Effectiveness of heat adaptation measures for urban areas in an oceanic climate: a systematic review

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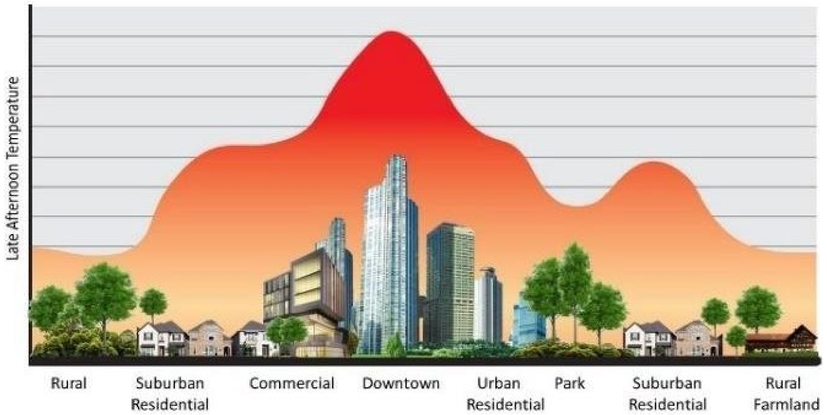

Fig. 1 The Urban Heat Island[3]

Background

- Climate change is causing more frequent and longer lasting heatwaves world-wide[1,2].
- This is particularly relevant for cities due to the urban heat island (UHI) effect, which results in urban areas being significantly hotter than their surroundings[3,4].
- Faced with rising numbers of heat-related illnesses and death, many local authorities are implementing heat adaptation measures[5].

But: do heat adaptation measures actually have an effect? We analysed evaluations of measures implemented in the oceanic/Cfb climate zone[6]

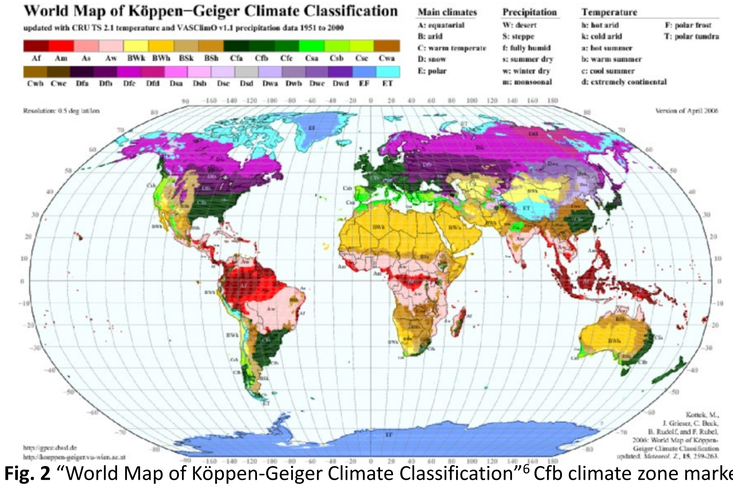

Fig. 2 "World Map of Köppen-Geiger Climate Classification"[6] Cfb climate zone marked in medium-dark green: Main climate class **C** – warm temperature; Precipitation class **f** – fully humid and Temperature class **b** – warm summer

"Respondents unanimously felt that preparing for heat events in the long term is unnecessary in the UK"[13]
While certainly not representative, especially in societies built around colder climates temperatures do not need to rise by much to have significant effects on the population[32].

Conclusion

There appears to be a marked lack of urgency in the majority of countries within the oceanic climate zone regarding heat adaptation measures.

Meanwhile, there should be:

More education

More / better urban green

Continuation / establishing of warning systems

Further research

Also, there could be:

Synergies in the fight against both air pollution and heat

Synergies in the fight against both obesity and heat

[27]

„Currently, public health efforts in response to heat focus primarily on reactive measures to cope with heat […] rather than long term adaptation to recurring heat waves"[13]
Lives are put at risk due to a lack of acknowledgement of the dangers of heat.

Type of review	Systematic Review, following PRISMA guidelines[7]
Databases	• 5 bibliographic (Cochrane, Embase, Pubmed, Scopus, Web of Science) • 3 grey (Climahealth, Climate Adapt, GHHIN, NIHHIS • 3 organisations (WHO, IMF, World Bank)
Inclusion criteria	• Primary research • Purposefully implemented measures • Measures in urban areas • Located in the oceanic/Cfb climate zone • Reporting on direct (e.g. heat stroke prevention) and/or indirect (e.g. lowering night-time temperatures to alleviate heat stress) human health outcomes • Containing evaluative elements
Studies identified	2945
Studies removed - title & abstract screening	2819
Studies removed - full text screening	109
Studies included	**17**

Fig. 3 Methods and screening – brief overview

Results

The measures investigated vary widely but can be summarised as:
Personal adaptation[9,10,11,12,13,14] – (see Fig. 4) Studies also suggest a need for more education on heat[9,13,14] and protective effects of personal fitness[11,13]).
Vegetation/urban green[15,16,17,18,19] – all reports suggest positive physical and psychological effects regarding relief from heat stress and a need for more and well-planned public green spaces.
Heat warning systems[20,21,22] - appear effective in reducing heat-related mortality, although confounders can not be ruled out
District cooling[23] - confirms effects of urban green, especially compared to artificial shading
Road humidification[24]- suggests a small reduction in road surface and overall temperature
Effects of Covid-19 restrictions[25] - confirm mitigating effects on UHI

Within daily routines	Changes to daily routines	Technical / Mechanical	Longer-term measures
Taking in more fluids Eating lighter meals Physically cooling the body - wetting skin - Bathing forearms/ feet - showering - swimming	Moving activities/ work to cooler times of the day Moving to cooler spaces (e.g. basements) Reducing activity, avoiding exertion Taking breaks Avoiding direct sun Avoiding being outdoors	Shading rooms Airing rooms at night Using a fan Suspending wet towels Using air conditioning	Improving physical fitness Avoiding use of south-westerly facing rooms as bedrooms

Fig. 4 Summary of suggested behaviours to relieve heat effects[9,10,12,13], divided into ease of implementation[26]

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