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By ROBERT LEE HOTZ

Brazil's Urban Ants May Predict Reaction To Warming Trends

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It's getting hotter in the human hive, and in some ant colonies, but the ants are learning to live with it.

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The Sacramento River winds its way through California's capital in a satellite photo, left, and a thermal infrared image.

NASA


In São Paulo, Brazil, leafcutter ants are thriving in temperatures

up to 20° F higher than in the countryside, biologist Michael J. Angilletta Jr. and his colleagues at Indiana State University reported last month. The urban ants acclimated to heat that, in recent experiments, all but killed their rural relatives.

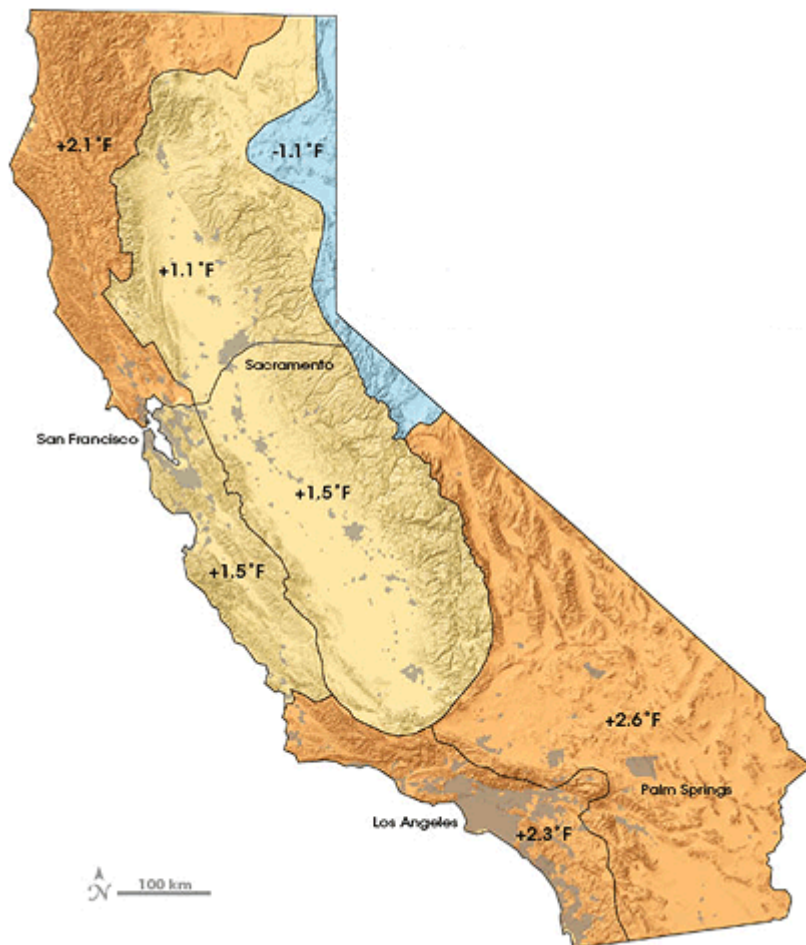
Under any circumstances, these leafcutter ants are hard to ignore. They can strip a citrus tree in a day. Single file, they parade in living ribbons of green, hoisting banners of leaf and grass often 20 times their body weight. They compost the clippings to help feed subterranean nests of up to eight million ants, all tended by the insect equivalent of a public-works department and squads of sanitation engineers.

Ants in the Brazilian metropolis have a head start on global warming because all cities, from Atlanta to Hong Kong, are heating up faster than the planet as a whole, which itself is responding to rising levels of greenhouse gases that trap the sun's heat.

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NASA's Jet Propulsion Laboratory and California State University, Los Angeles

Since 1950, temperatures have risen by between one and 2.5 degrees throughout most of the state of California.

raising the temperature of the continental U.S. by about half a degree every 100 years, University of Maryland researchers calculated in 2003. In California, the urban sprawls of Los Angeles, San Diego and San Francisco have been warming faster than the state as a whole since 1950, NASA scientists reported last month.

More recently, the urban building boom in China has been boosting the temperature there by one-tenth of a degree Fahrenheit every decade, according to a 2004 estimate by researchers at the Georgia Institute of Technology.

