

Sentinel settlement indicators for monitoring of the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals

Thomas Kemper, Aneta J. Florczyk, Martino Pesaresi

¹ Joint Research Centre, Via E.Fermi 2749, TP267, I-21027 Ispra (VA), Italy

{thomas.kemper,aneta.florczyk,martino.pesaresi}@jrc.ec.europa.eu

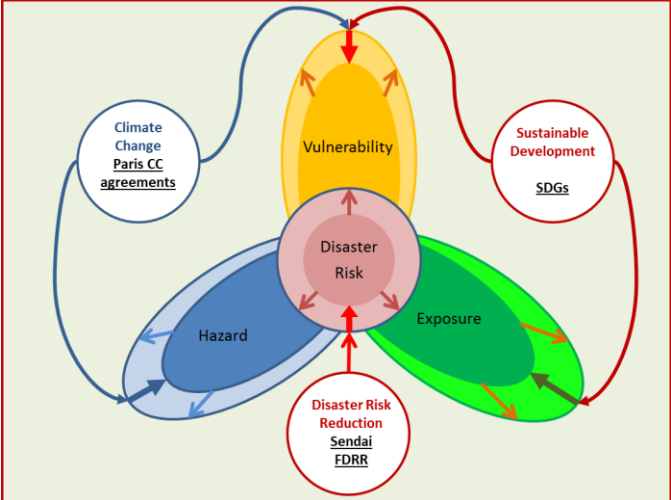
Abstract

In 2015 the United Nations adopted the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals. Both are accompanied by targets and will be further elaborated through indicators that are action oriented, global in nature and universally applicable. For several of these indicators adequate data is available only from remote sensing, in particular for human settlements. However, although there is a plethora of satellites producing images of the Earth at different spatial resolutions there is today no system that is monitoring globally and consistently human settlements.

This presentation describes an innovative concept for the mapping of human settlements at regional and global scales. The Global Human Settlement Layer (GHSL) concept was implemented and tested at the JRC using new, in-house developed methods for information extraction. The methods are based on image data sequencing and symbolic machine learning by association analysis. These techniques are well established tools in, for example, genome characterization studies, but so far not used in the remote sensing domain.

As a result of the open and free data access policies of the United States (for Landsat) and the European Union (for Sentinel) it is for the first time possible to produce with these methods cost-effective fine-scale global and regional settlement information. At the global scale the settlement maps were produced with historical Landsat data that go back to the beginning of civilian Earth Observation in the 70ies; collections of the year 1975, 1990, 2000, and 2014 were processed. The monitoring of future developments relies on the European Sentinel-1 and Sentinel-2 satellites of the Copernicus Programme with the first global update produced by the end of 2016.

However, providing global information is not sufficient for policy support. Therefore, indicators were developed in collaboration with decision makers that are ready for uptake in international frameworks such as Sendai or the SDG's. The presentation provides examples of such indicators and how they are integrated in the international frameworks.



Re-drawn from (IPCC, 2012 and Understanding Risk, 2012)

Figure 1. GHSL supporting international frameworks.

