

Water Security

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Context

Water security is one of the most basic human rights, yet there are a surprising number of examples of US cities where it is not a guarantee. Water security issues today can be considered a leading-edge indicator of deeper climate risks in the future.

CDP collects great quantities of information from cities on water security, and a lot of that information is in the form of free form text. This makes it hard to analyse and compare.

In order to help cities fully understand their current water security and future climate risks, we must first inspect this free text data in comparison with actual risks. Cities will benefit from an analysis of reported long-term risk with projected climate risk from water-stressed river basins or aquifers. With a more complete understanding of the full scope and magnitude of potential impact, we can begin to identify who is uniquely positioned to address each aspect of concern.

Problem Statement and Process

The goal of this project is to use natural language processing (NLP) to analyse freeform text data on water security in order to better understand the risks faced by **cities**. We will focus on aquifers and compare how cities are reporting their risks in that region. This will help us to identify which stakeholders are failing to report risks appropriately and to identify potential areas of concern.

Data Collection

Data Cleaning

Sentiment Analysis

Comparison

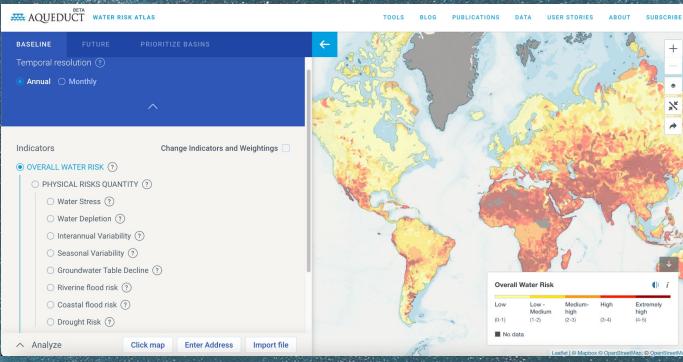
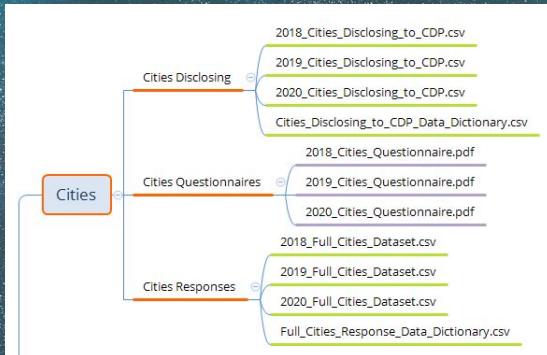
01

02

03

04

Data Collection



Kaggle
Free Text Data

<https://www.kaggle.com/competitions/cdp-unlocking-climate-solutions/data>

World Resources Institute
Water Risk Data

<https://www.wri.org/data/aqueduct-global-maps-30-data>

Cities Dataset

- Year Reported to CDP
- Account Number
- Organization
- City
- Country
- CDP Region
- Reporting Authority
- First Time Discloser
- Population
- Population Year
- City Location
- Questionnaire
- Parent Section
- Section
- Question Number
- Question Name
- Column Number
- Column Name
- Row Number
- Row Name
- Response Answer
- Comments
- Category
- latitude (decimal degrees)
- longitude (decimal degrees)

