The Impacts of Weather on a Mid-American Conference University Football Team and Players' Perceptions Regarding Weather

A thesis submitted to
Kent State University in
partial fulfillment of the requirements
for the degree of Master of Arts

By
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In loving memory of our baby angel, Alexis Noel (2/10/11), you are forever in Aunt Candy’s heart.
Chapter I

Introduction

The different regions of the United States have vastly different weather patterns, which in turn have an effect on the weather in that area. These differences then have an effect on football in those areas which host teams. The NFL Network recently had a special titled The Top Ten Bad Weather Games (NFL Network). This television show featured wonderful examples of weather affecting football games. Some of the games cited include the infamous Ice Bowl in Green Bay, the Fog Bowl in Chicago, and the 1981 AFC Championship which was played in Cincinnati with a -59°F wind chill (this is also the coldest recorded day in NFL history). None of these games were ever postponed due to weather. This did result, however, in the losing teams complaining about the unfair advantages that this gave the other team (which in these cases, 9 out of 10 times was the home team).

More locally, the Kent State football team has also experienced a variety of northeast Ohio weather. On October 28, 2006, Kent State hosted Ohio University at Dix Stadium. That day saw a host of different weather conditions. Sun, wind, sleet, snow, rain, and lightning (the latter of which caused a game delay of about 40 minutes) all made for a very interesting game. These regional aspects of weather have a direct impact on football players. When players come from a mild or moderate climate, such
as the south or west coast, they may be more likely to be set off balance by the weather
patterns that occur in the north and northeast, especially in the winter months.

This thesis examines the perception of and response to the Kent State University
football team to weather conditions over the 2007 football season. In particular, the
following questions are addressed:

- How do football players perceive and respond to different types of
  weather throughout the season?
- How does this response vary according to one’s position on the team or
  one’s previous football experience?
- How does the incidence of injury change during bad weather conditions?
- How do their injuries relate to weather conditions?
- Do players from the same geographic region tend to have the same
  perceptions regarding weather?
- How do the players’ perceptions of the weather change throughout the
  season and how do their perceptions correlate with their experience
  during the season?
- How do football players’ perceptions of weather correlate with actual
  conditions?

To answer these questions, a three-level approach was used. First, initial questionnaires
were given to the players, which they filled out during summer camp prior to the 2007
season. These questionnaires were broad in nature to gain an overall view of the
players’ perceptions on weather and how they felt that it affected the game of football. Next, during the season, the players were asked to fill out a brief, three question reaction survey which pertained to each particular game’s weather. These questions were directed at whether the players felt that weather had played a part in that game, whether they felt that their individual play was affected, and if they felt that the weather was of an advantage or disadvantage either to their own team or the opponent. Corresponding weather data and notes were collected at each game. Last, a final survey was given to the players at the conclusion of the 2007 football season.

Chapters Two and Three discuss background and data and methods, respectively. The data and methods section takes a closer look at weather data and player surveys that were collected and specific methods of analysis. Chapter four offers an understanding of the behavioral aspects of this study. This chapter also includes sections on injuries and weather and the stadium aspects of this research. Finally, chapters Five and Six discuss results and implications, and conclusions.

I feel that my position as a student equipment manager has given me a unique insight into the team. As an equipment manager, I take part in all aspects of the team’s practices and games with them; thus, I feel that I am part of an extended family with the coaches and players. I have been working with the team for two seasons and I feel that the players are able to trust me, and to be open and honest with their answers.
Chapter II
Background

The issues that will be considered in this background section are varied. This researcher starts with a view of the behavioral aspects, and then follows with weather perception and player perception of weather. Completing the background information are sections on injuries from weather, and finally, home field advantage and how the home field advantage applies to the weather aspects of this study. These issues fall into most of the concepts in behavioral geography, such as environmental perception and spatial interaction.

Behavior

Aitken and Bjorklund (1988) suggest definitions for transactionalism (“understanding person-in-environment contexts as a function of particular on-going transactions between the person and the environment”) and constructivism (“persons actively enter into a creative interaction with the environment, the result being construal of phenomena by the subject”). It appears that methodologies of constructivism “elicit stable cognitive representations as our frameworks for understanding the environment,” yet persons and environments do not exhibit stability; they are more dynamic in their interactions. Thus, transactionalism would seem to be the appropriate view to take in person/environment interactions. Aitken and Bjorklund
also assert that “individuals seek to make sense of their surroundings, and to define and locate themselves with respect to those surroundings.” People cannot control the environment, but they can control their behavior and feedback within the person/environment system. This behavior then allows for adaptation or change within the system. It is also interesting to note that the authors’ view that participant perspectives should be taken into account by incorporating the perspective of participants in the interpretation and analysis of an event (Aitken and Bjorklund, 1988). For this particular thesis, how the Kent State football players perceive specific weather conditions during a game and how they feel that it affects their play and the game itself should be noted. The researcher should be viewed as a participant, and studies within this area should concentrate on person/environment change.

Weather Perception

“Weather and climate perception are the means by which people seek to understand their surrounding atmospheric conditions where they live so that they might be able to effectively respond and adapt,” claims Stewart’s (2007) research, which set out to explore the use of adjectives that can describe various weather and climate conditions. For the most part, weather information is in quantitative form. This would be used mainly by professionals such as meteorologists and climatologists. However, the lay person has a tendency to state the weather in descriptive terms; thus, there was a need to devise the Climate Adjective Rating Scale (CARS). It seems that people are
likely to attach certain terms to reflect their experiences with different weather and climate conditions. It is interesting to note Stewart cites that “several researchers have noted that people’s responses to events are likely affected more by their perceptions of weather and climate than by the actual conditions.” The CARS is a list of terms with a five point scale rating for each term. There are 12 first order terms (such as, factor 3: cold and wintry, factor 4: hot and summery, etc.), and there are numerous terms that coincide with each of the 12 first order terms (for example, second order terms with factor 4 - scorching, hot, swelter, parched, etc.). There are two second order factors in the CARS. One is “bad, extreme conditions” and the second is “good, fair, routine conditions.” Here, the second order factors can tend to be “fuzzy” due to the fact that what might be considered “good” or “bad” weather conditions could vary by region and/or culture. Stewart asserts that the CARS is adaptable to other researchers because they can add or delete terms, and also translate terms dependent upon the region of study.

In order to evaluate the effectiveness of municipal heat watch warning systems, Sheridan (2007) conducted surveys of the public’s perceptions and responses to the warnings in four cities (Dayton, OH, Philadelphia, PA, Phoenix, AZ, and Toronto, Canada). The goals of the warning systems are to provide awareness of the heat event to the public and promote them to take appropriate actions, and for the municipalities to set up mitigation plans, if they have not done so already. In his survey, Sheridan found that more than half of the respondents perceived that heat was “not dangerous
to them or only slightly dangerous to them.” It is interesting that an acclimatization factor appeared in some comments made by some of the respondents; for example, a person who had moved to Toronto stated “this is cool to me; 122°F is hot” and “…Every year the heat is hot, you just prepare for it.” The acclimatization factor, in particular, was found to be of great interest by this researcher. It is the belief of this researcher that this would explain any football players coming from the south/southeast/southwest regions to have made more favorable comments considering the unusually warm 2007 season they had to play in as opposed to players from the north/northeast who thought it was too warm or hot.

During a specific study of Phoenix, Arizona, Kalkstein and Sheridan (2007) sought to assess any perceived risk and response by the public to the heat-health watch/warning system. They found that increased risk perception resulted in increased responses to the warnings. As a result of high mortality rates stemming from heat waves in Chicago in 1995 (>800 deaths) and Europe in 2003 (estimates from 22,000 to 50,000 deaths), more research has been dedicated to heat and the impacts it has on human lives. These facts seem to be consistent with the under representation of the actual impacts of heat by both lay persons and science.

