

Article

The Multifunctionality and Territoriality of Peri-Urban Agri-Food Systems: The Metropolitan Region of Madrid, Spain

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Abstract: This paper addresses the Multifunctional and Territorialised Agri-Food Systems (MTLAFS) in areas of direct urban influence, focusing on the metropolitan region of Madrid. MTLAFS are contextualised as alternatives to the hegemonic global model of mass production and consumption. They are created by combining two conceptual and theoretical bodies of knowledge that share many elements: the study of Local Agri-Food Systems (LAFS), a critical approach to agri-food economies and the re-territorialisation of agri-food systems. The paper analyses the factors that negatively affect the resilience of LAFS and it describes re-territorialisation strategies that enable MTLAFS to be built. By using a multi-criteria methodology to identify agri-environmental and food governance indicators, the research identifies and describes the characteristics that allow the case studies selected in the region of Madrid to be classified as MTLAFS. This has been carried out by gathering the main discussion points on the fractures and relocation strategies that accentuate the vulnerability or, on the contrary, enhance the resilience of the cases analysed. The paper concludes with some recommendations for strengthening the socio-ecological resilience of MTLAFS by using the systemic basis provided by the agro-urban project. This agro-urban project brings together different public policies, governance tools, territorial and food planning, as well as agrarian practices anchored to each specific territory. All these agrarian practices contribute to the configuration of an alternative territorial agri-food model that ensures food security and a shift towards the sustainable development of our planet.

Keywords: local agri-food systems; agri-food economies; peri-urban agriculture; agrarian heritage; food democracy; food security



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1. Introduction

Agri-food economies and Local Agri-Food Systems (LAFS) are facing multiple challenges in peri-urban areas. These challenges are caused by factors such as the intense urbanisation of metropolitan regions, neo-liberal policies on the deregulation of land use and the ever-increasing disconnection between the areas of production and consumption caused by the globalisation of agri-food production and commerce. However, despite such an unfavourable context, there is growing interest, from different theoretical perspectives and fields, in the study of the characteristics that make LAFS vulnerable, and, on the other hand, in the study of the factors that build up the socio-ecological resilience of LAFS. This resilience can be defined as how LAFS adapt to environmental and economic shocks or crises by making the most of the environmental and cultural opportunities that their geographical locations present.

To identify the origin of the main drivers that increase the vulnerability of LAFS, it is necessary to go back to the industrialisation of agriculture and the height of agrarian productivism in the Green Revolution. During the 1960s, the foundations of the productivism paradigm were laid, in which food systems were industrialised, as were food and farming. Large amounts of natural resources were consumed, particularly fossil fuels, to

produce large quantities of standardised foods [1]. In the following decades, this new production/consumption model replaced most of the diversified, place-based, culturally rooted agri-food models that had previously been used in different territories [2]. An extensive body of scientific literature has argued that the industrialised food system has caused major negative environmental and social impacts around the world [3,4]. One of the most serious impacts, at a global scale, is the effect of agricultural production on destabilising the planetary metabolism and the major role that this plays in crossing environmental boundaries [5]. At a local scale, the transition from agrarian to industrial metabolism meant an increase in the pressure on agri-ecosystems in general [6], the breaking up of short food supply chains [7] and the deterioration of tangible and intangible components of agrarian landscapes, which are drivers of socio-ecological resilience [8–11]. Moreover, agri-food economies have been progressively disconnected from their traditional constitutive elements as a result of historical processes [12]. With agricultural modernisation, a substantial number of small-scale farms in peri-urban areas have been dismantled [13]. Furthermore, in these areas, the diversity of high-quality landscapes, with high strategic food security values, has decreased. As a consequence, the conventional agri-industrial food system has shown that it cannot recover easily from economic and social shocks and natural changes. However, the LAFS, in many cases, have been able to maintain their socio-ecological resilience, given that they have conserved the multifunctionality of the agri-ecosystem [14].

As mentioned by Van der Ploeg [15], the vulnerability of LAFS in urban contexts is exacerbated by the pressures that directly affect the three constitutive elements of agri-food economies: nature, society and the actors managing the links between these two elements. As Van der Ploeg points out, nature stands as a reference point for agri-ecosystems and the natural resources within them, particularly land, water and biodiversity. Society stands for the consumption of foods and other environmental products and services provided by the agri-food system. Finally, the economic actors represent the agri-food economies responsible for producing, processing and distributing food in the agri-food system.

According to Berti [16], these three main constitutive elements of agri-food economies are experiencing three types of “fractures”, which are especially complex in peri-urban LAFS. The first fracture occurs between LAFS and the environment because of the negative externalities caused by the global food systems as major drivers of climate change, changes in land use, the depletion of freshwater resources and pollution of aquatic and terrestrial ecosystems through excessive nitrogen and phosphorus inputs [17]. The second fracture happens in the society and is caused by globalisation, climate change and urbanisation, which impede access to sufficient nutritious food [18]. Finally, we are witnessing a rupture between the dominant agri-food system and small-scale producers, which is contributing to the de-agriculturalisation and depopulation of the countryside because small-scale family farms are no longer economically viable. Specifically, in metropolitan regions and peri-urban areas, the fracture is being caused by a lack of policies for controlling urban expansion, loss of fertile soils and soil sealing [19,20].

The concept of Multifunctional Territorialised Agricultural Food Systems (MTLAFS) has emerged as an alternative to the hegemonic global model of mass production and consumption. These food systems aim to design multifunctional agri-ecosystems that are both sustained by nature and are sustainable in nature, and that can contribute to a sustainable food transition supported by social-mobilisation and governance mechanisms for territorial development [21]. Sustainable food is defined by the Food and Agriculture Organisation (FAO) [22] as food which “protects biodiversity and ecosystems, is culturally acceptable, economically accessible, fair and realistic, safe, nutritionally appropriate and beneficial for health, and which optimises the use of natural and human resources”.

MTLAFS are created by combining two conceptual and theoretical bodies of knowledge that share many elements: On the one hand, the theory of studying LAFS in both developed countries, particularly in the south of Europe, and developing countries (in-

cluding [23–26]); on the other hand, the critical focus of agri-food economies and the food re-territorialisation process [27–29].

Conceptually, MTLAFS are defined, first, by two fundamental features related to two types of multifunctionality: (1) Intrinsic multifunctionality referring to local agri-food economies regarding production, food supply and raw materials; (2) extrinsic multifunctionality, which is related to the specificity and identity of the territories in which MTLAFS are located, and the ecosystem services related to climate regulation and culture.

Second, the MTLAFS are also defined by re-territorialisation processes, which are new critical narratives which can be contrasted with the dominant paradigm of productivism. These narratives aim to reconnect food with the territories and societies in which these systems are present, on a foundation of endogenous resources, traditional know-how and the involvement of local actors. All these initiatives are characterised by a multi-actor focus, which aims to democratically reshape the relationship between production, distribution and consumption practices. These critical alternative processes take place at a local scale and in bioregional contexts, and they are linked to grass-root movements that have emerged to confront the processes of de-localisation and homogenisation tied to globalised circuits [30].

The alternative food networks have a leading role in the re-territorialisation process that characterises MTLAFS. These networks are fighting to create new food governance that is more participatory and horizontal. Different initiatives associated with short food supply chains are a key feature of this change, as they favour the democratisation of the agri-food system that is based on “fair” and “trust-based” relationships between producers and consumers, especially in urban and peri-urban areas [31]. Some of these initiatives are more deeply rooted in professional agri-food systems, while others are based on fair distribution and ensuring fresh, sustainable foods. However, in both cases, what underpins these initiatives is head-on criticism and the search for alternatives to the irrationality of the savage processes of urbanisation and sealing of quality agricultural land, and the all-encompassing power of the globalised food systems [32].

