THE RELATIONSHIP BETWEEN LEVELS OF GREENERY & LANDSCAPING AT TRACK AND FIELD SITES, ANXIETY AND SPORTS PERFORMANCE OF COLLEGIATE TRACK AND FIELD ATHLETES

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ABSTRACT

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Researchers wonder what it takes to improve athletic performance in athletes. Research has suggested that plants reduce anxiety, and reduced anxiety could, in turn, improve athletic performance. Research also shows that plants have psychological and restorative value such as improving coping mechanisms in human subjects as well as improving concentration and ability to focus attention that could affect performance of athletes. The main objective of this research was to investigate the impact of greenery/landscaping on athletic

performance and cognitive and somatic anxiety in track and field athletes. Four university track and field teams and 128 athletes participated in the study. Individual athlete performance and Competitive State Anxiety Inventory-2 cognitive and somatic anxiety tests were collected from 7 track meets. Greenness/landscaping level was determined by Likert-scale rating averages from professional horticulturists who individually rated each site. A regression analysis found that greenness level was a predictor (P=0.000) of best performance by athletes when performance level of athletes was the dependent variable and greenness level was the predictor. More of the athletes' best performance marks were at the track and field site that had the highest greenery rating (3.16), and many of the athletes' worst performance marks were achieved at the site that had the lowest greenery rating (1.73). The average norms recorded from all the track and field athletes across the nation were 20.34 for cognitive anxiety and 18.73 for somatic anxiety. A correlation analysis showed that greenness ratings at the different track and field sites affected all athletes' anxiety levels equally. All athletes regardless of event they competed in performed better at sites with higher greenness ratings. All athletes performed similarly at each of the track and field sites regardless of ethnicity, gender or grade classification.

CHAPTER 1

Introduction

Sports performance has been constantly improving with new technology. Ideas for improved training, new techniques and drills, as well as theories have been developed to benefit the athlete and their performance ability (Raglin et al., 1990). Tactics include enhancing confidence and reducing athletes' anxiety for more compelling performances (Raglin et al., 1990). Research has also discovered that athletes' poor performance can sometimes be related to high levels of anxiety (Raglin, 1992).

Scholars have studied how athletes' personally calm themselves and prepare for athletic performance. The factors most discussed included athletes' ability to imagine the event using personal relaxation and self-talk techniques which were strategies that the athletes used to get into an optimal mental state for their event (Durand, 2002). Most of the athletes did not engage in structured or systematic forms of relaxation, but rather remained calm by isolating themselves and by limiting their interactions with others in the sports competition environment (Durand, 2002).

Research has suggested psychological benefits from interactions with nature and green spaces. Hartig and Evans (1993) brought attention to theories focused on the positive effects of nature on human well-being. Ulrich (1983) emphasized the effects of nature on stress reduction. Other research demonstrated the recovery aspect of nature as well as a person's improved ability to maintain focused attention in a natural environment (Kaplan and Kaplan, 1989).

Studies have also suggested that plants affect peoples' quality of life and that plants promote positive thoughts when they are in the presence of plants (Larsen et al., 1998; Waliczek et al., 1996; Waliczek et al., 2005). Moreover, it has been suggested that physical environments influence psychological and physiological factors, such as people benefitting from interactions with plants and nature (Bringslimark et al., 2007; Dravigne et al., 2009).

Problem Statement

The intent of this study was to determine if the level of greenery and landscaping at track and field competition sites influenced collegiate athletes' performance and/or anxiety levels.

Study and Objectives

The specific objectives of this study were:

1. To compare levels of greenness/landscaping at various track and field competition sites.

2. To compare reported levels of performance of athletes at track and field sites with varying levels of greenery.

3. To compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery.

4. To compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distance runners at track and field sites with varying levels of greenery.

5. To evaluate the differences in demographic groups to determine if any particular group of athletes benefited more or less from additions of greenery or landscaped areas at track and field competition sites.

Definition of Terms

Anxiety: the hesitation brought on by a person whose values and personality are threatened (Spielberger, 1970).

Arousal: a state of the organism described as going back and forth from deep sleep to intense excitement (Martens, 1977).

Athlete: a person who is trained in sports requiring physical strength, agility or stamina (Merriam-Webster, 2009).

Cognitive anxiety: references to negative expectations, consequences of failure and the evaluation of one's ability relative to others (Krane and Williams, 1987).

Landscaping: for the purpose of this study, the ground level view of the plants, shrubbery, or trees surrounding the track and field competition site (Ingels, 2008).

Self-confidence: degree of certainty athletes possess about their ability to be successful in sports (Vealey, 1986).

Somatic anxiety: physiological symptoms such as butterflies in the stomach, excessive sweating, shakiness and/or muscle cramps (Krane and Williams, 1987).

Sport's performance mark: the athlete's performance in respect to their competition mark or time (Salminen et al., 1995).

Stress: the perception of substantial imbalance between response capability and environmental demand (Martens, 1977).

Track and field competition site: the sport arena that is surrounded by a 6-8 lane track (Merriam-Webster, 2009).

Null Hypotheses

1. There will be little difference between landscaping or greenery levels at the track and field sites.

2. There will be no difference between collegiate athlete performance at track and field sites that have more landscaping or greenery when compared to those track and field sites that have less landscaping or greenery.

3. There will be no difference between collegiate athlete anxiety levels at track and field sites that have more landscaping or greenery when compared to those track and field sites that have less landscaping or greenery.

4. There will be no difference in collegiate athletes of various demographic backgrounds on performance or anxiety levels at differently landscaped track and field sites.

5. There will be no difference in collegiate athletes between cognitive and somatic anxiety levels at track and field sites that have more landscaping or greenery when compared to those track and field sites that have less landscaping or greenery.

Limitations

The limitations of this study include the following:

1. Any research conducted on humans will have extraneous factors that can influence the outcomes of the study.

2. The sample population for this study came only from collegiate athletes competing from universities in Texas, and thus results from the study were not necessarily suitable for generalization to all collegiate athletes.

3. The only students responding to the anxiety and performance surveys were those willing to take time and those whose coaches approved their involvement in the study.

4. The study included only one season of track and field competition.

5. The study only used athletes from the sport of track and field.

6. Incentives were not able to be given to the athletes due to National Collegiate Athletic Association regulations because it would make them ineligible to participate in their sporting event for a year.

CHAPTER II

REVIEW OF LITERATURE

History of collegiate athletics

Intercollegiate athletics have been in existence for a more than 100 years and is a way that athletes can compete in sports while gaining a college education (Bates, 2009). It also offers support for student athletes to help finance a university education (Bates, 2009). The definition of "intercollegiate athletics" includes any athletic contest between universities (Bates, 2009). The first record of a collegiate track and field meet took place in 1864 between Oxford and Cambridge Universities (Bates, 2009).

In early December 1905, President Theodore Roosevelt asked some of the college athletics' leaders at two different White House conferences to push new reforms because of the amount of injuries and deaths in football (Grant et al., 2008). Following this request on December 28, in New York City, a meeting was convened by Chancellor Henry MacCracken, and the meeting resulted in the establishment of Intercollegiate Athletic Association of the United States

(IAAUS). IAAUS became an official organization in 1906 and then in 1910 changed its name to the National Collegiate Association of Athletics (NCAA), which is how it is still referred to today. In 1921, the first NCAA national championship took place (Grant et al., 2008).

By 1973, the NCAA membership was so great that they divided themselves into 3 divisions: I, II, and III. Women's athletic programs within the NCAA were not administered until 1980. Since then, enrollment for women in intercollegiate athletics has jumped by 55% to 170,000 female student-athletes, with there being a total of about 400,000 men and women involved in collegiate athletics within the United States. Presently, there are 1,033 member colleges and universities. These statistics show strength in the growth throughout the years with collegiate sports affiliated with NCAA (Grant et al., 2008).

Importance of collegiate sports in the United States

Professional sport organizations utilize college athletic programs to produce quality athletes that will eventually build professional sports organizations (Grant et al., 2008). If college athletic programs did not provide quality student athletes for professional sports, professional sports teams would suffer in talent and, therefore, economically. Sports are not just for entertainment, but they also provide the host communities with an economic resource (Grant et al., 2008).

When college athletics began, newspaper sales soared and the era of sports' writers began. Writers provided comment on athletic events, instead of just reporting the outcome of the games. One-quarter of subscribers indicated that their main interest in buying the paper was for the sports section (Evenson, 1993). As college football increased in popularity, the economics of funding athletic programs became a concern. With more success, there was a need for more money; bigger and better facilities were needed to accommodate fans (Grant et al., 2008).

In 2005-2006 fiscal year, the NCAA revenue totaled $521 million. The greatest percent of total income comes from various sources including donations, alumni, fans, parents, ticket sales, institutional support, and student activity fees (Grant et al., 2008). Stinson and Howard (2004) indicated patterns of donations from alumni are determined predominantly by their undergraduate experience. An NCAA financial report from the University of Oregon in 2004-2005 showed that the facilities maintenance fee was 16% of their budget (Grant et al., 2008). For media providers, intercollegiate sports provided a vital source of revenue. Companies spend billions for television, radio, and Internet advertisement slots during a college sporting event (Grant et al., 2008).

Positive and negative sport performance influences

Many factors have been shown to positively and negatively affect performance in sports. Studies through time have shown that athletes' performance can be enhanced through their diet. As physiology is better understood, so are athletes' nutrient requirements (Grandjean, 1997). Jackson et al. (1998) discovered that there is a relationship between athletes' performance and that of goal setting, emotional control, the absence of negative thinking and relaxation by athletes. One of their further studies discovered that the ability to concentrate feelings of sense of control, as well as clear goals impacted athletes' performance in a positive manner (Jackson et al., 2001).

Anxiety and performance

A great amount of research has been developed to determine the effects of anxiety on athletes (Hanin, 1980; Krane and Williams, 1987). Research has found that there is a significant relationship between emotional stress and the consistency of individual competitive performance and that athletes with poor performance indicated less emotional stress when compared to the athletes with good performance (Miller, 1960). Anxiety most often leads to uncontrollable feelings of inadequacy, worry, 'butterflies in the tummy feelings, rapid heartbeat, nervousness, and negativity. It can also produce positive or negative thoughts

from present or past competitions, which affect the athlete's level of confidence in their abilities (Martens et al., 1990).

According to Martens (1977), anxiety is the reaction brought upon by an environmental demand, and can be interpreted as intimidating by the individual. The multidimensional theory of anxiety has been given much attention due to the highly investigated relationship between anxiety and athletic performance (Krane and Williams, 1987). The athletes' performance decreases when anxiety levels are exceedingly high or when they fall below the normal range. The normal or optimal range of anxiety is considered to vary depending upon the function of the sport task and experience. Athletes who have less experience (freshman) perform well with lower levels of anxiety and more skilled (senior) athletes have been known to benefit from levels of anxiety at either progressively higher or moderate levels (Cox, 1990; Raglin et al., 1990). Studies have discovered that a significant percentage of collegiate athletes (30-40%) need high levels of precompetition anxiety for optimal performance (Raglin and Turner, 1992, 1993). Track and field athletes have been said to be at their best performance when their anxiety level is high for middle distances (200 - 400m) and low for short sprints (100m) or long distances (1 - 2 mile) (Landers and Boutcher, 1986).

The optimum track and field performance anxiety levels vary depending upon the events' requirement for physical power and muscle mass increase.

Unlike distance running which only requires the athlete to run, events like shot put, pole vault, and triple jump require higher anxiety levels because the events have more elements involved with moving the body weight at the right time with the right force (Turner and Raglin, 1995). However, there is a certain point in that, when reached, any further increases in anxiety levels have an inclination to interfere with performance (Ryan, 1965; Yerkes and Dodson, 1908). For example, a study done by Kais and Raudsepp (2005) found that exceedingly high levels of anxiety were associated with negative effects on performance.

Similarly, Yerkes and Dodson (1908) have an "optimal level of arousal" theory that accounts for the varying levels of arousal or anxiety needed to maximize performance in different activities. They emphasized that the correlation between performance and anxiety is curvilinear, and that performance increases with greater arousal or anxiety, but only to a certain level. At that point, optimal performance will digress because of the debilitating physical and psychological effects of excessive arousal.

