Winter 2016

Periodic Atlas of the of the Metroscape: Warming Up the City - Mapping the hottest (literally) neighborhoods of Portland

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Warming Up the City:

Mapping the hottest (literally) neighborhoods of Portland

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The city may burn, the rivers may swell, and the earth may quake,
Yet, without humans near...no disasters abound.

The profound recognition that natural disasters are only disasters when people are affected brings with it a need to know who might be vulnerable to the next episodic event. Recent evidence suggests that the shift in the climate system will bring with it significant increases in the magnitude, frequency, and duration of climate-induced events including heat waves, droughts, floods, and fires. In fact, an emerging research area called attribution science (science that seeks to understand the mechanisms behind climate change) suggests that these shifts are underway and responsible for many of the natural disasters we see in the news every day.

While the recent results of the Paris climate talks (COP21) offer a glimmer of hope for addressing the imminent natural disasters that confront our cities, identifying those who are most vulnerable requires unprecedented collaboration among multiple sectors and across academic disciplines.

As elsewhere, many in the Portland region are asking: Who are most at risk from climate change events here? One aspect of that question focuses on the extent to which a population is exposed to a specific climate hazard—in other words, it's a geographic question; another looks at those who may be most sensitive to and the least prepared for these hazards.

With support from the Institute for Sustainable Solutions at Portland State University and the Bullitt Foundation, a group of researchers and practitioners started a project in September 2014 to assess the impacts of a changing climate on neighborhoods in the city of Portland. Among the climate-induced natural disasters we examined was the urban heat island which is created when several landscape features, such as blacktop and buildings, absorb heat throughout the day making some neighborhoods much hotter than others.

Annually in the United States, heat waves kill more people than all other natural disasters combined; thus, an understanding of the factors that create local vulnerabilities is of paramount importance. To that end, in this edition of the Periodic Atlas we offer our analysis, which identifies those neighborhoods that bear a disproportionate level of heat stress during the hottest days of summer. We also identify areas that have the greatest social vulnerabilities because they have populations who may be most sensitive to excess heat and who may have the least capacity to cope.

Exposure

During the summers of 2014 and 2015, a group of students, faculty, and other volunteers conducted a series of field campaigns

to understand the differences in temperature throughout the region. They used GPS units and temperature gages, which were mounted on the passenger side of an automobile. The field teams drove for one hour (to minimize any changes in temperature) during three periods: morning (6:00 a.m.), afternoon (3:00 p.m.), and evening (7:00 p.m.). By statistically analyzing the data, we learned that areas within the city of Portland vary by upwards of 15 degrees Fahrenheit (figure 1).

But the story doesn't end there. In fact, the afternoon is different than the morning (figure 2) and evening temperatures (figure 3). Figure 4 depicts the hottest locations in the city throughout the day.

Isolating Vulnerable Populations

We looked to a group of expert practitioners and the literature to identify a set of 10 social factors that determine vulnerability to urban heat waves. Some of those factors include age, body mass index (BMI), the presence of air conditioning, and the extent of the tree canopy. These factors and the urban heat maps help us to identify potential areas of vulnerability (figures 5-8).

For example, a comparison of figures 4 and 5, indicates hot spots throughout the day just east of I205 and near I84 in areas with large populations of the elderly (figure 5). People in this age group often experience a disproportionate impact from

