

Climate and crime: How temperature change could impact future law enforcement

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Abstract

Established research reveals a connection between temperature and crime, but the nature of this relationship is contested. Some believe the correlation is linear, with crime increasing directly with heat, while others claim the relationship is curvilinear and expect an inverse effect to occur after a peak temperature. While other factors play a role in the rise of violent crimes, law enforcement agencies must be aware that the effects of climate could change the dynamics of their work.

Introduction

Weather has long disrupted policing. From thunderstorms to natural disasters, the elements impede law enforcement operations by making driving difficult, wreaking havoc on structures or impacting the comfort and mood of local citizens. With weather patterns and atmospheric conditions shifting around the planet, law enforcement departments will be confronted with new conditions under which they must continue to meet their mission of public safety.

The United Nations Intergovernmental Panel on Climate Change reported that the average global temperature has increased since 1880. Data

collected by the group over the past 50 years points to less frequent cold days, cold nights and frosts, and more extreme weather¹.

As average temperatures increase around the world, communities in the U.S. are likely to experience new local weather patterns that will alter the behavior of their residents. A significant amount of research demonstrates a connection between high temperatures and violent crimes. Understanding the nature of this relationship will allow law enforcement agencies to anticipate long-term changes in officer training, equipment acquisition and human resources.

Temperature influences criminal behavior

Through his analysis of 30 years of crime and weather data², economist Matthew Ranson showed that “temperature has a strong, positive effect on criminal behavior, with little evidence of lagged impacts.” Ultimately, his research found that higher temperatures correlate with more instances of crime, a relationship Ranson claims will continue as global warming raises average temperatures around the world.

Other researchers reached similar conclusions. A 2001 report by University of Iowa professor Craig Anderson stated that murders and assaults across the U.S. increased by 2.6 percent during the summer months. In Cleveland, researchers found an uptick in aggressive crimes between 1999 and 2004 that was associated with warmer temperatures³. Conversely, some cities experience a drop in crime when colder weather strikes. Members of the Atlanta Police Department said that when the metro area was iced over in the winter of 2012, the city had its lowest crime rates of the year⁴.

Factors contributing to this relationship could be cyclic. One study found that violent crime in Chicago increased on Saturdays, Sundays and Monday throughout the summer⁵. The weekend spikes may be due to an influx of people who share public spaces for recreation when they aren’t working. The summer weather brings more personal possessions outdoors too, increasing both the temptation to steal valuables, and the probability for angry or violent reactions to that theft. In the summer, people are also more likely to drink alcohol⁶, which can escalate confrontations.

Similarly, a rise in criminal activity could be attributed to students’ being out of school on break, which occurs in the U.S. during the warmest months of the year. Juveniles are the group most likely to commit crimes, and when they are not attending school, there is more opportunity for them to become entangled with the law⁷.

It should be noted that while undoubtedly a factor, scheduling cannot

1. It is almost certain that hot temperature extremes over land will become more frequent as global temperatures increase, and these heat waves are likely to grow longer in duration (IPCC, 2013).
2. Analysis of monthly crime and weather data included 2997 U.S. counties. It controlled for state-by-month and county-by-year fixed effects (Ranson, 2014).
3. Research of 2009 citywide data by Paul Butke and Scott Sheridan accounted for season, time of day and day of week. The researchers showed that the highest rates of aggressive crime occurred during summer and the lowest, during winter (Dahl, 2012).
4. The Atlanta experience is anecdotal. However, other law enforcement agents report similar experiences. As former New York City police officer Eugene O’Donnell says, “Jack Frost is the best policeman” (Dahl, 2012).
5. In addition to the 1977 Chicago summer data, researchers examined data from Houston in 1980-82, which confirmed a link between crime rates and days of week (Anderson & Anderson, 1984).
6. Rhode Island researcher Mark Wood, for instance, found an increase in alcohol consumption by teens in the summer prior to college (URI, 2010).
7. Laura Brinkman, a former associate director of the University of Chicago’s Crime Lab, said there is no clear causal explanation for summer increases in crime in urban settings (Jerpi, 2011).

be solely responsible for crime fluctuations. If it were, the temperature-crime relationship would disappear should the schedule change. A simple switch from an extended summer break to a longer winter break would automatically reduce the level of crime. This, however, is unlikely to happen.

