

The Decline of Climate Skepticism in France: An Analysis of Climate Change Attitudes over the Last Two Decades

Sébastien Bourdin ^{1,*} and André Torre ²

¹ EM Normandie Business School; 76600 Le Havre, France; sbourdin@em-normandie.fr

² INRAE, University Paris-Saclay, 91190 Gif-sur-Yvette, France; andre.torre.2@inrae.fr

* Correspondence author: sbourdin@em-normandie.fr

Abstract: This article analyzes the evolution of public attitudes toward climate change in France. In the context of a challenging economic environment, the climate crisis continues to be a significant concern for the French populace, a concern that is exacerbated by the increasing frequency of climate-related disasters globally. Utilizing a logit model applied to four waves of a longitudinal survey conducted in 2000, 2010, 2019, and 2021, our findings indicate a noteworthy decline in climate skepticism. This reduction is correlated with an enhanced recognition of the scientific consensus on climate change and a broader adoption of environmentally responsible behaviors. Our analysis reveals significant associations between political orientation and climate skepticism: individuals who voted for far-right parties demonstrate a higher propensity for skepticism, whereas those who supported environmentalist parties exhibit a lower likelihood of skepticism. These findings highlight the critical need for ongoing efforts to communicate climate science effectively, promote pro-environmental behaviors, and acknowledge the pivotal role of political actors in mitigating climate skepticism.

Keywords: climate change skepticism; global warming; eco-responsible behavior

1. Introduction

The impacts of climate change are complex and varied: not only global warming but also an increase in the frequency and intensity of storms, winter cold spells, potential changes in ocean circulation, wind patterns and hurricanes, sea level rise, droughts, and excessive rainfall. Additionally, these effects can lead to cascading and compounding risks, exacerbating the challenges we face (IPCC, 2018). Increasingly recognized as an inescapable reality, climate change has recently taken center stage in public discourse, political decisions, and citizen concerns (IPCC, 2018 and 2023).

However, despite the growing scientific consensus on the severity of this phenomenon (Cook et al., 2016), there is still a proportion of the population that disputes global warming, its anthropogenic causes, and its predicted effects (Whitmarsh, 2011). These individuals, sometimes referred to as “climate skeptical,” challenge the scientific consensus on climate change, particularly the notion that human activity is primarily responsible for this phenomenon (Poortinga et al., 2011). Climate skepticism can be related to a doubt about the concept of anthropogenic global warming but mostly to the belief that human activity is the cause of climate disasters. However, the consequences of global warming can result in escalating and amplifying risks, intensifying the difficulties we confront (IPCC, 2023).

Climate skepticism has been studied in a variety of contexts (Tranter & Booth, 2015; Busch & Judick, 2021; Hornsey & Lewandowsky, 2022), with a particular focus on specific determinants, such as political orientation (McCright & Dunlap, 2011a and 2011b; Hornsey et al., 2018; Huber et al., 2022), trust in science and scientists (Sharman & Howarth, 2017), level of education (Hamilton, 2011) and its geography (Bourdin et al., 2025). Despite their value, these studies do not fully capture the complex and multidimensional nature of climate skepticism, as they do not explore the diversity of possible determinants in a longitudinal framework. Also, the social acceptance of the measures taken to combat climate change and their impact on climate change skepticism have not yet been analyzed.

Furthermore, the increasing prevalence of conspiracy theories, which are amplified through various

media outlets and social network groups, has played a role in the dissemination of inaccurate information regarding climate change (Gemenis, 2021; Gruzd & Mai, 2020). This phenomenon peaked with the COVID-19 pandemic but has been further continued and amplified by the growing utilization of AI-generated content (Bozkurt & Gursoy, 2023), which continues to shape public opinion and foster skepticism. This has generated a scientific approach to fake news that aims to study the virality of false information and its impact on citizens (Lazer et al., 2018). For example, the emergence and spread of conspiracy theories have been associated with an increase in distrust of institutions, particularly scientific ones, and this could potentially fuel climate skepticism (Bodner et al., 2020). Therefore, it is essential to investigate the extent to which the pandemic, through the rise of conspiracy, may have affected attitudes toward climate change. Finally, climate skepticism is a little-explored phenomenon in France (Posthumus, 2019), which leaves a significant gap in our understanding of the dynamics of this phenomenon over a long period and on a national scale. In this context, understanding how climate skepticism evolves over time—and which factors explain its persistence or decline—has become a critical research priority.

Given the abovementioned shortcomings in the literature, the present study seeks to answer the following two questions: What factors are associated with climate skepticism in France? To what extent has the COVID-19 pandemic altered this phenomenon? Our study primarily centers on the analysis of cross-sectional survey data concerning public opinion on climate change in France. We rely on a unique dataset: the annual Baromètre survey conducted by ADEME between 2000 and 2021. Based on repeated cross-sectional samples representative of the French population, this survey allows us to assess changes in attitudes over time. We apply logistic regression models to four selected waves (2000, 2010, 2019, 2021), in order to investigate the evolution of climate skepticism and its determinants. The variables explored include sociodemographic characteristics, perceptions of scientific consensus, political preferences, and self-reported pro-environmental behaviors.

The French context is especially pertinent when considering skepticism regarding climate change and public attitudes toward climate policies. France has taken proactive measures to address climate change, including committing to international agreements, such as the Paris Agreement, and implementing national policies to reduce greenhouse gas emissions. France's commitment to international climate agreements and proactive approach to mitigating climate change since the early 1990s set it apart from other countries (Wang et al., 2023). This is particularly evident following President Emmanuel Macron's renowned slogan: "Make our planet great again" (Estève, 2023). However, these policies have not been without controversy, such as the Yellow Vests movement. The impact of national climate policies about carbon taxation on public opinion provides a context that requires focused study (Cepparulo & Giuriato, 2024). Initially sparked by a proposed fuel tax intended to reduce carbon emissions, the protests quickly evolved to encompass broader social and economic grievances. This movement underscored the challenges of implementing climate policies that are perceived as economically burdensome by segments of the population, particularly those in remote rural areas and with lower incomes (Bourdin & Torre, 2023).

Our specific focus lies on climate skepticism and its associated factors. We aim to investigate the temporal evolution of the correlation between these variables, with an emphasis on identifying a declining trend in climate skepticism since 2000 and a corresponding rise in confidence in climate science. More specifically, we rely on a unique database that contains the responses of 1,000 participants surveyed each year from 2000 to 2021. As part of our analysis, we use a logit model to study climate change skepticism as a function of a set of factors, thereby providing a multidimensional approach to the determinants of said skepticism.

This research contributes to the literature on climate change skepticism, particularly in France. Our first contribution lies in conducting a longitudinal empirical analysis, which enables a more accurate and complete assessment of climate change skepticism and its determinants, compared with case studies, qualitative analyses, and content analysis studies of media and social networks. Second, our research broadens the understanding of climate change skepticism by including a diverse set of variables. Going beyond the usual focus on sociodemographic and political factors, we explore the impact of behavioral and perceptual variables. Third, our study is notable because it examines the effect of the COVID-19 pandemic on climate skepticism, a topic that has remained largely unaddressed. Investigating this disruptive event may help comprehend how societal shocks can change attitudes toward climate change.

Our research has significant implications in several areas. First, it can inform communication about climate change by identifying specific groups that are more likely to be climate skeptics and highlighting the factors contributing to this stance. This, in turn, can help develop more effective communication strategies. For example, our work aligns with and expands on the findings of Leiserowitz et al. (2021), who examined different segments of the U.S. population based on their beliefs about global warming and provided recommendations for effective climate change communication. Similarly, Bayes et al. (2023) discussed the importance of scientific consensus messaging in shaping public opinion about climate

change and proposed a research agenda for this field. Furthermore, our findings can support environmental policy by providing insights into public attitudes toward different measures to combat climate change. This echoes the work of [Schuster et al. \(2024\)](#), who explored the role of visual data communication in conveying complex issues like climate change and provided guidance on how to simplify these messages effectively. Therefore, our findings could be used to design policies that are not only environmentally effective but also more acceptable to the public. Finally, this study could help develop strategies to reinforce public acceptance of the need for climate action and to encourage more sustainable behaviors.

The article is structured as follows. [Sections 2 and 3](#) contain the literature review and a detailed explanation of our methodology. They clarify the context and the process of our research. [Sections 4 and 5](#) present our results and provide an in-depth discussion of them. We conclude with the implications of our study and future research avenues.

2. Literature Review

2.1. Definition, Origins, and Manifestations of Climate Skepticism

Climate change skepticism, also known as climate change denial, refers to the position that questions or denies scientific consensus on various aspects of climate change, including its existence, causes, severity, and the necessary responses ([Marquart-Pyatt et al., 2011](#)). This skepticism is often intertwined with broader ideological, political, and social attitudes that oppose actions aimed at mitigating climate change. It may stem from various sources, such as distrust in scientific institutions, perceived economic threats, or ideological beliefs that prioritize individual freedom over collective environmental action ([McCright & Dunlap, 2011](#); [Hornsey et al., 2018](#)).

Research has shown that climate change skepticism is affected by multiple factors, including political affiliation, level of education, trust in science, and personal experiences with climate-related events. For instance, individuals who identify with conservative political ideologies are more likely to exhibit skepticism toward climate change ([McCright & Dunlap, 2011](#)). Lower levels of education and reduced trust in scientific authorities are also correlated with higher levels of skepticism ([Hamilton, 2011](#); [Sharman & Howarth, 2017](#)).

