

# Water Management for Unconventional Oil and Gas Development in the Permian Basin: Methods for understanding the links between stakeholder behavior and public perception



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## INTRODUCTION

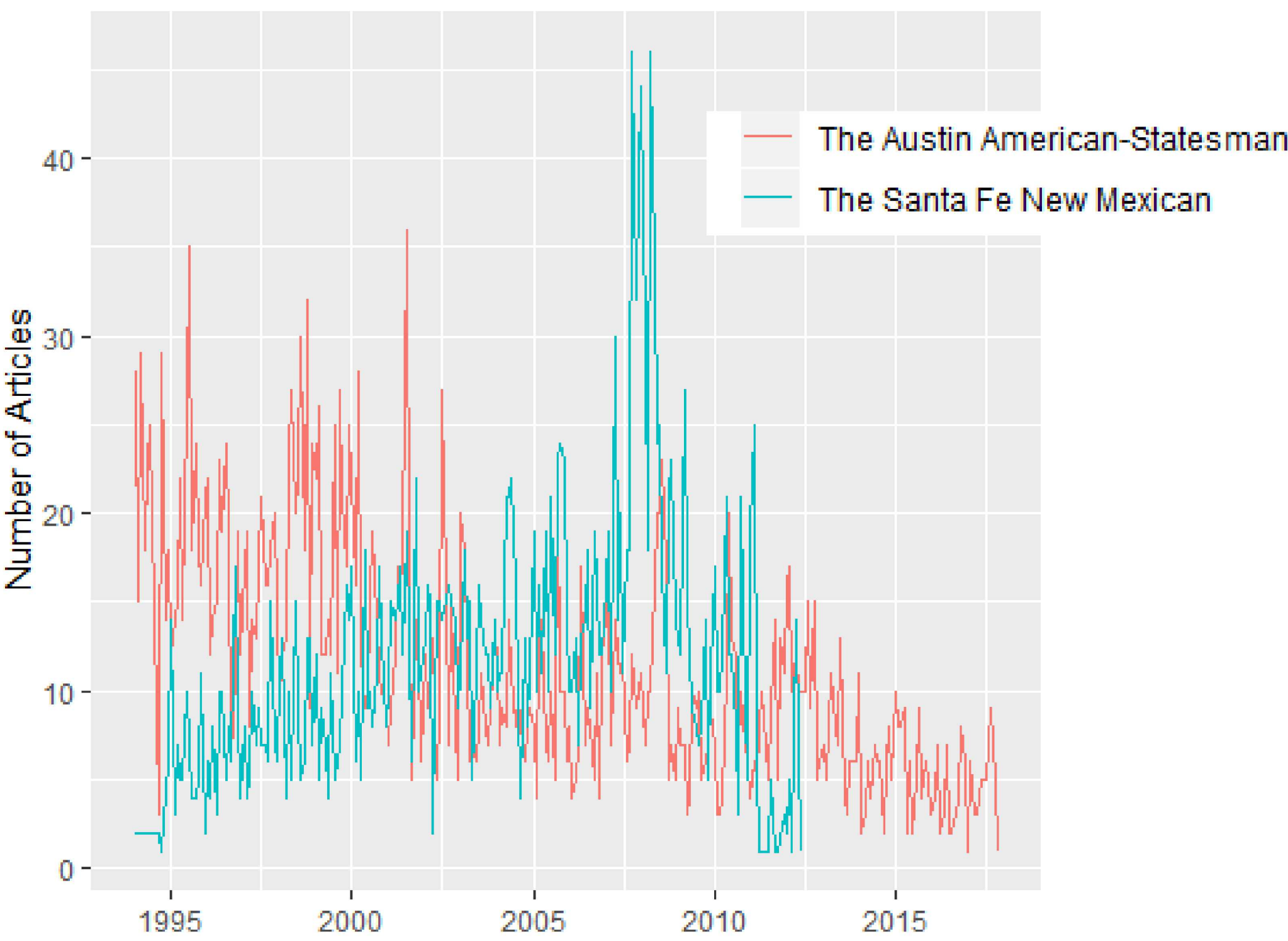
Water plays a critical role in the production of oil and gas (O&G). The Permian Basin (NM, TX) is projected to supply more than one-third of domestic oil and yet the region is arid and water is constrained by numerous competing demands. How water is managed is largely dependent upon stakeholders' risk perceptions associated with both existing and potentially new management strategies. The information stakeholders receive and communicate, as well as their expertise can provide essential information in planning for the region's energy future.

