

model. *International Journal of Remote Sensing*, 25(1), 129–143.

Russo, S., Dosio, A., Graversen, R., Sillmann, J., Carrao, H., Dunbar, M.B. ...Vogt, J.V. (2014). Magnitude of extreme heat waves in present climate and their projection in a warming world. *Journal of Geophysical Research: Atmospheres*, 119(22), 12500–12512.

Weather Research and Forecasting Model (WRF):
<https://www.mmm.ucar.edu/weather-research-and-forecasting-model>

2.10.3 Thermal Storage Score

Project Name: Nature4Cities (Grant agreement: No. 730468)

Author/s and affiliations: Florian Kraus¹, Bernhard Scharf¹

¹ *Green4Cities GmbH/GREENPASS GmbH*

Thermal Storage Score	Climate Resilience
Description and justification	The TSS (Thermal Storage Score) is one out of five Key Performance Scores of the GREENPASS® system. It expresses the stored energy within materials in an urban area. A high value indicates elevated probability of overheating and urban heat island risk. The indicator is relevant for the urban heat island mitigation and influenced by the application of NBS.
Definition	The TSS (Thermal Storage Score) describes the stored energy in urban materials on a standardized heat day.
Strengths and weaknesses	+ worldwide standardized key performance score regarding thermal storage capacity and energy + easy for communication and decision-making + useful for design optimization - needs simulation
Measurement procedure and tool	- modelling, simulation tools and GREENPASS® analysis and calculation - numerical value in J
Scale of measurement	Object and neighbourhood scale
Data source	
Required data	- air temperature (Ta) - incoming shortwave radiation (direct & diffuse) - physical parameters of surfaces and materials

	<ul style="list-style-type: none"> - project area incl. geo-position - NBS typology
Data input type	<ul style="list-style-type: none"> - climate framework conditions (solar irradiance, windspeed, relative humidity, air temperature, ...) - 3d model with surface and vegetation types incl. characteristics
Data collection frequency	- one to several times in planning and optimization process
Level of expertise required	easy understand – for planners and decision makers
Synergies with other indicators	-
Connection with SDGs	SDG 11 Sustainable Cities and Communities, SDG 13 Climate action
Opportunities for participatory data collection	-
Additional information	
References	<p>Kraus, F. (2017): The GREENPASS® Methodology. Pan European Network – Government 23 publication. October 2017.</p> <p>Scharf, B.; Schnepf, D. (2017): H2020: Special Report: Greenpass – unleash the power of green.</p> <p>Scharf, B. (2018): Coole Städte planen – Mit der „Greenpass-Methode“. Neue Landschaft 01/2018. ISSN 0548-2836. Patzer Verlag. Berlin-Hannover. 2018.</p> <p>Scharf, B.; Kraus, F. (2019): Green Roofs and Greenpass. Buildings 2019, 9, 205.</p> <p>Elagiry, M.; Kraus, F.; Scharf B., Costa, A.; De 2019 Lotto, R. (2019): Nature4Cities: Nature-Based Solutions and Climate Resilient Urban Planning and Modelling with GREENPASS® - A Case Study in Segrate/Milano/IT. 16th IBPSA - International Building Performance Simulation Association Conference.</p> <p>Kraus, F.; Scharf, B. (2020): IT-gesteuerte Natur in der dichten Stadt. Neue Landschaft 01/2020.</p> <p>Kraus, F.; Scharf, B. (2019): Management of urban climate adaptation with NBS and GREENPASS®. Geophysical Research Abstracts. Vol. 21, EGU2019-16221-1, 2019 EGU General Assembly 2019.</p> <p>Kraus, F.; Scharf, B. (2019): Climate-resilient urban planning and architecture with GREENPASS illustrated by the case study 'FLAIR in the City' in Vienna. OP Conf. Ser.: Earth Environ. Sci. 323 012087.</p> <p>Kainz, A.; Hollosi, B.; Zuvela-Aloise, M.; Kraus, F.; Scharf, B.; Tötzer, T.; Züger, J.; Reinwald, F. (2019): Modelling the effects of implementing green infrastructure to support urban</p>

	<p>climate change adaptation and resilient urban planning. EMS Annual Meeting Abstracts Vol. 16, EMS2019-341, 2019.</p> <p>Nature4Cities, D2.1 - System of integrated multi-scale and multi-thematic performance indicators for the assessment of urban challenges and NBS.</p> <p>https://www.nature4cities.eu/post/nature4cities-defined-performance-indicators-to-assess-urban-challenges-and-nature-based-solutions.</p> <p>Nature4Cities, D2.2 - Expert-modelling toolbox</p> <p>Nature4Cities, D2.3 – NBS database completed with urban performance data</p> <p>https://www.nature4cities.eu/post/applicability-urban-challenges-and-indicators-real-case-studies</p> <p>Nature4Cities, D2.4 - Development of a simplified urban performance assessment (SUA) tool</p>
--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

2.10.4 Thermal Load Score

Project Name: Nature4Cities (Grant agreement: No. 730468)

Author/s and affiliations: Florian Kraus¹, Bernhard Scharf¹

¹ Green4Cities GmbH/GREENPASS GmbH

Thermal Load Score	Climate Resilience
Description and justification	<p>The TLS (Thermal Load Score) is one out of five Key Performance Scores of the GREENPASS® system.</p> <p>It enables a statement regarding the contribution of the area to the urban heat island and the thermal load emitted to adjacent and surrounding areas. It's typically assessed for a project area on a heat day (30°C). The cooling capability of NBS has positive influence on the thermal load score and is important for climate adaptation. It's a crucial indicator that describes the impact of retrofit and new urban developments on the urban climate.</p>
Definition	<p>The TLS (Thermal Load Score) describes the mean difference (Delta K/C°) between the hourly average In- and Out-flow Air temperature of an area, from the ground to the roof level (of highest building in area) over the day (typical heat day).</p>
Strengths and weaknesses	<ul style="list-style-type: none"> + worldwide standardized key performance score regarding thermal load, air temperature and cooling capability of NBS + easy for communication, understanding and decision-making