

Article

Ecosystem Services Provided by Pastoral Husbandry: A Bibliometric Analysis

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Abstract: The ecosystem services provided by the age-old activity of husbandry are presently declining or seriously endangered. The situation is particularly serious for regulation services and for certain cultural services given their growing dependence on external inputs. This work performs a bibliometric analysis for the purpose of identifying the certainties and gaps associated with the different ecosystems generated by pastoral husbandry, and confirms the pressing challenges that the livestock industry is facing in the current context of global change. Two different tools, Scopus and VOSviewer, have been implemented to analyze 2230 documents published between 1961 and 2021 that include the terms “grazing” and “service”. The information required for the bibliometric analysis of authorship, country of origin, field of study and number of citations, among other categories, was drawn from the documents to the effect of evidencing their general thematic relationships. Finally, the current state of the ecosystem services currently provided by pastoral husbandry—provisioning, regulation, cultural and support services—was assessed. The results showed a greater abundance of scientific literature on provisioning and regulation services than on cultural and support services. An increase in the number of publications from the beginning of the 21st century was confirmed. The United States stands out as the country with the largest scientific production, and environmental sciences is the most prominent field in the study of ecosystem services. A recent larger academic effort to encourage the promotion of ecosystem services from the institutions has also been observed, as well as to include them as a factor in the development of environmental policies, which is described as the greatest challenge for the future of this discipline. Among other possible solutions, the new European Union agricultural subsidies—the so-called eco-schemes—appear to be essential for that effort to bear fruit as soon as possible.

Keywords: pastoral husbandry; provisioning; regulation; biodiversity; greenhouse gases



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1. Introduction

The first truly scientific approach to the concept of “ecosystem services” was developed by United States researchers at the end of the 1960s and the beginning of the 1970s, coinciding with the emergence of the environmental movement [1]. In 1970, the *Study of Critical Environmental Problems*, sponsored by the Massachusetts Institute of Technology, provided the first list of “environmental services” [1] (Table 1). From then on, various attempts were made, on the one hand, to properly define the concept of “ecosystem services” and, on the other, to enlist and categorize those services [2]. Daily [1] provided an important definition when she specified that ecosystem services are “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life”. Constanza et al. [3] affirmed that “ecosystem goods (such as food)

and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions". These authors also made the first step towards classifying those services and presented a more comprehensive list of 17 ecosystem services (Table 1) that derive from "natural capital", a concept coined a few years earlier by Constanza and Daily [4] to describe "the stock that yields the sustainable flow" of natural benefits. But only in the work by De Groot et al. [5] did the list become a hierarchical and systematized classification of 23 ecosystem functions from which goods and services derive. Those functions are divided into four categories: regulation, habitat, production and information functions (Table 1).

Table 1. Comparative analysis of the different lists of ecosystem services proposed since the term was coined. In the case of the Millennium Ecosystem Assessment, the category to which each service belongs is provided: provisioning (p), regulation (r), cultural (c) and support (s) services.

Study of Critical Environmental Problems [1]	Constanza et al. [3]	De Groot et al. [5]
	Refuge	Refuge function Breeding function
Atmosphere composition	Gas regulation	Gas regulation
Climate regulation	Climate regulation	Climate regulation
Flood control	Disturbance regulation	Disturbance prevention
	Water regulation	Water regulation
	Water provision	Water provision
	Waste treatment	Waste treatment
Soil retention	Erosion control and sediment retention	Soil retention
Pest regulation	Biological control	Biological control
Insect pollination	Pollination	Pollination
Soil formation	Soil formation	Soil formation
Matter cycling	Nutrient cycling	Nutrient regulation
Fisheries	Food production	Food
	Raw materials	Raw materials
	Genetic resources	Genetic resources
		Medicinal resources
		Ornamental resources
		Aesthetic information
	Culture	Cultural and artistic information
	Leisure	Leisure
		Spiritual and historical information
		Science and education

Obviously, the force of the idea of ecosystem services lies in its potential as a conceptual tool for the implementation of policies to counteract human impact on the planet—a societal demand that has increased over time and is today more central than ever. The publication of the *Millennium Ecosystem Assessment* report in 2005 provided the final endorsement and the term has become part of the international ecological action and environmental policy development vocabulary. The assessment focuses on the linkages between ecosystems (understood as dynamic complexes of plant, animal, and microorganism communities and the nonliving environment interacting as functional units) and human well-being [6]. The report described ecosystem services as "the benefits people obtain from ecosystems" and established four categories, which were very similar to the ones proposed by De Groot et al. [5], for a total of 30 types of services: (i) provisioning services (products obtained from the ecosystems); (ii) regulation services (benefits obtained from the regulation of ecosystem processes); (iii) cultural services (non-material benefits obtained from the ecosystems); and (iv) support services (required for the production of other ecosystem services) [6] (Table 1).

