Place Attachment, Climatology, and Tornado Risk Perception in Central Oklahoma

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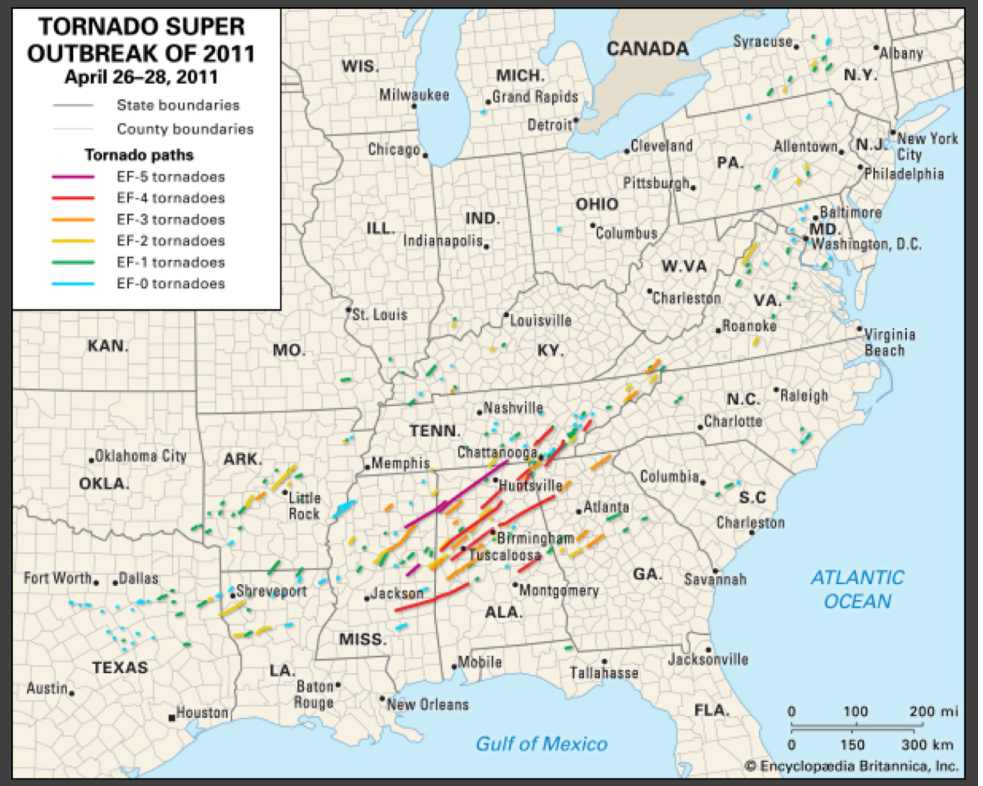
INTRODUCTION & BACKGROUND



April 11th, 2011: Super Tornado Outbreak

- Previous study found that perceptions of *physical geography* and *place attachment* are important factors in assessing tornado risk (Klockow et al., 2014)

Vernacular "Local" Knowledge

- Individuals develop weather perceptions through numerous cognitive, social, and cultural factors
- *Ways of knowing* that come from *living in a place* (Klockow et al., 2014)

Conceptualizing Risk: Physical Geography

- Tornado risk is heightened or lessened due to:
  - ➢ Highways and flat landscapes = heightened risk
  - ➢ Rivers and lee side of tall buildings = lessened risk

INTRODUCTION & BACKGROUND

Power of Place

- Bonds are highly influenced by personal experiences because it regulates the transactions across various environmental-psychological processes (de Dominicis et al., 2015; Cuba and Hummon, 1993)
  - ➢ *Place identity:* emotional and meaningful attributes
  - ➢ *Place dependence:* economic and resourceful (White et al., 2008)
- Home blurs the line between *the self* and *surroundings*

Risk Perception & Place

"Lightning doesn't strike twice in the *same* place"