Sheridan and Kalkstein (2004) investigated heat-based problems. They are implementing heat watch-warning systems in cities and areas across the United States and Canada that currently would be most susceptible when heat waves occur. The authors state that “oppressive ambient weather conditions are generally best correlated
with negative health effects in the near term.” This would most certainly pertain to and could impact summer training camps, as most players are taught to ignore the elements. However, as players become acclimatized as the summer wears on, they may become less susceptible to any illness or injury that would be a result from the heat or other environmental hazards.

**Player Perceptions of Weather**

Thornes (1977) asserts that weather plays a role as an interference factor in outdoor sports and sporting events. He also states that, in addition to the effect of weather on the sport itself, the effect of weather on the participants should be evaluated as well as this could impact the performance level of the athletes. The interaction between weather and outdoor sports is very complex, and this seems to be fueled by the fact that we cannot control the weather. Thornes (1977) breaks down outdoor sports into three categories. The first, specialized weather sports such as skiing or sailing, is dependent on certain weather conditions for the sport to take place. A second category, weather advantage sports, would be considered for a sport such as a golf tournament; where the weather could change throughout the day. Since the players all tee off at different times, this could clearly give some a distinct advantage over others. The last category, weather interference sports, would be the category in which football would fall. Thorne (1977) labeling for the weather on a given game day can be “warm, dry, bright but overcast, with little or no wind, excellent visibility, not too
humid and with a firm ground surface.” He concludes by offering that there are many inter-relations between weather and sport, and also that there is a lack of research in the field of sport geography as a whole; yet, there are considerable possibilities in this area of study.

Bale (2002) noted that “environmental determinism led to a mindset that saw athletic success as being rooted in the physical environment.” He argues that the physical environment has indeed become associated with sports, and that the differences in environments around the world have an effect on sporting performances. Bale also states that “...particular kinds of weather...can be crucial in certain sports events.”

When considering player perceptions, Hanton et al. (2005) used various stressors and how they were ranked by athletes. The authors used ten elite athletes for his study. His requirement for the “elite” was that the athletes were current national squad members in their sport, and had performed at the highest competitive event, such as in the Olympics or World Cup, for that sport. Some of the factors that were looked at included: injury risk (listed under “Performance Issues”) was chosen by seven out of ten of the athletes. Under “Environmental Issues”, inadequate training facilities rated low with only two out of the ten athletes choosing this; while extreme weather conditions and unfamiliar weather conditions each were chosen by four of the athletes.

The migration of players could be considered a part of weather perception as well. This would be due to the fact that some players want to travel from cooler to
warmer locations, where they might perceive that playing conditions are better.

Rooney (1969) showed that a large portion of players, at the time, did indeed migrate to the southern and western states. When Rooney (1969) did his study, it showed that the majority of college football players came from Ohio, Pennsylvania, California, and Texas. Ohio and Pennsylvania would be considered northern/northeast states, while California is west coast, and Texas is in the south. Rooney also noted that college football is organized geographically into conferences that broadly comply with our concepts of the regions of the United States. While Rooney also showed a migration of players from state to state, he did not look at the players’ perceptions to their changes in environment.

**Sports and Weather**

Considering the effects of weather on sports, Gelade and Dobson (2007), in a study of National Association (soccer) teams in the United Kingdom, found that summer months seem to have slower paced games. Also, skill was considered ahead of speed and stamina in certain types of weather. This was due to heat and players protective equipment causing them to play at a somewhat slower pace because of exertion in the heat. The climate of the home country equaled an approximation of the playing climate for players; 83 percent of players surveyed played either in their home country or a country with a similar climate.
Schatz (2005) asserted that the altitude in Denver, Colorado affects kicks and punts in their stadium, after he had researched for his company (FootballOutsiders.com) the effects that weather (and domed stadiums) had on the kicking game. Schatz (2005) posed questions for further research - - “Do other stadiums have particular effects on the kicking game?” and “What effects does weather, altitude, or specific stadium characteristics have on the rushing and passing game?”

Weather can also lead to injuries on the field. Orchard (2002) compiled statistics that looked at ground conditions and how they affected injury rates. For the majority of his research, Orchard (2002) used a rugby team as a subject. He found that injury incidence was higher in players when conditions were warmer and drier. It was also noted that total injury incidence was higher earlier in the playing season. In comparison, United States soccer teams showed a late season bias to injury incidence, with the U.S. soccer season being played from April though September (opposite the American football season). Orchard (2002) also showed the U.S. football early season injury bias, due to the warmer, drier conditions, which affected ground surface conditions. Injuries were less frequent on muddy, wet natural grass surfaces, due to the ground being more pliable in these conditions.

Orchard and Powell (2003) studied knee and ankle sprain rates in the National Football League. One conclusion was that the risk of injury did not vary significantly with weather or time of season in domed stadiums, as one would expect due to a controlled environment. Cool/wet conditions on natural grass surfaces, and, cool/dry
conditions on artificial turf in open air stadiums yielded lower injury rates. Shoe-surface traction was also shown to correlate with ambient temperature on artificial turf increasing as temperature cooled, thereby explaining the effects that were observed with the Astro-Turf. They suggest that the effects of natural grass may vary by grass species, ground hardness, shoot density, etc. It was proposed to further study surface characteristics and how they correlate with injuries.

Hodgson Phillips et al. (1997) studied the effects of seasonal change on injury incidence in a rugby league from 1993 to 1996. Results showed an increased incidence of injury during the summer season as compared to injury rates during the winter season. In addition, a decline in the severity of injuries resulted in three winter and one summer consecutive seasons. This research also showed an increase in injuries during actual matches versus practices, as one would expect. Although there was an increase in injury during the summer season, there was a decrease in the severity of the injuries. Further study is needed to see if this is a result of playing continual back to back seasons, or whether it is due to change in the playing season and ground conditions.

Albright et al. (2004) looked at the risk of injury to the same player during spring versus fall practice sessions in the Big Ten Conference football programs from spring of 1998 to fall of 2000. Results yielded 3950 fall injuries versus 1007 spring injuries. This decrease in the number of injuries incurred during spring practice may be due to a 1998 ruling by the National Collegiate Athletic Association that called for a decrease in the number of scrimmages and full-contact practices that are allowed during the spring.
practice sessions. However, results show that there was a statistically significant increase in injury rate in the spring (19.8 injuries per 1000 athlete exposures) versus fall (10.6 injuries per 1000 athlete exposures). Therefore, a conclusion of significant increase in spring practice injury was shown, and that the 1998 ruling actually promoted a greater increase in the spring practice injury risk, which could be due to various reasons such as type of practice, player position, position on depth chart, and the severity of the injury.

Cooper et al. (2006) collected data on environmental conditions in the southeast United States for a single football season, and looked at exertional heat illness also during this time. The authors found that the majority of reported exertional heat illness was related to heat cramps, which were associated with lack of acclimatization or conditioning. Research indicated that longer periods of acclimatization may be needed in order for the body to adjust to environmental conditions, and that by having an increased mandatory acclimatization period in hot regions can reduce exertional heat illness. Moran (2001) completed a review for the development of different stress indices for hot and cold environments, in the hopes of implementing these indices in sporting events. Exertional heatstroke appeared to be one of the main factors, in this study, that would be a cause of concern to athletes participating in sporting events. It was found that interior linemen were at higher risk due to larger muscle bulk. Moran (2001) found that there were 84 reported deaths from 1990-1995 caused by heatstroke in American college football players, and five high school player deaths in 1995. The
death of Minnesota Vikings offensive lineman Korey Stringer from complications of major organ failure brought on by heatstroke in 2001 (ESPN) has brought this issue to the forefront of the medical field in football. The availability of a stress index for coaches, athletes, and support staff could help to educate about risks taken in hot and cold stress environments.

