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The Sociology of Global Warming: A Scientometric Look

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Abstract:

The theory of anthropogenic global warming (AGW) enjoys considerable consensus among experts. It is widely recognized that global industrialization is producing an increase in the planet's temperatures and causing environmental disasters. Still, there are scholars – although a minority – who consider groundless either the idea of global warming itself or the idea that it constitutes an existential threat for humanity. This lack of scientific unanimity (as well as differing political ideologies) ignites controversies in the political world, the mass media, and public opinion as well. Sociologists have been dealing with this issue for some time, producing researches and studies based on their specific competencies. Using scientometric tools, this article tries to establish to what extent and in which capacity sociologists are studying the phenomenon of climate change. Particular attention is paid to meta-analytical aspects such as consensus, thematic trends, and the impact of scientific works.

Keywords: global warming, global cooling, climate change, sociology of disaster, environmental sociology, meta-analysis, scientometrics

1. Background

According to a growing number of economists, humanity is entering a new phase of development called the Fourth Industrial Revolution (4IR) [1]. Still, there is disagreement about the prospects of the revolution. As Klaus Schwab notices, some believe that “technology will unleash a new era of prosperity,” and others believe “it will lead to a progressive social and political Armageddon by creating technological unemployment on a massive scale” [2, p. 36]. It is worth noting, however, that technological unemployment is just one of the dark clouds gathering on the horizon. Another one, perhaps the scariest one, is global warming.

The two processes are related. After all, industrialization is indicted for being the main cause of climate change and other environmental disasters, such as “unsafe levels of air pollution, the depletion of fishing stocks, toxins in rivers and soils, overflowing levels of waste on land and in the ocean, loss of biodiversity, and deforestation...” [3, p. 1]. To conclude that the 4IR will bring a new era of prosperity, one must, first of all, assume that this new developmental phase is qualitatively different from the three that preceded it. Indeed, one thinks that the 4IR involves also

technological developments capable of reducing CO₂ emissions, such as the introduction of telework on a large scale, the expansion of the digital economy, the use of renewable energy sources, the planning of sustainable smart cities and green transport. Nonetheless, the narrative about the future of humanity is still dominated by uncertainty and controversy. If humans “have a unique opportunity to harness this Fourth Industrial Revolution (...) to help fix environmental issues”, on the other hand, it cannot be excluded that the 4IR could “also exacerbate existing threats to environmental security or create entirely new risks that will need to be considered and managed” [3, p. 1].

Not only the prospect of technological development is disputed, but also the theory of global warming itself is under debate. When scientific theories become at the same time socially relevant and controversial, to the point that even non-experts get involved in the discussion, it means that the time has come to face the question from a meta-analytical point of view. The meta-analyst, instead of espousing one of the positions on the field, takes a neutral stand and focuses on the dynamics of the debate, rather than on the merit of the matter.

There is little doubt that the issue of anthropogenic global warming (AGW) is both important and controversial. The harshness of the debate is perfectly understandable if one considers that many opinion leaders present AGW as an existential threat to humanity and propose solutions that put economic interests and common lifestyles at risk. Faced with this situation, it is not surprising that a strand of meta-analytical studies has already emerged and is being enriched over time with new contributions. To give just one example, in 2013, a group of researchers led by John Cook analyzed the evolution of the scientific consensus on climate change in the peer-reviewed literature indexed in *Web of science*. Attention was focused on articles published in scientific journals. Books, book chapters, and conference papers have been excluded from the analysis. The researchers examined 11,944 abstracts of as many articles published in the period between 1991 and 2011 and thematically focused on ‘global climate change’ or ‘global warming’. Cook’s team found that 66.4% of the research expressed no position on AGW, 32.6% expressed support of the theory, 0.7% claimed that it is unfounded, while the remaining 0.3% said they were uncertain about the causes of global warming. So, among the studies that expressed a position, 97.1% supported the thesis that the phenomenon exists and is mainly caused by human activities [4]. In terms of absolute frequency, the idea of AGW was supported by 3896 and rejected by 78 scientific studies. This means that, although there was no unanimity, consensus among the experts was very large (at least at the time of that study). To date, Cook’s article has been downloaded 1,170,341 times and cited 1257 times.

Here, we do not aim to question the consensus studies already carried out, but to explore other aspects of the issue, while remaining within a meta-analytical perspective. The purpose of our study is to understand how the debate on global warming has also involved sociologists, even though the issue seems in principle outside their competence. In other words, the question from which this research starts is the following: to what extent and in which capacity do sociologists contribute to the debate on global warming?

2. Research Methods and Techniques

To answer the above question, we will provide a meta-analysis centered on research topics and trends [5, p. 5], without neglecting the impact aspect, which has originally been the main focus of scientometrics [6]. When we will have to provide examples of studies falling within the themes of our research, we will choose the most influential ones. The number of citations is an indication of the impact, although not the only one possible since an article can also be widely read and rarely quoted.

We will carry out both quantitative and qualitative analyses. First of all, we will reconstruct the dynamics of the emergence, frequency, proximity, and relation of some expressions in English, such as ‘climate change’, ‘global warming’, ‘sociology of disaster’, and ‘environmental sociology’. By ‘emergence’ we mean the first appearance of a term-and-concept in the history of ideas. By

‘frequency’ we mean both the relative frequency of terms in the scientific literature and the absolute number of publications containing the terms. By ‘proximity’ we simply mean the co-presence (or togetherness) of two terms in the same publication. By ‘relation’ we mean the theoretical or instrumental connection between concepts.

As for the databases, we will use those provided by *Google* and in particular *Google Books* and *Google Scholar*. As we have seen, meta-analysis of data extracted from *Web of science* already exists. The choice of a more specialized database is perfectly understandable if the issue is establishing the consensus among climatology experts. In our case, however, we are interested in understanding what experts from other disciplines, and in particular sociology, write on the subject. It therefore seems useful to use a less selective database. Specialists in the humanities and the social sciences often prefer the book format to express their ideas or publish in journals that, though having a long history and reputation, are not necessarily indexed in *Web of science*.

