BRIEF

The impact of severe weather events on education:

Revisiting Hurricane Katrina while preparing for the next disaster

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Introduction

From Hurricane Helene in August 2024 to the Los Angeles wildfires in January 2025, severe weather events now impact millions of students each year. In 2024, there were 27 separate weather-related disasters with at least $1 billion in damage each, trailing only the record-setting 28 events in 2023. Twenty years ago, Hurricane Katrina demonstrated how natural disasters can fundamentally reshape educational systems, damaging or destroying over 100 schools and destabilizing many of the families they served. Careful study of the impacts of Katrina and other similar natural disasters on schools and students can reveal important takeaways for how schools can be ready for, and respond to, disruptive weather events.

The consequences of these events go beyond physical destruction. Nearly 10,000 schools had to temporarily close due to severe weather events in the 2024–25 school year alone. Severe weather events and natural disasters can be hugely disruptive to schools, causing major budgetary and instructional challenges while directly impacting students and teachers. These events can disrupt multiple aspects of children's lives, including academic progress, sense of security, and physical well-being.

As students return to school this fall during peak wildfire and hurricane season, it is essential to understand and prepare for the threats of severe weather. In this brief, we detail the evidence on how disruptions to students' day-to-day learning environments due to severe weather affect school functioning and teachers' and students' well-being. Our goal is to help educators and school system leaders recognize the impact of weather-related disruptions and emphasize the need for increased preparedness in school communities. Given the risk (and types) of severe weather varies across regions, we also raise awareness of the communities that are most vulnerable to the negative impacts of weather-related disruptions. Knowledge of both the effects of severe weather on schools and the relative likelihood of such events occurring in a given geographical location can support district leaders in making informed decisions about practical matters like resource allocation, scheduling, and infrastructure investments, as well as how much to prepare for the associated instructional and mental health challenges.

How does severe weather disrupt schools and affect the people in them?

Severe weather disruptions can interrupt almost every aspect of school functioning, with many downstream effects on teachers and students. We focus first on how school operations are impacted, then turn to research on how severe weather impacts teachers and students. One complication in discussing the impacts of severe weather and related natural disasters is that these events can take many shapes and forms with varying implications for education. Throughout this brief, we use both terms to refer broadly to weather-related disruptions that affect school communities, from persistent heat waves that strain day-to-day instruction to sudden large-scale disasters like Katrina that are limited in duration but have a long aftermath. While we discuss these different types of events in tandem, we also draw contrasts where the type, scale, or duration of impact matters for understanding their effects on schools.

Effects on schools

Reduced instructional time. One of the most common side effects of severe weather is missed instruction. In a 2022 survey, nearly half of educators nationwide said that the increased frequency of severe weather affected their schools' ability to provide in-person instruction. In many instances, schools closed due to severe weather for just one or two days before they were able to reopen for in-person instruction. However, in the case of larger natural disasters (major wildfires or hurricanes), school closures can last a week or longer, which can result in major logistical challenges to make up for missed instruction. Additionally, extreme heat in areas that are not accustomed to high temperatures is also resulting in increased rates of early dismissals and canceled school days.

It is also important to remember that the number of days schools stay closed does not always capture the full magnitude of the impact on a school's ability to provide instruction. For example, even when schools reopened in New Orleans after Katrina, students were often in makeshift classrooms, and not all students had returned to school. In these situations, a return to school is only the first step to a return to normalcy. As a result, learning was impacted in a manner far more severe than reflected purely by the number of days a school stayed closed.

School finances and infrastructure. Severe weather can also strain finances. Some of these funding challenges come not in response to, but in anticipation of, extreme weather events. For instance, school districts are now spending more to fix aging school buildings to better withstand extreme temperatures and severe weather. The average US school building is almost 50 years old, before air conditioning was common in many areas. As of 2020, about 50% of US school districts need multiple HVAC system updates. More than 10,000 public schools that did not need cooling systems in 1970 now need them (at an estimated cost of $40 billion dollars). Underinvestment in school infrastructure has been found to negatively impact students' health as well as academic outcomes. Additionally, districts that are in communities vulnerable to extreme weather are also being forced to spend higher percentages of their budget to insure school buildings. Funds put toward infrastructure improvements and insurance are incredibly important for long-term sustainability but can come at the expense of shorter-term spending on teaching and learning.

