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Method for Initial Heat Mapping of the Western Region

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Background to Heat Mapping

This is a part of the wood energy support services package delivered under the RASLRES European project.

The project brief requires a regional market profile of existing and potential heat users from the private and public sectors, focusing primarily on small to large scale commercial and industrial heat users. This should inform the long term planning of the bioenergy heating market in the region.

Objectives of a Heat Map

A heat map as construed here is a visual GIS interpretation of regional commercial and industrial heat users. In general, if a detailed localised heat map can be developed, it can support the following important energy policy aims:

- facilitate planning policies which promote district heating and/or cooling
- inform development of new heat networks;
- aid the development of Combined Heat & Power and Biomass schemes;
- assist planning of Energy from Waste locations;
- link heat demands with efficient sources of heat;
- aid better optimisation of heat, diversity of fuels etc

A top-down summary of energy balances and thermal demand for the region at a county level has been completed, and a bottom-up indication of heat end-users is done using a heat mapping methodology based on marketing databases. The methods used here can be considered experimental only and by their nature do not produce accurate results, but rather a general outline of the main identified heat users in the region.

There is an urgent need for improved regional data at county and sub-county level. It is our opinion that an accurate heatmap over a large region can only be prepared on foot of detailed, structured and formal survey methods, such as those employed by the Central Statistics Office (CSO).

Existing Heat Mapping Initiatives in Ireland

In the Irish context, there are a number of localised heat mapping projects underway. Some of these are described here.

South Dublin County Council, in association with Sustainable Energy Ireland (SEI) and Institute of Technology Tallaght (ITT), is currently preparing a Pilot Energy Study for the Tallaght area.

The overall study area is approximately 1,010 hectares and there are approximately 580 commercial energy users in the region and 14,000 dwellings. The output from the pilot energy study is expected to be a digital energy intensity map of the area linked to a database. Specified zones within the region will be colour coded to depict annual energy consumption for space heating, hot water production, and electricity consumption. Data compilation is by means of detailed energy survey work within the study area. The project is expected to be completed in 2010 (South Dublin County Council, 2009).

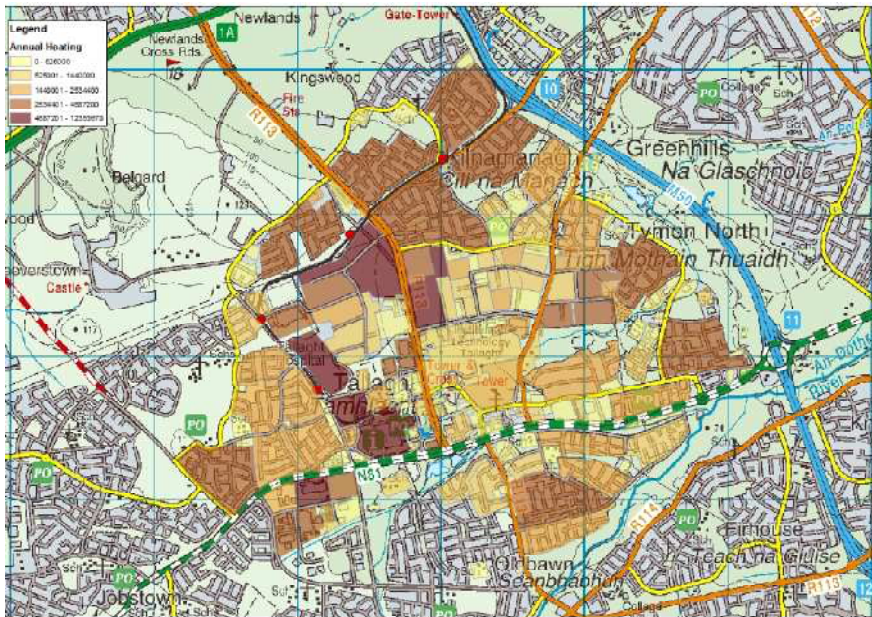


Figure 1: Preliminary Tallaght Energy Intensity Map (Kovera)

A project in Dundalk, is underway as part of an EU-funded project “HOLISTIC” under the Concerto programme. This multi-faceted project involves a significant district heating network. An important part of the process is to carry out detailed energy survey work and identify and map the heat users within the zone. Sustainable Energy Ireland is the lead partner in this EU project and have developed detailed tools for Community-level energy analysis, including the Energy MAP (Meally, 2010).



