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‘Climate change’ and its bearing on violent crimes in a Rio Grande Valley City in Texas

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‘CLIMATE CHANGE’ AND ITS BEARING ON VIOLENT CRIMES IN A

RIO GRANDE VALLEY CITY IN TEXAS

A Thesis

by

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ABSTRACT

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Previous theories have attributed aggression to biological influences but this thesis will focus on the frustration-aggression hypothesis. If such a theory is relevant, weather may have an effect on violent crime. This study intends to answer whether a relationship between violence (specifically violent crime) and warm temperatures exists and what type of relationship exists. The study tests the hypothesis that warm temperatures will have a positive association with violent crime. Based on secondary data the Part I Index crimes (Violent) or murder rape, robbery, and aggravated assault were collapsed into two variables, 'Violent' which omitted robbery and 'Violent 2' which included all four. It is also important to note the effect recent and further climate change has and will have in the future in regards to violent crime. If such an effect is possible, criminal justice agencies already understaffed may be bombarded with more paper work and calls for service.

Keywords: weather, violence, climate change, aggression, temperature

DEDICATION

The completion of my thesis would not have been possible without the support and patience of my friends, family, and thesis committee. Thank you to my mother, Blanca Estella Valdez, my father, Robert Valdez, my sister, Kristin Ashley Valdez, my grandmother, Maria Delia Saldana, and my step-mother and friend, Anna Maria Alvarado for putting up with my stress and frustration, for offering words of encouragement and just understanding of my situation. To Mrs. Maria Rodriguez for being like a second grandmother to me and treating me as if I was her granddaughter. Thank you to my home church, Destiny through Christ which has helped me become more patient. Thanks to my friends, Raul Roel Ramos, for the pep talks and the laughs, Orlando Diaz, Cassi Amaya, Carlos Ozuna, Rosie Rodriguez, Irene Judith Guerrero, Adriana Chavez, and Nancy Lopez for just being my support at times.

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CHAPTER I

INTRODUCTION

This interest of this thesis is to answer the questions: Does a relationship exist between hot/warm weather and the prevalence of violent crime (including specifically murder, rape, and aggravated assault) in McAllen, Texas? What type of relationship exists? Does the relationship support the hypothesis or fail to support the hypothesis?

The hypothesis for this thesis is that data will show a positive association between high (hot) temperatures and violent crime. The hypothesis is specifically based on the frustration-aggression hypothesis that hotter temperatures will lead to increased violence, whether by increasing frustration that leads to negative affect which will increase aggression through misinterpreted or direct social encounters as well as frustrating situations that caused aggression to become displaced.

This thesis will analyze secondary data from the Uniform Crime Report data for the city of McAllen, Texas from 2001 to 2010 in relation to monthly mean temperatures. The violent crime data will use Part I Index violent crimes (i.e. murder, rape, robbery, and aggravated assault.Violent crime (i.e. murder, rape, robbery, and aggravated assault) is used to test for aggression while temperature (i.e. mean temperature, average maximum temperature, and high temperature) is used to test for frustration and is noted as a stressor.

This study focused on the city of McAllen located in the Rio Grande Valley of South Texas. Due to the study being based in McAllen, Texas, demographics are discussed in regards to population, culture, and other factors. The comparison between the Rio Grande Valley with the state of Texas and the United States may also be noted.

This thesis notes several studies that relate violent crime to temperature in specific hot temperatures. As an introduction to aggression noted are also several theories of aggression including some instinct, biological, environmental, psychological, and sociological.
There are several theories of aggression and violence that may be applicable to this thesis.

Theories of Violence

Instinct Perspectives & Biological Theories & Explanations

Aggression has been thought by some to be a primal instinct that has been acquired from our ancestral history. Science has found a positive DNA relationship between chimps and humans. According to Lovgren (2005) a writer for National Geographic News noted that "Scientists have sequenced the genome of the chimpanzee and found that humans are 96 percent similar to the great ape species". According to the study, Lovgren (2005) further notes that humans and chimps may have originated from a common ancestor and the scientists conducting the study believe they diverged about six million years ago, which can account for the few important mutations that may be responsible for the differences between the two species, noted Wen-Hsiung Li, a molecular evolutionist at the University of Chicago in Illinois.

Since science has found a correlation to a common ancestor, we can deduct that chimps and humans have divergent yet similar aggressive tendencies. For example, a pet chimpanzee with no history of violence attacked the owner's friend who had just stopped by (O'Rourke, 2003). According to Teelen (2008) chimpanzees have been known to target and hunt lower order primates such as the red colobus while Gibbons (2007) notes their hunting of bush babies with spears. As we can see, these are some of the reasons why aggression has been attributed to biological reasons for centuries.

Aggression is like most behaviors which are attributed to innate human nature. Lorenz (2002) proposed aggression was born from a fighting instinct. Some scientists have attributed the aggressive behavior to the course of evolution which promoted survival of the species or as Darwin noted "survival of the fittest." This was a safety mechanism that made sure only the strongest genes were passed on to future generations making them stronger and better to adapt. Aggression is thus an instinct hence the modern instinct theory. According to this theory, there is the assumption in social biology that the aggressive behavior/gene increases the likelihood of survival and reproduction. Most social psychologists tend to be somewhat critical of such a theory as levels of some form of aggressions tend to vary greatly among various societies like that of the Tasaday and the Yanamano Indians (Ferguson & Eyre, 1998, 1999). The huge differences in regards to aggressive behavior indicate the great influence cultural as well as social factors have in regards to aggression. On the other hand, while aggression may differ greatly throughout culture and even within cultures as people have different tendencies, we must remember how we feel when someone tries to harm a relative or a stranger becomes to comfortable with our personal space (Ferguson & Eyre, 1998, 1999). Biological theories focus on physical and physiological attributes that predispose certain individuals to aggression..

Environmental, Social, Psychological, and Cultural Theories & Explanations

Although aggression may have an underlying link to biological influences, there is also evidence that certain external stressors can cause underlying aggression to surface. For the sake of this paper, I will use high temperatures as the stressor and note the incidence of violence in the crime data. Theories that relate to such stress and high temperatures include the excitation transfer/misattribution theory, direct provocation, and frustration-aggression hypothesis as well as some external factors. In regards to external factor theories, there exists cognitive, drive, and social explanations. In regards to cognitive theories, Ferguson and Eyre (1998, 1999) find that aggression is not simple but yet a rather complex interplay among various factors such as scripts, affective states (moods), attributions, and other factors like memories (e.g. Post-Traumatic Stress Disorder) or environmental stressors (e.g. temperature, noise, or crowding).

Hostile-Attributional Bias. An example of a cognitive theory is that of hostile-attributional bias. Several studies of adolescents have shown a tendency to perceive malice in the action of others and further doing so shows a relation with high/higher levels of aggression (Ferguson and Eyre, 1998, 1999). Dodge et al. (1986) had a similar finding that the greater the tendency boys had in attributing hostile intentions to others, the greater their tendency was to engage in aggressive behavior while playing with others (Ferguson and Eyre, 1998, 1999). The problem with such studies is that not everyone has been able to replicate them.

Direct Provocation. Another hypothesis exists on the concept of direct provocation. Direct provocation refers to the fact that the actions by others trigger aggression but only if someone perceives them to stem from malicious intent and therefore is a support for aggression/aggressive behavior (Ferguson and Eyre, 1998, 1999). A study by Harris (1993) found that both males and females have found physical as well as verbal aggression to provoke the most anger (Ferguson and Eyre, 1998, 1999). In regards to provoking anger in females, they are more likely than males to respond aggressively to condescension and insensitivity (Ferguson and Eyre, 1998, 1999). Males on the other hand are more likely to be provoked by casting aspersions in regards to their sexuality, incompetence as well as physical threats (Ferguson and Eyre, 1998, 1999).

Frustration-Aggression Hypothesis. The frustration-aggression hypothesis is considered a drive theory. Such drive theories suggest that aggression stems from external conditions that provoke the motive to harm others (Ferguson and Eyre, 1998, 1999). The hypothesis was developed in 1939 by a group of social psychologists (i.e. Dollard et al.) (Berkowitz, 1989, Ferguson and Eyre, 1998, 1999). Their explanation was that frustration caused aggression, and further that catharsis is the reduction that occurs in the aggressive drive following an aggressive act (Ferguson and Eyre, 1998, 1999). In this explanation, frustration is noted as the interference with goal-directed behavior which then arouses a drive with the primary goal of harming a person/object which is usually the perceived cause of the frustration (e.g. a coke machine) (Ferguson and Eyre, 1998, 1999). Although early tests of this theory were most successful, criticisms were noted in regards to the fact that frustration does not always result in aggression nor is aggression always the result of frustration, that frustration only leads to aggression when the intention is meant to hinder a person, and in regards to catharsis, the drive that is believed to work.

This explanation was revised by Berkowitz (1989) who proposed the incorporation of not only cognitive but also affective factors. His revision notes frustration as only one of many factors that may and can stimulate such negative affect. Frustration according to Berkowitz (1989) is an aversive experience which thus leads to aggression due to its unpleasantness which arouses such behavior. Berkowitz (1989) further makes the distinction that frustration at times leads to aggression due to a basic relationship between negative affect and aggressive behavior (Ferguson and Eyre, 1998, 1999). Aggressive behavior thus comes about if a frustrating event is seen or perceived as maliciously intended. The latter helps in explaining why unexpected, illegitimate and unjustified frustration has been known to produce stronger aggression. This is presumably because it tends to produce more negative affect than frustration which is expected or justifiable behavior.

Transfer/Misattribution Theory. Both the excitation transfer theories as well as the misattribution theory were developed by Zillman in 1983 and 1988. The tenet of the transfer theory is the arousal of the sympathetic system which facilitates the presence of aggressive behavior. This theory notes that one situation not only can persist but intensify emotional reactions that occur in later situations. Such a reaction of aggression is more likely to occur when the person is unaware of the presence of the lingering arousal or happens to recognize it but attributes it to the current situation. In 1994, Zillman expanded on his original theory to include the interaction between that of cognition and emotion. Emotion-arousing events can be reevaluated through our cognitions which can thus influence our emotional reactions. Arousal on the other hand can also influence our thoughts which produce a cognitive deficit (i.e. a reduced ability to rationally plan or even evaluate the consequences and outcomes our behavior will bring about.

Other Factors. There are other factors that may be involved with aggression include temperature, aggressive cues, noise, and crowding. According to Ferguson and Eyre (1998, 1999), hot weather has the ability to affect people's moods—usually negatively, and such bad/negative moods may lead them to respond to frustration in an aggressive manner. Another factor that can trigger aggression/aggressive behavior are aggressive cues. According to Harris (1976), Berkowitz (1962, 1964, 1969, 1978, 1982, 1989) and Worchel *et al*. (1976) the presence of aggression-associated cues act like triggers for hostile outbursts such as appropriate situational stimuli (e.g. guns) or stimuli associated with either reinforcement for aggression (Berkowitz, 1974) or aversive events (Berkowitz, 1982).

For the purpose of this thesis and study, the focus will be on hotter temperatures effect on frustration that increases aggression and leads to increased violence. This thesis will therefore base its argument on the frustration-aggression hypothesis, noting hot temperature as a conductor for frustration that in uncomfortable situations creates negative affect and leads to violence.

CHAPTER II

SURVEY OF THE LITERATURE

The idea that uncomfortable temperatures can have a relationship with increases in aggression has been rampant since the early 1800s (Anderson, 1989). The notion that not only weather and other related factors can affect aggressive behavior and thus violent crime has been a topic of various laboratory, field, correlation and archival studies that have indicated that hotter temperatures associate with higher levels of aggression (Anderson, 1989, 2001; Anderson & Anderson, 1998; Anderson, *et al.*, 2000). Some studies have also compared the violence rates of specific regions differing in climate and found hotter regions tended to have higher violent crime rates (Anderson & Anderson, 1996; Lombroso, 1911). Time period studies also found a relationship with relatively higher violence rates not only in hot years, but also in seasons, months, and days (Anderson *et al.*, 1997; Leffingwell, 1892). Field and archival studies find a similar relationship as they note a positive relationship between temperature and number of major league batters who have been hit by pitched balls (Reifman *et al.*, 1991). Some have found data that supports such a theory, while some have found no relation or further have found the opposite of such a hypothesis (Landau & Fridman, 1993; Modai *et al.*, 1994; Schory *et al.*, 2003).