There is, of course, also considerable expense associated with repairing and improving schools after a major weather event. First, the cost of repairing buildings and infrastructure can be steep. After severe weather events, repairing and rebuilding schools can take years to complete. For example, over one hundred school buildings were damaged or destroyed during Hurricane Katrina, which cost over 2 billion dollars and took close to 18 years to finish repairs. However, infrastructure is not the only monetary impact. In extreme cases, the damage from severe weather causes mass displacement, which can lead to school enrollment declines in

hard-hit communities. Given school funding is often determined on a per-student basis, drops in enrollment can force extreme budget cuts and ultimately school closures. After Hurricane Maria hit Puerto Rico in 2017, approximately one quarter of schools there permanently closed.

Effects on teachers

While severe weather impacts schools and their operations, much of the burden of addressing instructional needs of students falls to teachers. Yet during the challenges of recovery, the needs of teachers are often placed on the back burner as other priorities, like operational stability and infrastructure safety, take precedence. This in turn can affect teachers' abilities to support the heightened needs of their students.

Professional responsibilities. The burden of getting students caught up academically after a school disruption mainly falls on teachers. In the aftermath of events like hurricanes, they face condensed schedules, lost instructional days, and students who are socially and academically off track. This creates major challenges for delivering lessons as planned. Teachers in one study described how difficult it was to figure out what to prioritize and how to make up for lost time. They found themselves skipping important content, rushing through material, or struggling to engage students who were still reeling from the trauma. Without enough time or clarity, instruction becomes more reactive and fragmented—less about deep learning and more about getting through the day.

Many educators also perceive they must choose between meeting students' academic needs versus social and psychological needs. For example, teachers reported needing additional resources and training to handle students' mental health and behavioral struggles, both of which can be driven by trauma in extreme cases like Hurricane Katrina. Student mental health and trauma can have a powerful impact on classroom instruction, especially after a major school disruption. Teachers often find that students return to school anxious, distracted, or emotionally withdrawn, making it harder to focus on lessons. Some students may act out or shut down entirely, requiring more one-on-one attention and emotional support. Routine activities like group work or tests can become challenging when students are carrying the weight of recent trauma. Instruction slows down, shifts in focus, or has to be adapted on the fly to meet students where they are emotionally.

Teachers' mental health. Personal impacts of extreme weather on teachers compound increased job responsibilities. Teachers typically live in the same or nearby communities as the school they work in. When severe weather-related school disruptions occur, teachers are often coping with personal and professional disruptions at the same time that they are working to address student needs, which can lead to staff burnout. Many teachers may need their own mental health supports and additional flexibility in their schedules to deal with personal impacts on their own families and homes.

Teachers' physical health. Extreme weather and environmental conditions can take a real toll on teachers' physical health. For example, when air pollution levels rise, teachers are more likely to get sick. A recent study found that even a small increase in air pollution led to a noticeable jump in teacher absences. Just a 10-point rise in fine particle pollution (the kind that gets deep into your lungs) was linked to a 13% increase in teachers calling out sick. These kinds of health impacts not only affect teachers personally but also disrupt classrooms and learning.

