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Recognizing a New Environmental Education Phenomenon with Science Mapping Techniques: Eco-Anxiety

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Abstract

As awareness of global warming and ecological deterioration increases, the phenomenon of "eco-anxiety," which is a result of the negative effects of ecological crises on human mental health, has begun to take more place in our lives. Ecological problems disproportionately affect children, who are more susceptible to the economic, social, and health problems caused by the environmental crisis. For this reason, environmental educators, who have an active role in coping with eco-anxiety, need to know this phenomenon better. At the same time, research in the field of education on eco-anxiety is very important as it will reveal the points to be considered and the steps to be taken in the environmental education processes. This study aims to present a simple and understandable roadmap to those who want to research the concept of eco-anxiety, which is still very new but still popular. In this direction, books, scientific publications, and internet resources dealing with the concept of eco-anxiety were analyzed, and the findings were presented using visual and scientific mapping methods.

Keywords: Eco-Anxiety, Scientific Mapping, Visual Mapping, Environmental Education, Climate Change

1. Introduction

It is known that people start to show some signs of fear and anxiety due to the news about environmental problems in daily life (Taylor & Murray, 2020). Today, this phenomenon is known as "eco-anxiety." The concept of eco-anxiety explains a general phenomenon that includes anxiety about the ecological crisis. Studies emphasize that eco-anxiety is a comprehensive phenomenon that should be considered as an inseparable whole with many ecological emotions, and psychosocial and mental processes (Pihkala, 2020).

The problems caused by ecological crises play a major role in the development of eco-anxiety. Eco-anxiety may be experienced as much more than a mild concern for some people, as ecological problems often cause health problems, economic problems such as unemployment problems, and sometimes social problems related to injustice (Hrabok, Delorme & Agyapong, 2020).

The phenomenon of eco-anxiety is a concept that is just beginning to be understood but is also popular. Public opinion surveys reveal that eco-anxiety is not well-known as a concept, but the concerns it contains are known by

many people (Sitra, 2019). It can be said that the interest and studies on the concept of eco-anxiety have increased considerably recently (Jensen, 2019; Clayton, 2020). However, this increase is still insufficient considering the frequency and importance of the issue in public opinion, so much more data and research on the phenomenon of eco-anxiety is needed.

It is possible to come across studies examining the effects of eco-anxiety and climate change on human health. The common aspect of these studies is the anxiety problems caused by the environmental crisis. Eco-anxiety, which was first studied by psychologists, started to be the subject of multidisciplinary research over time, and with its increasing popularity, it has also been studied by eco-psychologists, eco-therapists, and sociologists, anthropologists, and ethnographers (Connor, 2016; Lockie, 2016). However, studies in the field of educational research and environmental education are quite limited.

Children are the most sensitive group to economic, social, and health-related problems caused by environmental damage caused by climate change. Children will inherit not only this nature but also possible ecological crises within this whole system (Whitehouse, 2013). For this reason, environmental educators need to be well acquainted with many possible eco-anxiety processes to better understand their own and their student's experiences.

When people care too much about climate change but feel there is nothing they can do to prevent it, they may begin to avoid it as a psychological defense. In such cases, environmental education is perhaps the best helper that people can benefit from against ecological crises and the problems they cause (Manning & Clayton, 2018). Therefore, environmental educators have important duties. Above all, environmental educators need to understand what kind of phenomenon they are dealing with when confronted with eco-anxiety and other forms of ecological emotion.

The fact that many terms are used in studies conducted in different fields regarding the concept of eco-anxiety further complicates the concept. It is thought that new research that will help clarify the concept and new multidisciplinary studies that will provide more information about the processes can clear many confusions in this sense.

The size and complexity of the current literature on a concept can make it difficult for readers. The huge amount of scientific knowledge available can sometimes intimidate researchers. Bibliometric analysis studies, on the other hand, will help to make an effective and systematic reading on a subject in a short time. Because such studies reveal the characteristics, changes, and developments of scientific products made for the research area examined with a clear projection.