Early studies to the 1960s

In an earlier study, Leffingwell's (1892) statistics tend to show clearly that crimes against the person tend to be proportionately more numerous in warm climates as opposed to crimes against property which tend to be more frequent within cooler regions (as noted in Mosby, 1913, p. 5). Mosby (1913) also noted that within the warmer climates of Italy and Spain the maximum of murders existed in Europe, on the other hand the cooler regions of England, Scotland, and Holland tended to have the fewest murders in proportion to population (p. 5). Another study by Enrico Ferri (n.d.) also demonstrated that in France the summer season tended to account for the greatest number of crimes against the person (as noted in Mosby, 1913, p. 5). He further mentioned that in winter, crimes against property reached its maximum, which seems to support Leffingwell's (1892) findings (as noted in Mosby, 1913, p. 5). Durkheim (1951) reported murders in France between 1827 and 1870 tended to fluctuate from month to month (As cited in Landau and Fridman, 1993). Wolfgang (1958) noted that in Philadelphia between the years 1948 and 1952 a fluctuation in crime rates and therefore no consistent pattern was present (As cited in Landau and Fridman, 1993).

As early as the nineteenth century, Adolph Quetelet was using data from France to observe the possible relationship between the seasons and crime rates or seasonal trends in behavior (as noted in Hipp *et al.*, 2004, p. 1334). Quetelet (1842, 1969) was also responsible for proposing the temperature/aggression theory in which he noted that "uncomfortably hot temperatures increase the frustration of individuals, leading to aggressive behavior" (as noted in Hipp *et al.*, 2004, p. 1334). Quetelet ([1842] 1968) further noted that "The season in their course, exercise a very marked influence: thus, during summer the greatest number of crimes against persons are committed and the fewest against property; the country takes place during the winter" (As cited in Landau and Fridman, 1993). Sutherland (1947) restated what is now known as this "thermic law of criminality" more than a century later with crimes against property increasing in the winter months while crimes against persons in the summer months (As cited in Landau and Fridman, 1993).

In relation to heat and crime, Mosby (1913) agreed that there is noticeable evidence that the great "waves of crime" occur in seasons of extraordinary heat and humidity, but also at the center of such a wave is the great center of population, where the social and individual factors of crime tend to merge with greatest force upon the given point (p. 8-9). The "mad dog season" he noted tends to occur simultaneously with the "crime wave" (Mosby, 1913, p. 9). Mosby (1913) further noted that the dogs may not always go mad if they are given relief at the proper time just as normal men will not commit crimes of violence in normal circumstances as well as under normal conditions (p. 9). Lombroso (1911) has also been identified in studying such a notion and noted that "the natural relation of heat to crimes of violence is more readily grasped than is the relation of cold to crimes against property" (as noted in Mosby, 1913, p. 9-10). Lombroso (1911) further mentioned that there is no apparent reason why this is so but that criminal records do seem to indicate such a relation to be fact (as noted in Mosby, 1913, p. 9-10).

Mosby (1913) again noted that such violent tendencies may arise in warm weather due to the fact that the means of livelihood tend to be more readily obtainable in warm weather and in warm climates and thus the earning capacity he mentioned tends to be greatly curtailed among the majority of men in the cooler seasons as well as in the colder regions of the globe (p. 10). Therefore, in warm weather violent behavior rises due to the competition for livelihood (i.e., food, mates, etc.). Since it has been noted by scientists that we share similar DNA with our animal counterparts, the chimpanzees, the stress related behavior exhibited by animals due to the weather may very well be a note that although not exactly the same, similar weather situations may make humans more prone to such behavior. MacDonald (n.d.), noted such a response in animals, which he noted were of the same species or related ones and tended to be fiercer in the torrid than in the less warmer regions of America, that lions of the Atlas mountains tended to be less formidable than those of the desert and cattle had been known during the warm season or even with the approach of a storm to mount an attack of fury and rush against persons as well as trees until the storm hit or the rain calmed them (as noted in Mosby, 1913, p. 3).

Another study in the relation of weather to violence was by Dr. Frank Lydston (n.d.) who discussed the influence of barometric and thermometric changes on the quality of human conduct in his work "Diseases of Society and Degeneracy" (As noted in Mosby, 1913, p. 5-6). Lydston (n.d.) noted that hot weather seemed to have an effect mainly in increasing crimes of impulse and that thus the neuropathic person finds it especially difficult to adjust themselves and their behavior to changes in the climatic environment (As noted in Mosby, 1913, p. 6). In his study, he further mentioned that such persons are already in a state of unstable mental equilibrium and thus it is easily destroyed by things such as hot weather that make the nerve centers hyperesthetic, as he mentions acts much like the way of alcohol (as noted in Mosby, 1913, p. 6). Dr. Lydston (n.d.) also mentions that "the tonic effect of cold weather in maintaining the nervous and mental equilibrium of neuropaths, and thus inhibiting crimes of impulse is obvious" (as noted in Mosby, 1913, p. 6).

Focusing on this idea, Dr. Lydston (n.d.) presents the psychological stressor of spring on the sexual system as he noted that "the physiological turmoil in the sexual system ushered in by spring is well known, as poets have sung of it, and rapists have been hanged for it. It bears a relation" he notes "not only to sexual crimes but to all crimes of impulse, such as murder and suicide" [Mosby, 1913, p. 6].

Noting the breakout of various riots that coincided with high temperatures, the National Advisory Commission on Civil Disorders (1968) noted the possibility of an indirect relationship. The indirect relationship noted such high temperatures on those days to account for the size of crowds congregating on the street, with emphasis on areas with congested housing (National Advisory Commission on Civil Disorders (1968). It should be noted, however, that both factors may be at work here—crowding and heat-related stress.

Such a link between heat and aggression was also studied when it came to drivers and honking their horns. According to Doobs and Gross (1968), drivers tended to honk their horn more in hot weather, than in cooler weather, and more at drivers of their own status than of a higher status.

1970 studies to 1990 studies

The study of heat in regards to aggression has also been studied in the outbreak of riots. The U.S. Riots Commission (1968) suggested high ambient temperatures played an important role in initiating dangerous cases of civil disobedience (As cited in Baron & Bell, 1976, p. 245). Goranson and King (1970) that a large portion of serious intances where collective violence was present tended to take place in the hot summer months in which heat wave or near heat wave conditions were prevalent (As cited in Baron and Bell, 1976, p. 245). In analyzing a study by Baron and Rausbergaer (1978), Carlsmith and Anderson (1979) made a convincing argument as they illustrated a serious methodological flaw and therefore used the existing data to demonstrate that the relationship between the daily temperature and the outbreak of a riot (i.e., collective behavior) was in fact clearly linear and positive (As cited in DeFronzo, 1984, p. 187-188; Kendrick and MacFarlane, 1986, p. 180).

As DeFronzo (1984) clarifies “the hotter the daily temperature in 1967 to 1971, the greater the probability of the outbreak of a riot” (p. 188). Although there were inconsistencies and the like, DeFronzo (1984) noted that “the one major analysis of criminally aggressive behavior outside a laboratory setting indicated a strong positive relationship between high temperatures and the occurrence of collective violence” (p. 188). Both Baron and Ransberger (1978) and Carlsmith and Anderson (1979) noted that there existed the probability that due to high temperatures people congregated outdoors on riot days and thus the congregating may have been to blame as opposed to any direct contribution from that of heat to aggressiveness (As cited in Kenrick & MacFarlane, 1986; Bushman, Anderson, & Wang, 2005). This view is similar to that of Nadelson and Nothman (1984) and Gould (1983) who noted that assaults and rapes increased in summer due to the increase in opportunities for interaction and contact and coincides with more time spent outdoors. Carlsmith and Anderson (1979) also found two problems with the field data including that the riots tended not to be independent of one another and that the small number of data points found in the high temperature range made it difficult to determine the precise nature of such a relationship (As cited in Kenrick and MacFarlane, 1986, p. 181). According to Kenrick and MacFarlane (1986), these two problems were exacerbated in combination since days in the very high temperature range were rare but also possibly not independent of each other (p. 181).

In their laboratory studies, Griffitt (1970) and Griffitt & Veitch (1971) suggested that people tend to be more irritable, prone to outbursts of “temper” and tend to be more negative in their reactions of others if their environment is uncomfortably hot rather than cool (As cited in Baron & Bell, 1976, p. 245). A study by Baron and Ransberger (1978) made the conclusion that the relationship between temperature and aggression could possibly be curvilinear and they further suggested that to a point temperature increases may be the contributing factor in tendencies of aggressive behavior (As cited in DeFronzo, 1984, p. 187). A report by DeFronzo (1984, p. 185), using the Federal Bureau of Investigation's (FBI) Uniform Crime Reports (UCR), noted that "climate has an independent impact on the variation of crime rates among place".

> In this same report, the results of Baron and associates (Baron, 1972; Baron, 1973; Baron and Bell, 1976; Baron and Lawton, 1972; Baron and Ransberger, 1978) further indicated "that the relationship of uncomfortably hot temperatures to aggressive behavior may be complex and potentially mediated by a number of factors including level of negative affect (i.e., feelings of irritation, annoyance, or discomfort) and the presence or absence of an aggressive model" (as noted in DeFronzo, 1984, p. 187; Kenrick and MacFarlane, 1986, p. 180).

Byrne (1971) noted that therefore high ambient temperatures may serve as the notorious "last straw" which may thus cause individuals to feel so uncomfortable they either minimize their discomfort or seek to escape (As cited in Baron & Bell, 1976, p. 246).

Thus this relationship has been called into question due to findings from several studies by Baron (1972), Baron & Bell (1975) and Baron & Lawton (1972), which have suggested the influence of uncomfortably warm temperatures upon that of overt aggression tends to be mediated by different factors (As cited in Baron & Bell, 1976, p. 245-246). Baron & Bell (1976) note that due to such an influence, "under appropriate circumstances, such environmental conditions may either facilitate, inhibit, or fail to affect this dangerous form of behavior" (p. 245-

246; As cited in Bushman *et al.*, 2005, p. 62). The best evidence to date came about in an experiment by Anderson, Dorr, DeNeve, and Flanagan (2000) which noted that under some conditions "normal" hot temperatures (i.e., under 100 ^{o} F) can cause a decrease in aggression but only occurs under fairly restrictive conditions like ambiguous provocation or later aggression trials.

There are studies that also note the relationship of temperature to honking and aggressive behavior. According to Turner, Layton, and Simons (1975), since an automobile provides protection, unusual power, easy escape, and some degree of anonymity, some people may have a lower threshold for hostility as they drive and become impatient with others. Such a circumstance in conjunction with no air conditioning, high temperatures, and trying to escape from the heat can cause aggressive behavior (e.g., honking, profanity, vulgar gestures) but can also be a means of escaping from it (e.g., honking for others to move). Such a relationship was dubbed by Anderson (1989) as the "negative affect escape" theory noting that negative affect induced by high temperatures should likely lead to stronger escape motives, which results in a U-shaped relationship between that of temperature and the occurrence of riots in the United States. In archival data by Cohn and Rotton (1997) noted that in accordance with the negative effect escape model, "assaults declined after reaching a peak at moderately high temperature".

A study by Vrij, Van Der Steen, & Koppelaar (1994) found that in the midst of increasing temperature, so too did increased tension, negative impression of the offender, and aggressive behavior coincide. Such a negative affect due to hot temperatures has been shown in various studies (Griffitt, 1970; Griffitt and Veitch, 1971; Bell and Baron, 1976; Baron and Bell, 1975, 1976). Temperature has also been known to have a direct linear increase in regards to horn honking with an increase in temperature, as temperature aggravated people waiting behind a nonmoving car at a green light (Kenrick and MacFarlane, 1986). According to Berkowitz (1983) it is the aversive events that produce such negative affect and that in turn increases aggression. Bushman, Anderson, and Wang (2005) note such aversive events as being either nonsocial (i.e., extreme temperatures, physical pain, loud noises, unpleasant odors, and smoke) or social (i.e., interpersonal frustration and provocation) (p. 62). Studies have thus noted the positive correlation between the rise in high uncomfortable temperatures and the rise in negative effect (Anderson *et al.*, 1996; Anderson *et al.*, 1995). According to Anderson (1989) such increases in heat-induced negative affect tend to be associated with a building of aggressive motives which in turn increases the likelihood that an individual will behave aggressively.