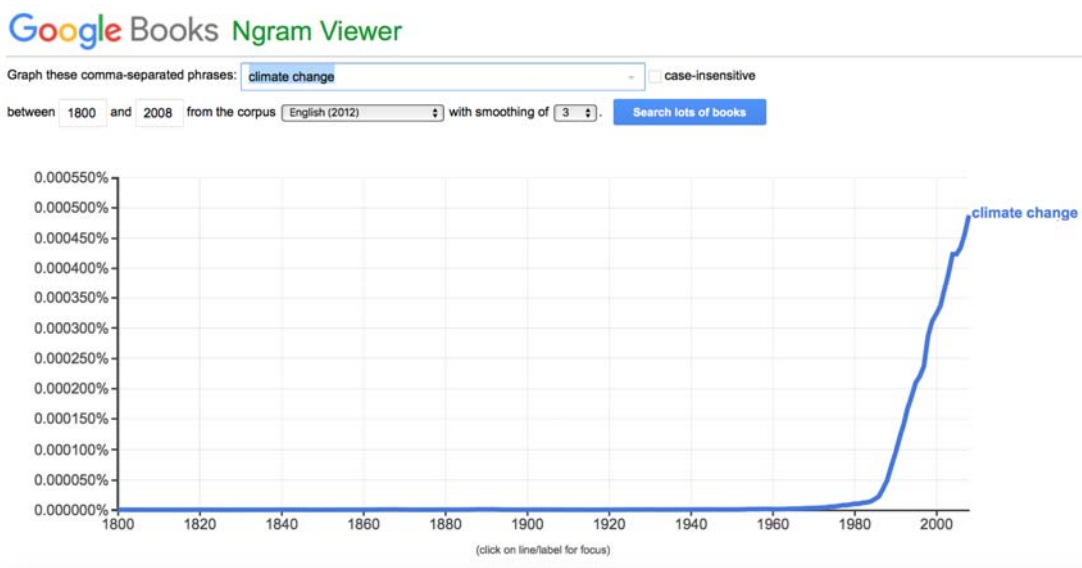
Further details on research techniques, and their intrinsic limitations, will be provided along the research path.

3. Climate Change, Global Cooling, Global Warming

Our scientometric analysis will begin with the detection of the emergence and relative frequency of the term ‘climate change’. Google offers an agile tool to carry out this type of search, namely *Ngram Viewer*. To begin with, we will simply extract the graphs provided by the tool, setting the period from 1800 to 2008.

The flaws of *Ngram Viewer* are well known, but they do not compromise its usefulness. Some occurrences of terms could be incorrectly identified. ‘False positives’ occur, for example, when looking for a term in periodicals (newspapers, magazines). Sometimes, the tool confuses the journal’s founding date with that of publication of the issue. This is why hand search is still needed when it comes to verifying the actual emergence of a concept. Also, the tool does not provide data after 2008, because the scan of works published after that year is still ongoing. For more recent periods, it will therefore be necessary to rely on *Google Scholar*.

As Graph 1 shows, there are sporadic occurrences of the term ‘climate change’ during the nineteenth and twentieth centuries, however, the real ‘emergence’ of this term-and-concept is located between the 1970s and 1980s.



Graph 1: Relative Frequency of the term ‘climate change’, period 1800-2018 (source: *Ngram Viewer*)

American geologist Roger Revelle and Austrian chemist Hans Suess were the first scholars to draw

attention to the danger represented by the increase in CO₂ emissions for the planet's climate balance. They pointed to the problem in an article published in *Tellus* in 1957, which has collected to date 1275 citations [7]. However, many years passed by before the issue became of central importance for the international scientific community.

The creation of the Club of Rome in April 1968, on the initiative of Italian entrepreneur Aurelio Peccei and Scottish scientist Alexander King, and the publication in 1972 of a report entitled *Limits to Growth* had a non-secondary role in the development of this trend. The report predicted that economic growth would not last indefinitely because of the limited availability of natural resources. It also drew attention to possible environmental disasters caused by industrial pollution. Although the report's main topic was not climate change, the problem was raised in the following form: "It is not known how much CO₂ or thermal pollution can be released without causing irreversible changes in the earth's climate, or how much radioactivity, lead, mercury, or pesticide can be absorbed by plants, fish, or human beings before the vital processes are severely interrupted" [8, p. 81]. Despite the lack of assertiveness, this observation did not go unnoticed and inspired many scientific studies. One must consider that nine million copies of the book were sold and even more people read the work in libraries or by photocopy.

Since 1972, experts from various United Nations sub-agencies began to systematically investigate the relations between climate anomalies and human activities, emphasizing the role of the concentration of CO₂ in the atmosphere [9, p. 34].

As can be seen from Graph 1, the takeoff of the term 'climate change' occurs in the early 1980s and then its growth became unstoppable. Some decisive events that occurred during that period must therefore be mentioned. One of these is the first global climate conference, organized by the World Meteorological Organization (WMO) in Geneva in 1978. Since then, the issue has become central to the scientific community. The second event is the 1988 Toronto conference, attended by "around 300 natural science scholars, economists, sociologists, and environmentalists from 48 countries" [9, p. 34]. On that occasion, for the first time, the scientific community involved the political world in the discussion, "calling for a 20 percent reduction in global CO₂ emissions by 2005, as well as for the formulation of an international convention on the matter" [9, p. 34].

In 1992, the problem of climate change began to interest the United Nations. Representatives of 178 countries attended a conference on environment and development in Rio de Janeiro. On this occasion, the *United Nations Framework Convention on Climate Change* was created. As many as 189 countries signed the convention and committed to reducing carbon dioxide emissions to slow down climate change. However, as noted by Hans-Werner Sinn, it is the Kyoto Protocol, signed in 1997, that opened a new chapter in climate policy, causing some countries to commit themselves for the first time to reducing greenhouse gas emissions by a certain percentage. Precisely, the Kyoto Protocol, ratified by 189 countries, established "the goal of reducing greenhouse-gas emissions over the period 2008–2012 by 5.2 percent on average relative to the year 1990" [9, p. 35].

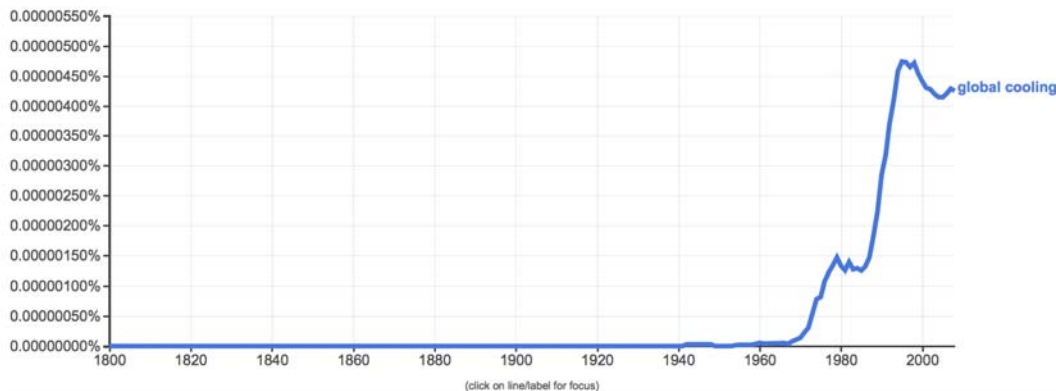
The term 'climate change' is used with increasing frequency, but it should be emphasized that it is a neutral term that indicates both heating and cooling. Before the aforementioned events, a theory also circulated that the prospect for planet Earth was that of anthropogenic global cooling [10, 11]. There is an ongoing debate to establish what percentage of climatologists was in favor of global cooling or global warming in the 20th century. Some climatologists argue that, even then, the experts who denounced the danger of global warming were the majority and the opposite impression derives from the fact that the idea of a new glaciation awaiting us on the horizon was dominant in the media, more than in the scientific literature [12]. However, the fact remains that scholars marching to a different drummer were not lacking, and their publications appeared in prestigious scientific journals, such as *Science*.

