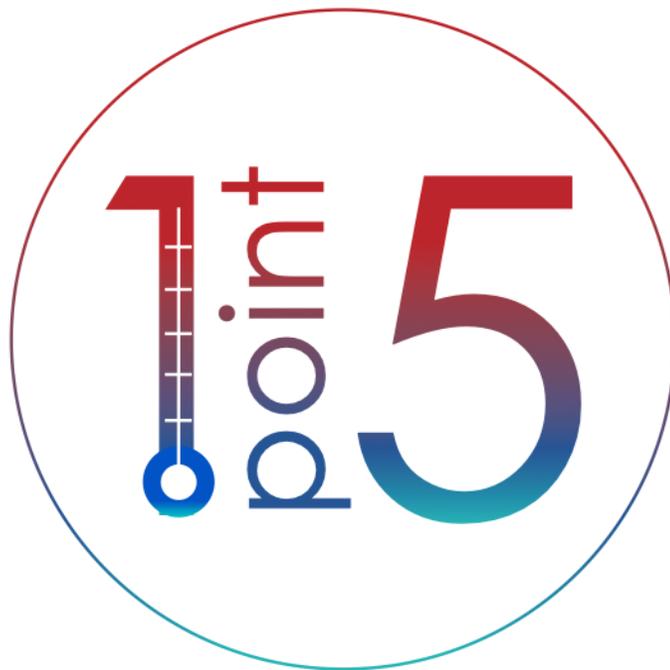


Labos 1point5

Collective decarbonization of research :
what can we learn from the findings of GDR Labos 1point5?



Olivier Aumont, Marion Avet, Guillaume Blanc, Mickaël Coriat, André Estevez-Torres,
Marie-Alice Foujols, Jérôme Mariette, **Mélissa Ridel**, Céline Serrano, Matthieu Simonin

<https://labos1point5.org>

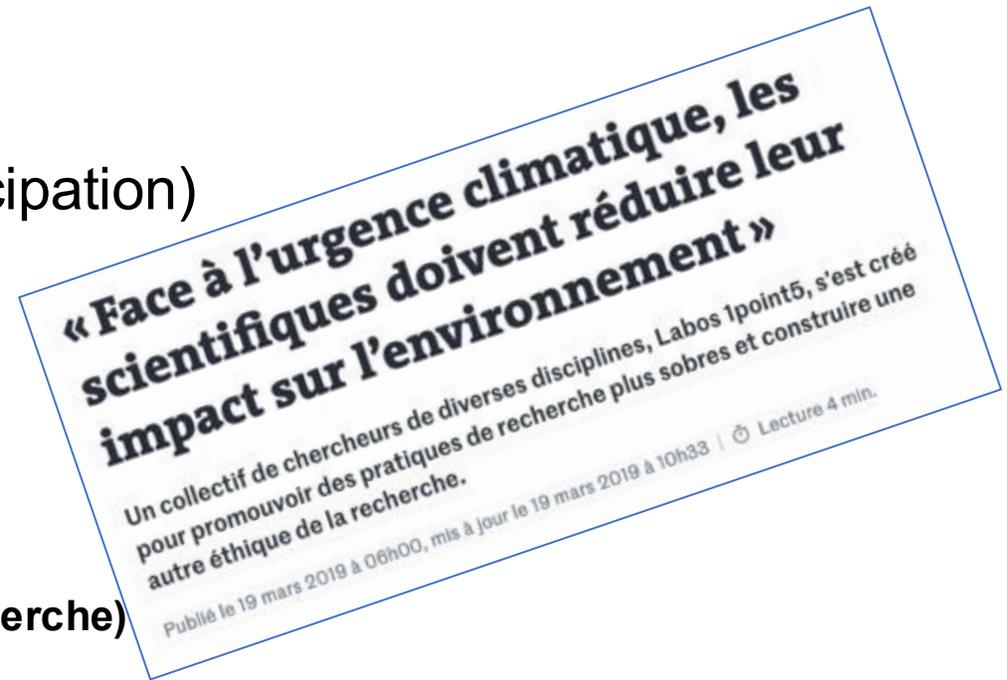
Lecturer and researcher at Sorbonne University (Paris)

Researcher in particle physics (Atlas Experiment at the LHC / CERN)

Labos 1point5 GdR coordination for about 3 years

1. A grassroots collective action « to understand and reduce the environmental footprint of research » :

- Created March 2019
(op-ed in *Le Monde* & website with call for participation)
- Networks of people, labs and initiatives
~4000 following our work



2. A research project called GdR (Groupement de Recherche)

- Created in Nov. 2021
- ~250 participating in research activities (all gender, discipline, age)
- Scientific publications on the evaluation and analysis of research carbon footprint

- It is essential to quantify and understand the carbon footprint of research, its determinants, uncertainties and heterogeneity (separating the true from the false on this subject)
 - Implementing locally designed and deliberated solutions in research laboratories, to re-appropriate our laboratories as decision-making places
 - Organize reflexive work on the coherence, responsibility and ethics of research in relation to the low-carbon transformation of our societies
- Reinventing a way of doing research that is compatible with planetary boundaries

Organization of the collective (since 2021)



509 members

Think tank
Arts and Sciences
(2 independent teams)

Scientific Committee of the Seminar

- Olivier Berné (CNRS)
- Faustine Cantalloube (CNRS)
- Patrick Hennebelle (CEA)
- Evelyne Lhoste (INRAe)
- Marie-Alice Foujols (CNRS)
- Mathieu Bouffard (Univ. de Nantes)
- Malgorzata Grybos (Univ. de Limoges)
- Freddy Bouchet (ENS)
- Thomas Legon (EHESS)
- Marie-Laure Parmentier (Inserm)
- Ségolène Vandeveldé (Univ. Paris 1)
- Elen Riot (Univ. de Reims)



264 members

Research group (GdR)

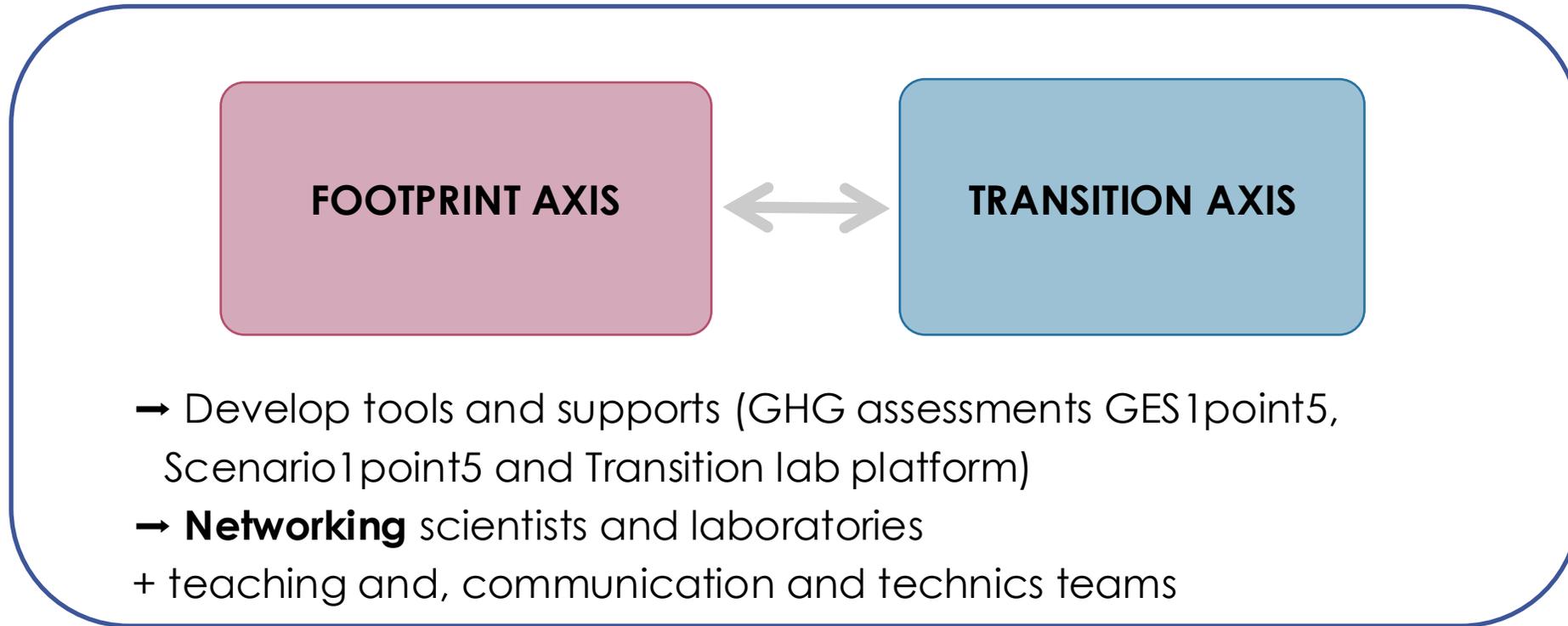
Management Team

- Olivier Aumont (IRD)
- Marion Avet (INRAe)
- Guillaume Blanc (Univ. Paris Cité)
- Mickäel Coriat (Univ. Toulouse)
- André Estevez-Torres (CNRS)
- Marie-Alice Foujols (CNRS)
- Jérôme Mariette (INRAe)
- Mélissa Ridet (Sorbonne Univ.)
- Céline Serrano (INRIA)
- Matthieu Simonin (INRIA)

Scientific Committee

- Valérie Masson Delmotte (HCC)
- Philippe Quirion (CNRS)
- Quentin Perrier (I4CE/ HCC)
- Catherine Bourgain (Inserm)
- Hervé Lefebvre (Ademe)
- Arnaud Saint Martin (CNRS)

Number of members updated to 01/01/2023.



Generate new knowledge on the carbon footprint of research.

