



## Questions & Answers Part 2

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to Argyro Kavvada ([argyro.kavvada@nasa.gov](mailto:argyro.kavvada@nasa.gov)), Thomas Kemper ([thomas.kemper@ec.europa.eu](mailto:thomas.kemper@ec.europa.eu)), Cascade Tuholske ([cascade@ciesin.columbia.edu](mailto:cascade@ciesin.columbia.edu)), or Dennis Mwaniki ([dennis.mwaniki@un.org](mailto:dennis.mwaniki@un.org)).

Question 1: How do you normalize / unify territorial units between different countries - which may have very different names to call their administrative units

Answer 1: We can keep the original administrative units. The only requirement is that the administrative information covers the full territory of analysis. The normalisation process comes with the generation of the population grid as input to the degree of urbanisation grid. In the final step this is translated back to the administrative units.

Question 2: How does your model deal with human mobility such as moving from one city to another or from different census units within the same city? This is particularly challenging in developing countries which are experiencing a fast urbanization rate, while census are taken place every several years.

Answer 2: The Degree of Urbanisation relies on data collected by the population census. Such a census is repeated only every 10 years. If we experience population movements in the meantime this is not taken into account. This is indeed a problem in many countries where a censuses are often more delayed. To some extent microcensuses that are projected to the full country can compensate for this. This is a problem in many countries.

Question 3: Was the elaboration of Slide 35 on access to green in urban centres part of a publication? Is it possible to share the reference?

Answer 3: *Christina Corbane, Pesaresi Martino, Politis Panagiotis, Florczyk J. Aneta, Melchiorri Michele, Freire Sergio, Schiavina Marcello, Ehrlich Daniele, Naumann Gustavo & Kemper Thomas (2020) The grey-green divide: multi-temporal analysis of greenness across 10,000 urban centres derived from the Global Human Settlement Layer (GHSL), International Journal of Digital Earth, 13:1, 101-118, DOI: 10.1080/17538947.2018.1530311*

Question 4: Can these Rasters be incorporated with open street maps to perform service area analysis for transit systems ?



Answer 4: The degree of urbanisation is a georeferenced product. As such it can be combined with OSM data. However, it is important to remember that the degree of urbanisation is produced always at a spatial resolution of 1 km<sup>2</sup>. This limits very local application.

Question 5: Is it possible to classify informal settlements?

Answer 5: The degree of urbanisation is classifying settlement types by population density regardless of the formality/informality of an area. It cannot be used to identify informal settlements. However, if informal settlements can be classified using data extracted from satellite imagery, such as the built-up data which is also used to disaggregate population (tools such as POP2G is used to do this disaggregation).

There are other classification techniques that are more appropriate for this

(<https://doi.org/10.3390/su132212640>). Here is another report on the classification of formal and informal settlements using higher resolution imagery;

<https://publications.jrc.ec.europa.eu/repository/bitstream/JRC92657/lbna27024enn.pdf>

Question 6: Does the EO toolkit also provide a platform to customize classification of satellite data using python or R libraries?

Answer 6: The toolkit provides a number of tools that can be accessed, but does not offer a processing platform. It points to the original locations of the tools and other resources. You will have to investigate for each of the tools, if also the source code is available. The GHSL tools are mostly provided as compiled programs, but we will also start providing source codes in the future.

Question 7: Which would be the most appropriate pop grid datasets for local and regional analysis?

Answer 7: This really depends on your local use case. There are two excellent references that walk end users through modeling techniques and 'best practices' when it comes to choosing the gridded population product(s) for your use-case.

"Leaving No One Off The Map: A Guide For Gridded Population Data For Sustainable Development" - <https://www.sdsntrends.org/research/leavingnooneoffthemap>

Leyk, Stefan, Andrea E. Gaughan, Susana B. Adamo, Alex de Sherbinin, Deborah Balk, Sergio Freire, Amy Rose et al. "The spatial allocation of population: a review of large-scale gridded population data products and their fitness for use." *Earth System Science Data* 11, no. 3 (2019): 1385-1409.

<https://doi.org/10.5194/essd-11-1385-2019>

You can calculate with a couple so you have a range.



Strymap URL:

<https://storymaps.arcgis.com/stories/55105b97e6e64a02927d6399147e606c>

Question 8: In assessing urban heat island effect in urban areas, can slums be classified as potential heat islands? Is urban heat island effect an urban disaster?

Answer 8: In Europe heat waves have in the past killing more people than other disasters (keeping COVID-19 apart). Most of the people died in urban areas because of the lack of green spaces. So, it is clearly an urban disaster. Per se slums are probably not potential heat islands although the local climate there is often extreme due to the lack of insulation. Urban Heat Island effect and heat health impacts, spatial resolution is at 2m temperature and humidity.

Global inventory of urban heat waves and exposure dataset (2m air and humidity):

Tuholske, C., Caylor, K., Funk, C., Verdin, A., Sweeney, S., Grace, K., ... & Evans, T. (2021). Global urban population exposure to extreme heat. *Proceedings of the National Academy of Sciences*, 118(41).

<https://sedac.ciesin.columbia.edu/data/set/sdei-high-res-daily-uhe-1983-2016>

<https://www.pnas.org/content/118/41/e2024792118.short>

Global urban heat island explorer (Land surface temperature)

Chakraborty, T., & Lee, X. (2019). A simplified urban-extent algorithm to characterize surface urban heat islands on a global scale and examine vegetation control on their spatiotemporal variability. *International Journal of Applied Earth Observation and Geoinformation*, 74, 269-280.

<https://linkinghub.elsevier.com/retrieve/pii/S0303243418304653>

<https://yceo.yale.edu/research/global-surface-uhi-explorer>

Question 9: I would like to know if we can use hexagons as units for analysing urban areas and territories within the tools mentioned today. They have to be 1km area right?"

Answer 9: This is an interesting proposal that we were discussing also when developing the method. We did not follow this approach, because working with hexagons is widely known. But in theory it could work and might provide more realistic results as it smoothes the edges of settlements. If you really need to work on hexagons, you can resample our grids from square to hexagons, being careful to preserve the population volume.



Question 10: Under types of built-up (slide number 18), what criteria is used to classify the built-up areas into residential and non-residential? Some cities have a substantial amount of urban population in informal settlements/slums. Others hardly have defined urban planning and you find residential, factories, warehouses and other commercial entities are found in the same neighborhood.

Answer 10: The classification of residential vs. non-residential areas is mostly based on the size of building complexes. It is mapping mostly larger industrial buildings and complexes. Smaller non-residential areas might not be detected. It would be classified in the current approach as non-residential.

Question 11: How demanding is the POPGRID Viewer in terms of data transfer speed or other PC requirements?

Answer 11: It is fairly fast for most PCs, no matter the internet connection. It can, however, only calculate area-estimates for one polygone at a time. We do however expect to add additional features in the future.

Question 12: How can I use this mapping and tool for urban liveability mapping for block or town level?

Answer 12: POPGRID Viewer contains only pop density estimates that do relate to liveability. The gridded pop datasets are at 1km spatial resolution. The GHSL are the built up areas and population, and greenness (which can be used to estimate livebability. If you have access to supplemental local datasets, try to combine.

Question 13: Even though there is a rapid increase of population in the developing countries which gives rise to so many challenges to the population such as unemployment,high depends on agriculture,which way should be appropriate to enhance the problems using remote sensing and GIS?

Answer 13: We can extract a lot of info from EO (size, density of houses, road networks), but then combine with other open information to address these issues. The Toolkit has a number of filters that can be used to determine which ones may serve as proxies.