

## Research Article

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# Relationships between soil salinity and economic dynamics: Main highlights from literature

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**Abstract:** Soil characteristics often have an impact on a farm's competitiveness and on the quality of the agricultural goods obtained through farming activities. The quality of these products leads to social consequences, namely because of its impact on human health. Considering these contexts and the pertinence of these issues, in this study the intention is to highlight the several dimensions related to soil salinity and the respective economic dynamics. To achieve these objectives, several documents were considered from the Web of Science Core Collection (WoS) and Scopus for search topics associated with these issues (soil salinity and economic dynamics). The metadata obtained from the two databases for these documents was first benchmarked. After this initial benchmarking to identify the main differences between WoS and Scopus, these documents were analysed through bibliometric approaches and later exploited using a literature review. An alternative approach to carrying out systematic reviews in the presence of a great number of documents (methodology based on benchmarking of metadata, from scientific databases, and bibliometric assessment and analysis) was suggested. The results show that the strategies for dealing with the soil salinity and the concerns for food security, desertification, climate change, nitrogen management, and plant osmoregulation deserved special attention from the researchers. In turn, the direct assessment of the socioeconomic impacts from soil salinity, or the impacts on several dimensions of sustainability motivated fewer studies.

**Keywords:** Web of Science, Scopus, bibliometric analysis, centrality metrics, systematic review

## 1 Introduction

Bibliometric analysis is a useful approach in highlighting the main insights from the literature about several scientific topics. In fact, bibliometric assessment has been considered by researchers for the more diverse topics of science, including in dimensions related to soil quality [1].

Specifically, concerning the relationships between soil domains and economic dynamics, there are not that many studies focused on bibliometric analysis, showing that there are some gaps here in the literature. In any case, the topics covered in the studies where the soil and economic fields were both addressed are, for example, those related to the following dimensions: biochar [2], soil use in farms [3], metals management [4], agricultural systems [5], microplastics [6], forest fires [7], sediments [8], water use in farms [9], indicators for ecosystems [10], the phosphorus [11], food security [12], contaminated site recovery [13], and rural development [14].

This literature survey specifically highlights that the several interrelationships between soil salinity/salinization and the economic fields through bibliometric analysis could be explored further. In fact, a search on the Web of Science Core Collection (WoS) [15] and Scopus [16] topics show that there are not so many studies (or none at all) that consider the bibliometric approaches in analysing the dynamics between soil salinization and economic activities.

Considering these gaps in the literature, the main objectives of this study are to highlight the main insights from the scientific research related to several interlinkages among soil salinity/salinization and economic sectors.

## 2 Materials and methods

To achieve the proposed objectives, a search for the topics “soil \*salini\*” and \*econom\* was carried out on 10 April 2021 on the scientific databases WoS and Scopus. On these two databases, 532 and 756 documents were obtained, respectively. The search topics were considered in this manner to allow for a wider search covering these

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fields, following, for example, Türkeli et al. [17]. In fact, considering the search topics in this manner allows for documents related to fields such as the following to be found: soil salinity, soil salinization, soil desalinization, economic, economics, socioeconomic, and economy. These studies were first benchmarked through the respective metadata obtained in the two scientific databases and subsequently explored with bibliometric analysis. The bibliometric assessment allows for the highlighting of scientific trends about these topics and to better organize the literature survey through a systematic review. In practice, the following methodology for a systematic review (methodology based on benchmarking of metadata, from scientific databases, and bibliometric assessment and analysis) is suggested [18–20]:

- Benchmarking of metadata obtained from the scientific databases;
- Assessment of the information obtained from the databases to identify the best methods for the bibliometric analysis;
- Survey, through literature review, the most representative documents as a sample of the total results obtained in the search, namely to deal with the large quantity of documents.

### 3 Benchmarking the metadata from WoS and Scopus

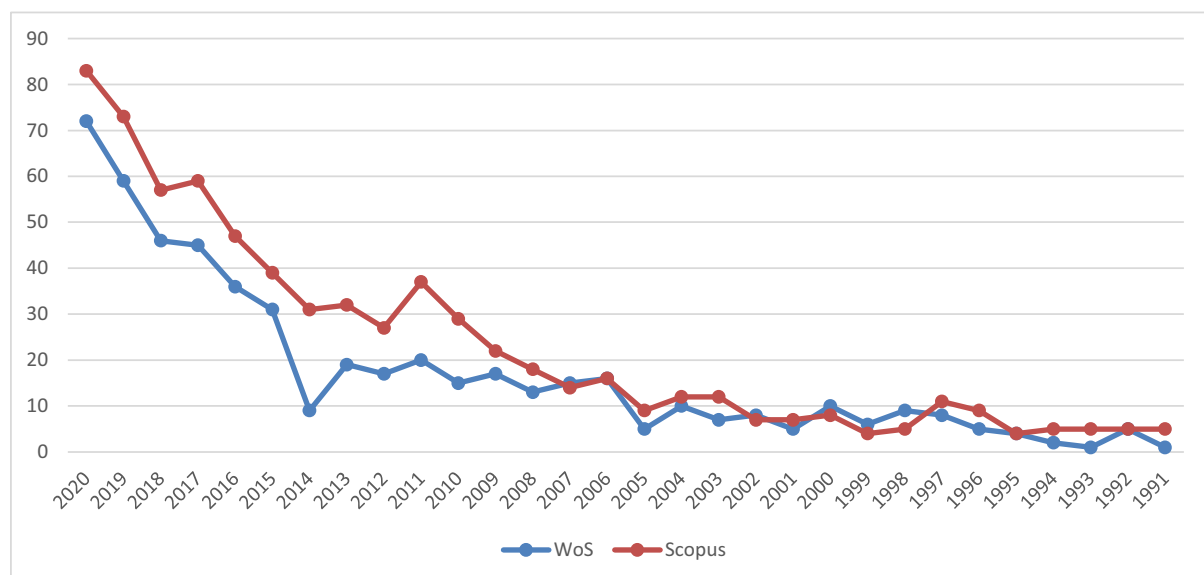
Figures 1–5 and Table 1 shown in this section were obtained through the metadata found on WoS and Scopus.

