FEB 27, 2023

OPEN ACCESS

DOI:
dx.doi.org/10.17504/protocols.io.n92ldpwdol5b/v1

Protocol Citation: Galateia Terti, Sarah Louart, Sandrine Anquetin, Kouamé Kouadio, Valéry Ridde, Isabelle Ruin, Véronique Yoboué, Emmanuel Bonnet 2023. The Health Impacts of Extreme Weather Events in Africa: A scoping review protocol. **protocols.io** https://dx.doi.org/10.17504/protocols.io.n92ldpwdol5b/v1

Protocol status: In development
We are still developing and optimizing this protocol

Created: Jan 17, 2023

Last Modified: Feb 27, 2023

PROTOCOL integer ID: 75383

The Health Impacts of Extreme Weather Events in Africa: A scoping review protocol

Galateia Terti[1], Sarah Louart[2], Sandrine Anquetin[3], Kouamé Kouadio[4], Valéry Ridde[5,6], Isabelle Ruin[3], Véronique Yoboué[7], Emmanuel Bonnet[1]

[1]Institut de Recherche Pour Le Développement, UMR 215 PRODIG, 5, Cours Des Humanités, 93 322 Aubervilliers Cedex, France;
[2]Université de Lille, Centre lillois d'études et de recherches sociologiques et économiques (Clersé), Lille, France;
[3]Université Grenoble Alpes, CNRS, IRD, Grenoble INP, IGE, 38000 Grenoble, France;
[4]Eco Epidemiology Unit, Pasteur Institute Côte d'Ivoire, Abidjan, Côte d'Ivoire;
[5]Institut de Recherche Pour Le Développement, Ceped, Université de Paris, Inserm ERL 1244, 45 Rue Des Saints-Pères, 75006 Paris, France;
[6]Institute Santé Et Développement, Université Cheikh Anta Diop, Dakar, Senegal;
[7]Laboratoire de Physique de l'Atmosphère, Université Félix Houphouët-Boigny, Abidjan, BPV 34, Côte d'Ivoire

Galateia Terti: galateia.terti@ird.fr;

Galateia Terti

ABSTRACT

Background

In the last 20 years, 12,000 extreme weather events worldwide led to devastating disasters, such as storms, floods, and heatwaves killing 500,000 people between 1999 and 2018. There is an imperative call for a deeper investigation of the intersection between weather extremes and health, especially in economically vulnerable countries that suffer the most. However, there are very few literature reviews on this research topic in low-income populations and even fewer in Africa. The existing review studies focus either on one particular weather hazard like floods or address specific aspects of human health or health systems. To our knowledge, our study is the first scoping review seeking to map the link between a wide range of health impacts (related to both physical and mental health) and extreme weather events. Our goal is to understand better the current and potential future outcomes of high-impact weather extremes on population health in Africa to support weather warnings and emergency decision-making toward a better capacity to prepare for and to cope with health risks.

Keywords: extreme weather event, high-impact weather, human impacts, health outcomes, human health, Africa

Methods

The protocol is developed based on the PRISMA-P 2015 checklist for protocols (Moher et al., 2015). Recommended items for systematic review protocols are adapted to meet the objectives of our scoping review protocol. A scoping review (ScR) approach was chosen due to the broad nature of our research question. We will use established ScR methods to extract knowledge from studies on extreme weather events and the associated outcomes on the health of the populations in Africa. The study is designed according to the PRISMA extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018, Page et al., 2021). A comprehensive literature research will be conducted in four scientific databases: PubMed, Web of Science Core Collection, ScienceDirect, and EBSCOhost (Academic Search Complete, APA PsycArticle, APA PsycInfo, EncoLit, GeoRef, GeoRef in Process, Psycology and Behavioral Sciences). The electronic search strategies are developed by the authors and will be validated by a health sciences librarian. We will include mainly peer-reviewed articles, but we will remain open to reviewing 'grey' literature that presents critical evidence on the typology of weather extremes and health issues in the African context. Google Scholar will search for ‘grey’ literature, such as key reports or references identified in included articles.

Results

We will synthesize evidence on the spatial and temporal occurrence of past weather extremes (namely heat waves, floods, torrential rains, and droughts) and their consequent impacts on the health of African people. We will intentionally keep the research question broad to explore the various aspects on which the occurrence of extreme weather events and their health impacts have been studied previously in Africa.

