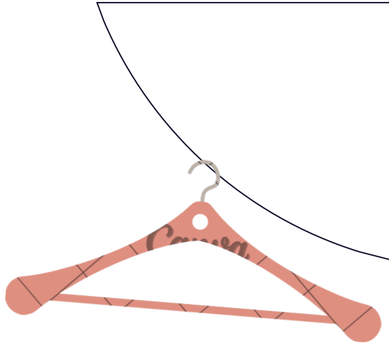


The Story of a T-Shirt:

Revealing Its Global Footprint and Hidden Costs

Team8：XS Team (Xu Liuyan，Su Yiming)

Research Question

What does a single cotton T-shirt really cost ?

(water, emissions, and waste)

Motivation

- **Necessities of life**
- **Easy to overlook its environmental cost**

Data & Dataset Analysis

1. Water Footprint

- Water Footprint Network

https://waterfootprint.org/resources/Hoekstra-2011-WaterFootprint-Cotton.pdf.

- **Data types：** Integer, String, Float
- **Dataset types：** Structured Data, Time Series Data, Panel Data, Environmental Indicator Data

year	country	total water footprint	blue water footprint	green water footprint	gray water footprint
2018	India	9.2	2.1	5.8	1.3
2018	China	7.5	3.2	3.1	1.2
2018	USA	5.8	1.9	3.4	0.5
2019	India	9.5	2.3	6	1.2
2019	China	7.3	3	3	1.3
2019	USA	5.6	1.8	3.5	0.3
2020	India	8.9	1.9	5.7	1.3
2020	China	7.6	3.3	3.2	1.1
2020	USA	5.9	2	3.3	0.6
2021	India	9.1	2	5.9	1.2
2021	China	7.4	3.1	3.1	1.2
2021	USA	5.7	1.9	3.4	0.4
2022	India	9.3	2.2	5.8	1.3
2022	China	7.5	3.2	3	1.3
2022	USA	5.8	1.9	3.5	0.4

2. Trade Flow

- UN Comtrade Database
https://comtradeplus.un.org/

- **Data types：** String, Integer, Float
- **Dataset types：** Structured Data, Panel Data, Time Series Data, Trade Transaction Data

Year	Exporter	Importer	CottonType	ExportVolume(kg)
2018	China	Bangladesh	Uncombed Cotton	613508
2018	China	Vietnam	Uncombed Cotton	16249087
2018	India	Bangladesh	Uncombed Cotton	357414089.2
2018	India	Vietnam	Uncombed Cotton	173530525.1
2018	USA	Bangladesh	Uncombed Cotton	202182010
2018	USA	Vietnam	Uncombed Cotton	755094097
2019	China	Bangladesh	Uncombed Cotton	9235588
2019	China	Vietnam	Uncombed Cotton	21382527
2019	India	Bangladesh	Uncombed Cotton	306378544
2019	India	Vietnam	Uncombed Cotton	59014045
2019	USA	Bangladesh	Uncombed Cotton	223661429
2019	USA	Vietnam	Uncombed Cotton	858483809
2020	China	Vietnam	Uncombed Cotton	753638
2020	India	Bangladesh	Uncombed Cotton	452664504.4
2020	India	Vietnam	Uncombed Cotton	109346173
2020	USA	Bangladesh	Uncombed Cotton	207241800
2020	USA	Vietnam	Uncombed Cotton	781788874
2021	China	Vietnam	Uncombed Cotton	6679765
2021	India	Bangladesh	Uncombed Cotton	634557514
2021	India	Vietnam	Uncombed Cotton	152103583
2021	USA	Bangladesh	Uncombed Cotton	165476479
2021	USA	Vietnam	Uncombed Cotton	565002091

3. Carbon Dioxide Emissions

- World Bank Open Data
  https://data.worldbank.org
- Fourth IMO GHG Study 2020 （Emission Factor: 0.01 kg CO_2/tonne-kilometer）
  https://www.imo.org/en/OurWork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx
- International maritime distance database （Shortest sailing distance）
  Sea-Distances.org

Carbon Emissions (kg CO_2) = Export Volume (kg) ÷ 1000 × Distance (km) × 0.01

- **Data types：** String, Integer, Float
- **Dataset types：** Structured Data, Panel Data, Time Series Data, Environmental Impact Data

