Concerned yet polluters: A survey on French research personnel and climate change

Marianne Blanchard, Milan Bouchet-Valat, Damien Cartron, Jérôme Greffion, Julien Gros

Concerned yet polluters: A survey on French research personnel and climate change

Marianne Blanchard[1,2], Milan Bouchet-Valat[2], Damien Cartron[3], Jérôme Greffion[4], Julien Gros[5]

1. CERTOP, Université de Toulouse - Jean Jaurès, Toulouse, France
2. Institut national d'études démographiques (INED), Aubervilliers, France
3. CMH, CNRS, Paris, France
4. IDHES, Université Paris Nanterre, Nanterre, France
5. LEST, CNRS, Aix-en-Provence, France

Abstract:

We present a survey on the French research community and climate change carried out in 2020. It is one of the largest surveys ever conducted on this issue: it is based on a sample of more than 6,000 respondents representative of the French public sector research community, regardless of their status and discipline. On the one hand, it measures practices that emit large amounts of greenhouse gases, such as air travel, and addresses the differences between disciplines and within them according to different individual characteristics (gender, status, location, etc.). On the other hand, it questions the representations of research actors concerning the climate emergency, and what they are willing to do to reduce their emissions.

The survey highlights three results: first, an acute awareness of environmental and climate issues widely shared by members of the scientific community; second, a willingness to implement changes; and third, a clear gap between these attitudes and practices that still emit large amounts of greenhouse gases. This raises the question of the role of research institutions, whose support is required to implement profound reforms in the organization of research activities.

Keywords: climate change; research; survey; flying; IT equipment; ecology

Introduction

For several decades, researchers have highlighted the role played by human activities in greenhouse gas emissions and their effects on climate change. With the academic community working more than ever on these issues, researchers from several countries have in the last few years been investigating the environmental impact of their own occupational activities. These initiatives were initially led by climate and environmental scientists, underscoring the seeming paradox [1], or even hypocrisy [2], of polluting as part of their research while insisting that the population change its behaviour. Several studies have demonstrated that scientists emit more greenhouse gases (GHGs) than the average citizen [3,4], notably owing to their frequent use of air travel.

Climate and environmental researchers stand apart from other researchers as their credibility and ability to raise awareness of the urgency of reducing GHG emissions might hinge on their own behaviour [5]. But researchers in other disciplines are also paying increasing attention to the impact of their occupational activities ([6] in geography, [7] in astronomy, [8] in the history of transport).

As more such initiatives are rolled out, a better understanding is being forged of the actual impact of research activities on GHG emissions. But much remains to explore concerning differences between disciplines, and within the same discipline, stemming from individual characteristics (such as sex, status, and location), which is essential for implementing appropriate and effective changes. In addition, research on how research personnel perceive climate urgency, and what they are willing to do to reduce their emissions, is thin on the ground. In short, knowledge is lacking on the practices and characteristics of the groups with the highest GHG emissions, and on their perceptions, including their opinions on and understanding of climate issues and the reforms they deem acceptable or unacceptable.

The survey “Research personnel and climate change” we present here seeks to shed light on these grey areas. Conducted in 2020, it addresses practices before 2020 (pre-COVID) as well as perceptions. It is based on a large sample of over 6,000 respondents representative of French research personnel, regardless of their status or discipline (covering more than 70 disciplines). This article introduces the main themes and the initial results. Following a review of the literature, we present the survey questionnaire, the protocol, and the response rates obtained. We then focus on a few fundamental findings of the collected data concerning the opinions of research personnel on climate change, their GHG emissions, and the solutions that they are willing to implement to reduce those emissions.

State of the literature and contributions of the survey

For a little over a decade, a growing number of members of the academic community have explored the environmental impact of their research activities, from the standpoint of individuals [9], research programmes [10,11], and institutions [12,13].

While some works have addressed issues such as waste management, and in particular the pollution generated by plastic waste in laboratories [14,15], or, more globally, the concept of ‘green campuses’ [16], in this article we focus on the GHG emissions stemming from research activities and the effect of the latter on climate change.

Despite the growing interest in these issues, resulting from increasing awareness of the risks and the mounting urgency of taking action, the research published thus far provides what remains a fragmented review of the practices and perceptions of researchers.

Literature focused on air travel

Almost all the studies on the environmental impact of research concern the use of air travel [4,8,17]. This is justified by the fact that flights generate a large share of the GHG emissions of research activity. The University of British Columbia in Canada has estimated that flights account for 63% to 73% of total emissions [18]. At École Polytechnique Fédérale de Lausanne (EPFL), air travel accounts for one-third of total GHG emissions, equivalent to all the emissions generated by electricity consumption, heating, and commuting [12].

Many publications focus on the carbon impact of conferences [19], one of the main reasons for air travel. The GHG emissions generated by air travel range considerably, from 500 kg CO_2e per participant [20] to 950 kg CO_2e [21,22]. To put this into context, the European Commission objective to reduce emissions by 55% by 2030 relative to 1990 corresponds to 2.1 t CO_2e/year/inhabitant [23].

Solutions have been proposed [24] to reduce emissions, such as organizing fewer conferences, optimizing venue access, implementing regional hubs hosting participants at the same time, and increasing the use of videoconferencing.

But the emphasis placed on air travel should not obscure other sources of the GHG emissions generated by research, including IT equipment, commuting, the use of office space, catering (canteens and food stands), heating, the consumption of electricity (lighting, power for machines), and digital technology [25,26]. In some disciplines, scientific equipment stands as a major source of emissions, for example in astronomy [7], with its energy-intensive supercomputers.

While we have devoted considerable attention to the use of air travel in our survey, notably through a special bloc of questions (see next section), we have also addressed other GHG-emitting practices, such as commuting and the use of experimental equipment and IT equipment, for which it appears possible to initiate discussions and short-term actions.

The contributions of a large-scale survey

Literature review shows that most existing research is limited to specific populations, be they members of the same institution [12,27,28], discipline [3,7], department [29], or working group [11]. The homogeneity of the population studied in these cases prevents taking simultaneous account of characteristics such as status, discipline, or geographical location to measure their impact on GHG-emitting practices. Furthermore, the sample sizes are often modest.

Exceptions exist, among them a study conducted in 2017 with 1,400 scientists from a range of disciplines in several countries [30], which demonstrated that climatologists often fly more than their peers from other disciplines for occupational reasons but less for personal reasons.

The limited scope of most studies largely results from the conditions in which they are produced. Many of them are undertaken by researchers on the margins of their main research activities, as part of their own examination of their environmental impact, and/or in the context of a given institution, as a preliminary medium for implementing measures to reduce environmental impact. In short, few dedicated and wide-ranging research projects have focused on this issue.

To our knowledge, our survey is the largest ever to be conducted in terms of sample size (over 6,000 respondents) and scale, as it covers all types of status and disciplines in French research. It is also the sole sociological study of these questions and includes an array of variables for characterizing individuals, serving ultimately to understand – looking beyond discipline and status – variations in practices and opinions, as well as their determinants. Among other aspects, we take account of sex, age, seniority and career stage, occupational activity venue, number of children, living standard, awareness of environmental issues, and international aspects.

The interest of considering practices and opinions

Some of the existing research is devoted solely to practices, notably the use of air travel. Several studies have drawn on the processing of data collected by the institution funding air travel (laboratories, universities, research consortiums) to quantify its GHG emissions [10,31]. While this approach serves to accurately measure travel, it is not always able to identify the reason for travel or to put into perspective the use of air travel and knowledge of and opinions on climate issues. More broadly, these studies do not help us to understand the meaning placed by individuals in their practices or their more general opinions on climate change and the necessity, or otherwise, of implementing change.

Research on the overall population suggests a weak link between knowledge of environmental issues and practices [32,33]. This result has been verified for researchers in the environment, economics, and health based on their personal practices (personal use of air travel, consumption of meat, etc.) [34].

The questionnaire

Our survey was designed as part of Labos 1point5, an interdisciplinary collective created in March 2019 bringing together research professionals with the objective goal of reducing the environmental footprint of research activities (https://labos1point5.org/).

The survey questionnaire was disseminated online from June to December 2020, immediately after the first COVID-19 lockdown in France. To reduce any COVID-19 disruptions on occupational practices, the respondents were asked about their practices in 2019. The survey does not aim to describe changes in the world of research generated by the epidemic.

The survey is based on a questionnaire administered online using the LimeSurvey software. The aims of the questions are to:

1. Measure practices generating substantial GHG emissions, both individually and collectively (primarily transport, equipment, and energy consumption): understand their contexts and determinants, differentiate between uses according to their motives and the interest for the respondents, and identify changes in practices having already been made for environmental reasons.
2. Explore solutions and their acceptability: gather the opinions of research personnel on the transformations to be implemented in the world of research to reduce GHG emissions, based on their opinions on regulatory and organizational proposals and on reductions they deem possible at an individual level.
3. Gather the perceptions of research personnel on environmental issues, climate change and ecology in general, identify any occupational or personal commitments to ecology, and assess knowledge of GHG emissions generated by occupational practices.
4. Assess the occupational and personal situation of the respondents: identify the position of respondents in the scientific field and in their career (discipline, status, publications, funding, internationalization) and determine the social position of respondents and their household.

The questionnaire was designed to take a reasonable amount of time to complete, at around 30 minutes. To prevent excessive completion times, two sets of questions identified as more time-consuming and unlikely to be crossed in the same analysis (professional flights on the one hand, and commuting and IT equipment on the other) were put in modules. Each respondent had to answer only one of the two modules, drawn at random. To limit the risk of respondents stopping the survey at an early stage, it begins with more consensual questions on occupational activity, and ends with more potentially sensitive questions concerning

personal aspects. The questions were organized into nine groups, overviewed below (for more details, see the English translation of the questionnaire in S3 Appendix).

Position relative to the environment and research

The aim with this group of questions is to quickly identify the position and mindset of the respondents relative to climate issues and their research practices. An initial series of questions serves to identify any potential climate skeptics and measure how concerned the respondents are about climate issues. A second set of questions concerns the respondent's position as a researcher, addressing aspects such as environment-linked research themes and having forgone research topics for ecological reasons.

Individual and laboratory practices

This section seeks to measure the efforts made collectively at laboratories and individually by respondents to shrink their carbon footprint. Some of the questions address daily behaviour (such as sorting waste, buying locally, and double-sided printing) that may admittedly have only a modest effect on emissions but indicates an initial engagement.

Further questions in this section address practices that generate more emissions, including the purchase and use of IT equipment, and the use, for the personnel concerned, of experimental equipment of varying size. A table aims to assess changes in emissions in different fields over the last five years.

Transports in an occupational setting

These questions aim to identify transport practices in two areas that we can expect to have a heavy impact on the GHG emissions of research personnel: air travel (see Appendix S2) and commuting. Owing to their length, the most detailed questions in this section are organized into two separate modules posed randomly to one respondent in two. The more general questions were posed to the entire sample.

Besides precisely measuring these polluting practices, the objective is to determine the underlying reasons, such as the subjective interest in conferences or congresses abroad and obstacles to favouring the use of trains and carpooling.

Since international conferences have become an increasingly important reason for air travel in the last few decades, we ask the respondents about what value they found in their last conference abroad. For those having forgone an international trip, we seek to identify the reasons, notably environmental.

Regarding commuting, the questionnaire serves to precisely review the transport modes and times of the interviewees and identify the extent of teleworking (in the pre-lockdown period).

Use of videoconferencing

The objective of this section is to estimate the use of videoconferencing and audioconferencing (and the reluctance of using these media) as well as the effect of the lockdown on these uses and how they are perceived. We notably seek to determine whether the respondents extended their use of videoconferencing after the lockdown.

To that end, we measure the degree of use (before and after the lockdown) and the diversity of use (meetings, conferences, juries, etc.), along with changes in the personal opinion of the

respondents regarding videoconferencing. We aim to precisely determine any obstacles to extending the use of videoconferencing beyond lockdown situations.

Concrete solutions in research

This set of questions collects the opinions of respondents on solutions seen as possible and desirable for reducing GHG emissions. The questions concern individual changes (what the interviewee is willing to do) and collective changes.

Personal opinions on ecology in general

These questions aim to forge a deeper understanding of the respondents' positions on ecology in general, based among others on standard questions from the 'environmental attitudes inventory' [35], addressing how individuals feel about environmental risks, their commitment to environmental protection, their personal use of air travel, and global changes that they see as desirable or useful.

Personal activity and situation

Questions on key personal information (sex, age, status, discipline, etc.) are asked at the start of the questionnaire, other aspects being covered at the end. The questions concern variables likely to increase climate impact (particularly owing to travel), including access to extensive funding or an extremely international profile. The number of publications of the respondent, particularly in English, serves to test the existence of a relationship between the frequency of trips and the production of researchers.

Further questions help to measure the occupational situation of the respondent (career advancement, job situation, and whether the individual is at a strategic moment in their career, for example seeking a new position or promotion). Questions are asked on part-time work and sick leave to account for the fact that reduced working time likely corresponds to a reduction in GHG-emitting activities.

Questions are asked to specify the respondent's personal situation (socio-demographic variables, couple, children, income, education level of parents, etc.) with the assumption that opinions and behaviour depend in part on the socio-demographic characteristics of the individuals and on their socialization in their youth. A question on household income serves to determine living conditions and gauge whether the latter are related to occupational practices.

Lastly, information on the places of residence and work is collected to better understand commuting distances and measure differences in behaviour according to the type of area in which the individual works (Paris region, large city, average sized town). Only derived data are disseminated in the survey database (department, size of urban unit, part of the catchment area of a town, etc.).

Quiz on GHG emissions

This quiz was given on an optional basis to respondents having finished the rest of the questionnaire. The aim is to assess the respondent's understanding of how much emissions need to be reduced if we are to limit climate change and their perception of the largest sources of emissions. This information is important for testing the relationship between individual behaviour, the sense of climate urgency, and the perception of how much individual activities emit greenhouse gases.

Sample and non-response bias

Building the sample: draw and reminders

The Centre National de la Recherche Scientifique (national scientific research centre, CNRS) is the largest public-research institution in France. Working alone or together with other institutions, such as universities, the CNRS coordinates the activity of over 1,100 research laboratories across the country. Our population includes all the employees of CNRS regardless of their activity (including technical and administrative staff), as well as researchers and professors from other institutions (universities, private and public research institutes, etc.), PhD students and postdoctoral researchers, and any other type of personnel who are members of these structures.

To build a representative sample of this population, we used the CNRS directory, Labintel, which includes the 130,000 people affiliated with a CNRS unit or service. In all, it covers around half of the 250,000 public-research employees listed in 2018 in France by the Ministry of Higher Education and Research (including part-time employees; authors calculations based on [36]).

In June 2020, 30,000 email addresses were drawn at random (simple random sample) and the address holders were sent a message at the end of June asking them to respond to the questionnaire, along with a unique access link. Out of the 30,000 addresses, 4.6% generated an error when the questionnaire invitation was sent. However, it is probable that a much higher proportion of the invitations was never received, as servers do not systematically issue an error message when an email is unable to be delivered, anti-spam filters may block messages, and some email accounts are not used (notably those of non-permanent personnel, whose addresses do not appear to be systematically withdrawn or updated when they leave or change status). The quality of the survey database varies according to the status of personnel. It is excellent for paid CNRS staff, good for regular staff not paid by the CNRS, and average for other personnel, notably PhD students.

Ultimately, 6,723 people, corresponding to 23.6% of the invitations sent without error, went beyond the homepage of the questionnaire and 6,469 people (or 22.7% of invitations) completed the first page of questions. This is a relatively high response rate for a self-completed online questionnaire. The result is all the more satisfying as the respondents were notified that the time required to fill in the questionnaire was fairly long (estimated at 15 to 20 minutes on the homepage). To convince the individuals drawn to respond, in our initial message we stressed how important their participation was to fully reflect the ‘diversity of practices and opinions’ and to ‘find answers to environmental issues by reflecting the multiplicity of viewpoints’, while at the same committing to the anonymity of responses. To fully guarantee future respondents of the serious nature of the survey, we also stressed our institutional affiliations (CNRS, universities), the structure in which the questionnaire was built (Labos 1point5), and the context in which the data would be processed (a CNRS-Inrae research network, GDR).

The response rate, quite low following the initial message (10%), was improved by issuing four reminders to the people having failed to respond to the questionnaire, in July, September, October, and November. In those reminders, we reiterated the interest of the survey and reassured recipients that the message was not spam or a phishing attempt (first reminder). The third reminder proved particularly effective, the number of new responses being two and a half times higher than after the second reminder. This may be explained by the change in tone of the message, with less academic and more natural wording. The subject (‘Survey on research and climate change: your participation counts!’) and content (‘We need you to top the mark of 5,000 respondents, ensure representativeness and reflect the diversity of practices and opinions’) had been adjusted to attract the attention of the recipients, mention being made

of a ‘last-chance reminder’ and a questionnaire that would ‘soon be closed’. In addition, the email was no longer sent from an impersonal address associated with the collective (enquete@labos1point5.org), but from the institutional address of the sole woman in the design team. This personalization, and perhaps the female first name, may also have further encouraged the recipients to respond [37]. The last reminder, also more effective than the second, adopted a similar tone. Specific reminders for people having started but not finished the questionnaire were sent at the same frequency, with a supplementary reminder at the end of November.

The relevance of this series of reminders was reflected in the fact that most responses were obtained on the day that each message was sent (nearly 80%), this trend having clearly accentuated over time.

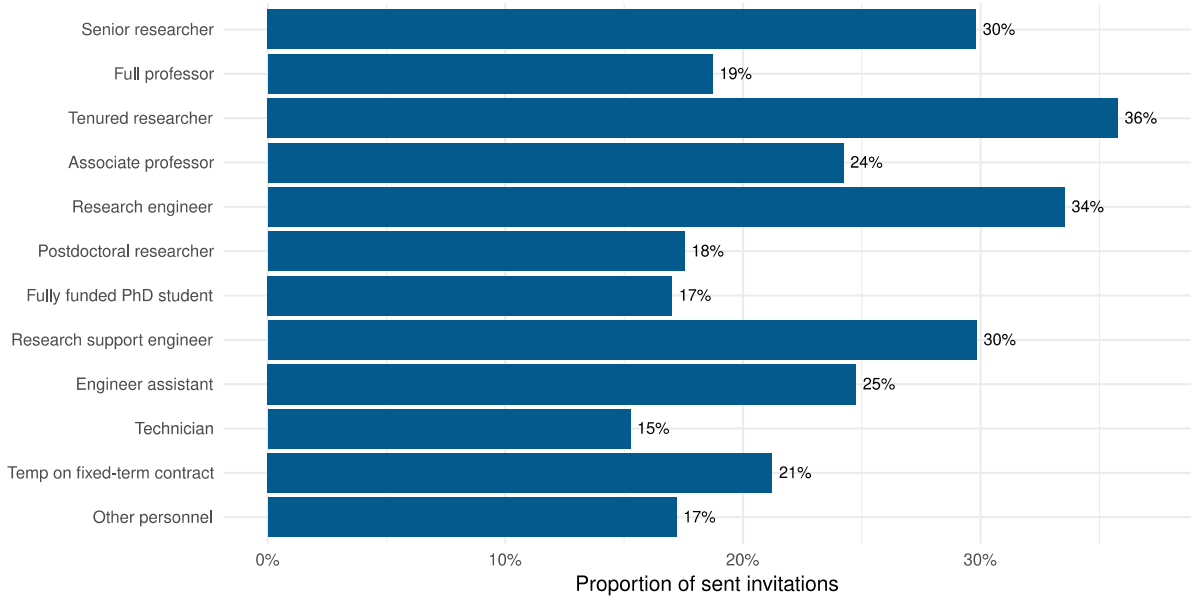
Despite the long response time (median of 28 minutes and average of 40 minutes for those reaching the last page and excluding those having responded over several days), few respondents gave up along the way (15%). The good response rate for a self-completed online questionnaire, along with the low abandon rate, likely reflect both an interest in the topic from research personnel and the successful design of the online questionnaire, which was tested on numerous people before the survey was publicly launched.

Response rate by status and discipline

The information available in the CNRS directory can be used to calculate the response rates, which vary according to status, discipline, and sex. We will focus here on the response to the first page of the questionnaire. Regarding status, researchers, research engineers and research support engineers stood apart with a response rate of 30% to 36%, while just 17% of fully funded PhD students, 15% of technicians, and 17% of other personnel responded (Fig 1). The response rate of non-permanent personnel was probably under-estimated given that the information concerning them in the database is not always up to date.

These differences also applied in terms of discipline (approached by CNRS institutes), the response rate standing at 31% for personnel working in earth sciences, astronomy, and astrophysics, 26% to 28% for physics and ecology personnel, and 20% to 21% for personnel in the human and social sciences, chemistry, biology, and information and engineering sciences (Fig 2). Women responded slightly more than men (25% and 22%), which can be attributed to their greater sensitivity to ecology [38]. The trends indicated here using raw percentages are confirmed when estimating a logistic regression controlling for these three variables and the region (see section 1.1 in S1 Appendix).

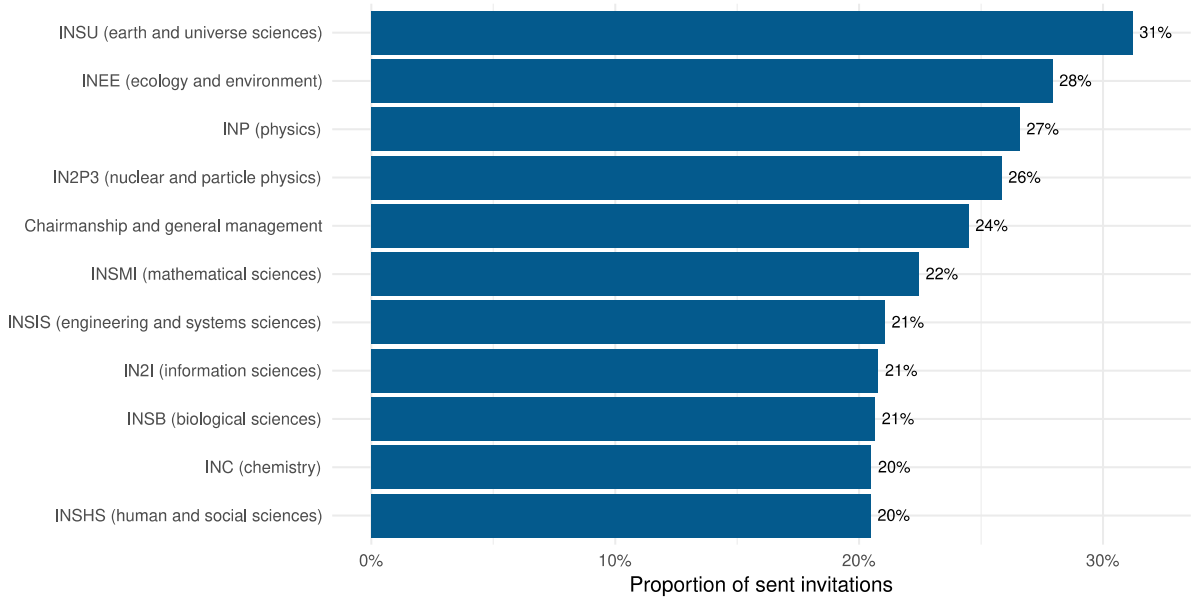
Fig 1. Response rate to the first page of the questionnaire by respondent status



Several tenure statuses exist in France for personnel carrying out research at a public education and/or research institution. Researchers perform this activity on a full-time basis, while professors devote half of their working hours to teaching.

See S4 Appendix for the French version of statuses. The CNRS directory uses a slightly less precise set of statuses than the one used in the survey questionnaire.

Fig 2. Response rate to the first page of the questionnaire by respondents' disciplinary institute at CNRS



Differences between early and late respondents

One method of analyzing non-response biases consists in examining the trend over time in the characteristics of respondents. This aspect has been analyzed in several studies (for example, [39–42]). By identifying who participated in the survey at a later stage, after several reminders, we can attempt to understand who did not respond. The underlying reasoning is that late respondents would have been non-respondents if reminders had not been sent [42].

By means of a question on how concerned the respondent is about climate change, we can note that more early respondents than late respondents say they are 'Extremely concerned' by climate change (33% of respondents before the first reminder compared with 27% after the last reminder). More early respondents say they 'strongly agree' that a major ecological catastrophe is going to occur (61% compared with 50% after the last reminder). More early respondents had also carried out a carbon assessment. The greater concern for the environment on the part of early respondents is also reflected in a greater propensity to fully complete the questionnaire, which appears to suggest that they are more motivated to respond to the survey. The phenomenon of late respondents providing more incomplete data has already been identified in other surveys [43,44].