0 µL

INTRODUCTION

1 Rationale

- The devastating effects of extreme weather and climate events on human health are evident, and they expect to increase in number and frequency due to changes in climatic conditions and urbanization in Africa and worldwide. Recent studies indicate the impact of extreme rainfall and heat waves on the incidence of diarrhea diseases and childhood malnutrition (Wang et al., 2015), the spread of water- and vector-borne diseases during flooding, and the

augmentation in flood victims in West and Central Africa (Roy et al., 2018). There is an imperative call for a deeper investigation of the intersection between weather extremes and health, especially in economically vulnerable countries that suffer the most. However, there are very few systematic reviews on this research topic in low-income populations and even fewer in Africa. The existing review studies focus either on one particular weather hazard like floods (Suhr and Steinert, 2022; Wanger et al., 2022) or address specific aspects of health, for example, related to pregnancy or infant feeding in hot weather (Edney et al., 2022). Rataj et al. (2016) did a systematic review of the impact of several weather extremes in developing countries, such as floods, storms, tornados, and others, indicating an increase in injuries and mental disorders in all the reviewed studies. However, none of the 17 studies included in the analysis was about Africa. More recently, Theron et al. (2022) reviewed studies on climate-related weather extremes and their effect on emergency health care in Africa. Although comprehensive, that scoping review addresses only human impacts in terms of demand surges and additional challenges for preparedness in the health system. To our knowledge, our study is the first scoping review seeking to map the link between a wide range of health impacts (related to both physical and mental health) and high-impact weather events to support early weather warning systems in Africa.

2 Objectives

We will conduct a scoping review to systematize the existing knowledge on the outcomes of extreme weather events (heat waves, floods, torrential rains, and droughts) on the health of the populations in Africa. The review is designed to answer the following questions:

- What is the scope of studies on weather extremes and human health in Africa?
- What type of climate-sensitive health outcomes are attributed to weather extremes in Africa?
- What are the sources and the methods of analysis of health impacts from weather extremes on the African population?
- What challenges are associated with identifying and analyzing health-impact data in Africa?

Table 1 presents our research question according to the participants, interventions, comparators, and outcomes (PICO) framework.

If the identified literature allows for it, we aim to get further insights on:

- What is the geographic distribution of extreme weather- or climate-induced human health impacts in the African continent? Are there any temporal patterns identified in the occurrence of these impacts?
- What hydrometeorological and socioeconomic factors interact and stimulate social vulnerability to weather extremes amplifying health risks in Africa?
- How to support weather warnings and emergency decision-making at the community or the individual level toward a better capacity to cope with health risks from extreme weather in Africa?

PICO criterion	Definition

	PICO criterion	Definition
	Participants/population	No specific target population. Impacted people in African territory might have different socio-econimic profils (adults, children, elderly) and might suffered from different health outcomes (diseases, injuries, deaths).
	Intervention(s)/ Exposure(s)	We will analyze studies that present health issues caused by extreme weather events in Africa. We will focus on health impacts that occurred during the weather event or right after its aftermath.
	Comparator(s)/ control	N/A
	Context	We focus on studies on African countries.
	Main outcome(s)	List and analysis of the typologies of extreme weather hazards and their consequences in terms of human health to understand social vulnerability to those events. Recommendations to support weather warning systems in Africa.

Table 1. The main concepts within the research question according to the population, intervention, comparator, outcome (PICO) framework.

METHODS

3 Eligibility criteria

- **Context:** A study must be related to weather extremes research and focus on the African context to be eligible for inclusion. In addition, studies must discuss the outcomes of extreme weather on human health. The studies on the impact of extreme weather events on other domains like agriculture, animal species and plants, food safety, and chronic diseases will be excluded. In particular, we look for studies that treat health issues of humans that are associated with the occurrence of hazardous events and their aftermath.
- **Language:** We will include articles written in English or French. We will keep out of this work articles written in a language other than English or French.
- **Type of literature:** We will include mainly peer-reviewed articles or reports, but we will remain open to reviewing 'grey' literature that presents critical evidence on the typology of weather extremes and health issues in the African territory. We will exclude conference proceedings, commentaries, letters to the editor. This decision might be revised based on the number of relevant studies that we will identify for inclusion. Literature reviews (systematic, scoping, etc.) are also excluded. However, we will check their reference lists for additional relevant literature (to be searched afterwards in Google Scholar).
- **Date limits:** From 2000 and afterward. Discussions on the weather- and climate-induced events and their hazardous impacts on human health and healthcare started to increase in the African context in the last 20 years or so. For example, we estimated that 80% of the studies identified through our search strategy in PubMed database were published from 2000 and

afterwards (whereas the first records are dated to 1946).

