SPATIAL DATA FOR THE DESIGN OF CRITICAL CARTOGRAPHIES IN THE METROPOLITAN AREA OF SEVILLE (SPAIN)

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Introduction

In a non-large term, in many parts of the world, cities will face the challenge of leaving behind their identity as a community related to history and urban form. The growth, or the necessity for cooperation or administrative reasons, impel changes in what is considered one of the most immovable endeavours in the imaginaries: the feeling of belonging. In all of them, landscape plays a fundamental role that we can represent preliminarily as urban metabolism organizations, complex overlapping analysis and datascapes. The fieldwork, digital registration, processed treatment, public domain and powerful computation tools, as well as the shared results for comparisons, resilient strategies and homeostatic settlements, provide qualified information to design new protocols for entrusting how people assume this feeling of belonging to a new territoriality, new dimensions, uses in public spaces, mobility, heritage and conservation of natural areas (Amoroso 2010; Toscano and Kinkle 2015; Peran 2009; Jameson 1990).

Accordingly, this research is part of the European Project Erasmus Plus K2: TellME (Training for Education, Learning and Leadership. Towards a new MEtropolitan discipline. REF: 2017 1 IT02 KA203 036974 NATIONAL PROJECT ID: CF80057930150), led by the Polytechnic of Milan and with the participation of more than ten universities and international research centres from European and American countries such as Italy, Slovenia, Spain, Mexico and Argentina. Through the contributions established during the last three years, in the period 2017-2020, a set of conceptual bases have been achieved for the design of a methodology capable of addressing the problems faced by contemporary metropolises, which can be extrapolated and replicated in different contexts of an international nature. In this context, the following professors have formed the research team of the School of Architecture of the University of Seville (TellME-ETSAS): Dr. Domingo Sánchez Fuentes (in charge), Dr. Carlos Tapia Martín, Dr. Blanca del Espino Hidalgo Dr. Emilio J. Mascort Albea and Dr. Pedro Górgolas Martín. Additionally, the architects Ignacio García González and Francisco M. Hidalgo Sánchez, as well as the geographer Miguel A. Gutiérrez, have collaborated as technicians of the proposal. Following is a description of the work carried out by the TellME-ETSAS group for the analysis of

the case of the metropolitan area of Seville. Given the extensive work carried out in different fields of knowledge, this contribution will focus on the study of the spatial data required for the design of critical cartographies of the metropolitan area of Seville. All of this is linked to the methodological precepts sponsored in the TellME project bases and supported by the concept of critical cartography. These theoretical studies were carried out within the framework of the subject Architectural History, Theory and Composition in the fourth year of the Bachelor's degree in Foundations of Architecture (Historía, Teoría y Composición Arquitectónicas, HTCA4), taught by professor Carlos Tapia Martín.

Finally, it is necessary to indicate that the issues of analysis addressed have a strong link with those related to equity and equality, from the point of view of metropolitan sustainability. Consequently, cartographies are provided which seek to show the current situation of the metropolitan area of Seville from the following topics: Urban Metabolism, Environmental Justice and Green-Grey Infrastructure (Maruši 2015). Authors display these images as organic and unfinished works, which should be conceived as starting points and must be completed and complexed. Therefore, these maps should represent the fundamentals of future critical cartographies, capable of addressing issues as important today as the natural heritage system or collective health.

Critical cartographies

One of the methodological pillars used in the TellME-ETSAS research is the use of critical cartography as a strategy to decrypt latent processes and realities. We can define this method as a kind of representation of operational landscapes in the sense of Neil Brenner, upgrading a way inaugurated by Harley in the 80's with a political bias (Brenner 2014; Crampton and Krygier 2005).

According to these approaches, the existence of case studies in which critical cartographies have been mapped in order to understand processes that can be considered chaotic or unstable (Hall and Pain 2012; Kim 2016; Sims 2011). In this sense, the investigation with possible strategies that could be incorporated into the TellME methodology has incorporated complementary case studies, referring to other locations with an emphatic symbolic or representative presence as Oresund, Tunis and Valparaiso. In this sense, a study has been made of previous strategies to make dynamics and processes visible (Fig. 1).

Through the analysis of historical examples such as Charles J. Minard's Figurative Map (1869), which quantifies and evaluates the casualties of the Napoleonic army during Russian campaigns. Thus, an update of this pioneering strategy has been replicated to the study of migrant population flows through the Oresund Strait, which configures the Danish–Swedish border. In this case, the gap about the returning lines are concerned with not legalised migrants. Additionally, this case study was analysed based on parameters that could be directly linked to the concept of urban metabolism: energy, food, water, etc.

