

Urban Design

**how climate information
can help in:**

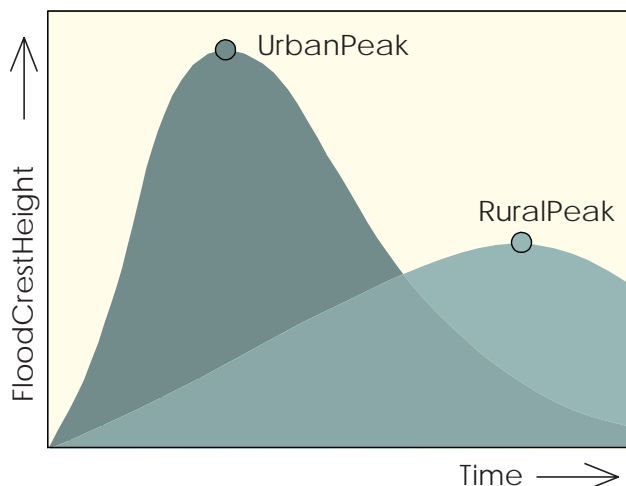
-  **design of more liveable neighborhoods;**
-  **energy conservation;**
-  **economic savings; and**
-  **reduced emissions of greenhouse gases.**



What has climate got to do with urban design?

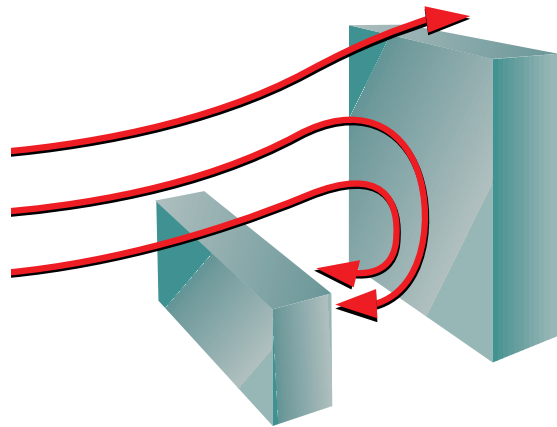
We know that when a town or city is built, the climate of the area changes. When plants and soil give way to asphalt and concrete, the natural heat and moisture balances of the region are affected. Heat is stored in bricks and concrete and trapped between close-packed buildings. Heat, water vapour and pollutants are given off by motor traffic and industrial processes. The transfer of radiated heat and light is affected by air pollution. As a result:

- nights become warmer (the so-called urban heat island effect);
- hours of sunshine decrease;
- winds (hence air pollution) vary across town, depending on building height and street layout;
- downwind of the city, more showers, hail and thunder are likely;
- run-off from rainfall peaks higher and faster.

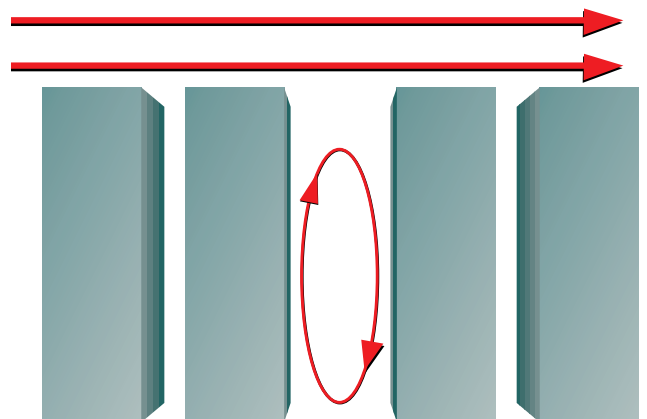


The city's paved surfaces affect run-off.

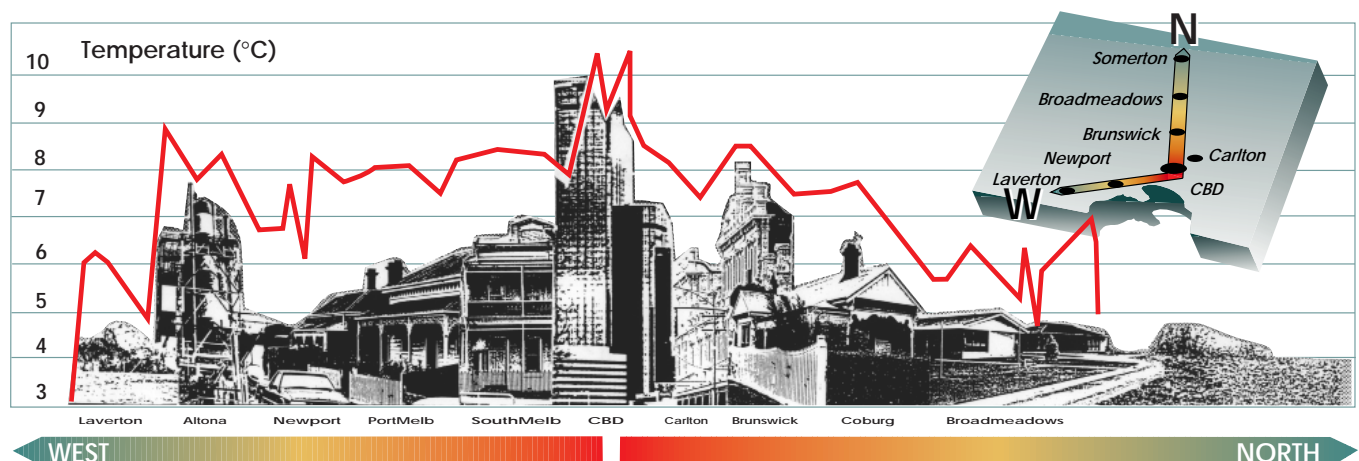
When we understand how this happens, we can **take control** of the process; we can design subdivisions so as to create the **best possible** urban microclimate.



