Philadelphia, Pennsylvania

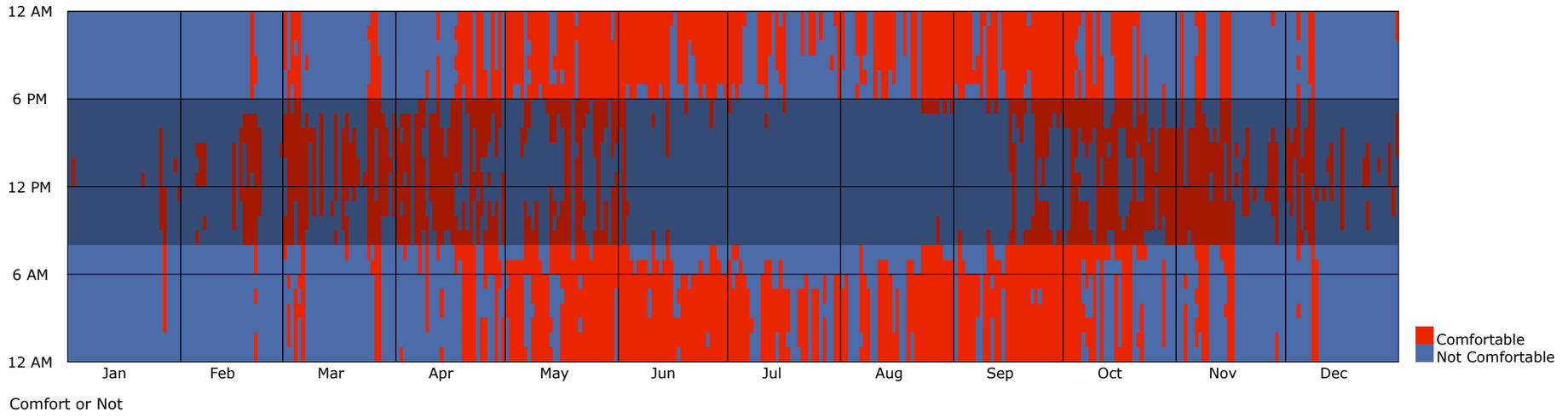
Thermal Comfort Analysis

Climate zone 4A
Location: 39.87, -75.23
Occupied hours: 6pm - 8am

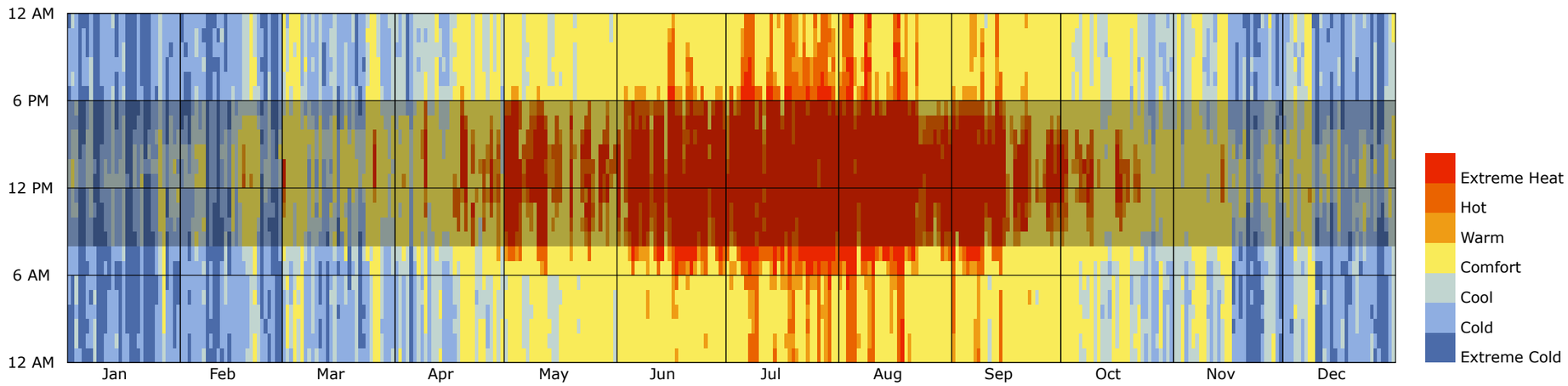
This thermal comfort analysis uses climate data from Philadelphia that has been extrapolated to 2050 values. The resulting calculation shows that Philadelphia is mostly comfortable outdoors between the month of May to the month of October during the occupied hours. For all other months, the outdoor condition tends to be too cold for it to be comfortable. In July and a little in the beginning of August, the afternoon gets too hot to be comfortable.

In total, it is comfortable for 36% of the year. With consideration of proper attire and adaptation, the comfortable range of Philadelphia can be considered to be extended to April and the first half of November for the occupied hours. This is about 18.7% of the time during the year.

