. (Tonsler Park might be one example of many.)

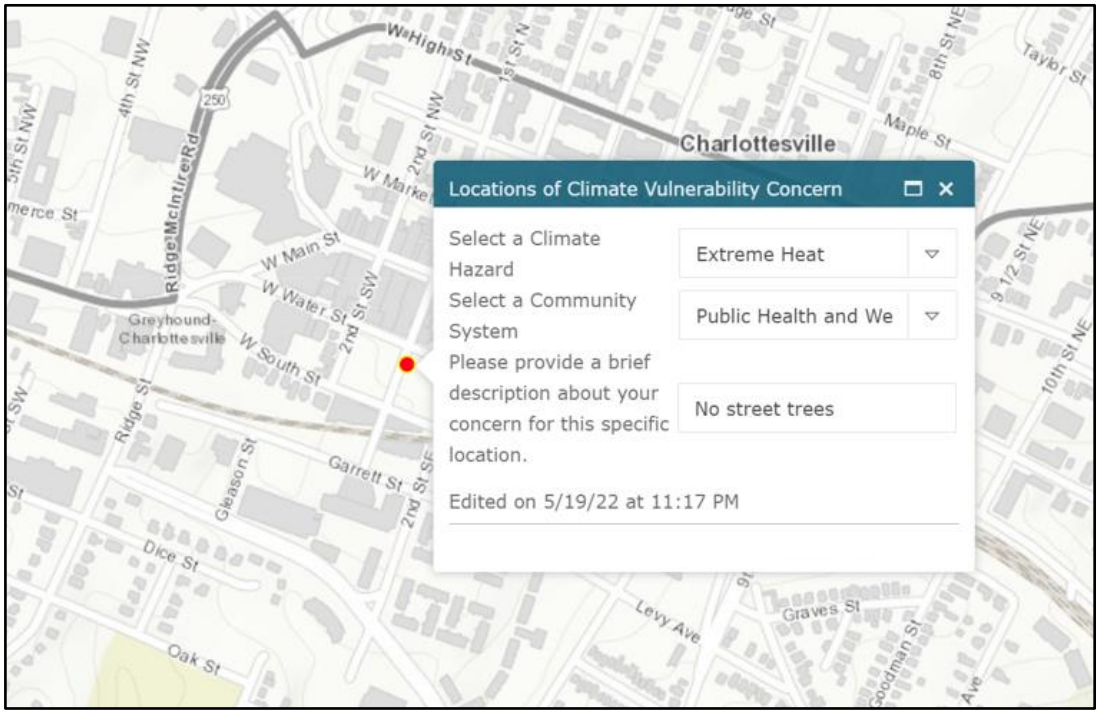


Point 4

Climate Hazard: Extreme Heat

Community System Affected: Public Health and Wellness

Specific Concern for this Location: No street trees.

