Efficient Cooling for Urban Environments

How Outdoor Misting Systems Contribute to Healthy Public Spaces & Communities

mistafog

Introduction

Climate change is a global challenge, but its harshest effects are felt at a local level, especially in geographical areas with already demanding weather conditions. Humid climates are anticipated to experience even hotter temperatures in the future.[1] In addition, studies show that the “urban heat island” effect has the greatest impact on cities in these regions.[2]

In a climate like Australia's, cooling public spaces is important as doing so has the potential to increase access to the outdoors and deliver positive impacts to the community. People require places to gather and interact with one another, as well as secure areas for physical activity and other pursuits. Urban public spaces help meet a variety of community needs, from sustainability to safety, and serve as a connection point that improves community health.

Climate-specific solutions are urgently needed to increase outdoor comfort as Australian temperatures are rising and showing no signs of abating. Local and state governments, as well as businesses, are becoming increasingly aware of this fact with many looking for efficient and cost-effective cooling solutions that can be used outdoors. Misting systems can deliver immediate and targeted cooling of air, structures, and surfaces, allowing for the comfort and cooling effect that those in the immediate vicinity need.

In this whitepaper, we look at why rising local temperatures and urban heat pose a serious public health issue in more detail and identify effective strategies that can be utilised by architects and designers to improve thermal comfort in public spaces.


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Rising temperatures and the urban heat island effect

Climate change stresses ecosystems through a range of effects, with the most prominent being rising local temperatures. Australia's average temperature has risen by 1.44±0.24°C on average since national records began in 1910.[3] Every decade since 1950 has been warmer than the one before it and both day and night-time temperatures have increased over time.[4]

Another effect of climate change is the increased incidence of extreme climate events, including more frequent, more severe, and longer heat waves. Along with rising average temperatures there has been an increase in extreme nationally averaged daily heat events across all months, including a higher frequency of extremely hot days in the summer.[5] At the same time, the frequency of extremely cold days and nights have declined across Australia.[6]

Due to the “urban heat island" effect, cities are likely to experience some of the worst effects of global warming. Cities create urban heat islands when natural land and greenery is replaced by dense clusters of pavement, buildings, and other surfaces that absorb and retain heat, and further exacerbated by human activities that generate heat, such as transport, industry, and electricity usage. Scientists say the urban heat island effect can raise temperatures in cities by several degrees compared with surrounding areas.[7]

In Australia, the urban heat island effect poses a significant climate threat to human health in growing urban populations. Australia is more urbanised than many countries with the proportion of its people concentrated in cities larger now than at any time in its history, according to government reports.[8]

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Effects of extreme heat

Rising urban temperatures will have a range of adverse impacts, including increased pollution and energy consumption, but its greatest impacts are felt in relation to human health and wellbeing. In Australia, heatwaves have always been a threat to public health, especially to vulnerable social groups, but recently, they have become more dangerous due to their increasing intensity and frequency. Additionally, the effects of a natural heat wave can be made worse by heat islands, especially when there are limited public spaces that provide thermal relief during hot weather.

According to scientific studies, the number of fatalities during heatwaves in Brisbane, Sydney, and Melbourne increased consistently and significantly between 1988 and 2009, underscoring the growing danger of extreme temperatures.[9] The CSIRO further notes that extreme heat has caused more deaths in Australia than any other natural hazard.[10] Other heat-related health complications include general discomfort, respiratory difficulties, heat cramps, heat exhaustion, and non-fatal heat stroke.