**Home Field Advantage**

Acker (1997) studied the home field advantage phenomenon, and how it differs for each NFL team. He found that domed stadium teams averaged 3.22 points higher for home field advantage, compared to 3.01 for teams with open air stadiums. Differences between domed and open air stadium home field advantages were calculated by multiplying the team’s home field advantage by the number of years played in the open air or domed stadium; then adding the results that were looked at in several different categories, and dividing that by the total number of years played in each stadium type for the entire league. The conclusion was that home field advantage is significant in the NFL.

Bale (2003) suggests that keeping playing fields “even” such as, all surfaces in a given sport are either artificial or natural should stave off any unfair home field advantage. He goes on to cite that environmental influences can be unfair in a sport match, and that this unfairness can be alleviated by moving sports indoors in order to maintain “predictability and placelessness.” Bale (2004) also notes that people have
attempted to neutralize the physical environment impacts by using artificial
environments for sports and sporting events. This is seen as being necessary in some
cases in order to lessen the impacts from weather, for instance, on playing surfaces and
players.
Chapter III

Data Collection & Methodology

This chapter details the survey/questionnaire development and implementation, along with collection of weather data and stadium analysis. Statistical analysis concludes the chapter. The basic timeline of this research is shown in Figure 1.

August 2007
Initial Interviews and Surveys

August – November 2007
Reaction Surveys after each game

August – November 2007
Data Collection and Input

Final Surveys and Post-season Interviews

Figure 1. Data collection timeline
Survey Development

Consent forms were handed out along with an initial two page questionnaire, and explained to the football players in August, 2007. This was completed at the end of summer training camp and before the first game of the season. The questionnaires and consent forms were collected upon completion and then compiled using SPSS. Ninety-seven out of 104 players that were currently on the active Kent State roster at the time filled out the initial questionnaire (Figure 2). The players were allowed to choose their own code name at this point in the study. This was done to help ensure privacy.
Code Name __________________ (Please choose something you will remember for the season)
Home State __________________
Offense/Defense (Please circle one)
Lineman/Nonlineman (Please circle one)

Please answer the following questions:

1. How would you describe the weather & climate where you have played most of your football (Please indicate on each line)
   - Hot-----------Warm-------------Cool-------------------Cold
   - Dry-------------------Rainy-----------------------Snowy

2. If you have played most of your football in a state other than Ohio, do you feel that the weather in northeast Ohio has affected you and/or your play? Yes/No. Please explain _______________________________________________________________________________________________________
   If you have played most of your football in Ohio, do you feel that this has given you an advantage in certain weather conditions? Yes/No. Please explain _____________________________________________________________

3. Please rate the following weather conditions for playing football: (1=excellent, 2=good, 3=not a factor, 4=poor, 5=absolute worst)
   - Heat 1-----2-----3-----4-----5
   - Cold 1-----2-----3-----4-----5
   - Strong wind 1-----2-----3-----4-----5
   - Sun 1-----2-----3-----4-----5
   - Clouds 1-----2-----3-----4-----5
   - Rain 1-----2-----3-----4-----5
   - Snow 1-----2-----3-----4-----5

4. Weather has an effect on my play. (Please circle one)
   1-----------2-----------3-----------4-----------5
   (Agree) (Unsure) (Disagree)

5. You are playing in a game in which the temperature is 35 degrees, with a wind chill factor of 21 degrees, snow is falling, a teammate is shivering, and says “it’s freezing!” Rate the validity of his complaints (do you agree with his complaint?) by circling a number.
   1-----------2-----------3-----------4-----------5
   (Agree) (Unsure) (Disagree)

6. The game day air temperature is 80 degrees, it’s 90 degrees on the field, a teammate is feeling lightheaded and is vomiting. Do you feel that the weather is affecting him or that his symptoms have nothing to do with the weather?
   1-----------2-----------3-----------4-----------5
   (Agree) (Unsure) (Disagree)

7. At what temperature do you think it is too hot to play football? _________

8. At what temperature do you think it is too cold to play? _______________
Once it was decided that a questionnaire and survey would be used in the course of this study, the first course of action that was taken was to complete the Application for Approval to use Human Research Participants. The application was submitted through the Research and Graduate Studies Department for approval by the Institutional Review Board (IRB). This research fell into the level one category, as determined by the IRB, which consists of interviewing, surveys, and observations with no invasive procedures being conducted. A copy of the questionnaire and consent form had to be submitted along with the application to the IRB. Once approval was received in August 2007, the study was able to proceed.

**Survey Implementation**

Once the season commenced on August 30, 2007, players were asked to complete a three question reaction survey (Figure 3) for each game during the season that was specific to each game’s weather. It can be noted at this time that due to time constraints and trying to figure out a well-laid foundation for having the players fill out the reaction surveys after each game, the Iowa State game did not have any reaction
surveys completed as it was felt that too much time had elapsed between the game and when the survey should have been handed out.

The questions for the reaction survey include: did the player feel that the weather had played a part in the game, did the player feel that his own play was affected by the weather, and if the player felt that our team or the opposing team had an advantage due to the weather. Space was also allotted for the players to make any comments that they might deem appropriate in regards to the weather. Kent State’s 2007 schedule consisted of 12 games, seven road games and five home games (Figure 4).
<table>
<thead>
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<th>Date</th>
<th>Opponent</th>
<th>Location</th>
<th>Time</th>
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<tbody>
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<td>Iowa State</td>
<td>Ames, IA</td>
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</tr>
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<td>09/08/07</td>
<td>Kentucky</td>
<td>Lexington, KY</td>
<td>6 pm</td>
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<td>Delaware State</td>
<td>Kent, OH</td>
<td>4 pm</td>
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<tr>
<td>11/24/07</td>
<td>Buffalo</td>
<td>Kent, OH</td>
<td>1 pm</td>
</tr>
</tbody>
</table>

Figure 4. 2007 Kent State University Football Schedule

A minor “added incentive” was given to the players for filling out a reaction survey in the form of a piece of candy. This turned out to be a semi-Pavlovian experiment, as the players then knew that they received the candy in turn for filling out a survey, and if it was not out by a certain time, they made sure to ask for it.

A final questionnaire (Figure 5) was completed by the players after the conclusion of the season on November 24, 2007. One question in particular was included on both the initial and final questionnaires in order to see if the players had a change in opinion over the course of the season, especially those players who were not from the local region. This particular question was actually a rating scale of various weather elements.
Weather Data Collection

Weather data was collected at the beginning of each quarter by the researcher. An added benefit of the researcher’s job as a student equipment manager is to be directly on the sideline with the team, thus having direct access to the field and sideline areas. An infrared thermometer was used to assess the field and sideline ground temperatures. A handheld Kestrel instrument was used to obtain air temperature, wind speed, wind chill, relative humidity, heat index, and dew point. Air and ground conditions were observed and noted.

The first order of business upon entering each stadium was to get familiarized with how the stadium was situated (North, South, East, and West) so that it would be easy to obtain wind direction when I was taking the readings. Readings were taken just prior to the beginning of each quarter and one overtime period that occurred during Kent State’s final game. Notations were also made as to ground and sky conditions during each game (Table 4.1) as observed by the researcher.

Statistical Analysis

Different categories were chosen for comparison purposes. Offensive versus defensive, linemen versus non-linemen, and “local” versus “non-local” were categories were considered. The “local” region consisted of all players from Ohio, Pennsylvania, and West Virginia. The “non-local” region consisted of all players from the remaining states. This division was decided upon due to the fact that most of the players from
Pennsylvania and West Virginia were very close to the Ohio border, and these players indicated hometown weather patterns that were similar to Ohio in their questionnaire responses. The offense/defense and linemen/non-linemen divisions were created because these groups typically tend to view different aspects of the football game differently.
Chapter IV

Results

In this chapter, the results that were gathered during the 2007 Kent State football season are explored in greater detail. The focus is on weather data that was gathered during each game, player questionnaires and surveys, and stadium analysis for each stadium that Kent State played a game in during the season.