Overall, early respondents are more in favour than late respondents of introducing regulatory constraints to protect the environment (respectively, 47% and 40% 'strongly agree'). The former are also more inclined to think that we need to protect the environment more than economic growth (58% versus 47%). Concerning research specifically, early respondents think more often that this sector should set an example in terms of reducing GHG emissions (50% vs 42%). Early respondents are more inclined to consider many of the collective solutions proposed in the questionnaire as a priority, such as limiting air travel (56% vs 51%), reducing the weight of international conferences in career assessments, funding train tickets (64% vs 56%), and integrating GHG emissions into project-funding criteria.

But the distinction between early and late respondents is not systematic, whether in terms of opinions or ecological commitment. Only a small percentage of both groups think it is pointless to take steps to protect the environment if others fail to do so. They also share the same opinion on taking ecology into account when voting or joining or donating to an environmental protection organization. Members of each of the two groups are divided regarding the ability of more and better technology to solve environmental problems.

These observations are valid when controlled for age, sex, discipline, and status (see linear regression results in section 1.2 of S1 Appendix). Age is one of the characteristics with the greatest impact on response time. The youngest individuals required a half reminder message less than the oldest individuals. Differences between disciplines are slighter and, for the most part, not statistically significant. Differences in status could in part be related to differential variations in the workload over time, as occupations with the fastest response times at the end of the university year were not the same in the back-to-school period.

Lastly, a set of indicators suggests that the individuals most engaged in their work environment or those feeling the happiest about their work are more inclined to respond. The individuals with the fastest response times work less on a part-time basis and have had more work published in the last three years. They also see themselves more as being in a moment in their career in which they are seeking to be promoted, recruited or tenured, and consider that they are paid better. In a further observation, non-French nationals respond later to the questionnaire.

Comparison with other surveys

A final method for assessing non-response biases is to compare our survey with others that have no reason to suffer from the same bias. This is true of the 'Styles de vie et environnement' (lifestyles and environment) survey based on the ELIPSS panel, which is a random sample panel of individuals living in France who have committed to respond to a broad variety of subjects, not limited to ecology. 90% of individuals with higher-level occupations in the civil service said they were somewhat or very concerned by climate change (compared with 93% in our survey, including when considering solely the sub-sample of higher-level occupations). 42% of them strongly agree with the statement, 'If things continue at the current pace, we will soon experience a major ecological catastrophe' (compared with 59% in our survey). These comparisons do not appear to reveal a major bias in our survey, as the latter difference could reflect, at least in part, a real difference between individuals with higher-level occupations in the civil service in general and researchers in particular, who as scientists are potentially more familiar with ecological issues.

Another survey, administered in spring 2020 among European demography researchers [45], may also be used as a reference as ecology was not its main theme. 91% of respondents said they were somewhat, very, or extremely concerned by climate change and 69% very or extremely concerned. These figures are very close to those obtained in our survey (93% and 71%, respectively, and 97% and 82% for researchers in sociology and demography).

Results

Consensus on the gravity of climate issues

A strong consensus exists on the reality, causes, and consequences of climate change among French research personnel. 99% of the respondents think that 'the climate of the planet is changing' and 95% think that human activity plays a major role in, or is the only cause of, climate change (Table 1). This result can be compared with the fact that 80% of French people think that 'global warming is caused by human activity' and just 66% of them consider that climate change is a certainty for most scientists [46].

This consensus on the reality of the situation and the underlying reasons is accompanied by an equally unanimous sense of concern. A full 99% of the respondents say they are concerned about climate change, 72% of them very or extremely concerned (including 32% extremely concerned). The concern of research personnel observed in our survey has increased in the last few years, with 80% of respondents saying they are more concerned than five years ago (including 45% much more concerned). And regarding the consequences of global warming, 90% of the respondents agree with the statement, 'If things continue on their present course, we will soon experience a major ecological catastrophe'. 74% of them even think that 'this type of catastrophe could cause a collapse of our societies'.

This vision of reality and the concerns of the respondents come hand in hand with a widely held expectation for changes in practices in their occupational activity. A full 88% of the respondents say they agree with the statement, 'Climate urgency calls for profound changes in the practice of our professions' (47% saying they strongly agree). This strong desire for change is confirmed when the question is asked in a more concrete fashion, referring to the objective in France's Low-Carbon Strategy on a one-third reduction in GHG emissions by 2030. A full 91% of respondents agree with the objective of reducing carbon emissions from research by one-third by 2030. And 48% even want to set an example by reducing them by more than one-third.

Opinions on climate change differ little from one discipline to the next. In general, there are no more than five percentage points of variation from the average between disciplines. All disciplines agree on the certainty of climate change, the role played by human activities in that change, and the demand for radical changes in our professions. However, individuals in some disciplines, such as physics, chemistry, medical research, and biology, are less convinced that research should set an example in the reduction of GHG emissions (around 40% compared with an average for all disciplines of 48%). In contrast, oceanographers, meteorologists, environmental physicists, population biologists, and ecologists are more firmly convinced that the situation is urgent and action needs to be taken.

The status of personnel plays an important role in the responses. Surprisingly, while PhD-level positions (including PhD students) are more concerned about climate change than support staff, the latter are more willing to change research conditions to reduce GHG emissions. Just 62% of research support assistants say they are very or extremely concerned about climate change, compared with 76% of researchers. Conversely, 48% of research support engineers strongly agree with the idea that climate change calls for profound changes in our professions, compared with 40% of senior researchers or full professors.

Table 1. Opinions regarding climate and ecological issues

Do you think the climate of the planet is changing (rise in temperatures in the last century)?							
	Yes, definitely	Yes, probably	No, probably not	Non, definitely not	No opinion	Total	
Frequency	5756	535	18	6	31	6346	
%	91	8	0	0	0	100	
To what degree are you concerned about climate change?							
	Extremely concerned	Very concerned	Somewhat concerned	Slightly concerned	Not at all concerned	No opinion	Total
Frequency	1994	2534	1335	367	60	52	6342
%	31	40	21	6	1	1	100
Are you more or less concerned than 5 years ago?							
	Much more	Somewhat more	Neither more nor less	Somewhat less	Much less	No opinion	Total
Frequency	2806	2254	1069	96	42	20	6287
%	45	36	17	2	1	0	100

In your opinion, are human activities the cause of this climate change?							
	Yes, they are the only cause	Yes, they play a major role	Yes, they play a small role	No, they play no role	No opinion	Total	
Frequency	1159	4871	197	9	46	6282	
%	18	78	3	0	1	100	
Do you think that climate urgency calls for profound changes in the practice of our professions?							
	Yes, strongly agree	Yes, somewhat agree	No, somewhat disagree	No, strongly disagree	No opinion	Total	
Frequency	2996	2594	397	107	247	6341	
%	47	41	6	2	4	100	
If things continue on their present course, we will soon experience a major ecological catastrophe							
	Yes, strongly agree	Yes, somewhat agree	No, somewhat disagree	No, strongly disagree	No opinion	Total	
Frequency	3337	1788	198	97	265	5685	
%	59	31	3	2	5	100	
This type of catastrophe could cause a collapse of our societies: the basic needs (food, energy, health, etc.) will no longer be assured for the majority of the population							
	Yes, strongly agree	Yes, somewhat agree	No, somewhat disagree	No, strongly disagree	No opinion	Total	
Frequency	2045	2105	489	361	605	5605	
%	36	38	9	6	11	100	
France has committed to reducing its greenhouse gas emissions by one third by 2030. In this respect, do you think that public research must reduce its emissions by							
	More than one-third	Around one-third	More than one-third	Total			
Frequency	2717	2423	495	5635			
%	48	43	9	100			

High-emissions practices: air travel and IT equipment

The respondents agree on the climate situation and share the same concerns. But the practices and habits of the research sector emit substantial amounts of greenhouse gases, notably through air travel, experimental equipment, buildings and infrastructure, IT equipment and its renewal, and receptions at conferences. To explore how research personnel aim to reduce these emissions, and to understand any reticence on their part, we need to know how much greenhouse gas is emitted and why, as emissions levels and reasons differ according to discipline and status. To that end, we will focus on two sources of emissions: air travel and IT equipment.

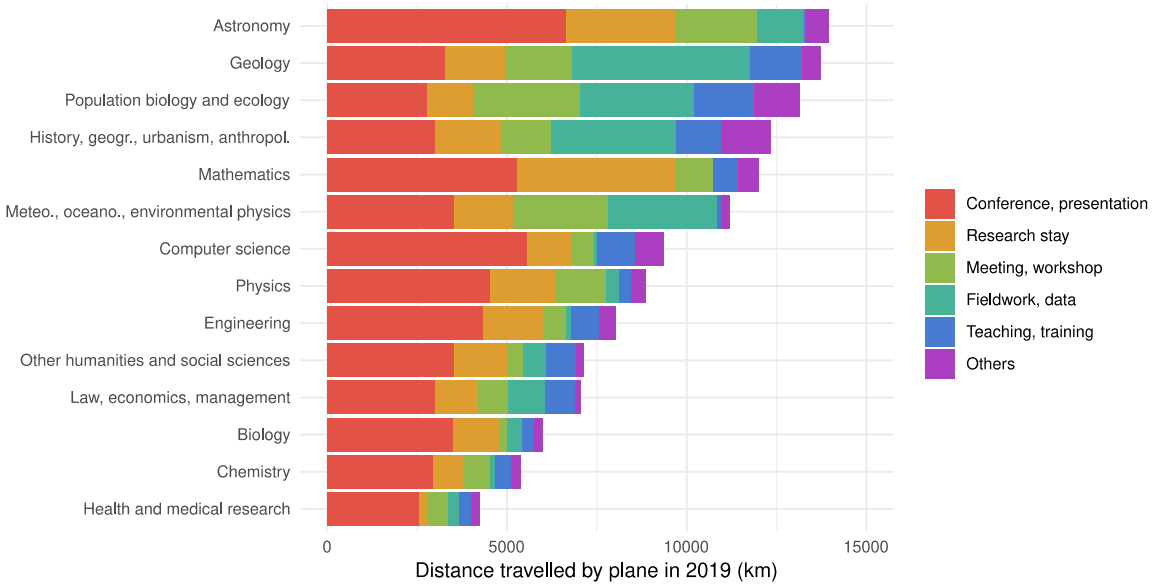
Excluding the research sector and at global level, the GHG emissions generated by air travel result from a minority of individuals (11% of the world population took a plane in 2018, 4% for an international flight), which explains in part why they account for just 2% of worldwide emissions [47]. But air travel is a widespread practice in research, constituting the sector's number-one source of emissions (see above).

Professional travel is part and parcel of today's research work, notably for conferences abroad, fieldwork or observations in distant countries, research stays, teaching, and participation on juries or in international research programmes. As they are faster than trains, sometimes cheaper, and can be used to travel to far-flung destinations, planes are often the preferred means of transport for research personnel. As research support personnel have more modest travel requirements, we are limiting our analysis here to PhD-level positions (including PhD students), who account for 77% of our sample.

58% of PhD-level respondents travelled by plane for professional reasons in 2019. By way of comparison, in France in 2017, one person in five with an occupation of the same level travelled by plane at least once for professional reasons; this was the case for individuals with higher-level occupations in the civil service and similar sectors (teachers and artistic occupations) and for individuals with higher-level occupations in the private sector. Yet these are the professions that fly the most, and by far, as only 7% of the economically active population flying for professional reasons in the same year ('Styles de vie et environnement' survey, ELIPSS 2017, processed by the authors). Research personnel, then, are heavy users of air travel. On average, they flew 9,000 km in the year preceding the survey, emitting approximately 2 tonnes of CO_2e, and those having flown at least once travelled 15,500 km (the method for calculating distances and GHG emissions is detailed in S2 Appendix).

But the use of air travel varies considerably according to academic discipline. In some disciplines, where air travel is common, a researcher flies an average 10,000 km to 15,000 km a year (Fig 3). This is the case for astronomy, geology, anthropology, and mathematics, as well as for some disciplines focused on research on the environment and climate, which explains why researchers in the latter two fields were the first to question themselves on their paradoxical use of air travel [1]. Air travel is less frequent in other disciplines such as biology, chemistry, the human sciences, and medical research, the distance traveled being three times lower on average.

Fig 3. Distance traveled by plane in 2019 by discipline of respondents

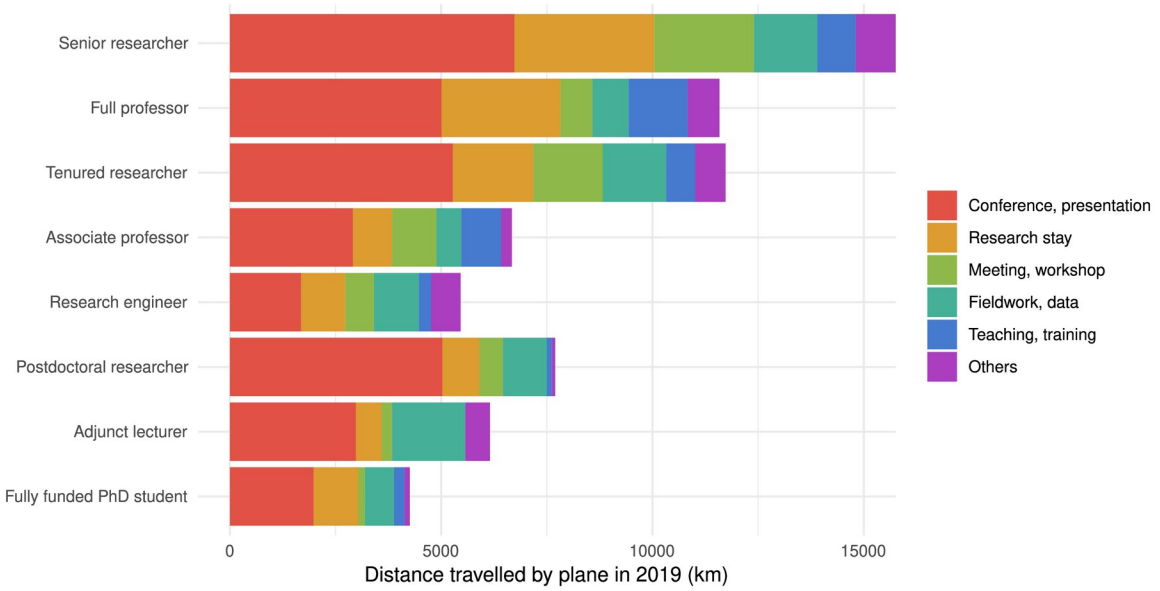


These differences in the use of air travel do not simply concern its intensity. Depending on the discipline, professionals do not fly for the same reasons. Geologists travel extensively for field studies, the production and collection of data, or research stays, but not so much to attend conferences. In contrast, astrophysicists, though flying as much as anthropologists, do so twice as less for data but twice as much for conferences. That being so, whether the individual belongs to a discipline that makes little or extensive use of air travel or to a discipline in which empirical activity requires them to fly or not to fly, in almost all cases conferences are the main reason for air travel. They account for roughly 40% of the distance travelled by all respondents. Data production and collection (11% of the total distance) and research stays (18%) account for far fewer flights.

Naturally, such variations exist not just between disciplines but between different statuses. Research personnel travel more as their careers advance (Fig 4), which confirms results in the literature and generalizes them to multiple disciplines and institutions [7,12,28,30]. Also, researchers travel more than professors, the latter devoting half of their work time to teaching. While senior researchers fly an average 15,000 km a year, full professors fly only slightly over 10,000 km. Tenured researchers fly an average 10,000 km a year, associate professors around 7,000 km, and research engineers 5,500 km. Among young researchers, postdoctoral researchers travel nearly 8,000 km by air a year, twice as much as fully funded PhD students, with adjunct lecturers falling in between.

The reasons for air travel are fundamentally similar across statuses. While air travel distances differ, the reasons for flying vary relatively little. 40% to 50% of the air travel of the respondents is for conferences, apart from research engineers, who travel much less for this reason, and postdoctoral researchers, who travel much more for it. Research engineers, PhD students and adjunct lecturers devote a larger proportion of their flying distances to fieldwork and data. Conversely, the distance travelled for research stays increases as individuals advance in their careers, with the exception of PhD students who are the status with the highest proportion of distances flown for this motive. Logically, air travel for teaching concerns professors (both associated and full) more than other statuses.

Fig 4. Distance traveled by plane in 2019 by status of respondents



See S4 Appendix for the correspondence with French statuses.

IT equipment is another major source of the GHG emissions and, more broadly, the pollution of the research sector. This equipment emits less pollution than air travel, the functioning of buildings, and heavy scientific equipment used in some disciplines, but it is interesting because it concerns all disciplines and may be measured relatively reliably through an individual questionnaire. It is also a field in which emissions reduction initiatives may potentially be implemented as regards the frequency of equipment replacements, without necessarily impacting core research activities.

To estimate the environmental cost, and notably the GHG emissions of IT, the focus is often placed exclusively on the energy consumed by equipment use. Yet the lifecycle ('cradle to grave') of the equipment also needs to be considered. The production of IT equipment accounts for over half of the total GHG emissions [48] and consumes extensive resources, notably rare-earth metals. In addition, IT equipment produces a substantial quantity of hazardous waste at end of life (waste electrical and electronic equipment, or WEEE), which is complex and costly to recycle.

To give an idea of scale, over its life cycle, a laptop emits approximately 150 kg of CO_2e, a desktop computer 200 kg, a high-performance computer 400 kg, and a 21.5-inch screen 250 kg [48]. Lengthening the lifespan of equipment would sharply reduce the corresponding emissions.

Our survey shows that most research personnel are equipped with IT devices (a computer or tablet purchased with professional financing) under five years old (62% of respondents). More importantly, 42% of the respondents have several devices, and among the latter 40% (or 17% of the total sample) consider that some of those devices are not indispensable. This suggests that there is some scope for reducing the emissions generated by IT equipment, through the more frugal management of devices.

Major differences are observed between disciplines and statuses. The share of respondents with a device aged under five years old is higher in the natural sciences, mathematics, and computer science (between 60% and 73%) than in humanities and social sciences (47% to 55%). The same trend is observed regarding the proportion of respondents with several devices. The share of respondents considering that all these devices are not indispensable

varies little from one discipline to the next. Lastly, and unsurprisingly, the number and recentness of devices increases in step with professional status (30% of adjunct lecturers have a device aged under five years old compared with 69% of senior researchers). The same trend can thus be observed as with air travel.

The fact that personnel possess devices that they do not consider as indispensable can be attributed in part to project-based research funding, which may lead to expenditure of questionable usefulness to use up any credits that have not been spent before the end of the contract. 60% of the respondents say they have already had some leftover money to spend. Of this 60%, 35% say they had already used leftover money to buy IT equipment that was not indispensable.

However, only 6% of the respondents concerned report having used leftover budget money to buy plane tickets considered as non-essential. Air transport emissions being particularly high, the GHG emissions of this expenditure, seen as non-essential, may nevertheless be substantial. These results underscore some of the perverse effects of funding research on a project-by-project basis or via non-extendable annualized credits. They call at the very least for new mechanisms enabling personnel to use the funds granted in a manner that they see as more productive for their research.

Scientific community willing to change practices

So what needs to be done? How is this strong ecological sensibility reflected in the perceptions research personnel have of their profession? What do they see as the necessary changes required for reducing the GHG emissions of their research activity?

Several questions serve to identify the fields (air travels, experiments, etc.) in which respondents are willing to make the effort to reduce their emissions by 2030 and those in which they are less inclined to do so. Since the time horizon calls for medium-term planning, questions concerning individual efforts were asked only to permanent personnel. However, more general questions, with no specified time frame, and regarding the solutions to be rolled out and the risks involved, were asked to all the respondents.

Regardless of the field, most respondents say they are willing to reduce their emissions by at least one-third by 2030 (Fig 5). This is particularly true concerning air travel for conferences and IT equipment, with just 2% and 7%, respectively, of the respondents saying they are opposed to reducing the related emissions. And while a few variations were observed depending on status and discipline, the percentage remains under 10% in almost all cases (results detailed in S1 Appendix).

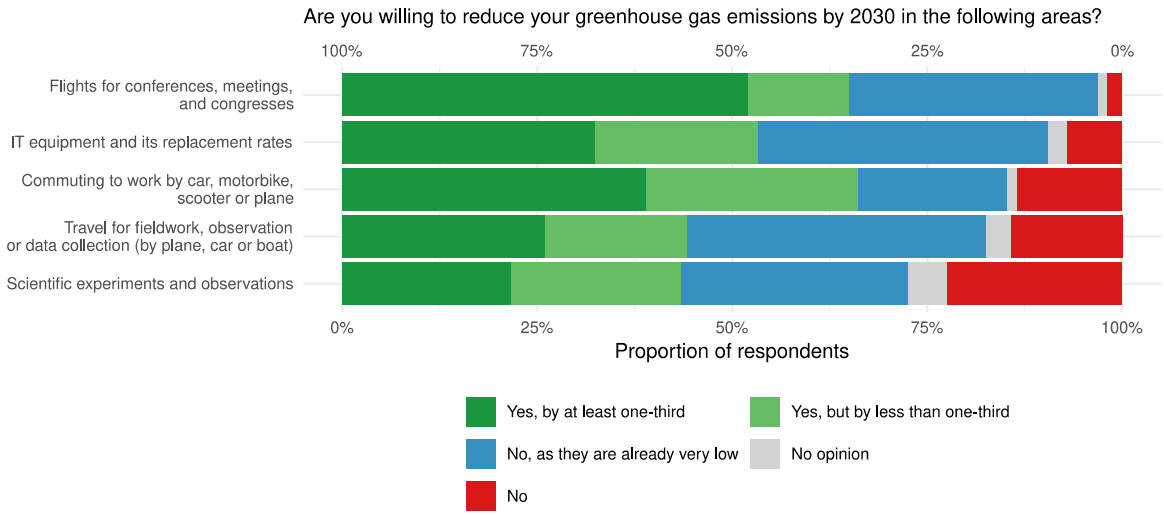
Opposition is stronger for changes regarding core research activities. 14% of concerned respondents are opposed to reducing emissions stemming from travel for fieldwork, observation, and data collection. Similarly, nearly one-quarter are against reducing the emissions generated by scientific experiments and observations. This reluctance is even stronger concerning the concrete means for achieving these reductions, being expressed by 42% of the sample when envisioning a reduction in their use of equipment for experiments and observations.

A willingness to limit emissions does not imply that one believes it is without consequences or without danger. We asked the respondents to assess the risks that could be involved in the reduction of professional air travel (regardless of the reason) and the reduction of emissions generated by experimental equipment in the next ten years.

While the respondents are globally in favour of a reduction in professional air travel, many of them say it could engender some of the risks we presented to them and that these risks are problematic. For example, many of the respondents (54%) are afraid that it poses a risk to the professional integration of young researchers. In something of a paradox, this fear is

expressed slightly more by people further along in their careers than the young researchers themselves. Many of the respondents (44%) are also afraid that this could increase bureaucracy. Further concerns among the respondents are that initiatives to reduce emissions could harm the dissemination of their work (36%) and isolate French research from the rest of the world (43%), the latter being more of an issue for researchers and professors for PhD students, postdoctoral researchers, adjunct lecturers, and support staff. Fears that these actions could hinder access to funding (16%) and eliminate some of the advantages of the profession (like travelling and discovering other countries...) (11%) are less frequent. Regarding this last point, most respondents think that cutting down on air travel will eat away at what they see as the innate advantages of the profession, but that this does not pose a problem. This result can be interpreted as a sign of willingness consistent with the strong convictions in favour of the climate expressed in response to the other questions.

Fig 5. Willingness to reduce GHG emissions by 2030 in various areas



The proportion of respondents concerned varies according to the question.

These risks affect the functioning of research as currently organized (career paths, administrative and financial framework, etc.). But what about when the measures suggested in the questionnaire affect the scientific approach in itself (data production, experiments, etc.)?