Year	Destination	TotalTransp	AvgEmissio	Unit
2018	Bangladesh	43794.2	77.5	kgCO2
2018	Vietnam	127213.61	71.7	kgCO2
2019	Bangladesh	47368.42	77.5	kgCO2
2019	Vietnam	139850.55	71.7	kgCO2
2020	Bangladesh	46166.91	77.5	kgCO2
2020	Vietnam	128914.85	71.7	kgCO2
2021	Bangladesh	40977.25	77.5	kgCO2
2021	Vietnam	95737.32	71.7	kgCO2
2022	Bangladesh	36695.79	77.5	kgCO2
2022	Vietnam	67430.02	71.7	kgCO2

4. Waste Generation

- Eurostat

https://ec.europa.eu/eurostat/web/waste/data/database

- **Data types：** String, Integer
- **Dataset types：** Structured Data, Time Series Data, Environmental Statistics Data

country	year	waste_type	variable	value	unit	data_source
EU27	2018	Textile	generation	2170000	Tonne	Eurostat (env_wasgen)
EU27	2020	Textile	generation	1930000	Tonne	Eurostat (env_wasgen)
EU27	2022	Textile	generation	2070000	Tonne	Eurostat (env_wasgen)

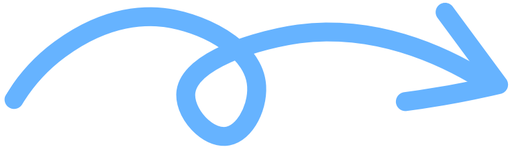
Tools, Libraries & Implementation

- **Observable Plot (main visualization library)**
- **Inputs (user interface controls)**
- **JavaScript data manipulation**
- **HTML + CSS for stylized narrative sections**
- **Custom functions for:**
  - stacked bar calculations
  - tooltip formatting
  - percent-of-total calculations
  - unit conversions (L → days drinking; kg → km driven)