To address certain gaps in the literature, we have developed an innovative analytical framework for conceptualising MTLAFS using a systemic, place-based approach, with a double objective: (a) Identifying different processes for the construction and renewal of local resources and their territorial anchorage, focusing on bottom-up strategies developed by the emerging agri-food economies; (b) strengthening the legitimacy and resilience of MTLAFS through the creation of bridges between nature, society and agri-food economies.

This paper is structured as follows. In the first section, the drivers that negatively affect the resilience of the LAFS are analysed, followed by a description of re-territorialisation strategies to build MTLAFS based on LAFS. In the second section, the materials and methods are presented, and the characterisation of the territorial context of the case studies is shown. The third section describes the features that enable us to classify the two case studies as MTLAFS. The results section compiles the main discussion points concerning the drivers that accentuate the vulnerability, or, on the other hand, improve the socio-ecological resilience of the case studies. The final section concludes with some of the key elements that enable the scaling up of sustainable food at a bioregional scale.

Strategies for the Re-Territorialisation of LAFS

This paper maintains that the re-territorialisation of LAFS requires the stimulus of three strategies to re-establish proximity with nature, society and agri-food economies. These three strategies need to be supported by participatory processes and territorial governance in each local context, and they need to be in harmony with the endogenous characteristics of each specific geographical area (Figure 1). The term “geographical area” is defined in this paper as a bioregion, in other words, a territory with its own distinctive ecological, economic and cultural features that are the result of historical processes that are shown by the tangibility of landscapes and their identity-based and symbolic meanings [33].

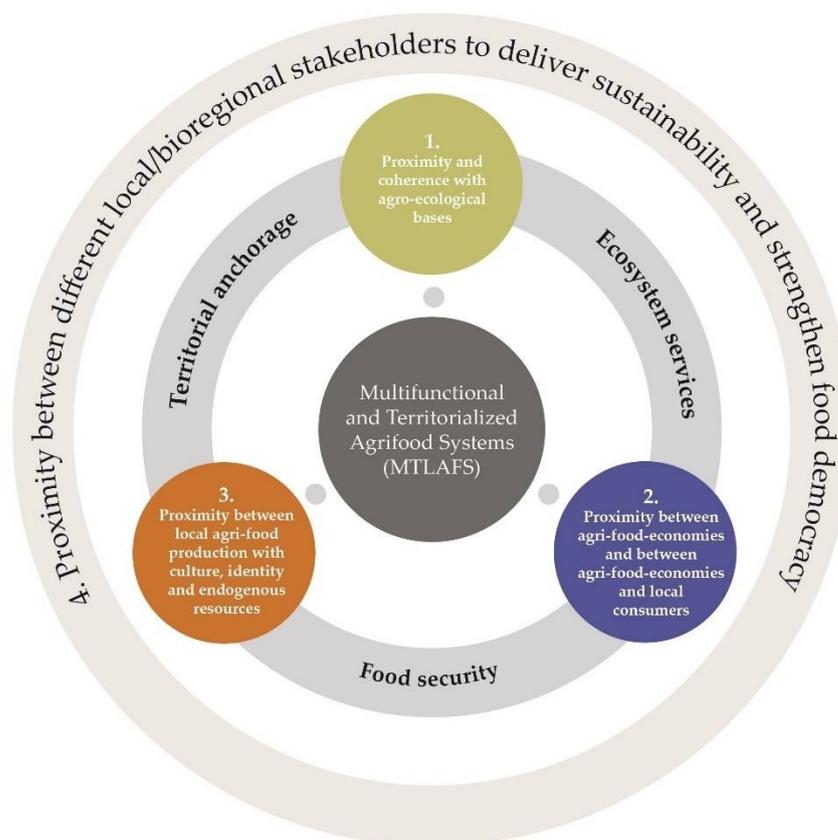


Figure 1. Process for the re-territorialisation of local food systems. The transition towards Multifunctional and Territorialized Agrifood Systems (MTLAFS) relies on the development of the 4 strategies in a synergic manner with local food stakeholders to improve food security and food democracy, territorial anchorage, provision of ecosystem services and to deliver sustainability.

The first strategy for the re-territorialisation consists of strengthening and reestablishment of proximity and coherence with agri-ecological bases [9] to improve the provision of ecosystem services. Local stakeholders, especially crop and livestock farmers, play an active part in the conservation of the biological cycles of the agri-ecosystem. This nature-based strategy includes diversification at a farm level, organic agriculture, extensive livestock farming and the introduction of agroecology practices at a bioregional scale. From a governance perspective, this strategy includes the implementation of specific policies to conserve nature and a wide range of species. Moreover, there are strategies led by civil society groups, such as land stewardship agreements, which try to protect nature, biodiversity, ecological integrity and the landscape values of mainly private lands. All these strategies aim to improve the supply of sustainable foods, the regulation of water cycles and land conservation.

The objective of the second strategy is to promote proximity between different agri-food economies, and between agri-food economies and local consumers to strengthen bioregional food security. This strategy includes policies, initiatives and cooperative practices that aim to mobilise social innovation by establishing networks of small-scale food producers and processors within ecological, political, cultural and economic environments to scale up the production and consumption of sustainable foods in the local market [34]. This strategy includes support for all types of short food supply chains, the development of school canteen programmes that create alliances with local producers, the creation of food hubs that bring together and empower small-scale producers, as well as the establishment of cooperative supermarkets. These initiatives have emerged as real alternatives to conventional food supply chains since their main objective is to contribute to the scaling-up of the food produced and distributed through sustainable practices [35]. It also addresses the

promotion of a social and solidarity-based economy, and it ensures cooperation to manage the resources democratically, depending on people's real needs [36]. These economic alternatives focus on increasing nutritional quality, diversity and universal access to sustainable food. In this strategic framework, the economic and social viability of small-scale farms and artisanal food processors is an essential condition that needs to be ensured by the renewed agri-food policies. Family-based agriculture is recognised as the key to ensuring the optimisation of the rest of the system.

The objective of the third strategy is to improve proximity between local agri-food production with culture and endogenous resources. This strategy aims to strengthen the territorial anchorage of the food produced and processed at a bioregional scale and reconnect it to each specific area by introducing specific attributes that revalorise identity-based foods, and by connecting the past, present and future. The food anchorage strategies are a result of the activation of different local resources—environmental, agricultural, technical, legal, regulatory, human, social and economic resources—which can be used to obtain better incomes linked to the territorial specificity of a food product [37]. These cultural and identity-based re-territorialisation initiatives connect with the newly created meaning of landscape that, in this case, is managed by the farmers on peri-urban lands [38]. These values are recognised and valued by urban dwellers, creating a meeting point between the countryside and the city. The idea is not to convert the landscape into just another element to be protected, but to create a bond that enables communication and education between farmers and urban consumers, both of which are groups that live and benefit from the landscape services in their agrarian surroundings. The conscious decision to consume local products can also provide consumers with a positive organoleptic experience, a pleasant feeling caused by food that is tied to a specific landscape.

Together with these three strategies that strengthen the triple “proximity” of nature, local communities and agri-food economies, there is another transversal strategy that is essential for the creation of MTLAFS that is related to bringing different regional stakeholders together to deliver sustainability and strengthen food democracy. This new strategy deals with different forms of self-governance and more inclusive processes to improve socio-ecological resilience by developing food policies at multiple levels and responding to multi-scalar issues. In addition, this strategy activates local production systems based on the enhancement of heritage resources (environmental, territorial, landscape and socio-cultural common assets) and encourages environmental policies aimed at the closure of water, waste, food and energy cycles at a local level [29]. This also includes the development of participatory processes to encourage agri-food economies that contribute to social justice and enhance food security [28]. Finally, this strategy includes the renewed understanding of “agri-urban commons”, which are an opportunity for territorial democracy and resistance to the loss of agrarian activities in metropolitan areas [39].