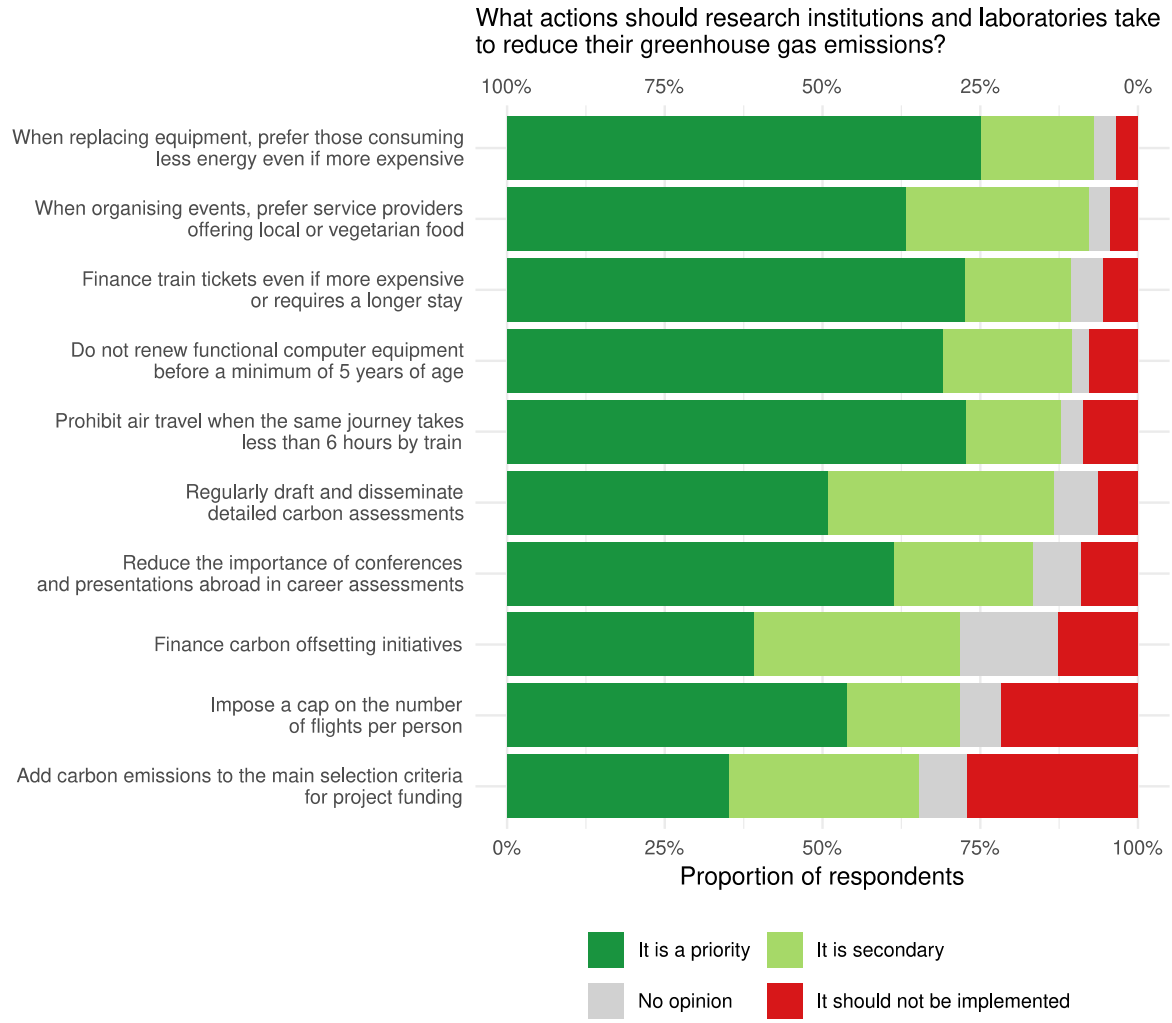
Surprisingly, very few respondents (18%) are worried about the harmful impact of the reduction of professional air travel on the quality of scientific work. The level of concern in this respect varies substantially according to the discipline, with no relation to the distance traveled. However, of the half of the respondents who use air travel to access some field sites or to collect/produce some data, many (47%) think that implementing a policy on the reduction of air travel would hinder them in this regard and that it is a problem. This risk is seen as greater in disciplines where it is common to travel long distances by plane to produce or collect data (this is the case for 72% of historians, geographers, urbanists and anthropologists, 73 % of geologists and 61 % of population biologists and ecologists).

Generally speaking, where the empirical approach, data and experiments are affected, the respondents are more concerned about the risks associated with a decrease in emissions, which is consistent with their being less willing to reduce their emissions in these areas. When we suggested to respondents using experimental and observation equipment (60% of the sample) that they reduce the emissions generated by this equipment, half of them said it would probably impact the quality of their work. Much mention is also made of the risks

stemming from competition-based research, with 44% of respondents fearing that it would set them back relative to rival teams, 33% that it would reduce their access to funding, and 29% that it would lead to a decline in their number of publications.

These fears being so, what type of collective solutions should be implemented? A large majority of the respondents agree with the solutions suggested in the questionnaire (Fig 6). Almost all the respondents agree with the measures providing simply for a review (carbon assessment) or those coming at no cost for institutions, such as financing train travel where more expensive than plane travel, preferring to buy energy-efficient equipment even where more expensive, and funding carbon offsetting initiatives. Even measures that transform some career organization aspects are accepted by most respondents, as are others having a greater impact on the daily lives of the respondents. These include favouring local or vegetarian food stands, not replacing IT equipment before five years, and prohibiting air travel for journeys that take under six hours by train. Ultimately, the respondents express relatively strong opposition to just two measures: capping the number of flights per person (22%) and integrating carbon emissions into the selection criteria when financing projects (28%). These two initiatives, among the most radical, may for some disciplines impact the core of scientific data production.

Fig 6. Support to institutional actions to reduce GHG emissions



Conclusion

Our survey highlights three results. First, members of the scientific community are acutely aware of environmental issues. Second, they are willing to implement change. And third, there is a substantial divide between these attitudes and practices emitting large quantities of greenhouse gas. In today's post-health crisis environment, many research personnel have already tried out new working methods, particularly with the unprecedented increase in the use of videoconferencing [49]. A mere 8% of our respondents used videoconferencing several times a week before the lockdowns; 72% of them did so during the lockdowns. Most importantly, 68% of the respondents said they had a more positive image of videoconferencing following their lockdown experience despite the particularly trying situation and a lack of preparation. This result shows that new work organization methods acceptable to personnel may be implemented quickly where collective action is taken. More broadly, the pandemic demonstrated that individuals and organizations alike were able, when faced with a threat, to radically change their way of working. The lessons of the pandemic should inspire us to rethink the way research works [50].

The key now is for institutions to drive and support profound change to fight against climate change. The scientific community is ready to make these changes but, for now, its members are unable to implement them individually without running the risk of being negatively impacted owing to the way the research sector operates (promotion of mobility in career assessments, project-by-project funding, competition, etc.). Failing this institutional action, the necessary changes will not take place [51].

As an occupation with a highly developed awareness of climate issues, and one that generates high levels of greenhouse gas emissions, the research community is currently facing regulatory issues that all sectors will soon have to deal with.

Acknowledgments

We would like to thank all the members of the Labos 1point5 collective whose suggestions helped improve the questionnaire, as well as all the volunteers who tested it. Support from the CNRS was also key to the success of the survey.

References

1. Grémillet D. Paradox of flying to meetings to protect the environment. Nature. 2008;455: 1175. doi:10.1038/4551175a
2. Kevin Anderson. Hypocrites in the air: should climate change academics lead by example? In: Comment on climate [Internet]. 12 Apr 2013 [cited 21 Jul 2020]. Available: http://kevinanderson.info/blog/hypocrites-in-the-air-should-climate-change-academics-lead-by-example/
3. Fox HE, Kareiva P, Silliman B, Hitt J, Lytle DA, Halpern BS, et al. Why do we fly? Ecologists's sins of emission. Front Ecol Environ. 2009;7: 294. doi:10.1890/09.WB.019
4. Spinellis D, Louridas P. The carbon footprint of conference papers. PLOS One. 2013;8: 1–8. doi:10/ggbs2j
5. Le Quéré C, Capstick S, Corner A, Cutting D, Johnson M, Minns A, et al. Towards a culture of low-carbon research for the 21st Century. Tyndall Center for Climate Change Research; 2015 Mar. Report No.: 161. Available: https://tyndall.ac.uk/sites/default/files/twp161.pdf
6. Nevins J. Academic Jet-Setting in a Time of Climate Destabilization: Ecological Privilege and Professional Geographic Travel. Prof Geogr. 2014;66. doi:10.1080/00330124.2013.784954
7. Stevens ARH, Bellstedt S, Elahi PJ, Murphy MT. The imperative to reduce carbon

emissions in astronomy. ArXiv191205834 Astro-Ph. 2020 [cited 30 Jun 2020]. Available: http://arxiv.org/abs/1912.05834
8. Passalacqua A. The carbon footprint of a scientific community: A survey of the historians of mobility and their normalized yet abundant reliance on air travel. J Transp Hist. 2021;42: 121–141. doi:10.1177/0022526620985073
9. Kjellman SE. As a climate researcher, should I change my air-travel habits? Nature. 2019 [cited 21 Jul 2020]. doi:10.1038/d41586-019-01652-2
10. Waring T, Teisl M, Manandhar E, Anderson M. On the Travel Emissions of Sustainability Science Research. Sustainability. 2014;6: 2718–2735. doi:10.3390/su6052718
11. Quéré CL, Capstick S, Corner A, Cutting D, Johnson M, Minns A, et al. Towards a culture of low-carbon research for the 21stCentury. 2015. Available: https://tyndall.ac.uk/sites/default/files/twp161.pdf
12. Ciers J, Mandic A, Toth LD, Op 't Veld G. Carbon Footprint of Academic Air Travel: A Case Study in Switzerland. Sustainability. 2019;11: 80. doi:10.3390/su11010080
13. ETH Zürich. Flugreisen Studierender an der ETH Zürich 2006 und 2015. Resultate, Methodik und Diskussion. Zürich; 2017 Oct. Available: https://ethz.ch/content/dam/ethz/associates/services/organisation/Schulleitung/mobilitaetsplattform/Report%20Studierendenreisen%20ETH%20Z%C3%BCrich%202006%20und%202015.pdf
14. Howes L. Can Laboratories Move Away from Single-Use Plastic? ACS Cent Sci. 2019;5: 1904–1906. doi:10.1021/acscentsci.9b01249
15. Madhusoodanan J. What can you do to make your lab greener? Nature. 2020;581: 228–229. doi:10.1038/d41586-020-01368-8
16. Choi YJ, Oh M, Kang J, Lutzenhiser L. Plans and Living Practices for the Green Campus of Portland State University. Sustainability. 2017. doi:10.3390/su9020252
17. Glover A, Strengers Y, Lewis T. The unsustainability of academic aeromobility in Australian universities. Sustain Sci Pract Policy. 2017;13: 1–12. doi:10.1080/15487733.2017.1388620
18. Wynes S, Donner SD. Addressing greenhouse gas emissions from business-related air travel at public institutions: a case study of the University of British Columbia. Victoria: Pacific Institute for Climate Solutions; 2018 Jul. Available: pics.uvic.ca/sites/default/files/AirTravelWP_FINAL.pdf
19. Hischier R, Hilty L. Environmental impacts of an international conference. Environ Impact Assess Rev. 2002;22: 543–557. doi:10.1016/S0195-9255(02)00027-6
20. Desiere S. The Carbon Footprint of Academic Conferences: Evidence from the 14th EAAE Congress in Slovenia. EuroChoices. 2016;15: 56–61. doi:10.1111/1746-692X.12106
21. Vandepaer L. Environmental footprint Sustainable Summits Conference 2018. Chamonix-Mont-Blanc; 2018. doi:10.13140/RG.2.2.26703.53929
22. Astudillo MF, AzariJafari H. Estimating the global warming emissions of the LCAXVII conference: connecting flights matter. Int J Life Cycle Assess. 2018;23: 1512–1516. doi:10.1007/s11367-018-1479-z
23. European Union. 2030 climate & energy framework. 2021 [cited 8 Dec 2021]. Available: https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2030-climate-energy-framework_en
24. Klöwer M, Hopkins D, Allen M, Higham J. An analysis of ways to decarbonize conference travel after COVID-19. Nature. 2020;583: 356–359. doi:10.1038/d41586-020-02057-2
25. Achten WMJ, Almeida J, Muys B. Carbon footprint of science: More than flying. Ecol Indic. 2013;34: 352–355. doi:10.1016/j.ecolind.2013.05.025
26. Song G, Che L, Zhang S. Carbon footprint of a scientific publication: A case study at Dalian University of Technology, China. Ecol Indic. 2016;60: 275–282. doi:10/f75dj2
27. Storme T, Beaverstock JV, Derrudder B, Faulconbridge JR, Witlox F. How to cope with mobility expectations in academia: Individual travel strategies of tenured academics at Ghent University, Flanders. Res Transp Bus Manag. 2013;9: 12–20.

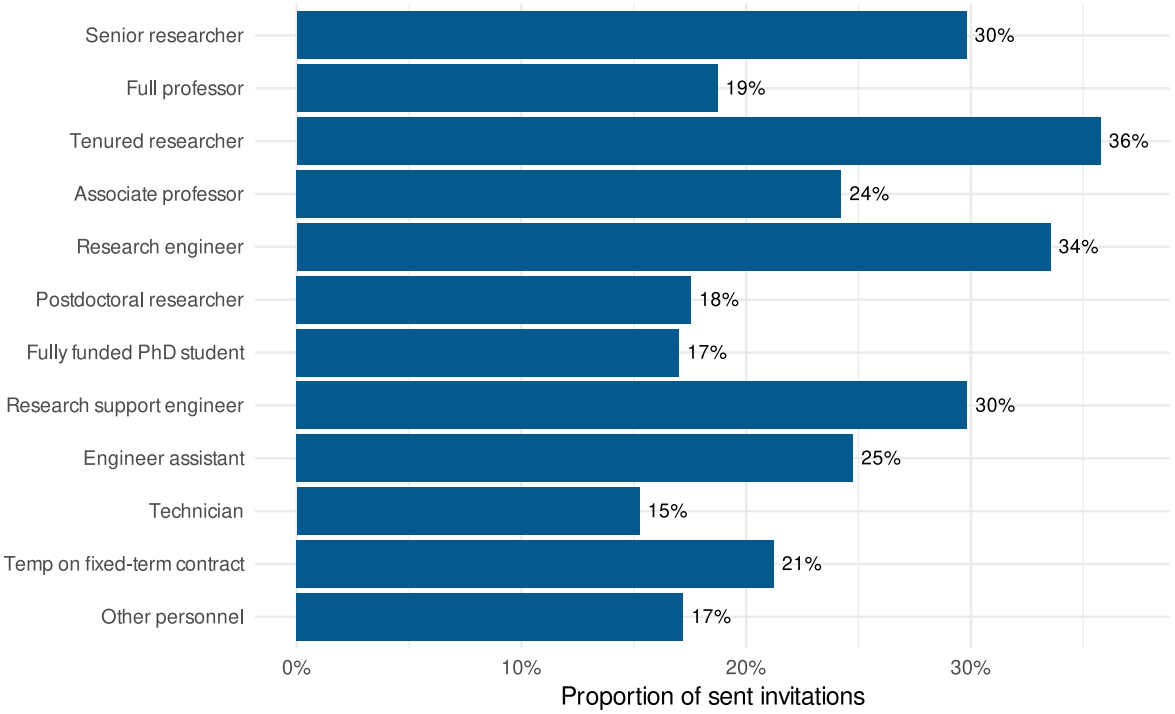
doi:10.1016/j.rtbm.2013.05.004
28. Wynes S, Donner SD, Tannason S, Nabors N. Academic air travel has a limited influence on professional success. J Clean Prod. 2019;226: 959–967. doi:10.1016/j.jclepro.2019.04.109
29. Cluzel F, Vallet F, Leroy Y, Rebours P. Reflecting on the environmental impact of research activities: an exploratory study. Procedia CIRP. 2020;90: 754–758. doi:10.1016/j.procir.2020.01.129
30. Whitmarsh L, Capstick S, Moore I, Köhler J, Le Quéré C. Use of aviation by climate change researchers: Structural influences, personal attitudes, and information provision. Glob Environ Change. 2020;65: 102184. doi:10.1016/j.gloenvcha.2020.102184
31. Stohl A. The travel-related carbon dioxide emissions of atmospheric researchers. Atmospheric Chem Phys. 2008;8: 6499–6504. doi:10.5194/acp-8-6499-2008
32. Howarth C, Waterson B, Mcdonald M. Public understanding of climate change and the gaps between knowledge, attitudes and travel behavior. Transportation Research Board 88th Annual Meeting. Washington DC; 2009. Available: https://www.researchgate.net/publication/313211885_Public_understanding_of_climate_change_and_the_gaps_between_knowledge_attitudes_and_travel_behavior
33. Alcock I, White MP, Taylor T, Coldwell DF, Gribble MO, Evans KL, et al. 'Green' on the ground but not in the air: Pro-environmental attitudes are related to household behaviours but not discretionary air travel. Glob Environ Change. 2017;42: 136–147. doi:10.1016/j.gloenvcha.2016.11.005
34. Balmford A, Cole L, Sandbrook C, Fisher B. The environmental footprints of conservationists, economists and medics compared. Biol Conserv. 2017;214: 260–269. doi:10.1016/j.biocon.2017.07.035
35. Milfont TL, Duckitt J. The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. J Environ Psychol. 2010;30: 80–94. doi:10.1016/j.jenvp.2009.09.001
36. SIES. L'état de l'emploi scientifique en France. Paris: Ministère de l'Enseignement supérieur, de la recherche et de l'innovation; 2020. Available: https://www.enseignementsup-recherche.gouv.fr/cid154848/l-etat-de-l-emploi-scientifique-en-france-edition-2020.html
37. Fan W, Yan Z. Factors affecting response rates of the web survey: A systematic review. Comput Hum Behav. 2010;26: 132–139. doi:10.1016/j.chb.2009.10.015
38. Pearson A, Ballew MT, Naiman S, Schuldt JP. Race, class, gender and climate change communication. Oxf Encycl Clim Change Commun. 2017. doi:10.1093/acrefore/9780190228620.013.412
39. Chen R, Wei L, Syme PD. Comparison of early and delayed respondents to a postal health survey: a questionnaire study of personality traits and neuropsychological symptoms. Eur J Epidemiol. 2003;18: 195–202. doi:10.1023/A:1023393231234
40. Gummer T, Struminskaya B. Early and Late Participation during the Field Period: Response Timing in a Mixed-Mode Probability-Based Panel Survey. Sociol Methods Res. 2020;Online First. doi:10.1177/0049124120914921
41. Olowokure B, Caswell M, Duggal HV. Response patterns to a postal survey using a cervical screening register as the sampling frame. Public Health. 2004;118: 508–512. doi:10.1016/j.puhe.2003.12.013
42. Rao K, Pennington J. Should the Third Reminder be Sent? The Role of Survey Response Timing on Web Survey Results. Int J Mark Res. 2013;55: 651–674. doi:10.2501/IJMR-2013-056
43. Friedman EM, Clusen NA, Hartzell M. Better Late? Characteristics of Late Respondents to a Health Care Survey. ASA Proc Jt Stat Meet. 2003; 992–998.
44. Kennickell AB. Analysis of nonresponse effects in the 1995 Survey of Consumer Finances. J Off Stat. 1997;15: 283–304.
45. van Dalen HP, Henkens K. Population and Climate Change: Consensus and Dissensus among Demographers. Eur J Popul. 2021. doi:10.1007/s10680-021-09580-6
46. ADEME. Les représentations sociales du changement climatique. 21° vague, Juillet

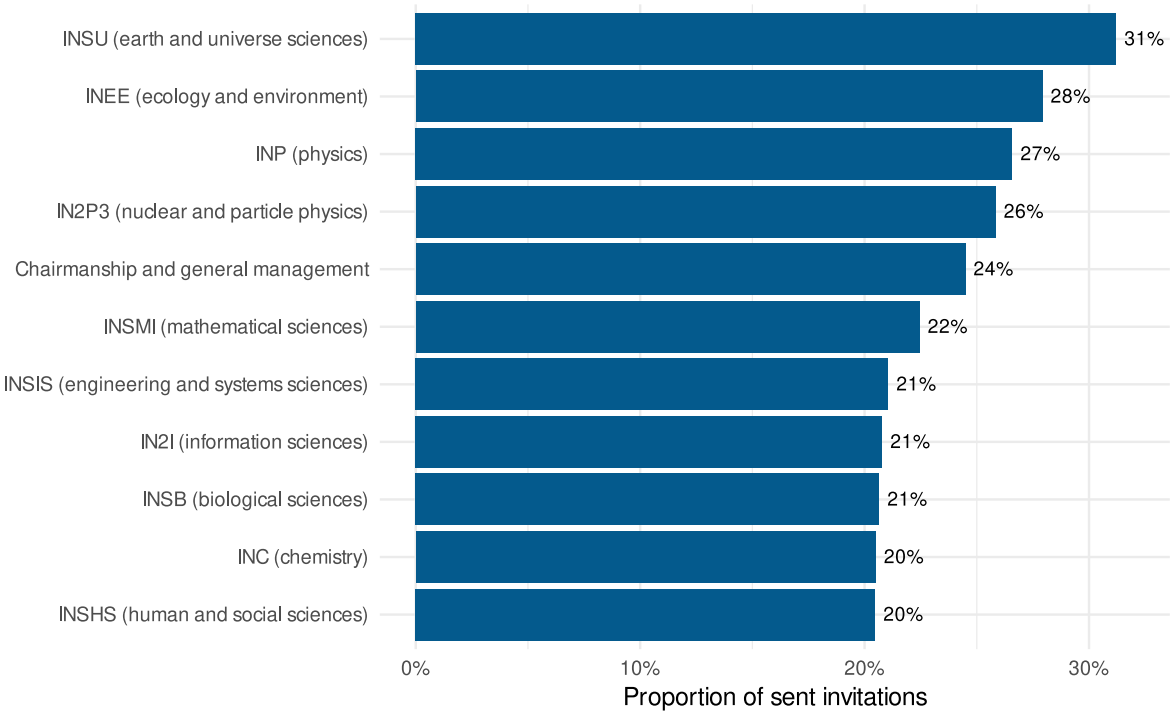
2020. 2020. Available: https://librairie.ademe.fr/changement-climatique-et-energie/4057-representations-sociales-du-changement-climatique-21-eme-vague.html
47. Gössling S, Humpe A. The global scale, distribution and growth of aviation: Implications for climate change. Glob Environ Change. 2020;65: 102194. doi:10.1016/j.gloenvcha.2020.102194
48. ADEME. Modélisation et évaluation du poids carbone de produits de consommation et biens d'équipements. Paris; 2018. Available: https://librairie.ademe.fr/cadic/1193/poids_carbone-biens-equipement-201809-rapport.pdf
49. Glausiusz J. Rethinking travel in a post-pandemic world. Nature. 2021;589: 155–157. doi:10.1038/d41586-020-03649-8
50. Jordan CJ, Palmer AA. Virtual meetings: A critical step to address climate change. Sci Adv. 2020;6: eabe5810. doi:10.1126/sciadv.abe5810
51. Nursey-Bray M, Palmer R, Meyer-Mclean B, Wanner T, Birzer C. The Fear of Not Flying: Achieving Sustainable Academic Plane Travel in Higher Education Based on Insights from South Australia. Sustainability. 2019;11: 2694. doi:10.3390/su11092694
52. Jungbluth N, Meili C. Recommendations for calculation of the global warming potential of aviation including the radiative forcing index. Int J Life Cycle Assess. 2019;24: 404–411.

S1 Appendix. Additional tables and plots

1 Sample and non-response bias

1.1 Response rate by status and discipline





Logistic regression on the probability of response:

Variable	Odds ratio	95% CI
Institute		
INSU (earth and universe sciences)	—	
INEE (ecology and environment)	0.88	0.76, 1.01
INP (physics)	0.81**	0.70, 0.93
IN2P3 (nuclear and particle physics)	0.69***	0.58, 0.83
Chairmanship and general management	0.63***	0.53, 0.75
INSMI (mathematical sciences)	0.73***	0.62, 0.86
INSIS (engineering and systems sciences)	0.65***	0.57, 0.74
IN2I (information sciences)	0.66***	0.57, 0.76
INSB (biological sciences)	0.56***	0.50, 0.63
INC (chemistry)	0.60***	0.53, 0.68
INSHS (human and social sciences)	0.65***	0.58, 0.73
Region		
01, Ile-de-France Villejuif	—	
02, Paris-Centre	1.06	0.92, 1.23
04, Ile-de-France Gif-sur-Yvette	1.20*	1.03, 1.40
05, Ile-de-France Meudon	1.16	0.97, 1.38
06, Centre-Est	1.21*	1.02, 1.44
07, Rhône Auvergne	1.25**	1.08, 1.46
08, Centre-Limousin-Poitou-Charentes	1.37**	1.13, 1.66
10, Alsace	1.13	0.94, 1.36
11, Alpes	1.70***	1.45, 2.00
12, Provence et Corse	1.29**	1.10, 1.52
13, Occitanie Est	1.13	0.95, 1.34
14, Occitanie Ouest	1.18*	1.01, 1.38
15, Aquitaine	1.26*	1.06, 1.51
16, Paris Michel-Ange	1.10	0.86, 1.41
17, Bretagne et Pays de la Loire	1.25**	1.07, 1.46
18, Hauts-de-France	1.00	0.82, 1.20
19, Normandie	1.54***	1.22, 1.93
20, Côte d'Azur	0.93	0.74, 1.16
Status		
Senior researcher	—	
Full professor	0.55***	0.48, 0.63
Tenured researcher	1.27***	1.11, 1.45
Associate professor	0.73***	0.64, 0.82
Research engineer	1.12	0.96, 1.31
Postdoctoral researcher	0.49***	0.39, 0.61
Fully funded PhD student	0.47***	0.42, 0.53
Research support engineer	0.93	0.81, 1.08
Engineer assistant	0.70***	0.59, 0.83

Variable	Odds ratio	95% CI
Technician	0.38***	0.33, 0.45
Temp on fixed-term contract	0.59***	0.51, 0.68
Other personnel	0.47***	0.39, 0.56
Sex		
Man	—	
Woman	1.31***	1.23, 1.39

1.2 Distribution of sample by discipline and status

	n	%	val%
Law, economics, management	364	5.6	6.0
Other humanities and social sciences	508	7.9	8.3
History, geography, urbanism, anthropology	535	8.3	8.8
Mathematics	351	5.4	5.8
Computer science	395	6.1	6.5
Physics	540	8.4	8.9
Chemistry	669	10.3	11.0
Astronomy	246	3.8	4.0
Geology	235	3.6	3.9
Meteorology, oceanology, environmental physics	206	3.2	3.4
Health and medical research	572	8.8	9.4
Engineering	708	10.9	11.6
Biology	547	8.5	9.0
Population biology and ecology	221	3.4	3.6
NA	370	5.7	NA

	n	%	val%
Senior researcher	612	9.5	9.5
Full professor	588	9.1	9.1
Tenured researcher	741	11.5	11.5
Associate professor	1085	16.8	16.8
Research engineer	603	9.3	9.3
Postdoctoral researcher	252	3.9	3.9
Adjunct lecturer	64	1.0	1.0
Fully funded PhD student	938	14.5	14.5
Research support engineer	629	9.7	9.7
Research assistant/Project manager	41	0.6	0.6
Engineer assistant	327	5.1	5.1
Technician	225	3.5	3.5
Technical assistant	46	0.7	0.7
Other personnel	315	4.9	4.9
NA	1	0.0	NA

1.3 Differences between early and late respondents

To what degree are you concerned about climate change?

