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Addressing the Environmental Challenges of Outdoor Recreational Sport: The Illustrative Case of Disc Golf

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Addressing the Environmental Challenges of Outdoor Recreational Sport: The Illustrative Case of Disc Golf

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Addressing the Environmental Challenges of Outdoor Recreational Sport: The Illustrative Case of Disc Golf

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Environmental issues are manifest throughout our lives. Sport is no exception. The concern for sustainable sport management has precipitated efforts to reduce the ecological footprint of sport, and to use sport to raise environmental awareness. This dissertation examines the challenges of reducing the ecological footprint of an urban recreational sport: disc golf.

The project consists of four studies. The ecological degradation associated with the sport of disc golf is reported in the first study. It is shown that disc golf increases soil compaction, which yields greater soil erosion and a decrease in vegetation cover. The second study examines player behaviors, and identifies two behaviors that are clearly related to the environmental degradation, and that could be reduced without interfering

with the game: (1) dragging bags with disc golf equipment along the ground, and (2) using tress as practice targets. The subculture of disc golfers is explored in the third study in order to identify characteristics of the subculture that could be leveraged to foster the desired behavioral changes. Disc golfers felt a strong sense of ownership and attachment to the park in which they played, and placed a high value on the sport and the park in which they played. However, disc golfers were unaware of the environmental effects of their behaviors. In the final study, a brochure was distributed to players that informed them about the environmental damage caused by dragging bags and using trees for target practice, and that appealed to their sense of ownership and attachment to the park in which they played. A multiple baseline study of disc golfer behaviors in three parks demonstrated that the brochure reduced the target behaviors so significantly that they were virtually extinguished.

It is concluded that behavioral management strategies can be useful tools for environmental management of urban sport settings. It is suggested that appeals to supportive subcultural values enable self-policing of target behaviors. It is also noted that education can be an effective intervention when the values are supportive but player ignorance of their impact has allowed environmentally damaging behaviors to be tolerated.

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Chapter 1: Introduction

> *Most thoughtful people agree that the world is in serious trouble…fossil fuels will not last forever, and many other critical resources are nearing exhaustion; the earth grows steadily less habitable; and all this is exacerbated by a burgeoning population that resists control. The timetable may not be clear, but the threat is real. That many people have begun to find a recital of these dangers tiresome is perhaps an even greater threat.*
>
> Skinner, 1987, p.1

Although some would support Skinner's view and would be alarmed by the possibility of an environmental crisis not far into the future, others would all too easily overlook existing environmental problems. The reality, however, is that environmental problems such as global climate change, air and water pollution, the greenhouse effect, and the clearing of tropical rain forests exist, and those problems are the result of human behavior (Gardner & Stern, 1996; Oskamp, 2000). Environmental problems are conveyed in almost every aspect of our everyday activities, and sport is not an exception (Trendafilova & Chalip, 2007). The building of sport facilities, including the associated infrastructure such as roads and parking lots, requires clearing of sometimes large land areas, while sport events bring large crowds into a confined area and place stress on the environment in a relatively short time. In addition, many sport activities take place outdoors and threaten the environment and pose risks that should not be overlooked.

The urgency of the environmental problems has caused sports organizations to become increasingly involved. The concern for sustainable management of sport

activities has precipitated two types of environmental initiatives: to reduce the ecological footprint of sport, and to use sport as a means to raise environmental awareness (Schmidt, 2006). Recognizing that environmental degradation associated with sport could pose a threat to the industry, the International Olympic Committee (IOC) made the environment the "third pillar" of Olympism in 1995, adding it to the two existing pillars: sport and culture. In support of that initiative, the IOC established the Sport and Environment Commission, drawing a global membership encompassing environmental experts, athletes, sport administrators, and IOC members to address environmental issues. The IOC has also made environmental features an important requirement in a city's bid to host the Olympic Games.

Another significant step in the recognition of sport's relationship to the environment was the adoption of the Nagano Declaration in November 2001, following the Fourth World Conference on Sport and the Environment. More than 350 delegates from 90 countries attended the Conference. In addition to representatives from national governments, the United Nations, and the World Bank, 80 National Olympic Committees (NOCs) were represented, as well as 24 International Federations (IFs) and 6 Organizing Committees for the Olympic Games (Nagano, Sydney, Salt Lake City, Athens, Torino and Beijing). The Nagano Declaration calls upon all participants in sport and all enterprises associated with sport to intensify their efforts to foster environmental sustainability through their policies and practices.

It is evident that sport and the environment are in a relationship that requires careful planning, evaluation, and reevaluation in order to provide for a sustainable future.