The discourse around climate skepticism has evolved over time, adapting to new scientific findings and societal changes. Initially, skepticism may have focused on questioning the very existence of global warming, but it has since shifted to questioning anthropogenic causes or downplaying potential impacts. This adaptability highlights the underlying opposition to climate action rather than a consistent scientific critique ([Oreskes & Conway, 2010](#); [Painter & Ashe, 2012](#)).

Manifestations of climate skepticism can vary widely, from challenging scientific evidence and expressing concerns about environmental policies to opposing the social and economic transformations needed to respond to global warming ([Poortinga et al., 2011](#); [Capstick et al., 2015](#)). The proliferation of such skepticism has often been fueled by partisan media, political actors, and the fossil fuel industry, which can amplify this stance and give it a disproportionate influence in public debates and policy decisions ([Vesa et al., 2020](#); [Brulle & Werthman, 2021](#)). Several studies have shown that the rise of the internet and social networks has created new avenues for the dissemination of climate change-related misinformation, which has both amplified climate skepticism and complicated the task of understanding and combating it ([Jang & Hart, 2015](#); [Koteyko et al., 2019](#)).

Recent research has also highlighted several strategies for countering climate skepticism and strengthening public commitment to climate action—from communicating science via outreach activities to public engagement—based on systems thinking and an approach inspired by values ([Hornsey et al., 2018](#); [van der Linden et al., 2019](#)). [Jakučionytė-Skodienė & Liobikienė \(2021\)](#) found that the implementation of actions related to global warming mitigation varies in European Union countries. For example, most respondents in their study said they regularly reduced and recycled their waste, while fewer people reported undertaking high-cost actions, such as purchasing energy-efficient homes or electric cars. While it may not be surprising that fewer people are able to undertake high-cost actions due to their financial burden, the authors emphasize the importance of developing strategies that increase the accessibility and affordability of such actions.

2.2. Theoretical Framework for Understanding Climate Skepticism

Climate skepticism goes beyond rejecting scientific facts; it involves a combination of ideological, social, and psychological factors. Political beliefs strongly influence how individuals view climate policies and the role of the government in addressing environmental challenges. Distrust in scientific institutions, often fueled by conspiracy theories and misinformation, weakens public confidence in climate science. Additionally, social identity plays a key role, as people tend to align their views with

those of their political or social groups. While personal experiences with extreme weather can reduce skepticism, cognitive biases often prevent such experiences from changing firmly held beliefs. This section outlines a theoretical framework that covers the different aspects influencing climate skepticism, setting the stage for an empirical investigation of its causes.

Political ideology plays a major role in shaping public attitudes toward climate change. Research shows that individuals with conservative or far-right political views are more likely to be skeptical about climate change (Lockwood, 2018). This skepticism often comes from the belief that climate policies threaten personal freedoms, economic interests, or traditional values. For example, measures such as carbon taxes or green energy subsidies may be seen as intrusive by those with conservative views. This opposition aligns with a broader resistance to government regulation and international agreements, which are perceived as undermining national sovereignty. As a result, climate change becomes not just a scientific issue but a highly political one, in which acceptance of the scientific consensus depends on political alignment (McCright & Dunlap, 2011; Lockwood, 2018).

Another key factor in climate skepticism is trust in scientific institutions. People who have little trust in scientists, experts, or government institutions are more likely to question climate science (van der Linden et al., 2019). This skepticism may not only target the conclusions of scientists but also the methods and credibility of the scientific process itself. This type of skepticism reflects a deeper distrust of expertise and authority, often driven by the perception that scientists may be biased, influenced by political agendas, or disconnected from everyday concerns (Sharman & Howarth, 2017). Distrust in science is often worsened by misinformation campaigns and conspiracy theories, especially in the age of social media, in which echo chambers reinforce these views (Gruzd & Mai, 2020). As trust in scientific institutions declines, individuals may turn to alternative sources of information that align with their existing beliefs, further deepening their skepticism (Hornsey et al., 2018).

Social identity theory offers another perspective for understanding climate skepticism. According to this theory, people's views on climate change are shaped by their affiliations with social or political groups. For many, skepticism is not just about misunderstanding the science but a way to signal loyalty to a political or ideological group. This is especially true in polarized societies, where climate change is viewed as a partisan issue. Because climate action is often linked to progressive or left-wing politics, conservative individuals may reject it as a way of expressing their political identity, regardless of scientific evidence (Hornsey et al., 2018). This can lead to "motivated reasoning," in which people interpret information in a way that supports their group's beliefs (Kahan, 2012).

Personal experience with climate disasters can also influence climate skepticism. Studies have shown that individuals who have experienced the effects of extreme weather, such as floods or heatwaves, are more likely to accept the reality of climate change. These experiences make the abstract consequences of climate change more immediate and real, reducing skepticism. However, this relationship is not simple. Cognitive biases, especially confirmation bias, can lead people to interpret these events in a way that fits their preexisting beliefs. For example, someone who is already skeptical of climate change might attribute a flood to natural causes rather than human-driven global warming (Whitmarsh, 2008; Ogunbode et al., 2020), or to a human action of governments trying to disrupt the climate, especially with extreme events like hurricanes or massive flooding. This is the same way that they consider that COVID-19 came from human intervention orchestrated by governments or great power bodies (Tam & Chan, 2023). This selective interpretation can reinforce skepticism rather than challenge it (Stevenson et al., 2014).

2.3. Factors Explaining Climate Skepticism

The literature has revealed a range of factors that are associated with climate skepticism. While the aforementioned forms of skepticism serve as manifestations, they can also be affected by a set of underlying determinants: (i) socioeconomic and demographic characteristics, (ii) behaviors and attitudes, and (iii) sociopolitical factors.

Research has indicated that socioeconomic and demographic characteristics are significant contributors to the development of climate skepticism. Notably, an individual's level of education has been recognized as an important predictor of such skepticism. Hamilton (2011) found that individuals with higher levels of education generally exhibited lower levels of doubt regarding climate change. A more recent analysis by Poortinga et al. (2019) corroborated this finding. Authors demonstrated that individuals with higher educational attainment were more likely to effectively incorporate knowledge about global warming and its consequences. However, this association has also faced scrutiny. Huber (2020, 2022) contended that populist attitudes can significantly influence climate change skepticism, sometimes superseding the effects of education. Huber's research suggested that a higher educational level does not necessarily correlate with reduced skepticism when strong populist attitudes are present (Huber, 2020). The political context and broader social environment also impact attitudes towards global warming. Several scholars (Hamilton, 2011; McCright & Dunlap, 2011a and 2011b; Lockwood, 2018)

have emphasized the role of political polarization in exacerbating climate skepticism. Additionally, [Ballew et al. \(2019, 2020\)](#) asserted that conservative white males tend to downplay the impacts of global warming or attribute them to natural causes. A recent study found that such attitudes further reinforced climate change skepticism ([Hornsey et al., 2018](#)).

Age is a significant factor influencing perceptions of climate change. Older individuals may have more to lose from the necessary transformations required to address this issue ([Milfont et al., 2015](#)). [Faulques et al. \(2022\)](#) identified a generational effect relating to behaviors that promote ecological transition, with younger individuals being more inclined to take action due to their direct experience with the current and future impacts of global warming ([Skeiryte et al., 2022](#)). Additionally, some researchers have identified gender as potentially related to climate change skepticism. For instance, [Finucane et al. \(2013\)](#) described the “white male” phenomenon, which posits that white men tend to exhibit greater tolerance for various technological and environmental risks compared to other demographic groups.

Attitudes and behaviors, particularly trust in science and its practitioners, are also critical for understanding climate skepticism. According to [Sharman and Howarth \(2017\)](#), individuals displaying low trust in science and scientists are more likely to engage in climate-skeptical behavior, a notion supported by [Whitmarsh \(2011\)](#) as a major contributing factor. This distrust of science may also correlate with a heightened propensity for conspiratorial thinking ([Gemesis, 2021](#)). The COVID-19 pandemic further exacerbated this trend ([Bodner et al., 2020](#); [Gruzd & Mai, 2020](#)). Another factor that may explain individual differences in climate skepticism is the perception of vulnerability to the risks associated with global warming ([Stevenson et al., 2014](#)). A heightened sense of personal vulnerability can serve as a potent motivator for commitment to climate action ([Ojala, 2013](#)). Individuals who perceive themselves as directly affected by the consequences of climate change tend to express fewer climate-skeptical opinions. For example, two studies indicated that residents in areas prone to climate disasters, such as flooding, were less likely to embody climate skepticism ([Whitmarsh, 2008](#); [Ogunbode et al., 2020](#)).

Lastly, a relatively understudied but potentially significant aspect of climate skepticism, from a political perspective, pertains to social acceptance of measures aimed at combating climate change ([Bourdin et al., 2025](#)). One hypothesis suggests that some individuals adopt climate skepticism in response to opposition toward environmental policies perceived as restrictive ([Fairbrother, 2022](#)).

3. Methodology

This section is structured into two main parts. Section 3.1 presents the dataset, the operationalization of variables, and the rationale for their selection in light of the theoretical framework. Section 3.2 details the statistical method used to explore climate skepticism across four key moments in time, and explains the modelling approach and its empirical justification.