Cognitive performance and productivity may be affected by rising temperatures. In such conditions, people who work outside are more vulnerable to illnesses like heat exhaustion and heat stroke and will have greater exposure to air pollution.[11] Heat stress has also been shown to impact cognitive performance, including working memory, information retention and information processing.[12]

Urban heat has broader impacts to the society and wellbeing. Excess urban heat can affect the viability of public spaces and make cities less comfortable, both of which can take an emotional toll on residents. According to a Beijing study into the impact of high urban temperatures on human emotional health, the harsh urban thermal environment was found to make residents more stressed and exhausted, reduced their enjoyment of life, and brought on negative emotions like depression, anger, pain and hostility.[13]

Cooling public spaces

Strategies to improve thermal comfort

Thermal comfort is an important factor in quality of life and economic vitality in cities and is essential to make open public spaces accessible and viable. It is essential that local governments and businesses partner with architects, designers and specifiers to identify efficient, cost-effective solutions that combat the effects of urban heat. Such efforts will be critical to the sustainability of urban developments in the face of climate change.

While there is no single solution, several strategies have been identified to reduce the impacts of urban heat. These strategies include reducing greenhouse gas emissions, increasing vegetation and green spaces, providing appropriate shade structures, outdoor misting systems, using reflective building materials, and incorporating sustainable and water-sensitive design practices into urban planning and new developments.[14]

Why outdoor misting systems?

Studies indicate that misting systems are one of the most effective solutions for cooling public spaces. An outdoor misting system is a type of cooling system that pumps atomised water mist into the air to cool down the surrounding area. As the mist evaporates, it rapidly cools the air, creating a comfortable thermal environment.

Research to date has demonstrated the effectiveness of outdoor misting systems in reducing outdoor temperatures. A case study, published in 2022, was performed in the summertime climate of Tempe, Arizona to measure the impact of evaporative misters on the thermal environment in outdoor restaurants.[15] Microclimate measurements were taken at five restaurants at midday within four types of exposure: misted sun, misted shade, sun only, and shade only. Misters improved thermal conditions based on the set measures across all days, sites, and exposure conditions.

Another experiment, this time in an extreme climate in Chile, highlighted the potential of mist cooling in this environment.[16] The findings showed that misting led to a significant reduction in air temperature, mean radiant temperature and universal thermal climate index, without significant increases in ambient humidity. Results showed over a 15°C cooling effect in all three metrics at peak times.

The data also demonstrates improvements in users' perception of thermal comfort. For example, an experiment, published in 2015, combining a water mist spray with a fan was conducted to cool an outdoor space and evaluate the comfort of 141 participants on hot summer days.[17] It was discovered that the cooling effect of the mist and fan combination was extremely effective, easily surpassing the thermal load of pedestrians, and resulted in almost instant decreases in skin temperature.

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Outdoor misting systems by **Mistafog**

Mistafog provides misting systems for cost-effective cooling for all commercial applications. Systems are specialised to control heat, humidity, odour, outdoor cooling and misting services for a wide range of sectors and applications, including council and public space areas such as parks, playgrounds, shopping centres and alfresco eateries.

Misting or fogging systems as they are sometimes known work the same way as the breeze that would come off the ocean at a coastal location, using adiabatic or evaporative cooling to provide perfect outdoor cooling. Mistafog's high pressure misting lines and nozzles produce ultrafine atomised water droplets that flash evaporate, leaving no water, but ample cooled air to create a comfortable thermal environment for all users.

Mistafog's outdoor cooling systems and outdoor cooling fans are more effective the hotter the weather gets. Because air conditioning systems struggle as the temperature rises, they become very ineffective and costly to run. Mist cooling systems on the other hand, can evaporate more atomised water quicker as the temperature becomes hotter, providing a much bigger difference between the ambient temperature and the comfort temperature that users feel.

To optimise the cooling experience in your outdoor area a Mistafog system comes with controls that help to keep the mist cooling at a level that is ideal for your users and provide optimal cooling. The first of these features is the adjustable run and stop times which allows the system to dispense the maximum amount of atomised water that the area is able to evaporate at any time according to the prevailing temperature. This runtime control then automatically adjusts as the ambient temperature rises.

Mistafog have installed systems in Sydney, Melbourne, Brisbane, Gold Coast, Adelaide, Perth, Canberra and Hobart, but can supply and install anywhere in Australia.

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All information provided correct as of May 2023