Mega events and sport facilities have been the main focus of concern for managers and developers. A particular area of concern that has received little attention is outdoor sport participation. This area needs more attention because of its requirements for land availability, easy access and the increase of number of people seeking to participate in outdoor recreation. With the current movement towards adopting a healthier lifestyle and advocating the benefits of being active, the attraction to participate in outdoor recreational activities will grow in the future, therefore placing an even greater burden on the ecosystem. Considering the exponential rate of population growth around the world and the fact that land for recreational use is a limited natural resource, urgent measures are necessary to avoid environmental tragedy (Jones, 2003). The scope of this study will only include outdoor recreational activities and will not focus on the environmental problems associated with large scale sport events and sport facilities.

In contemporary society, two trends coincide to intensify the environmental risks posed by outdoor recreational sports. First, the world population explosion has increased the size of the potential market for outdoor recreational sport. Second, the percentage of the population seeking outdoor recreational sport has increased substantially in recent decades, a phenomenon fueled in part by the rapid growth in the popularity of "extreme sports" among young people (Griffin, 2002), and in part by sporting goods manufacturers and retailers seeking to develop markets for outdoor recreation equipment (Ryan, 2004). In fact, many outdoor sports are the result of new designs of recreational equipment, such as canopies for paragliding or the introduction of personal watercraft for use in coastal areas (Reynolds & Elson, 1996). Thus the aggregate demand for outdoor recreational

sports has increased dramatically in recent years.

The increased demand for outdoor space and outdoor recreational sports is due not only to an increase in the number of participants, but also to an increase in the frequency with which participants engage in their chosen activity. Table 1.1 shows the change in frequency of participation by Americans between 1994 and 2002 in twelve outdoor activities tracked by the Sporting Goods Manufacturers Association (SGMA, 2003).

Recreation Activity	**1994**	**2002**	**% increase**
Fresh water fishing ^	10,770	13,287	23%
Overnight camping ^	6,521	12,975	99%
Motor/power boating ^	7,624	8,526	12%
Hunting with firearms ^	4,355	7,152	64%
Golf +	4,557	6,043	33%
Hiking *	2,079	4,999	140%
Saltwater fishing ^	2,111	3,844	82%
Wilderness camping ^	1,587	3,247	105%
Mountain biking off road *	1,257	2,556	103%
Snowboarding #	695	2,034	193%
Canoeing #	1,654	1,883	14%
Alpine skiing ^	948	1,152	22%

Table 1.1: Increased Frequent U.S. Participation in Outdoor Recreation (in thousands).

The Sporting Goods Manufacturers Association defines "frequent participation" differently for different activities, as shown:

10 or more days per year
^ 20 or more days per year
* 30 or more days per year
+ 40 or more days per year

As an examination of Table 1.1 shows, the increase in frequency of participation has been substantial in just eight years (over 53% in aggregate). Although this includes activities that are often categorized as "recreational" (e.g., camping, fishing, and hiking), they are included here for two reasons. First, the sporting goods industry classifies these as sports. Second, and more importantly, the environmental risk results from the combined impact of all activities, so excluding activities that might popularly be classified as recreation would underestimate the risk.

This approach is also consistent with government tracking, as the National Survey on Recreation and the Environment (NSRE) includes activities like hiking and bird watching, as well as activities traditionally classified as sport (e.g., skiing and biking). That survey shows that over 97% of Americans participate in outdoor sport activities, with walking, bird watching, and hiking being the fastest growing activities (United States Department of Agriculture, n.d.), and that the trend for higher levels of participation across most activities will continue into the foreseeable future. A disturbing trend is also the fact that most outdoor recreationists are trying a greater number of activities, which has the potential to lead to user conflicts as well as to surpassing the carrying capacity of the ecosystem.

Environmental concerns about outdoor recreational sports are not new. Although the problems have recently become increasingly salient, attention to environmental issues related to outdoor activities dates back to the early part of the 20th century, as represented by the experimental studies of Meinecke (1928) in the United States and Bates in the United Kingdom (1935, 1938). Both scholars demonstrated negative effects of recreation

and nature-based activities on vegetation and soil. More recently, Vankat and Major (1978) showed that the plant species composition in Sequona National Park in the United States has changed as a result of increased use of the park. Similarly, the reindeer density in Finland has been reduced as a consequence of outdoor recreational activities (Helle & Sarkela, 1993). Similar environmental problems have been reported in Australia, where an increase in outdoor recreational sport has caused a decline in vegetation cover, an increase in soil erosion, and stress on water resources (Hall, 1994).

The increasing saliency of environmental problems resulting from outdoor recreational sport has engendered renewed effort to improve management of natural resources that are used by recreationists. Goeft and Alder (2001) examined problems associated with mountain biking in the southwest of Western Australia. They suggested that mountain-bike-specific trails should be established in order to sequester the environmental effects, and that sharing of trails with motorized vehicles should be avoided. Font, Yale, and Tribe (2001) sought to develop sustainable environmental management through implementation of the specific environmental management system (EMS) for forests. The system consists of five steps: policy, site review, program, operations, and audit and review of the program. The EMS illustrates the ongoing effort to systematize environmental management of outdoor recreation environments in order to cope with the increasing stress those environments face.

