A HEALTH PLANNING TOOL IDENTIFYING AREAS OF NEED AND DISADVANTAGE FOR STORMWATER HARVESTING PLANS

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INTRODUCTION

In Australia, sedentary lifestyles are significantly contributing to an increase in preventable chronic diseases. There is considerable evidence that health inequality is experienced by the socioeconomically disadvantaged (Marmot 2006), with a strong correlation between the environment where people live and health status i.e. physical space and healthy populations. In addition, the impact of deaths with respect to heatwaves is correlated to maximum ambient temperature thresholds and contributed to by the urban heat island effect. Retaining stormwater in the built environment creates better quality greenspace for communities which can facilitate increased physical activity. This has the potential to reduce obesity, cardiovascular disease, diabetes and improve mental health. Greenspace can also assist in reducing the urban heat island effect in built environments, subsequently reducing extreme temperatures and mortality during heatwaves.

In recent times vast urbanisation has taken place around the world and 'demographers estimate that by 2030 approximately two-thirds of all people will live in large towns or cities' (McMichael 2000). Whilst modern 'westernisation' has doubled our life expectancy, it has also created disparities between ancient and present ways of living which has paved the way for the emergence and prevalence of lifestyle related diseases such as type 2 diabetes and heart disease (Pryor 2006). 'Australia is a highly urbanised country, with approximately 90% of the population now residing in towns or cities, thus the experience and contact that the majority of Australian's have with nature is more likely to occur in an urban rather than a rural setting' (Barnett et al. 2006).

The importance of creating supportive environments for health was recognised in the Ottawa Charter in 1986 (World Health Organisation 1986) and as established by the World Health Organisation, the physical environment is one of the major determinants of health, which dictates the health and wellbeing of individuals and a community. Many factors combine together to affect the health of individuals and populations and whether people are healthy or not is determined by their circumstances and environment. 'The context of people's lives determine their health, and so blaming individuals for having poor health or crediting them for good health is inappropriate' (World Health Organisation 2010).

Increasing urbanisation, combined with a spatial planning policy of densification, will mean that more people face the prospect of living in residential environments with limited greenspace (Maas 2006). 'There is evidence that poorer socioeconomic groups tend to have poorer nutrition, less physical activity in leisure time, greater prevalence of smoking and more damaging patterns of alcohol use' (Victorian Government Department of Health 2010). Research has also shown that in metropolitan Melbourne, public open space that supports physical activity are more likely to be situated in higher socioeconomic status neighbourhoods than in low socioeconomic status neighbourhoods (Crawford et al. 2008), therefore ensuring the environment which people live in is supportive will act to increase the health of individuals - especially people from low socioeconomic groups without resources to move to greener areas (Maas 2006).

'Australia has one of the most variable rainfall climates in the world' (Australian Government Bureau of Meteorology 2011). Stormwater offers an alternative water source to drinking water which is especially valuable during sustained periods of drought. Utilising stormwater harvesting can also reduce the volume and speed of flow of water in the drainage system and reduce the amount of pollution reaching our waterways during periods of heavy rainfall (Melbourne Water 2011).