Ngram viewer reveals that the term 'global cooling' emerges in the sixties and takes off in the seventies. As for frequency, Graph 2 shows that this term experiences a first decrease in the early 1980s and a second decrease at the turn of the millennium.

Google Books Ngram Viewer

Graph these comma-separated phrases: case-insensitive

between and from the corpus with smoothing of



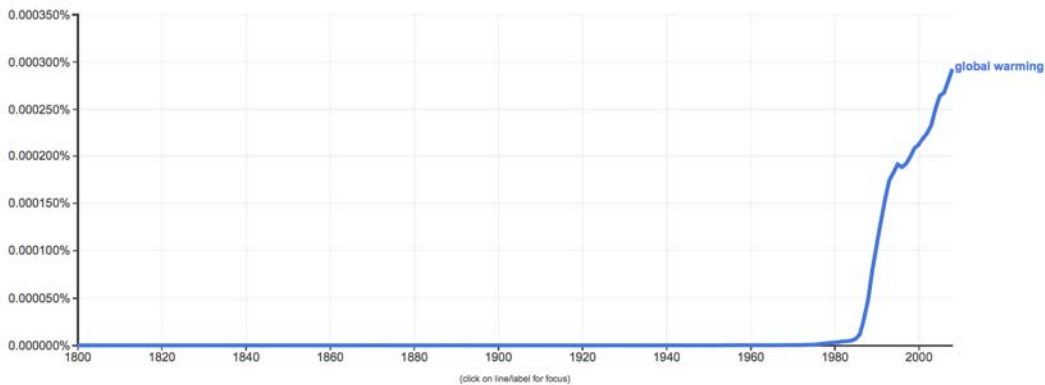
Graph 2: Relative Frequency of the term ‘global cooling’, period 1800-2008 (source: *Ngram Viewer*)

We can instead note, in Graph 3, that the expression ‘global warming’ took off in the 1980s and steadily grew until 2008.

Google Books Ngram Viewer

Graph these comma-separated phrases: case-insensitive

between and from the corpus with smoothing of



Graph 3: Relative Frequency of the term ‘global warming’, period 1800-2008 (source: *Ngram Viewer*)

From these graphs, however, we cannot *sic et simpliciter* infer that the ‘fashion’ changed in the 1980s or that, all in all, the two predictions on the fate of the planet have had the same weight in the scientific literature. To get a more precise idea of the situation, we must shift from relative frequencies to absolute numbers. The peak in the use of the term ‘global cooling’ was recorded in 1998 and amounts to 0.0000047162%.

Google makes raw data available to all ngram corpora online [13]. We are interested in the total counts for the English corpus. A file provided by the search tool contains the total number of tokens per year. The line of our interest is the following one: 1998,9406708249,45989297,87421. It means that, in 1998, 87421 books were published in English, containing 45989297 pages and 9406708249 words. With a simple formula, we can calculate the absolute number of occurrences of the expression ‘global cooling’ in the scientific literature, in the peak year.

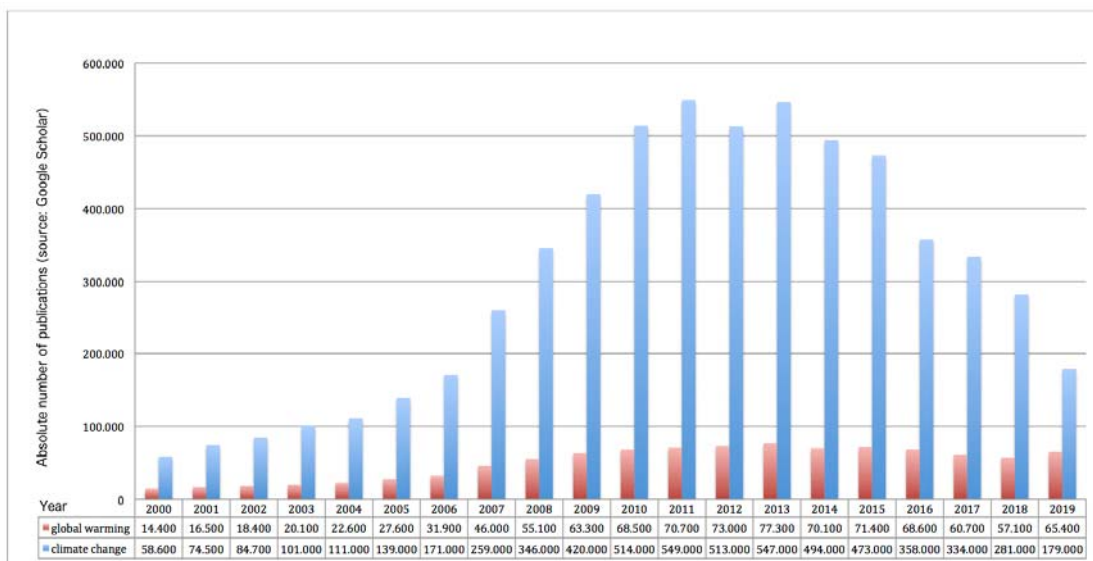
$$0.0000047162 \times 0.01 \times 9406708249 = 443,639 \approx 444$$

We repeat the same operation with the term ‘global warming’. This time, the peak was recorded in 2007 and amounts to 0.0002792486%. The line provided by the tool for that year is the following one: 2007,16206118071,82969746,155472. Let us apply the formula again.

$$0.0002792486 \times 0.01 \times 16206118071 = 45255,357 \approx 45256$$

As one can see, the term ‘global warming’ is used a hundred times more than ‘global cooling’, in absolute terms. Furthermore, even if the use of the expression ‘global cooling’ continues to grow, both in relative and absolute terms, it must not be forgotten that the term is widely used also in geological studies concerning the past. This consideration, of course, also applies to the expression ‘global warming’. Indeed, many articles and books detected by the search engine discuss the phenomena of global cooling or global warming which occurred in geological eras that precede the so-called Anthropocene.

The numbers confirm, however, that the hypothesis of global warming was already dominant in the past. At the beginning of the 21st century, both experts and the media abandoned the hypothesis of global cooling. Therefore, in the surveys concerning the new millennium, we will also abandon this concept by limiting our search to the expressions ‘climate change’ and ‘global warming’ (Graph 4). Our focus will shift from the frequency of terms to the distribution of the annual frequency of publications including the terms. We will extract the data from *Google Scholar* and use it to create charts in *Excel*.