Likewise, Hanin's (1980) Zone of Optimal Functioning (ZOF) hypothesis determined the connection between anxiety-related emotional states and athletic performance (Cox, 1990; Hardy, 1990; Raglin, 1992). The ZOF hypothesis presumes that each individual has a different precompetition anxiety that allows for peak performance. Therefore, it is predicted that the athlete's performance is

best when he/she is in his/her unique optimal zone of functioning. This zone is considered to be an athlete's individual desired level of anxiety state for that specific activity (Raglin and Turner, 1993).

Cognitive and somatic anxiety

Athletes' anxiety can be defined and measured in two different ways: cognitive versus somatic. Cognitive anxiety is related to an athlete's negative expectations, consequences of failure and the evaluation of his/her ability relative to others. Cognitive anxiety has been shown to exert a strong influence on the performance of the athlete regardless of the individual athlete's physical ability (Humara, 2001). Cognitive anxiety has also been shown to cause negative concerns about performance, disrupted attention, and a lack of concentration. Somatic anxiety is associated more with physiological symptoms of anxiety such as butterflies in the stomach, excessive sweating, shakiness, and muscle cramps (Krane and Williams, 1987; Martens et al., 1990).

Demographic differences in sports performance of athletes

Findings have revealed that males and females cope differently with performance-related anxiety with sports mainly with the difference being that women seeking more social support for emotional reasons (Crocker and Graham, 1995) while men do not. Research has shown that among college athletes, cognitive and somatic anxiety levels decrease among more experienced athletes

compared with less experienced underclassmen due to the ability of the experienced athletes to control negative thoughts more easily than underclassmen (Krane and Williams, 1987; Martens et al., 1990). Female and male athletes also show a variation in performance depending on varying levels of anxiety. Men perform better with moderate levels of somatic anxiety. Women perform better when both somatic anxiety and cognitive anxiety are high (Taylor, 2006).

Tactics athletes use to achieve the ideal anxiety state

Studies have shown that, typically, better athletic performance is because of either low levels of cognitive anxiety and somatic anxiety or high levels of confidence (Krane and Williams, 1987; Martens et al., 1990; Rodrigo et al., 1990). An athlete's confidence has been said to be affected by his/her ability to utilize imagery for mental toughness and his/her ability to focus after a mistake (Abma et al., 2002). Confidence is also enhanced by the individual's expectation of a successful performance (Bandura, 1977).

Lazarus and Launier (1987) have studied various forms of coping behaviors and concluded that there are four ways in which people cope with anxiety: direct action (active or passive avoidance, attack), inhibition of action, information seeking, and intrapsychic coping (redefining of the situation, denial). Coping refers to the process of mastery or management of behaviors by the

process of dealing with threat, harm, or challenge (Lazarus and Launier, 1987). Research showed that imagery is utilized by athletes and is a very important psychological skill. Imagery has shown association with improvement in the athletes' confidence levels (Callow et al., 1998).

Thomas et al. (1999, 1994) claimed that the skills involved in regulating arousal, processing information, and managing emotions are important for collegiate athletes because it shows that they are able to differentiate between successful and unsuccessful performances. Neil (1980) stated that superstitious behaviors such as wearing the same pair of socks for every game, having the exact same personal warm-up routine, placing a lucky coin in a shoe, etc. are ways that athletes calm their nerves in order to reduce anxiety, build confidence, and cope with uncertainty.

Measuring anxiety

Martens (1977) developed the instrument, the Sport Competition Anxiety Test (SCAT), to measure the tendency for a person to show varying levels of state (specific to the situation) anxiety in competitive sport situations. The situation-specific trait anxiety approach is based on the idea that most people do not show higher anxiety levels in all circumstances, but only in certain types of situations. In other words, high competitive trait (general characteristic) anxiety players are expected to display higher levels of anxiety when compared to low competitive

trait anxiety players in competitive situations, but not necessarily in other circumstances. These higher levels of anxiety observed from high competitive trait anxiety players in competitive situations are said to affect performance (Martens, 1976). Martens (1976) suggested that the higher competitive trait anxiety subjects perform more poorly when compared to low competitive trait anxiety subjects in competitive situations. However, no differences were found in research comparing high and low competitive trait anxiety subjects in non-competitive situations (Martens, 1976).

There are other factors that affect an athlete's performance such as "cognitive interference". For example, worry is often cited as a component of 'cognitive interference' which basically means that an individuals thoughts are unwanted, intrusive, undesirable, and at times disturbing (Sarason et al., 1996). Due to its association with worry, 'cognitive interference' has been extensively looked at with its relation to performance in areas such as academic testing and sports performance. Results have suggested that worry has a negative effect upon performance of cognitive as well as physical tasks (Sarason and Sarason, 1987). Burton explained that worry is often defined as 'cognitive anxiety' or 'concern' (1988). Schwarzer said that worry is also defined as 'trait anxiety' (1996).

Martens et al. (1990) developed a Competitive State Anxiety Inventory-2 (CSAI-2) that measured for varying levels of cognitive anxiety and somatic anxiety. Using this instrument, previous studies showed that prior to competition perceived levels of cognitive anxiety remain relatively stable within a 24-hour period of a competition, but somatic anxiety levels were shown to have a large increase from 24-hours to 1-hour prior to competition (Gould et al., 1980). Prior to competition, an athlete creates a level of expectation for their performance (Wiggins, 1998). A study done by Kais and Raudsepp (2005) indicated that more intense levels of cognitive anxiety led to a more positive performance. Therefore, based on research, anxiety prior to a competition is not necessarily portrayed as a negative sign; instead, it indicates an athlete's concern about the competition and their performance (Kais and Raudsepp, 2005).

An investigation by Gould et al. (1980) provided support for Hanin's Zone of Optimal Performance (ZOF) hypothesis and found that a relationship existed between a runner's anxiety and their ZOF performance. The results extended the ZOF principles of Hanin (1980) to support the CSAI-2, showing that cognitive and somatic anxiety appear to operate in a manner that is consistent with the ZOF principles. This further supported the idea that there were credible differences in athletes' optimal levels of pre-competition anxiety needed for best performance (Gould et al., 1980).

Athletic performance and anxiety recall

Research has shown that athletes are capable of correctly recalling their anxiety levels for past performances, with recalled values running very close to actual precompetition anxiety experienced (Hanin, 1986; Raglin, 1990). A study done by Salminen et al. (1995) tested the credibility of the athletes being able to recall their anxiety levels correctly and consistently. Their results supported the accuracy of the athlete in his/her ability to identify their correct anxiety level for up to 1-week prior to the competition. Therefore, it is feasible to measure the level of anxiety of athletes prior to an athletic competition. Additionally, studies have shown that athletes can correctly recall their anxiety level during a past competition retrospectively (Raglin et al., 1990; Salminen et al., 1995).

Results of research (Wilson et al., 2000) showed that athletes recalled individual precompetition anxiety levels with approximately equal levels of accuracy to what was recorded during the competition. Prior to the competition, the evaluations of anxiety made are consistent within the last 24-hours prior to competition (Wiggins, 1998). Research in the area of adult men and women and their accuracy of predicted anxiety has been two-sided. Raglin and Turner (1992) found that men and women to have the same level of accuracy in their anxiety prediction; however, Martens (1977) states that male athletes are more accurate in assessing anxiety levels when compared to females.

Passive and active interactions with nature and impact on humans

Research has provided evidence that plants, trees, shrubs and naturalized areas are beneficial to people by reducing stress and through the renewal of the mind (Ulrich, 1984). Studies have shown that, compared to urban settings, there are restorative effects for humans within natural settings which positively impacts peoples' emotional state (Ulrich et al., 1991). Viewings of natural scenery are said to evoke a higher aesthetic response and create more positive feelings of well-being when compared to their counterparts of non-natural scenery (Ulrich, 1979; Wohlwill, 1976).

Environment and behavior research has further stressed that exposure to nature can have positive psychological benefits for people (Hartig et al., 1991; Kaplan, 1983; Ulrich, 1979; Wohlwill, 1983). This explained why some people seclude themselves in natural environments such as wilderness areas or urban parks for contact with nature during stressful times or as a retreat (Hartig and Evans, 1993). One study indicated that stress recovery was much faster and more complete for individuals viewing natural settings, as opposed to those viewing scenes of traffic environments (Ulrich et al., 1991). Gezondheidsraad (2004) suggested that leisure in green environments provided feelings of relaxation and allowed for people to be open for reflection.

A study compared the temperament of subjects when they first viewed an unlandscaped urban environment setting of parking lots, cars, buildings, small sidewalk vegetation, and few trees, and then viewed a naturally landscaped environment of grassy meadows, many trees, vines, shrubs, and rock or pebble pathways (Ulrich, 1979; Ulrich et al., 1991). Exposure to the urban environment led to a higher level of psychological aggravation in the subjects. The change from urban to natural settings reflected a consistent improvement in well-being and positive feelings. The study also resulted in a significant decrease in fearfulness and arousal, in a positive way, when people moved from viewing urban scenes to viewing naturally landscaped scenes (Ulrich, 1979; Ulrich et al., 1991).

Two studies were done on plants and people in an office environment, both ending with similar results: plants created a better environment for office workers (Larson et al., 1998; Lohr et al., 1996). One study placed plants in a windowless environment within the workplace where office-worker study participants were performing stressful tasks on the computer. Research observations concluded that the presence of plants in the room helped reduce mental fatigue, increased attentiveness, lowered blood pressure, and increased productivity of participants (Lohr et al., 1996). Another study found that workers benefited from the perceived attractiveness of the presence of plants in the office.

Participants also commented that presence of plants made the office seem more comfortable (Larsen et al., 1998).

Research by Dravigne et al. (2009) found that the presence of live interior plants or window views of exterior green spaces affected perceptions of employee job satisfaction. There were four groups within the study: a group with plants and windows, a group with plants and no windows, a group with windows and no plants, and a group without windows and plants. The study concluded that the two groups without plants rated their job satisfaction poorly, and the two groups with plants rated their job satisfaction better, which indicated higher job satisfaction with the presence of plants in the office place (Dravigne et al., 2009).

Research compared active interactions with nature between three groups of people who were vacationing: one group vacationed in the wilderness, another vacationed in the urban environment, and a control group of people did not vacation during the research time period. Only participants who engaged in regular physical fitness regimens during their vacation were included in the study. Pre-tests and post-tests were used to check directed attention tasks and were highly demanding in terms of cognitive skills or thinking. The wilderness group showed a significant improvement in their proof-reading performance for

the post-test, while the other groups' results were the same in the pre and post test (Hartig et al., 1991).

Another study observed patients with high blood pressure, and moody or emotional issues due to the medicine they were taking, and showed that a 20 minute walk in a natural environment changed emotions positively including a stimulating a decrease in anger/aggression (Hartig and Evans, 1993). Furthermore, research has shown that active involvement in gardening provides psychological benefits such as an increase in self-esteem and reduced stress levels (Cammack et al., 2002; Patel, 1991; Waliczek et al., 1996). Therapists and participants in horticultural therapy programs have reported similar positive benefits such as increased in self-confidence, self-esteem, concentration, and learning of practical skills (Gezondheidsraad, 2004). Other beneficial effects that have resulted from gardening included reduced levels of stress and mental fatigue, as well as better social and cultural integration (Armstrong, 2000).

Involvement, either passive or active, with natural areas have been said to refresh the human mind and body (Lewis, 1996). Ideas that support the theory of being refreshed, discussed the connection that people feel to natural areas because they are genetically programmed to biological rhythms that humans' developed over centuries of time in natural environments (Orians and Heerwagen, 1992). Ulrich (1983) believed that individuals' perceptions of certain

physical qualities in certain scenes can actually support psycho-physiological stress recovery. Positive emotion and the restriction of negative sub-consciousness can be invoked through landscapes or sceneries with natural elements like vegetation and water, which all help to reduce high stress to moderate levels (Fredrickson and Levenson, 1998). Ulrich (1983) believed that humans are biologically ready to respond in a positive way to environmental features that create possibilities for survival and presumed an evolutionary basis for aesthetic and restorative responses to some natural scenes. Some examples of natural scenes that are known to be restorative include those that are predominantly vegetation and/or water, and if human-made objects such as cars or buildings are inconspicuous or absent (Ulrich, 1983). One study defined a natural vegetative sight as one dominated by trees and other vegetation with some openness among trees and occasional light breezes in the background (Ulrich, 1991). Pressures of work, city noise, and other forms of stress move people towards seeking relief in outdoor settings (Knopf, 1983).