Only the coincident information, for the two databases, was considered (in general WoS makes more information available than Scopus) to carry out a benchmark between the two scientific platforms.

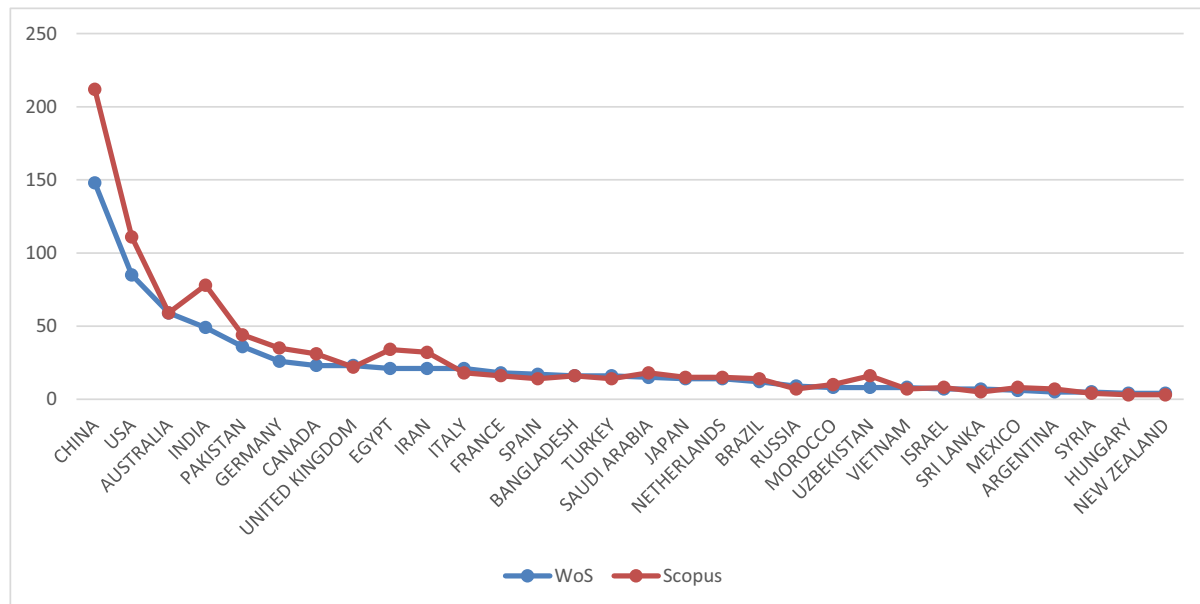
There has been an increasing trend over the most recent decades for the number of documents published in sources indexed on WoS and Scopus for the topics covered here (“soil \*salini\*” and \*econom\*”), which is more accentuated after 2014 (Figure 1). This trend reflects the concerns of several stakeholders, namely researchers, concerning sustainability, where adequate water and soil management may bring relevant contributions towards an environmentally compatible development. Climate change and the consequent global warming have brought new pressures and challenges for the social actors, including researchers from different scientific fields.

On the other hand, China, the United States, Australia, and India are the leading countries in terms of numbers of records relative to the relationships between soil salinity/salinization and economic dynamics (Figure 2). This is good news, considering the dimension of these countries and the impacts that they may have on soil quality, but it could be interesting to see other relevant countries on the world conjuncture having more publications on these issues. In fact, the problems related to soil salinity are global and require focused strategies where several countries are called upon to contribute and participate.

The publications with more records are the following (Figure 3): Agricultural Water Management, Land Degradation Development, Science of the Total Environment, and Irrigation and Drainage. The publications with more records are, in general, more related to specific issues of