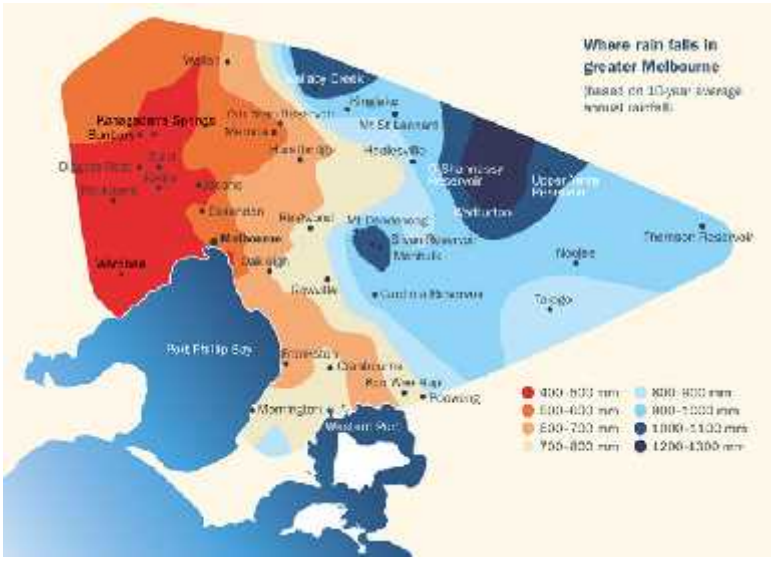
This project developed a health planning tool that supports the identified link between community health and wellbeing and the planning, placement and improvement of green infrastructure. The tool provides a planning mechanism to identify disadvantaged communities and populations at risk of chronic illness and heatwaves. Targeting disadvantaged populations and implementing projects that retain stormwater in the built environment in these communities can create quality greenspace to:

- facilitate an increase in physical activity to reduce obesity and lifestyle-related diseases

- improve mental health
- reduce the heat island effect and morbidity and mortality during heatwaves
- reduce the level of health disparity between communities.

TECHNIQUE

Figure 1: Where rain falls in greater Melbourne



(Melbourne Water 2011)

Figure 1 demonstrates where the majority of rain falls in greater Melbourne. To ensure projects are implemented in areas of greatest need, this tool is being trialled in the western metropolitan region of Melbourne which characteristically has lower rainfall than other regions of Victoria and relatively high levels of disadvantage. Melbourne experiences hotter daytime temperatures over the grassy plains on which the western suburbs are built, compared to one in the treed and forested suburbs in the outer east where higher elevations also have some cooling effect (Australian Bureau of Meteorology 2010).

METHOD

Two different types of datasets have been populated; the first utilises data from within a municipality and the second uses data for local government areas at a regional level. These datasets have been used to generate a mapping overlay that identifies vulnerable populations within communities. On each of the maps, two variables are layered on top of each other to provide graphic representations highlighting populations within municipalities or a region that are disadvantaged and at risk from preventable chronic diseases or heatwaves.

Local government level data

Local government data was assembled at collection district level which is the smallest unit (approximately 225 dwellings) for collection, processing and output of data within the Australian Bureau of Statistics Census. Data from collection districts provide a small enough sample that is representative of areas within a municipality.

Five variables were identified at collection district level for comparison:

1. Index of relative socio-economic disadvantage (IRSED) includes a combination of statistics which are considered to reflect levels of disadvantage such as income level, employment status and education. This combination of statistics reflective of adversity provides an overall level or rating of disadvantage.
2. Population ages by collection district was also utilised as it can identify vulnerable populations such as young children and older residents who are at a greater risk of heatwave morbidity and mortality.
3. Proficiency in English was used to indicate vulnerable populations, as levels of English spoken can show potentially disengaged populations and risk during heatwaves.

4. Population projection data was also utilised as it can identify areas of growth within certain municipalities (population projection to the years 2013, 2018 and 2023).
5. Dwelling characteristics relates to impacts from heatwaves as large blocks of units or houses can trap heat and further increase the heat island effect experienced within an area.

Regional level data

The second dataset was populated for municipalities within the entire Western region and utilises health data such as rates of diabetes, physical activity and mental health status collected in the Victorian Population Health Survey.

At a regional level, five variables were identified to be layered and mapped,

1. The level of self-rated health status as fair or poor. This is valuable as it provides a general depiction of the conceived health status of people within a community.
2. The percentage of persons who are overweight or obese was utilised as it provides a good indication of people that may be at risk of lifestyle diseases and would benefit from increased physical activity.
3. Percentage of persons who do not meet the physical activity guidelines was also used as it provides an ideal representation of people that may benefit from the increase in quality greenspace within a municipality.
4. Percentage of persons who have a high or very high degree of psychological distress was utilised as it can indicate populations that have mental health issues.
5. Prevalence of type 2 diabetes was also utilised as this disease is related to lifestyle and health. Type 2 diabetes results from a combination of genetic and environmental factors although the risk is greatly increased when associated with lifestyle factors such as high blood pressure, being overweight or obese, insufficient physical activity and poor diet (Diabetes Australia 2011).