	Criterion	Inclusion	Exclusion
	1st key-concept	Main weather extremes: heat waves, floods, torrential rains, and droughts	Cascading events (e.g., wildfires) or other hazards linked to climate (e.g., air pollution)
	2nd key-concept	Outcomes on human health during the hazardous event or its aftermath (short-term)	Outcomes on animals or other domains (e.g., agriculture, food safety), and chronic diseases
	3rd key-concept	African countries	Country outside Africa
	Language	English or French	Other language
	Type of study	Peer-reviewed articles or reports, relevant 'grey' literature	Conference proceedings, commentaries, letters to the edirtor, and review studies (systematic, scoping, rapid)
	Date	Publications between 2000 and January 2023	Publications from 1999 and before

Table 2. Inclusion and exclusion criteria.

4 Information sources

We choose databases for Public Health Research as well as general databases:

- PubMed
- Web of Science Core Collection
- ScienceDirect
- EBSCOhost (Academic Search Complete, APA PsycArticle, APA PsycInfo, EncoLit, GeoRef, GeoRef in Process, Psycology and Behavioral Sciences)

'Grey' literature:

Google Scholar will search for ‘grey’ literature, such as key reports or references identified in included articles.

5 Search strategy

The electronic search strategies for each database are developed by the authors and will be validated by a health sciences librarian. The search strategy is built on three key concepts: 1) extreme weather events **and** 2) health outcomes, **and** 3) Africa (Appendix A). Several keywords for each concept are used as search terms and then combined to ensure that the identified studies meet the inclusion criteria for the context of our study (see the eligibility criteria in step 3 of this protocol).

First, we developed the research equation for the PubMed database and afterward modified it to fit the requirements of the other databases. However, especially for PUBMED, a health research database, we decided to erase the search terms related to our second key concept to avoid unnecessary restriction of the health outcomes concept. To eliminate irrelevant studies that do not refer to human health we applied the filter "Human" for the species treated in PubMed study

records.

For the same purpose, we refined the search in other databases by excluding from the listed categories of publications the ones that were directly related to animal or plant sciences. In particular, we carefully selected 34 and 16 categories in the EBSCOhost and the Web of Science databases, respectively (Appendix A) .

The search started in October 2022 and will be completed in February 2023. The search is limited to the last 22 years (01/01/2000 – 31/01/2023), where most publications on our topic developed (80% of the search results in PubMed, 96% of the search results in EBSCOhost, 94% of the search results in Web of Science before excluding specific categories). The study will take into account literature published in English or French.

The search strategies can be found in Appendix A.

6 Study records

6.1 Data management

Search results from the online electronic databases will be downloaded and imported into Covidence, an online program for collaborative screening and data extraction. The team will keep an archive of the citation files in RIS format for information security. The studies will be de-duplicated in Covidence and get ready for screening.

6.2 Study selection process

We will follow a two-step workflow (i.e., titles and abstracts, then full-texts) for study selection. For the first step we will explore existing machine-learning algorithms for (semi-)automatic screening. For example, the screening process will be undertaken by the first author (GT) in R studio software (Retool) or python (Abstrackr tool). If applied, the automated screening will be pilot-tested with a manual screening of a subset of records in Covidence (EB) before the final implementation. After the initial screening, the full texts of the candidate eligible studies will be independently reviewed by two authors to make decisions on final inclusions. Disagreements will be solved by discussion with two co-authors if needed. The study selection process will be reported using the PRISMA 2020 flow diagram, including reasons for excluding full-text articles.

6.3 Data collection process

Data from the eligible studies will be extracted and verified by two investigators (GT & SL). We will use an MS Excel sheet to record crucial information (e.g., author, year of publication, spatial resolution, addressed weather events, health outcomes reported, implications for practice and research). We will first pilot test the data abstraction for about 5 articles to ensure consistency and to test the data extraction form. Potential disagreements are to be discussed through consultation with the original publication. Several team members will check the

items/information to collect from each article to ensure completeness. It is necessary to ensure the homogeneity of data extraction among all the included studies.