Weather Data

After assessing the data, it was apparent that this was an abnormally warm football season. The first eight games (with the exception of the Delaware State game) were relatively warm and mild as shown by the average air temperatures and air and ground conditions (Table 1). Average sideline temperatures ranged from 70° to 98°F during this period, with the exception of the Iowa State game. There was an average sideline temperature of 63°F in this instance, although this was the only evening game during the season. Field temperatures were extremely varied. Both the highest and lowest average field temperatures were measured on artificial turf surfaces. Nine games were played on artificial turf and three games were on grass fields. The highest average field temperatures of 100°F were recorded in Peden Stadium in Athens, Ohio,
and Ohio Stadium (more commonly referred to as “The Horseshoe”) in Columbus, Ohio recorded a temperature of 101°F, and in the Rubber Bowl in Akron, Ohio, a temperature of 114°F was recorded. Time of day and cloud cover are a factor here, as the games versus Akron and Ohio State were both at noon, the Ohio University game started at 3 pm; however, for all of these games, the sun had been out for most of the morning or day with relatively few (if any) clouds in the sky, causing the increased field temperatures in these cases.

The final four games started to show some variability in weather. Sideline temperatures averaged 53, 47, 55, and 43°F respectively. These games also showed the greatest wind speeds during any games. The final four games collectively averaged 3.75 mph wind speeds, and two of these four had the only wet ground conditions of the season.

Rain occurred only during the Central Michigan game. There was a mild, steady sprinkling during the first half and steady rain during the second half of the game. There was no rain during the Buffalo game; however, the ground was wet due to steady rain from the previous day.
<table>
<thead>
<tr>
<th>Game Date</th>
<th>Time</th>
<th>Air Temp.</th>
<th>Air Conditions</th>
<th>Ground</th>
<th>Opponent</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/30/2007</td>
<td>8pm</td>
<td>74°F</td>
<td>Clear</td>
<td>Dry</td>
<td>@ Iowa State</td>
</tr>
<tr>
<td>9/8/2007</td>
<td>6pm</td>
<td>85°F</td>
<td>Scattered clouds</td>
<td>Dry</td>
<td>@ Kentucky</td>
</tr>
<tr>
<td>9/15/2007</td>
<td>4pm</td>
<td>65°F</td>
<td>Scattered clouds</td>
<td>Dry</td>
<td>Delaware State</td>
</tr>
<tr>
<td>9/22/2007</td>
<td>12pm</td>
<td>84°F</td>
<td>Clear 1st half, overcast 2nd half</td>
<td>Dry</td>
<td>@ Akron</td>
</tr>
<tr>
<td>9/29/2007</td>
<td>3pm</td>
<td>79°F</td>
<td>Clear 1st qtr, few clouds last 3 qtrs</td>
<td>Dry</td>
<td>@ Ohio</td>
</tr>
<tr>
<td>10/6/2007</td>
<td>3pm</td>
<td>86°F</td>
<td>Scattered clouds</td>
<td>Dry</td>
<td>Miami</td>
</tr>
<tr>
<td>10/13/2007</td>
<td>12pm</td>
<td>70°F</td>
<td>Scattered clouds</td>
<td>Dry</td>
<td>@ Ohio State</td>
</tr>
<tr>
<td>10/20/2007</td>
<td>4pm</td>
<td>71°F</td>
<td>Clear</td>
<td>Dry</td>
<td>Bowling Green</td>
</tr>
<tr>
<td>10/27/2007</td>
<td>1pm</td>
<td>55°F</td>
<td>Sprinkling 1st half, raining last half</td>
<td>Wet</td>
<td>Central Michigan</td>
</tr>
<tr>
<td>11/10/2007</td>
<td>4pm</td>
<td>49°F</td>
<td>Overcast, sun setting/dark sky last 2 qtrs</td>
<td>Dry</td>
<td>@ Northern Illinois</td>
</tr>
<tr>
<td>11/17/2007</td>
<td>12pm</td>
<td>53°F</td>
<td>Clear 1st half, overcast 2nd half</td>
<td>Dry</td>
<td>@ Temple</td>
</tr>
<tr>
<td>11/24/2007</td>
<td>1pm</td>
<td>39°F</td>
<td>Overcast 1st half, overcast 2nd half &amp; OT</td>
<td>Wet</td>
<td>Buffalo</td>
</tr>
</tbody>
</table>

The lowest recorded field temperatures (Figure 5) were in Huskie Stadium in Dekalb, Illinois (46.5°F) and in Dix Stadium in Kent, Ohio (43°F). These games were played at 4 pm and 1 pm, respectively, and the sky was overcast.
Player Questionnaires

The initial questionnaire was filled out by 96 out of 104 players from the team. Players were asked to rate a variety of weather conditions, if they felt that they had received an injury that was weather-related, to describe the climate where they had played football prior to coming to Kent State, and various other questions which pertained to football and/or weather (Figure 2).

The first question on the initial questionnaire asked the players to describe the weather and climate where they had played the majority of their football games. The local (Ohio, Pennsylvania, West Virginia) group cited dry and warm, and rainy and cool as being the weather types where they had played. All other states clearly showed hot and dry weather conditions. The offense and defense were closely related, as far as
numbers, across all categories. The lineman section had strongly stated that rainy and cool was the weather in their regions. The non-lineman seemed to be strongly aligned with the “all other states” section as they listed hot and dry as their weather types.

Question two asked the non-local players whether they think that the weather in Ohio has affected their play, and asked local players if they feel that living here in Ohio had given them advantages in certain weather conditions. Thirty-one non-local players responded “Yes” to the weather that had an effect on them, 38 responded “No”, and 27 did not respond. Some players cited physical reasons in their answers:

- **Cold weather has made it difficult breathing.**
- **It rains a lot so it’s tough on the joints.**
- **I’ve never played in humidity and it affects my breathing.**
- **I have more endurance due to cooler weather less humidity in Ohio.**

Others felt that it was a more of a psychological issue:

- **Football is a mental game. When you’re really involved in the game you don’t feel the weather you just think and feel about the game.**
- **You have to be able to adapt.**
- **The weather is so sporadic it is hard to adjust.**

And some seemed to express a “love-hate” relationship about the weather:

- **The weather fluctuates and it is more exciting with unexpected weather.**
• I never played in this type of weather and I hate it.

• Ohio weather is awful, either warm and humid or cold and bitter.

For the second part of the question, 34 of the local players responded “Yes” they felt that they have an advantage from playing here in Ohio, 16 responded “No”, and 46 did not respond. This group also had some interesting comments, again, with some citing both physical and psychological reasons for how they felt:

• Because I have played in the rain more than others I am better prepared.

• A lot of players from the south aren’t used to the snow.

• Cold weather doesn’t affect me mentally as much.

• Other people coming to Ohio are not used to the weather.

• I’m more acquainted with the shift from hot (August) to cold (November) during the course of a season.

Some players simply stated the unpredictability of weather as a factor:

• Ohio’s weather is unpredictable. We are prepared for all weather patterns.

• The wind and rain and snow in high school made me better.

• Because you play in everything in this state.

• I think it’s helped because one then has the ability to play in any condition.

