

Master's Degree Dissertation

Climate Change Communication: Evolution, Frames and the Movable Middle

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Master's Degree in Sustainability Management

UPF Barcelona School of Management – ESCI-UPF

Academic Year 2022 – 2023

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A ustedes cinco.

Project performed within the framework of the **MSc in Sustainability Management** program taught by Barcelona School of Management and ESCI-UPF, centre associated with Pompeu Fabra University.

Abstract

Climate change is humanity's most pressing issue and it has been confirmed as such by extensive scientific evidence. Climate change communication plays a key role in addressing its complexity, explaining the state of affairs, and effectively engaging the public to partake in climate action. The present work explores the evolution of climate change communication and the intersection of science communication and policymaking. It also examines various climate change framings used in communications and reflects upon them using social science theories. Research suggests that the usage of certain frames could be ineffective in engaging audiences and may even lead to unintended consequences. Therefore, the present work aims to encourage communicators to carefully select appropriate framings and provides forward-looking recommendations for communicating the climate crisis and promoting climate action among the movable middle.

Keywords:

Climate change communication, science communication, public engagement, climate action, movable middle

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I. On the challenge at hand

For decades society perceived global warming as a phenomenon affecting lonely polar bears and distant generations that we would never meet. Today, that story seems to display a plot twist. There is global scientific consensus that confirms that human-induced climate change is already among us and will take a heavy human toll unless we transform our way of living.

Humans are advanced and complex animals. We've come to organise ourselves, build communities, draw social norms of what to do and where to do it. We decide what we give value to and how we cherish and take care of those things. Is how human beings work. We fight for what we believe in and, if the situation deserves it, we do collectively.

We have advocated to eradicate slavery, get women to vote, to demand universal health and education, civil rights, freedom of speech, among other milestones in modern society. We understand that systemic change requires a very large number of people to make the necessary policies to be developed. But even with major climate strikes all over the world and weather hazards threatening our lives, it seems that not everyone is equally concerned.

There are some people who are concerned and active, a few who are aware but don't believe in, and a large group of people who know but have not decided to take action yet. How can we explain these different levels of engagement in a crisis that concerns us all? Can we learn something from those who are active? What triggered them to act? Was it fear, hope, despair, outrage, curiosity or responsibility?

Science has it clear and it is not good news. It tells us that the damage is irreversible and that in order **to avoid the worst tomorrow, we must act today**. Scientists have assessed and presented the state of affairs. Policymakers are striving to incorporate these discoveries into their public plans without disrupting their economies. If scientists and policymakers are in the captain's cabin, who is talking to the passengers? How is this crisis being communicated to the broader population and encouraging them to do their bit? Especially that group who has not yet decided where to position themselves at.

With an increased pressure in the private sector, corporations are being forced to deliver climate pledges and raise their ambitions to decarbonise their activities - basically, if they want to stay in business. In consequence, climate action is being announced today all over the place with words that an average reader can hardly relate to. We have alarming scientific reports with a ticking clock, yet every day a new company claims that they will save the planet by 2050 - literally in 27 years. Is this really what we need to hear or is this just an industry-led and media-fuelled cloud of smoke that will actually prevent more people from boarding this boat before it sails?

The climate crisis needs to be communicated in a way that genuinely engages people. We can't afford to communicate this issue ineffectively. Crafting messages for society is a privilege, but it has lost carefulness in an era of content immediacy and information overload. Climate change communicators should pay attention to how they are framing messages and inviting people onboard.

The present work presents a brief evolution of climate change communications and the intersection between science communication and policymaking. Subsequently, it analyses common climate change framings and reflects if communicators should further pursue or avoid these frames. In essence, ensuring that communicators utilise their platforms to accelerate people's climate action and steer the ship where it needs to go.

II. Background

In order to embark upon the quest to explore and analyse climate change communications, it will be necessary first to define some concepts that will serve as the backbone of this work. The first term is **social science** which encompasses all branches of science that study how societies function and the human behaviour of individuals within these societies. It comprises disciplines such as anthropology, psychology, philosophy, sociology, economics, human geography, political science, among others. "Strictly speaking, the social sciences, as distinct and recognized academic disciplines, emerged only on the cusp of the 20th century. (...) In the largest sense, the origins go all the way back to the ancient Greeks and their rationalist inquiries into human nature, the state, and morality" (R. A. Nisbet & Greenfeld, 2023, para. 3).

The second term is **science communication** which is broad in nature and not exclusive to any of the above-mentioned fields of social sciences. Science communication promotes public understanding of science, which leads to multiple benefits such as “science itself; national prosperity; national power and influence; democratic government; society as a whole; intellectual life; aesthetic appreciation; and morality” (Thomas & Durant, 1987, p. 2). Throughout this work, science communication will refer to any communication, engagement or outreach material with or about science addressed to non-expert people for multiple purposes. In the context of this work, the purpose of science communication will be for the audience to understand and engage with climate change. To note that science communication should not be confused with **Communication Science**, which is a specific social science field that studies “how messages flow through diverse communications channels, how stakeholders interpret them, and how those processes affect beliefs, attitudes, and behaviors about science and scientists” (Fischhoff & Scheufele, 2013, para. 7).

According to the first Article of the United Nations Framework Convention on Climate Change - the world’s climate authority - “**Climate change** refers to a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UNFCCC, 1992, para. 2).

Finally, **climate crisis** will refer to the acknowledgement that humanity is facing an extremely dangerous point in history that will lead to devastating environmental, humanitarian, economic, social, and political consequences, as well as massive biodiversity loss. According to scientific consensus, this situation is the result of unprecedented changes in the planet’s natural cycles accelerated by human activities, mainly industrial and power generation. Unless there is a significant transformation of society’s contemporary economic model, this situation will persist and worsen. For the purpose of this work, anthropogenic climate change, climate change, climate crisis and climate emergency will be used interchangeably.

This work aims to be thought-provoking for **anyone developing climate change and climate action messages**. Throughout this work, the **movable middle** will refer to the segment of society that is informed about climate change but has not yet taken a position to

commit to act or reject climate action. This work is addressed to anyone who wants to produce, disseminate and promote messages that encourage climate action. This includes, but is not limited to, professional communicators, scientists, policymakers, science educators, journalists, content creators, or concerned individuals. Henceforth called **communicators**.

Climate change has become a **key cross-cutting issue in many disciplines** and this unfolds a range of cross-pollination areas for research and analysis (Hornsey et al., 2016). This work presents correlations of climate change communications with social science theories. Inevitably, the scope of this research is limited and will leave out a number of related topics that are interesting areas of research in the realm of climate change communications, such as the role of mass media and social media, the impact generated by youth activism, sustainability as a marketing tool for the corporate world, climate change as an ideological and political issue, among others.