University landscaping

The landscape at a university is far more than just space between buildings. It is an organization of outdoor spaces and everything it encompasses: pavements, walls, lights, seating, signs, trees, shrubs, and other plantings. Yahres (2000) suggested that the appearance, the way a space is designed, used, and

maintained can weigh heavily in a student's decision on where to attend school. He has found that the campus visit was the most important deciding factor for incoming students when choosing a school to attend, with 62% of the students polled responding that "appearance of the grounds and buildings" influenced their choice (Yahres, 2000).

In the past, reports in trade magazines have shown that of all the grounds maintenance invested in the entire university, only 20% are spent on maintaining the campus' landscape (Yahres, 2000). Campus trends have reported to have low levels of funds available for landscaping. Therefore, plants installed are often short-lived and a quick fix, which leads to landscaping needing to be redone later. It is common for campuses to use seasonal flowers that will need to be replaced (Fickes, 2000; Kautz and Rayburn, 2007; Yahres, 2000). Due to budget constraints in facilities' departments, maintenance professionals are constantly struggling with how to design and install new landscapes while attempting to maintain old trees and shrubs. They are often torn between the choice of pruning, replacing, or removing the plants (Esselburn, 2006).

Conclusion

There are many theories in sports performance research that are said to benefit the athlete and their performance ability (Raglin et al., 1990). Some thoughts are that enhancing an athlete's confidence and reducing the athletes'

anxiety would create more compelling performances (Raglin et al., 1990). Ulrich's (1983) research emphasized the effects of nature on stress reduction. Studies have also suggested that when people are passively in the presence of plants, the plants promoted a decline in negative thoughts (Larsen et al., 1998; Waliczek et al., 1996; Waliczek et al., 2005). Research has also discovered that athletes' poor performance can sometimes be related to high levels of anxiety (Raglin, 1992). Psychological benefits such as lowered anxiety have been to known to come about from interactions with nature and green spaces (Hartig and Evans, 1993).

CHAPTER III

METHODOLOGY

The intent of this study was to determine if the level of greenery and landscaping at track and field competition sites influenced collegiate athletes' performance and/or anxiety levels.

Study and objectives

The specific objectives of this study were:

1. To compare levels of greenness/landscaping at various track and field competition sites.
2. To compare reported levels of performance of athletes at track and field sites with varying levels of greenery.
3. To compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery.
4. To compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distance runners at track and field sites with varying levels of greenery.

5. To evaluate the differences in demographic groups to determine if any particular group of athletes benefited more or less from additions of greenery or landscaped areas at track and field competition sites.

Sample schools and athletes

A total of 512 track and field athletes from 19 different universities within Texas were asked to participate in the study. The universities contacted included: Texas State University-San Marcos, Rice University, University of Houston, Texas A&M University, University of Texas-San Antonio, Baylor University, Stephen F. Austin University, Southern Methodist University, Texas A&M University-Corpus Christi, Texas A&M University-Pan Am, Texas Southern University, Texas Christian University, University of Texas-Arlington, University of Texas-El Paso, Sam Houston State University, University of North Texas, Texas Tech University and University of Texas. Athletes that participated in the events of shot put, discus, hammer throw, and javelin field events were not invited to participate because their event placement most commonly occurs outside of the track stadium, and therefore, they would not have viewed and been influenced by track and field landscaping. Athletes that participated in the following events were included in the study: triple, long and high jump, and pole vault; sprints (100m, 200m, 100m-Hurdles), mid-distance running (400m, 400m-Hurdles, 800m), and long distance running (1500m, 3200m, 5000m, 10000m, and

steeple chase). Four different universities chose to participate and within those teams a total of 128 athletes agreed to participate in the study.

The schools and track and field teams were contacted through e-mail with a note detailing the study and how researchers would be using information from athletes (Appendix A). After 2 weeks, researchers sent another e-mail to encourage responses and followed up with phone calls to each coach (Appendix B). Researchers sent another short e-mail after phone conversations so that coaches could reply with their response on whether they did or did not want to participate (Appendix C).

Track meet selections

The track and field competition sites were chosen based on the track team schedule for all teams that agreed to participate in the study. Of all of the track meets in which each of the 4 teams were participating during Spring 2009, there were 4 locations that included all participating teams in competition. Each of the track meets was a multiple team meet, which means that more than three different schools were at each meet competing against each other. Therefore, these sites/meets were those for which data was collected. The schools and locations were: University of Texas, Austin, TX, Rice University, Houston, TX, Stephen F. Austin University, Nacogdoches, TX, and Texas Tech University, Lubbock, TX.

Levels of greenness/landscaping

In order to measure the differing levels of greenness/landscaping at each track and field site, a Likert rating scale was used (Likert, 1967). The system of measurement was based on a reliable and valid instrument that has been previously used in research (Kuo and Sullivan, 2001). Each number on the scale related to a full description explaining the levels of greenery and landscaped areas of the track and field competition site from the center of the field, accounting for only what the researcher could view from a 360-degree area at each location. Each track and field site was rated on the levels of landscaping during the same period as the outdoor competition season. The Likert rating scale consisted of the following rating criteria:

1 – no greenery, traffic is visible, buildings are in view, only grass on field

2 – minimal greenery, some turf, no shrubs – 25% greenery

3 – minimal greenery, some turf and shrubs – 50% greenery

4 – some greenery, turf, trees and shrubs – 75% greenery

5 – fully landscaped around all perimeter of the track, viewings of trees or field scapes in the distance

The researcher recorded information regarding the landscape from various angles including the middle of the field and from the stadium seating on both sides of the field if applicable, using photographs to document views. In

order to maintain consistency in the study, the researcher was the sole photographer for recording the information at each site. The photographs of multiple views for each track and field site were viewed by 3 professional horticulturists who privately and individually rated each landscape using the Likert scale. Scores resulted in an average greenery rating from each professional horticulturist for each track and field site. These scores from each of the 3 horticulturists were averaged together to result in one final composite score for each track meet site.

Instrumentation

Somatic and cognitive anxiety instrument

Somatic and cognitive anxiety was assessed using the Competitive Sports Anxiety Inventory - 2 (CSAI-2) (Martens, 1977). The survey took 5-10 minutes for participants to complete and consisted of 18 statements (9 for the somatic anxiety scale and 9 for the cognitive anxiety scale) regarding how each athlete felt while he/she competed in sporting events. The somatic anxiety scale questions pertained to feelings of tense muscles, butterflies in the stomach, and other physiological symptoms (Appendix D) (Martens, 1977). The cognitive anxiety scale questions measured negative self-evaluation, negative expectations of success, and other mental components of anxiety (Appendix D) (Martens, 1977).

In order to respond, each athlete marked one of the following 4 answer choices: "not at all", "hardly ever," "sometimes" or "often." Athletes chose the answer which most pertained to their feelings/emotions at the time the survey was administered.

Scoring was determined through the allocation of 1, 2, 3 or 4 points for each of the responses available and chosen by the respondent. This resulted in a score ranging from 9 (low anxiety) to 36 (high anxiety). Scoring was measured with separate totals for each of the scales. This instrument had been tested for reliability and validity (Martens, 1977) and normed on a nationwide sample of athletes. The published reliability for the cognitive anxiety instrument was 0.79, and for the somatic anxiety instrument was 0.82 (Martens, 1977).

Sports performance questions

To measure the variable of sports performance, there was a space allocated at the bottom of the survey for each athlete to report his or her performance at each of the 7 different track meets, at the 4 different selected competition locations. For those athletes that did not return their surveys for each meet, the researcher used the live results webpage (www.flashresults.com) for track and field competitions and recorded performance for each athlete for each meet. The researcher ranked all the listed performances for each athlete for the season as best, 2nd best, 3rd best and lowest performance (Table 4).

Demographic questionnaire

A demographic questionnaire was created by the investigator using other known reliable and valid instruments as models (Dravigne et al., 2009) in order to obtain background information on each participant. The questionnaire inquired about each participant's gender, ethnicity, year of eligibility, main event in which the athlete was participating, university of attendance, best mark overall with year of performance and location, as well as each previous season of collegiate competition best mark and location (Appendix C).

Data collection and analysis

For this study, each athlete was asked to complete 7 surveys throughout competition season, during the time span between 1 hour before and 1 hour after participation in their event at selected competitions. A chosen team member or coaching staff member was asked to collect all the written surveys after each selected meet and to return them to Texas State University-San Marcos in a pre-addressed and stamped manila envelope. Data were entered into a Microsoft Excel™ (Seattle, WA) spreadsheet and then downloaded into SPSS® Version 17.0 (Chicago, IL) for statistical analysis. Data analyses included frequencies and descriptive tests, as well as regression tests, a chi-square analysis, Pearson Product – moment correlation tests and analysis of variance tests in order to compare data between different groups of athletes.

CHAPTER IV

RESULTS

The purpose of this study was to determine if the level of greenery and landscaping at track and field competition sites influenced collegiate athletes' performance and/or anxiety levels. Descriptive statistics and data analysis are contained in this chapter concerning results from 7 different track meets at 4 different locations. Demographic information was also collected from the athletes, as well as information on the events in which they participated and, when possible, individual anxiety tests were also administered to athletes.

The specific objectives of this study included the following:

1. To compare levels of greenery/landscaping at various track and field competition sites.

2. To compare reported levels of performance of athletes at track and field sites with varying levels of greenery.

3. To compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery.

4. To compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distance runners at differently landscaped track and field sites.

5. To evaluate the differences in demographic groups to determine if any particular group of athletes benefits from more or less additions of greenery or landscaped areas at track and field competition sites.

Descriptive Statistics

Demographics

Of the 512 athletes that were asked to participate in the study, 128 participants (26%) completed consent forms and provided demographic information. Participants were from Texas A&M University - Corpus Christi (17.2%), Texas Tech University, Lubbock, TX (23.4%), Stephen F. Austin University, Nacogdoches, TX (38.3%), and Texas State University-San Marcos, TX (21.1%). The gender distribution was fairly evenly distributed with 55.5% female and 44.5% male respondents (Table 1), yet varied in comparison to the overall distribution within NCAA which had 55% male and 45% females (DeHass, 2009).

The study included approximately 42.5% Caucasian athletes, 37.8% African American athletes, 9.4% Hispanic athletes, 1.6% Asian American athletes, and 8.7% athletes considering themselves as "other" (Table 1). Reports from

NCAA for Division I track and field athletes showed the ethnicity reports for the year of 2007-08 to be similar to the research participants except for that this research group included more minority group athletes (African American and Hispanic) and less Caucasian athletes. Overall, track and field athletes within the United States included approximately 61.1% Caucasian athletes, 28.5% African American athletes, 3.9% Hispanic athletes, 1.4% Asian American athletes, and 5.1% athletes considering themselves as "other" (DeHass, 2009). However, regionally, the ethnicity amongst the Texas schools that were surveyed included approximately 65.1% Caucasian athletes, 12.5% African American athletes, 9.6% Hispanic athletes, 1.5% Asian American athletes, and 3.6% athletes considering themselves as "other." This sample included more African American athletes and less Caucasians in comparison to ethnic breakdown statistics for Texas, but a similar amount of Hispanics (Table 1).

The athletes surveyed were grouped by their year of eligibility. The sample population consisted of 32.8% freshman students, 28.2% sophomore students, 20.6% junior-level students, and 15.3% senior-level students (Table 1).