Other studies have also focused on the idea of a seasonality of crime, whether it would be personal crimes like robbery, etc. or violent crimes like aggravated assault. In a study of weather and crime by Michael & Zumpe (1983a) there came about associations indicating that the timing and magnitude of the annual changes in regards to assaults and rapes in what was then known as the modern United States were influenced by annual temperature rhythms, in which robberies and murders were exempt (p. 273). They further noted that such an association of the behavior as well as the temperature changes could have arisen through a common factor, since as they noted that it would be difficult conceptualizing such a mechanism by which behavioral changes were able to influence temperature (p. 273). Michael and Zumpe (1983a) reported a peak in the summer between July and August for that of assault and rape, for robbery in winter between November and December and noted seasonal influences in regards to the homicide (murder) trends were virtually absent (Also cited in Landau and Fridman, 1993).

A study by Lab and Hirschel (1987) noted:

Higher levels of crime seem to occur in the summer months. The generally good weather during these months draws the populace out of doors. This leaves unoccupied and often unlocked homes readily available for theft and burglary. The warm seasons also brings people together outdoors where assaults and robberies—often coupled with increased alcohol consumption—are most prevalent (p. 31).

Lab and Hirschel (1987) also noted that although rising temperatures tended to accompany increases in aggression, the opposite effect occurred during time of high humidity and physical activity as well as aggression were reduced while rain, cloud cover, and other forms of inclement weather associated with lower property crime levels and even increased depression (p. 31). Therefore, low humidity coupled with high temperatures may lead to increased aggressive behavior (Lab & Hirschel, 1987, p. 32).

Anderson (1989) also concluded that eventhough less severe violent crimes like assault, rape, and spousal violence all peaked with the summer months, December he found was one of the highest murder months with the inclusion of July and August, and contradicts his general thesis of heat increasing aggression. Deutch (1978) studied seven index crimes in 10 U.S. cities and found that robbery, burglary, aggravated assault, larceny, and motor vehicle theft were seasonal, while homicide and forcible rape were not. Robbery Deutch (1978) noted was more prevalent within during the winter months with peaks either in December or January. In another study by Deutch and Alt (1977) found that assault with a gun as well as armed robbery in Boston tended to be seasonal while homicide was not. They further found that robbery was rather high during the winter months although there were two single years that noted summer peaks with one in June and the other in August. Block (1983) on the other hand noted that aggravated assault was seasonal and homicide was not for the area of Illinois from 1972-1981. In studying crime in West Germany, Lamp (1983) found that the series of total crime, rape, and theft all tended showed a peak in more or less in the summer, while the homicide series tended to be free from any seasonal influence (As cited in Landau and Fridman, 1993). Cohen & Felson (1979) used the routine activities theory to explain the association between weather and crime, this theory uses a social explanation and focuses specifically on the changing of activities and patterns in order to explain seasonal oscillations in all varieties of crime (as noted in Hipp *et al.*, 2004, p. 1334).

In a study by DeFronzo (1984) results indicated that associations between climatic conditions and that of crime patterns tended to be very weak as opposed to the influence of other variables such as poverty, income, etc. (Also cited in Landau and Fridman, 1993). Cheatwood (1988) came to the conclusion that a great majority of studies had failed to find any sign of a significant association between that of season and homicide. He further noted that although some months may show consistency most of the months of the year show none, and the few months that do show it do not usually occur within one season, therefore explaining the lack of seasonality reported in a plethora of previous studies (Cheatwood, 1988). For example, Warren, Smith, and Tyler (1983) found a peak in homicides for the months July through September and in December, in analyzing the same data, Lester (1979) came to the same conclusion. In his study, Cheatwood (1988) found homicide rates to be higher for the months of July, August, and December, thus reinforcing the two previous studies. He notes that these common months do not share common features in respect to weather, temperature, and other physical characteristics but that the commonality is that during these months there is increased human interaction (Cheatwood, 1988). He further notes that during this time not only are schools out for a long period of time but also traveling, alcohol consumption, and a general social interaction are at a high level (Cheatwood, 1988). When it came to robbery rates, Cheatwood (1988) found that they are higher in October, November, December, and January. According to Landau and Fridman

(1993), robbery does show a seasonal pattern with it being more prevalent during the colder months of the year.

Michael and Zumpe (1983a, 1983b, 1986) also studied annual rhythms in the battering of women and found that rhythms tended to be closely related to annual changes in ambient temperatures for the locations studied and further that the time of maxima was similar to that previously reported for assaults and rapes. Their findings seem to support the hypothesis of violence by men toward women increases in summer independently to that of any major seasonal changes in regards to the opportunity for contact between the perpetrator and the victim (Michael and Zumpe, 1986). Such a theory of increased opportunity and contact does not account for the similar increase in attacks on women within the home, a place where opportunity for contact is rather constant year-round (Michael and Zumpe, 1986). According to Michael and Zumpe (1986) the Humane Society for the entire United States noted that child abuse in the state of Texas followed a similar pattern. They also found that the maxima for wife abuse in Atlanta and Texas occurred about 40 days earlier in the year as opposed to those for Oregon and California but the difference in timing corresponded, within a few days, to the differences in that of the rape maxima for those states as well as correlated with the times of that of the local temperature maxima (Michael and Zumpe, 1983).

More recent studies have also found a link between weather and crime. In a correlation study between climate and crime in eastern Tokyo, Ikegaya and Suganami (2008) studied crime based on the weather, with descriptions such as “sunny days” and “sunny and cloudy days”. They found that on “sunny days” cases which involved murder and bodily injury which resulted in death accounted for 80 cases, while “sunny and cloudy days” accounted for 33 in a five-year period from 1998-2002 (Ikegaya and Suganami, 2008, p. 228-229).

As for the mediating impact of weather on psychological conditions, Hippocrates in the early age of modern medicine noted his observations that cold and warm winds seemed to affect not only the physical but also the psychological wellness of his patients (as noted in Schory *et al.*, 2003, p. 624). Chayatte, Chen, Braonstein, & Brass (1994) as well as Polansky, Varner, & O'Gorman (1985) noted that only a small number of medical conditions have actually been linked to weather variables such as barometric pressure (as noted in Schory *et al.*, 2003, p. 624). Others like Gupta & Murray (1992), Symonds & Williams (1976), Goodwin & Jamison (1990) and Grider, El-Mallakh, Huff, Buss, Miller, & Valdes noted that in the psychiatric world, seasonal variations in disease manifestation tend to be clearly associated with things like seasonal affective disorder or bipolar illness (as noted in Schory *et al.*, 2003, p. 624).

There are also others like Modai, Kikinzon, & Valevski (1994) that have found no such correlation between humidity or other weather variables and their influence on psychiatric presentations (as noted in Schory *et al.*, 2003, p. 624). On the other hand, several studies have refuted that other psychological stressors like phases of the moon are associated with acts of violence like homicide and suicide (as noted in Schory *et al.*, 2003, p. 625). According to Barker, Hawton, Fagg, & Jennison (1994) seasonal factors like maximum temperature, rainfall and things such as cloud cover have been significantly correlated to parasuicide in women (As cited in Schory *et al.*, 2003, p. 624). Geller and Shannon (1976) on the other hand noted an association between high humidity and psychiatric presentations (As cited in Schory *et al.*, 2003, p. 624). Cohn (1990) has noted that eventhough most violent crimes against the person (i.e. assaults, collective violence, domestic violence, and rape) tend to increase with heat, such a relationship between heat and homicide is uncertain.

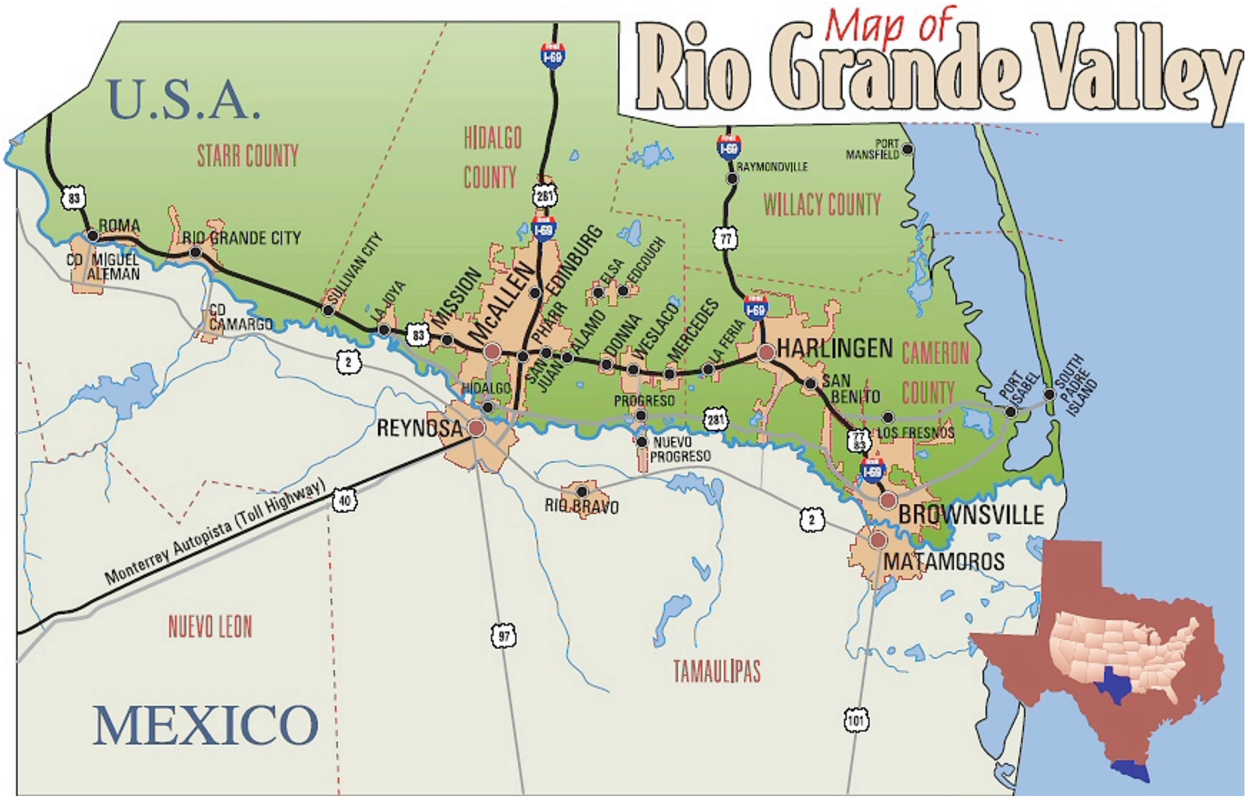
CHAPTER III

THE RIO GRANDE VALLEY & McALLEN

Although not an actual valley, the Rio Grande Valley is a delta or floodplain located near the southernmost tip of South Texas. It lies north of the Rio Grande River and consists of four counties, Starr, Hidalgo, Willacy, and Cameron County. According to the U.S. Census Bureau (2009), the 2009 estimated population for the individual counties is as follows—Starr-62,671, Hidalgo-741,152, Willacy-20,395, and Cameron-396,371, with an estimated total of 1,220,589. According to the 2010 U.S. Census, each county's actual population was as follows—Starr-60,968, Hidalgo-774,769, Willacy-22,134, and Cameron-406,220, with a total of 1,263,091 and a difference of 42,502 (U.S. Census Bureau, 2010).

McAllen is a city that resides in the county of Hidalgo in the Rio Grande Valley of Texas (Refer to Figure 1 below). In the area it is known to be the place to eat, shop, and live. The city is known for its booming economy. The city of McAllen is also located very close to the Mexico-Texas border, as the city is north of the city of Hidalgo which is right across the city of Reynosa, Tamaulipas, Mexico. Due to this location, crime in the area including the city of McAllen is sometimes affected by border violence occurring in the area from territorial war that is in effect among the Mexican drug cartels.

