

Climate change and its environmental impacts – methodological approaches

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OUTLINE

- Research approaches: meteorological vs. remote sensing
- Spatio-temporal scales: micro, urban, regional to global
- Knowledge gaps

MONITORING ENVIRONMENTAL CONDITIONS

Using both meteorological and remote sensing measurements





The Urban Heat Island (UHI)



The most studied phenomenon of urban climate research

Increased air temp. in the urban area, being maximal in the central urban district (CBD), in comparison to the rural area

Note the cooling effect of parks (PCI) due to shading & evapotranspiration

How do we identify the UHI and its intensity?



- Note the large temp. variations of the surface layer during daytime compared to the air temp. showing Cool Island within the "urban canyon" (Urban Canopy Layer, UCL)
- Though there is higher agreements during nighttime, still large variations are well seen
- Air temperature is measured at different levels of the city (e.g., the UBL) and the peak UHI of air vs. surface temperatures appears in different hours and intensity

Voogt, 2004 http://www.ucar.edu/learn



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Shading: a dominant feature within urban areas



Urban Green Infrastructure as a tool for urban heat mitigation: distribution of studied variables (90 researches)



THERMAL COMFORT

The state of mind which expresses satisfaction with the thermal environment (ASHRAE, 2004)



The relations between calculated PMV and predicted percentage dissatisfied

Pearlmutter et al. 2010

An example from a park studied in Jaffa (Saaroni et al. 2015)







No difference in the air temp. above grass (green) and paved (red) surfaces

However, pronounced difference between the temp. of the **paved surface** (right) and the **non-irrigated grass** (left)





Though no differences in air temperature, differences in the **subjective comfort perception** during noon time are well seen (related also to psychological aspects) The impacts of pine forest thinning on micro-climate and ant community Research Area: Kedoshim Forest - Long-term Ecological Research (LTER)



STUDY METHODOLOGY

Monitoring through different weather conditions using the long-term meteorological station



High resolution micro-scale measurements (air, surface and under-surface)



Ants sampling and laboratory data analysis













Aiming to reveal the controlling factors

Thermal distribution of the different substrates



exposed to the sun

shaded

Micro-climate thermal differences were found to affect the diversity, composition and structure of ant community though not the number of species and appearances

KNOWLEDGE GAPS

- Methodologies for estimating the <u>combined effect</u> of surface & air monitoring at **larger scales** (e.g., city-scale)
- Factor separation methodologies for understanding the controlling factors of environmental/ecological systems
- Quantifying **future scenarios** (e.g., of the contribution of types of UGI to urban heat mitigation), based on output of **climate models**
- Methodologies for evaluating the **applicability** of translating the general principles found into a set of **practical rules**, e.g., for city planners and managers



THANKS

