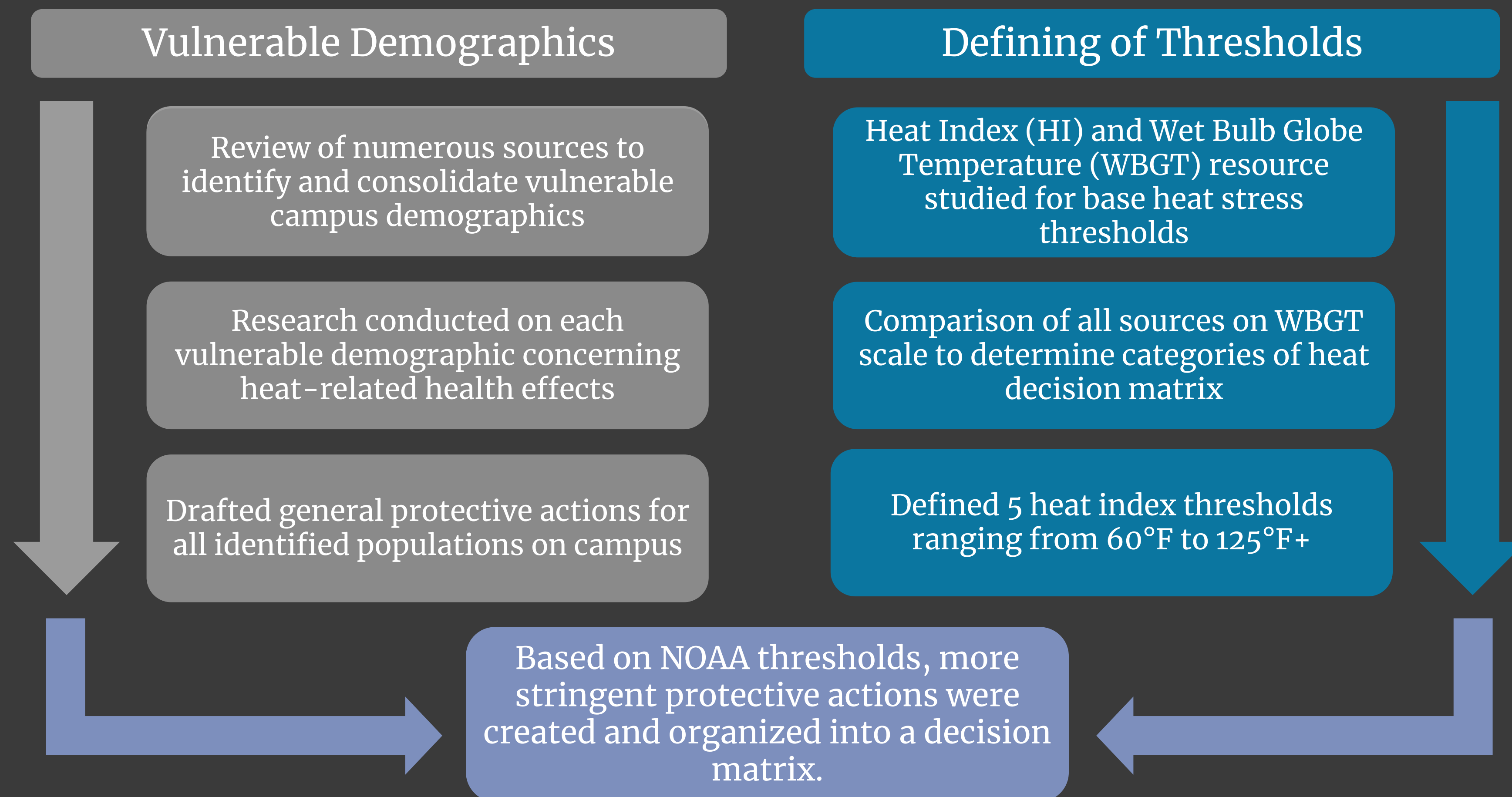


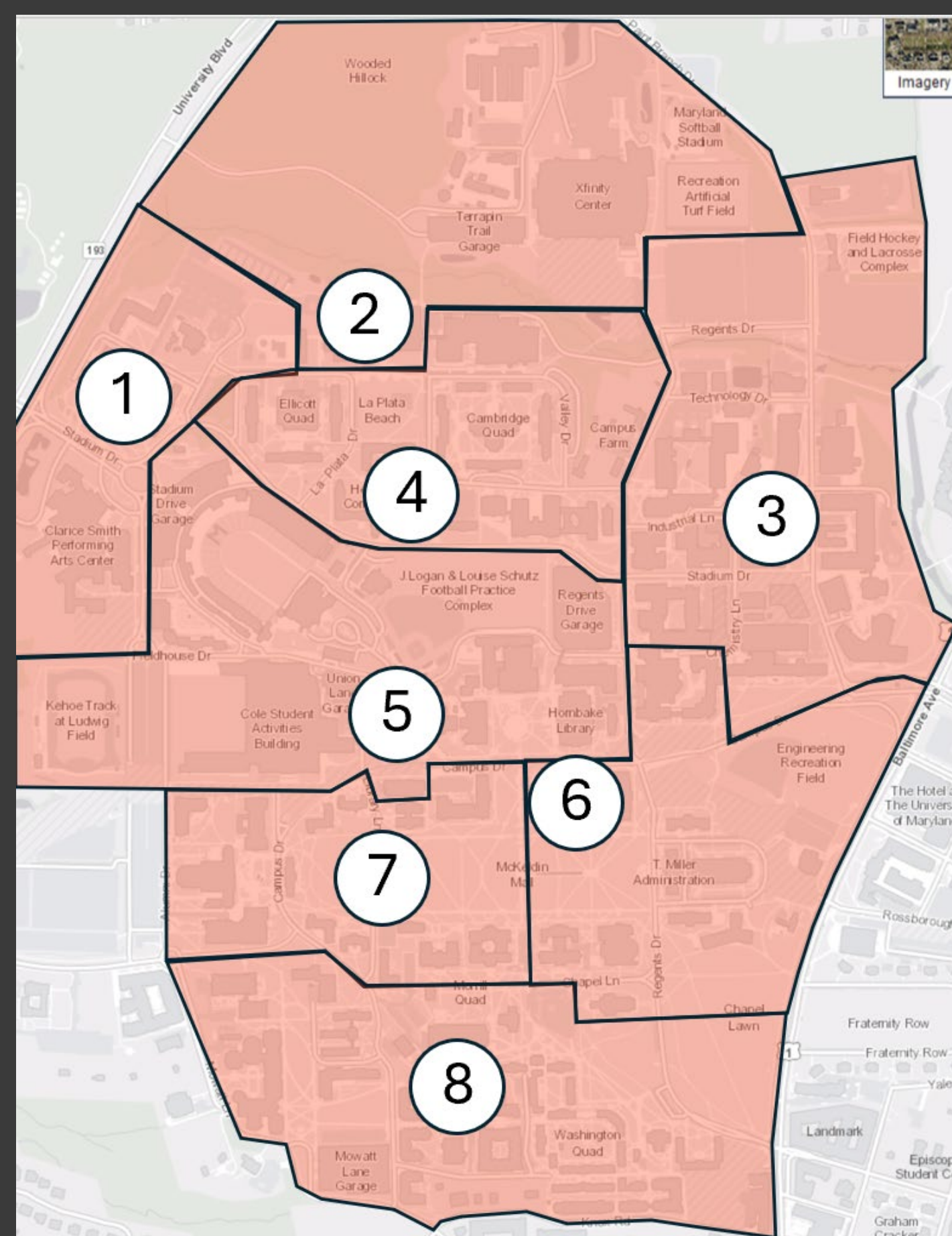
Background

The University of Maryland, College Park (UMD) has seen a significant increase in the intensity and frequency of excessive heat conditions in recent years. These heat waves threaten the safety of the UMD campus community. The Office of Emergency Management and Business Continuity at UMD hopes to meet these challenges with an informed, specialized decision matrix to employ during excessive heat events. While this tool will be most used during hot summer months, it should also prepare the university for “one-off” days of excessive heat during the school year when the campus is highly populated. This matrix will work by prescribing protective actions to be taken by the university to ensure community safety and preserve the continuity of campus operations whenever feasible. Protective actions will be determined by the severity of the heat conditions and the population on campus being considered (i.e., students and faculty, facilities management staff, athletics, etc.).

Matrix Methodology



Location Optimization



1. Denton Dining Hall
2. Eppley Recreation Center
3. Jeong H. Kim Engineering Building
4. Yahentamitsi Dining Hall
5. Adele H. Stamp Student Union
6. Edward St. John's Learning & Teaching Center
7. McKeldin Library
8. South Campus Dining

To identify distribution locations for heat relief items, the team first selected buildings that are hubs for student life throughout campus. These include dining halls, the student union, recreation centers, and popular study spots. Once these locations were selected, the team created 5-minute walking zone radii for each and identified occupied campus buildings within these zones. Using population data provided by the UMD Department of Transportation Services (DOTS), we confirmed that these distribution locations served at least 80% of the campus population. Our final distribution strategy allows 92% of the campus, or over 35,000 people, to be located within a 5-minute walking distance of a distribution center.