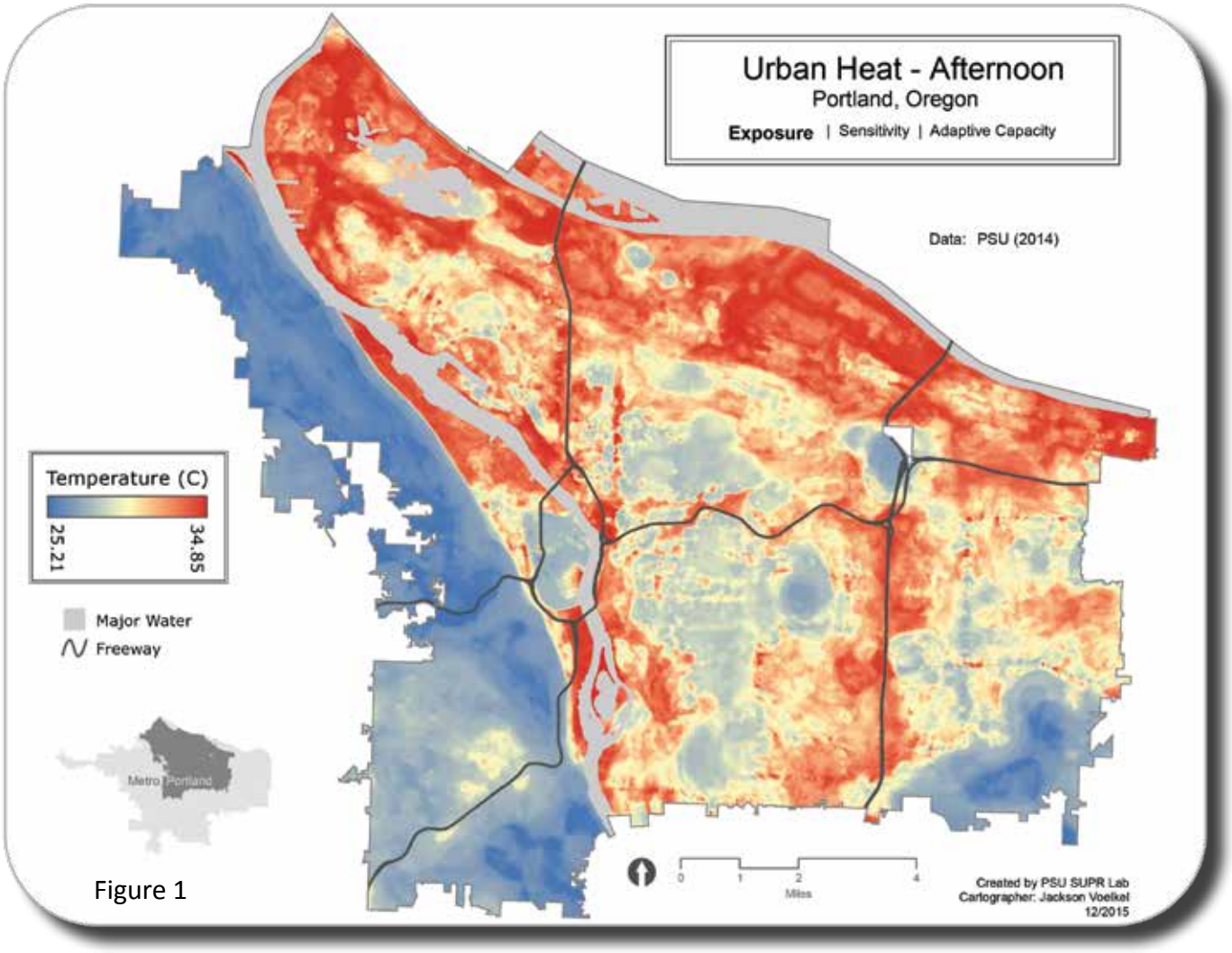


Figure 1

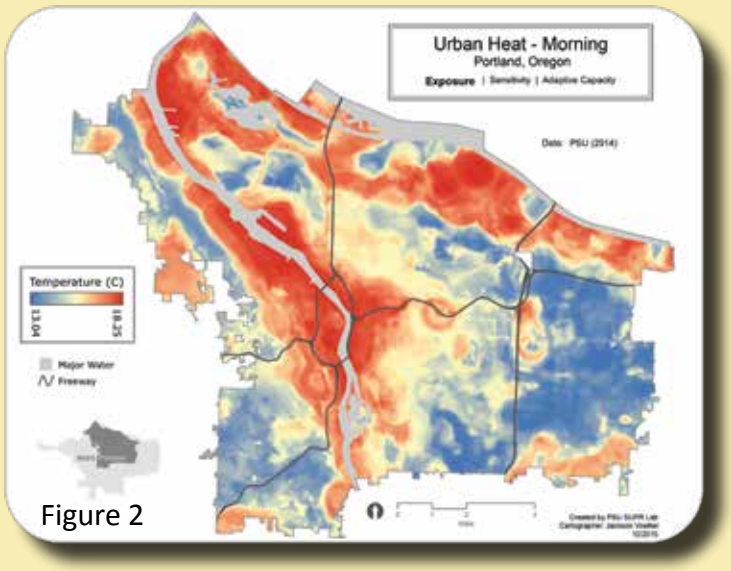


Figure 2

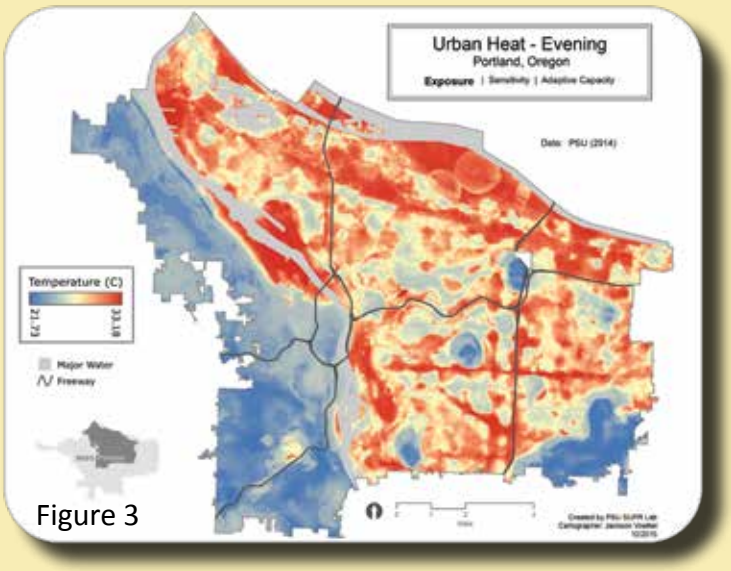


Figure 3

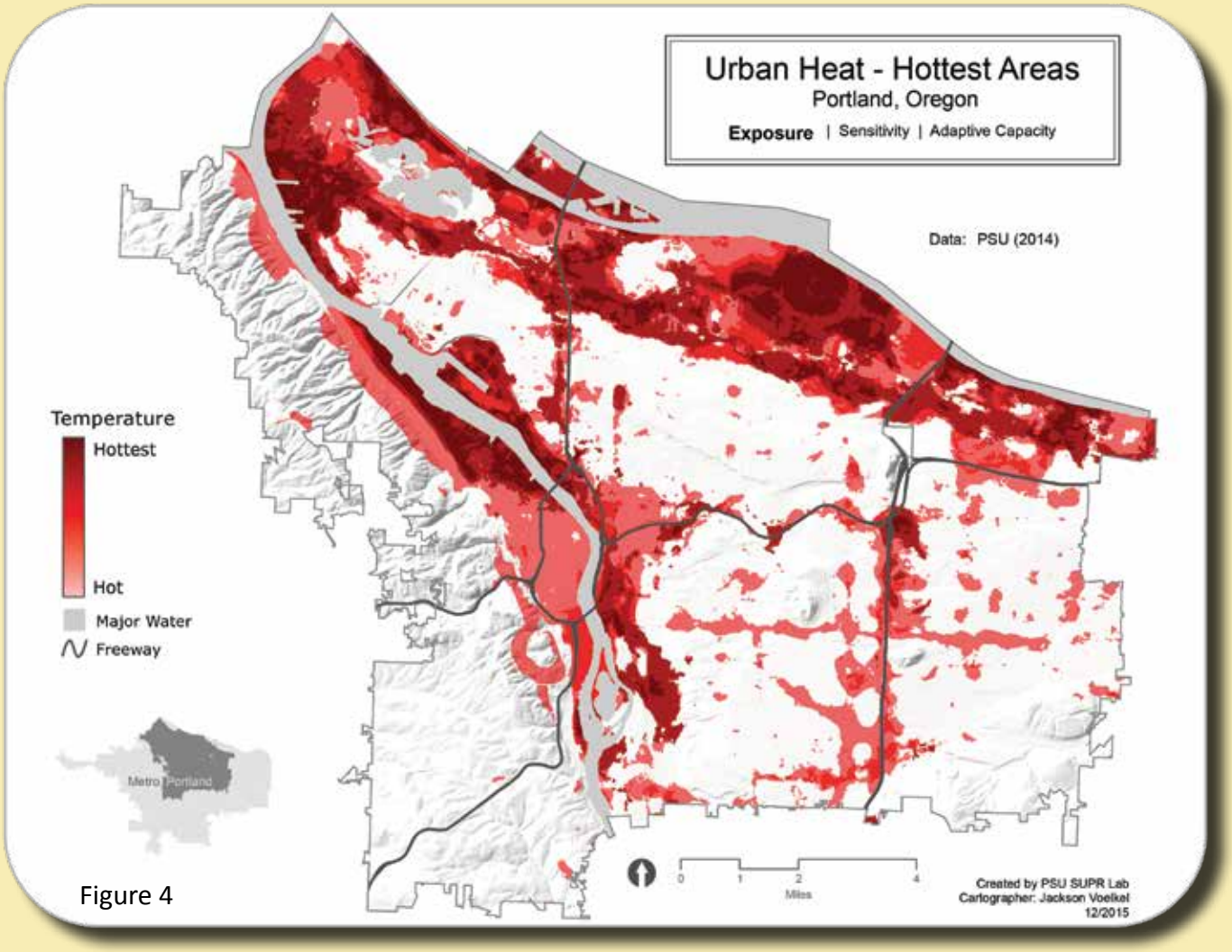


Figure 4

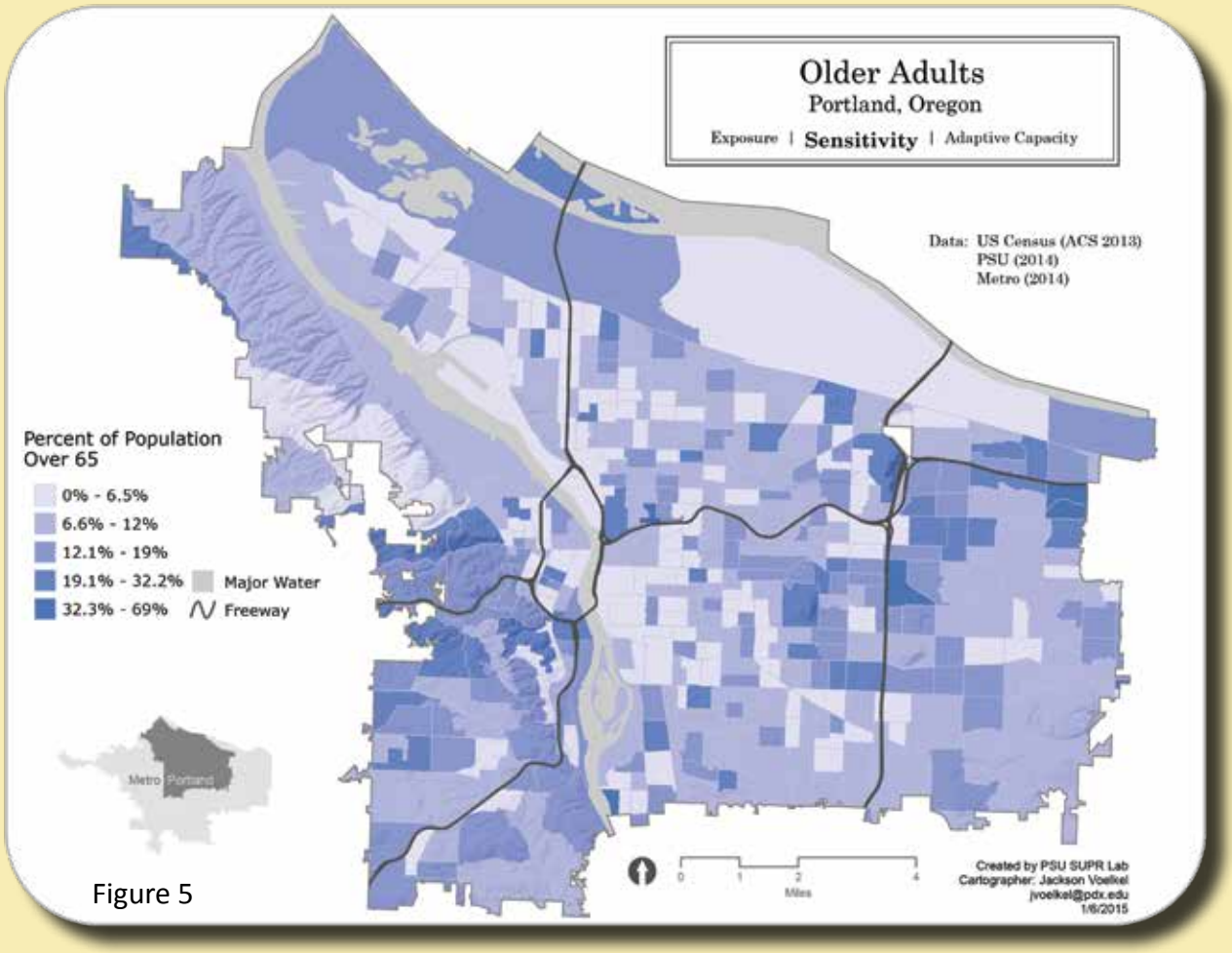


Figure 5

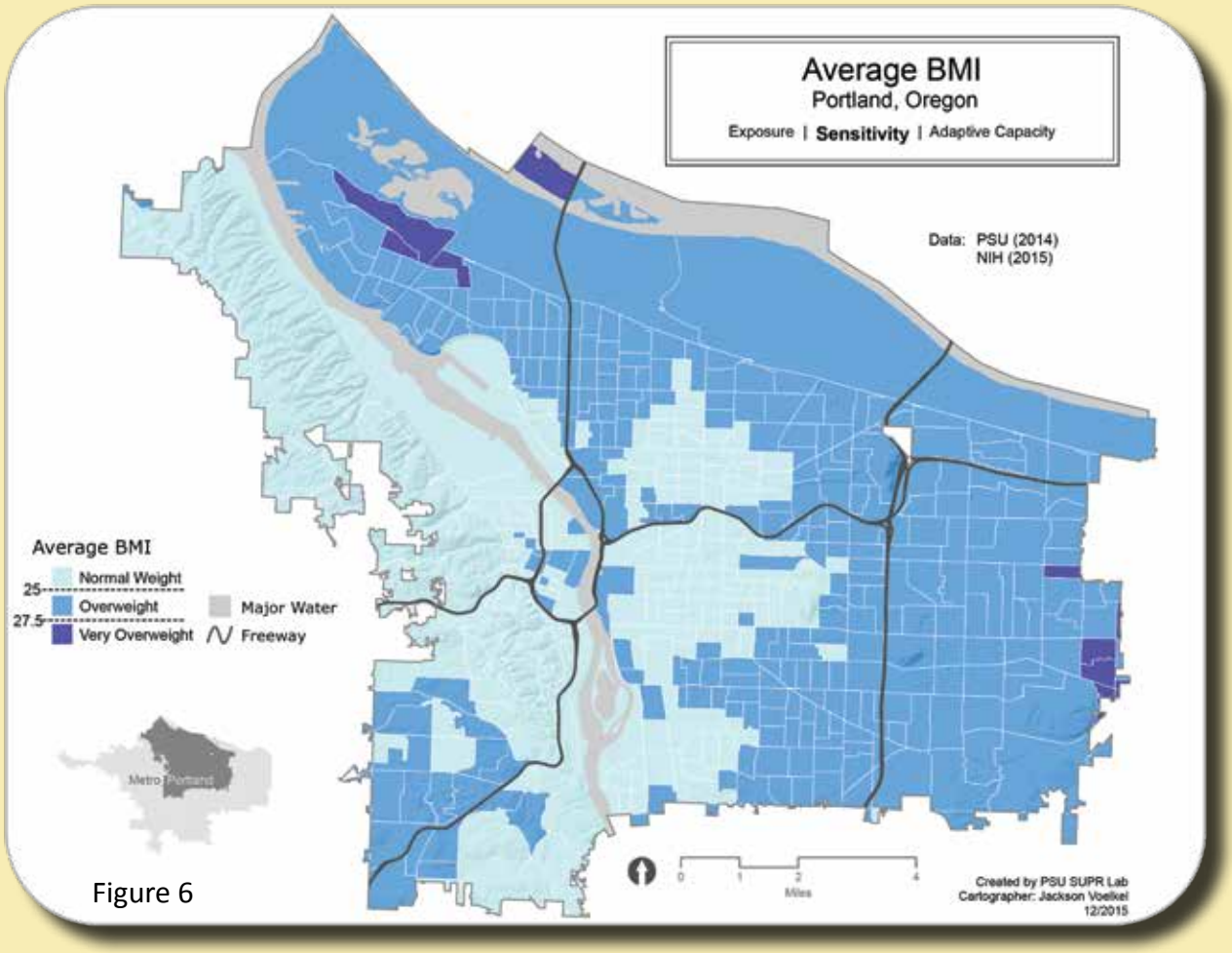


Figure 6

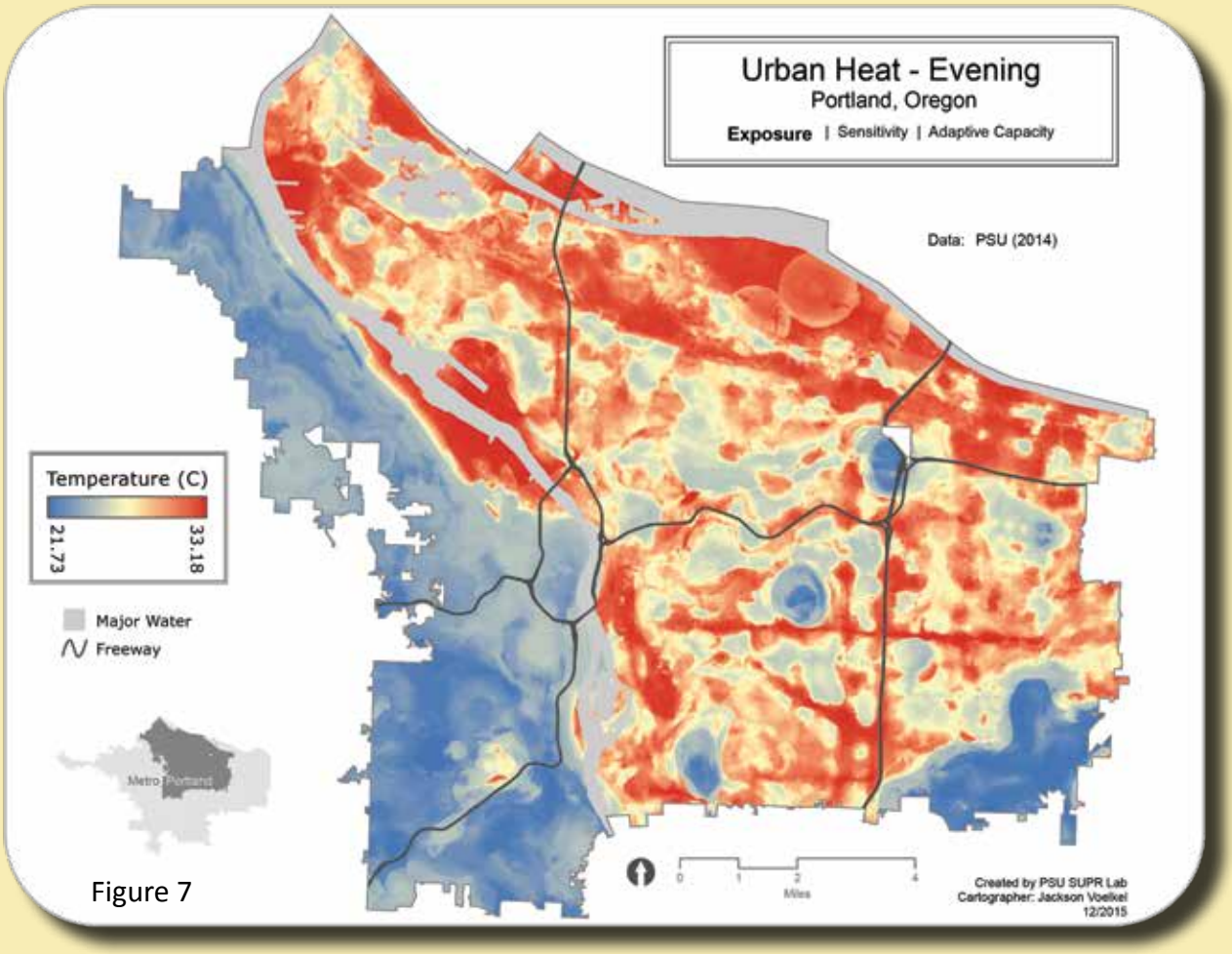


Figure 7

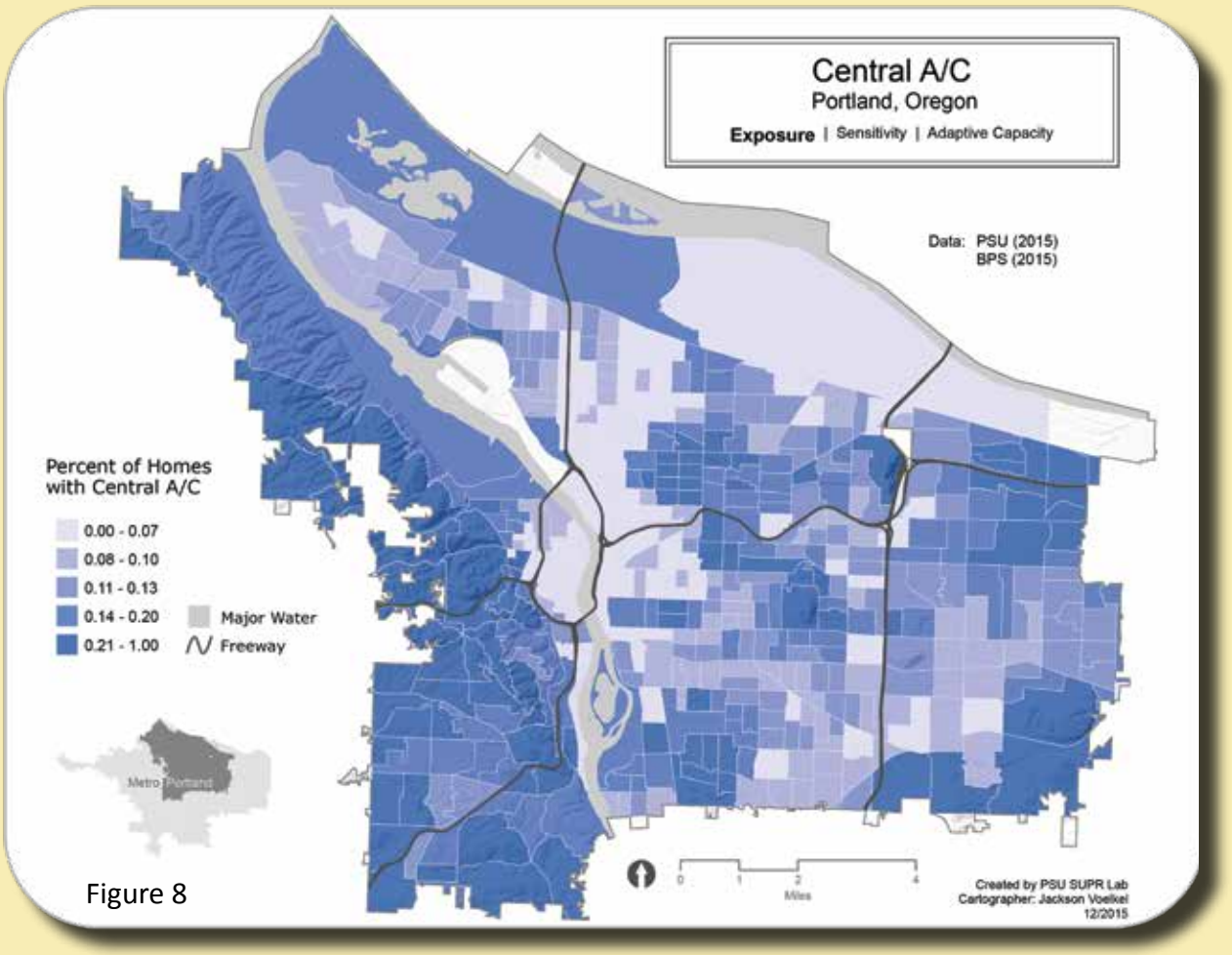


Figure 8