As evidenced by later works, the definition and categorization of the ecosystem services still need some refinement [7]. The concept is still ambiguous and a clearer distinction between the mechanisms through which the services are obtained and the services themselves is required [8]. The discussion on the consistency of the category of cultural services is a recurring one, because it appears to be subjective, but the fact that it is included in most models proves that, even if open to qualification, those services need to be considered [9]. Support services are also questioned by authors who see them as intertwined with other categories, particularly with regulation services [2]. However, all the contributions of the Millennium Ecosystem Assessment are useful because they are widely acknowledged, recognizable and easily comprehensible [6].

In summary, ecosystem services have come to fill up an argumentative void in environmental protection from a perspective that may be described as utilitarian, but is also transcendent in a world characterized by the market economy [2]. In their work, Constanza et al. [3] drew attention to that need after observing how decision-makers ultimately dismissed natural capital services. This way, the ongoing effort of authors working in the field of sustainability sciences to provide evidence of the link between human wellbeing and natural capital and to propose a theory of value beyond the monetary has allowed not only to fill up the argumentative void in the academic sphere, but to permeate the political and administrative discourse so that it can truly be useful [10].

However, the current valorization of ecosystem services should not make us think that they did not exist in the past. Even if science and academia did not use the concept before, human beings have always perceived the environmental retribution they could profit from through their relationship with the environment. An obvious example is animal domestication. Moreover, through their relationship to domesticated animals, human beings began to transform their environment, and the maintenance of livestock suddenly became a reason to manage and shape that environment to take advantage of everything it could offer. A paradigmatic example is that of the *dehesa*, a Mediterranean ecosystem where human intervention led to the spatial dispersion of trees in order to enable the spreading out of the livestock [11]. According to the Millennium Ecosystem Assessment in Spain (2011), the *dehesa* is an example of agroecosystem, i.e., a “type of ecosystem modified and managed by humans for the purpose of obtaining food, fiber and other materials of biotic origin”. Agroecosystem diversity is very high across the world in accordance with the intensity of human intervention, and ranges from extremely simplified agroecosystems with a very high level of inputs—such as intensive agriculture or livestock breeding—to highly complex low-intensity systems—including family vegetable gardens or transhumance [12]. Therefore, we need to keep in mind that, when anthropic actions take into consideration the specificities of the territory, as in agroecosystems, they may have an essential role to play in the provision of ecosystem services [13].

The above-mentioned domestication of wild animals was one of the achievements of the Neolithic revolution, whether it happened earlier or later on during that process. To again use the example of the Mediterranean region and, more specifically, that of the Iberian Peninsula, radiocarbon dating identifies the first human groups with domestic sheep and caprine stocks in the Mediterranean coasts around 5600 AD [14]. If those stocks and the interaction with them have been maintained until today, it is simply because of the benefits they provide to human beings. Through good management practices in pastoral husbandry, a proper management and conservation of the ecosystems that the stocks graze is possible. Therefore, livestock plays an important role as a provider not only of ecosystem services, but of ecosystem regulation and maintenance services, such as the control of accumulated biofuel, the dispersion of Mediterranean species, the decomposition of litter, the enhancement of the nutrient cycle, the balance between native and invasive species, landscape conservation, etc. [15]. However, as advanced by the conclusions of the Millennium Ecosystem Assessment [6], the ecosystem services rendered by age-old husbandry practices are currently in decline or seriously endangered. Regulation services—conservation of habitats of interest to other species, soil fertilization or pasture

improvement—and some cultural services—gastronomic traditions, identity and sense of belonging to a territory, or landscape beauty—are especially at risk because of the increasing dependence on external inputs in food production services [15–17].

It is thus possible to affirm that pastoral husbandry is on the wane. The intensification of stockbreeding activities for the purpose of developing more productive systems has had a negative impact on biodiversity and, consequently, on the ecosystem services provided. In particular, this process is affecting the marginal areas that pastoral husbandry has traditionally used, progressively relegating it to a much less relevant role [18]. However, all of these problems could be solved in a context like the current one, where the sustainability of animal production is being questioned [19], and the demand for food produced in ways that respect animal wellbeing and helps to preserve ecosystems and biodiversity is growing.