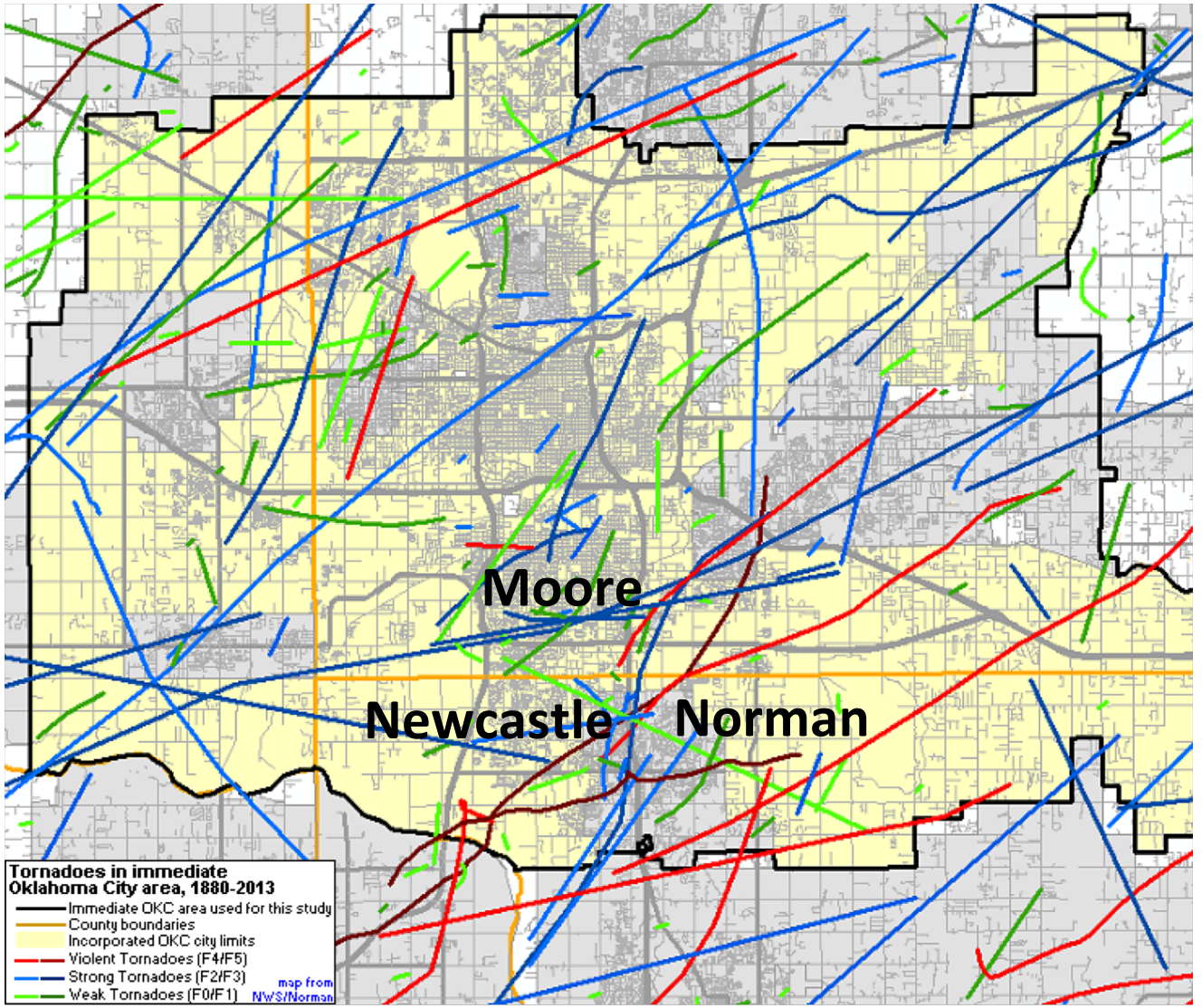
- Potential induced vulnerability or optimism bias (Suls et al., 2013)
  - ➢ Tendency to feel *less* at risk for a disaster or threat

WHY STUDY THIS?