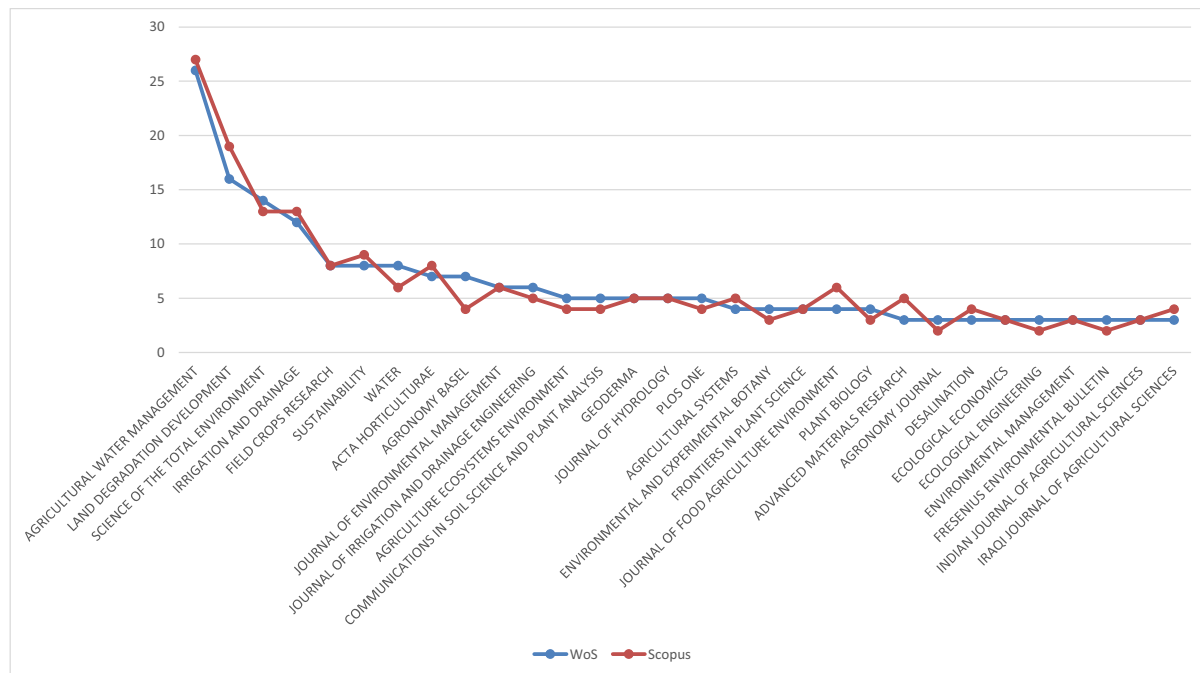
**Figure 1:** Distribution of the several documents from the WoS and Scopus databases over the most recent decades, about “soil \*salini\*” and \*econom\*.



**Figure 2:** Number of records found on the WoS and Scopus databases for countries, about “soil \*salini\*” and \*econom\*.

soil and water management or associated with sustainability. It seems that the journals that are more focused on socioeconomic dimensions provide less importance to these interlinkages. Nonetheless, soil salinity is, also, a socioeconomic problem that may compromise agricultural productivity and the goals for food security.

The most productive authors are the following (Figure 4): Sharma PC, Qadir M, Khan S, Murtaza G, Ghafoor A, Greiner R, Adamowski J, Datta KK, Gorji T, and Inam A. In turn, in line with the trends highlighted before among the most productive organizations are those presented as follows (Figure 5): Chinese Academy of Sciences, Indian Council of Agricultural



**Figure 3:** Number of records found on the WoS and Scopus for the several sources, about “soil \*salini\*” and \*econom\*.

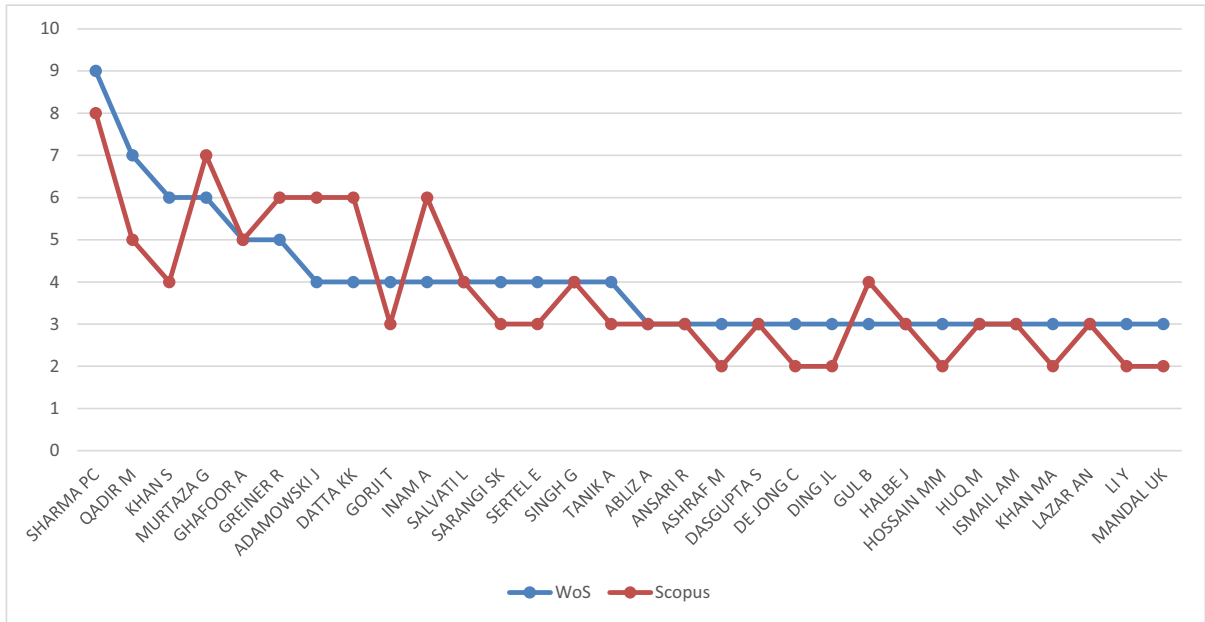


Figure 4: Number of records found on the WoS and Scopus for the several authors, about “soil \*salini\*” and \*econom\*.