In the renewed framework of MTLAFS, which operates in metropolitan regions and peri-urban areas, the renewed urban agri-food policies stand out as fundamental drivers for the development of local self-sustainable projects, and for achieving social well-being by caring for and enhancing the heritage of the commons [40,41]. As an example, different projects are developing strategies of territorial anchorage, such as the Agrarian Parks, aimed at the promotion of the multifunctionality of peri-urban agriculture, focusing particularly on the proximity and quality of food, and their ability to reshape cultural landscapes for collective enjoyment [42,43]. Similarly, there are policies that adopt a food chain approach to capture the value of final products as a form of re-territorialisation based on communicating the “quality”, “origin” and “cultural traditions” of local products [44]. Other policies defend agri-ecological farming and the use of traditional knowledge for sustainable management of resources and conservation of agri-ecosystem services [2,45].

2. Materials and Methods

2.1. Study Area

The Autonomous Region of Madrid is an administrative-political region that functions as an urban region or city-region [46]. It is located in the centre of Spain (Figure 2), with altitudes that vary from 2428 m above sea level at the peak of Peñalara (Sierra of Guadarrama) to 494 m above sea level in the vicinity of the River Tajo in Aranjuez. It covers 8030 km² and has a population of 6,751,251 inhabitants (National Statistics Institute, 2020), 48% of whom reside in the municipality of Madrid (the capital city of the region and the state, 3,233,527 inhabitants, National Statistics Institute, 2020) and in another twenty metropolitan cities that have over 50,000 inhabitants each.

The region is characterised by a Mediterranean climate, with a marked contrast between the mountainous areas of the north—the Sierra of Guadarrama—with a Mediterranean sub-humid mountain climate that is cold in winter, and a continental Mediterranean climate on the plains in the centre and south of the region. It is a territory of stark altitudinal, biogeographic and socio-economic contrasts, with intense urbanisation and major pressure on resources in the metropolitan area, which has not stopped growing demographically and economically since the 1960s. On the other hand, the rural areas of the mountainous north and the sedimentary plains in the south and east still have interesting agricultural, livestock and forest landscapes, with natural vegetation formations, especially in the Sierra de Guadarrama, and an agrarian patchwork whose high landscape value can be measured in ecological, economic, cultural and aesthetic terms. The case study selected covers a total area of 73,328 ha (Table 1) (Case study 1: 16,549 ha; Case study 2: 20,115)

Table 1. Territorial and agrarian indicators of the selected case studies.

	CASE STUDY 1			CASE STUDY 2		
	Ciempozuelos	San Martín de la Vega	Titulcia	Rascafría	Alameda del Valle	Pinilla del Valle
Total census population	23,390	8281	1194	1870	247	205
Municipal area (ha)	4964	10,590	995	15,030	2501	2584
Utilised agricultural area (UAA) of agricultural holdings	2276	2301	547	3412	1693	1211
Total number of agricultural holdings	133	238	16	49	18	13
Agricultural holdings of over 50 ha	11	2	4	7	11	1
Utilised agricultural area farmed by the landowner	1221	1772	416	1830	1309	970
Livestock units	302	660	0	2046	819	423

Source: Agricultural Census 2009, National Institute of Statistics of Spain.

The following criteria were used to select the cases:

- The case study has the potential to become an example of full or mature MTLAFS, because of its sustainable endogenous resource management in accordance with the criteria displayed in Table 1.
- The case study exhibits a diversity of characteristics and functions in terms of its landscape quality, patrimonial heritage, traditional farming, identity-foods, tangible and intangible agrarian heritage, communal property, territorial quality labels, high natural values and associative network at a bioregional level [47].

The first case study deals with the “Sedimentary hills and alluvial plains with dry and irrigated crops” (*Campiñas* and *Vegas*). It corresponds to the agri-ecosystems of the sedimentary plains in the south and east of this region, with a continental Mediterranean climate, marked summer drought and harsh winter, and a long agricultural tradition. The predominant crops are cereals, vineyards and spots of olive groves in the countryside and dry moorland, and horticultural and fodder produce on the *Vegas* (alluvial plains) irrigated by the main rivers of the region. Even though it is an extremely agricultural area, natural elements of major floristic, ecological and landscape interest have been conserved: in the *campiñas* and moorland covered by dry crops, there are small spots of Mediterranean forest vegetation with *Quercus ilex*, *Q. coccifera*, *Pinus halepensis* and different species of continental Mediterranean scrubland; on the alluvial plains, there are some stretches of riverbank vegetation next to the River Jarama and hydrophilic vegetation next to the irrigation channels and in the humid areas of the alluvial plains. Three municipalities in the lower section of the Jarama valley and its borders have been selected for this case study: Ciempozuelos, San Martin de la Vega and Titulcia (Table 1).

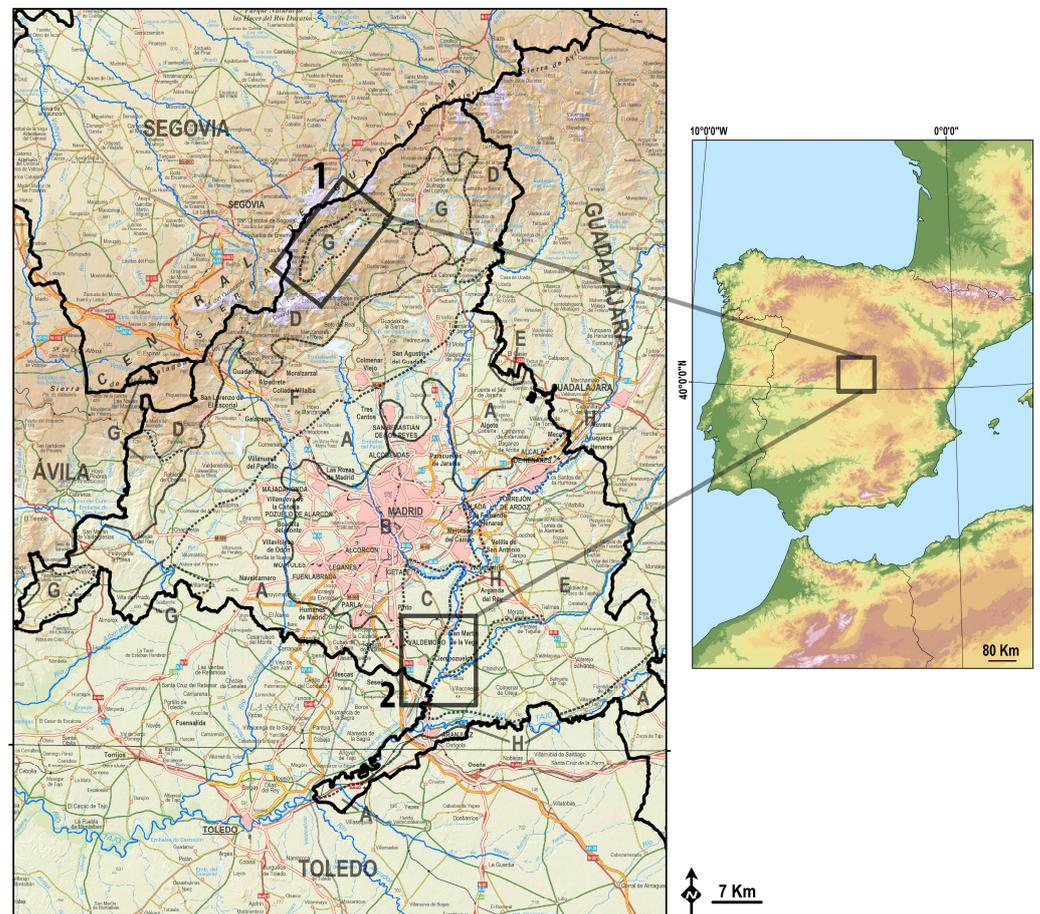


Figure 2. Study area and the location of the two case studies. Landscapes: (A) Open field countryside with cereals crops (*Campiñas*); (B) Madrid and its metropolitan area; (C) Inland plains; (D) Iberian inland mountain massifs (*Sierra*); (E) Moorland and plateaus (*Páramos*); (F) Peneplains and foothills; (G) Iberian inland mountain ranges and depressions and their borders; (H) Alluvial plains and riverbanks (*Vegas*). Source: created by the authors. Landscape Cartography: [48].