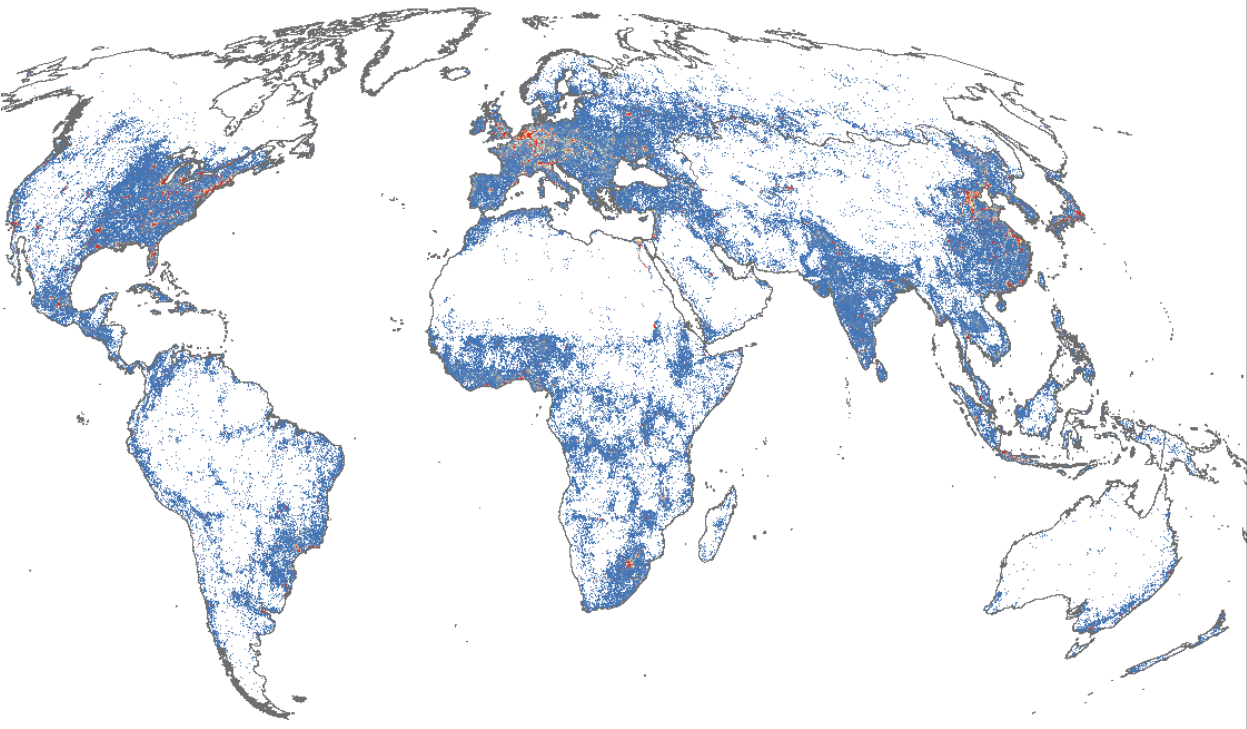


Figure 2. Global Human Settlement Layer.

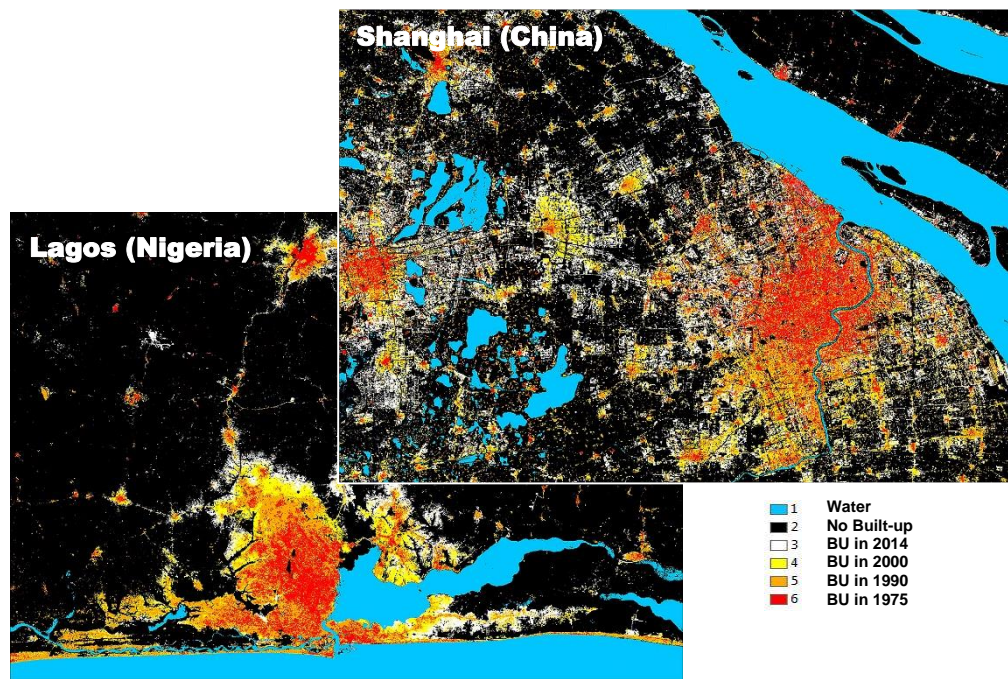
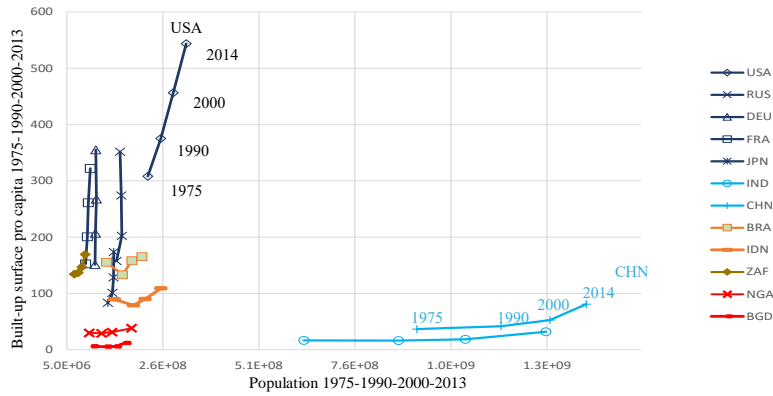


