Researchers emphasize evaluation of tradeoffs in battling urban heat island

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A team of researchers from Arizona State University have found that warming resulting from megapolitan expansion is seasonally dependent, with greatest warming occurring during summer and least during winter. Among the most practical ways to combat urbanization-induced warming – the painting of building's roofs white – was found to disrupt regional hydroclimate, highlighting the need for evaluation of tradeoffs associated with combating urban heat islands (UHI).

"We found that raising the reflectivity of buildings by painting their roofs white is an effective way of reducing higher average temperatures caused by urban expansion," said Matei Georgescu, an assistant professor in ASU's School of Geographical Sciences and Urban Planning. "However, increased reflectivity also modifies hydroclimatic processes and, in the case of the 'Sun Corridor,' can lead to a significant reduction of rainfall. Our maximum Sun Corridor expansion scenario leads to a 12% reduction in rainfall, averaged across the entire state. Painting roofs white leads to an additional 4% reduction in rainfall."

The research is presented in the paper, "Seasonal hydroclimatic impacts of Sun Corridor expansion," published in the Sept. 7, 2012 issue of *Environmental Research Letters*. Georgescu, the lead author of the paper, is joined by Alex Mahalov, The Wilhoit Foundation Dean's Distinguished Professor in the School of Mathematical and Statistical Sciences at ASU, and Mohamed Moustaoui, an associate professor in ASU's School of Mathematical and Statistical Sciences.

The paper focuses on Arizona's Sun Corridor, the most rapidly growing megapolitan area in the United States. Located in a semi-arid environment, the Sun Corridor is composed of four metropolitan areas: Phoenix, Tucson, Prescott and Nogales. With a population projection expected to exceed 9 million people by 2040, the rapidly expanding megapolitan offers the opportunity to identify tradeoffs focused on sustainable expansion of the built environment.

The authors utilized 2050 projections of Sun Corridor growth developed by the Maricopa Association of Governments (MAG), the regional agency for metropolitan Phoenix that provides long-range and sustainably oriented planning. They conducted continuous multi-year, multi-member, continental scale numerical experiments for several 2050 Sun Corridor growth and adaptation scenarios and compared results with a modern day Sun Corridor representation.

"For a maximum expansion scenario, we find greatest warming to occur during summer, in excess of 1 degree C (1.8 degrees F) when averaged over the entire state of Arizona. Warming remains considerable during both spring and fall seasons, approaching 0.9 C. For a minimum expansion scenario, the consistent theme of maximum warming during summer with reduced, although still significant, warming during spring and fall seasons persists," Georgescu added.

Whereas previous research has documented the contribution of cool roofs as an effective UHI mitigation approach, this work emphasizes the need to broadly evaluate impacts by exploring consequences that extend to hydrology and rainfall.

"Truly sustainable development will have to consider impacts extending beyond average temperature," Georgescu explained. "A crucial step in that approach is to identify potential adaptation and mitigation strategies

and assess tradeoffs, to ensure that we make smart decisions with minimum damaging consequences."

Provided by Arizona State University