Bibliometric studies prepared by using science mapping techniques have the feature of a guide prepared with the help of visual maps for authors who plan to conduct academic studies on certain disciplines, subjects, or concepts. Researchers can access information such as the most cited studies on the subject, the most productive authors, the most cooperating institutions and countries, and which academic journals should be followed most, most shortly. Bibliometric analysis studies are very valuable not only for academics and readers working in the relevant field but also for policymakers, universities, and institutions that make strategic plans on that subject. It is very important to support bibliometric analyzes with simple tables and correct visuals to be more understandable. This research aims to present a bibliometric analysis of academic studies dealing with the concept of eco-anxiety, using scientific mapping techniques and visual elements.

Eco-anxiety poses some challenges in terms of environmental education. To overcome these negativities, some preventive updates are needed in the curriculum. Environmental educators need to be aware of the anxiety about ecological problems and the many possible mental states and emotions that may develop in children (Pihkala, 2020). Since ecological concerns have the potential to be transferred from teachers to students, eco-anxiety is a phenomenon that should be handled carefully in environmental education processes. Especially in the field of environmental education, much more scientific research is needed to determine the factors that cause eco-anxiety in students and teachers, to have more information about the phenomenon, and to make more concrete suggestions.

When the literature is examined, no empirical research has been found that investigates how educators perceive eco-anxiety in students, what strategies they apply to respond to it, or how effective these strategies are. In addition, the number of other eco-anxiety studies conducted within the scope of environmental education is quite limited. In this context, it is thought that this study is valuable in terms of being a simple and understandable aid to researchers in future studies on the concept of eco-anxiety, a new but trendy concept.

2. Method

In this research, the science mapping method and the visual mapping technique, which is one of the techniques used in this method, were used. There are many software and websites that provide the visual and scientific mapping. These software and online tools, on the other hand, need the information from scientific databases to analyze (Chen, 2017). In this study, Web of Science was used as a database, CiteSpace and Excel as software, Google Ngram Viewer, Carrot2 Clustering, and WordCloud Generator were used as online tools.

First, the analysis of the books scanned in the Google search engine was made. Ngram Viewer, provided by Google, is a platform that presents the frequencies of the books published on a subject over the years with the help of graphs. The software is limited to the books Google scanned through 2019. This online graphical tool gives the number of books containing a keyword in chronological order (Sparavigna & Marazzato, 2015; Roth, 2016).

Published scientific articles, as well as printed books, provide important data to researchers when performing bibliometric analysis. Scientific databases are the easiest and fastest way to access these resources. After the related books were scanned, in the second stage of the research, the word "eco-anxiety" was scanned in Web of Science, one of the databases that scan high-quality scientific publications, and 72 scientific publications containing this concept were identified. Then, a data set was created by downloading the imprint information of these publications. Using these data, findings regarding the type, index, category, research areas, author, country, journal, keyword, and citation information of the publications were obtained. These findings were presented using tables, bar charts, treemap charts, cartograms, and word cloud visualization techniques.

In the third and last part of the findings, Carrot² online software was used to analyze the internet resources that include the word "eco-anxiety." Carrot², which can scan texts and small document collections on websites and cluster the results according to their relationships, is an open-source clustering engine that offers visualization in the form of foam tree maps (Carrot2 Clustering, 2022).

3. Results

In this section, the findings related to the books used in the research, scientific publications obtained from the web of science database, and internet resources will be presented with the help of some visual and scientific mapping techniques.

3.1. Findings on printed books

The word "eco-anxiety" was scanned in the Google Ngram Viewer, which is an auxiliary tool for bibliometric studies, and the findings are given in Figure 1. Accordingly, it is seen that the concept of eco-anxiety has become very popular in recent years and has begun to take place more in books.