The second case study deals with the “Ash forests and meadows in mountain basins and depressions” (*Sierra*), that spread across the depression and foothills of the Sierra of Guadarrama. There is extensive livestock farming in this area on the best-preserved pastureland and meadows in the region. This livestock farming vocation maintains, with its traditional management, outstanding mixed formations of woodland and meadows,

with hedges of *Fraxinus angustifolia* and *Quercus pyrenaica*. The three municipalities selected for this case study are in the Lozoya Valley: Rascafría, Alameda del Valle and Pinilla del Valle (Table 1).

There are major differences in the territorial and agrarian indicators (Table 1) for the two case studies selected. The total population of Case 1 (*Campiñas* and *Vegas*) is 32,875 inhabitants, with a density of almost 200 inhabitants per square kilometre. Case study 2 (*Sierra*) has only 2322 inhabitants, with a low population density of 11 inhabitants per square kilometre, typical of mountain areas. On the other hand, livestock farming is very important in the mountain municipalities (3288 livestock units), as opposed to the southern municipalities, where agricultural activity is predominant, and livestock is less economically significant (962 units). Likewise, the three municipalities in the area of *Campiñas* and *Vegas* have a lot of farms (387), and medium-sized and small farms are predominant. In contrast, in the *Sierra*, a considerably lower number of farms (80), and large properties, some of which are communal, are more predominant.

The two case studies are extremely different, and this choice was made so that the model of MTLAFS in different bioregional contexts could be validated. Nevertheless, both case studies are affected by similar urban pressures. With these case studies, we want to show the strengths and weaknesses of each of the MTLAFS by using the methodological bases that have been designed (Table 2).

Table 2. Criteria used to characterise and describe the MTLAFS, and types of indicators.

Criteria	Description	Indicators
1 Proximity and coherence with agri-ecological bases	Practices, initiatives and policies aimed at conserving and improving the provision of local ecosystem services	Organic agriculture; belonging to protected areas; private territorial conservation formulas
2 Proximity between agri-food economies, and between agrifood economies and local consumers	Collective policies and initiatives aimed at mobilizing social innovation to strengthen food security	Short food supply chains, alternative food networks and cooperation in production and consumption
3 Proximity between local agri-food production with culture, identity and endogenous resources	Collective initiatives to strengthen territorial anchoring of locally produced and processed food. Incorporation of specific attributes to create identity foods and to reconnect the countryside and the city	Genetic, landscape, and tangible and intangible agrarian heritage; communal property and territorial quality labels
4 Proximity between different local/bioregional stakeholders to deliver sustainability and strengthen food democracy	Participatory processes that encourage proximity to nature, society and agrifood economies and that strengthen food democracy	Communities and organisations for the sustainable management of resources; organisations for territorial and agri-food development; public policies of support for sustainable food

2.2. Methodological Bases

In the initial research phase, a methodological framework was designed for the description of the elements that make up the MTLAFS and for their subsequent analysis. A multi-criteria approach was outlined using different qualitative and quantitative methods to identify agri-environmental and food governance indicators and to analyse the level of internal and external multifunctionality of the MTLAFS. This methodological framework (Table 1) summarises and organises the information that is used to consider and evaluate the MTLAFS, focusing on local and regional scales.

The table structures the information using four criteria that refer to the four strategies for the re-territorialisation of the LAFS as shown in Section 1. Structuring the information in this way helps to identify the positive and negative drivers that affect proximity to nature, society and agri-food economies. In other words, it helps to consider the degree of maturity of the MTLAFS and their socio-ecological resilience. The second level of analysis of the

methodological framework proposed consists of a series of indicators that are available on online databases, cartographic databases and inventories created by public institutions to facilitate this information to other researchers that want to apply the same methodology to their research by making the information open access. The parameters of the indicators selected have the following characteristics: wide territorial coverage, preferably for the whole country; detailed scales and data from alternative sources mainly created from basic research.

2.3. Data Collection

The main information sources for the characterisation of the MTLAFS for each case study were expert interviews, online searches, document analysis and field survey data analysis. All of this was supported by the results obtained in previous studies [48–53]. The information was processed in two phases: the first phase was quantitative, in which an exhaustive review of documentary and cartographic material was carried out, which was later analysed. The data obtained from this phase were then complemented with fieldwork to characterise each case study. This was carried out by using the criteria and indicators designed in the methodology for MTLAFS (Table 1). In the second research phase, a micro-sociological qualitative study was carried out with in-depth interviews with the key agents in both study areas. The contributions made by the actors have been very important for identifying their roles in the different forms of governance, as well as for providing information on how the agri-food system functions referring to specific local and regional indicators (Table A1).

2.3.1. Document and Cartography Review and Quantitative Analysis

The sources of information have been classified in accordance with four criteria which can be seen in Table 1. The different sources selected for the research together with the institutions from which they originate, and the types of data are listed in Tables 3 and A1.

Table 3. Types of sources and data used in the research.

Criteria	Source Origin	Data Type
A Proximity and coherence of the MTLAFS with the agri-ecological bases and how to improve them (Table 2; criterion 1)	Nature Databank. Ministry for Ecological Transition and Demographic Challenge. Government of Spain	Systematic information on protected natural spaces, forest ecosystems, an inventory of habitats, ecosystems and livestock routes.
	The Land Stewardship Platform. Biodiversity Foundation. Government of Spain	Information on the activities carried out by the different entities that act as land stewards. The inventory of territorial stewardship is published every two years, and it provides data from the entities themselves and information on the characteristics of each land stewardship agreement.
	Survey on Crop Areas and Yields (ESYRCE). Spanish Land Use-Land Cover Frame Survey. Ministry of Agriculture, Fisheries and Food	This has been carried out annually since 1990 in conjunction with the Regional Statistical Services Office. The survey is based on field research, and it collects information on the ground in a georeferenced sample of the country.
	Study on the characterisation and evaluation of the landscape in the Region of Madrid, carried out for the regional government by the “Landscape and Territory” (Universidad Autónoma de Madrid) Mata et al. [47].	This research provides mapping, at a scale of 1:25,000 of the different types of landscapes in the Region of Madrid, as well as other results.
	Inventory	Field work, between 2018 and 2020, to identify the habitats and the species of vegetation in the ecosystem that have high nature, productivity and culture values, as well as the results of previous studies [50,52,53].

Table 3. Cont.

Criteria	Source Origin	Data Type
B Initiatives and policies aimed at improving the proximity between agri-food-economies, and between agri-food-economies and local consumers (Table 2: criterion 2)	General Health Registry of Food Companies and Foodstuffs in Spain (RGSEAA). Ministry of Consumer Affairs	Census of food companies by municipality.
	Register of Cooperative Societies for the Region of Madrid, Spain.	List of the cooperatives registered in the Register of Cooperative Societies by municipality.
	Inventory	Field work and interviews with local agents between 2018 and 2020, to identify short food supply chains, such as farmers' markets, direct sales, consumer groups and community supported agriculture.
C Policies and initiatives aimed at reconnecting local agri-food production with territorial culture and endogenous resources link to agrarian and landscape heritage (Table 2: criterion 3)	Spanish Inventory of Traditional Knowledge related to Agricultural Biodiversity. Ministry of Agriculture, Fisheries and Food.	Traditional crops, traditional crop varieties and their location, by municipality.
	National Catalogues of Commercial and Protected Varieties. EU Plant Variety database. European Commission.	Varieties of agricultural, plant and vegetable species, whose seeds can be sold throughout the European Union, the varieties are listed by country.
	Catalogue of Spanish Grape Varieties. Madrid Institute for Rural, Agrarian and Food Research and development (IMIDRA)	Information listed by municipality.
	National Rural Network. Ministry of Agriculture, Fisheries and Food. Government of Spain. Madrid Food Quality Marks. Regional Government of Madrid, Spain	Protection of Designated Origin, protected geographical indicators, quality labels, geographical designation and quality assurance seals
D Policies and initiatives aimed at improving the proximity between different local/bioregional stakeholders to deliver sustainability and strengthen food democracy (Table 2: criterion 4)	National Federation of Irrigation Associations of Spain (FENACORE)	Surface and underground water used for irrigation
	National Rural Network. Ministry of Agriculture, Fisheries and Food. Government of Spain	LEADER territorial map and the Local Action Groups
	Urban Food Policies. The website of the Milan Urban Food Policy Pact.	Register of the cities that have signed up to the Pact.
	Inventory of Municipal and Regional Agri-urban Projects (Soil Banks, Agrarian Parks, etc.).	Field work and interviews with local agents between 2018 and 2021 to identify the existence of XDSF, such as farmers' markets, direct sales, consumer groups and community supported agriculture.