Although there is now recognition that environmental problems are increasingly associated with outdoor recreational sports, and despite efforts to control and manage those problems, progress to date has been minimal. Planning practices are often

developed retrospectively rather that prospectively, with the result that planning is often overwhelmed by the rapid growth in environmental demand by sport. Furthermore, since many of those sports take place in areas that are unmonitored and the effects of those sports are incremental, substantial environmental damage can occur before it is even recognized that a problem is brewing. Taken together, these conditions make prevention and redress of environmental degradation associated with sport a particularly challenging undertaking.

While concerns about environmental problems associated with sport have been expressed at all levels and in a variety of settings, an area that deserves some special attention is the development and utilization of urban land for sport activities. Urban areas are particularly vulnerable to disturbance and change and present special environmental challenges, due partly to the concentration of people in relatively small areas and partly to their role as centers of industrial production. Urban parks sustain the ecological health of cities and are valuable resources for recreational activities. Between 1950 and 2000, the total population of the world increased almost two-and-a-half fold. At the beginning of that period, only 30% of the world's population was urban; five decades later, the number of urban residents had nearly quadrupled, representing 47% of the total (Jones, 2003) and the alarming prognosis is that by the year 2030 the world will become predominantly urban, with 60% of people living in cities (Vlek & Steg, 2007).

Cities are a direct threat to the environment through habitat conversion and an indirect threat through the effects human populations typically have on the environment: habitat fragmentation, resource depletion, waste generation, and freshwater consumption

(Ricketts & Imhoft, 2003). Habitat loss and fragmentation are important factors contributing to a reduction in the planet's biodiversity (Rolstad, 1991) and consequently a central component of sustainability. Environmental degradation has typically resulted not only in a decrease in biodiversity but also in a reduction in the quality of natural services various ecosystems provide (Conroy, Allen, Peterson, Pritchard, & Moore, 2003).

The concomitant increase in demand for sport in urban settings has exacerbated the challenge associated with ecological degradation (Bynam, 2003, 2004). Thus the identification and assessment of environmental impacts as a result of modern urbanization have become a top priority among conservationists and managers. Managers of urban outdoor recreational activities are well aware of the challenges facing their field today. Those challenges arise because of efforts to offer a broad spectrum of activities to satisfy individual and group needs and at the same time to preserve nature for future generations to enjoy. When the range of obligations is so broad, the escalation of conflicts is inevitable. The manner in which those conflicts are resolved is what determines the short- and the long-term impacts of the decisions.

A factor that needs to be considered when evaluating the variables affecting increased outdoor participation is the nationwide effort to overcome obesity (Centers for Disease Control and Prevention, n.d.). Government goals are aimed at lifestyle changes and the particular goal of Healthy People 2010 is to significantly reduce the proportion of adults and children who are obese (Kumanyika, 2001). Towns and cities are encouraged to provide more opportunities for walking, cycling and involvement in other outdoor

activities (Kumanyika, 2001). Therefore, recent trends such as the nationwide move to overcome obesity, the increased interest in outdoor recreational activities and the tremendous increase in urban population require attention and urgent actions based on new managerial approaches.

The question then is how do we continue to provide opportunities for outdoor recreational activities in a sustainable manner? The conventional approach has been to use managerial strategies aimed at restoration and/or preservation of outdoor areas utilized for recreational purpose (Cole, 1981, 1990) or to enforce rules and regulations to control usage (Sun & Walsh, 1998; Uphoff & Langholz, 1998). Although sometimes necessary, this approach is not sufficient to achieve long-term effects. The problem is that restoration and preservation practices are often applied too late when the carrying capacity of the ecosystem has been surpassed (Bryan & Taylor, 1987). Also, enforcing rules and regulations is too expensive and complicated to be efficiently implemented at all levels (Udehn, 1993). This project, however, will tackle the problem from a different perspective by employing a behavioral approach and by attempting to modify the undesirable behaviors seen among outdoor participants.

In order to achieve this goal, this study is designed and organized in the following manner. The second chapter contains the review of literature and focuses on the theoretical and empirical work related to the problem with the purpose of establishing the framework for this study. Chapters three, four, five and six each consist of separate studies. Chapter three evaluates the ecological impacts associated with disc golf, an outdoor sport chosen as an illustrative example of some of the environmental challenges

sport faces. In chapter four, undesired behaviors that are logically related to the ecological degradation due to the sport of disc golf are identified. Chapter five describes the story of the subculture of disc golfers and identifies the contingencies upon which intervention measures should be designed to modify problematic behaviors. In chapter six, a behavioral modification intervention is designed and tested. The last chapter offers an integrative discussion of the results from all four studies and their implications for future research, theory and practice.