Figure 3.1: Map of the Rio Grande Valley with main cities noted



History of McAllen

The city of McAllen became a settlement in the 1700s and was established in the 1740s as a small town. Around the early 1850s a man by the name of John McAllen arrived in the Rio Grande Valley and began development that would later come together as the City of McAllen (City of McAllen, City History, n.d.). In 1904, McAllen with the help of others established a town site which was then known as West McAllen. A year later was reached by the St. Louis, Brownsville and Mexico railroad. On their own tract of land, other developers began what they named East McAllen in the year 1907. Soon after, the two groups joined forces and by 1910 several businesses, churches, residences, and even a newspaper had been built.

In 1910, the population of McAllen was about 150 people and the next year, the city was incorporated with a growth to over 5,300 residents by 1920. McAllen grew steadily over several decades and in 1960 the U.S. Census reported 32,728 residents. Although the city did not add many residents this year they did manage to build a new city hall, double its library size, established a museum and had previously added a civic center and airport in the previous decades. In the 1970s the city exploded with growth and in 1980 it almost doubled to 66,281 residents and continued on its steady growth. In 1976 McAllen opened the doors of La Plaza Mall, which is now the Rio Grande Valley's most frequented shopping venue. After a remodel, high end stores like Bebe, Banana Republic, Ann Taylor, Hollister, and Abercrombie & Fitch opened their doors bringing in wealthy shoppers from local as well as out of the country and state.

According to the City of McAllen's City History (n.d.) McAllen has happened to transform into the Valley's business, commerce and government center over the last three decades. Not only has it become a home to various national businesses but is the center of most state and federal government operations in the Valley (City of McAllen, City History, n.d.). In 1993 not only was the construction of the McAllen-Miller International Airport completed but the newly created South Texas Community College (STCC) happened to register its first-ever students and in 1995 a new city hall building was dedicated (City of McAllen, City History, n.d.). The city of McAllen was chartered in January 31, 1927 and has in place a city manager/city council form of government.

Demographics

According to the U.S. Census' Profile of Selected Social Characteristics (2000) for the area of McAllen, Texas, the educational attainment for the population of 25 years of age or older (62,678 in total), 14,380 of them have completed less than the 9^{th} grade, 7,399 had achieved anywhere in between 9^{th} through 12^{th} grade education with no high school diploma. Those that are high school graduates consist of 11,902 and include the completion of equivalency. Of those who achieved higher education, 11,495 had completed some college with no degree, 2,729 had attained an Associate's degree, 9,301 had obtained a Bachelor's degree, and 5,472 have received a Graduate or professional degree.

Under the U.S. Census Bureau, the 2005-2009 American Community Survey estimates that the average household size for the city of McAllen at 2.96 and the average family size at 3.45. The estimated population for those 16 years and over who are in the labor force is 55,152 from an estimated total population of 126,090. This same report notes the per capita income (income divided by population) in the area (in 2009 inflation-adjusted dollars) to be about 19,047. They further estimate that 24.2 percent of families in the area are below the poverty level compared to the U.S. average of 9.9 percent. On the other hand, individuals below poverty level consist of 27.2 percent as opposed to the U.S. average of 13.5 percent. Of the total 2000 U.S. Census population for the area of McAllen, 106,414, Hispanic and Latinos (of any race) made up 85, 427, Not Hispanic or Latino made up 20,987, and White alone made up 17,924. This area as the data shows is for the most part made up of Hispanic or Latinos of various races.

According to the information, we can estimate not only that educational attainment is quite low with either barely a high school diploma or an equivalent and some college without a degree. Richardson and Resendiz (2006) note that although McAllen has a booming economy, it also leads the nation in unemployment, is one of the three highest in population growth rates in the U.S., but also ranks near the bottom on the national level in regards to per capita income (p. xii). Since it is very close to the border area, it has had the highest rate of drug seizures in the nation (Richardson & Resendiz, p. xii). The Rio Grande Valley area also ranks number one in regard to the number of low-income housing enclaves, also known as colonias. (Richardson & Resendiz, p. xii). This is due to the fact that it "hosts the largest number of migrant farmworkers in the U.S. during the winter months" (Richardson & Resendiz, p. xii).

CHAPTER IV

METHODOLOGY

The Research Question

The question my research is focused on answering is What is the relationship between violence and temperature? and Is there a positive relationship between violence and temperature? Therefore, the causal hypothesis for this study is that high temperatures have an effect on violence and will exhibit a positive correlation. The null hypothesis is that there will be no causal relationship what so ever.

Data Collection

This quantitative study utilizes secondary data from the city of McAllen's Uniform Crime Reports from 2001 through 2010. The Uniform Crime Reports are annual compilations of crime statistics submitted by cities, agencies and various other entities throughout the United States to the Federal Bureau of Investigation (FBI). The study utilizes violent crime in general as well as specifically for the crimes of murder, rape, robbery, and aggravated assault. These violent crimes are all defined by the Federal Bureau of Investigation for the Summary Reports submitted by each local police department every year.

Their definitions are for the violent crime are noted by the FBI's UCR Handbook in the following sentences. Murder is defined as "the willful (nonnegligent) killing of one human being by another" (FBI, 2004, p. 15). Rape is described as "The carnal knowledge of a female forcibly and against her will" (FBI, 2004, p. 19). They define the crime of robbery as "The taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear" (FBI, 2004, p. 21). Finally they note the definition of aggravated assault as "An unlawful attack by one person upon another" (FBI, 2004, p. 23).

There was no involvement of human subjects or identifying information about them, because the study is based on secondary data. There was direct communication with a member of the UCR department for the McAllen Police Department, Irma L. Gutierrez, who is also a crime statistician. Since the population of McAllen has increased over the time period of this study, and experiences significant seasonal fluxes in population, with a larger population in winter and a smaller population in summer (see Perkins, *et al.*, 2001, p. 25), the crime data were calculated as rates per 100,000 population, and each month's population of McAllen for all the months covered in this study period were estimated on best data available. As for the continual population growth, the U.S. Census data for McAllen in 2000 (population 106,414) and 2010 (population 129,877) were used as fixed figures, then interpolated for the 2001 through 2010 months, using a monthly increase percent (.15 percent) and compounding the increase each month, like compounded monthly interest (U.S. Census Bureau, 2010).

Calculation of Rates

Estimates for the seasonal fluxes in McAllen are based the available Lower Rio Grande Valley of Texas (LRGV) data – which are also estimates; these estimates for McAllen were made conservatively and lower than the LRGV data and estimates, since greater populations during the cooler months and smaller populations during the hot summer months would have the effect of changing the violent crime rates and increasing the strength of the correlation in my study.

In winter, roughly from October through about mid-April a large number of retired people from the northern Midwest states come to spend the warmer winter months in the LRGV, which includes Hidalgo, Cameron, Starr, and Willacy counties. It is estimated that from a 2009-2010 study that 144,000 Winter Texans lived in the LRGV in the winter of 2010 (Simpson, 2011), making the population swell from 1,264,000 to about 1,408,000, with Winter Texans composing about 10.2 percent of the population. A 2004-2005 study found that 18.1% arriving in October, 20% more arriving in November, 18.1% in December, 33.3% in January, and 6.7% in February, making February the most populous month (Simpson, 2011). However, there is not such a high a rate of Winter Texans in McAllen as elsewhere in the LRGV, since McAllen does not have many trailer parks (Winter Texans tend to live in trailer parks), and it is estimated that only about 5% of the Winter Texans stay in McAllen (Simpson, 2011), even though those living in towns surrounding McAllen would likely be making many of their day trip destinations to McAllen to shop and for entertainment. Based on these studies I have calculated the percent of McAllen's population that is increased by Winter Texans October through April conservatively, as shown in Table 4.1.

During spring, summer, and fall, migrant farm workers who live in the LRGV during the winter, migrate out of the LRGV to northern states to help with the farm work. Some leave as early as March, and most have left by May; then in the fall they return around October. LRGV population in 2000 was 978,369, and it is estimated that 29 percent of the 196,704 migrant worker in Texas, or 57,044, live in the LRGV (Perkins, *et al.*, 2001, pp. 28-29). However, this is a gross underestimate regarding the actual population shift, because it does not take into account the families that migrate north with the workers; it is estimated that this about doubles the number of people leaving the LRGV (Perkins, *et al.*, 2001, p. 29), making the total come to about 114,088 people. These 114,088 people comprise about 11.7 percent of the population. Because many of them live in poorer areas, such as the *colonias* and outlying areas, I estimate the percent of the migrant workers living in McAllen and leaving the LRGV in the summers to do migrant work to be about 6%, with smaller percentages away in spring and fall (see Table 4.1). It should also be noted that many McAllen residents leave the LRGV in the summer to go on vacation and escape the *canicula*, or heatwave that goes from about July 15^{th} through the end of August – and is likely gaining days and weeks with the onslaught of climate change. However, I do not have data or estimates on this.

Table 4.1: Estimates of the Seasonal Population Flux in McAllen, Texas			
	Winter Texans	Migrant Farm Workers	Net Gain or Loss
Jan	+ 5.0%		+5.0%
Feb	+ 5.4%		+ 5.4%
Mar	+ 3.4%		+ 3.4%
Apr	+ 0.5%	- 2.0%	- 1.5%
May		- 5.0%	- 5.0%
Jun		- 6.0%	- 6.0%
Jul		- 6.0%	- 6.0%
Aug		- 6.0%	- 6.0%
Sep		- 6.0%	- 6.0%
Oct	+ 1.1%	- 3.0%	- 1.9%
Nov	+ 2.2%		+ 2.2%
Dec	+ 3.2%		+ 3.2%

The study also utilizes weather data from the online source Weather Warehouse (2005-2010) which contains weather history for previous years for the city of McAllen, Texas from a weather station located at the McAllen Miller International Airport. Weather Warehouse is an online weather portal, run and owned by Weather Source, LLC, which has expertise in historical weather data. The study includes data from their site and analyzes the monthly average maximum temperature, the highest monthly temperature, and the monthly mean temperature for every month from the years 2001 to 2010. Both the crime statistics (monthly crime rates) as well as the weather statistics have been compared through the analytical software and statistics program SPSS (Statistical Package for the Social Sciences).

Variables

The independent variable in the study will be high temperature and the dependent variable will be violent crime. The high temperatures would be considered interval level data since temperature in Farenheit lacks a true zero. The violent crime data would be considered ratio level as it contains a true zero, it can be grouped, ranked and the exact measure between two distances can be determined (i.e. there can be an absence of crime).

The variables for the study include murder, rape, robbery, aggravated assault, monthly mean temperature, monthly high temperature, and monthly average maximum temperature. Murder (includes homicide), rape, robbery, and aggravated assault are common crimes that are reported on the Uniform Crime Reports. Although they are reported to the police, they do not account for the 'black figure of crime'(i.e. the crime that is not reported to the police). They also may not account for technical or appropriate errors in the data if any. Monthly mean temperature for the purpose of this study is defined as the "average of all the daily mean temperatures ([min+max]/2)" (Weather Source, LLC, 2005). High temperature refers to the "highest temperature recorded for the month" (Weather Source, LLC, 2005). Weather Source, LLC, for the purpose of their data and thus this study defines average maximum temperature as the average (arithmetic mean) of all the daily high temperatures for the month. The data for the study are in Table 4.2 located in Appendix A under Tables.

There are several variables categorized under what we term violent crime including murder, rape, robbery, and aggravated assault as raw scores. In order to notice an impact the incorporation of raw scores for murder, rape, and aggravated assault were lumped into one variable named 'Violent'. The 'Violent' variable excluded robbery as it is still a violent crime but is more about using violence to gain an economic benefit as opposed to causing harm to another person. In another variable titled 'Violent 2' the same process was repeated using all the raw scores for murder, rape, robbery, and aggravated assault. The variable 'Violent 2' is used to compare whether there is a higher impact on all the violent crimes in general when robbery is included.

More variables included the murder rate, rape rate, robbery rate, aggravated assault rate, violent rate, and violent 2 rate. These rates were calculated using the net population, the influx rates of the migrant workers as well as winter texans through the Excel program. These rates which took into account the net population as well as population influxes due to winter Texans and migrant workers and noted a well-rounded statistical picture of the variation in population throughout the years and months, which helps paint a clearer picture of the relationship between violent crime and hot temperatures.

