



[humic-substances.org/](http://humic-substances.org/)



[irc-orcasa.eu/](http://irc-orcasa.eu/)

*Joint Seminar of the Brazilian Chapter of the IHSS-NOM and the IRC-Soil Carbon*

# ***An interactive global review of practices for increasing soil carbon***

Julien Demenois, Damien Beillouin, Rémi Cardinael, Marc Corbeels, Jean-Baptiste Laurent, David Berre, Annie Boyer, Abigail Fallot, Frédéric Feder, François Thévenin

04/08/2023

## Initial objectives and key messages

- **Target** : contribute to the policy debate on soil carbon and lead to more science-based decisions of stakeholders
- **How ?** through a global and comprehensive qualitative and quantitative analysis of scientific papers
- **Key results** :
  1. Land management and land-use change have a much higher impact on soil C than climate change
  2. Conversion to cropland results in a loss of soil carbon
  3. Multiple efficient options to increase soil carbon in cropland
  4. Blind spot on Africa and carbon rich areas

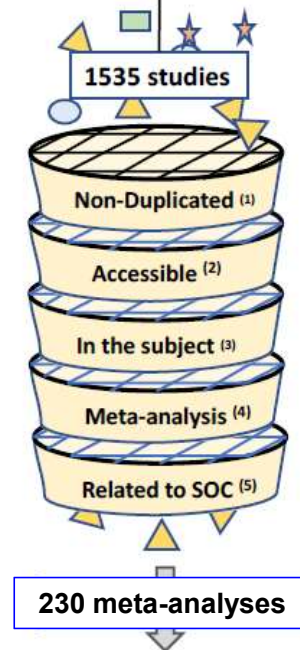
# Our method in brief

## 1. IDENTIFICATION OF THE STUDIES



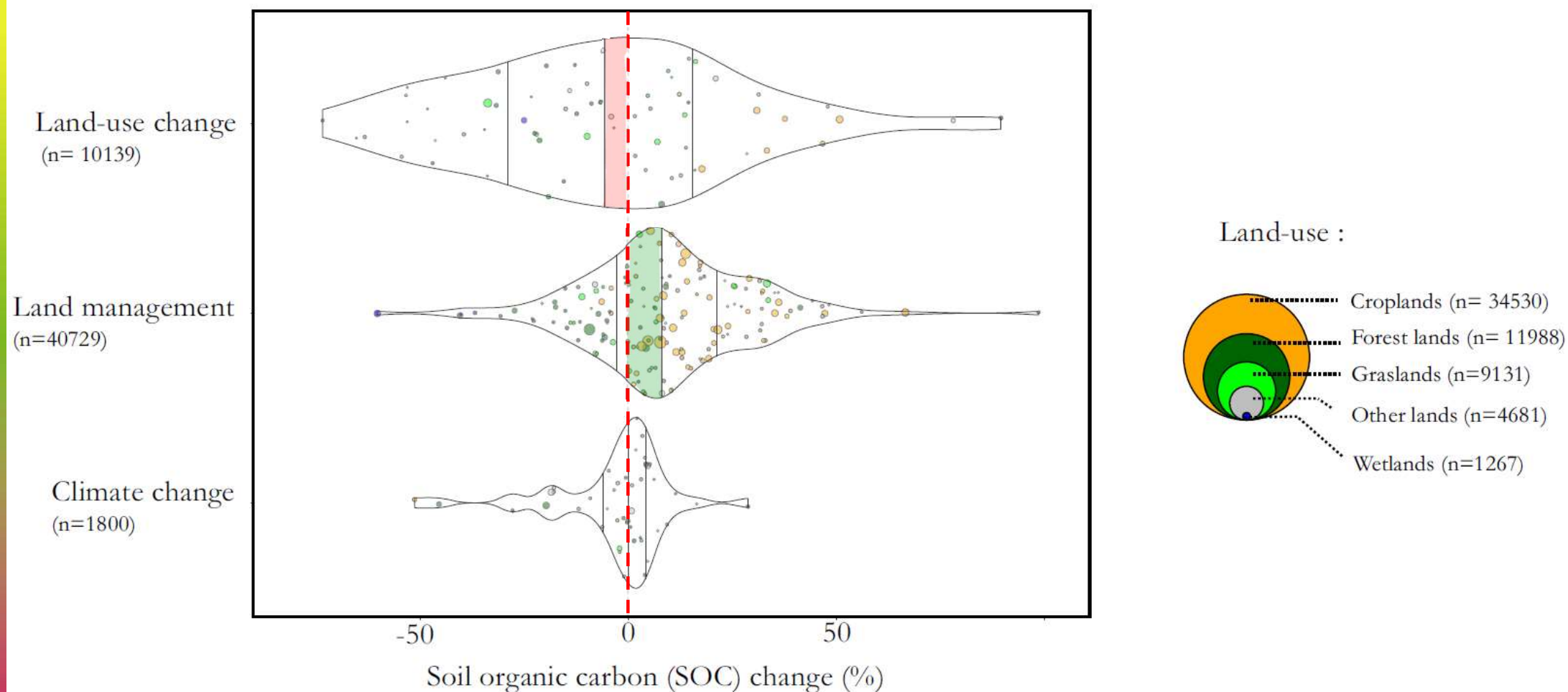
## 2. SELECTION OF THE STUDIES

**A focus on meta-analyses  
published between 1900 and 2022**

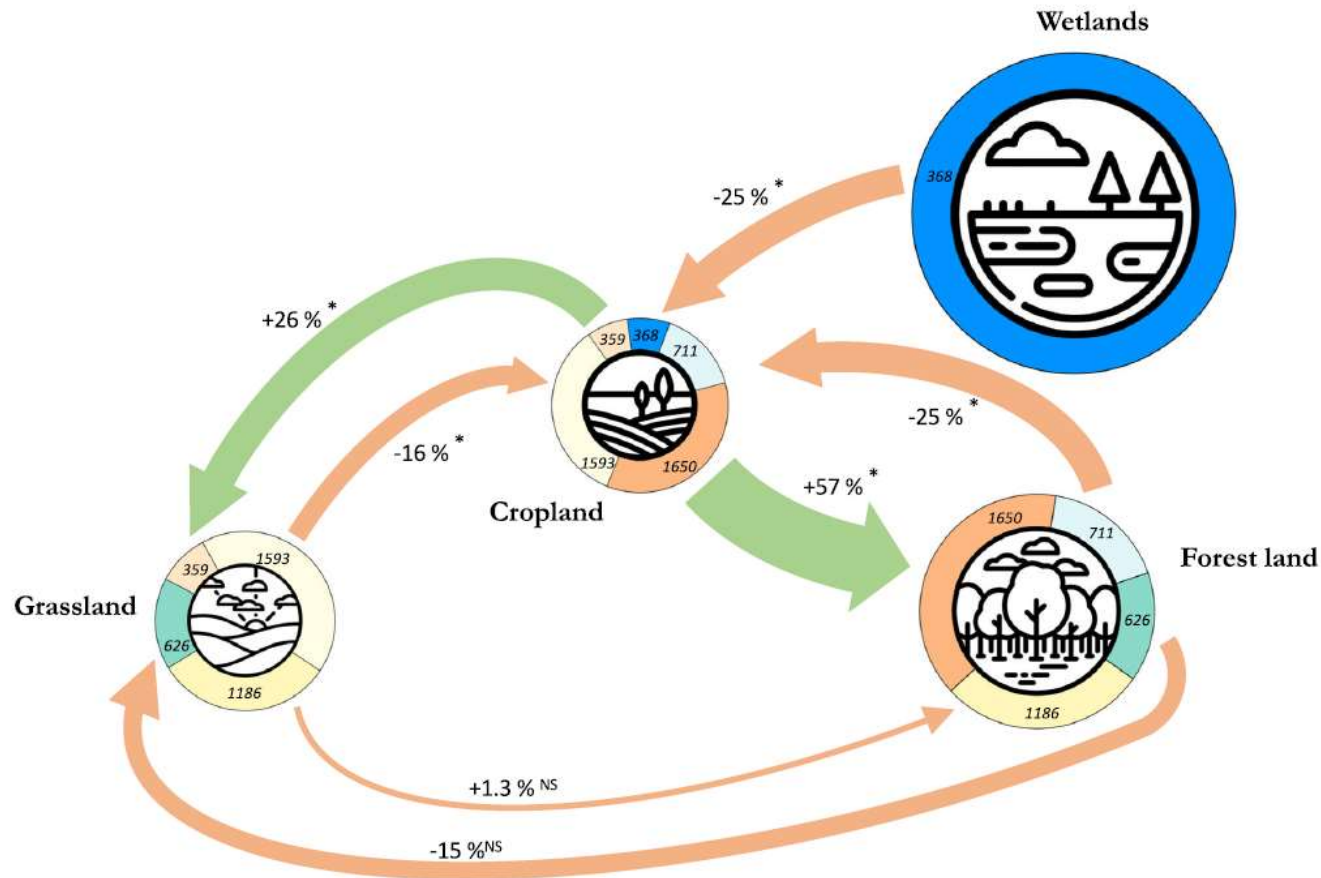