Chapter 2: Review of Literature

When discussing environmental issues associated with outdoor recreational sports it is logical to start with the origins of the problem and its underlying causes. Understanding the factors leading to the ecological degradation can assist in the search for solutions. Without a comprehensive knowledge of the principals elucidating the existing conflict, the efforts to overcome the challenges will most likely be destined to fail. The following review of literature is organized into two parts. The first part presents the sources of the conflict between the surrounding environment and outdoor recreational sports. The second part contains a review of the directions in which means for solutions should be sought. The integration of both parts sets the framework for this study and the rationale behind the emerging research questions.

SOURCES OF THE PROBLEM

Hardin's Tragedy of the Commons

Understanding Hardin's (1968) classical work on the tragedy of the commons is essential for comprehending the roots of the environmental problems associated with outdoor recreation. In order to review his notion of the tragedy of the commons and its relevance to sport, it is appropriate to begin with a definition of tragedy used by Hardin. Whitehead, a British mathematician and philosopher stated, "The essence of dramatic

tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things" (Whitehead, 1948, p.17). Another definition pertinent to the following discussion is that of commons. Commons is any resource used as it belongs to all and therefore shared by all. In other words, when anyone can use a shared resource simply because one wants or needs to use it, then one is using a commons. For example, land, water, air, fisheries, wood, national parks, highways, parking and many other resources are a part of the commons, because they are a component of our life support and social systems and are available to everyone without any restrictions. The conditions for a tragedy to occur are especially favorable when resources decline, carrying capacity is exceeded and/or population grows too large, which in many cases is due to uncontrolled use and lack of appropriate managerial practices.

Before going further into the discussion of Hardin's work, it is necessary to distinguish between a public good and a common pool resource to avoid any confusion. While the use of a public good by everyone (e.g., the weather forecasting, the solar energy) does not diminish the availability of that good, the consumption of the common pool resource by some depletes the resource for usage by others, or in other words the resource is subtractable (Ostrom, 1990, 2003).

Borrowing Whitehead's tragedy definition and considering a common pool resource, Hardin (1968) presented an illustrative example in which a tragedy of the commons develops:

> The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for

> centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy. (p. 1244)

When each herdsman, acting in a rational manner, starts adding another cow to his herd in order to increase personal profit, the inevitable outcome would be overgrazing and eventual ruin of the commons.

As Hardin argued, when common-pool resources are exploited collectively and without formal restriction, usage will escalate until those resources are depleted to the point of ruin. Although Hardin was particularly concerned to project the ultimate effects of population growth, he also noted that national parks and public lands are at risk of ruin because they are collectively used. The problem is that each individual's use adds to the impact of others' use with the individual impact being imperceptible in-and-of itself. Further, the benefits to each individual user outweigh (to them) the costs they individually incur.

Attempts to solve the commons problem have been made and a solution to avert the collapse of the commons was the introduction of private ownership of land (Harding, 1997). However, commons other than land cannot be divided up so easily. In reality assigning property rights to air, for example, is not that easy and without a doubt the logic of the commons still prevails today. The case of fishing rights in coastal areas is just one expression of it.

Hardin does not envision any technical solutions to the set of problems classified

as the commons problems. He rather shifts the focus for solution towards the political and social realm, making these three assumptions:

(1) that there exists, or can be developed, a criterion of judgment and system of weighting that will render the incommensurables commensurable in real life;

(2) that possessing this criterion of judgment, coercion can be mutually agreed upon, and that the application of coercion to effect a solution to problems will be effective in modern society; and

(3) that the administrative system, supported by the criterion of judgment and access to coercion, can and will protect the commons from further desecration. (p.55)

Hardin also argued that the best (and possibly only) means to prevent a tragedy of the commons is to employ coercive means (e.g., regulatory supervision with sanctions). However, recent economic work has endeavored to locate bases for cooperative and sustainable use of common resources (Burger & Gochfeld, 1998).

Hardin's tragedy of the commons applies to and has been analyzed not only in the realm of natural resources but also in other aspects of our lives such as the savings and loan crisis that was due to the federal government creation of the Federal Savings and Insurance Corporation (Hardin, 2002) and in the attempt to understand the social costs of narcissism (Campbell et al., 2005). Although the notion of the tragedy of the commons has been widely discussed, its relevance to sport has not been adequately examined. Hardin's (1968) exposition of the commons problem provides a particularly useful framework for understanding the root problems associated with the increasing demand for outdoor recreational sport. For the management of outdoor recreational sport, this

mandates that a workable foundation for cooperation among users be located. Studies support Hardin's description of the problem (e.g., Campbell, Bush, Brunell, & Shelton, 2005; Ehrlich & Holdren, 1971; Hardin, 1985), and it is now generally agreed that proactive management of resources is required if the environment is to be used in a sustainable fashion (Goeft & Alder, 2001; Landsberg et al., 2001; Mason & Leberman, 2000; Reynolds & Elson, 1996; Sun & Walsh, 1998).