The aim of this study is to carry out a systematic assessment, through a bibliometric analysis, of the different ecosystem services provided by pastoral husbandry. We have attempted to answer the following research questions, which we believe could be of interest to researchers in this field: (i) what are the global trends of scientific publications on the topic of grazing services?; (ii) which institutions, together with their corresponding collaboration networks, work more intensely on this issue?; and (iii) which discipline publishes the most on this topic? Finally, the implications of this reality, the challenges ahead and the possible future lines of research within this field are also discussed in this review article.

2. Materials and Methods

Bibliometric analysis is a popular and rigorous method for exploring and analyzing large volumes of scientific data [20]. It differs from traditional narrative reviews in that it implements a replicable, scientific and transparent procedure based on exhaustive literature searches of published studies [21]. Unlike systematic literature reviews that tend to rely on qualitative techniques, which may be marred by the interpretation bias of scholars from different academic backgrounds, a bibliometric methodology uses quantitative techniques to analyze bibliometric data and can thus avoid or mitigate that bias. Bibliometric analysis can offer a balance between comprehensively identifying a larger pool of publications and systematically identifying a smaller set of studies that fit criteria for inclusion [22].

First, a search was made in different databases (PubMed, Scopus, Google Scholar, etc.) of articles on the topic using certain keywords in English, such as “ecosystem services”, “pastoralism”, “grazing” or “husbandry services”, as well as combinations of those terms and possible translations of them into Spanish. This initial step, prior to the actual bibliometric analysis, was intended to provide a first overview of the status of ecosystem services in pastoral husbandry in academic publications. For the development of the biometric analysis, data were gathered from the Scopus database of Elsevier. In order to cover full calendar years, 2021 was set as the end date of the search period; consequently, the search yielded results for the period 1961–2021. An exhaustive search was carried out in Scopus using [TITLE-ABS-KEY (grazing AND service) AND (EXCLUDE (PUBYEAR, 2022))] as the search field. The final number of articles found in the search was 2229. Subsequently, a specific function of Scopus was used to collect information from the set of articles for the bibliometric analysis of authorship, country of origin, field of study and number of citations, among other categories. The information obtained from this database was analyzed and processed with VOSviewer software (Leiden University and CWTS) for the purpose of revealing the general thematic relationships among previously obtained manuscripts [20]. A bibliometric map with four clusters was thus obtained by VOSviewer software. Cluster size was determined by the number of keywords within the cluster, the frequency of occurrence of those keywords, and their similarity index. The frequency of co-occurrence was calculated on the basis of keywords repeated more than 40 times.

Finally, after the bibliometric analysis, the articles were subject to a thorough review. This review enabled the assessment of the general situation of ecosystem services

currently related to pastoral activities, including provisioning, regulation, cultural and support services [6].

3. Results

The distribution of the documents per year identified is shown in Figure 1. As indicated above, the academic use of the concept of ecosystem services did not take root until the 1970s. The few references to it during the 1960s are interpreted as mere coincidences, explained by their appearing in articles on agriculture; this is confirmed by reading the abstracts of those articles. However, despite the emergence of the term in the environmental debate, during the last three decades of the 20th century its use was far from common, with an average of 5 publications per year (between 1961 and 2000, see Figure 1). Only after the benchmark work by Daily [1] and other contemporary works were published did the topic gain relevance and gather sufficient attention to cause a noticeable change of trend around year 2001. In the 21st century, the production of works referring to ecosystem services in pastoral husbandry greatly increased to reach the amount of 2230 documents available in 2021, rising from five to 96 yearly publications in the period 2001–2021 (Figure 1). These trends were determined by using adjusted coefficients of determination for both periods ($R^2 > 0.84$ and $R^2 > 0.98$, respectively).

