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Maps of demand and supply points, as well as district heating and cooling infrastructure

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Abstract
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This document presents the post processing methodology and the validation steps used for data collected for D I.1.1. It accompanies the main deliverable which is a source file of heat maps for dissemination over the web. The source file 'geodatabase CY_heatmaps.gdb' contains georeferenced layers that illustrate the heating and cooling demand and waste heat for the whole country. The layers cover the whole extent of Cyprus and are provided in two levels of detail: The first is the immediate result of the analysis and is provided as a choropleth map on a postal code level (based on the postal code shapefile provided by MECIT). The second level of detail includes further disaggregation of the data within each postal code using the ancillary layers.

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- Kostas Kavvadias
- Mindaugas Jakubcionis
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Abstract

This document presents the post processing methodology and the validation steps used for data collected for D I.1.1. It accompanies the main deliverable which is a source file of heat maps for dissemination over the web. The source file 'geodatabase CY_heatmaps.gdb' contains georeferenced layers that illustrate the heating and cooling demand and waste heat for the whole country. The layers cover the whole extent of Cyprus and are provided in two levels of detail: The first is the immediate result of the analysis and is provided as a choropleth map on a postal code level (based on the postal code shapefile provided by MECIT). The second level of detail includes further disaggregation of the data within each postal code using the ancillary layers.

Construction of heat map

The file geodatabase CY_heatmaps.gdb containsgeoreferenced layers that illustrate the heating and cooling demand and waste heat for the whole country.

The layers cover the whole extent of Cyprus and are provided in two levels of detail: The first is the immediate result of the analysis and is provided as a choropleth map on a postal code level (based on the postal code shapefile provided by MECIT). The second level of detail includes further disaggregation of the data within each postal code using the ancillary layers.The following layers are provided by JRC:

Name	Description	Type
PO_codes	Postal codes (provided by MECIT)	Vector[1]
useful_2013	Useful energy demand per postal code and per end use(kWh)	Table
Biomass_potential	Raster map of solid biomass potential (MJ)	Raster (100m)[2]
Power_plants	Power plants in Cyprus. Electricity production and waste heat (MWh)	Vector[1]
dasy_res_SC	Dasymetric map of residential space cooling (kWh)	Raster (10m)[2]
dasy_res_SH	Dasymetric map of residential space heating (kWh)	Raster (10m)[2]
dasy_res_WH	Dasymetric map of residential water heating (kWh)	Raster (10m)[2]
dasy_ser_SC	Dasymetric map of service space cooling (kWh)	Raster (10m)[2]
dasy_ser_SH	Dasymetric map of service space heating (kWh)	Raster (10m)[2]
dasy_ser_WH	Dasymetric map of service water heating (kWh)	Raster (10m)[2]

[1] Geographic Coordinate System: WGS_1984_UTM_Zone_36N

[2] Geographic Coordinate System: ETRS_1989_LAEA_L52_M10

The table layer useful_2013 consist of the following data:

Name	Sector	Use
agr_SH	Agriculture	Heating
ind_H	Industry	Heating
ind_C	Industry	Cooling
res_SC	Residential	Space cooling
res_SH	Residential	Space Heating
res_WH	Residential	Hot Water
ser_SC	Service	Space cooling
ser_SH	Service	Space Heating
ser_WH	Service	Hot Water

The above-mentioned maps are provided for the selected base year (2013). Ancillary layers such as geographical/topological basemaps are not provided by JRC.

Raster maps need some further postprocessing in order to be "production ready", such as: resampling, boundary cleaning, selection of classes and symbology.

Post processing methodology

The analysis described on the first deliverable (D I.1.1), has been done at a postal code level, which resulted in a choropleth map with an aggregated value of energy use per zone. A modern technique that has been used to improve the spatial distribution of the population in order to provide more accurate data is dasymetric mapping. Ancillary data such as land use are employed to improve the disaggregation process by allowing the discrimination of distinct functional areas and respective densities (Martins, Sousa, & Fragoso, 2012;Gallego, 2010; Batista e Silva, Gallego, & Lavalle, 2013).

Using this technique the heat map was constructed. Energy data were redistributed from choropleth map zones (eg. postal codes) to dasymetric map zones based on a combination of areal weighting and the estimated population density of each ancillary class (Fig. 1).

