Supplementary Sections 2 - 7

# Supplementary Sect. S2.

This plot below describes the correlation coefficients between precipitation-related variables. Here, we plotted the results across SPI and SSI, which helped us to select SPI for its high correlation with SSI. As a result, we did not include SSI in our regression analysis.

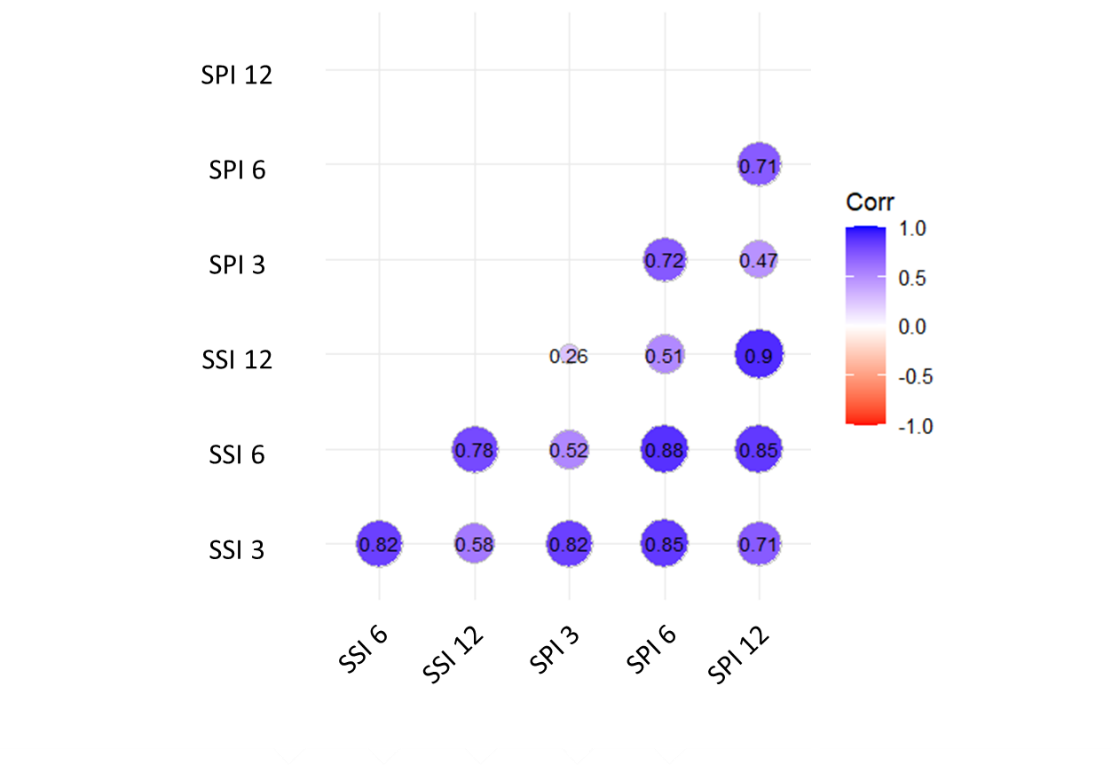


Figure S Correlation coefficients between precipitation-related variables

# Supplementary Sect. S3.

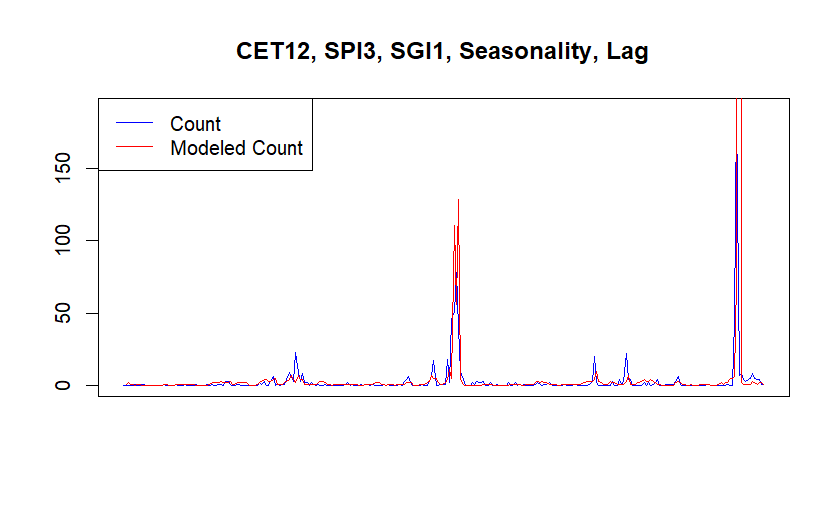
We summarised the combination of variables (temperature, precipitation, groundwater, seasonality) and the corresponding performance of negative binomial regression analysis (AIC, Deviance, Theta, Standard error of theta). Based on the result, we chose CET-12, SPI-3, SGI-1, and Seasonality to be included as this combination holds the smallest AIC.

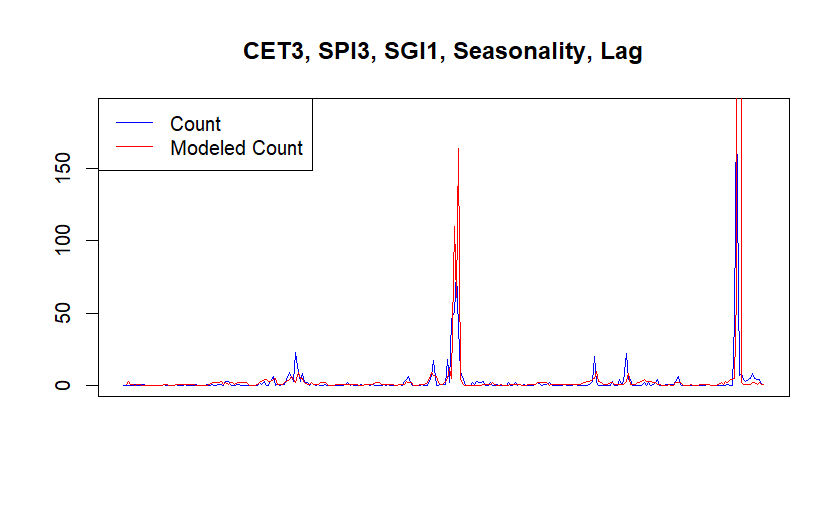
Table S Summary of AIC from all possible combinations of explainable variables