Something similar has been done for the case of the city of Tunis, whose problems exemplify the drama that is experienced in the waters of the Mediterranean Sea. The maps and graphics show the economic processes that affect the population. Cartographies of sociodemographic evolution related to the increase and density of population have been designed: percentage of population at risk of vulnerability, households with dependent persons, unemployed or dependent citizens without their own vehicle.

Through the problems represented in the analysis of the city of Valparaiso, the case of the social dimension and equity can be approached through cartographies that raise environmental justice as another key issue. Through the maps designed in this case, problems related to environmental and anthropic risks, energy consumption and urban vulnerability are shown.

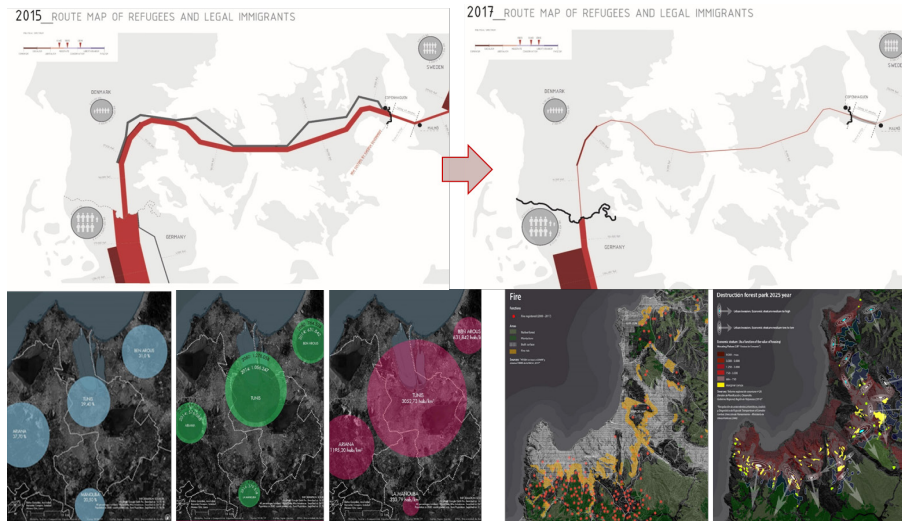


Figure 1. Examples of critical cartographies applied to the analysis of the Oresund (above), Tunis (bottom left) and Valparaiso (bottom right) Source: Students of the subject HTC4 of the degree of Fundamentals of Architecture at the University of Seville, course 2018-19.

This type of experimental and analytical work has led to interesting and expressive cartographies that have provided visions capable of showing certain underlying realities. All of this by of the use of a territorial scale for these analyses, providing a broad perspective of the different problems. Nevertheless, an important methodological shortcoming has been detected in the development of these actions with a view to producing digital and interactive maps that can be shared in open format. Despite the fact that the maps produced have made use of scientific and institutional sources, a large part of the data was not accessible in downloadable, editable and geographically referenced formats. This issue, added to the excessive expressive rigidity that sometimes involves the use of Geographic Information Systems (GIS), appears as one of the main handicaps found in the design of critical cartography that can be integrated into the current sphere of digital applications.

Consequently, these reflections should lead to the preparation of maps of structures that determine the path towards a sustainable future for metropolitan realities. For the approximation to these cartographies, the study of semiological proposals that allow to unify criteria at a global level is key. This work is being carried out in the methodological framework of the TellME Project.

State of the art on spatial data in the Seville-Doñana Bioregion

As mentioned, many of the data used in the experimental critical cartographies were not spatial or geographic data. Previously shown maps were not tool facts, shareable as open data, in the sense of the definition levels provided by Tim Berners-Lee in 2010 (Bizer, Heath, and Berners-Lee 2011). One of the objectives of the work developed by the TellME-ETSAS team in the Seville case study was the analysis of the spatial data available for the construction of critical cartographies, which can be published as interactive maps of an analytical character.