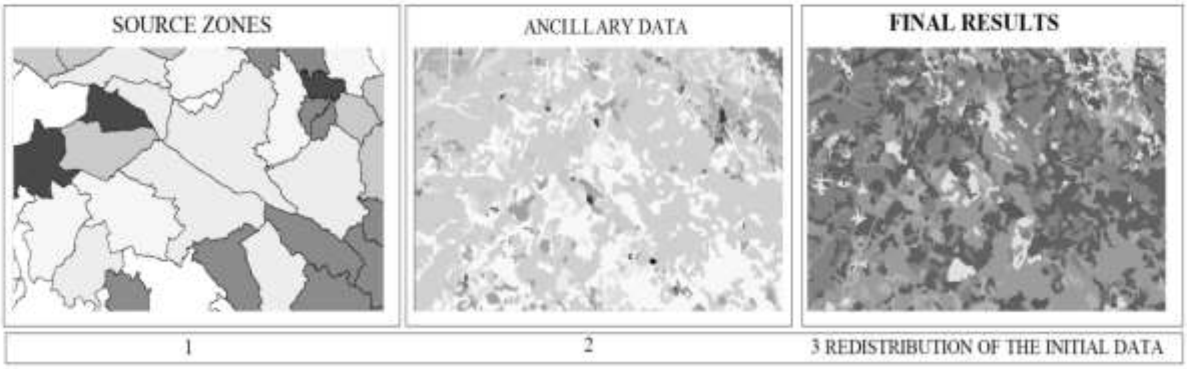

Figure 1. Construction of Dasymetric map.

As ancillary data weighting factors, information about built-up area from JRC's Global Human Settlement Map was used. All layers were masked by Corine land uses so that only relevant land use classes were used: e.g. Areas marked as industrial zones were excluded from the residential heat maps. The final resolution of the raster map grid is a 10x10m. From the three (space heating, space cooling, sanitary hot water) choropleth maps per sector, the final maps were produced.

Validation

The resulted dasymetric maps were checked for consistency from the derived choropleth maps. For that purpose the energy per postal code was aggregated per postal code (Zonal Statistics) and compared with the one from the choropleth. Overall there was 0.3% difference between the two layers. The smaller postal codes had bigger divergence (up to 20%) due to errors caused in their boundaries. The scatter plot in Figure 2 shows the consistency of the two layers. Each dot represents a postal code. The closer each dot to the black curve, the higher the convergence of the dasymetric and the choropleth map for this postal code. Thus, it can be safely assumed that the produced map is accurate for visualization purposes.

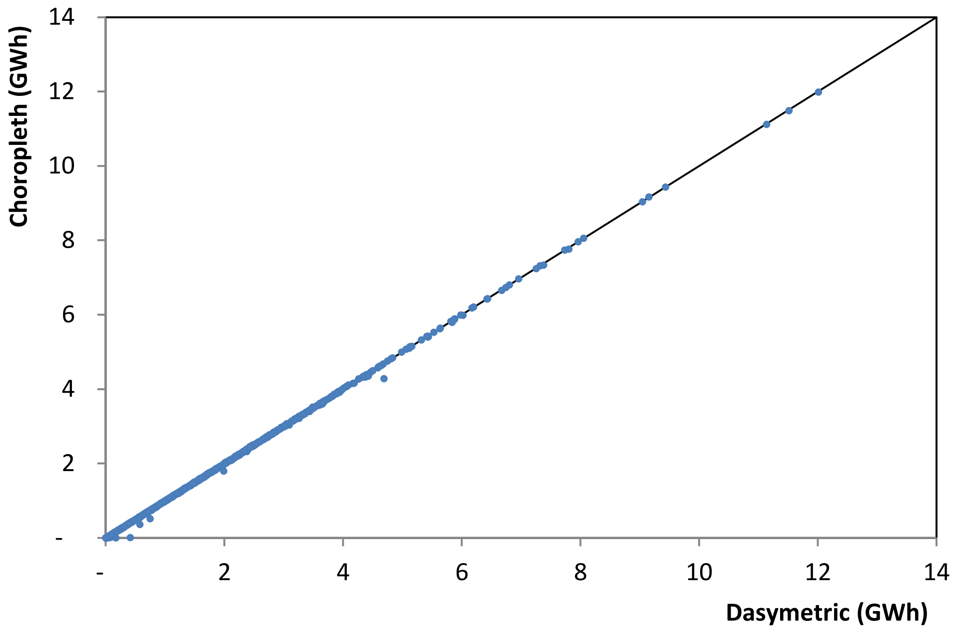

Figure 2. Validation of results.