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Temperature** | **Precipitation** | **Groundwater** | **Seasonality** | **AIC** | **Deviance** | **Theta** | **SE.theta** |
| CET 12 | SPI 3 | SGI 1 | Included | **883.87** | 247.44 | 0.527 | 0.077 |
| CET 3 | SPI 3 | SGI 1 | Included | 884.83 | 246.37 | 0.519 | 0.076 |
| - | SPI 12 | - | Included | 885.06 | 246.52 | 0.503 | 0.073 |
| - | SPI 3 | SGI 1 | Included | 885.24 | 245.66 | 0.507 | 0.073 |
| - | SPI 12 | SGI 1 | Included | 885.64 | 246.84 | 0.509 | 0.074 |
| CET 6 | SPI 3 | SGI 1 | Included | 885.67 | 246.65 | 0.516 | 0.075 |
| CET 3 | SPI 12 | - | Included | 886.12 | 247.44 | 0.510 | 0.074 |
| CET 12 | SPI 12 | - | Included | 886.18 | 247.80 | 0.511 | 0.075 |
| CET 3 | SPI 12 | SGI 1 | Included | 886.41 | 248.00 | 0.519 | 0.076 |
| CET 6 | SPI 12 | - | Included | 886.64 | 247.36 | 0.508 | 0.074 |
| CET 12 | SPI 12 | SGI 1 | Included | 886.85 | 248.14 | 0.518 | 0.076 |
| CET 6 | SPI 12 | SGI 1 | Included | 887.29 | 247.63 | 0.514 | 0.075 |
| CET 12 | SPI 6 | SGI 1 | Included | 889.71 | 247.54 | 0.504 | 0.074 |
| CET 3 | SPI 6 | SGI 1 | Included | 890.00 | 246.65 | 0.500 | 0.073 |
| CET 6 | SPI 6 | SGI 1 | Included | 891.11 | 246.81 | 0.496 | 0.072 |
| - | SPI 6 | SGI 1 | Included | 891.16 | 245.28 | 0.483 | 0.069 |
| CET 12 | SPI 3 | SGI 1 | - | 892.06 | 245.83 | 0.468 | 0.067 |
| - | SPI 3 | SGI 1 | - | 892.95 | 244.56 | 0.454 | 0.064 |
| CET 3 | SPI 3 | SGI 1 | - | 893.04 | 245.08 | 0.462 | 0.065 |
| CET 3 | - | SGI 1 | Included | 893.11 | 245.12 | 0.476 | 0.068 |
| CET 6 | SPI 3 | SGI 1 | - | 894.10 | 245.02 | 0.458 | 0.065 |
| - | - | SGI 1 | Included | 895.13 | 243.22 | 0.456 | 0.064 |
| - | - | SGI 1 | Included | 895.13 | 243.22 | 0.456 | 0.064 |
| CET 12 | - | SGI 1 | Included | 895.29 | 244.53 | 0.466 | 0.066 |
| - | SPI 12 | - | - | 895.42 | 245.36 | 0.442 | 0.062 |
| CET 6 | - | SGI 1 | Included | 895.68 | 244.31 | 0.464 | 0.066 |
| CET 3 | SPI 12 | - | - | 896.32 | 246.25 | 0.448 | 0.063 |
| CET 12 | SPI 6 | - | Included | 896.46 | 245.42 | 0.465 | 0.066 |
| CET 12 | SPI 12 | - | - | 896.90 | 246.29 | 0.447 | 0.063 |