III. Evolution of climate change communication

Whether in scientific, social or political contexts, the **physical phenomenon of climate change**, the heating effect of greenhouse gases in the atmosphere, human-attributed or not, has been explained since the 19th century but has undergone significant iterations. One of the first scientists to talk about this was Eunice Foote, who discovered through her own experiments in the 1850s that *carbonic acid gas* - what we refer today as carbon dioxide - had an effect on the sun's rays and that high concentration levels would lead to high temperatures in the earth (Foote, 1856). After her and others, this physical phenomenon has been further mentioned in different manners such as *carbonic acid in the air* and *inadvert climate modifications* (See Annex 1: Evolution of climate change terminology). The evolution of these terms can be attributed to the fact that findings on climate change are naturally discovered in scientific settings and communicated in related fora but, as history shows, the science makes its way off the laboratory bench and scientific journals at some point.

The translation of scientific knowledge to laypeople (nonspecialists) is known as **popularisation of science** (LaFollette, 2015) and has a long history behind it. J. Meadows (1986) explains that “in the early seventeenth century the natural science of the day was the

common property of all educated people. The scientific revolution ensured that, by the end of that century, some attempt at interpreting science had already become necessary” (Meadows, 1986, p. 341). In America, for example, “Such diffusion was initially practiced by scientists who identified their efforts with acculturation of the masses and who saw themselves as engaged in moral missions to evangelize about science” (LaFollette, 2015, para 6).

In the 18th century, with the Industrial Revolution **science forged a very close bond with industry and technology**. The *Great Exhibition of the Works of Industry of All Nations* was an international fortnight-long trade fair in London during the autumn of 1851; It was organised to showcase scientific, industrial and technological discoveries in a grand fashion (Research Outreach, 2022). This exemplifies how science also became an entertainment extravaganza. Museums served as another venue for informal science learning. Cain & Rader explain (2017) that museums have sought ways to reform themselves to appeal to a wider public since the 1880s. However, it wasn’t until the 1960s that they began incorporating **science communication approaches**, transitioning from the typical display of objects and labels to more interactive exhibitions that could stimulate critical thinking and increase visitors' science understanding (Cain & Rader, 2017). The **democratisation of science** gained traction in the 19th century with a growing number of science professionals and an increased public interest to read and understand science (Meadows, 1986).

Science literacy, or the public understanding of science, **is a good thing for society**. It fosters people's ability to benefit from scientific discoveries (Thomas & Durant, 1987). Looking back at London in 1928, even amidst efforts to keep in secret the discovery of penicillin for military reasons (Shama, 2014), this scientific breakthrough marked the beginning of an era that would significantly improve people’s quality of life - the era of antibiotics (Ligon, 2004). Also, in a society marked by wartime, science communication aimed to provide **glimmers of hope** through ad hoc analogies of the time. For instance, penicillin was advertised as an ordinary mould that would serve as a “wonder drug, weapon or healing agent” during the war (Life magazine, 1944).

There came a moment in which the showcase of scientific achievements changed abruptly. The **traditional media channels** like newspapers, broadcasts and radio were disrupted with the rise of digital technologies, television and the internet (Bubela et al., 2009). This transformation had a profound effect on the way science communication was disseminated

and offered a range of possibilities for the public to select how they wish to be informed. As of today, search engines are the most trusted source of general news and information worldwide (Edelman, 2023) (See Annex 2: Most trusted sources of news and information 2011-2022).

This **new media landscape** has unfolded a variety of outlets for climate change communicators to use like social media channels, newsletters, websites, podcasts, video platforms, among others. According to Reuters Institute, people prefer to consume climate-related content first through documentaries (35%) and then via major news outlets (33%) (Newman et al., 2022). Just in 2020, 160 million households watched on Netflix at least one film or show where they could learn about environmental issues (Stewart, 2021). A Reuters' report shows that populations under the age of 35, are more likely to consume climate information from social media profiles like celebrities or climate activists, and that they prefer smaller or alternative news outlets (Newman et al., 2022).

Opening the spectrum of possibilities for science communicators, has also resulted in inaccurate science information getting spread (National Academies of Sciences, Engineering, and Medicine, 2017). **Disinformation and misinformation** of science are unfortunately consequences of the uptake of these new channels. One source of disinformation, which is the intentional practice of spreading false or misleading information, is rooted in vested interests of industries whose status quo is at risk. In the context of climate change, these are industries that are being compelled to transform towards decarbonisation. Further elaboration on this will be provided when explaining the climate denialism frame.

Climate change content has been produced through scientific methods, such as climate models, monitoring of sea levels and paleoclimate research. However, these are not the only sources from which individuals become aware of climate change. **People on the front line**, those who live on coasts and small islands, farmers, fishermen, indigenous communities, marginalised populations and more, are experiencing and suffering first-hand the effects of climate change. These groups are being forced to move within their own countries to find a more suitable place to live and where they can secure food, water and jobs, among other things. The Internal Displacement Monitoring Centre's Report (2022) showed that in 2021, figures of **internal displacements** due to environmental catastrophes outnumbered those for conflict and violence reasons (See Annex 3: Internal displacements breakdown of 2021) and

94% of them (23.7 million displacements) were caused because of weather-related events like storms, cyclones, floods, wildfires, droughts, landslides and extreme temperatures (IDMC, 2022).

This demonstrates the critical task communicators and policymakers have ahead, as these are moments of great peril for humanity. Effective action to reduce climate change “is a question of morality, ethics, sanity, and self-preservation” (Armstrong et al., 2018, p. 20). In light of this, **climate change communication** needs to focus on “educating, informing, warning, persuading, mobilizing and solving this critical problem” (Yale Program on Climate Change Communication, n.d.). There is a clear **urgency to move the movable middle into action** and communicators need to carefully reflect on how to deliver this message and obtain intended results. However, undertaking the task of communicating climate change involves a unique complexity, as there is a delicate interplay between communicating the facts and provoking society’s behavioural responses (Nerlich et al., 2010).

IV. Intersection between science communication and policymaking

Public sentiment towards science is not homogeneous. In the United States support for or reservations about scientific advances vary according to religious, economic and educational background. For more affluent citizens, science represents a chance to prosper, while for less educated and less economically secure citizens, science and technology represent a threat to their jobs and standard of living (M. C. Nisbet & Nisbet, 2019). In Europe, science and technology are highly valued; 86% believe it is a positive thing, 82% have a high level of interest and 92% are confident that technologies such as solar energy will have a beneficial effect in the future (European Commission, 2021). In Latin America, science and religion compete with each other (Pew Research Center, 2014).