7 **Data items**

We have not specified yet the detailed variables for which data will be sought.

8 **Risk of bias**

The risk of bias will not be assessed (not applicable for scoping reviews).

9 **Data synthesis**

The elements of the selected studies will be summarized narratively in the text and presented in summary tables in the ScR. We will conduct a descriptive analysis of the data presented in the literature (e.g., types and frequency of extreme weather events and types of human health outcomes). When relevant, we will present our analysis through graphs or synthetic figures. Reporting of the findings will follow the PRISMA-ScR checklist (Tricco et al., 2018; Page et al., 2021).

10 **Confidence in cumulative evidence**

The strength of the body literature will not be examined.

REFERENCES

11

- Edney, J.M., Kovats, S., Filippi, V. and Nakstad, B., 2022. A systematic review of hot weather impacts on infant feeding practices in low-and middle-income countries. *Frontiers in pediatrics*,*10*.
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P. and Stewart, L.A., 2015. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews*,*4*(1), pp.1-9.
- Rataj, E., Kunzweiler, K. and Garthus-Niegel, S., 2016. Extreme weather events in developing countries and related injuries and mental health disorders-a systematic review. *BMC public health*,*16*(1), pp.1-12.
- Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E. and Chou, R., 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*,*88*, p.105906.
- Roy, J., Tscharket, P., Waisman, H., Abdul Halim, S., Antwi-Agyei, P., Dasgupta, P., Hayward, B., Kanninen, M., Liverman, D., Okereke, C. and Pinho, P.F., 2018. Sustainable development,

poverty eradication and reducing inequalities.

- Suhr, F. and Steinert, J.I., 2022. Epidemiology of floods in sub-Saharan Africa: a systematic review of health outcomes. *BMC public health*,*22*(1), p.268.
- Theron, E., Bills, C.B., Hynes, E.J.C., Stassen, W. and Rublee, C., 2022. Climate change and emergency care in Africa: A scoping review. *African Journal of Emergency Medicine*,*12*(2), pp.121-128.
- Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D., Horsley, T., Weeks, L. and Hempel, S., 2018. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine*,*169*(7), pp.467-473.
- Wang, L., Kanji, S. and Bandyopadhyay, S., 2009. The health impact of extreme weather events in Sub-Saharan Africa. *World Bank Policy Research Working Paper*, (4979).
- Wagner, S., Souvignet, M., Walz, Y., Balogun, K., Komi, K., Kreft, S. and Rhyner, J., 2021. When does risk become residual? A systematic review of research on flood risk management in West Africa.*Regional Environmental Change*,*21*, pp.1-18.

APPENDIX A

12

	Key-concept	Keywords & Mesh Terms
	Extreme weather event	"extreme weather"[MeSH Terms] OR "extreme weather"[Title/Abstract] OR "extreme meteorological event*"[Title/Abstract] OR "climate disaster*"[Title/Abstract] OR "extreme hot weather"[MeSH Terms] OR "extreme hot weather"[Title/Abstract] OR "hot temperature"[MeSH Terms] OR "hot temperature"[Title/Abstract] OR "extreme heat"[MeSH Terms] OR "extreme heat"[Title/Abstract] OR "extreme rainfall" [Title/Abstract] OR "heavy precipitation"[Title/Abstract] OR "torrential rain*"[Title/Abstract] OR "floods"[MeSH Terms] OR "flood*" [Title/Abstract] OR "torrent*"[Title/Abstract] OR "cyclonic storms"[MeSH Terms] OR "storm*"[Title/Abstract] OR "water logging"[Title/Abstract] OR "inundation*"[Title/Abstract] OR "high water*"[Title/Abstract] OR "droughts"[MeSH Terms] OR "droughts"[Title/Abstract]
	Health outcomes	"health"[Title/Abstract] OR "environment and public health"[MeSH Terms] OR "public health"[Title/Abstract] OR "health services accessibility"[MeSH Terms] OR "health services accessibility" [Title/Abstract] OR "health services misuse"[MeSH Terms] OR "health services misuse"[Title/Abstract] OR "health impact assessment"[MeSH Terms] OR "impact*"[Title/Abstract] OR "effect*"[Title/Abstract] OR "injur*"[Title/Abstract] OR "trauma*"[Title/Abstract] OR "mortalit*" [Title/Abstract] OR "death*"[Title/Abstract] OR "sick*"[Title/Abstract] OR "illness*"[Title/Abstract] OR "disease*"[Title/Abstract] OR "deliver*" [Title/Abstract] OR "malnutrition"[MeSH Terms] OR "malnutrition" [Title/Abstract] OR "vector borne diseases"[MeSH Terms] OR "vector borne diseases"[Title/Abstract] OR "waterborne diseases"[MeSH Terms] OR "waterborne diseases"[Title/Abstract] OR "mosquito borne disease*" [Title/Abstract] OR "diarrhea"[MeSH Terms] OR "diarrhea" [Title/Abstract] OR "heat stress disorders"[MeSH Terms] OR "disorder*" [Title/Abstract] OR "stress, physiological"[MeSH Terms] OR "stress" [Title/Abstract] OR "mental health"[Title/Abstract]