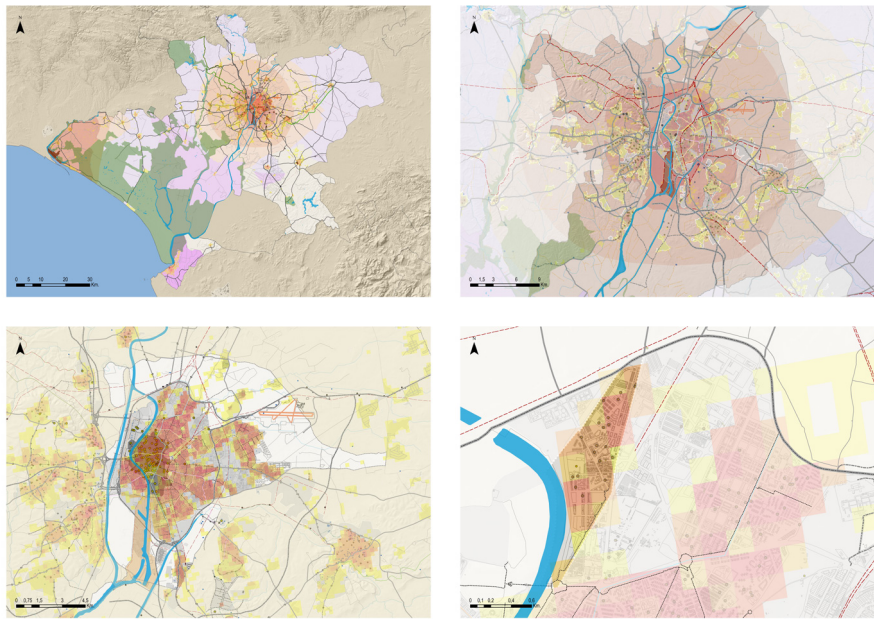
Another of the efforts made for the main case study has been the development of dynamics that allow chronological evolutions and enable the prediction of future scenarios. In the case of the metropolis of Seville, one of the main dynamics detected is the confrontation between the increase in the protected natural space that has its main focus in the National Park of Doñana, and the growth of urban space, exemplified in the city of Seville. In this way, the territory made up of the metropolitan area of the city of Seville and the Doñana National Park has been taken as the greatest extent. Thanks to this work, the TellME-ETSAS team has defined this area as the "Seville-Doñana Bioregion", thus contributing to the debate on an issue which must be of complete validity and scientific relevance (Tapia Martín 2019).

Consequently, the team was able to determine the analytical scales of action contemplated in the project, in accordance with the terminology proposed in the TellME project bases (XL-Extra Large, L-Large, M-Medium, S-Small, XS-Extra Small). Thus, the following areas of action, which correspond to the limits established for the use of the spatial data collected, have been proposed (Fig.2):

- The XL scale corresponds to the area of the Seville-Doñana Bioregion, with a single framework for action.
- The L scale includes two principal areas of action. LocationL1 consist of the the inner rings from Seville Metropolitan Area (Coq 2012; Junta de Andalucía 2009) and location L2 is shaped for Doñana National Park and its surroundings.
- The M scale relates to main urban areas, with location M1 corresponding to the city of Seville.
- The S scale is linked to smaller urban centres and large urban districts. The S1 location is linked to the San Jerónimo neighbourhood, located in the city of Seville.

The use of the XS scale, corresponding to the architectural and neighbourhood area, is also proposed for future work.