| - | SPI 12 | SGI 1 | - | 897.03 | 245.45 | 0.444 | 0.062 |
| CET 6 | SPI 12 | - | - | 897.29 | 245.66 | 0.443 | 0.062 |
| CET 3 | SPI 12 | SGI 1 | - | 897.63 | 246.49 | 0.451 | 0.064 |
| CET 12 | SPI 12 | SGI 1 | - | 898.53 | 246.38 | 0.448 | 0.063 |
| CET 12 | SPI 6 | SGI 1 | - | 898.59 | 245.92 | 0.447 | 0.063 |
| CET 6 | SPI 6 | - | Included | 898.87 | 245.22 | 0.456 | 0.064 |
| CET 6 | SPI 12 | SGI 1 | - | 898.91 | 245.73 | 0.445 | 0.063 |
| CET 3 | SPI 6 | SGI 1 | - | 898.97 | 245.12 | 0.443 | 0.062 |
| CET 3 | SPI 6 | - | Included | 899.96 | 243.89 | 0.448 | 0.063 |
| - | SPI 6 | SGI 1 | - | 900.13 | 244.21 | 0.430 | 0.060 |
| CET 6 | SPI 6 | SGI 1 | - | 900.42 | 244.91 | 0.437 | 0.061 |
| CET 12 | SPI 6 | - | - | 901.49 | 244.16 | 0.426 | 0.059 |
| - | SPI 6 | - | Included | 902.43 | 243.07 | 0.432 | 0.060 |
| CET 6 | SPI 6 | - | - | 904.34 | 243.45 | 0.415 | 0.057 |
| CET 3 | - | SGI 1 | - | 904.72 | 244.10 | 0.416 | 0.057 |
| CET 3 | SPI 6 | - | - | 904.92 | 242.86 | 0.412 | 0.056 |
| CET 12 | SPI 3 | - | Included | 905.48 | 241.96 | 0.425 | 0.058 |
| - | SPI 6 | - | - | 906.59 | 242.33 | 0.400 | 0.054 |
| CET 6 | SPI 3 | - | Included | 907.60 | 242.71 | 0.421 | 0.058 |
| - | - | SGI 1 | - | 908.26 | 242.82 | 0.397 | 0.054 |
| - | - | SGI 1 | - | 908.26 | 242.82 | 0.397 | 0.054 |
| CET 12 | - | SGI 1 | - | 908.61 | 243.85 | 0.404 | 0.055 |
| CET 6 | - | SGI 1 | - | 909.02 | 243.42 | 0.402 | 0.055 |
| CET 12 | SPI 3 | - | - | 909.12 | 241.85 | 0.397 | 0.053 |
| CET 6 | SPI 3 | - | - | 912.23 | 242.50 | 0.390 | 0.053 |
| CET 3 | SPI 3 | - | - | 913.68 | 241.65 | 0.384 | 0.051 |
| - | SPI 3 | - | - | 915.67 | 240.90 | 0.372 | 0.049 |
| - | SPI 3 | - | - | 915.67 | 240.90 | 0.372 | 0.049 |
| CET 6 | - | - | Included | 927.16 | 241.05 | 0.359 | 0.047 |
| CET 3 | - | - | - | 933.53 | 240.96 | 0.330 | 0.042 |
| CET 6 | - | - | - | 935.16 | 241.07 | 0.327 | 0.042 |
| - | - | - | Included | 935.79 | 240.16 | 0.332 | 0.043 |
| - | - | - | Included | 935.79 | 240.16 | 0.332 | 0.043 |
| CET 12 | - | - | - | 936.43 | 240.65 | 0.323 | 0.041 |