**Keywords :** meta-analysis,  
systematic review, soil carbon

# Land management and land-use change have a much higher impact on soil C than climate change

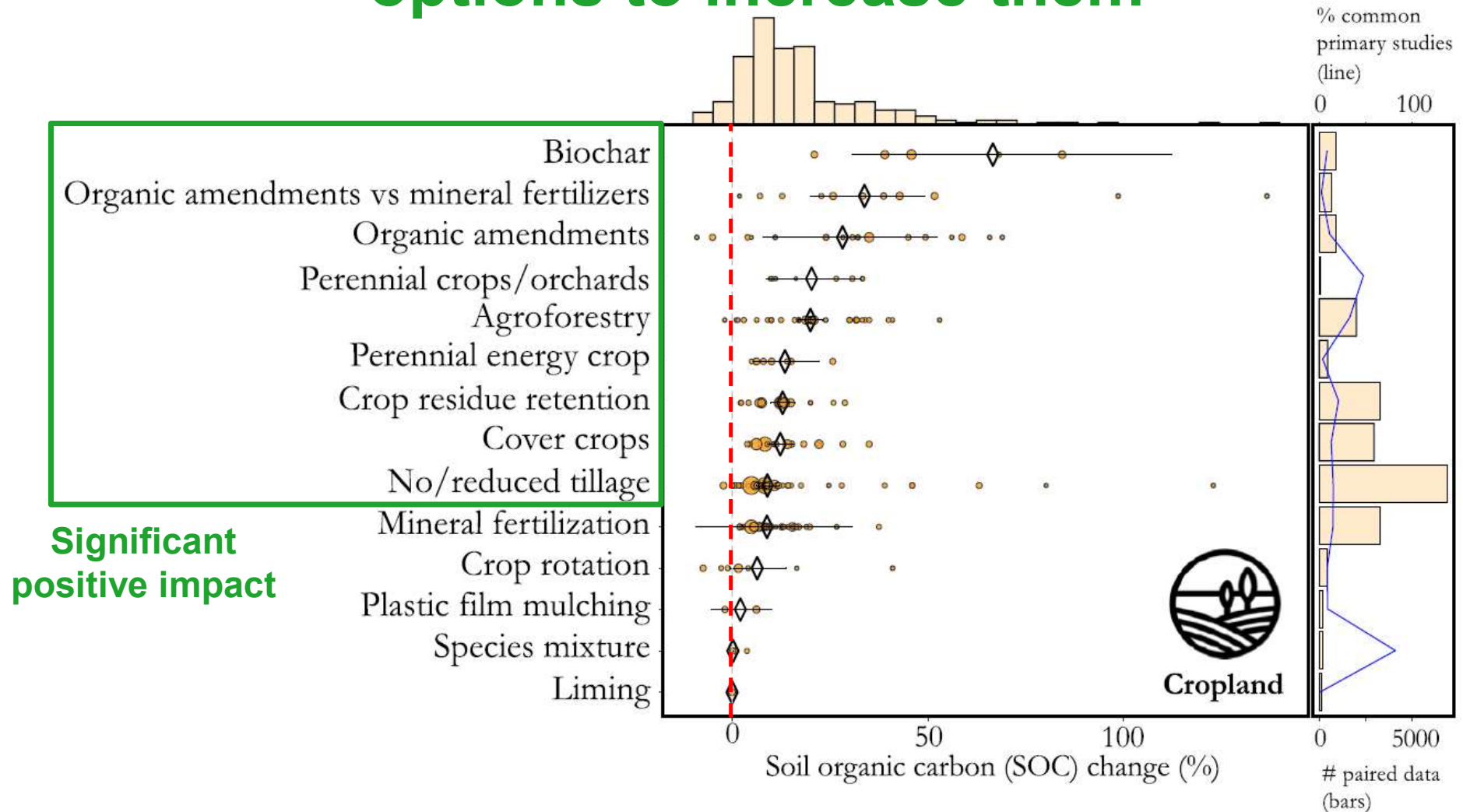


# Impacts of land-use change on soil carbon

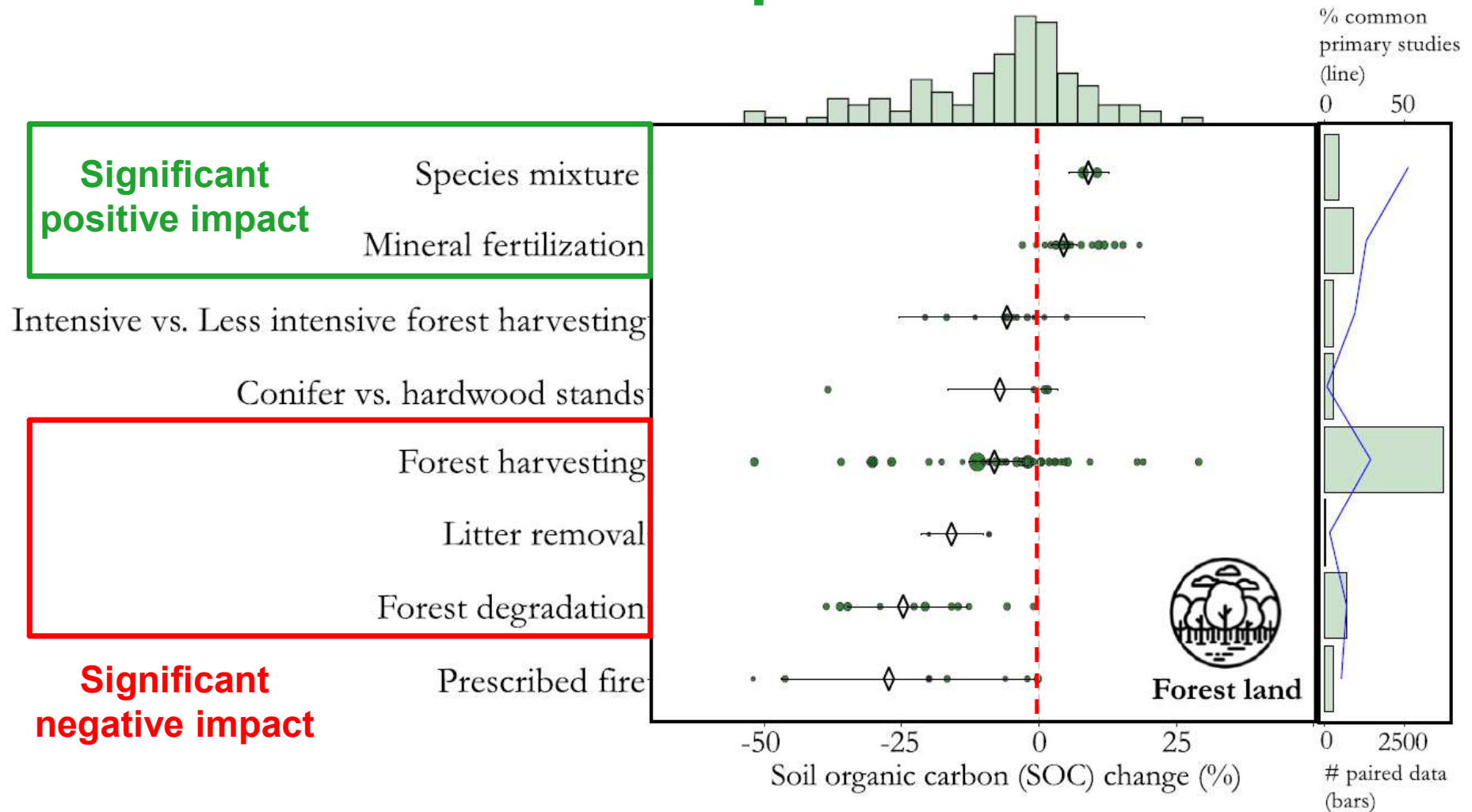


- > Conversion to cropland = loss of soil carbon
- > Conversion to forest land = increase or no impact on soil carbon