Figure 2: Dundalk Sustainable Energy Zone (SEI)

Existing Heat Mapping Initiatives in the UK

An extensive urban mapping project in the UK is the London Heat Map, managed by the London Development Agency. This brings together detailed information about building stock, estimates of heat demand and considers in depth networks for development of district heating infrastructure (www.londonheatmap.org.uk). It has been under development since 2005, and is a long-term

interactive project which will gradually become more useful and sophisticated as boroughs and others start inputting real energy data into the map.

A UK-wide industrial heat map has been developed. This is a fairly simple application, which localises the large heat users based on a combination of data from the Environment Agency Pollution Inventory, the Scottish Environmental Protection Agency European Pollution Emission Register submissions and the UK National Allocation Plan. The map identifies around 790 sites. The values given for the heat load at the sites are estimated from the reported emissions of carbon dioxide (www.industrialheatmap.com). It is understood that there is currently a more sophisticated heat map being prepared to replace this version.

A Scottish heat map was prepared in 2007 for the Forum for Renewable Energy Development in Scotland (FREDS) group. The map was produced by AEA Technology and presented to FREDS to support the policy recommendations of the group (FREDS, 2008).

It contains a graphical view of the 1km grid of carbon dioxide emissions data adjusted to represent a proxy for heat use. The company took information on CO₂ emissions across the UK from the National Atmospheric Emissions Inventory (NAEI). This data was manipulated to map heat use and forms the basis of the heat map.

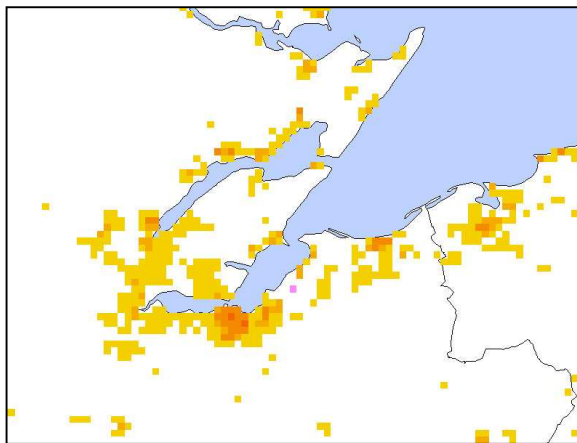


Figure 3: Sample of Scottish Heat Map (FREDS)

A further initiative, currently underway in Scotland, entails a more detailed heat mapping project than the FREDS project, localised in the Highlands council area. The objective is to investigate, determine the potential structure, content and uses of a heat map and produce one for the Highland Council area to a methodology that is repeatable for other Local Authorities. It is expected to be completed in 2010 (Highland Council, 2010).

Methodology for Heat Mapping in the Western Region

The Kompass database of organisations in the Western Region contains detailed marketing information for ~11,000 companies. It is proposed to use this as the basis for an initial demonstration of the heat map concept in the Western Region. It is proposed initially to trial employee number as a proxy for public sector, commercial and industrial heat demand.

Below are outlined, under the relevant heading, some general analysis and parsing of the data to obtain an appropriate sample for digitisation. The data operations are carried out sequentially, using the previous dataset as an input.

Data cleaning

- The data was sorted for unique serial numbers and 18 duplicates deleted – 10,988 unique values remain.
- Contact details and other additional information was removed from the dataset.

Industry sector classification

- There are 66 industry sector category codes in the database. This data is too agglomerated to provide a meaningful analysis regarding likely energy use. The industry categories are not accurately described, with many sites filed under generic headings. More detailed classification data is available to purchase from Kompass, which would enable further classification by target sectors.
- The categories include a number of low energy-intensity categories, such as transport services or construction. After an analysis of a data sample, it was decided to remove a number of categories, as follows, including their Kompass code: 14 Quarried stone; 51 Civil and marine engineering contractors; 52 Building industry; 72 Land transportation; 74 Sea and inland waterway transportation; 76 Supplementary transport services.
- There were a number of locations not classified by sector, which remain in the dataset.
- 10,014 unique locations remain after removing these sectors.

Employee Number

- It was decided to remove all organisations with < 10 employees. The data points are too numerous for effective digitisation if a lower threshold is selected.
- It was considered to amalgamate by District Electoral Division (DED), but a large proportion of the data had no DED identified.
- Filter for ≥ 10 employees :2,826 unique locations remain.
- This operation removed just over 17% of the workforce in the region.

