UFZ HELMHOLTZ Centre for Environmental Research

Automatized drought impact detection from newspaper articles using natural language processing and machine learning

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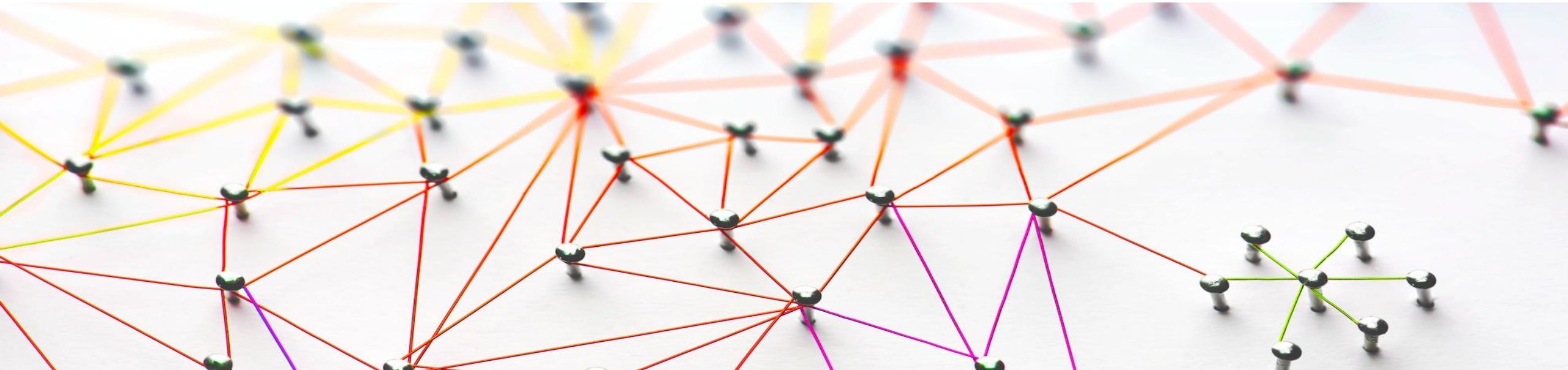


Manifold drought impacts and their assessment

Drought impacts observed in Germany 2018/2019

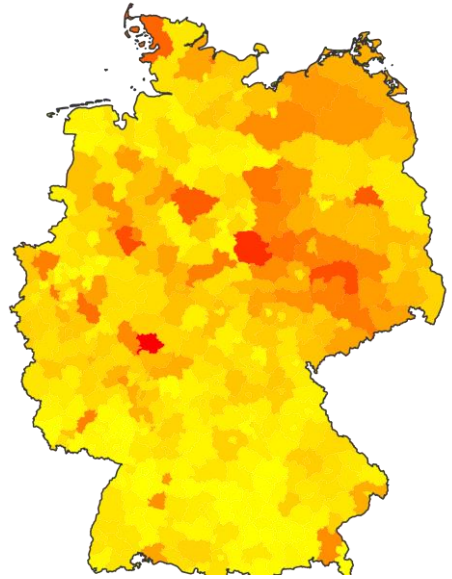
de Brito, M. M., Kuhlicke, C., & Marx, A. (2020). Near-real-time drought impact assessment: a text mining approach on the 2018/19 drought in Germany. *Environmental Research Letters*, *15*(10), 1040a9.

Leveraging machine learning and natural language processing to mine drought impacts

Sample collection

Machine learning

Natural language processing

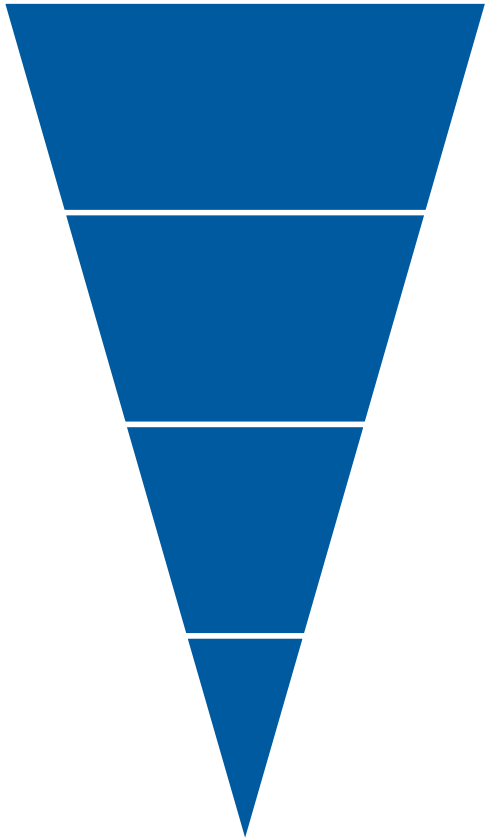


Newspaper articles covering Germany between 2000-2021

Drought impact statements
- *What type of drought impact?*
- *Where was the impact?*
- *When did it happen?*