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Comments

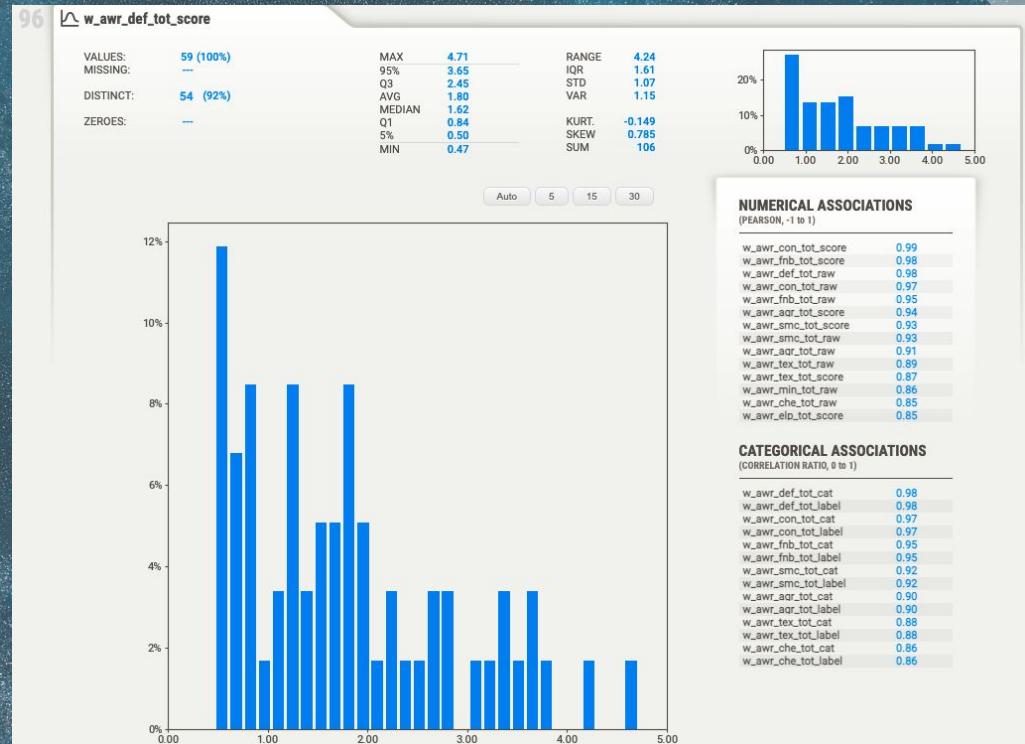
VALUES:	849 (100%)	59	6%	Boulder County's water portfolio (what we have jurisdiction and ownership of) does not consist of any p...
MISSING:	—	46	5%	No data available
DISTINCT:	125 (15%)	40	5%	The city's water management strategy also includes the completion of plans and studiessuch as the W...
		36	4%	One third of our sewer system is a combined sewer system, which can overflow during wet weather co...
		36	4%	We do not have accurate information on percentage of different types of wastewater collected. We do k...
		36	4%	Blackwater: includes night soil from informal settlements, septic tank tankage and portable toilet tan...
		569	67%	(Other)
50	6%	50	6%	Boulder County's water portfolio (what we have jurisdiction and ownership of) does not consist of any potable water, only non-potable used f...
46	5%	46	5%	No data available
40	5%	40	5%	The city's water management strategy also includes the completion of plans and studiessuch as the W...
36	4%	36	4%	Refers only to 93.5% percentage of population served by public sewer.
36	4%	36	4%	One third of our sewer system is a combined sewer system, which can overflow during wet weather co...
36	4%	36	4%	We do not have accurate information on percentage of different types of wastewater collected. We do k...
36	4%	36	4%	Blackwater: includes night soil from informal settlements, septic tank tankage and portable toilet tan...
36	4%	36	4%	(Other)
36	4%	36	4%	I cannot find data on this table.
36	4%	36	4%	Currently, all wastewater collected in the city are combined, except for industrial wastewater which is handled separately by another Agency.
36	4%	36	4%	There are no available numbers for groundwater, link water and surface water.
36	4%	36	4%	Other than the available infinit Sources: Boston Massachusetts Water Resources Authority Water Flow Components, Boston W...
36	4%	36	4%	No se cuenta con la información sobre porcentaje de aguas negras/residuales tratadas. El tratamiento prim...
36	4%	36	4%	Seattle's drainage and wastewater collection system is a blend of combined, partially-separated and separated systems. About two-thirds of...
20	2%	20	2%	O Plano Diretor de Desenvolvimento Integrado, aprovado pela LC 612/2018, apresenta uma série de diretrizes para a proteção e gestão dos r...
19	2%	19	2%	saneamento e meio ambiente.
15	1%	15	1%	Web Link not available at this time, currently going through approval process. Stage of Implementation: plan in implementation, measureme...
10	1%	10	1%	暫無相關資訊，無在建的工程項目。
10	1%	10	1%	Access to water ist Standard
10	1%	10	1%	não é um plante da comunidade que abrange o território de Valongo
10	1%	10	1%	The number of wells is a overall city average, presented here to all sectors.
10	1%	10	1%	PWSA and ALCO SAN are not part of the City, but are government agencies in control of water sanitation and management. Their Wet Weather...
10	1%	10	1%	The water management is delegated to the municipal utility Stadtwerke Heidelberg. They coordinate the sources, the purchase of water out...
10	1%	10	1%	Se cuentan con datos de usuarios residenciales y no residenciales con medidor. Los usuarios no residenciales se consideraron en la categoría...
10	1%	10	1%	Water planning and efficient function of water resources, particularly during extended periodof drought and diminished supplies. Since the...
10	1%	10	1%	Elinorino Municipality's Wastewater Plan from 2012 is currently going through an updating process. This will include taking new data on clim...
9	1%	9	1%	Residential - Public / Private / Institutional: data are not separated from this category
9	1%	9	1%	Source of water: DJB, 2019
9	1%	9	1%	Source of water: City of Ridgefield, Washington government (City), Independent, Partnership for Water, company/ope...
9	1%	9	1%	primaria GM is supplied (for private uses) from rawwater transferred into treatment via aqueducts and other infrastructure (stored in...
6	1%	6	1%	This question gave an error message when rain and surface water were selected - these were deselected to enable submission
6	1%	6	1%	Water source for municipal water utility is a series of artificial lakes. A limited number of individual properties are served by private wells.
5	1%	5	1%	https://tallinn.ee/adm/www/tallinn.ee/news/reviews/2017/02/19/eklatius-glacier-source-of-anchors-water-is-dripping-away-but-oh-so-slow...
5	1%	5	1%	La fuente de agua más grande que abastece a la ciudad es el río del Grande, del cual la ciudad toma su nombre. Hace muy poco se ter...
5	1%	5	1%	Johannesburg doesn't have any large river system. It depends on water piped from neighbouring Lesotho (a small highland country landlock...
5	1%	5	1%	Bloomington Water Conservation Plan https://bloomington.in.gov/sites/default/files/2017-06/cbu_conservation_plan.pdf
2	1%	2	1%	Unknown but would imagine 100%
2	1%	2	1%	100% of the dwellings located in the municipality are served by water supply (source: INE, 2017)
2	1%	2	1%	Dallas receives surface water from several sources (Ray Roberts Lake, Lewisville Lake, Grapevine Lake, Lake Ray Hubbard, Lake Tawakoni, L...
2	1%	2	1%	PAES
2	1%	2	1%	1,752,803 habitantes equivalente al 97.03% de la población del municipio de León.
2	1%	2	1%	de conformo Revisão do Plano Municipal de Saneamento Básico de Extrema/MG, aprovado pelo Decreto Municipal nº 3.510/2019.
2	1%	2	1%	Foi considerado como cenário, do ponto de vista estratégico, a poluição da água a montante das capturações, localizadas na bacia hidrográfic...
2	1%	2	1%	(Other)
79	9%	79	9%	