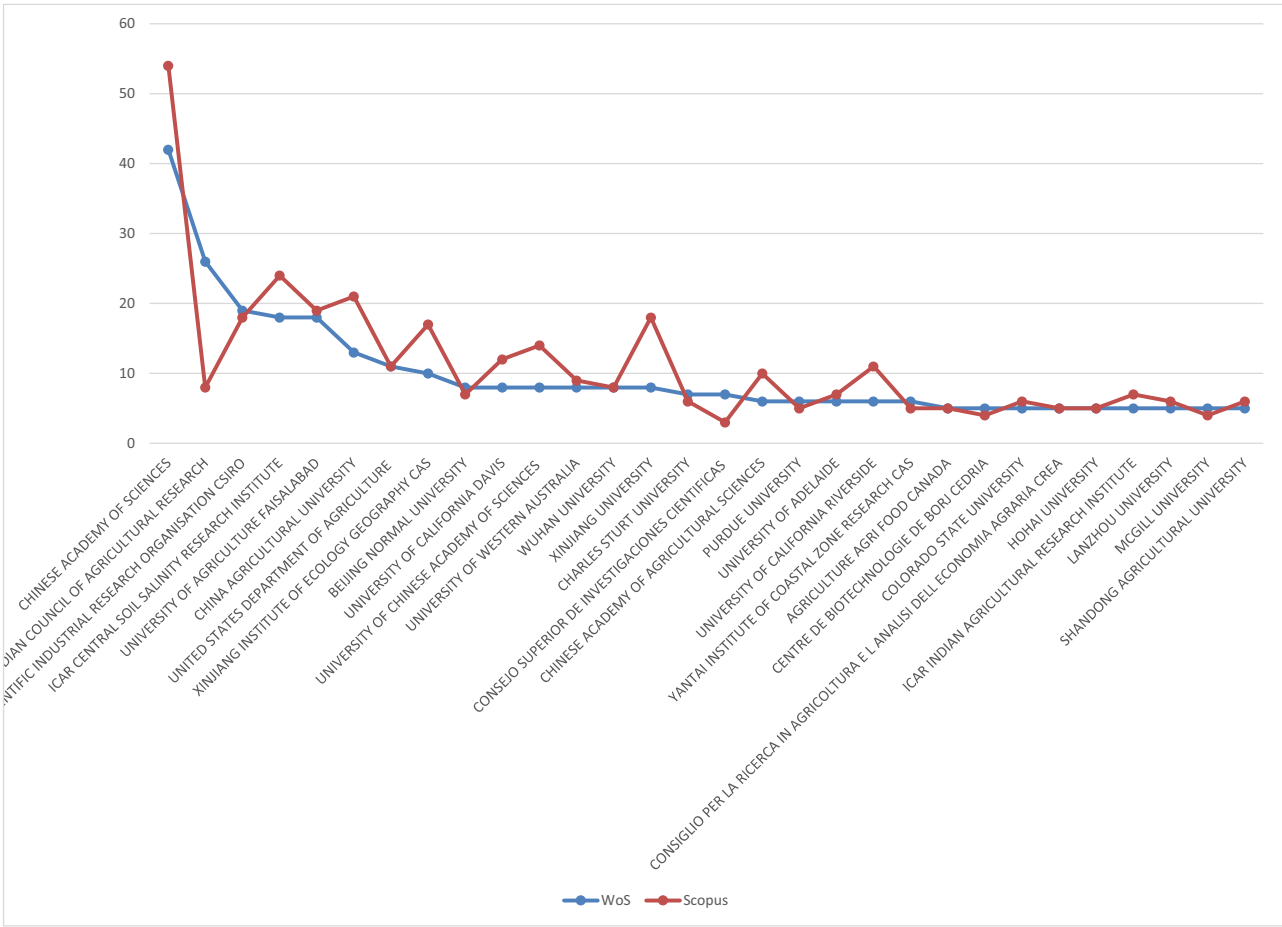


Figure 5: Number of records found on the WoS and Scopus for the several organizations, about “soil \*salini\*” and \*econom\*.

**Table 1:** Coefficients of correlation between WoS and Scopus for the records related with several metadata

Metadata	Years	Countries	Sources	Authors	Organizations
Coefficient of correlation	0.967* (0.000)	0.989* (0.000)	0.965* (0.000)	0.668* (0.000)	0.888* (0.000)

Note: \*, Statistically significant at 1%.

Research, Commonwealth Scientific Industrial Research Organisation Csiro, Icar Central Soil Salinity Research Institute, University of Agriculture Faisalabad, China Agricultural University, United States Department of Agriculture, Xinjiang Institute of Ecology Geography Cas, University of California Davis, University of Chinese Academy of Sciences, Xinjiang University, Chinese Academy of Agricultural Sciences, and University of California Riverside.

The coincidental metadata between WoS and Scopus has a higher correlation, in terms of a number of records, for the item countries than for the item years and sources. In addition, the item authors are those with a lower level of correlation in the number of records obtained from the two databases (Table 1). This means that the authors who published in sources indexed to WoS did not publish in the same manner in publications indexed to Scopus. The coefficients of correlation were obtained following Stata [21–23] procedures.

respectively, 2013.070 and 19.162, in general, the documents where these terms have higher occurrences were published in dates and have average citations around the mean.