Effects on students

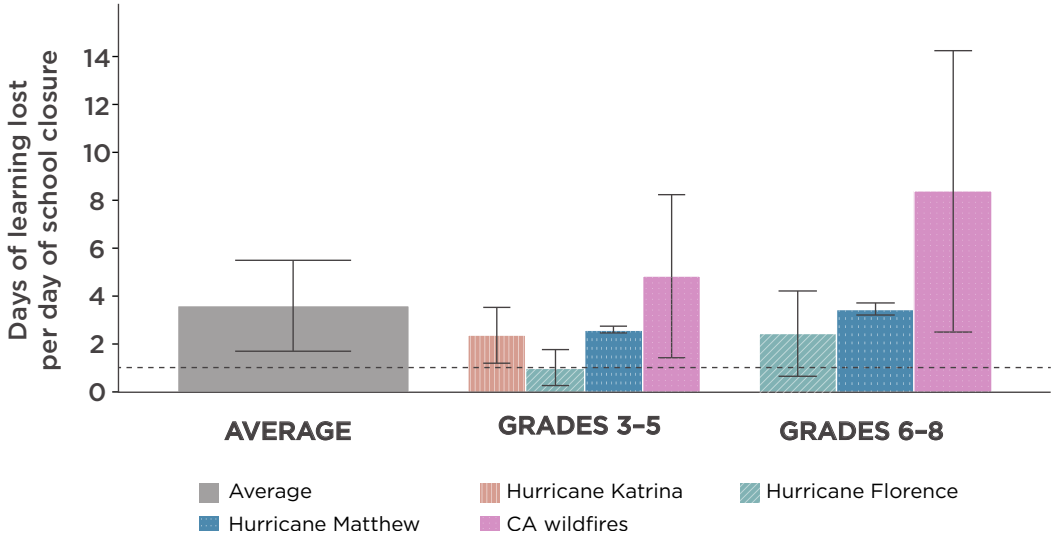
Severe weather and its corresponding school disruptions can have wide ranging effects on students, including academic achievement, mental health, and physical well-being. Negative effects on students can stem from a combination of school mechanisms (lost instructional days, damaged buildings) and direct

impacts of severe weather on students and their families and communities (housing insecurity, exposure to environmental stressors, lost household income).

Student achievement. A growing body of research has demonstrated that severe weather events can have sizeable (but varied) effects on student achievement. Detailed studies of students' test scores after weather-related school closures were conducted following Hurricane Katrina in Louisiana, Hurricane Florence in North Carolina, Hurricane Matthew in North Carolina, and wildfires in California. To better understand the academic cost of lost instructional time, we reviewed findings from these studies to summarize how days of school closure have translated into days of learning lost across different events and contexts.

Figure 1 shows the estimated days of learning lost[1] (calculated based on state end-of-year test scores) for each school day closed due to a hurricane or wildfire. In other words, it reflects how much academic ground was lost for every day students were out of school. There are two key takeaways from this figure. First, days of learning loss outpaces the actual number of days a school stays closed: a school closure day is tied to an average of 3.6 days of learning lost. While we might expect missing one day of school would correspond to a single day of learning, these results suggest that missed instruction is compounded with other on-going disruptions to students' lives and routines (both in and out of school) that lead to larger than expected test score declines. Second, there is a lot of variability in how achievement is impacted across these events. For example, impacts were inconsistent across the three hurricanes studied. These differences could be due to factors like the length of the disruption to schooling and the resources available to schools to address student needs.

Figure 1. Estimated days of learning lost per day of school closed due to severe weather



Note: Severe weather results were pulled from Morrill and Westall (2023); Fuller and Davis (2021); Luo and Xu (2005), and Sacerdote (2012). Estimates in standard deviation units of test score declines per day of school missed were benchmarked against typical year-to-year growth estimates reported by Hill et al. (2008) and then rescaled into days of learning (assuming 180 days in a standard school year). In standard deviation units, these estimates range from a 0.005 to 0.015 SD (average=0.0069SD) drop per day of school closed. Only results for math are shown here, but reading results were similar. The dashed line at 1.0 represents a one-to-one loss (i.e., one day of missed school resulting in one day of unrecovered learning).

1 The studies reported (a) standardized drops in test scores at the end of the disrupted school year and (b) the length of school closures. We calculated the estimated drop in test scores per day of school missed and benchmarked these estimates against expected gains for a given grade/subject. For more information about the calculations (and limitations) of days/months of learning metric, see Kuhfeld et al. (2024) or Baird & Pane (2019).

While closures are one clear way weather disrupts learning, even when schools remain open, environmental conditions like extreme heat and poor air quality can also have a negative effect on student learning. For students in schools without air conditioning, a 1°F hotter school year reduces that year's learning by 1 percent. Extremely high temperatures (over 100 degrees) during the school year have also been shown to decrease math and reading test scores. Meanwhile, poor air quality can also impact learning. Wildfire smoke exposure during the school year is linked to measurable declines in student test scores, particularly for younger students. Research suggests these declines can translate into long-term disadvantages—contributing to lower future earnings, particularly in economically disadvantaged districts.