GES 1point5 : a tool to measure the carbon footprint of laboratories



Launch of the collective *Labos 1point5* (March 2019)

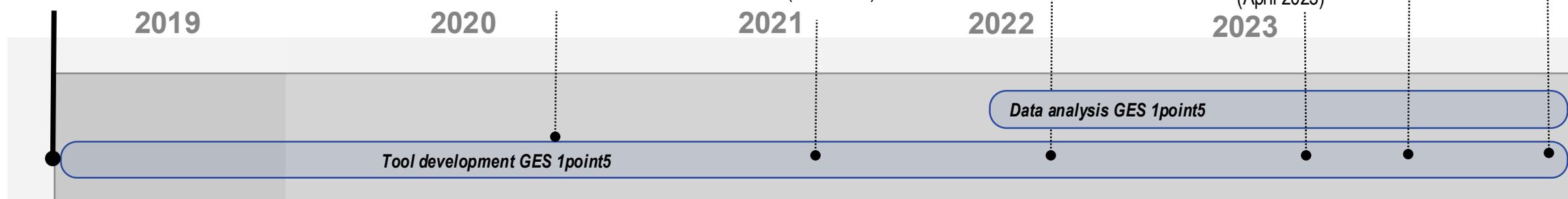
Launch of the tool *GES 1point5* (Oct. 2020)

GES 1point5
Add computer
module
(Nov. 2021)

GES 1point5
Add purchase
module
(Déc. 2022)

Launch of the tool
scenarisation
(April 2023)

Launch of the tool *GES 1point5*
Labs in transition Add first
infrastructures
(Dec. 2023)



- ▶ **Scope:** commuting, business trips, vehicles, buildings (electricity, heating and air conditioning), computer equipment, purchases
- ▶ **2 calculators** : commuting, business trips
- ▶ **In progress:** research infrastructures (computing, telescopes, accelerator, etc.) and *GES 1point5* campus edition, scenarisation tool, labs in transition tool

ENVIRONMENTAL RESEARCH INFRASTRUCTURE AND SUSTAINABILITY

ACCEPTED MANUSCRIPT • OPEN ACCESS

An open-source tool to assess the carbon footprint of research

Jerome Mariette¹, Odile Blanchard², Olivier Berne³ , Olivier Aumont⁴, Julian Carrey⁵, Anne Laure Ligozat⁶, Emmanuel Lellouch⁷, Philippe-E Roche⁸, Gael Guennebaud⁹, Joel Thanwerdas¹⁰, Philippe Bardou¹¹, Gerald Salin¹², Elise Maigne¹³, Sophie Servan¹⁴ and Tamara Ben-Ari¹⁵ — Hide full author list

Recommended by :



INRAE

Inria

Inserm
La science pour la santé
From science to health



SORBONNE
UNIVERSITÉ

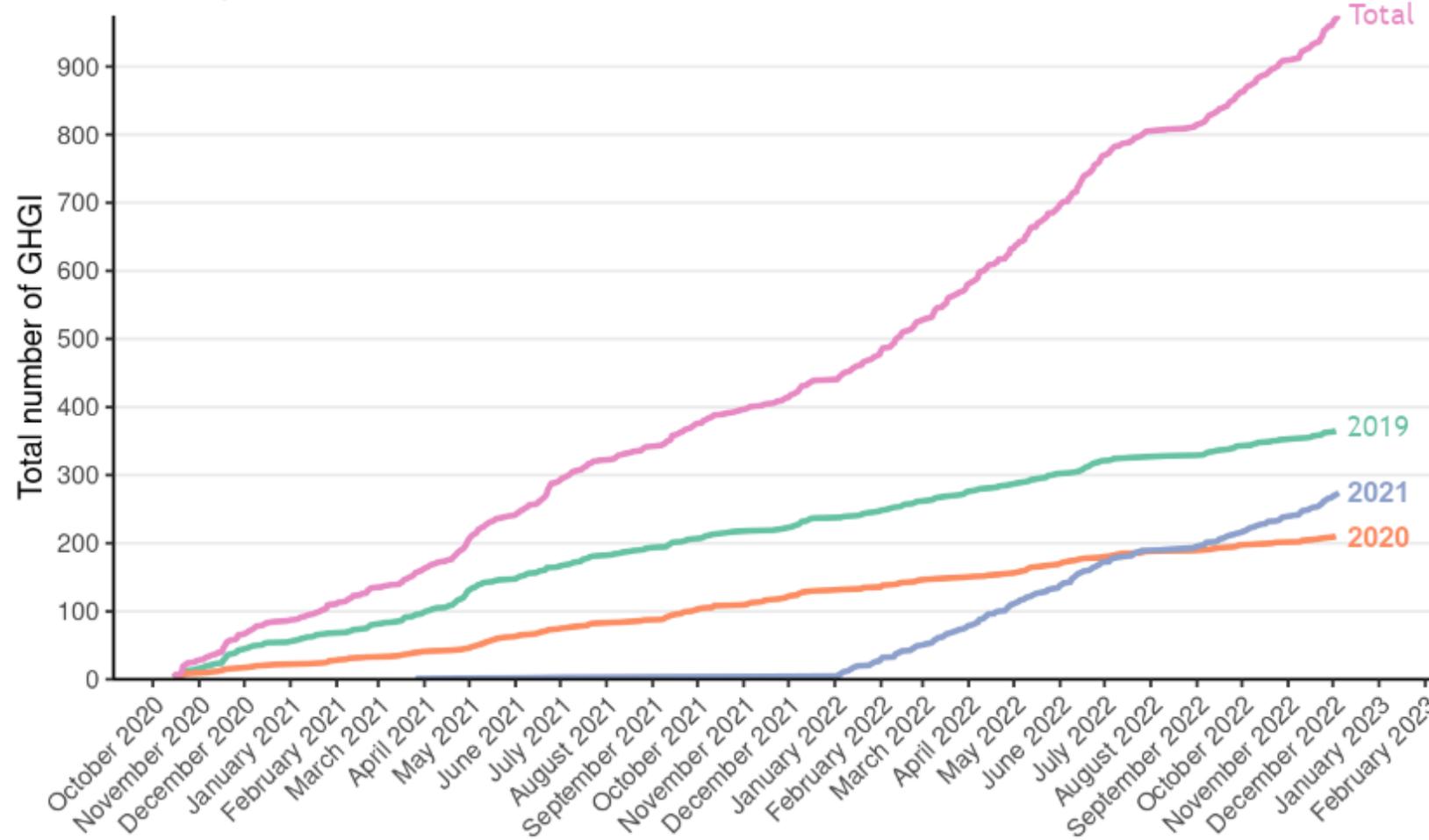
[Mariette et al. (2022)]

In short :

- ▶ **GES 1point5, a benchmark tool for lab footprints + a unique database on research footprints (>2,800 assessments)**
- ▶ **Ramp-up of the transition labs platform (since November 2023)**
- ▶ **Significant efforts towards internationalization and interdisciplinarity (SHS in particular)**
- ▶ **3 international conferences, 3 teaching conferences, 2 study days**
- ▶ **Scientific publications : 10 articles published, several in preparation**
- ▶ **Significant outreach (press articles, ~20 presentations/year)**
- ▶ **Contributions to general reflection: prospective in Physics, Astrophysics, for CNES, and for IRD**

GHG inventories creation evolution

For the years 2019, 2020 and 2021

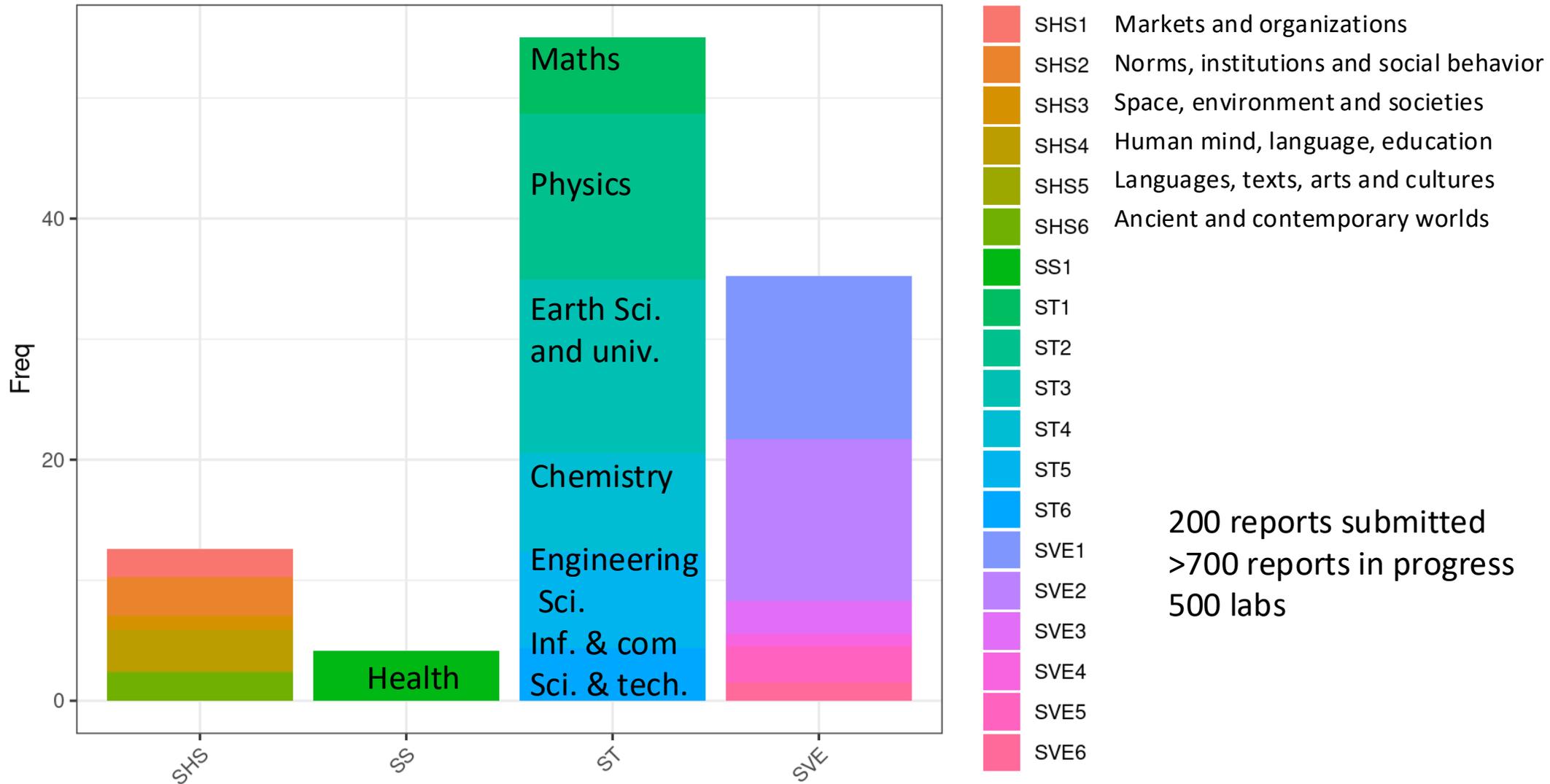


- High adoption rate
- 700 labs
(on ~ 2000 labs/UMR)

