

Ninety years of alien plant species accumulation across regional and local scales in central European fields

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→ Introduction:

We examined the spread of alien species using data from the AgriWeedClim database in Central Europe's arable fields. We examined the temporal dynamics of plant invasions across the region and within individual plots giving insights into how these dynamics manifest differently from broader regional patterns to local plot-level interactions

→ Data Sources

AgriWeedClim database (Glaser et al., 2022):

- **10** Central European countries
- ca. **900,000** km²
- **1930 - 2019**
- **21,747** plots = **413,145** species records
- **1448** species, **1103** native, **160** neophyte, **185** archaeophyte

Climate data:

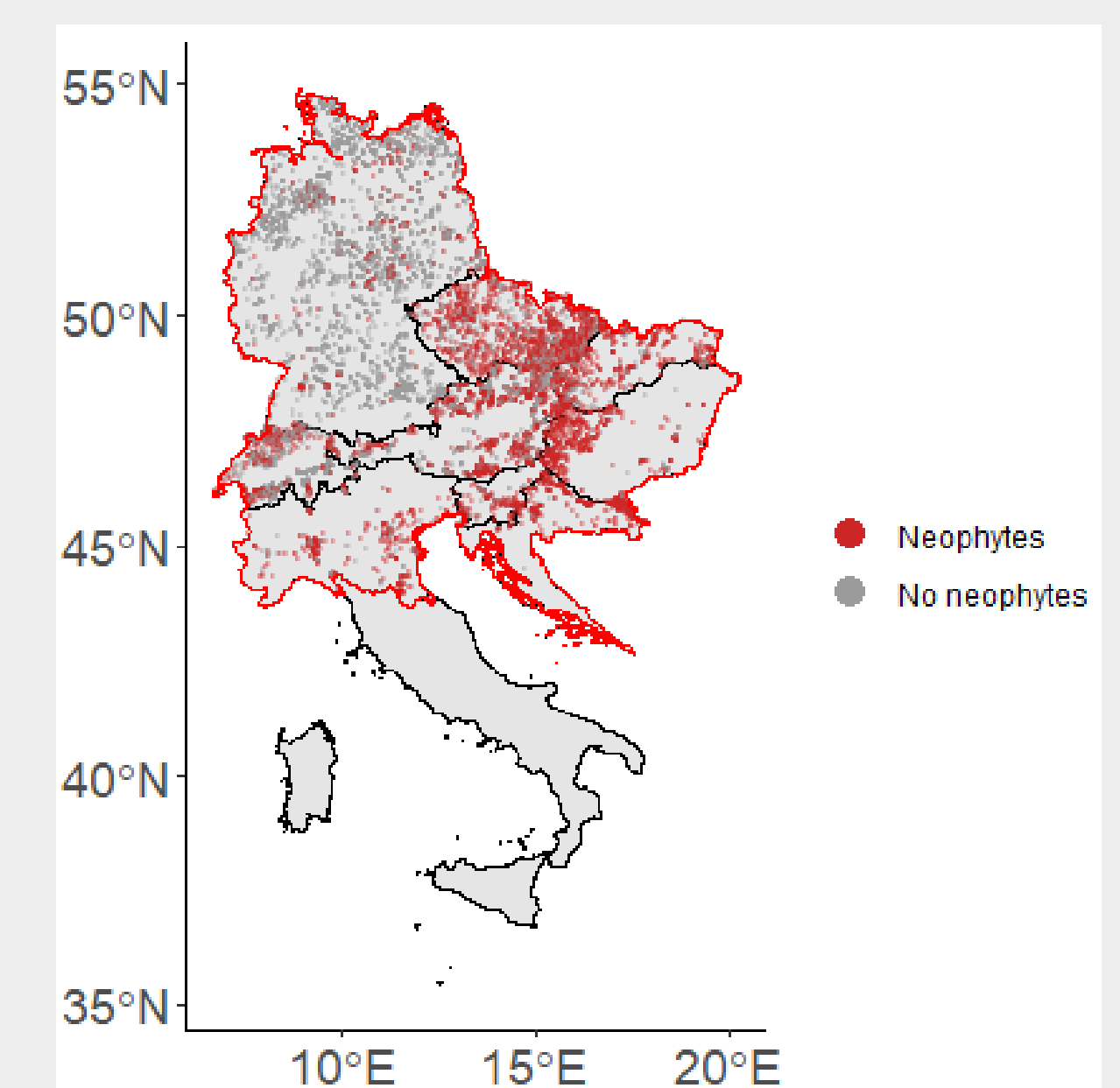
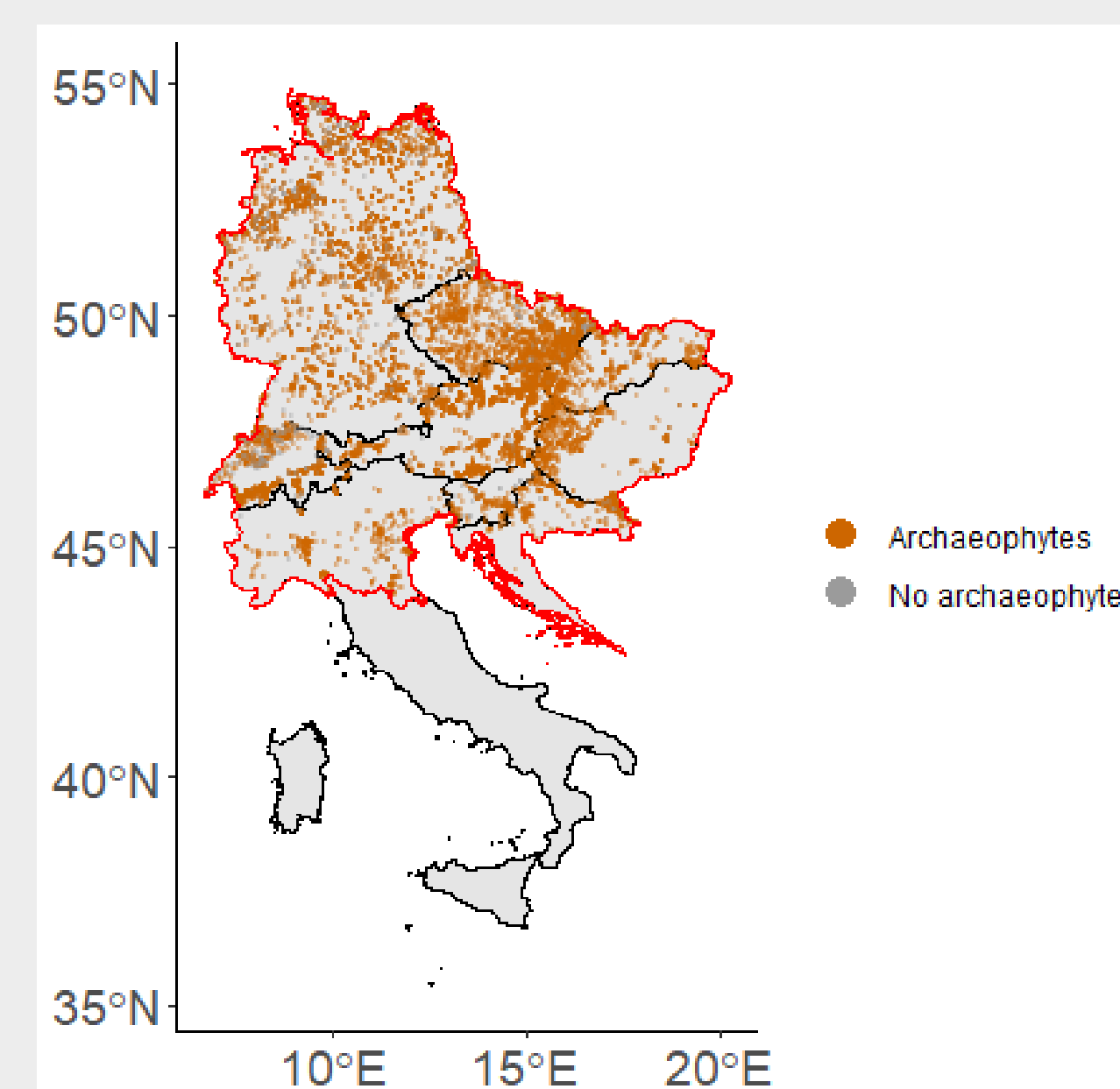
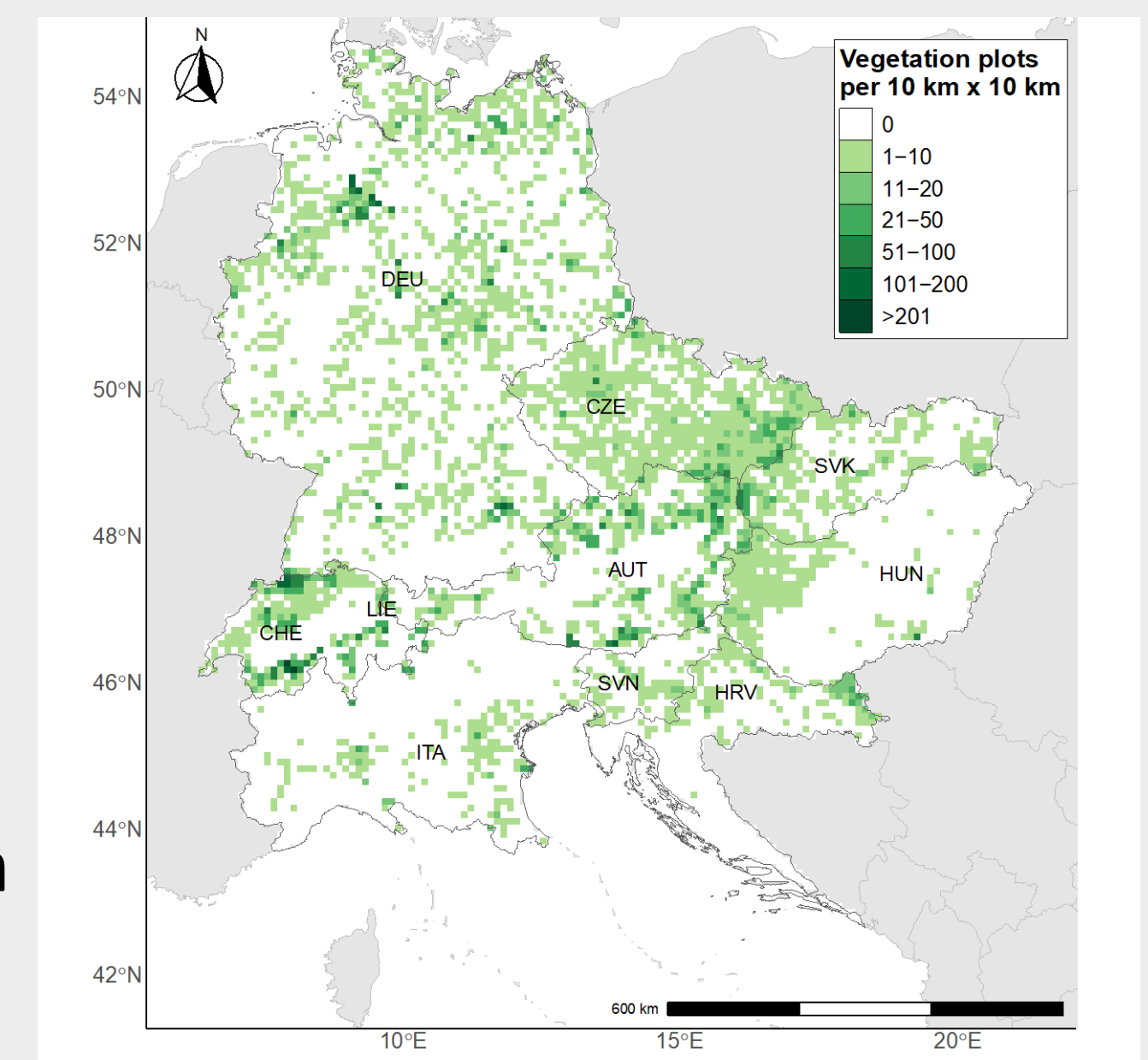
- CRU database (Harris et al., 2020)