• If you can play in bad weather, you will be a good team.
A rating scale was given as the third question, with a Likert scale from one being excellent to five being absolute worst. The players were asked to rate heat, cold, strong wind, sun, clouds, rain, and snow; and how they felt that these weather elements affected conditions for playing football. According to the players, sun and clouds were rated as the best factors in which to play football. Sixty-two percent of the offense and defense groups chose the positive categories for sun; which was comparable to 64% of the linemen and non-linemen group who chose these categories. Cloudy conditions had a sixty-four percent total in the positive categories from both sets of groups. Weather variables receiving the highest percentage of ratings as poor and absolute worst were snow, rain, cold, and heat. Snow had the highest overall percentages, with 72% of linemen/non-linemen, and 68% of the offense/defense choosing the negative categories. Fifty-eight percent of the offense/defense subgroup ranked rain in the negative categories; while the linemen/non-linemen group had 61% of their total in the negative categories. The offense and defense gave cold 54% of their negative ratings compared to 57% in the linemen/non-linemen group. Heat seemed to fall in the middle of all of the weather variables, but still showed the greatest percentage of ratings in the negative categories, with 48% of both groups choosing this variable. Wind showed evenly across the board with both subgroups having 50% of their totals in the negative rankings, and the other 50% combined in the positive and neutral categories.

Question four asked if the players felt that weather had an effect on their play. They were given the options of agree, unsure, and disagree. Among all players, 45% felt
that weather indeed had an effect on their play, 23% felt unsure, and 32% felt that weather did not have an impact on their play. Most of the numbers were consistently close among the individual groupings, including offense vs. defense and local vs. non-local. However, one difference that showed up was between linemen and non-linemen: 39% of non-linemen did not think that weather affected their play, compared with 22% of linemen who felt the same way.

The next two questions gave the players both a cold and hot scenario, and were asked if they agreed or disagreed. The fifth question gave a scenario which depicted an air temperature of 35 degrees, a wind chill factor of 21 degrees, snow, and a teammate who is shivering complaining about the cold. Question six was a hot scenario in which the air temperature is 80 degrees, field temperature is 90 degrees and a teammate is feeling lightheaded and is vomiting. Players were asked if they felt that the weather was affecting their teammate for both scenarios. Players were asked if they agreed, disagreed, or were unsure for their response to the given scenarios. Question five, the cold scenario responses, showed the majority to be in agreement with a teammate complaining about the cold. Question six, the hot scenario also showed that the majority of players felt that the teammate in this scenario was affected by heat. Thus, the majority of players would back up how their teammates feel about these specific weather scenarios. (Figure 6)
Questions seven and eight asked the players to list the temperatures in which they thought that it was “too hot” or “too cold” to play football. Results showed a wide range of answers, particularly for the cold temperatures (Figures 7 and 8 and Tables 2 and 3).
Figure 7. Response to initial questionnaire “what temperature is too hot?”

Figure 8. Response to initial questionnaire “what temperature is too cold?”
The temperature at which the players felt that it was too hot to play football centered in the 91-100°F range. For the cold temperature ranges, the 11-20°F range showed the majority, although the 0-10°F, 21-30°F, and 31-40°F ranges were all relatively close.

Table 2. Responses to question “At what temperature do you think it is too hot to play football?”

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Non-local</th>
<th>Offense</th>
<th>Defense</th>
<th>Linemen</th>
<th>Non-linemen</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-80°</td>
<td>8%</td>
<td>3%</td>
<td>10%</td>
<td>7%</td>
<td>6%</td>
<td>10%</td>
</tr>
<tr>
<td>81-90°</td>
<td>28%</td>
<td>15%</td>
<td>35%</td>
<td>29%</td>
<td>35%</td>
<td>29%</td>
</tr>
<tr>
<td>91-100°</td>
<td>57%</td>
<td>67%</td>
<td>50%</td>
<td>57%</td>
<td>53%</td>
<td>55%</td>
</tr>
<tr>
<td>&gt;100°</td>
<td>8%</td>
<td>13%</td>
<td>5%</td>
<td>7%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>n</td>
<td>53</td>
<td>39</td>
<td>20</td>
<td>28</td>
<td>17</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 3. At what temperature do you think it is too cold to play football?

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Non-local</th>
<th>Offense</th>
<th>Defense</th>
<th>Linemen</th>
<th>Non-linemen</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10°</td>
<td>5%</td>
<td>8%</td>
<td>5%</td>
<td>14%</td>
<td>12%</td>
<td>9%</td>
</tr>
<tr>
<td>-1 to -10°</td>
<td>7%</td>
<td>8%</td>
<td>5%</td>
<td>7%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>0 – 10°</td>
<td>22%</td>
<td>15%</td>
<td>32%</td>
<td>11%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>11 – 20°</td>
<td>35%</td>
<td>18%</td>
<td>27%</td>
<td>29%</td>
<td>35%</td>
<td>27%</td>
</tr>
<tr>
<td>21 – 30°</td>
<td>20%</td>
<td>15%</td>
<td>14%</td>
<td>18%</td>
<td>12%</td>
<td>18%</td>
</tr>
<tr>
<td>31 – 40°</td>
<td>9%</td>
<td>33%</td>
<td>14%</td>
<td>21%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>&gt;40°</td>
<td>2%</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>n</td>
<td>55</td>
<td>40</td>
<td>22</td>
<td>28</td>
<td>17</td>
<td>33</td>
</tr>
</tbody>
</table>
Question 9 asked players if they felt that they had an injury which they thought was weather related; and if so, what was the injury and what month did it occur. The following breakdown resulted:

Yes – 14

No – 81

Didn’t respond – 1

Of those players who responded that they did feel that their injury was sustained due to the weather; several listed cramps, pulled hamstrings, and dehydration. Also cited were an ankle injury “due to wet grass” and pulled muscles and body aches due to cold weather. Players were asked if they felt that games changed due to weather from September to November. Sixty-six responded yes, twenty-six responded no, and four did not respond. Some responses that were received included:

- The ability to do certain things on the football field can be limited due to the weather. For instance a fast player may not be able to avoid defenders as easy as normally if snow or rain was on the ground.

- A team from a hot climate that plays a team in a cold climate at their home might not do as well.

- The weather is colder, your muscles become stiff.

- Get a little colder and players slow down.
**Reaction Surveys**

The reaction surveys were designed to be short three question surveys that the players could answer after each game. These surveys asked the players to look at each game’s particular weather and how it affected the team and their individual play. Also, please note that reaction surveys were not done for the Iowa State game; this was due in part to figuring out the best way in which to dispense the surveys to the team.

The first question (Figure 9 and Table 4) shows that, for the most part, players felt that the weather for this particular season did not play a part in the games. While roughly 21% of players felt that the Delaware State game was affected “a little” by the weather, it appears that the 38% of players felt that weather “somewhat” affected the Central Michigan game. Approximately 13% of players felt that the Miami game and 15% felt that the Central Michigan game was “very much” affected by the weather. Recall that the Central Michigan game was the only game during the season that the team experienced rain during a game. The Chi-square test for the first question on the reaction survey yielded a $P = .067$, not statistically significant; as 68% of responses fell in the “not at all” and “a little” categories. These responses were used to see if there was a link between the weather and the players’ perceptions for each game during the season, and to see if the responses varied according to the weather.
Table 4. Did you feel that weather played a part in today’s game?

<table>
<thead>
<tr>
<th>Game</th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>A lot</th>
<th>Very Much</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>@Kentucky</td>
<td>19</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>Delaware State</td>
<td>22</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>@Akron</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>@Ohio</td>
<td>14</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Miami</td>
<td>15</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>@Ohio State</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Bowling Green</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Central Michigan</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>@Northern Illinois</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>@Temple</td>
<td>10</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Buffalo</td>
<td>37</td>
<td>20</td>
<td>25</td>
<td>4</td>
<td>5</td>
<td>91</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td><strong>159</strong></td>
<td><strong>51</strong></td>
<td><strong>61</strong></td>
<td><strong>17</strong></td>
<td><strong>18</strong></td>
<td><strong>306</strong></td>
</tr>
</tbody>
</table>

Figure 9. Reaction survey question one, Do you feel that weather played a part in today’s game?

