



# SHANGHAI

In 2013, temperatures in Shanghai topped 38° C (100° F) for 10 straight days, making it the hottest July in 140 years. The city's Xujiahui weather observatory recorded a temperature higher than 41° C (105° F), an all-time record, on July 26. The evening brought no relief from the heat. Temperatures dropped only into the high 80s, some 10 degrees above normal.

The heat wave made headlines around the world, but it is unlikely to be the last such event for two reasons. The first is global: The long-term rise in average temperatures may cause changes in weather patterns, such as a shift in the jet stream, that may increase temperatures in and around Shanghai, as well as changes the frequency and intensity of the monsoon.

The second reason to expect more heat waves in Shanghai is because of its success: The city has been booming for decades, and the population now tops 20 million. And Shanghai continues to grow: Since 1984, the area of urbanized land in Shanghai increased more than three times, at an annual rate of nearly 11 percent. According to one study, between 1997 and 2008 alone, developed land in Shanghai more than doubled, mostly as a result of converting cropland and forest to urban use.

In response, Shanghai made a concerted effort to increase green spaces in the city. The United Nations estimates that the city doubled the amount of green spaces between 2000 and 2008. As part of its green spaces expansion, a number of parks have been established in Shanghai's urban areas.

The city has also undertaken a massive effort to increase the amount of green walls and rooftop gardens in the city. New rules introduced in October 2015 mandate that at least 50 percent of the roof area of all new buildings must be covered in plants. Shanghai plans to plant 400,000 square meters of rooftop gardens in 2016 alone. By 2020, 2 million square meters of greenery will likely be added to the roofs and walls of Shanghai's buildings.

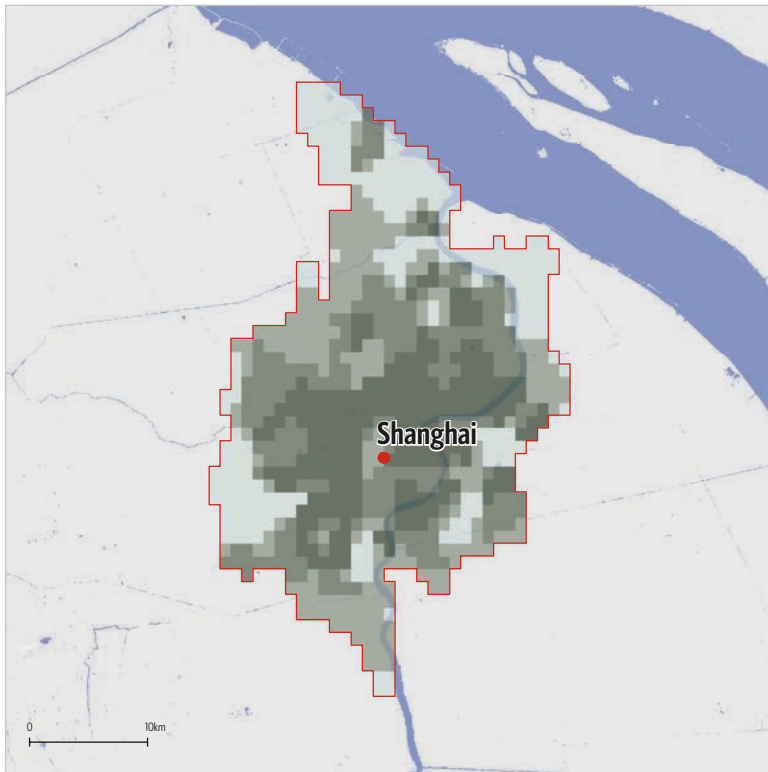
More green roofs by themselves will not be enough. As a relatively high-density city, Shanghai also has a high estimated ROI of tree planting for temperature mitigation. Generally, the neighborhoods with the highest ROI are in the denser central portions of the city. For an annual additional cost of \$1.6 million, almost 2 million people could have a reduction of summertime temperatures of 1.5° C (2.7° F).

Shanghai is trying to change course on a broader scale, improving transportation and moving to an economic model based less on land-hungry industry and more on banking and information technology. By 2020, the city government plans to extend Shanghai's metro, already the world's longest, to more than 800 kilometers. In July 2010, the central government announced plans for a Shanghai-Nanjing high-speed rail route. The new route is expected to cut journey time between the two cities from two hours to just 72 minutes, and has the potential to ease traffic congestion if commuters opt for the new train rather than their cars.

The city is also reducing its dependence on coal. Under the 2013 Clean Air Action Plan, the city will ban the burning of coal by 2017, which means shutting or upgrading thousands of coal-fired boilers and furnaces.

Meeting Shanghai’s growing energy demands without coal and while preserving open space will require a large-scale shift to renewable sources. China built the world’s first large-scale offshore wind farm in Asia near the East China Sea Bridge, a 20-mile crossing that links Shanghai with the Yangshan Deep Water Port.

## Results from the Shanghai study



Map 28. Neighborhood-level ROI for Shanghai (temperature reduction).

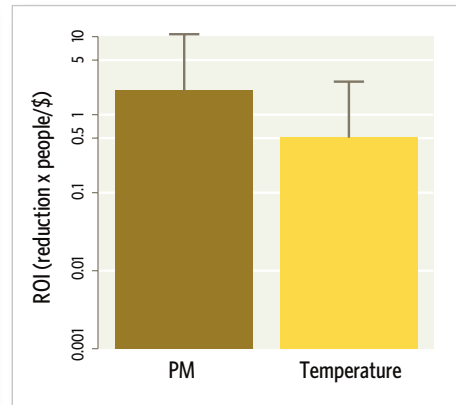


Figure 33. ROI for tree planting for Shanghai.



Investment	Annual Cost (\$)	> 1 ug/m <sup>2</sup> PM <sub>2.5</sub> *	1.5 deg C
10% of sites	1,610,000	1,980,000	1,980,000
20% of sites	3,230,000	3,140,000	3,140,000
Full Investment	16,200,000	6,800,000	6,800,000

\*Note: Most people will receive a reduction of > 10 ug/m<sup>2</sup> PM<sub>2.5</sub> in this city

Table 21. Temperature and PM reduction benefits under three investment scenarios for Shanghai.