RESULTS

Utilising the identified variables in a combined and varied manner allowed for the generation of numerous graphical representations which highlight populations that would benefit from stormwater harvesting projects to either facilitate an increase in physical activity or act to reduce the heat island effect.

Figure 2: Index of Relative Socio-Economic Disadvantage (IRSED) and percentage of residents aged over 65 at municipal level

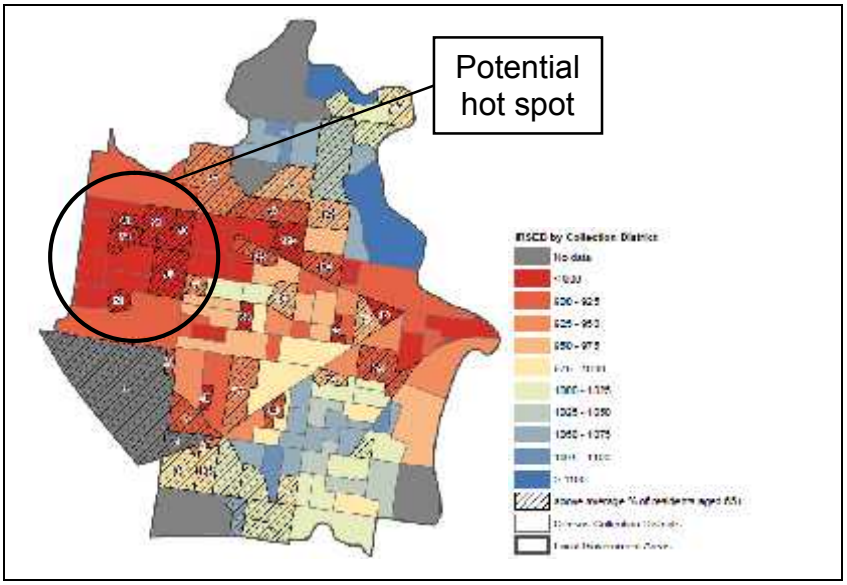


Figure 2 at local government level utilises the variables IRSED and percentage of residents aged over 65 to highlight potential target areas of populations vulnerable to heatwaves. The shaded areas show an above average percentage of aged residents and areas in red are the most disadvantaged. The lower the IRSED value the higher the level of disadvantage.

Characteristically, disengaged and disadvantaged populations are seen to be at a greater risk during times of extreme temperatures and are more likely to suffer from preventable chronic diseases. Lessons learned from several heat waves in the US over the last decade and the European heat wave in 2003, when over

45,000 people died, have indicated that there are common themes in population vulnerability during heat events. The greatest risks appear to be for urban populations, the very young and elderly, persons with chronic disease or disability, and persons living in a built environment that enhances the effects of local weather during heat waves. Additionally, people who are socially isolated are at a greater risk, as are people living in areas of lower socioeconomic circumstance (Loughnan et. al. 2009).