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
Not at all concerned	1	0	1	1	1	1
Slightly concerned	6	6	5	5	7	6
Somewhat concerned	20	23	19	21	23	21
Very concerned	39	40	44	42	41	40
Extremely concerned	34	30	30	30	27	31
No opinion	1	1	1	1	1	1
Total	100	100	100	100	100	100

If things continue on their present course, we will soon experience a major ecological catastrophe

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
Completely agree	61	59	61	55	51	59
Somewhat agree	29	31	31	33	39	31
Somewhat disagree	3	3	3	4	4	3
Completely disagree	2	1	1	2	1	2
No opinion	4	5	4	5	6	5
Total	100	100	100	100	100	100

I agree with having regulatory constraints (quotas, bans) put in place to protect the environment, even if it limits my comfort

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
Completely agree	47	46	49	41	38	45
Somewhat agree	40	42	37	45	50	42
Somewhat disagree	7	7	9	8	8	8
Completely disagree	3	2	2	4	2	3
No opinion	2	2	2	3	2	2
Total	100	100	100	100	100	100

Protecting the environment is more important than protecting economic growth

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
Completely agree	58	56	58	51	47	55
Somewhat agree	31	33	31	36	39	33
Somewhat disagree	6	6	7	7	8	7
Completely disagree	1	2	2	2	1	2
No opinion	3	4	2	3	4	3
Total	100	100	100	100	100	100

France has committed to reducing its greenhouse gas emissions by one-third by 2030. In this respect, do you think that public research should:

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
Set an example (reduce emissions by more than one-third)	50	49	49	46	42	48
Reduce emissions by around one-third	42	44	41	44	47	43
Benefit from an exemption (reduce emissions by less than one-third)	8	8	10	9	11	9
Total	100	100	100	100	100	100

What actions should research institutions and laboratories take to reduce their greenhouse gas emissions?

- Impose a cap on the number of flights per person

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
It is a priority	56	54	53	51	51	54
It is secondary	17	17	18	19	19	18
It should not be implemented	21	22	20	24	23	22
No opinion	6	7	9	6	8	7
Total	100	100	100	100	100	100

- Add carbon emissions to the main selection criteria for project funding

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
It is a priority	36	35	37	32	34	35
It is secondary	30	31	29	31	32	30
It should not be implemented	27	27	26	29	26	27
No opinion	7	7	9	8	8	8
Total	100	100	100	100	100	100

- Reduce the importance of conferences and presentations abroad in career assessments

	After the first message	After the first reminder	After the second reminder	After the third reminder	After the fourth reminder	All
It is a priority	64	62	63	57	56	61
It is secondary	20	23	23	24	24	22
It should not be implemented	8	7	8	12	12	9
No opinion	8	8	6	7	8	8
Total	100	100	100	100	100	100

Linear regressions on the number of reminders sent before the questionnaire was completed:

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Characteristic	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]
(Intercept)	2.4***	0.053	2.3***	0.093	2.4***	0.096	2.2***	0.101	2.1***	0.112	2.4***	0.113
Sex												
Man	—	—	—	—	—	—	—	—	—	—	—	—
Woman	0.08*	0.037	0.06	0.039	0.06	0.040	0.07	0.042	0.05	0.043	0.04	0.042
Other	-0.28	0.419	-0.30	0.419	-0.32	0.419	-0.31	0.432	-0.22	0.432	-0.29	0.430
Age												
50-54 years old	—	—	—	—	—	—	—	—	—	—	—	—
Under 29 years old	-0.35***	0.066	-0.43***	0.096	-0.41***	0.097	-0.45***	0.103	-0.44***	0.105	-0.44***	0.104
30-34 years old	-0.23**	0.078	-0.28**	0.088	-0.26**	0.089	-0.33***	0.094	-0.33***	0.096	-0.32***	0.094
35-39 years old	-0.20**	0.073	-0.20**	0.078	-0.19*	0.079	-0.23**	0.082	-0.21*	0.085	-0.21*	0.083
40-44 years old	-0.08	0.070	-0.06	0.074	-0.06	0.075	-0.11	0.078	-0.10	0.080	-0.09	0.078
45-49 years old	-0.06	0.071	-0.05	0.074	-0.03	0.075	-0.11	0.078	-0.09	0.080	-0.08	0.078
55-64 years old	0.08	0.068	0.07	0.071	0.09	0.071	0.04	0.075	0.05	0.077	0.05	0.076
65 years and older	0.34**	0.112	0.21	0.117	0.21	0.120	0.21	0.126	0.20	0.131	0.24	0.128
Status												
Associate Professor			—	—	—	—	—	—	—	—	—	—
Senior researcher			0.02	0.080	0.02	0.080	0.00	0.083	-0.02	0.086	-0.01	0.084
Full professor			0.12	0.079	0.10	0.080	0.04	0.084	-0.02	0.086	0.04	0.084
Tenured researcher			-0.15*	0.071	-0.15*	0.071	-0.14	0.073	-0.14	0.075	-0.18*	0.074
Research engineer			-0.03	0.077	-0.05	0.078	-0.02	0.081	-0.03	0.084	-0.03	0.082
Postdoctoral researcher			0.13	0.113	0.12	0.113	0.06	0.119	0.06	0.121	0.08	0.122
Adjunct lecturer			0.27	0.194	0.23	0.197	0.33	0.206	0.36	0.208	0.29	0.205
Fully funded PhD student			0.06	0.098	0.04	0.099	0.06	0.104	0.04	0.106	0.03	0.106
Research support engineer			-0.13	0.079	-0.16*	0.080	-0.18*	0.083	-0.19*	0.085	-0.18*	0.083
Research assistant/Project manager			0.17	0.237	0.30	0.246	0.45	0.251	0.35	0.254	0.42	0.257
Engineer assistant			-0.12	0.102	-0.15	0.104	-0.14	0.108	-0.10	0.114	-0.13	0.110

[1] *p<0.05; **p<0.01; ***p<0.001

[2] SE = Standard Error

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Characteristic	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]
Technician			0.06	0.117	0.09	0.120	0.14	0.127	0.14	0.135	0.11	0.130
Technical assistant			0.03	0.288	0.15	0.299	0.45	0.341	0.46	0.341	0.46	0.360
Other personnel			0.33**	0.100	0.40***	0.103	0.43***	0.111	0.44***	0.114	0.41***	0.113
Discipline												
Physics			—	—	—	—	—	—	—	—	—	—
Law, economics, management			0.11	0.100	0.15	0.101	0.21	0.105	0.22*	0.108	0.23*	0.106
Other humanities and social sciences			0.11	0.092	0.12	0.092	0.18	0.097	0.20*	0.100	0.23*	0.097
History, geography, urbanism, anthropology			0.18*	0.091	0.17	0.092	0.21*	0.096	0.22*	0.098	0.22*	0.097
Mathematics			-0.09	0.100	-0.09	0.101	-0.04	0.106	-0.05	0.108	-0.03	0.107
Computer science			-0.10	0.097	-0.08	0.097	-0.04	0.101	-0.02	0.103	-0.03	0.101
Chemistry			0.04	0.085	0.02	0.085	0.07	0.090	0.03	0.092	0.08	0.090
Astronomy			-0.04	0.112	0.00	0.113	0.05	0.117	0.11	0.120	0.07	0.117
Geology			-0.11	0.114	-0.10	0.114	-0.08	0.117	-0.06	0.120	-0.05	0.118
Meteorology, oceanology, environmental physics			-0.11	0.119	-0.09	0.120	-0.07	0.125	-0.01	0.127	-0.05	0.126
Health and medical research			0.13	0.088	0.15	0.089	0.25**	0.094	0.23*	0.096	0.22*	0.094
Engineering			0.11	0.084	0.13	0.084	0.15	0.088	0.15	0.090	0.17	0.088
Biology			0.13	0.089	0.14	0.090	0.16	0.094	0.17	0.096	0.22*	0.094
Population biology and ecology			0.11	0.116	0.14	0.117	0.17	0.122	0.18	0.125	0.17	0.123
Degree of concern about climate change												
Very concerned					—	—			—	—		
Not at all concerned					-0.10	0.247			0.08	0.343		
Slightly concerned					-0.06	0.085			-0.12	0.104		

[1] *p<0.05; **p<0.01; ***p<0.001

[2] SE = Standard Error

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Characteristic	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]
Somewhat concerned					-0.03	0.051			-0.09	0.058		
Extremely concerned					-0.14**	0.045			-0.04	0.050		
No opinion					-0.11	0.325			-0.28	0.403		
Desirable GHGs emission reduction target for public research by 2030												
Set an example (reduce emissions by more than one-third)							—	—				
Reduce emissions by around one-third							0.10*	0.041				
Benefit from an exemption (reduce emissions by less than one-third)							0.21**	0.072				
A major ecological catastrophe is going to occur												
Completely agree									—	—		
Somewhat agree									0.13*	0.050		
Somewhat disagree									0.11	0.125		
Completely disagree									-0.30	0.208		
No opinion									0.14	0.109		
Regulatory constraints to protect the environment												
Completely agree									—	—		
Somewhat agree									0.02	0.048		
Somewhat disagree									-0.09	0.090		
Completely disagree									-0.19	0.144		
No opinion									0.12	0.159		

[1] *p<0.05; **p<0.01; ***p<0.001

[2] SE = Standard Error

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Characteristic	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]
Protecting the environment is more important than protecting economic growth												
Completely agree									—	—		
Somewhat agree									0.11*	0.049		
Somewhat disagree									0.07	0.092		
Completely disagree									0.08	0.182		
No opinion									0.13	0.132		
Desirable GHG emission reduction target for public research by 2030												
Set an example (reduce emissions by more than one-third)									—	—		
Reduce emissions by around one-third									0.06	0.045		
Benefit from an exemption (reduce emissions by less than one-third)									0.21**	0.082		
Impose a cap on the number of flights per person												
It is a priority									—	—		
It is secondary									0.04	0.057		
It should not be implemented									0.00	0.057		
No opinion									0.04	0.093		
Add carbon emissions to the main selection criteria for project funding												
It is a priority									—	—		
It is secondary									0.03	0.052		

[1] *p<0.05; **p<0.01; ***p<0.001

[2] SE = Standard Error

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Characteristic	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]	**Beta**[1]	**SE**[2]
It should not be implemented									-0.02	0.058		
No opinion									0.06	0.090		
Reduce the importance of conferences and presentations abroad in career assessments												
It is a priority									—	—		
It is secondary									0.12*	0.051		
It should not be implemented									0.24**	0.077		
No opinion									-0.04	0.088		
Being in a moment in one's career in which one is seeking to be promoted, recruited or tenured												
No											—	—
Yes											-0.09*	0.043
Feeling underpaid												
No											—	—
Yes											0.07	0.043
Born abroad												
Yes											—	—
No											-0.14*	0.060
No. Obs.	6,429		6,065		5,926		5,318		5,051		5,212	
R^2	0.014		0.025		0.028		0.031		0.041		0.032	
Adjusted R^2	0.012		0.019		0.021		0.024		0.029		0.025	

[1] *p<0.05; **p<0.01; ***p<0.001

[2] SE = Standard Error

2 Opinions

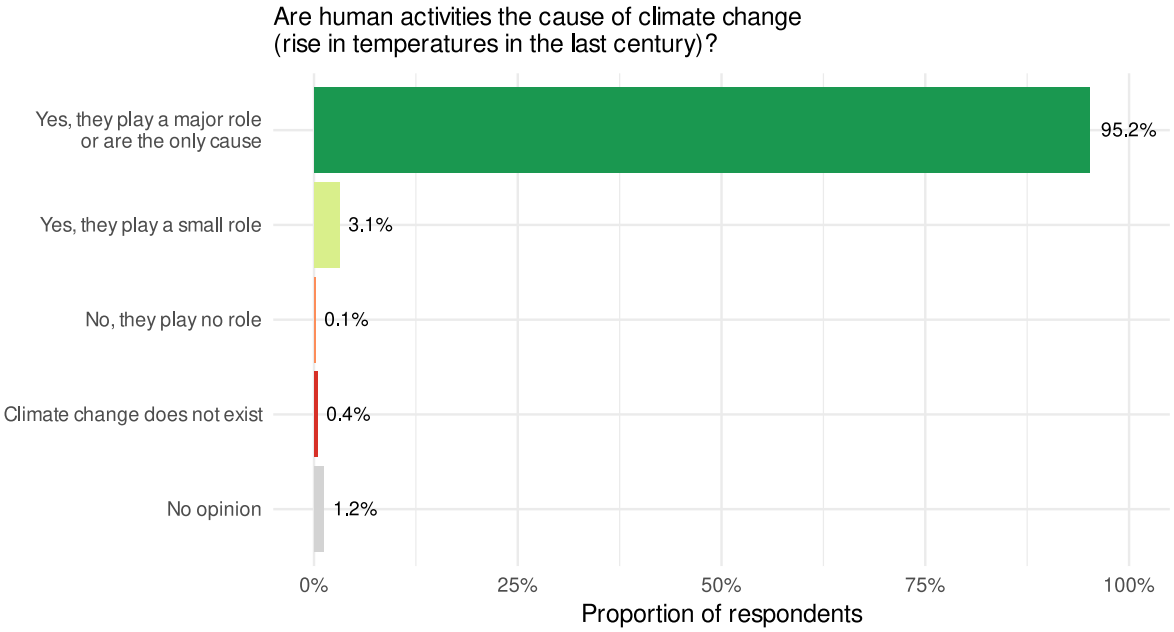
2.1 Overview

Opinions of respondents on a selection of questions by discipline et status (%) :

	Climate is definitely changing	Very or extremely concerned	Much more concerned than 5 years ago	Human activites cause climate change	Calls for profound changes in our professions	We will soon experience an ecological catastrophe	It could cause a collapse of our societies	Research must reduce its emissions by more than one-third
Law, economics, management	92	71	50	95	90	91	74	58
Other humanities and social sciences	90	75	46	97	86	91	72	53
History, geography, urbanism, anthropology	92	74	45	95	88	90	75	50
Mathematics	92	72	45	96	81	89	69	51
Computer science	89	72	42	97	90	92	70	53
Physics	90	73	41	96	83	87	74	39
Chemistry	88	67	45	96	87	88	73	42
Astronomy	95	76	41	99	89	91	71	50
Geology	92	74	40	97	90	89	68	41
Meteorology, oceanology, environmental physics	95	84	39	99	96	95	80	52
Health and medical research	93	67	50	96	90	94	79	42
Engineering	90	70	47	96	88	89	75	52
Biology	88	70	44	96	90	92	77	43
Population biology and ecology	95	83	42	97	93	95	81	54
All	91	72	45	96	88	90	74	48

	Climate is definitely changing	Very or extremely concerned	Much more concerned than 5 years ago	Human activites cause climate change	Calls for profound changes in our professions	We will soon experience an ecological catastrophe	It could cause a collapse of our societies	Research must reduce its emissions by more than one-third
Senior researcher	90	76	47	95	83	88	69	38
Full professor	89	71	44	94	80	84	68	42
Tenured researcher	92	77	44	96	88	92	76	44
Associate professor	90	74	42	96	86	90	74	48
Research engineer	90	70	41	96	90	90	74	47
Postdoctoral researcher	93	75	45	98	92	96	75	49
Adjunct lecturer	95	76	42	100	87	95	75	56
Fully funded PhD student	95	75	53	98	92	94	76	52
Research support engineer	90	65	41	96	94	90	76	56
Research assistant/Project manager	92	74	53	100	97	94	66	51
Engineer assistant	87	62	40	94	93	88	79	53
Technician	86	53	44	95	93	88	74	54
Technical assistant	80	37	44	90	88	80	70	33
Other personnel	93	70	45	95	86	90	75	54
All	91	71	45	96	88	90	74	48

2.2 Human activities and climate change



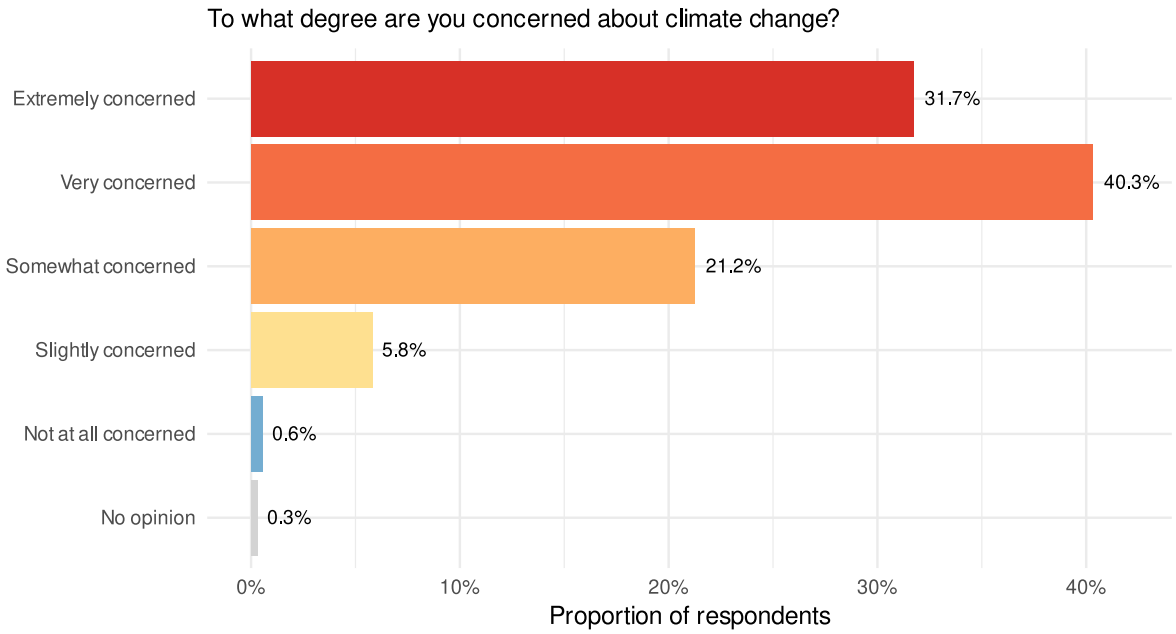
For 95.1% of respondents, human activities play a major role or are the only cause of climate change.
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=6337)

	n	%	val%
Yes, they are the only cause	1159	17.9	18.3
Yes, they play a major role	4871	75.3	76.9
Yes, they play a small role	197	3.0	3.1
No, they play no role	9	0.1	0.1
Climate change does not exist	24	0.4	0.4
No opinion	77	1.2	1.2
NA	130	2.0	NA

	Yes, they play a major role or are the only cause	Yes, they play a small role	No, they play no role	Climate change does not exist	No opinion	Total
Law, economics, management	94	4	0	1	1	100
Other humanities and social sciences	96	2	0	0	1	100
History, geography, urbanism, anthropology	94	4	0	1	1	100
Mathematics	94	2	1	1	2	100
Computer science	96	2	0	0	2	100
Physics	95	3	0	0	2	100
Chemistry	95	4	0	1	1	100
Astronomy	98	1	0	0	0	100
Geology	95	2	0	0	2	100
Meteorology, oceanology, environmental physics	99	0	0	0	1	100
Health and medical research	95	3	0	0	1	100
Engineering	95	4	0	0	1	100
Biology	95	4	0	0	1	100
Population biology and ecology	97	2	0	0	0	100
All	95	3	0	0	1	100

	Yes, they play a major role or are the only cause	Yes, they play a small role	No, they play no role	Climate change does not exist	No opinion	Total
Senior researcher	95	3	0	0	1	100
Full professor	92	4	0	1	3	100
Tenured researcher	96	3	0	0	1	100
Associate professor	95	3	0	0	1	100
Research engineer	95	3	0	0	1	100
Postdoctoral researcher	98	2	0	0	0	100
Adjunct lecturer	100	0	0	0	0	100
Fully funded PhD student	97	2	0	0	1	100
Research support engineer	95	3	0	0	1	100
Research assistant/Project manager	100	0	0	0	0	100
Engineer assistant	93	5	0	1	1	100
Technician	93	5	0	0	1	100
Technical assistant	90	7	2	0	0	100
Other personnel	93	5	0	1	1	100
All	95	3	0	0	1	100

2.3 Concern about climate change



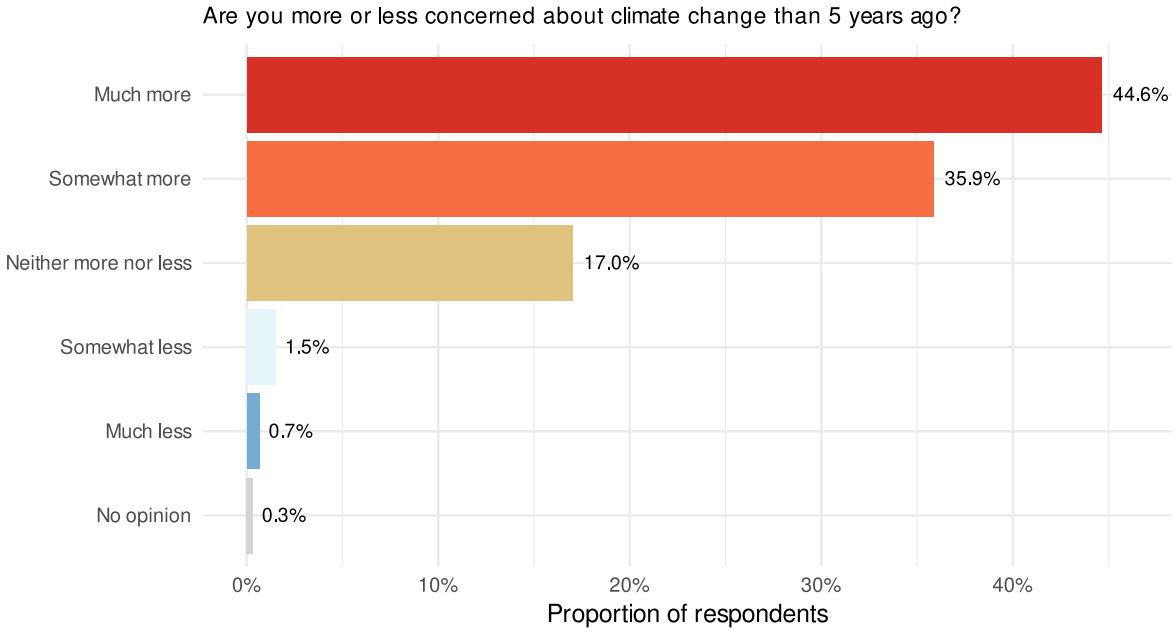
Interpretation: 31.7% of respondents are extremely concerned about climate change
Source: “Research personnel and climate change” survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=6287)

	n	%	val%
Not at all concerned	60	0.9	0.9
Slightly concerned	367	5.7	5.8
Somewhat concerned	1335	20.6	21.1
Very concerned	2534	39.2	40.0
Extremely concerned	1994	30.8	31.4
No opinion	52	0.8	0.8
NA	125	1.9	NA