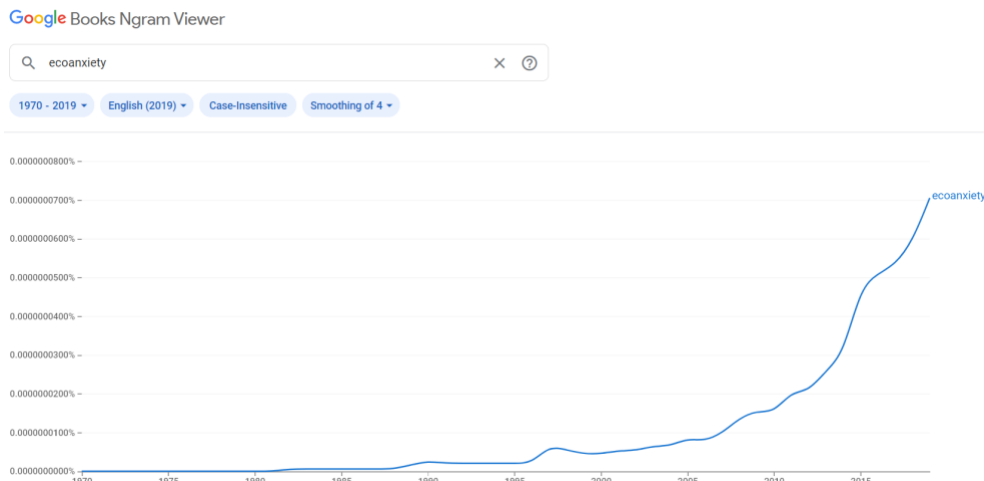


Figure 1: Number of books on eco-anxiety by years (Google Ngram Viewer)

3.2. Findings on Web of Science publications

The word “eco-anxiety” was scanned on the Web of Science and scientific publications containing this concept were identified. First of all, the distribution of the related publications by years was examined. The obtained results are presented in Figure 2. Accordingly, the frequency of using the concept of eco-anxiety in scientific publications, just like in printed books, has increased considerably in recent years. Most of the studies dealing with the concept of eco-anxiety have been conducted after 2020. According to these findings, it can be said that the concept has high popularity in scientific studies.

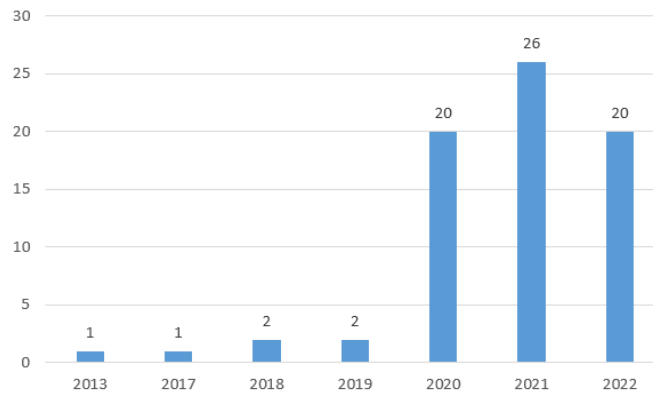


Figure 2: Number of publications on eco-anxiety by years (Web of Science)

In the search mode in the Web of Science database, 72 scientific publications dealing with the concept of eco-anxiety were identified. 71 of these studies were written in English and 1 in French. Document types of publications are given in Figure 3.

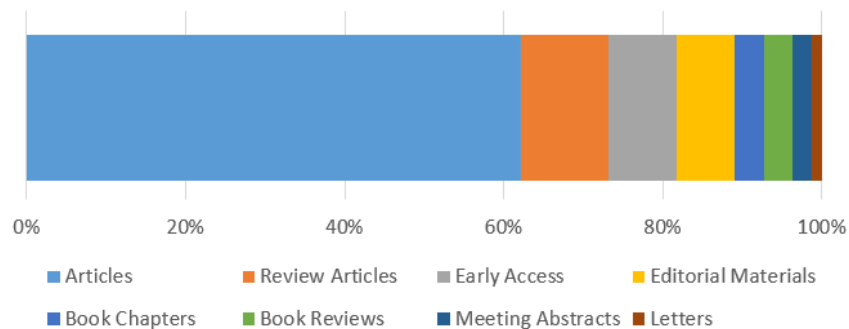


Figure 3: Eco-anxiety publications' document types

It can be said that most of the 72 identified scientific publications are articles. In the study, the indexes in which the publications dealing with the concept of eco-anxiety were scanned were also determined and given in Table 1. It has been observed that some publications are scanned in more than one index at the same time.

Table 1: Number of publications on eco-anxiety by indexes

Web of Science Index	Record Count
Social Sciences Citation Index (SSCI)	45
Science Citation Index Expanded (SCI-EXPANDED)	29
Emerging Sources Citation Index (ESCI)	14
Arts & Humanities Citation Index (A&HCI)	8
Book Citation Index – Social Sciences & Humanities (BKCI-SSH)	3
Conference Proceedings Citation Index – Science (CPCI-S)	2
Book Citation Index – Science (BKCI-S)	1

When Table 1 is examined, it is seen that most of the identified publications were published in journals scanned by the Social Sciences Citation Index and Science Citation Index Expanded. Web of Science also classifies publications according to categories and research areas. A scientific publication can be in more than one category and research area at the same time. The Web of Science categories of the publications identified in the research was visualized with the treemap chart and presented in Figure 4.