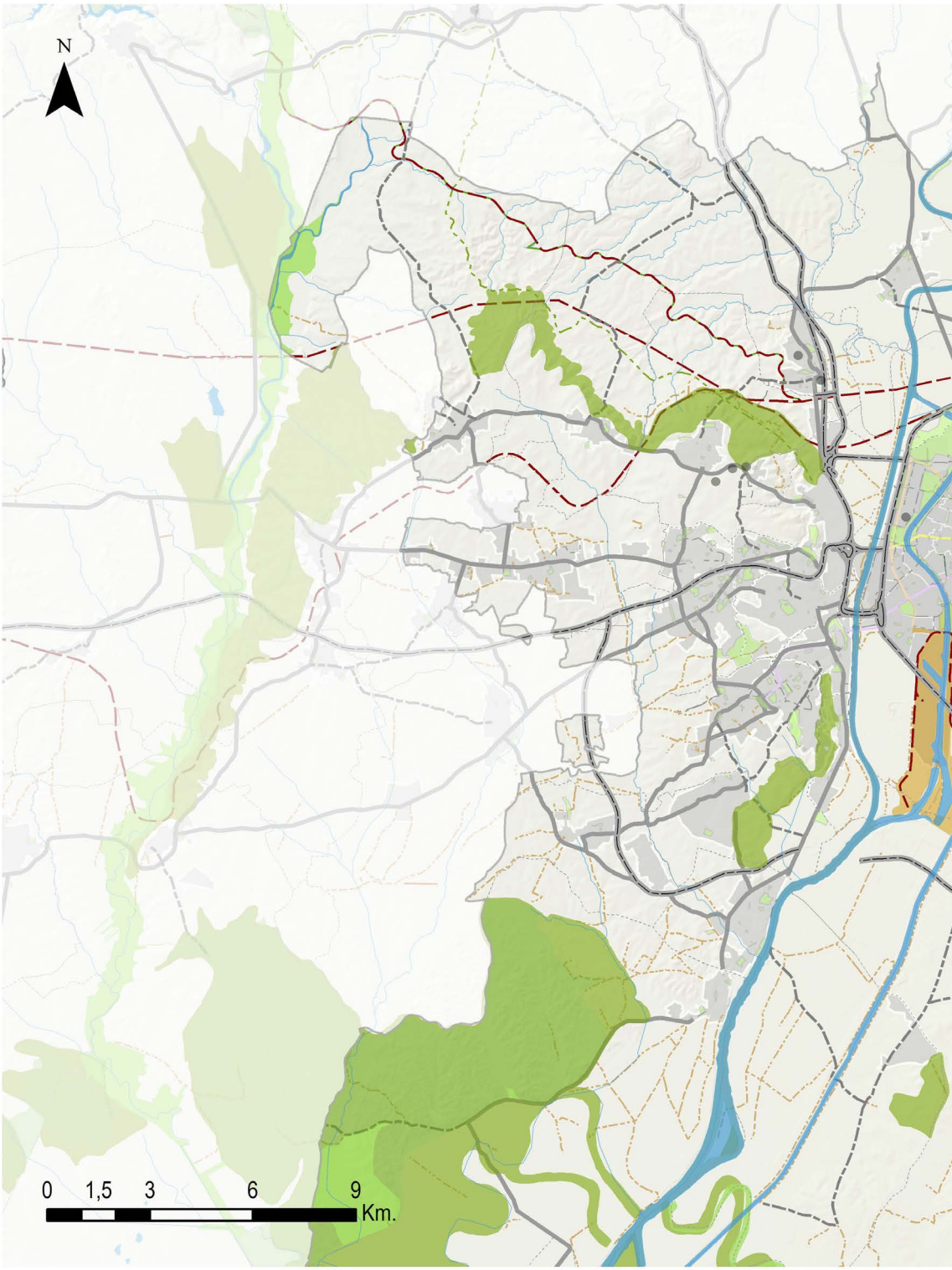
- For future developments of the work, the implementation of data on a XXS scale is considered, which would be linked to a detail level able to show architectural interiors data (Mascort-Albea 2017).



location L1 (top right), location M1 (bottom left) and location S1 (bottom right). Source: Authors.

Other methodological issues have been related to the origin and content of the spatial data involved. Due to the temporal and economic scope of the project, the production of own data has been left out of the initial approaches. Once strategies such as the georeferencing of existing information or the creation of datasets through field work have been ruled out, all the collected data came from open sources, provided by institutional or collaborative platforms. Below are the categories established to classify the data sources used, as well as a reflection on those most relevant in the development of the cartographies:

- The information from international sources covering the entire planet has been categorised as Global Data. Collaborative platforms such as Open Street Maps or institutional sources such as NASA have proved useful for the visualisation of basic territorial structures, in the first case, and environmental risk assessment in the second.
- The INSPIRE platform provides the operational framework for the publication of data in the context of the European Union (UE). However, only a few sources have been specifically used as UE Data.
- At national level, there are many useful geoportals that provide general and thematic information. Among those sources that have been categorised as Spanish National Data in the project, all those that provide general spatial and statistical information through the IDEE stand out. Likewise, the Virtual Property Cadastre Office provides very detailed information on the territory up to the cadastral scale. All of this is available through a download service that allows you to obtain the urban and rural properties of any municipality. Among the most relevant thematic sources, the sectorial geoportals of the different ministries and institutions such as the IGME stand out, related to information on the geotechnical and geological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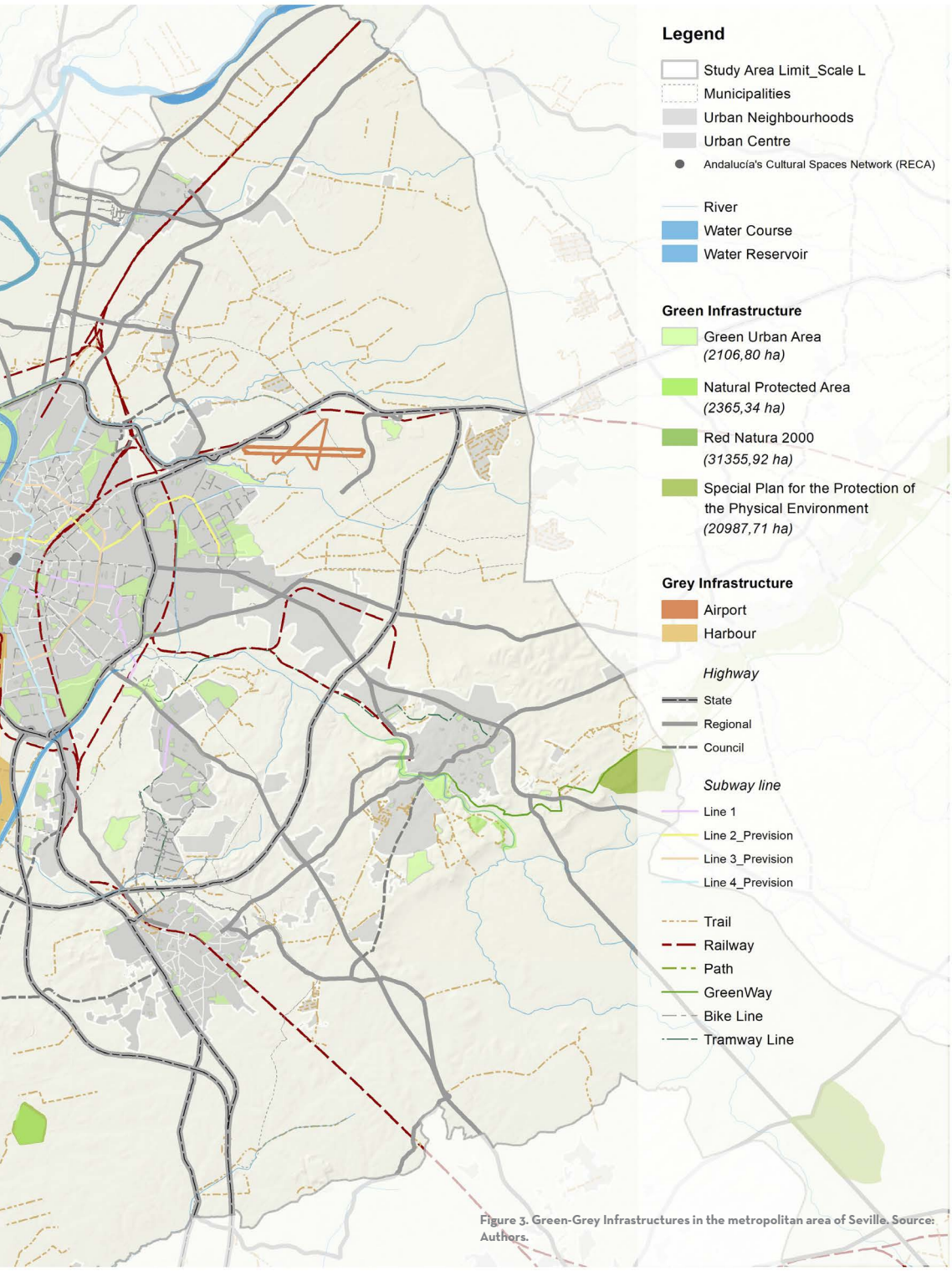

Figure 3. Green-Grey Infrastructures in the metropolitan area of Seville. Source: Authors.