The second question (Table 5 and Figure 10) asked players if they felt that their own play was affected due to the weather during the game. Again, as with the first
question, the majority of players felt that overall their individual play was not affected by the weather during any particular game; although some games showed greater percentages of players that felt that their play was “a little” to “very much” affected by weather. The Central Michigan game stands out here again, as well as the Northern Illinois game. The Miami, Temple, and Buffalo games also show variety with this question. The Northern Illinois and Buffalo games had the lowest overall temperatures out of all games played during the season.

<table>
<thead>
<tr>
<th>Game</th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>A lot</th>
<th>Very Much</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>@Kentucky</td>
<td>24</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>Delaware State</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>@Akron</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>@Ohio</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Miami</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>@Ohio State</td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Bowling Green</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Central Michigan</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>@Northern Illinois</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>@Temple</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Buffalo</td>
<td>35</td>
<td>5</td>
<td>14</td>
<td>1</td>
<td>2</td>
<td>57</td>
</tr>
<tr>
<td>n</td>
<td>134</td>
<td>25</td>
<td>44</td>
<td>9</td>
<td>11</td>
<td>223</td>
</tr>
</tbody>
</table>

The Chi-square test revealed a statistically insignificant P value of .189 when players were asked whether they felt that their individual play had been affected by weather for each game. These responses were used to gage any differences between each game’s
weather and players’ perceptions to each game’s weather. Here, 71% of players felt their play was either “not at all” or “a little” affected.

![Figure 10. Reaction survey question two, Do you feel that your play was affected by today’s weather?](image)

The last question (Table 6 and Figure 11) asked whether they felt that weather conditions during a game gave either our team or the opponents an advantage or disadvantage. As with the first two questions, results show that the majority of players felt that neither team was affected by the weather. The games that stand out in this particular question are Miami, Ohio State, Bowling Green, and Central Michigan. Approximately 20% of players felt that the opponents had the advantage due to weather conditions during the Miami, Bowling Green, and Central Michigan games.
Oddly, almost 30% of players felt that our team had the advantage at the Ohio State game, which was also our worst loss of the season by a score of 48-3 points.

Table 6. Question three – Was weather an advantage/disadvantage for our team or the opponents?

<table>
<thead>
<tr>
<th>Game</th>
<th>Helped them a lot</th>
<th>Helped them a little</th>
<th>Neither</th>
<th>Helped us a little</th>
<th>Helped us a lot</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>@Kentucky</td>
<td>1</td>
<td>3</td>
<td>28</td>
<td>2</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>Delaware State</td>
<td>1</td>
<td>2</td>
<td>27</td>
<td>1</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>@Akron</td>
<td>0</td>
<td>1</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>@Ohio</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Miami</td>
<td>2</td>
<td>3</td>
<td>22</td>
<td>1</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>@Ohio State</td>
<td>0</td>
<td>1</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Bowling Green</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Central Michigan</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>@Northern Illinois</td>
<td>0</td>
<td>2</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>@Temple</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Buffalo</td>
<td>2</td>
<td>7</td>
<td>75</td>
<td>7</td>
<td>0</td>
<td>91</td>
</tr>
<tr>
<td>n</td>
<td>7</td>
<td>25</td>
<td>245</td>
<td>16</td>
<td>13</td>
<td>306</td>
</tr>
</tbody>
</table>

Eighty percent of players felt that the weather was neither an advantage nor disadvantage for the season, and 10% fell to either side of that (Table 6). The Chi-square test was statistically insignificant with a P value of .835 (when given a value of .05 as being statistically significant) for these responses.
Individual game comments included the following:

Game #2

- *Weather was perfect*

- *Practicing in the Ohio weather helped in the hot humid air of Kentucky*

Game #3

- *I have more endurance in cooler weather*

Game #5

- *Helped because nice weather*

Game #6

- *Hot bad for both teams*
Game #10

- *Cold, hard to use hands*

Game #11

- *Windy, hard on kicking game*

Game #12

- *Buffalo was probably much more suited to cold weather*
- *Very cold, un-motivating*

Final Questionnaires

The final questionnaires given at the conclusion of the 2007 football season tried to decipher whether players attitudes towards specific weather factors had changed since the beginning of the season. It also was used to determine if players felt that they had suffered an injury due to weather during the season, and if, overall, they felt that their play had been affected during the season because of weather conditions.

The first question asked players if they felt that weather had an effect on their play during the season (Figure 12). No players, across any of the divisions, felt that weather had “very much” of an effect. The majority across all divisions felt that weather had impacted them “a little” or “not at all.” The offense and non-linemen had the highest rates for the “a little” selection; and the defense and players from all other states showed the showed the highest among the “not at all” selection. The highest
percentages for the “a lot” selection came in the non-linemen and all other states
groups. The “somewhat” selection ranked highest among the offense and non-linemen
groups.

Figure 12. Question 1 (final) Do you feel that weather has had an effect on your play this season?

These responses would most likely be due to the relatively mild (weather-wise) season
that the football team encountered during the year in which this study was done.

Question number two (Figure 13) had a negligible response, as only two of the
players from the entire team felt that they had suffered an injury due to the weather
during the season. The following all-inclusive list of injuries (Table 7) was tabulated at the end of the season.

<table>
<thead>
<tr>
<th>Game</th>
<th>Date</th>
<th># of injuries</th>
<th>Type of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>@Iowa State</td>
<td>8/30</td>
<td>3</td>
<td>AC joint sprains, ankle sprain</td>
</tr>
<tr>
<td>@Kentucky</td>
<td>9/8</td>
<td>6</td>
<td>Heat related problems, concussion, knee bruise</td>
</tr>
<tr>
<td>Delaware State</td>
<td>9/15</td>
<td>2</td>
<td>Ankle sprain, concussion</td>
</tr>
<tr>
<td>@Akron</td>
<td>9/22</td>
<td>6</td>
<td>Shoulder bruises, hip pointer, knee injury, shoulder contusions</td>
</tr>
<tr>
<td>@Ohio</td>
<td>9/29</td>
<td>5</td>
<td>Groin strain, shoulder bruises, eye contusion, ACL</td>
</tr>
<tr>
<td>Miami</td>
<td>10/6</td>
<td>7</td>
<td>Rib contusion, neck burner, dental injury, ankle sprains, fatigue related problems</td>
</tr>
<tr>
<td>@Ohio State</td>
<td>10/13</td>
<td>3</td>
<td>Neck strain, neck burner, ankle sprain</td>
</tr>
<tr>
<td>Bowling Green</td>
<td>10/20</td>
<td>5</td>
<td>Concussion, hip pointers, knee contusion, forearm fracture</td>
</tr>
<tr>
<td>Central Michigan</td>
<td>10/27</td>
<td>6</td>
<td>Concussions, hip pointer, ankle sprain, neck burner, neck strain</td>
</tr>
<tr>
<td>@Northern Illinois</td>
<td>11/10</td>
<td>7</td>
<td>ACL, shoulder strain, MCL tear, finger dislocation, concussion, rib contusion, neck strain</td>
</tr>
<tr>
<td>@Temple</td>
<td>11/17</td>
<td>7</td>
<td>Shoulder subluxation, shoulder bruises, neck burner, ankle sprains</td>
</tr>
<tr>
<td>Buffalo</td>
<td>11/24</td>
<td>6</td>
<td>Shoulder strains, knee sprain, rib bruise, shoulder subluxation</td>
</tr>
</tbody>
</table>
Heat related problems from the Kentucky game were the only obvious weather related problems. All other injuries can be left to interpretation as to whether or not they were weather-related.