The link between crime and geography is more substantial.

A 1987 study by Craig Anderson revealed that geographic differences in violent crime are related to the temperatures of cities⁸. Accounting for social, demographic and economic variables, Anderson showed that hotter quarters of the year produced more violent crimes, regardless of location. Interestingly, the link between temperature and violent crimes—including murder, rape and assault—is stronger than between temperature and non-violent crimes, such as larceny, theft, robbery and burglary. Crime maps indicating the amount of violent crime per capita by state confirm that, in general, the hot South suffers more than the cooler North⁹. The South is particularly violent with regards to murder, aggravated assault and property crimes.

The influence climate change has on crime rates could have a massive effect around the globe. According to a 2014 study¹⁰, the frequency of interpersonal violence increases by about 4 percent for every 1 standard-deviation (SD) shift away from the local norm toward either a warmer climate or more extreme rainfall. Interpersonal conflicts also rise with this change by 14 percent. Because global warming is expected to raise temperatures anywhere from 2 to 4 standard deviations by the year 2050, a major increase in violence and criminal activity could be on the horizon worldwide.

One way to explain these numbers is that, when the weather gets uncomfortably hot, people are prone to irritability. Discomfort can translate into angry outbursts. The warmer temperatures that bring people outdoors also increase the chance they will encounter other people, leading to more opportunities for irritability to turn to violence.

Does crime have a peak temperature?

According to the Ranson study, rising temperatures due to climate change can be expected to add as many as 22,000 murders, 1.2 million aggravated assaults, 260,000 robberies and 180,000 cases of rape between 2010 and 2099. Though Ranson's projections reflect only a small percentage increase over current statistics, the U.S. police force would have to grow in size by 4 percent to respond to the rise in crime. The costs of fighting these additional crimes would range anywhere from \$38 billion to \$115 billion¹¹.

8. Two studies confirmed that violent crime was more prevalent in hotter quarters and years, and that the temperature-crime link was stronger for violent than for nonviolent crime (Anderson, 1987).

9. According to the FBI 2012 crime statistics report published by Business Insider, the South had been and remained particularly violent for many years (Lubin, Nudelman & Fuchs, 2013).

10. Researchers synthesized 60 primary studies and 45 data sets on global climate and human conflict from 10,000 BCE to present day (Hsiang, Burke & Miguel, 2013).

11. Ranson used 15 separate climate models to estimate the cost of a 5-degree rise in global temperatures over the next century. Each model gave him a range of crime rates (Ranson, 2014).

Such math is possible when researchers like Ranson presume the temperature-crime relationship is linear—the higher the temperature gets, the more crime increases, regardless of how hot the environment becomes. There is indeed some evidence to back up this position. A 1984 report determined that the relationship between heat and crime in the cities of Houston and Chicago was linear¹², and Ranson’s earlier work showed similar statistical patterns, especially with regard to violent crimes like assault. Property crimes, such as burglary, did show a peak in temperature: these crimes level off after reaching 40 degrees Fahrenheit¹³.

Research from Arizona State University also showed a linear relationship with temperatures for horn honking among drivers¹⁴. The results were more pronounced when the data was restricted to include only those drivers who had their windows rolled down and presumably no air conditioning to provide relief from the heat.

Importantly, though, a 2012 study of daily ambient temperature and violent crime in Dallas from 1993 to 1999 found that the relationship between the two was curvilinear rather than linear: at one peak temperature, crime decreases as heat continues to rise¹⁵. This analysis determined that temperatures contributed to an increase in aggravated crime up to 80 degrees Fahrenheit, but then the effect lessened. Moreover, once the temperature hit 90 degrees Fahrenheit, temperature and crime were negatively correlated. Before this critical point, analysts suspect, warmer temperatures drew people outside to face more opportunities for crime. Eventually, though, the increasing heat became so oppressive, it pushed people back inside for shade and air-conditioning.

Spending time indoors is equated with lower crime rates, even when temperature is not the motivation to remain inside. A study from the University of California, Berkeley, found that major sporting events correlate with large drops in all types of crime in the Chicago area, and the researchers believe that this decrease can be attributed to fewer potential offenders and victims in public¹⁶. Additionally, during the Super Bowl—generally the most-watched television broadcast in the U.S.—the crime rate in Chicago dropped by an average of 25 percent.