Once the indicators had been identified, they were tested in the two case studies selected, obtaining detailed qualitative information on the drivers that improve their socio-ecological resilience.

2.3.2. Qualitative Analysis

For each case study, 10 in-depth interviews were held with crop farmers, livestock farmers, agrarian organisations and decision-makers to collect qualitative information about the different actors that participate and contribute to these agri-food systems. A total of 20 interviews were conducted with different types of local stakeholders with knowledge of the local food systems. Moreover, a focus group was organised with ten representative stakeholders from rural development institutions (2), representatives of the irrigation communities (2), the academic sector (2), the associative agricultural sector (2) and a representative from the farmers' union (2).

Two criteria were established for the selection of the crop farmers for both case studies: the size of farms (small and medium estates measuring between 2 and 4 hectares) and horticultural production. In the absence of an up-to-date census on these types of producers that could have been used as a sample, the snowball technique was used for the selection

of test units (crop farmers). For the sample of livestock farmers in the “Ash forests and meadows” case study, active holdings were selected that are representative of pastureland and hay meadows in the bottom of the valley and the foothills with ash forests. The criteria followed to select them were: small scale farms with quality labels and that keep their herds.

The number of crop farmers selected is small because the objective of the research is to test the methodology presented. We are not aiming for representativity nor exhaustivity, but a general view of the roles and strategies of agri-food governance that are represented in the case studies.

The questionnaires are made up of ten questions that are organised into six sections. The sections cover the following issues: (a) Farming systems and farming practices; (b) institutional support; (c) impact on and participation in governance strategies in the area; (d) drivers that limit the reconnection between nature, society and the agri-food economies; (e) strategies and difficulties to market products with quality labels; (f) knowledge of biological values of the holdings and conservation formulas. All the questions were aimed at understanding the local and regional context. All the interviews were held in person, and they lasted for around one hour. They took place between 2018 and 2021. Due to the COVID-19 pandemic and the lockdown decreed in Spain, the interviews were interrupted between March and September 2020. Fieldwork was carried out continuously with the permission granted by the of the academic authorities responsible for this.

2.4. Evaluation of Indicators

In the final phase, a quantitative evaluation was carried out for each of the indicators selected, and these were applied to each of the case studies. This evaluation was carried out by establishing an equal weighting (25) for each of the four criteria considered, giving the same weighting for each indicator in each criterion. Criterion 1 contains six indicators with a maximum of 4.2 points each; criterion 2 contains four indicators with a maximum of 6.3 points each; criterion 3 contains nine indicators with a maximum of 2.7 points each; and criterion 4 contains five indicators with a maximum of 5 points each. Thus, the lowest value (0) was considered for indicators that did not exist, when there was a high level of resource degradation, and/or a lack of public policies and initiatives developed by local actors. The highest value for each criterion has been applied in cases where each indicator offered the highest coverage and the best representativeness and coherence. The ratings were awarded based on the information from a database created from the sources consulted (Table 1), together with the expert judgement of the authors of this study and the data collected in the qualitative phase.

3. Results

In this section, the most important drivers of the four criteria that characterise the MTAFS are reviewed and commented on. This is carried out by using the information obtained from the statistical cartographic sources in Table 1, as well as the qualitative analysis of the in-depth interviews. The drivers are summarised in the tables for each criterion and the two MTLAFS (Tables 4–7). Therefore, the degree of maturity of both MTLAFS has been evaluated by using the results provided by the evaluation of the 25 indicators selected for the four criteria that were previously established (Table 2). This evaluation has made it possible to identify and weigh up the socio-ecological resilience of the MTLAFS, and, their main weaknesses.

Table 4. Positive drivers. Criterion 1. Proximity and coherence with agri-ecological bases.

Case 1. Sedimentary Hills and Alluvial Plains with Dry and Irrigated Crops (<i>Campiñas and Vegas</i>)	Case 2. Ash Forests and Meadows in Mountain Basins and Depressions (<i>Sierra</i>)
<p>Area of interest in terms of its geomorphology, well-preserved fauna, and flora, with numerous species that are endemic to habitats where gypsum is present.</p> <p>Alluvial plains with a high agri-ecological value that are generally well managed</p> <p>Maintenance of high-value ecological landscape structures in the alluvial plains and the sedimentary hills: Forests on the banks of the River Jarama with <i>Populus alba</i>, <i>Fraxinus angustifolia</i>, <i>Salix alba</i>, <i>S. fragilis</i>, <i>S. triandra</i> y <i>Tamarix gallica</i>; natural hygrophila vegetation associated with irrigation channels and lagoons; copses and elements of natural linear vegetation; local varieties of centenary olive trees</p> <p>Artificial wetlands on the alluvial plains, rich and diverse ornithology, and with a large, well-conserved reed bed. Marsh birds and <i>Anatidae</i> birds of great interest</p> <p>The River Jarama is in a good state of conservation. It is one of the most important tributaries of the River Tajo, with different levels of fluvial terraces on which the irrigated crops are located</p> <p>Wide coverage of the Natura 2000 Network, Birds Directive Sites (SPA) <i>Cortados y cantiles de los ríos Jarama y Manzanares</i>; Site of Community Importance (SCI) <i>Vegas, Cuestas y Páramos del Sureste de Madrid</i>; Site of Community Importance (SCI) <i>Vegas, Cuestas y Páramos del sureste de Madrid</i></p> <p>IBA (Important Birdlife Areas) <i>Cortados y Graveras del Jarama</i></p> <p>Southeast Regional Park with high ecological, paleontological, and archeological values</p>	<p>High value physiographic and landscape area, with excellently conserved ecosystems, especially the forest formations</p> <p>Unique intra- mountain fosse</p> <p>Landscape elements with strong identity-based characteristics (stone walls, irrigation channels), which are of interest for the conservation of biological elements.</p> <p>Pastures of high interest, including hay meadows at the bottom of the valley, with priority habitats of interest such as the hay meadows of <i>Alopecurus pratensis</i> <i>Sanguisorba officinalis</i>, the thermophilic ash <i>Fraxinus angustifolia</i> and the hydrophilous tall herb communities on the edges of the plain.</p> <p>Livestock system with a cycle that is complex, comprehensive, and strongly connected to biodiversity</p> <p>High river course of the River Lozoya that is very well conserved, excellent water quality and supplies water for the irrigation of the hay meadows</p> <p>Wide coverage of Protected Natural Areas with diverse types of protection: Site of Community Importance (SCI) <i>Cuenca del Río Lozoya y Sierra Norte</i>; Bird Directive Sites (SPA) <i>Alto Lozoya</i>; National Park <i>Sierra de Guadarrama</i>; Biosphere reserve <i>Cuencas Altas del Río Manzanares, Lozoya y Guadarrama</i></p>

Table 5. Positive Drivers. Criterion 2. Proximity between agri-food economies and between agri-food economies and local consumers.

