Climate Change Overview and The 97% Claim

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I. Introduction

NASA defines climate change as: "A long-term change in the average weather patterns that have come to define Earth's local, regional and global climates" [1]. These changes can be generated by natural causes, which affect the climate over decades to thousands of years, or by human activities that influence the level of greenhouse gases in the atmosphere [2]. A central question that can be drawn from these two types of causes is: "How much of climate change is anthropogenic and how much is natural?". This question has led to the claim that 97% of climate scientists agree that human actions are a major cause of global warming [3], but how accurate is this claim? The answer will shape environmental policy, educational directives, and emerging issues such as the legal status of climate refugees both now and into the future [4, 5].

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II. The Changes

The climate is changing in many different ways. In 2008, the atmospheric carbon dioxide level was reported at 407.4 parts per million (ppm), the highest value ever recorded in the last 800,000 years. The rate of change has spiked during the last century[6]. Over the last 20 years, Earth's average surface temperature has been estimated to have increased by 0.25 to 0.4 degrees Celsius[7], and global average sea levels have risen by more than 0.2 meters since 1880. They are estimated to continue rising at around 4mm per year[8]. These are just a few of the many symptoms of climate change.

Considering these changes are occurring, how concerned should we be? One way to find an answer is to examine some specific examples and their consequences. In 2017, Hurricane Harvey struck the area of Houston (Texas, U.S), costing an estimated $125 billion dollars [9] and killing over 68 people [10]. Although hurricanes are a natural phenomena, it has been estimated that 19% of Harvey's total volume of rainfall was human induced (through emissions causing global warming), which worsened the destruction caused by flooding[11]. Another example is the biodiversity impact. The International Union for Conservation of Nature (IUCN) has red flagged 6275 species of animals and 2435 species of plants that are endangered due to global warming [12]. These numbers are associated with the increasing rates of extinction [13]. Rising sea levels have triggered communities from equatorial low-lying islands to challenge other countries' legislation seeking refugee status based on climate change grounds [14]. The impacts of climate change are broad-reaching and can lead to significant economic, environmental, socio-political, and humanitarian disasters.

III. Alarmists?

Researchers have been accused of being alarmists, however there is significant evidence to support their claims. One study shows that researchers have been relatively conservative about climate change, and points out that estimations of increasing greenhouse gas emissions in the atmosphere have in fact been underestimated [15]. Another important point is to analyze who the critics are, and whether or not their dissent is credible. The 97% claim has been heavily criticized by media vehicles as "overstated" [16, 17]. On the side of public opinion, a research paper evaluated 47 countries and their general population perception of global warming [18]. The research found that 90% of interviewees (N=67028) think that global warming falls into the range of "somewhat serious" to "very serious". Another survey on the general population of the United States revealed that one third believed there was a wide disagreement amongst scientists about global warming happening at all [19]. While the general population might disagree that there is a consensus in the scientific community, their opinion is not necessarily backed by scientific evidence. The credibility of their dissent is therefore questionable.

IV. The 97% Claim

The paper that popularized the 97% claim was conducted by Cook et al. (2013)[3]. It analyzed the abstracts of 11944 peer-reviewed papers, in which 32.6% (3893) supported the anthropogenic-cause, and 0.7% (836) rejected it. The majority of papers didn't manifest a position on the matter (66.4%) or were uncertain (0.3%). In the second part of this study, 8547 authors were then emailed to self-rate their own papers' positions, and around 14% (1189 authors) responded to the email, agreeing by a quantity of 97.2% on the anthropogenic cause of global warming. One thing to take into consideration is that from those 1189 authors, it is unclear how many evaluated the same paper, therefore data diversity cannot be guaranteed. Moreover, the 97% number comes from a subset of the original data that corresponds to a third of the total

sample size. Perhaps, a more appropriate claim would be: "On a sub-sample of around twelve thousand peer-reviewed articles on global warming, 97% of climate scientists that hold positions on the causes of climate change agree that global warming has a human factor, whereas the majority of papers on the sub-sample do not take a stand". This would make it more evident what the context around the claim is.

Despite that, prior and posterior studies on the consensus have shown that this percentage remains stable, with results using other methodologies varying from 90%-100% agreement on anthropogenic global warming [20 - 25]. It appears reasonable to say that there is a strong consensus of scientists who take a position on climate change that global warming has an anthropogenic component, and little to no strong evidence on the contrary.

V. Conclusion

The aim of this essay has been to provide a definition and general overview of climate change and its diverse impacts, while also examining the specifics of the 97% consensus claim. The investigation and evidence presented shows that the concerns around climate change are valid and alarming; climate change significantly impacts different areas of our society. On the 97% claim, it introduces its origin and verifies that the claim is based on a sub-dataset of the original research, but the percentage is supported by other papers that utilize different methodologies. The 97% claim still needs to be put into context as it currently implies the consensus exists amongst climate scientists as a whole, and not the selected subset.

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