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Rural policing and territorial accessibility: An analysis of the Guardia Civil operational deployment model in the province of Cáceres, Spain

Bezpieczeństwo na obszarach wiejskich a dostępność terytorialna – analiza modelu rozmieszczenia operacyjnego Guardia Civil w prowincji Cáceres w Hiszpanii

Abstract: Although rural criminology has become internationally established, it remains at an early stage of development in Spain, where a significant knowledge gap persists regarding the provision of public safety in rural areas. This article addresses that gap by analysing the operational deployment of the Guardia Civil in the province of Cáceres, a vast, sparsely populated territory with complex topography that severely constrains mobility.

Traditionally based on a static structure consisting of physical posts in most municipalities, reductions in personnel and ongoing depopulation have compelled the Guardia Civil to transition towards a dynamic management model centred on “operational hubs” (*núcleos operativos*). This system groups local posts under a coordinated territorial command. While it aims to guarantee minimum service provision through 24-hour operational patrol coverage, its actual impact on territorial equity and citizens’ access to police services remains unknown. To evaluate this impact, the study applies an original quantitative methodology based on geographic information systems (GIS) to estimate the potential distribution of police service hours per municipality (HPM). This theoretical indicator combines demographic variables, the locations of operational hubs and road-network impedance – derived from origin–destination matrices – to measure public safety in terms of actual accessibility and accounting for the friction imposed by distance and topography.

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The results reveal a structural inequality in the distribution of police services. The geospatial analysis identifies extreme disparities, with the potential allocation of resources varying by as much as 26-fold between the best-connected and the most isolated municipalities. Clear centre-periphery patterns emerge, heavily disadvantaging mountainous areas. Furthermore, the frequency analysis demonstrates that operational precariousness is the norm: the vast majority of rural municipalities subsist with only minimal police presence, while optimal accessibility is reserved for a small administrative minority.

In conclusion, this study diagnoses a latent territorial inequality and provides a replicable GIS-based tool for public planning. It demonstrates that resource allocation based exclusively on demographic criteria is insufficient in depopulated territories and proposes incorporating geospatial accessibility indicators to advance a more equitable model of rural policing.

Keywords: rural criminology, Guardia Civil, policing, geographic information systems, rural areas, police management

Abstrakt: Choć kryminologia wsi zyskała już pozycję na arenie międzynarodowej, w Hiszpanii wciąż znajduje się na wczesnym etapie rozwoju, przez co utrzymuje się tam istotna luka w wiedzy na temat zapewniania bezpieczeństwa publicznego na obszarach wiejskich. Niniejszy artykuł odnosi się do tej luki i analizuje operacyjne rozmieszczenie formacji Guardia Civil w prowincji Cáceres – rozległym, słabo zaludnionym terytorium o skomplikowanej topografii, która poważnie ogranicza mobilność.

Tradycyjnie model ten opierał się na strukturze statycznej, składającej się z fizycznych posterunków w większości gmin. Jednak redukcja personelu oraz postępujące wyludnianie zmusiły Guardia Civil do pójścia w stronę dynamicznego modelu zarządzania, opartego na „węzłach operacyjnych” (núcleos operativos). System ten grupuje lokalne posterunki pod skoordynowanym dowództwem terytorialnym. Choć jego celem jest zagwarantowanie minimalnego poziomu świadczenia usług poprzez całodobowe patrole operacyjne, jego rzeczywisty wpływ na równość terytorialną i dostęp obywateli do usług policyjnych pozostawał nieznany. Aby ocenić ten wpływ, w badaniu zastosowano autorską metodę ilościową opartą na systemach informacji geograficznej (GIS) w celu oszacowania potencjalnego rozkładu liczby godzin pracy policji przypadających na gminę (HPM). Ten teoretyczny wskaźnik łączy zmienne demograficzne, lokalizację węzłów operacyjnych oraz opór sieci drogowej (pochodzący z macierzy początek-koniec podróży), aby mierzyć bezpieczeństwo publiczne w kategoriach rzeczywistej dostępności, z uwzględnieniem oporów wynikających z odległości i topografii.

Wyniki wskazują na strukturalną nierówność w dystrybucji usług policyjnych. Analiza geoprzestrzenna ujawniła skrajne dysproporcje: potencjalna alokacja zasobów między najlepiej skomunikowanymi a najbardziej odizolowanymi gminami różni się aż 26-krotnie. Wyraźnie rysują się wzorce typu centrum-peryferie, które silnie dyskryminują obszary górskie. Ponadto analiza częstotliwości dowodzi, że niestabilność operacyjna jest normą: zdecydowana większość gmin wiejskich funkcjonuje przy minimalnej obecności policji, podczas gdy optymalna dostępność jest zarezerwowana dla nielicznej mniejszości administracyjnej.

W rezultacie badanie to diagnozuje ukrytą nierówność terytorialną i dostarcza powtarzalnego, opartego na GIS, narzędzia do planowania publicznego. Dowodzi ono, że alokacja zasobów oparta wyłącznie na kryteriach demograficznych jest niewystarczająca na terytoriach wyludnionych, oraz postuluje włączenie wskaźników dostępności geoprzestrzennej w celu wypracowania bardziej sprawiedliwego modelu ochrony porządku publicznego na obszarach wiejskich.