3.1. Data

The dataset used in this study originates from the social barometer initiated by ADEME in 2000 (ADEME is the *Agence Nationale de la Transition Écologique*, whose mission is to accelerate the reduction of energy consumption, develop renewable energy sources, and lower greenhouse gas emissions through innovation and research.) and then repeated every year, which concentrates on public perceptions of climate change. This annual survey gauges shifts in the environmental concerns of the French population, their perceptions regarding the causes and consequences of global warming, their opinions on pertinent public policies and measures, and their individual commitments to environmental issues. The survey was conducted among a sample of individuals that is representative of the French population aged 15 and above (see Appendix B). The sampling was executed using the quota method, which accounted for variables such as gender, age, socio-professional category, urbanization category, and region of residence. The quota method involves segmenting the population into distinct subgroups, or quotas, based on specific attributes, including age, gender, or educational attainment. Participants are then selected in a manner that ensures the composition of the sample aligns with the proportions of these attributes within the broader population. If necessary, ADEME applies survey weights to adjust the sample to more accurately reflect the French population. Currently, data is available from 2000 to 2021.

Our response variable is a dichotomous variable that evaluates whether the respondent is a climate skeptic. Specifically, participants were asked to respond to the following question: “According to the prevailing scientific consensus, global warming is primarily attributable to human activities; however, some argue that it is solely a natural phenomenon that has persisted throughout history. What is your opinion?” Two response options were provided: “A. The occurrence of global warming can be attributed to human activities”; “B. It represents a natural phenomenon that has continuously existed.” Responses were categorized, with selections of option B classified as indicative of climate change skepticism.

The variables employed in our analysis (refer to the table in Appendix A for comprehensive

descriptions) were chosen based on (i) their relevance to our research inquiries and (ii) their availability and consistency in the database over time (the skepticism variable was consistently operationalized, and the predictors in the model remained stable across each survey wave). The selected variables align with the key aspects of climate skepticism identified in our theoretical framework in order to establish a direct connection between theory and empirical analysis.

We collected demographic data—including gender, age, education level (categorized as primary, secondary, vocational, and higher education [EDUC]), and the type of area of residence (rural, small to medium towns, or large cities [TYPoterr])—to explore how these factors correlate with climate skepticism. These variables facilitate an examination of how social identity and personal experience contribute to shaping attitudes toward climate change. According to social identity theory, individuals may align their beliefs with those prevalent in their political or social groups, while those residing in regions more directly affected by climate events may display varying levels of skepticism based on their personal experiences.

To capture distrust in scientific institutions, we assessed respondents' belief in climate change research [BELIEV]. This allowed us to evaluate the role that confidence in scientific findings plays in shaping climate skepticism, in line with our theoretical framework. Furthermore, we analyzed respondents' attitudes toward climate action and their perceptions of the effectiveness of such measures [OPI]; [CLIMCHGT], which relate to how political ideology influences support for government intervention in climate policy and shapes views on the gravity of climate change.

The survey also incorporated questions regarding opinions on local climate policies and awareness of existing mitigation efforts [AWARTER], as well as attitudes toward public policies such as carbon taxes [TAX]. These variables enable us to assess the extent to which political ideology affects views on climate-related government interventions and contributes to climate skepticism. Additionally, we examined perceptions of the personal impact of climate change [SUFF], which helps to assess whether personal experiences of climate-related events are associated with reduced skepticism.

In examining cognitive biases and individual actions, we collected data on behaviors related to waste sorting and consumption reduction [BEHAVwaste]; [BEHAVconsum], to offer insights into how personal behaviors may reflect and reinforce existing climate change beliefs. Finally, we analyzed respondents' transportation choices [TRANSP] and political affiliations [VOTE], with a specific focus on voters for green and far-right parties, to further investigate the relationship between political identity and climate skepticism.

3.2. Data Analysis Method

We adopted a modeling approach based on cross-sectional logistic models for the years 2000, 2010, 2019 (before the COVID-19 pandemic), and 2021 (after the pandemic). This method was chosen because it effectively handles cases where the dependent variable is dichotomous (climate skeptic or non-climate skeptic). However, the empirical strategy does not structure the analysis to capture over-time changes comprehensively. Instead, the study applies exploratory regressions to four selected survey waves. These years were chosen based on both data availability and key moments in the public debate on climate change. The selection follows a clear rationale: 2000 marks an early stage of climate change awareness in France, 2010 follows the Copenhagen Summit and a period of increasing public engagement with environmental issues, 2019 precedes the COVID-19 pandemic, and 2021 allows an assessment of shifts caused by the crisis. While a more continuous approach could provide additional depth, the available dataset does not permit panel analysis, as it consists of repeated cross-sectional surveys rather than a longitudinal follow-up of the same individuals.

In mathematical terms, a logistic model is formalized as follows:

$$P(Y = 1|X) = 1/(1 + e^{-(\alpha + \beta X)})$$

where $P(Y=1|X)$ represents the conditional probability that the dependent variable Y is equal to 1 (i.e., the individual is climate skeptical) given the set of independent variables X . The letter e refers to the natural log base, α is the intercept term, and β is the vector of the covariate coefficients. Here, we measure the probability that a person is a climate skeptic as a function of the logistic transformation of the linear combination of our independent variables.

This approach allowed us to explore how predictors of climate skepticism evolved over time and the potential effect of the COVID-19 pandemic on these attitudes, given its role in increasing conspiracism (Bodner et al., 2020; Gemenis, 2021). More specifically, we were able to assess how the effects of the variables of interest on the probability of being a climate skeptic changed between 2000, 2019, and 2021.

The rationale for this cross-sectional method is that climate skepticism is probably affected by a complex set of factors that may evolve over time (Whitmarsh, 2011). Furthermore, the COVID-19 pandemic is likely to have triggered significant changes in attitudes toward climate change due to its

impact on the public's awareness of global environmental issues (Latkin et al., 2022; Latkin et al., 2023). Thus, even if conspiracy theories are widespread today, COVID-19 and awareness of environmental problems might have had a positive effect on perceptions of global warming. By using cross-sectional logistic models for different years, we were able to better understand how these various factors have contributed to climate skepticism at different points in time.

4. Results

4.1. General Trends

Figure 1 shows the evolution of climate change skepticism in France. Overall, the phenomenon has declined over the past 20 years, from almost half of all respondents to 277 in 2021. These numbers should be seen in the context of the growing awareness of the challenges of climate change among the French. The latest ADEME survey even indicated that global warming is the third most important concern for the population, after public health and immigration and before employment. This concern has grown steadily over the period under review, rising from 7% to 13% of the respondents, for whom it is the number 1 worry. The data suggest a notable difference between age groups regarding environmental concerns: 23% of individuals aged 15–24 expressed concerns about these issues compared with just 8% of those aged 65 and over. In the latter group, an interest in health issues was predominant.

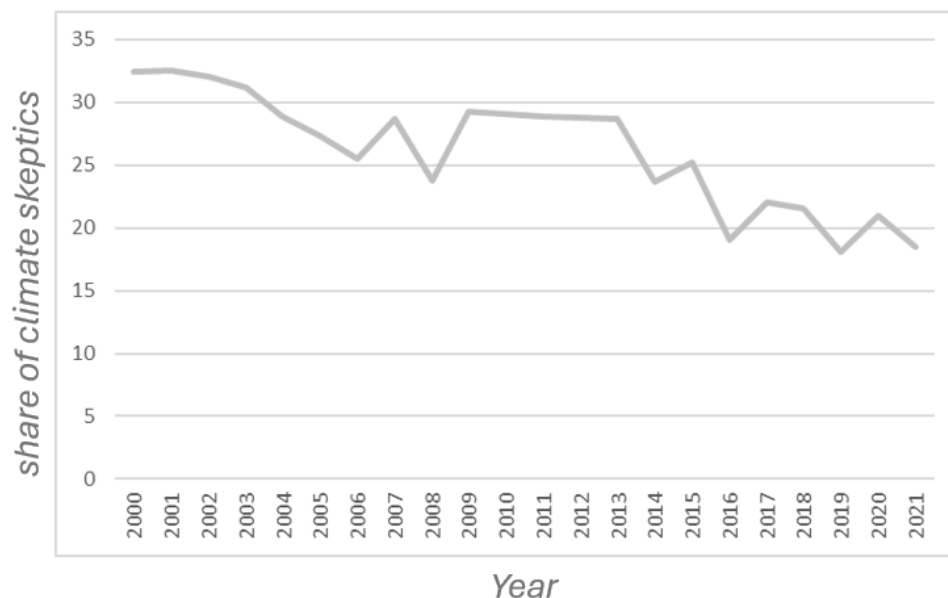


Figure 1. Change in the share of climate skeptics between 2000 and 2021 (in % of the total population). Source: ADEME.

Our statistical analyses indicate that 51% of the respondents had “often” or “sometimes” felt the effects of extreme climate events (compared with 22% in 2013), which proves the growing link between personal experiences and climate-related disturbances. These experiences are no longer entirely shaped by the media; they play a significant role in molding social representations of global warming. Another factor may be the growing belief in the scientific consensus regarding this problem (Figure 2).

Question: There is talk of an increase in the greenhouse effect, which would lead to warming of Earth's atmosphere. With regard to this, which of the following two statements do you agree with?

