Extreme Events in Kansas

Kansas Water Hub

University of Kansas

June 24th, 2024

Motivation for Project

Reduce Vulnerability to Extreme Events

Reduce Vulnerability to Extreme Events

Precipitation in Kansas varies greatly from year to year as it lies in the transition zone from relatively abundant precipitation in the east to relatively little precipitation in the west.

Flooding

Flooding usually occurs quickly when precipitation exceeds infiltration and then exceeds channel capacity.

Drought

Kansas is one of the many states with a history of significant effects from drought. From late 2010 to late 2015, for instance, a multi-year drought occurred in Kansas. The drought peaked in 2012, the warmest and one of the driest years on record, averaging 4.9 inches of rain in May through July.

Data, Research, and Study Needs

Work with state and federal partners to identify existing data gaps, including needs for additional stream gages within the monitoring network to improve river forecasting.	Develop flow modeling for future flood planning, and identify basins lacking the data necessary to support more sophisticated modeling methods.
Support efforts to improve forecasting to predict extreme conditions and pursue flexible reservoir management strategies that maximize the benefit of such information.	Evaluate historical and current climate trends, and projections for extreme events to update flood planning based on such statistics as appropriate.

Table: Kansas Water Plan Highlighted Needs

Questions of Interest

How can Kansas adapt to severe droughts?

Adapting to changing conditions and minimizing harm from severe droughts is vital for Kansas water resource management and agriculture.

How can communities respond effectively to disasters

Declared disasters are a snapshot of extreme events and can provide insight about how communities respond after a disaster has occurred.

Overview of Data

FEMA Open Data

1. FEMA Open Data Link
   - Data on disaster declarations
   - Information on public assistance provided to state and local governments
   - Information on individual assistance provided to eligible applications received

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2. Kansas Mesonet Data Link
   - Information for most counties: includes precipitation, temperature, wind, etc.
3. PRISM Data Link
   - Information at 4km square blocks: often imputed, includes precipitation and temperature.

Quick Shoutout to KDSC Student

Community Data Lab Student worked with Open FEMA Data

- Dasha Yermol, PhD student in Brain, Behavioral, and Quantitative Psychology
- Mentored by Elaina Sutley, professor of Civil, Environmental, and Architectural Engineering at the University of Kansas
- Dasha Yermol CDL Poster (Link)

This was my first exposure to Open FEMA data and it was helpful thinking about how to use the data for the water dashboard.

Natural Disasters in Kansas in FEMA Data

Type of Incident	Freq.	Percent	Cumulative
Biological	5	5.95	5.95
Fire	13	15.48	21.43
Flood	13	15.48	36.90
Hurricane	1	1.19	38.10
Other	1	1.19	39.29
Severe Ice Storm	2	2.38	41.67
Severe Storm	40	47.62	89.29
Snowstorm	3	3.57	92.86
Tornado	6	7.14	100.00
Total	84	100.00	

Individual National Applicants to FEMA Post Disaster

Applicant Age Group	Freq.	Percent	Cumulative
less than 19	114,101	0.54	0.54
19-34	4,902,739	23.38	23.92
35-49	6,563,936	31.31	55.23
50-64	5,613,366	26.77	82.00
65+	3,390,007	16.17	98.17
NA	383,423	1.83	100.00
Total	20,967,572	100.00	

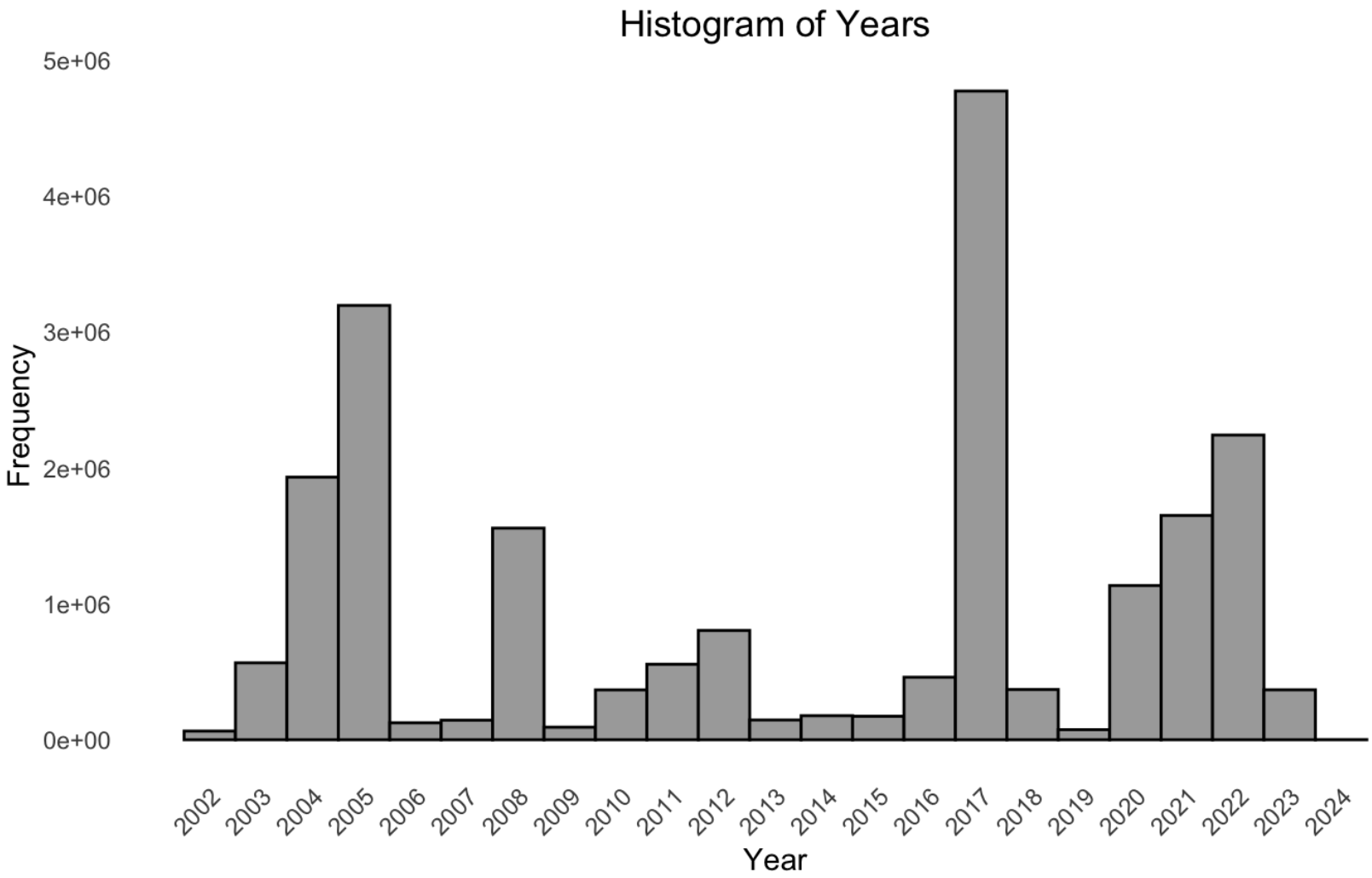
Table: These counts are for natural disaster declarations between 2002 and 2023.