## RESEARCH QUESTIONS

How do the dynamics between media portrayal, social media expression, and stakeholder expertise influence water management choices in the Permian Basin? Can media provide insight into temporal feedbacks between disseminated information and stakeholder responses?

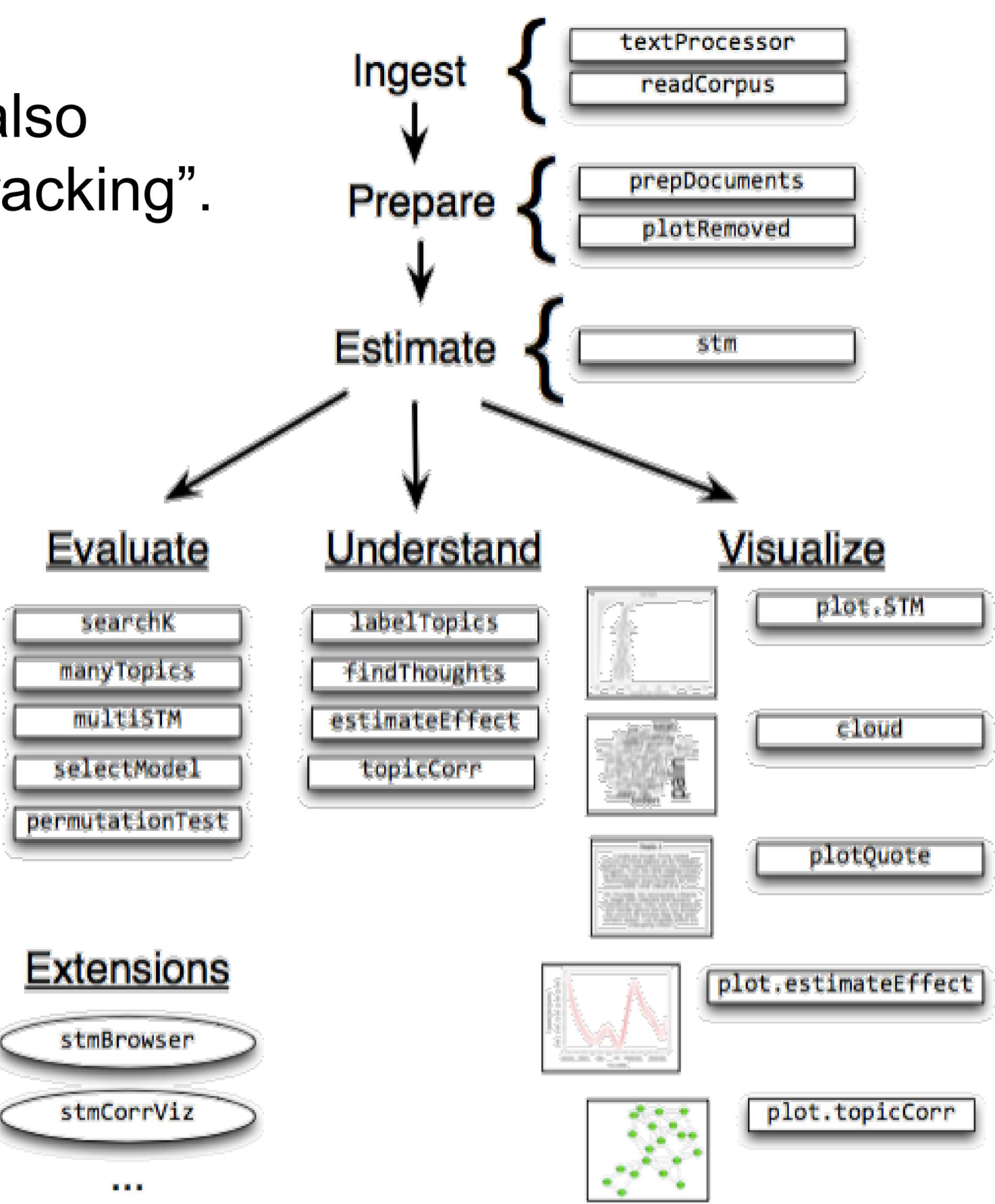
## DATA AND METHODS

- Water Corpus (Gunda et al., 2018) includes ~1.8 M articles containing the word 'water' from 37 regional newspapers downloaded from Lexis Nexis (1994-2017).
- Corpus was filtered to include only coverage from papers in NM (Santa Fe New Mexican) and TX (Austin American-Statesman) that also included the terms: "oil", "gas", "drilling", "hydraulic fracturing", and "fracking".