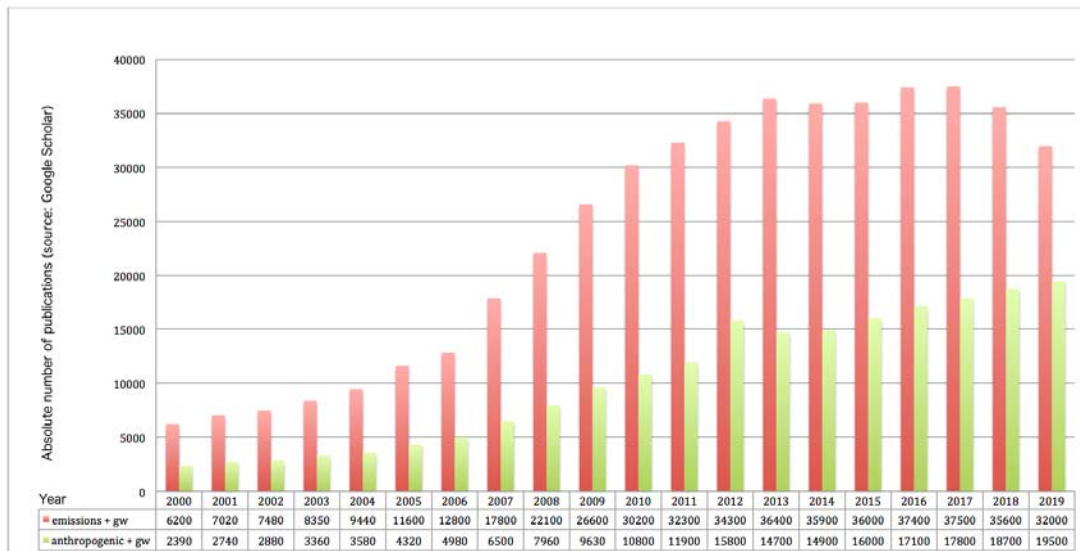


Graph 4: Absolute Frequency of publications including the terms ‘global warming’ and ‘climate change’, period 2000-2019 (source: Google Scholar)

Google Scholar is known not to be a fully reliable database [14, pp. 10-11]. However, when working on large numbers – as in our case – the detected general trend is still informative. It is anyway a more reliable figure than that deriving from a simple ‘impression’, which often reflects a local situation (of one’s department, or one’s country).

Overall, 2,360,000 scientific publications containing the expression ‘climate change’ were detected. If research is limited to the period 2000-2019, the amount of publications is 1,070,000. As one can see, after an almost exponential growth in the period 2000-2011, there is a stall and then, starting from 2013, a constant decline. The curve of scientific publications containing the expression ‘global warming’ also follows a similar trend, although the peak is reached in 2013.

This trend seems to be in contrast with the impression obtained from the public debate, but we have already stressed that these terms are also used in the geological field to describe phenomena not related to anthropic activities. More significant figures are obtained when the expression ‘global warming’ is entered in the search engine in combination with terms such as ‘emissions’ or ‘anthropogenic’. The dominant narrative is in fact that global warming is of anthropogenic origin and the CO2 emissions of cities, industries, and means of transportation are the main cause of the phenomenon.



Graph 5: Absolute Frequency of publications including the word-combinations ‘emissions’ + ‘global warming’ and ‘anthropogenic’ + ‘global warming’, period 2000-2019 (source: Google Scholar)

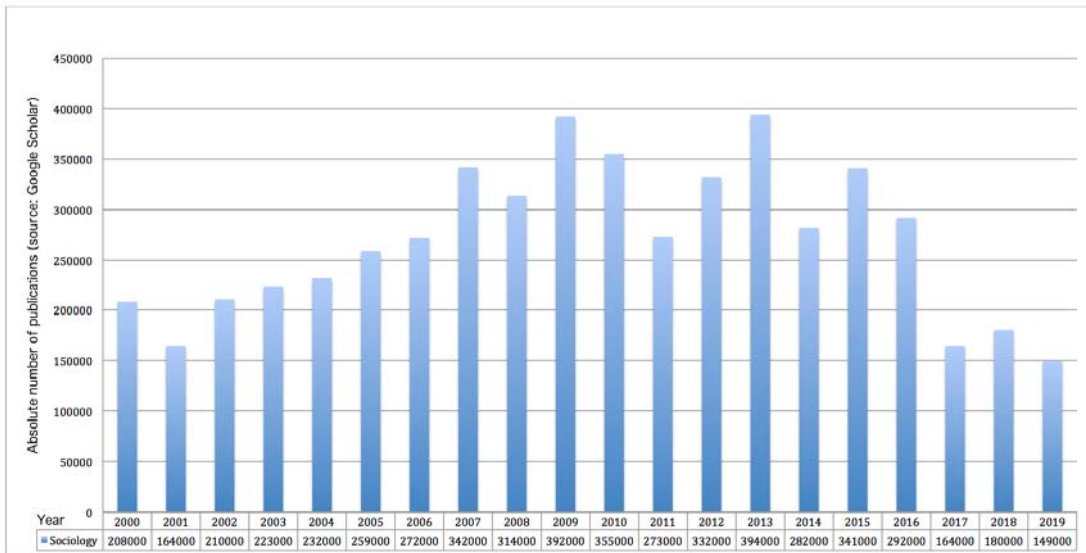
As for the ‘emissions’ plus ‘global warming’ word combination search, Graph 5 shows a steady growth in publications in the period 2000-2013 and, then, a stabilization around an average figure of 35,000 per year.

Even less unequivocal is the figure obtained by searching the word combination ‘anthropogenic’ plus ‘global warming’. As the graph shows, the growth of publications is constant and passes from a minimum of 2390 items in the year 2000 to a maximum of 19,500 items in the year 2019. Globally, in the last twenty years, 130,000 articles including the expressions ‘emissions’ and ‘global warming’ have been published, with a growing frequency. In the same period, 128,000 publications containing the expressions ‘anthropogenic’ and ‘global warming’ appeared.

Graph 5 represents the distribution of absolute frequencies. The relative frequencies would tell us the proportion of the intellectual effort devoted to this field of research. However, in this context, the global effort is more significant than the relative one. After all, it is the global effort that increases the likelihood of finding an effective solution to the problem of climate change. However, we can rule out the hypothesis that the growth of publications on global warming is a side effect of the general growth of publications, because the distribution of the latter on a global level follows a different trend [14, p. 14].