Individual Kansas Applicants to FEMA Post Disaster

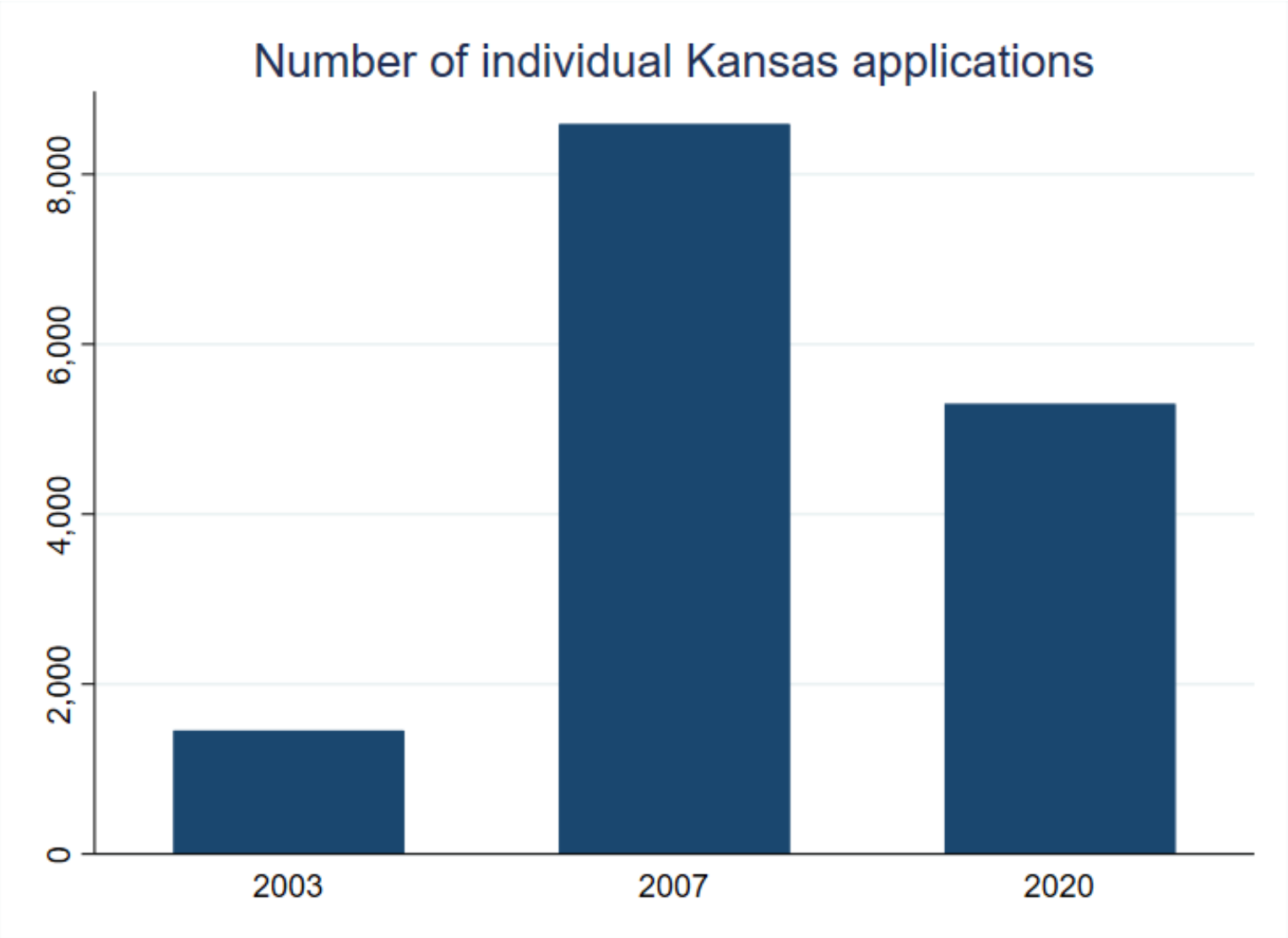
Applicant Age Group	Freq.	Percent	Cumulative
less than 19	49	0.32	0.32
19-34	2,271	14.81	15.13
35-49	4,101	26.74	41.86
50-64	4,862	31.70	73.56
65+	3,943	25.71	99.26
NA	113	0.74	100.00
Total	15,339	100.00	

Table: Kansas applicants are more likely to be 50 or older than the national distribution of applicants.