There are particular scientific moments that **polarise public sentiment with science**, such as genetically modified foods or artificial intelligence, while others events **bring people closer to science**, like space exploration (Funk et al., 2020). For instance, the Covid-19 pandemic grew public trust and perceived value in science and scientists all over the world (Wellcome Trust, 2021; Jensen et al., 2021). As stated before, communicating science is not an easy task. There are certain elements that come into play that define public opinion and the course of

public policies; These are values, economic interest, personal benefits and any affiliation loyalty (National Academies of Sciences, Engineering, and Medicine, 2017) This is how science communication plays a dual role. “The media not only influence public perceptions but also **shape and reflect the policy debate**. Few decisions are made by policymakers and stakeholders without the media in mind” (Bubela et al., 2009, p. 515).

The following reflections briefly portray two science-related moments in modern history and the **effects they had on public perception and policymaking**. While recognising that much more could be explored about these correlations, this chapter only aims to acknowledge the connection between them.

Soviet Union’s Sputnik Launch (Kazakhstan, 1957): According to Siddiqi (2008) the launch of Sputnik was, in fact, the culmination of a series of events in which the media took a leading role. In the context of the Cold War and two years before the Sputnik launch, Moscow’s newspaper announced the expert commission that the Soviet Union had formed to master space; Soon after, the New York Times did not waver in announcing to the US that the “Space race” had begun (Siddiqi, 2008). The surprise launch of Sputnik was a blow to US’s confidence by positioning the Soviet Union economically and technologically (Cavanagh, 2007). The launch of Sputnik had a large-scale unintended consequence on the other side of the globe, as it ended up **galvanising education policies** in the US. With the purpose of regaining technological superiority lost by the Soviet Union, the US **unleashed educational reforms in science and engineering** (Powell, 2007). “In the wake of Sputnik, education departments increasingly **committed themselves to engaging children as future scientists**” (Cain & Rader, 2017, p. 208).

The “Silent Spring” Book (United States, 1962) The environmental impacts caused by pesticide use in the U.S. were evidenced by Rachel Caron’s best-selling science book *The Silent Spring* in the 60s. “It was a beautiful book written by a scientist at a time when scientists were not ‘supposed to’ write beautiful books” (Dunn, 2012, p. 578). Oreskes (2004) believes that, because the book was written in popular and emotional strokes rather than scientific jargon, it captured the attention of many average readers to such an extent that it **ignited an environmental movement** among the citizenry. Such was the pressure that the president of the time, John F. Kennedy, summoned a group of scientific advisors to study the issue in depth, which would later lead to **prohibitive policies on the use of the pesticide**

DDT in the country (Oreskes, 2004). Moreover, Rachel's book also played a lead role in the **conception of the US Environmental Protection Agency** later in 1970 (Lewis, 1985) and the **delisting of bald eagles from the endangered species** category in 2007 as a result of pesticide control (Dunn, 2012).

From the author's standpoint, the **intersection between science communication and policymaking is thrilling**. Science communication has the capacity to provoke reassessments of existing norms and catalyse transformations. In the context of the climate crisis, everyone has the moral responsibility to protect what is at stake and for this to happen, communicators can help ignite this change. Climate change might sit in the scientific arena, but solving the climate crisis sits in all of us.

V. Common frames in climate change communications

There is an ever-growing list of **voices speaking out on climate**. Climate popularisers range from international bodies to all tiers of governments, from teachers to young activists, from scientists to celebrities. Even hairdressers in Australia have organised among themselves to generate informed conversations on climate change with their clients (Readfearn, 2023). **All groups of society play an important role as generators of climate conversations**, however, it is fair to recognise that each of them cater to different audiences, needs and agendas. With this in mind, we can assume that there is no one-size-fits-all approach for climate change communications or magic recipe for success. Instead, communicators must be mindful in deciding how to curate their messages to suit their audiences, needs and agendas.

There are two fundamental ideas to keep in mind from now on: **people are not empty vessels waiting to be filled with information and there is no communication maxim that assures successful engagement** (Nerlich et al., 2010). Any communication will be interpreted in different ways simply because each receiver has unique experiences that have shaped their beliefs. One paramount aspect of how messages are interpreted is how they are presented in the first place. According to Bubela et al. (2009) people will decide to pay attention to an issue depending on **how it is being framed**.

“Frames are interpretative packages and storylines that help communicate why an issue might be a problem, who or what might be responsible and what should be done. Frames are used by lay publics as interpretative schemas to make sense of and discuss an issue; by journalists to condense complex events into interesting and appealing news reports; by policy-makers to define policy options and reach decisions; and by scientists to communicate the relevance of their findings. In each of these contexts, frames simplify complex issues by lending greater weight to certain considerations and arguments over others. Framing is an unavoidable reality of the science communication process” (Bubela et al., 2009, p. 515).

Frames are a strategic tool for communicators, they serve a filter through which people understand an issue (Feldman & Hart, 2021). “What we say about climate change and how we say it matters. It affects how people think, feel and act” (Heard, 2020). But as stated in the beginning of this work, communicating about climate embeds a particular complexity because it interplays with many disciplines and other communication ‘enterprises’ like health, risk and science (Bubela et al., 2009). Climate change can be framed “as a scientific, health, business, political, environmental, national security, moral, or religious issue” (Yale Program on Climate Change Communication, 2022a, para. 1).

The flexibility of choosing frames **should never compromise the accuracy of scientific information**. Bubela (2009) explains that “any reframing of an issue needs to remain true to the state of the underlying science” (p. 515) and should never be compromised by publishing deadlines, desire for boosting profiles or in pursuit of profits (Bubela et al., 2009).

Four frames have been identified in contemporary climate change communication, engagement and outreach efforts. The following section will reflect on what they are, what they mean, and if any social science theory supports or challenges it. To subsequently reflect on their effectiveness in provoking or impeding climate action among individuals within the movable middle.

Frame 1: Tomorrow's burden

“Global warming will affect our children”

Probably one of the oldest, if not the first, frame about climate change is the notion that **global warming will affect future generations and very remote places**. Numerous communication guidelines recommend developing messages that can portray climate change as something real and visible by the usage of familiar examples and imagery.