References

Gallego, F. J. (2010). A population density grid of the European Union. Population and Environment, 31(6), 460-473.

Martins, M. d., Sousa, A. M., & Fragoso, R. M. (2012). Redistributing Agricultural Data by a Dasymetric Mapping Methodology. Agricultural and Resource Economics Review, 41(3), 351–366.

Batista e Silva, F., Gallego, J., & Lavalle, C. (2013). A high-- resolution population grid map for Europe. Journal of Maps.

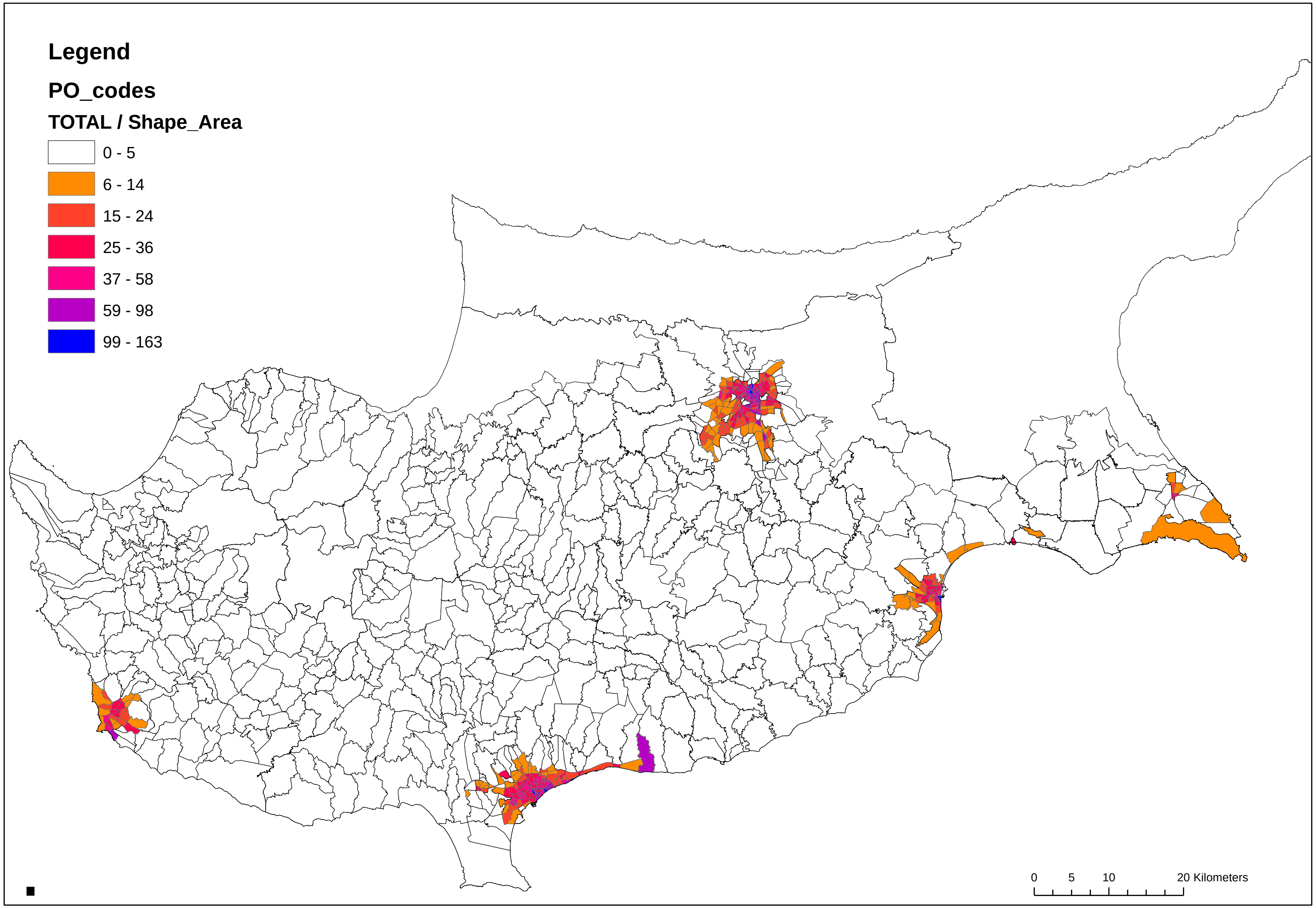

Figure 3. Sample Results: Heating and cooling demand per postal code (kWh/m2).