Analysis & Tests

This study runs a correlational statistical analysis known as the Pearson *r* or the Pearson test. This test is used to measure the strengh of a relationship between linear (interval/ratio level) related variables. This data analysis also uses a one-tailed test which is a statistical test in which there is only one critical region in one tail that contains all of the values at which the null hypothesis ($\rho = 0$). In doing a one-tailed test the variables violent crime ('Violent' and 'Violent 2' in raw scores as well as in rates) and hot weather (mean temperature) will show whether a positive relationship exists. Since this is what the hypothesis is interested in, a one-tailed test is used.

CHAPTER V

THE IMPACT OF HOT WEATHER ON VIOLENCE IN MCALLEN

After the data was inputted into an Excel data file, I converted it into SPSS in order to run the tests. I first did a univariate analysis (See following Tables 5.1- 5.3) that included a Pearson r correlation. The purpose of a frequency is to show which months had the highest [frequency] amount of the certain variable (see Appendix A). A scatterplot serves the purpose of showing the distributions of the variables through time (see Figures 5.1-5.4).

Pearson *r* Correlational Test

The data further shows a one-tailed, Pearson *r* correlation for mean temperature and 'Violent' and mean temperature and 'Violent 2' as raw scores and as rates. Table 5.1 below shows the 'Mean Temp' correlated with raw scores for 'Violent' (murder, rape, aggravated assault) at a weak and positive .214 but significant at a .009, allowing us to reject the null hypothesis. The significance was not as evident in Table 5.2 when all the individual variables were combined into Violent Rate 2 (Mur+Rape+Rob+AgAss) as it was a positive weak .209 with a significance of .011. Table 5.3 below shows the mean temperature correlated with the variables 'Violent' and 'Violent 2' rates. Although both are weak with a .288 for 'Violent' and a .297 for

‘Violent 2’ a positive relationship exists and they both are significant with a .001 for ‘Violent’ and a .000 for ‘Violent 2’, allowing us to reject the null hypothesis.

Table 5.1
Mean Temperature & ‘Violent’ (Raw Scores)
Correlations

		Mean Temp	Violent
Mean Temp	Pearson Correlation	1	.214**
	Sig. (1-tailed)		.009
	N	120	120
Violent	Pearson Correlation	.214**	1
	Sig. (1-tailed)	.009	
	N	120	120

**. Correlation is significant at the 0.01 level (1-tailed).

Table 5.2
Mean Temperature & ‘Violent 2’ (Raw Scores)
Correlations

		Mean Temp	Violent2
Mean Temp	Pearson Correlation	1	.209*
	Sig. (1-tailed)		.011
	N	120	120
Violent2	Pearson Correlation	.209*	1
	Sig. (1-tailed)	.011	
	N	120	120

*. Correlation is significant at the 0.05 level (1-tailed).

Table 5.3—Mean Temperature & 'Violent Rate' and 'Violent 2 Rate' Correlation Table

		Mean Temp	Violent (Murder+Rape+AgAss Rate)	Violent 2 (Mur+Rape+Rob+AgAss Rate)
Mean Temp	Pearson Correlation	1	.288**	.297**
	Sig. (1-tailed)		.001	.000
	N	120	120	120
Violent (Murder+Rape+AgAss Rate)	Pearson Correlation	.288**	1	.939**
	Sig. (1-tailed)	.001		.000
	N	120	120	120
Violent 2 (Mur+Rape+Rob+AgAss Rate)	Pearson Correlation	.297**	.939**	1
	Sig. (1-tailed)	.000	.000	
	N	120	120	120

Scatterplots

The scatterplots below were done using the rates of the variables of 'Violent' and 'Violent2'. The figures show a best fitting regression line as well as a lowess or loess regression line. The best fitting line in the line that best fits the data. The term loess is an acronym for locally estimated scatterplot smoothing on the other hand, lowess stands for locally weighted scatterplot smoothing and is one of many non-parametric regression techniques, but arguably the most flexible. The lowess line is also a regression line that is a function that attempts to capture general patterns in stressor-response relationships while at the same time reducing the noise. The problem is that it makes minimal assumptions about the relationships among variables. The result of a loess application is a line through the moving central tendency of the stressor-response relationship. Loess is basically used to visually evaluate the relationship between two variables. It is particularly useful when using large datasets, where trends can be harder to visualize.

In regards to the rates for ‘Violent’ (Figure 5.1 and Figure 5.3) and ‘Violent 2’ (Figure 5.2 and Figure 5.4) and mean temperature, the scatterplots showed a slanted s-curve as the variables on were low at the lower temperatures and once the weather was 70º or above it increased leveling off or lowering at about 85º to 90º. This is similar to Bushman *et al.* (2005) and Rotton and Cohn (1997) that violence and temperature would correlate to a certain extreme where it would then level off or decrease as people’s reaction was to escape the heat rather than deal with it.