→ Analysis:

To assess invasion dynamics, we used general mixed-effect models, incorporating random effects to adjust for the variability introduced by the **type of study**, which reflects different research methodologies. We also considered the **month of collection** to address seasonal patterns in species emergence and distribution, as well as **crop type**, which could significantly influence the invasiveness of plots.

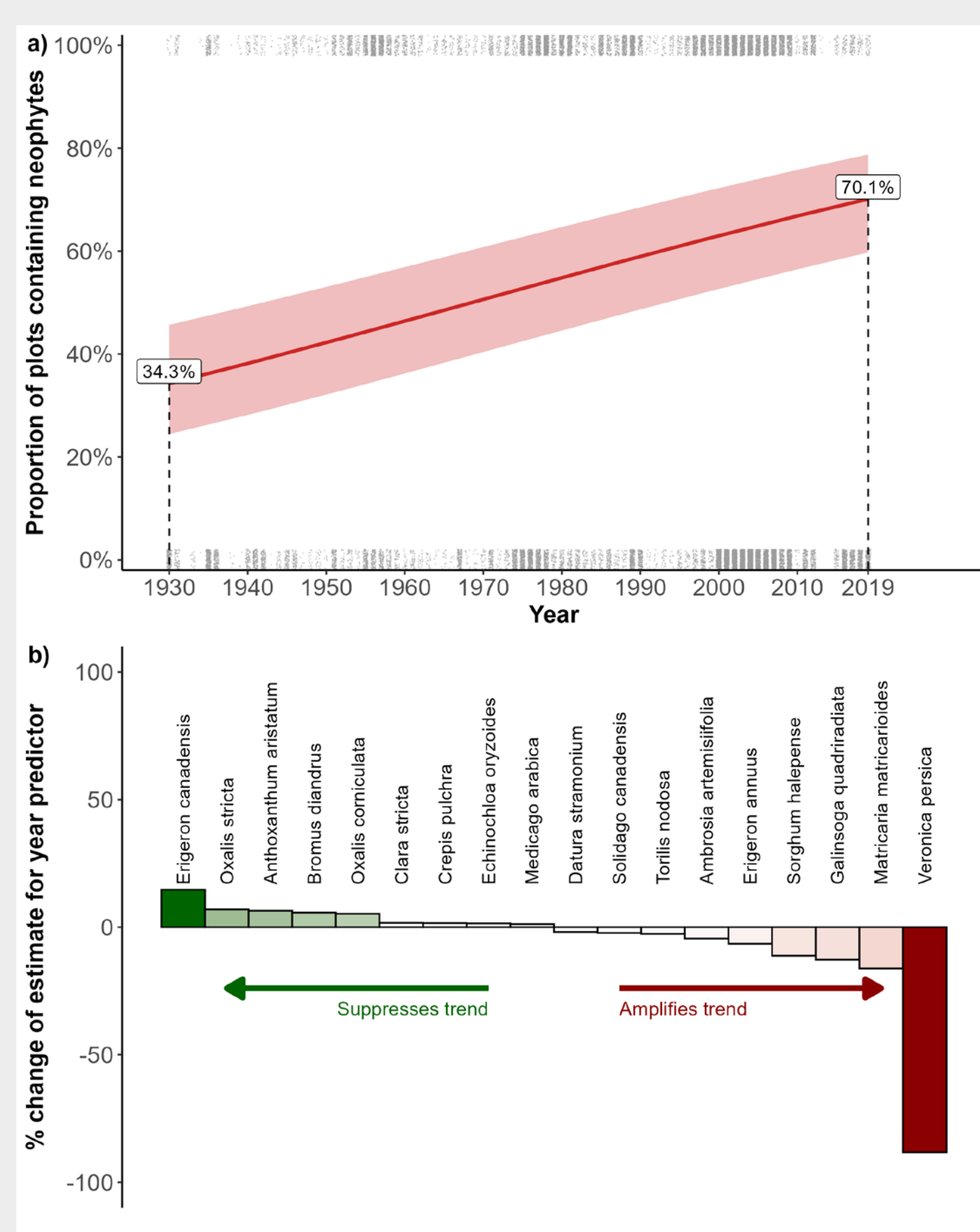
→ Research questions:

- What **proportion** of sampled arable fields harbour **at least one neophyte** per plot?
→ Assessing alien species invasion extent.
- What is the alien **species proportion** in these invaded plots?
→ Understanding species diversity.
- How prevalent are alien species in **abundance** in these plots?
→ Evaluating their dominance.