Słowa kluczowe: kryminologia wsi, Guardia Civil, praca policji, systemy informacji geograficznej, obszary wiejskie, zarządzanie policją

Introduction

Rural criminology remains a largely unexplored field in Spain. To date, very few studies have sought to analyse the problems of Spanish rural areas from a criminological perspective. At international level, one of the most extensively researched topics within rural criminology is policing. Policing constitutes a broader domain than the institution of the police alone, as it encompasses multiple factors and actors, ranging from the public and private sectors to community-based initiatives (Ceccato 2015). The existing research addresses a wide range of issues, including the implementation and challenges of community policing in low-density settings (Eman, Bulovec 2023); the management and optimisation of police resources in geographically extensive areas with limited personnel (Ruddell, Lithopoulos 2014; Rodgers, Asquith 2022; Bullock, Garland 2023); accessibility and police response times (Stenbacka 2022; Tibaduiza, Barrick 2024); rural residents' perceptions of the police (Whiteside, Brennan, Mulrooney 2023; Madenüs 2024); officers' perceptions of their work (Contessa, Wozniak 2018; Lynn, Osborne, Edwards 2023); and the specific characteristics of investigating agricultural crime (Whiteside, Brennan, Mulrooney 2023) and environmental crime (Eliason 2021). This consolidated international research agenda within rural criminology contrasts sharply with the situation in Spain, where studies on policing in rural areas remain sparse (Ortiz García, Rufo Rey 2023; Rufo Rey 2025), leaving a substantial knowledge gap.

Within the broader international literature on policing, the efficient management and optimisation of police resources constitute one of the main research strands (Liu et al. 2019; Ellison et al. 2021; Sabado et al. 2022; Das, Banerjee, Sun 2025). These studies aim to improve police effectiveness, promote equity in service distribution and rationalise the use of personnel and equipment. To this end, they frequently employ quantitative methods, including mathematical models for patrol allocation and design (Zhu, Wang, Xie 2021; Zhou, Zhang, Ding 2024), the design of efficient and balanced police districts (Zhu et al. 2021) and route optimisation to improve response times (Clark et al. 2022; Kim et al. 2023). Other studies rely on crime data and geographic information systems (GIS) to identify patterns, predict hotspots and allocate resources to areas with greater anticipated need (Braga et al. 2019; Fitzpatrick, Gorr, Neill 2020).

Despite this extensive body of work, Spain again represents an exception, as very few studies have pursued this line of inquiry. On the one hand, Federico Liberatore and Miguel Camacho-Collados (2016) proposed a new optimisation model – the Equitable Police Districting Problem – aimed at designing patrol districts that balance territorial equity (allocating resources to high-risk areas to improve policing) and racial equity (ensuring fair and proportional police contact across population groups) in the city of Madrid. On the other hand, Juan Palma-Borda, Eduardo Guzmán and María V. Belmonte (2025) developed a multi-agent reinforcement learning model based on a decentralised, partially observable Markov

decision process to optimise patrol routes and maximise surveillance coverage in high-crime areas of the city of Málaga.

However, both studies were developed and validated in urban environments characterised by abundant data and frequent events. Extending such models to rural contexts poses significant challenges due to lower data availability and fewer observable events. Indeed, even internationally, mathematical and model-based studies on police management, optimisation and territorial distribution in rural areas remain extremely rare. One notable exception is Habibollah Rahimi et al. (2017), who applied data envelopment analysis to assess the efficiency of Iran's rural traffic police, concluding that their effectiveness was very high (95%). It is likely that the scarcity of data and events in rural areas discourages researchers from developing mathematical optimisation models for rural policing.

Research on policing in rural contexts also requires, as a preliminary step, a definition of what is meant by "rural". Scholars in rural criminology consistently highlight the intrinsic difficulty of establishing a universal definition of this concept (Ceccato 2015; Weisheit 2016). Rural areas are not homogeneous, and the definition of rural is subject to intense debate (Donnermeyer 2018), as it is a polysemic concept whose meaning varies depending on geographical context, academic discipline and definitional criteria, including demographic (population size or density), geographic (land use or distance to urban centres), economic (agricultural and livestock-based economies) and sociocultural factors (community identity and lifestyle).

Despite the difficulty of arriving at a unified definition, rural areas tend to share a set of common characteristics. Joseph F. Donnermeyer and Walter S. DeKeseredy (2014) identified four features common to rural communities: low population size or density; a higher likelihood of mutual acquaintance among residents, which fosters regular interaction and shared values and is often associated with greater density of acquaintanceship or collective efficacy; exposure to significant transformations driven by global, technological and national policies (in Spain, regional ones as well), often accompanied by service shortages; and cultural representations of rurality ranging from idyllic to threatening, although idyllic representations tend to prevail in Spain – particularly in Extremadura. Nevertheless, rural areas are far from homogeneous, even within the same territory, due to substantial cultural, political and social diversity. As Matt Bowden and Alistair Harkness (2022) argue, the simple urban–rural dichotomy is inadequate, as it ignores geographical, demographic, cultural and accessibility nuances. These specificities justify the need for differentiated criminological analyses and, consequently, for tailored approaches to police planning and management.

Although a single global definition of rurality may be unattainable, it is essential to specify the conceptual framework of each study by adopting clear and contextually relevant criteria. In this research, while European Union classifications could be considered, priority is given to Spain's existing legal and administrative thresholds, especially the regulatory framework of the Autonomous Community of Extremadura.

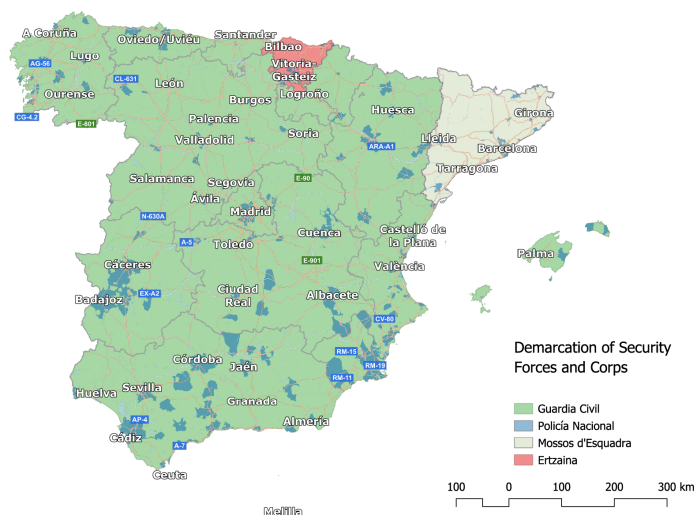
The primary legal reference is Law 45/2007 of 13 December on Sustainable Rural Development. Under this law, rural territory is conceptualised through three categories. “Rural environment” refers to aggregated areas composed of municipalities or local entities with fewer than 30,000 inhabitants and a population density below 100 inhabitants per km². “Rural zone” denotes the *comarcas* or sub-provincial areas in which the Sustainable Rural Development Programme applies, as delimited by the relevant Autonomous Community. Finally, “small rural municipalities” are those within the rural environment with a resident population below 5,000 inhabitants.