Storyline & Visualization Choices

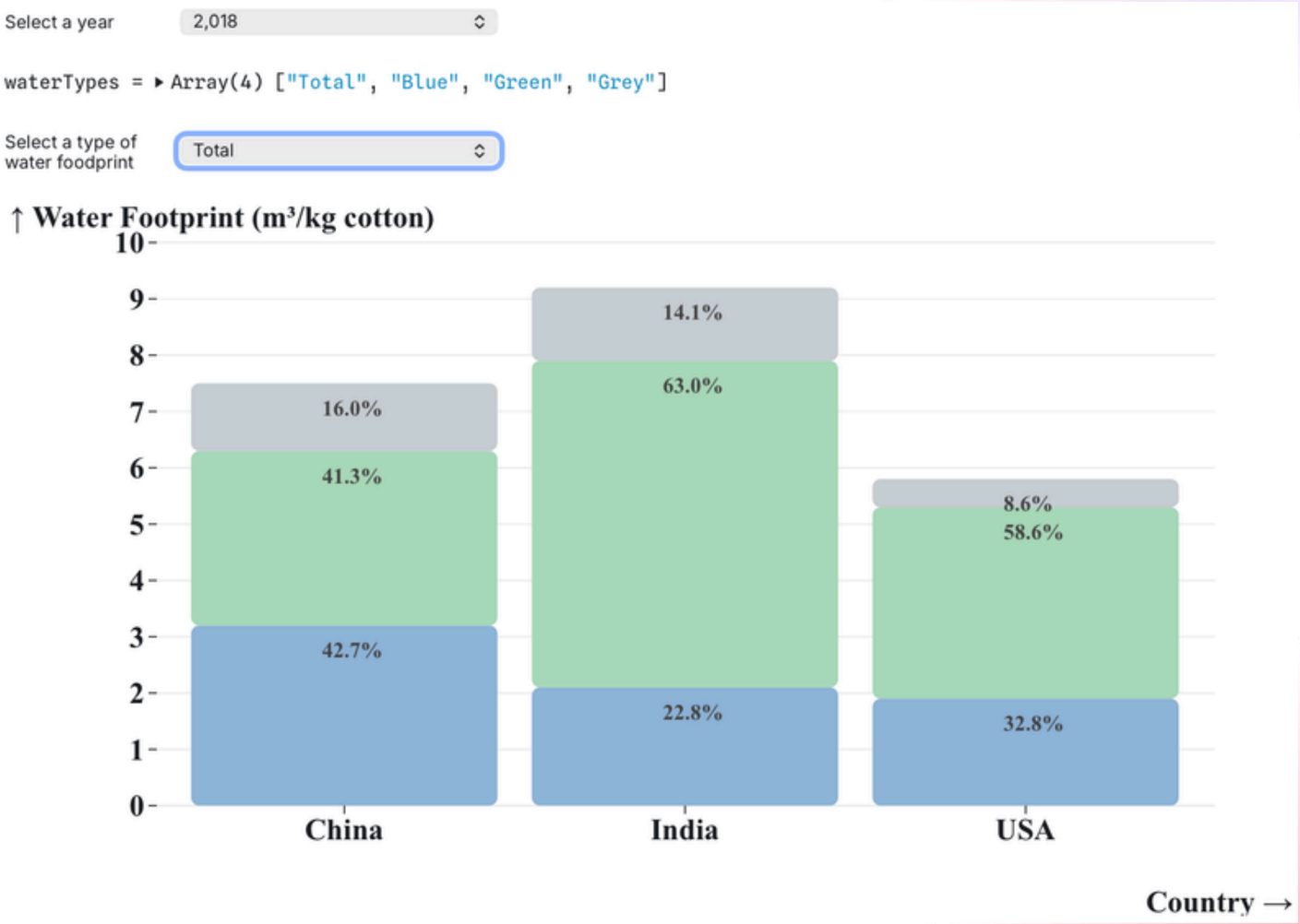
AC1: 💧 Water Footprint

The journey of a T-shirt begins in the farmland. Major cotton-producing countries utilize vast amounts of water to cultivate the raw material for T-shirts



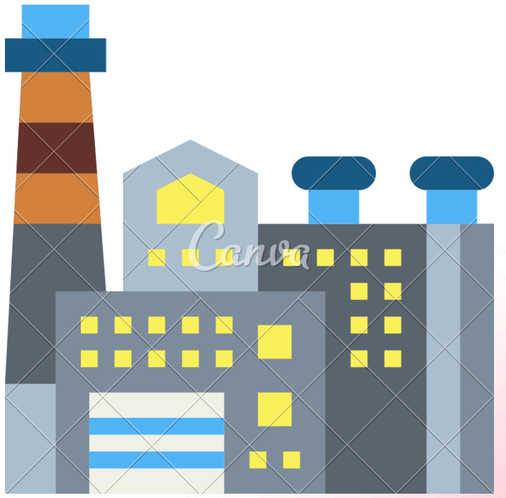
Bar Chart

Showing blue(rivers and aquifers), green(rainfall), and grey(waste) water contribution of growing cotton