Water Risk Dataset

Focus: Overall Water Risk

271 Columns:

- The_geom
- Account Number
- Organization
- Input_address
- Match_address
- Latitude
- Longitude
- Major_basin_name
- Minor_basin_name
- Aquifer_name
- ...
- W_awr_tex_rrr_raw
- W_awr_tex_rrr_score
- W_awr_tex_rrr_cat
- W_awr_tex_rrr_label
- W_awr_tex_rrr_weight_fraction
- W_awr_tex_tot_raw
- W_awr_tex_tot_score
- W_awr_tex_tot_cat
- W_awr_tex_tot_label
- w_awr_tex_tot_weight_fraction



Sentiment Analysis of Free Form Text

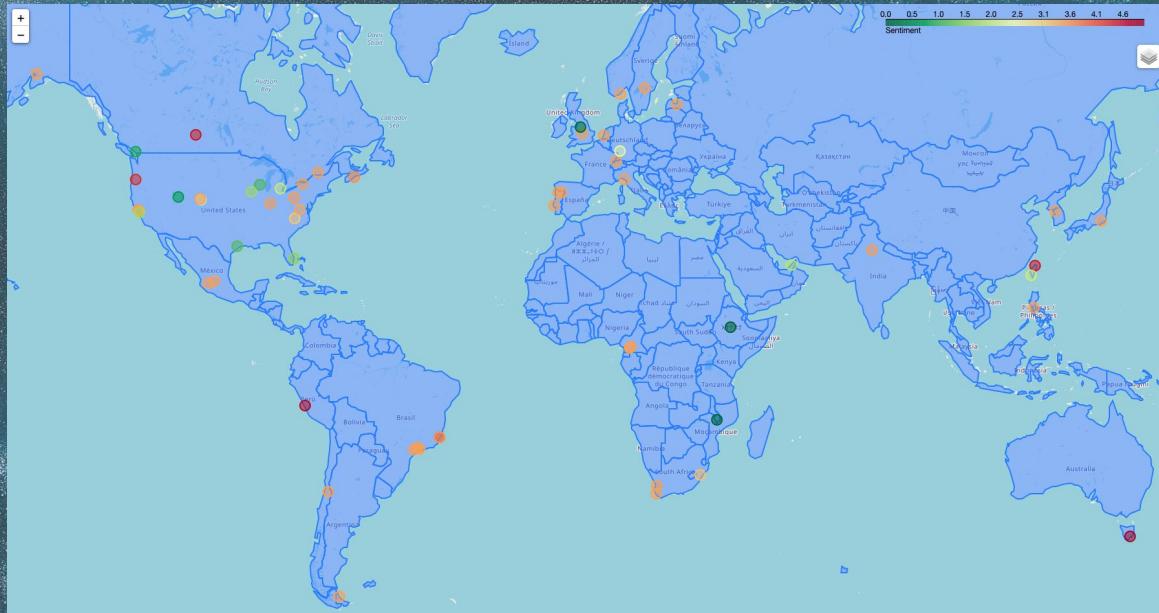
Example

Yes, Incidences of risk could extend to increased water stress, declining water quality, regulatory or energy supply issues