Hardin (1968, 1985) stressed the importance of an interdisciplinary approach in the search for solutions to the commons problem, emphasizing the need to integrate social and political theory with biological data. Although there has been increasing emphasis on technological advances to address the problem, there are many instances where technical remedies are not sufficient. There are three reasons why technical solutions are not feasible in the case of outdoor recreational sport. First, land is finite and cannot be increased. Second, there is a limit to the speed with which an ecosystem can recover and regenerate. Third, the ecosystem cannot be replaced. Thus, the effort to find solutions must draw from advances in the social sciences. Indeed, the need for a solution that draws upon social knowledge is evidenced by the fact that the tragedy of the commons has its roots in social behavior.

Theory of Collective Action

Collective action is a classic problem in social science. Mancur Olson's (1965) book *The Logic of Collective Action* triggered an avalanche of theoretical and empirical work that continues to this day. Olson addressed a class of social dilemmas classified as "collective action problems". Collective action problems occur when a group of

individuals have common interests but not all individuals in that group would act together and would share the cost of goods that will benefit everyone. Some will attempt to benefit from the public good without contributing to its provision. Due to the nature of the public good, non contributors cannot be excluded, therefore setting conditions favorable for free-riding. In fact Olson argues that rational individuals would rather free-ride (especially in large groups) than invest resources in collective action, unless there is some kind of coercion or selective incentives (e.g. social status, prestige and social pressure). In other words, each group member would seek to receive the benefits of other's contribution while avoiding the cost of participation. Usually the process of collective action involves identifying a group of individuals who share a common concern and then communicating the concern to each member of that group. Coordination of individual contributions and accountability is necessary for collective action to succeed.

Essentially, the tragedy of the commons is a result of failed collective action. Unilateral individual actions, although necessary, would not be sufficient to overturn the tragedy of the commons. It would seem, therefore, that one approach to redress the problem would be to nurture effective collective action to solve the problem (Lubell, 2002). Specifically, those with a stake in protecting outdoor recreational sport environments would have to come together to formulate and implement solutions. Those solutions would include means to monitor and enforce environmentally friendly behaviors. However, as Olson's (1965) analysis shows, collective action in a case like this is unlikely to emerge, and is unlikely to be sustainable if it does emerge. The pivotal

problem is that the costs of collective action are borne by those who join in the action, but the benefits accrue even to those who do not. Therefore, the logical choice is not to participate (i.e., not incur the costs), but to enjoy the benefits of any collective action (undertaken by others) that is successful – hence the proclivity for free-riding. Unfortunately, this logic applies to every possible participant, with the result that most collective action groups will either not form or not endure, particularly as the size of the requisite group grows.

The pivotal result of collective action failures is that socially desirable outcomes are not attained. In the case of environmental problems, it is nonetheless essential that societies find means to balance aggregate social interests with those of individuals (Espejo & Stewart, 1998). It has, therefore, been of interest to determine if the requisite means to foster collective action could be found (Lubell, 2002). The challenge is to find a social mechanism through which to unite enough people who are socially connected and who share appropriate interests and resources. That task requires communication of shared objectives while overcoming the incentive to free-ride (Sally, 1995) – a task that is best accomplished when communication is face-to-face (Cardenas, 2000). However, the dispersed (and often individual) nature of outdoor recreation sport is an impediment to the ongoing communication required for collective action.

Collective action can withstand free-riding if there is a sufficient number of individuals who can be incentivized to cooperate strategically (Heckathorn, 1996). The decisive factor is the availability of information to each member about the actions of other group members. This information is itself costly, particularly when combined with

incentives for cooperation, particularly as the size of the group grows. The lower-bound on group size is the minimum number of persons required for effective collective action. In the case of outdoor recreational sports, this mandates sizable groups, however, each free-rider becomes a potential source of environmental damage, and the damage becomes more severe as the number of free-riders increases. Indeed, given the continuous increase in the number of participants in outdoor recreational sports, the conditions for free-riding are amplified, and it becomes increasingly attractive to become a free-rider. Small face-to-face groups are unlikely to intervene successfully, and large groups are costly to maintain. Although some advocacy groups, like the Sierra Club, have managed to sustain themselves, a higher degree of collective action is required to fully address the problem. The conditions necessary for achieving that higher level of collective action require behavioral modifications based on a new set of values and norms. Collective action based on values and norms is more likely to sustain than one based on selective incentives and/or regulatory practices.

Voluntary collective action to address the environmental challenges of outdoor recreational sport faces some constraints based on the social conditions of collective action which encourage free-riding, thereby reducing the likelihood that groups will form, maintain themselves, or be effective. The standard remedy has been to seek a solution based on regulation of natural resource use through legal sanctions (Uphoff & Langholz, 1998) or through the designation of some areas as protected (Carrus, Bonaiuto, & Bonnes, 2005). The purpose of these strategies has been to compensate for the rational nature of outdoor participants which in many cases is the cause for the ecological

degradation.