Figure 3: Obesity levels and type 2 diabetes at regional level

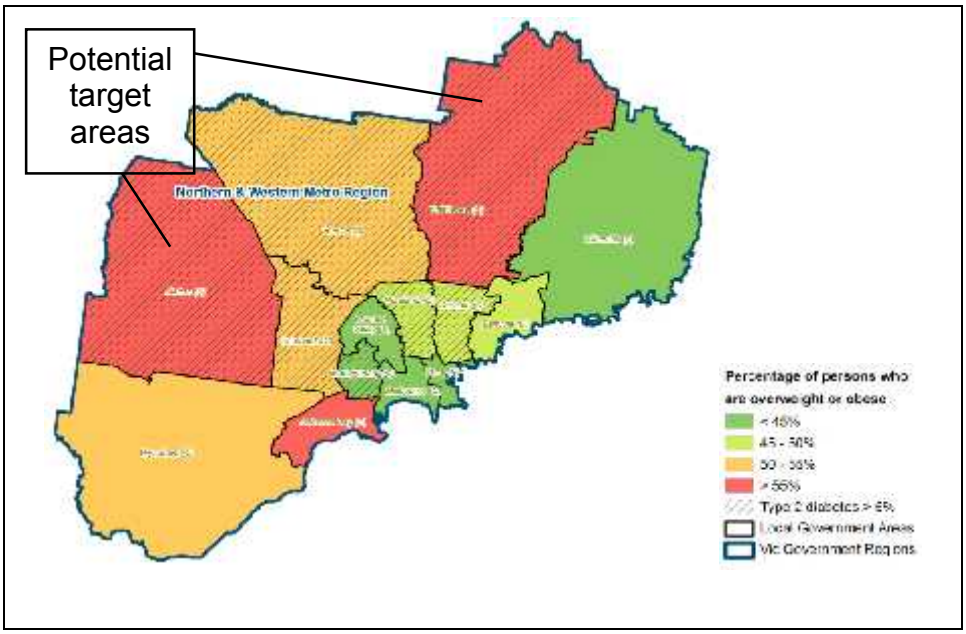


Figure 3 at regional level combines the two variables: obesity levels and type 2 diabetes. Local government areas in red show high levels of obesity and the hatched areas show prevalence of type 2 diabetes above the Victorian state average.

Obesity in Australia has more than doubled in the past 20 years with over seven million adult Australians being overweight or obese (Australian Institute of Health and Welfare 2001). Physical inactivity is responsible for an estimated 8,000 deaths per year in Australia, and costs the health system at least $400m in direct health care costs (Stephenson 2000).

Diabetes is on the rise worldwide and it has been estimated that nearly one million Australians have the condition (Health Insite 2011). Recently published data from the workplace health checks indicate that almost 25% of Victorian workers are currently in the high risk categories for developing type 2 diabetes (Diabetes Australia – Vic 2008). Municipalities showing high levels of obesity and type 2 diabetes should be encouraged to invest in appropriate green infrastructure to facilitate exercise as physical activity can reduce obesity and lifestyle-related diseases.

DISCUSSION

The link between health and access to quality greenspace has been well documented. It is now seen that access to greenspace can not only positively impact the health of an individual but the lack of access can also contribute to a greater disadvantage of already vulnerable populations. Studies have shown that greenspace provides a range of environmental, economic and quality of life benefits for individuals and local communities (Pyper 2004).

Benefits from greenspace include: filtering air pollution, protecting biodiversity, reducing stormwater run-off, and cooling heat islands within cities. Economic benefits arise by making areas attractive to tourism, and through improved real estate prices. ‘Perhaps the most significant gain, however, is made through the effect of greenspace on the physical, spiritual and mental wellbeing of individuals and the community as a whole’ (Pyper 2004). Convenient facilities for physical activity are associated with reduced obesity rates which adds to accumulating evidence that creating supportive environments for health means creating supportive environments for physical activity (Nelson 2009).

A study by Ellaway 2005 utilised data which detailed a link between physical activity and greenspace. For respondents whose residential environment contains high levels of greenery, the likelihood of being more physically active is more than three times as high, and the likelihood of being overweight and obese is about

40% less. Conversely, for respondents whose residential environment contained low levels of greenspace, the likelihood of being more physically active is about 50% less, and the likelihood of being overweight or obese is approximately 50% higher (Ellaway 2005). 'The increase in the incidence of obesity illustrates several aspects of urban living. Among city dwellers, it reflects the combination of easier access to energy-dense processed foods and a decline in physical activity at work, at home, and recreationally' (McMichael 2000).