There is a theory called **Psychological Distance** that explains that people's process of decision-making can vary depending on how close or distant they feel from an issue (Keller et al., 2022). This theory assumes that the proximity or distance can have an effect on the level of engagement and concern (Armstrong et al., 2018). To exemplify, someone living in a snowy mountain village will relate better to messages of “ice sheets melting in the poles” and therefore, this theory assumes that they will have a greater motivation to act in comparison to someone living in the sunny Caribbean. This can also be extended to the concept of time. Individual climate actions that require a certain level of personal sacrifice often lack immediate or near-term rewards. Consequently, some individuals may feel discouraged as they are unable to reap the benefits.

While this theory may seem intuitive and obvious, studies have yielded contradictory results. Some papers claim that **being psychologically distant is not a barrier to being concerned about climate change, nor does attempting to reduce it will guarantee climate action** (van Valkengoed et al., 2023). Other authors say that although there can be links between climate perception and action, results are inconsistent and often measured with different sets of variables (Keller et al., 2022).

What is important, is that the so-called **psychological distance has been decreasing** over time because of the experience of severe weather-related events and high-level political events like UNFCCC's Conference of the Parties (COP) have brought this issue closer to people (van Valkengoed et al., 2023). Many individuals perceive climate change as something immediate or nearby. In fact, 77% people are worried that climate change will lead to droughts, rising sea levels and other natural disasters (Edelman, 2022).

The problem does not seem to be an issue of proximity, but rather that **we have not been able to explain exactly what needs to be done**. Individuals who wish to take action claim not knowing how to reduce their climate impact and what climate-friendly options they can choose (Edelman, 2022). As psychological distance will continue to vanish through time, due to weather-events, this frame is set to become obsolete soon. **One recommendation** for communicators is still the use of familiar associations but with the caveat of framing messages that speak to concrete, tangible and clear steps on how anyone can mitigate climate change.

Frame 2: Climate denialism

“We’ve always had changes in temperatures, is part of the natural cycle”

One communication frame that draws particular attention is **climate denialism**. With just one click, Google’s search engine displays 4,150,000 hits¹ on "*How to communicate to climate deniers*" under a wide variety of articles, books, videos, podcasts and more, to provide guidance on holding conversations with this group. However, climate change **scepticism is decreasing** (Hornsey et al., 2016). Climate concern has increased sharply since 2015 in many advanced economies (Bell et al., 2021). The frequency and severity of real-life events, like floods, forest fires and heat waves explain why people are changing what they think (Yulsman, 2021).

Poll shows that **the number of climate sceptics is rather low** in most parts of the world. According to a global Reuters Institute survey, only 9% of respondents did not see climate change as a serious problem; the rest ranked it as either an extreme, serious or somewhat worrying issue (Reuters Institute, 2020). A study conducted by Meta and the Yale Program on Climate Change Communication, showed that only 2% of respondents claimed not to be concerned about climate change (Leiserowitz et al., 2022). IPSOS found that globally only 16% of people are not convinced of the importance of their countries to shift away from fossil fuels (IPSOS, 2022). In India only 7% of people are disengaged with this issue (Leiserowitz et al., 2023).

¹ Search conducted on 3 June 2023

Interest and preoccupation about climate change has several **explanatory factors**. Reuters Institute (2022) found that one driver that can explain the population's different level of interest in reading climate change news is **political polarisation**. In countries with higher divisions between left and right the interest is low, like in Australia or the United States, while countries with less polarised politics, like Greece and Portugal, the interest is over half of respondents (Newman et al., 2022). In the author's opinion, other factors that could be further explored to explain this divide are age, gender, science literacy, ideologies, beliefs, set of values and geographic location. However, the crux of this section is not to dwell on the different types of interest and their drivers, but to examine the usefulness of framing communications targeting those who believe that anthropogenic climate change is not true.

Dividing people between advocates and negationists is not accurate and is unfair. Producing communications through the lens of a bifurcated street of climate deniers or climate defenders **is counterproductive**. This approach motivates polarised media and content, which sells more than nuanced debates, but fosters **the Ostrich Effect**, a behaviour in which people selectively choose information that is useful for them and rationally avoid that which is not (Karlsson et al., 2009). Also, the discomfort of learning information that contradicts one's beliefs and preconceived ideas of the world is called **cognitive dissonance**, and this feeling strengthens denial attitudes (Sandman, 2009).

Psychological barriers (cognitive bias) **prevent people from establishing constructive dialogue** with people that think differently, creating echo chambers that further divide society (Bretter & Schulz, 2023). Ultimately, by giving too much attention to climate negationists, we over magnify their real share and inadvertently cause **pluralistic ignorance**. This means inaccurately assuming that our social circles are climate deniers and therefore, to avoid holding a minority opinion, we self-silence. In the context of climate change, **people self-silence from having climate conversations** and what is worse, from taking climate action (Geiger & Swim, 2016).

Unfortunately, climate deniers will never completely perish because of what continues to nurture them. Coined in 1992, **Agnotology** is the field that studies ignorance. Proctor & Schiebinger (2008) study it in different variants, for example if ignorance is a decision or rather something passively formed. For the purpose of this work we will focus on **ignorance**

as a strategic resource “something that is made, maintained, and manipulated” (Proctor & Schiebinger, 2008, p. 15). The authors sustain that since science and industry are intertwined, secrecy (ignorance) plays an important role - just as the alleged less than a handful of people that know Coca-Cola’s ingredient, for instance.

Many industries craft ignorance (or *agnogenesis* as the authors refer to) but specially those who find value in the perpetuation of ignorance, doubt and disbelief, like the tobacco industry with the relation between cancer and smoking. Proof of this are their multiple advertisements of doctors smoking and sowing the benefit of the doubt. Even in 1969, an executive from the Brown and Williamson tobacco company wrote in an internal strategy memo: "*Doubt is our product*" (Oreskes & Conway, 2010). In fact, in the context of climate change, industries involved in sustaining doubt are, not coincidentally, the biggest polluters: fossil fuel, coal, automotive, electric utility industries and their respective stakeholders (Treen et al., 2020).

Unfortunately, the **fossil fuel industry and their interested parties are replicating the tobacco techniques** of resisting scientific evidence, discrediting scientists, raising questions to cast doubt, manufacturing controversy, producing climate propaganda and finding myriad ways to circulate false information (Supran & Oreskes, 2021; Turrentine, 2022). Henry Charles Lea Professor of the History of Science at Harvard University, Naomi Oreskes, recently shared in a podcast interview:

“The whole point of science denial is always been delay. It’s been to push back action so that these industries can continue to operate business as usual [and] continue to make extremely large profits. So it’s always been about pushing back policy action. (...) [the fossil fuel industry] knew that eventually fossil fuels would be regulated if not actually banned one day and the game wasn’t to stop it but to delay it. (...) They have actually succeeded beyond their wildest dreams. I think back in the 80s they thought, you know “we’ll delay this for a decade or two. We’ll be in great shape”. They have delayed it for four decades, so they have had a shocking success” (Dickinson & Tanner, 2023).