Spatial-temporal drought impact dataset

Sample collection → removing duplicate & non-relevant information



Download articles from news-aggregator database using keywords

Calculate Jaccard similarity between all articles, remove duplicate articles with similarity > 0.90

Detect articles with non-relevant topics using a topic modelling approach

Text corpus for drought impact analysis

Drought impact classification: Turning text to logistic regression

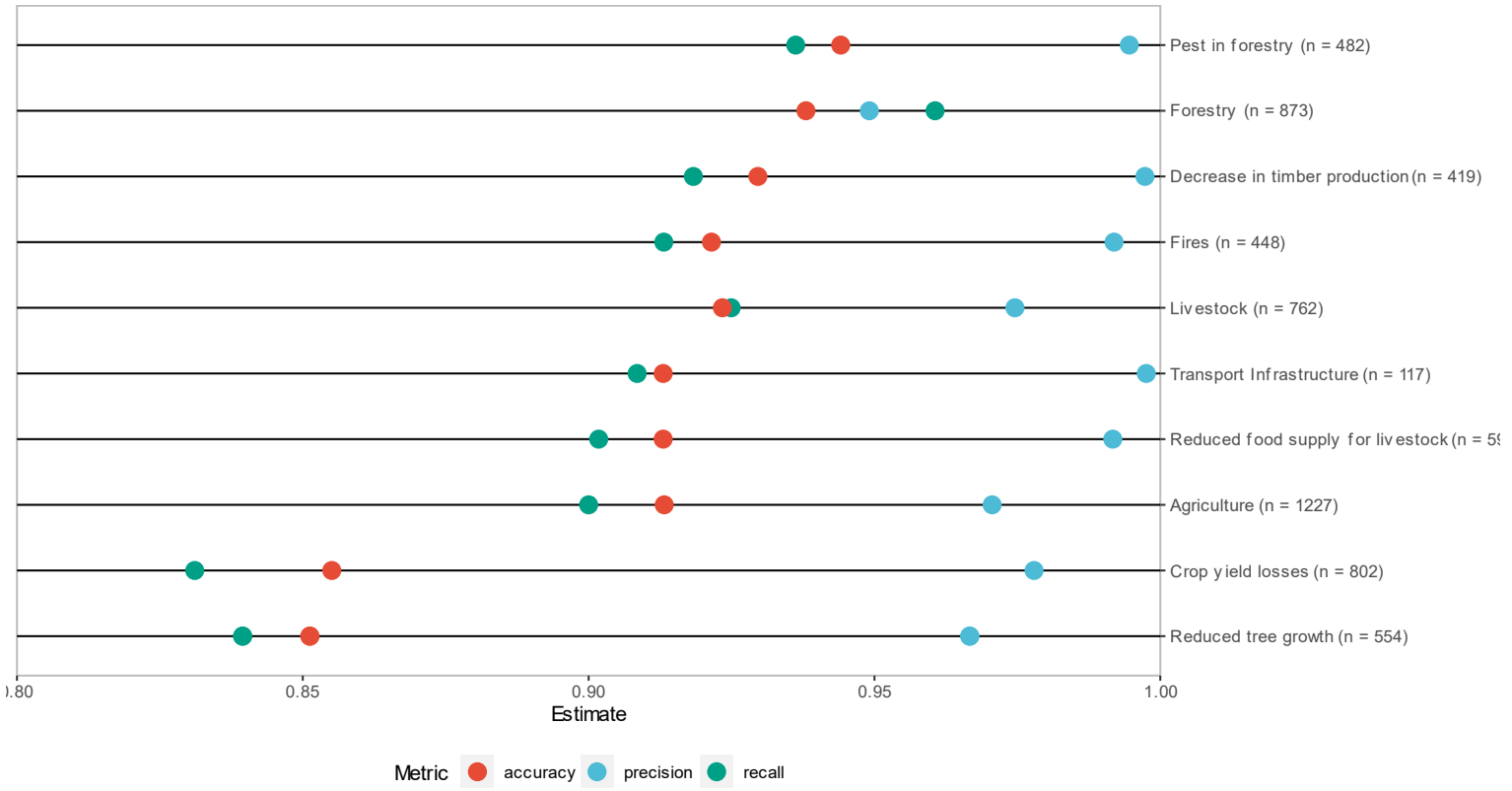
Text in classification models?