# Supplementary Sect. S4.

Based on the results from negative binomial regression, we reconstructed the model and compared the modelled result (red) with actual values of dependent variable, i.e. the count of monthly newspaper articles (blue). Here below, we presented three best models with the smallest AICs. From this comparison, we conclude that the parsimonious model with only two variables (SPI-12, Seasonality), despite its rank in the third place, was good enough to replicate the results of the best model that uses four variables (CET-12, SPI-3, SGI-1, Seasonality).





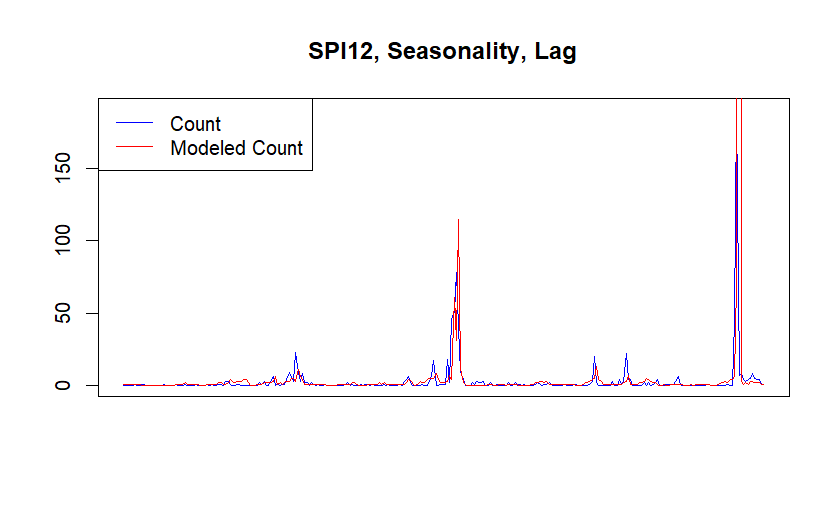


Figure S Comparisons between actual article counts (blue) and modelled article counts (red) for three best models

# Supplementary Sect S5.

To define the number of topics, *k,* we tested several numbers and plotted the coherence and exclusivity metrics in structural topic modelling. Considering the highest possible coherence and the highest possible exclusivity, we chose k = 15.