Social media are their breeding ground (Turrentine, 2022) and, although it is not the purpose of this work, a critical reflection should be made on the questionable policies of these platforms combating these intentional practices and the millions of dollars in revenue they keep receiving from them (Climate Action Against Disinformation, 2023). There is factual evidence that **heavy-emitters of greenhouse gases are spending millions of dollars on**

social media ads that generate disturbing large views of disinformation (Lewton & McCool, 2021). There are 10 publishers on Facebook that account for 69% of climate denial content and who's accounts total 186 million followers (Center for Countering Digital Hate, 2021). What is more, the proliferation of false climate content is also being automatically generated by technology like bots and algorithms (National Environmental Treasure, 2021).

One should pay serious attention to the fact that these denial tactics have taken new forms as **delayism and deflection** tactics (Yulsman, 2021; Supran & Oreskes, 2021; Mann, 2021). These new techniques find its forms in narratives such as unproven climate solutions, scientific uncertainty, society's economic burdens of the green transition, fancy sustainability reports, promising speeches, pledges and targets, government control conspiracies theories on our current lifestyles, recycling as the golden rule of individual climate action and diverting blame from industries to consumers. To give one example, the concept of "carbon footprint" is actually a creation of British Petroleum. BP commissioned Ogilvy & Mather, a British advertising and marketing firm, to develop a campaign that could deflect responsibility away from them while focusing on how the diet, transport and travels of each individual was contributing to global warming (Mashable, 2020).

Given that climate denialism is being fuelled by industries whose status quo will continue to be challenged by the green transition, and that we can assume climate denialism content will continue to exist, **one recommendation** is for communicators to divert their efforts away from framing climate change communications on the assumption that climate deniers are a big influential group and instead focus on nurturing messages aimed at the movable middle so that they do not fall prey to the subtle and successful intentional tactics of denial, delay, and deflection. Communicators should also encourage people from talking about climate, everywhere and with everyone. Climate scientist Katharine Hayhoe defends that **the most important thing anyone can do to fight climate change is to talk about it.**

Frame 3: Catastrophism

"This is the last warning for humanity"

Our choice of words matter a lot. Is not a coincidence that The Guardian newspaper decided to update their house style guide in 2019 to recommend its editors to replace the

word climate “change” to climate “crisis or emergency” to accurately describe the seriousness of the issue (Carrington, 2019). There is a communication frame that focuses on the urgency and magnitude of climate change and, as a result, the selection of words is dominated by **fatalism and catastrophism** tones.

Messages around the sixth mass extinction, apocalypse and destruction of humanity are used mostly by climate activists and non-governmental groups. It was three years ago when Greta Thunberg met face to face with Angela Merkel to urge her to declare a climate emergency (Bloomberg Quicktake, 2020). **Activists and environmentalists advocacy groups have played a key role in escalating the climate crisis** to where it is today, pressuring governments to put the issue on the agenda, forcing corporations to change and mobilising people in almost every corner of the world. Greta’s movement *Fridays for Future* organised the biggest climate protest in history mobilising millions of people across 185 countries (Laville & Watts, 2019). The commonly ungrateful work of activists and environmentalists has been key in seeding this issue in the minds of people of all ages. However, looking ahead, there should be deep reflection before using this frame, as **doomsday messages can create gridlocks** to attract the movable middle.

First and foremost, climate change has been originally **conceptualised as an issue** rather than an opportunity for action, so naturally narratives around will be negative (Meyer et al., 2020). Secondly, although doom and gloom headlines grab attention on social media, people usually do not read beyond the headlines and brief previews (Feldman & Hart, 2021). Thirdly, crisis and emergency are not understood in the same way. Crisis is perceived as a temporary disruption in normality caused by a particular event, whereas emergency implies a major danger that requires immediate intervention (Feldman & Hart, 2021).

Receiving information about climate change through a lens of fatalism and fear can create **climate inaction or eco-paralysis** (Brossard & Lewenstein, 2010). It makes people create mental shortcuts of despair and hopelessness by thinking that the problem is too big to be solved (Hawkins, 2019). “Pure crisis and emergency frames extinguish hope, and in so doing, they block much-needed energy and engagement” (Heard, 2020, p. 5). Emergency messages are perceived as sensationalist, which also affects the credibility of the issue (Feldman & Hart, 2021). It also makes people experience anxiety, apathy or denial (Meyer et al., 2020, p. 11). According to Clayton (2020) **climate anxiety** is an emotional response that affects

psychologically people who care about the environment, particularly younger adults and people who have experienced climate change events. It can be triggered due to the uncertainty about the future or the grief of losing what we care about (Clayton, 2020).

An important caveat here is that there are authors that defend this to be the right angle to energise climate mitigation (Hornsey et al., 2016; Nabi et al., 2018; van Zomeren et al., 2010). In addition, this work does not suggest that the present climate situation should not be referred to as a crisis or emergency. In the author's opinion, this frame is effective for communicators targeting the public and private sectors. However, the above-mentioned evidence suggests that **it is not the right frame for engaging audiences outside of these two groups**, what we refer to in this work as the movable middle.

Fortunately, for most cases, we are past the stage of explaining what climate change is. In light of this, **one recommendation** to communicators targeting the movable middle is to deviate from the overarching frame of climate change as a topic of daunting emergency and uncontrollable magnitude. "Treating climate change as a perpetual crisis or emergency has the potential to lead to desensitization and disengagement among some audience segments" (Feldman & Hart, 2021, p. 14). Instead of disempowering the movable middle, communicators should frame this issue as a moment of **unprecedented innovation, creativity and collective action**. People should not be incentivised to care by fear-induced messages, they should go through a self-thinking process of believing that solutions are real, possible and exciting.

Communicators can take advantage of moments of high media attention, such as the COPs and heat waves when public support for the environment is at its peak (YouGov, 2023), to disseminate these messages. With a note of caution to verify that proposed solutions are within the reach of the segment addressed, this means, whether the surrounding physical, economical or legal infrastructure enables certain activities. For example, ensuring that activities such as switching to renewable energy sources or recycling methods are indeed possible (Nerlich et al., 2010), otherwise we would be incentivising unreal solutions and making this issue simply unachievable.