Athletes were grouped according to the events in which they were competing, and only recorded data in one of the events in which they competed if they chose to participate in more than one event. There were 4 categories into

which athletes were classified: 26.8% were placed in the triple, long and high jump, and pole vault; 16.5% participated in sprints (100m, 200m, 100m-Hurdles), and 31.5% competed in mid distance running (400m, 400m-Hurdles, 800m). Lastly, 25.2% were long distance runners (1500m, 3200m, 5000m, 10000m, and steeple chase) (Table 1).

Table 1. Demographic analysis of the overall student athlete sample by grade classification, gender, ethnic group, and competitor's event in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Variable		Sample size (no.)[z]	Sample size (%)
Grade classification	Freshmen	43	33.9
	Sophomores	37	29.1
	Juniors	27	21.3
	Seniors	20	15.7
	Total[z]	127	100
Gender	Female	71	55.5
	Male	57	45.5
	Total[z]	128	100
Ethnic Group	Caucasian	54	42.5
	Hispanic	12	9.4
	African American	48	37.8
	Asian American	2	1.6
	Other	11	8.7
	Total[z]	127	100

Table 1 - continued

Variable		Sample size (no.)[z]	Sample size (%)
Competitor's Event	Event 1 (Triple, long & high jump, pole vault)	34	26.8
	Event 2 (Sprints - 100m, 200m, 100m-Hurdles)	21	16.5
	Event 3 (Mid distance - 400m, 400m-Hurdles, 800m)	40	31.5
	Event 4 (Long distance – 1500m, 3200m,5000m, 10000m, steeple chase)	32	25.2
	Total[z]	127	100

[z]Number of respondents for each category varied due to non-responses.

Findings related to objective one

The first objective of the study was to compare levels of landscaping at various track and field competition sites. The track and field sites showed considerable differences in their levels of greenery. The researcher photographed each site during competition season and at a time when people were not present, such as the early morning or just before sunset. Several photographs were taken in order to obtain a 360-degree view from the center of the field (Appendix 4).

Three horticulture professionals privately and individually rated each of the photographed track and field sites and then scores for all 3 horticulturists were averaged in order to obtain an overall greenery rating for each site. A score of 5 for a field site was considered to have the highest level of greenery and a score of 0 was the lowest rating possible and had no greenery. The greenery rating system used by the researchers was based on a previously tested reliable and valid instrument (Kuo and Sullivan, 2001).

University of Texas, Austin, TX received a 2.08 greenery rating; Rice University, Houston, TX received a 2.88 greenery rating; Stephen F. Austin University, Nacogdoches, TX received a 3.16 greenery rating, and Texas Tech University, Lubbock, TX received a 1.73 greenery rating (Table 2).

Table 2. Greenness/landscape[z] ratings for each of the track and field competition sites in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Track and field competition site	Greenness/landscape rating[z]
University of Texas - Austin, TX	2.08
Rice University - Houston, TX	2.88
Stephen F. Austin University - Nacogdoches, TX	3.16
Texas Tech University - Lubbock, TX	1.73

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using a Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

Findings related to objective two

The second objective of this study was to compare reported levels of performance of athletes at track and field sites with varying levels of greenery. Performance was ranked as best, second best, third best and worst, and then coded and entered in to SPSS® Version 17.0 (Chicago, IL) with 1 being entered for the worst performance, 2 being entered for the third best performance, 3 being entered for the second best performance and 4 for being entered for the best performance. A regression analysis was performed to determine if the presence of greenery on the track and field competition site was a predictor of better performance by athletes. The analysis indicated that greenness level was a predictor (P=0.000) of best performance by athletes when performance level of athletes was the dependent variable (Table 3). The researcher ranked all the listed performances for each athlete for the season as best, 2nd best, 3rd best and lowest performance. Track and field sites with the highest ratings in greenness resulted in the greatest number of athletes achieving their best performances (Figure 1).

Table 3. Results of a linear regression analysis using greenness/landscape rating[z] as a predictor and performance level[y] of athletes as the dependent variable in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Greenness/landscape rating[z]/performance[y]	df	Mean Square	R^2	B	F	*P*
Regression	5	68.339	0.611	0.341	36.714	0.000*
Residual	117	1.861				
Total	122					

*Statistically significant at the 0.05 level.

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using a Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Performance was established from comparison of all the athletes' marks during Spring 2009.

Descriptive data based on performance verified results from the regression analysis. Performance data were collected from 7 different track meets at 4 different locations. Not all of the athletes that participated in the study participated in all 7 track meets.

Most of the athletes' best performance marks were at Stephen F. Austin University, Nacogdoches, TX (47.7%) which had the highest greenery rating (3.16), and most of the athletes' worst performance marks were achieved at Texas Tech University, Lubbock, TX (68%) which had the lowest greenery rating (1.73)(Table 4, Figure 1).

The percentage of athletes that made their best marks and poorest marks at a certain location followed closely with the greenness ratings. Generally, as the greenness rating increased, the poorest marks decreased for that track and field site. When looking at the best marks there is a notable difference between Stephen F. Austin University, Nacogdoches, TX (3.16) and the other universities with Stephen F. Austin University having 25% more best marks compared to the other universities (Table 4). The other 3 universities are closer in numbers of best marks by athletes, but showed decreases in percentages of best marks as the greenness rating decreased for each competition site (Table 4, Figure 1).

Interestingly enough, Stephen F. Austin University, Nacogdoches, TX also had the lowest number of poorest results (39.75%) (Table 4, Figure 1). Rice University, Houston, TX, had the second highest greenness rating (2.08), and did not fall in order with the performance results since an exceptionally high percentage of athletes' (54.54%) had their lowest performance at the site. Perhaps due to the fact that Rice University was in a large city (Houston, TX) where skyscrapers were the bordering scenery, the immediate greenery at the field made less of an impact on best performance of athletes. Pressures of work, city noise, and other forms of stress move people towards seeking relief in outdoor settings (Knopf, 1983) and the natural scenery present was not restorative

because the human-made objects such as cars or buildings were not inconspicuous or absent (Ulrich, 1983) even though greenery was present.

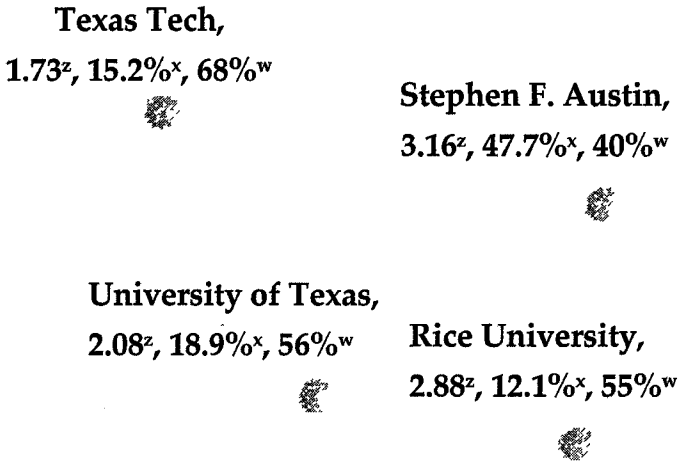


Figure 1. Location of track and field sites and percentage of athletes' best and poorest marks[y] at each site during the researched competition season in the study of the relationship between levels of greenery/landscaping[z] at track and field sites, anxiety, and sports performance.

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using a Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Performance was established from comparison of all the athletes' marks during Spring 2009.

[x]Percentage of best marks for the Spring 2009 competition season.

[w]Percentage of poorest marks for the Spring 2009 competition season.

A chi-square analysis was used to examine performance and greenery data (Table 4). Statistically significant differences were found in the chi-square analysis results that indicated the performance amongst the athletes that participated in the track meets differed from the expected results at each of 4 track and field meets that corresponded with each of the 4 sites included in the study (Table 4).

The number of athletes that participated overall in the study was 128. Due to non-response to some questions, the number of athletes from which information was gathered for this analysis was 124. When determining the best and worst marks of the athletes, the previous year's best marks were taken into account from the athletes' demographic questionnaire. If the athletes did not perform better in 2009 when compared to their previous year of competition, the athletes did not receive a best mark but instead, the best mark for 2009 was counted as the second best mark. If the athlete only had 1 recordable mark for the year, it was counted as the worst mark if it was not greater than their previous year's best mark. Additionally, all athletes did not attend all 7 track meets where information was recorded.

The chi-square analysis also indicated statistically significant differences when comparing the observed versus the expected percentage of athletes' ranked

performances. The difference in expected and observed performance percentages supports the idea of greenery having an impact on performance. Of the athletes that participated in the meet, Texas Tech University, Lubbock, TX showed statistically significant differences in expected (25%) and observed (68.18%) lowest marks and also had the lowest greenness ratings (1.73)($P = 0.000$). Of the athletes that participated in the meet, Stephen F. Austin University, Nacogdoches, TX was more closely aligned with best and poorest expected results (20.8%, 20.8%) and observed results (34.93%, 39.75%). Stephen F. Austin University, Nacogdoches, TX also had the highest greenness rating (3.16) of all the track meet sites (Table 4; Figure 1; $P = 0.000$).

Table 4. Results of a chi-square analysis comparing athletes' performance[y] at different track and field sites with varying greenness levels[z] in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Track meet/Attendance + mark	Greenness Rating[z]	Observed N (%) Overall	Expected N (%) Expected	df	*P* value
Texas Relays, University of Texas, Austin, TX	2.08				
Attendance +lowest mark		9 (56.25%)	4 (25%)	3	0.029*
Attendance + best mark		3 (18.75%)	4 (25%)		
Total athletes attending meet		16			
Texas Twilight, University of Texas, Austin, TX	2.08				
Attendance +lowest mark		13 (40.62%)	8 (25%)	3	0.021*

Table 4 - continued

Track meet/Attendance + mark	Greenness Rating[z]	Observed N (%) Overall	Expected N (%) Expected	df	*P* value
Attendance + best mark		10 (31.25%)	8 (25%)		
Total athletes attending meet		32			
Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16				
Attendance +lowest mark		12 (31.57%)	9.5 (25%)	3	0.064
Attendance + best mark		5 (13.15%)	9.5 (25%)		
Total athletes attending meet		38			
Rice Invite, Rice University, Houston, TX	2.88				
Attendance +lowest mark		30 (54.54%)	13.8 (25%)	3	0.000*
Attendance + best mark		9 (16.36%)	13.8 (25%)		
Total athletes attending meet		55			
Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73				
Attendance +lowest mark		15 (68.18%)	5.5 (25%)	3	0.000*
Attendance + best mark		4 (18.18%)	5.5 (25%)		
Total athletes attending meet		22			
Big VII Conference, Texas Tech University, Lubbock, TX	1.73				
Attendance +lowest mark		8 (32%)	6.3 (25%)	3	0.067
Attendance + best mark		10 (40%)	6.3 (25%)		
Total athletes attending meet		25			
Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16				

Table 4 - continued

Track meet/Attendance + mark	Greenness Rating[z]	Observed N (%) Overall	Expected N (%) Expected	df	*P* value
Attendance +lowest mark		33 (39.75%)	20.8 (25%)	3	0.000*
Attendance + best mark		29 (34.93%)	20.8 (25%)		
Total athletes attending meet		83			

*Statistically significant at $P < 0.05$.

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using the following Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Best Performance was established from comparison of all the athletes' marks during Spring 2009.

When athletes' anxiety levels are high or fall below normal range it is said that athletes' performance can be negatively affected (Cox, 1990; Raglin et al., 1990). This study found that greenery appeared to be a predictor of best performance by athletes. Findings could be due to the greenery helping to reduce high stress levels of athletes, as well as vegetation influencing the athletes' emotional states and ability to positively evaluate themselves during a high stress event. These findings support literature which has provided evidence that plants, trees, shrubs and naturalized areas are beneficial to people through the renewal of the mind and by reducing stress (Ulrich, 1984). Another study has shown that there are restorative effects in natural settings compared to urban settings, which positively changes the person's emotional state (Ulrich et al.,

1991). Naturally landscaped scenes help reduce high stress to moderate levels (Fredrickson and Levenson, 1998).