Case 1. Sedimentary Hills and Alluvial Plains with Dry and Irrigated Crops (<i>Campiñas and Vegas</i>)	Case 2. Ash Forests and Meadows in Mountain Basins and Depressions (<i>Sierra</i>)
<p>Significant presence of <i>manchego</i> and <i>alcarreño</i> sheep and farms for the production of artisanal milk and cheese</p> <p>Unique cases of agri-ecological management and local varieties of crops (asparagus and artichokes)</p> <p>Agroecological projects and a slight increase in organic agriculture certifications: horticultural production (<i>La Huerta Madre Vieja, Conciencia Grows, El Huertecito</i>); organic olive oil (<i>La Aceitera de la Abuela</i>); meat (Livestock farming <i>Campogrande</i>); cheese (<i>Marques de Mendiola, Cheese factory</i>)</p> <p>Historical olive mill <i>La Abuela</i> en Titulcia: produces organic olive oil</p> <p>Traditional grocery market with direct sales of local products</p> <p>Short food supply chains: direct farm sales; sales at farmhouses; groups of consumers who reside in the City of Madrid; online sales and supplying restaurants and shops in the area</p> <p>Agrarian cooperatives (4)</p> <p>Development of gastronomic tourism related to wine and oil tasting, routes on livestock trials, local popular celebrations and traditional gastronomy</p>	<p>GanadeMad, a cooperative of livestock farmers in the Guadarrama mountain range with short food supply chains</p> <p>Organic meat production in some farms</p> <p>Dairy companies in El Paular (Yoghurt produced from goat's milk and cow's milk)</p> <p>Organic horticultural production at the Economato Macabeo in Alameda de la Valle</p> <p>Rascafría is the headquarters for the market fair "<i>La Despensa de Madrid</i>", which travels around the whole region</p> <p>Development of the agri-food market in Rascafría, promoting and selling local artisanal agri-food products</p> <p>The food producer, Puente de Molina, has certification for the ecological production of forest fruits</p> <p>Production of apiculture interest such as <i>Entreabejas</i> and <i>La Gota</i> (Rascafría)</p> <p>Development of gastronomic tourism related to mushroom tasting in winter, meat tasting of locally produced zero food mile meat and local bean varieties</p>

Table 6. Positive drivers. Criterion 3. Reconnecting local agri-food production with culture, identity, and endogenous resources.

Case 1. Sedimentary Hills and Alluvial Plains with Dry and Irrigated Crops (<i>Campiñas</i> and <i>Vegas</i>)	Case 2. Ash Forests and Meadows in Mountain Basins and Depressions (<i>Sierra</i>)
<p>Alluvial plains with family farms with small historical plots and traditional agrarian practices</p> <p>Grasslands used for crop farming and livestock farming on the banks of the Jarama, producing high-quality meat products and artisanal cheeses</p> <p>Extensive network of rural paths and livestock trails with late medieval origins (<i>Mesta</i>).</p> <p>Historical water use with a high historical-cultural value: wells, water galleries and mines associated with subterranean waters</p> <p>Royal Irrigation Channel of the River Jarama and its historical irrigation network, connecting the territory, with significant tangible and intangible values and territorial identity</p> <p>Local architectural heritage tied to large agricultural and livestock holdings with catalogued barns: <i>Casas del Soto Gutiérrez, del Conde y de las Riadas</i> in Ciempozuelos; <i>Soto Pajares</i> and <i>La Mariquita</i> in San Martín de la Vega; groups of cave houses in the escarpment of the alluvial plains</p> <p><i>Espartinas Salinas</i>, an archeological site protected as an Asset of Cultural Interest related to salt mining</p> <p>High level of diversity, representivity and landscape interest</p> <p>Territorial Quality Labels: Protection of Designated Origin Olive oil from Madrid, wines from Madrid, M de Madrid, which guarantees the origin and the quality of the horticultural products cultivated to support and revalorise the agrarian sector</p>	<p>Traditional dry stone walls with wooden gates, mark the boundaries of small private properties at the bottom of the valley</p> <p>Development of small gardens in the outskirts of villages</p> <p>Irrigation network, fundamental infrastructure for the maintenance of the hay meadows, even though it is most of it is not in working order</p> <p>Small watermills and elements of the system that are of hydraulic heritage interest</p> <p>Network of rural settlements with a high landscape value and great potential for becoming attractions for agricultural and livestock fairs, and which nodes of food exchange</p> <p>Extensive network of paths and livestock trails that structure and organise the agricultural and livestock landscape</p> <p>Recent Project for the promotion of controlled grazing using this public infrastructure with sheep and cows</p> <p>High level of diversity, representivity and landscape interest</p> <p>Heritage of native breeds of cows. Livestock with the <i>100 Raza Autóctona seal</i> such as the <i>Iberian-Black</i> cow from Avila, the <i>Black Serrana</i> cow, the <i>Morucha</i> cow and the <i>Manchego</i> sheep</p> <p>Agrarian heritage of local varieties of beans (<i>Plancheta, Ochavada, Careta</i>, etc.)</p> <p>Quality labels associated with farms with IGP livestock <i>Meat from the Sierra de Guadarrama</i> and <i>Meat from Ávila</i>, M de Madrid, etc.</p> <p>Extensive coverage of Public Utility Forests and Neighbourhood Associations (Associations that use the common pastureland for extensive livestock grazing)</p>

Table 7. Positive Drivers. Criterion 4. Proximity between different local/bioregional stakeholders.

Case 1. Sedimentary Hills and Alluvial Plains with Dry and Irrigated Crops (<i>Campiñas</i> and <i>Vegas</i>)	Case 2. Ash Forests and Meadows in Mountain Basins and Depressions (<i>Sierra</i>)
<p>Agri-ecological food networks: Association of agri-ecological vegetable gardens of Madrid</p> <p>Small-scale agrarian plots that are in a network of short food supply chains</p> <p>Aracove Association for Rural Development, which manages LEADER funds</p> <p>Regional research centre for good agricultural practices: Instituto Madrileño de Desarrollo Rural</p> <p>Irrigation Association of the Royal Irrigation Channel of the River Jarama. Brings together all the owners of crop and livestock land</p> <p>Municipal soil bank (San Martín de la Vega)</p>	<p>GALSINMA, an association for rural development that manages LEADER funds</p> <p>Research and management centres <i>Puente del Perdón</i>, El Paular.</p> <p>Community organisation for the municipalities of the Valley of Lozoya</p>

According to the evaluation method described in Section 2.4, case study 1 scores 63 points out of 100, while case study 2 obtains a slightly lower score, 56.32. Both obtain a medium-high score (second quartile), which shows that they are agri-food systems with many of the features of mature MTLAFS, criterion 4 on governance is the weakest in both case studies (Figure 3).