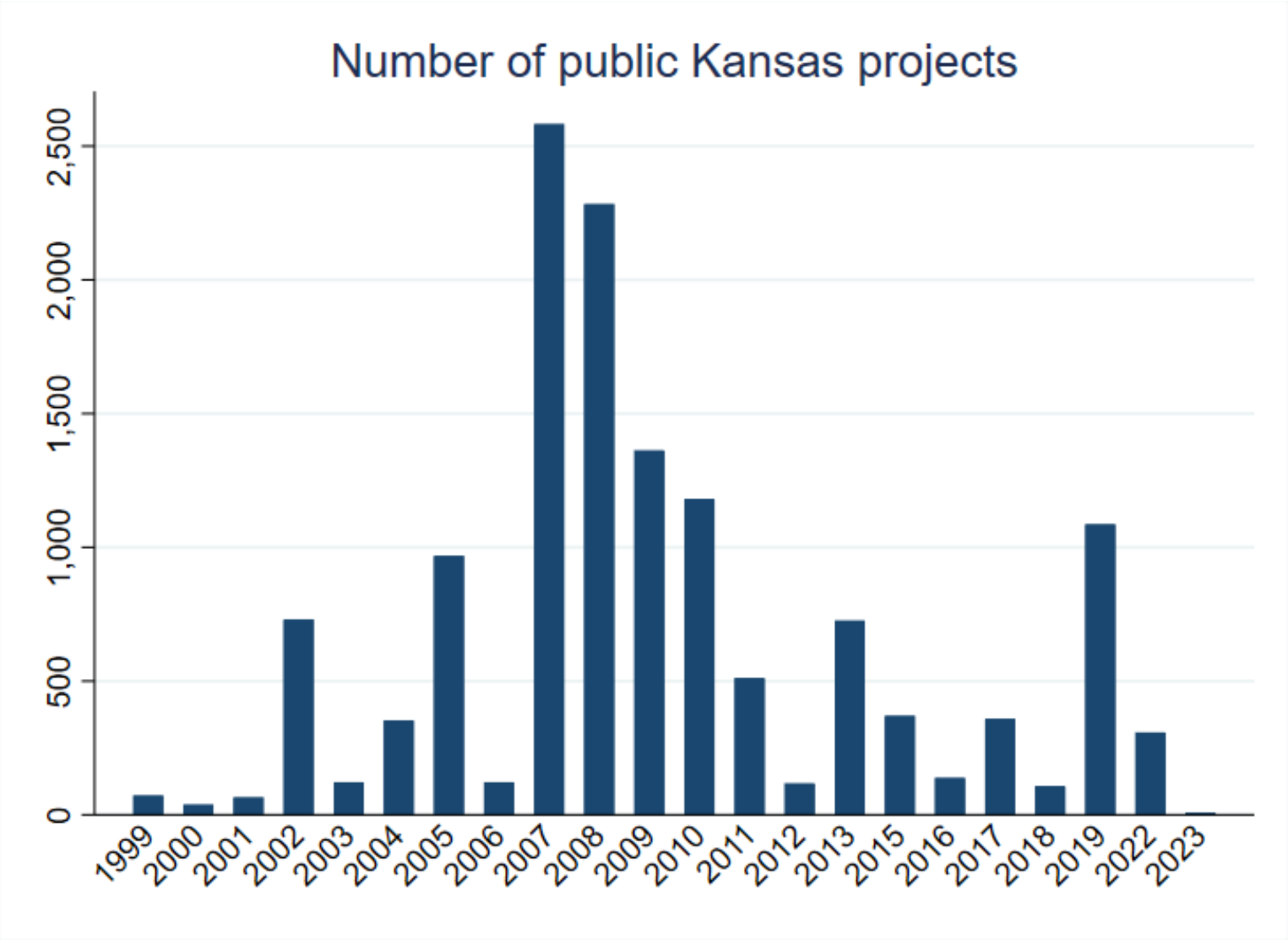
Count of total US applications by year



Count of Kansas applications by year



Count of Public Kansas Projects



Public Application Projects

Incident Type	Freq.	Percent	Average Cost per Project
Flood	104	0.76	37,249.63
Severe Ice Storm	866	6.36	86,279.57
Severe Storm	12,208	89.71	107,829.8
Snowstorm	358	2.63	246,201.5
Tornado	72	0.53	45,446.65
Total	13,608	100.00	109,229.2

Table: Snowstorms tend to lead to projects that are more costly, on average, than other extreme events.