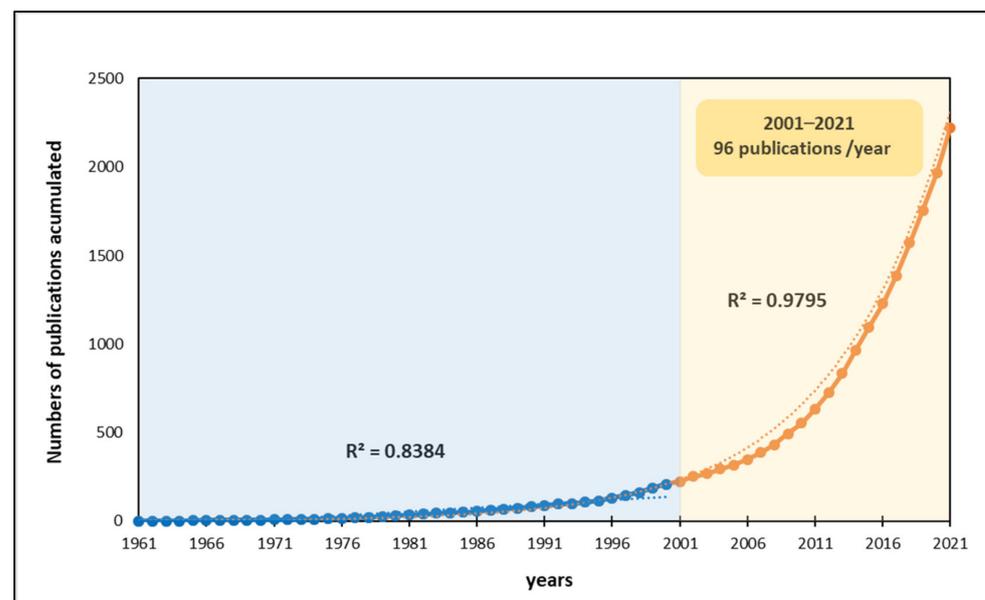


Figure 1. Evolution of the number of publications per year and accumulated in the period 1961–2021, resulting from the search in Scopus of the terms “grazing” and “service”. The adjusted coefficient of determination used in each stage is shown.

Most of the documents analyzed (81%) were published as scientific works; the rest were reviews (7.2%), book chapters (6.2%), papers presented at conferences on the topic (3.8%), and other texts classified in rarer categories, each accounting for less than 1%. As usual within the scientific community, the “de facto lingua franca” was English, in which 93.7% of the documents analyzed were written.

With regard to the institutions funding this type of work, it was observed that the main one was the National Natural Science Foundation of China, closely followed by similar bodies attached to the governments of the United States and European Commission. The Chinese Academy of Sciences and the United States Department of Agriculture (USDA) are the two institutions whose researchers have, up to now, published more works on this topic. This explains why most documents resulting from the search (727) originate in the United States (Figure 2), making its territory, where livestock production is so prominent, a relevant object of analysis in relation to ecosystem services. The contribution of the

following countries is also noteworthy: China (214 documents), the United Kingdom (197), Australia (183) and Germany (166) are on a second level of importance, followed by Spain (109) and France (102), among others, on the third level. The authors leading these types of studies was the Australian David J. Eldridge, (10 documents), although there are prominent researchers from other countries, for instance, the American Justin D. Derner and Leslie M. Roche, Sandra Lavorel from France, and Wolde Mekuria from Ethiopia, who have each published nine documents.

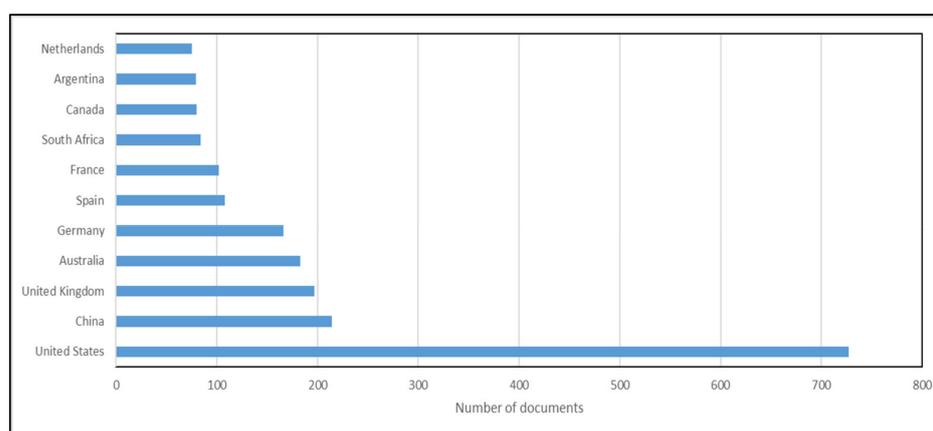


Figure 2. Scientific production addressing the topic of ecosystem services in pastoral husbandry by country, as obtained from the search in Scopus. The countries included are those in which more than 70 documents have been published.