Although our supply is secure, water quality can potentially be an issue in Iowa due to nitrate and pesticide contamination from farming. Iowa City's water plant no longer directly pulls from the Iowa River, which has mitigated these issues.

Because our area is experiencing increased precipitation and our main source is alluvial wells associated with the Iowa River, water supply is not expected to be an issue.

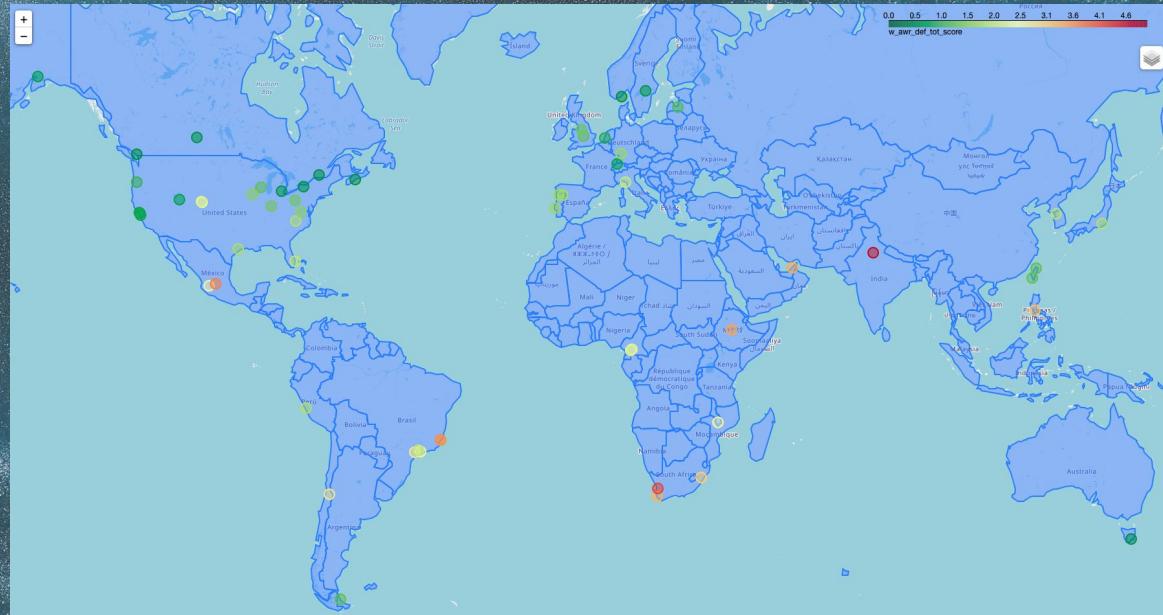
Climatologists have predicted that precipitation levels will continue to rise in this area due to climate change.