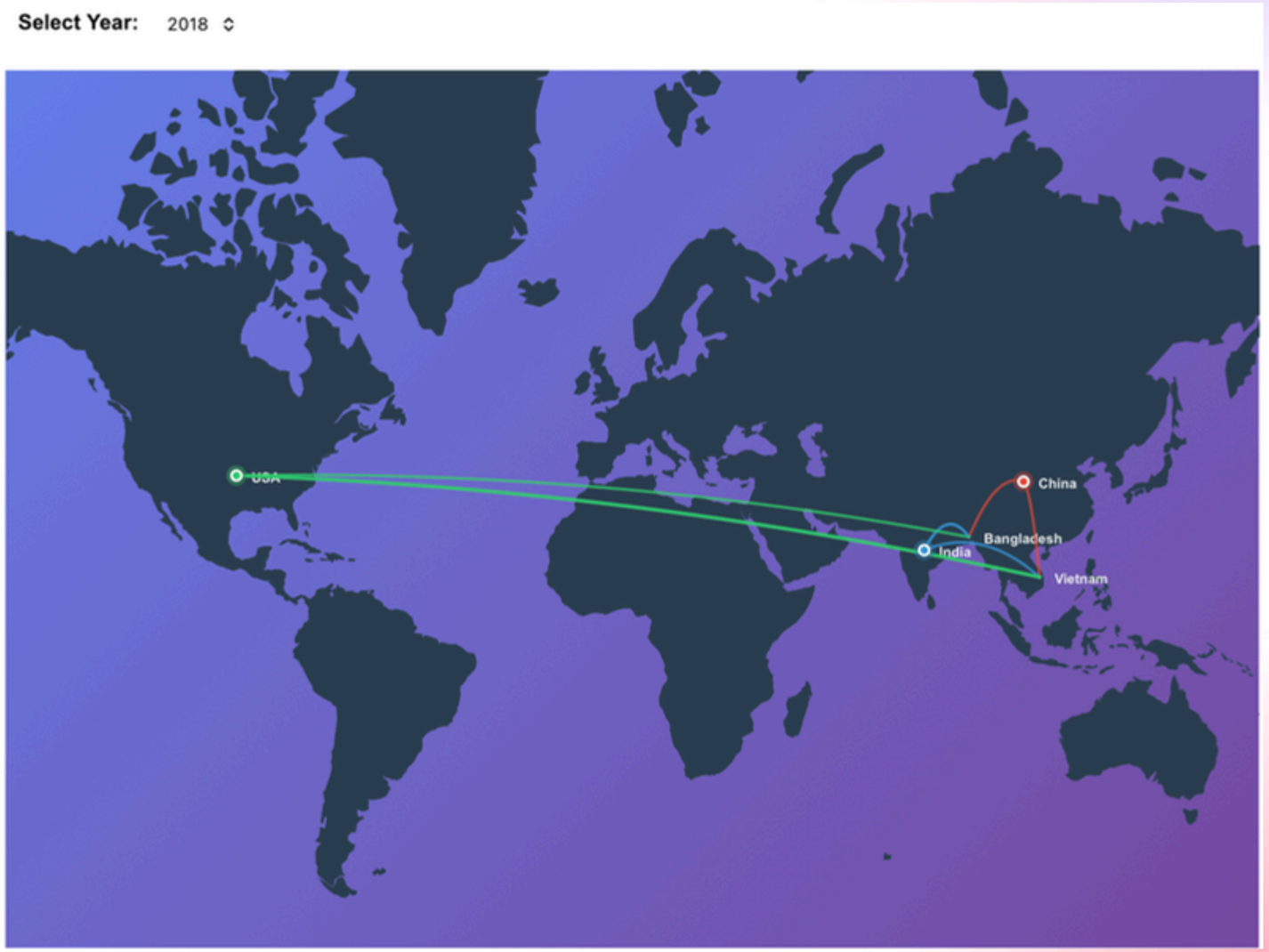
ACT2:🌍 Trade Flow

Then, the cotton is transported from the farmland to the mills, dye houses, and factories in major T-shirt manufacturing countries, where it is processed into a T-shirt