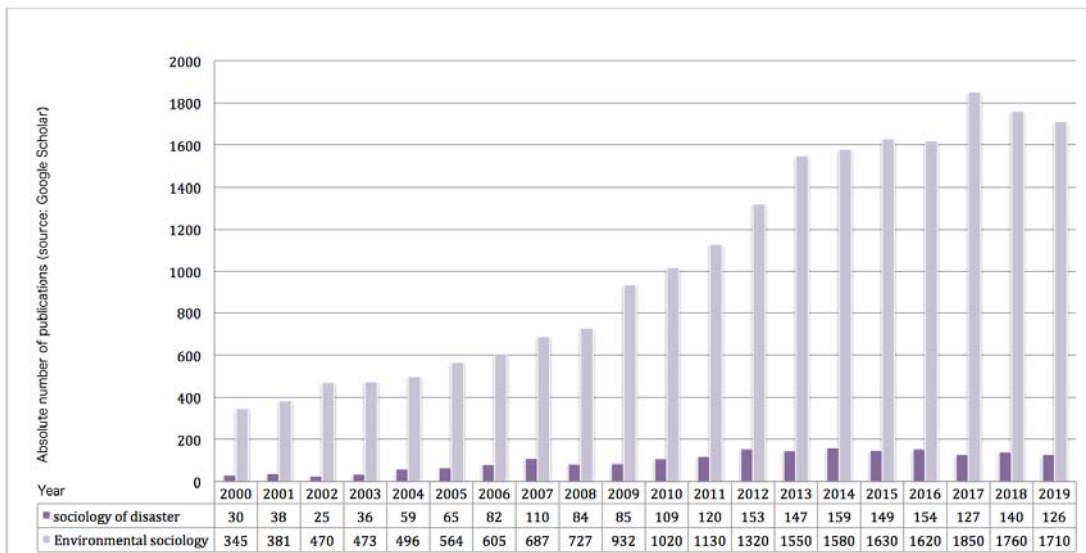
4. Sociology, Environmental Sociology, Sociology of Disaster

If we take a look at the trend of publications containing the term ‘sociology’, we can see that, after a period of growth that culminates in 2013 with 394,000 items, a steady decline begins (see Graph 6).



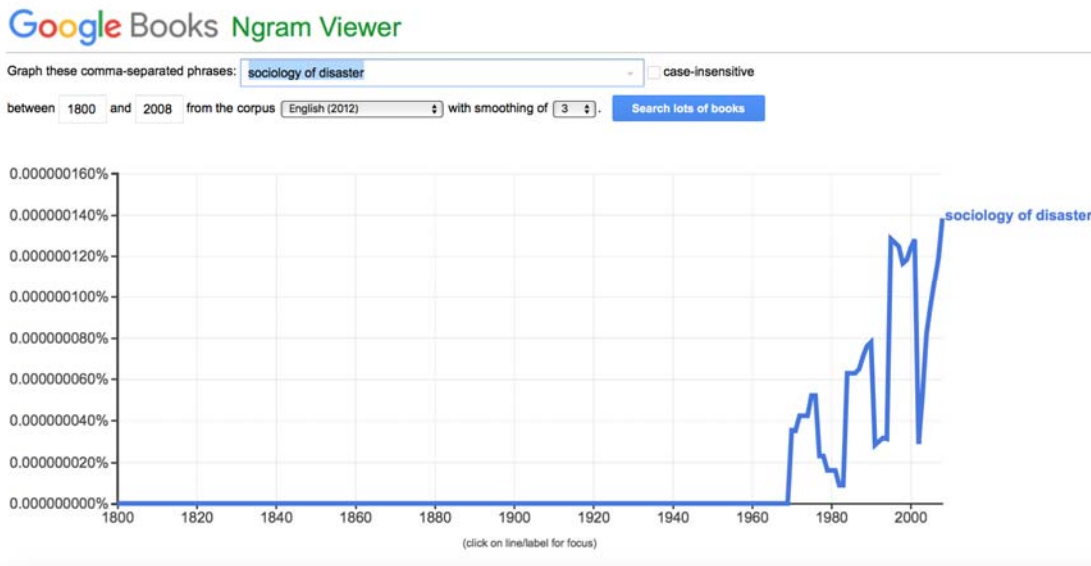
Graph 6: Absolute Frequency of publications including the term ‘sociology’, period 2000-2019 (source: Google Scholar)

The figure is significant when compared with publications containing expressions such as ‘sociology of disaster’ or ‘environmental sociology’, which indicate subdisciplines of sociology. In Graph 7, as regards the sociology of disaster, we see that after a growth that follows the trend of the mother discipline, in the period between 2012 and 2019 growth stops, but a similar decline is not noticed. This means that, in the face of a decline in interest in sociology, the sociology of disaster stands out, even if it is numerically at a much lower level. As far as environmental sociology is concerned, the figure simply ‘contradicts’ the trend of the mother discipline. In other words, this subdiscipline enjoys growing interest.



Graph 7: Absolute Frequency of publications including the terms ‘sociology of disaster’ or ‘environmental sociology’, period 2000-2019 (source: Google Scholar)

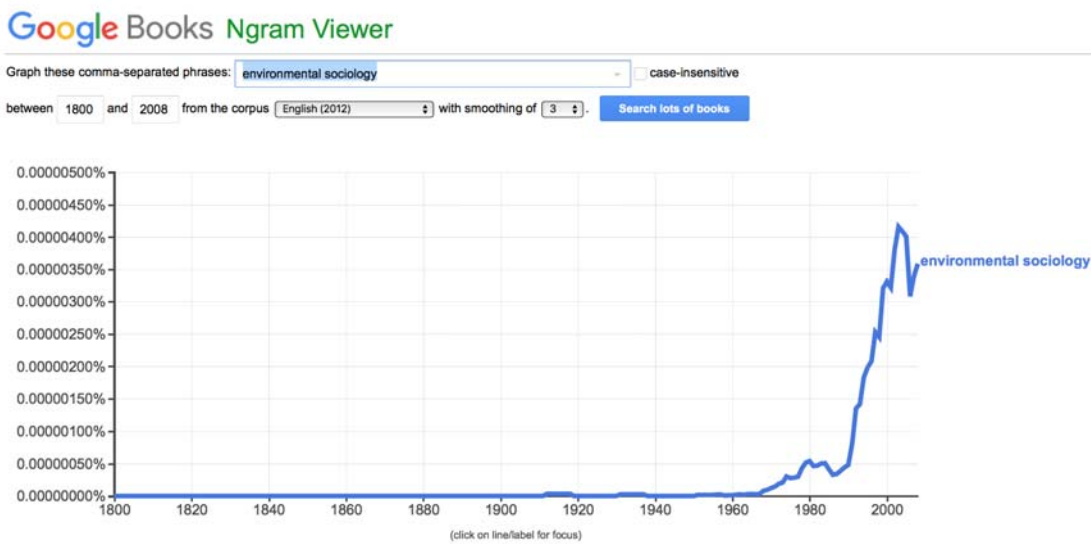
While reams have been written on the history of sociology, less has been said about the histories of the sociology of disaster and environmental sociology. It, therefore, seems useful to also take a look at the emergence of these fields of study, once again using *Ngram Viewer*.