Overall Water Risk

Low risk in developed countries

High risk in less developed countries

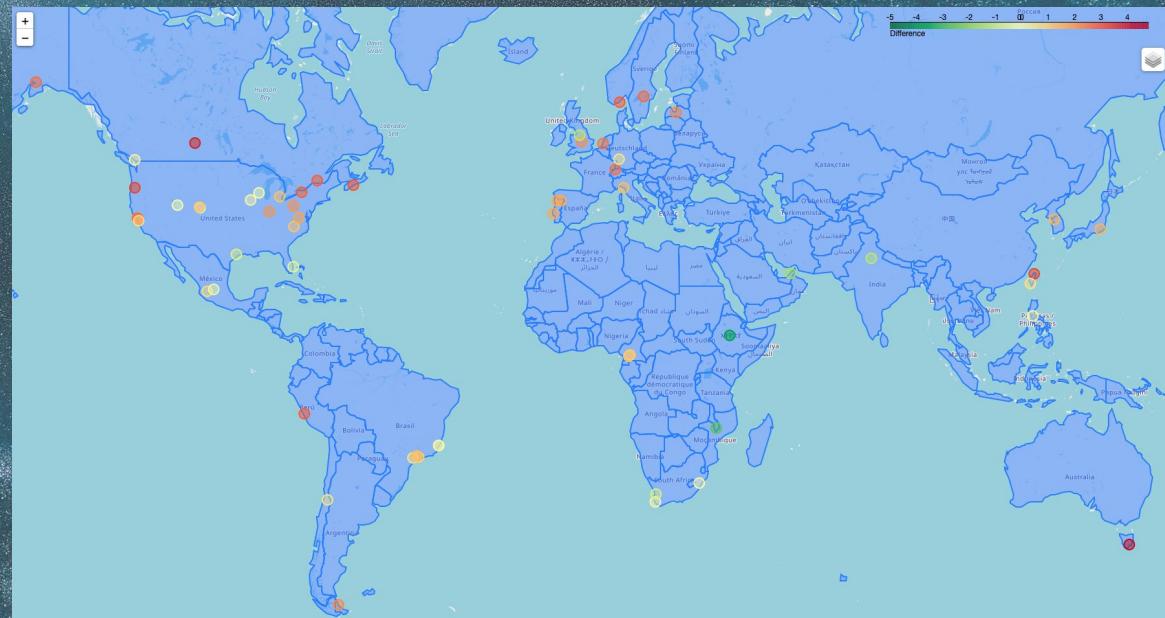


Discrepancy between Sentiment and Overall Water Risk

Difference =
Sentiment Score -
Overall Water Risk

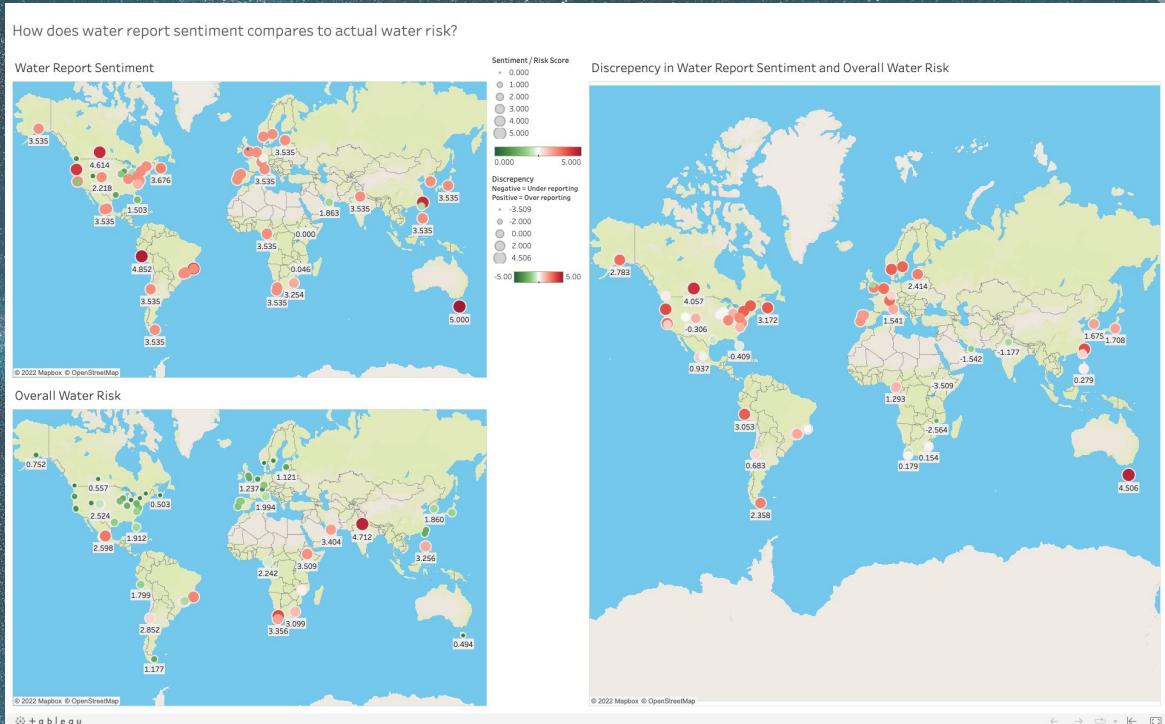
Positive = Over
reporting

Negative = Under
reporting



Interactive Dashboard

- Built using Tableau, accessible via online and mobile devices
- Shows the spatial distribution of water risks
- List details of each reported region



https://public.tableau.com/views/Challenge2WaterSecurity/Dashboard1?language=en-GB&display_count=n&origin=viz_share_link

Future works and improvements

- Include corporations and climate change and analyse the relationship between them
- Segment free form text into sectors for comparison with water risk data
- Include different risk metric and sectors and how they affect report sentiments
- Analyse actions taken by local authorities to combat water risk and climate change



Thank You!