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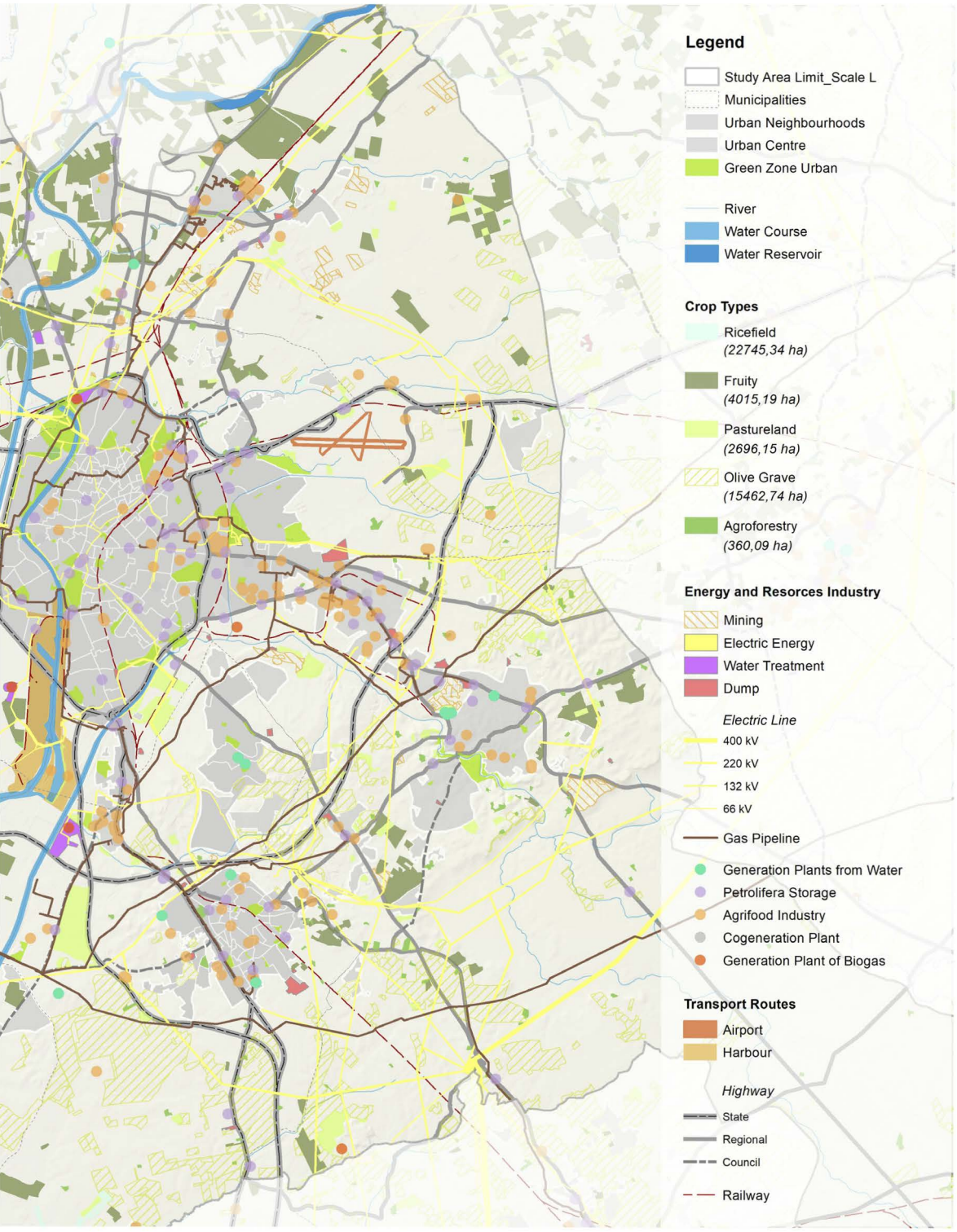
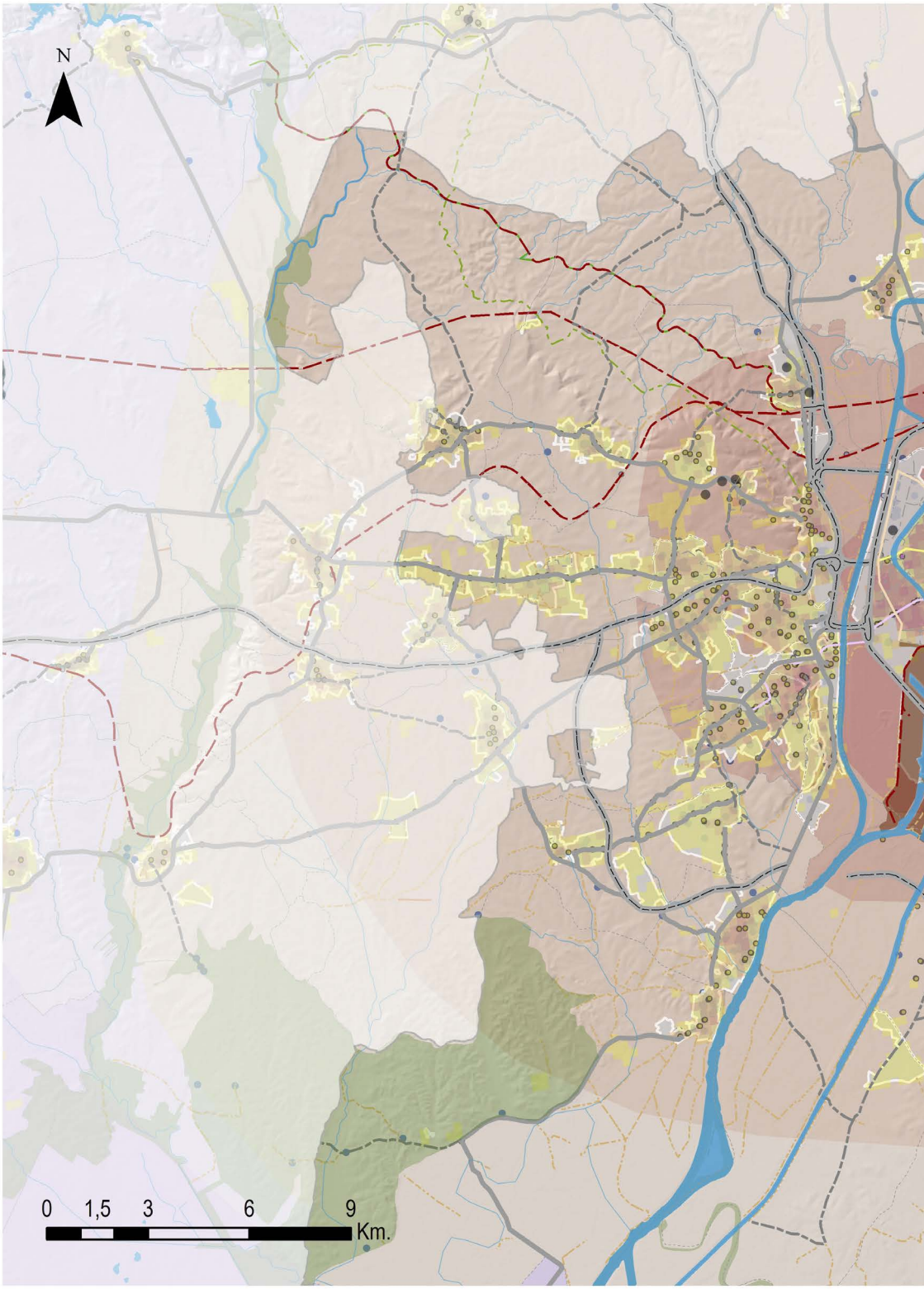