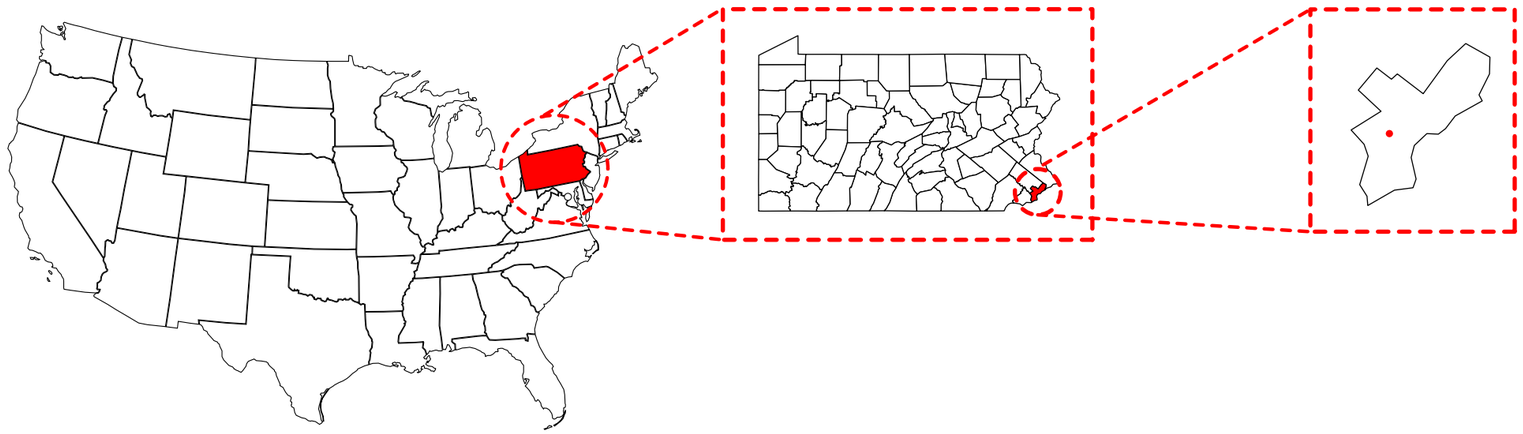
The hottest times of the year tend to be concentrated from 6am to 6pm during the months of June, July, August, and the first half of September. This is likely compounded by the humidity that can be found in Philadelphia climate. This comprises about 19% of the time. The coldest times of the year is during all day between the second half of November until February. This comprises about 25.8% of the time.