Results related to objective three

The third objective of the study was to compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery. Cognitive and somatic anxiety surveys (CSAI-2) were distributed at each of the 7 track meets that were included within the study during the Spring 2009 competition season. Due to the fact that researchers could not provide incentives in order to increase response rates of athletes because it would be violating the NCAA regulations, there were a limited number of responses. If athletes took more than one survey because they participated in more than one track meet, they were then represented more than once within the averages. A Cronbach's alpha reliability test determined that the internal consistency of the instrument was 0.778 which is considered to be of a suitable level (Gall et al., 2006: Martens et al., 1990).

Twenty-four of the 128 athletes responded to the cognitive and somatic anxiety surveys for a 30.7% response rate. Of the 24 participants, approximately 8 (33.33%) were freshman, 7 (29.16%) were sophomores, 4 (16.66%) were juniors, and 5 (20.83%) were seniors (Table 6). There were 16 (66.66%) females and 8

(33.33%) males. Approximately 9 (37.50%) of the respondents were Caucasian, 8 (33.33%) were Hispanic, 5 (20.83%) were African American, and 1 (4.16%) was Asian American. There were 4 (16.66%) athletes that competed in the triple, long and high jump, and pole vault; 1 (4.16%) competed in sprints (100m, 200m, 100m-H), and 5 (20.83%) were mid-distance runners (400m, 400m-H, 800m). Lastly, 14 (58.33%) were long distance runners (1500m, 3200m, 5000m, 10000m, and steeple chase).

There were only 4 track meets from which surveys were returned out of the 7 in which surveys were distributed. The most responses were gathered at Southland Conference, Stephen F. Austin University, Nacogdoches, TX, (11, 45.83%). Texas Relays, University of Texas, Austin, TX had 1 response (4.16%); Texas Twilight, University of Texas, Austin, TX had 7 responses (29.16%), and Rice Invite, Rice University, Houston, TX had 5 responses (20.83%) (Table 5). Therefore, not all of the 4 track and field sites included in the overall study were represented since no responses to the cognitive and somatic anxiety instrument were gathered from Texas Tech University, Lubbock, TX.

In comparison to norm samples, which were obtained from researchers who have conducted independent competitive anxiety research with the sport of track and field using the CSAI-2 (Martens, 1977), the overall average mean scores

for all of the athletes at all of the meets were somewhat high for both the cognitive and somatic anxiety scores. The average norms recorded from all the track and field athletes across the nation were 20.34 for cognitive anxiety and 18.73 for somatic anxiety (Martens, 1977) with mean scores recorded for this study being 22.52 for cognitive anxiety and 26.03 for somatic anxiety (Table 5).

Since response rates were low and since all track and field sites were not represented, no other statistical comparisons could be made amongst demographic groups.

Table 5. Demographic breakdown of the athletes that completed the CSAI-2 survey[z] by grade classification, gender, ethnic group, competitors' event, and track meet at which the surveys were recorded in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Variable		Sample size (no.)	Sample size (%)	Cognitive Anxiety Score[y] Mean	Somatic Anxiety Score[x] Mean
Grade classification	Freshmen	8	33.33	20.60	22.63
	Sophomores	7	29.16	23.11	26.62
	Juniors	4	16.66	26.00	28.00
	Seniors	5	20.83	22.63	27.57
Gender	Female	16	66.66	17.00	28.06
	Male	8	33.33	19.92	23.16
Ethnic group	Caucasian	9	37.50	20.90	24.77

Table 5 – continued

Variable		Sample size (no.)	Sample size (%)	Cognitive Anxiety Score[y] Mean	Somatic Anxiety Score[x] Mean
	Hispanic	8	33.33	21.30	27.27
	African American	5	20.83	25.00	26.30
	Asian American	1	4.16	29.00	29.00
	Other	1	4.16	21.50	22.00
Competitors' event	Event 1 (Triple, long & high jump, pole Vault)	4	16.66	19.25	25.30
	Event 2 (Sprints - 100m, 200m, 100m-Hurdles	1	4.16	18.50	15.00
	Event 3 (Mid distance - 400m, 400m-Hurdles, 800m)	5	20.83	25.40	26.20
	Event 4 (Long distance – 1500m, 3200m, 5000m, 10000m, steeplechase)	14	58.33	22.83	27.18
Track meets with surveys	Texas Relays, University of Texas, Austin, TX	1	4.16	25.00	26.00
	Texas Twilight, University of Texas, Austin, TX	7	29.16	20.68	23.36
	Rice Invite, Rice University, Houston, TX	5	20.83	22.52	28.97

Table 5 – continued

Variable		Sample size (no.)	Sample size (%)	Cognitive Anxiety Score[y] Mean	Somatic Anxiety Score[x] Mean
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	11	45.83	22.98	24.49
	Total	24	100	22.32	29.43

[z]Competitive Sports Anxiety Inventory - 2 was used to assess athletes' somatic and cognitive anxiety (Martens, 1977).

[y]The cognitive anxiety scale had 9 questions regarding how each athlete felt while he/she competed in sporting events that measured negative self-evaluation, negative expectations of success, and other mental components of anxiety. In order to respond, each athlete marked one of the following 4 answer choices: "not at all", "hardly ever," "sometimes" or "often." Athletes chose the answer which most pertained to their feelings/emotions at the time the survey was administered. Scoring was determined through the allocation of 1, 2, 3 or 4 points for each of the responses available and chosen by the respondent. This resulted in a score ranging from 9 (low anxiety) to 36 (high anxiety).

[x]The somatic anxiety scale had 9 questions regarding how each athlete felt while he/she competed in sporting events that pertained to feelings of tense muscles, butterflies in the stomach, and other physiological symptoms. In order to respond, each athlete marked one of the following 4 answer choices: "not at all", "hardly ever," "sometimes" or "often." Athletes chose the answer which most pertained to their feelings/emotions at the time the survey was administered. Scoring was determined through the allocation of 1, 2, 3 or 4 points for each of the responses available and chosen by the respondent. This resulted in a score ranging from 9 (low anxiety) to 36 (high anxiety).

Pearson product-moment correlation tests were run to determine if there were any statistically significant relationships between cognitive and somatic anxiety scores from the CSAI-2 surveys and greenness levels of each track and field site. Low response rates for some meets limited statistical comparisons. Overall, no statistically significant correlations were found (Table 6). Cognitive

and somatic anxiety scores were similar for athletes regardless of the track and field site. No site appeared to affect either type of anxiety, negatively or positively, of the athletes that responded to the survey.

Table 6. Pearson product - moment correlation test results between overall greenness/landscaping level[z] and overall somatic anxiety[y] mean scores and overall cognitive anxiety[x] mean scores for each track meet[w] in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety[yx], and sports performance.

Overall greenness/overall somatic and cognitive anxiety score[yx]	Sample Size (no.)	Pearson Correlation	*P*
Overall Somatic anxiety	24	0.214	0.316
Overall Cognitive anxiety	24	0.069	0.747

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using the following Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]The somatic anxiety scale had 9 questions regarding how each athlete felt while he/she competed in sporting events that pertained to feelings of tense muscles, butterflies in the stomach, and other physiological symptoms. In order to respond, each athlete marked one of the following 4 answer choices: "not at all", "hardly ever," "sometimes" or "often." Athletes chose the answer which most pertained to their feelings/emotions at the time the survey was administered. Scoring was determined through the allocation of 1, 2, 3 or 4 points for each of the responses available and chosen by the respondent. This resulted in a score ranging from 9 (low anxiety) to 36 (high anxiety).

[x]The cognitive anxiety scale had 9 questions regarding how each athlete felt while he/she competed in sporting events that measured negative self-evaluation, negative expectations of success, and other mental components of anxiety. In order to respond, each athlete marked one of the following 4 answer choices: "not at all", "hardly ever," "sometimes" or "often." Athletes chose the answer which most pertained to their feelings/emotions at the time the survey was administered. Scoring was determined through the allocation of 1, 2, 3 or 4 points for each of the responses available and chosen by the respondent. This resulted in a score ranging from 9 (low anxiety) to 36 (high anxiety).

[w]Texas Relays, University of Texas, Austin, TX; Texas Tech Invite, Texas Tech University, Lubbock, TX; and Big VII, Texas Tech University, Lubbock, TX; track meets had limited data and the correlations were not able to be conducted.

Findings related to objective four

The fourth objective of the study was to compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distancerunners at track and field sites with varying levels of greenery.

Events were coded based on past research that formed the idea that athletes perform best under particular circumstances in regards to anxiety levels (Landers and Boutcher, 1986). Those events considered to be "high anxiety" events were mid distance running events (400m, 400m-Hurdles, 800m). Those events known to be events where athletes perform well under low anxiety included sprints (100m, 200m, 100m-Hurdles), and long distance running events (1500m, 3200m, 5000m, 10000m, and steeple chase). Events such as triple, long and high jump and pole vault were those included in the study that did not fall into either of the anxiety performance categories because anxiety was not known to be as influential in athlete performance.

A regression analysis was run to determine if presence of greenery was a predictor of best performance by athletes in events that were considered to be those in which athletes perform best under low anxiety, high anxiety or in events where anxiety is not known to be as influential in performance (Table 7). Performance data were collected from 7 different track meets at 4 different

locations. Not all of the athletes that participated in the study participated in all 7 track meets. Statistically significant results (P=0.001; P=0.003; P=0.006) supported the previous performance findings from all athlete performance data (Table 3) that better performance occurred at the track and field site with more vegetation (Table 7). Since the results did not change when data was split based on type of event/preferred level of anxiety, results from this study indicated that all athletes performed better at the more vegetated track and field site regardless of event and level of anxiety that past research has indicated might be beneficial for best performance for that event (Fredrickson and Levenson, 1998).

Table 7. Results of a linear regression analysis comparing low anxiety[x], high anxiety[w], and not applicable[v] anxiety events where greenness/landscape rating was used as a predictor and performance level within the various events by preferred anxiety level was used as the dependent variable in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Greenness/Landscape rating[z]/best performance[y]	df	Mean Square	R^2	B	F	*P*
Low anxiety events[x]						
Regression	1	48.973	0.271	1.821	14.160	0.001*
Residual	38	3.459				
Total	39					
High anxiety events[w]						
Regression	1	33.726	0.164	1.418	9.806	0.003*
Residual	50	3.439				

Table 7 - continued

Greenness/Landscape rating[z]/best performance[y]	df	Mean Square	R^2	B	F	*P*
Total	51					
Anxiety events not applicable[v]						
Regression	1	39.496	0.228	1.954	8.883	0.006*
Residual	30	4.446				
Total	31					

*Statistically significant at $P < 0.05$.

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using the following Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Best Performance was established from comparison of all the athletes' marks during Spring 2009.

[x]Those events known to be events where athletes perform well under low anxiety included sprints (100m, 200m, 100m-Hurdles), and long distance running events (1500m, 3200m, 5000m, 10000m, and steeple chase).

[w]Those events considered to be "high anxiety" events were mid distance running events (400m, 400m-Hurdles, 800m).

[v]Events such as triple, long and high jump and pole vault were those included in the study that did not fall into either of the anxiety performance categories because anxiety was not known to be as influential in athlete performance.

To further compare athlete performance within the categories of high and low anxiety events and those events that are not known to be influenced by anxiety level, univariate ANOVA tests were conducted. Results indicated no statistically significant differences between the three groups (P=0.600; Table 8).

These results verified previous results from the regression analysis that found that all athletes within anxiety level groups performed similarly with better performances at the site with higher greenness ratings and poorer performances at the site with the lowest greenness rating (Table 7).