Data Structure

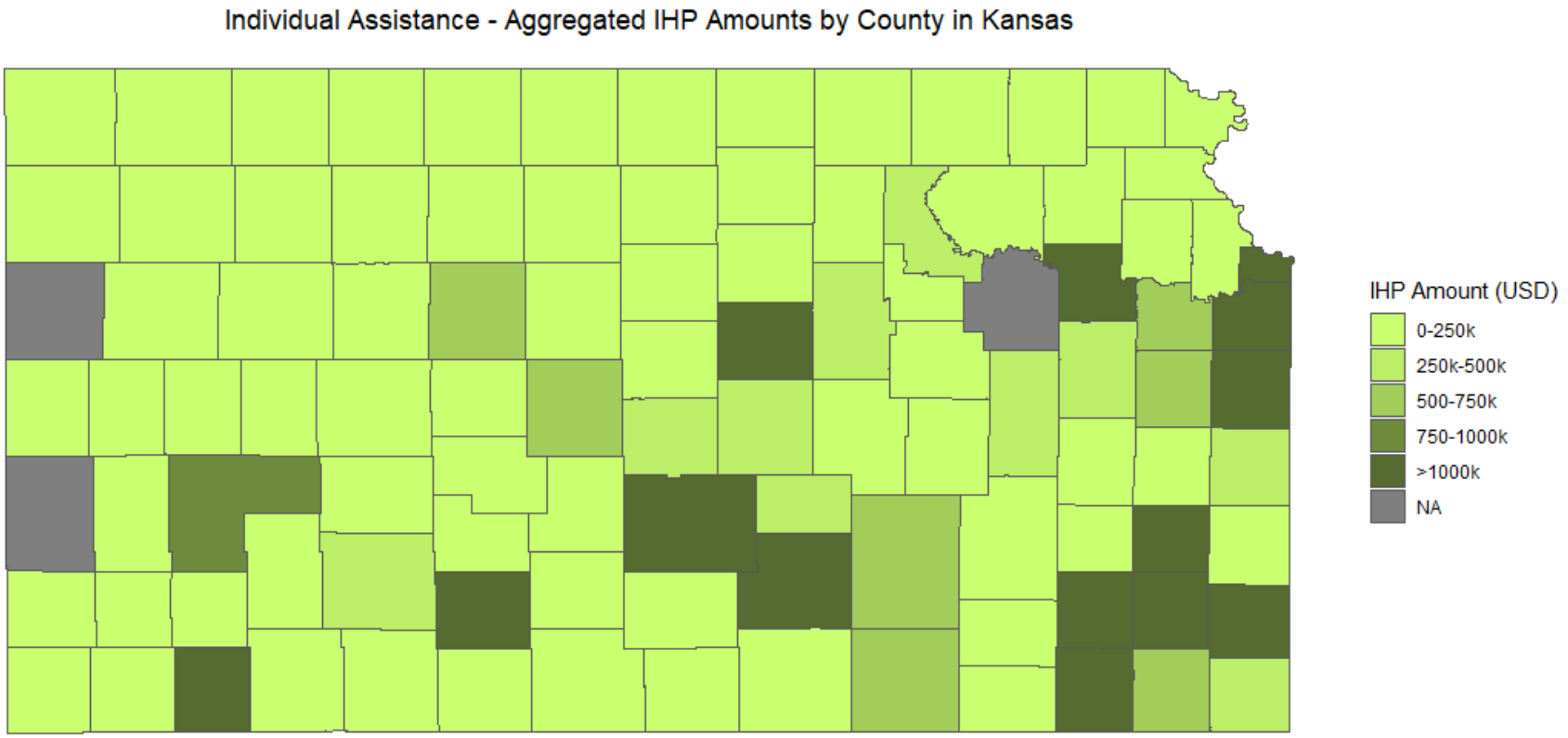
1. Public Assistance
   - This data is organized at the disaster - project level
   - Project applications can be identified as statewide or with a county tag
2. Individual Assistance
   - This data is organized at the disaster - individual level
   - Applications can be identified with a county tag

The county tag allows this data to be connected with other information, including:

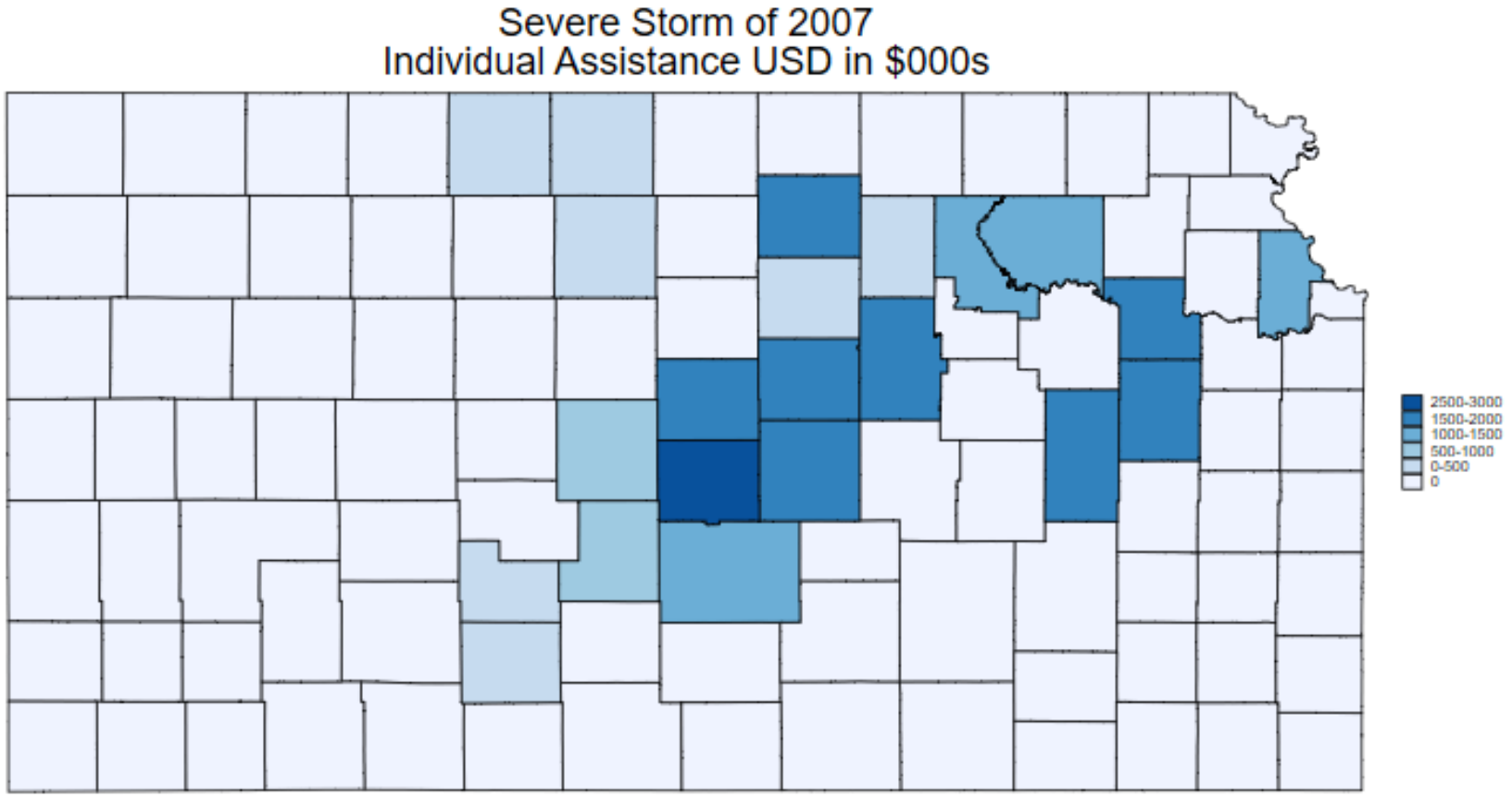
1. County Census characteristics
2. County measures of rainfall, drought, other?