- A) This is a hypothesis on which not all scientists agree.*
- B) This is a certainty for most scientists.*

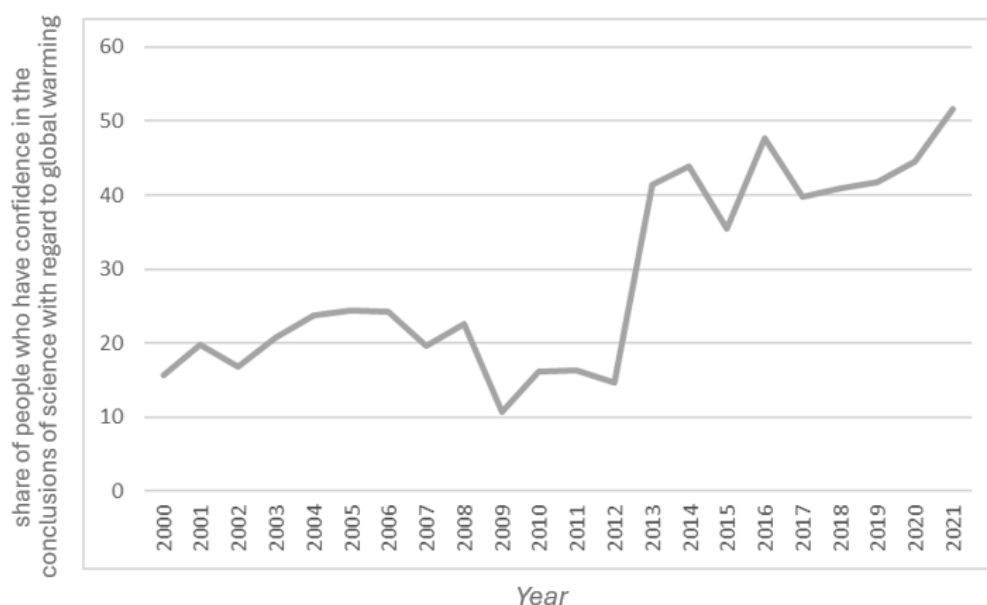


Figure 2. Change in the share of people who have confidence in the conclusions of science with regard to global warming between 2000 and 2021 (in % of the total population). *Source: ADEME.*

A notable trend appears in the evolution of trust in climate science. Between 2000 and 2021, the percentage of respondents who agreed with the statement that "climate change is a certainty for most scientists" increased significantly. However, a particularly sharp rise in confidence in climate science occurred in 2013. One potential explanation for this shift is the strong visibility of scientific reports and media coverage at the time. The publication of the Fifth Assessment Report (AR5) by the Intergovernmental Panel on Climate Change (IPCC) in late 2013 likely played a key role. This report reinforced the consensus on anthropogenic global warming, received widespread coverage in the French media, and contributed to a rise in public awareness. Additionally, extreme weather events in 2013, such as Typhoon Haiyan, which devastated the Philippines, led to extensive discussions about climate change. In France, the government also introduced new debates on energy transition, which further increased climate-related discourse in public debate. These elements may have collectively driven the sharp increase in confidence in climate science observed that year.

4.2. Results of the Cross-Section Model

2000: The role of scientific uncertainty

The logistic regression analysis (Table 1) for the year 2000 indicates that several factors have a significant correlation with climate skepticism. Concerning people's perceptions of and attitudes toward global warming, we find that the opinion that the latter is a hypothesis on which not all scientists agree is strongly associated with climate skepticism (coef. 0.736, $p < 0.001$). This indicates that perceived disagreement within the scientific community could play an important role in promoting climate-skeptical ideas.

1 **Table 1.** Logit model.

			Model 1 (2000)		Model 2 (2010)		Model 3 (2019)		Model 4 (2021)	
Variable Category	Variable Name	Description	Coeff.	<i>p</i>	Coeff.	<i>p</i>	Coeff.	<i>p</i>	Coeff.	<i>p</i>
Demographic Factors	Sex	Male	0,144	*	0,198	**	0,407	***	0,473	***
	Age	Age 15-24	-0,325		-0,357	*	-0,589	**	-0,531	**
		Age 25-49	-0,262	**	-0,260	**	-0,399	*	-0,344	*
		Age 50-64	-0,198	*	-0,281	*	-0,112		-0,193	
	EDUC	Lower/Primary Level	0,026	**	0,028	**	-0,008		0,136	
		Secondary Level	-0,069		-0,017		0,048		0,214	
	TYPoterr	Rural	0,036		0,042		-0,108		-0,326	
		Between 2 and 20 000 inhabs	0,047		0,084		0,028		-0,333	
		Between 20 and 100 000 inhabs	-0,002		0,001		0,088		-0,349	
		More than 100 000 inhabs	-0,031		0,070		0,146		-0,416	*
Perceptions and attitudes towards climate change	BELIEV	A hypothesis on which scientists do not all agree	0,736	***	0,831	**	0,859	***	0,795	***
	OPI <i>"Out of these four opinions, which one is closest to your own?"</i>	(i) Technical progress will provide solutions to limit climate change	0,251	**	-0,246	**	0,293	**	0,901	***
		(ii) We will need to significantly change our lifestyles to limit climate change	-0,537	**	0,396	**	-1,098	***	-1,048	***
		(iii) It is up to the states to seek a global agreement to limit climate change	-0,409	**	0,754		-0,782	***	-0,715	***

	CLIMCHG T <i>"Do you think that climate change will be limited to reasonable levels by the end of the century?"</i>	Yes, definitely	-0,442	**	0,501	**	-0,296		-0,437	
		Yes, probably	-0,017		0,058		0,245		0,070	
		No, probably	0,159		-0,076		0,451	*	0,098	
		No, definitely not	0,264		-0,281		0,270		0,242	
	SUFF <i>"Where you live, have you ever suffered the consequences of climatic disasters?"</i>	Yes, often	-0,292	*	0,260	**	-1,818	***	-1,658	***
		Yes, sometimes	-0,099		0,140		-0,257		-0,388	
		No, rarely	0,083		-0,037		0,149		0,472	**
		No, never	0,449	***	-0,426	***	0,376	***	0,373	***
	AWARTE R <i>"Do you know of measures already taken by</i>	Yes, and they seem sufficient to you	0,221	*	-0,284	*	0,202		0,661	

	<i>your territory to [...] cope with the consequences of climate change?"</i>									
		Yes, but they do not seem sufficient to you	-0,056		0,089		0,060		0,391	
		you are not aware of any	0,097		-0,096		0,180	**	0,461	**
	TAX "Do you support or oppose a rising carbon price / an increase in the carbon tax, [...]?"	Very supportive	-0,552	***	0,566	***	-0,591	*	-0,674	**
		Somewhat supportive	-0,258	***	0,202	**	-0,298		-0,656	***
		Not supportive	-0,067		0,048	**	-0,009		0,036	
		Not supportive at all	0,301	**	-0,266	**	0,306	***	0,564	***
Individual actions and behaviors	BEHAVwaste "Tell me if you are sorting your waste"	You already do it	-0,157	***	0,101	***	-0,123	***	-0,131	***
		You could do it quite easily	-0,132	**	0,115	**	-0,160	*	-1,004	***
		Very supportive	-0,108		0,102		-0,121		-0,085	
		You can't do it	0,194	**	-0,178	**	0,459	**	0,678	***
	BEHAVconsum	You already do it	-0,129		0,165		-0,346	*	-0,024	

	<i>"Tell me if you are consuming less"</i>									
		You could do it quite easily	-0,254	***	0,221	***	-0,203		-0,669	*
		Very supportive	0,158		-0,176		0,345		0,252	
		You can't do it	0,039		-0,064		0,602	***	0,362	**
	TRANSP <i>"For your daily commutes, what is the main mode of transport you use?"</i>	Public transportation (urban (including subway) and train)	0,046		-0,052		-0,084		-0,223	
		With soft mobility (by bike or on foot)	0,032		-0,025		-0,129		-0,277	***
	VOTE	Voting for ecological parties	-0,433	***	0,405	***	-1,085	***	-1,599	***
		Voting for extrem right parties	1,529	**	-1,638	***	0,927	***	1,436	**
		R ²	0,47		0,56		0,58		0,56	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

2010: Emerging political and individual dimensions

The regression analysis conducted in 2010 provides insights into the factors that may be associated with climate skepticism. It reveals a shift in public opinion regarding climate change compared with the year 2000. Notably, gender emerges as a more significant predictor, as being male is correlated with a higher likelihood of climate skepticism (coef. 0.198, $p < 0.01$). In terms of perceptions and attitudes toward climate change, the belief that technological advancements will provide solutions to address climate change is significantly correlated with lower levels of skepticism (coef. 0.251, $p < 0.01$). It indicates a belief in the power of innovation and technology to tackle environmental challenges. Additionally, the belief that significant lifestyle changes are necessary to combat climate change is strongly associated with reduced climate skepticism (coef. -0.537 , $p < 0.01$), suggesting an increasing recognition of the importance of personal responsibility and action. On the contrary, individuals who believe that it is solely the responsibility of states to pursue global agreements to limit climate change exhibit heightened skepticism (coef. -0.409 , $p < 0.01$), which might indicate a sense of individual disempowerment or cynicism toward political solutions. Association with environmental parties has also become a stronger predictor of a position against climate skepticism (coef. -0.433 , $p < 0.001$), highlighting the political dimension of environmental issues. These shifts, compared to the year 2000, demonstrate a larger emphasis on both technological optimism and individual agency in addressing climate change, alongside a more evident political polarization in climate opinions by 2010.