Table 8. Analysis of variance test comparing site of best 2009 performance, greenness/landscaping rating[z], and athletes involved in events that were either low anxiety[x], high anxiety[w] and events that were not influenced by levels of anxiety[v] in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	Sample Size (%)	df	F	*P*
Low Anxiety events[x]	Texas Relays, University of Texas, Austin, TX	2.08	2	5.0	2	0.513	0.600
	Texas Twilight, University of Texas, Austin, TX	2.08	7	17.5			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	1	2.5			
	Rice Invite, Rice University, Houston, TX	2.88	4	10.0			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1	2.5			
	Big VII, Texas Tech University, Lubbock, TX	1.73	7	17.5			

Table 8 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	Sample Size (%)	df	F	*P*
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	18	45.0			
High Anxiety events[w]	Texas Relays, University of Texas, Austin, TX	2.08	1	1.9	2	0.513	0.600
	Texas Twilight, University of Texas, Austin, TX	2.08	8	15.1			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	6	11.3			
	Rice Invite, Rice University, Houston, TX	2.88	9	17.0			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	3	5.7			
	Big VII, Texas Tech University, Lubbock, TX	1.73	5	9.4			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	20	37.7			
Anxiety events not applicable[v]	Texas Relays, University of Texas, Austin, TX	2.08	5	14.3	2	0.513	0.600

Table 8 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	Sample Size (%)	df	F	*P*
	Texas Twilight, University of Texas, Austin, TX	2.08	2	5.7			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	5	14.3			
	Rice Invite, Rice University, Houston, TX	2.88	3	8.6			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1	2.9			
	Big VII, Texas Tech University, Lubbock, TX	1.73	3	8.6			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	13	37.1			

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using the following Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Best Performance was established from comparison of all the athletes' marks during Spring 2009.

[x]Those events known to be events where athletes perform well under low anxiety included sprints (100m, 200m, 100m-Hurdles), and long distance running events (1500m, 3200m, 5000m, 10000m, and steeple chase).

[w]Those events considered to be "high anxiety" events were mid distance running events (400m, 400m-Hurdles, 800m).

[v]Events such as triple, long and high jump and pole vault were those included in the study that did not fall into either of the anxiety performance categories because anxiety was not known to be as influential in athlete performance.

Findings related to objective five

The fifth objective was to evaluate differences in demographic groups to determine if any particular group of athletes benefited more or less from additions of greenery or landscaped areas at track and field competition sites. A univariate analysis of variance was run to compare athletes' best performance and the variables of gender, ethnicity, and grade classification to observe whether any particular demographic group benefitted more from the presence of greenery/landscaping in terms of performance in comparison to other groups. No differences were found in comparisons (Table 9). All athletes performed similarly at each of the track and field sites regardless of ethnicity, gender or grade classification. Therefore, all athletes and groups of athletes appeared to have more best performance marks at the sire with more vegetation and more poor performance marks at the site with the least vegetation.

Research has shown that passive and active interactions with natural areas have had positive mental and physical effects on individuals (Ulrich et al., 1991). Kaplan further explained that research has found such effects of nature to be global, and not bound by culture, ethnicity, age, place of residence, or occupation (Kaplan, 1992; Lewis 1996).

Table 9. Results of a univariate analysis of variance comparing track and field site of best performance among athletes of different gender, ethnicities, and grade classification in the study of the relationship between levels of greenery/landscaping at track and field sites, anxiety, and sports performance.

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
Gender						
Males	Texas Relays, University of Texas, Austin, TX	2.08	2	1	1.04	0 317
	Texas Twilight, University of Texas, Austin, TX	2.08	7			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	4			
	Rice Invite, Rice University, Houston, TX	2 88	6			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	3			
	Big VII, Texas Tech University, Lubbock, TX	1.73	9			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	25			
Females	Texas Relays, University of Texas, Austin, TX	2.08	6			
	Texas Twilight, University of Texas, Austin, TX	2.08	10			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	8			
	Rice Invite, Rice University, Houston, TX	2.88	10			

Table 9 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	2			
	Big VII, Texas Tech University, Lubbock, TX	1.73	6			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	26			
Ethnicity						
Caucasian	Texas Relays, University of Texas, Austin, TX	2.08	4	4	1.173	0.173
	Texas Twilight, University of Texas, Austin, TX	2.08	6			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	3			
	Rice Invite, Rice University, Houston, TX	2.88	7			
	Texas Tech Invite, Texas Tech University, Lubbock, TX6	1.73	2			
	Big VII, Texas Tech Unive3rsity, Lubbock, TX9	1.73	5			
	Southland Co25nference, Stephen F. Austin University, Nacogdoches, TX	3.16	23			
African American	Texas Relays, University of Texas, Austin, TX	2.08	3			
	Texas Twilight, University of Texas, Austin, TX	2.08	3			

Table 9 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	8			
	Rice Invite, Rice University, Houston, TX	2.88	6			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1			
	Big VII, Texas Tech University, Lubbock, TX	1.73	9			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	18			
Hispanic	Texas Twilight, University of Texas, Austin, TX	2.08	4			
	Rice Invite, Rice University, Houston, TX	2.88	3			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3 16	4			
Asian American	Texas Twilight, University of Texas, Austin, TX	2.08	1			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	1			

Table 9 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
Other	Texas Relays, University of Texas, Austin, TX	2 08	1			
	Texas Twilight, University of Texas, Austin, TX	2.08	3			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	1			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1			
	Big VII, Texas Tech University, Lubbock, TX	1.73	1			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	4			
Grade Classification						
Freshman	Texas Relays, University of Texas, Austin, TX	2.08	1	3	0.404	0.751
	Texas Twilight, University of Texas, Austin, TX	2.08	6			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3 16	6			
	Rice Invite, Rice University, Houston, TX	2.88	7			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	3			
	Big VII, Texas Tech University, Lubbock, TX	1.73	3			

Table 9 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	17			
Sophomore	Texas Relays, University of Texas, Austin, TX	2.08	2			
	Texas Twilight, University of Texas, Austin, TX	2.08	4			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	4			
	Rice Invite, Rice University, Houston, TX	2.88	9			
	Big VII, Texas Tech University, Lubbock, TX	1.73	5			
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	12			
Junior	Texas Relays, University of Texas, Austin, TX	2.08	1			
	Texas Twilight, University of Texas, Austin, TX	2.08	5			
	Dogwood Relays, Stephen F. Austin University, Nacogdoches, TX	3.16	1			
	Texas Tech Invite, Texas Tech University, Lubbock, TX	1.73	1			
	Big VII, Texas Tech University, Lubbock, TX	1.73	1			

Table 9 - continued

Variable	Site of best 2009 performance	Greenery rating	Sample Size (no.)	df	F	*P*
	Southland Conference, Stephen F. Austin University, Nacogdoches, TX	3.16	11			
Senior			0			

[z]Greenness/landscaping level was determined by averages from ratings of professional horticulturists who individually rated each site and created a mean from the data at each site. Greenness was rated using the following Likert scale of 1-5. One was considered to have no greenery and five was considered to be fully landscaped.

[y]Best Performance was established from comparison of all the athletes' marks during Spring 2009.

Cognitive and somatic anxiety responses were limited and, therefore, statistical comparisons could not be made based on demographic groups and overall anxiety levels.

Therefore, descriptive statistics were used to make observations for grade classifications, gender, ethnic groups and events. Looking at grade classification and optimal anxiety performance, research shows that athletes who have less experience (freshman) will perform well with lower levels of anxiety and more skilled (senior) athletes have been known to have a beneficial level of anxiety at either progressively higher or moderate levels (Cox, 1990; Raglin et al., 1990). Cognitive anxiety scores for each grade classification were higher than the norm

averages (Martens, 1977). Junior grade classification had the highest overall scores for both somatic and cognitive anxiety (Table 5).

The short sprint athletes had relatively low cognitive (18.5) and somatic (15.0) anxiety scores (Table 5) in comparison to the other athletes and in comparison to the norm scores, and studies have shown that low anxiety is beneficial or the ideal state for the athletes in these events (Landers and Boutcher, 1986). Research has found that long distance athletes are in their best state when anxiety is low (Landers and Boutcher, 1986). The long distance event athletes in this study had cognitive (22.83) and somatic (27.18) anxiety scores that were very high (Table 5) in comparison to the norm sample. The mid-distance events were found to do their best in past research when the anxiety level was high. In this research, both cognitive (25.4) and somatic (26.2) anxiety scores amongst athletes were also high (Table 5). The optimum track and field performance anxiety levels vary depending upon the events' requirement for physical power and muscle mass increase. Events like shot put, pole vault, and triple jump require higher anxiety levels because the events have more elements involved with moving the body weight at the right time with the right force, unlike distance running which only requires the athlete to run (Turner and Raglin, 1995).

Both the females and the males showed high levels of somatic anxiety (28.06, 23.16) and lower levels of cognitive anxiety (17.00, 19.92) (Table 5).

Ethnic group samples were small due to the overall small sample size. With that in mind, Asian American ethnic group had the highest score for both the cognitive and somatic anxiety score, and are the highest scores for somatic and anxiety scores overall (Table 5).

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Purpose of the Study

The main objective of this study was to determine if the level of greenery and landscaping at track and field competition sites influenced collegiate athletes' performance and/or anxiety levels. The specific objectives of this study included the following:

1. To compare levels of greenery/landscaping at various track and field competition sites.
2. To compare reported levels of performance of athletes at track and field sites with varying levels of greenery.
3. To compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery.

4. To compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distance runners at track and field sites with varying levels of greenery.

5. To evaluate the differences in demographic groups to determine if any particular group of athletes benefited more or less from additions of greenery or landscaped areas at track and field competition sites.

Summary of the Literature Review

Sports performance has been constantly improving with tactics that include enhancing confidence and reducing athletes' anxiety for better performances (Raglin et al., 1990), because it has been discovered that athletes' poor performance can be related to high levels of anxiety (Raglin, 1992).

Scholars have studied how athletes personally calm themselves and prepare for athletic performance. Most athletes did not engage in structured or systematic forms of relaxation. Instead, they remained calm by isolating themselves and limiting interactions with others during competition (Durand, 2002).

Hartig and Evans (1993) brought attention to theories focused on the positive effects of nature and psychological benefits from interactions with nature and green spaces. Nature has also been shown to decrease stress through

passive interaction (Ulrich, 1983). Kaplan and Kaplan (1989) found that natural environments improve a person's ability to maintain focused attention.

Research has found that a decrease in negative thoughts occurs when people are in the presence of plants (Larsen et al., 1998; Waliczek et al., 1996; Waliczek et al., 2005). Physical environment has also been suggested to influence psychological and physiological factors in humans (Bringslimark et al., 2007; Dravigne et al., 2009). People receive benefits from interactions with plants and nature (Bringslimark et al., 2007; Dravigne et al., 2009).

Methodology

Sample Group

A total of 512 track and field athletes from 19 different universities within Texas were asked to participate in the study. Of those asked to participate, 128 participants completed consent forms and provided demographic information.

Athletes that participated in the events of shot put, discus, hammer throw and javelin field events were not invited to participate because their event placement is most commonly outside of the track stadium, and therefore, they would not have viewed and been influenced by track and field greenery and landscaping.

The schools and track and field teams were contacted through e-mail with a note detailing the study and how researchers would be using information from athletes (Appendix A). After 2 weeks, researchers sent another e-mail to encourage responses and followed up with phone calls to each coach (Appendix B). Researchers sent another short e-mail after phone conversations so that coaches could reply with their response on whether they did or did not want to participate (Appendix C).

Participants were from 4 universities: Texas A&M University - Corpus Christi, TX, Texas Tech University, Lubbock, TX, Stephen F. Austin University, Nacogdoches, TX, and Texas State University- San Marcos, TX.

Instrumentation

Somatic and cognitive anxiety was assessed using the Competitive Sports Anxiety Inventory - 2 (CSAI-2) (Martens, 1977). The survey took 5-10 minutes for participants to complete and consisted of 18 statements (9 for the somatic anxiety scale and 9 for the cognitive anxiety scale) about how the person felt when they competed in sports. This specific instrument has been tested for reliability and validity (Martens, 1977) and normed on a nationwide sample of athletes. In order to respond, each athlete responded to statements using a Likert scale that corresponded to the following 4 answer choices: "not at all", "hardly ever,"

"sometimes" or "often." Athletes chose the answer which most explained their feelings/emotions at the time the survey was administered. The published reliability for cognitive anxiety instrument was 0.79, and for the somatic anxiety instrument was 0.82 (Martens, 1977).