	Not at all concerned	Slightly concerned	Somewhat concerned	Very concerned	Extremely concerned	No opinion	Total
Law, economics, management	1	6	22	36	35	0	100
Other humanities and social sciences	1	4	19	39	36	1	100
History, geography, urbanism, anthropology	1	4	21	37	36	0	100
Mathematics	1	7	19	43	29	1	100
Computer science	1	7	19	42	30	1	100
Physics	2	6	18	39	34	1	100
Chemistry	1	7	24	44	22	1	100
Astronomy	1	5	17	39	37	0	100
Geology	2	5	19	35	38	1	100
Meteorology, oceanology, environmental physics	1	1	13	40	44	0	100
Health and medical research	1	7	24	40	27	1	100
Engineering	1	6	22	39	31	1	100
Biology	0	6	24	40	30	1	100
Population biology and ecology	0	3	13	41	42	1	100
All	1	6	21	40	32	1	100

	Not at all concerned	Slightly concerned	Somewhat concerned	Very concerned	Extremely concerned	No opinion	Total
Senior researcher	1	5	17	39	37	1	100
Full professor	2	6	19	38	33	2	100
Tenured researcher	0	5	18	40	37	1	100
Associate professor	1	5	20	39	35	1	100
Research engineer	1	7	22	43	27	1	100
Postdoctoral researcher	1	5	19	40	35	0	100
Adjunct lecturer	0	0	23	48	27	2	100
Fully funded PhD student	1	5	18	42	33	1	100
Research support engineer	1	7	27	42	23	1	100
Research assistant/Project manager	0	0	26	42	32	0	100
Engineer assistant	1	11	26	41	21	1	100
Technician	0	8	36	32	21	2	100
Technical assistant	2	12	49	27	10	0	100
Other personnel	1	7	22	37	33	1	100
All	1	6	21	40	31	1	100

2.4 Change in degree of concern



Interpretation: 44.6% of respondents are much more concerned about climate change than 5 years ago
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=6287)

	n	%	val%
Much more	2806	43.4	44.6
Somewhat more	2254	34.9	35.9
Neither more nor less	1069	16.5	17.0
Somewhat less	96	1.5	1.5
Much less	42	0.6	0.7
No opinion	20	0.3	0.3
NA	180	2.8	NA

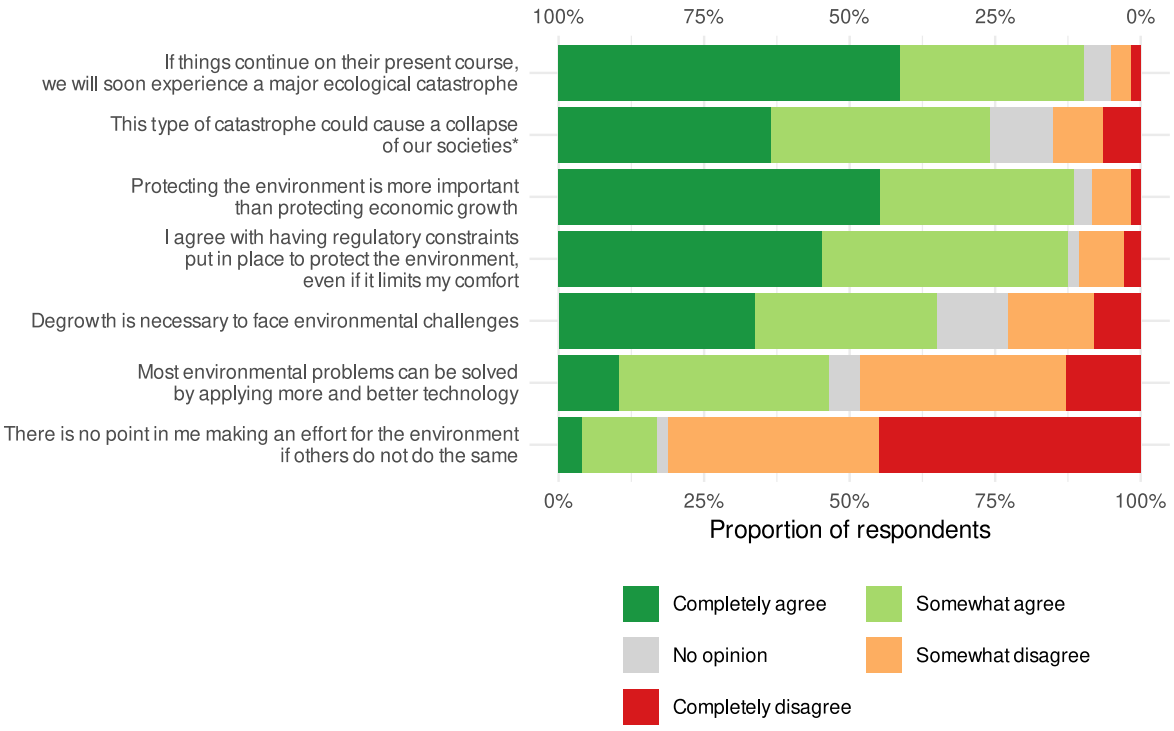
	Much more	Somewhat more	Neither more nor less	Somewhat less	Much less	No opinion	Total
Law, economics, management	50	34	14	1	1	0	100
Other humanities and social sciences	46	37	14	2	1	0	100
History, geography, urbanism, anthropology	45	36	17	1	1	0	100
Mathematics	45	36	17	1	1	1	100
Computer science	42	39	18	1	1	0	100
Physics	41	36	20	2	1	1	100
Chemistry	45	38	15	1	1	1	100
Astronomy	41	37	20	1	0	0	100
Geology	40	36	23	1	0	0	100
Meteorology, oceanology, environmental physics	39	31	27	3	1	0	100
Health and medical research	50	31	16	2	1	0	100
Engineering	47	33	18	1	1	0	100
Biology	44	40	13	1	1	0	100
Population biology and ecology	42	36	19	2	1	0	100
All	45	36	17	1	1	0	100

	Much more	Somewhat more	Neither more nor less	Somewhat less	Much less	No opinion	Total
Senior researcher	47	32	20	0	0	0	100
Full professor	44	32	22	1	1	0	100
Tenured researcher	44	36	17	1	1	0	100
Associate professor	42	38	19	1	0	0	100
Research engineer	41	39	19	1	0	0	100
Postdoctoral researcher	45	36	13	3	2	0	100
Adjunct lecturer	42	34	19	5	0	0	100
Fully funded PhD student	53	33	10	2	1	1	100
Research support engineer	41	39	17	2	1	0	100
Research assistant/Project manager	53	32	11	5	0	0	100
Engineer assistant	40	40	18	2	0	0	100
Technician	44	38	14	3	0	0	100
Technical assistant	44	41	10	5	0	0	100
Other personnel	45	36	16	2	0	0	100
All	45	36	17	2	1	0	100

2.5 Opinions on ecology in general

	Completely agree	Somewhat agree	No opinion	Somewhat disagree	Completely disagree	Total
If things continue on their present course, we will soon experience a major ecological catastrophe	59	31	5	3	2	100
This type of catastrophe could cause a collapse of our societies*	36	38	11	9	6	100
Protecting the environment is more important than protecting economic growth	55	33	3	7	2	100
I agree with having regulatory constraints put in place to protect the environment, even if it limits my comfort	45	42	2	8	3	100
Degrowth is necessary to face environmental challenges	34	31	12	15	8	100
Most environmental problems can be solved by applying more and better technology	10	36	5	35	13	100
There is no point in me making an effort for the environment if others do not do the same	4	13	2	36	45	100

* Respondents disagreeing with previous question are classified as “Strongly disagree”.



* Respondents disagreeing with previous question are classified as “Strongly disagree”
Interpretation: 59% of respodents completely agree with the statement that we will soon experience a major ecological catastrophe
Source: “Research personnel and climate change” survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=5685)

If things continue on their present course, we will soon experience a major ecological catastrophe

	n	%	val%
Completely agree	3337	51.6	58.7
Somewhat agree	1788	27.6	31.5
Somewhat disagree	198	3.1	3.5
Completely disagree	97	1.5	1.7
No opinion	265	4.1	4.7
NA	782	12.1	NA

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	No opinion	Total
Law, economics, management	59	32	3	2	5	100
Other humanities and social sciences	64	27	2	1	5	100
History, geography, urbanism, anthropology	61	29	3	3	5	100
Mathematics	55	33	4	3	5	100
Computer science	62	29	3	1	5	100
Physics	57	30	5	3	5	100
Chemistry	54	34	5	2	6	100
Astronomy	65	26	3	2	5	100
Geology	58	31	5	2	4	100
Meteorology, oceanology, environmental physics	68	27	4	1	1	100
Health and medical research	59	35	2	1	3	100
Engineering	56	33	4	1	5	100
Biology	55	36	4	1	4	100
Population biology and ecology	66	29	2	2	2	100
All	59	31	3	2	4	100

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	No opinion	Total
Senior researcher	53	35	5	2	4	100
Full professor	48	36	5	5	6	100
Tenured researcher	59	33	4	1	4	100
Associate professor	62	29	3	2	4	100
Research engineer	57	33	3	2	5	100
Postdoctoral researcher	66	30	2	0	1	100
Adjunct lecturer	59	36	0	0	5	100
Fully funded PhD student	68	25	1	1	4	100
Research support engineer	58	32	4	1	5	100
Research assistant/Project manager	54	40	0	0	6	100
Engineer assistant	55	33	5	1	7	100
Technician	51	37	5	1	6	100
Technical assistant	30	50	13	0	7	100
Other personnel	61	29	3	1	6	100
All	59	31	3	2	5	100

This type of catastrophe could cause a collapse of our societies: the basic needs (food, energy, health, etc.) will no longer be assured for the majority of the population

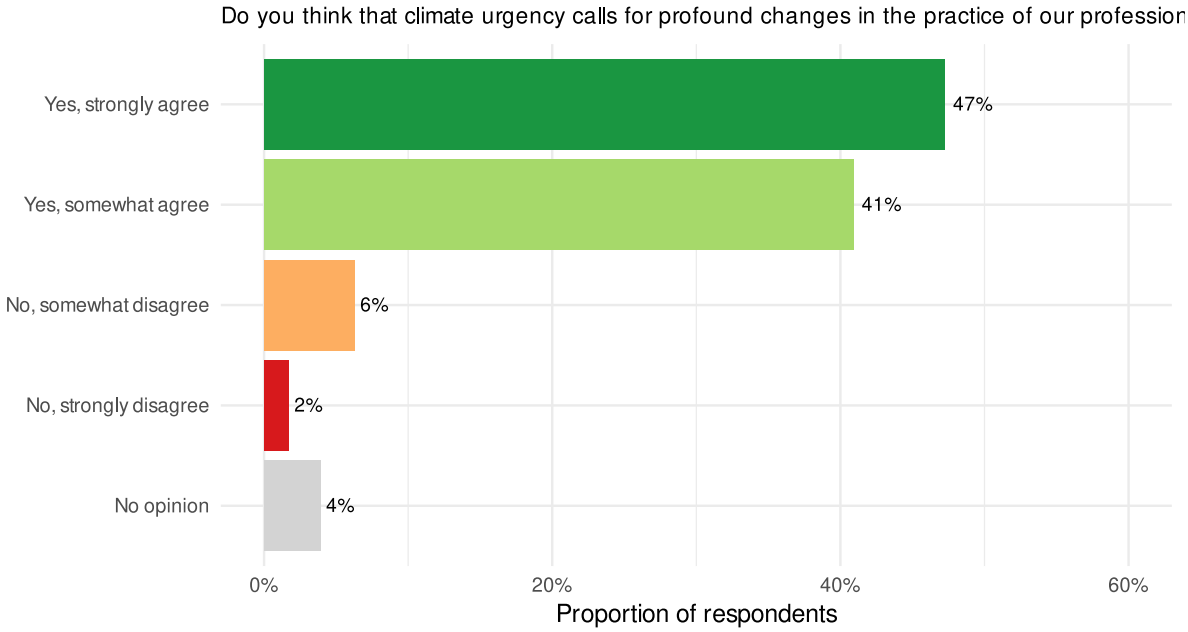
	n	%	val%
Completely agree	2045	31.6	36.5
Somewhat agree	2105	32.5	37.6
Somewhat disagree	489	7.6	8.7
Completely disagree	361	5.6	6.4
No opinion	605	9.4	10.8
NA	862	13.3	NA

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	No opinion	Total
Law, economics, management	35	39	9	5	12	100
Other humanities and social sciences	42	31	8	6	14	100
History, geography, urbanism, anthropology	40	35	8	7	10	100
Mathematics	30	39	10	8	13	100
Computer science	35	36	12	5	13	100
Physics	37	37	7	9	10	100
Chemistry	33	39	9	7	11	100
Astronomy	35	36	10	6	13	100
Geology	35	33	12	8	12	100
Meteorology, oceanology, environmental physics	44	36	8	6	6	100
Health and medical research	39	40	8	3	10	100
Engineering	35	40	9	7	10	100
Biology	36	41	8	6	9	100
Population biology and ecology	42	38	6	6	7	100
All	37	38	9	6	11	100

	Completely agree	Somewhat agree	Somewhat disagree	Completely disagree	No opinion	Total
Senior researcher	34	36	11	9	10	100
Full professor	26	42	11	11	10	100
Tenured researcher	39	37	8	6	10	100
Associate professor	36	38	9	6	11	100
Research engineer	36	38	9	6	11	100
Postdoctoral researcher	37	38	12	4	9	100
Adjunct lecturer	39	36	11	0	14	100
Fully funded PhD student	42	35	9	4	11	100
Research support engineer	36	40	6	6	12	100
Research assistant/Project manager	31	34	20	0	14	100
Engineer assistant	41	38	4	6	11	100
Technician	35	38	9	7	10	100
Technical assistant	27	43	7	13	10	100
Other personnel	39	35	8	5	12	100
All	36	38	9	6	11	100

(Respondents disagreeing with previous question are classified as “Strongly disagree”)

2.6 Profound changes in our professions



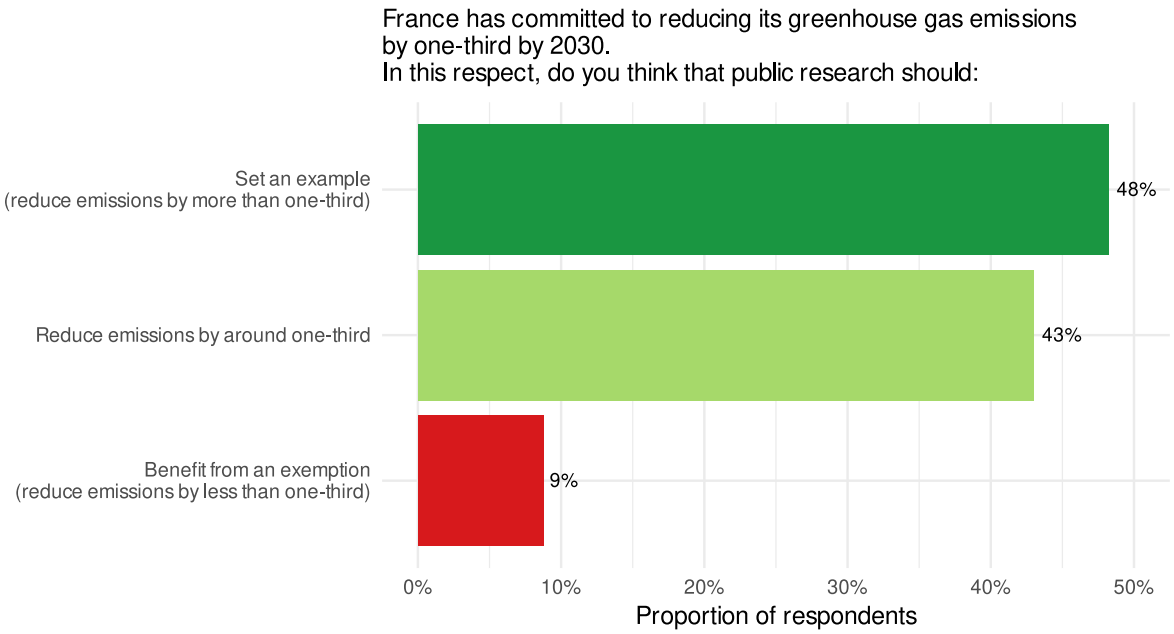
Interpretation: 47% of respondents think that climate urgency calls for profound changes in the practice of our professions
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=6341)

	n	%	val%
Yes, strongly agree	2996	46.3	47.2
Yes, somewhat agree	2594	40.1	40.9
No, somewhat disagree	397	6.1	6.3
No, strongly disagree	107	1.7	1.7
No opinion	247	3.8	3.9
NA	126	1.9	NA

	Yes, strongly agree	Yes, somewhat agree	No, somewhat disagree	No, strongly disagree	No opinion	Total
Law, economics, management	52	37	4	3	3	100
Other humanities and social sciences	50	36	8	1	5	100
History, geography, urbanism, anthropology	48	40	7	1	4	100
Mathematics	41	39	11	2	6	100
Computer science	50	41	5	2	3	100
Physics	45	38	10	3	4	100
Chemistry	40	46	7	2	4	100
Astronomy	50	39	6	2	2	100
Geology	51	40	6	2	2	100
Meteorology, oceanology, environmental physics	65	31	2	1	1	100
Health and medical research	45	45	5	1	4	100
Engineering	49	40	6	1	5	100
Biology	41	49	6	2	3	100
Population biology and ecology	58	35	3	1	3	100
All	47	41	6	2	4	100

	Yes, strongly agree	Yes, somewhat agree	No, somewhat disagree	No, strongly disagree	No opinion	Total
Senior researcher	40	43	10	3	4	100
Full professor	40	40	13	3	4	100
Tenured researcher	44	44	6	2	4	100
Associate professor	46	41	8	2	4	100
Research engineer	47	42	5	2	4	100
Postdoctoral researcher	50	41	5	0	3	100
Adjunct lecturer	47	40	3	3	6	100
Fully funded PhD student	55	36	4	1	3	100
Research support engineer	51	42	3	0	3	100
Research assistant/Project manager	55	42	3	0	0	100
Engineer assistant	48	45	3	0	4	100
Technician	46	46	3	1	3	100
Technical assistant	32	56	2	0	10	100
Other personnel	54	32	6	2	6	100
All	47	41	6	2	4	100

2.7 Reduction in emissions by one-third by 2030



Interpretation: 48% of respondents think that public research should reduce its emissions by more than one-third by 2030
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=5635)

	n	%	val%
More than one-third	2717	42.0	48.2
Around one-third	2423	37.5	43.0
Less than one-third	495	7.7	8.8
NA	832	12.9	NA

	More than one-third	Around one-third	Less than one-third	Total
Law, economics, management	58	35	7	100
Other humanities and social sciences	53	43	4	100
History, geography, urbanism, anthropology	50	44	5	100
Mathematics	51	43	6	100
Computer science	53	39	8	100
Physics	39	44	17	100
Chemistry	42	46	13	100
Astronomy	50	40	10	100
Geology	41	46	13	100
Meteorology, oceanology, environmental physics	52	42	6	100
Health and medical research	42	49	9	100
Engineering	52	39	9	100
Biology	43	48	9	100
Population biology and ecology	54	39	7	100
All	48	43	9	100

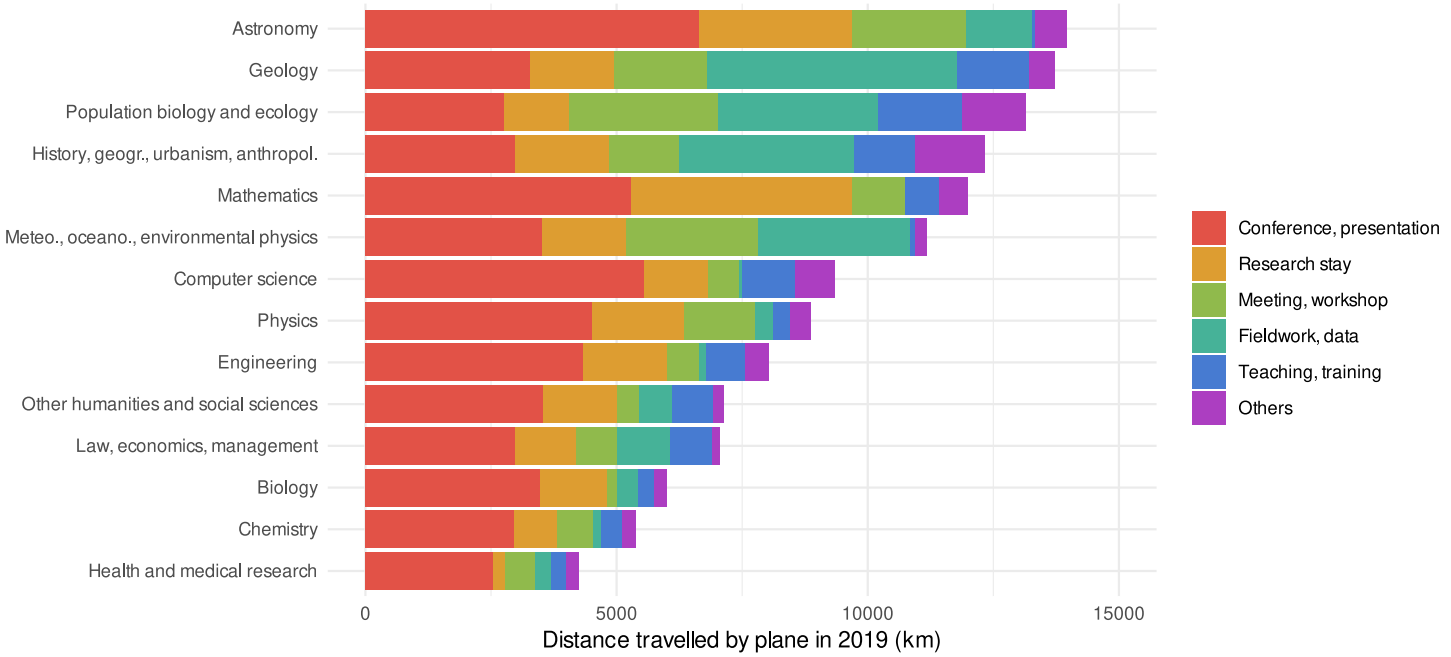
	More than one-third	Around one-third	Less than one-third	Total
Senior researcher	38	48	13	100
Full professor	42	46	12	100
Tenured researcher	44	47	9	100
Associate professor	48	45	7	100
Research engineer	47	44	9	100
Postdoctoral researcher	49	42	10	100
Adjunct lecturer	56	36	7	100
Fully funded PhD student	52	39	9	100
Research support engineer	56	37	7	100
Research assistant/Project manager	51	46	3	100
Engineer assistant	53	40	6	100
Technician	54	41	5	100
Technical assistant	33	60	7	100
Other personnel	54	40	7	100
All	48	43	9	100

3 Practices

3.1 Flights

Analyses in this section cover only PhD-level positions (researchers, professors, research engineers and PhD students).