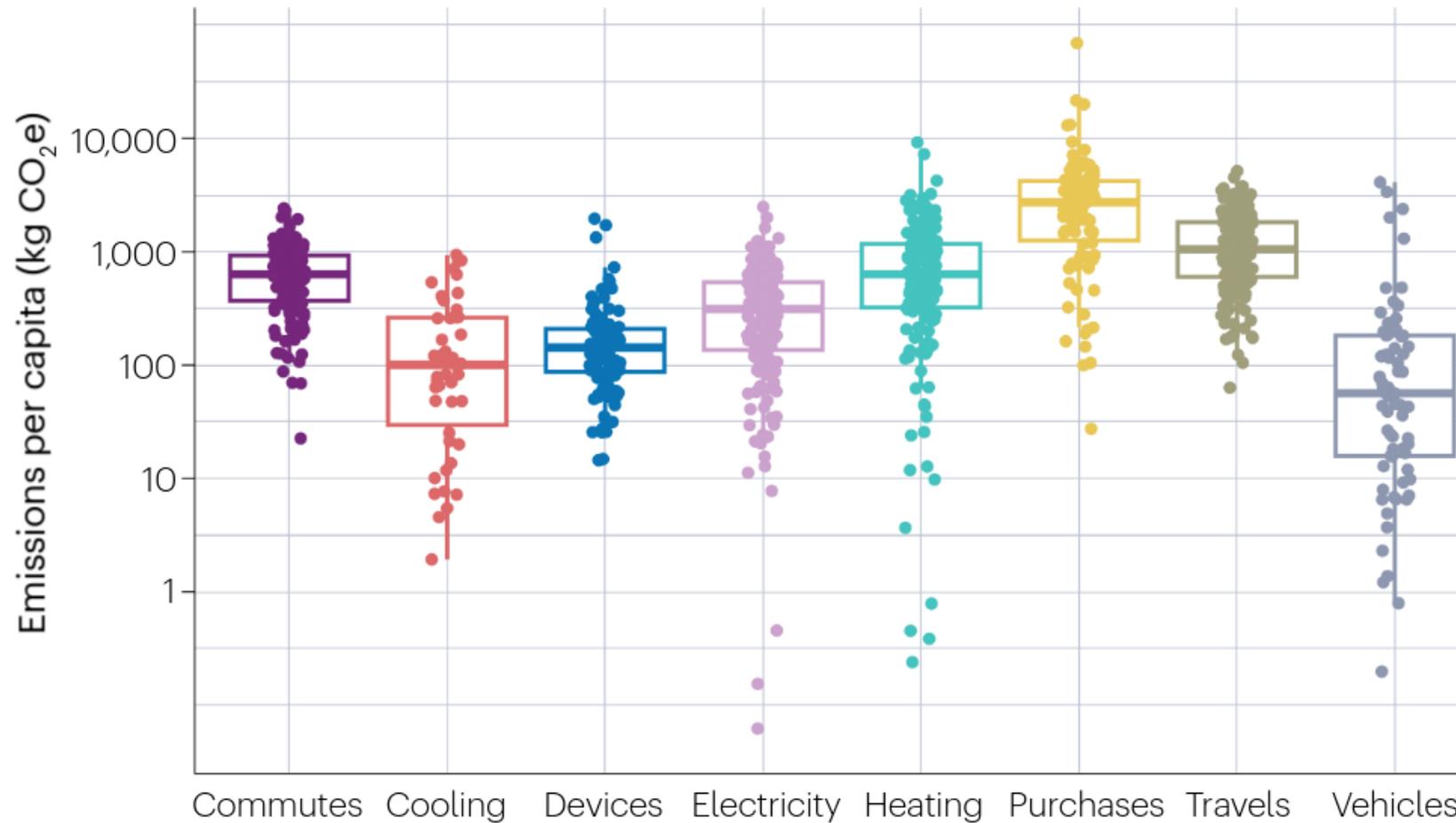
Data source: GES 1point5

[J. Mariette et al (2022)]

Disciplinary distribution of laboratories for submitted GHG assessments



Footprint axis: distribution of the carbon footprint of laboratories

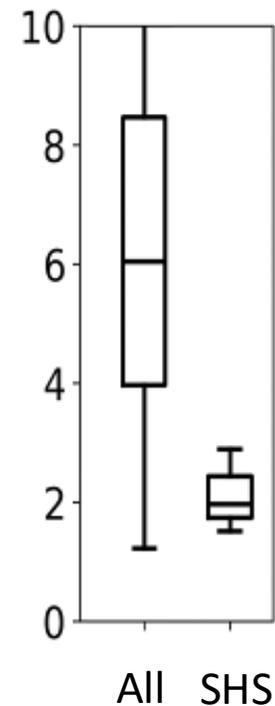
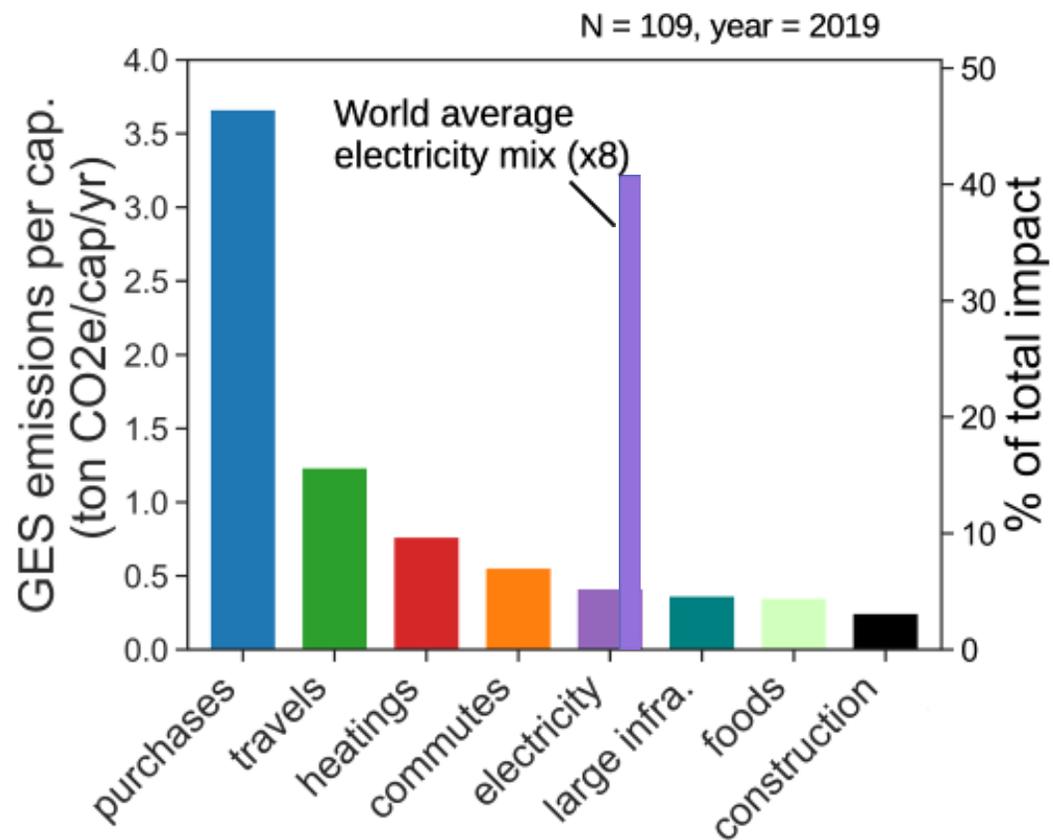


- Year 2019 (~150 labs)
- Validated reports
- Heterogeneity between laboratories
- Purchases (40%) and missions (25%) dominate the laboratory footprint
- Infrastructure not included

~1000 t CO₂e / year per lab
~7,3 t CO₂e/year per capita
~1 250 000 t for the total sector

[T. Ben Ari, Nature Reviews Physics (2023)]

Footprint axis: distribution of the carbon footprint of laboratories



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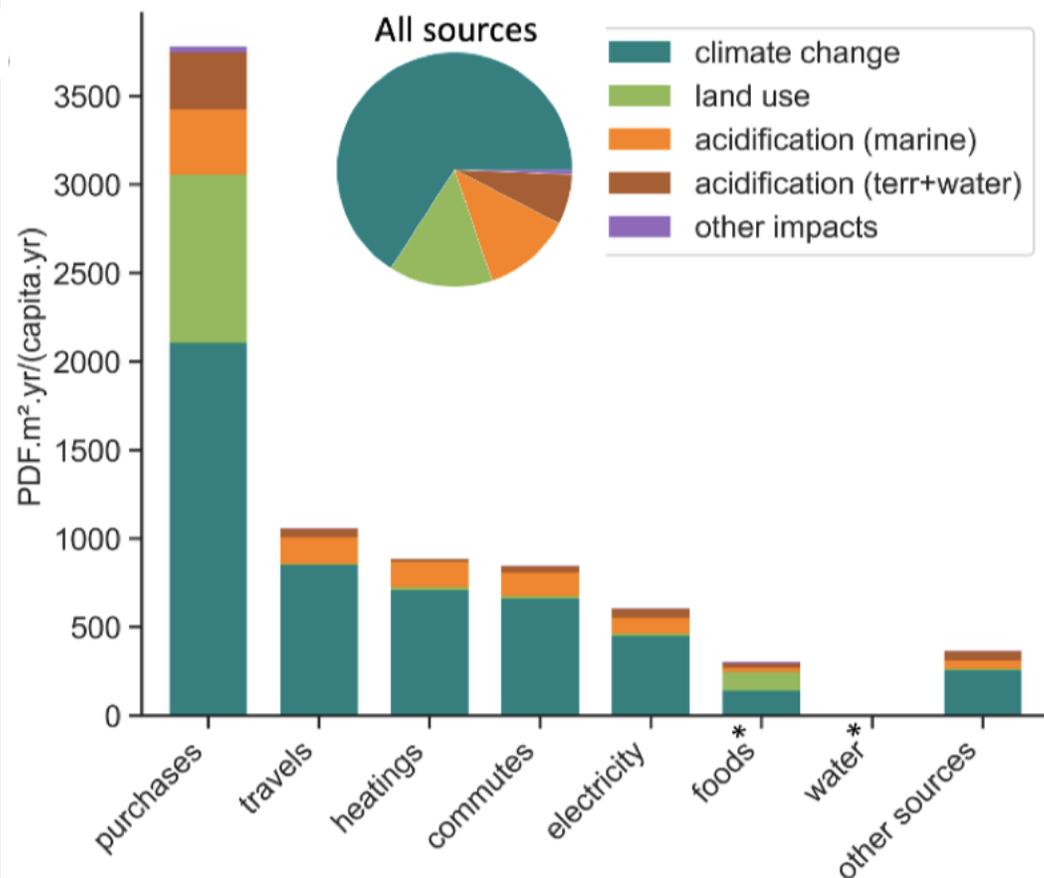
J. Mariette et al, *Env. Res.* **2022**