As for the fields of study, agricultural and biological sciences are the ones with a larger production of documents (34%) (Figure 3), followed by environmental sciences (32%) and social sciences, with a much smaller academic output (8% of the total); the prevalence of the two first areas is evident. The results are not surprising given that those sciences belong within the environmental field, to which the concept of “ecosystem services” is attached.

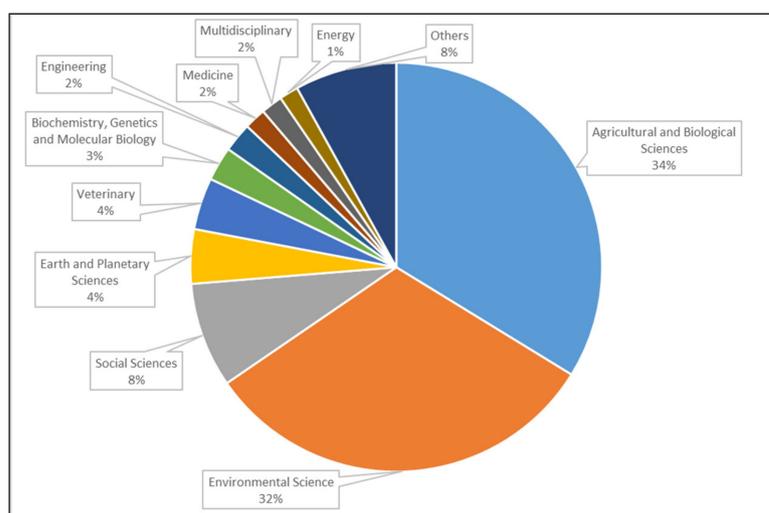


Figure 3. Main fields of study to which the documents subject to the bibliometric analysis are related. Only the fields where more than 60 documents have been produced are shown.

Figure 4 shows the connection between the documents obtained from the search according to the more or less frequent presence of certain keywords in them. The resulting map includes four major fields, which are differentiated by color, where the keywords “ecosystem service”, “grazing” and “animals” stand out at the core of the relationships between documents.

Each of these four groups differentiated by the software were drawn in the form of lists in order to compare them (Table 2). Cluster 1, including concepts such as “carbon sequestration”, “nutrient cycling” or those referring to the soil, was closely connected to regulation services. Cluster 3, which comprised terms like “crop production” or “milk production”, was mostly related to provisioning services. Clusters 2 and 4 included a wide variety of terms that reflected different types of services and, in contrast with clusters 1 and 3, were not closely connected to any of them. The conclusion that can be drawn is that some types of services—regulation and provisioning—receive greater attention and are more thoroughly studied than others, such as cultural and support services, showing an imbalance that may be due to the apparent profitability of each service.

Table 2. Keywords found in the documents analyzed according to the clustering made with VOSviewer. The minimum number of times each term included in those clusters needed to appear was set at 40.

Cluster 1	Cluster 2	Cluster 3	Cluster 4
Agriculture	Abundance	Agricultural production	Adaptation
Carbon	Anthropogenic effect	Animal husbandry	Climate change
Carbon sequestration	Biodiversity	Animals	Decision making
Ecology	Conservation of natural resources	Bovine	Forage
Ecosystems	Ecosystem function	Cattle	Grazing pressure
Environmental protection	Ecosystem service	Controlled study	Land management
Forestry	Fires	Crop production	Livestock grazing
Forests	Grassland	Food supply	Pastoralism
Land use	Grazing	Milk production	Pasture
Nitrogen	Herbivory	Physiology	Rangelands
Nutrient cycling	Invasive species	Procedures	Semiarid region
Remote sensing	Landscape	Reproduction	Sustainability
Restoration ecology	Plant community	Seasons	
Soil conservation	Species diversity	Sheep	
Soil fertility	Species richness		
Soils	Vegetation structure		
Water quality			
Water supply			
Wetlands			