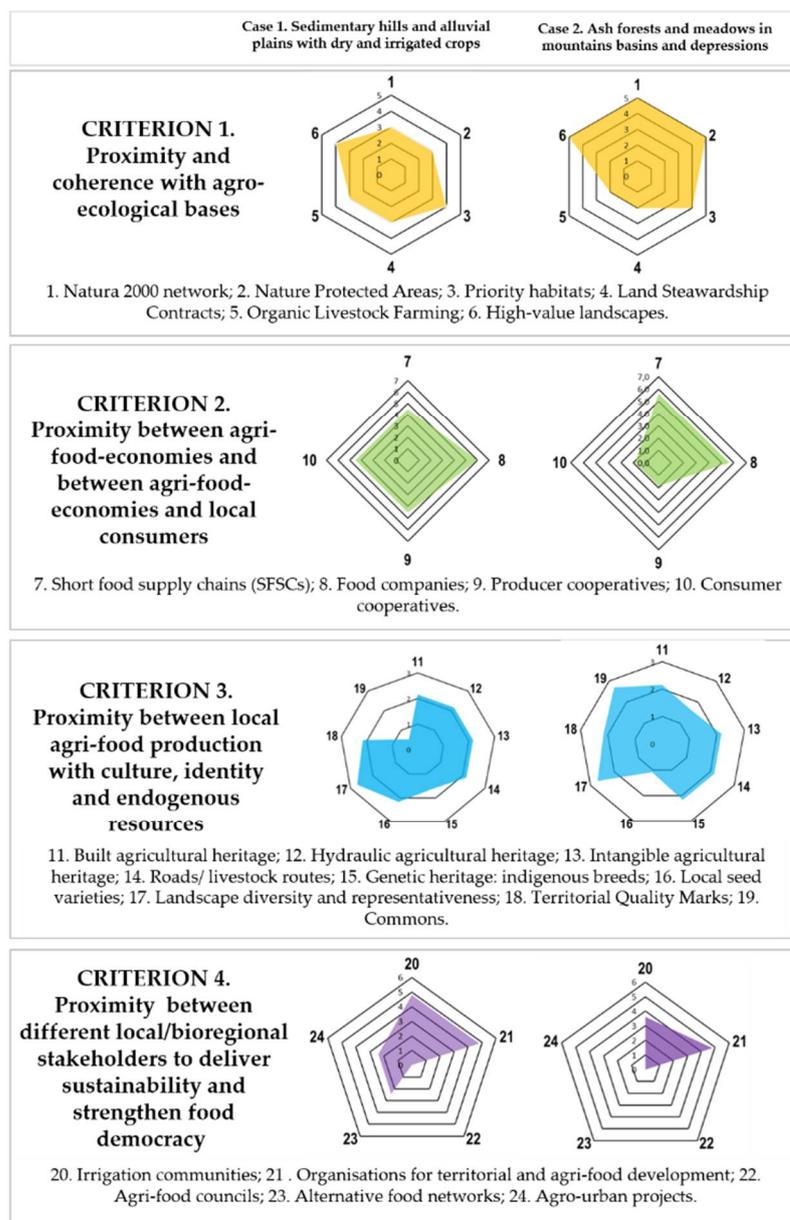


Figure 3. Evaluation of the MTLAFS Case 1. Sedimentary hills and alluvial plains with dry and irrigated crops (*Campiñas* and *Vegas*) and Case 2. Ash forests and meadows in a tectonic basin and depressions (*Sierra*). Source: Created by the authors.

Criteria 1 and 3 are those with the highest values and greatest strengths in both case studies and are therefore discussed together. The analysis of criteria 1 highlights the excellent conservation of the agri-ecological bases in the *Sierra* (case study 2), especially the coverage indicators of the Natura 2000 Network, the Protected Natural Areas, and the presence of Priority Habitats. *Campiñas* and *Vegas* (case study 1) shows a situation in which the values are slightly lower for the coverage of the Natura 2000 network (2.5 out of 4.2) and the Protected Natural Areas (2.5 out of 4.2).

The results obtained from the indicators of criterion 3 are high for both case studies (2.7 and 2.2 out 2.7) because of the significant amount of intangible and tangible heritage, landscape and nature management and the presence of territorial quality labels. Both cases studies have agri-food systems with strong natural and cultural heritage values. In general, the agricultural and livestock activity present in both case studies means they are well managed. Their ecological and cultural values have received institutional recognition for

their use of different forms of protection. The natural resources that belong to each bioregion are coherently integrated with the production systems. The extensive stockbreeding in the *Sierra*, have a significant presence of rural commons. Small-scale farms maintain traditional practices in both case studies, despite having undergone different levels of modernisation. Rural commons are still deeply rooted in the specific socio-ecological contexts of the bioregions, holding on to a large amount of their heritage and landscape values.

Despite the strengths of these two criteria—proximity with nature and the cultural connection with each specific area—there is a growing tendency towards a loss of biodiversity in both case studies. In the *Campiñas* and *Vegas* case study, this loss is caused by an increase in surface area used for fodder crops that are subsidised by the Common Agricultural Policy (CAP), which is a detriment to horticultural production. It has also been caused by the disappearance of some small-scale farms because they are no longer profitable. Policymakers lack a strategic vision to protect fertile lands and small-scale farms that could guarantee food security. During the past few decades, this problem has led to a tendency for open-pit mining to take over these lands, causing conflicts between different sectors (crop farmers, livestock farmers, companies, conservation organisations, etc.). In the *Sierra* case study, the abandonment of small-scale farms at the bottom of the valley has impoverished the biodiversity of the meadows and has increased scrubland coverage. This impact has caused a general deterioration in the landscape led by the abandonment of some traditional structures (stone walls, hedgerows, infrastructure belonging to traditional irrigation, etc.), and a moderate and dispersed urban pressure on paths and small historical settlements.

Criterion 2—proximity between the agri-food economies and local and regional consumers shows a clear difference between the two case studies (Case 1: 5.0 and Case 2: 3.8 out of 6.3). The values in the *Campiñas* and *Vegas* case study are higher because these areas have good farming practices, short food supply chain initiatives, more food producers and traditional oil and wine cooperatives. However, in the study case of the *Sierra*, the short food supply chain initiatives are much weaker. Nevertheless, the agri-food economies in both case studies have great potential to increase and strengthen regional food security.

The results of criterion 4 show medium (3.0) and very low (0.0–1.0) values for both case studies, especially for the MTLAFS of the case study of the *Sierra*. The existence of territorial development organisations that manage European funds (LEADER) and the presence of an irrigation association in the *Campiñas* and *Vegas* are the only two aspects that obtain high values (4.0). Despite the existence of some territorial governance structures, the weakness of the self-governing processes and the cooperative initiatives between producers and artisanal processors are clear. The lack of interest shown by irrigation associations in decision-making on the regional agri-food system is surprising, and it makes it harder to strengthen the proximity between agri-food economies and local consumers. In addition, the policies, and resources of the regional administration are insufficient. More innovative projects are needed to encourage bottom-up processes for strengthening MTLAFS. Moreover, there are no fiscal benefits nor any specific support for the agriculture and livestock sector that operates in protected natural spaces.

4. Discussion

The two MTLAFS analysed in the urban Region of Madrid, according to the conceptual criteria that define them, and the methodology developed, show the strengths, potentialities and weaknesses of these types of food systems in metropolitan contexts. This information is essential for overcoming difficulties related to food security and sovereignty [54,55] and the provision of ecosystem services in urban proximity [56–58] (Figure 4).



Figure 4. Images of the two case studies. Case 1, “Sedimentary hills and alluvial plains with dry and irrigated crops” (*Campiñas and Vegas*): (A) *Vega* of San Martín with garlic cultivation; (B) organic oil mill in Titulcia; (C) traditional ditch in Titulcia; (D) vegetable garden in Ciempozuelos. Case 2, “Ash forests and meadows in mountains basins and depressions” (*Sierra*) (E) pollarded ash trees in hedgerows in Lozoya Valley; (F) stone walls with irrigation ditch in Alameda del Valle; (G) sale of cheese at a local food fair; (H) black Avileña livestock in winter pastures in Rascafría. Source: authors’ images.

As in other peri-urban areas [8,59–61], both MTLAFS conserve high values of biodiversity, cultural and landscape heritage even though they are in very different bioregional contexts, and they face different pressures. The agri-ecological potential of the two case studies to produce sustainable food is a decisive aspect for the classification of these agri-food systems as MTLAFS. Without underestimating their food supply capacity, their ecosystem services [57], and specifically, their landscape services [62] are their most important contributions to ensuring territorial sustainability (Figure 4).