The results from the documents found on the Scopus database (Table 3) are similar to those obtained in documents from WoS. Nonetheless, it is important to note that there are some relevant differences in this information obtained from Scopus that should be highlighted. For example, there is an absence of such a clear association with water usage (drainage). On the other hand, the researchers are more concerned, in these documents, with erosion and the importance of the related policies. Finally, in these documents, India appears individualized among the several countries. The several impacts from economic activities on soil salinity/salinization and the socioeconomic implications from soil quality are not, specifically, among the terms with higher occurrences both in

## 4 Bibliometric analysis

In this section, the bibliometric information is analysed through the VOSviewer [24,25] and Gephi [26,27] software. VOSviewer was considered for analysing the main terms (co-occurrence links from text data) referred to in the several documents obtained from WoS and Scopus and to obtain files for the Gephi software. With Gephi, centrality metrics were found to identify the more relevant documents that will be considered in the following section for a systematic review.

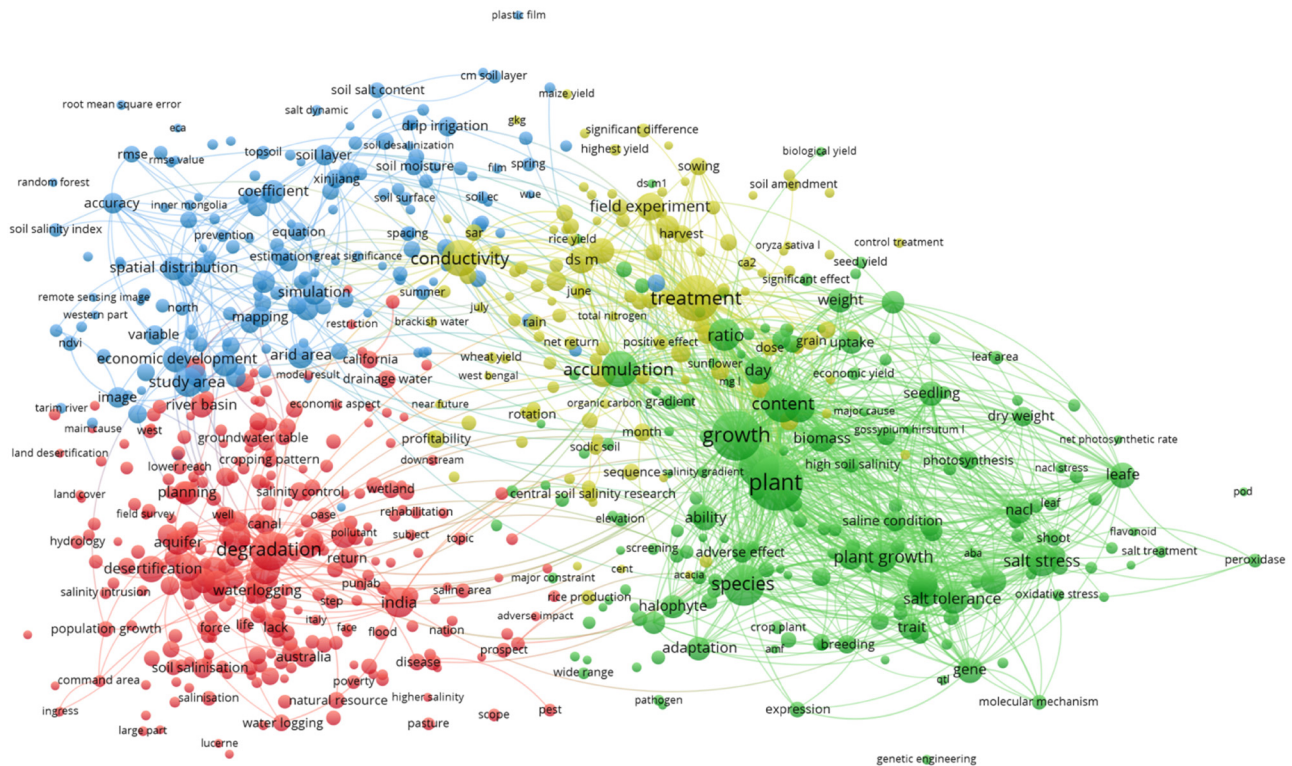
Table 2 shows that for the topics “soil \*salini\*” and \*econom\* in the documents from WoS, the terms with higher occurrences (number of documents in which a term appears) are those related to yield, plant growth, treatment, concentration, drainage, salt stress, root, and tolerance. These results reveal that there is a clear concern from the researchers about the impacts of soil salinity on plants, salt accumulation, and its relationship with water usage. The relationships between soil quality and water do, in fact, deserve special attention from researchers. Considering that the global average for the “average publication year” and for the “average citations” is,

**Table 2:** Metrics for the top 20 terms with more occurrences (number of documents in which a term appears), considering 5 as a minimum number of occurrences for a term, for the documents from WoS

Terms	Occurrences	Avg. pub. year	Avg. citations
Yield	130	2012.515	20.100
Plant	124	2014.597	22.557
Growth	87	2013.310	18.943
Treatment	82	2013.354	11.683
Response	80	2012.800	18.250
Concentration	75	2013.253	21.320
Species	60	2014.900	15.617
Mechanism	54	2014.648	34.870
Content	51	2015.412	16.647
Accumulation	43	2015.233	16.302
Experiment	43	2014.326	9.302
Ratio	43	2012.465	17.861
Drainage	42	2009.381	23.357
Salt stress	42	2016.786	21.119
Saline soil	41	2015.195	22.829
Plant growth	40	2015.000	19.425
Root	39	2015.000	13.333
Degradation	38	2012.474	15.079
dS m	38	2012.947	12.947
Tolerance	38	2015.579	17.790







**Figure 7:** Network visualization map for the documents from Scopus.

the terms linked to plant and plant growth are grouped in the blue cluster (lower right corner). Note, for example, the great relatedness between the terms economic analysis and subsurface drainage system or between economic return and water productivity (or drip irrigation).