T. Ben Ari, *Nature Reviews Physics* (**2023**)

M. De Paepe et al, *PLOS sust & trans*, **2024**

Other impacts : damage on ecosystems

Average contribution of each impact to the sources



ecosystem damage is dominated by climate change, land use and acidification

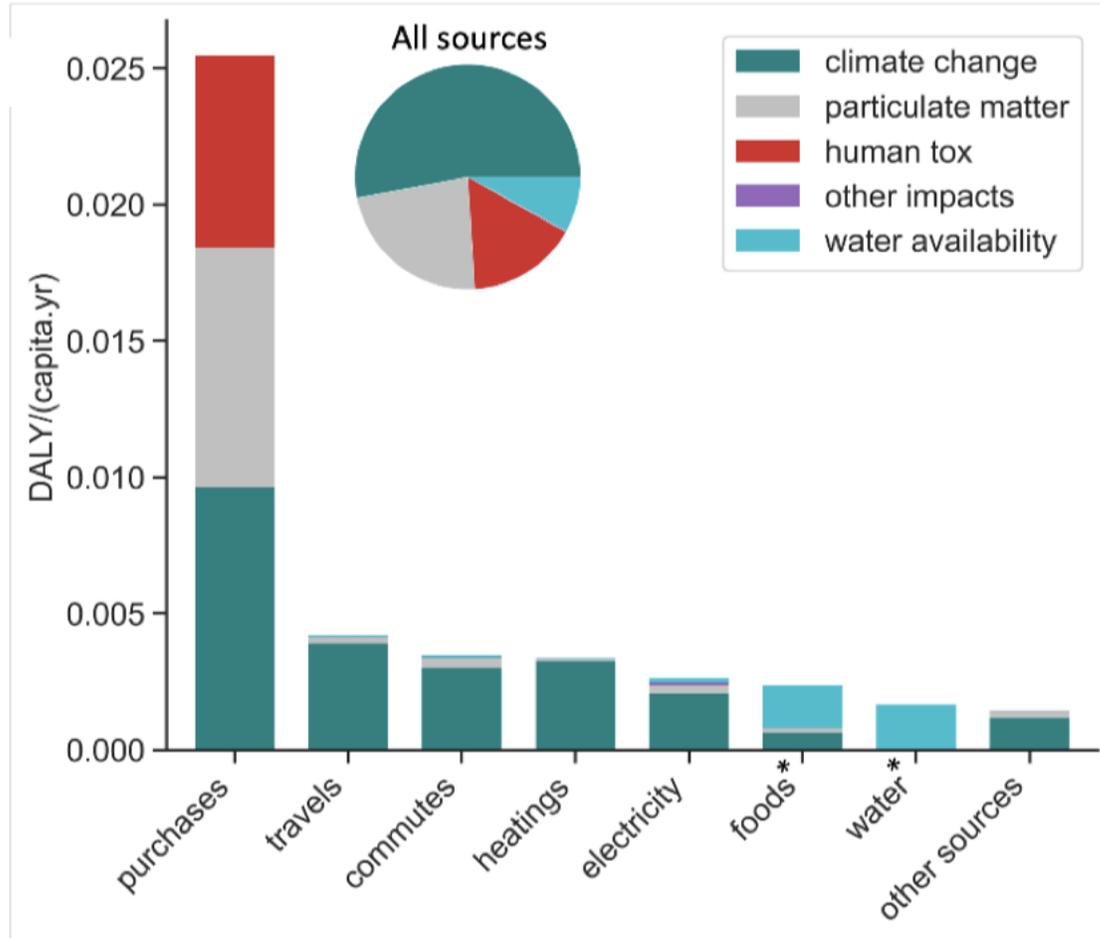
In average: 8200 PDF.m² .yr/(capita.yr)

➤ means all species on 8200m² disappear (during 1 year)

Loubet et al, Zenodo, 2025

Other impacts : damage on human health

Average contribution of each impact to the sources



human health damage is dominated by climate change, particulates, toxicity

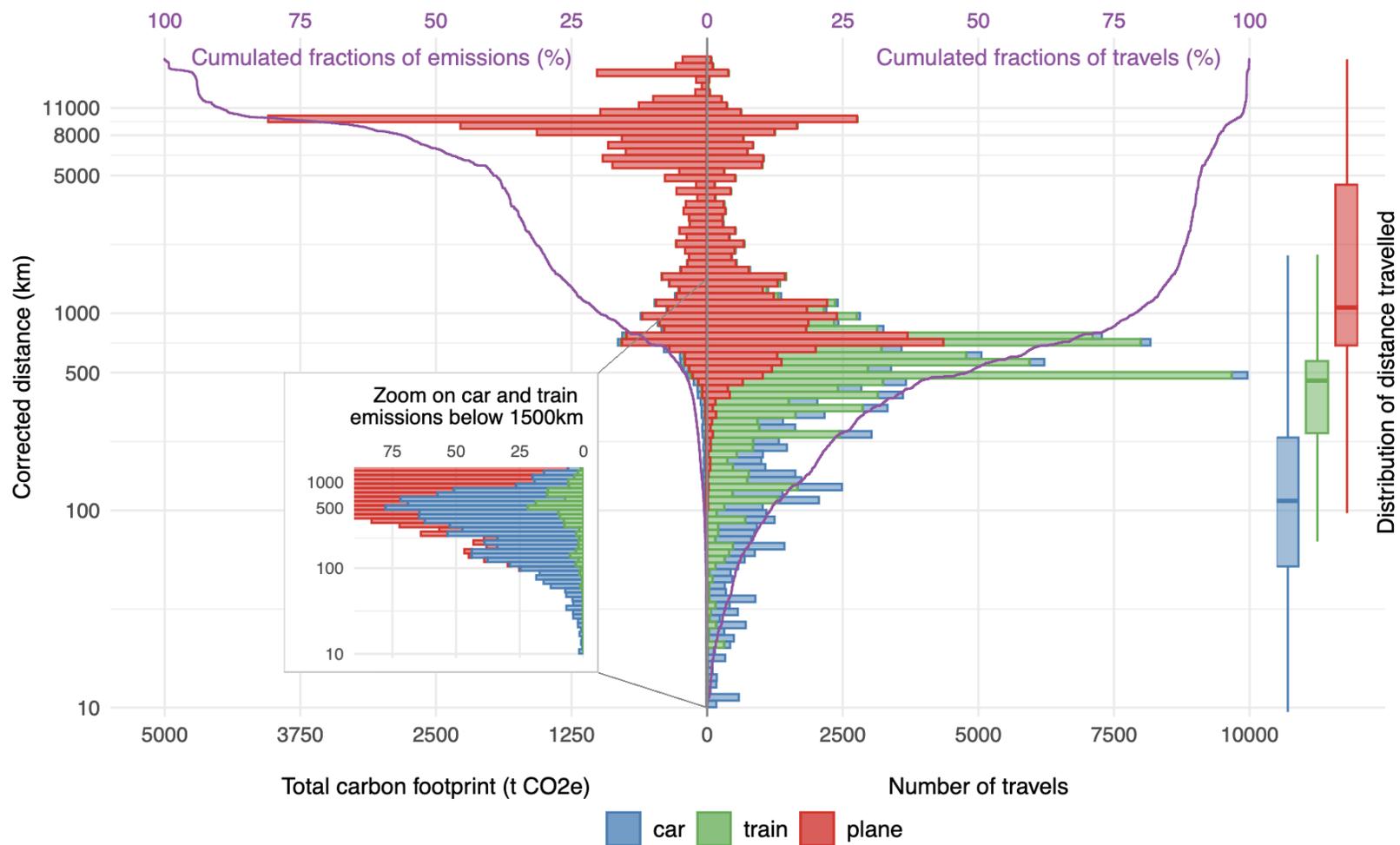
Note : DALY means Disability Adjusted Life Year
For comparison, tobacco = 0.025 DALY/capita.year
See <https://www.healthdata.org/>

In average: 0.04 DALY/(capita.year)

- means a loss of 15 days of life globally while working
- 200 days per year (ie., 7.5% days lost/days worked)