Regarding the legislation of the Autonomous Community of Extremadura, Law 3/2022 of 17 March on Measures in Response to Extremadura’s Demographic and Territorial Challenge does not establish its own definition or classification of Extremadura’s rural areas, although the statute addresses the demographic and territorial challenge; instead, it refers to the “Strategy for the Demographic and Territorial Challenge of Extremadura”, approved by Decree 32/2022 of 30 March. This instrument is insufficient for that purpose, as it offers no specific and operational classification based on clear criteria that would allow measures to be applied differentially according to the varying needs of rural Extremadura (Torrecillas Martínez 2024). As a result, regional legislation does not allow for an adequate definition of Extremadura’s rural territory that would account for its heterogeneity and problems. For this reason, the primary reference must be Law 45/2007, i.e. regarding populations under 30,000 and with a density below 100 inhabitants per km².

Additionally, another key criterion must be considered for identifying rurality in Extremadura in this study: the territorial distribution of the State Security Forces and Corps. Historically, the distribution of the State Security Forces in Spain was determined by Royal Decree 1316/1977 of 2 June on the territorial and functional demarcation of public order forces, which – despite predating current policing legislation – establishes in its Article 1 that the Government Police (the former designation of what is now the National Police) would be stationed in provincial capitals and cities with more than 20,000 inhabitants when necessary due to their characteristics. Subsequently, Organic Law 2/1986 of 13 March on the Security Forces and Corps – still in force today – provides an operational criterion to delimit the rural sphere, since Article 11.2 assigns the National Police the exercise of its functions in provincial capitals and urban centres designated by the Government, while the Guardia Civil exercises its functions in the rest of Spanish territory – corresponding to rural areas – and in territorial waters. Although this law removed the 20,000-inhabitant threshold, it partially preserved the demographic logic introduced by Royal Decree 1316/1977, leaving it as an administrative criterion. This criterion can be crucial in research on policing within rural criminology, because in Spain there are municipalities with fewer than 30,000 inhabitants – rural under Law 45/2007 – that nevertheless have a National Police presence, which gives them distinctive characteristics compared to strictly rural municipalities, at least from a policing and security standpoint.

Similarly to Portugal's National Republican Guard or France's National Gendarmerie, public security in Spain is generally the responsibility of the National Police in provincial capitals and designated cities, and of the Guardia Civil in rural municipalities. Some Autonomous Communities also maintain regional police forces, such as the Mossos d'Esquadra in Catalonia, the Ertzaintza in the Basque Country and the Foral Police in Navarre, which exercise full or shared security competences. Municipalities may also establish Local Police forces with specific responsibilities, primarily related to traffic and municipal ordinances. The distribution of these offences across Spain's territory is illustrated in Figure 1.

Figure 1. Demarcation of Security Forces and Corps in Spain



Source: Authors' own elaboration.

Accordingly, in Extremadura, the police force is organised according to the national model, with the National Police, Guardia Civil and Local Police having a presence. Following the territorial distribution established by Organic Law 2/1986, the National Police perform their functions in the two provincial capitals, Cáceres and Badajoz, as well as in municipalities designated by the Government, which in this region are Mérida, Don Benito–Villanueva de la Serena (a shared station for both municipalities), Almendralejo and Plasencia. The remainder of the territory (rural) falls under the competence of the Guardia Civil. Finally, the Local Police provide services in municipalities where they exist, whether due to legal obligation or voluntary establishment.

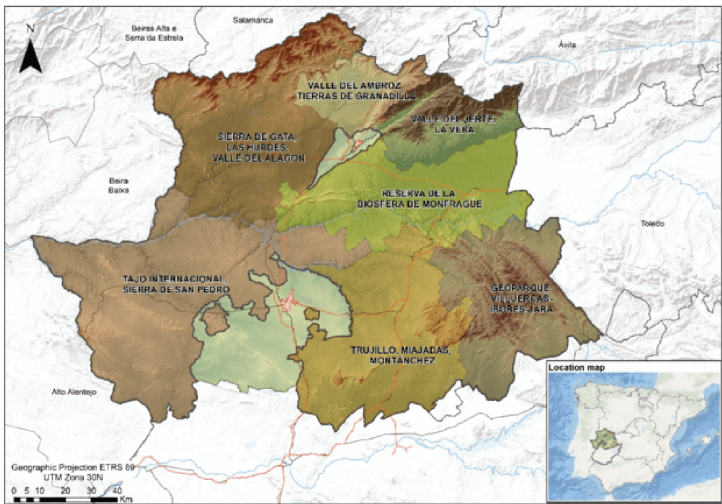
This study focusses geographically on Extremadura, and more specifically on the province of Cáceres. Extremadura is located in southwestern Spain and has territorial and demographic characteristics that make it an appropriate case study for rural criminology. It is the fifth largest Autonomous Community in Spain (41,634 km²), but also one of the least populated, with 1,053,595 inhabitants

according to the National Institute of Statistics (INE) data for 2024, and it has one of the lowest population densities (25.33 inhabitants/km²). The population distribution is uneven, as the province of Badajoz exceeds that of Cáceres in population (664,970 vs 388,625, respectively). Badajoz has 165 municipalities and Cáceres has 223. In 2024, 42.19% of the population was concentrated in seven municipalities classified as urban in this study: Badajoz (150,570), Cáceres (96,441), Mérida (59,857), Plasencia (39,829), Don Benito (37,728), Almendralejo (34,284) and Villanueva de la Serena (25,784). In contrast, 57.81% of Extremadura’s population resides in the remaining 381 municipalities, 90.98% of which have fewer than 5,000 inhabitants and are therefore classified as small rural municipalities. Notably, the highest proportion of the region’s rural municipalities (65.55% of the total) is found in the province of Cáceres (Romo, Pintor, Gallego 2025).

