Dreams of Drowning

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[**Title Slide:**] Thank you for the opportunity to be here today. I have been strongly influenced by my young co-panelists. Recently, Matt spoke at a campus even about the need to develop a thick skin because of the high rate of rejection for ceative writers.

[**Reviewer's Comments:**] Under Andrew's influence, I wrote the introdution section of a scientific article as if it were creatve non-fiction. I'd like to share it with you today. And no, I didn't mistype those reviews.

[**Canoe Slide:**] The most common way I die in my dreams is by drowning. I come canoeing down a tributary into a roaring river, capsize and, before drowning, wake up. The dreams probably began in my childhood, when I could stand on our back porch and see the incised North Carolina creek that would regularly overtop its banks and flood the bottomland where we pastured our cows. [**Rafting Slide:**] As I reached and passed through adolescence, my fascination with roaring waters continued, and I grew to love whitewater rafting and canoeing. However, when I took my first academic job at the University of New Orleans, flooding became a more existential concern.

[**New Orleans map:**] As I lived and worked in New Orleans, I learned that the Mississippi River was not the major flooding concern, having been

turned into a play area of the U.S. Army Corps of Engineers. I once heard a spokesman for the Corps say, "If you give us enough money, we can make the Mississippi go wherever you want." Instead, the real danger to New Orleans was storm surge from an advancing hurricane, inundating the city from Lake Pontchartrain, an estuary connected to the Gulf of Mexico through passages in the east of the lake and to the interior of the city through multiple drainage canals. The levees along these canals proved the weakest points in New Orleans' protection when Hurricane Katrina hit.

Eight months before Katrina, I took a job at a small Midwestern university in Dubuque, Iowa. It stood near the Mississippi but a thousand miles upstream from New Orleans and on bluffs 250' above river level. [**Katrina damage:**] Katrina put 6.5' of water in my former home in New Orleans, but water damage in Dubuque would be from new sources.

[**Hail:**] The ceiling inside my Dubuque home was first damaged by leakage after a hail storm. The roof was old and needed replacing anyway, so I was happy to receive the insurance money to replace it. However, a year and a half afterward, the roof leaked again, this time due to a common Midwestern problem of which my Southern background had left me poorly prepared—an ice dam. [**Ice dam:**] Ice dams form on roofs when melting and refreezing block drainage of meltwater, backing it up under shingles. The drywall in my ceiling once again had to be replaced.

[**Ceiling damage:**] As I pondered my ceiling and the multiple causes of its damage plus the multiple causes to the flooding in New Orleans, I realized that data I was using for a class problem also indicated multiple causes of flooding. Students were working with annual peak discharge (the

biggest flood each year on record) obtained from a government database. [**Grant River graph:**] Many annual peak floods occurred in later winter/early spring, but a few most extreme floods occurred in the summer months. During those months, I have floated in an inner tube on the river we were studying, the Grant River just across the Mississippi in Wisconsin. [**Grant River tubing:**] I have watched its waters pass under my bobbing beer cooler, a quite different river from the Mississippi River into which it flows just upstream from Dubuque. Did it respond differently with season, more impacted by local storms than a large stream like the Mississippi or Wisconsin Rivers?

In the Dubuque area, the summer months are humid, with over half the yearly precipitation occurring then, often as thunderstorms. [**Dubuque thunderstorm:**] These convection-driven storms are more localized than the wide blanket of ice and snow of the winter months. The dumping of several inches of rain over a small basin can lead to flash-flooding. However, in a larger basin, the localization of the storm may mean that the amount of input is minor when averaged over the entire basin area.

In contrast, winter in Dubuque starts early and lasts a long time. The surface of streams remain frozen most of the winter, often sufficiently thick for cars to drive atop. Snow accumulates on the ground as warm wet air from the Gulf of Mexico meets cold Canadian air. By March or April, snow begins to melt and ice on streams begins to break up. [**Ice on River:**] Large chunks of ice impede flow, form temporary dams and, along with the melting snow, rapidly increase stream levels. As the ice moves down streams, it breaks lose more ice, jams, accumulates, is lifted by water from the melting snow, then

often lets go quite quickly. If this process occurs over a large area, streams in that drainage basin flood.

The Mississippi River is incised into the more-than-400-million-year-old limestone and dolomite that forms the beautiful bluffs in the Dubuque area. [**House on bluffs:**] The Mississippi near Dubuque has stayed in its course for 500,000 years, the area having been spared the Pleistocene glaciation that blanketed much of the Midwest, including most of Iowa. Instead, the Mississippi continued to cut down through the fractures in the limestone, reducing the local base level and forcing the nearby streams dumping into it to incise their own channels.

Tilling the resulting hilly terrain was beyond the experience of the first European farmers of 200 years ago or so, and massive amounts of soil were lost to the streams. [**Catfish Creek:**] What were cold, deep, and narrow altered to warm, shallow, and broad. Over a similar time-scale, human-induced global climate change has certainly raised ocean temperatures. [**Temp graph:**] And the Upper Midwest is not immune to the ocean's impact. Though Dubuque is 2000 miles from the Pacific Ocean, the impact of El Niño reaches out to Dubuque to alter flood patterns. And warmer water in the Gulf of Mexico evaporates more easily, to be visited upon our landscape.

[**Cannon fire:**]A problem all scientists using statistics face is deciding whether their sample estimates actually represent the population they are attempting to describe. Such decisions are as much art as science. We of necessity reduce the number of variables we are considering so as to try to see meaningful patterns in our data. [**Cracked pavement:**] However, occasionally we remove variables that are more important than we realize.

Furthermore, there are always assumptions built into our analysis that are seldom clearly met. That said, we still must make decisions in the face of uncertainty.

In the case of flooding, our decisions impact many lives. [**Epic surge:**] An underestimated flood risk puts additional lives and property at risk. If we assume that the past is our guide to the future, systemic alterations such as global climate change may lead us to underestimate risk. If we miss important variables, perhaps global or seasonal influences, our estimates may vary widely from reality. And if in looking at population estimates, we accidentally lump two populations together, the best we can hope for is greater uncertainty.

[**Poster:**] After working through data not only for the Grant River but a dozen other nearby streams, such, I believe, is the case in the Dubuque area, and possibly for similar climate zones. Peak annual floods in the Dubuque area represent two populations—summer floods due to convection-driven storms and winter/spring floods due to snow and ice melting. [**Seasonal exceedence:**] Because the convection-driven storms are more localized, smaller basins are most impacted. And the likelihood of their being flooded is greater than we scientists have thought.

My grandmother, who lived in a trailer parked in the side yard of my childhood home, feared the summer storms. [**My home:**] When thunder grew closer, my grandmother would leave the insecurity of her trailer and come cower in the basement of our house. I was too young at the time to ask her the source of her fear. Perhaps she, too, died in her dreams, expiring during an intense thunderstorm. Was it the wind, the rainfall, or

the lightning that brought about her demise? [**Flooded trailer:**] Or did she dream of her trailer-home floating away like a canoe in a flood?

But my particular story ends more happily. [**Accepted:**] I am not alone in wanting to cross the boundary from science into creative writing. Nor is this desire new. a boundary may be fenced, but we can learn to hurdle it, with a little help from our friends. [**Andrew:**]