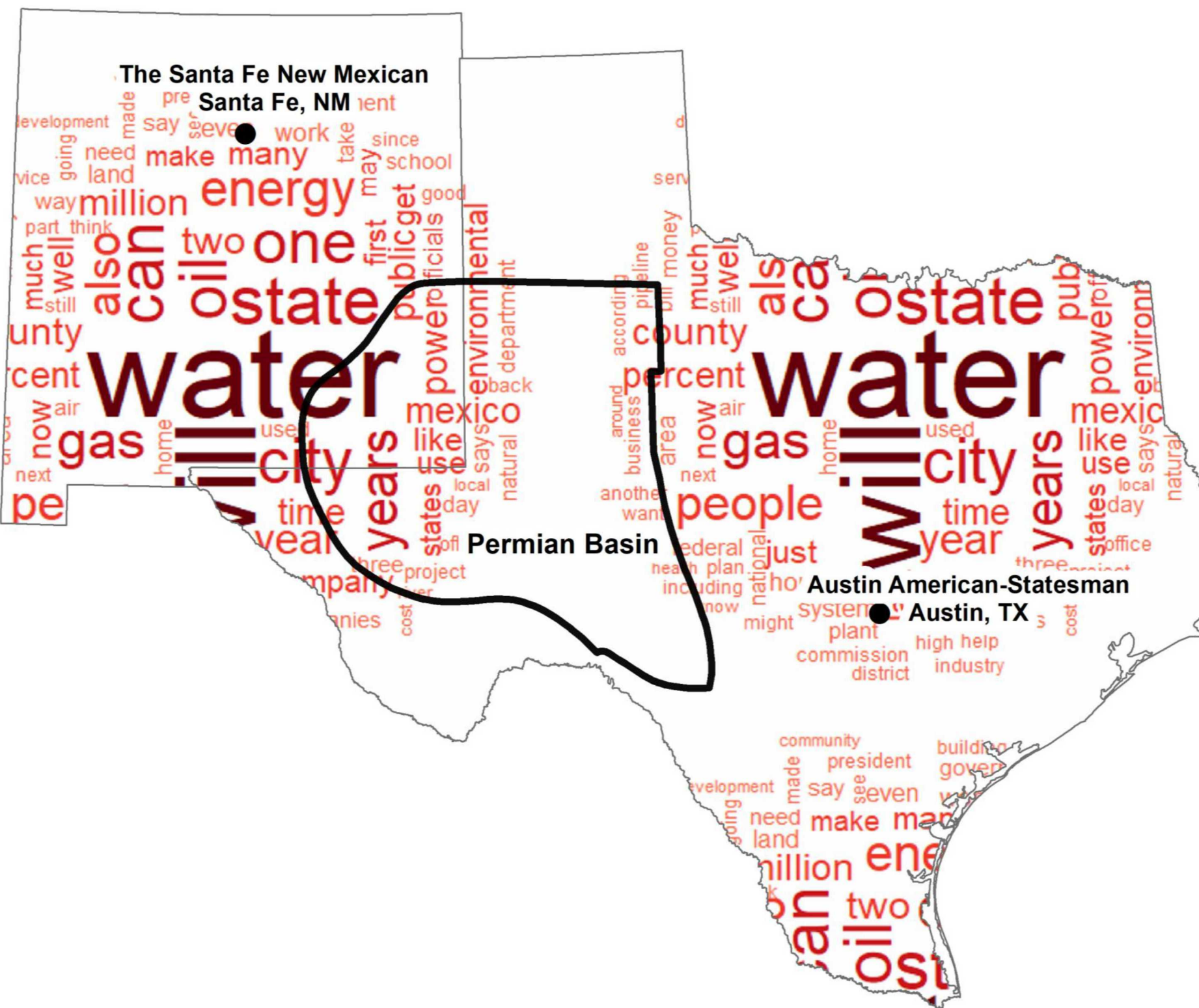


Newspaper coverage of articles in the Austin American-Statesman (red) and The Santa Fe New Mexican (blue) from the Gunda et al. (2018) water corpus. Note that coverage in the Santa Fe New Mexican stops in August, 2013.

Structural Topic Model (STM): is used to find and evaluate relationships between topics and associated metadata in R software (Roberts et al., 2017). STM methods are also described in Gunda et al., 2018.