# Low soil carbon values in cropland, but multiple options to increase them

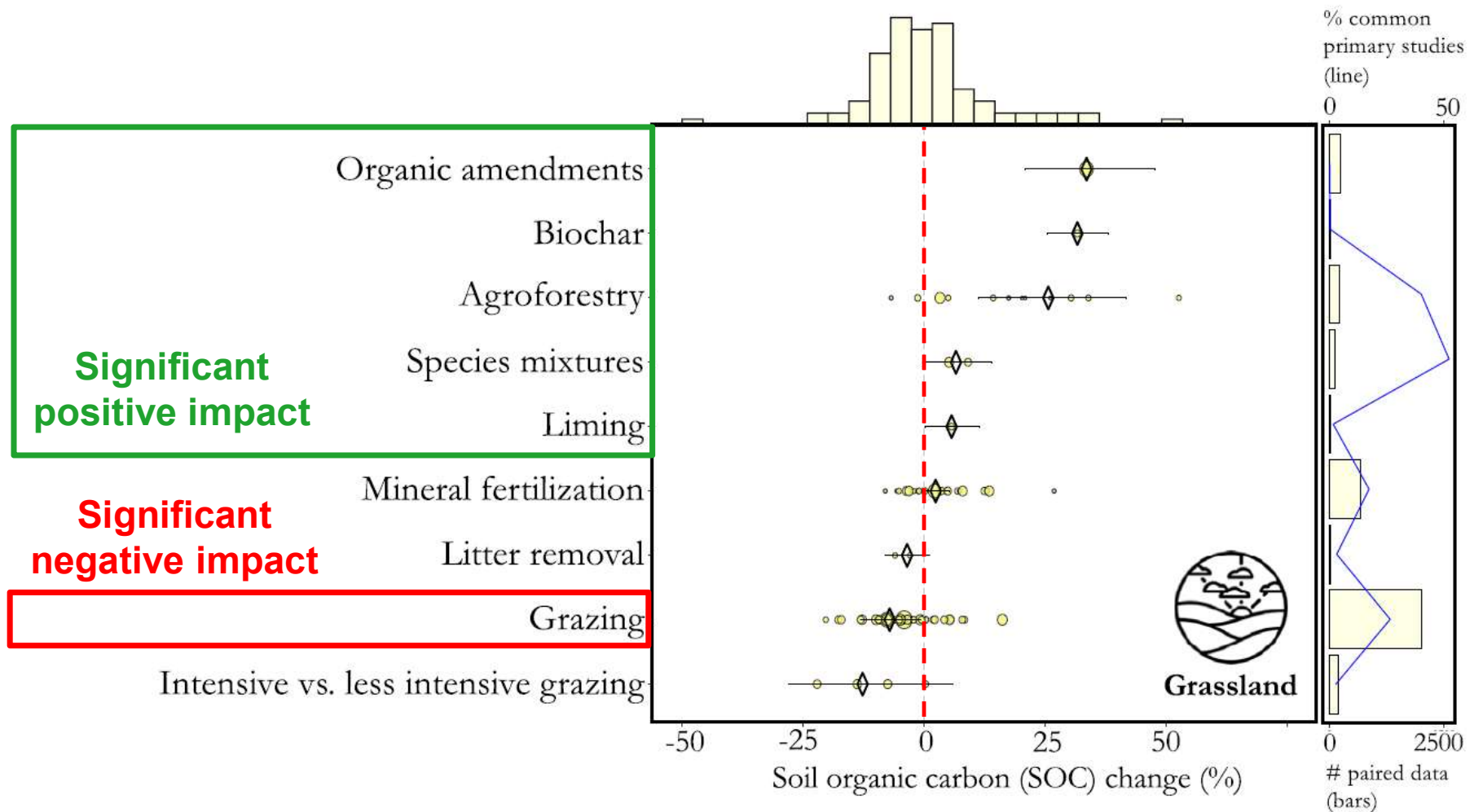


# Higher soil carbon values in forest land, but mixed effect