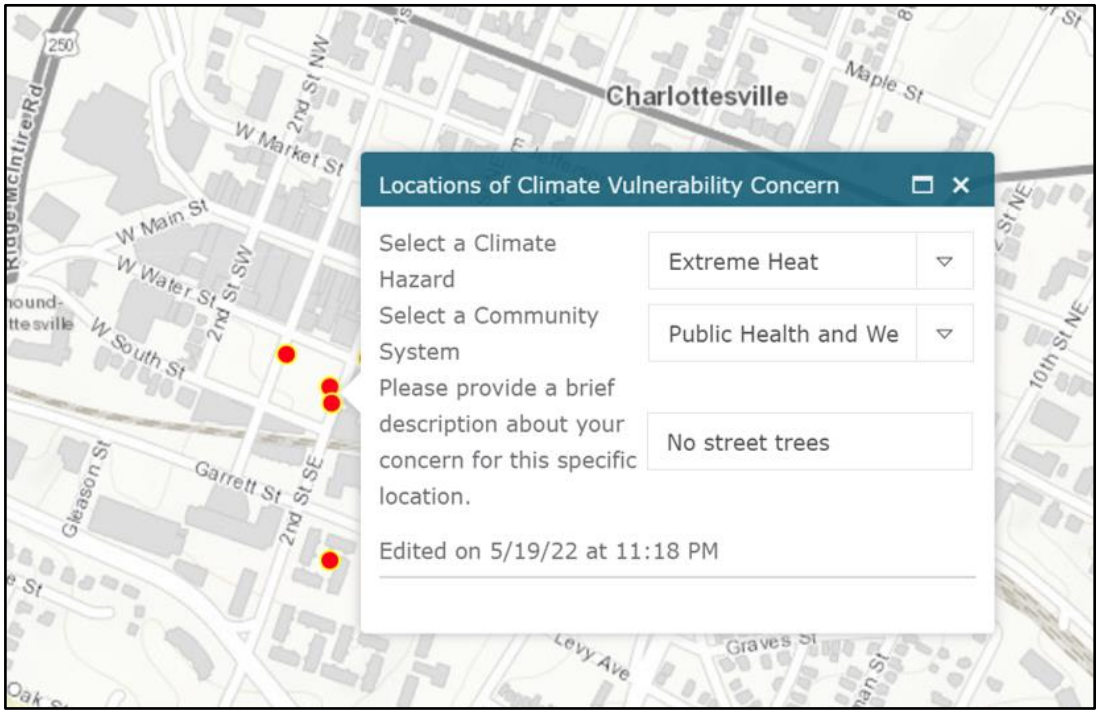


Point 5

Climate Hazard: Extreme Heat

Community System Affected: Public Health and Wellness

Specific Concern for this Location: No street trees.

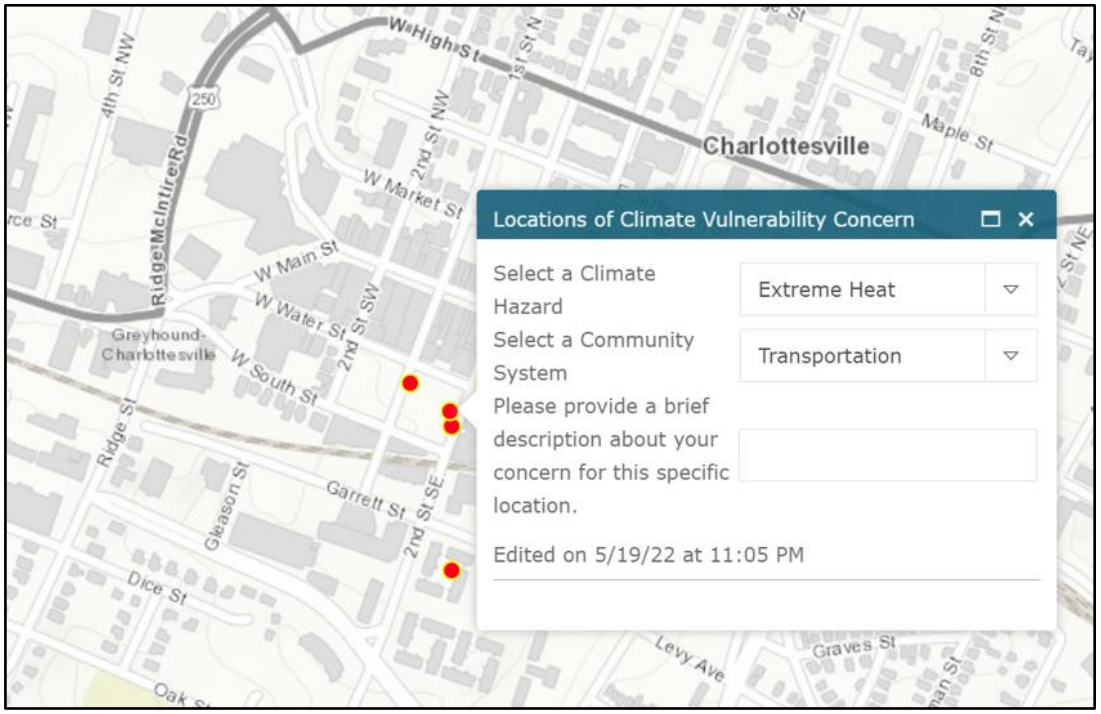


Point 6

Climate Hazard: Extreme Heat

Community System Affected: Transportation

Specific Concern for this Location: [No information provided.]



Point 7

Climate Hazard: Precipitation and Flooding

Community System Affected: [No information provided.]

Specific Concern for this Location: [No information provided.]