



Hazard Identification and Risk Assessment

4.11 Extreme Temperatures: Excessive Heat

4.11.1 Hazard Profile

A heat wave is a prolonged period of excessive heat, often combined with high humidity. These conditions can be dangerous and even life-threatening without proper precautions (VDEM). Heat-related illnesses, like heat exhaustion or heat stroke, happen when the body is not able to properly cool itself. Extreme heat can cause injury or death to humans and animals and can increase the risk of wildfire due to drought.

4.11.1.1 Geographic Location/Extent

Extreme heat is not a hazard with a defined geographic boundary. All localities within the CVPDC area are exposed to the hazard. Urban areas within the CVPDC such as Lynchburg are at a higher risk of excessive heat due to the “Heat Island” effect. Excessive heat can occur at any time during the year, but is most dangerous during the summer between June and August when average temperatures are at their highest.

4.11.1.2 Magnitude / Severity

Heat is more harmful to human health when humidity is high because humid air hinders the evaporation of sweat, and thus reduces the body’s ability to cool itself. To determine the effect of both heat and humidity, the National Weather Service formulated the Heat Index based on the range of warm-season conditions typically seen on Earth (Figure 4-133). These Heat Index thresholds were utilized as criteria for the issuance of heat advisories and excessive heat warnings.⁵⁹ This index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. The danger an individual experiences is highly dependent on age, with the elderly and the very young at a higher risk of a heat disorder or death than an average adult.

4.11.1.3 Previous occurrences

According to the CDC WONDER (Wide-ranging Online Data for Epidemiologic Research) data from 1979 to 2011, the CVPDC area has experienced 3659 total days on the NWS Heat Index. Of those 3659 days, 2603 were rated at a level of caution, 1024 were rated at extreme caution, and 32 were rated at danger. There were no days of extreme danger reported. The record high temperature in Lynchburg is 103°F on June 29, 2012, recorded at Lynchburg Regional Airport Meteorological Station.

A widespread and dangerous heat wave swept through the Eastern United States in July 2019. The city of Lynchburg opened two cooling centers on July 20-21 for residents: College Hill in 811 Jackson Street, and the Salvation Army in 2215 Park Avenue. In addition, the Miller Park Pool and Riverside Park Sprayground were also opened to provide relief to the vulnerable community. Other residents used the Lynchburg bus system to stay cool and residents in other CVPDC jurisdictions found relief in commercial buildings.

Cooling Center

A Cooling Center is a facility that has been opened for short term operations due to a specific emergency or event. It is normally opened when temperatures have or may become dangerous. Its paramount purpose is the prevention of death and injury related to exposure to the elements. Cooling Centers can help stranded motorists or residents that have lost critical services or just need somewhere to escape the heat.

⁵⁹ Heat Index. National Weather Service. <https://www.weather.gov/safety/heat-index>



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4.11.1.4 Relationship to Other Hazards

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards such as droughts, wildfires, or urban fires. This could result in a broad and far-reaching set of impacts throughout a jurisdiction or the entire CVPDC area. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy and infrastructure; and losses of ecosystems, wildlife habitats and water resources. Figure 4-134 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

4.11.2 Impact and Vulnerability

4.11.2.1 Human Health

Extreme heat can pose severe and life-threatening problems for people. According to the NWS, it is one of the leading weather-related killers in the United States, resulting in hundreds of fatalities each year and even more heat-related illnesses. Health risks to residents in the region exposed to extreme heat include dehydration, heat cramps, fainting, heat exhaustion, and heat stroke (Table 4-136). Extreme heat has a special impact on the most vulnerable segments of the population - the elderly, young children and infants, impoverished individuals, and persons who are in poor health. The high-risk population groups with specific physical, social, and economic factors that make them vulnerable include:

- Older persons (age > 65)
- Infants (age < 1)
- Homeless population
- Very low and low income persons
- People who are socially isolated
- People with mobility restrictions or mental impairments
- People taking certain medications (e.g., for high blood pressure, depression, insomnia)
- People engaged in vigorous outdoor exercise or work or those under the influence of drugs or alcohol.