of practices



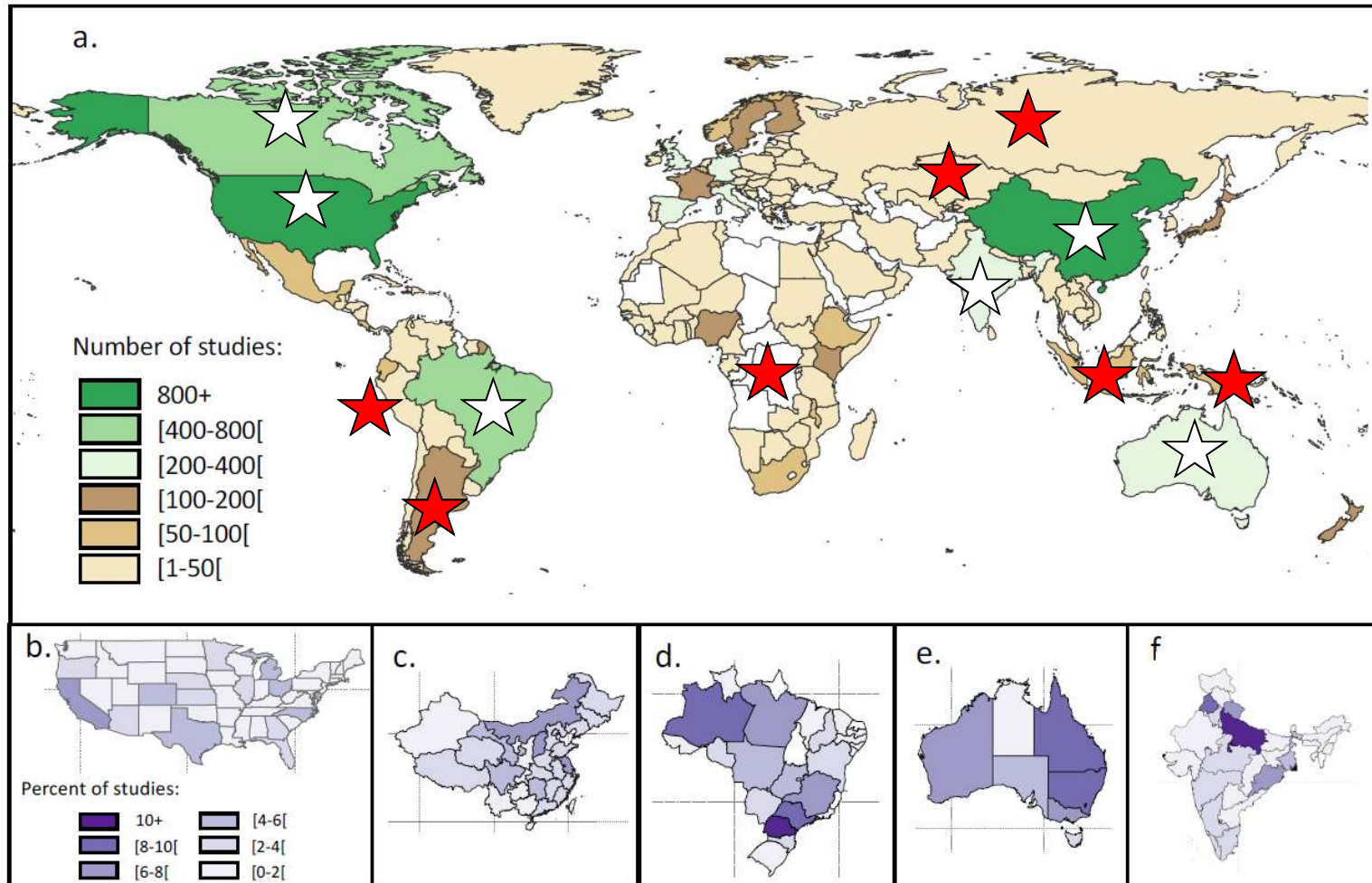


# High soil carbon values in grassland, and various options to still increase it





# Blind spot on Africa and