The region is divided into two provinces – Badajoz in the south and Cáceres in the north. Respectively, they are the largest and second largest provinces in Spain. Cáceres, which constitutes the study area, covers 19,868 km² and borders Portugal. It represents an operationally complex setting due to its vast territorial extent (19,868 km²) and geographical heterogeneity. The territory is structured along a north–south transition that conditions mobility and accessibility, ranging from mountainous areas characterised by abrupt topography and narrow valleys to a south-central penepplain dominated by extensive *dehesa* landscapes and delimited by the axis of the Tagus River. This geographic duality alternates areas of difficult access with open and dispersed surfaces, posing evident logistical challenges for providing public services.

To better understand the north–south transition and the geographical complexity of the province of Cáceres, Figure 2 shows the seven rural tourist territories of the province (Nieto Masot, Ríos Rodríguez 2021).

Figure 2. Seven tourist territories in northern Extremadura (Cáceres)

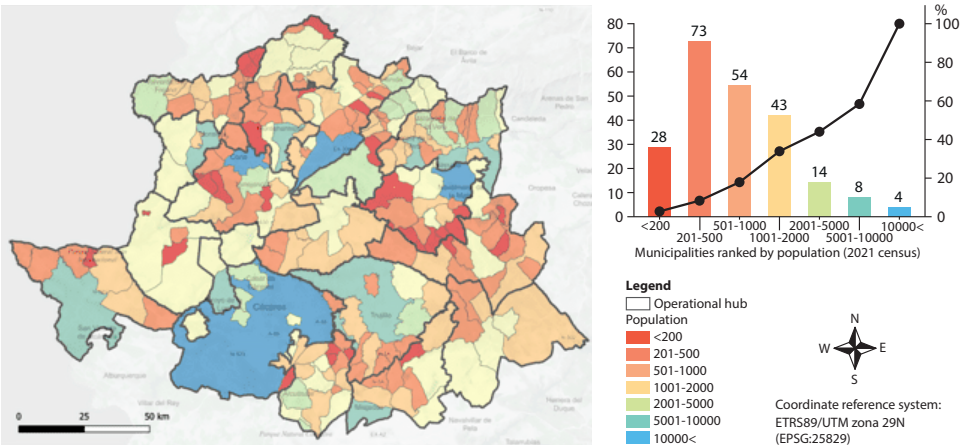


Source: Map reproduced from Nieto Masot and Ríos Rodríguez (2021).

In this regard, the north and northwest of the province form the southern edge of the Spanish Central System, with aligned mountain ranges – the Gata and Hurdes Mountains – and incised valleys such as Ambroz, Jerte and La Vera, thus constituting rugged mountainous relief with steep slopes (Vich, Ortiz 1997). The southwest is also mountainous due to the presence of mid-elevation ranges such as Villuercas–Ibores–Jara, with an Appalachian-type landscape (elongated ridges and parallel valleys) (Lagar Timón, García Marín, Pulido Fernández 2013). Finally, the central and southern parts of the province are characterised by a granite and slate peneplain typical of the Meseta, with moderate altitudes and gentle forms, dominated by holm oak and cork oak *dehesas* (Pereira et al. 2018; Sánchez-Martín, Blas-Morato, Rengifo-Gallego 2019).

From a demographic and social perspective, the province is divided into 223 municipalities – compared to 165 in Badajoz (Rengifo Gallego, Sánchez Martín 2019). There is an overwhelming predominance of low-density rural municipalities (221), with only two cities in the province: Cáceres and Plasencia. To better understand the degree of rurality in Cáceres province, Figure 3 shows the classification of municipalities according to population size.

Figure 3. Municipalities in the province of Cáceres classified by population size



Source: Authors’ own map based on INE 2021 data.

To understand the logistical challenge posed by the Guardia Civil’s deployment, it is essential to know the municipal and demographic structure of Cáceres province. As can be seen in Figure 3, the province suffers from extreme micromunicipalism. This is statistically confirmed by the accompanying histogram. The modal range of municipalities lies between 200 and 500 inhabitants (73 municipalities), and the sum of the first three categories shows that the vast majority of municipalities in Cáceres (155) do not exceed 1,000 inhabitants, while only four municipalities exceed 10,000 inhabitants.

This vast territorial extent, combined with low population density and a large number of rural municipalities (221), results in marked geographic dispersion. These factors are compounded by a pronounced population ageing process in areas furthest from Cáceres and Plasencia (Sánchez-Martín, Gurriá-Gascón, Rengifo-Gallego 2025).

The provincial economy is closely linked to the primary sector, particularly extensive livestock farming and agriculture (De Tena Rey, Domínguez Álvarez, García-Moruno 2019), alongside growing rural and nature tourism (Sánchez-Martín, Rengifo-Gallego, Blas-Morato 2019).