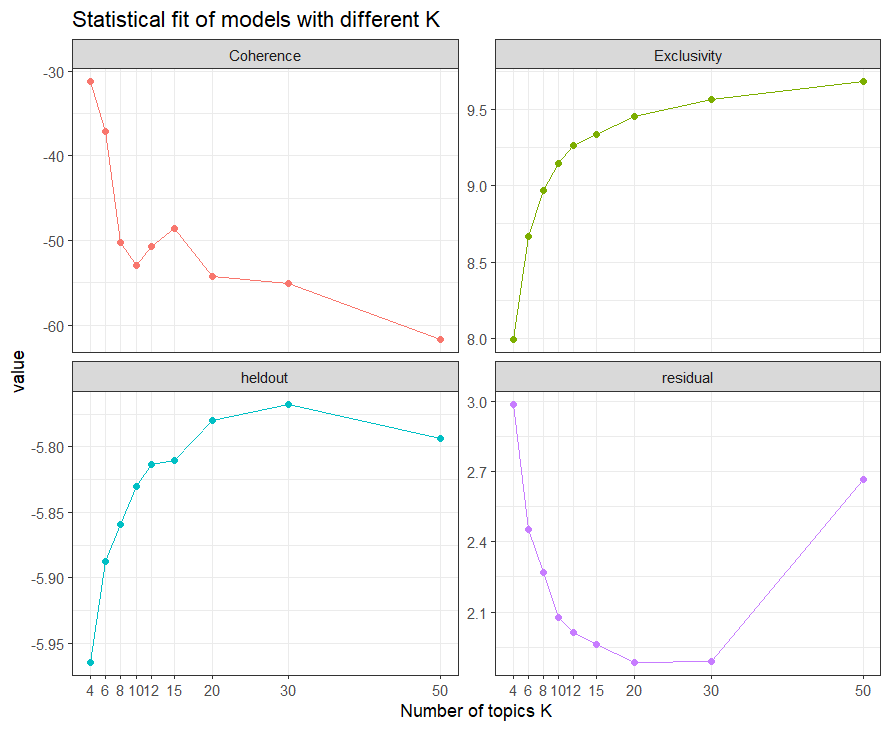


Figure S Coherence, exclusivity, heldout, and residual according to different number of topics, k, in topic modeling

# Supplementary Sect S6. Topic modelling: Topical proportions

After selecting k=15 as the number of topics, we conducted structural topic modelling and plotted the expected proportions of topics within the corpus. For ease of interpretation, the topics were reordered in ascending order (e.g., Topic 1 → #1, Topic 5 → #2, Topic 14 → #3), and the results are summarized in Table 1.

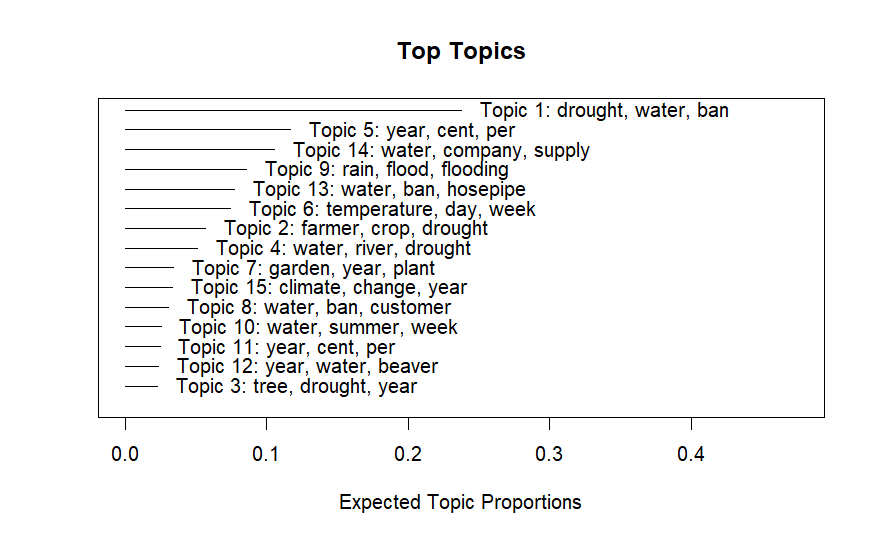


Figure S Expected topic proportions as a result of structural topic modelling with k = 15

# Supplementary Sect S7.

In the manuscript, we zoomed into the drought events of spring 2012 and summer 2022. Here below, we stratified the topical composition in the entire temporal period of our corpus, i.e. January 2000 to August 2023.