Digitisation Quality

- The latitude and longitude for locations is included within the Kompass dataset.
- A large number of sites were not digitised in the Kompass database. Of the sample with ≥ 10 employees, 611 (22%) were not digitised, including a number of large employers, with a total of 27,168 employees).
- Upon digitisation, 2 further sites were removed which were outside the boundaries of the region and incorrectly digitised.
- It is evident that a number of the remaining points are not accurately digitised – for example Clare County Council is digitised in Inagh, ~12km west of Ennis. Such inconsistencies have not been corrected.

Data aggregation

- The 2 largest remaining employers (HSE & Supermacs) were deleted as they are aggregated figures from multiple smaller sites. There may be a number of further aggregation errors in the data. 2,211 unique locations remain.

Digitising the Data:

The data was transformed from Excel to a visual GIS display using the following steps:

- Export from Kompass Excel database as CSV file
- Use the delimited text plugin to import into GIS software.
- Transform to Irish Grid Co-ordinates TM65
- A graduated symbol, based on employee number was defined, using 4 classes between 10 and 2,000 employees

Results

A number of example maps have been generated for the region, including an overview and one for each county. These samples are included as an appendix.

Conclusions

The following observations are made, particularly regarding using Employee number as proxy for heat demand:

- In the main, employee number gives only a representative visual proxy for commercial and industrial heat demand.
- There are a number of anomalies misrepresenting site heat demand which show up when the data is digitised.
- The primary function of the Kompass database is for marketing purposes. The quality of the database is poor for digitisation purposes. A large part of the sample was not digitised.
- In considering future work, it may be appropriate to ascertain sector-specific benchmark data to create a realistic link between workforce number and/or turnover and energy use within an enterprise.
- A more detailed focus on gathering energy data for a discreet zone may be the most appropriate application of a heat map, as in the London or Tallaght examples outlined.