carbon rich areas

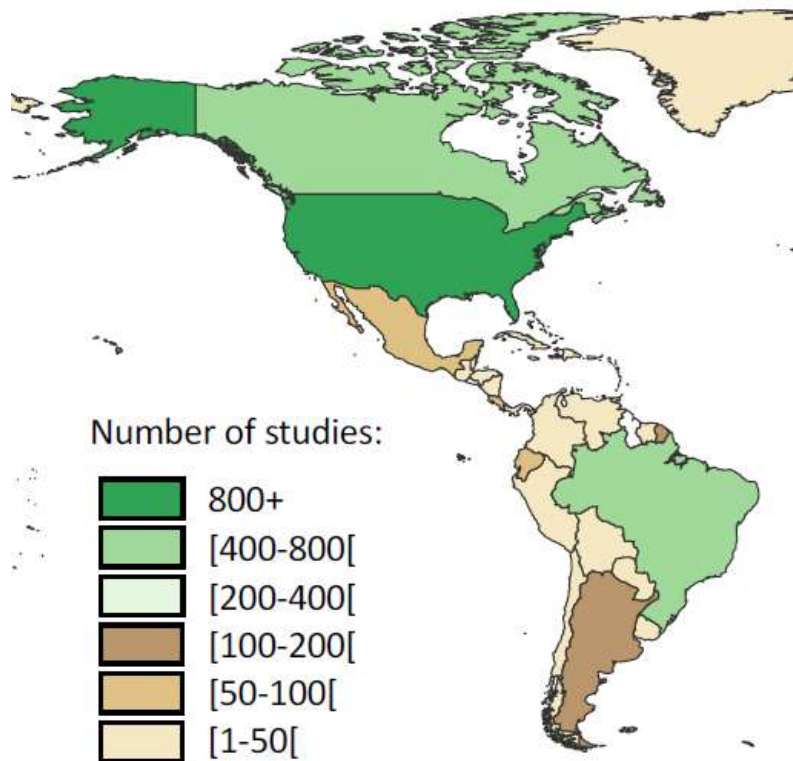


★  
C rich areas

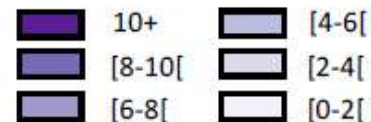
~1/2 of the 13 200 studies were conducted in USA or China.