Descriptive Analysis

Individual Assistance Across All Declared Kansas Disasters



Individual Assistance for DN1699: Severe Storm of 2007



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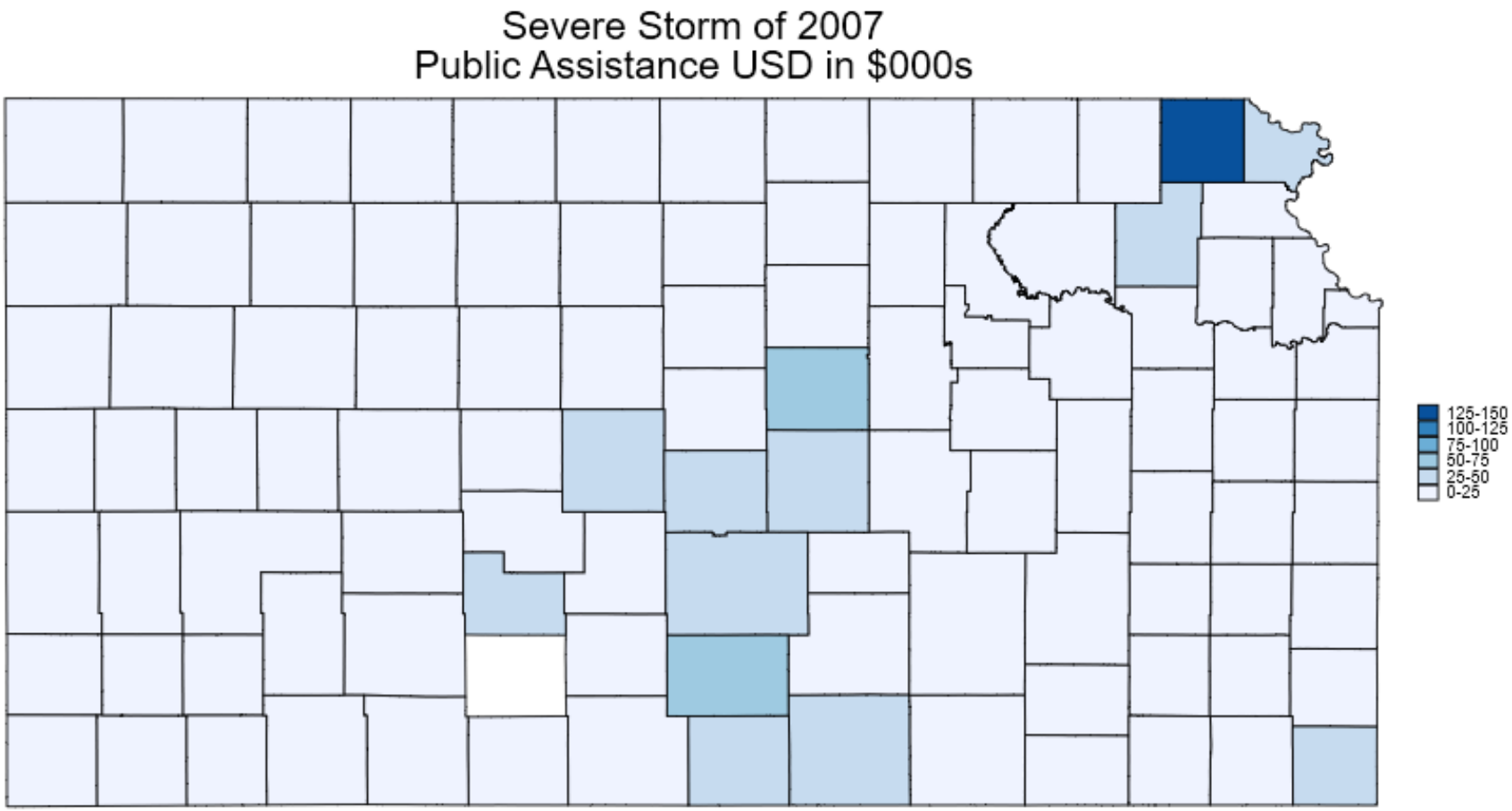
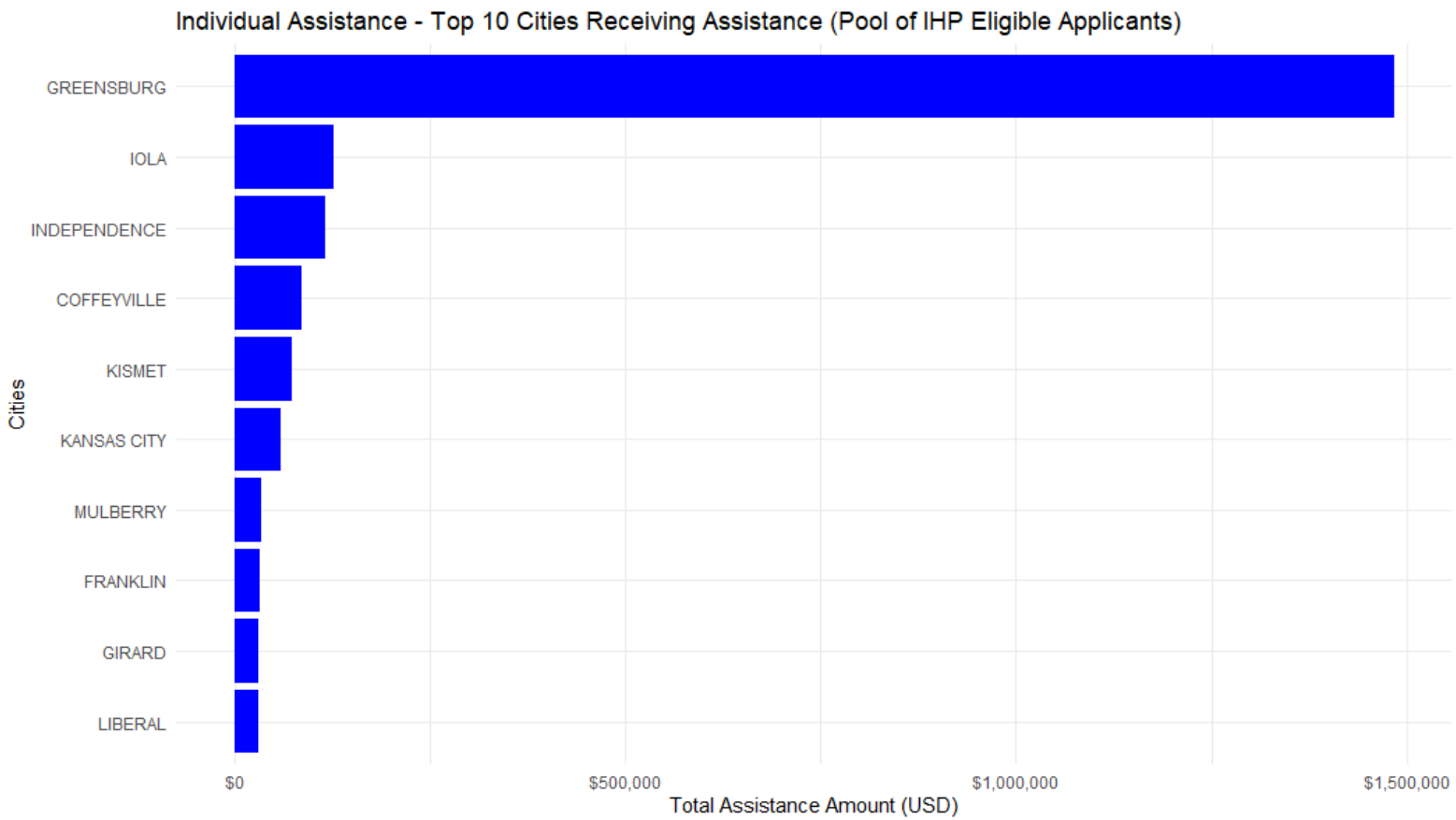
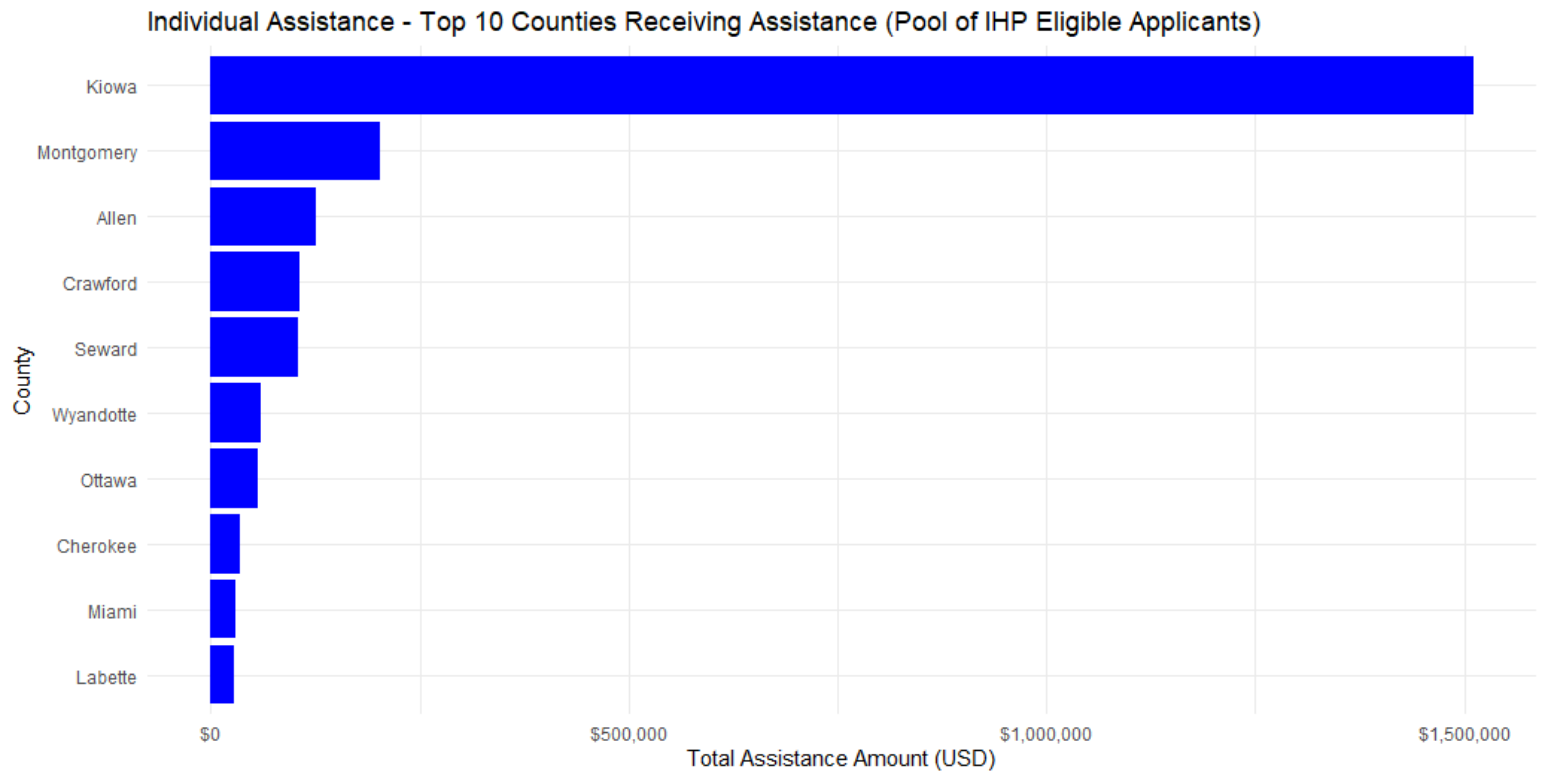