We have found that people in many cases develop *false senses of security* based on where they live – for example, people in Norman feel much less at risk to tornadoes as people in Moore, although the official tornado record dating to 1880 does not indicate a preference

CONCERN:

If some places feel they are *less at risk*, will this adversely affect preparedness and responsiveness?



RESEARCH QUESTIONS

1. Could place-based optimism bias be at play in shaping how people feel? Do some have a false sense of security?

1. What role do recent or well-remembered events have in shaping risk perceptions?

1. Do some places attain a "more risk prone" status, and if so, why?

PRELIMINARY STUDY RESULTS

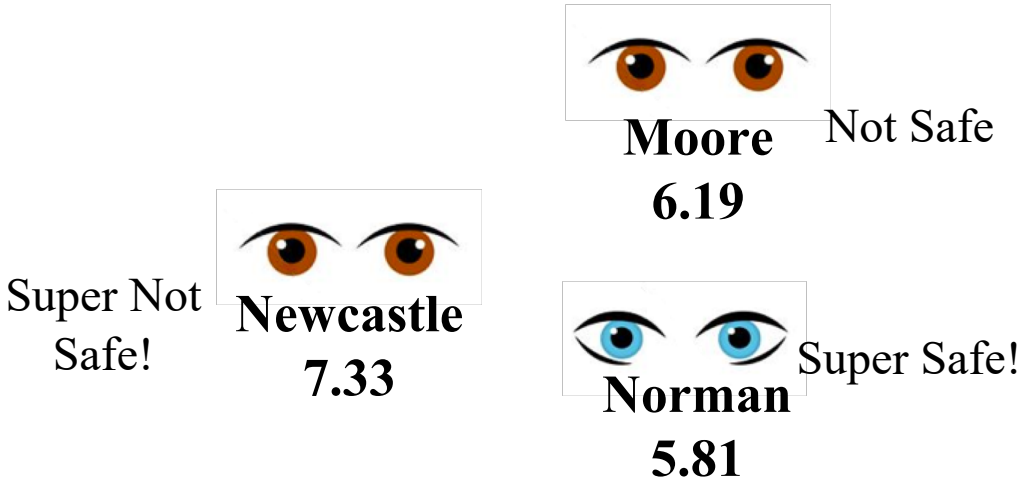
Norman Town Hall Meeting (2012)
Peppler et al., 2018

2012 Town Halls and Limited Surveys

- Described in Peppler, Klockow, and Smith 2018

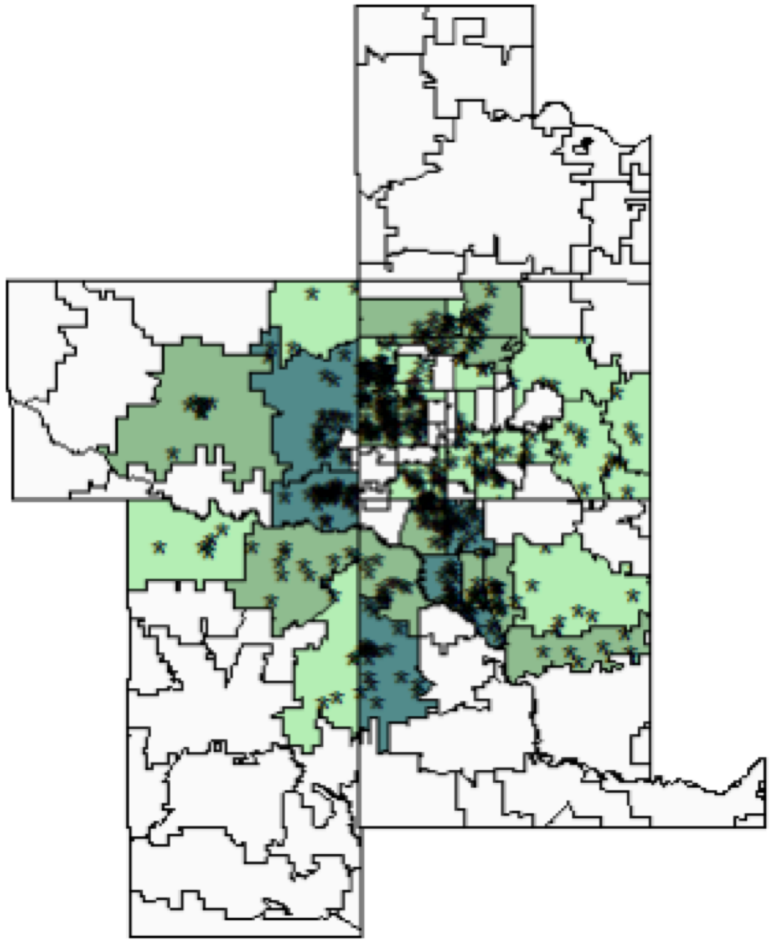
Their findings:

- Perspectives of risk (scale from 1 to 10) vary by place, even if only separated by a few miles
- Many feelings of risk are shaped by previous experiences



CURRENT STUDY

METHODS: DATA AND TECHNIQUES



*Each respondent is denoted by a **

Tornado Tracks

- NOAA's Storm Prediction Center Severe Weather GIS (SVRGIS) webpage
  - ➢ 20 Years (1996 – 2016): 186 total tracks
  - ➢ EF1 – EF5, ≠ EF 0 or EF -9

Survey Data (2016)

- **463** Survey Respondents across Central Oklahoma
- Phone and survey; data include zip codes, geo locations (lat/long), etc.

Data Manipulation

- Use of ArcGIS and Python to visualize risk perception within certain mile radius of resident homes.

Challenges

- Average risk perception was difficult to calculate in zip codes with only one respondent recorded

RESULTS:
RECENCY, DISTANCE, & INTENSITY

The *difference* in average risk ratings (scaled from 1-10) for those who **have** and those who have **not** had a tornado within certain parameters.

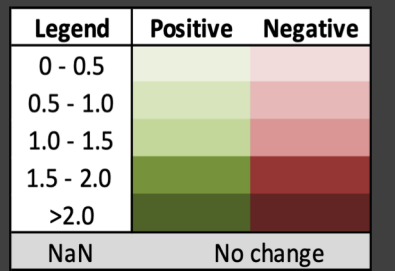
Table 1 (top): Tornadoes of all intensities, which are EF1– EF5, but ≠ -9 or 0.

Table 2 (middle): Tornado intensities from mag > 3 (EF3 – EF5).

Table 3 (bottom): Tornado intensities for mag> 4 (EF4 – EF5).

Legend

Cells shaded in **GREEN** indicate a positive shift in risk rating, while cells shaded in **RED** indicate a negative shift in risk rating. Cells shaded in **WHITE** are inconclusive, or insignificant. **GREY** are no changes in risk, which is **the average rating of 6.41**.



MAG 1-5	MILES				
TIME	1mile	5miles	10miles	15miles	20miles
1yr	-1.29 YES: 5.14 NO: 6.43	0.6 YES: 7 NO: 6.40	(-0.73) *** YES: 6.04 NO: 6.77	(-0.22) ** YES: 6.37 NO: 6.59	-0.06 YES: 6.41 NO: 6.47
5yrs	0.44 YES: 6.78 NO: 6.34	0.6 YES: 7 NO: 6.40	1.42 YES: 6.42 NO: 5	NaN YES: 6.41 NO: NaN	NaN YES: 6.41 NO: NaN
10yrs	0.05 YES: 6.45 NO: 6.40	(-0.39) * YES: 6.41 NO: 6.8	NaN YES: 6.41 NO: NaN	NaN YES: 6.41 NO: NaN	NaN YES: 6.41 NO: NaN
20yrs	0.03 YES: 6.43 NO: 6.40	NaN ** **YES: 6.41** NO: NaN	NaN YES: 6.41 NO: NaN	NaN YES: 6.41 NO: NaN	NaN ** **YES: 6.41** NO: NaN