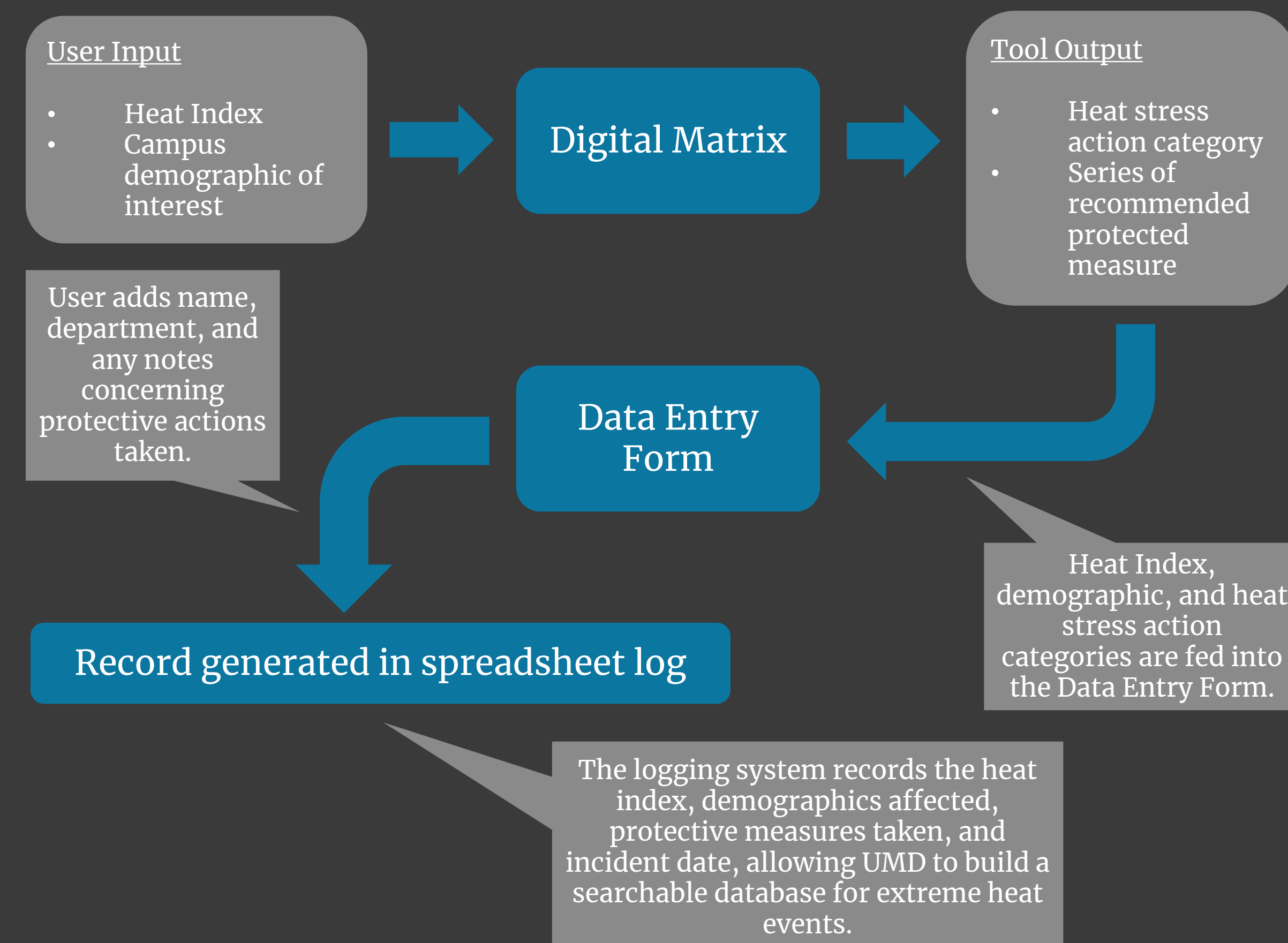
Figure 1: Campus Heat Relief Item Locations