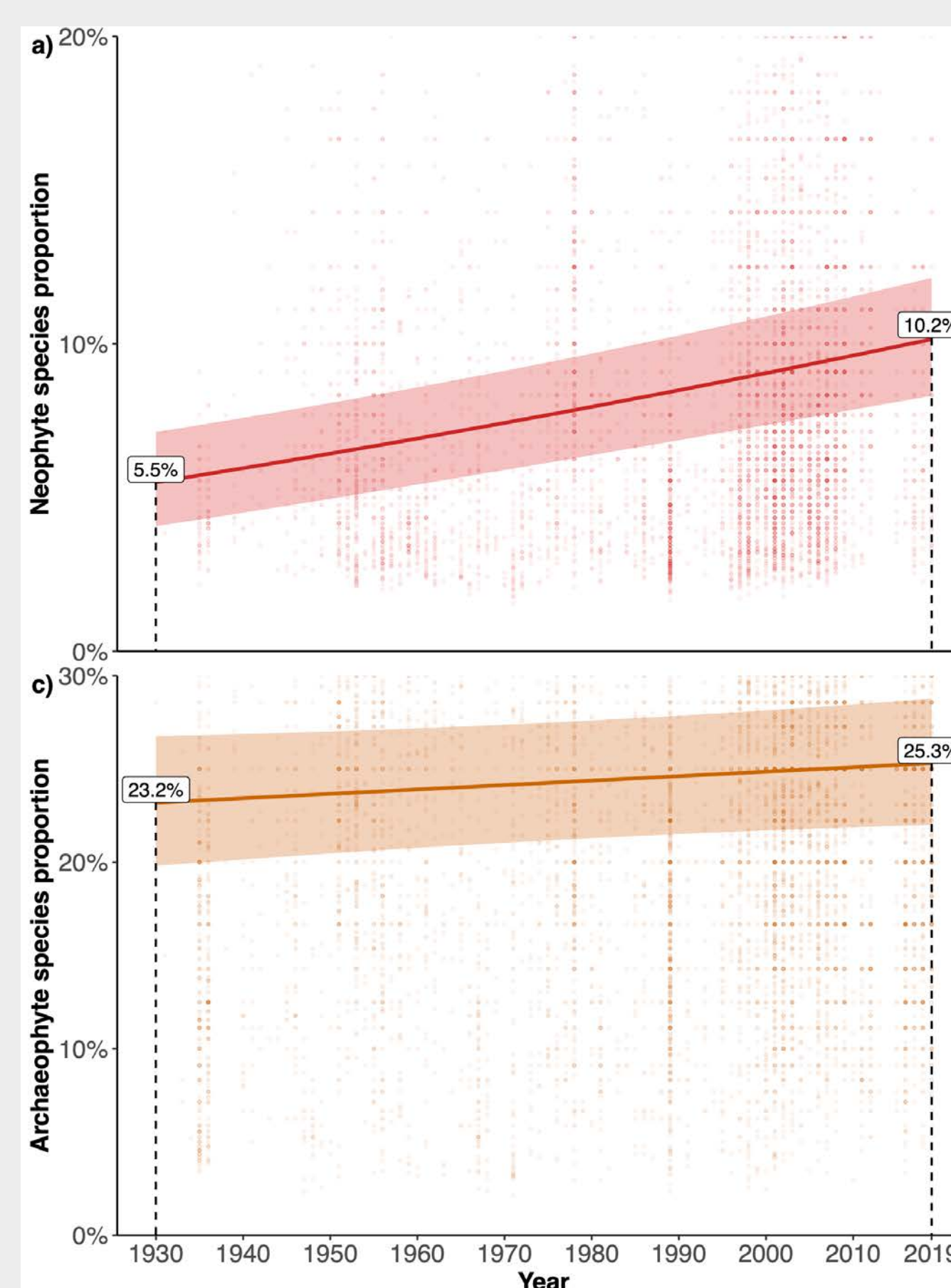
→ Results & Discussion

The number of **plots containing at least one neophyte increased** from 34.3% to 70.1% in between 1930 and 2019.