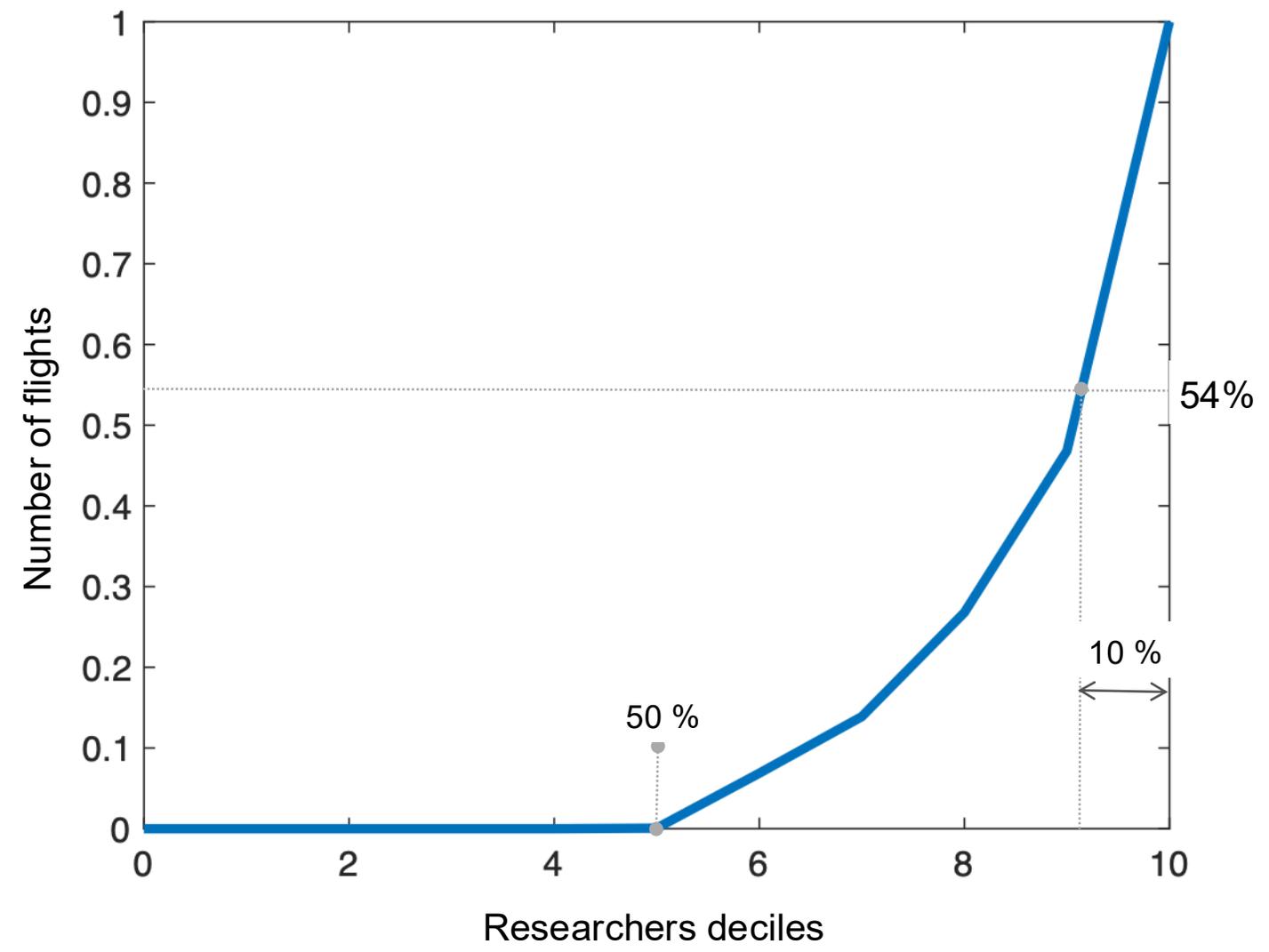
Loubet et al, Zenodo, 2025

▶ Travelled distance versus cumulated emissions

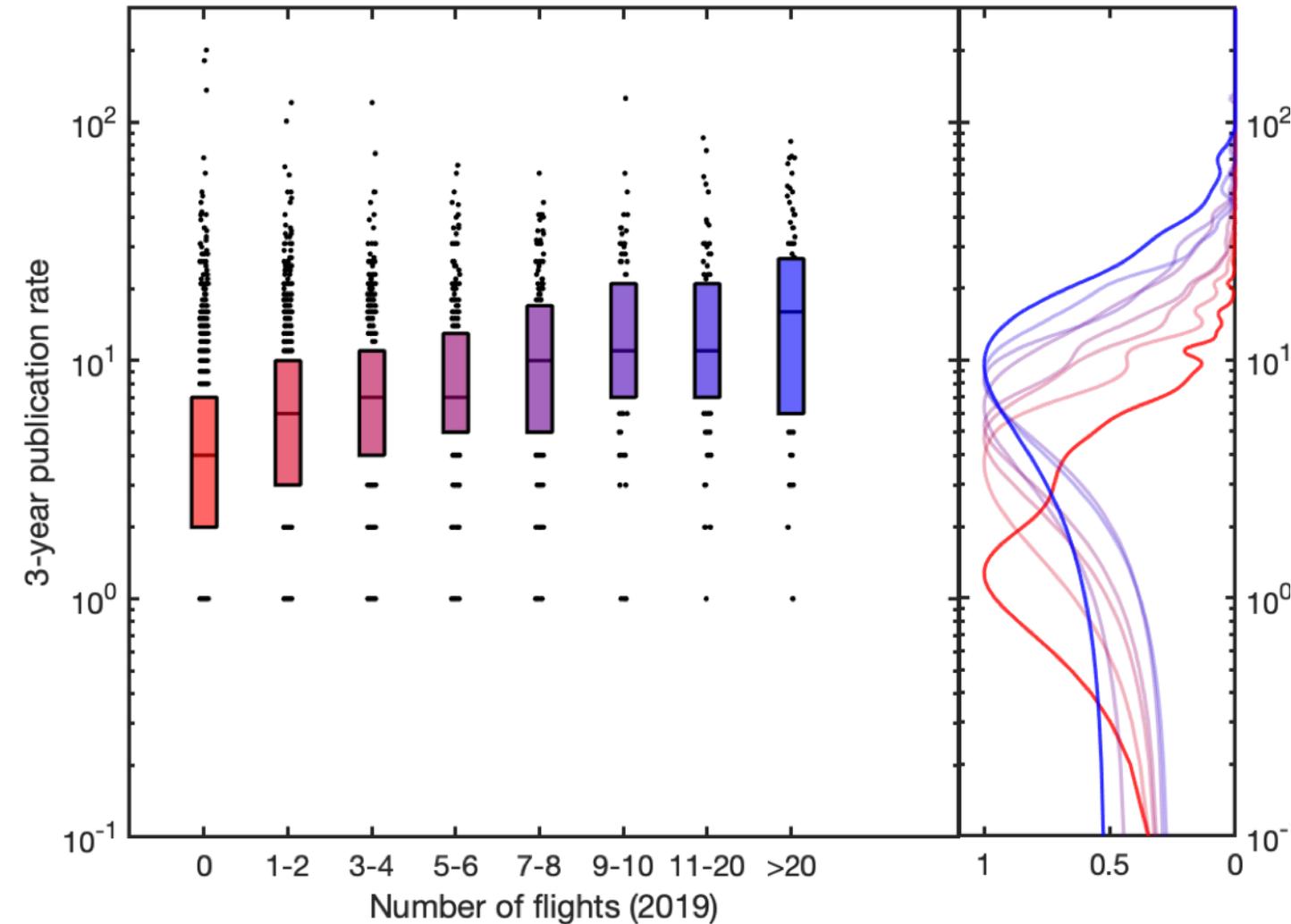


[GES 1point5 database]
T. Ben Ari, G. Lefort et al.
submitted to Environmental
Research Letter

Air-travel inequality



[GES 1point5 database]



- ▶ In the competition for different forms of capital in the academic world, access to air travel seems to be a determining factor
- ▶ Among the motives that drive scientists to travel long distances, the quest for visibility (and the rewards it allows) probably plays an important role

[Survey database]

[0. Berné et al. (2022)]

travel footprint – reduction scenario



Minimum Allowable Distance (in distance or approximate duration) for Air Travel Clearance

		No modal shift policy	375km (~2h30)	600km (~4h)	In mainland France	900km (~6h)	1000km (~6h40)	1200km (~8h)	1500km (~10h)	
Air Mileage Moderation in Quantity or Distance	No moderation policy	0	0.3	3	8	12	15	18	21	
	Reduce air travel number for conferences	20% fewer trips	8	8	10	13	17	20	23	26
		50% fewer trips	19	19	21	24	27	29	32	34
		1 trip/3 years	13	13	14	17	18	19	21	22
		1 trip/4 years	18	18	19	22	22	23	24	23
	Reduce long-haul air travel number	20% fewer trips	13	14	16	21	26	28	32	35
		50% fewer trips	32	33	35	40	45	47	51	53
		1 trip/4 years	28	28	31	35	40	43	46	49
		1 trip/6 years	37	38	40	45	50	52	56	59
	Reduce air travel mileage	20% decrease	20	20	22	26	30	32	34	37
		50% decrease	48	49	50	52	54	56	57	59
		5800km/year	38	38	39	41	42	44	45	46
		4500km/year	47	48	48	50	51	52	52	53
	Reduce air travel number	20% fewer trips	19	20	22	25	29	31	34	36
		50% fewer trips	48	48	49	52	54	55	57	58
		1 trip/year	36	36	33	32	29	28	27	27
1 trip/2 years		61	61	58	57	51	50	46	44	

~ 137,000 missions analysed in 2019

Aviation accounts for ~95% of mission emissions

Evaluation of :
replacement of air travel by rail
restrictions on air travel

T. Ben Ari, G. Lefort et al.
submitted to Environmental
Research Letter

travel footprint – reduction scenario



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Quota number of conferences / seminars :

-20% fewer conferences = 8% reduction in greenhouse gas emissions

-50% less conferences = 19% reduction in greenhouse gas emissions

1 conference every 3 years per agent (median) = 13% reduction in GHG emissions

~ 137,000 travels analysed in 2019

travel footprint – reduction scenario



Minimum Allowable Distance (in distance or approximate duration) for Air Travel Clearance

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Replace the plane with the train French public service recommendation (~2h30) = 0.3% reduction

French Ministry of Higher Education and Research recommendation since 2022 (~4h) = 3% reduction