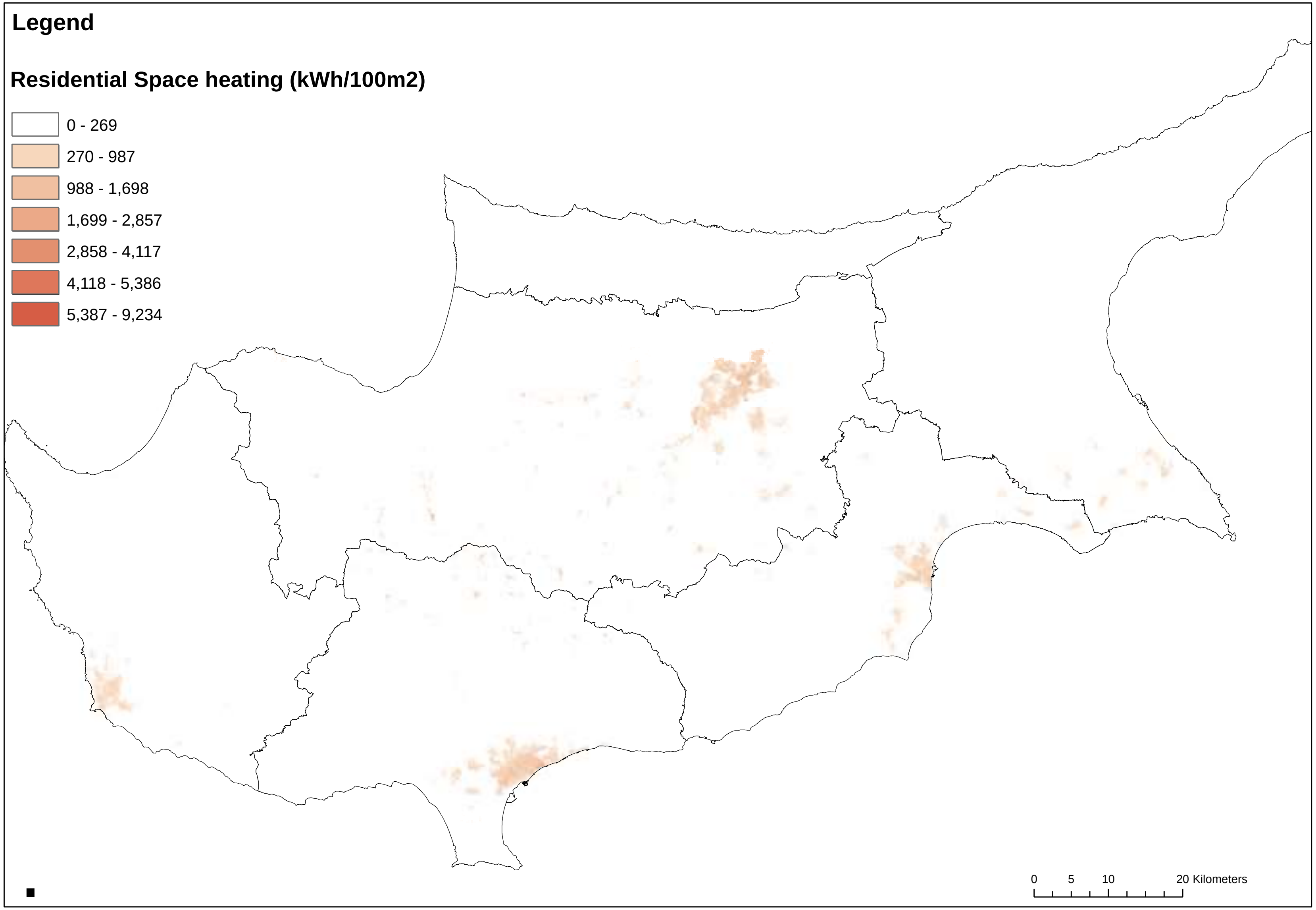

Figure 4. Sample Results: Residential Space Heating demand (kWh/100m2).