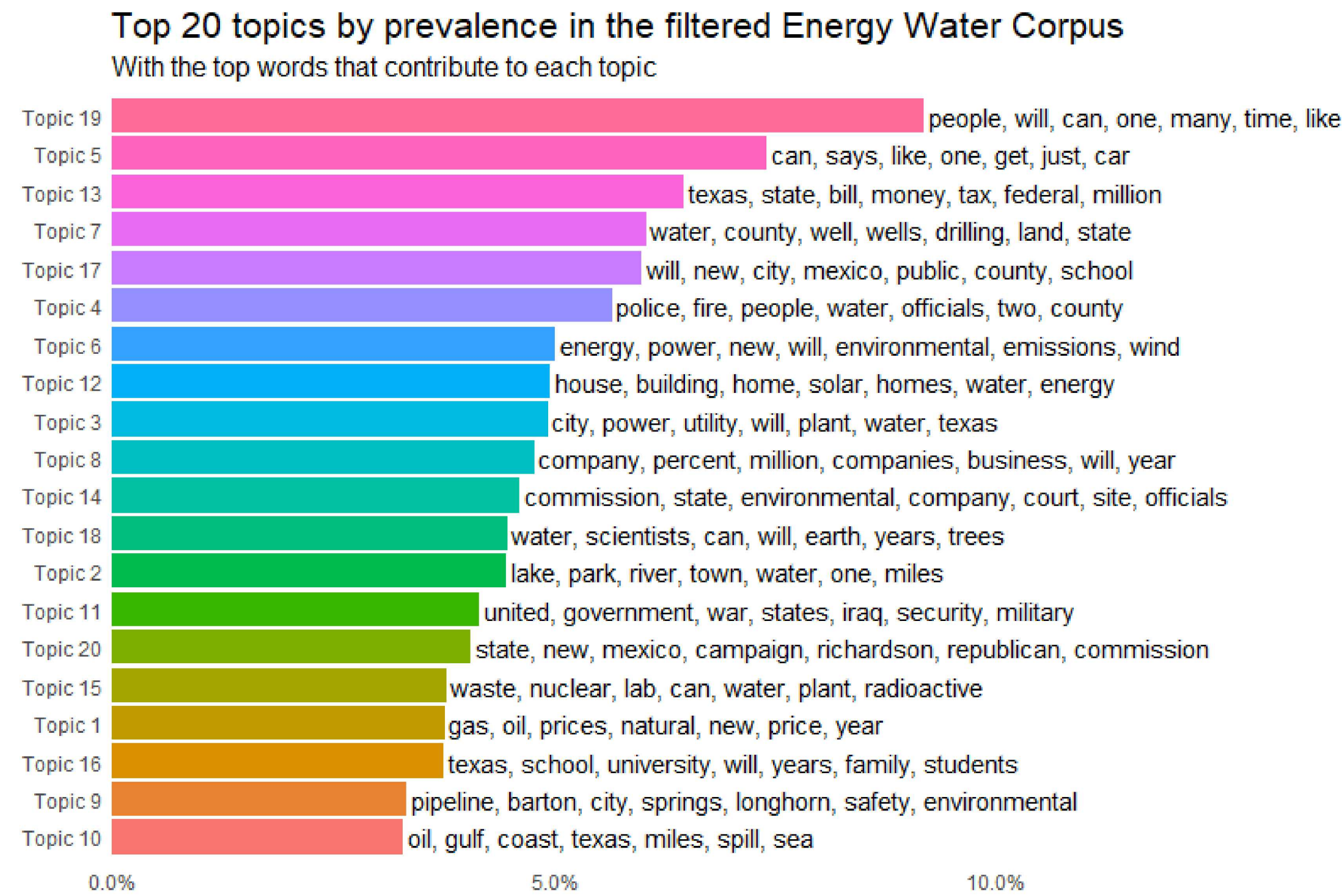


STM Vignette (Roberts et al., 2017)



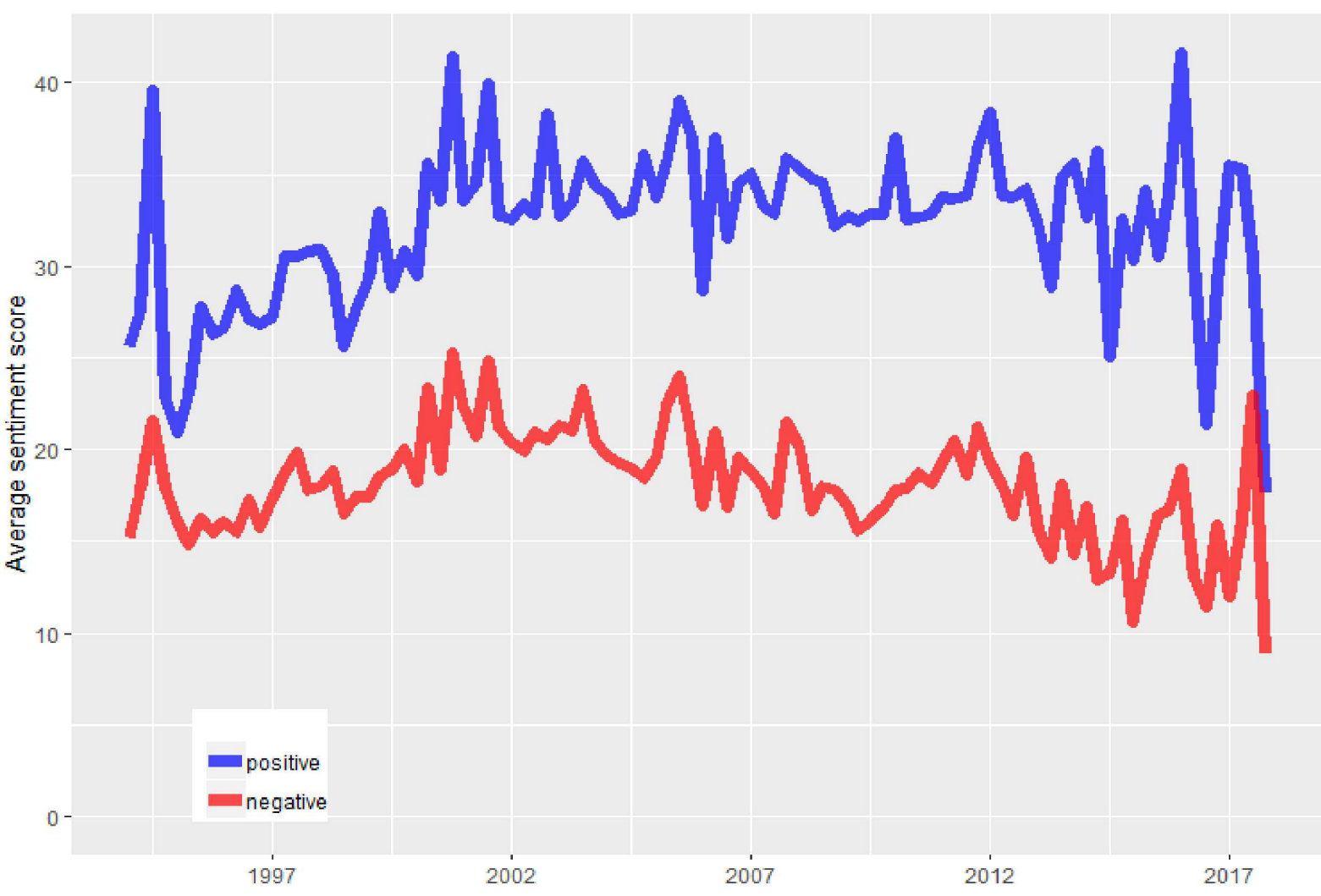
Word Cloud generated from NM and TX subset from the Energy-Water Corpus. Results show the diversity of frequently appearing words in the corpus ranging from energy and policy to economic and environmental terms.