Figure 5.1-Mean Temperature & ‘Violent’ Raw Score Scatterplot

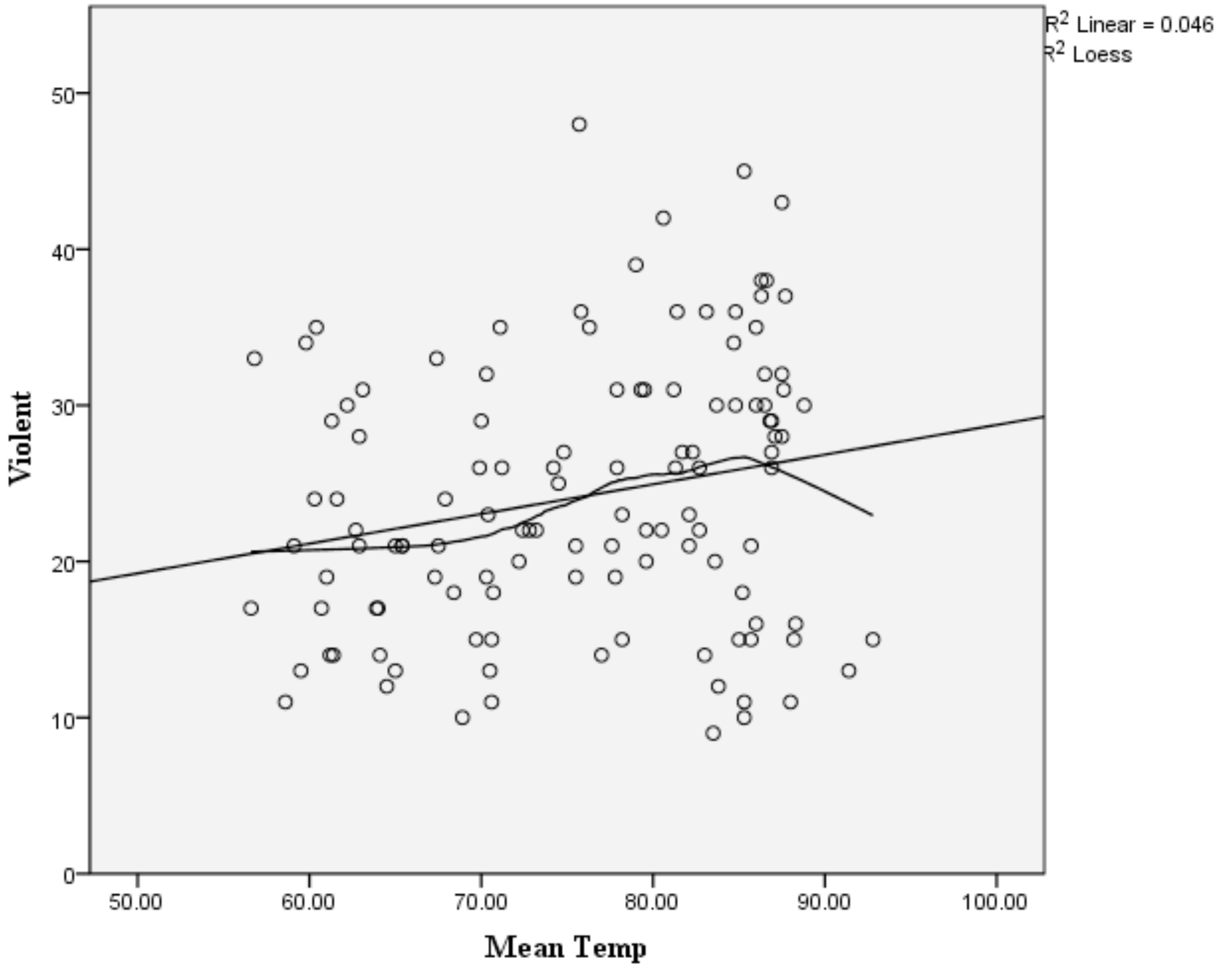


Figure 5.2-Mean Temperature & 'Violent 2' Raw Score Scatterplot

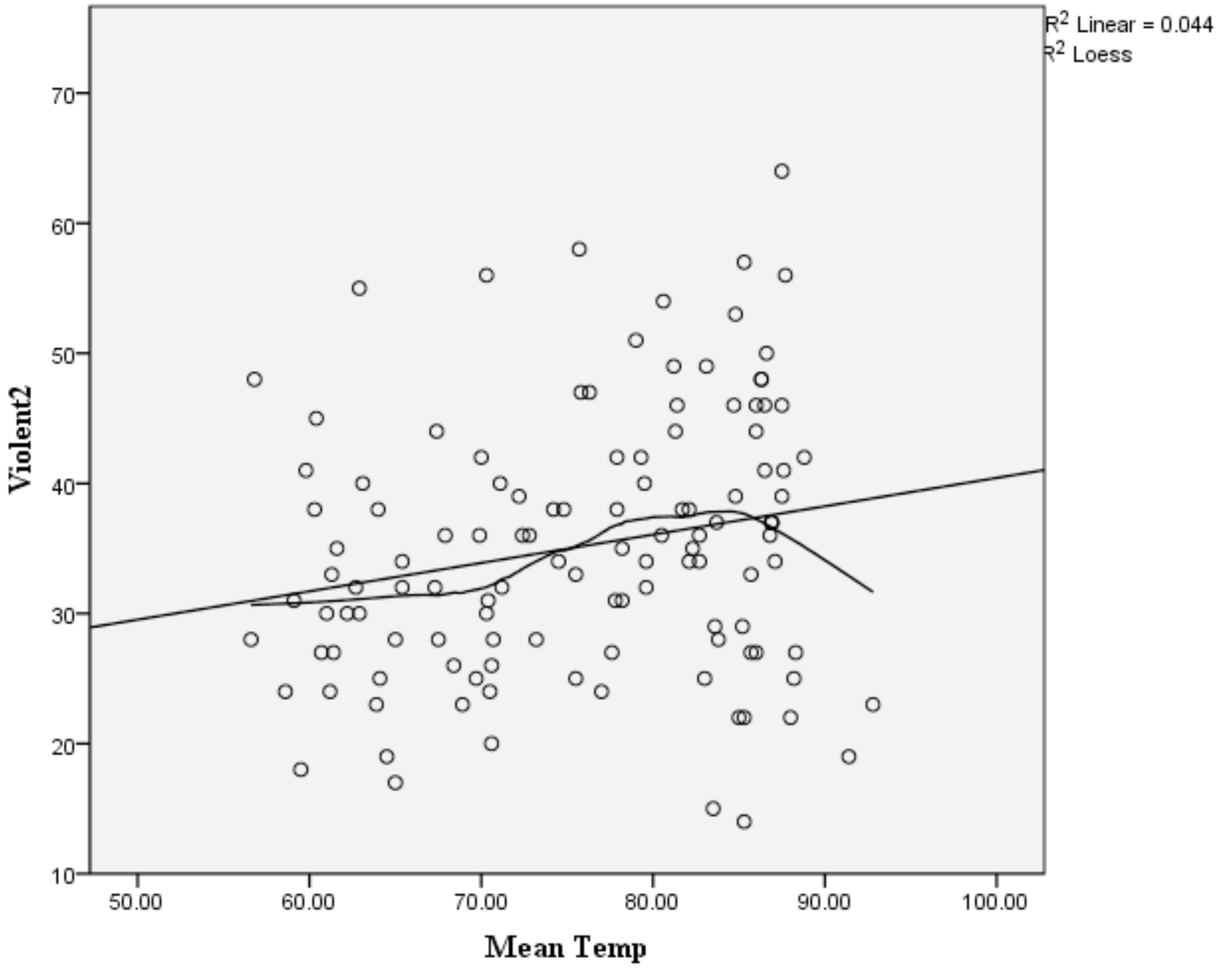


Figure 5.3- Mean Temperature & 'Violent' Rates Scatterplot

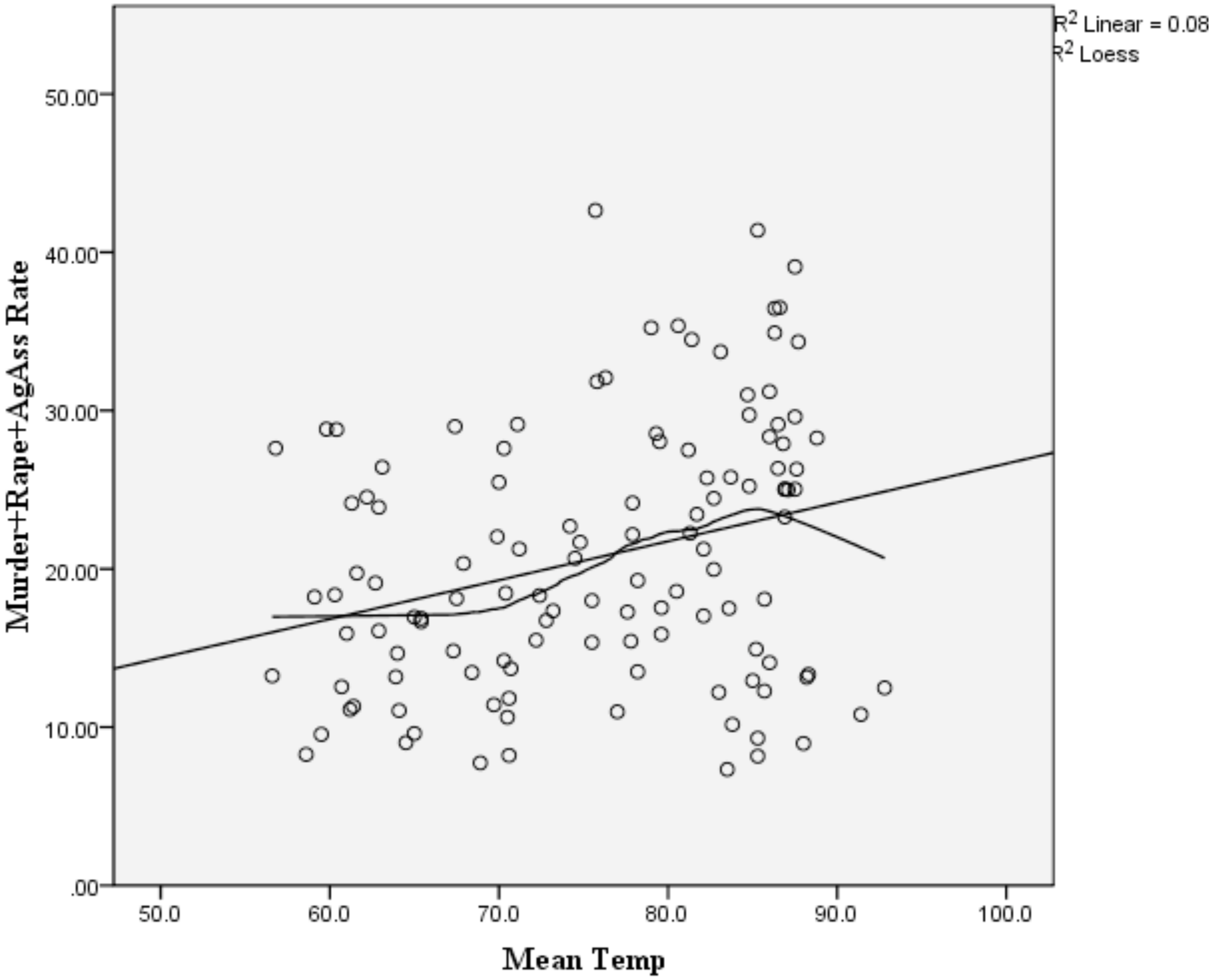
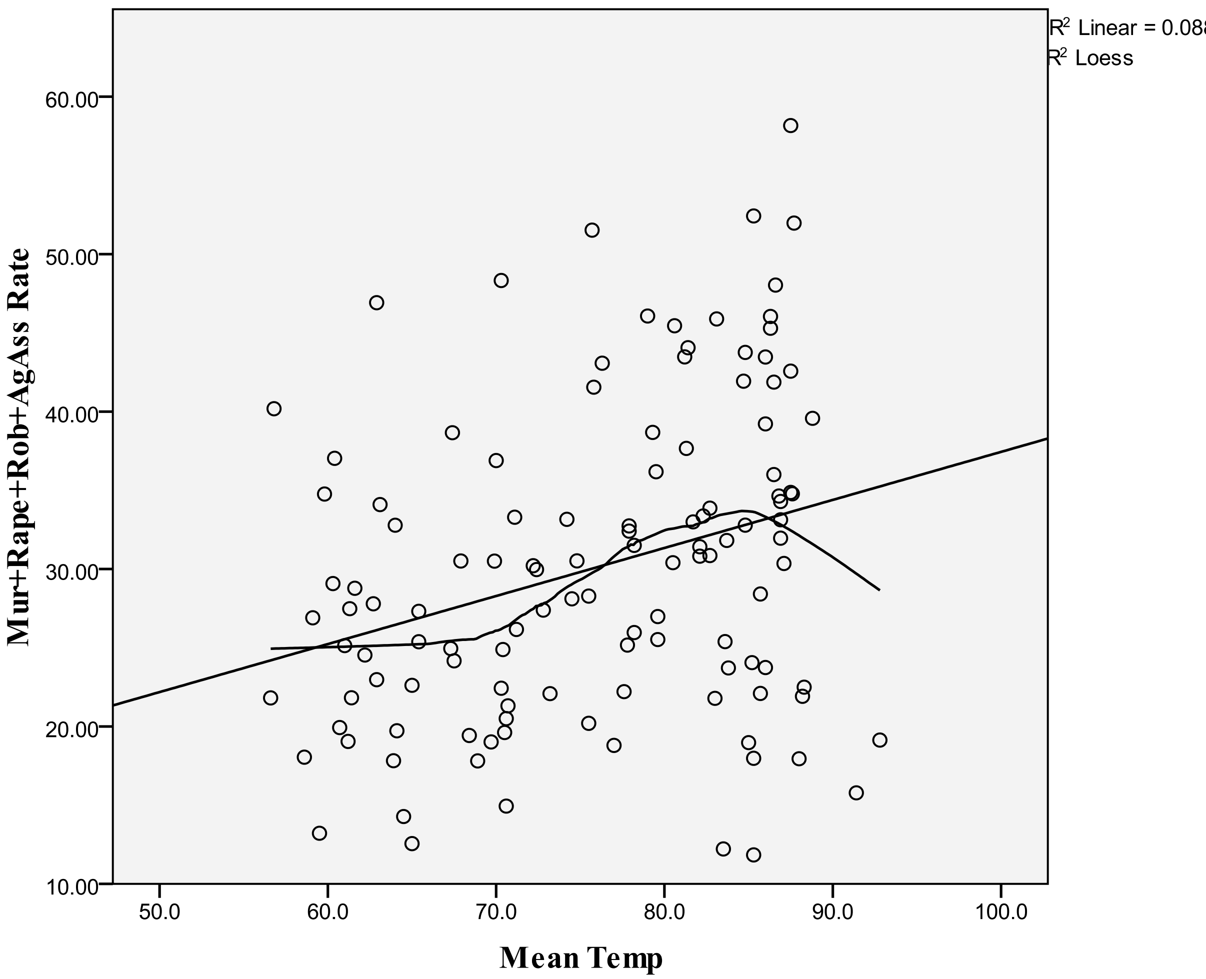


Figure 5.4- Mean Temperature & ‘Violent 2’ Rates Scatterplot



CHAPTER VI

SUMMARY AND CONCLUSION

The purpose of this study was to find out if there is a significant association, between hot weather and violent crime, and whether it is a positive correlation or not. A correlation is the association or relationship between variables (hot weather and violent crime). A positive correlation is when high scores within one variable (hot weather) are linked to high scores on a second variable (violent crime), and an increase in one score is associated with an increase in the other. A negative correlation is when one variable (x) has a high score while another variable (y) has a low score and as one goes up the other goes down and vice versa. No correlation is the absence of any relationship between the two variables.

Due to the fact that this study is based on secondary data, there may be some threat to the reliability of the data. The outcome of the study may have been affected by underreporting of crime, technical mistakes, and the fact that the data set was rather small and was also conducted in a local city with a rather decent population size which does not compare to a major city like Dallas, Houston, or Los Angeles. The way the crimes are or were categorized may have affect the variables making one variable seem higher than another or vice versa.

The data yielded a weak positive correlations yet the correlations were significant showing that there does exist a minimal positive correlation between temperature (mean temperature) and violence (violent crime variables). Due to the fact that the data showed a positive correlation existed, the data has supported my hypothesis that not only does a relationship exist but the variables of violence positively correlate with that of warm(hot) temperature.

In regards to this study, one might say that if climate change continues to bring about extreme weather temperatures, violent crime is likely to increase in the city of McAllen and in large the Rio Grande Valley. As weather reaches extremes, ecosystems and sustainability will suffer causing harm to not only local entities but also to less developed nations that depend on the weather and the land to sustain themselves. Seasonal variability will also increase making cyclones, heat waves and flooding more unpredictable as well as more severe. This will cause a major problem for criminal justice agencies who are already understaffed increasing patrol, paper work, and calls for service. When all the other impacts of climate change that contribute indirectly to violence—hurricanes, floods, droughts, and wildfires—are factored in, the increase in violence and violent crime due to climate change could prove to be quite substantial.

For example, according to Le Treut *et al.* (2007), climate change is a complex, interactive system that consists of the atmosphere, land surface, snow and ice, oceans, and other bodies of water and living things. The climate is often characterized by atmospheric component, where climate is usually defined as 'average weather' (Le Treut *et al.*, 2007), or the weather at the aggregated statistical level. Thus climate is described within the terms of mean and variability of temperature, precipitation, and wind as it occurs over a period in time, which can range from months to millions of years, noting that the classical period is 30 years (Le Treut *et al.*, 2007). The climate system over time can change and evolve based on its own internal dynamics as well as changes in external factors known as 'forcings' (Le Treut *et al.*, 2007). Such external factors include natural disasters such as volcano eruptions and solar variations, including human-induced changes in the atmospheric compositions (Le Treut *et al.*, 2007).

Since the area of McAllen and the Rio Grande Valley as a whole is in hurricane-prone region, it is safe to assume that future projections of increasing hurricanes may impact violent crime as well. More extreme storms such as tropical cyclones (also referred to as typhoons and hurricanes) are another type of weather event linked to climate change. According to the National Climatic Data Center (2004) the year 2004 was to date the most costly hurricane season the U.S. had ever seen with five land-falling hurricanes that caused record economic damage of at least 42 billion USD. In 2005, that record was broken mostly by Hurricane Katrina which seems to have been the most costly hurricane in history as damage estimates were in excess of 100 billion USD (Graumann *et al.*, 2005). The Rio Grande Valley, located in hurricane-prone area, also experienced heavy damage from Hurricane Emily that year, six weeks before Hurricane Katrina.

The National Climatic Data Center (2005) adds that 2005 also witnessed not only the highest number of hurricanes but also the most named storms in any season, not to mention a record number of the most intense, ‘category 5’ hurricanes and finally the most intense hurricane to ever be recorded, Wilma. According to van Aalst (2006), such harsh 2004 and 2005 hurricane seasons seem to be consistent with a type of trend, that the frequency but particularly the intensity of the tropical cyclones in the Atlantic seem to have been on the rise since 1995. Not only did Emanuel (2005) show that worldwide, the destructiveness of such tropical cyclones has increased over the past 30 years, mainly due to an increase in their average intensity as well as lifetime but Webster *et al.*, (2005) also showed in a separate study that the number of very intense category 4 and 5 nearly doubled in the period since 1970.