MAG 3-5	MILES				
TIME	1mile	5miles	10miles	15miles	20miles
1yr	NaN YES: NaN NO: 6.41	NaN YES: NaN NO: 6.41	NaN YES: NaN NO: 6.41	NaN YES: NaN NO: 6.41	NaN YES: NaN NO: 6.41
5yrs	**2.33 **** YES: 8.71 NO: 6.38	1.32 *** YES: 7.51 NO: 6.19	0.38 YES: 6.61 NO: 6.23	0.37 ** YES: 6.54 NO: 6.17	0.07 YES: 6.43 NO: 6.36
10yrs	0.78 YES: 7.16 NO: 6.38	0.74 *** YES: 6.90 NO: 6.16	0.7 ** YES: 6.69 NO: 5.99	**2.05 ***** YES: 6.48 NO: 4.43	NaN YES: 6.41 NO: NaN
20yrs	0.81 ** YES: 7.11 NO: 6.3	0.69 *** YES: 6.79 NO: 6.10	0.45 ** YES: 6.54 NO: 6.09	(-1.09)** YES: 6.41 NO: 7.5	NaN ** **YES: 6.41** NO: NaN

MAG 4-5	8.7				
TIME	1mile	5miles	10miles	15miles	20miles
1yr	NaN YES: NaN NO: 6.41	NaN Yes: NaN NO: 6.41	NaN Yes: NaN NO: 6.41	NaN YES: NaN NO: 6.41	NaN YES: NaN NO: 6.41
5yrs	**2.33 **** YES: 8.71 NO: 6.38	1.26 *** YES: 7.48 NO: 6.22	0.35 YES: 6.61 NO: 6.26	0.38 YES: 6.55 NO: 6.17	0.07 YES: 6.43 NO: 6.36
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*Note: *** $p < 0.001$; ** $p < 0.05$; * $p < 0.01$*

Tornadoes mag -9 (unknown) are not included

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RECENCY, DISTANCE, & INTENSITY

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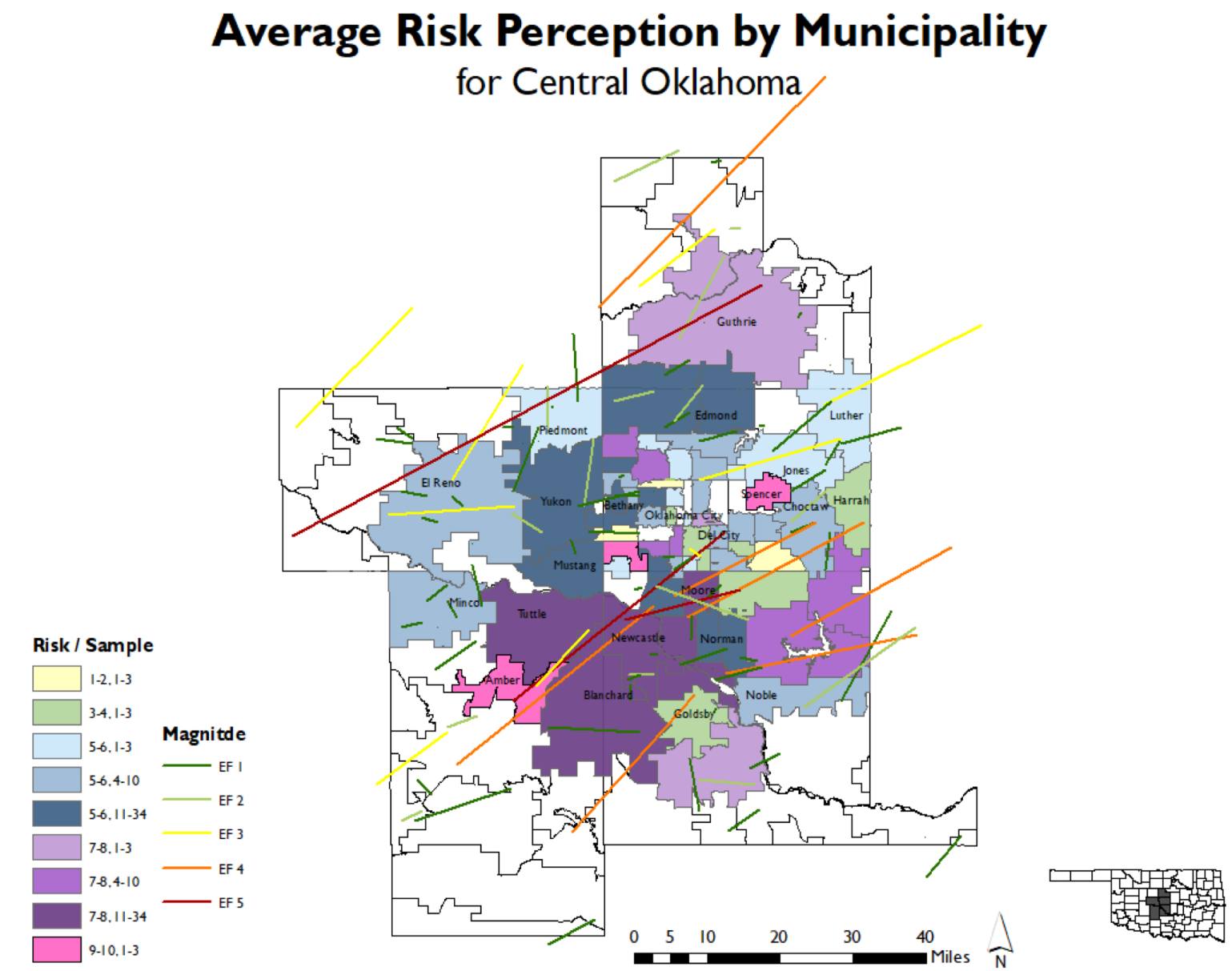
We found that both **time**, **distance**, and **intensity** impact perceived risk. From the T-Test Tables, we are able to make clear inferences about the thresholds of the magnitude and direction of the average effects of tornadoes on risk perceptions.