The precise nature of the connection between temperature and violent crime is difficult to test. The higher temperatures anticipated by climatologists for the future are not common now, and no research has been done to investigate how long it might take for high temperature to contribute to a criminal act. For instance, the time of a crime is rarely distinguished in these studies. Critics of temperature-crime research note that most assaults occur between 9 p.m. and 3 a.m., characterized by a

12. Analysis in both studies showed no evidence of curvilinear trends (Anderson & Anderson, 1984).
13. The study compared current and lagging temperatures, with all coefficients relative to a 60 to 70-degree day. Temperatures were binned in 10-degree intervals with all temperatures 90 degrees and above grouped together (Ranson, 2012).
14. A study conducted during spring and summer in Phoenix, Arizona, examined the influence of ambient temperatures on responses of other drivers to a car stopped at a green light (Kenrick & MacFarlane, 1986).
15. The Negative Affect Escape Model predicts that violence associated with temperature increases only to the point when the flight response (e.g., avoid the heat) overpowers aggression (Gamble & Hess, 2012).
16. During an NFL lockout, Super Bowl MVP Ray Lewis claimed: “If we don’t have a season ... watch how much crime picks up if you take away our game.” Inspired by this idea, researchers analyzed Chicago crime data in half-hour intervals and cross-referenced this data with professional sports schedules (Copus & Laqueur, 2014).
17. Responses to two studies that establish a link between crime and temperature re-examined original data. One of these responses looked at the hottest times of the day and hottest months of the year. The other compared the six-hour periods of the day marked by the highest and the lowest crime rates. Neither of these responses confirmed a curvilinear relationship between crime and temperature (Bushman, Wang and Anderson, 2005).

natural temperature drop after nightfall¹⁷. Time of day may prove less of a factor, however, than time spent enduring a particular temperature. Crime may lag behind the conditions that helped motivate the behavior.

Law enforcement agencies are interested in the resolution of this debate, since temperature could be included in crime forecasts that impact budgets and other resource management. A linear relationship likely means all agencies should expect crime to rise, as Ranson projects. A curvilinear model, however, may benefit Southern cities at the expense of their Northern counterparts, creating opportunities to migrate resources rather than increase them.

Law enforcement must adapt to future crime

Forecasting future crime is difficult. Nonetheless, there are many opportunities for agencies to take advantage of data offered to them. Currently, law enforcement departments are testing predictive analytics to generate leads on the possible locations of future crimes.

In Santa Cruz, California, an early test run of technology called PredPol reduced burglaries by 19 percent, even though the police department had just experienced a 20 percent decrease in staff and a 30 percent increase in other types of crime¹⁸. While many of these technologies rely on geography and crime history to anticipate the location of criminal behavior, weather also plays a role.

In a similar fashion, temperature projections might be used as data that influences the potential distribution of law enforcement resources.

Due to the relatively slow rate of global warming, police departments have time to adjust to changes in weather patterns. However, their strategies vary considerably depending on how law enforcement interprets the data. Crime projections derived from a linear relationship to temperature (i.e., violent crimes will rise everywhere) will produce scarcity over time, and thus present a more critical long-term problem than the curvilinear interpretation (i.e., violent crime hot spots will shift north).

Ranson's linear projections of an ever-growing crime spree¹⁹ translate to significant budget increases for everyone. His analysis might be too sweeping. Regardless, there is little doubt that at least some cities will experience temperature-related shifts in criminal behavior. Therefore, in addition to providing ample infrastructure for emergency response, affected departments will have to invest more in payroll, training and technology to outfit each officer with necessary knowledge and tools.

18. PredPol calculates crime forecasts by considering the times and locations of previous crimes and the sociological data about criminal behavior. The resulting heat map shows where, based on history, crimes are more likely to occur (Kelly, 2014).

19. Ranson used current crime rates in combination with projected temperature increases to predict a 2.2 percent increase in murders and 3.1 percent increase in rapes. His analysis also suggests that cold weather presents obstacles to non-violent crime (Ranson, 2014).

These officers will have to battle the vicious cycle that comes when a community is exposed to increased crime.