Map

Illustrating the global journey from cotton fields to manufacturing

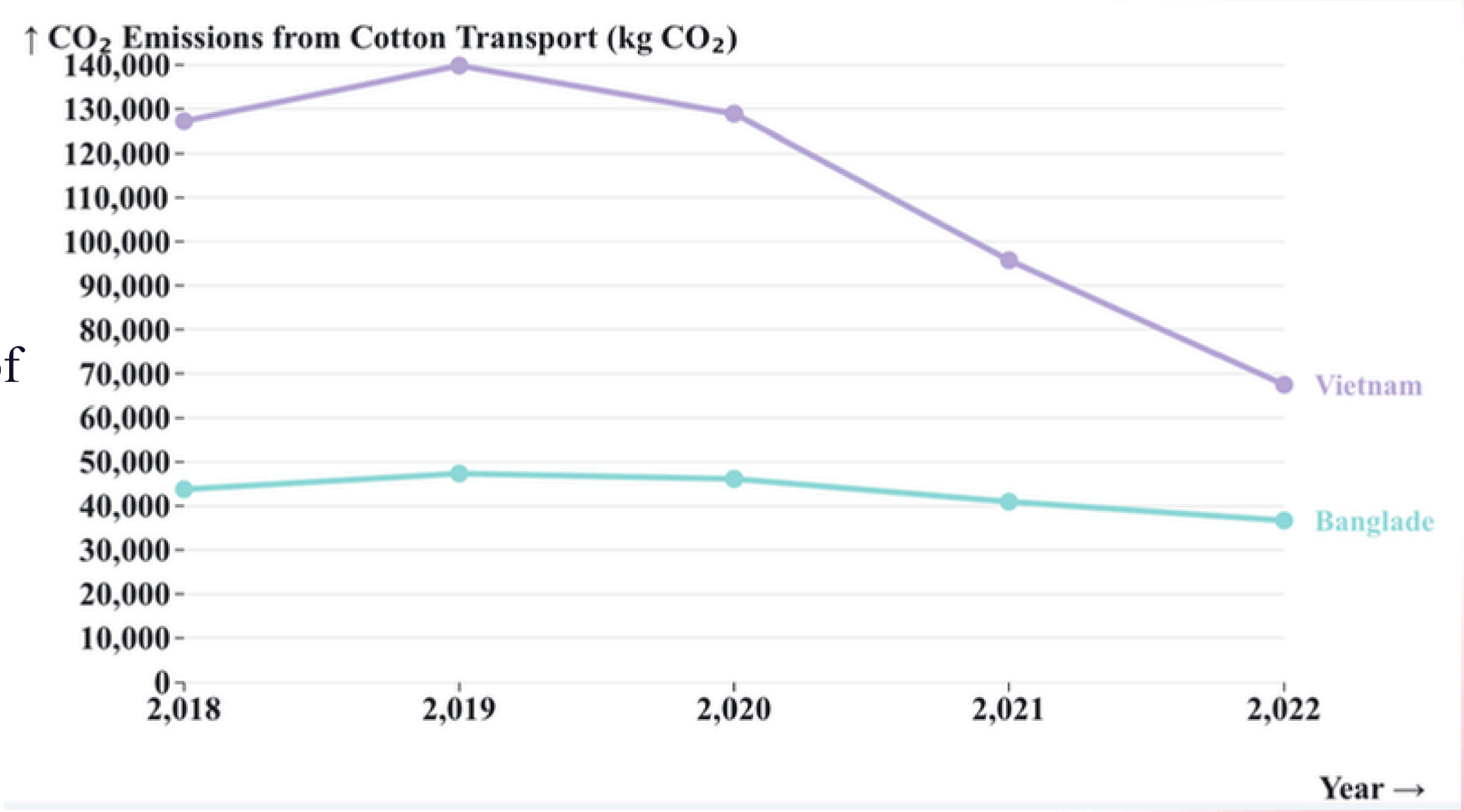


ACT3：🌫️ CO_2 Emissions

During the transportation of cotton, a large amount of carbon dioxide is produced.