Strong winds occur at street level when a tall building juts above its surroundings.



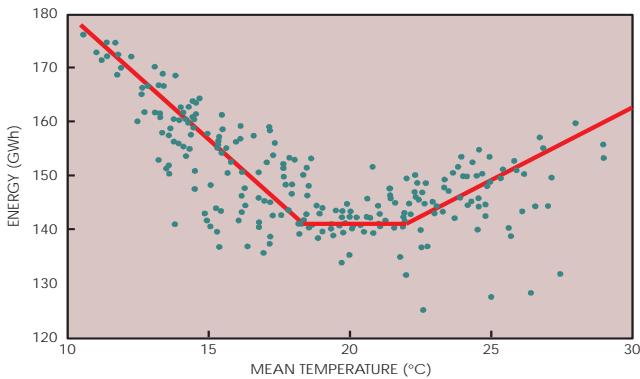
Streets running across the wind direction are sheltered if building heights are fairly uniform.



The urban heat island is obvious in this study of Melbourne temperatures on a calm, clear winter night.
Reproduced with permission from 'The Age' (c1992 'The Age')

Why is the Bureau of Meteorology interested in urban design?

Our climate data bank and our climate expertise are national assets which are funded by the taxpayer. It's the Bureau's responsibility to ensure that these resources are used to return every possible benefit to the community.

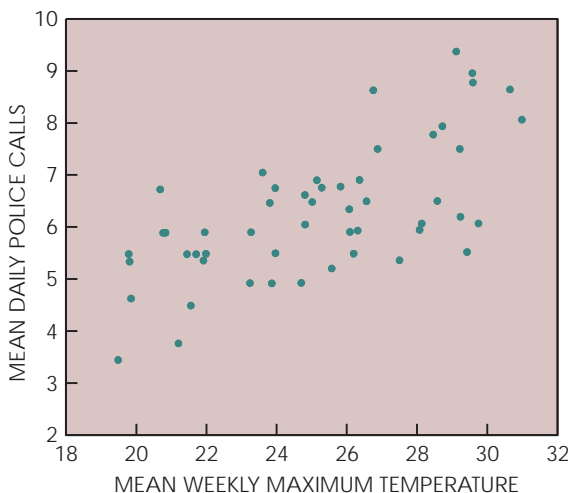


Courtesy of Pacific Power

Climate and energy use - Sydney, 1990-91.
P. Gannon, Pacific Power

What city climates do to people

In most Australian climates, the urban heat island effect is not beneficial. Peak demand for electricity in many Australian cities occurs on hot days. The city heat island magnifies this demand peak, because more energy is used for indoor cooling. During heat-waves, the city's warmer nights cause extra thermal stress, resulting in increased urban death rates. There is evidence that aggressive behavior



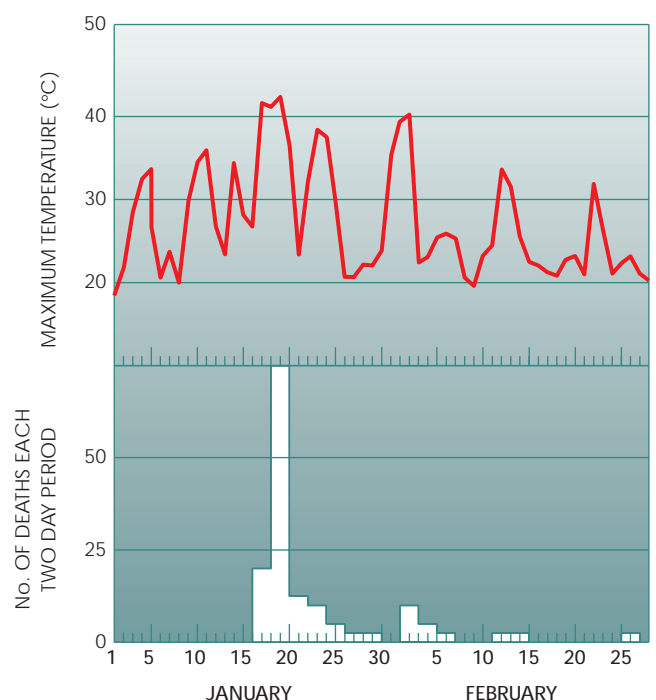
Domestic violence and temperature - Brisbane 1992.
Auliciens and DiBartolo, ACRU, University of Qld

in cities increases during hot weather. Increased run-off can result in flash-floods. Pedestrians may be buffeted by strong winds near tall buildings. On still nights, local air-flows induced by the urban heat island may recirculate pollutants around the city, leading to progressively decreasing air quality.