Figure 4: Number of publications on eco-anxiety by categories

It has been found that in the publications related to eco-anxiety, a total of 31 different categories have been studied. The most studied categories are environmental sciences (15 publications), psychology multidisciplinary (13 publications), religion (11 publications), psychiatry (10 publications), environmental studies (9 publications), pediatrics (9 publications), public environmental occupational health (9 publications) However, it is seen that the category of educational research (3 publications) is not among the top 10 categories with the most publications. On the other hand, the research areas of the articles were also examined and the findings were shared in Figure 5 with treemap chart visualization.



Figure 5: Number of publications on eco-anxiety by research areas

It has been concluded that publications on eco-anxiety have been studied in 23 different research areas. The most widely published fields of study are psychology (24 publications), environmental sciences ecology (18 publications), religion (11 publications), psychiatry (10 publications), pediatrics (9 publications), and public environmental occupational health (9 publications). Similarly, there are only 3 articles in the field of educational research. When examined from this aspect, it can be said that the number of articles on educational research dealing with the concept of eco-anxiety is limited.

3.2.1. Findings on top-publishing authors

The authors who mostly discussed the concept of eco-anxiety in their studies were identified with the CiteSpace software, and the top 5 authors who made the most publications on the concept of eco-anxiety are given in Table 2.

Table 2: Top 5 authors with the most publications on eco-anxiety

Authors	Record Count
Panu Pihkala	8
Charles Ogunbode	3
Navjot Bhullar	2
Marc Eric S Reyes	2
Claire Henderson-Wilson	2

72 publications examined within the scope of the research were produced by 181 different authors. When Table 2 is examined, it is seen that the most popular author is Panu Pihkala (8 publications), who conducts research in the field of environmental theology. Other popular authors are Charles Ogunbode (3 publications), Navjot Bhullar (2 publications), Marc Eric S Reyes (2 publications), and Claire Henderson-Wilson (2 publications). Four other popular authors are researchers in psychology and health. From this point of view, it is possible to say that educational researchers are not among the most popular authors in the field of eco-anxiety.

3.2.2. Findings on authors' countries

The countries of the authors of the publications used in the research have been analyzed. Accordingly, it has been determined that the articles dealing with the concepts of eco-anxiety were prepared by researchers from 37 different countries. In Figure 6, the countries of the authors have been shown on the world map with the cartogram visualization technique.