Figure 4. Urban Metabolism in the metropolitan area of Seville. Source: Authors.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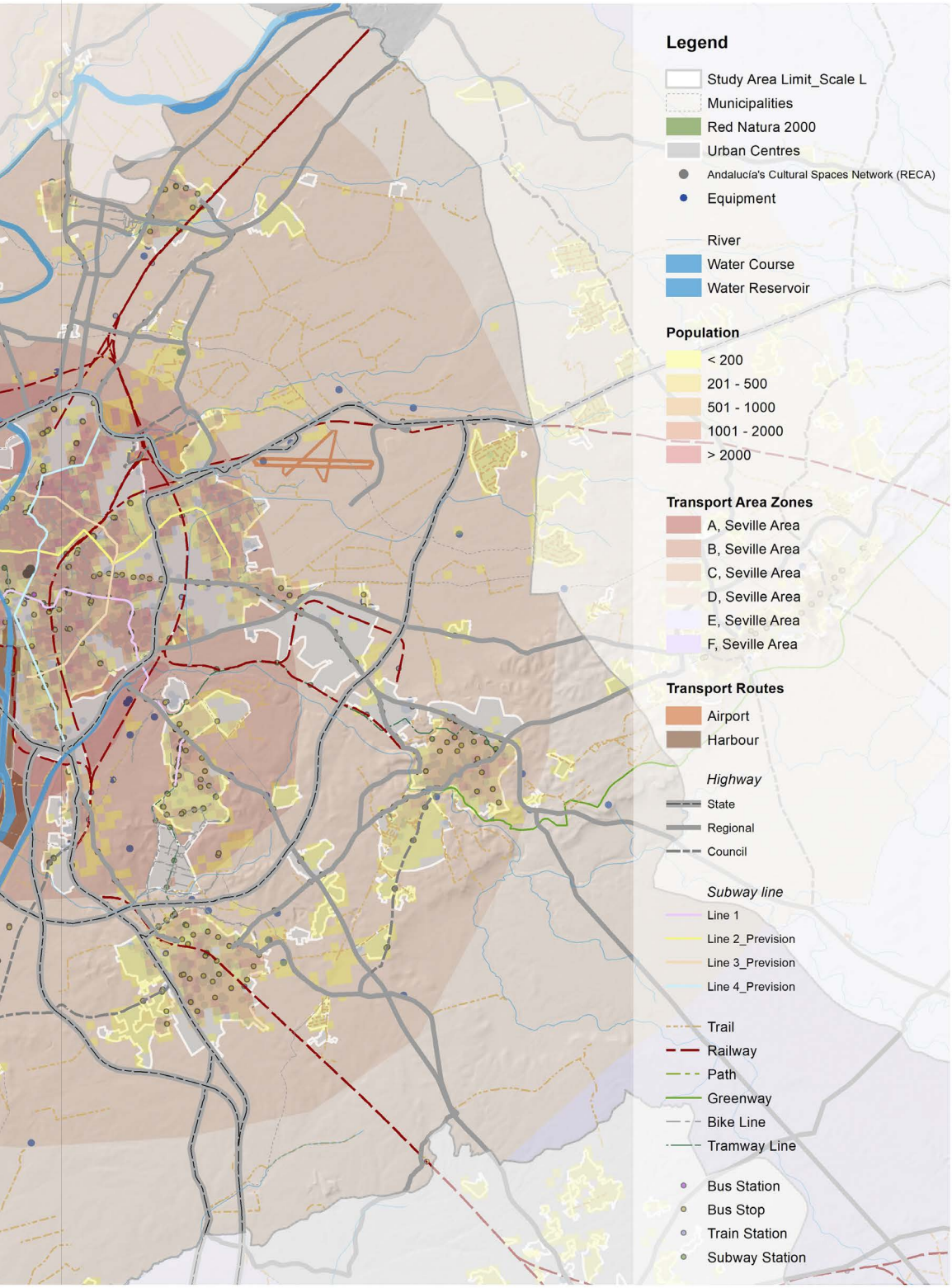