Figure 13. Question 2 (final) Did you sustain a weather-related injury this year?

The third question was a repeat of the weather elements rating scale from the initial questionnaire, in which the players were given the Likert scale on weather variables and asked to again rank them from excellent to absolute worst as conditions to play football. The one item in particular that stands out on the heat graph (Figure 14) is that, by the end of the season, the linemen considered this to not be a factor to them. The positive categories of excellent and good decreased considerably across all divisions (offense, defense, linemen, non-linemen, OH/WV/PA, and all other states). Offense and
defense showed a slight increase in the poor category compared with initial results, and the absolute worst category dropped off altogether in all groups except the all other states group when compared to the initial questionnaire.

The cold weather ratings also appeared to decrease across categories and divisions (Figure 15). This could be largely due to the mild weather season that the football team happened to encounter during this year of study. The largest drop was in the offense group. They had a 33% decrease from what they reported on the initial questionnaire in the poor category.

Strong wind showed an increase in the poor category among the offense and non-linemen groups (Figure 16), while the absolute worst category decreased across all groups, and, in two groups (defense and linemen) did not even register. The positive categories showed a decrease when compared to the initial responses across all groups.

The poor category increased across all divisions for the ratings on sun (Figure 17). The linemen showed an increase in the good category while non-linemen saw a decrease here. The non-linemen and all other states groups had an increase among the positive categories, when compared to their initial ratings for the sun category.

Clouds (Figure 18) increased in not being a factor across all groups, and the negative categories dropped off all together across all groups. The positive categories decreased from the initial reactions for this category across all groups.

The majority of all groups, except all other states, felt that rain was not a factor, in comparison with this same category on the initial questionnaire (Figure 19). All other
states group showed a decrease in this category as this group also had no ratings in the positive categories. They showed at least small numbers in these categories on the initial questionnaire. The non-linemen group also displayed this trend in the excellent rating. Negative categories showed decreases among all groups, except the all other states group which had an increase when compared to the responses on the initial questionnaire.

All groups showed an increase for snow (Figure 20) *not being a factor*, again, possibly due to the fact that there was no game during the season in which the team had to play in snow. It is also interesting to note here that the positive categories decreased and the negative categories increased across the groups as compared to initial responses.
Table 8. Summary of P values (final) question three, Do you feel that weather was an advantage/disadvantage to our team or to the opposing team today?

**Final P Values**

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>REGION</th>
<th>LINEMAN/NON-LINEMAN</th>
<th>OFFENSE/DEFENSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>.329</td>
<td>.053</td>
<td>.138</td>
</tr>
<tr>
<td>Cold</td>
<td>.204</td>
<td>.740</td>
<td>.878</td>
</tr>
<tr>
<td>Strong Wind</td>
<td>.213</td>
<td>.000</td>
<td>.430</td>
</tr>
<tr>
<td>Sun</td>
<td>.527</td>
<td>.903</td>
<td>.648</td>
</tr>
<tr>
<td>Clouds</td>
<td>.308</td>
<td>.871</td>
<td>.031</td>
</tr>
<tr>
<td>Rain</td>
<td>.213</td>
<td>.543</td>
<td>.284</td>
</tr>
<tr>
<td>Snow</td>
<td>.493</td>
<td>.341</td>
<td>.370</td>
</tr>
</tbody>
</table>

When the Chi-square tests were run in SPSS, the final P values (Table 8) for the weather factors showed all weather variables to be statistically insignificant at the .05 level. The only factor that showed any significance was the heat for the linemen/non-linemen group. The fact that most of the P values showed no statistical significance could be due to various factors, one of which could be the abnormally mild season that happened during the 2007 football season for the Kent State team.
Heat Rating Scale (final)

Cold Rating Scale (final)
Strong Wind

![Strong Wind Rating Scale](chart)

Figure 16. Strong Wind Rating Scale (final)

Sun

![Sun Rating Scale](chart)

Figure 17. Sun Rating Scale (final)
Figure 18. Clouds Rating Scale (final)

Figure 19. Rain Rating Scale (final)
The fourth question (Figure 21) asked players what they thought was the ideal temperature in which to play football. As one can see from Figure 21, 70 - 79° F was chosen by the majority of players to be considered the “ideal playing temperature.” A normal distribution curve is shown after the final temperatures were analyzed.
What is the best temperature for playing football in?

![Bar chart](chart.png)

Figure 21. Question four (final) What is the best temperature for playing football in?

Finally, there was an area for the players to add any comments that they felt would be helpful for this research regarding weather and/or football. The following are some of the comments that were received:

- *Cloudy days with little to no wind are perfect.*
- *Strong wind doesn’t help QB’s.*
- *This is good. (Research that is being done.)*
- *Weather helps some teams but hurts others who give into the conditions.*
- *I believe no matter what you do you will always have the weather God gives you.*
- *Not much of a factor for D-Ends.*
- *Weather effects every game especially wind and weather? Can slow a team down.*
Chapter V

Discussion

Although this was an unusually mild weather season for the football team, it did produce answers for the questions which were presented in chapter one. Ideally, this researcher was hoping to have the team encounter more of a variety of weather conditions than what had occurred throughout the season. The limitations of this study will also be discussed in this chapter.

Individual game comments were used when assessing how players perceived and responded to different types of weather during the season. When looking at the individual game comments made against the actual weather conditions, these would appear to be considered normal under each game’s circumstances. There were no “terrible” weather conditions during the season. There were no games in which there was snow, torrential rain downpours, or thick fog; thus there would be no comments that would reflect these types of weather conditions. This researcher observed first hand some actions taken by players during the season. For example, during the final game, where the air temperature averaged 39°F, some players from Florida huddled around the heater and stated that “it was freezing” while players from Ohio were telling them to “get away from those heaters, it’s not that cold.” Though not excessively cold, this was the coldest game of the season for the team. This game might have seemed to
be colder to the players also because of its placement during the season at the end of
November, which is typically cold in northeast Ohio during this time.

Players’ responses were also sorted by their position on the team. Offensive
players were compared with defensive players; and likewise linemen with non-linemen.
A number of differences were observed between the initial and final questionnaires.
Offensive players shifted opinions as the season progressed in response to the heat
variable, with more rating it in negative and neutral categories at the end of the season;
while the defense showed a decrease in the positive and negative categories and an
increase in the neutral category. In the cold weather ratings, the defensive players
showed an increase in the poor category, but a decrease in the absolute worst. The
offense, on the other hand, showed a significant decrease in poor and an increase in the
not a factor categories. A decrease was noticed in the positive categories for the
weather variable of sun for both the offensive and defensive groups, as well as a
decrease in the absolute worst for both groups. The negative category showed
increases among both groups.

The strong wind variable decreased in the positive categories from the initial to
the final questionnaire for the offense and defense, and the poor category increased for
both, while the absolute worst decreased. Ohio players increasingly felt by the end of
the season that strong wind is poor to play in. The non-Ohio group showed a decrease
in the positive categories and increase in not a factor category. The rain variable was
interesting because the offense showed a decrease in the positive categories and
negative categories, and a significant increase in the neutral category. The defense appeared the same across the positive, neutral, and negative categories, while there was an increase in the excellent category and a decrease in the absolute worst category for this group. While one would think that clouds would not make much of a difference during the game, the defense showed a significant decrease in the excellent area from the initial to final questionnaire, while it had an increase in the good and not factor categories. The offense mimicked these increases and decreases. All the other groups for this weather variable had increased their views that clouds were not a factor during games. The variable of snow showed a decrease in the positive categories since the beginning of the season for the offense and defense. There was a large percentage increase in the neutral category for the offense, while the defense showed a slight increase in this area. The offense had a decrease in the poor category and remained the same in the absolute worst, while the defense remained the same in the poor and decreased in the absolute worst.