2019: Reinforcing divides and behavioral awareness

In 2019, we observe a trend similar to that of 2000 concerning males (coef. 0.407, $p < 0.001$). However, the coefficient for men has become more positive, suggesting that the gender gap in climate skepticism may have widened. Attitudes toward global warming have also evolved. In particular, two ideas—that we need to change our lifestyles to limit this problem (coef. -1.098 , $p < 0.001$) and that it is up to states to seek an international agreement to limit climate change (coef. -0.782 , $p < 0.001$)—are now associated with a lower probability of being climate skeptical.

The relationship between climate disasters and belief in human-caused global warming is complex and is related to preexisting global warming beliefs. Existing research suggests that the impact of extreme weather experiences on climate change beliefs can vary depending on the type of event and individual predispositions (Borick & Rabe, 2017; Howe, 2021; Marlon et al., 2021). Our study suggests that skeptics are less likely to report being affected by climate disasters. However, this result should be interpreted with caution, as the perception of such events is significantly shaped by existing climate beliefs.

2021: The growing link between behavior and belief

In 2021, the same trends observed in 2019 continue for males (coef. -0.473 , $p < 0.001$) and for the age groups 15–24 (coef. -0.531 , $p < 0.01$) and 25–49 (coef. -0.344 , $p < 0.05$). The fact that the coefficient for young people is high could reflect greater exposure to scientific information on the climate or greater concern for the future of the planet. Perceptions of and attitudes toward climate change have also continued to evolve in a way that is similar to those of 2019. Furthermore, the variables representing behaviors relative to the reduction of consumption and the increase in waste sorting are both significant, which shows that the respondents who declare their intention to act in an ecological manner (i.e., waste reduction and responsible consumption) are less likely to be climate skeptics. This result underlines the close link between individual environmental awareness and the recognition of global warming. In addition, people who say that they can “easily” adopt these behaviors are also less likely to be climate skeptics, which suggests a potential relationship between the perceived difficulty of ecological action and climate skepticism. Moreover, our analysis indicates that individuals who strongly or moderately support environmental taxes are less likely to be climate skeptics. This relationship could be explained by the fact that support for concrete ecological policies, such as carbon taxes, often reflects a higher level of environmental awareness and acceptance of scientific consensus on climate change. Previous studies have demonstrated that individuals who recognize the urgency of climate action are more likely to endorse policies aimed at reducing carbon emissions, which correlates with lower levels of skepticism (Drews & van den Bergh, 2016; Klenert et al., 2018). This suggests that backing for ecological policies is not only a behavioral marker of climate concern but also indicative of broader pro-environmental attitudes. Finally, those who vote for green parties are less likely to be climate skeptics—as one would expect. However, those who vote for far-right parties are significantly more likely to be skeptical of global warming. This could reflect marked ideological differences.

Synthesis and temporal comparison

When comparing the four models, we see that some factors remain significant and stable over time, showing continuity in their impact on climate skepticism. For instance, male gender remains significantly associated with higher climate skepticism in all the years examined. In addition, the idea that climate

change is a hypothesis on which not all scientists agree is also associated with a greater likelihood of being a climate skeptic in all the models, although its effect appears to diminish slightly over time. This diminishing effect could be attributed to the growing prominence of scientific discourse in media and policy-making, as well as the intensified efforts in public engagement and education. These factors may gradually undermine the basis of skepticism rooted in the perception of scientific disagreement.

However, a number of changes do occur. They underline the importance of a cross-sectional approach to understanding climate skepticism and its determinants. First, over the years, the data reveal a significant transformation in public sentiment regarding the role of technology in addressing climate change. In 2000, there was a noticeable association between the belief that technical progress would provide climate change solutions and higher levels of climate skepticism. This shift may be explained by the fact that individuals who trust in technological progress often see it as a means to address climate change without needing significant lifestyle or policy changes. In some cases, this belief can diminish the urgency to acknowledge the human causes of climate change, as people assume that future technological advancements will resolve the issue, regardless of its origins (Tranter & Booth, 2015). This emerging optimism, often termed “technological optimism” (Huber, 2020), suggests that climate skeptics may view technology as a convenient solution, thereby justifying their reluctance to fully accept human responsibility for climate change. However, our study did not directly measure trust in technology, which limits our ability to draw stronger conclusions on this point.

Second, with regard to individual actions, the data show that eco-responsible behaviors (e.g., household waste sorting and consumption moderation) are increasingly associated with lower climate skepticism. It is possible that people sort their household waste because they are less skeptical about climate change (Cook et al., 2016). This suggests a growing awareness of the importance of individual actions and commitment in the fight against global warming. However, it is equally plausible that external factors, such as social pressure or guidance from neighbors and friends, drive these behaviors, and individuals then justify their actions by adjusting their climate attitudes (Whitmarsh, 2011).

Third, there has been a noticeable shift in political opinion. In the 2000 model, voting for green parties was significantly associated with lower climate skepticism, while choosing far-right parties was linked to higher skepticism. These associations are stronger in the more recent models, which indicates an increasing polarization of attitudes toward climate change along political lines.

5. Discussion

The results of our study show that the climate crisis persists as a major concern in the minds of the public, at least in France. Moreover, there seems to be a growing awareness of the dangers of climate change. These are highlighted by the increased frequency of extreme climate events (e.g., drought, fires, floods, and deadly heat waves), not only in France but also in many other countries, both near and far. From this point of view, our study confirms the role of personal experience in the formation of climate skepticism. Exposure to climate-related disasters has been shown to diminish skepticism, as direct confrontation with the consequences of climate change renders the associated risks more palpable. This finding is consistent with the theory that individuals are more inclined to acknowledge the reality of climate change when they are personally affected, notwithstanding the presence of cognitive biases such as confirmation bias, which can lead skeptics to minimize the significance of such events. These findings corroborate the conclusions reached by previous researchers in different geographic settings, such as Carlton et al. (2016) and Albright and Crow (2019).

Our models reveal a significant shift in perceptions of and attitudes toward climate change. The diminishing association between the belief that global warming is a contested hypothesis and climate skepticism over time reflects a growing public confidence in the scientific consensus. This shift underscores the importance of trust in scientific institutions, a key factor in our theoretical framework (Sharman & Howarth, 2017; van der Linden et al., 2019). Efforts by scientists and the media to emphasize the broad agreement on climate change may have helped restore this trust, despite ongoing misinformation campaigns and conspiracy theories that seek to undermine it. The communication efforts of scientists and the media to highlight the breadth of the agreement on the phenomenon may have had a positive effect (van der Linden et al., 2019); this is also true of the educational efforts of bodies such as the Intergovernmental Panel on Climate Change. This trend may be attributed to the increased attention paid to science during the COVID 19 pandemic, despite the conspiracy theories that developed at the time (Gruzd & Mai, 2020).

On the other hand, the impact of gender on climate skepticism remains consistent throughout the period taken into consideration, with men being more likely to be climate skeptics than women. This highlights how social identity and political alignment shape responses to climate science and policy and can reinforce skepticism in some groups. This finding corroborates previous studies that have demonstrated a similar trend (e.g., McCright & Dunlap, 2011; Ballew et al., 2019; Ballew et al., 2020).

However, it should be noted that the effect of gender on climate skepticism appears to intensify over time. Future research could explore the reasons for this trend, which can perhaps be related to the “white male” phenomenon (Finucane et al., 2013)—a defensive reflex, sometimes linked to political affiliation, of groups that feel threatened by ongoing changes.

The significant link between environmentally responsible behavior and lower climate skepticism underscores the role of cognitive biases. Individuals who engage in pro-environmental actions may be less likely to exhibit skepticism because their behaviors reinforce their beliefs about climate change, a form of cognitive consistency. However, it is also possible that external pressures or social norms drive these behaviors and may lead individuals to align their beliefs with their actions (Whitmarsh, 2011; Milfont et al., 2015). Our research reveals that this trend became more pronounced during the pandemic, perhaps as a result of increased attention to public health and nature (Latkin et al., 2023).

Finally, our analyses point to the importance of political variables. We found that voting for green parties is associated with a lower probability of being a climate skeptic, while choosing far-right parties correlates with a higher probability of this trait. These findings are in line with the literature suggesting that attitudes toward climate change can be strongly linked with political ideology (Dunlap & McCright, 2008; Marquart-Pyatt et al., 2011; Hornsey et al., 2018). Our research findings demonstrate a significant correlation between voting for ecological parties and a decreased likelihood of holding climate skepticism. The negative coefficients associated with this relationship demonstrate an increasing trend over time, ranging from -0.436 to -1.595 . A crucial factor contributing to this correlation appears to be the active involvement of ecological parties and their supporters in educational and awareness initiatives focused on environmental and climate issues. Individuals who are exposed to such information are more likely to comprehend the importance of these issues and are therefore less inclined to question the credibility of climate change research. Conversely, the association between voting for far-right parties and greater climate skepticism can be explained by several factors. According to Lockwood (2018), far-right parties often have a worldview based on nationalism, national sovereignty, and resistance to social change, which opposes globalization. Thus, climate change—a global problem requiring international coordination and major changes in lifestyles and production patterns—can be seen as incompatible with their values and objectives (Mewes et al., 2024). For some radical right-wingers, it is yet another avatar of the globalization injunction issued by technocratic elites. Moreover, Hamilton (2011) explained that far-right parties are often characterized by a distrust of elites, including scientific experts. This distrust can translate into a rejection of scientific findings on climate change. In addition, some may see the focus on global warming as a distraction from other issues they consider more pressing, such as immigration or the economy. Finally, climate change has become a highly politically polarized issue. If an emphasis on this problem is seen as part of the ideology of the other political camp (e.g., left-wing or green parties), then rejecting this emphasis can become an aspect of the political identity of the far right. However, in the French context, the relationship between right-wing ideology and climate concern appears to be less pronounced than in other Western countries, as highlighted by Hess and Renner (2019). This may be because right-wing parties in France, such as Les Républicains (right) or the Rassemblement National (extreme right), have not necessarily adopted a position of systematic rejection of climate science, as is often the case with their counterparts in other countries. Therefore, political discourse in France can include environmental concerns, even on the right, especially when they can be aligned with economic or national sovereignty concerns.