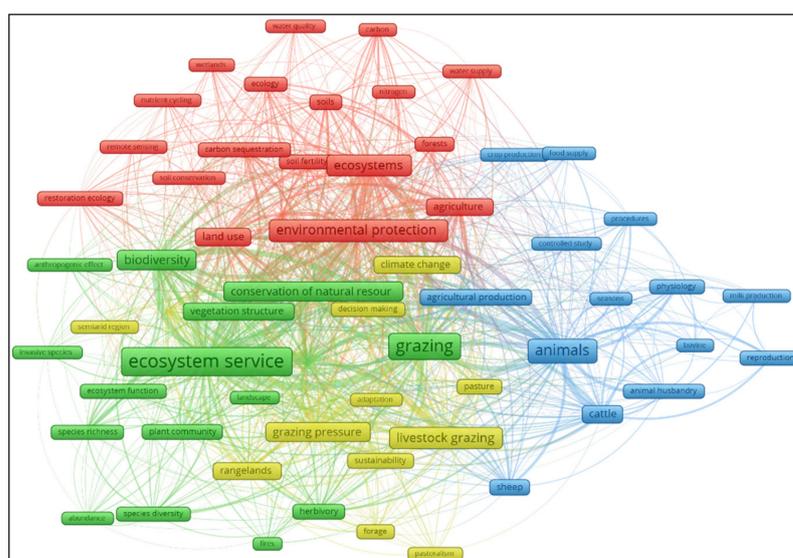


Figure 4. Clusters of keywords appearing in articles about grazing services with a frequency greater than 40 (obtained using VOSviewer software) Four major fields are defined and differentiated by color. Cluster 1 is depicted in red, cluster 2 in green, cluster 3 in blue, and cluster 4 in yellow. The complete list of keywords in each group is shown in Table 2.

4. Discussion

The documents gathered in the search may be divided into: (i) those focused on the valuation of services in a specific context; (ii) those that describe the compensations between services occurring in ecosystems; and (iii) those that examine policy implementation plans and the way they are perceived by society. The growing number of documents on this topic is based on the development of these three categories.

Based on the analysis of ecosystem functions and services made by Gómez-Baggethun and De Groot [10], Table 3 presents a list of functions, goods and services that may be attributed to natural ecosystems where livestock breeding is developed.

Table 3. Ecosystem functions, goods and services associated with pastoral husbandry. From Gómez-Baggethun and De Groot [10].

Functions	Examples of Goods and Services
Refuge and breeding site	Fire prevention Maintenance of the biodiversity of domesticated wild species, seed dispersal
Atmospheric and climate regulation	Carbon sink
Nutrient regulation	Maintenance of soil health and of productive ecosystems, improvement of soil fertility
Raw materials	Energy and natural fertilizers
Recreation	Ecotourism
Medicinal resources	Medicinal plants
Ornamental elements	Materials used in craftwork: leather and fur
Aesthetic information	Landscape enjoyment
Artistic, cultural and historical information	Depictions of nature in books, films, cultural heritage, etc.
Science and education	Environmental education, scientific purposes
Housing	A place to live, maintenance of rural populations
Agriculture	Food and raw materials, functional food
Tourism infrastructures	Reduction of combustible biomass through the development of tourism activities: hiking

Various authors [23,24] have concluded that well-adapted local breeds provide most provisioning, regulation and cultural services. Therefore, the current discourse on provisioning services highlights the importance of reinforcing the husbandry of endangered or less commercially available autochthonous breeds, which not only provide meat, milk and dairy products, fibers and textiles, but also improve the genetic heritage of the species, which is a diversity value in itself as well as a source of protection for the breed in the face of difficulties [25]. As pointed out by Martín-Collado et al. [26], within the field of animal science it is essential to distinguish the exact role that breed, species and breeding practices play in the supply of ecosystem services. Husbandry practices (including the choice of species and breeds) modify the structure and functioning of the ecosystem, which may cause ecosystem disservices (for instance, the reduction of water availability).

The different species and breeds, most of them autochthonous, living in one territory are part of its ecosystem and provide a livelihood for people inhabiting those rural areas, where it is sometimes very difficult to pursue an economic activity other than extensive livestock rearing. In the Mediterranean region and, more specifically, in Andalusia, sheep breeds (such as the Merina, Merina de Grazalema or Segureña), cattle breeds (such as the Retinta, Berrenda or Pajuna), goat breeds (such as the Payoya, Malagueña, Murciano-Granadina, Florida, Blanca Andaluza or Negra Serrana), and pork breeds (mainly the

Ibérica), are good examples of the rich genetic diversity of the *dehesas* and mountain areas, although many of those breeds, as well as the production models developed around them, are currently endangered [27].