Trenberth (2005) notes "there is no sound theoretical basis for drawing any conclusions about how anthropogenic change affects hurricane members or tracks, and thus how many hit land"—again, climate change deals with overall statistics and can only indicate increased odds of such events—but also points out the effect global warming has already had on changing environmental conditions in the areas where tropical storms mainly occur, such as providing more energy (warmer sea surface temperatures) that helps to fuel the storms and in return makes them more intense in regard to wind speed and rainfall. It should also be noted that hurricanes are appearing outside their known areas—such as cyclone Catarina in 2004 which was the first ever hurricane to hit Brazil (NASA, 2011). As this thesis is being written, the news is full of stories about heavy tornado damage in the U.S. Midwest and South, and wildfires burning out of control throughout much of Texas. Newscasters seem to understand now the difference between weather and climate and how climate change can be playing a role in creating conditions for these events and increasing their odds, even if no single event by itself can be attributed to climate change.

The seasonal climate in the area of McAllen and the Rio Grande Valley has felt a change as days have been more hot and humid in recent years. According to Leiba (2010) on August 24 of 2010, deep south Texas experienced some of the hottest temperatures of the summer and the year with most of the area warming above 100 degrees. He further notes that these temperatures happened to be a response to a very early seasonal cold front which was moving south across the nation's heartland (Leiba, 2010). Coincidentally the very next morning (August 25), record low temperatures happened to be set just several hundred miles north with some temperatures being in Ft. Supply, Oklahoma 41 degrees, which was a temperature that also tied the coldest temperature ever recorded in Oklahoma on August 25, in Amarillo, Texas 49 degrees , Gage, Oklahoma 49 degrees, and Ponca City, Oklahoma 52 degrees (Leiba, 2010). If heat has been shown to correlate with violence then we can also expect violence to escalate to a point (see Bushman *et al.*, 2005) as days reach extremes and land sustainability suffers leading to starvation and possibly poverty and political destabilization.

It should be noted that unusual cold spells in some parts of the world do not disprove climate change, since it is the global average temperature that counts, and this has been increasing. In fact some scientists suggest climate change may contribute to increasing "negative Arctic oscillations" in winter, which shift the usual west-east pattern and bring severe cold snaps from north-to-south, leaving much greater warming in the Arctic (Petoukhov and Vladimir, 2010; IPY-OSC, 2010). This does not bode well for winter agriculture in subtropical areas facing greater freeze risk, such as the Rio Grande Valley of Texas and Northern Mexico, which lost about one billion dollars this past winter of 2010-2011 to such freezes (Grassroots Press, 2010).

Various climate models have tried to make future projections in regards to climate change, but usually they are only able to model large patterns in the atmosphere and large areas of the earth's surface, but not smaller-scale areas (van Aalst, 2006, p. 8). This not only leaves people vulnerable to climate-change-enhanced natural disasters but also prevents them from knowing how extreme the natural disasters will be that affect them.

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APPENDIX

APPENDIX A-VARIABLE FREQUENCY TABLES

‘Violent’ Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9	1	.8	.8	.8
	10	2	1.7	1.7	2.5
	11	4	3.3	3.3	5.8
	12	2	1.7	1.7	7.5
	13	4	3.3	3.3	10.8
	14	5	4.2	4.2	15.0
	15	7	5.8	5.8	20.8
	16	2	1.7	1.7	22.5
	17	4	3.3	3.3	25.8
	18	3	2.5	2.5	28.3
	19	5	4.2	4.2	32.5
	20	3	2.5	2.5	35.0
	21	10	8.3	8.3	43.3
	22	7	5.8	5.8	49.2
	23	3	2.5	2.5	51.7
	24	3	2.5	2.5	54.2
	25	1	.8	.8	55.0
	26	7	5.8	5.8	60.8
	27	4	3.3	3.3	64.2
	28	3	2.5	2.5	66.7
	29	4	3.3	3.3	70.0
	30	6	5.0	5.0	75.0
	31	6	5.0	5.0	80.0
	32	3	2.5	2.5	82.5
	33	2	1.7	1.7	84.2
	34	2	1.7	1.7	85.8
	35	4	3.3	3.3	89.2
	36	4	3.3	3.3	92.5
	37	2	1.7	1.7	94.2
	38	2	1.7	1.7	95.8
	39	1	.8	.8	96.7
	42	1	.8	.8	97.5
	43	1	.8	.8	98.3
	45	1	.8	.8	99.2
	48	1	.8	.8	100.0
	Total	120	100.0	100.0	

‘Violent2’ Frequency Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	1	.8	.8	.8
	15	1	.8	.8	1.7
	17	1	.8	.8	2.5
	18	1	.8	.8	3.3
	19	2	1.7	1.7	5.0
	20	1	.8	.8	5.8
	22	3	2.5	2.5	8.3
	23	3	2.5	2.5	10.8
	24	4	3.3	3.3	14.2
	25	5	4.2	4.2	18.3
	26	2	1.7	1.7	20.0
	27	6	5.0	5.0	25.0
	28	6	5.0	5.0	30.0
	29	2	1.7	1.7	31.7
	30	4	3.3	3.3	35.0
	31	4	3.3	3.3	38.3
	32	5	4.2	4.2	42.5
	33	3	2.5	2.5	45.0
	34	6	5.0	5.0	50.0
	35	3	2.5	2.5	52.5
	36	7	5.8	5.8	58.3
	37	4	3.3	3.3	61.7
	38	7	5.8	5.8	67.5
	39	3	2.5	2.5	70.0
	40	3	2.5	2.5	72.5
	41	3	2.5	2.5	75.0
	42	4	3.3	3.3	78.3
	44	3	2.5	2.5	80.8
	45	1	.8	.8	81.7
	46	5	4.2	4.2	85.8
	47	2	1.7	1.7	87.5
	48	3	2.5	2.5	90.0
	49	2	1.7	1.7	91.7
	50	1	.8	.8	92.5
	51	1	.8	.8	93.3
	53	1	.8	.8	94.2
	54	1	.8	.8	95.0
	55	1	.8	.8	95.8
	56	2	1.7	1.7	97.5
	57	1	.8	.8	98.3
	58	1	.8	.8	99.2
	64	1	.8	.8	100.0
	Total	120	100.0	100.0	

APPENDIX B-STUDY DATA

TABLE 4.2 – Temperature, Population, and Crime Data for McAllen, 2001 – 2010.

Year & Month	Hi Temp[1]	Mean Max Temp[1]	Mean Temp[1]	Pop[2]	Winter Texans + Migrant[3]	Net Pop	Murder Rate[4]	Rape Rate[4]	Robbery Rate[4]	Agg Assault Rate[4]	Violence Rate 1[5]	Violence Rate 2[6]
1.01	84	69.0	59.1	109745	0.050	115232	0.00	0.00	8.68	18.22	18.22	26.90
1.02	92	76.7	67.5	109910	0.054	115845	0.00	0.86	6.04	17.26	18.13	24.17
1.03	92	78.2	67.4	110074	0.034	113817	0.00	0.88	9.66	28.12	28.99	38.66
1.04	96	88.6	79.3	110240	0.015	108586	0.00	0.00	10.13	28.55	28.55	38.68
1.05	99	93.1	82.3	110405	0.050	104885	0.95	0.95	7.63	23.84	25.74	33.37
1.06	103	97.7	86.8	110571	0.060	103936	0.00	0.00	6.73	27.90	27.90	34.64
1.07	101	96.8	86.6	110736	0.060	104092	0.00	2.88	11.53	33.62	36.51	48.03
1.08	103	97.3	86.3	110903	0.060	104248	0.00	0.96	9.59	35.49	36.45	46.04
1.09	96	90.5	81.4	111069	0.060	104405	0.00	0.00	9.58	34.48	34.48	44.06
1.10	96	87.5	76.3	111235	0.019	109122	0.00	0.00	11.00	32.07	32.07	43.07
1.11	89	80.1	70.0	111402	0.022	113853	1.76	0.00	11.42	23.71	25.47	36.89
1.12	84	72.8	62.7	111569	0.032	115140	0.87	1.74	8.69	16.50	19.11	27.79
2.01	90	74.7	63.1	111737	0.050	117324	0.00	0.85	7.67	25.57	26.42	34.09
2.02	89	70.6	59.8	111904	0.054	117947	0.00	0.00	5.93	28.83	28.83	34.76
2.03	98	81.0	70.3	112072	0.034	115883	0.86	0.00	20.71	26.75	27.61	48.32
2.04	98	89.3	79.5	112240	0.015	110557	0.00	1.81	8.14	26.23	28.04	36.18
2.05	100	93.5	83.1	112409	0.050	106788	0.94	0.94	12.17	31.84	33.71	45.89
2.06	102	96.7	86.0	112577	0.060	105823	0.94	0.94	15.12	26.46	28.35	43.47
2.07	100	96.2	86.3	112746	0.060	105981	1.89	0.94	10.38	32.08	34.91	45.29
2.08	103	99.9	88.8	112915	0.060	106140	0.00	1.88	11.31	26.38	28.26	39.57
2.09	99	92.3	82.7	113085	0.060	106300	0.00	0.00	9.41	24.46	24.46	33.87
2.10	95	86.3	78.2	113254	0.019	111102	0.00	0.90	18.00	12.60	13.50	31.50
2.11	90	74.4	64.0	113424	0.022	115920	0.00	1.73	18.12	12.94	14.67	32.78
2.12	87	73.4	62.9	113594	0.032	117229	0.00	0.85	23.03	23.03	23.88	46.92
3.01	85	66.6	56.8	113765	0.050	119453	0.00	3.35	12.56	24.28	27.63	40.18
3.02	90	70.6	61.3	113935	0.054	120088	0.83	0.00	3.33	23.32	24.15	27.48
3.03	87	78.0	67.9	114106	0.034	117986	0.00	0.00	10.17	20.34	20.34	30.51
3.04	98	85.1	75.7	114277	0.015	112563	0.89	1.78	8.88	39.98	42.64	51.53
3.05	100	95.2	85.3	114449	0.050	108726	0.92	0.00	11.04	40.47	41.39	52.43
3.06	101	98.0	87.7	114621	0.060	107743	0.00	1.86	17.63	32.48	34.34	51.98
3.07	102	97.2	86.9	114792	0.060	107905	0.00	0.00	9.27	25.02	25.02	34.29
3.08	106	98.2	87.5	114965	0.060	108067	0.93	2.78	12.95	25.91	29.61	42.57
3.09	98	90.1	82.1	115137	0.060	108229	0.00	3.70	10.16	17.56	21.25	31.41
3.10	91	85.0	75.8	115310	0.019	113119	0.88	0.88	9.72	30.06	31.82	41.55
3.11	87	80.3	69.9	115483	0.022	118023	0.85	0.85	8.47	20.33	22.03	30.50
3.12	82	73.8	61.0	115656	0.032	119357	0.00	2.51	9.22	13.41	15.92	25.13
4.01	86	70.5	61.6	115829	0.050	121621	0.00	0.82	9.04	18.91	19.73	28.78