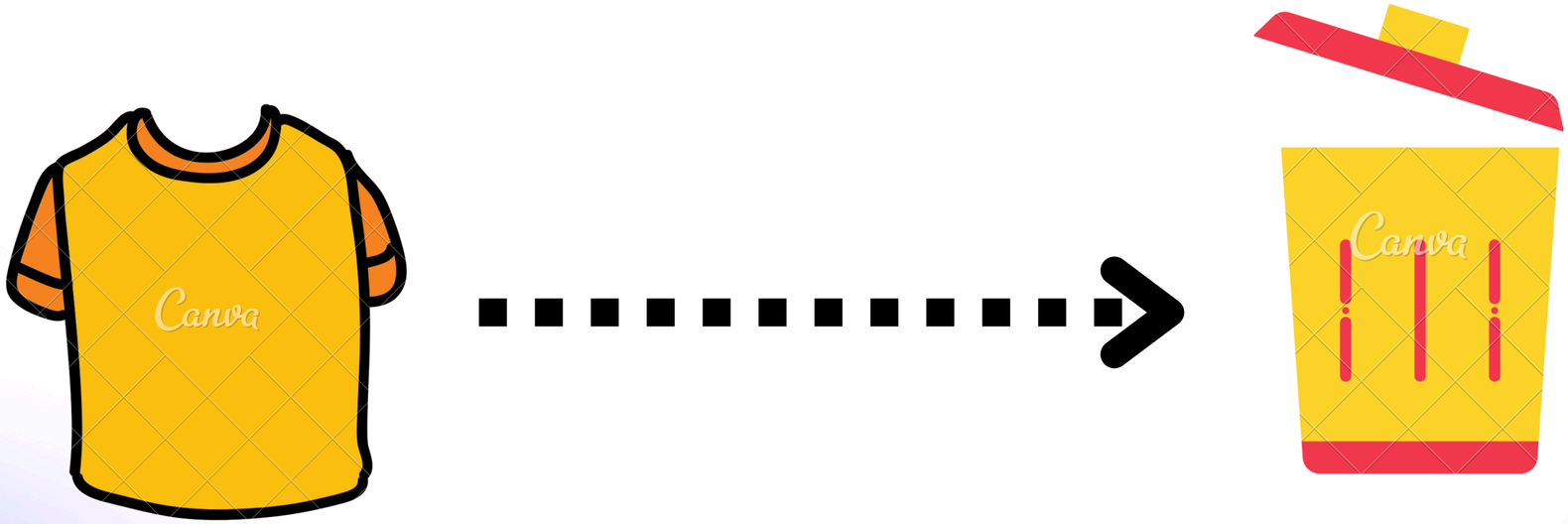
Line Chart

Comparing emission trajectories of Vietnam, Banglade.