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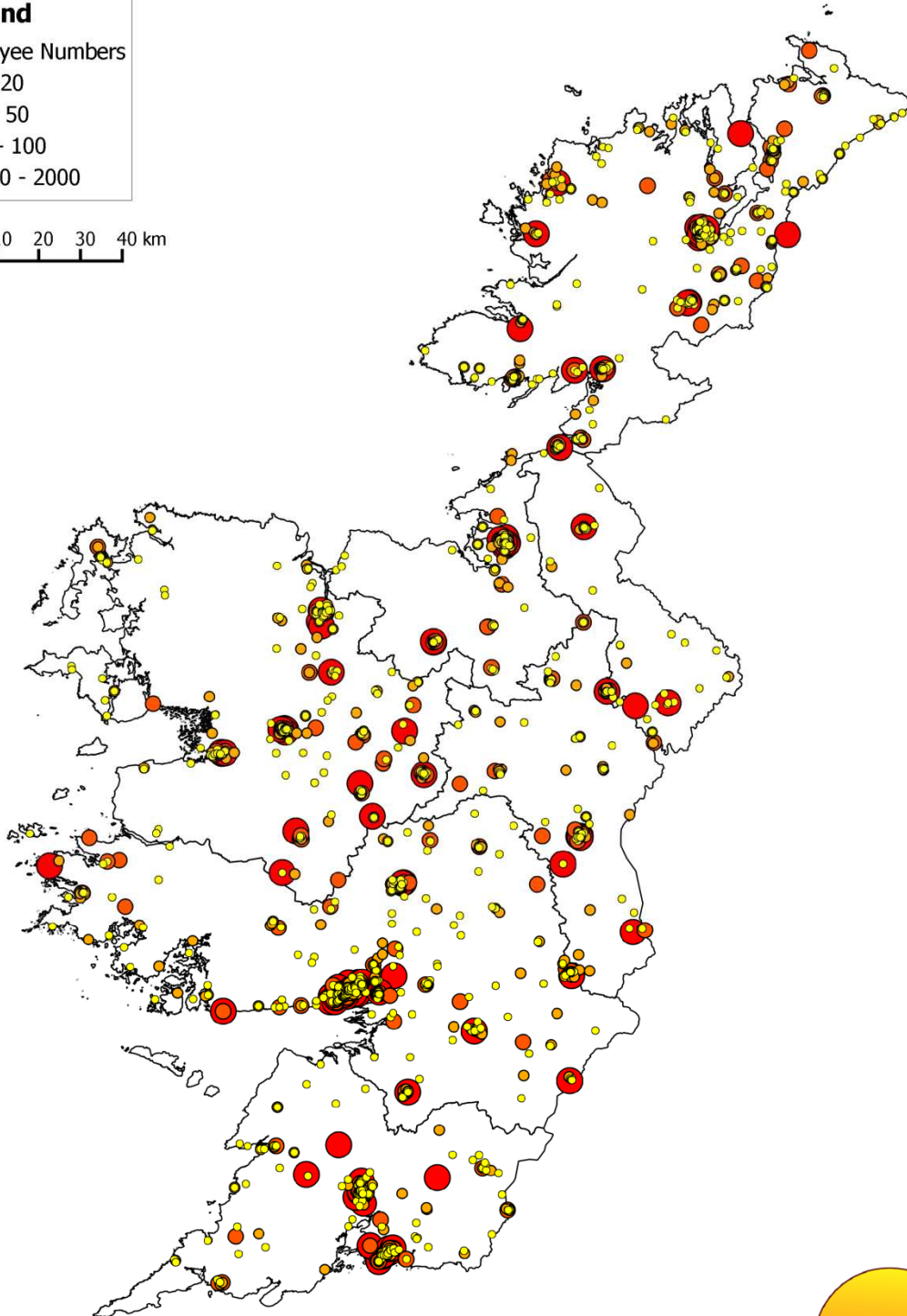
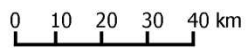
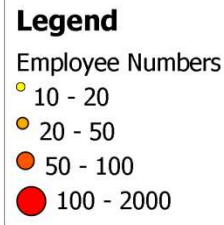