6. Conclusion

Main results and contributions

Our study investigates the sociodemographic and behavioral determinants of climate change skepticism in France. The findings indicate a decline in climate skepticism within the population. Specifically, it appears that the numerous scientific warnings regarding global warming, alongside intensified media attention and political mobilization, have cultivated an atmosphere of increased sensitivity to environmental issues, particularly concerning climate change. The results of our research demonstrate that the climate crisis persists as a significant concern among the public, at least in the context of France.

From this perspective, our study corroborates the role of personal experience in shaping climate skepticism. Empirical evidence suggests that exposure to climate-related disasters diminishes skepticism, as direct encounters with the repercussions of climate change render associated risks more tangible. This observation aligns with the theoretical framework positing that individuals are more inclined to acknowledge the reality of climate change when personally affected, despite the influence of cognitive biases such as confirmation bias, which may lead skeptics to downplay the significance of such events. These findings reinforce the conclusions drawn by prior researchers in various geographic contexts,

including [Carlton et al. \(2016\)](#) and [Albright and Crow \(2019\)](#).

Moreover, our models clarify a structural evolution in climate-related beliefs. The diminishing correlation between the perception of global warming as a contested hypothesis and climate skepticism over time reflects an increasing public confidence in the scientific consensus. This shift underlines the critical importance of trust in scientific institutions, a fundamental element in our theoretical framework ([Sharman & Howarth, 2017](#); [van der Linden et al., 2019](#)). Efforts by scientists and the media to underscore the broad agreement on climate change may have contributed to restoring this trust, notwithstanding the persistence of misinformation campaigns and conspiracy theories aimed at undermining it. The communicative initiatives of scientists and the media to highlight the consensus surrounding the phenomenon of climate change may have had a beneficial impact ([van der Linden et al., 2019](#)); this also applies to the educational initiatives of organizations such as the Intergovernmental Panel on Climate Change. Furthermore, this renewed focus on scientific discourse may have been reinforced by the heightened visibility of science during the COVID-19 pandemic, despite the proliferation of conspiracy theories during that time ([Gruzd & Mai, 2020](#)).

Another pattern that remains stable over time is the gender gap in climate skepticism. The influence of gender on climate skepticism demonstrates consistency throughout the period under consideration, with men exhibiting a higher likelihood of being climate skeptics compared to women. This observation highlights the ways in which social identity and political alignment shape responses to climate science and policy, potentially reinforcing skepticism among certain groups. This finding supports prior research that has identified a similar trend (e.g., [McCright & Dunlap, 2011](#); [Ballew et al., 2019](#); [Ballew et al., 2020](#)). However, it is important to note that the effect of gender on climate skepticism appears to intensify over time.

Our study also reveals an increasing correlation between behavior and belief. The significant relationship between environmentally responsible behavior and diminished climate skepticism highlights the influence of cognitive biases. Individuals who engage in pro-environmental actions may be less likely to exhibit skepticism, as their behaviors reinforce their beliefs about climate change, a manifestation of cognitive consistency. Nonetheless, it is also plausible that external pressures or social norms drive these behaviors, leading individuals to align their beliefs with their actions ([Whitmarsh, 2011](#); [Milfont et al., 2015](#)). This pattern became particularly pronounced during the pandemic, potentially as a result of heightened awareness concerning public health and nature ([Latkin et al., 2023](#)).

Finally, our results explain the political dimension of climate skepticism. We found that voting for green parties is associated with a lower probability of being a climate skeptic, whereas support for far-right parties correlates with a higher probability of exhibiting this trait. These findings are consistent with the literature suggesting that attitudes toward climate change are strongly linked to political ideology ([Dunlap & McCright, 2008](#); [Marquart-Pyatt et al., 2011](#); [Hornsey et al., 2018](#)). Our research demonstrates a significant correlation between voting for ecological parties and a decreased likelihood of holding climate skepticism. The negative coefficients associated with this relationship indicate an increasing trend over time, ranging from -0.436 to -1.595 . A key factor contributing to this correlation appears to be the active involvement of ecological parties and their supporters in educational and awareness initiatives focused on environmental and climate issues. Individuals exposed to such information are more likely to grasp the importance of these issues and are consequently less inclined to question the credibility of climate change research. Conversely, the association between voting for far-right parties and increased climate skepticism can be explained by several factors. According to [Lockwood \(2018\)](#), far-right parties often espouse a worldview grounded in nationalism, national sovereignty, and resistance to social change, which is antithetical to globalization. Thus, climate change—a global problem demanding international coordination and significant alterations in lifestyles and production patterns—may be perceived as incompatible with their values and objectives ([Mewes et al., 2024](#)). For some radical right-wing individuals, it represents yet another manifestation of the globalization agenda propagated by technocratic elites. Moreover, [Hamilton \(2011\)](#) noted that far-right parties frequently exhibit a distrust of elites, including scientific experts. This distrust can manifest as a rejection of scientific findings on climate change. Additionally, some may perceive the focus on global warming as a diversion from other issues they rank as more urgent, such as immigration or the economy. Ultimately, climate change has evolved into a highly politically polarized issue. When an emphasis on this problem is viewed as part of the ideology of the opposing political camp (e.g., left-wing or green parties). However, within the French context, the relationship between right-wing ideology and climate concern appears less pronounced than in other Western nations, as highlighted by [Hess and Renner \(2019\)](#). This may be attributed to the fact that right-wing parties in France, such as Les Républicains (traditional right) or the Rassemblement National (far-right), have not necessarily adopted a position of systematic rejection of climate science, which is often observed among their counterparts in other countries. Consequently, political discourse in France can encompass environmental concerns, even from the right, particularly when such concerns can

be aligned with economic or national sovereignty issues.

Implications et recommendations

Our findings have important implications for public policy and communication regarding global warming. They indicate that males and individuals who support far-right parties are more likely to be skeptical about climate change in France. While directly targeting these groups through communication campaigns may not be the most effective approach, it is crucial for communications to develop messages that align with the values of these groups, such as national sovereignty and economic security (Ballew et al., 2020). For example, messages could emphasize that a reduction in climatic accidents could reduce the number of foreign climate migrants, or how renewable energy sources reduce reliance on imported fuels, which are prone to international disputes and price volatility. By investing in domestic renewable energy, a nation can assert greater control over its energy sources, thereby exercising sovereignty.

Moreover, research suggests that disengaged or less concerned groups may be more receptive to messaging, and efforts could be directed toward them as well (Peeters et al., 2019). To effectively engage disengaged or less concerned groups in the dialogue about climate change, two key strategies can be employed. First, communication efforts should aim to bridge the gap between the global phenomenon of climate change and its local impacts. This can be achieved by illustrating the effects of changing weather patterns on local agriculture, the health implications of increased heat waves, and the economic consequences of climate disasters. By highlighting these specific and tangible examples, the issue of climate change becomes more relevant and urgent to these groups. Research has shown that localized portrayals of climate change impacts can significantly enhance public engagement and understanding (Bayes & Druckman, 2021; Palm & Bolsen, 2022). Second, the role played by messengers within these communities should be harnessed. Local leaders, respected community figures, and relatable influencers can play a crucial role in serving as the voice for climate-related issues. Their involvement ensures that the message is received as credible and relevant, as peer-to-peer communication often holds greater sway than information from distant or impersonal sources (Dekoninck & Schmuck, 2022). Finally, it is important to highlight the immediate, tangible benefits of addressing climate change. For instance, showcase how energy-efficient practices can lead to lower household expenses, how improved air quality can have a direct positive impact on public health, and how the development of green spaces can enhance community well-being. By focusing on the proximate advantages of climate action, these policies could foster a sense of personal gain that motivates engagement and support for climate initiatives.

Additionally, our findings demonstrate that engaging in eco-responsible behaviors, such as recycling and embracing sustainable lifestyles, is correlated with a diminished propensity for climate skepticism. The implementation of policies that promote these behaviors has the potential to alleviate climate skepticism on a broader scale. To effectively address this issue, policy recommendations should prioritize community-driven sustainability initiatives and high-visibility environmental projects.