3.1.1 Reasons for flying by discipline



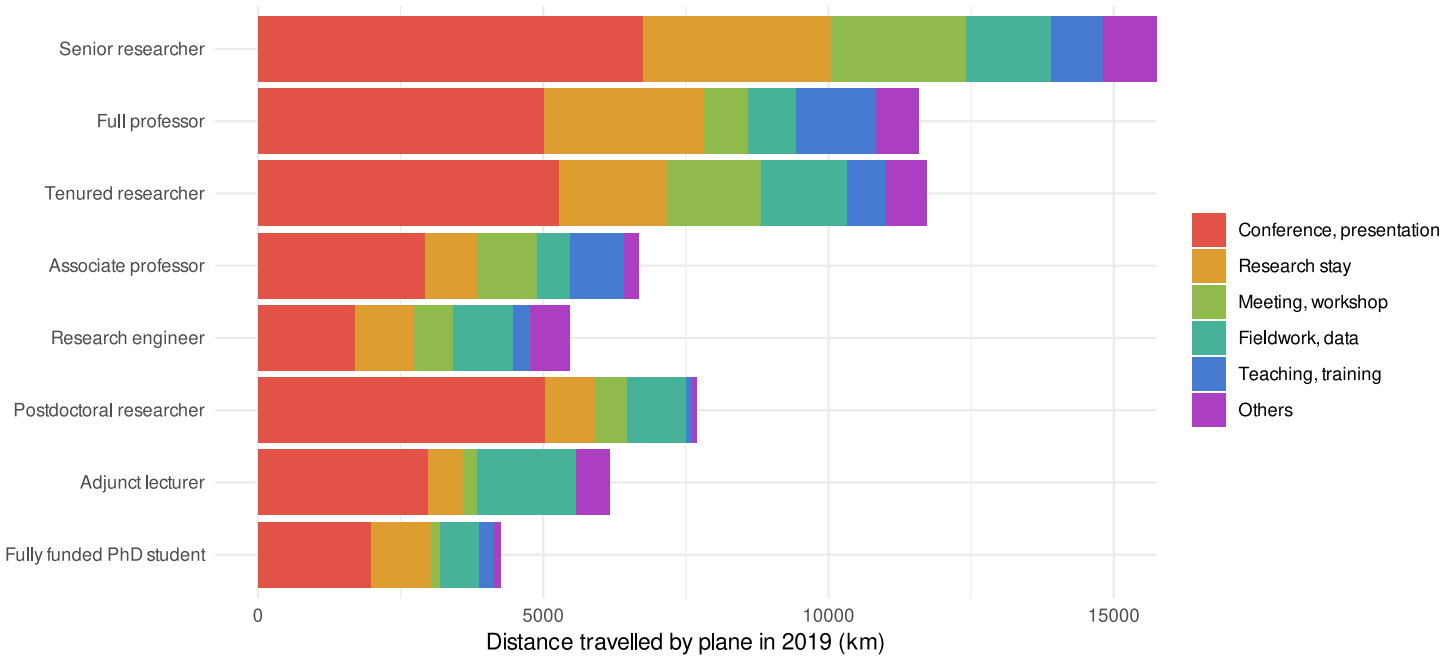
Distance travelled by plane in 2019 (km):

Discipline	Fieldwork, data	Research stay	Meeting, workshop	Teaching, training	Others	Conference, presentation	Total
Law, economics, management	1052	1225	807	844	150	2980	7133
Other humanities and social sciences	660	1491	428	810	202	3529	7459
History, geogr., urbanism, anthropol.	3491	1863	1383	1225	1376	2986	12685
Mathematics	0	4416	1053	673	570	5280	12125
Computer science	71	1274	606	1074	778	5545	9347
Physics	346	1838	1409	356	414	4513	9050
Chemistry	178	867	697	427	270	2947	5485
Astronomy	1318	3043	2268	56	628	6642	13964
Geology	4981	1697	1837	1427	505	3265	13872
Meteo., oceano., environmental physics	3036	1676	2619	110	235	3511	11187
Health and medical research	316	246	582	312	250	2545	4347
Engineering	137	1676	628	792	471	4336	8324
Biology	421	1341	184	328	242	3483	6020
Population biology and ecology	3195	1293	2965	1667	1263	2762	13445

Distance travelled by plane in 2019 (row %):

Discipline	Fieldwork, data	Research stay	Meeting, workshop	Teaching, training	Others	Conference, presentation	Total
Law, economics, management	15	17	11	12	2	42	100
Other humanities and social sciences	9	20	6	11	3	47	100
History, geogr., urbanism, anthropol.	28	15	11	10	11	24	100
Mathematics	0	36	9	6	5	44	100
Computer science	1	14	6	11	8	59	100
Physics	4	20	16	4	5	50	100
Chemistry	3	16	13	8	5	54	100
Astronomy	9	22	16	0	4	48	100
Geology	36	12	13	10	4	24	100
Meteo., oceano., environmental physics	27	15	23	1	2	31	100
Health and medical research	7	6	13	7	6	59	100
Engineering	2	20	8	10	6	52	100
Biology	7	22	3	5	4	58	100
Population biology and ecology	24	10	22	12	9	21	100

3.1.2 Reasons for flying by status



Distance travelled by plane in 2019 (km):

Status	Fieldwork, data	Research stay	Meeting, workshop	Teaching, training	Others	Conference, presentation	Total
Senior researcher	1507	3309	2357	907	960	6731	16101
Full professor	863	2817	754	1396	750	5005	11866
Tenured researcher	1508	1902	1643	683	718	5275	12136
Associate professor	594	928	1046	943	250	2911	6699
Research engineer	1068	1044	677	290	697	1685	5542
Postdoctoral researcher	1041	881	552	121	78	5025	7698
Adjunct lecturer	1736	614	244	0	581	2979	6154
Fully funded PhD student	697	1061	152	247	122	1980	4290

Distance travelled by plane in 2019 (row %):

Status	Fieldwork, data	Research stay	Meeting, workshop	Teaching, training	Others	Conference, presentation	Total
Senior researcher	9	21	15	6	6	42	100
Full professor	7	24	6	12	6	42	100
Tenured researcher	12	16	14	6	6	43	100
Associate professor	9	14	16	14	4	43	100
Research engineer	19	19	12	5	13	30	100
Postdoctoral researcher	14	11	7	2	1	65	100
Adjunct lecturer	28	10	4	0	9	48	100
Fully funded PhD student	16	25	4	6	3	46	100

3.2 IT equipment

	n	%	val%
At least one device under 5 years old	1838	28.4	62.2
No device under 5 years old	1115	17.2	37.8
NA	3514	54.3	NA

	n	%	val%
No device or a single device	1701	26.3	57.6
Several devices	1252	19.4	42.4
NA	3514	54.3	NA

	All devices considered essential	Some devices considered non-essential	Total
No device or a single device	17	83	100
Several devices	41	59	100
All	27	73	100

	At least one device under 5 years old	No device under 5 years old	Total
Law, economics, management	55	45	100
Other humanities and social sciences	47	53	100
History, geography, urbanism, anthropology	49	51	100
Mathematics	62	38	100
Computer science	73	27	100
Physics	68	32	100
Chemistry	67	33	100
Astronomy	73	27	100
Geology	69	31	100
Meteorology, oceanology, environmental physics	63	37	100
Health and medical research	61	39	100
Engineering	68	32	100
Biology	62	38	100
Population biology and ecology	66	34	100
All	62	38	100

	No device or a single device	Several devices	Total
Law, economics, management	70	30	100
Other humanities and social sciences	63	37	100
History, geography, urbanism, anthropology	68	32	100
Mathematics	57	43	100
Computer science	52	48	100
Physics	52	48	100
Chemistry	60	40	100
Astronomy	56	44	100
Geology	43	57	100
Meteorology, oceanology, environmental physics	48	52	100
Health and medical research	56	44	100
Engineering	55	45	100
Biology	54	46	100
Population biology and ecology	56	44	100
All	57	43	100

	All devices considered essential	Some devices considered non-essential	Total
Law, economics, management	23	77	100
Other humanities and social sciences	28	72	100
History, geography, urbanism, anthropology	25	75	100
Mathematics	25	75	100
Computer science	28	72	100
Physics	28	72	100
Chemistry	24	76	100
Astronomy	23	77	100
Geology	31	69	100
Meteorology, oceanology, environmental physics	30	70	100
Health and medical research	28	72	100
Engineering	30	70	100
Biology	24	76	100
Population biology and ecology	34	66	100
All	27	73	100

	At least one device under 5 years old	No device under 5 years old	Total
Senior researcher	69	31	100
Full professor	65	35	100
Tenured researcher	67	33	100
Associate professor	67	33	100
Research engineer	68	32	100
Postdoctoral researcher	43	57	100
Adjunct lecturer	29	71	100
Fully funded PhD student	56	44	100
Research support engineer	67	33	100
Research assistant/Project manager	53	47	100
Engineer assistant	64	36	100
Technician	54	46	100
Technical assistant	43	57	100
Other personnel	41	59	100
All	62	38	100

	No device or a single device	Several devices	Total
Senior researcher	40	60	100
Full professor	41	59	100
Tenured researcher	54	46	100
Associate professor	53	47	100
Research engineer	51	49	100
Postdoctoral researcher	84	16	100
Adjunct lecturer	79	21	100
Fully funded PhD student	77	23	100
Research support engineer	58	42	100
Research assistant/Project manager	79	21	100
Engineer assistant	53	47	100
Technician	64	36	100
Technical assistant	57	43	100
Other personnel	81	19	100
All	58	42	100

3.3 Leftover budget money

	n	%	val%
Has had leftover budget money to spend	3642	56.3	60.1
Has not had leftover budget money to spend	2419	37.4	39.9
NA	406	6.3	NA

Having used leftover budget money to buy IT equipment considered as non-essential:

	n	%	val%
Yes	1241	19.2	20.5
No	2302	35.6	38.0
I have not had leftover budget money to spend	2517	38.9	41.5
NA	407	6.3	NA

	n	%	val%
Yes	1241	19.2	35
No	2302	35.6	65
NA	2924	45.2	NA

	Yes	No	I have not had leftover budget money to spend	Total
Law, economics, management	15	30	54	100
Other humanities and social sciences	24	32	45	100
History, geography, urbanism, anthropology	19	39	42	100
Mathematics	24	35	41	100
Computer science	30	30	40	100
Physics	22	45	33	100
Chemistry	14	42	43	100
Astronomy	20	39	41	100
Geology	18	45	37	100
Meteorology, oceanology, environmental physics	24	37	39	100
Health and medical research	14	40	46	100
Engineering	23	39	38	100
Biology	19	42	39	100
Population biology and ecology	27	35	38	100
All	20	38	41	100

	Yes	No	I have not had leftover budget money to spend	Total
Senior researcher	25	54	21	100
Full professor	32	46	22	100
Tenured researcher	22	51	28	100
Associate professor	28	42	31	100
Research engineer	22	43	35	100
Postdoctoral researcher	9	21	70	100
Adjunct lecturer	14	17	69	100
Fully funded PhD student	6	19	76	100
Research support engineer	21	34	45	100
Research assistant/Project manager	0	30	70	100
Engineer assistant	19	33	48	100
Technician	24	32	44	100
Technical assistant	18	32	50	100
Other personnel	11	29	60	100
All	20	38	42	100

Having used leftover budget money to buy plane tickets considered as non-essential:

	n	%	val%
Yes	192	3.0	3.2
No	3275	50.6	54.4
I have not had leftover budget money to spend	2554	39.5	42.4
NA	446	6.9	NA

	n	%	val%
Yes	192	3.0	5.5
No	3275	50.6	94.5
NA	3000	46.4	NA

	Yes	No	I have not had leftover budget money to spend	Total
Law, economics, management	5	41	55	100
Other humanities and social sciences	3	51	45	100
History, geography, urbanism, anthropology	5	52	44	100
Mathematics	7	49	43	100
Computer science	5	53	42	100
Physics	2	65	34	100
Chemistry	2	55	43	100
Astronomy	6	52	42	100
Geology	3	62	35	100
Meteorology, oceanology, environmental physics	6	52	42	100
Health and medical research	2	51	47	100
Engineering	2	58	40	100
Biology	1	60	39	100
Population biology and ecology	2	60	38	100
All	3	55	42	100

	Yes	No	I have not had leftover budget money to spend	Total
Senior researcher	4	75	21	100
Full professor	4	73	23	100
Tenured researcher	3	69	27	100
Associate professor	4	64	31	100
Research engineer	3	62	36	100
Postdoctoral researcher	3	27	69	100
Adjunct lecturer	3	22	74	100
Fully funded PhD student	3	21	76	100
Research support engineer	1	53	46	100
Research assistant/Project manager	3	27	70	100
Engineer assistant	3	47	50	100
Technician	4	48	47	100
Technical assistant	6	50	44	100
Other personnel	2	36	62	100
All	3	54	42	100

4 Solutions

4.1 Reductions in personal GHG emissions in a professional setting by 2030

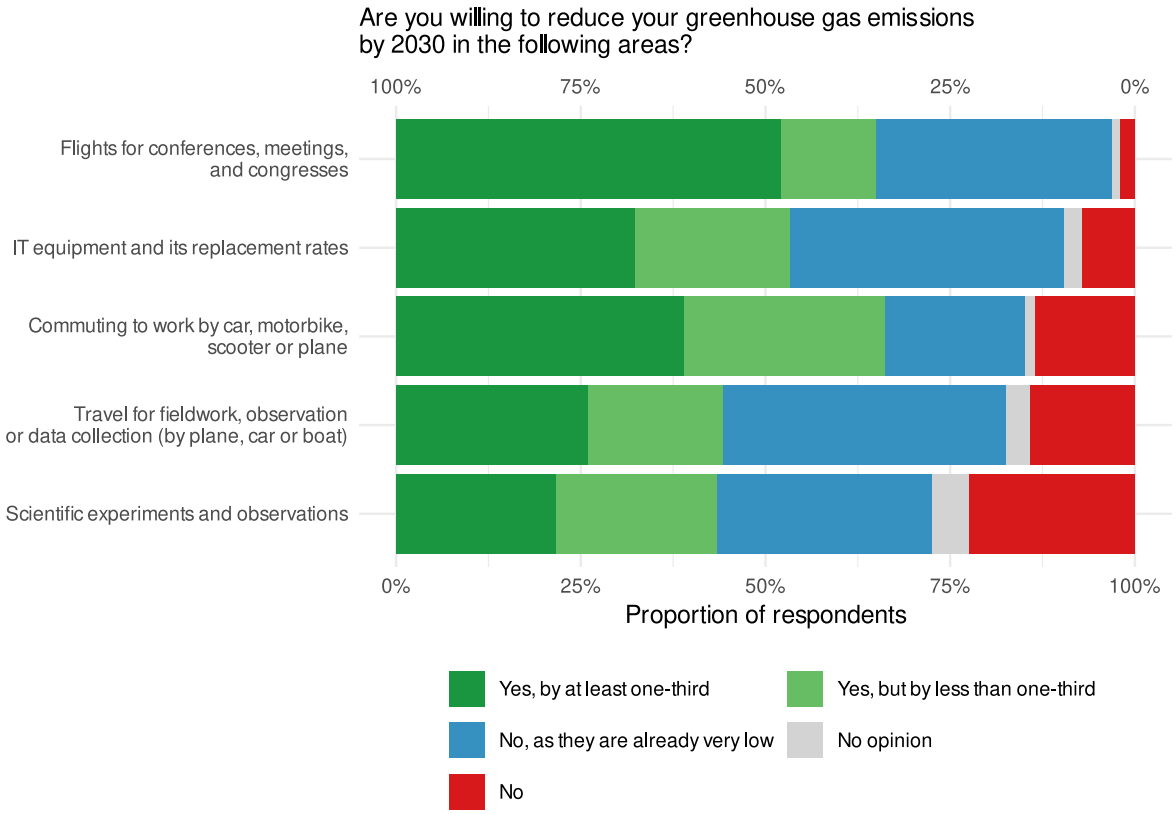
Are you willing to reduce your greenhouse gas emissions by 2030 in the following areas?

	Yes, by at least one-third	Yes, but by less than one-third	No, as they are already very low	No opinion	No	Not concerned	Total
Flights for conferences, meetings, and congresses	44	11	27	1	2	15	100
IT equipment and its replacement rates	31	20	36	2	7	3	100
Commuting to work by car, motorbike, scooter or plane	38	27	19	1	13	2	100
Travel for fieldwork, observation or data collection (by plane, car or boat)	13	9	20	2	7	49	100
Scientific experiments and observations	13	13	18	3	14	40	100

Proportion of “No” anwsers, excluding those not concerned:

	Scientific experiments and observations	Travel for fieldwork, observation or data collection (by plane, car or boat)	Commuting to work by car, motorbike, scooter or plane	IT equipment and its replacement rates	Flights for conferences, meetings, and congresses
Law, economics, management	19	15	9	7	2
Other humanities and social sciences	18	13	22	3	1
History, geography, urbanism, anthropology	14	16	10	5	1
Mathematics	11	5	16	5	2
Computer science	6	2	15	9	1
Physics	32	17	17	9	3
Chemistry	26	12	17	9	3
Astronomy	24	14	15	8	4
Geology	32	26	8	9	2
Meteorology, oceanology, environmental physics	27	22	0	6	1
Health and medical research	20	12	15	9	2
Engineering	19	5	11	8	2
Biology	26	12	13	6	2
Population biology and ecology	23	21	9	5	5
All	23	14	13	7	2

	Scientific experiments and observations	Travel for fieldwork, observation or data collection (by plane, car or boat)	Commuting to work by car, motorbike, scooter or plane	IT equipment and its replacement rates	Flights for conferences, meetings, and congresses
Senior researcher	29	16	17	9	3
Full professor	23	15	11	12	4
Tenured researcher	27	18	7	8	1
Associate professor	19	13	13	6	2
Research engineer	22	15	17	8	2
Postdoctoral researcher	40	0	0	22	0
Adjunct lecturer	0	0	50	0	0
Fully funded PhD student	16	14	0	4	4
Research support engineer	20	11	13	5	0
Research assistant/Project manager	17	0	11	0	0
Engineer assistant	17	9	14	5	2
Technician	13	8	21	3	0
Technical assistant	0	0	10	4	0
Other personnel	17	9	17	5	3
All	23	14	14	7	2

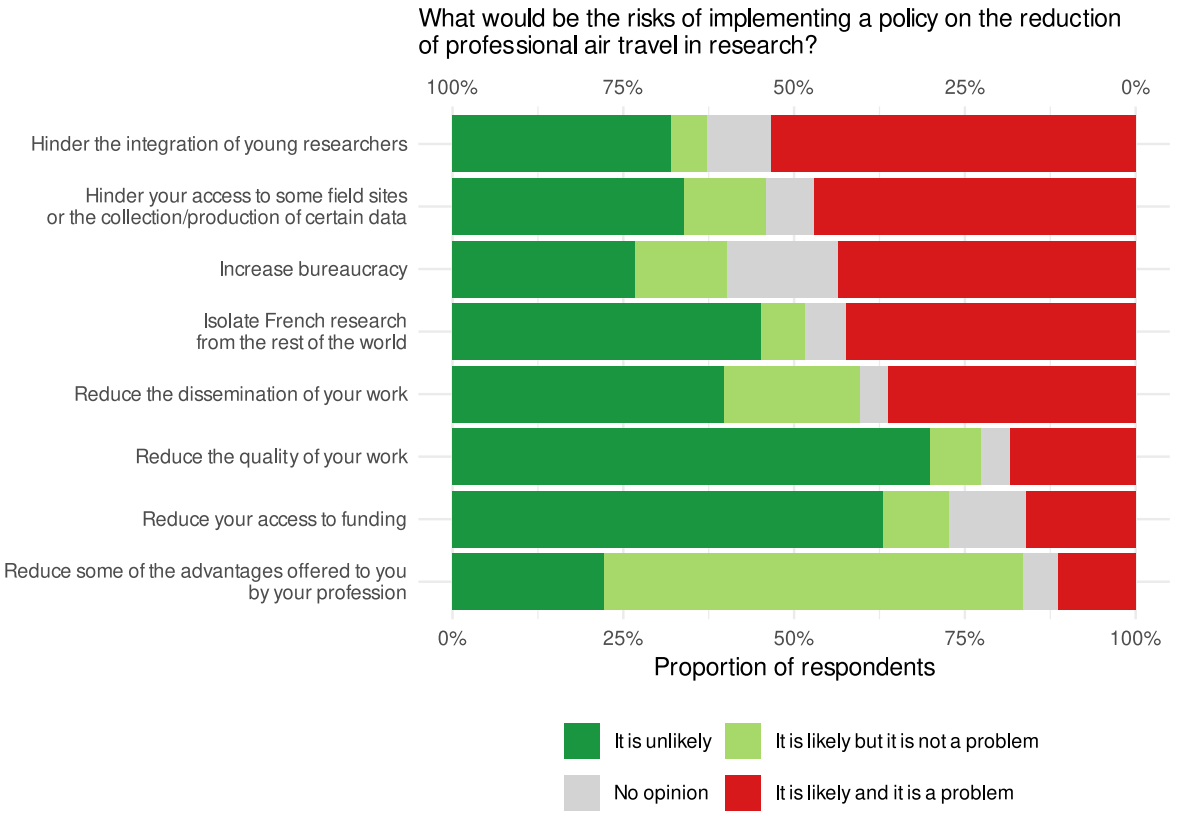


Note: the proportion of people concerned varies according to the question
Interpretation: 32% of respondents say they are unable to reduce the emissions they generate by flying to conferences as they are already very low
Source: “Research personnel and climate change” survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=4107)

4.2 Risks associated with reduced flying

What would be the risks of implementing a policy on the reduction of professional air travel in research?

	It is unlikely	It is likely but it is not a problem	No opinion	It is likely and it is a problem	Not concerned	Total
Hinder the integration of young researchers	30	5	9	51	5	100
Hinder your access to some field sites or the collection/production of certain data	19	7	4	26	45	100
Increase bureaucracy	26	13	16	42	5	100
Isolate French research from the rest of the world	43	6	6	41	4	100
Reduce the dissemination of your work	37	19	4	34	6	100
Reduce the quality of your work	65	7	4	17	7	100
Reduce your access to funding	57	9	10	14	10	100
Reduce some of the advantages offered to you by your profession	19	54	5	10	12	100



Note: the proportion of people concerned varies according to the question
Interpretation: 54% of respondents think it likely that a reduction in the number of flights would negatively impact the integration of young researchers and that it is a problem
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=4760)

Proportion of "It is likely and it is a problem" answers, excluding those not concerned:

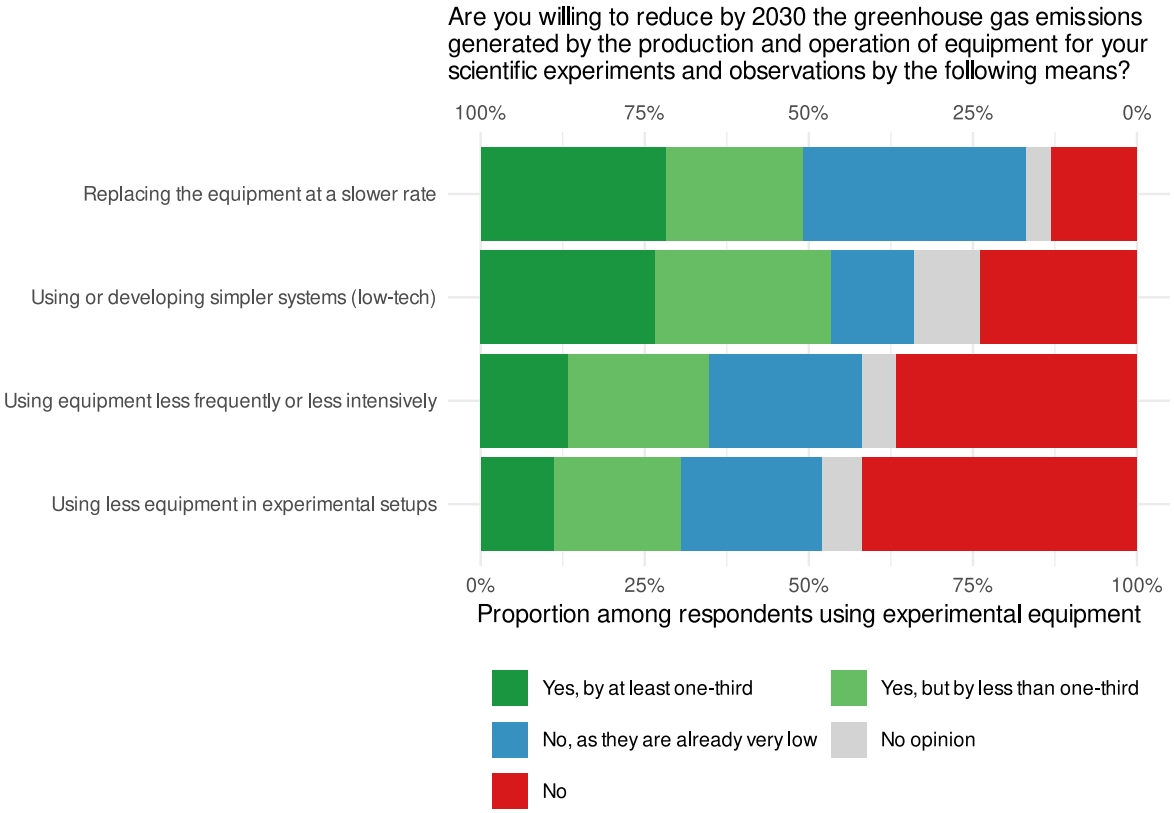
	Reduce the quality of your work	Hinder your access to some field sites or the collection/production of certain data
Law, economics, management	26	54
Other humanities and social sciences	24	57
History, geography, urbanism, anthropology	34	72
Mathematics	27	15
Computer science	16	20
Physics	15	36
Chemistry	12	32
Astronomy	20	48
Geology	25	73
Meteorology, oceanology, environmental physics	13	58
Health and medical research	10	31
Engineering	14	24
Biology	13	35
Population biology and ecology	18	61
All	18	47

	Isolate French research from the rest of the world	Hinder the integration of young researchers	Reduce the dissemination of your work
Senior researcher	49	60	41
Full professor	53	62	36
Tenured researcher	43	56	39
Associate professor	42	57	36
Research engineer	41	46	30
Postdoctoral researcher	35	56	40
Adjunct lecturer	36	46	40
Fully funded PhD student	38	49	39
Research support engineer	37	34	24
Research assistant/Project manager	38	42	31
Engineer assistant	36	38	25
Technician	39	40	19
Technical assistant	20	25	40
Other personnel	39	51	33
All	42	53	36

4.3 Reductions in personal GHG emissions of experimental equipment by 2030

Are you willing to reduce by 2030 the greenhouse gas emissions generated by the production and operation of equipment for your scientific experiments and observations by the following means?