Rational Choice Theory

Rational choice theory attempts to explain social phenomena based on individualism, rationality, consequentialism, egoism and maximization (Hardin, 2002). Its main focus is the individual decision-making process, when the individual has a number of alternative options to choose from. According to the theory, an individual will choose the option with the maximum benefits to himself under the existing constraints. The tragedy of the commons and the collective action problem derive from rational choice theory. In essence the tragedy of the commons is a result of failed collective action, which could be partially explained by the fact that human beings are rational creatures by nature and rationality plays a large part in the individual decision-making process. Looking 174 years back in history, William Lloyd, a political economist at Oxford University, tried to present a rational explanation for the commons problem by stating that human actions are guided by self-interest (Hardin, 2002). Even when individuals understand the long-term consequences of their actions, they generally are powerless to prevent such damage without some coercive means of controlling the actions of each individual.

There are three challenges that rational choice theory faces: collective action, social norms, and social structures (Hardin, 2002). Collective action occurs when the individual acts in a way not to maximize the individual profit, but rather to achieve an outcome that is optimally beneficial to the group. If this is the case, then rational choice theory could only explain collective action if it includes social norms and structures as

the factors influencing collective action. The next question then is why do social norms exist? What is it that makes individuals follow norms? Social norms as well as the fact that people change their values and beliefs cannot be explained by rational choice theory. Rational choice theory can only explain why people might institute a norm and then enforce it. In other words, it can only explain what people do but not why they do it. According to rational choice theory, social structures are simply chains of interconnected individual actions. These actions are more or less determined by a system of control. For example, the existence of enforcement forces plays the role of one such structure, the objective of which is to limit social actions to a certain degree.

The fact that some people would decide that to reach their goal they are better off cooperating with others does not simply support the view of rational choice advocates. If individuals are rational and always choose to join a group only when the benefits of participation outweigh the cost, then how would one explain membership in organizations where the benefits do not outweigh the cost? The fact that people do join organizations and groups means that there is something more than pure rationality in their decision to join. Instead of considering other variables that could affect an individual's decision (e.g., reputation, social norms), rational choice theory adopts a methodological individualist position and attempts to explain all social phenomena in terms of the rational calculations made by self-interested individuals who always opt for the alternative with the highest expected self net benefit.

People are motivated by the rewards and costs of actions and by the profits that they can make (Hardin, 2002). In many cases, however, rational decisions prevail even

when those profits are not extrinsic or materialistic in nature. Individuals would weight the rewards and costs of their actions and make a decision which would in some instances lead to a benefit of intrinsic value. Exploring the factors impacting this type of rational decision could contribute to the design of intervention programs for behavioral modifications among outdoor sport participants. Although this kind of investigation may take some time, the long-term benefits far outweigh the expenses associated with the current means of regulatory focused management.

MEANS TO SOLVE THE PROBLEM

Voluntary Cooperation

By incorporating the socio-cultural domain in the search for solutions to the environmental problems associated with outdoor recreational sports, we can pursue effective tools for managing those environments – tools that do not incur the high costs associated with enforcement of rules and regulations. Indeed, research shows that common-pool resources are least likely to become overexploited and degraded if they are managed through social norms and conventions (Berkes, 1989; Bromley & Feeny, 1992; Jodha, 1992). For example, the decline in litter over the past four decades in the United States has been attributed to the creation and expansion of a social norm that proscribes littering (Haab & McConnell, 2002).

The core challenges for achieving the requisite behaviors among outdoor recreational sport participants are: (1) ensuring that those using a common-pool resource

share a similar and relatively accurate view of the problem they need to solve, (2) devising simple norms with which most can comply, (3) monitoring activities sufficiently so that those who break agreements are detected and sanctioned by members of their group, and (4) ensuring that trust and reciprocity are supported rather than undermined (Trendafilova & Chalip, 2007). Therefore, appropriate social norms grounded on trust, reciprocity, and the requisite social values must be created.

How? Collective action normally entails the development of a critical mass – a small segment of the population that chooses to contribute significant time and resources even though the majority does little or nothing (Oliver, Marwell, & Teixeira, 1985). Usually this group consists of individuals who voluntarily decide to participate and contribute, and who have considerable knowledge about the resource. The value of return expected from some specified level of contribution is not necessarily what triggers the development of the critical mass. In other words, the immediate return does not always have to be bigger than the input of the critical mass, and therefore in most cases the critical mass individuals are rather resourceful and financially stable. The power of the critical mass is in its ability to pay the start-up costs and induce widespread collective action. When a social solution to the collective dilemma is required, what matters most is the relationship among the possible contributors to the critical mass, not the relationship among everyone in the interest group (Oliver & Marwell, 1988).