-> more than 80% of African countries have fewer than 40 studies

# Many studies in Brazil but fewer in Caatinga biome

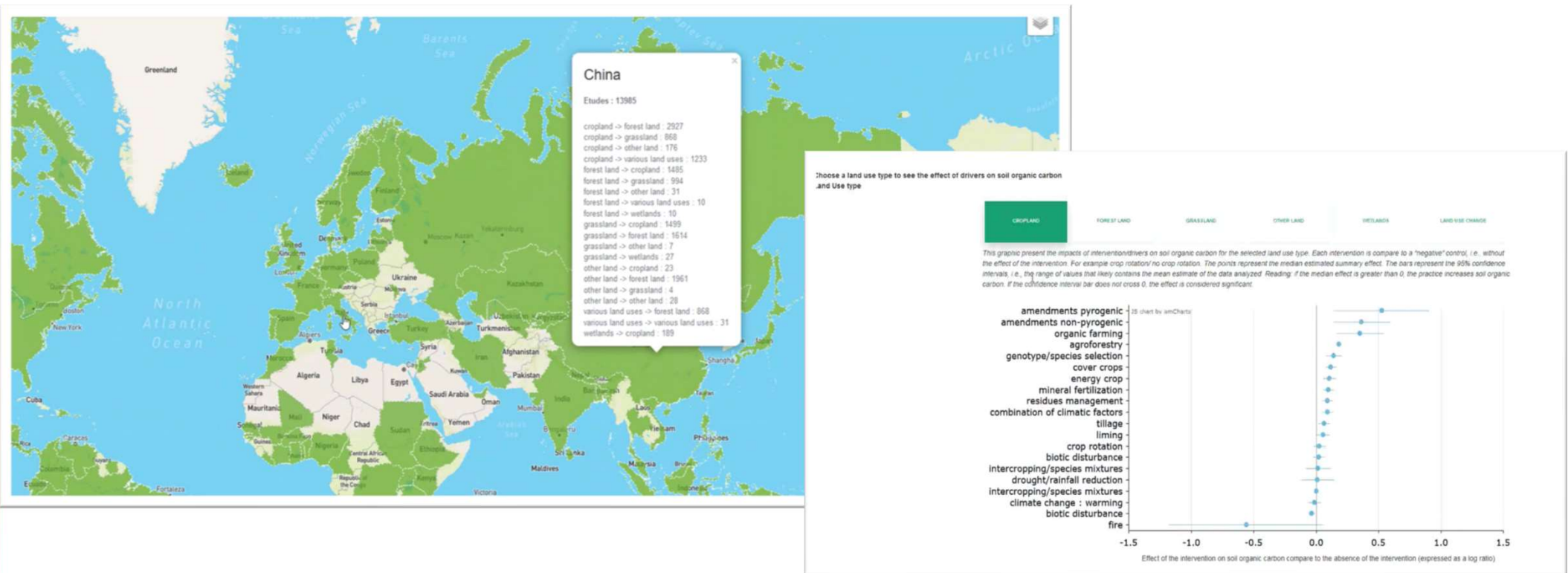


Percent of studies:



# Towards an interactive global review

- A first prototype of Review4C already available here : <http://www.review4c.net/>



# Towards an interactive global review

- Keep developping an interactive and living database (Review4C) in ORCaSA project using machine learning, as part of the knowledge platform of the IRC on soil carbon



## Conclusions in a nutshell

1. Land management and land-use change have a much higher impact on soil C than climate change
2. Conversion to cropland leads to soil carbon loss
3. Organic amendments and perennial plants are efficient options to increase soil carbon in cropland
4. Still understudied practices : crop diversification, irrigation, perennial crops, deep-rooted annual crops
5. A huge need to drive research studies in Africa and carbon rich areas

# Resources and authors

- ***Soil Organic Carbon in the Anthropocene: A Global Meta-analysis*** », Beillouin Damien, Corbeels Marc, Demenois Julien, Berre David, Boyer Annie, Fallot Abigail., Feder Frédéric., Cardinael Rémi. 2023. *Nature Communications*, 3700 (2023). <https://doi.org/10.1038/s41467-023-39338-z>
- ***A global overview of studies about management, land-use change and climate change effects on soil organic carbon***. Beillouin Damien, Cardinael Rémi, Berre David, Boyer Annie, Corbeels Marc, Fallot Abigail, Feder Frédéric, Demenois Julien. 2022. *Global Change Biology*, 28 (4) : 1690-1702. <https://doi.org/10.1111/gcb.15998>
- ***A global database of land management, land-use change and climate change effects on soil organic carbon***. Beillouin Damien, Demenois Julien, Cardinael Rémi, Berre David, Corbeels Marc, Fallot Abigail, Boyer Annie, Feder Frédéric. 2022. *Scientific Data*, 9:228, 10 p. <https://doi.org/10.1038/s41597-022-01318-1>
- ***A global database of management, land-use change and climate change effects on soil organic carbon***. Beillouin, D., Demenois, J., Cardinael, R., Berre, D., Corbeels, M., Fallot, A., Boyer, A., & Feder, F. 2021. CIRAD Dataverse, V3. <https://doi.org/10.18167/DVN1/KKPLR8>
- <http://www.review4c.net/> to explore the related database
- **The team behind this work** : Beillouin Damien, Cardinael Rémi, Berre David, Boyer Annie, Corbeels Marc, Fallot Abigail, Feder Frédéric, Laurent Jean-Baptiste, Thévenin François, Demenois Julien



[humic-substances.org/](http://humic-substances.org/)



[irc-orcasa.eu/](http://irc-orcasa.eu/)

*Joint Seminar of the Brazilian Chapter of the IHSS-NOM and the IRC-Soil Carbon*

# Thank you for your attention

Julien Demenois (Cirad), [julien.demenois@cirad.fr](mailto:julien.demenois@cirad.fr), « 4 per 1000 Initiative » correspondent