Limitations and future research

Despite the strengths of our study, it has several limitations that need to be discussed. These limitations primarily concern the external validity of our findings and the constraints imposed by our reliance on secondary data. The use of an established database restricted our analysis to the existing wording and content of the questions, which may not fully capture the nuances of public opinion on climate change. This inherent limitation hinders our ability to explore a wider range of predictors that could potentially impact climate skepticism, possibly omitting significant variables. Specifically, the question regarding the causes of climate change offered only two binary options: “A. The occurrence of global warming can be attributed to human activities” and “B. It represents a natural phenomenon that has continuously existed.” This design did not allow for respondents who may hold more nuanced views, such as those believing both natural and human factors contribute to climate change, or those who are uncertain. Studies such as Leiserowitz et al. (2023) have shown that in France and elsewhere, many people fall into these middle categories. As a result, the binary nature of this question limits the complexity of the respondent beliefs that could have been captured in our analysis. Furthermore, our examination of attitudes toward global warming is focused solely on France, where cultural perceptions likely differ from those in other world regions. Therefore, the impact of cultural perceptions on climate skepticism observed in our study may not be directly applicable or yield comparable results in emerging countries or different cultural contexts. Moreover, despite a general trend toward decreased climate skepticism in our sample, a notable portion of the population remains unconvinced about the reality of global warming. Another limitation is that the “longitudinal” study did not look at the change in attitudes of the same individuals over time, and the factors affecting change can therefore not be seen as “causal”. This highlights the importance of further investigating the perspectives of these individuals.

Future research should address these limitations. Exploring the motivations and beliefs of individuals who persistently deny climate change could provide valuable insights to help overcome skepticism.

Additionally, investigating geographical and cultural differences in attitudes toward climate change, particularly in developing countries where its impacts are keenly felt, would contribute to a more comprehensive understanding of the issue on a global scale. Furthermore, conducting longitudinal studies would offer a deeper understanding of how and why public opinions on climate change evolve over time, especially in response to new information from the media and scientific communities. This approach could help identify the dynamic interplay among knowledge dissemination, cultural influences, and changing attitudes toward global warming.

References

- Albright, E. A., & Crow, D. (2019). Beliefs about climate change in the aftermath of extreme flooding. *Climatic Change*, 155(1), 1-17.
- Ballew, M. T., Leiserowitz, A., Roser-Renouf, C., Rosenthal, S. A., Kotcher, J. E., Marlon, J. R., ... & Maibach, E. W. (2019). Climate change in the American mind: Data, tools, and trends. *Environment: Science and Policy for Sustainable Development*, 61(3), 4-18.
- Ballew, M. T., Pearson, A. R., Goldberg, M. H., Rosenthal, S. A., & Leiserowitz, A. (2020). Does socioeconomic status moderate the political divide on climate change? The roles of education, income, and individualism. *Global Environmental Change*, 60, 102024.
- Barnes, J., Dove, M., Lahsen, M., Mathews, A., McElwee, P., McIntosh, R., ... & Yager, K. (2013). Contribution of anthropology to the study of climate change. *Nature Climate Change*, 3(6), 541-544.
- Bayes, R., & Druckman, J. N. (2021). Motivated reasoning and climate change. *Current Opinion in Behavioral Sciences*, 42, 27-35.
- Bayes, R., Bolsen, T., & Druckman, J. N. (2023). A research agenda for climate change communication and public opinion: The role of scientific consensus messaging; and beyond. *Environmental Communication*, 17(1), 16-34.
- Bodner, J., Welch, W., & Brodie, I. (2020). COVID-19 conspiracy theories: QAnon, 5G, the New World Order and other viral ideas. McFarland.
- Bourdin, S., & Torre, A. (2023). Geography of contestation: A study on the Yellow Vest movement and the rise of populism in France. *Journal of Regional Science*, 63(1), 214-235.
- Bourdin, S., Molica, F., & Marques, S. A. (2025). Too much or not enough? The dual nature of green discontent and its geography. *Regional Studies* (forthcoming).
- Bozkurt, V., & Gursay, D. (2023). The Artificial Intelligence Paradox: Opportunity or Threat for Humanity?. *International Journal of Human-Computer Interaction*, 1-14.
- Brulle, R. J., & Werthman, C. (2021). The role of public relations firms in climate change politics. *Climatic Change*, 169(1-2), 8.
- Busch, T., & Judick, L. (2021). Climate change-that is not real! A comparative analysis of climate-skeptic think tanks in the USA and Germany. *Climatic Change*, 164(1-2), 18.
- Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., & Upham, P. (2015). International trends in public perceptions of climate change over the past quarter century. *Wiley Interdisciplinary Reviews: Climate Change*, 6(1), 35-61.
- Carlton, J. S., Mase, A. S., Knutson, C. L., Lemos, M. C., Haigh, T., Todey, D. P., & Prokopy, L. S. (2016). The effects of extreme drought on climate change beliefs, risk perceptions, and adaptation attitudes. *Climatic Change*, 135, 211-226.
- Cepparulo, A., & Giuriato, L. (2024). Constitutionalizing the fight against climate change. Insights from France. *Environmental Science & Policy*, 157, 103756.
- Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R., Verheggen, B., Maibach, E. W., ... & Nuccitelli, D. (2016). Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, 11(4), 048002.
- Dekoninck, H., & Schmuck, D. (2022). The mobilizing power of influencers for pro-environmental behavior intentions and political participation. *Environmental Communication*, 16(4), 458-472.
- Estève, A. (2023). Preventing and Managing Climate Risks: France's Approach to Climate Security. In *Climate Security in the Anthropocene: Exploring the Approaches of United Nations Security Council Member-States* (pp. 113-130). Cham: Springer International Publishing.
- Fairbrother, M. (2022). Public opinion about climate policies: A review and call for more studies of what people want. *PLOS Climate*, 1(5), e0000030.
- Faulques, M., Bonnet, J., Bourdin, S., Juge, M., Pigeon, J., & Richard, C. (2022). Generational effect and territorial distributive justice, the two main drivers for willingness to pay for renewable energies. *Energy Policy*, 168, 113094.
- Finucane, M. L., Slovic, P., Mertz, C. K., Flynn, J., & Satterfield, T. (2013). Gender, Race and Perceived Risk: The 'White-Male' Effect. In *The Feeling of Risk* (pp. 125-139). Routledge.
- Gemenis, K. (2021). Explaining conspiracy beliefs and skepticism around the COVID-19 pandemic. *Swiss Political Science Review*, 27(2), 229-242.
- Gruzd, A., & Mai, P. (2020). Going viral: How a single tweet spawned a COVID-19 conspiracy theory on Twitter. *Big Data & Society*, 7(2), 2053951720938405.
- Hamilton, L. C. (2011). Education, politics and opinions about climate change evidence for interaction effects. *Climatic Change*, 104(2), 231-242.

- Haugseth, J. F., & Smepllass, E. (2023). The Greta Thunberg effect: A study of Norwegian youth's reflexivity on climate change. *Sociology*, 57(4), 921-939.
- Hess, D. J., & Renner, M. (2019). Conservative political parties and energy transitions in Europe: Opposition to climate mitigation policies, *Renewable and Sustainable Energy Reviews*, 104, 419-428.
- Hornsey, M. J., & Lewandowsky, S. (2022). A toolkit for understanding and addressing climate skepticism. *Nature human behaviour*, 1-11.
- Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). Relationships among conspiratorial beliefs, conservatism and climate skepticism across nations. *Nature Climate Change*, 8(7), 614-620.
- Huber, R. A., Greussing, E., & Eberl, J. M. (2022). From populism to climate scepticism: the role of institutional trust and attitudes towards science. *Environmental Politics*, 31(7), 1115-1138.
- Intergovernmental Panel on Climate Change (IPCC). (2018). Global warming of 1.5°C. An IPCC Special Report.
- Intergovernmental Panel on Climate Change (IPCC). (2023). Annual update of large-scale indicators of the state of the climate system and human influence, *Earth System Science Data*, 15, 6, 2295-2327.
- Jakučionytė-Skodienė, M., & Liobikienė, G. (2021). Climate change concern, personal responsibility and actions related to climate change mitigation in EU countries: Cross-cultural analysis. *Journal of cleaner production*, 281, 125189.
- Jang, S. M., & Hart, P. S. (2015). Polarized frames on "climate change" and "global warming" across countries and states: Evidence from Twitter big data. *Global environmental change*, 32, 11-17.
- Koteyko, N., Nerlich, B., & Hellsten, I. (Eds.). (2019). Climate Change Communication and the Internet. Routledge.
- Latkin, C. A., Hendrickson, Z. M., Dayton, L., & Bonneau, H. (2023). Political and Social Drivers of COVID-19 Prevention and Climate Change Behaviors and Attitudes. *Climate*, 11(3), 53.
- Latkin, C., Dayton, L., Coyle, C., Yi, G., Winiker, A., & German, D. (2022). The association between climate change attitudes and COVID-19 attitudes: The link is more than political ideology. *The Journal of Climate Change and Health*, 5, 100099.
- Lazer, D. M., Baum, M. A., Benkler, Y., Berinsky, A. J., Greenhill, K. M., Menczer, F., ... & Zittrain, J. L. (2018). The science of fake news. *Science*, 359(6380), 1094-1096.
- Leiserowitz, A., Roser-Renouf, C., Marlon, J., & Maibach, E. (2021). Global Warming's Six Americas: a review and recommendations for climate change communication. *Current Opinion in Behavioral Sciences*, 42, 97-103
- Lockwood, M. (2018). Right-wing populism and the climate change agenda: exploring the linkages. *Environmental Politics*, 27(4), 712-732.
- Lorenzoni, I., & Pidgeon, N. F. (2006). Public views on climate change: European and USA perspectives. *Climatic change*, 77(1-2), 73-95.
- Marquart-Pyatt, S. T., Shwom, R. L., Dietz, T., Dunlap, R. E., Kaplowitz, S. A., McCright, A. M., & Zahran, S. (2011). Understanding public opinion on climate change: a call for research. *Environment: Science and Policy for Sustainable Development*, 53(4), 38-42.
- Masson-Delmotte V. (2011), Climat : le vrai et le faux, Le Pommier, Paris, 208 p.
- Mayer, A., & Smith, E. K. (2019). Unstoppable climate change? The influence of fatalistic beliefs about climate change on behavioural change and willingness to pay cross-nationally. *Climate Policy*, 19(4), 511-523.
- McCright, A. M., & Dunlap, R. E. (2011a). The politicization of climate change and polarization in the American public's views of global warming, 2001-2010. *The Sociological Quarterly*, 52(2), 155-194.
- McCright, A. M., & Dunlap, R. E. (2011b). Cool dudes: The denial of climate change among conservative white males in the United States. *Global environmental change*, 21(4), 1163-1172.
- Mewes, L., Tuitjer, L., & Dirksmeier, P. (2024). Exploring the variances of climate change opinions in Germany at a fine-grained local scale. *Nature Communications*, 15(1), 1867.
- Milfont, T. L., Milojev, P., Greaves, L. M., & Sibley, C. G. (2015). Socio-structural and psychological foundations of climate change beliefs. *New Zealand Journal of Psychology (Online)*, 44(1), 17.
- Ogunbode, C. A., Doran, R., & Böhm, G. (2020). Individual and local flooding experiences are differentially associated with subjective attribution and climate change concern. *Climatic Change*, 162, 2243-2255.
- Ojala, M. (2013). Coping with climate change among adolescents: Implications for subjective well-being and environmental engagement. *Sustainability*, 5(5), 2191-2209.
- Painter, J., & Ashe, T. (2012). Cross-national comparison of the presence of climate skepticism in the print media in six countries, 2007-10. *Environmental Research Letters*, 7(4), 044005.
- Palm, R., & Bolsen, T. (2022). Housing market response to sea-level rise in Florida. Springer.
- Peeters, W., Diependaele, L., & Sterckx, S. (2019). Moral disengagement and the motivational gap in climate change. *Ethical Theory and Moral Practice*, 22, 425-447.
- Poortinga, W., Spence, A., Whitmarsh, L., Capstick, S., & Pidgeon, N. F. (2011). Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Global Environmental Change*, 21(3), 1015-1024.
- Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G., & Fisher, S. (2019). Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global environmental change*, 55, 25-35.
- Posthumus, S. (2019). Climato-skepticism in France. *Climate Change Scepticism: A Transnational Ecocritical Analysis*, 175-205.
- Roxburgh, N., Guan, D., Shin, K. J., Rand, W., Managi, S., Lovelace, R., & Meng, J. (2019). Characterising climate change discourse on social media during extreme weather events. *Global environmental change*, 54, 50-60.