Most ambitious recommendation in university reduction plans (Lausanne, ~10h) = 21% reduction

travel footprint – reduction scenario



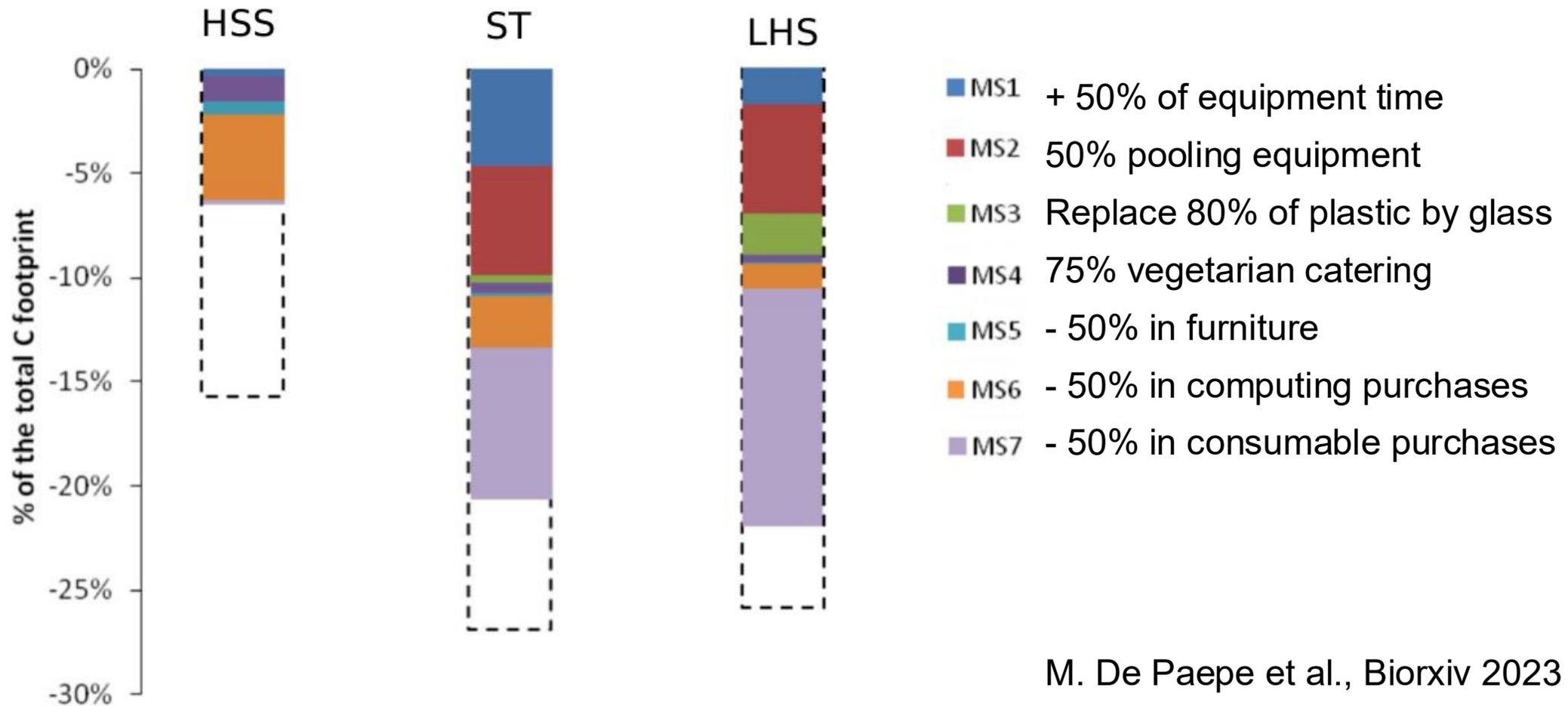
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Europe: to achieve 50% reduction by 2030 (Paris Agreement)

- 50% reduction in the number of long-haul aircraft + minimum distance of 1,500 km for aviation
- Quota of 4,500 km per agent + minimum distance for aviation
- 50% reduction in the number of travels

Purchases footprint – reduction scenario



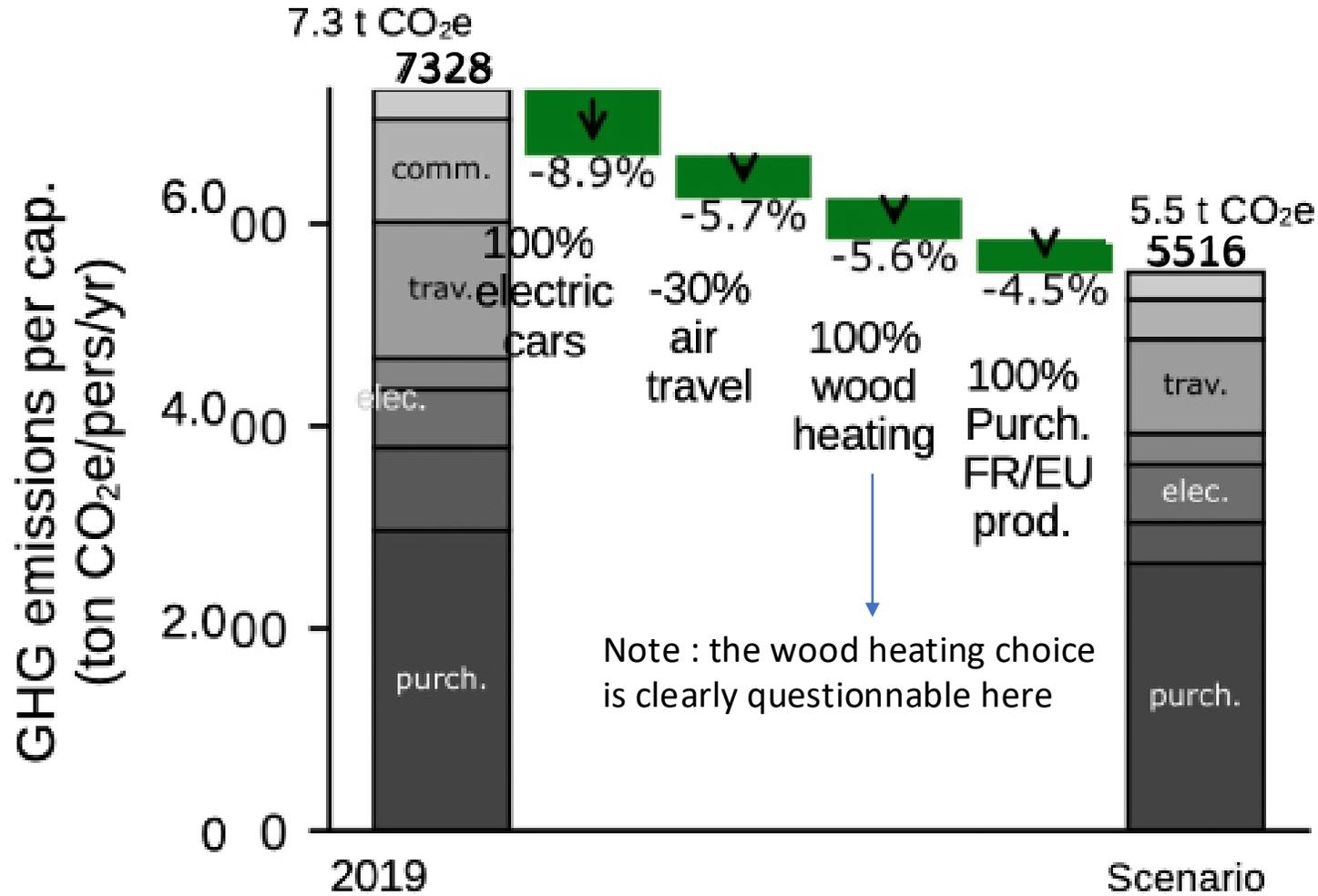
M. De Paepe et al., Biorxiv 2023

Demand-based strategies can achieve a 20% reduction in the total footprint (-40% in the purchasing footprint).

25% mitigation is possible



French research units

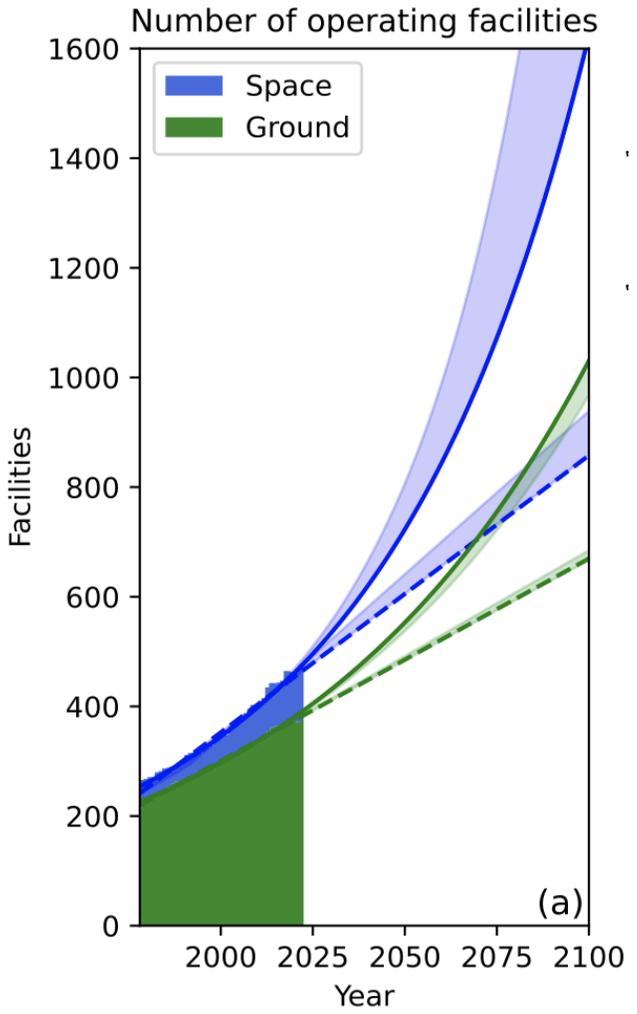


25% mitigation is possible with available technologies but sufficiency is needed for more