Crime begets crime, threatening public safety. As people see others carrying out violent acts, the desire to adhere to laws or rely on law enforcement may wane, especially as regions are forced to allocate more funds toward economic and disaster recovery and away from other social programs²⁰.

Programs aimed at reducing crime and rehabilitating suspects—whether focused on physical welfare or emotional needs of at-risk individuals—could face significant strain from more frequent and severe violence. Such stressors could decrease the effectiveness of these preventative programs and put them in jeopardy of losing funding or community support.

Local departments may also have to contend with rising population rates. A recent study by a team of U.S. professors found that a rise in temperature above an average of 77 degrees Fahrenheit corresponds to an increase in outmigration²¹. The impact of climate change on population was more prevalent than natural disasters, potentially due to the long-term economic or environmental difficulties.

Since climate change is expected to increase the degree and frequency of weather volatility, natural disasters like floods and hurricanes could also challenge local law enforcement. A report from the European Parliament predicted that occurrences of flash floods, droughts and heat waves will plague new regions that have not yet had to work out emergency responses to such events. Additionally, the severity of hurricanes will grow, resulting in a 30 percent rise in the most intense category of storms by the year 2100²².

Disasters tax the resources not only of federal and state emergency agencies but also of local law enforcement, which will have to play a larger role in disaster response. In addition to its regular function, law enforcement will have to expand training and purchase specialized equipment. Disasters are known to increase the strain on individuals, thus also leading to spikes in criminal behavior²³.

Not all small and mid-sized cities are well equipped to deal with these changes. As criminal patterns shift, regions accustomed to less crime may need to reconsider their recruitment practices, acquire lighter uniforms and equipment, stock supplies of water, and require special training to diffuse tense situations resulting from added community stress.

Efforts to mitigate violent crime in the region benefit from stronger

20. Criminologist Robert Agnew argues that by the end of the century, the global cost of climate change will impact up to 60 percent of the workforce in developing nations and up to 20 percent of GNP, numbers significant enough to lessen local and regional resources (Agnew, 2012).

21. Analysis of data from 7,185 Indonesian households over a 15-year period showed that permanent outmigration increases after temperatures reach 25 degrees Celsius. Natural disasters also cause outmigration, but in this case, it is usually temporary (Bohra-Mishra, Oppenheimer & Hsiang, 2014).

22. Modelling indicated increases in greenhouse gas concentrations drive more severe weather: heat waves will occur every other year, and precipitation changes will yield more flash floods and droughts (Anderson & Bausch, 2006).

23. Natural disasters could also lead to crime reduction, as communities pull together to address physical and emotional damage. When disaster strikes a community with economic disparity, however, resource scarcity is more likely to lead to outbursts of negative emotions and crime. (Agnew, 2012).

collaboration with other departments. Departments that lack experience in dealing with rising crime rates, for example, could require further training. Those that suffer from manpower shortage might enjoy the benefits of technology capable of filling in any skill gaps.

Law enforcement agencies may not be able to make firm predictions about how temperature change will impact criminal activity, but understanding past crime-temperature relationships—and tracking how each community is adapting to new weather patterns—will inform future law enforcement strategy. This knowledge may not help officers prevent crime altogether, but it will place them in a better position to respond to future emergencies.

Conclusion

Economist Matthew Ranson's projections for law enforcement put a \$115 billion price tag on climate change. While that figure may be disputed, there is little doubt that in the future some cities will experience temperature-related shifts in criminal behavior.

There is no scientific evidence that hot weather causes crime, but experts have found strong correlations between rising temperatures and an increase in crime. Researchers note that incidents of violent crime, in particular, are more likely to spike during the hottest times of the day and year. Changes in climate—such as rising temperatures, longer periods of drought and natural disasters—may prompt people to act irrationally, thus significantly impacting the work of emergency responders.

Officers must anticipate how weather shifts will alter their available resources and workload in the future. Locations already prone to natural disasters will experience these disasters in greater number and intensity. In other places, weather patterns will evolve, creating new demands for resources, infrastructure and expertise. When disaster strikes a community suffering economic disparity, resource scarcity is more likely to lead to outbursts of negative emotions and crime. Familiarity with these dynamics could help first responders adjust their strategies to be better prepared to keep the public safe.

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