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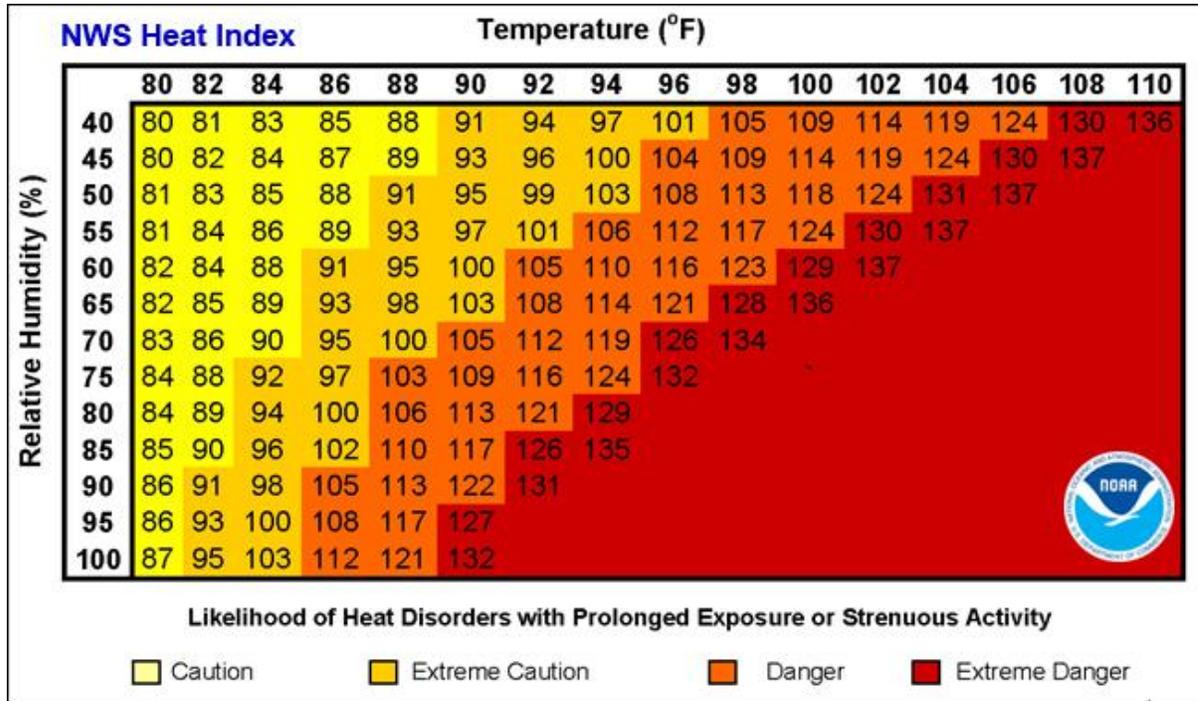