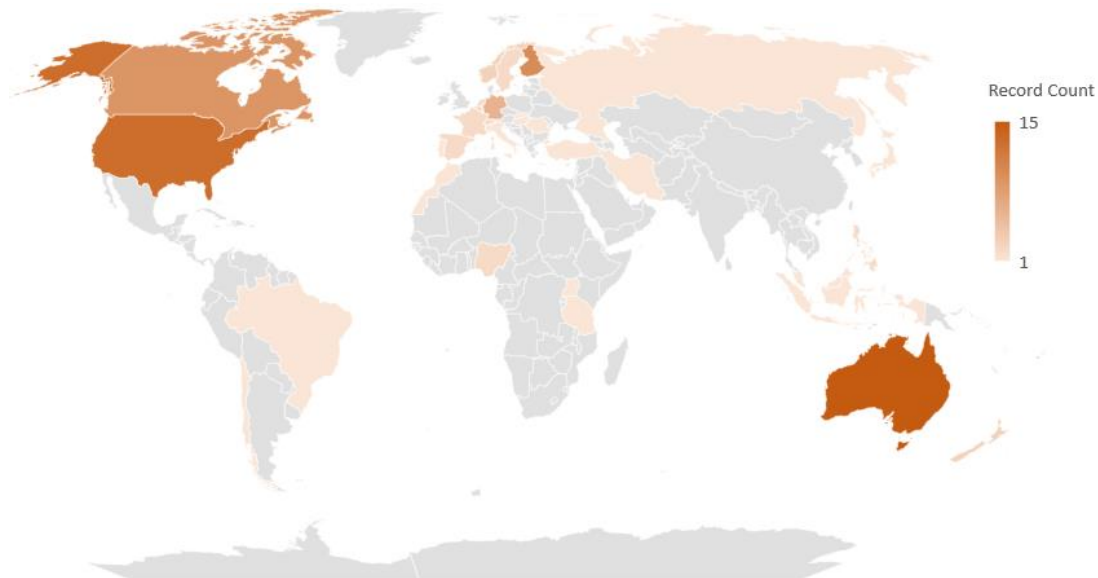


Figure 6: The countries of the authors of the publications

The countries of the authors that have published the largest number of articles addressing the concept of eco-anxiety are listed as follows: Australia (15 publications), the USA (13 publications), England (10 publications), Finland (10 publications), Canada (9 publications), Germany (6 publications). It can be said that the articles dealing with the concept of eco-anxiety were mostly published by authors from the Americas and then from the European continent.

3.2.3. Findings on top-publishing journals

The journals in which the most published scientific publications dealing with the concept of eco-anxiety were determined and given in Table 3.

Table 3: Top 5 journals with the most publications on eco-anxiety

Publication Titles	Record Count
International Journal of Environmental Research and Public Health	7
Religions	5
Child and Adolescent Mental Health	4
Journal of the American Academy of Child and Adolescent Psychiatry	4
Sustainability	3

It was observed that the studies identified within the scope of the research were published in 53 different journals. It was concluded that the ones that published the most among these were the journals in the fields of health, child, environmental research, religions, and psychiatry. It is possible to say that there is no journal within the scope of educational research among the popular journals in the field of eco-anxiety.

3.2.4. Findings from the most cited articles

Within the scope of the research, the 10 most cited articles from the publications containing the concept of eco-anxiety were determined with the CiteSpace software. The authors, names, journals, and citations of the articles are given in Table 4.

Table 4: Top 10 most cited articles

Authors	Years	Articles	Journals	Citations
Clayton, S. Manning, C. Krygsman, K.	2017	Mental health and our changing climate: Impacts, implications, and guidance	Washington, DC: American Psychological	24

Speiser, M.			Association and ecoAmerica	
Cunsolo, A. Ellis, N. R.	2018	Ecological grief as a mental health response to climate change-related loss	Nature Climate Change	23
Pihkala, P.	2018	Eco-anxiety, tragedy, and hope: Psychological and spiritual dimensions of climate change	Zygon	21
Clayton, S.	2020	Climate anxiety: Psychological responses to climate change	Journal of Anxiety Disorders	19
Clayton, S. Karazsia, B. T.	2020	Development and validation of a measure of climate change anxiety	Journal of Environmental Psychology	19
Pihkala, P.	2020	Anxiety and the ecological crisis: An analysis of eco-anxiety and climate anxiety	Sustainability	19
Hayes, K. Blashki, G. Wiseman, J. Burke, S. Reifels, L.	2018	Climate change and mental health: Risks, impacts and priority actions	International Journal of Mental Health Systems	12
Cunsolo, A., Harper, S. L. Minor, K. Hayes, K. Williams, K. G. Howard, C.	2020	Ecological grief and anxiety: the start of a healthy response to climate change?	The Lancet Planetary Health	11
Burke, S. E. Sanson, A. V. Van Hoorn, J.	2018	The psychological effects of climate change on children	Current Psychiatry Reports	11
Usher, K. Durkin, J. Bhullar, N.	2019	Eco-anxiety: How thinking about climate change-related environmental decline is affecting our mental health	International Journal of Mental Health Nursing	9

When Table 4 is examined, it is seen that the most cited publication is related to climate change and mental health issues. The most popular articles were published between 2017-2020. From this point of view, it can be said that the word eco-anxiety appears as a very new concept in the literature. The most cited authors were Susan Clayton (62 cites), Panu Pihkala (40 cites), and Ashlee Cunsolo (34 cites).

3.2.5. Findings on the most used keywords in publications

The keywords of the articles addressing the concept of eco-anxiety were analyzed and the 50 most used keywords were visualized with the word cloud technique and presented in Figure 7.



Figure 7: Word cloud of 50 most used keywords in publications

It was determined that a total of 202 different keywords were used in 72 publications used in the research. A word cloud was created with the first 50 most used words from these words. The most prominent keywords are as follows: climate-change (11), grief (8), ecological (7), impacts (5), health (5), eco-anxiety (5), and anxiety (5).