In order to understand the operational logic of this model, it is necessary to analyse the actual availability of police resources. Although the number of Guardia Civil personnel nationwide has grown steadily since 2018, reaching 81,232 officers in 2024, this figure has still not matched the historical peak recorded in 2011 (83,334 officers) (Dirección General de la Guardia Civil 2025: 134–135). However, it should be noted that there is a lack of disaggregated official data, making it impossible to precisely determine the number of officers assigned to each Autonomous Community and province. The only available information on this issue can be found in press releases, according to which Extremadura had 2,863 personnel distributed across the region in 2025 (El Periódico Extremadura 2025), although their territorial distribution remains unknown. Despite the lack of detailed information regarding personnel allocation, previous studies conducted in the region and demands made by different police unions at both the national and regional levels have highlighted the functional shortage of resources in rural areas (Ortiz García, Rufo Rey 2023; JUCIL 2025; Rufo Rey 2025; AUGC 2026).

Traditionally, the Guardia Civil model was characterised by placing barracks – currently referred to as posts – in the vast majority of rural municipalities. However, current circumstances, particularly the progressive reduction in personnel, have forced a transition from a static, localist model of security towards a dynamic, *comarca*-based model structured around so-called “operational hubs” (*núcleos operativos*).

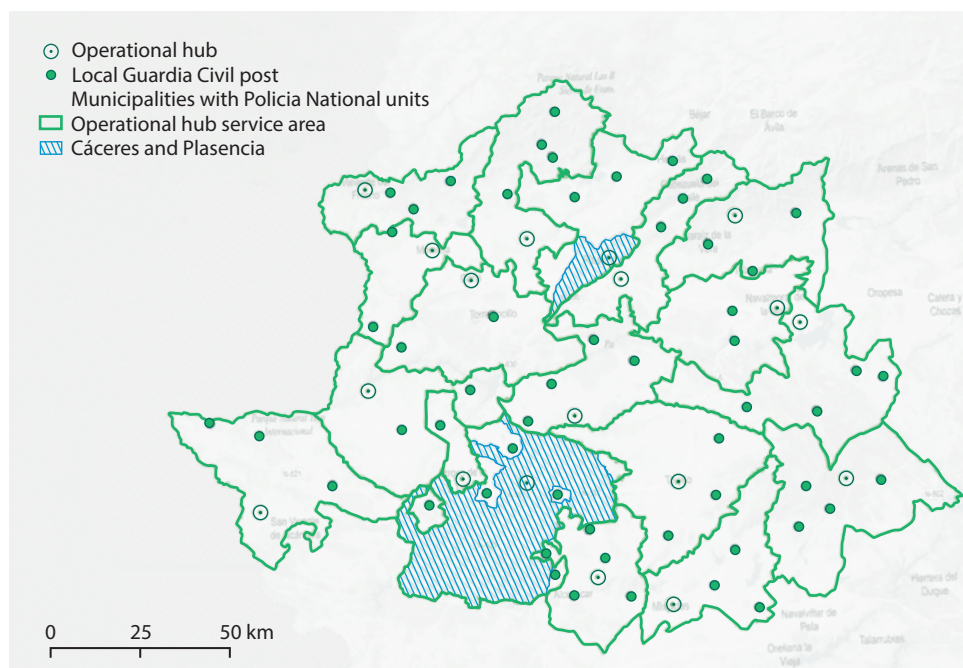
It should be noted that, within the European context, the rural policing model presents a series of essential dynamics that help to illustrate the model of the Guardia Civil. Gorazd Meško, Matt Bowden and Katja Eman (2025) point out that a significant proportion of rural areas in Europe have historically been policed under the “gendarmerie” model, that is, a system of militarised police forces with a strong territorial presence. This is the model upon which the Guardia Civil is based.

However, since the 2000s, the design of rural security has undergone a profound transformation, as many countries worldwide have generally opted to close small rural police stations or reduce their hours of operation (Mouhanna 2024). Nearby countries with highly diverse geographical realities, such as France, Sweden, Finland and Denmark, have implemented policies aimed at centralising police forces by merging units and reducing the number of police districts or operational areas in order to improve administrative efficiency in response to

resource shortages (Meško, Bowden, Eman 2025). This trend towards centralising state policing resources creates tension between state authorities – which seek to optimise resources on a macro scale – and local authorities – which demand community-orientated policing and a greater police presence. These structural reforms entail the risk of weakening ties with the territory, as the reduction of permanent personnel in small municipalities separates officers from the communities they serve. In this regard, the transition from the traditional static model of the Guardia Civil to the operational hubs does not constitute an isolated phenomenon in itself, but rather forms part of a broader trend that has also been followed by other European countries.

Although this reorganisation maintains the administrative structure of territorial posts as a reference point for citizen service, operational activity and citizen-security management are centralised at an operational hub, which functionally groups several posts under a coordinated command, thus creating a unified zone of action, as shown below (Figure 4).

Figure 4. Distribution of operational centers and areas of action in the province of Cáceres



Source: Authors' own map.

Under this system, crime prevention resources cease to be strictly assigned to a specific municipality and instead operate at the zonal level. The primary objective is to guarantee minimal levels of police presence, aiming to ensure at least one active patrol 24 hours a day and a daily citizen-attention service within

the operational hub's service area. In this sense, providing this minimal service would require at least three officers. Hierarchically, this structure fits within the chain of command between the territorial company and the posts. The Provincial Command Headquarters, through the companies, assigns responsibility for these hubs to officers or NCOs, who coordinate duty rosters across the grouped posts.

In addition to the policing model, the specific criminological context of the region must also be taken into account. According to the latest data published by the National Statistics Institute (INE n.d.), Extremadura recorded the lowest crime rate in Spain, with 33.5 offences per 1,000 inhabitants. However, when considering the evolution of this rate, it should be noted that it has increased by 29.8% since 2021. Nevertheless, from the perspective of rural criminology, as numerous studies have pointed out, a low crime rate does not imply the absence of crime, particularly in rural areas where under-reporting and under-recording of offences contribute to the so-called dark figure of crime, which distorts official statistics and reinforces the notion of the rural idyll (Ceccato, Abraham 2022; Hale, Harkness, Mulrooney 2022).