Despite the important role played by ecosystem services, the FAO [28] has stressed the need for appropriate legislation on their management in developing countries because of the lack of formal recognition of their value on the part of the ruling classes. Only in European Union countries has this need been adequately fulfilled [29]. It is important to underline, in relation to the protection and promotion of the above-mentioned breeds, that they provide access to a whole market, like the current one, where value-added products are sought because of their gastronomic quality and sustainability [30]. They produce benefits that go beyond those associated with ecosystem services, for they encourage business and overall development in environments where husbandry is supported and promoted [31]. Another important factor in favor of protecting autochthonous breeds is livestock diversification, because diversity enhances multifunctionality [32] and the integration of agents that may provide services to the agroecosystem.

Support services are often mentioned in relation to other services. Primary production, photosynthesis or nutrient cycling, among other support services, are usually taken into consideration for the purpose of subsequently connecting them, for instance, to a provisioning service such as the production of forage or the quality of animal products—which is mainly the result of the way animals are fed [31], thus creating a feedback loop. Regarding primary production, it has been found that in Mediterranean ecosystems pastoral livestock stimulates the production of pastures giving rise to what is called the “pastoral paradox”: the most appetizing and nutritious pasture species, which are usually the most grazed ones, increase their abundance thanks to grazing. Mediterranean species have evolved together with pastoral livestock, so they can withstand grazing much more than others due to their greater capacity for regrowth or trampling support. In this sense, they have competitive advantages [33]. Likewise, pastoral livestock can facilitate the improvement of soil resources through: (i) trampling, which activates the recycling of nutrients and the conservation of poor soils by improving their structure, favoring drainage and reducing erosion; (ii) the movement of livestock during grazing, which connects different agroecosystems, thus facilitating horizontal fertility and contributing to seed dispersal; and (iii) access to stubble and crop residues, which favors the recirculation of nutrients and avoids additional work (droppings increase the biological activity of soils and the presence of detritivores, mycorrhizae, fungi, etc.).

It is important to underline that, very often, the contribution of pastoral husbandry to this type of ecosystem services is described in critical terms due to the risk of overgrazing. Only through lighter, less intensive forms of pastoralism, based on the application of a mixed-method approach to agroecosystems, can the balance between the services provided by pastoral husbandry and the damaging effects of this activity on the environment [34,35].

Other services examined in the documents analyzed are the so-called regulation services, which include, for instance, climate regulation, fire prevention, plant species control or pollination. With regard to climate regulation, Teague et al. [34] point out that ruminants are usually accused of being the source of greenhouse gas emissions—mostly via methane production, but through proper pasture management these animals may actually help increase soil carbon sequestration, thus offsetting the emissions. According to McDermot and Elavarthi [36], agroecosystems have the capacity to sink 1.2 to 3.1 billion tons of carbon per year over a period of 50 years. These authors consider that this degree of carbon sequestration is capable of offsetting a third of the annual increase in atmospheric CO₂, which is estimated at 3.3 PgC/year. One ton of carbon sequestered in the soil allows the elimination of 3.67 tons of atmospheric CO₂, in addition to improving agronomic productivity and enhancing soil resilience. According to Bork et al. [37], the key lies in the activity of the roots of herbaceous species: their response to grazing is to produce more roots and more exudates through them. The higher root mass produced in grazed grasslands partially explains why grazing tends to concentrate more carbon in the soil. In spite of this,

the relationship between pastoralism and organic soil carbon is not linear, and a thorough study of each agroecosystem seems necessary if any conclusions are to be drawn [38,39]. The success of grazing management will depend on how well the increase in livestock efficiency is balanced with the need to maintain the chemical, physical, hydrological and biological properties of each type of soil (a key element of the ecosystem). It is important to note that, although the capacity of vegetation to act as a carbon sink is well documented in the literature [38,40,41], grazing lands associated with livestock production, which could significantly balance the net greenhouse gas emissions emission values, has been rarely considered to date [40]. This is due, to a large extent, to the difficulties in measuring it. It is therefore necessary to develop methodologies that facilitate the quantification of the carbon sequestered by grasslands and stored in their soils, and of the methane they oxidize, and to propose an emission model that is closer to the complex reality of these production systems.