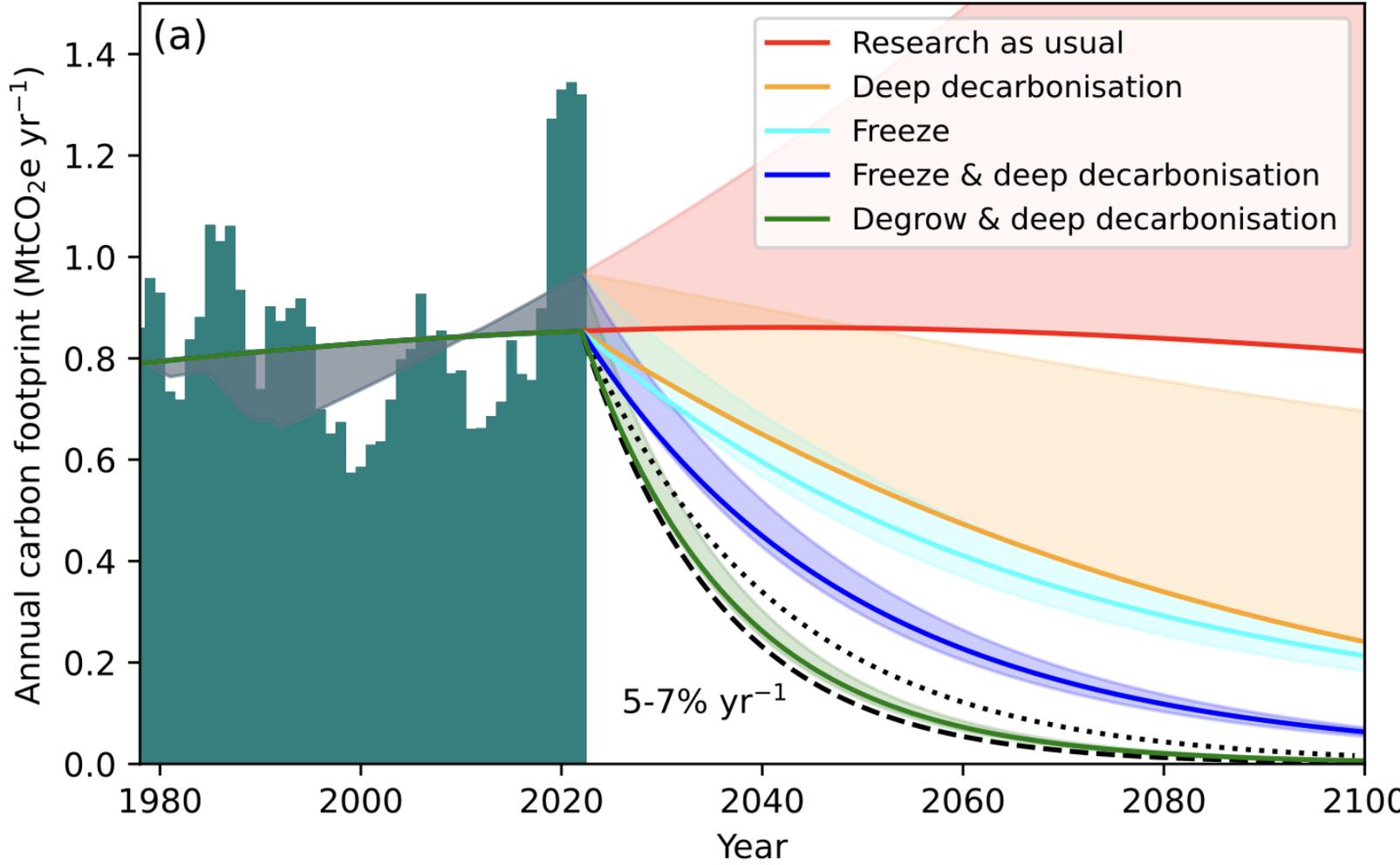
Travel < 1000 km → 15 % of travel emissions
 Travel > 6000 km → 50 % of travel emissions

Loubet et al, Zenodo, 2025
 T. Ben-Ari et al, Env. Res. Lett. 2024

Infrastructures in the scenario for sufficiency



World astronomy infrastructures (space+ground)



25% mitigation is possible with available technologies
but sufficiency is needed for more

..... that observe this process of
taking the environment into account in research

2 selected results !

1. The spread of eco-responsible standards in research laboratories hinders the shift towards sustainability.

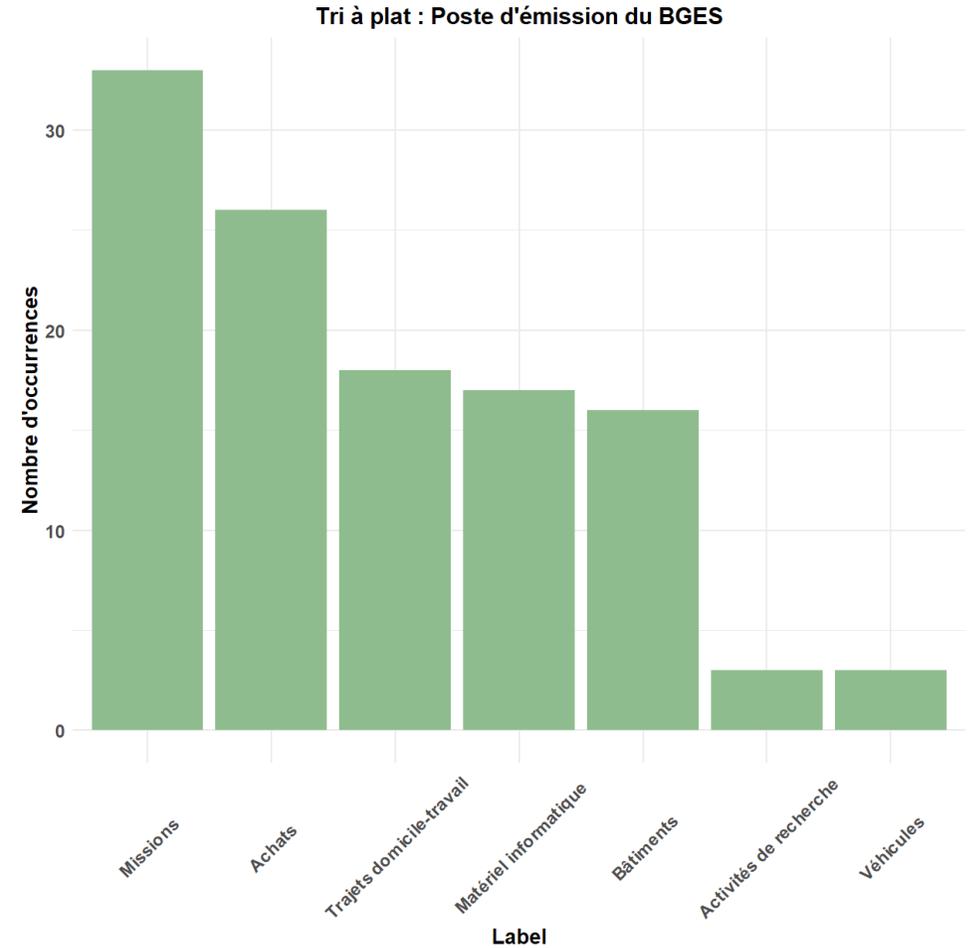
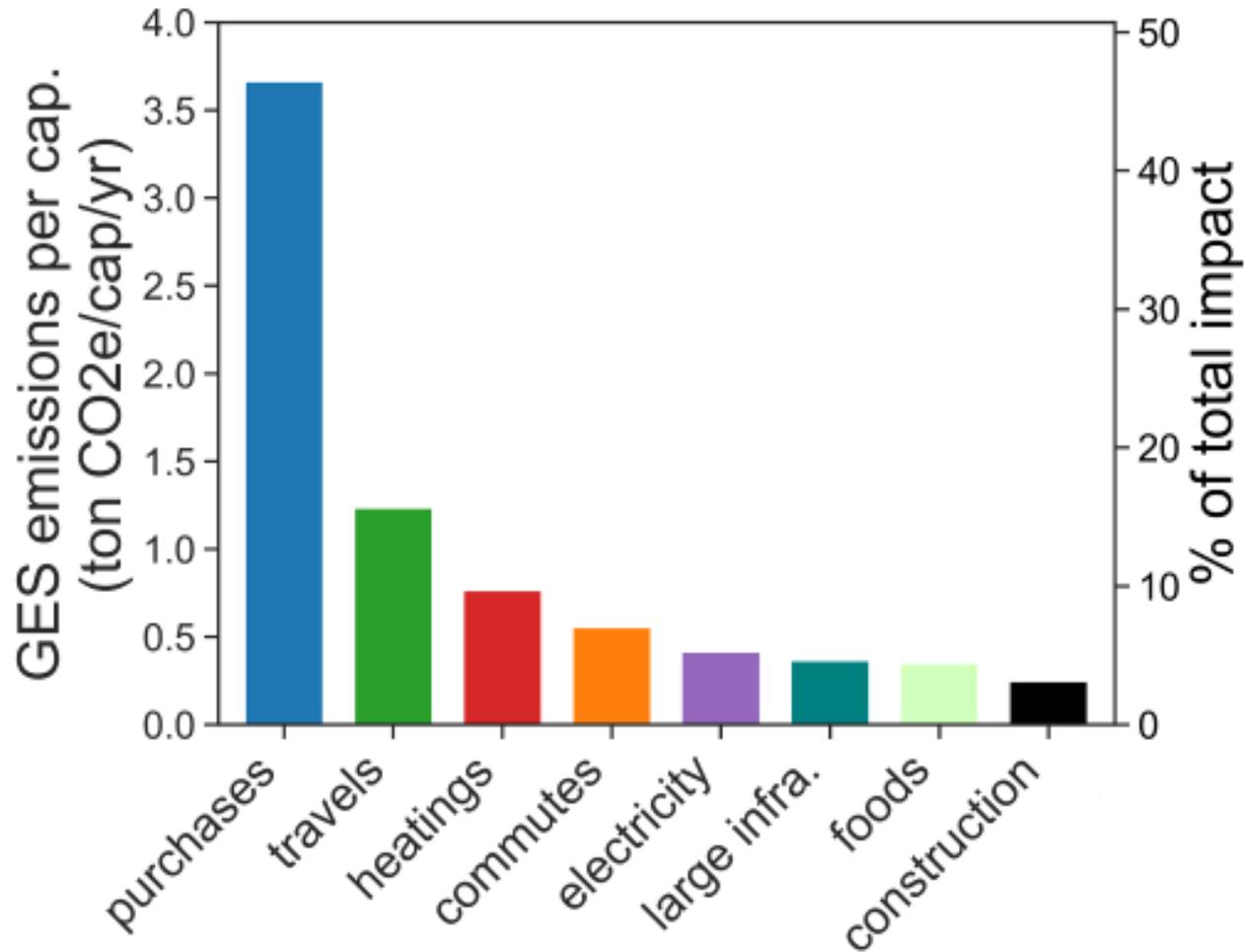
2. Collegial governance of laboratories is not conducive to change. However, the process of gradual empowerment of laboratories and their democratic organizational leanings could prove to be tools for their greening. and the humanities and social sciences that observe this process of taking the environment into account in research