Another important issue is that, in Spain, official crime statistics are not published for municipalities with fewer than 20,000 inhabitants. This makes it impossible to determine what is occurring in 98% of the region – at least on the basis of police-recorded data. Nevertheless, the Statistical Crime Service publishes quarterly data at the regional, provincial and municipal levels for municipalities with more than 20,000 inhabitants. These data make it possible to form a general picture of crime patterns in the rural areas of Extremadura. Specifically, in the province of Cáceres, a total of 11,830 offences were recorded in 2025, of which 5,300 were registered in the urban areas (Cáceres and Plasencia) and 6,530 in the rural areas of the province (SEC n.d.). This finding is particularly significant, as it demonstrates that more than 50% of all recorded offences in the province of Cáceres occur in rural areas.

In this context of large territorial expanses, geographic dispersion, scarce police resources and limited prior research, there is a clear need for analytical tools that would allow for an objective assessment of the distribution and accessibility of police resources in rural Spain. Accordingly, the main objective of this research is to estimate the potential distribution of Guardia Civil police service hours per municipality in the province of Cáceres, weighting accessibility to operational resources. To construct an accessibility indicator, a specific quantitative methodology based on geospatial analysis was developed and applied. This indicator is intended to function as an objective criterion for allocating and comparing police resources in a rural environment characterised by high geographic dispersion, thereby contributing to closing an existing gap in Spanish rural criminology regarding policing.

1. Methodology

This study is based on analysing territorial accessibility to security posts and operational units in the province of Cáceres, using spatial analysis tools and relational databases. The data sources, the integration and analysis processes and the formulation of the proposed indicator are detailed below.

1.1. Data sources

The following information sources were used:

- Origin–Destination matrix (*origen_destino*): Calculated using GraphHopper, this contains estimated travel times between the main population centres of all municipalities. Each record includes the INE code of the origin municipality, the destination municipality and the travel time.
- Municipality–Local post relationship (*municipi_puesto*): This table links each municipality to the security post to which it is assigned, with both identified by their INE code.
- Local post–Operational hub (*puesto_núcleo operativo*): This table associates each post with the corresponding operational unit, also identified by INE code.
- Spatial layers: A polygon layer shows the municipal boundaries of the province and a point layer represents the main population centres, including the location of posts and operational-unit headquarters.

1.2. Data integration and processing

All tables were integrated into an Excel workbook, and the worksheets were subsequently imported into a relational database in Microsoft Access. Within this database, the following queries were executed:

- Query 1 – calculation of the mean travel time from each municipality to all posts within its operational unit
- Query 2 – calculation of the travel time from each municipality to the headquarters municipality of its operational unit
- Query 3 – calculation of the travel time from each municipality to the headquarters municipality of the post to which it belongs.

1.3. Accessibility indicator

Based on the results of the previous queries, an indicator was defined to estimate the potential distribution of police service hours per municipality, weighting accessibility to operational resources:

$$HPM = \frac{(HPT \cdot ITT)}{\Sigma ITT}$$

where:

- *HPM* is *horas de servicio policial asignadas al municipio* (police service hours assigned to the municipality),
- *HPM* is *total de horas disponibles en el núcleo operativo* (the total hours available in the operational hub), calculated as:¹

$$HPM = 7 \text{ days} \cdot 24 \text{ hours} \cdot 3 \text{ police officers}$$

- and *ITT* is the inverse of the total access time:

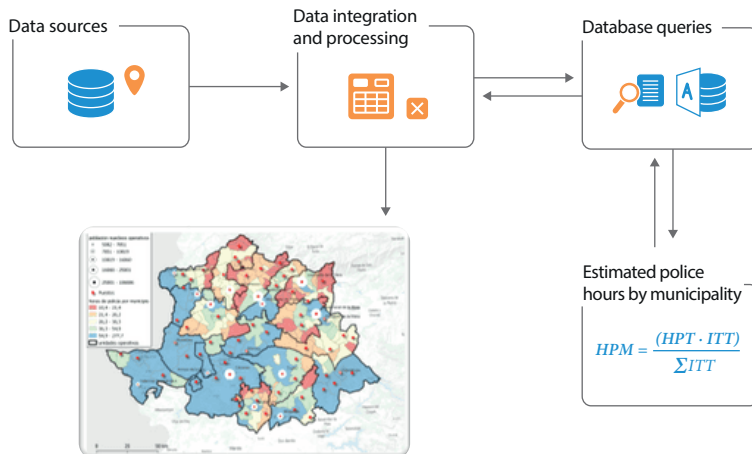
$$ITT = \frac{3}{t_{mean}} + \frac{2}{t_{operational \text{ hub}}} + \frac{1}{t_{municipality \text{ post}}}$$

where:

t_{mean} , $t_{operational \text{ hub}}$ and $t_{municipality \text{ post}}$ correspond to mean travel time to the posts in the unit, travel time to the headquarters municipality of the operational unit and travel time to the headquarters municipality of the post, respectively

- and ΣITT is the sum of *ITT* across all municipalities in the operational hub. A summary schematic of the methodological process is in Figure 5.

Figure 5. Methodological framework for territorial accessibility to police services in the province of Cáceres