	Key-concept	Keywords & Mesh Terms
	Africa	"africa"[MeSH Terms] OR "afric*"[Title/Abstract] OR "south africa"[MeSH Terms] OR "africa, southern"[MeSH Terms] OR "south africa" [Title/Abstract] OR "africa, western"[MeSH Terms] OR "western africa" [Title/Abstract] OR "africa, northern"[MeSH Terms] OR "northern africa"[Title/Abstract] OR "africa, eastern"[MeSH Terms] OR "eastern africa" [Title/Abstract] OR "africa, central"[MeSH Terms] OR "central africa"[Title/Abstract] OR "namibia"[MeSH Terms] OR "mozambique"[MeSH Terms] OR "burundi"[MeSH Terms] OR "angola"[MeSH Terms] OR "benin"[MeSH Terms] OR "comoros"[MeSH Terms] OR "cameroon" [MeSH Terms] OR "egypt"[MeSH Terms] OR "burkina faso"[MeSH Terms] OR "djibouti"[MeSH Terms] OR "libya"[MeSH Terms] OR "cabo verde"[MeSH Terms] OR "eritrea"[MeSH Terms] OR "chad"[MeSH Terms] OR "morocco"[MeSH Terms] OR "cote d ivoire"[MeSH Terms] OR "ethiopia"[MeSH Terms] OR "congo"[MeSH Terms] OR "democratic republic of the congo"[MeSH Terms] OR "sudan"[MeSH Terms] OR "gambia"[MeSH Terms] OR "kenya"[MeSH Terms] OR "tunisia"[MeSH Terms] OR "ghana"[MeSH Terms] OR "madagascar"[MeSH Terms] OR "guinea"[MeSH Terms] OR "malawi"[MeSH Terms] OR "equatorial guinea"[MeSH Terms] OR "guinea bissau"[MeSH Terms] OR "mauritania"[MeSH Terms] OR "mauritius"[MeSH Terms] OR "gabon" [MeSH Terms] OR "liberia"[MeSH Terms] OR "sao tome and principe" [MeSH Terms] OR "mali"[MeSH Terms] OR "reunion"[MeSH Terms] OR "botswana"[MeSH Terms] OR "rwanda"[MeSH Terms] OR "lesotho" [MeSH Terms] OR "niger"[MeSH Terms] OR "seychelles"[MeSH Terms] OR "nigeria"[MeSH Terms] OR "somalia"[MeSH Terms] OR "atlantic islands"[MeSH Terms] OR "uganda"[MeSH Terms] OR "eswatini"[MeSH Terms] OR "senegal"[MeSH Terms] OR "tanzania"[MeSH Terms] OR "sierra leone"[MeSH Terms] OR "zambia"[MeSH Terms] OR "togo"[MeSH Terms] OR "zimbabwe"[MeSH Terms] OR "namibia"[Title/Abstract] OR "mozambique"[Title/Abstract] OR "burundi"[Title/Abstract] OR "angola" [Title/Abstract] OR "benin"[Title/Abstract] OR "comoros"[Title/Abstract] OR "cameroon"[Title/Abstract] OR "egypt"[Title/Abstract] OR "burkina faso"[Title/Abstract] OR "djibouti"[Title/Abstract] OR "libya" [Title/Abstract] OR "cabo verde"[Title/Abstract] OR "eritrea" [Title/Abstract] OR "chad"[Title/Abstract] OR "morocco"[Title/Abstract] OR "cote d ivoire"[Title/Abstract] OR "ethiopia"[Title/Abstract] OR "congo"[Title/Abstract] OR "democratic republic of the congo" [Title/Abstract] OR "sudan"[Title/Abstract] OR "gambia"[Title/Abstract] OR "kenya"[Title/Abstract] OR "tunisia"[Title/Abstract] OR "ghana" [Title/Abstract] OR "madagascar"[Title/Abstract] OR "guinea" [Title/Abstract] OR "malawi"[Title/Abstract] OR "equatorial guinea" [Title/Abstract] OR "guinea bissau"[Title/Abstract] OR "mauritania" [Title/Abstract] OR "mauritius"[Title/Abstract] OR "gabon"[Title/Abstract] OR "liberia"[Title/Abstract] OR "sao tome and principe"[Title/Abstract] OR "mali"[Title/Abstract] OR "reunion"[Title/Abstract] OR "botswana" [Title/Abstract] OR "rwanda"[Title/Abstract] OR "lesotho"[Title/Abstract] OR "niger"[Title/Abstract] OR "seychelles"[Title/Abstract] OR "nigeria" [Title/Abstract] OR "somalia"[Title/Abstract] OR "atlantic islands" [Title/Abstract] OR "uganda"[Title/Abstract] OR "eswatini"[Title/Abstract] OR "senegal"[Title/Abstract] OR "tanzania"[Title/Abstract] OR "sierra leone"[Title/Abstract] OR "zambia"[Title/Abstract] OR "togo" [Title/Abstract] OR "zimbabwe"[Title/Abstract]