Frame 4: Informing the general public

“People uninformed are people unengaged”

There is a widespread assumption that suggests that public climate inaction is due to a scientific knowledge gap. This supposition is rooted in a model that has been studied since the 1980s, called the **Information Deficit Model**. This theory defends that a “gap” in knowledge must be filled in order for things to be “better” (Brossard & Lewenstein, 2010). In the context of climate change, this means that if people were offered more information about climate change, they would start to care and act more about it.

Critics argue that **this model is outdated and oversimplifies reality**, as it doesn’t take into account cognitive and social factors (Nerlich et al., 2010). It also fails to acknowledge that people’s ideologies, identities, and values play an important role when it comes to creating their own perceptions (Bubela et al., 2009). It is also argued by numerous authors that **knowing more doesn’t necessarily lead to action** (Bubela et al., 2009; Holmes et al., 2011; Meyer et al., 2020; Nerlich et al., 2010).

Several causes contribute to this gap of knowledge, one often cited is **poor scientific literacy**. Nerlich (2010) defends that “while laypeople may perhaps know less about science per se, they still have a good understanding of the social and political function of science in society” (p. 100); Therefore, climate action messages should not focus on the rationality of the issue, but on making it appealing, interesting and meaningful to the public (Nerlich et al., 2010).

This does not suggest that the scientific community should step aside - quite the contrary. **Universities and research institutions hold the first place of trust** in people’s minds when it comes to climate action (Edelman, 2022). There are several online tools to help dejargonizing scientific texts. The Up-Goer Five Text Editor² is an online tool that challenges people to explain things using only the 1,000 most used words in English. Any result should be taken with a grain of salt, as the average vocabulary of a native English-speaking adult is between 20,000 and 35,000 words (R.L.G., 2013). While conducting a small test with a random paragraph in the latest scientific report of the Intergovernmental Panel on Climate

² The Up-Goer Five Text Editor website: <https://splasho.com/upgoer5/>

Change (IPCC), 73 words out of 141 words (52%) did not fall into the most commonly used words in English (See Annex 4: Testing IPCC with the Up-Goer Five Text Editor).

We can affirm that **scientific literacy is important**, especially now that the climate jargon keeps flourishing and expanding. For better or for worse, this new jargon (net-zero, science-based targets, triple bottom line, carbon neutral, carbon footprint, circular economy, ESG, etc.) is being particularly driven by the private sector. In fact, this increased involvement of industries raises the concern of maintaining science accuracy and with it, public trust in science (Bubela et al., 2009). **These words can easily be misinterpreted or, even worse, hold no meaning for lay readers.** Proof of this is the climate strategy of dairy company Horizon Organic (Peters, 2020) that was advertised in their milk cartons as “*We’re going carbon positive by 2050*”. Being “carbon positive” makes sense to anyone who understands carbon sequestration, but it was definitely an unwise choice of words that ended up confusing their consumers on Twitter. So yes, climate literacy is important, but perhaps more for creators than for consumers in this era of continuous proliferation of climate lexicon.

Dejargonizing science should not be pigeonholed into translating scientific concepts for lay readers. It should mean coming up with universal tools that can forge a trusting relationship between science and ordinary people. The central point becomes on how experts connect with non-specialists. In essence, **there is a significant difference between informing and engaging**. Science popularisers should know that displaying scientific findings in colloquial language will not automatically trigger needed emotions like curiosity, wonder and involvement.

One recommendation is developing **creative climate communication products that can be understood universally**. Climatologist Ed Hawkins found inspiration from a crocheted baby blanket to explain to laypeople how temperatures have been rising globally (Sengupta, 2022). By choosing colours that people could understand - red for hot and blue for cold - he created an open source platform³ where anyone can see the warming changes of a certain country or region from 1850 to 2022. **The warming stripes have become a climate symbol**. They have even been included in the United Nations IPCC Sixth Assessment Report. (See Annex 5: Warming stripes at IPCC’s AR6).

³ Warming stripes official website: <http://www.showyourstripes.info>

“Climate change communicators are urged to move from one-way communication to dialogue and reflexive engagement (Nerlich et al., 2010). Coming up with engaging symbols and concepts like the warming stripes that **translates science to non-specialists**, will be of utmost importance to raise awareness of climate change and to explain upcoming global adaptation strategies.

VI. Looking ahead

To our advantage, anthropogenic climate change is widely acknowledged. To our disadvantage, we have a long journey ahead. The interplay of climate change with other social science disciplines creates an endless array of communication possibilities.

In this work, communicators are urged to dispel old habits and discover new manners to cascade a new set of messages. There is no single communication maxim that will convince the movable middle, but there are some strategies that can make us engage with them. However, clinging to outdated views of the world, perpetuating divisive frames, sounding doomsday alarms and, engaging in never-ending battles against bots will not lead us to resolve this climate crisis. Regrettably, some frames will persist and new ones will emerge. It is in this regard that communicators must strengthen their creative muscles to strike the right balance between the current state of affairs and a sense of agency. Mobilising those who are on the ground and those who are from afar.

We are at an incredibly decisive moment in history, and not wanting to make others take action is no longer optional when you understand what is at stake. In Plato’s allegory, he tells the story of a group of people who were born chained in a dark cave and grew up observing immense shadows of moving objects projected onto the walls. One day, a brave explorer decides to venture outside and discovers that there is an unimaginable place to live. He returns and tries to convince others to do the same, but the fear of leaving their safe space hinders them from going and exploring what is out there.

Anyone who knows the situation we find ourselves in, is that explorer. The world has been a prisoner of a system that has profited on our ignorance, but once you know, it is very difficult not wanting to go back to the cave and convince others.

There is a future where we can thrive. Resource depletion, displaced families, environmental refugees and ecosystem collapse are definitely not what we anyone would like to see. Mobilising the movable middle, at this stage, is imperative. We won't be able to change the course of the boat if we don't promote values like citizenship, justice, ethics and a deep sense of community. A small galvanised public is regrettably not sufficient, we do need the movable middle.

In the hope that all communicators can generate more climate awareness and response, and with deep appreciation for their hard work, this work ends with a final reflection. "A sustainable society doesn't consume less, recycle more, use renewable energy and take the train. It is also more community-focused, less prejudiced, more equal, and happier - because it values people and the environment" (Holmes et al., 2011).