"Because of the drought the farmers cannot avoid reduced yields"

Words ('tokens') as variables

Lasso logistic regression

Impact observed ←→ no impact observed



Location identification: Examining an article's geographic scope

Detection of potential locations in text using

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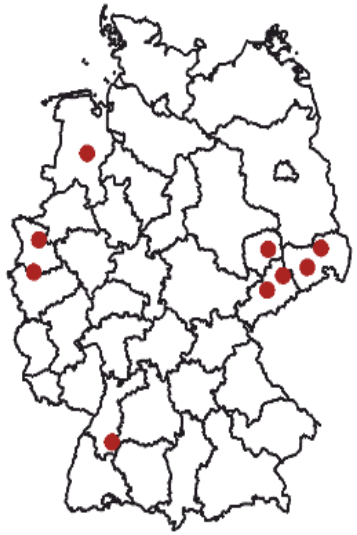
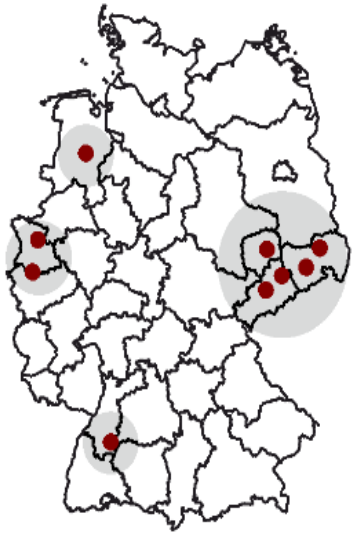
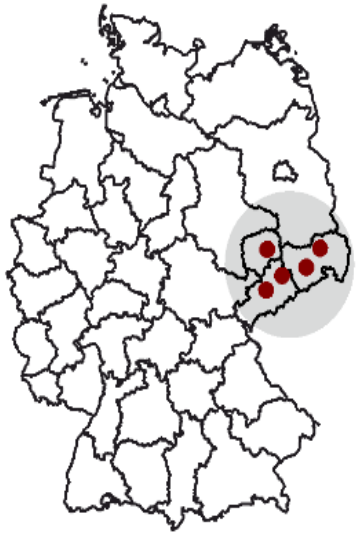
Geoparsing potential locations via gazetteer data



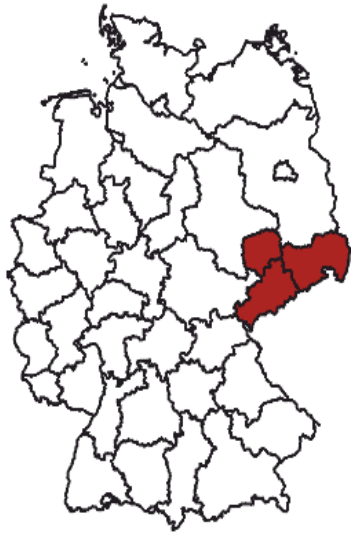
Sorting potential locations in clusters



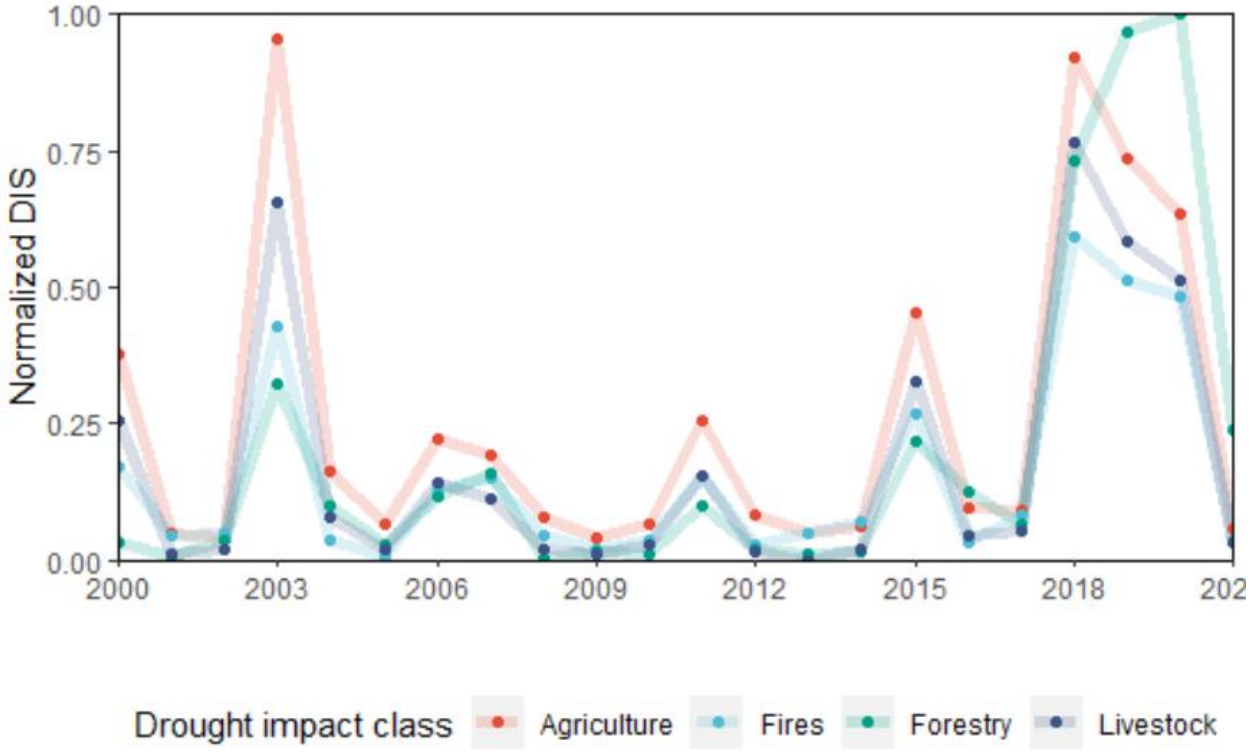
Selecting one cluster as the drought impact location area