## RESULTS

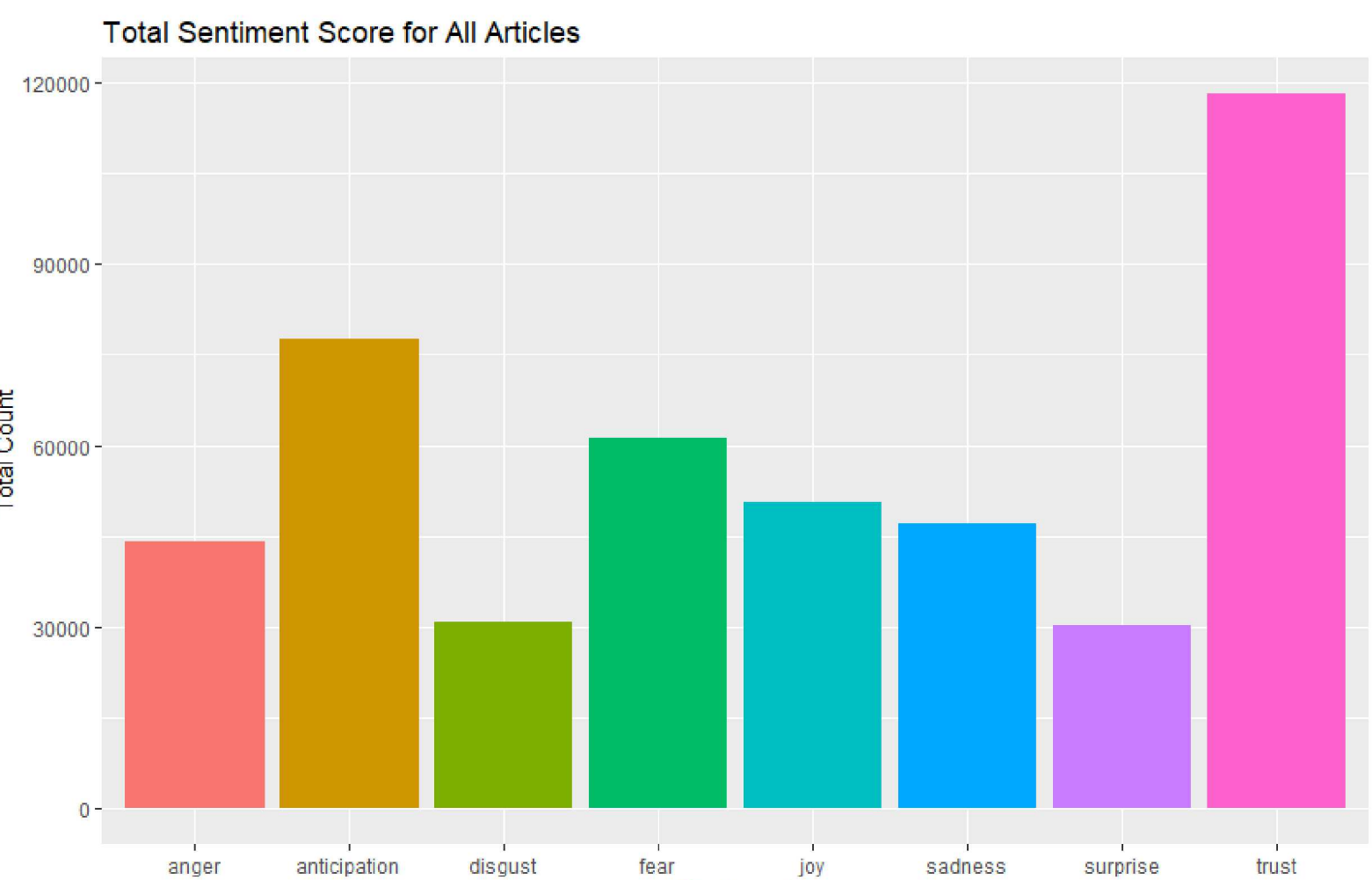


Example of FREquently and Exclusively (FREX) Used Terms corresponding to Energy Policy Infrastructure and Climate (EPIC) Factors

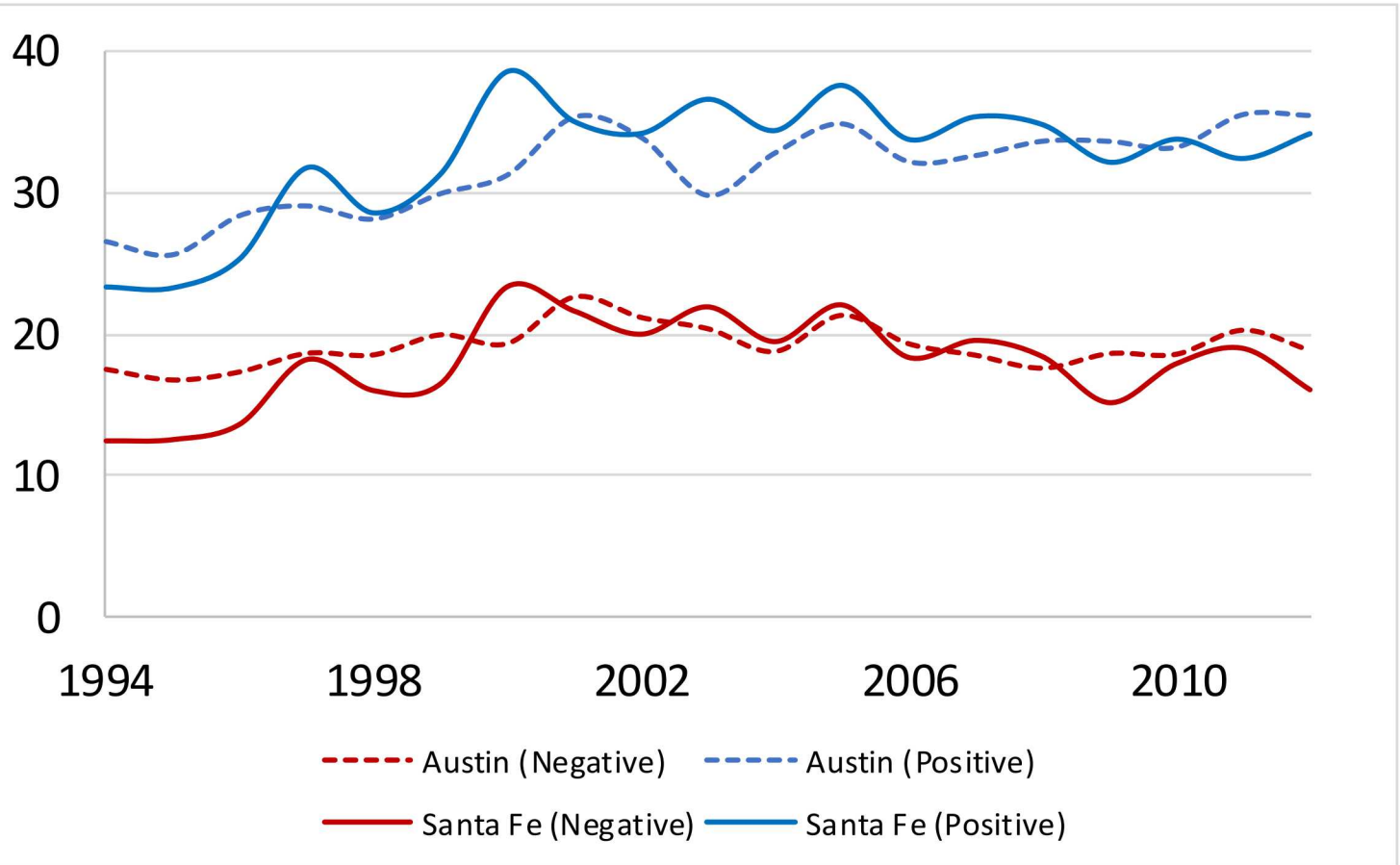
TOPIC	FREX Words
Topic 1: Economics	prices, gas, fracking, gallon, price, cents, production lawsuit, court, settlement, contamination, suit, filed, cleanup
Topic 14: Policy	pipeline, barton, longhorn, pipelines, springs, pool, koch
Topic 9: Infrastructure	pipeline, barton, longhorn, pipelines, springs, pool, koch
Topic 6: Climate	renewable, emissions, wind, ethanol, coal, hydrogen, energy