Student mental health. Severe weather can have both short- and long-term effects on children's mental health. These impacts are often dependent on several factors including the type of weather event, how long the event and its aftermath lasted, and how many different aspects of a child's life it touched. Severe weather events, especially those that escalate quickly like wildfires and flash floods, can lead to a rise in anxiety, post-traumatic stress, and depression in children. Without additional supports, these mental health challenges can have long-lasting impacts on students' learning and development.

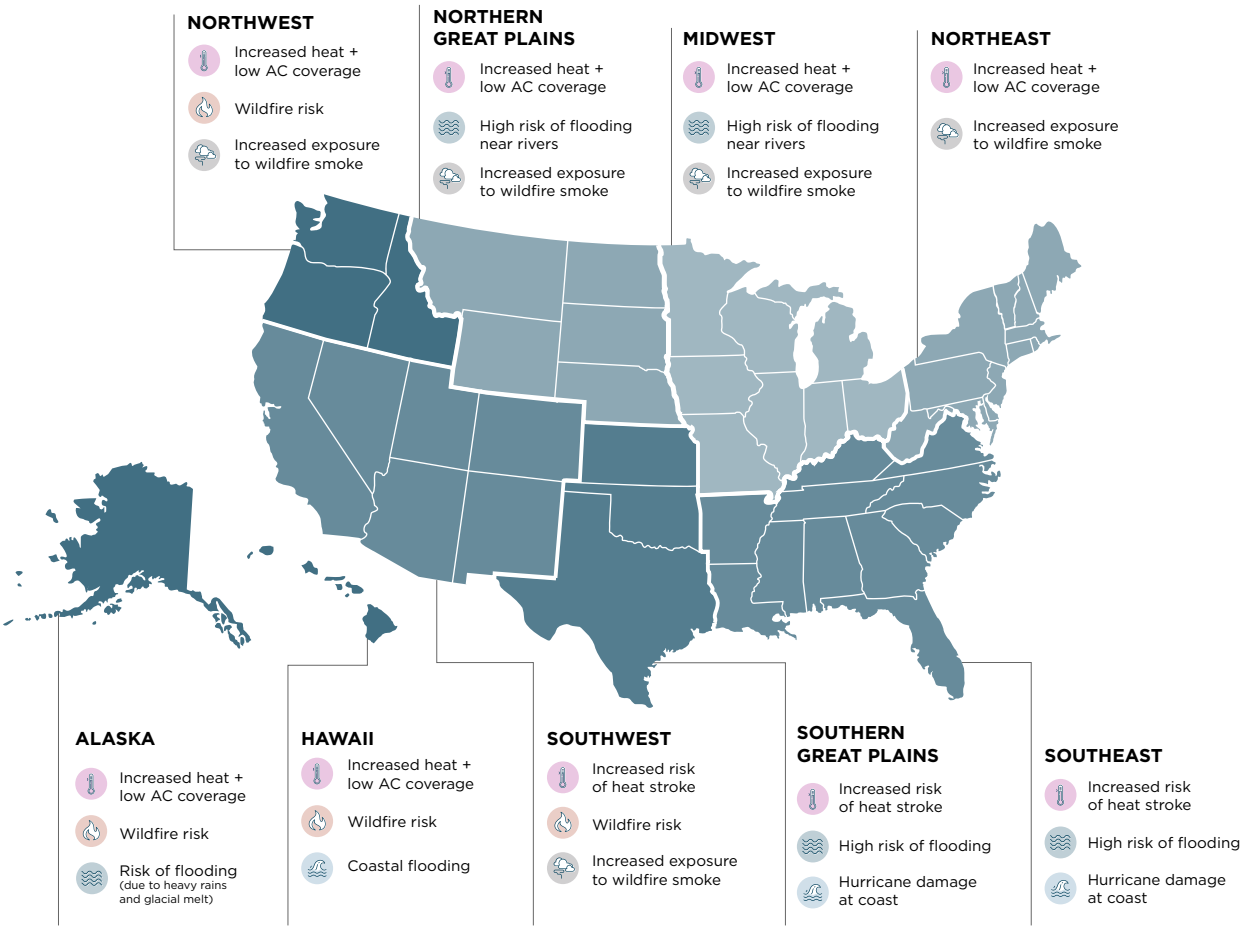
Student physical health. Extended exposure to extreme heat and poor air quality can have long-term impacts on students' physical well-being. These exposures are associated with long-term neurological issues and increased rates of childhood asthma. Additionally, acute exposure to mold after flooding or smoke after wildfires can lead to respiratory problems, fatigue, and cognitive difficulties that interfere with students' ability to concentrate and learn in class. These physical implications say nothing of the risks of severe injury or death that can occur during a major hurricane like Katrina or the recent floods in Texas.