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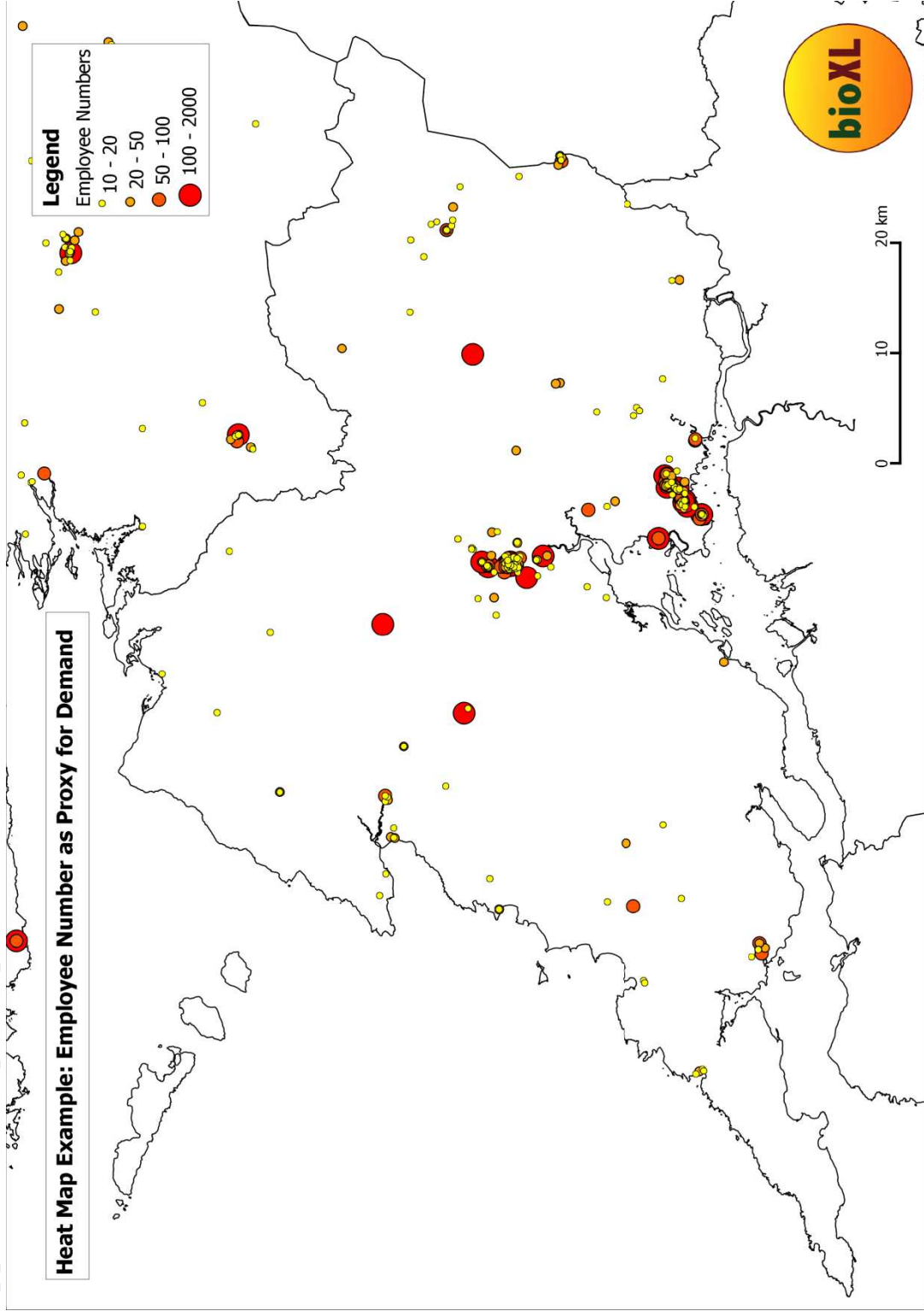
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Appendix 1: Sample Heat Map – WDC Region