Designing with climate

Some of the things which can be done . . .

- In a **warm humid climate**, we need air movement to keep us comfortable. Streets and buildings can be oriented to catch the breezes. A mix of building heights will promote air movement. Vegetation should not block the breezes: trees with branches far from the ground, such as palms, are ideal. Much of the ground surfacing should be permeable, to reduce run-off from the intense rainfalls likely in this zone.
- In a **hot dry climate**, protection from the intense sunshine is essential (we need shade, and pale surfaces to reflect the sun's radiation). Glare and reflected heat from these pale surfaces is reduced by shading from eaves, verandahs and from vegetation. Trees not only provide shade, they are Nature's own evaporative coolers - perfect for the dry atmosphere, if water supply permits. City-wide plantings lessen the urban heat island, greatly improving summer comfort.
- What to do when summer is warm and winter is cold? In a **temperate climate**, the wind direction usually changes markedly with the season. Because streets oriented perpendicular to the wind are sheltered, it may



Heat-wave deaths - Melbourne, 1959.
D.W. Rankin



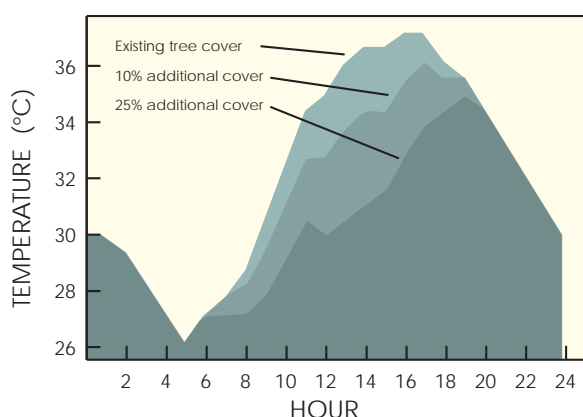
Australia's main climate zones (based on temperature and humidity).

be possible to choose a street layout which blocks cold winter winds, but allows cooling summer breezes through the city (see example opposite). Zoning to prevent isolated tall buildings will increase winter wind protection.

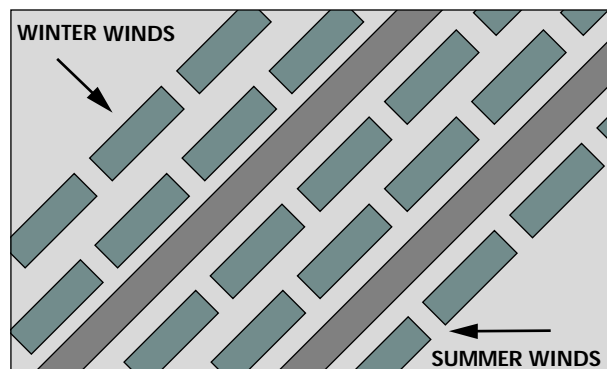
Climate sensitive design - the rewards

When climate expertise is part of the urban design team's skills . . .

- city-dwellers enjoy a more comfortable climate;
- as a result, less energy is needed for indoor temperature control, so money is saved and emission of greenhouse gases is reduced;
- air drainage patterns carry pollutants away from residential areas;
- stormwater run-off and peak energy demand decrease, so city infrastructure costs less.



Cooling effect of adding tree cover to a city in a hot dry climate zone.
Huang et al., Lawrence Berkeley Laboratory, USA



Street layout suitable for SW Australia's temperate climate. Streets are sheltered from cold winter winds, but open to summer breezes.

More about climate and design

Contact the Bureau's National Climate Centre for more information and . . .

- get independent advice from the Bureau on climate aspects of your urban development project;
- ask about our climate data service;
- see the entry on the Bureau's home page at <http://www.bom.gov.au/climate/enviro/index.shtml> for more information on designing with climate;
- ask us for a list of references on climate-sensitive design or a reprint of a short paper on the subject.

Contact Details

Telephone: (03) 9669 4589

Fax: (03) 9669 4515

Mail: GPO Box 1289K, Melbourne, 3001, Att: SRSC

E-mail: Climate.appl@bom.gov.au



BUREAU OF METEOROLOGY
DEPARTMENT OF THE ENVIRONMENT, SPORT AND TERRITORIES