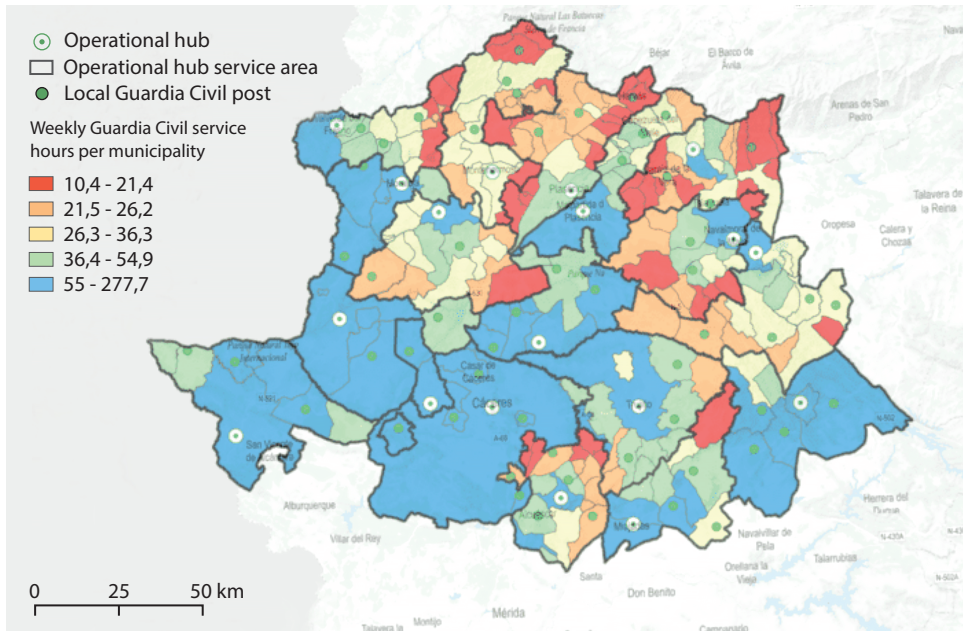
Source: Authors' own elaboration.

¹ A staffing level of three officers represents the minimum threshold necessary to ensure service provision within an operational hub; this also reflects a common reality in the current configuration of many rural units.

2. Results

Applying the accessibility indicator – hours per municipality (HPM) – to the rural municipalities and road networks of Cáceres province reveals a profound disparity in the potential distribution of Guardia Civil service. The results, as shown in Figure 6, indicate that theoretical operational capacity is not distributed homogeneously, but is strongly conditioned by the location of the operational hubs.

Figure 6. Spatial distribution of potential hours of service by the Guardia Civil by municipality



Source: Author's own elaboration.

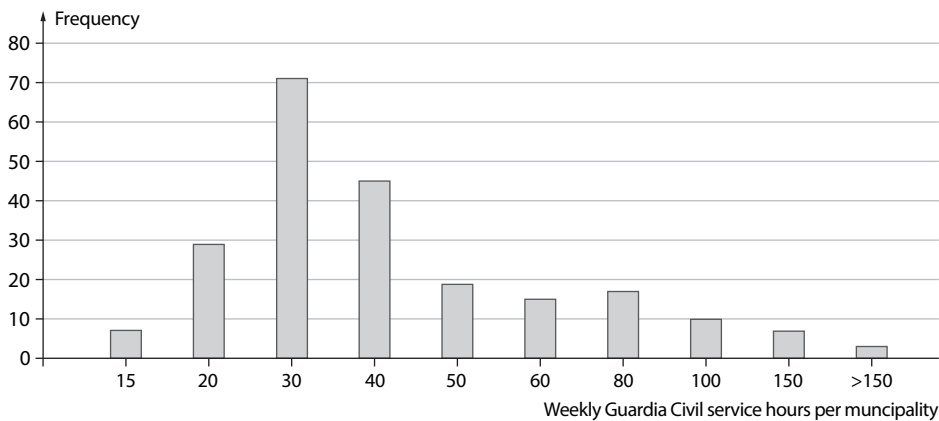
An analysis of this map identified three key structural patterns:

1. Quantitative gap – The range of values reveals extreme inequality. While municipalities with the highest accessibility (blue areas) reach potential values of up to 277.7 weekly Guardia Civil hours, the most isolated municipalities (red areas) barely exceed 10.4 hours. This implies that, under the model, a well-connected municipality can receive – at least theoretically – up to 26 times more potential police presence than a peripheral or isolated municipality.
2. Periphery vs centre – There is a clear concentration of green and blue zones in the central area of the province and along high-capacity transport corridors (the A-66 and A-5 motorways). By contrast, the red and orange zones coincide with the most peripheral and mountainous areas.

- 3. Distance-decay effect – The map visually demonstrates how the central location of the operational hubs (circled points) acts as the epicentre of service provision. Municipalities hosting the hub headquarters or their immediate neighbours enjoy the maximum levels of hours. As travel time from the epicentre increases, potential service hours decrease sharply in municipalities located at the outer edges of each hub’s area.

To understand the magnitude of this inequality, it is necessary to analyse not only where these differences occur, but also how frequently. Figure 7 displays the frequency histogram of service hours per municipality, revealing the statistical profile of police deployment.

Figure 7. Frequency distribution of potential Guardia Civil hours per municipality



Source: Authors’ own elaboration.

Figure 7 reveals a deeply asymmetric distribution, with a pronounced skew towards lower values. The vast majority of rural municipalities in the province of Cáceres are clustered in the intervals corresponding to the lowest coverage, around 30 to 40 weekly hours. This shows that scarcity is not merely an anomaly limited to the most isolated municipalities, but rather a frequent condition for the average rural municipality in the province of Cáceres.

By contrast, the right-hand side of the figure shows that municipalities with optimal levels of provision – between 100 and 150 hours – are statistical outliers that almost exclusively correspond to operational hub headquarters. In short, the frequency analysis confirms that the current security model produces a pyramidal structure in which most rural municipalities operate under minimum police-presence thresholds, while high-capacity presence is confined to a small minority.

In summary, the results show that, although the operational hub model optimises human resource management from an internal perspective, it does not provide citizens with territorially homogeneous service provision, at least under its current territorial configuration.

3. Discussion

This research constitutes a pioneering approach within the field of rural criminology in Spain. As outlined above, the existing literature has focussed predominantly on urban settings or on general sociological analyses, leaving a significant gap in quantitative scientific research on the distribution of policing services in rural areas. Likewise, no international study has been identified that would measure the territorial distribution of a comparable policing model using an indicator such as the one proposed here. That said, reference should be made to the study by Richard Stassen and Vania Ceccato (2021), who analysed police accessibility in Sweden using GIS; however, their methodological approach and metrics differ substantially from those employed in the present research, as will be discussed below. Consequently, the discussion of these findings cannot be based on direct comparison with previous studies, but must instead focus on the capacity of the proposed indicator to make visible and to objectify an operational reality that, until now, had remained concealed beneath a formal administrative structure.