TABLE 4.2 – Temperature, Population, and Crime Data for McAllen, 2001 – 2010 (cont'd)												
Year & Month	Hi Temp[1]	Mean Max Temp[1]	Mean Temp[1]	Pop[2]	Winter Texans + Migrant[3]	Net Pop	Murder Rate[4]	Rape Rate[4]	Robbery Rate[4]	Agg Assalt Rate[4]	Violence Rate 1[5]	Violence Rate 2[6]
4.02	85	73.1	62.2	116003	0.054	122267	0.00	0.82	0.00	23.72	24.54	24.54
4.03	86	81.5	72.4	116177	0.034	120127	0.83	0.00	11.65	17.48	18.31	29.97
4.04	92	82.9	74.2	116351	0.015	114606	0.00	2.62	10.47	20.07	22.69	33.16
4.05	103	89.0	79.0	116526	0.050	110700	0.00	0.90	10.84	34.33	35.23	46.07
4.06	99	94.0	84.7	116701	0.060	109699	0.91	0.91	10.94	29.17	30.99	41.93
4.07	103	97.5	86.5	116876	0.060	109863	0.91	3.64	12.74	24.58	29.13	41.87
4.08	103	99.2	87.5	117051	0.060	110028	0.00	0.91	19.09	38.17	39.08	58.17
4.09	97	91.9	82.7	117227	0.060	110193	0.91	1.81	10.89	17.24	19.96	30.85
4.10	98	91.4	81.7	117403	0.019	115172	0.00	2.60	9.55	20.84	23.44	32.99
4.11	94	82.7	71.1	117579	0.022	120165	0.00	0.00	4.16	29.13	29.13	33.29
4.12	87	71.6	60.4	117755	0.032	121523	0.00	0.00	8.23	28.80	28.80	37.03
5.01	85	74.8	65.0	117932	0.050	123828	0.81	0.81	5.65	15.34	16.96	22.61
5.02	90	73.8	65.4	118109	0.054	124486	0.80	1.61	10.44	14.46	16.87	27.31
5.03	99	83.3	71.2	118286	0.034	122307	0.00	5.72	4.91	15.53	21.26	26.16
5.04	101	87.5	75.5	118463	0.015	116686	0.00	3.43	10.28	14.57	18.00	28.28
5.05	102	91.5	81.2	118641	0.050	112709	0.00	1.77	15.97	25.73	27.50	43.47
5.06	101	97.6	86.9	118819	0.060	111690	0.90	5.37	9.85	17.01	23.28	33.13
5.07	104	97.5	87.5	118997	0.060	111857	0.89	1.79	9.83	22.35	25.03	34.87
5.08	106	97.2	87.1	119176	0.060	112025	0.00	0.89	5.36	24.10	24.99	30.35
5.09	105	97.5	86.0	119354	0.060	112193	0.89	3.57	8.02	26.74	31.20	39.22
5.10	98	88.6	77.9	119533	0.019	117262	1.71	2.56	10.23	17.91	22.17	32.41
5.11	93	83.2	70.5	119713	0.022	122346	0.00	0.82	8.99	9.81	10.63	19.62
5.12	89	71.6	61.4	119892	0.032	123729	0.81	0.81	10.51	9.70	11.32	21.82
6.01	90	78.3	65.4	120072	0.050	126076	0.00	1.59	8.72	15.07	16.66	25.38
6.02	93	77.2	64.1	120252	0.054	126746	0.00	0.79	8.68	10.26	11.05	19.72
6.03	99	85.3	74.8	120433	0.034	124527	0.00	0.80	8.83	20.88	21.68	30.52
6.04	99	91.6	80.6	120613	0.015	118804	0.84	1.68	10.10	32.83	35.35	45.45
6.05	102	94.2	83.0	120794	0.050	114754	0.87	0.87	9.59	10.46	12.20	21.79
6.06	101	97.3	86.0	120975	0.060	113717	0.00	2.64	9.67	11.43	14.07	23.74
6.07	100	96.6	86.5	121157	0.060	113887	0.00	4.39	9.66	21.95	26.34	36.00
6.08	102	98.2	88.2	121339	0.060	114058	0.88	3.51	8.77	8.77	13.15	21.92
6.09	101	93.0	83.6	121521	0.060	114229	0.00	0.88	7.88	16.63	17.51	25.39
6.10	94	87.1	78.2	121703	0.019	119390	0.00	3.35	6.70	15.91	19.26	25.97
6.11	93	82.2	70.4	121885	0.022	124567	0.00	0.00	6.42	18.46	18.46	24.89
6.12	84	70.4	61.2	122068	0.032	125974	0.00	3.18	7.94	7.94	11.11	19.05
7.01	83	64.9	56.6	122251	0.050	128364	1.56	2.34	8.57	9.35	13.24	21.81
7.02	96	74.8	63.9	122435	0.054	129046	0.00	1.55	4.65	11.62	13.17	17.82
7.03	91	82.6	73.2	122618	0.034	126787	0.79	1.58	4.73	14.99	17.35	22.08

TABLE 4.2 – Temperature, Population, and Crime Data for McAllen, 2001 – 2010 (cont'd)

Year & Month	Hi Temp[1]	Mean Max Temp[1]	Mean Temp[1]	Pop[2]	Winter Texans + Migrant[3]	Net Pop	Murder Rate[4]	Rape Rate[4]	Robbery Rate[4]	Agg Assalt Rate[4]	Violence Rate 1[5]	Violence Rate 2[6]
7.04	96	84.8	74.5	122802	0.015	120960	0.00	1.65	7.44	19.01	20.67	28.11
7.05	98	91.3	81.3	122986	0.050	116837	0.00	3.42	15.41	18.83	22.25	37.66
7.06	101	97.1	86.9	123171	0.060	115781	0.00	1.73	6.91	23.32	25.05	31.96
7.07	100	93.1	85.0	123356	0.060	115954	0.86	0.00	6.04	12.07	12.94	18.97
7.08	101	94.8	85.7	123541	0.060	116128	0.00	1.72	10.33	16.36	18.08	28.42
7.09	98	92.9	83.7	123726	0.060	116302	0.00	3.44	6.02	22.36	25.79	31.81
7.10	96	89.8	77.6	123912	0.019	121557	0.82	3.29	4.94	13.16	17.28	22.21
7.11	93	81.5	70.6	124097	0.022	126828	0.00	0.79	8.67	11.04	11.83	20.50
7.12	92	79.1	67.3	124284	0.032	128261	0.00	0.78	10.14	14.03	14.81	24.95
8.01	89	70.6	60.3	124470	0.050	130694	0.00	0.00	10.71	18.36	18.36	29.08
8.02	97	82.9	70.7	124657	0.054	131388	0.00	0.76	7.61	12.94	13.70	21.31
8.03	104	85.2	72.2	124844	0.034	129088	0.77	0.77	14.72	13.94	15.49	30.21
8.04	103	89.1	77.8	125031	0.015	123156	0.81	3.25	9.74	11.37	15.43	25.17
8.05	102	95.0	84.8	125219	0.050	118958	2.52	2.52	7.57	20.18	25.22	32.78
8.06	103	98.7	87.6	125406	0.060	117882	0.85	2.54	8.48	22.90	26.30	34.78
8.07	106	92.1	83.8	125594	0.060	118059	0.00	1.69	13.55	8.47	10.16	23.72
8.08	100	93.8	85.3	125783	0.060	118236	0.85	0.00	2.54	8.46	9.30	11.84
8.09	99	90.0	80.5	125972	0.060	118413	0.84	0.84	11.82	16.89	18.58	30.40
8.10	95	86.6	75.5	126161	0.019	123763	0.00	0.81	4.85	14.54	15.35	20.20
8.11	90	80.4	68.9	126350	0.022	129129	0.00	0.00	10.07	7.74	7.74	17.81
8.12	91	73.7	62.9	126539	0.032	130589	1.53	1.53	6.89	13.02	16.08	22.97
9.01	88	76.8	64.5	126729	0.050	133066	0.00	1.50	5.26	7.52	9.02	14.28
9.02	101	82.2	70.3	126919	0.054	133773	0.00	0.75	8.22	13.46	14.20	22.43
9.03	102	84.3	72.8	127110	0.034	131431	0.76	0.76	10.65	15.22	16.74	27.39
9.04	98	91.5	79.6	127300	0.015	125391	1.60	3.19	7.98	12.76	17.55	25.52
9.05	101	94.9	84.8	127491	0.050	121117	0.00	1.65	14.04	28.07	29.72	43.76
9.06	103	98.3	88.3	127682	0.060	120021	0.00	0.83	9.17	12.50	13.33	22.50
9.07	109	104.2	92.8	127874	0.060	120201	1.66	1.66	6.66	9.15	12.48	19.13
9.08	106	102.8	91.4	128066	0.060	120382	0.00	0.83	4.98	9.97	10.80	15.78
9.09	103	94.3	85.2	128258	0.060	120562	0.00	1.66	9.12	13.27	14.93	24.05
9.10	101	89.6	79.6	128450	0.019	126010	0.00	0.79	11.11	15.08	15.87	26.98
9.11	89	80.8	69.7	128643	0.022	131473	0.00	0.76	7.61	10.65	11.41	19.02
9.12	88	66.9	58.6	128836	0.032	132959	0.00	1.50	9.78	6.77	8.27	18.05
10.01	87	70.3	60.7	129029	0.050	135481	0.00	0.74	7.38	11.81	12.55	19.93
10.02	85	69.1	59.5	129223	0.054	136201	0.00	0.00	3.67	9.54	9.54	13.22
10.03	94	80.5	68.4	129416	0.034	133817	0.75	1.49	5.98	11.21	13.45	19.43
10.04	97	86.2	77.0	129611	0.015	127666	0.00	0.78	7.83	10.18	10.97	18.80
10.05	95	91.3	82.1	129805	0.050	123315	0.00	1.62	13.79	15.41	17.03	30.82

TABLE 4.2 – Temperature, Population, and Crime Data for McAllen, 2001 – 2010 (cont'd)												
Year & Month	Hi Temp[1]	Mean Max Temp[1]	Mean Temp[1]	Pop[2]	Winter Texans + Migrant[3]	Net Pop	Murder Rate[4]	Rape Rate[4]	Robbery Rate[4]	Agg Assalt Rate[4]	Violence Rate 1[5]	Violence Rate 2[6]
10.06	99	94.8	85.7	130000	0.060	122200	2.45	0.82	9.82	9.00	12.27	22.09
10.07	97	93.0	85.3	130195	0.060	122383	0.00	0.00	9.81	8.17	8.17	17.98
10.08	102	98.0	88.0	130390	0.060	122567	0.82	2.45	8.97	5.71	8.97	17.95
10.09	99	92.7	83.5	130586	0.060	122750	0.00	0.00	4.89	7.33	7.33	12.22
10.10	96	90.2	77.9	130782	0.019	128297	0.00	0.78	8.57	23.38	24.16	32.74
10.11	96	83.3	70.6	130978	0.022	133859	0.00	0.75	6.72	7.47	8.22	14.94
10.12	90	76.9	65.0	131174	0.032	135372	0.00	0.00	2.95	9.60	9.60	12.56

Sources:

[1] Weather Source, LLC. Past Monthly Weather Data for McAllen, Texas, Mcallen Miller International Airport. Weather Warehouse. Retrieved 2010-2011 from http://weather-warehouse.com; **Hi Temp** refers to the highest temperature of the month; **Mean Max Temp** refers to the mean of the daily maximum temperatures for the month (those above 90 degrees filled with yellow); and **Mean Temp** refers to the mean of the mean daily temperatures ([maximum + minimum daily temperatures]/2) for the month.

[2] U.S. Census Bureau. (2010). Census 2000 Redistricting Data (Public Law 94-171) Summary File, Table PL1, and 2010 Census Redistricting Data (Public Law 94-171) Summary File, Table P1. http://2010.census.gov/news/xls/cb11cn37_tx_2010redistr.xls (months between 2000 and 2010 interpolated and estimated from 2000 and 2010 census figures).

[3] Percent of Winter Texans living in the LRGV, minus the Migrant Workers who have left the Valley (net gain in black, net loss in red), estimated from figures provided by Perkins, *et al.* (2001) and Simpson (2011).

[4] Uniform Crime Reports Department of the McAllen Police Department, McAllen, Texas.

[5] Violent crime index, including murder, rape and aggravated assault in McAllen, Texas.

[6] Violent crime index, including murder, rape, robbery, and aggravated assault in McAllen, Texas.

BIOGRAPHICAL SKETCH

The author Vanessa Valdez currently resides in the city of Pharr located in the South Texas, Rio Grande Valley. She attended The University of Texas Pan-American for her undergraduate as well as her graduate education. She majored in two areas during her undergraduate schooling, combining a Bachelor of Arts in Psychology and a Bachelor of Science in Criminal Justice and graduating in August of 2008. She returned to the University of Texas Pan-American for her graduate education continuing in one of her chosen fields and graduating with a Master of Science in Criminal Justice. In her graduate education, Vanessa was a keynote speaker in several professional presentations. She may be reached at 8316 S. Cage Blvd., Pharr, Texas, 78577.