Graph 8: Relative Frequency of the term ‘sociology of disaster’, period 1800-2018 (source: *Ngram Viewer*)

As one can see from Graph 8, a research field called ‘sociology of disaster’ emerged in the 1960s. We find the expression, for example, in an article by Jerome R. Saroff on the 1964 Alaska earthquake, included in the volume *Sociology in Action* edited by Arthur B. Shostak. Quite interestingly, the article refers to an antecedent use of the expression. Indeed, Saroff writes: “A decade ago the term ‘sociology of disaster’ would have left many sociologists unclear as to precisely what it implied. Today, it is a recognized and growing area of sociology deserving serious attention” [15, p. 108]. And, further below, he adds what follows: “The sociology of disaster is still in the stage of development where the collection of information is its major concern, and much of existing disaster literature is essentially descriptive rather than analytic” [15, p. 109].

Graph 9 shows that the research field called ‘environmental sociology’ also emerged in the 1960s. The item identified in 1936 is, in fact, a false positive.



Graph 9: Relative Frequency of the term ‘environmental sociology’, period 1800-2018 (source: *Ngram Viewer*)

If the absolute frequencies are calculated starting from the relative frequencies provided by *the Ngram Viewer*, the preponderance of environmental sociology in contrast to the sociology of disaster becomes apparent. The relative peak of occurrences of the term ‘sociology of disaster’ is

registered in 2003. The line of the ngrams corpora for that year is as follows: 2008,19482936409,108811006,206272. By applying our formula, we obtain the absolute number of occurrences.

$$0.0000001383 \times 0.01 \times 19482936409 = 26.944 \approx 27$$

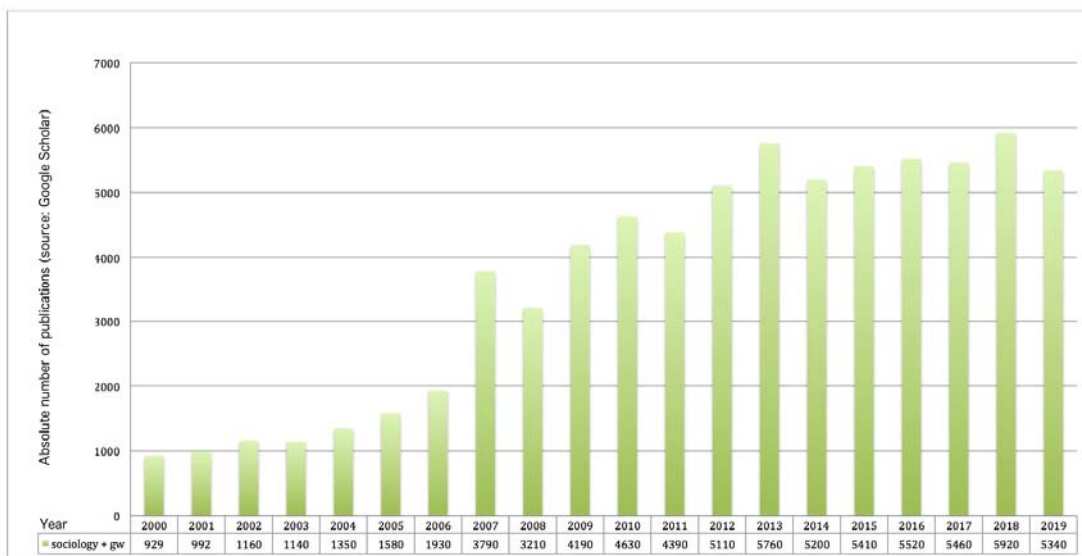
As one can see, the number is rather small. We repeat the same operation with ‘environmental sociology’. In this case, the relative peak is recorded in 2003 and amounts to 0.0000041565%. In that year, 127066 volumes were published, containing 68561620 pages and 13632028136 terms. Let us apply the formula again.

$$0.0000041565 \times 0.01 \times 13632028136 = 566.615 \approx 567$$

It is a much higher number. It now becomes useful to combine the data we have collected and see how general sociology, environmental sociology, and sociology of disaster are related to the problems of global warming.

5. A Look at the State of Proximity and Theoretical Relations

First of all, we detect the state of proximity, or compresence in the same publication, of the terms ‘sociology’ and ‘global warming’ (Graph 10). Overall, in the two decades 2000-2019, 17,600 publications contain both terms, while 19,800 publications include both the terms ‘sociology’ and ‘climate change’.



Graph 10: Absolute Frequency of publications including the terms ‘sociology’ and ‘global warming’, period 2000-2019 (source: Google Scholar)

As the graph displays, the growth is continuous and there is a clear discontinuity starting from the year 2007. The publications containing both terms double compared to 2006, going from 1930 to 3790 items. After a slight drop in 2008, we register again a considerable growth in the biennium 2009-2010.

A possible explanation for this shift is found in an article published in *Current Sociology* in 2008, signed by Constance Lever-Tracy. The author notes that 2005 was a crucial year for the debate on global warming. The date ‘2005’ returns 69 times in her text. It already appears at the very beginning of the article, where we read what follows: “During 2005, escalating climate change, at least partly induced by human activity, came dramatically closer, both to public awareness and to present or imminent experience” [16, p. 445]. Lever-Tracy recalls the many

catastrophic events – starting from the tsunami in the Indian Ocean – that fill the pages of newspapers that year. She concludes that “the year 2005 was also a social ‘tipping point’, with global warming perhaps irreversibly on the public agenda” [16, p. 459]. This explains quite well the significant increase in publications in 2007, if we take into account the physiological time of reaction, research, writing, evaluation, and publication of the results.

Lever-Tracy’s article aims to mobilize the sociological community. She asks her colleagues to take a more active role in the study of global warming. The author recognizes that this idea has made its way into the awareness of ordinary people, but laments that sociologists, except for those involved in environmental sociology, are not particularly engaged on this front. Of course, the importance of a topic, i.e. the quantity of publications it deserves, basically remains a subjective judgment, but it is also true that normative articles – such as the one we are discussing – often have a decisive impact.

Lever-Tracy starts from the assumption that global warming is a fact and that it is (at least in part) of anthropogenic origin. Therefore, she tries to understand the reasons that leave sociologists suspicious or indifferent about the issue. The fundamental reason for the disengagement is identified in the belief that sociologists are not competent to judge the phenomenon. Still, for the author, the belief is ungrounded because the phenomenon, being capable of causing social change, should also be taken into consideration by general sociology. Another brake on the commitment of sociologists would come from the fact that they “have remained much closer to the social constructivist paradigm of nature” [16]. In the sociological perspective, natural scientists do not simply study facts, they socially construct them, and the construction of scientific facts is partly determined by material interests and cultural influences. Lever-Tracy hopes that this theoretical perspective will soon be overcome and a multidisciplinary cooperation between social and natural scientists will become reality.