Search terms for PubMed database.

Research equation: #1 AND #3

Filters:

Species: Humans

Date: 01/01/2000 – 31/01/2023

13

	Key-concept	Keywords
	Extreme weather event	extreme weather OR extreme meteorological event* OR climate disaster* OR extreme hot weather OR hot temperature OR extreme heat OR extreme rainfall OR heavy precipitation OR torrential rain* OR flood* OR torrent* OR cyclonic storm* OR storm* OR water logging OR inundation* OR high water* OR drought
	Health outcomes	health OR human impact* OR injur* OR trauma* OR mortalit* OR death* OR sick* OR illness* OR disease* OR victim* OR patient* OR deliver* OR malnutrition OR diarrhea OR stress* OR disorder* OR morbidit*
	Africa	afric* OR south africa OR southern africa OR western africa OR northern africa OR eastern africa OR central africa OR namibia OR mozambique OR burundi OR angola OR benin OR comoros OR cameroon OR egypt OR burkina OR burkina faso OR djibouti OR libya OR cabo verde OR eritrea OR chad OR morocco OR cote d'ivoire OR ethiopia OR congo OR sudan OR gambia OR kenya OR tunisia OR ghana OR madagascar OR guinea OR guinea bissau OR mauritania OR mauritius OR gabon OR equatorial guinea OR malawi OR democratic republic of congo OR liberia OR sao tome and principe OR mali OR reunion OR botswana OR rwanda OR lesotho OR niger OR seychelles OR nigeria OR somalia OR atlantic islands OR uganda OR eswatini OR senegal OR tanzania OR sierra leone OR zambia OR togo OR zimbabwe

Search terms for Web of Science database.

Research equation: (TS=1) AND (TI=2) AND (TS=3)

Notes:

- TS - Search Topics: Searches title, abstract, author keywords, and Keywords Plus.
- TI - Search Titles: Searches article titles. Title refers to the title of a journal article, proceedings paper, book, or book chapter.

Filters:

Exclude the following Web of Science categories:

- Plant Sciences
- Agronomy
- Marine Freshwater Biology
- Veterinary Sciences
- Horticulture
- Food Science Technology
- Agriculture Mutidisciplinary
- Agriculture Dairy Animal Science
- Biodiversity Conversation
- Fisheries
- Zoology
- Entomology
- Agricultural Engineering
- Agricultural Economics Policy
- Ornithology

- Foresty

Date: 01/01/2000 – 31/01/2023

14