The use of livestock to prevent fires is known around the world and has been demonstrated throughout human history [42]. Fire prevention is one of the most valued and frequently remunerated ecosystem services provided by pastoral husbandry. Pastoral husbandry helps reduce combustible biomass, consequently decreasing the risk of fire [43]. Certainly, as with many other services provided by agroecosystems, it requires that pastoral activities are properly organized in order to be fully effective. The work developed by the Red de Áreas Pasto-Cortafuegos de Andalucía (RAPCA, Andalusian Network of Pasture-Firebreak Areas) exemplifies such an attempt. Through a controlled management of the livestock by the shepherds' activities, it helps clear the grass and brush from strategically designed fire lanes [44], and contributes to diversifying the income of farmers, who receive economic compensation, albeit minor, for their work [45].

Plant species control through herbivory cannot be highly targeted, but is important enough to prevent the spread of invasive species or to reduce the density of herbal or woody species competing among themselves and hindering landscape heterogeneity [46]. Grazing changes the abundance and diversity of flowers, thus affecting the structure and dynamics of the entire community of interactions. [47]. The effect of grazing on pollinators and their pollination services can vary from positive to negative depending on the way in which livestock modify the vegetation and on whether the observed foraging intensity increases or decreases the floral resources used by pollinators [47,48].

Cultural services are more connected to human subjectivity than to objective matter. In general terms, society recognizes the importance of the ecosystem services provided by livestock farming [29], valuing each category—even the relatively invisible support services, but it particularly appreciates cultural services, which are perceived as elements of the common identity [29,49]. However, despite this positive reception, the scientific community has not truly delved into the study of cultural services, which have been barely characterized. It seems necessary to take these services out of the purely subjective level in order to examine them more thoroughly, because being the most “human” of all ecosystem services, they can help society understand the general concept more accurately.

5. Conclusions and Future Prospects

The bibliometric analysis and the assessment of the documents revealed the great scientific and academic interest in the role that pastoral husbandry plays in current ecosystems. Most documents analyzed insist on the need to encourage the promotion of ecosystem services from the institutions and to take them into consideration as a factor in the development of environmental policies. In this sense, the different approaches on ecosystem services can be an obstacle in themselves, given the general lack of agreement on: (i) their definition and classification; (ii) the way to integrate them in land management [7,50]; and (iii) the actual steps to be taken in decision-making processes. Ultimately, those approaches remain mere theoretical interpretations [51]. The Ecosystem Service Database and other platforms created for the purpose of making the most important studies on the topic available to researchers, or the application ARIES, developed to evaluate ecosystem services using artificial intelligence, are tools—sponsored, in these two cases, by the University of

Vermont—which are expected to improve scientific communication and to help implement measures to solve the problems associated with those services [7]. On the other hand, some studies have placed emphasis on the reduction of services associated with bad land management practices and on how this is causing massive economic losses across the world [52]. Providing a more appropriate framework for action should support rather than undermine the efforts to propose practical measures.

Although it is true that in European Union countries ecosystem services are acknowledged at a national and even regional level, this recognition is still limited and does not ease the supply and flow of ecosystem services in general and those related to pastoral husbandry in particular [29]. One example of European Union policies aimed not only at protecting populations dependent on agriculture, but also, in principle, at managing ecosystem services are the subsidies provided through the Common Agrarian Policy (CAP) mechanism. However, they are constantly being reformed because their allocation methods are often controversial. To solve this situation, in 2021 a debate was initiated on a new type of subsidy known as an eco-scheme. Eco-schemes are released following the fulfillment of stricter requirements related to the maintenance of specific ecosystem services [53].

There is no doubt that, when well-managed, pastoral husbandry and the use of autochthonous breeds are an opportunity, even a necessity, for livestock farming to continue providing innumerable ecosystem services. There can be many reasons for the absence of concrete actions: (i) lack of recognition to and remuneration of the ecosystem services associated with this model of husbandry; (ii) because of the low prices at source of meat and milk (the main source of income for animal farms), which most often do not compensate the costs of production; (iii) due to changes in food habits, including the decrease in the demand of ruminant meat resulting from the “bad press” that livestock breeding has gained in recent times; or (iv) to the lack of real and effective institutional support for this production model. The reality is that no measures are taken and, within a few years, extensive and pastoral husbandry will most probably disappear or become so residual that most ecosystem services provided by them will be lost. In addition to putting food sovereignty at risk, this will have a negative effect on the regulation of ecosystems associated with the Mediterranean forest and will certainly contribute to the depopulation and abandonment of many rural areas. This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

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