

## The Schools Weather and Air Quality (SWAQ) Project

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The Schools Weather and Air Quality project – [www.swaq.org.au](http://www.swaq.org.au) – is a citizen science project funded by the Australian Government's Department of Industry, Innovation and Science as part of the Inspiring Australia – Citizen Engagement Program. The researchers, Angela Maharaj, Melissa Hart, and Giovanni Di Virgillio at UNSW's Climate Change Research Centre, and the ARC Centre of Excellence for Climate Extremes (CLEX), are partnering with Finnish instrument vendor, Vaisala, to create a network of sensors covering 20 primary schools across the Sydney metropolitan region. SWAQ is placing weather and air quality sensors in Sydney schools to collect data for urban climate, meteorology and air pollution research.

The Head of Air Quality at Vaisala, John Liljelund, travelled from Finland to finalise the project's partnership, and issued the following statement: "We are proud and excited to participate in this educational project that we believe will be a great example for schools anywhere in the world on how to develop their science education by partnering with a company with deep roots in innovation and research."

Urbanisation can modify the climate in cities, resulting in the urban heat island (UHI) effect, whereby a city is warmer than the surrounding rural areas. Both temperature and air quality can also vary greatly within a city due to: variations in land-use, surface and geographical characteristics, pollutant emissions and transport infrastructure across the city (Di Virgilio et al. 2018; Hart and Sailor 2009). In most Australian cities, there are not enough places where meteorological and air quality observations are taken to adequately monitor the effects of increased urbanisation.

Despite being Australia's largest city, and undergoing rapid development, Sydney has not been the focus of much research into urban climate or air quality, which is why this SWAQ network is so important. Similar networks have been implemented in cities in other countries (e.g., Birmingham, UK and Victoria BC, Canada), though here SWAQ is using higher quality sensors in order to better support research.

### Citizen Science and Student Engagement

SWAQ is involving school students in the siting and installation of instruments, and analysis of the data in syllabus-aligned classroom activities. Both teachers and students will be able to monitor the conditions at their school in real time, relate changes in concentrations of pollutants to the weather conditions, and observe how the onset of events such as bushfires, heatwaves, or thunderstorms can affect air quality. Researchers will visit the schools to work with students to gather additional local data (e.g., reporting types of land cover around the school). Students

will therefore learn valuable STEM skills through being directly involved in the analysis of meteorological and air quality data collected on their school grounds.

For high school students the project will demonstrate how data collected can be used for *student research* projects involving work on this new, unpublished research. These projects will be tailored for use in NSW Science Year 11 and 12 depth studies, and the new Science Extension initiatives.

SWAQ data will be available freely online via a dedicated website for school and public use. The data will be accompanied by real-time visualisations to illustrate the environmental conditions in a local area.

SWAQ has also been fortunate to have design consultancy company, Tobias, and Data visualisation specialists, 'Small Multiples', join the team to develop effective data visualisations.

As part of its consultation process, SWAQ and Tobias, recently conducted concept testing (pictured) for the website visualisations at UNSW, Sydney with over 30 high school science students selected from a range of schools around Sydney, the Australian Capital Territory and regional NSW.



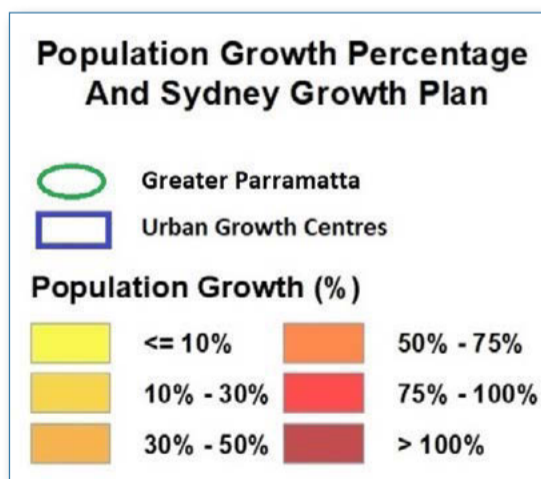
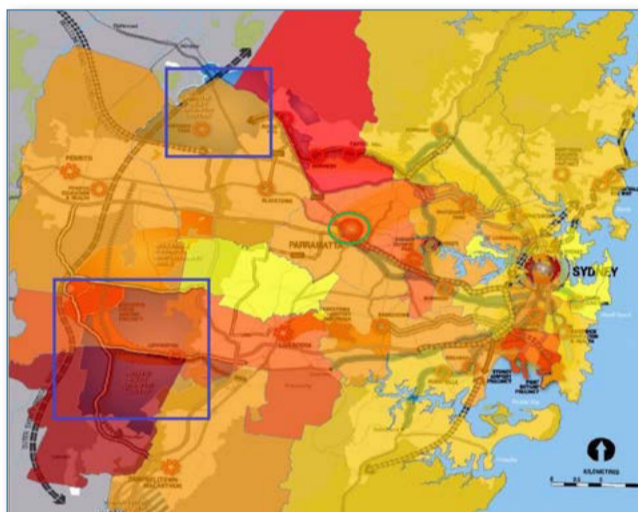
SWAQ concept testing with high school students at CCRC, UNSW Sydney.

### The Science

This project has three key research foci around urbanisation: environmental change, energy use and health. Sydney's population is predicted to grow by 30% within 20 years, most of which is slated for the semi-rural fringes (according to the Greater

## The Schools Weather and Air Quality (SWAQ) Project (continued)

Sydney Commission, 2018). The consequent urbanisation is predicted to adversely impact temperature and air quality in the areas of most rapid population growth. At present the intensity of Sydney's UHI (the temperature difference between the city and its rural surroundings) is difficult to calculate due to a lack of temperature observations in the rural surrounds. The location of Sydney in a coastal basin also complicates factors because a coastal rural site will differ significantly from an inland rural site due to the moderating influence of the ocean and the sea breeze. SWAQ monitoring sites enhance existing air quality and meteorology networks by targeting regions lacking monitoring instruments, specifically urban growth areas and the rural fringe.



*Projected population growth (2036) and areas of planned urban development for Sydney.*

Importantly, SWAQ sensors are sited differently from standard weather stations which are installed away from built spaces. SWAQ is interested in the impacts of the urban environment upon weather and air quality, and thus sensors are to be installed in courtyards, school playgrounds and street canyons, according to the World Meteorological Organisation's (WMO) guidance for observations at urban sites (Oke, 2006).

For the first time the SWAQ network will allow detailed analysis of the impacts of urbanisation on Sydney's weather, climate and air quality. With these observations the magnitude of the urban heat island, and how it differs across the city, can be calculated. The spatial variability of the health and energy impacts of heat and air quality can also be analysed. For example, data collected can be used in research related to the weather-sensitivity of energy consumption, and provide insights into how weather (e.g. heatwaves) may interact with urban air quality to impact human health.

### Get Involved!

The SWAQ team aims to work collaboratively with schools and teachers on the educational components of the project. The team would like to hear from teachers interested in either being part of the primary school observation network (must be in the greater Sydney area), SWAQ outreach and classroom activities on urban climatology or NSW Secondary teachers who are interested in providing input to help develop student projects using the network data.

Please go to [www.swaq.org.au](http://www.swaq.org.au) and sign up to the mailing list.

SWAQ is one of several educational resources supported by CLEX.

(<https://climateextremes.org.au/special-projects/>).

### References:

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