urban heat; thus, this concentration of heat and the elderly suggests potential vulnerability.

Those with pre-existing health conditions may also be more sensitive to excessive heat. While BMI is an imperfect measure, it is often used as a proxy for the existence of pre-existing health conditions. Figure 6 shows large areas of the city where the average BMI is higher than normal and a few areas in North Portland and East Portland where it is much higher than normal. There is considerable overlap between these areas and locations where urban heat is concentrated. Figure 7 indicates the distribution of urban heat in the evening when temperatures tend to be warmer and most people are home. One mitigating factor is the availability of air conditioning. Figure 8 indicates the percentage of homes with central air conditioning.

Another important but sometimes overlooked mitigating factor is shading from vegetation, especially large canopy trees. As figure 9 illustrates, some neighborhoods in the city have a lot more large canopy trees than others. The lack of significant tree canopy is especially apparent on the east side of the Willamette where better canopy is present in neighborhood parks and some older, more affluent inner eastside neighborhoods such as Eastmoreland and Laurelhurst.

Potentially-deadly urban heatwaves are but one of many climate-induced stressors that will become increasingly important as we consider how the region changes in the future. Taking actions to reduce the impacts of such natural disasters will be in our collective interest because ultimately, they affect all of us. In the next phase of the project, which we expect to begin in early 2016, we will evaluate the extent to which specific built environmental interventions—such as expanding the tree canopy, changing the reflectivity of surfaces, and modifying building designs—will help to temper heat stress in specific neighborhoods.

In the meantime, we have developed an online tool (see www.climatecope.org) that houses all of our data and allows researchers, urban planners, public health practitioners, and others participating in urban climate discussions to understand how natural disasters will impact different places and people in the region. We welcome feedback about this and other climate related topics through the www.suprlab.org website. M