The somatic anxiety scale questions pertained to feelings of tense muscles, butterflies in the stomach, and other physiological symptoms (Appendix D) (Martens, 1977). The cognitive anxiety scale questions measured negative self-evaluation, negative expectations of success, and other mental components of anxiety (Appendix D) (Martens, 1977). A Cronbach's alpha reliability test determined that the internal consistency of the instrument was 0.778 which is considered to be of a suitable level (Gall et al., 2006: Martens et al., 1990).

To measure the variable of sports performance, there was a space allocated at the bottom of the survey for each athlete to report his or her performance at each of the 7 different track meets, at the 4 different selected competition locations. For those athletes that did not return their surveys for each meet, the researcher used the live results webpage (http://www.flashresults.com) for track and field competitions and recorded performance for each athlete for each meet.

In order to measure the differing levels of greenness/landscaping at each track and field site, a Likert rating scale was used. The system of measurement was based on a reliable and valid instrument that has been previously used in research (Kuo and Sullivan, 2001). Each number on the scale related to a full description explaining the levels of greenery and landscaped areas of the track and field competition site from the center of the field, accounting for only what the researcher could view from a 360 degree area at each location. Each track and field site was rated on the levels of landscaping during the same period as the outdoor competition season. The Likert rating scale consisted of the following rating criteria:

1 – no greenery, traffic is visible, buildings are in view, only grass on field

2 – minimal greenery, some turf, no shrubs – 25% greenery

3 – minimal greenery, some turf and shrubs – 50% greenery

4 – some greenery, turf, trees and shrubs – 75% greenery

5 – fully landscaped around all perimeter of the track, viewings of trees or field scapes in the distance

The researcher recorded information regarding the landscape from various angles including the middle of the field and from the stadium seating on both sides of the field if applicable, using photographs to document views. In

order to maintain consistency in the study, the researcher was the sole photographer for recording the information at each site. The photographs of multiple views for each track and field site were viewed by 3 professional horticulturists who privately and individually rated each landscape using the Likert scale. Scores resulted in an average greenery rating from each professional horticulturist for each track and field site. These scores from each of the 3 horticulturists were averaged together to result in one final composite score for each track meet site.

Results

Objective One

The first objective of the study was to compare levels of landscaping at various track and field competition sites.

The scores were obtained from averaged ratings from 3 professional horticulturists who individually and independently rated photographs of the sites taken by the main researcher. A Likert rating scale of 1 to 5, with 1 being low amounts of greenery and landscaping and 5 being high greenery level (Likert, 1967). University of Texas, Austin, TX received a 2.08 greenery rating; Rice University, Houston, TX received a 2.88 greenery rating; Stephen F. Austin

University, Nacogdoches, TX received a 3.16 greenery rating, and Texas Tech University, Lubbock, TX received a 1.73 greenery rating (Table 2).

Objective Two

The second objective of this study was to compare reported levels of performance of athletes at track and field sites with varying levels of greenery.

A regression analysis was performed to determine if the presence of greenery on the track and field competition site was a predictor of better performance by athletes. The analysis indicated that greenness level was a predictor (P=0.000) of best performance by athletes when greenness level was the predictor and performance level of athletes was the dependent variable (Table 3). Track and field sites with the highest ratings in greenness resulted in the greatest number of athletes achieving their best performances (Figure 1).

Most of the athletes' best performance marks were at Stephen F. Austin University, Nacogdoches, TX (47.7%) which had the highest greenery rating (3.16) and most of the athletes' poorest performance marks were at Texas Tech University, Lubbock, TX (68%) which had the lowest greenery rating (1.73) (Table 4, Figure 1).

Results of a chi-square analysis also showed that there were statistically significant differences between the numbers of athletes that performed well or

poorly at individual sites relative to the expected number (Table 4) verifying results from the regression analysis. Texas Tech University, Lubbock, TX showed large deviations between expected (25%) and observed (68%) lowest performance marks and had the lowest greenness ratings (1.73). Stephen F. Austin University, Nacogdoches, TX was more closely aligned with best and poorest expected (20.8%, 20.8%) and observed (35%, 40%) which had the highest greenness rating (3.16) (Table 4, Figure 1).

This study found that greenery appeared to be a predictor of best performance by athletes. Findings could be due to the greenery helping to reduce high stress levels of athletes, as well as vegetation influencing the athletes' emotional states and ability to positively evaluate themselves during a high stress event. Naturally landscaped scenes have been found to help reduce high stress to moderate levels (Fredrickson and Levenson, 1998). These findings support literature that provides of plants, trees, shrubs and naturalized areas can be beneficial to people through the renewal of the mind and by reducing stress (Ulrich, 1984).

Objective Three

The third objective of the study was to compare reported levels of cognitive and somatic anxiety for athletes at competitions held at track and field sites with varying levels of greenery.

The CSAI-2 survey was distributed to the athletes before the competition, and they were asked to respond within an hour of competing. Twenty-four of the 128 athletes responded to the cognitive and somatic anxiety surveys for a 30.7% response rate.

Low response rates overall and for some meets limited statistical comparisons. Cognitive anxiety scores for athletes in each grade classification were higher than the nationwide averages that were determined in past research while norming the instrument (Martens, 1977). Athletes competing in short sprints had very low cognitive (18.5) and somatic (15) anxiety scores, and studies have shown that low anxiety, and calmness within athletes is beneficial or the ideal state for the athletes in these events (Landers and Boutcher, 1986). Research has found that long distance athletes are in their best state when anxiety is low and athletes are calm (Landers and Boutcher, 1986). However, the long distance event athletes in this study had cognitive (22.83) and somatic (27.18) anxiety scores that were very high. Athletes competing in mid-distance events were

found to do their best in past research when anxiety levels were high. In this research, both cognitive (25.4) and somatic (26.2) anxiety scores amongst mid-distance athletes were also high.

Pearson product-moment correlation tests were run to determine if there were any statistically significant relationships between cognitive and somatic anxiety scores for each athlete from their CSAI-2 surveys and greenness levels of each track and field site. Overall, no statistically significant correlations were found (Table 6). Cognitive and somatic anxiety scores were similar for athletes regardless of the track and field site. No site appeared to affect either type of anxiety, negatively or positively, of the athletes that responded to the survey.

Objective Four

The fourth objective of the study was to compare the impact of low vs. high anxiety levels on track and field performance of short, middle, and long distance runners at track and field sites with varying levels of greenery.

A regression analysis was run to determine if presence of greenery was a predictor of best performance by athletes in events that were considered to be those in which athletes perform best under low anxiety, high anxiety or in events where anxiety is not known to be as influential in performance (Table 7).

Performance data were collected from 7 different track meets at 4 different locations. Statistically significant results (P=0.001; P=0.003; P=0.006) supported the previous performance findings from all athlete performance data (Table 3) that better performance occurred at track and field sites with more vegetation (Table 7). Since the results did not change when data was split based on type of event/preferred level of anxiety, results indicated that all athletes had more best performance marks in more vegetated track and field sites regardless of event and level of anxiety.

A univariate ANOVA test was conducted to further examine findings, and the results indicated no statistically significant differences between the three groups (P=0.600; Table 8). This verified previous results from the regression analysis that found that all athletes perform better more often at sites with higher greenness ratings (Table 7).

Objective Five

The fifth objective was to evaluate the difference in demographic groups to determine if any particular group of athletes benefited more or less from additions of greenery or landscaped areas at track and field competition sites.

A univariate analysis of variance was run to compare athletes' best 2009 performance and the variables of gender, ethnicity, and grade classification to observe whether any particular demographic group benefitted more from the presence of greenery/landscaping in terms of performance in comparison to other groups. No differences were found in comparisons (Table 9). Therefore, no particular demographic group appeared to benefit more or less in terms of sports performance from the presence of vegetation. Kaplan further explained that research has found such effects of nature to be global, and not bound by culture, ethnicity, age, place of residence, or occupation (Kaplan, 1992; Lewis 1996).

Cognitive and somatic anxiety responses were limited and, therefore, statistical comparisons could not be made based on demographic groups.

Conclusions

1. The overall results from this study indicated that amount of greenery and landscaping was a predictor of best and worst performance by athletes. Research has stated that vegetation can lead to less anxiety in people. However, due to the fact that there were not enough responses from the athletes' anxiety tests administered, the connection could not be made in this

study. Cognitive and somatic anxiety test scores for those athletes that responded were higher than the published norm sample.

2. Results from this study indicated that there were no differences in cognitive and somatic anxiety levels from one track meet and site to another, regardless of the greenery level. All athletes that were administered the anxiety tests had higher than normal cognitive and somatic anxiety scores.
3. Results from this study indicated that there were no differences seen in athletes from different events or different demographics groups. Performance was similar for all groups, and all athletes had more best performances at sites with more vegetation and more poorest performances at the site with the least amount of vegetation.

These findings are relevant to those coaches or athletes who are trying to get the edge, compete at their highest level and achieve their greatest performance. In order to utilize the information, coaches could place plants on the buses transporting athletes, in the locker rooms, or even make time to take the athletes to places heavily vegetated before competitions. Research has found that these results do not stand true only for track and field athletes. It seems as if there would be a huge impact in sporting events if landscaping or interiorscaping was used more often as part of the competition site. Athletes

would have lowered cognitive anxiety because of the plants elevating the athlete's attitude. Somatic anxiety levels could also be affected. At universities, currently budgets do not generally include a high percentage for landscaping/interiorscaping when dealing with sports fields. Trade magazines have shown that of all the grounds maintenance invested in the entire university, only 20% are spent on maintaining the campus' landscape (Yahres, 2000). Once research comes out showing the benefits of plants on athletes, perhaps there will be an increase in percentage of funds allocated for landscaping/interiorscaping. Results were correlated but not necessarily causal. Therefore, it is important to note that factors were not controlled for in the study because the research took place in an actual "real-life" setting that included changes in the weather, the time of day the competitions took place, changes in social or emotional stress, changes in the intensity of workouts from week to week, travel time to competitions, or injuries. These factors have a high contribution factor when looking at an athlete's optimal performance and should be taken into further consideration in future studies.

Recommendations for Additional Research

1. It is recommended that more research be conducted in this area by expanding the study to include athletes and track and field sites from universities nationwide to see if results of this study may be replicated.
2. It is recommended that more studies be conducted to further explore the variables of cognitive and somatic anxiety of track and field athletes and the impact of vegetation since data responses were limited in this study.
3. It is recommended that more studies be conducted to further explore other factors that may contribute to sports performance.
4. It is recommended that more research emphasis be conducted on the athletes perception of their performance at track and field meets with various greenery levels.
5. It is recommended that the study be replicated with other types of sporting activities.

APPENDIX A

Emailed Request for Participation

Dear Track and Field Coach,

I am a master's student at Texas State University – San Marcos pursuing a degree in Agriculture Education under the guidance of Dr. Tina Cade. I am conducting research to complete the thesis requirement of my degree and some of your athletes have been selected to participate in data collection.

The intent of this study is to determine the impact of the track and field competition site on anxiety levels and performance. If you agree to participate in this study, coaches or assigned team leaders will be asked to distribute and collect the surveys for the participating athletes. There will be a pre-addressed and stamped envelope for the coach or assigned team leader in which to place the completed surveys after each corresponding meet to send back to the researcher. The athletes will be given a letter of assent and demographic survey to fill out before the study begins. The demographic survey also includes questions regarding students' past collegiate performances. All information gathered in this study will remain confidential.

The study hopes to look at athletes at multiple competition sites to discern if there is correlation in performance and anxiety and competition site among differing athletes. Other collegiate athletes are being surveyed in the same way during the spring of 2009 competition season. At each competition site in spring 2009, the athlete will be asked to fill out a short survey which will be used to test and quantify the levels of anxiety and athletes will be asked to report their performance. The survey is easy to take. To complete most of the survey, athletes will simply check the box that applies to their feelings at the moment prior to competition: "hardly ever", "sometimes" or "often". The survey will take from 10-15 minutes to complete, depending upon the athlete. The questions deal with emotions experienced during competition. The results from each athlete will

remain confidential and will be matched with their coding information for sorting purposes.