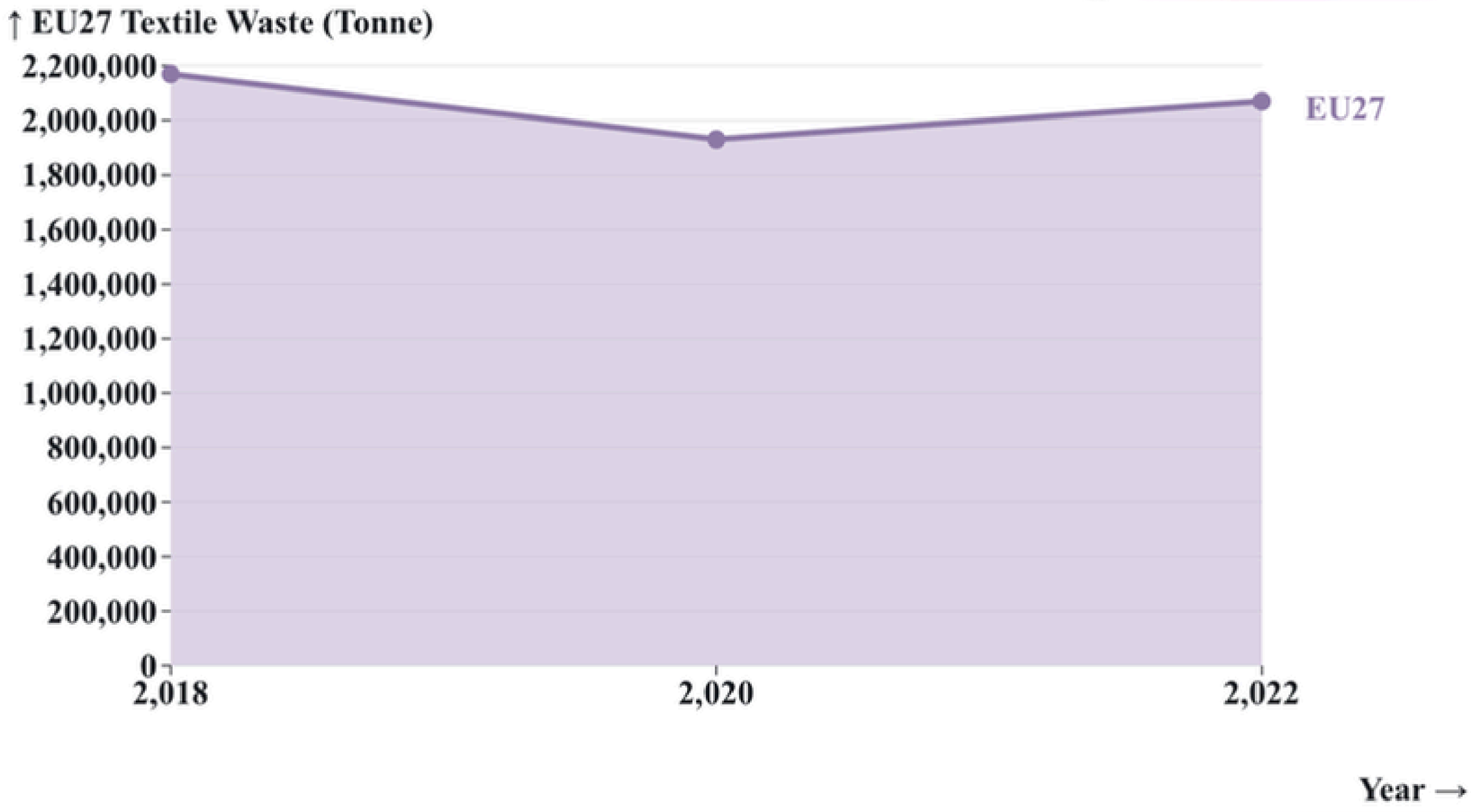
♻ Textile Waste

When a T-shirt reaches people, it is not the end of its journey. For most clothes, the journey ends at the garbage dump.

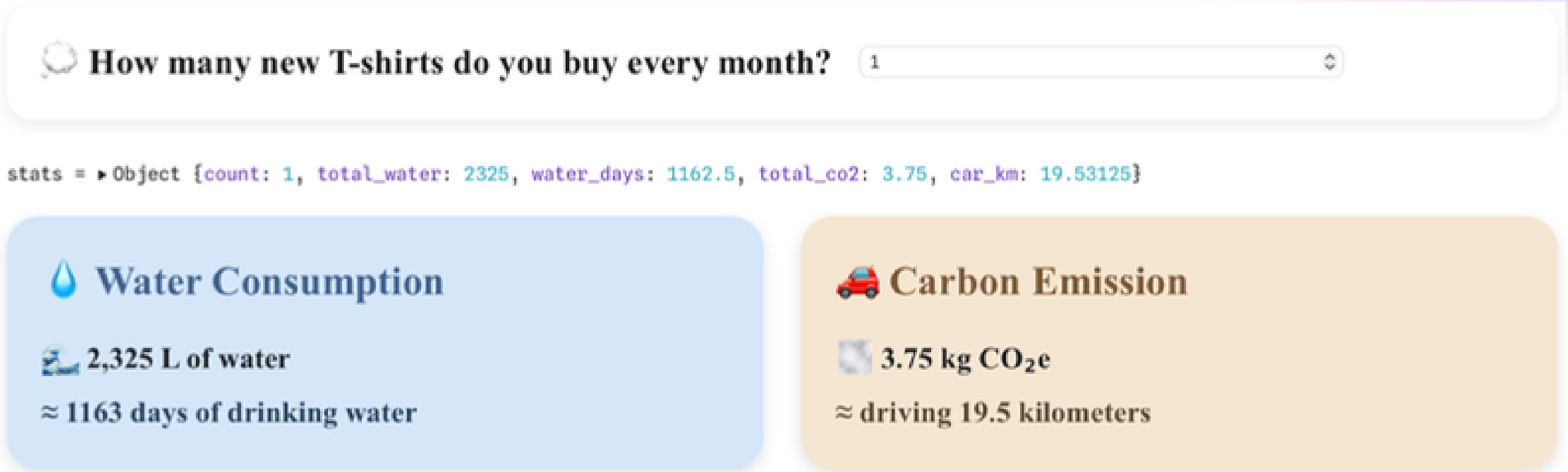


Line chart

Showing increasing EU textile waste generation



ACT4：



Interactive Calculator

Converting “number of T-shirts purchased” to liters of water, days of drinking water, kg CO_2, and car km driven

Workload Distribution

Xu Liuyan

- Waste generation & CO2 emissions cleaning
- Waste generation, CO2 emissions and Water footprint visualizations
- Calculator logic
- Narrative text

Su Yiming

- Trade data & Water footprint cleaning
- Video production
- Trade FlowVisualization
- T-shirt Conversion Consumption Chart

Link： https://observablehq.com/d/7dce43c2abd30fb4

Thanks for watching

https://www.worldbank.org/en/news/feature/2019/09/23/costo-moda-medio-ambiente