The pattern shown in Figure 7 (for the documents obtained from Scopus) for the four clusters created is significantly different from that described in Figure 6 (data from WoS). The only cluster that demonstrates great similitudes is that associated with the following

**Table 4:** Top 20 documents, from WoS, with higher centrality metrics

Document	DOI	Closeness centrality
Yigezu et al. (2021) [28]	10.1016/j.agwat.2021.106802	0.860
Perri et al. (2018) [29]	10.1029/2018gl079766	0.603
Shalaby et al. (2021) [30]	10.1016/j.ecoenv.2021.111962	0.586
Butcher et al. (2016) [31]	10.2134/agronj2016.06.0368	0.574
Singh (2021) [32]	10.1016/j.jenvman.2020.111383	0.574
Zeng et al. (2016) [33]	10.1016/j.fcr.2016.08.007	0.570
Stavridou et al. (2017) [34]	10.1111/gcbb.12351	0.566
Huang et al. (2020) [35]	10.1093/treephys/tpaa017	0.566
Bhuiyan et al. (2017) [36]	10.16943/ptinsa/2016/48857	0.564
Goehring et al. (2019) [37]	10.3390/agronomy9100592	0.560
Hayat et al. (2020) [38]	10.1080/10643389.2019.1646087	0.558
Etesami and Glick (2020) [39]	10.1016/j.envexpbot.2020.104124	0.555
D'odorico et al. (2013) [40]	10.1016/j.advwatres.2012.01.013	0.554
Qadir and Oster (2004) [41]	10.1016/j.scitotenv.2003.10.012	0.552
Mukhopadhyay et al. (2021) [42]	10.1016/j.jenvman.2020.111736	0.551
Welle and Mauter (2017) [43]	10.1088/1748-9326/aa848e	0.549
Nouri et al. (2017) [44]	10.1016/j.psep.2017.01.021	0.548
Xu et al. (2016) [45]	10.2174/1389202917666160202215548	0.546
Qadir et al. (2000) [46]	10.1002/1099-145x(200011/12)11:6<501:aid-ldr405>3.0.co;2-s	0.544
Ventura et al. (2015) [47]	10.1093/aob/mcu173	0.544

terms: plant, plant growth, accumulation, and salt stress. The other terms appear distributed across the other clusters, but with a different organization. In any case, there is in this map a lower relevance for the dimensions related to water usage (drainage, for example).

Considering as items, documents, and bibliographic coupling links (the relatedness of items is based on the number of references they share), the results presented in Tables 4 and 5 were obtained from bibliographic data. This information will be considered for a systematic review in the following section. In these tables, the top 20 most relevant documents from WoS and Scopus are shown, respectively, considering the closeness centrality metric (a node with great closeness value having minor distances to other nodes) as a reference.

## 5 Systematic literature review

Soil salinization is a real problem that compromises the productive capacity of the land having several impacts on global sustainability [29]. The agricultural sector is one of the main economic activities to be directly affected [45]. New technologies and new scientific models may play a relevant role here to improve the methodologies in research and subsequently produce better results [43]. The Climate-

Smart Agriculture approaches may, also, bring about relevant contributions here.

There are several ways to revert these impacts; however, phytoremediation seems to be the most sustainable approach [36]. Halophytic plants and the associated halotolerant bacteria may provide interesting contributions towards phytoremediation approaches [39], including greenhouse environments [52]. The use of short rotation with willows is another relevant technique in dealing with salt in the soils in North American prairies [35]. Other techniques have been suggested worldwide, such as seed priming [49], the identification of more salt-tolerant genotypes [54], soil amelioration [46], foliar application of bio-compounds [30], genetic transformation [48], and more adjusted agricultural practices [42]. These are interesting findings that may support the design of more adjusted policies and decisions of several stakeholders.

In environments where there is salt stress, the efficient use of macronutrients by plants may be compromised [51]. The relationships between soil salinity and the application of nitrogen, for instance, have been the focus of some studies [33]. Other negative stresses such as water shortage and soil alkalinity may arrive [44]. Soil salinity affects the plants in their capacities to absorb water and nutrients and brings about problems of toxicity [53]. Nonetheless, the use of ameliorant sources of calcium (gypsum) in agronomic practices may improve, for