Our numbers confirm that the interest in global warming is relatively greater in publications that explicitly refer to environmental sociology. Besides, the figure shows that the occurrences of sociological works on global warming have risen since the publication of Lever-Tracy’s article. The article itself had a role in this growth, as it has been cited 140 times at the time of writing.

A response to Lever-Tracy’s ‘call to arms’ came, in the same journal, from Reiner Grundmann and Nico Stehr [17]. These sociologists do not dispute the importance of the problem raised, but cast doubts on some of the author’s positions. In particular, they underline the virtues of constructivism because, starting from their proper perspective, sociologists can say something original. The sociologist’s task can be neither to popularize the results acquired by natural scientists nor to propose practical solutions. To accomplish these goals there are already scientific journalists and politicians. Sociologists must contribute to the debate, but based on their specific skills and competencies. Furthermore, unlike Lever-Tracy, the authors do not believe that climate change should become the main focus of sociology. They point out that, formulated in these terms, the appeal is likely to remain wishful thinking.

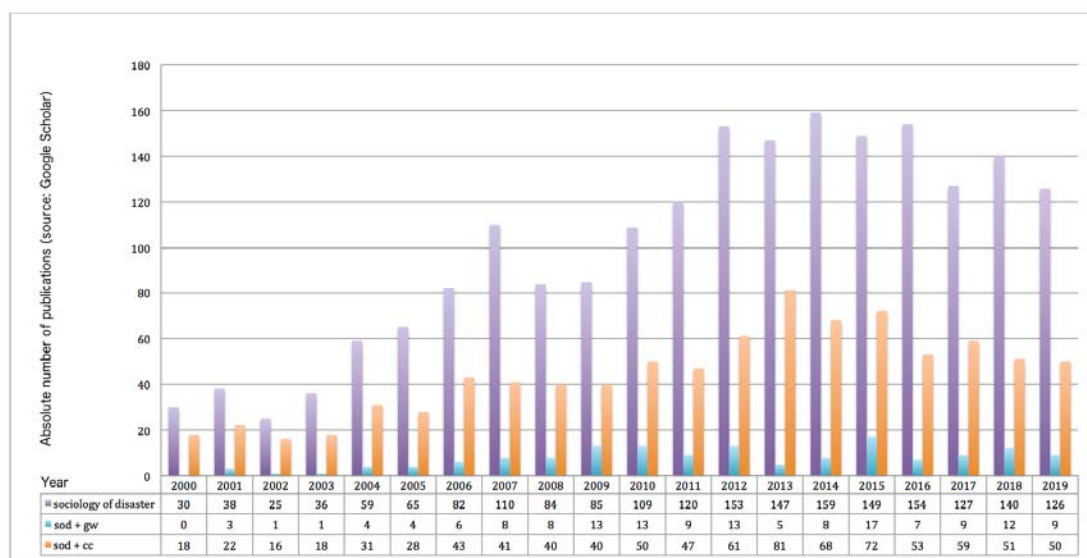
Note that Lever-Tracy does not completely abandon the constructivist perspective. She writes that “while sociologists may not be trained to evaluate the scientific evidence, they should know to be wary of the powerful corporate interests motivated to deny global warming, and respectful of the choice of ‘speaking truth to power’ that many scientists have now adopted” [16, p. 448]. However, as one can see, she applies this perspective selectively only to studies and narratives that deny global warming. This implies abandoning the postulate of the axiological neutrality of sociology. The sociology of knowledge was born when a tool of political struggle (the denunciation of hidden interests) was transformed into a research method [18, p. 11]. But this method must be systematically applied to study all the parties involved in the struggle; otherwise, there is a risk of turning sociology into ideology.

A significant push to the debate has been also given by the publication of *The Politics of Climate Change* by Anthony Giddens, described by the author himself as “a book about nightmares, catastrophes – and dreams” [19, p. 1]. The volume ignites the general interest on the issue of global warming, at all levels, so much so that even the former American President Bill Clinton recognizes

it as “a landmark study in the struggle to contain climate change, the greatest challenge of our era,” and openly recommends it by saying: “I urge everyone to read it” [19, cover]. To date, the book has collected 2,760 citations.

Quite curiously, a year before publication, Lever-Tracy had accused Giddens of being the example of the disengagement and of having also raised doubts about the reliability of climatological studies. A year later, Grundmann and Stehr recognized the importance of Giddens’ contribution, but not without stressing that it was a political rather than a sociological contribution in the strict sense. The moral of the story is that you can’t please everyone.

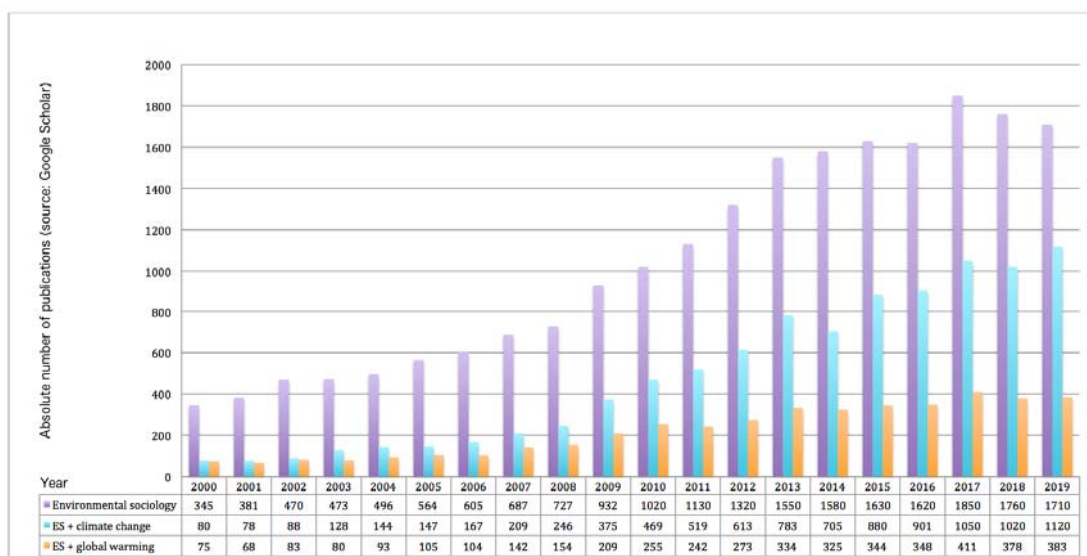
If we tighten the target on publications that include the terms ‘sociology of disaster’ and ‘global warming’ in the period 2000-2019, we find very few occurrences (Graph 11). A total of 150 items over twenty years are detected. They are too few to establish a reliable trend. One can observe a growth up to the biennium 2009-2010 and then a discontinuous trend. More indicative are the figures concerning publications including the terms ‘sociology of disaster’ and ‘climate change’. We have detected a total of 889 publications distributed over 20 years. The publications constantly grew from the year 2000 (18 occurrences) to the year 2013 when the peak is reached with 81 occurrences. Then there is a drop to the 50 items detected in 2019.