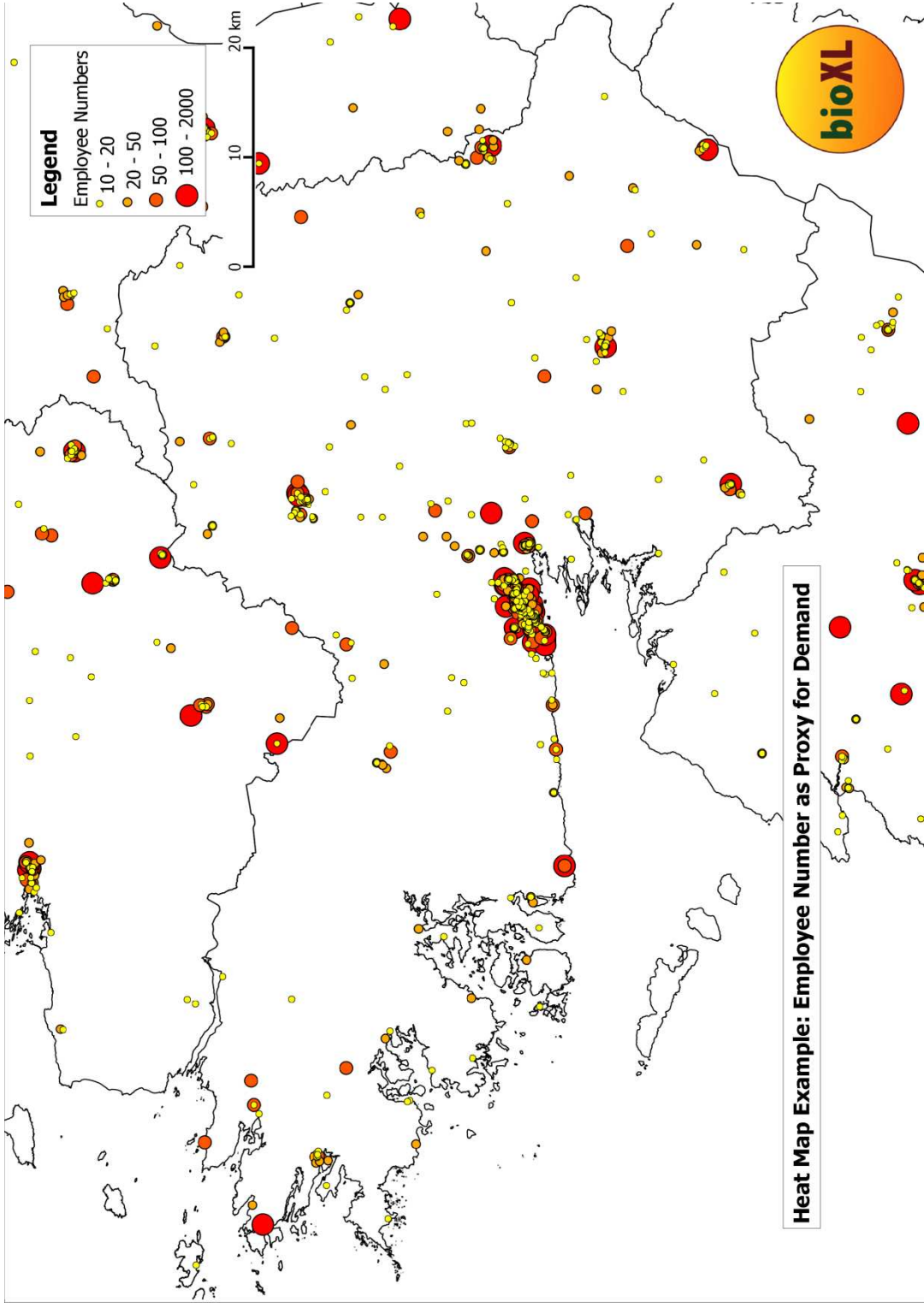
Heat Map Example: Employee Number as Proxy for Demand