3.3. Findings on Internet resources

The contents in which the concept of eco-anxiety is mentioned in internet resources were analyzed with Carrot2 software and the results are shared in Figure 8.

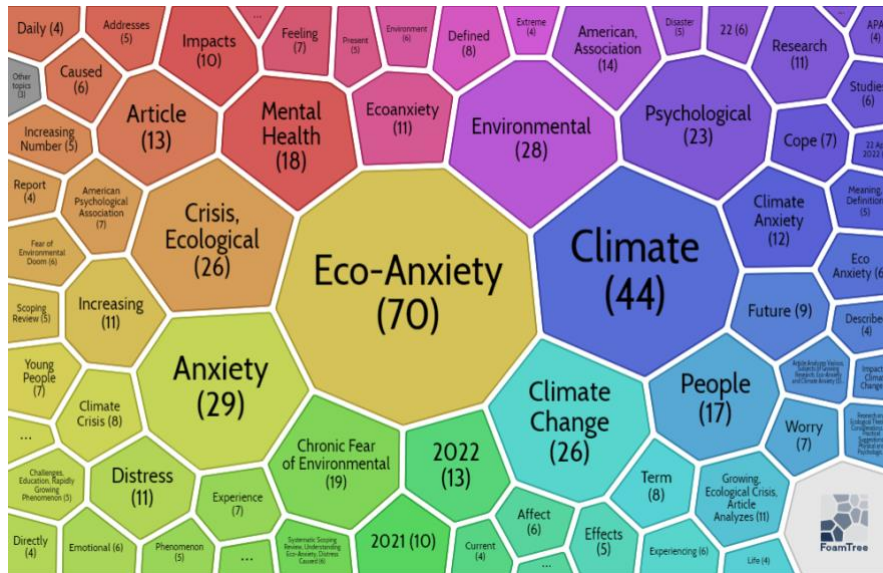


Figure 8: Foam tree map for clusters of internet resources

When the resulting foam tree map is examined, the main cluster (70 docs) consists of documents that include the concept of eco-anxiety in internet resources, and the largest clusters closely related to it are listed as follows: climate (44 docs), anxiety (29 docs), environmental (28 docs), climate change (26 docs), crisis-ecological (26 docs), psychological (23 docs).

4. Discussion and Conclusion

The phenomenon of eco-anxiety creates some difficulties in environmental education processes. For this reason, it is important for educators and academics to know well the eco-anxiety situations that develop in individuals due to environmental problems and to know how to approach individuals who experience this problem in environmental education processes. For this, much more research and new information about the phenomenon of eco-anxiety are needed.

Exploring the relationships that develop between learning and the phenomenon of eco-anxiety is very valuable in terms of environmental education. However, when the literature is examined, it is seen that the number of educational researchers is very low among the studies dealing with the issue of eco-anxiety. There is an urgent need for more scientific studies on this subject both in terms of teacher training processes and to provide a more effective environmental education.

This study was carried out to provide convenience and to save time for researchers who are interested in the phenomenon of eco-anxiety before they conduct new studies. In this context, a summary map of eco-anxiety studies was created from the findings obtained and shared in Table 5 to be a guide for future research.

Table 5: The summary map of eco-anxiety phenomenon studies

	1	2	3	4	5
Research categories	environmental sciences	psychology multidisciplinary	religion	psychiatry	environmental studies
research areas	psychology	environmental sciences ecology	religion	psychiatry	pediatrics
Authors	Panu Pihkala	Charles Ogunbode	Navjot Bhullar	Marc Eric S Reyes	Claire Henderson-Wilson
Countries	Australia	USA	England	Finland	Canada
Journals	International Journal of Environmental Research and Public Health	Religions	Child and Adolescent Mental Health	Journal of the American Academy of Child and Adolescent Psychiatry	Sustainability
Articles	Mental health and our changing climate: Impacts, implications, and guidance	Ecological grief as a mental health response to climate change-related loss	Eco-anxiety, tragedy, and hope: Psychological and spiritual dimensions of climate change	Climate anxiety: Psychological responses to climate change	Development and validation of a measure of climate change anxiety
Keywords	climate change	grief	ecological	impacts	health
Clusters	climate	anxiety	environmental	climate change	ecological crisis

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