VII. Annexes

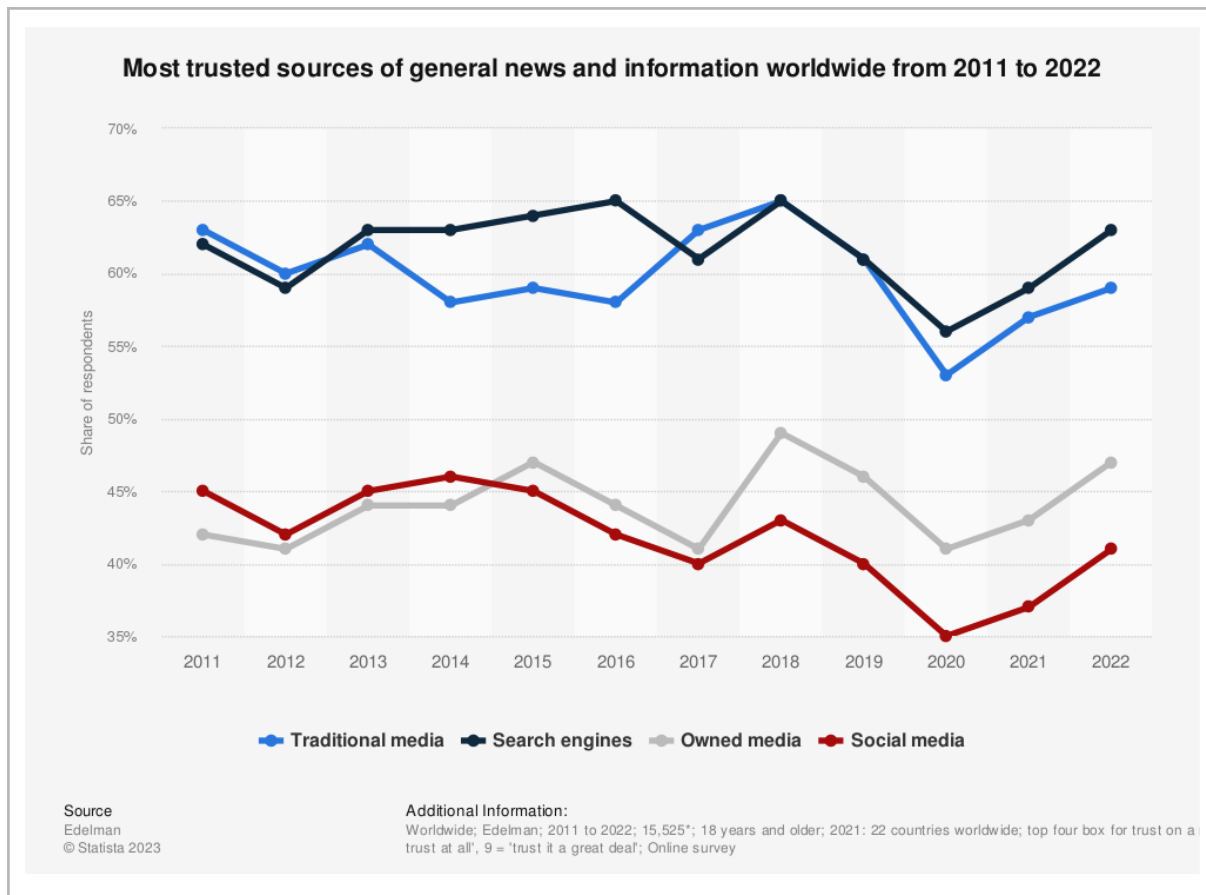
Annex 1: Evolution of climate change terminology

Year	Terminology	Author, Source
1820	Théorie analytique de la chaleur (The Analytical Theory of Heat)	Joseph Fourier, Théorie analytique de la chaleur
1856	“Circumstances affecting the Heat of the Sun’s Rays”, “An atmosphere of that gas (carbonic acid gas) would give to our earth a high temperature”	Eunice Foote
1861	“On the absorption and radiation of heat by gases and vapours, and on the physical connexion of radiation, absorption, and conduction”	John Tyndall
1896	“Influence of Carbonic Acid in the Air upon the Temperature of the Ground”	Svante Arrhenius, Philosophical Magazine and Journal of Science
1956	“The Carbon Dioxide Theory of Climatic Change”	Gilbert Plass
1970	“Rapid transitions in climate”	Broecker
1971	“Inadvert Climate Modifications”	William H. Matthews, William Kellogg and G.D. Robinson, Global Environment: Man’s Impact on the Climate
1975	“Global warming”*, “Climatic Change”	Wallace Smith Broecker, Climatic Change: Are We on the Brink of a Pronounced Global Warming?
1989	“Global change”	U.S. Global Change Research Program
1990	“Climate change”	IPCCC Scientific Assessment

Note to reader: This list is not intended to be a complete list, but to show an approximation of the evolution of the term we refer to in 2023 as “climate change”. This list does not distinguish between anthropogenic and not-anthropogenic climate change and takes as reference dates that can be found in published documents through a basic internet search.

*Although the term of global warming is coined to Wallace Smith Broecker, it was first used in 1952 in a San Antonio Express article and in 1958 in an Editorial in the Hammond Times of Indiana.

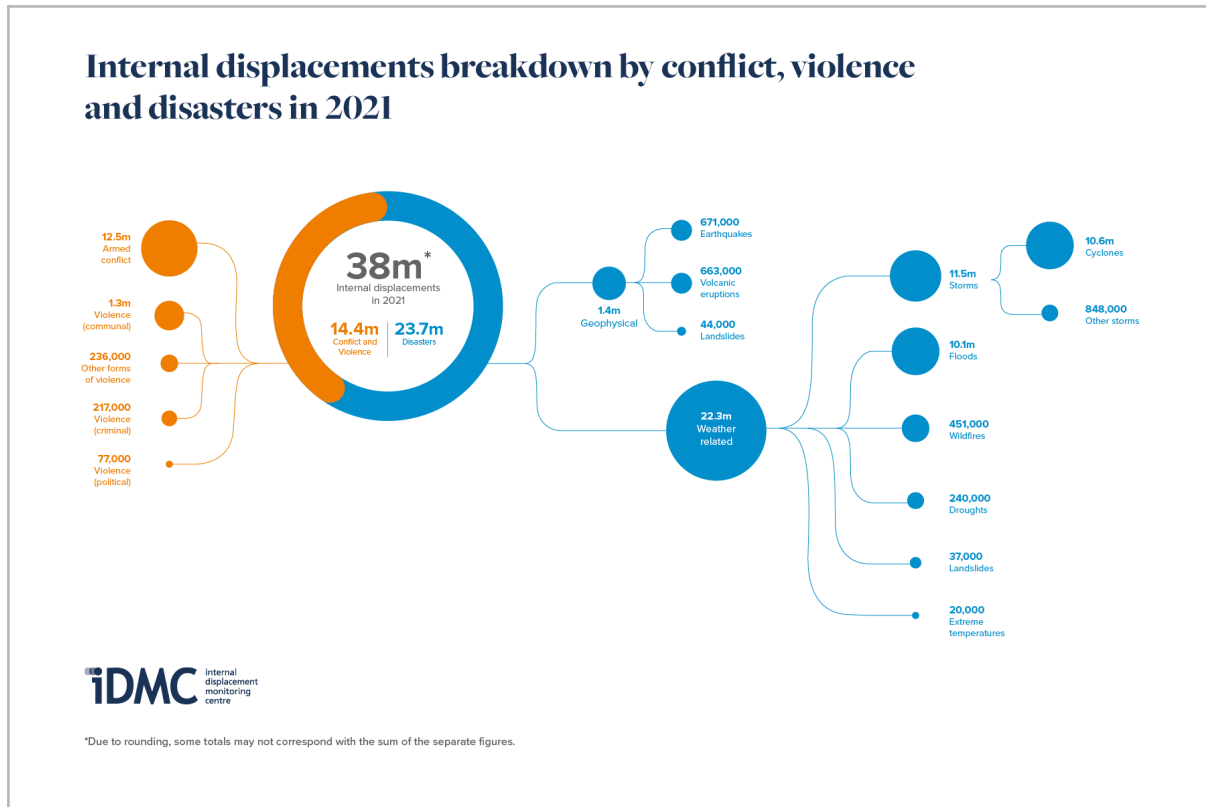
Annex 2: Most trusted sources of news and information 2011-2022