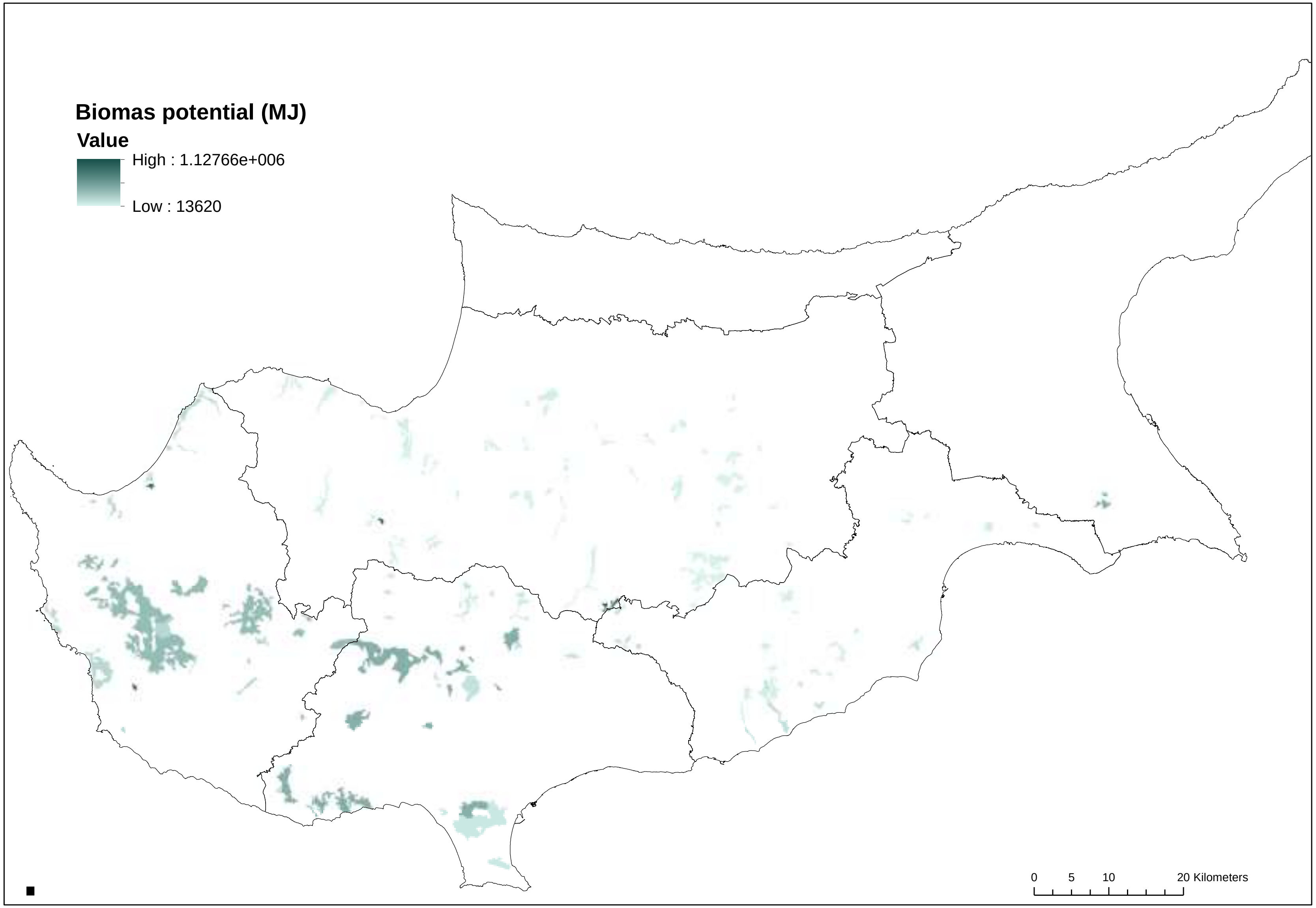

Figure 5. Sample Results : Biomass potential (MJ).

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