2.14 Daily Temperature Range (DTR)

Project Name: UNaLab (Grant Agreement no. 730052)

Author/s and affiliations: Laura Wendling[1], Ville Rinta-Hiiro[1], Maria Dubovik[1], Arto Laikari[1], Malin zu-Castell Rüdenhausen[1], Ana Ascenso[2], Silvia Coelho[2], Ana Isabel Miranda[2], Peter Roebeling[2], Ricardo Martins[2], Rita Mendonça[2]

[1] *VTT Technical Research Centre Ltd, P.O. Box 1000 FI-02044 VTT, Finland*

[2] *CESAM – Department of Environment and Planning, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal*

Daily temperature range (DTR) – Direct measurements	**Climate Resilience**
Description and justification	Nature-based solutions can support climate change adaptation by reducing local ambient air temperature. They can also provide insulation from cold and/or shelter from wind. By moderating the urban microclimate, green infrastructure can support reduction in energy use and improved thermal comfort (Demuzere et al., 2014).
Definition	The range between minimum and maximum mean monthly local temperatures determined by direct measurement (°C)
Strengths and weaknesses	+ Straightforward assessment of ambient air temperature + Reliable in the long run - Requires a rather large amount of monitoring stations to be installed to monitor various NBS intervention areas
Measurement procedure and tool	Ambient air temperature can be assessed through continuous monitoring of temperature, near the NBS intervention area, and calculation of the average minimum and maximum monthly temperature before and after NBS implementation. The daily temperature range (DTR) is calculated as $$DTR_j = \frac{\sum_{i=1}^{I} (TX_{ij} - TN_{ij})}{I}$$ where TX_{ij} = daily maximum temperature on day *i* in period *j* TN_{ij} = daily minimum temperature on day *i* in period *j* *I* = the number of days in period j
Scale of measurement	Plot to district scale
Data source	

Required data	Automated continuous monitoring of ambient air temperature
Data input type	Quantitative
Data collection frequency	Annually; at minimum, before and after NBS implementation
Level of expertise required	Low
Synergies with other indicators	Evaluated from *TX_x, Monthly mean value of daily maximum temperature, TN_n, Monthly mean value of daily minimum temperature*; related to *Warm spell duration index (WSDI)* indicator
Connection with SDGs	SDG 3 Good health and well-being, SDG 11 Sustainable cities and communities, SDG 13 Climate action
Opportunities for participatory data collection	Participatory data collection is feasible through direct temperature measurements if these are not automated
Additional information	
References	http://etccdi.pacificclimate.org/list_27_indices.shtml Demuzere, M., Orru, K., Heidrich, O., Olazabal, E., Geneletti, D., Orru, H., Faehnle, M. (2014). Mitigating and adapting to climate change: Multi-functional and multi-scale assessment of green urban infrastructure. Journal of Environmental Management, 146, 107-115.

2.15 Cooling of ambient air

2.15.1 Air cooling

Project Name: Naturvation (Grant Agreement no. 730243)

Author/s and affiliations: Peter Olsson[1]

[1] *CEC – Centre for Environmental and Climate Research, Lund University, Lund, Sweden*

Air cooling (°C)	**Climate Resilience**
Description and justification	The air cooling indicator measures the lowering of air temperature by a nature-based solutions (NBS). Green and blue infrastructure can cool the air by providing shade and by evapotranspiration, the process by which water is transferred from the land to the atmosphere by evaporating from the soil, water surfaces or plants (e.g., 1). Cooling the air can be a climate action for adaptation to