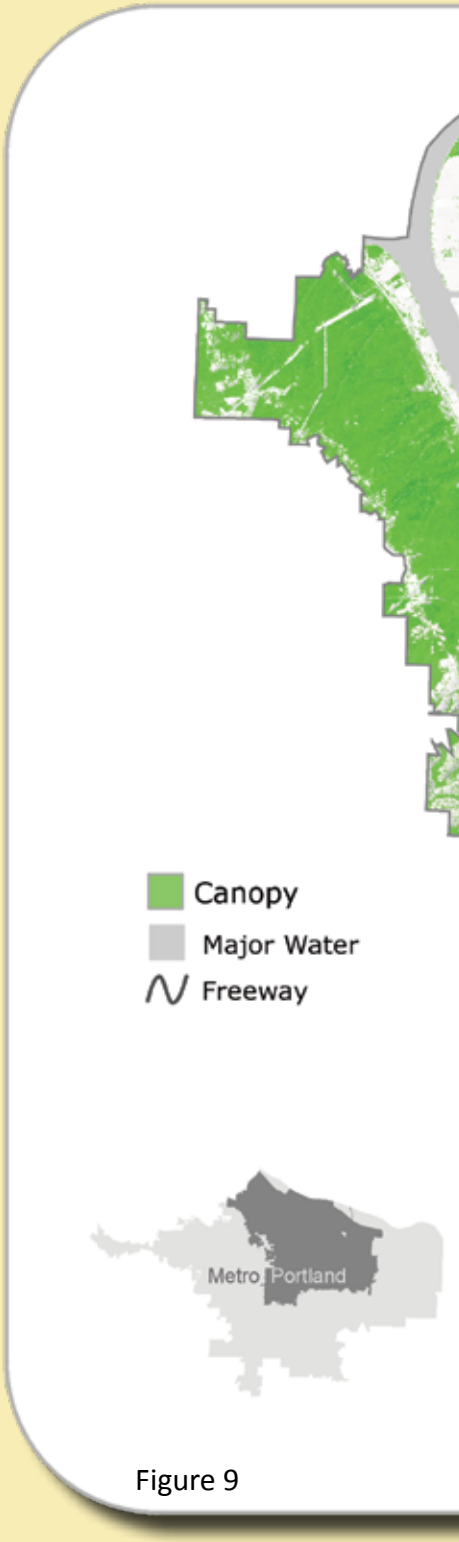
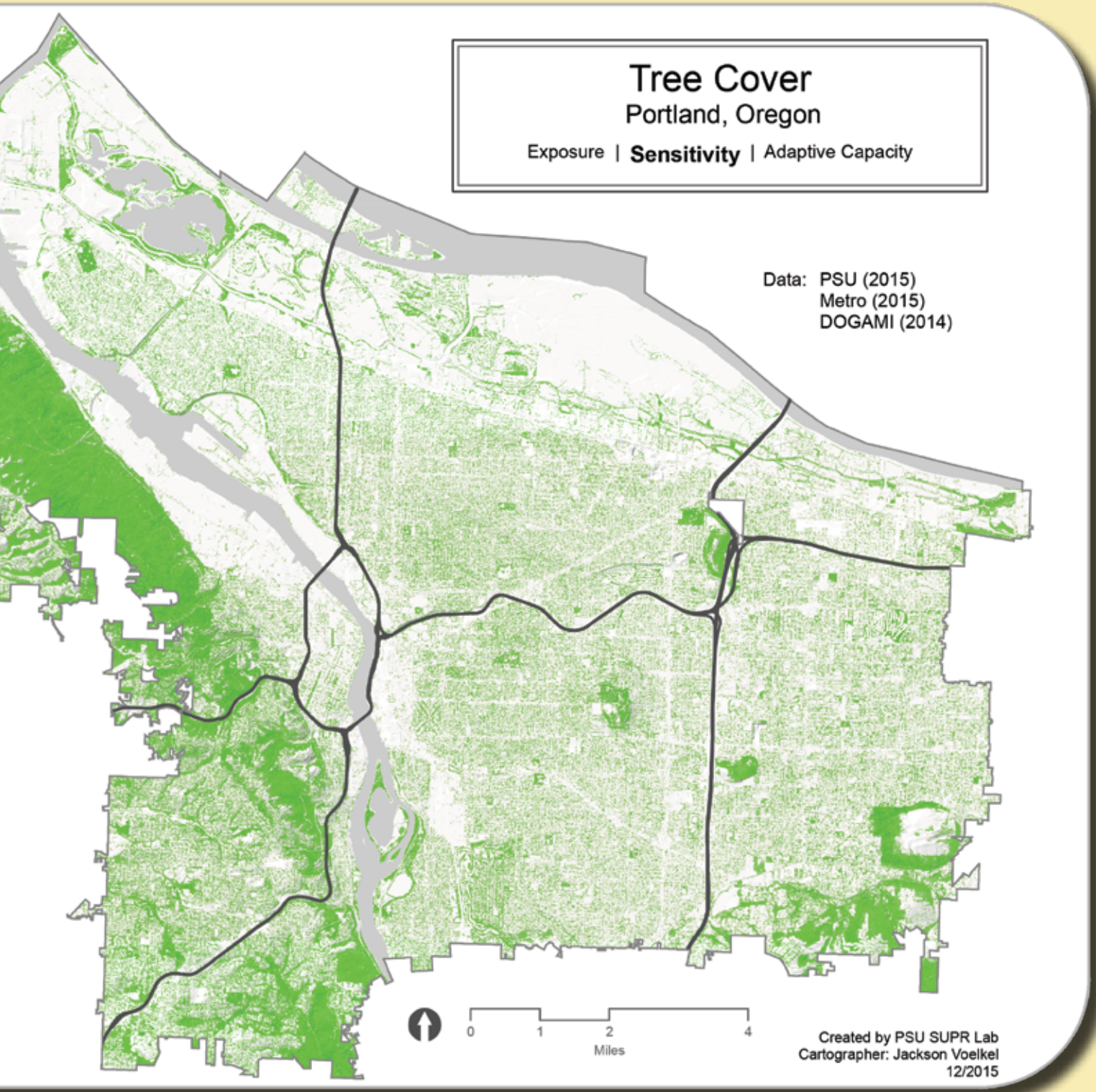


Figure 9


Tree Cover
Portland, Oregon
Exposure | Sensitivity | Adaptive Capacity
Data: PSU (2015)
Metro (2015)
DOGAMI (2014)
0
1
2
4
Miles
Created by PSU SUPR Lab
Cartographer: Jackson Voelkel
12/2015