**Table 5:** Top 20 documents, from Scopus, with higher centrality metrics

Document	DOI	Closeness centrality
Yu et al. (2021) [48]	10.1186/s12870-021-02856-3	0.856
Johnson and Puthur (2021) [49]	10.1016/j.plaphy.2021.02.034	0.645
Murtaza et al. (2016) [50]	10.1007/978-3-319-34451-5_3	0.566
Butcher et al. (2016) [31]	10.2134/agronj2016.06.0368	0.564
Murtaza et al. (2013) [51]	10.1007/978-1-4614-6108-1_16	0.563
Yigezu et al. (2021) [28]	10.1016/j.agwat.2021.106802	0.561
Bhuiyan et al. (2017) [36]	10.16943/ptinsa/2016/48857	0.548
Gerhardt et al. (2017) [52]	10.1007/978-3-319-52381-1_2	0.547
Hayat et al. (2020) [38]	10.1080/10643389.2019.1646087	0.545
Stavridou et al. (2017) [34]	10.1111/gcbb.12351	0.544
D'odorico et al. (2013) [40]	10.1016/j.advwatres.2012.01.013	0.543
Singh (2021) [32]	10.1016/j.jenvman.2020.111383	0.542
Xu et al. (2016) [45]	10.2174/1389202917666160202215548	0.542
Zeng et al. (2016) [33]	10.1016/j.fcr.2016.08.007	0.541
Welle and Mauter (2017) [43]	10.1088/1748-9326/aa848e	0.540
Etesami and Glick (2020) [39]	10.1016/j.envexpbot.2020.104124	0.540
Perri et al. (2018) [53]	10.1002/2017wr022319	0.539
Goehring et al. (2019) [37]	10.3390/agronomy9100592	0.538
Mukhopadhyay et al. (2021) [42]	10.1016/j.jenvman.2020.111736	0.536
Niu et al. (2010) [54]	10.21273/hortsci.45.8.1192	0.535



**Table 6:** Summary of the main insights from the literature review for the topics related to the relationships between soil salinity and economic dimensions

Document	Focus	Main insights	Potential directions for future research
[36]	Soil salinity remediation	Phytoremediation	Analyse the strengths and weaknesses of salt-tolerant plants
[31]	Food security	Impacts of soil salinization on corn and soybean growth	Improve the knowledge about osmotic stress and specific ion toxicities
[40]	Desertification	Desertification causes and impacts, including socioeconomic	Improve the knowledge about the desertification control approaches
[39]	Halophytic plants and halotolerant bacteria	Most halotolerant bacterial genera: <i>Halomonas</i> , <i>Bacillus</i> , <i>Streptomyces</i> , <i>Oceanobacillus</i> , and <i>Pseudomonas</i>	Promote experiments in different climate conditions and for long periods
[52]	Phytoremediation and use of plant growth-promoting rhizobacteria	The absorption of sodium and chloride from the soil into foliar plants decreases the level of salt in the soil	Promote experiments for different conditions and periods
[37]	Agricultural Policy/Environmental Extender (APEX) model and the growth of the halophyte quinoa	Quinoa may not be effective for reducing the level of salt in the soil	Improve understanding about crop salt absorption dynamics and stress reactions
[38]	Potential of <i>Pennisetum</i> genus (Poaceae) for phytoremediation	<i>Pennisetum</i> species have higher productivities	Investigate the potentialities of the soil with problems of salinity to produce biomass
[35]	Short rotation with willows ( <i>Salix</i> spp.) as soil remediation on North American prairies	Two native willow genotypes present higher potential for remediating	Bring more insights about the sulphate absorption and sulphur metabolism
[49]	Seed priming	Priming may mediate stress tolerances	More research at proteomic and transcriptomic levels
[42]	Climate change context	Adjusted agricultural practices to improve the socioeconomic conditions	Improve farming sustainability under climate change conditions
[50]	Nitrogen management in rice–wheat system	Calcium improves nitrogen use efficiency	Improve the knowledge about other ways to improve the nitrogen use
[51]	Nitrogen use efficiency	Improvements in the agricultural income will support to decrease rural poverty	Improve the knowledge about other ways to improve the nitrogen use
[54]	Salinity tolerance of 20 genotypes of chile peppers	Relative tolerance of chile genotypes varied with substrate in some genotypes	Examine the response to salinity during other growth stages
[44]	Green remediation	Halophytoremediation	Improve knowledge about biological, physical, and chemical mechanisms related to halophytes
[53]	Plant osmoregulation	Osmoregulation appears as a water-saving behaviour	Assess the ecosystem response and transpiration-salinity feedback
[29]	Vegetation controls	Phytoremediation should be carefully evaluated based on the long-term effects of salinity	Analyse the use of moderately tolerant or highly tolerant plants
[41]	Irrigation management approaches	Strategies to improve crop production under irrigated conditions	Bring more insights about the linkages between the several stakeholders, namely among the researchers and farmers
[46]	Amelioration strategies	Cropping in conjunction with leaching was the most successful way to ameliorate saline soils	Evaluate movement and reactions of salts in soils
[30]	Cucumber production with salinity and heat stress	Foliar application of nano-Se ( $25 \text{ mg L}^{-1}$ ) improves cucumber growth parameters. Foliar application of Si (silicon, $200 \text{ mg L}^{-1}$ ) presents the greatest impact on enzymatic antioxidant capacities, greatest increase in marketable fruit yield and yield quality	Assess the different responses of cultivated plants to combined stresses

(Continued)