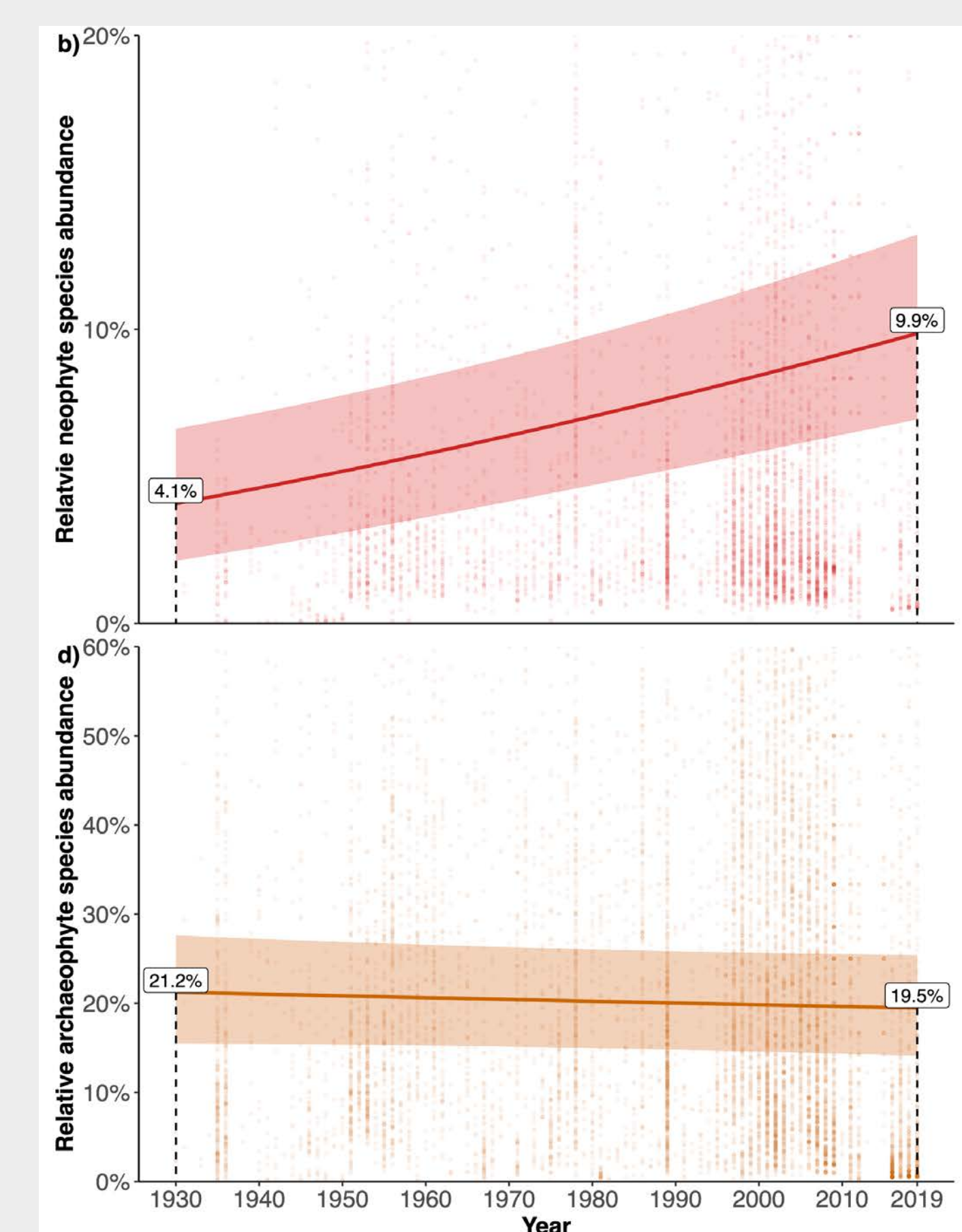
→ A **marked increase** of neophytes over time was observed **across** the entire **study region**. By 2019, roughly **70%** of arable field plots harboured at least one neophyte species

Both **neophyte** and **archaeophyte proportion increased** from 5.5% to 10.2% and 23.2% to 25.3% , respectively.



→ Both metrics of neophytes on plot level **doubled**, but **stayed around 10%**, highlighting a **contrast** in neophyte spread **between regional and plot level scale**. The proportion of archaeophytes **changed marginally** and the relative abundance decreased slightly, showing **differing trends** between archaeophytes and neophytes.

Relative **neophyte abundance increased** from 4.1% to 9.9% and **archaeophyte abundance decreased** from 21.2% to 19.5%.



Acknowledgements

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References

- Glaser, M., Berg, C., Buldrini, F., Buholzer, S., Bürger, J., Chiarucci, A., Chytrý, M., Dřevovojan, P., Follak, S., Kůzmič, F., Lososová, Z., Meyer, S., Moser, D., Pyšek, P., Richner, N., Šilc, U., Wietzke, A., Dullinger, S., & Essl, F. (2022). AgriWeedClim database: A repository of vegetation plot data from Central European arable habitats over 100 years. *Applied Vegetation Science*, 25(3). <https://doi.org/10.1111/avsc.12675>
- Seebens, H., Bacher, S., Blackburn, T. M., Capinha, C., Dawson, W., Dullinger, S., Genovesi, P., Hulme, P. E., van Kleunen, M., Kühn, I., Jeschke, J. M., Lenzner, B., Liebhold, A. M., Pattison, Z., Pergl, J., Pyšek, P., Winter, M., & Essl, F. (2021). Projecting the continental accumulation of alien species through to 2050. *Global Change Biology*, 27(5), 970–982. <https://doi.org/10.1111/gcb.15333>
- Harris, I., Osborn, T. J., Jones, P., & Lister, D. (2020). Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset. *Scientific Data*, 7(1). <https://doi.org/10.1038/s41597-020-0453-3>