	Yes, by at least one-third	Yes, but by less than one-third	No, as they are already very low	No	No opinion	Not concerned	Total
Replacing the equipment at a slower rate	25	19	31	12	3	9	100
Using or developing simpler systems (low-tech)	22	22	10	19	8	19	100
Using equipment less frequently or less intensively	12	19	20	32	4	13	100
Using less equipment in experimental setups	9	16	17	34	5	18	100

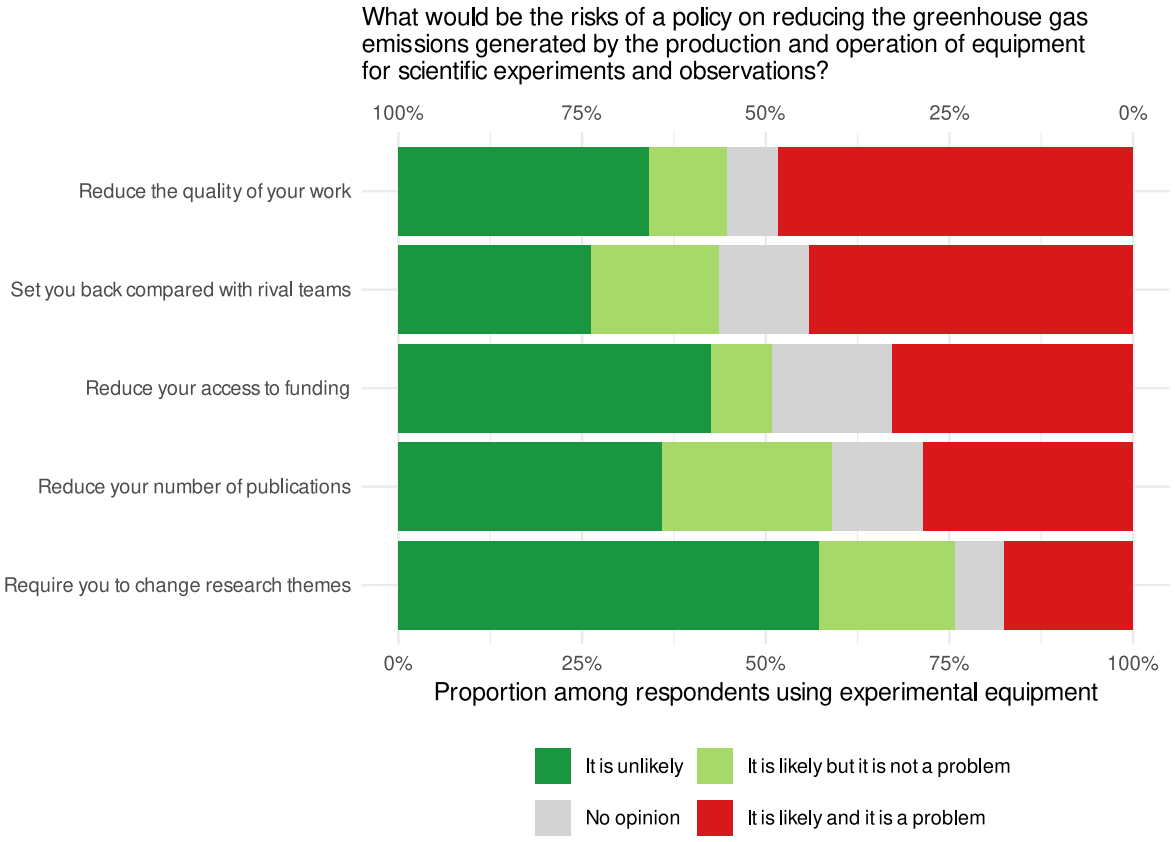


Note: the proportion of people concerned varies according to the question.
Interpretation: 34% of respondents say they are unable to reduce their emissions by replacing equipment at a slower rate because they are already very low.
Source: "Research personnel and climate change" survey, Labos 1point5, 2020
Coverage: personnel associated with a CNRS unit and using experimental equipment (n=2257)

4.4 Risks associated with reduced emissions of experimental equipment

What would be the risks of a policy on reducing the greenhouse gas emissions generated by the production and operation of equipment for scientific experiments and observations?

	It is unlikely	It is likely but it is not a problem	No opinion	It is likely and it is a problem	Not concerned	Total
Require you to change research themes	51	17	6	16	10	100
Reduce your number of publications	32	20	11	25	11	100
Reduce your access to funding	38	7	14	29	11	100
Set you back compared with rival teams	24	16	11	40	9	100
Reduce the quality of your work	32	10	7	45	6	100

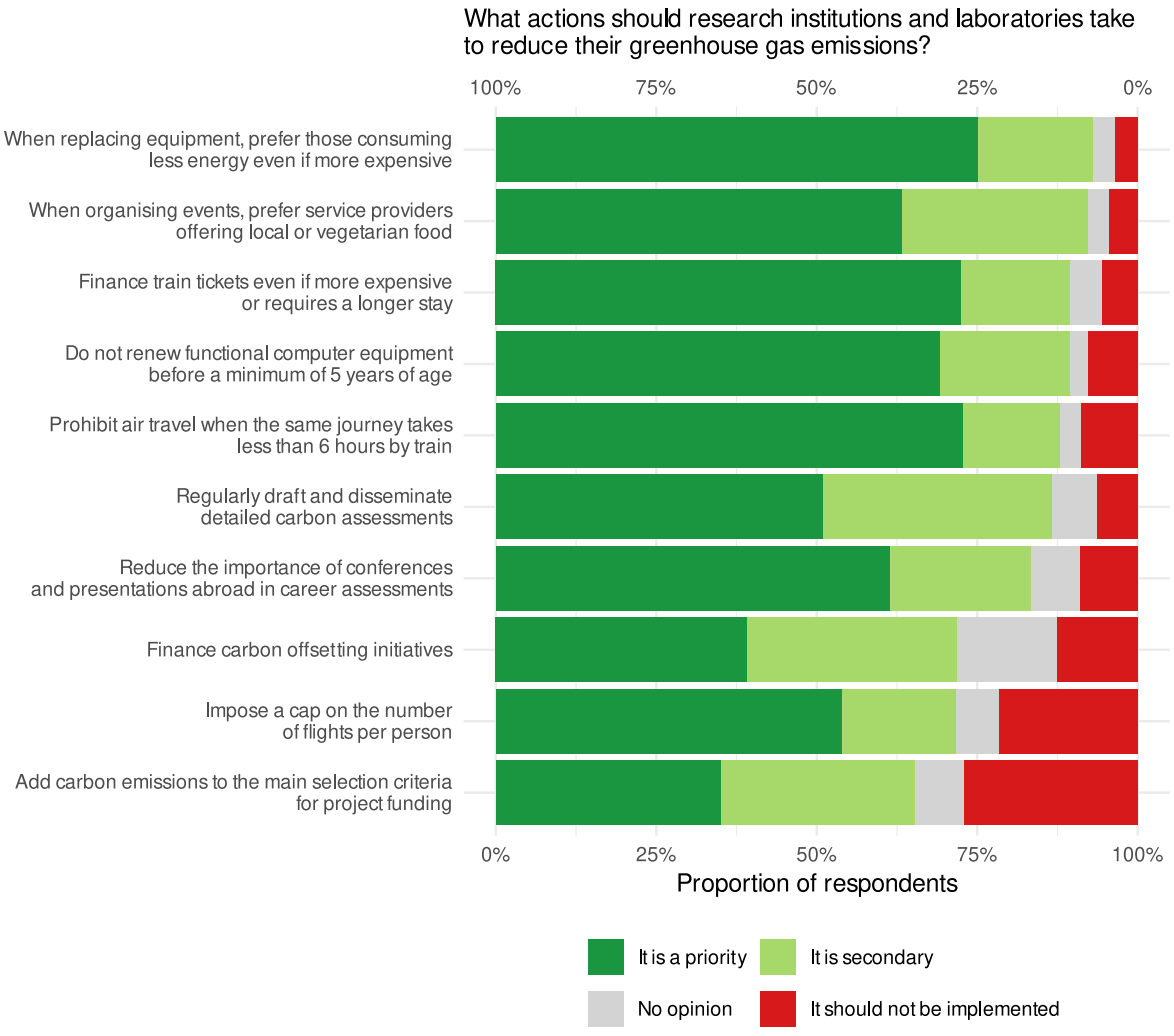


Note: the proportion of people concerned varies according to the question
ents think it likely that a reduction in the number of flights would negatively impact the integration of young researchers and that it is a problem.
Source: “Research personnel and climate change” survey, Labos 1point5, 2020
Coverage: personnel associated with a CNRS unit and using experimental equipment (n=3173)

4.5 Institutional solutions

What actions should research institutions and laboratories take to reduce their greenhouse gas emissions?

	It is a priority	It is secondary	No opinion	It should not be implemented	Total
When replacing equipment, prefer those consuming less energy even if more expensive	75	18	3	4	100
When organising events, prefer service providers offering local or vegetarian food	63	29	3	5	100
Finance train tickets even if more expensive or requires a longer stay	72	17	5	6	100
Do not renew functional computer equipment before a minimum of 5 years of age	69	20	3	8	100
Prohibit air travel when the same journey takes less than 6 hours by train	73	15	3	9	100
Regularly draft and disseminate detailed carbon assessments	51	36	7	6	100
Reduce the importance of conferences and presentations abroad in career assessments	61	22	8	9	100
Finance carbon offsetting initiatives	39	33	16	13	100
Impose a cap on the number of flights per person	54	18	7	22	100
Add carbon emissions to the main selection criteria for project funding	35	30	8	27	100



Interpretation: 75% of respondents think that choosing more energy-efficient equipment is a priority
Source: “Research personnel and climate change” survey, Labos 1point5, 2020
Coverage: personnel affiliated with a CNRS unit (n=5698)

S2 Appendix. Calculation of air travel distances and the corresponding GHG emissions

The questionnaire includes questions on air travel for professional reasons in 2019 through two distinct sets of questions. The first set, concerning the number of flights and total flight time (to pick among four possible ranges), was asked to all respondents. This information was not used here; instead, we used information generated by a second set of more detailed questions posed to half of the respondents in a random manner.

The latter set of questions consists of a table in which respondents were asked to enter all the airplane journeys taken in 2019 (up to a maximum of 5 journeys), specifying for each one the number of times the journey was taken, the city of departure and arrival, the number of days spent at the destination, the main reason and any secondary reason for the trip. This approach encouraged respondents to recount in detail their professional trips in 2019 rather than give an approximate total number. A list of the main French and international airports was provided to the respondents, helping them to select the cities (without forcing them to choose from the list) and serving to limit manual recoding and ambiguous names. The GPS coordinates of the corresponding airports were obtained from a list of world airports and the orthodromic distance between the place of departure and arrival was calculated using the haversine formula. The distances reported are thus theoretical, the real journeys necessarily being longer, notably for flights involving stopovers.

Limiting the number of journeys to 5 implies an under-estimation of flying on the part of the respondents with the most air miles. Each of these 5 journeys is defined by a combination of departure, arrival, time spent at destination, and reason, but the number of flights that could be reported per journey is unlimited. Only 4% of respondents in PhD-level positions reported a fifth journey in the table. Of this 4%, 60% reported more round-trip flights in the simplified question than in the table, for an average of 10.6 round trips, compared with 6.2. Overall, the under-estimation of air travel in the table therefore appears to be limited.

The calculation of GHG emissions generated by air travel is subject to uncertainty depending on the way in which the radiative forcing resulting from factors other than CO_2 (vapour trails, etc.) is considered. These factors are not taken into account by some GHG calculators, while the literature suggests that in all likelihood they double the emissions factors of flights [52]. Based on [24], we can select emissions factors of between 200 g CO_2e/passenger/km (for short-haul flights) and 300 g CO_2e/passenger/km (for long-haul flights). The detailed data on flights collected in the survey could be used to establish precise estimates of the emissions corresponding to each flight, but for the sake of simplicity we report distances, and only a rough estimate of the average emissions is provided here.

S3 Appendix. English translation of the questionnaire

Text of the invitation message :
Title message: [National survey] Research personnel faced with climate change

Dear colleague,

You have been selected to participate in the first large-scale survey of research staff's opinions and professional practices regarding climate change. The survey is open to all staff, regardless of **their status, discipline and level of familiarity with environmental issues**.

Your participation in this questionnaire is essential to reflect the diversity of practices and opinions of those who make up the world of research, and to find answers to environmental issues while respecting the multiplicity of points of view.

The answers to the questionnaire will be used **anonymously in the framework of the future CNRS research group GDR-1point5**. This questionnaire was designed by researchers within the multidisciplinary collective Labos 1point5, which analyses the impact of research staff activities on the environment and climate (see here on CNRS Info).

You can fill in the questionnaire at this address:
https://www.enquetes.mate-shs.cnrs.fr/index.php/113464?token=[% user.gecos %]
It is possible to answer in several times, by following again this same link.
The answers are strictly confidential (GDPR information notice here).

We thank you in advance for your participation. If you have any questions, please contact us at enquete@labos1point5.org.

Labos 1point5

Reminder message text :
Title message: [National survey: reminder] Research personnel faced with climate change

Dear colleague,

A week ago, you received a message inviting you to participate in a study on the opinions and professional practices of research staff in relation to climate change.

Some of you have told us that you are afraid that this is spam or phishing. We would like to reaffirm that this is a study coordinated by researchers, within the Labos 1.5 collective, which brings together research staff with the aim of analysing the impact of research activities on the environment and the climate. You will find more information on this collective in the June 2019 *CNRS Info* :
http://www.cnrs.fr/fr/cnrsinfo/recherche-et-environnement-le-collectif-labos-1point5-promeut-une-recherche-responsable

We are sending you this invitation to participate in this study, reminding you that it is intended for all staff, **regardless of their status, discipline or degree of familiarity with environmental issues**. **Your participation in this questionnaire is essential to reflect the diversity of practices and opinions** of those who make up the world of research, and to find answers to environmental issues while respecting the multiplicity of points of view.

You can fill in the questionnaire at this address:
https://www.enquetes.mate-shs.cnrs.fr/index.php/113464?token=[% user.gecos %]
It is possible to answer them in several times, by following again this same link. You are of course free not to answer them or to answer only part of the questions if you wish.
The answers are strictly confidential (GDPR information notice here).

We thank you in advance for your participation. If you have any questions, please contact us at enquete@labos1point5.org.

For Labos 1point5,
Milan Bouchet-Valat (INED), Marianne Blanchard (Toulouse Jean-Jaurès University, CERTOP), Damien Cartron (CNRS, CMH), Jérôme Greffion (Paris Nanterre University, IDHES), Julien Gros (CNRS, LEST)

Text of the reminder message for incomplete responses :
Title message: [National survey: reminder] Research personnel faced with climate change

Dear colleague,

You have started to answer the questionnaire entitled "Researchers and climate change". Thank you very much for your time!

We have noticed that you have stopped filling in the questionnaire. However, complete answers to the questionnaire are very valuable to us. For example, the questions at the end allow us to understand your opinion on the concrete solutions to be implemented and to correctly understand your personal situation.

Also, if you have the opportunity, we would be very grateful if you could finish filling out the questionnaire. This will greatly improve the quality of our study.

You can continue to respond at this address:
https://www.enquetes.mate-shs.cnrs.fr/index.php/113464?token=[% user.gecos %]
Your previous answers have been retained.

If you have any questions, you can contact us at enquete@labos1point5.org.

For Labs 1point5,
Milan Bouchet-Valat (INED), Marianne Blanchard (Toulouse Jean-Jaurès University, CERTOP), Damien Cartron (CNRS, CMH), Jérôme Greffion (Paris Nanterre University, IDHES), Julien Gros (CNRS, LEST)

First page of the questionnaire :

This questionnaire is the first large-scale study of research personnel's opinions and professional practices regarding climate change. It is intended for all staff, regardless of **their status, discipline and level of familiarity with environmental issues.**

You have been selected at random from among all research personnel. **Your participation in this questionnaire is essential to reflect the diversity of practices and opinions** of those who make up the world of research, and to find answers to environmental issues while respecting the multiplicity of points of view.

The answers to the questionnaire will be used **anonymously within the future CNRS research group GDR-1point5**. This questionnaire was designed by researchers within the multidisciplinary collective Labos 1point5, which brings together research personnel to analyse the impact of research activities on the environment and climate.

This questionnaire is about your professional situation and practices, as well as your representations and opinions on research and the environment. It includes some optional questions about personal opinions that are considered sensitive data under the European Data Protection Regulation (GDPR). You are free to continue without answering them, as with most questions. ***The answers are strictly confidential.***

The questionnaire takes about 15-20 minutes to complete. It is possible to answer it in several times, by following the same link again. ***We thank you very much for your time!***

The aggregated statistical results of this research will be disseminated in professional and scientific conferences, in professional and academic journals, in reports for authorities or research organizations, in media for the general public, and on social networks.

Initial results will be given at the end of the questionnaire. *If you are interested in the more detailed results of the survey, you can ask to be kept informed.*
Contact: enquete@labos1point5.org

The data collected in the context of this project have been declared to the CNRS Data Protection Officer at the following address CNRS-Service Protection des Données - 2 rue Jean Zay - 54500 - Vandoeuvre lès Nancy, dpd.demandes@cnrs.fr. You can access the information relating to this declaration here.

☐ By checking this box, I acknowledge that I have read the information regarding data collection for this project and agree to participate in this study

*The questions marked with an * are not asked of staff not directly involved in research (BAP E-F-G-J).*

General information

To begin, we would like to gather some information about your situation in the research community.

1. Are you... ☐ a woman ☐ a man ☐ other
2. How old are you?
   ☐ Under 18 years ☐ 18-24 years ☐ 25-29 years ☐ 30-34 years ☐ 35-39 years
   ☐ 40-44 years
   ☐ 45-49 years ☐ 50-54 years ☐ 55-59 years ☐ 60-64 years ☐ 65-69 years
   ☐ 70 years or older
3. Currently, are you a PhD student? ☐ Yes ☐ No
4. What is your primary employment status? [REQUIRED]
   ☐ Civil servant ☐ Permanent contract ☐ Fixed-term contract ☐ Self-employed
   ☐ Unemployed/no job ☐ Retired ☐ Other
5. What is (or was) your primary employment status? [MANDATORY]

☐ Full professor	☐ Associate professor	☐ Adjunct lecturer	☐ PhD student with funding	☐ CIFRE doctoral contract
☐ Senior research	☐ Tenured researcher	☐ Research assistant/ Project manager	☐ Postdoctoral researcher	
☐ Research engineer	☐ Research support engineer	☐ Engineer assistant	☐ Technician	☐ Technical assistant
☐ Other: _____				

6. *IF PhD STUDENT != YES and (UNEMPLOYED (question 4) or RESEARCH ASSISTANT/PROJECT MANAGER/TECHNICIAN/TECHNICAL ASSISTANT/OTHER (question 5))* : Are you currently associated with (primarily or secondarily) or member of a public research institution? [REQUIRED]
   ☐ Yes ☐ No

7. FOR PhD STUDENTS OR RESEARCHERS: What is your main research discipline? Please choose from the following National Council of Universities (CNU) sections. You can type the first characters or the number to start a search. (list of CNU sections)

FOR SUPPORT PERSONNEL: To which branch of professional activity (BAP) do you belong? (list BAP + Other + DK) [MANDATORY]

FOR SUPPORT PERSONNEL and OTHER NON-PhD STUDENTS: Are you close to one of the following disciplines? Please choose among the CNU sections. You can type the first characters or the number to launch a search. (list of CNU sections)

*Filter for those in BAP E-F-G-J (excluding A-B-C-D who are involved in research activities): short questionnaire (questions marked with an * are skipped)*

8. *If civil servant/permanent contract/fixed-term contract:* What is your main employer?
   ☐ CNRS ☐ A university ☐ A grande école or grand établissement
   ☐ Inserm ☐ Inrae ☐ Inria ☐ IRD ☐ Ined
   ☐ CEA ☐ CNES ☐ ONERA ☐ Cirad ☐ Ifremer
   ☐ Another public institution
   ☐ A company
   ☐ Other : _____

9. What institutions is your main laboratory (or of the unit or team in which you work) affiliated with? *(Several answers are possible.*)
   ☐ CNRS ☐ A university ☐ A grande école or grand établissement
   ☐ Inserm ☐ Inrae ☐ Inria ☐ IRD ☐ Ined
   ☐ CEA ☐ CNES ☐ ONERA ☐ Cirad ☐ Ifremer
   ☐ Another public institution
   ☐ A company
   ☐ Other : _____

Your position on the environment and research

We'll now talk about your position on current environmental issues and how they relate to your research.

10. Do you think the climate of the planet is changing (rise in temperatures in the last century)?
   ☐ Yes, definitely ☐ Yes, probably ☐ No, probably not ☐ No, definitely not ☐ No opinion

11. *If yes climate change.* In your opinion, are human activities the cause of this climate change?
   ☐ No, they play no role ☐ Yes, they play a small role
   ☐ Yes, they play a major role ☐ Yes, they are the only cause ☐ No opinion

12. *If yes climate change.* To what degree are you concerned about climate change?
   ☐ Not at all concerned ☐ Slightly concerned ☐ Somewhat concerned
   ☐ Very concerned ☐ Extremely concerned ☐ No opinion

13. *If yes climate change.* Are you more or less concerned than 5 years ago?
   ☐ Much more ☐ Somewhat more ☐ Neither more nor less ☐ Somewhat less ☐ Much less ☐ No opinion

14. Regardless of your field of work, are you involved in research related to ecology, the environment, or climate?*
   ☐ Yes ☐ No, but I have been in the past ☐ No

15. Have you ever:*

	Yes, I already have	I thought about it	No
Reoriented your research towards themes more related to ecology, the environment or climate	☐	☐	☐
Forgone research programs/themes due to their negative impact on the environment	☐	☐	☐

16. Do you think that climate urgency calls for profound changes in the practice of our professions?
☐ Yes, strongly agree ☐ Yes, somewhat agree
☐ No, somewhat disagree ☐ No, strongly disagree ☐ No opinion

Your practices and those of your laboratory (management of equipment, energy, etc.)

We will now discuss your professional practices and those of your laboratory to limit the impact of research on the environment.

17. In your laboratory (or in the unit or team in which you work):

	I don't know	Yes	No	No, but the issue has been discussed	Not concerned
You can recycle your paper waste	☐	☐	☐	☐	☐
You are encouraged to take the train rather than the plane even if it is more expensive or longer	☐	☐	☐	☐	☐
There is a charter, a working group or a person designated to reduce the ecological footprint of research activities	☐	☐	☐	☐	☐

18. In your laboratory (or in the unit or team in which you work), collective measures have been implemented to:

	I don't know	Yes	No	No, but the issue has been discussed	Not concerned
Limit the environmental impact of drinks and buffets (reducing plastic waste, offering organic, local or vegetarian menus, etc.)	☐	☐	☐	☐	☐
Limit the generation of waste from experiments	☐	☐	☐	☐	☐
Reduce greenhouse gas emissions from observation and data collection trips	☐	☐	☐	☐	☐
Reduce the power consumption of servers (storage, calculation...)	☐	☐	☐	☐	☐

19. As an individual, when technically possible:

	Always or often	Sometimes	Rarely or never	I don't have control, not concerned
Do you turn off or suspend the computer you use at work when you leave the office at night?	☐	☐	☐	☐
During the winter, do you turn down the heating in your office outside of working hours?	☐	☐	☐	☐
Do you limit the sending of large attachments in your emails?	☐	☐	☐	☐
Do you print on both sides?	☐	☐	☐	☐

MODULE 2: IT EQUIPMENT

20. **For your work**, you use (*leave blank the boxes that do not concern you or that would be 0*) :

	Number	How many are less than 5 years old?	How many do you consider essential?
Shared computers in the lab			
Personal desktop computers purchased with professional funding			
Personal desktop computers purchased by you			
Personal laptops purchased with professional funding			
Personal laptops purchased by you			
Tablets purchased with professional funding			
Tablets purchased by you			

21. The last time you changed the computer you use for your work, for what reasons did you do so? *(Multiple answers possible.)*
    - ☐ I never changed my computer for professional use
    - ☐ I got a new job contract
    - ☐ It was stolen, I lost it
    - ☐ It didn't work at all anymore
    - ☐ It didn't work very well anymore
    - ☐ It wasn't powerful enough
    - ☐ It couldn't be updated anymore
    - ☐ I wanted a new one
    - ☐ I wanted a better one (better autonomy, screen, etc.)
    - ☐ It was proposed to me/I had the opportunity to do it
    - ☐ I was forced to do it
    - ☐ Other

END OF MODULE 2: IT

22. In the past 5 years, have you ever spent money on the following items to finish a budget leftover when it was not really essential (for you or others)?