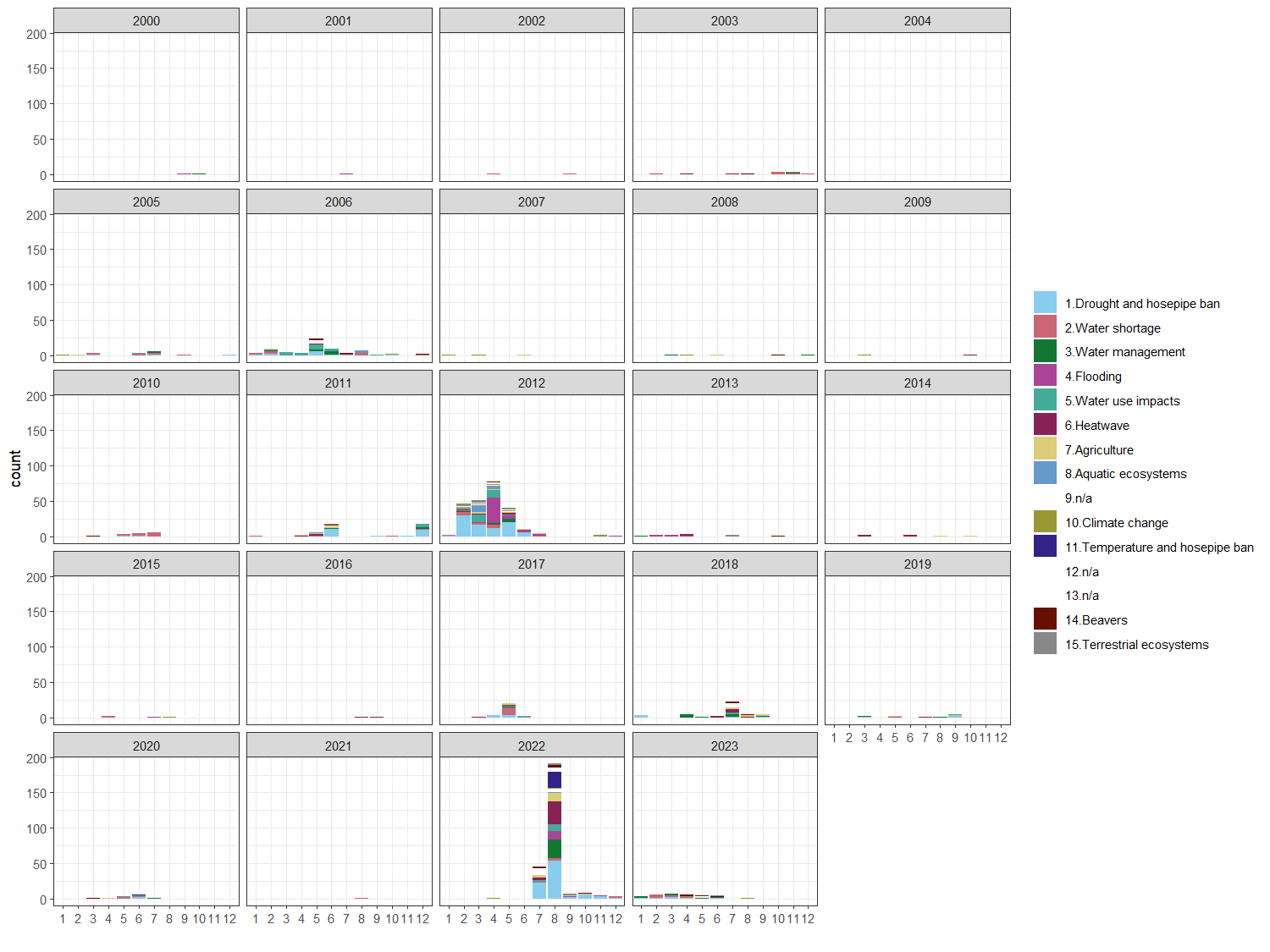


Figure S Overview of monthly topical composition in the entire corpus