It was argued that collective action is not likely to be an effective means to govern or regulate outdoor recreational sport environments, because free-riding would make such governance or regulation ineffective. However, the argument here is that a smaller

and, therefore, more feasible action group could be effective if the ultimate objective is to change the culture – the norms and values – of outdoor recreationists. Rather than apply collective action directly to management or lobbying to protect outdoor recreational sport environments, it would be more effective to use collective action more strategically to shift participants' values and norms. Although change of that kind is likely to take some time, as did creation of a norm proscribing littering, this strategy offers a long-term solution to complement short-term legislative and regulatory stop gaps. The encouraging news is that the presence of definable subcultures among sport participants establishes the necessary basis for undertaking the necessary interventions.

Sport Subcultures

The study of sport subcultures, socialization into these subcultures, and the practical importance of such inquiry have received considerable attention in the sociology of sport literature (Donnelly, 1981; Donnelly & Young, 1988; Wheaton, 2007). Subcultures are segments of the main culture that have their own specific cultural elements, but still share some common characteristics with the mainstream culture. Loy, McPherson, and Kenyon (1978) identify three types of sport subcultures: occupational (e.g., coaches, trainers, etc.), avocational (e.g., joggers, little leaguers, etc.) and deviant (e.g., gambling, hooliganism, etc.). While in the occupational subcultures the work role dominates, departure from the social norms characterizes the deviant subculture, and the focus of the avocational subculture is leisure activities.

Subcultures are formed in sport because participants come to identify themselves with the values, beliefs, symbols, and norms of their sport (Amato, Peters, & Shao, 2005;

Donnelly, 1981; Donnelly & Young, 1988; Green & Chalip, 1998). Shared values, beliefs, symbols, and norms cultivate shared experiences, social interaction, and mutual affirmation and support among participants and aficionados. Thus, each sport's subculture becomes a potential lever for shaping behaviors among those who identify with the sport. Just as each sport's subculture can be leveraged to market products and services to participants and fans (Green, 2001), social marketing techniques targeted at particular sport subcultures (cf. Andreasen, 2006) and interventions designed to modify the subculture (cf. Poole & Van de Ven, 2004) can be used to create the desired norms and values.

Exploiting sport subcultures for the purpose of modifying human behavior and achieving environmental sustainability provides for a novel approach to the study of subcultures. In the past sport subcultures have been studied with the marketing purpose of leveraging sport events (Green, 2001), learning more in depth about spectators' and consumers' characteristics (Wheaton, 2007) or with the purpose of understanding deviant behavior in the sport context (Sugden, 2007). Investigating sport subcultures with the aim of managing environmental problems associated with sport has the potential not only for achieving a less costly solution to the problems (when compared to traditional managerial practices) but also for achieving a long-lasting behavioral modification, based on shared values and beliefs.

Sport participants and spectators are socialized (to a greater or lesser degree) into the values, norms, and beliefs associated with their sport (Green, 2001). These values, norms, and beliefs extend beyond the sport activity as they encompass matters linked to

lifestyle, personal identity, and group membership. This renders the potential for sport subcultures to influence participant behaviors and enable collective action. Shared beliefs and values cultivate a common identity, which nurtures group effort (Brewer & Kramer, 1986; Kollock, 1998; Kramer & Brewer, 1984). The challenge then is to formulate interventions that can socialize participants (and, where appropriate, spectators) into the desired beliefs and values, and to use those beliefs and values to prompt environmentally friendly behavioral norms. The social technologies for so doing are increasingly well understood (Andreasen, 2006; Poole & Van de Ven, 2004), but the application and elaboration of those technologies for change of sport subcultures remains to be explored.

Since each sport shares a unique subculture, each sport should be targeted separately. Since subcultures reside amidst local and national cultures, the necessary interventions are likely to vary in different local and regional contexts, even for the same sport (cf. Atran & Medin, 2005; Dietz, Fitzgerald, & Shwom, 2005; Zube, 1991). Thus, although environmental management of outdoor recreational sport is a global concern, the strategies and tactics employed to foster and nurture the desired changes will vary by sport, and will be tailored to fit with local and regional customs. Tactics are likely to include (but are probably not limited to) provision of feedback about environmental consequences of their sport, demonstrations of impact, and enhancement of social relations among participants.

When the target group is relatively small and shares common norms and values, it may be unnecessary to create formal sanctions, regulations, and other enforcement rules

(Ostrom, 1999). This has the advantage that it enables efficient management of resources without high monitoring expenditures, while at the same time developing a sense of empowerment and ownership. Local users who are members of a target subculture are capable of changing their own rules, enforcing the rules upon which they agree, and learning from experience to design better rules (Ostrom, 2003). Change will be incremental, beginning with one or two values and beliefs, and building further as associated behaviors become the norm. By changing only a few rules at the beginning, everyone can come to understand those rules while evaluating how they work. The process requires dedication and patience, but it has promise as a long-term solution (Geller et al., 1982).