Sentiment over time for all articles shows that positive and negative sentiment peaked in the mid-2000's and variability decreased. However, negative and positive sentiments began to fluctuate again in 2015 and exhibited new high values in 2017. This time period corresponds to increasing drilling activity in the Permian Basin.



Total Sentiment Score for All Articles (1994-2017) is dominated by trust and anticipation, which both score high on the positive scale as generated by the NRC sentiment package (R).



Comparison of sentiment in Santa Fe and Austin Papers show similar oscillating positive and negative sentiment on an annual basis with the Santa Fe New Mexican having greater scores overall. In addition, the Austin American Statesman exhibits seemingly more tempered sentiment.

## SUMMARY

- Both papers are geographically removed from local O&G activity and are similar in coverage.
- Regulatory and economic issues are most prevalent topics.
- Positive and negative sentiment are most sensitive to "trust" and "fear" respectively with generally positive sentiment.
- Overlapping FREX words suggest model should be further refined to include broader categories associated with EPIC factors

## FUTURE ACTIVITIES

The results of this research provide initial insight into the use of STM to better understand how stakeholders (agents) perceive existing and emerging water management issues, causation, risk and responsibility. Future work includes:

- Expand energy-water corpus to include small regional newspapers including: Hobbs News-Sun, Carlsbad Current-Argus, Artesia Daily Press, the Jal Record, Roswell Daily Record and local Texas papers.
- STM of corpus of active social media (Twitter) participants over the last five years including identification of frequently active participants in energy discussions that are location specific.
- Expert elicitation of stakeholders including: oil and gas producers, midstream operators, water sellers, regulators.
  - What topics are of greatest interest/influence in decision making?
  - Are stakeholders active participants in media/social media outlets?

## REFERENCES & ACKNOWLEDGEMENTS

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 Roberts, M. E., Stewart, B. M., & Tingley, D. (2014). stm: R package for structural topic models. *R package*, 1, 12.  
 Julia Silge. *Training, evaluating, and interpreting topic models*. 08 Sept. 2018. <https://julia.silge.com>

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