Figure 4-133 National Weather Service Heat Index

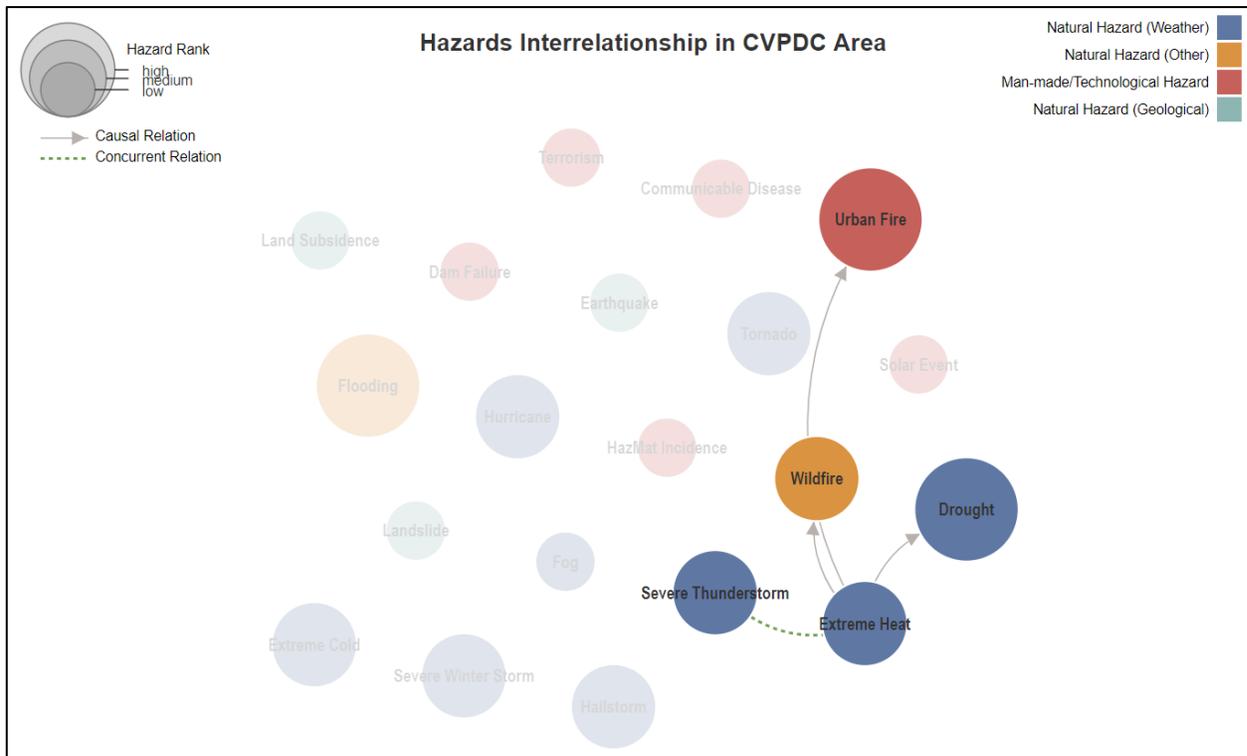


Figure 4-134 Hazards interrelationship



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Table 4-136 Health Hazards Associated with Heat Index Values

Category	Heat Index	Health Hazards
Extreme Danger	130°F- Higher	Heat Stroke/ Sunstroke is likely with continued exposure
Danger	105°F - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/ or physical activity
Extreme Caution	90°F - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged and/or physical activity
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity

4.11.2.2 Urban / building / infrastructure / transportation

The impact of excessive heat is most prevalent in urban areas, where urban heat island effects prevent inner-city buildings from releasing heat built up during the daylight hours. Secondary impacts of excessive heat are severe strain on the electrical power system and potential brownouts or blackouts.

Extreme heat can have a negative impact on transportation. Highways and roads are damaged by excessive heat as asphalt roads soften and concrete roads expand and can buckle, crack, or shatter. Moreover, concrete has been known to "explode," lifting chunks of concrete and putting those nearby at serious risk. Stress is also placed on automobile cooling systems, diesel trucks, and railroad locomotives which lead to an increase in mechanical failures. Steel rails are at risk of overheating and warping which can lead to train derailments.

4.11.2.3 Agriculture

In the agriculture community, livestock, such as rabbits, poultry, pigs, and cows are severely impacted by heat waves. Ill-timed high temperatures inhibit crop yields and wheat, corn, and grape yields can all be significantly reduced by extreme high temperatures at key development stages.

4.11.3 Risk Assessment

Except the two cooling center shelters in the City of Lynchburg, no cooling shelter was set up in other jurisdictions in the CVPDC area as of this plan update. Figure 4-135 shows the location of the two shelters (*i.e.*, College Hill center and Salvation Army center) and the surrounding geographic patterns (*i.e.*, young, old, and poor populations).

4.11.4 Probability of Future Occurrences

The likelihood or future probability of occurrence of excessive summer heat in the CVPDC area is occasional. Future extreme heatwave conditions are difficult to predict, but expected to increase. Some climate models indicate by 2050, the typical number of heat wave days in Virginia is projected to increase from more than 10 to nearly 60 days a year.⁶⁰ According to a report by EPA in 2016 (EPA 430-F-16-048), in the coming decades, Virginia's changing climate is likely to "increase the number of unpleasantly hot days, increase the risk of heat stroke and other heat-related illnesses, reduce crop yields, and harm livestock".⁶¹ In the past, multiple localities throughout the region have issued burn bans to prevent the occurrence of wildfires due to extreme heat and

⁶⁰ <https://statesatrisk.org/virginia/all>

⁶¹ <https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-va.pdf>



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dry conditions. Mitigation activities should be tailored towards protecting lives and preventing injury from extreme temperature events, such as issuing advisories and warnings, and identifying the location of vulnerable populations.