Contact with nature may also provide an effective strategy in the prevention of mental ill health (Pryor 2006). 'Experiencing nature in an outdoor environment can help tackle mental health problems' (Townsend & Weerasuriya 2010) as improved mental health builds individual self-esteem and self-image, reduces stress, improves concentration, enhances memory and learning and encourages social interaction and development of social skills (Healthy spaces and places 2009). In contrast, less greenspace can mean reduced mental well-being, or at least less opportunity to recover from any mental stresses (Pretty 2004).

It has been well documented that greenspace can assist cooling that may reduce the urban heat island effect. The term "heat island" describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. 'The main contributing factors are changes in the characteristics of the urban surface, replacement of vegetation by asphalt and concrete, and the decrease of surface moisture available for evapotranspiration' (Loughnan et. al. 2009). Increased daytime temperatures, reduced night time cooling, and higher air pollution levels associated with urban heat islands can affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality. Heat islands can also exacerbate the impact of heat waves, which are periods of abnormally hot, and often humid, weather (U.S Environmental Protection Agency 2010).

'Heat-related deaths and illness are preventable yet annually many people succumb to extreme heat' (Centres for Disease Control and Prevention 2009) and the frequency and intensity of heatwaves will likely increase over the coming century as world temperatures rise' (McMichael 2000). South-eastern Australia was affected by one of the most extreme heatwaves in its history in late January and early February 2009. The heatwave extended over 13 days with the last part of the heatwave coinciding with the 'Black Saturday' bushfires in Victoria, which caused the loss of 173 lives and the destruction of over 3,500 structures (Victorian Department of Human Services, 2009). It was estimated that 374 excess deaths occurred in Victoria during the first week of the heatwave prior to any influence from the bushfires (Australian Bureau of Statistics 2010).

The World Health Organisation estimates that the warming and precipitation trends due to human influenced climate change of the past 30 years has already claimed over 150,000 lives annually, (Patz et al. 2005, p.310). Improving and increasing the integration of vegetation and green spaces into our built environment can help adapt our cities to the worst effects of climate change, whilst reducing our urban greenhouse gas emissions (Green Infrastructure Research Group 2009).

CONCLUSION

The rise in sedentary behaviour and chronic disease is paralleled by a decline in physical activity levels (Dollman et al, 2006). Despite the known benefits of physical activity, more than 50 per cent of Australians aged 18–75 do not undertake sufficient physical activity to provide health benefits and 15% have no physical activity in their leisure-time (Australian Institute of Health and Welfare 2011).

'In Australia heatwaves claim more lives than any other natural hazard' (Loughnan et. al. 2009) and already vulnerable populations are at an increased risk during periods of extreme temperatures. This incorporates disengaged and disadvantaged populations including low socioeconomic and non-English speaking populations, children, people aged 65 years and over and those with chronic medical conditions. High density housing such as large blocks of units or houses can trap heat and further increase the heat island effect experienced within an area

In order to address these health issues, evidence (Maller et. al. 2008) suggests that:

- People who live close to green spaces undertake more physical activity and have lower prevalence of disease.
- Well-designed open spaces are restorative, reducing mental fatigue and stress.
- Parks and open spaces also provide a place to socialise and build social networks, explore, have fun, experience contact with nature and escape the indoors.
- Water-sensitive urban design reduces the heat island effect.

Both levels of data can be used individually or collectively to provide valuable maps to identify target areas for heatwave planning and also chronic disease prevention and it is anticipated that this information should be used by those sectors involved in land and water planning. The health related tool across a region can be used to identify municipalities with health and lifestyle related issues. The second tool at collection district level can be used to identify areas of disadvantage and populations at risk, to ensure stormwater harvesting projects are implemented in the areas of greatest need of high quality green infrastructure.

This health planning tool is being developed to support demonstration projects currently underway. It will provide a mapping overlay that identifies areas of highest need through the social determinants of health. Specifically it will endeavour to identify areas where stormwater harvesting plans will enhance the health and wellbeing for those communities in relation to physical exercise and susceptibility to heatwave.

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