Table 6: Continued

Document	Focus	Main insights	Potential directions for future research
[32]	Salinization management	Previous studies have poorly considered economic, social, and environmental aspects of the salinization problem altogether	Use more adjusted models, technologies, and approaches
[34]	Bioenergy grass <i>Miscanthus</i> × <i>giganteus</i>	High salinity soil may be an alternative for the cultivation of dedicated biomass crops	Improve the knowledge about the possibility of using <i>Miscanthus</i> for phytoremediation
[47]	Halophyte-based production systems	Irrigation practices cause an increase in soil salinity due to over irrigation, inefficient water use, and poor drainage	Analyse direct germination in salinity conditions and genotype selection
[43]	Estimating the economic and policy implications in California	Soil salinity reduced agricultural returns by \$3.7 billion (\$1.7–\$7.0 billion) in 2014	Need for high-resolution data in agro-environmental assessment
[45]	Food quality	The strategies in physiological and molecular levels used by halophytes are diverse	Improve the knowledge about the halophytes tolerance and adaption to salinity stress
[28]	Raised beds in irrigated wheat in Egypt	Raised beds increase the yield	Close the gap by making comparisons between traditional tillage, raised beds in general and mechanized raised beds
[48]	Cloning and overexpression of PeWRKY31 from <i>Populus</i> × <i>euramericana</i>	Overexpression of PeWRKY31 brings more resistance to the transgenic plant	Bring more knowledge about the economic benefits
[33]	Sunflower seed yield	The maximum seed yield decreases rapidly with soil salinity until 12 dS m <sup>-1</sup> . With soil salinity levels below 18 dS m <sup>-1</sup> , the optimal N application fluctuates among 100 and 160 kg ha <sup>-1</sup>	Increase experiments to reveal the crop response mechanism for S and N

instance, the efficiency in nitrogen use [50]. These are examples of other practices that could improve the sustainability of agricultural activities.

The impacts of soil salinity on farming productivity may bring serious challenges to food supply over the coming decades [31]. Some estimations suggest that around 20% of the world's irrigated land is affected by problems of salinity [37], or possibly even more [41]. The use of soil with salinity problems to produce biomass as a source of renewable energy may provide a solution, in some cases, towards dealing with the problems of competition for land to produce food and crops for energy [34]. This could be a solution in improving the frameworks for food security worldwide.

Soil salinity is a consequence of diverse dynamics, including climate change and other drivers of the processes of desertification, meaning that there are some causes that are more easily controllable than others [40]. These contexts of soil salinization and its control are particularly problematic in developing countries [38]. The

expansion of irrigated agricultural land is another relevant threat to global efforts implemented in dealing with the problems of salt in the soil [32]. Irrigation contributions to soil salinization from over irrigation in farming bring about unadjusted water use and problems related to the drainage [47]. Raised beds may provide relevant solutions in mitigating some of the problems associated with over irrigation [28].

Table 6 provides the main contributions from the literature survey for the topics “soil \*salini\*” and \*econom\*, namely to highlight the main gaps and present suggestions and directions for future research. This table reveals that a great part of the studies focused on the strategies in dealing with soil salinity, where phytoremediation has its relevance. Other dimensions addressed are those related to food security, desertification, climate change, nitrogen management, and plant osmoregulation. Few studies directly assessed the socio-economic impacts from soil salinity or considered the impacts on the several dimensions of sustainability.

## 6 Discussions, conclusions, policy implications, and future research/studies

In this research, the intention was to analyse several insights from the scientific literature about the diverse interrelationships between soil salinity/salinization and the economic causes and implications. To achieve this and to perform a systematic review, a new methodology was suggested based on the benchmarking of metadata, from scientific databases, and bibliometric assessment and analysis. In this manner, several documents from WoS and Scopus were considered (532 and 756, respectively) in a search conducted on 10 April 2021 for the topics “\*salini\*” and \*econom\*. These studies were first benchmarked between the two scientific databases considered and later assessed through bibliometric analysis considering the VOSviewer and Gephi software, namely to obtain centrality metrics to identify the most relevant documents for the systematic review.

The metadata analysis, for the coincident information between the two databases, shows that after 2014 the number of documents published in sources indexed to WoS and Scopus increased significantly. In turn, China, the United States, Australia, and India are the countries that have more records. The sources with more records are the following: Agricultural Water Management, Land Degradation Development, Science of the Total Environment, and Irrigation and Drainage. The most productive authors are the following: Sharma PC, Qadir M, Khan S, Murtaza G, Ghafoor A, Greiner R, Adamowski J, Datta KK, Gorji T, and Inam A. Finally, some of the most productive organizations are presented next: Chinese Academy of Sciences, Indian Council of Agricultural Research, Commonwealth Scientific Industrial Research Organisation Csiro, Icar Central Soil Salinity Research Institute, and University of Agriculture Faisalabad. This framework reveals that there is still some way to go in some countries, namely in developing countries and in those that are more threatened by climate change, where the problems associated with soil salinity have special relevance.

The bibliometric analysis highlights that the main focus of the scientific research conducted for the topics addressed here is that related to the following terms: yield, plant growth, treatment, concentration, drainage, salt stress, root, tolerance, erosion, and policies. The literature survey confirms this focus of the scientific research to be on soil salinity tolerance and remediation and their relationships to water use, plant growth, and their respective productivity. The literature also highlights the challenges in dealing with

food security, desertification, climate change, and nitrogen management.

In terms of practical and policy implications, the design of new policy instruments is suggested to better promote awareness in the several stakeholders, namely farmers, of the problems associated with soil salinity, highlighting causes, consequences, and alternatives. This involvement of the stakeholders in the soil salinization problem will increase the concerns for soil quality. It is also important to design new policy measures that promote more efficient use of the soil and water resources. The recommendation here for future research is to address the main socioeconomic impacts from soil salinity both directly and indirectly on the numerous dimensions within society.

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**Data availability statement:** The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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