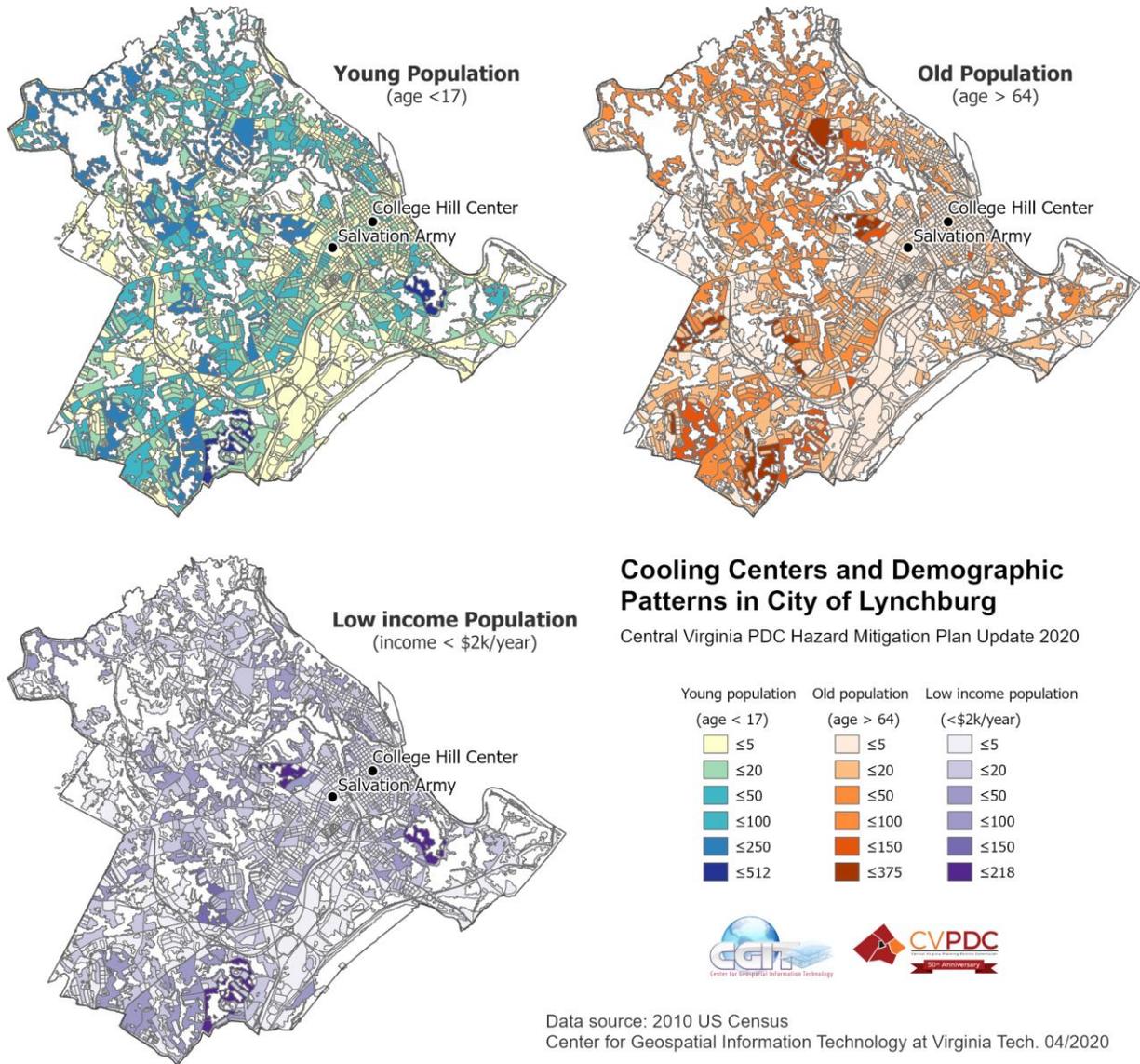


Figure 4-135 Cooling center shelters and demographic patterns in City of Lynchburg

4.11.5 References

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