Linemen showed a significant increase in not a factor for the heat variable since the beginning of the season, and a decrease in negative categories, while the non-linemen also showed an increase in not a factor, there was a slight increase in negative and slight decrease in positive categories. The linemen decreased their negative views, and increased in positive and neutral categories for the cold variable since the beginning of the season, while the non-linemen decreased their poor views and increased in the good category. These reactions would, more than likely, also be the impact of the mild
weather season. Non-linemen showed a decrease in their positive perceptions of sun since the beginning of the season, while increasing in *not a factor*. For the strong wind variable, the non-linemen group showed an increase in the negative categories and a decrease in the positive and neutral areas from the initial to the final questionnaires. Interestingly, the linemen showed a significant increase in *poor*, while having the *absolute worst* category fall off the chart altogether by the end of the season. The linemen increased their positive views of sun, while decreasing in *not a factor*. Linemen and non-linemen both had an increased view that rain was *not a factor* during games. As would be expected, since there was no snow during this season, the non-linemen viewed snow as *not a factor*; however, their negative views of this weather variable remained relatively unchanged over the course of the season. The linemen also felt that snow was *not a factor*, and their opinions on *good* and *absolute worst* did not show significant changes since the beginning of the season; while they showed a slight increase in *excellent* and a slight decrease in the *poor* categories.

The incidence of injury during inclement weather conditions and how these injuries relate to weather conditions can both be assessed with the same data. When looking at the injury report (Table 7) and weighing this data against the individual game conditions (Table 1), we cannot see any great significance as to how weather would have played a role in these injuries since the game conditions tended towards mild weather conditions overall. The number and types of injuries for the game versus Central Michigan (the only game that was played in rain) were comparable with all of
the other injuries that occurred during the season. In order to better answer this question, a study of several seasons with varying weather conditions would be appropriate.

As one would expect, players from the same geographic regions appear to perceive the various weather conditions similarly. One example can be seen with the cold weather ratings. The Ohio region group reacted more positively than the other states group, which is probably due to the players playing in cold weather conditions within the state. However, both groups felt less negative about cold weather by the end of the season. It would bear repeating here that the football team encountered a relatively mild weather season overall. When comparing the heat weather variable between these groups; the other states group decreased in the poor and good areas, and showed a slight increase in the absolute worst. On several occasions, some of these players were heard commenting on “how bad the humidity is up here” (meaning in Ohio), and is probably due to where they come from within the country. They are acclimated to their particular region, and then associate any problems adjusting to any type of weather condition with the new region, in this case, Ohio. Clouds were not considered to be a factor for both Ohio and non-Ohio players. And while a small percentage of players chose the negative categories on the initial questionnaire, these categories were not chosen at all on the final questionnaire.

We can examine how football players’ perceptions of weather correlate with actual conditions by looking at the reaction surveys and the individual game conditions.
We can begin by looking at Figures 9, 10, and 11 (graphs depicting the reaction surveys), and comparing the results with the individual game conditions in Table 4.1. The mild weather conditions seem to correlate with the answers provided to the first question of whether or not the players felt that weather had played a part in that particular day’s game. The majority chose “a little” or “not at all” for the games. For the rainy game against Central Michigan, an increase can be seen in the “somewhat”, “a lot”, and “very much” categories. The second question posed to the players was if they felt that their individual play was affected by the weather. Again, far more players felt that their play in the Central Michigan game was affected by the weather. Also, the Northern Illinois game showed an increase as far as players thinking that their play was affected from “a little” to “very much.” This could be due to playing in an unfamiliar stadium, and also because of the way that the stadium was laid out. This researcher also felt that it was colder here, even though statistically speaking, she has been in colder environments. Even though the last game against Buffalo was actually colder, it needs to be stated that the Buffalo game was at home while the team played at Huskie Stadium in DeKalb, Illinois.

A third question was asked of the players if they felt that our team or their opponents had an advantage for the game given the weather conditions. Looking at Figure 10, one can see that a large majority felt that neither team had an advantage or disadvantage due to the weather. Again, the most likely scenario for this response is due to the mild weather conditions encountered by the team all season long. One
exception occurred on the reaction survey for the Ohio State game, however, where more players felt that we had somewhat of an advantage over Ohio State. This is interesting because this game happened to be our worst loss of the season with a final score of 48-3 in favor of the Buckeyes.

The results chapter yielded what one could have expected, given the relatively mild weather that was encountered during the season, with some interesting data in certain areas. The team only had to deal with rain during one of their games, did not have any snow games during the season, and only two out of their twelve games had wet ground conditions. In order to assess how players’ perceptions of the weather change throughout the season, and how their perceptions correlate with their experience during the season, further data collection would need to be obtained over several seasons. This would then hopefully subject the players to more and varied weather conditions with which to more accurately assess their perceptions.

This study also brought another question to mind, do the players possibly think that it is colder or warmer at an away game than on their home field? Are they used to their stadium, having home field advantage, and not paying attention to the weather as much since this is their home turf and they feel that they are accustomed to it? These questions would need to be looked into in a future study. The questions that were intended to be answered within this study would, in all likelihood, have shown more of a variety within each of the sections and categories that were taken into consideration, had the team been able to experience a broader range of weather conditions. Future
studies which would cover several seasons, and would contain several incoming classes
(Perhaps following these classes through a complete four or five year cycle) would be
more likely to contain more accurate images of how players’ perceptions of weather do
affect their playing abilities, both mentally and physically.
Chapter VI

Conclusion

This study followed the 2007 Kent State football team to assess their perceptions of the influence of weather conditions on their game. This study started with an initial questionnaire handed out after the summer training camp and before the start of regular season games. A three question reaction survey was handed out following each game during the season, in order to compare the players’ perceptions with actual weather conditions for each game. This researcher collected all of the weather data and implemented all of the surveys and questionnaires first hand. A final questionnaire was completed by the players after the conclusion of the season. The players were very receptive to this study.

Overall, the football team encountered an unusually mild season in regards to the weather. Thus, it was of no surprise that by the end of the season, the majority of players’ perceptions had changed about certain weather variables since the beginning of the season. Weather such as snow and rain, for example, were not as detrimental as players’ had originally thought. Perceptions of rain had increased to not being a factor among all groups with the exception of the players that were from outside of Ohio. Likewise, snow had increased to not being a factor for all of the groups. Weather
conditions such as heat, cold, snow, and rain would seemingly have had more of an impact on players and their perceptions had they actually been exposed to them.

There were a few interesting results that presented themselves in this study. One of these interesting results was that the team as a whole felt that we had the advantage during the Ohio State game due to weather. Another was the fact that only two of the players felt that their injuries were weather-related out of all of the injuries that had occurred during the season. Of no surprise though was the result of the final statistical assessment. The values for the weather variables yielded no statistical significance across any of the categories.

With the 2007 season being what it was weather-wise, one would have to agree that the tabulated results were what would have been expected. If only there had been some snow during games, with a few rainy and windier games thrown in; this research had the potential to see some dramatic results among the divisions of groups. Offering this study to two consecutive incoming classes over a four-to-six year period for a more accurate study and findings would be more beneficial, as this would allow for the players to be in different venues, states, and weather conditions over a longer period of time. Players’ body temperatures, style of gloves (if any) used, and cold weather gear (if used or not) could also have been used as measurements toward this research, along with assessing the age of the turf or grass field that was being played on. In addition, video from each game could be assessed to view the weather and players actions on the
field and sidelines. Also, players could be measured and assessed during spring ball and summer camp leading up to regular season games.
References


ESPN; “Vikings have contingency plan for extreme heat.”