Figure 5. Environmental Justice in the metropolitan area of Seville. Source: Authors.

properties of the soil.

- Published and displayed through the IDEA platform, a remarkable amount of Andalusian Regional Data can be downloaded through the DERA repository. The hosted regional information is very well categorised, has a complete set of metadata and is subject to regular updates.
- Despite the existence of spatial data infrastructures at a provincial level, such as IDEASevilla, it has been possible to obtain Seville Local Data almost exclusively through institutional platforms linked to the metropolitan head. In this sense, the Seville City Council's Open Data Portal and the IDE Seville are noteworthy, as they provide cartographic bases and thematic data of very high detail and quality.
- However, the quantity and quality of this information contrasts with the absence of local platforms and repositories in the other municipalities that make up the metropolitan area of Seville. This reality is a clear factor of inequality in relation to the georeferenced data that can be accessed by a resident in this territorial context. Of course, the consultation of open and editable quality information must be considered as another standard relating to the quality of life of citizens and one of the challenges that must be addressed in the short term from the area of governance.

The detailed analysis and systematic gathering of the spatial data for the Seville case study has revealed numerous information gaps. These weaknesses are mainly on the urban scale and make it difficult to perform comprehensive analyses from the point of view of environmental, economic and social sustainability. Therefore, the graphic products presented in this paper should be considered as "work in progress" maps. Nevertheless, from their visualisation, readings and interpretations can be extracted that contribute to building a notion of what is currently happening in the metropolitan area of Seville, in terms of equality and equity.

Green-Grey Infrastructure, Urban Metabolism and Environmental Justice in the Seville Metropolitan Area.

In this last section, we share the interpretations and reflections derived from the production of critical cartographies through the exclusive use of spatial data, according to the methodological approaches described above. This is the case for the metropolitan area of Seville (L1 area), and with maps on the following subjects: Green-Grey Infrastructure, Urban Metabolism and Environmental Justice.

From the observation of the Green-Grey Infrastructure mapping (Fig. 3), questions regarding the absence of a true metropolitan interconnectivity are clearly highlighted, compared to other case studies of such population and extent. This issue is not only reflected in the almost exclusive dependence on private road transport but also in the absence of a network of inter-municipal green spaces. In this way, the cartography attempts to reflect the excessive dependence of mobility on major road axes and the weakness of public transport at present to articulate a true metropolitan network. The city of Seville itself has been affected by a number of issues, such as the following: the underground has only one existing line, the airport has no railway connections despite its proximity to the existing route, and the second ring road is currently incomplete. This disconnection is especially evident in the areas that are to form the green infrastructure. In this sense, the need

for a greater number of metropolitan parks that generate green leakage routes to natural areas emphasizes.

Through the maps of Urban Metabolism (Fig. 4), emphasis is placed on the relationship that the head of the metropolis establishes with the basic services of production and consumption for the citizens. This question provides data on the main centres of production and distribution channels for energy, as well as the supply of foodstuffs on a local scale. Among the large supply infrastructures that the city possesses, the Port of Seville stands out for its history and its singular condition, the only one of a fluvial nature in Spanish territory. Despite its humble flow of goods, it handles cruise traffic and deploys a number of facilities with a strong presence in the southern part of the city of Seville. It can also be seen how the main productive fabric that is implanted in the territory is made up of farms that occupy a large extension extending towards the eastern and western periphery. However, the industrial fabric and energy production is also present around the urban centres of the metropolitan area.

The cartography related to Environmental Justice (Fig. 5) tries to show the strong contrasts between the centre and the periphery that occur in the metropolitan area of the city of Seville. In a situation close to the port, on the southern edge of zone B, the former floodable area of Tablada stands out, a large void which, due to its central position in the metropolitan range, should constitute a serious candidate to become the future great green lung of the area studied. This question can be linked to the issue of latent land for development, which should be incorporated into the green network in order to opt for a territory that has to opt for compactness and balance, rejecting policies of expansionary excavated growth.

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