Which schools and communities are at most risk?

Beyond understanding the effects of extreme weather on schools and students, it is equally important to examine which communities are most vulnerable to these disruptions to inform districts' decisions on advanced planning. Local vulnerability can be evaluated through multiple publicly available resources, including the US Climate Vulnerability Index and the FEMA National Risk Index. While the threat of severe weather is growing across the country and can be unpredictable, some areas remain uniquely vulnerable to severe weather events. An estimated quarter of all public schools are in census tracts that face a very high risk of severe weather.

Figure 2 highlights the severe weather risks that are projected to be the biggest threats in each region of the country. Extreme heat is a threat across most of the country. In the Northwest and Southwest, some of the largest risks come from wildfires, while the South and Midwest face greater inland flooding risks. It is important to keep in mind that, while some parts of the country have low relative risk for the most destructive severe weather events like hurricanes or wildfire, these communities still face elevated risks for health effects and missed learning due to air quality and increased heat exposure.

Figure 2. Severe weather vulnerability across the United States



Note. This figure summarizes information about the risk of specific severe weather events gathered from reports published by the EPA and the CDC.

Beyond geographic variability in vulnerability, the effects of severe weather on students are not uniformly felt. Families of color and students in socially vulnerable communities are at higher risk when severe weather strikes. Since the majority of funding for school facilities comes from bond or tax measures voted on locally, there are pronounced racial/ethnic and socioeconomic inequities in who has access to modern and safe school buildings. Black and Hispanic students experienced reductions in test scores due to extreme heat at a rate that was three times as large as those of White students. After Hurricane Katrina, mental health challenges were higher among racial and ethnic minority youth, likely because their families were more likely to be displaced by the hurricane while having the least access to support.

Conclusion

Severe weather events are no longer isolated anomalies. They are becoming a regular part of the school year in communities across the country. This brief highlights how severe weather events can cause deep and lasting disruptions to student learning and well-being, often in ways that far exceed the immediate days schools are closed. It also makes clear that while some communities are disproportionately at risk, no school is immune. Below, we highlight our key takeaways from this brief:

1. **Many schools face major budget and infrastructure challenges related to severe weather.** Given the age and poor conditions of school infrastructure nationally, school districts are having to spend more to replace or repair heating and cooling systems in anticipation of more frequent severe weather. Inequities in funding for school facilities, which primarily comes from local taxes and bond measures, can contribute to inequities in student outcomes.

2. **Teachers need support to meet students' varied needs.** After school disruptions, teachers must balance meeting students' academic and mental health needs. To do this well, teachers need guidance on how to cover the year's curriculum in a constrained timeline as well as additional resources and training to handle students' mental health and behavioral struggles.

3. **A day of school missed after severe weather can translate to more than a day of learning lost.** Our summary of the research on the effects of severe weather on test scores indicate that there is not a 1:1 correspondence between the amount of school missed and days of learning lost. Missing one day of school due to canceled school days can translate to academic losses that are two to four times greater than the missed instructional time itself. This may be because these disruptions don't just impact instructional time but also present a number of other challenges that may make it harder to concentrate on learning when students do return to schools.

4. **No school is totally "low risk."** While certain areas and groups of students face known predictable risks, almost no area in the United States is completely devoid of extreme weather. In the last few years, places that were historically deemed to be at lower risk, like the mountains of western North Carolina and urban/suburban communities in Los Angeles, faced massive damage from floods and wildfires. While there are some schools who are uniquely vulnerable, all school districts should be planning for the potential of a severe weather threat.

This brief focuses on raising awareness of the scale and variation of educational impacts from weather-related disruptions, and of the communities that are exposed. In our second brief (forthcoming), we will shift from problem to response, highlighting lessons learned from school systems that have weathered disasters and outlining concrete actions districts can take to build resilience.

ABOUT THE AUTHORS

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