Figure 3. Urbanization trends 1975-2014 (GHS-BUILT multi-temporal).

**National development trajectories
on built-up pro capita and population growth**



Built-up vs. GDP pro capita

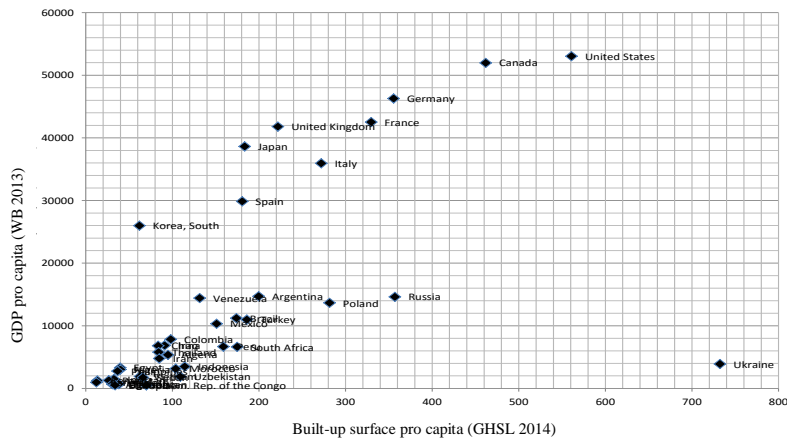


Figure 4. Indicator creation capacity.

Bibliography

M. Pesaresi, G. Huadong, X. Blaes, D. Ehrlich, S. Ferri, L. Gueguen, M. Halkia, M. Kauffmann, T. Kemper, L. Lu, M.A. Marin-Herrera, G.K. Ouzounis, M. Scavazzon, P. Soille, V. Syrris and L. Zanchetta, A Global Human Settlement Layer From Optical HR/VHR RS Data: Concept and First Results. *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.* (6):2102–2131, doi:10.1109/JSTARS.2013.2271445, 2013.

M. Pesaresi, D. Ehrlich, S. Ferri, A.J. Florczyk, S. Freire, F. Haag, M. Halkia, A.M. Julea, T. Kemper and P. Soille, Global Human Settlement Analysis for Disaster Risk Reduction, *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XL-7/W3, 837-843, doi:10.5194/isprsarchives-XL-7-W3-837-2015, 2015.

M. Pesaresi, S. Ferri, D. Ehrlich, A.J. Florczyk, S. Freire, M. Halkia, A. Julena, T. Kemper, P. Soille and V. Syrris, Operating procedure for the production of the global human settlement layer from Landsat data of the epochs 1975, 1990, 2000, and 2014, JRC Technical Report 2016.