A summary of the research findings will be made available. Dr. Cade or Ms. Matthews can be reached at any time to answer questions regarding the study by phone at (512) 245-3324 or via e-mail at tc10@txstate.edu (Cade) or jm2008@txstate.edu (Matthews).

If you are interested please respond to this e-mail stating your interest. If you are not interested please respond stating that you are not interested so I can confirm that you received the e-mail and have made your decision.

Sincerely,

Jennifer C. Matthews
M.Ed. Graduate Student
Department of Agriculture
Texas State University – San Marcos

APPENDIX B

Informed Assent

Dear Track and Field Athlete,

You have been selected to participate in study based on your performance in the year of 2008 in Track and Field. The intent of this study is to determine the difference in anxiety levels and performance in respect to the track and field competition site. The research is being conducted by Texas State University-San Marcos under the direction of Dr. Tina Cade and graduate student Jennifer Matthews. The researchers can be reached at any time to answer questions regarding the study by phone at (512)245-3324 or via e-mail at tc10@txstate.edu or jm2008@txstate.edu. Participation is voluntary and participants may withdraw from the study at any time without interference with their performance and status.

Prior/After each valid competition in Spring 2009, you will fill out a short survey (CSAI-2) which will be used to test and quantify the levels of anxiety and performance of participating athletes. The survey is easy to take. You simply check the box on the anxiety survey that applies to your feelings at the moment prior to competition and record your performance at each correlating competition site. The anxiety survey will take about 5-10 minutes to complete. Each survey you complete will be returned to the designated coach or team leader after each correlating competition. Demographic information will also be asked and filled out after the assent has been given, with questions also applying to your prior collegiate performances. Your results will remain confidential and will be matched with your coding information for sorting purposes. A summary

of the findings will be provided to participating coaches/athletes upon completion of the study.

Questions about the research, research participants' rights, and/or research-related injuries to participants, should be directed to one or both of the Internal Review Board co-chairs, Dr. Eric Schmidt (512-245-3979 – es17@txstate.edu) and/or Dr. Lisa Lloyd (512-245-8358 – LL12@txstate.edu), or to the OSP Administrator, Ms. Becky Northcut, at 512-245-2102. I have read and understand the explanation given to me. All of my questions have been answered, and I voluntarily agree to participate in this study.

Athlete's Name: _____

Athlete's Signature: _____

Date: _____

APPENDIX C

Demographic Survey

Please fill out and return with attached assent form.

To obtain confidentiality in this study for your protection you will need to choose a 5 digit/letter code and remember it for use on the surveys. It will be your code instead of using your name for identification purposes with the surveys and results you will be submitting to Texas State University.

____ ____ ____ ____ ____ (5-digit/letter code)

Name_____

Circle the most appropriate answer for each category.

Gender: Male Female

Ethnicity: Caucasian African American Hispanic Asian American Other_____

Year of Eligibility: Freshman Sophomore Junior Senior

If you compete in more than 1 event, then choose only one event to record and keep it the same throughout the entirety of the study.

Event_____

University currently attending_____

Best Time/Mark overall_____

Year performed_____ Location_____

Best Time/Mark each competition season ONLY as a collegiate athlete

2008_____ Location_____

2007_____ Location_____

2006_____ Location_____

2005_____ Location_____

APPENDIX D

Competitive State Anxiety Inventory – 2

Directions: A number of statements that athletes have used to describe their feelings before competition are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate ***how you feel right now*** –at this moment. There are no right or wrong answers. Do ***not*** spend too much time on any one statement, but choose the answer which describes your ***immediate thoughts.***

Take within **1 hr** (before/after) of competition	Not At All	Somewhat	Moderately So	Very Much So
1. I am concerned about this competition.	1	2	3	4
2. I feel nervous.	1	2	3	4
3. I feel at ease.	1	2	3	4
4. I have self-doubts.	1	2	3	4
5. I feel jittery.	1	2	3	4
6. I feel comfortable.	1	2	3	4
7. I am concerned that I may not do as well in this competition as I could.	1	2	3	4
8. My body feels tense.	1	2	3	4

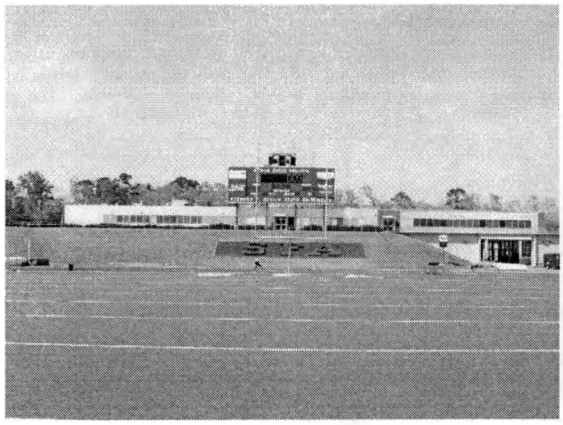
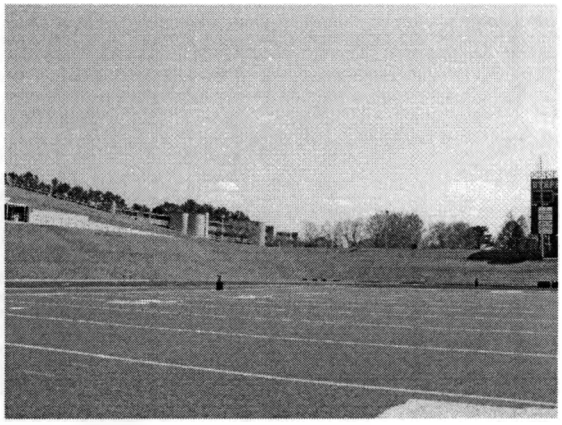
9. I feel self-confident.	1	2	3	4
10. I am concerned about losing.	1	2	3	4
11. I feel tense in my stomach.	1	2	3	4
12. I feel secure.	1	2	3	4
13. I am concerned about choking under pressure.	1	2	3	4
14. My body feels relaxed.	1	2	3	4
15. I'm confident I can meet the challenge.	1	2	3	4
16. I'm concerned about performing poorly.	1	2	3	4
17. My heart is racing.	1	2	3	4
18. I'm confident about performing well.	1	2	3	4
19. I'm concerned about reaching my goal.	1	2	3	4
20. I feel my stomach sinking.	1	2	3	4
21. I feel mentally relaxed.	1	2	3	4
22. I'm concerned that others will be disappointed with my performance.	1	2	3	4
23. My hands are clammy.	1	2	3	4
24. I'm confident because I mentally picture myself reaching my goal.	1	2	3	4
25. I'm concerned I wont be able to concentrate.	1	2	3	4
26. My body feels tight.	1	2	3	4
27. I'm confident of coming through under pressure.	1	2	3	4

Please record your best mark for today's competition: _____

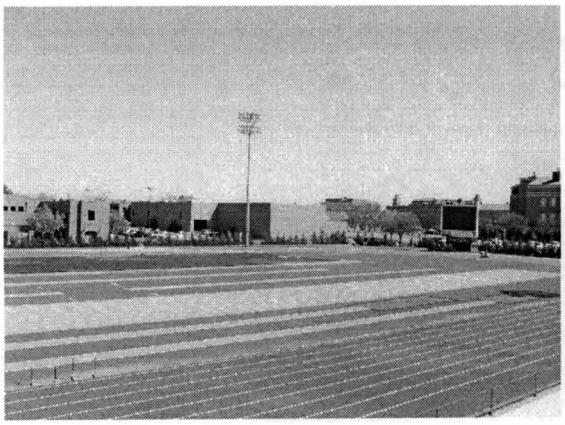
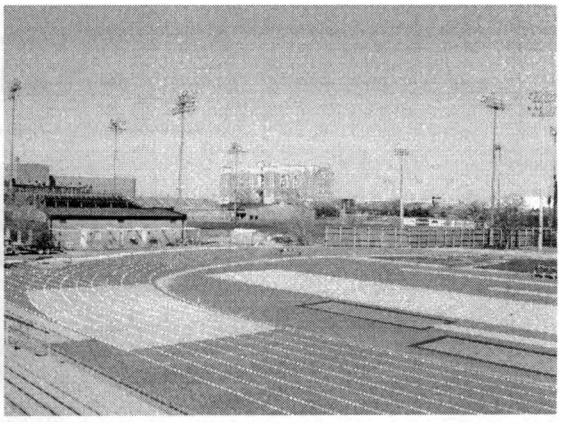
Location: _____ Date:
_____

Personal 5-digit/letter CODE ____ ____ ____ ____ ____ (If you can't remember you can neatly write your name.)

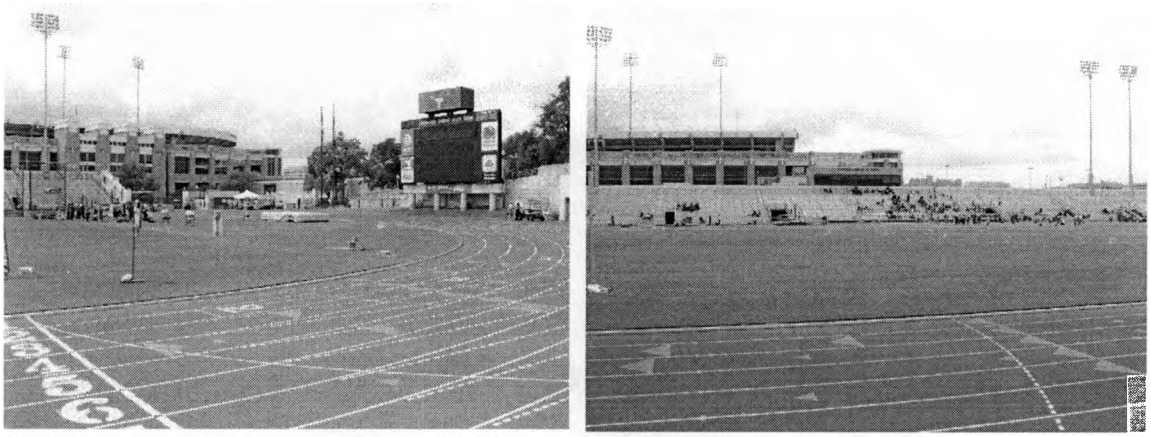
APPENDIX E

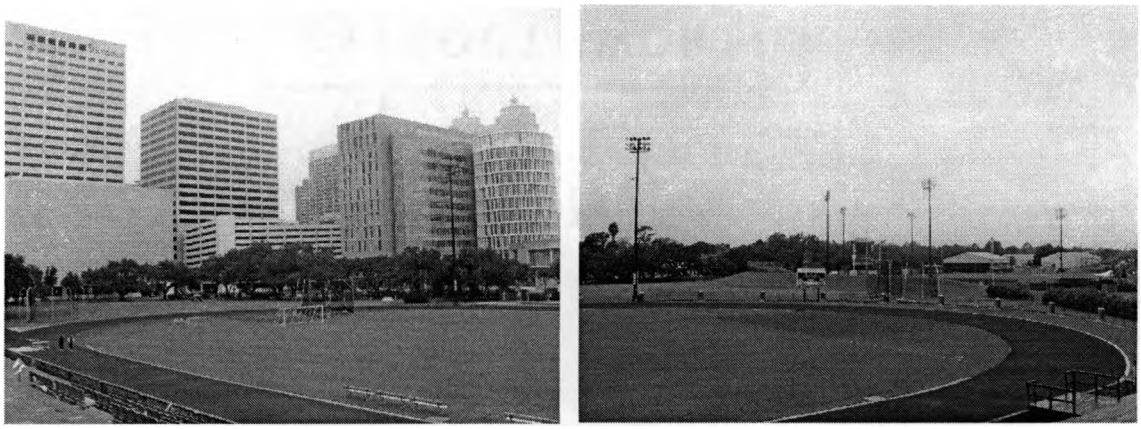
Stephen F. Austin University, Nacogdoches, TX, Greenness Rating: 3.16

Texas Tech University, Lubbock, TX, Greenness Rating: 1.73



University of Texas, Austin, TX, Greenness Rating: 2.08



Rice University, Houston, TX, Greenness Rating: 2.88

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VITA

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