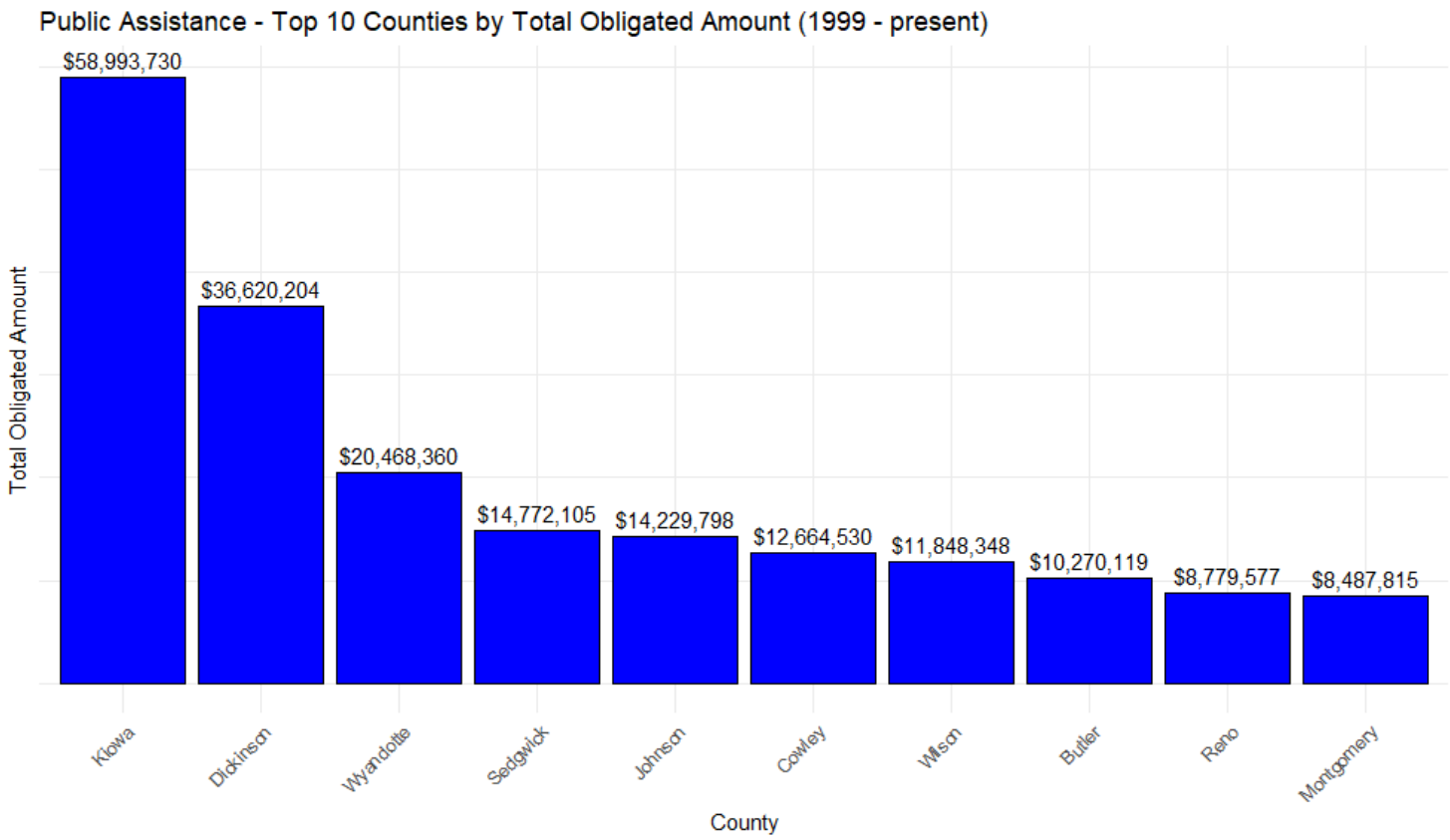
Top Cities in Kansas Receiving Individual Assistance