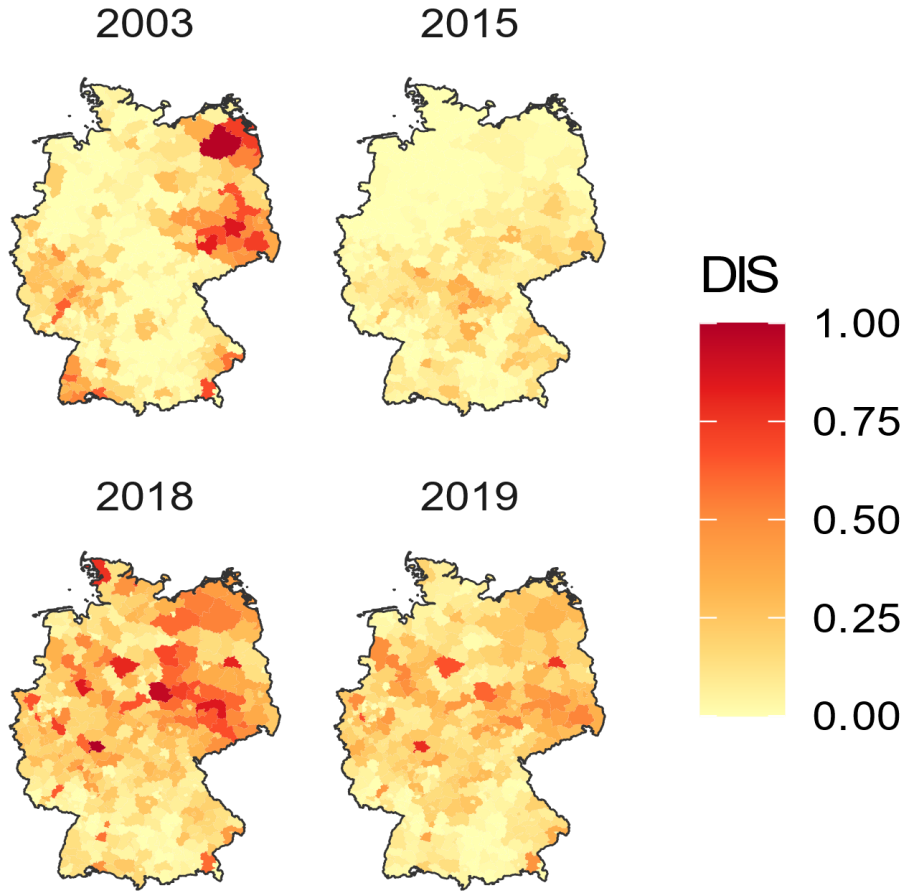


Mapping drought impact locations to statistical units



A spatial-temporal perspective on drought impacts in Germany





Empirical validation of the resulting dataset

- **Does the resulting dataset match the trends of external indicators?**
  - Validation with both bio-physical measures (precipitation deficit) and impact-specific indicators (e.g. forest fire statistics)
  - Correlation analysis concerning both spatial (in each year) and temporal trends (in each spatial unit)
- → **General spatial and temporal trends reflected across all indicators**
  - Years with drought events perform better on average

Conclusion and outlook

- Automatization of a yet manual task in drought impact assessment, while maintaining high levels of accuracy
- → remove limitations to the number of processed texts
  → larger datasets
- Easy adaptation to other domains, hazard types, or case studies (e.g. floods, training on other languages)
- Dataset potentials: ML to model linkages with bio-physical drought indicators

Thank you for having me

Questions, comments, ideas?
Or drop me a message

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