- Salerno, F. (2023). The Greta Thunberg effect on climate equity: A worldwide Google Trend analysis. *Sustainability*, 15(7), 6233.
- Sarathchandra, D., Haltinner, K., & Grindal, M. (2022). Climate skeptics' identity construction and (Dis) trust in science in the United States. *Environmental Sociology*, 8(1), 25-40.
- Schuster, R., Gregory, K., Möller, T., & Koesten, L. (2024). "Being Simple on Complex Issues"—Accounts on Visual Data Communication about Climate Change. *IEEE Transactions on Visualization and Computer Graphics*.
- Sharman, A., & Howarth, C. (2017). Climate stories: Why do climate scientists and skeptical voices participate in the climate debate? *Public Understanding of Science*, 26(7), 826-842.
- Simonet, G., & Fatorić, S. (2016). Does "adaptation to climate change" mean resignation or opportunity? *Regional environmental change*, 16(3), 789-799.
- Skeirytė, A., Krikštolaitis, R., & Liobikienė, G. (2022). The differences of climate change perception, responsibility and climate-friendly behavior among generations and the main determinants of youth's climate-friendly actions in the EU. *Journal of environmental management*, 323, 116277.
- Steg, L. (2023). Psychology of climate change. *Annual Review of Psychology*, 74(1), 391-421.
- Stevenson, K. T., Peterson, M. N., Bondell, H. D., Moore, S. E., & Carrier, S. J. (2014). Overcoming skepticism with education: interacting influences of worldview and climate change knowledge on perceived climate change risk among adolescents. *Climatic change*, 126, 293-304.
- Tam K.P., Chan H.W., 2023, Conspiracy theories and climate change: A systematic review, *Journal of Environmental Psychology*, 91, <https://doi.org/10.1016/j.jenvp.2023.102129>
- Tranter, B., & Booth, K. (2015). Skepticism in a changing climate: A cross-national study. *Global Environmental Change*, 33, 154-164.
- Van der Linden, S., Leiserowitz, A., & Maibach, E. (2019). The gateway belief model: A large-scale replication. *Journal of Environmental Psychology*, 62, 49-58.
- Van Rensburg, W., & Head, B. W. (2017). Climate change scepticism: reconsidering how to respond to core criticisms of climate science and policy. *Sage Open*, 7(4), 2158244017748983.
- Vesa, J., Gronow, A., & Ylä-Anttila, T. (2020). The quiet opposition: How the pro-economy lobby influences climate policy. *Global Environmental Change*, 63, 102117.
- Wang, D., Dong, L., & Mei, J. (2023). An advanced review of climate change mitigation policies in Germany, France, and the Netherlands. *Environmental Research Letters*, 18(10), 103001.
- Whitmarsh, L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *Journal of risk research*, 11(3), 351-374.
- Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Global Environmental Change*, 21(2), 690-700.
- Williams, H. T., McMurray, J. R., Kurz, T., & Lambert, F. H. (2015). Network analysis reveals open forums and echo chambers in social media discussions of climate change. *Global environmental change*, 32, 126-138.

Appendix A. Description of Variables

Some variables have been omitted (in bold) due to perfect multicollinearity.

Variable Category	Variable Name	Description
Demographic Factors	Sex	Respondent's sex: Male /Female
	Age	Respondent's age: Age 15-24 / Age 25-49 / Age 50-64 / Age 65+
	EDUC	Level of Education: Lower/Primary (ISCED* 0, 1, 2), Secondary (ISCED 3, 4), Tertiary (ISCED 5, 6, 7, 8) * International Standard Classification of Education (ISCED)
	TYPoterr	Territory typology: Rural, between 2 and 20 000 inhabs, between 20 and 100 000 inhabs, more than 100 000 inhabs, Paris agglomeration
Perceptions and attitudes towards climate change	BELIEV	Individual's belief in climate change research: There is talk of increasing greenhouse effect that would cause a warming of the Earth's atmosphere. In your opinion, is this rather... (i) ...a hypothesis on which scientists do not all agree? / (ii) ...or a certainty for most scientists?
	OPI	Opinion about the mitigation: Out of these four opinions, which one is closest to your own? (i) Technical progress will provide solutions to limit climate change / (ii) We will need to significantly change our lifestyles to limit climate change / (iii) It is up to the states to seek a global agreement to limit climate change / (iv) There is nothing to be done, climate change is inevitable.
	CLIMCHGT	Do you think that climate change will be limited to reasonable levels by the end of the century?: Yes, definitely / Yes, probably / No, probably not / No, definitely not

	SUFF	Suffering the consequences: Where you live, have you ever suffered the consequences of climatic disasters? (i) Yes, often / (ii) Yes, sometimes / (iii) No, rarely / (iv) No, never
	AWARTER	Awareness of measures already taken by their territory to adapt to climate change: Do you know of measures already taken by your territory to adapt and better cope with the consequences of climate change (rising water levels, drought, decrease in snowfall, heatwaves, floods, etc.)? (i) Yes, and they seem sufficient to you / (ii) Yes, but they do not seem sufficient to you / (iii) No, you are not aware of any
	TAX	Favorability towards a rising carbon price/an increase in the carbon tax: Do you support or oppose a rising carbon price / an increase in the carbon tax, provided it does not penalize the purchasing power of middle and modest income households, and the tax revenues are used to fund ecological transition measures, especially in territories? Very supportive / Somewhat supportive / Not supportive / Not supportive at all
Individual actions and behaviors	BEHAVwaste	Waste sorting behavior: Tell me if your are sorting your waste (i) you already do it / (ii) you could do it quite easily / (iii) you could do it but with difficulty / (iv) You can't do it
	BEHAVconsum	Attitude of consuming less: Tell me if your are consuming less (i) you already do it / (ii) you could do it quite easily / (iii) you could do it but with difficulty / (iv) You can't do it
	TRANSP	Main mode of transport for daily trips: For your daily commutes (home-to-work journeys or other trips), what is the main mode of transport you use? (i) Personal motor vehicle (by car (even if you're not the driver), by motorized two-wheeler) / (ii) Public transportation (urban (including subway) and train) / (iii) With soft mobility (by bike or on foot)
	VOTE	Electoral behaviour: (i) voting for ecological parties / (ii) voting for extrem right parties

Appendix B. Descriptive Statistics

Year	Number of Participants	Male (%)	Female (%)	15-24 yo (%)	25-49 yo (%)	50-64 yo (%)	65+ yo (%)	% Believing Climate Change is Happening
2000	962	52.29	47.71	15.59	44.91	20.69	18.81	32.46
2010	989	52.48	47.52	13.04	41.96	23.76	21.23	29.45
2019	1487	46.94	53.06	15.27	40.42	21.32	23.00	18.22
2021	1566	53.77	46.23	14.69	39.40	24.97	20.95	17.69