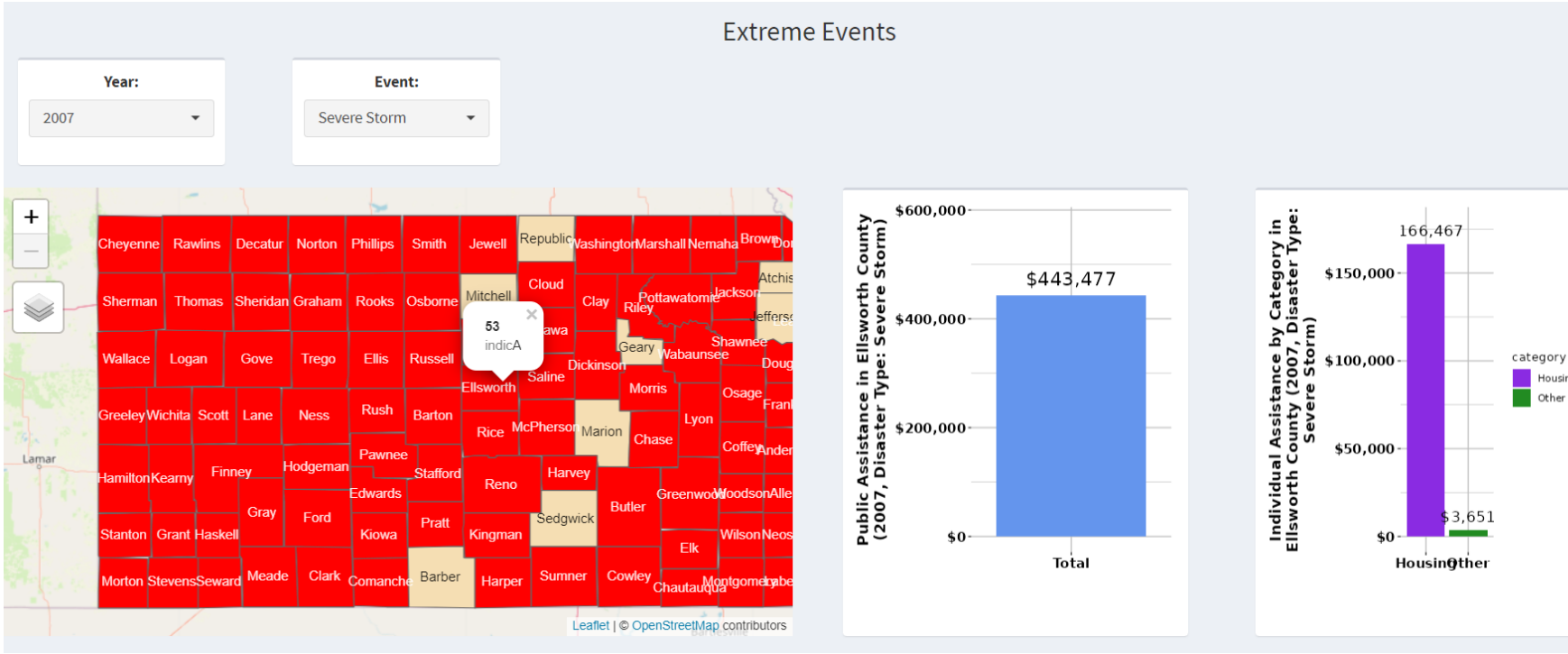
Top Counties in Kansas Receiving Individual Assistance



Top Counties in Kansas Receiving Public Assistance



Sneak peak of the dashboard



Extreme events interactive visualizations

Future research work on extreme events

How can we connect extreme events to other pillars of the water plan:

1. Link extreme events with data on well use?
2. Link extreme events with storage capacity in reservoirs?
3. Link extreme events with water quality information?

Do more with PRISM and Mesonet data:

1. Connect precipitation and drought data to other pillars.
2. Think about how drought and precipitation as context for the disaster declaration data in FEMA.

Questions and Feedback

Thank you for your survey responses