Their heritage values, as fundamental constitutive elements of MTLAFS, should not be considered as examples of passive inheritance. On the contrary, these values represent a heritage of local knowledge that can be very useful for adaptation to global change in vulnerable areas. Therefore, they are a decisive component of identity-food recognised by geographical quality labels [36] and drivers of socio-ecological resilience and social innovation, which require the engagement of public and private actors and policies to activate them. The case studies show that the MTLAFS can be converted into systems that lead to the conservation of natural resources in a context of enormous environmental deterioration and growing social demand for sustainable food rooted in its landscape. The European Landscape Convention [63] has recognised this renewed importance of agricultural landscapes. Landscapes are no longer mere objects of protection but become a form of communication, education and reconnection of rural-urban relations [46,64,65]. This landscape-based approach is also essential for small farms to improve their economic viability [11].

However, the important heritage values of the two case studies analysed are up against major shortcomings and weaknesses that affect their heritage. Even though both case studies are in very different bioregional contexts, one of the main drivers of the fracture between agriculture and nature, the deterioration of agricultural heritage systems, and, especially the loss of high-quality fertile soils, is the disappearance of small-scale agrarian activity. Family-based agriculture faces a series of difficulties in competing with large-scale industrialised agriculture in the urban market, despite the opportunity that its proximity to the metropolitan market provides, due to the lack of specific policies.

Turning this tendency around will require acting on the other two criteria of the MTLAFS. On the one hand, strengthening the proximity between local actors, and on the other hand, increasing the proximity between these local actors and alternative agri-food networks. In this way, geographical proximity and organisational proximity are reinforced [66], transcending the local context. The other strategy is to strengthen food governance, [67,68], in other words, boosting the proximity of the local farmers and regional policymakers. In our case, the Regional Government of Madrid has a Strategic Rural Plan for the implementation of the CAP after 2020, but it lacks bottom-up process and measures that are truly committed to the agri-food transition and the potential of MTLAFS.

The two MTLAFS analysed in the urban Region of Madrid show, with some differences, the weaknesses of existing producer and consumer cooperatives. This is a result of the small number of networks, especially in the *Sierra*, and their reduced capacity for social innovation, leading initiatives for change in the agri-food transition and getting involved in the decision-making processes concerning agrarian and food policies.

In this context, improving food governance and cooperative place-based approaches is a priority, as in other similar agri-food systems [69]. This includes the promotion of effective self-governance by the local and bioregional actors, who can learn from previous experiences [70,71]. Nevertheless, in the absence of robust local leadership, the regional government should take the initiative and create specific projects that adapt to the bioregional specificities and potentialities; projects that need to be aimed at strengthening and activating the outstanding heritage and landscape values of the MTLAFS. This includes supporting local organisations that are already active in the territory, but who need financial assistance, technical support and so that they can promote and support the implementation of other cooperative formulas and territorial instruments for agroecological transition, as the land stewardship agreements [72].

In relation to governance, it is important to highlight the overwhelming need for regional coordination and cooperation between the policies of nature conservation and agrarian policies. Both the MTLAFS analysed contain major areas of agriculture and live-stock farming within protected areas. The new European Union Strategy on Biodiversity 2030 included in the Green Deal, as with the Farm to Fork Strategy, influences, in declarative and strategic terms, the in-depth environmentalisation of agri-food systems, in the pursuit of the conservation of biodiversity and human health [73–75]. The Strategic Plan

for the CAP after 2020 is an opportunity for state governments, and especially regional governments, to act on MTLAFS where the agricultural and livestock agri-ecosystem is coherently linked to nature and contributes not only to quality local food but also biological and landscape diversity. These MTLAFS should therefore be seen as laboratories for cooperation between conservation and agricultural policies.

5. Conclusions

The consolidation of the bioregional MTLAFS is a strong sustainable alternative to the hegemonic agri-industrial model, particularly in agricultures that operate in areas of direct urban influence.

MTLAFS are an example of concepts built to strengthen the relationship of proximity between nature, society and agri-food economies based on a systemic and place-based approach combined with a process of re-territorialisation. This is in stark contrast to the globalised agri-industrial model and its intensive use of resources and consumption of fossil fuels, which is highly specialised, financialised and de-localised. The concept of MTLAFS has been adopted to respond to multi-scalar issues by developing new synergic relations between sustainable ecosystem management with agri-ecological basis, which enables multifunctional agroecosystems to provide numerous services, to fight climate change as well as to ensure food security. This is a strategic factor in urban regions with major environmental shortcomings. Second, they have been created to anchorage the food chain and to improve local economic sustainability. This means creating policies to communicate the values of identity food through strategies of re-territorialisation based on cultural and patrimonial values, multifunctional landscapes and short food supply chains. Third, MTLAFS can help achieve territorial rural development by creating integrated food policies that include preserving genetic diversity of plants and animals, by stimulating traditional local know-how of small-scale farms, by reinforcing agri-food economies and its connection to local markets. Finally, the strategies for MTLAFS are also characterised by strengthening food democracy by improving cooperation between bioregional actors, involving different stakeholders in decision-making and boosting participation of local communities to regain democratic control over the local food system. In essence, the MTLAFS bring together a wide range of strategies as a critical alternative to the industrialised food systems to preserve the landscape and historical and identity-based footprints of each territory.

This paper presents a methodology whose place-based and systemic approach is innovative when compared with other methodologies with fragmented approaches. Its innovative approach lies in the fact that it integrates the analysis of four forms of proximity that are needed to re-territorialise food systems and improve their socio-ecological resilience in a defined geographical area. The methodology proposed has been presented in such a way that it can be used for the characterisation and analysis of the diversity of MTLAFS. It can also be used for the identification of their main strengths and finally, for structuring ideas on possible changes to the status quo by combining the four strategies proposed.

Finally, the empirical study provides results that enable conclusions to be made. For example, strategies that favour the transition towards mature MTLAFS need active leadership and social innovation, complemented by democratic local and regional policymakers to encourage the development of place-based economies. The study also concludes that the future of the socio-economic resilience of MTLAFS depends on an increase in local knowledge and social initiatives that complement each other to specifically support the agri-ecological transition towards the production of sustainable food that does not deplete natural resources. Finally, all these strategies need to be combined with a commitment to promote the conservation of the tangible and intangible heritage expressed in the landscapes of the MTLAFS, shaped by the farmers and perceived and enjoyed by the people as a common good.

From a systemic place-based approach that acknowledges the interdependence between socio-economic and ecological processes, the transition needed towards mature MTLAFS is a response to the approach of the agro-urban project [30,76]. The agro-urban

project involves a critical conceptual framework and a bottom-up strategy that brings together different public policies, governance tools, territorial planning and food planning, enhancement of commons, as well as renewed agricultural practices anchored to each specific territory to ensure a shift towards the sustainable development of our planet [30].

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Appendix A

Table A1. Elements and sources to characterise the MTLAFS in the case studies, using the criteria established in the methodological bases.

Criteria *	Indicators	Data Repository (accesses on 14 February 2022)
1	Natura 2000 network	Link
	Nature Protected Areas	Link
	Priority habitats	Link
	Land stewardship contracts	Link
	Organic Livestock Farming	Link
	High-value landscapes	Link
2	Short food supply chains (SFSCs)	-
	Food companies	Link
	Producer cooperatives	Link
	Consumer cooperatives	Link
3	Built agricultural heritage	-
	Hydraulic agricultural heritage	-
	Intangible agricultural heritage	-
	Roads/livestock routes	Link
	Genetic heritage: indigenous breeds	Link
	Local seed varieties	Link1 ; Link2
	Landscape diversity and representativeness	Link
	Territorial Quality Labels Commons	Link Link
4	Irrigation associations	Link
	Organisations for territorial and agri-food development	Link
	Agri-food councils	-
	Alternative food networks	-
	Agro-urban projects	-

* Criteria: 1. Balance/proximity with agri-ecological bases; 2. proximity between the agri-food-economies, and the agri-food economies and local consumers; 3. reconnecting local agri-food production with culture, identity, and endogenous resources; 4. proximity between different local/bioregional stakeholders to deliver sustainability and strengthen food democracy.

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