- **Having a large, nearby tornado in the last 5 years increased mean risk rating by 2.33.**
- However, risk ratings decrease as intensity decreases and time increases.
- There is possible backfire effect where residents feel less risk prone when they are close to weak tornadoes.
- Significant negative values at greater distances indicate optimism bias, or that tornadoes will happen "there, but *not* here."
- But there are more small tornadoes (mag <2) than there are large ones (mag>4), which explain the negative risk ratings in Table 1.
- Therefore, it is *not* about the number of tornadoes alone, but how many **large** (mag>3) and **recent** (<10 yrs) tornadoes are near you.

RESULTS:
SPATIALIZING RISK

Risk perception scores were shaded with a qualitative color scheme that ranged from light yellow (weak) to magenta (strong), which was then saturated for values of higher sample sizes and desaturated for lower sample sizes.

- Risk Perception is heightened SW of Oklahoma City, and lessens as you travel NNE
- Moore (8) and Newcastle (8) feel more at risk than Norman (5)
- Risk Perception **increases with proximity to a strong tornado** (EF4 – EF5)



DISCUSSION & CONCLUSION

Preliminary Findings:

Depending upon where you live may alter your perception of tornado risk. It is clear that *recent* and *well-remembered* events shape risks (RQ2) as well as specific place-based optimism biases (RQ1), like town boundaries (Moore vs Norman) and land topography (RQ3).

Current Findings:

Since it is not about the number of tornadoes that have occurred, but about how many *large* (>EF 3) and *recent* tornadoes (< 10 years) have occurred *near* someone (<10 miles), it is possible that place-based optimism can shape how risk prone someone may feel.

FUTURE WORK

It is apparent that perceptions of risk between adjacent or close-by areas differ substantially due to influences of place attachment and tornado recency, distance, and intensity.

With the anticipated continuation of this project, we would like to understand how distances from urban centers influence risk proneness.

Additionally, more qualitative studies are needed to understand cognitive biases from people who encounter evidence that challenges their beliefs of tornado climatology.

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QUESTIONS?

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