Source: Edelman (2023). Most trusted sources of general news and information worldwide from 2011 to 2022.

Statista

Annex 3: Internal displacements breakdown of 2021



Source: Internal Displacement Monitoring Center (2022). Global Report on Internal Displacement.

Annex 4: Testing IPCC with the Up-Goer Five Text Editor

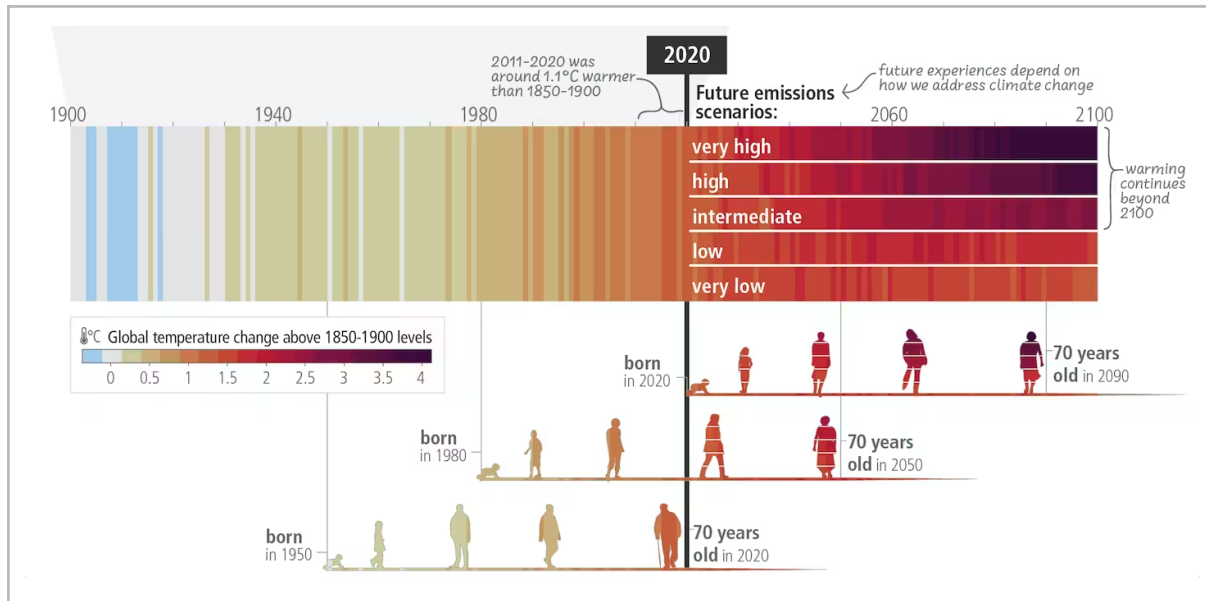
Can you explain a hard idea using only the 1,000 most used words?	
Original Paragraph of the IPCC Report (1)	Words that are not included in the 1000 most used words in English will appear in red (2)
<p>Glaciers are melting at unprecedented rates, causing negative societal impacts among communities that depend on cryospheric water resources (<i>high confidence</i>).</p> <p>Over the last two decades, the global glacier mass loss rate has been the highest since the glacier mass balance measurements began a century ago (<i>high confidence</i>). Melting of glaciers, snow decline and thawing of permafrost have threatened the water and livelihood security of local and downstream communities through changes in hydrological regimes and increases in the potential of landslides and glacier lake outburst floods. Cryosphere changes have impacted cultural uses of water among vulnerable mountain and Arctic communities and Indigenous Peoples (<i>high confidence</i>), who have long experienced historical, socioeconomic and political marginalisation (<i>medium to high confidence</i>). Cryosphere change has affected ecosystems, water resources, livelihoods and cultural uses of water in all cryosphere-dependent regions across the world (<i>very high confidence</i>).</p> <p>(141 words in total)</p>	<p>Glaciers are melting at unprecedented rates, causing negative societal impacts among communities that depend on cryospheric water resources (<i>high confidence</i>).</p> <p>Over the last two decades, the global glacier mass loss rate has been the highest since the glacier mass balance measurements began a century ago (<i>high confidence</i>). Melting of glaciers, snow decline and thawing of permafrost have threatened the water and livelihood security of local and downstream communities through changes in hydrological regimes and increases in the potential of landslides and glacier lake outburst floods. Cryosphere changes have impacted cultural uses of water among vulnerable mountain and Arctic communities and Indigenous Peoples (<i>high confidence</i>), who have long experienced historical, socioeconomic and political marginalisation (<i>medium to high confidence</i>). Cryosphere change has affected ecosystems, water resources, livelihoods and cultural uses of water in all cryosphere-dependent regions across the world (<i>very high confidence</i>).</p> <p>(73 words in red)</p>

Note to reader: Test conducted on 8 May 2023

Source (1): IPCC (2022). Climate change 2022 - Impacts, adaptation and vulnerability. p. 50

Source (2): Theo Sanderson (n.d.). The Up-Goer Five Text Editor. Splasho. <https://splasho.com/upgoer5/>

Annex 5: Warming stripes at IPCC's AR6



Source: United Nations Intergovernmental Panel on Climate Change (2023). AR6 Synthesis Report. Figure SPM.1

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