Heat Decision Matrix

Demographics	Heat Stress Action Categories based on NOAA Heat Index Values (°F)				
	Category 1: 65-80	Category 2: 80-89	Category 3: 90-102	Category 4: 103-124	Category 5: 125+
<b>Athletes</b>	<ul style="list-style-type: none"> <li>Follow normal practice and play procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Recommended minimum of <b>three 4-minute breaks along with 32 ounces of water intake per hour.</b></li> </ul>	<ul style="list-style-type: none"> <li>Recommended minimum of <b>four 4-minute breaks</b> along with <b>32 ounces of water</b> intake per hour.</li> <li>Restrict Football players to helmets, shoulder pads, and shorts, if possible.</li> <li>Remove protective equipment (i.e., helmet, shoulder pads) when not in play, if possible.</li> </ul>	<ul style="list-style-type: none"> <li>Consider canceling outdoor practice and <b>moving indoors.</b></li> <li>If air conditioning is not available indoors, potentially consider ceasing all practice.</li> </ul>	<ul style="list-style-type: none"> <li><b>Strongly consider canceling all practice and play.</b></li> </ul>
<b>Student Dorm Residents with no HVAC?</b>	<ul style="list-style-type: none"> <li>No additional action necessary.</li> </ul>	<ul style="list-style-type: none"> <li>Open windows at night when the air temperature is lower to increase ventilation.</li> <li>Place a box fan in the opening of the dorm window to increase ventilation if possible.</li> </ul>	<ul style="list-style-type: none"> <li>Consider avoiding being in the dorm rooms except for early morning and evening/night periods when temperatures are lower.</li> <li>Move to the dorm common room to cool down if necessary/possible.</li> </ul>	<ul style="list-style-type: none"> <li>Follow category 3 recommendations</li> </ul>	<ul style="list-style-type: none"> <li>Follow category 3 recommendations</li> </ul>
<b>Outdoor Workers</b>	<ul style="list-style-type: none"> <li>No additional action necessary.</li> </ul>	<ul style="list-style-type: none"> <li>Recommended <b>10 mins of total rest per hour of work.</b></li> </ul>	<ul style="list-style-type: none"> <li>Recommended <b>20 mins</b> of total rest break per hour of work</li> <li><b>Loose clothing</b> is recommended for optimal heat regulation.</li> </ul>	<ul style="list-style-type: none"> <li>If possible, <b>reschedule work</b> for non-peak daylight hours (during the evening or morning). Otherwise: Recommended <b>30 mins</b> of total rest per hour of work.</li> </ul>	<ul style="list-style-type: none"> <li><b>Strongly consider canceling</b> all non-essential work</li> <li>For essential work: If possible, reschedule work for non-peak daylight hours (during the evening or morning). Otherwise: Recommended <b>40 mins</b> of total rest break per hour of work.</li> </ul>
<b>Disabilities</b>	<ul style="list-style-type: none"> <li>No additional action necessary.</li> </ul>	<ul style="list-style-type: none"> <li>If physically or mentally disabled, <b>stay with a caretaker</b> when possible.</li> </ul>	<ul style="list-style-type: none"> <li>In case of power outages due to heat, <b>charge all electric mobility assistance devices</b> (if applicable).</li> </ul>	<ul style="list-style-type: none"> <li>Try to avoid going outdoors for prolonged periods of time.</li> </ul>	<ul style="list-style-type: none"> <li>Follow category 4 recommendations.</li> </ul>
<b>Common Actions for Each Demographic</b>	<ul style="list-style-type: none"> <li><b>Proper hydration</b> throughout the day, especially before and during physical activity.</li> <li><b>Monitor yourself and those in your care</b> for heat-stress-related symptoms.</li> </ul>	<ul style="list-style-type: none"> <li><b>Shaded areas, along with air-conditioned spaces/buildings</b> are preferred.</li> </ul>	<ul style="list-style-type: none"> <li>Continue to follow previous categories' guidelines, and new Category 3 guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>Continue to follow previous categories' guidelines, and new Category 4 guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>Continue to follow previous categories' guidelines, and new Category 5 guidelines.</li> </ul>

Figure 2: Heat Decision Matrix

Note: The above decision matrix leaves out some demographics for the purpose of showing the general structure of our decision matrix. The following groups were leave out of the above graphic: Indoor operations, children (Pre-K-12), Older Adults, Chronic Conditions, and Pregnant People.



Using customized VBA Userforms, our team created a specialized Excel management system for extreme heat events at UMD. This tool lets users interact with our decision matrix digitally by entering the current heat index and selecting a campus demographic of interest. Our tool will then return a series of recommended protective measures and give the user the option to record any protective actions taken. Our data entry form records all pertinent information for an extreme heat event and feeds automatically to a log sheet in the workbook.

The log can be searched for previous entries by heat index, demographic, level of action taken, date of incident, and more. This will allow UMD to easily make a historical database of decisions taken on campus and effectively monitor the long-term impacts of extreme heat events.

Conclusion

With the constructed heat decision matrix, campus leadership and the OEMBC will be well-equipped to make informed decisions to protect UMD's campus community and its numerous demographics. Simultaneously, the heat relief item supply locations will provide 92% of the campus with items to protect against heat-related health concerns. With these measures in place, UMD's campus will be more resilient towards extreme heat events.

Citations and Acknowledgements

OSHA Technical Manual (OTM), Occupational Safety and Health Administration. <https://www.osha.gov/otm#5>

Wet Bulb Globe Temperature: Guidelines - Charts, National Weather Service. <https://www.weather.gov/arx/wbgt>

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