See theses.fr/2024BORD0312
and here E. Monneau's results to be published

Data from Transition 1point5 : what labs do



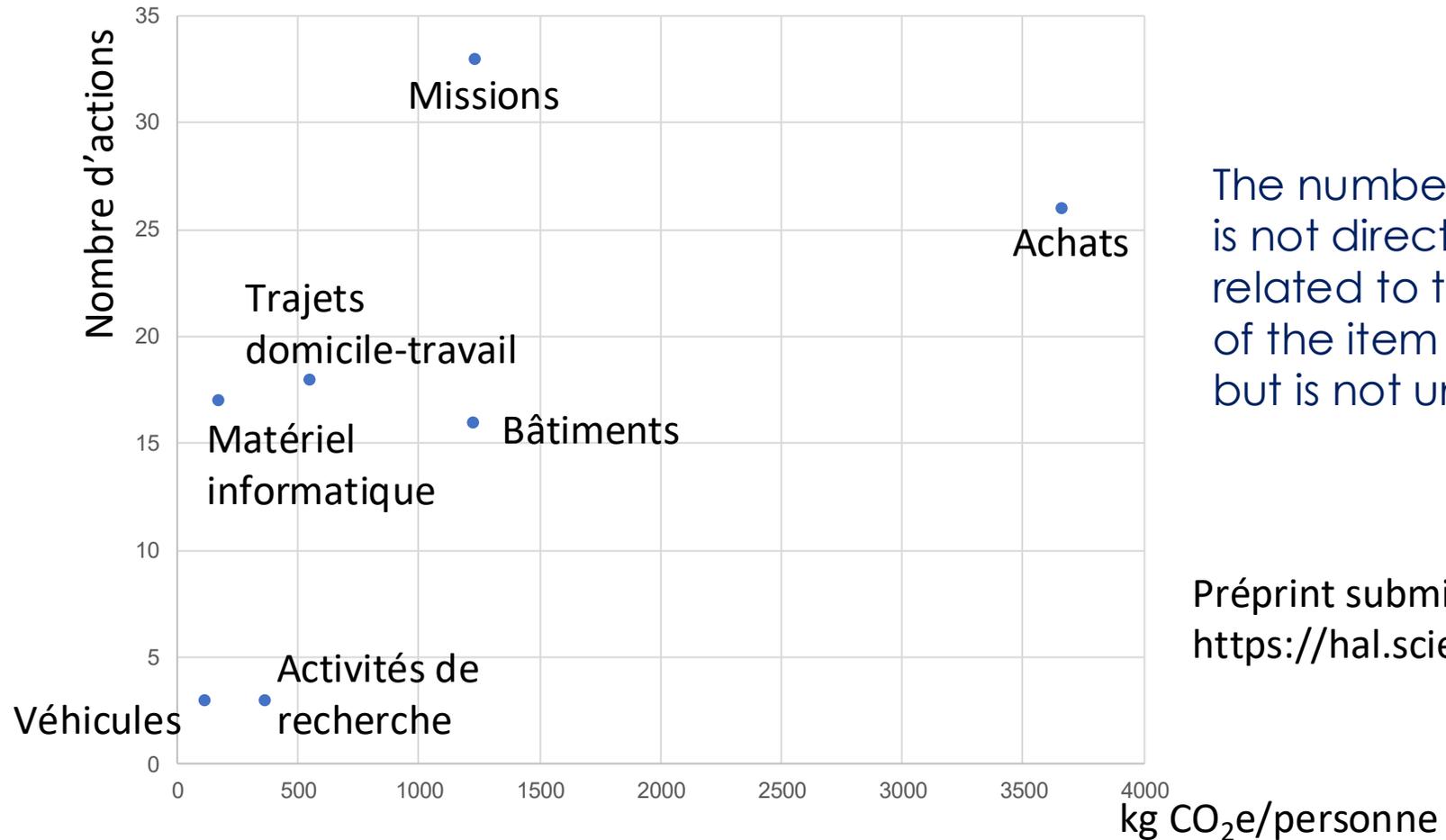
Is there a link between the choice of reduction categories and the level of emissions in the greenhouse gas emissions report of laboratories?



What labs do



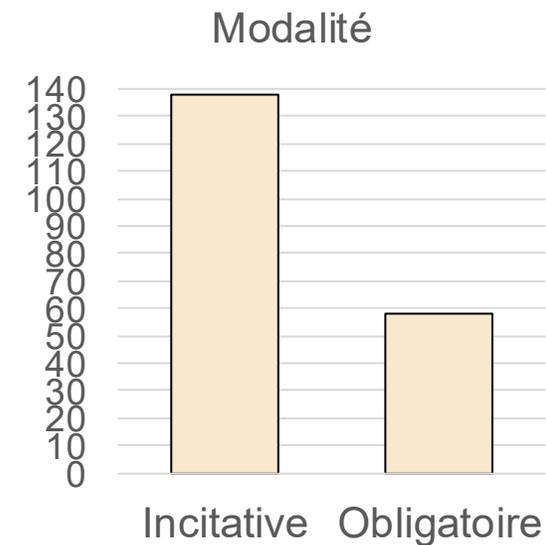
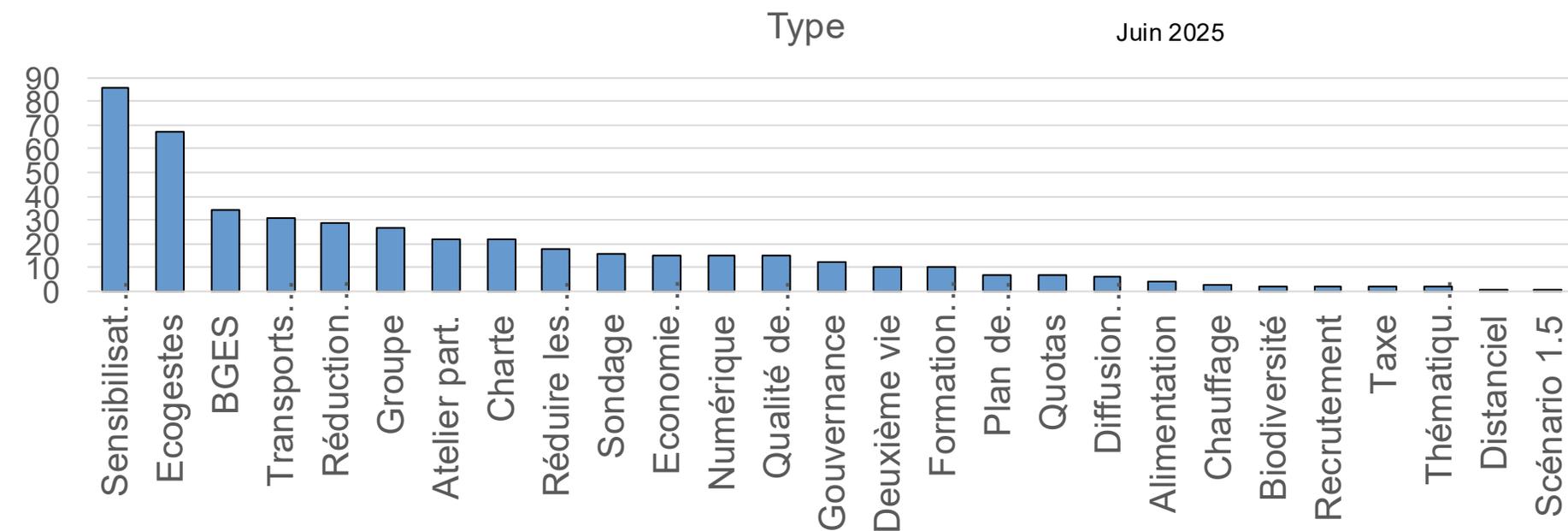
Is there a link between the choice of reduction categories and the level of emissions in the greenhouse gas emissions report of laboratories?



The number of actions is not directly related to the emissions of the item but is not unrelated

Préprint submitted
<https://hal.science/hal-05508584v1>

First results from labs in transition : preferred methods...



Awareness-raising and eco-friendly actions dominate the initiatives undertaken.

Awareness-raising is not necessarily a first step; it is a long-term process...

... even to the point of running out of steam, if we think about murals (inflation in the types of murals and lack of volunteers to create new ones).

Open questions:

- Awareness-raising vs. training? We know that awareness-raising, once it has taken place, is only [transformative in the short term](#).
- What role do [emotions play as drivers of action](#)?

Simulators: carbon footprint missions, commuting to and from work



Videos: regular seminars (can be seen afterwards), 1point5 lab days, lectures (can be seen afterwards)

Seminar cycle example :

Sobriété et effet rebond *Hiver 2023*

Éthique et responsabilité *Automne 2022*

Transmission *Printemps 2022*

Technologie et sobriété *Hiver 2022*

Décarboner en 2050 *Automne 2021*

Now : Climate initiatives in the academic world

+ Publications, positioning texts Decrypts
A regular newsletter

TEXTES DU COLLECTIF

Recherche : pour une éthique environnementale

Oser enseigner la transition écologique

Enseigner la transition environnementale dans le supérieur

Transition environnementale de la LPPR

Responsabilité de l'ESR

Texte fondateur



« Taking into account the environmental impact of research must be considered as part of research ethics ».

Two parts:

« Reflect on ways of limiting the footprint of 'everyday' research practices. »

« Looking at the environmental footprint of research topics and ways of dealing with them. »

citations from the CNRS Ethics comity (2022)

The causes of our footprint?

Of course, use of the tools produced by Labos 1point5

but

don't overlook the normative context established by institutions, such as the quest for "scientific visibility"



Thank you for your attention