In the absence of direct precedents in the field of rural criminology, this study adopts and adapts analytical frameworks drawn from transport geography and public service planning. Specifically, the methodology is inspired by research addressing the objective measurement of accessibility and the phenomenon of demand decay over a distance. In this regard, reference is made to studies such as Manuel Sánchez Fernández et al. (2017), who validated the use of impedance models in road networks to estimate distance-related demand decay in urban bus use in the city of Cáceres, and Javier Gutiérrez Puebla et al. (2013), whose work on demand modelling highlights the importance of accounting for spatial heterogeneity rather than relying on global planning approaches. The present study introduces an inverse indicator that does not measure demand, but rather the potential hours of service provision. Accordingly, the discussion does not rely on a comparison with previous policing studies, but instead centres on the indicator's ability to render an operational reality visible and objectively measurable.

The most relevant finding of this study lies in the demonstrated disconnect between the administrative design of security provision – namely, the operational hubs – and the geographic reality of the province. The results confirm that the strategy of regionalisation and aggregating local posts, while responding to a necessary logic of internal efficiency aimed at mitigating personnel shortages, generates negative effects in terms of territorial equity. The indicator shows how resource allocation based on administrative assignment ignores the influence of distance, a factor already identified by Sánchez Fernández et al. (2017) as decisive in access to public services in this region. In this sense, municipalities that administratively belong to the same operational hub and theoretically share identical resources in practice exhibit substantial inequalities in service provision and access – ranging from nearly 280 hours to barely 10 – due to their geographic position and the quality of the road network.

The indicator further reveals the existence of a structural vulnerability that extends beyond the province's peripheral areas. While the identification of critical areas in the results map (Figure 5) visualises the fact that the absence of policing services in rural areas is not uniform and is largely associated with zones of complex topography – such as the northern and north-western mountain ranges of the province (Figure 2), marked in red – the frequency distribution analysis (Figure 6) also demonstrates that operational precariousness is not limited to the most remote and isolated municipalities, but rather constitutes a province-wide standard.

From a criminological perspective, this implies a dilution of formal social control, as police response capacity depends almost exclusively on travel time, thereby substantially weakening the preventive function of patrols. Under this premise, a two-speed security system emerges, in which both municipal location and transport infrastructure become discriminatory variables that shape access to policing services.

In this context, it is relevant to contrast these findings with recent international evidence on police restructuring in low-density areas. Studies such as that by Stassen and Ceccato (2021) in Sweden, which analysed accessibility to police stations following national centralisation, concluded that the system maintained a reasonable level of equity under the logic of Central Place Theory, ensuring that a large majority of the population (87.7%) had access to a police station within 20 minutes. However, the radical divergence between their conclusions and the territorial observations of the present study is not attributable solely to differences in topography, but rather to the nature of the object of measurement. Whereas the Swedish model assesses citizens' accessibility to police stations for administrative purposes (an input-orientated approach), this research measures the operational projection capacity of the police force into the territory (an output-orientated approach). This distinction is critical, as the functional centralisation embodied in the operational hubs may be administratively efficient – as suggested by the Swedish case – but the indicator developed here reveals that, when applied to preventive policing in territories with complex topography, this logic generates a structural protection gap, sacrificing the immediacy of emergency response in favour of bureaucratic efficiency.

Finally, in the absence of prior research, this study establishes a methodological baseline for the management of policing services in rural areas. It demonstrates that the use of geographic information systems is indispensable for moving beyond purely demographic or historical criteria in the allocation of police operations, aligning with the argument advanced by Gutiérrez Puebla et al. (2013) regarding the need for local models capable of capturing real spatial variation. The territorial imbalances identified herein are not solely the result of a general shortage of officers, but also of planning processes that have failed to incorporate accessibility variables into their design. Consequently, the novel indicator provides public authorities with a necessary corrective criterion for progressing towards a fairer rural security model that is more closely adapted to the realities of the territory.

Conclusions

This research confirms that the current operational organisation of the Guardia Civil in the province of Cáceres, based on the operational hub model, has consolidated a deep security gap between the centre and the periphery of the province. The geospatial analysis validates that the administrative efficiency achieved through staff aggregation – which functions for internal management – has not translated into real and equitable effectiveness.

From a quantitative standpoint, the study concludes that a systematic inequality exists. The detected disparity in potential allocation of up to 26-fold between municipalities shows that geographic location is a more influential factor in objective security than administrative assignment itself. In particular, the areas with the fewest hours of police presence coincide with the most remote and least accessible parts of the province, demonstrating that the distance–topography nexus acts as a discriminatory factor that severely penalises these rural municipalities. Likewise, the frequency distribution confirms that operational precariousness is not a problem restricted to remote and isolated enclaves, but rather the standard for most municipalities, reflecting a normalisation of scarce police presence as the province's prevailing condition.

From a critical criminological perspective, it is necessary to note that the hub model appears to respond more to a logistical need for operational survival in the face of personnel shortages than to a genuine service-improvement strategy per se. Under this premise, the immediacy and physical reference point of an open barracks (today, the local post) in the village – an element that is key to subjective perceptions of safety in rural settings (Ortiz García, Rufo Rey 2024) – are sacrificed in exchange for maintaining a functional mobile response capacity in increasingly depopulated territories.

Finally, this study provides an original methodological solution for public policy planning, moving beyond resource allocation criteria based solely on demography or historical inertia by integrating real accessibility metrics that allow for assessment and redesign towards a fairer, more balanced policing deployment that is more consistent with the realities of rural municipalities.

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