"The impact of global warming is amplified just because of what we have done to where we live and work," said climate oceanographer Bill Patzert at NASA's Jet Propulsion Laboratory.

São Paulo, South America's largest city, generates one of the world's most intense urban heat-island effects. Temperatures along its ant trails can reach 113°. When the heat is its most severe, the ants "wobble when they are walking. They will crouch down and not get up. Eventually, they will lose complete mobility," Dr. Angilletta said.

To compare the heat tolerance of urban and rural ants of the same species, the researchers exposed hundreds of ants to 108° temperatures inside a walk-in test chamber, keeping the city ants

Every city is a man-made microclimate. Asphalt, glass and other building materials absorb and reflect the energy of sunlight, sometimes in surprising ways. The temperature of artificial playground turf can reach 150°. These higher temperatures mean hotter days, warmer nights, less frost, longer growing seasons, altered rainfall patterns and more smog.

At the same time, big cities trap concentrations of carbon dioxide that the planet as a whole may not record for decades. Last year, New York City alone emitted as much carbon dioxide as all of Ireland or Portugal -- three-quarters of it from buildings.

Such islands of heat are the Galápagos of global warming -- a natural laboratory of selective pressure and adaptation. "These urban ecosystems can be used as models to understand what will happen in global climate change," said Dr. Angilletta.

All told, land-use changes have been



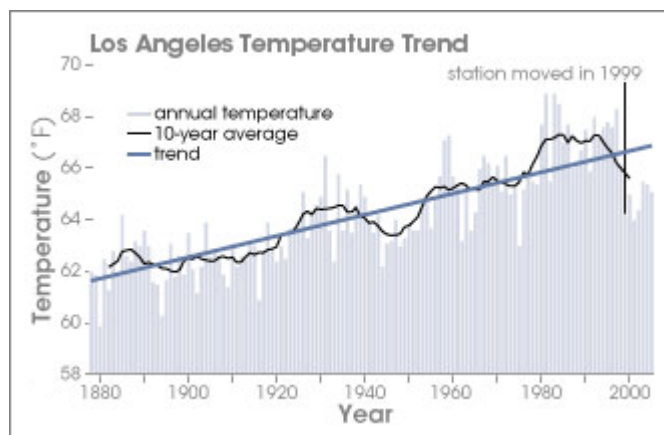
NASA and Indiana State University

In the Sao Paulo experiment, ants were collected from colonies in the center of the city, at locations numbered one through four, and in spots increasingly further away from the city, locations

and country ants in separate petri dishes. They then timed how long it took for the insects to be overcome by the heat -- what researchers called the "knockdown time."

As the experiment wore on, scientists dropped moist cotton balls into the dishes to keep the ants from merely getting dehydrated. After four hours, the São Paulo ants had yet to succumb.

In the end, the urban ants took 20% longer to drop from the heat than their country cousins. (The scientists sweltering inside the chamber, meanwhile, barely made it through four hours of observation.) No one knows yet whether ants survive higher heat through changes in behavior, or whether urban warming has modified their genetic code.



NASA's Jet Propulsion Laboratory and California State University, Los Angeles.

The average temperature in downtown Los Angeles has risen by more than four degrees since the 1880s.

Since the beginning, people have survived climate change by altering the world around them. To engineer is human. As temperatures continue to rise, however, humans keep cool in ways that intensify urban warming. Scientists led by Yukitaka Ohashi at Okayama University of Science in Japan reported in January that on a warm day, Tokyo's office air conditioners generate enough waste heat to raise the city's temperature almost 3°. All told, cities consume 75% of the world's energy and produce 80% of its greenhouse gas emissions.

one knows how quickly our species will adapt; no one knows whether rising temperatures may be altering us already in unsuspected ways. What's the knockdown time for a global society of city dwellers?

Inadvertently, we have made ourselves part of a climate change experiment on a planetary scale. No

This month, U.N. climate experts warned that as many as a quarter of the world's plants and animals may become extinct as temperatures soar in coming decades. Since Aesop, though, the smart money has been on ants.

• Robert Lee Hotz makes his debut as science columnist for The Wall Street Journal. Send comments to sciencejournal@wsj.com².

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