Comfort or Not



Outdoor Comfort

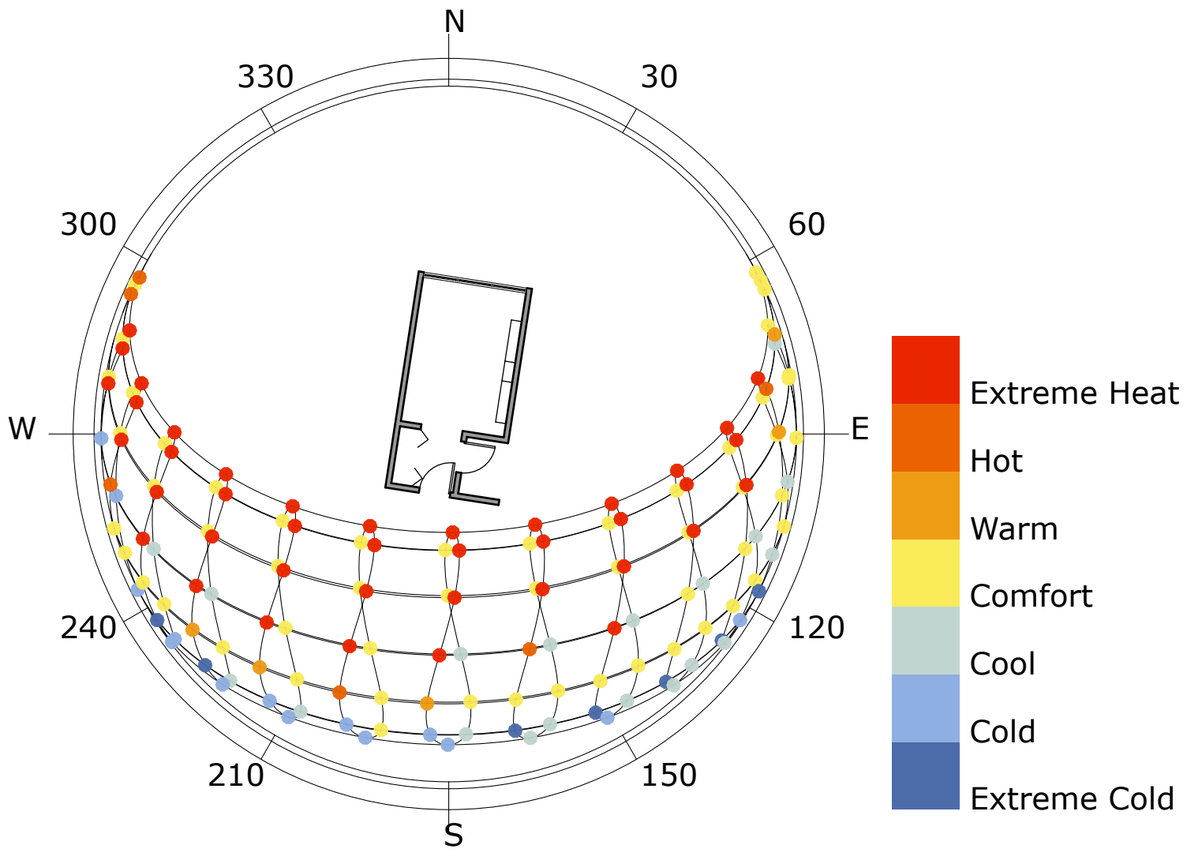


Location

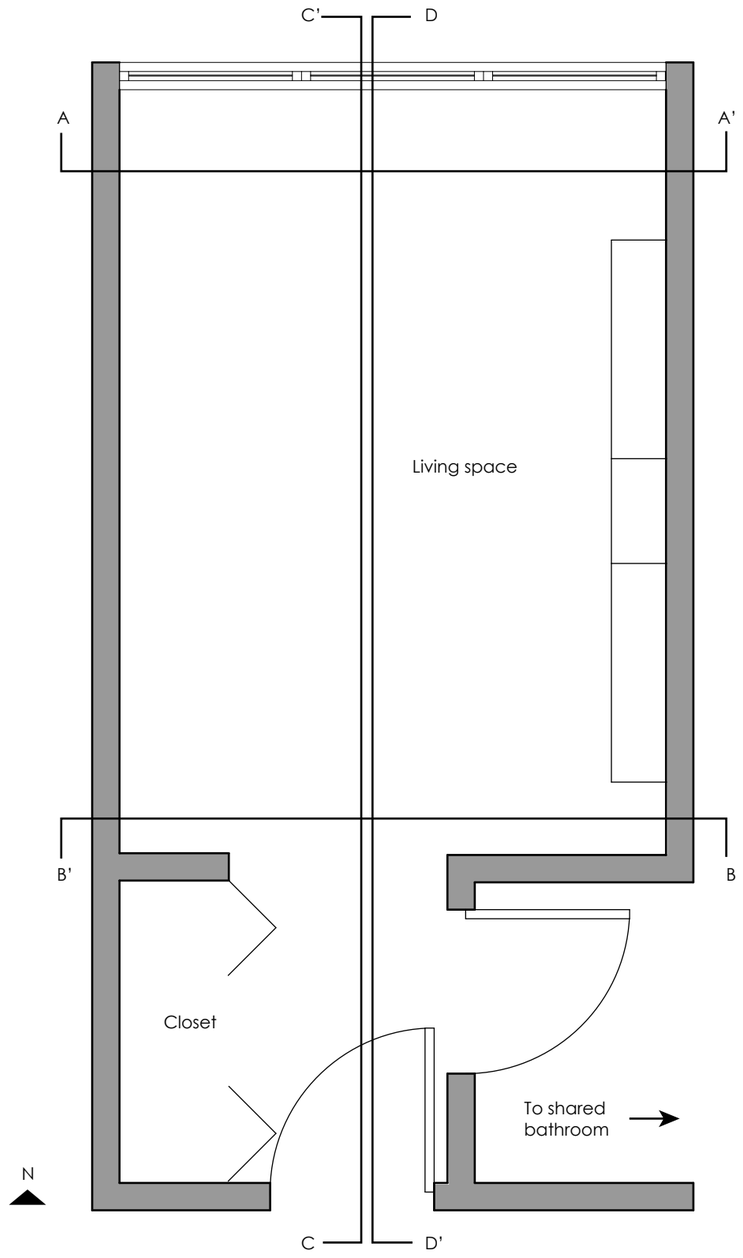
Dream Room

The sunpath diagram of Philadelphia coupled with outdoor thermal comfort calculation results reveal that the hottest sun positions are mostly located from June to September during the afternoon. For the room in question, this poses a problem mostly in late June afternoons when the low sun will come into view in an already hot climate. Because the room faces north, it does not receive much useful direct sunlight throughout the entire year.

Based on the outdoor comfort calculations, the occupants of the room can expect to enjoy opening the windows for outdoor air ventilation during the mornings and evenings between the months of May to September.



Sun-Path Diagram - Outdoor Comfort



Plan - 1" = 2.5'

To answer the question of for how many percentage of the time can a smart shading system provide effective shading to make a person comfortable, it is necessary to perform the outdoor comfort calculation twice: once without mean radiant temperature accounted (to simulate times that are comfortable having the smart shading), and once with the mean radiant temperature accounted (to simulate times when it would be comfortable even without the shading). Once we have the number of hours comfortable from both scenarios, we can do a boolean OR function to get all the hours that are comfortable under both situations, and divide that by the total number of hours to obtain the percentage.

For Philadelphia, the resulting number of hours for which it would be comfortable, provided that there is a smart shading device for hours when it is needed, is 4196 hours, or 47.9% of the time.