Graph 11: Absolute Frequency of publications including the terms ‘sociology of disaster’, and the word-combinations ‘sociology of disaster’ (sod) + ‘global warming’ (gw) or ‘sociology of disaster’ (sod) + ‘climate change’ (cc) over the period 2000-2019 (source: Google Scholar)

The first example of scientific work including both terms appears in 2001. Gary A. Kreps writes the entry “Sociology of disaster” for the *International Encyclopedia of the Social and Behavioral Sciences* and mentions global warming as a risk (“Global warming and ozone depletion are defined objectively and subjectively as environmental hazards or risks”) which can, however, potentially turn into a disaster (“The possible disastrous consequences of these hazards, including secondary effects such as sea-level rises in the oceans, remain matters of scientific and public debate”) [20].

The most significant aspect revealed by the graph is that about half of the publications including the term ‘sociology of disaster’ also mention the issue of climate change. The connection between the two concepts becomes even more evident when the field of environmental sociology is explored (see Graph 12).



Graph 12: Absolute Frequency of publications including the terms ‘environmental sociology’, and the word-combinations ‘environmental sociology’ (es) + ‘global warming’ (gw) or ‘environmental sociology’ (es) + ‘climate change’ (cc) over the period 2000-2019 (source: Google Scholar)

Once again, the use of the term ‘climate change’ is predominant over that of ‘global warming’. Still, in this case, we have an absolute number of publications ten times higher. In the first twenty years of the 21st century, at least 16,200 books or articles containing the term ‘environmental sociology’ were published and 9,810 of these publications mention the issue of climate change. In 2019, about two-thirds of publications dealing with environmental sociology, for whatever reason, also talk about climate change.

As an example, we can cite a report prepared by Joane Nagel, Thomas Dietz and Jeffrey Broadbent on the *Workshop on Sociological Perspectives on Global Climate Change*, held in Arlington, Virginia, on May 30-31, 2008 [21]. The approach of these scholars is the one typical of ‘engaged sociology’. Their report tries to answer two questions: 1) what is the state of sociological research on global climate change? 2) what are the main climate change questions that sociologists should try to answer? It, therefore, proposes both a state of the art and a research program for the future. The compilers show that, on the analytical-descriptive level, sociological analyzes of the causes of climate change as well as sociological perspectives on the impact of global warming exist and are legitimate. Besides, on the axiological-normative level, they encourage both sociological approaches to mitigation and adaptation to climate change and recommendations for the advancement of sociological research in this sector. In other words, sociologists can and must deal with the causes of the problem, by studying aspects such as the implications of urbanization, industrialization, and the spread of consumerist culture in the world. Starting from this knowledge, they can suggest possible solutions. For instance, some studies emphasize the role of information communication technologies and teleworking, in the frame of the digital economy, in reducing the negative side effects of industrialization [22].

Among the publications falling under the label ‘environmental sociology’, we can also find examples of ‘value-free sociology’ – that is, studies mainly aimed to reconstruct and analyze the dynamics of narratives. Fritz Reusswig contributes to the collective book *Environmental Sociology* with a chapter entitled “The New Climate Change Discourse: A Challenge for Environmental Sociology” [23]. The author proposes a detailed analysis of the climate change discourse in Germany and the United States of America and shows how the different social actors involved in the debate use thematically coupled sequences of topics to influence each other or the social context, to make their respective interests and points of view prevail in collective decision-making processes.

6. Summary and Conclusions

Thousands of studies claim that global warming is an ongoing process of anthropogenic origin, an unwanted side effect of the industrial revolutions, which is already producing environmental catastrophes and could lead to the extinction of many living species, including humankind. Among those who espouse this thesis, there are pessimists and optimists. Pessimists predict a future of famines, epidemics, floods, and wars for resources. Some scientists say that we have already passed crucial climate ‘tipping points’. This means that it is too late to stop and reverse the process. In other words, humanity has to prepare to adapt to irreversible and negative changes. In their view, only if world leaders declare a state of emergency, right now, we will be able to mitigate, at best, the effects of global warming. Optimists believe that it is still possible to put the train back on the tracks. A radical transformation of the mode of production and consumption, a profound change of lifestyle, the reduction of all forms of pollution and waste of resources, demographic control, and other well-conceived initiatives may reverse the trend and save the planet.

On the other hand, some experts consider the catastrophic predictions related to the so-called ‘greenhouse effect’ to be largely exaggerated. Some of these scholars believe that the phenomenon is to a certain extent imaginary, while others believe that the phenomenon exists but is not of anthropogenic origin. Rarely, one may find researchers convinced that, in reality, the Earth is cooling and not heating. Although being a minority, the existence of climate dissenters cannot be denied.

It should be stressed that the lack of unanimous agreement can only disturb those who have an outdated and dogmatic image of science, one based on the idea that the rigorous application of the scientific method can only produce irreproachable, correct, cumulative studies, especially if they are evaluated by peers and published in class A journals. We underline this aspect because, among the supporters of the AGW theory, some deemed it necessary to deny the existence of studies of a different orientation or to question the intellectual honesty of the outliers. There is no need to venture into this enterprise. Anyone familiar with the history of science, the functioning of scientific communities, the fundamental epistemological questions of the field, knows well that science is a human enterprise and, as such, fallible. Consensus does not mean truth, but a high degree of consensus is already a remarkable and sufficient result to decide lines of action.

Our research shows that sociologists display a growing interest in the topic of global warming. Sociological publications concern the most disparate aspects. Typically sociologists engage in public opinion surveys or discourse analysis, trying to understand what common people and political leaders know and think about the phenomenon. However, their focus can be on behaviors as well. Lifestyles and policies that are believed to produce or mitigate the phenomenon are also studied. Although many geologists and climatologists are convinced that the issue of climate change is fundamentally their territory, it must not be forgotten that global warming is not only a natural phenomenon but also a social and cultural one.

If global warming is produced by the ways of life, production, consumption, and transport of humans, it is clear that social scientists have something significant to say about it. Anthropologists, philosophers, sociologists, historians, psychologists, economists, etc., would have something important to say on climate change even if the phenomenon were not of anthropic origin since it would anyway have catastrophic repercussions on the life of humans and the organization of society. And they would have a right to speak even if the phenomenon were completely imaginary, because human behaviors are the consequence of beliefs, regardless of whether they are true or false. One of the most significant sociological ideas is indeed the so-called ‘Thomas theorem’, elaborated by American sociologist William Thomas in 1928: «If men define situations as real, they are real in their consequences» [24, 25].

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