	Yes	No	I haven't had to use any leftover budget
Funding for air travel	☐	☐	☐
Purchase of computers, monitors or tablets	☐	☐	☐

23. *If in Science and technology or Life and environmental sciences, or if in BAP A, B, C or E:* Do you regularly use the following equipment to perform your scientific experiments and observations? *(Several answers are possible.)*

☐ Very large, energy-intensive shared research infrastructures (particle accelerator, radio telescope, oceanographic ship, aircraft, etc.)
☐ Large computing infrastructure (supercomputer or data center)
☐ Extensive non-laboratory experimental setups (fields, greenhouses, farms, etc.) or an animal house
☐ Large, expensive equipment (MRI, positron emission tomography, scanning microscope, frequency comb, etc.)
☐ Expensive equipment (oscilloscope, centrifuge, fume hood, freezer, laser, electromagnet, cryostat, vacuum pump, mass spectrometer, optical microscope, photomultiplier, etc.)
☐ Small laboratory equipment (glassware, small electronics, etc.)
☐ None of the above

24. Over the past 5 years, would you say that your greenhouse gas emissions in the following areas have...

	Increased sharply	Increased somewhat	Been more or less stable	Decreased somewhat	Decreased sharply	Not concerned	I don't know
Air travel for conferences, meetings, and congresses	☐	☐	☐	☐	☐	☐	☐
Travel for fieldwork, observation or data collection (by plane, car or boat)*	☐	☐	☐	☐	☐	☐	☐
Scientific experiments and observations (excluding travel)*	☐	☐	☐	☐	☐	☐	☐
Computer equipment and its replacement rates	☐	☐	☐	☐	☐	☐	☐
Commuting to work by car, motorcycle, motor scooter or plane	☐	☐	☐	☐	☐	☐	☐

Your transportation for professional purposes

Now let's talk about your use of transportation for professional purposes, looking first at your use of air travel and its reasons.

25. For the year 2019 (January 1 to December 31), approximately how many round trips flights did you make for professional purposes excluding commuting? *For a one-way trip, indicate 0.5 round trips.*
    _ _ round-trip flights
    IF > *0:* For approximately how many hours of flying in total?
    ☐ From 1h to 10h ☐ From 11h to 20h ☐ From 20h to 50h ☐ Over 50h

26. *IF = 0: In the* previous two years (2017 and 2018), did you fly for professional purposes excluding commuting?
    ☐ Yes, for more than 10 hours in total ☐ Yes, for less than 10 hours in total ☐ No

MODULE 1: FLIGHTS

27. ***If you flew in 2019*** (if not, go to the next question), please describe in the following table your first 5 round-trip flights by plane in 2019, grouping together those made several times for the same reasons. Indicate the French names of the cities (e.g. Londres rather than London), using the suggestions that appear when possible (these names will be used to calculate the distance of the flight). For a one-way trip, enter 0.5 round trips.

	City of departure (take-off)	City of arrival (final landing)	Number of days worked on site - Less than two days - From two days to one week - From more than a week to a month - More than one month	Primary reason for travel - Conference, presentation - Research stay - Meeting, workshop - Teaching, training, summer school - Fieldwork, production and data collection - Getting funding - Evaluation of research - Jury - Other	Secondary reason for travel (if any) - None - Conference, presentation - Research stay - Meeting, workshop - Teaching, training, summer school - Fieldwork, production and data collection - Getting funding - Evaluation of research - Jury - Other	Number of **round trips** made
Journey 1						_ _ round trips
Journey 2						_ _ round trips
Journey 3						_ _ round trips
Journey 4						_ _ round trips
Journey 5						_ _ round trips

28. *IF > 0*: Of these flights, what proportion did you fly in premium or business class?
☐ Zero ☐ Less than a quarter ☐ Between a quarter and half ☐ More than half

29. *If > 0:* In 2019, did you fly for a work trip that takes less than 6 hours by train (excluding commuting)?
☐ Yes ☐ No ☐ I don't know

30. *If yes:* What are your main reasons for flying in these cases? *(Several answers possible.)*
☐ Flying is faster ☐ Flying is cheaper
☐ Flying is more convenient ☐ I like flying
☐ Flying saves me an overnight stay ☐ Administrative rules encourage me to fly

☐ It allows me to accumulate *miles*
☐ I do not think about it ☐ Other (specify: _____)

31. In the last 5 years, have you, for environmental reasons, taken the train rather than the plane in a professional context when the journey was longer?
☐ Yes, several times ☐ Yes, once ☐ No, but I thought about it ☐ No

END OF MODULE 1: FLIGHTS

32. Have you ever attended a conference/symposium abroad?
☐ Yes, within the last 5 years
☐ Yes, but more than 5 years ago -> skip the next question
☐ No -> skip the next two questions

33. *If yes in the last 5 years*: approximately how many times in the last 5 years?
☐ Less than once a year ☐ Once a year
☐ Twice a year ☐ Three times a year ☐ More than three times a year

34. *If yes:* Did the last such event in which you participated allow you to:

	Yes, to a great extent	Yes, somewhat	No, not really	No, not at all	No opinion
Advance in your work (comments/exchanges)	☐	☐	☐	☐	☐
Develop/maintain your international networks	☐	☐	☐	☐	☐
Maintain/strengthen professional or friendly ties with colleagues working in France	☐	☐	☐	☐	☐
Improve your CV	☐	☐	☐	☐	☐
Visit, do tourism	☐	☐	☐	☐	☐

MODULE 1: FLIGHTS

35. In 2019, did you forego one or more professional trips abroad (including deciding not to apply for a conference) for the following reasons?

	Yes, that was the main reason	Yes, but that was a secondary reason	No
Conflict with private commitments (family, appointments...)	☐	☐	☐
Conflict with other professional commitments	☐	☐	☐
Comfort and health reasons (travel time, jet lag, fatigue, etc.)	☐	☐	☐
Environmental considerations	☐	☐	☐
Difficulties in financing the trip	☐	☐	☐
The possibility of replacing travel with video conferencing	☐	☐	☐

END OF MODULE 1: FLIGHTS

MODULE 2: COMMUTING

36. Under normal circumstances (before the lockdown), on average, how many days do you work only from home? *Do not include any days worked on weekends.*

☐ Never ☐ Less than 1 day per week ☐ 1 day per week ☐ 2 days per week
☐ 3 days per week ☐ 4 days per week ☐ 5 days per week

Let's talk about your commute to work, in normal times (before the lockdown).

37. Before the lockdown, how much time did you spend on average **per week** on the following transport to and from work? *Enter the **sum of all trips to** and from work, including long-distance trips. Leave blank the boxes that do not apply to you or that would be 0.*

	hours per week	minutes per week
Bus, subway, tramway, RER		
High-speed train		
Other trains		
Alone in a car		
Multiple people in a car		
Motorcycle, motor scooter		
Bicycle or kick scooter		
Walk		
Airplane		

38. *If alone in a car on one of the trips:*
For trips you make alone in your car, why don't you carpool? *(Multiple answers possible.)*

☐ I value the flexibility of my hours
☐ It takes too much organization
☐ I haven't found anyone with a similar route and hours
☐ I'm afraid to carpool with someone I don't get along with
☐ I don't know how to find a carpooler
☐ I have too atypical or irregular hours
☐ I have to drop the kids off at school
☐ I'm afraid of the unreliability of others
☐ The trip is too short
☐ Other: _____

39. *If several people in a car:* With whom do you usually make multi-person car trips?

☐ With my spouse ☐ With colleagues ☐ With friends ☐ Other

END OF MODULE 2: COMMUTING

Video and audio conferencing

We would now like to discuss your use of video and audio conferencing. By this we mean remote exchanges between at least 3 people, whatever the means used.

40. Before the lockdown, what was your usual use of video or audio conferencing in a professional context?

☐ Never ☐ Less than once a month ☐ 1 to 3 times a month
☐ 1 to 4 times a week ☐ 1 to 2 times a day ☐ More than 2 times a day

41. During the lockdown, what was your use of video or audio conferencing in a professional context?

☐ Never ☐ Less than once a month ☐ 1 to 3 times a month
☐ 1 to 4 times a week ☐ 1 to 2 times a day ☐ More than 2 times a day

42. Currently, in your experience, for which uses do you think video or audio conferencing is suitable?

	I have never tested	Very suitable	Rather suitable	Rather unsuitable	Not suitable at all	No opinion
Work meeting of 3 to 5 people	☐	☐	☐	☐	☐	☐
Work meeting of 15 people	☐	☐	☐	☐	☐	☐
Oral examination (recruitment, thesis...)	☐	☐	☐	☐	☐	☐
Seminar presentation	☐	☐	☐	☐	☐	☐
Conference or congress with several presentations	☐	☐	☐	☐	☐	☐

43. Since the lockdown, has your experience made you more or less supportive of video or audio conferencing?

☐ Much more favorable ☐ Somewhat more favorable ☐ My opinion hasn't changed
☐ Somewhat less favorable ☐ Much less favorable ☐ No opinion

44. Let's imagine a one-day meeting, located 2 hours from your home by car. Could the following reasons lead you to choose video or audio conferencing over travel? *If you don't drive, suppose a colleague drives you.*

	Yes, to a great extent	Yes, somewhat	No, not really	No, not at all	No opinion
Save time	☐	☐	☐	☐	☐
Limit travel fatigue	☐	☐	☐	☐	☐
Limit travel costs	☐	☐	☐	☐	☐
Balance your family constraints with your professional activity	☐	☐	☐	☐	☐
Limit your greenhouse gas emissions	☐	☐	☐	☐	
Be able to do other things at the same time as the meeting	☐	☐	☐	☐	☐
Easily bring together many people who are far apart geographically	☐	☐	☐	☐	☐

45. Let's always imagine a one-day meeting, located 2 hours away from your home by car. Could the following issues prevent you from choosing video or audio conferencing over travel?

	Yes, to a great extent	Yes, somewhat	No, not really	No, not at all	No opinion
It generates technical problems	☐	☐	☐	☐	☐
It limits the relational aspects	☐	☐	☐	☐	☐
It makes it difficult to write or draw while discussing (diagrams, formulas, equations...)	☐	☐	☐	☐	☐
It's more tiring to follow than a face-to-face meeting	☐	☐	☐	☐	☐

Concrete solutions in research

We would now like to hear your views on concrete solutions that could be put in place to reduce greenhouse gas emissions from research activities.

46. France has committed to reducing its greenhouse gas emissions by one third by 2030. In this respect, do you think that :

☐ Public research must set an example by reducing greenhouse gas emissions by more than one-third
☐ Public research must reduce its greenhouse gas emissions by around one-third
☐ Because of its role, public research may benefit from an exemption, i.e. provide lesser efforts in terms of reducing greenhouse gas emissions

47. *If civil servant, permanent contract or self-employed:* Are you willing to reduce your greenhouse gas emissions by 2030 in the following areas? *This does not take into account reductions you have already made in the past.*

	Yes, by at least one-third	Yes, but by less than one-third	No, as they are already very low	No	Not concerned	No opinion
Flights for conferences, meetings, and congresses	☐	☐	☐	☐	☐	☐
Travel for fieldwork, observation or data collection (by plane, car or boat)*	☐	☐	☐	☐	☐	☐
Scientific experiments and observations (excluding travel)*	☐	☐	☐	☐	☐	☐
IT equipment and its replacement rates	☐	☐	☐	☐	☐	☐
If car, motorcycle/scooter or plane: Commuting to work by car, motorbike, scooter or plane	☐	☐	☐	☐	☐	☐

48. *If civil servant, permanent contract or self-employed AND if using experimental equipment:* Are you willing to reduce by 2030 the greenhouse gas emissions associated with the production and operation of equipment for your scientific experiments and observations by the following means?

	Yes, by more than one-third	Yes, but by less than one-third	No, as they are already very low	No	Not concerned	No opinion

Using equipment less frequently or less intensively	☐	☐	☐	☐	☐	☐
Using or developing simpler systems (low-tech)	☐	☐	☐	☐	☐	☐
Using less equipment in experimental setups	☐	☐	☐	☐	☐	☐
Replacing the equipment at a slower rate	☐	☐	☐	☐	☐	☐

49. *If using experimental equipment:* In your opinion, what would be the risks of a policy on reducing the greenhouse gas emissions generated by the production and operation of equipment for scientific experiments and observations?

	It is likely and it is a problem	It is likely, but it is not a problem	It is unlikely	No opinion	Not concerned
Reduce the quality of your work (or that of your team)	☐	☐	☐	☐	☐
Require you to change research themes	☐	☐	☐	☐	☐
Reduce your access to funding	☐	☐	☐	☐	☐
Set you back compared with rival teams	☐	☐	☐	☐	☐
Reduce your number of publications	☐	☐	☐	☐	☐

50. In your opinion, what would be the risks of implementing a policy on the reduction of professional air travel in research? *

	It is likely and it is a problem	It is likely but it is not a problem	It is unlikely	No opinion	Not concerned
Reduce the quality of your work (or that of your team)	☐	☐	☐	☐	☐
Reduce your access to funding	☐	☐	☐	☐	☐
Reduce the dissemination of your work (or that of your team)	☐	☐	☐	☐	☐

Hinder your access to some field sites or the collection/production of certain data	☐	☐	☐	☐	☐
Reduce some of the advantages offered to you by your profession (like travelling and discovering other countries...)	☐	☐	☐	☐	☐
Isolate French research from the rest of the world	☐	☐	☐	☐	☐
Hinder the integration of young researchers	☐	☐	☐	☐	☐
Increase bureaucracy (enforcement, evaluation criteria...)	☐	☐	☐	☐	☐

51. What actions should research institutions and laboratories take to reduce their greenhouse gas emissions?

	It is a priority	It is secondary	It should not be implemented	No opinion
Finance train tickets even if more expensive or requires a longer stay	☐	☐	☐	☐
Finance carbon offsetting initiatives	☐	☐	☐	☐
Regularly draft and disseminate detailed carbon assessments	☐	☐	☐	☐
Impose a cap on the number of flights per person	☐	☐	☐	☐
Add carbon emissions to the main selection criteria for project funding	☐	☐	☐	☐
Reduce the importance of conferences and presentations abroad in career assessments	☐	☐	☐	☐
Prohibit air travel when the same journey takes less than 6 hours by train	☐	☐	☐	☐
Do not renew functional computer equipment before a minimum of 5 years of age	☐	☐	☐	☐
When replacing equipment, prefer those consuming less energy even if more expensive	☐	☐	☐	☐
When organising events, prefer service providers offering local or vegetarian food	☐	☐	☐	☐

52. *If alone or with several people in a car:* If carpooling was organized at the level of your laboratory or more widely at your site, would you be willing to use it for your home-work trips?

☐ Yes, definitely ☐ Yes, probably ☐ No, probably not ☐ No, definitely not

Your personal position on ecology in general

To better understand your views on research and the environment, we would now like to gather your more general opinion on ecology and its role in politics. *Feel free to skip any questions you do not wish to answer.*

53. In the last 10 years, have you ever...

	Yes	No	I do not wish to answer
Calculated all or part of your greenhouse gas emissions (carbon footprint)	☐	☐	☐
Consulted an Intergovernmental Panel on Climate Change (IPCC) report or summary (not a news article)	☐	☐	☐
Joined or made a donation to an environmental association	☐	☐	☐
Participated in a climate march	☐	☐	☐
Gave a decisive importance to ecology in a vote	☐	☐	☐

54. How many round trips did you make by air in 2019 in a **personal** setting?
☐ No round trips ☐ 1 or 2 round trips ☐ 3 or 4 round trips ☐ More than 5 round trips

55. Have you, in the last 5 years, changed your practices regarding air travel in a **personal** setting?
☐ No ☐ Yes, I take it much less ☐ Yes, I take it a little less
☐ Yes, I take it a little more ☐ Yes, I take it a lot more

56. In the past 5 years, have you, for environmental reasons, made efforts to reduce or keep low your personal consumption of some of the following items: clothing, meat, high-tech equipment, energy needed to heat your home?
☐ Yes, a lot ☐ Yes, a little ☐ No

57. To what extent do you agree with the following statements?

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	No opinion
Most environmental problems can be solved by applying more and better technology	☐	☐	☐	☐	☐
Protecting the environment is more important than protecting economic growth	☐	☐	☐	☐	☐
There is no point in me making an effort for the environment if others do not do the same	☐	☐	☐	☐	☐
I agree with having regulatory constraints (quotas, bans) put in place to protect the environment, even if it limits my comfort	☐	☐	☐	☐	☐
Degrowth is necessary to face environmental challenges	☐	☐	☐	☐	☐
If things continue on their present course, we will soon experience a major ecological catastrophe	☐	☐	☐	☐	☐
If agree: This type of catastrophe could cause a collapse of our societies: the basic needs (food, energy, health, etc.) will no longer be assured for the majority of the population	☐	☐	☐	☐	☐

Information about your activity and your personal situation

Let's finish with a few questions about your activity in the research world and your personal situation.

58. Are you involved in one or more research projects with dedicated funding (i.e. other than your institution's own funds)? *(Several answers possible.)*

	Yes, as a member	Yes, as (co-)lead	No
National Research Agency (ANR)	☐	☐	☐
Other French public funding	☐	☐	☐
European funding (European Research Council (ERC), H2020, etc.)	☐	☐	☐
Other international public funding	☐	☐	☐
Private funding (including private foundation)	☐	☐	☐

59. Your relationship to the international scene. *Whether you are French or foreign, the questions concern you as they are: for example, whether you are French or Italian, if you grew up in Italy, answer that you did your schooling outside France.*

	Yes	No
Is your current main job located outside of France?	☐	☐
Were you born in a foreign country?	☐	☐
Do you have a foreign nationality (including dual nationality)?	☐	☐
Did you spend at least one year of your primary or secondary education outside France?	☐	☐
Have you studied (higher education) for at least three months outside France?	☐	☐
Have you done one or more postdocs outside France?*	☐	☐
Have you worked (in teaching and/or research but not as a postdoc) for at least three months outside France?	☐	☐
Are you currently involved in an international research program?*	☐	☐
Are you actively involved in a non-French or international professional association?	☐	☐

60. Since 2017 inclusive, approximately how many articles have you published (as an author or co-author) in peer-reviewed journals?*

_ _ items

61. *If > 0*: Of these articles, approximately how many were published in English?
_ _ items

62. *If researcher or other/NR:* Do you know approximately your h-index?*
☐ Yes ☐ No ☐ Not concerned ☐ I am not sure what the h-index *is*
63. *If yes:* Can you indicate the approximate value of your h-index? _ _ _

64. Do you hold a PhD thesis? ☐ Yes ☐ No

65. *If yes:* In what year did you defend it? _ _ _ _

66. Are you at a point in your career where you are seeking promotion, recruitment or tenure?
☐ Yes ☐ No

67. Do you feel like you are...
☐ Very well paid ☐ Well paid ☐ Fairly paid ☐ Poorly paid ☐ Very poorly paid

68. If Civil servant/Permanent contract/Fixed-term contract/Self-employed: Are you currently employed full-time?
☐ Yes ☐ No

69. *If no:* What is your work time share?
☐ 90% ☐ 80% ☐ 70% ☐ 60% ☐ 50% or less

70. In the last 3 years, have you interrupted your research activity (due to maternity leave, sick leave, layoff) for more than 3 months?*
☐ Yes ☐ No

71. Do you live in a couple? ☐ Yes ☐ No

72. How many children do you have? __
73. *If > 0:* What is the age of the youngest? _ _ years

74. What is the highest degree held by your parents?

	Mother	Father
No diploma	☐	☐
Lower secondary	☐	☐
Upper secondary	☐	☐
Short tertiary (Bachelor or less)	☐	☐
Long tertiary (Master’s, etc.)	☐	☐
Doctorate	☐	☐
Don't know	☐	☐

75. When you were 18, what was your parents' employment status?

	Mother	Father
Civil servant or public sector employee	☐	☐
Private sector employee	☐	☐
Self-employed	☐	☐
Unemployed	☐	☐
Inactive or retired	☐	☐
Deceased	☐	☐
Don't know	☐	☐

The next two questions will allow us to calculate the size of the agglomeration, the type of municipality (rural/urban) and the distance between your place of residence and your place of work. You are free not to answer if you wish. We will destroy the information concerning the exact commune within one year.
Please indicate "Foreign" for municipalities located outside of France.

76. What is your place of residence? _ _ _ _ _

77. What is the municipality where your workplace is located? _ _ _ _ _

78. If you add up all the sources of income in your household, can you give the net monthly income **after tax** for your household in 2019? *Take into account all the money coming in from everyone in your household: wages and professional income, pensions, various allowances, any proceeds from property or financial investments, etc.*

☐ Less than 1,500 euros per month
☐ From 1,500 to 2,499 euros per month
☐ From 2,500 to 3,499 euros per month
☐ From 3,500 to 4,499 euros per month
☐ From 4,500 to 5,999 euros per month
☐ From 6,000 to 7,999 euros per month
☐ From 8,000 to 9,999 euros per month
☐ From 10,000 to 15,000 euros per month
☐ Over 15,000 per month
☐ I do not wish to answer
☐ I don't know

79. Would you agree to be contacted by a researcher in a few months or more to answer further questions on the topics covered in this questionnaire? *Giving your consent does not commit you to anything, you will simply receive an invitation to respond. In order to preserve the confidentiality of your answers, your address will be recorded in a separate file and for this purpose only.*

☐ I disagree to be contacted again ☐ I agree to be contacted again at the following email address:

Please enter here any comments you may have:

Let's finish with a little quiz! Can you estimate the greenhouse gas emissions of different professional practices? The correct answers will be given to you right after you fill it in.

80. ☐ I take the quiz ☐ I decline the quiz

81. *If Quiz.* In your opinion, what level of emissions per capita should the planet reach in 2030 to limit warming to +1.5°C in 2100? *For your information, greenhouse gas emissions per capita on the planet are currently 7 tons of CO_2 equivalent per year, and the average emission of a French is 11 tons (carbon footprint).*

__ tonnes of CO_2

82. *If Quiz*. How much greenhouse gas emissions (in kg of CO_2 equivalent) do the following actions represent (knowing that the carbon footprint of a French is on average 30 kg per day)? *Indicate the value that you think is closest.*

	10 g	100 g	1 kg	5 kg	25 kg	50 kg	100 kg	250 kg	500 kg	1000 kg	2000 kg	3000 kg	5000 kg
Drive 50 km to and from work for a year (about 12,000 km)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fly from Paris to New York and back (about 12,000 km)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Travel from Paris to Marseilles and back by high-speed train	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Build a new laptop	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Make 3 hours of videoconference with your computer (for one person)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Print a 200 page thesis in 10 copies, double-sided	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Produce a 150 g beef steak	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Thank you for your participation in this survey. We greatly appreciate your time.

If you want to know more about the Labos 1.5 collective, please visit our website http://labos1point5.org. Feel free to subscribe to our newsletter or to get involved in our activities.

Quiz answers :

	Weight in kilograms of CO_2
Global per capita CO_2 emissions in 2030 to limit warming to +1.5°C	3 t according to the IPCC and the UN (25 Gt in total for a projection of 8.5 billion inhabitants), i.e. a reduction of 55%

	for the current average emissions per inhabitant of the planet, or 75% for the carbon footprint of a French.
Drive 50 km to and from work for a year (about 12,000 km)	3.1 t (0.259 kg/km * 12,000 km according to ADEME)
Fly from Paris to New York and back (about 12,000 km)	1 t according to ADEME without taking into account the vapour trails, double with
Travel from Paris to Marseilles and back by high-speed train (1600 km)	3.2 kg according to Oui.sncf (1.9 g/km for 1600 km) and between 2.7 and 5.9 kg according to ADEME (from 1.7 g/km to 3.7 g/km)
Build a new laptop	250 kg (210 kg for Dell laptop according to Ecoinfo)
Do 3 hours of video conferencing (for one person)	Precise and reliable estimates not available. 60 g per hour based on a quick estimate using Carbonalyser tables (not including material manufacturing) 4.5 kg according to a simplified calculation of the EPFL: about half for the amortization of the dedicated equipment, and half for the electricity produced according to the European mix; thus much less in France if we exclude the equipment.
Print a 200 page thesis in 10 copies, double-sided	4.58 kg (for paper only) according to ADEME
Produce a 150 g beef steak	4.29 kg for 150 g (28.6 kg for 1 kg according to ADEME)

S4 Appendix. French statuses and their English translations

Senior researcher: Directeur·rice de recherche

Full professor: Professeur·e

Tenured researcher: Chargé·e de recherche

Associate professor: Maître·sse de conférences

Research engineer: Ingénieur·e de recherche

Research support engineer: Ingénieur·e d'études

Engineer assistant: Assistant·e ingénieur·e

Technician: Technicien·e

Postdoctoral researcher: Post-doc

Adjunct lecturer: Attaché·e temporaire d'enseignement et de recherche (ATER)

Fully funded PhD student: Doctorant·e contractuel·le

Research assistant/Project manager: Chargé·e d'études/de mission

Technical assistant: Adjoint·e technique