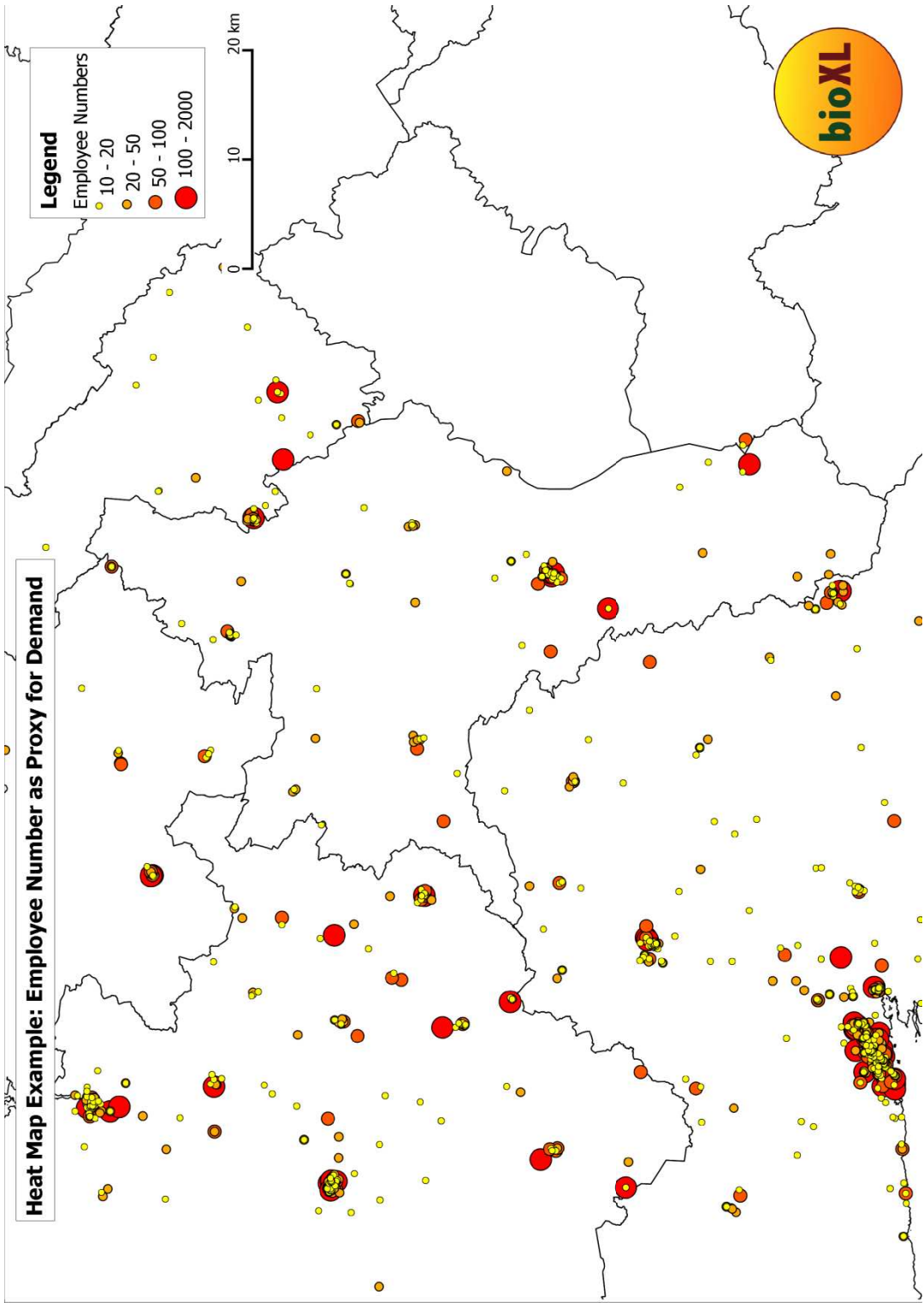
Appendix 2: Sample Map – Clare



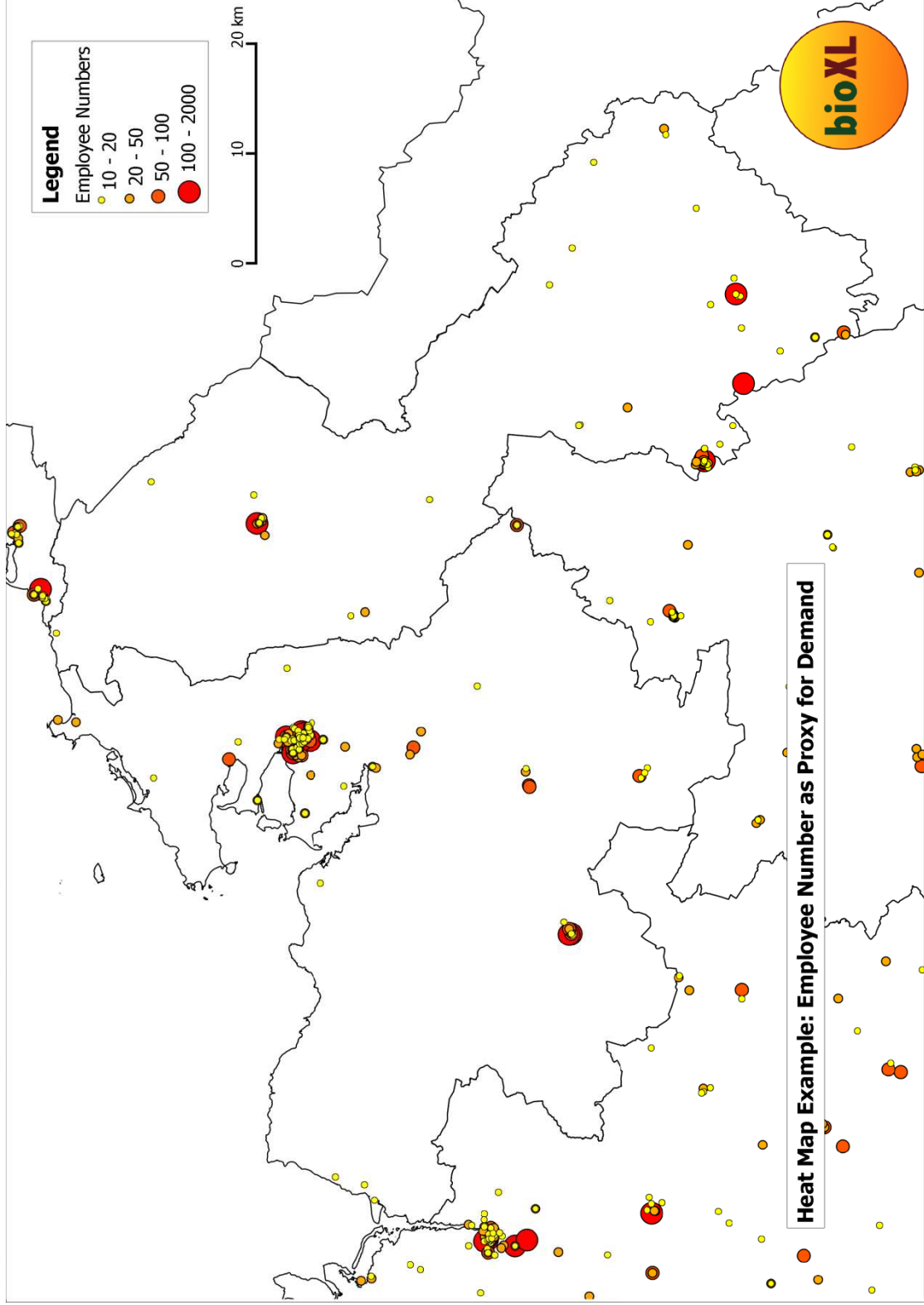
Appendix 3: Sample Map – Galway



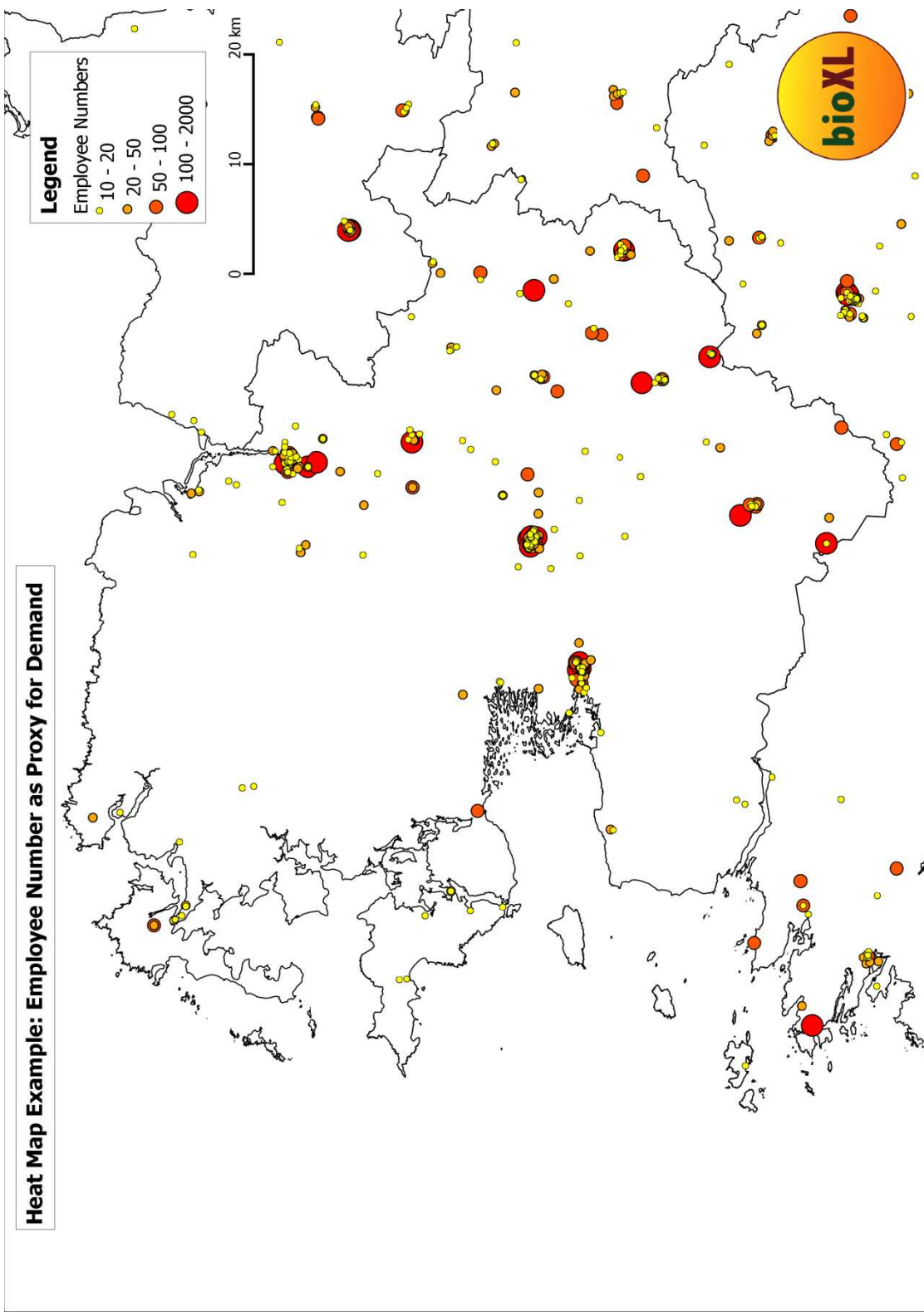
Appendix 4 : Sample Map – Roscommon



Appendix 5: Sample Map – Sligo/Leitrim



Appendix 6: Sample Map – Mayo



Appendix 7: Sample Map – Donegal

Heat Map Example: Employee Number as Proxy for Demand