Behavioral Approach to Social Change

Considering the fact that most environmental problems, including these associated with sport are due to human activities and require human behavior modifications, we should look for solutions within the realm of social sciences and in particular at behavioral approaches utilized for social change. Traditional behavioral approaches focus on the antecedents-behavior-consequences model of behavior change (Lehman & Geller, 2004). Factors such as the situation, the organism, the behavior itself and the consequences are usually analyzed (Luthans & Kreitner, 1985). In fact, as Lehman and Geller (2004) point out "Behaviors are directed by the antecedent stimuli that preceded them and announce the availability of a positive or negative consequences". Antecedent strategies for behavioral change such as promoting awareness and using prompts (Geller, 1989; Daamen, Staats, Wilke, & Engelen, 2001; Staats, Van Leeuwen, & Wit, 2000;

Werner, Rhodes, & Partain, 1998) and consequence strategies such as rewards and feedback (Dwyer et al., 1993; Geller, Winett, & Everett, 1982; Shultz, 1998; Raj, Nelson & Rao, 2006) have been successfully used in different settings.

Most of the work on environmental protection has focused on behavior changes such as recycling, littering, carpooling, and transportation use (Bamberg, 2002; Cone & Hayes, 1980; Geller, Winett, & Everett, 1982). The main focus has been on: (1) identifying the problem behavior, (2) measuring the behavior frequency, (3) analyzing the situation, (4) designing an intervention program, and (5) evaluating the program. Most behavioral approaches are grounded in the main premise of Skinner's theory (1953), which focuses on observing a particular behavior and relating that behavior to the conditions that elicited it. Skinner's entire behavioral philosophy revolves around the belief that behavioral modifications could be achieved through the management of consequences. The nature of the consequences affects the individual's tendency to repeat or not the behavior in the future.

Adding a cultural twist within the behavioral approaches to social change could provide for achieving valuable information about the cultural practices guiding the behaviors of individuals and organizations (Schein, 2004). Evaluating the socialization process to which one is subjected could reveal deep assumptions about the culture. Observing behavior patterns within the culture can help discover artifacts that reflect the culture, thus enhancing the cultural knowledge. Artifacts include things that one sees, hears and feels when one encounters a new group with an unfamiliar culture (e.g., language, technology, myths, stories, rituals, ceremonies). Observing and analyzing

artifacts assists in the process of making inferences about the group culture. Incorporating cultural elements in behavior change approaches has proved to be successful (Malott & Glenn, 2006).

Behavior change approaches, incorporating the cultural knowledge, are closely tied to social marketing, which employs traditional marketing principles to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals or groups (Kotler, Roberto, & Lee, 2002). The intent is to achieve a positive social impact. In order for social marketing to be successfully implemented, the target audience needs to perceive greater benefits in the promoted behavior than in the current behavior. Therefore, the aim of any social marketing campaign is to increase the perceived benefits of the target behavior, to decrease the barriers for achieving the target behavior, and to decrease the benefits of the competing behaviors.

The framework of social marketing is based on Prochaska and DiClemente's (1982) model of social change. According to the model, behavior change occurs in a series of stages:

1. Pre-contemplation – usually there is no intention to change.
2. Contemplation – there is some level of awareness about the problem.
3. Preparation – a decision has been made to take some actions.
4. Action – the new behavior has been performed, but old habits are still in place and could lead to a relapse.
5. Maintenance – the newly adopted behavior becomes automatic and the benefits of change are realized.

Although in most cases the transition from one stage to the next follows consecutively the steps one through five, there are instances when individuals may return to a "lower" stage or even skip a stage. Behavior changes based on Prochaska and DiClemente's model have been widely used in child welfare, health psychology, and organizational change (cf. DePanfilis, 2000; Gelles, 2000; Prochaska, 2000).

An interesting case of social marketing is McKenzie-Mohr's (2000) community based social marketing approach. The premises of this approach are based on the belief that behavior changes are more likely to result from community based initiatives. The challenge is not only to identify the target behavior one wishes to change but also to identify the barriers to achieving the desired change. The primary advantage of social marketing is that it starts with people's behavior and works backward to select a particular tactic suited for that behavior (McKenzie-Mohr & Smith, 1999) along with the fact that it is based on voluntary actions. Social marketing strategies have proven to be successful (e.g., in smoking and exercise campaigns, pollution prevention, transportation), and deserve some consideration when behavior change is the goal of the intervention (Fernholz, Howe, Bowyer, & Wenban-Smith, 2006).

The social changes achieved through behavioral approaches are focused on planned intervention development, which encompasses problem identification, program development itself and program evaluation (Twain, 1983). Program development should be focused on the transmission of information relevant to the problem and the means through which solutions could be found. Although, relevant information is necessary, it is not sufficient to power useful intervention development. Other factors such as values,

norms, beliefs and timing play an important role. In fact, when creating social planned changes, a key factor is the existence of a change agent, which could be an individual or a small group organized to produce the change. The change agent plays the role of the critical mass discussed earlier in relation to the collective action problem associated with common pool resources and their management.

Social change based on behavior approaches is the logical direction in which we should be looking in order to achieve environmental sustainability (Geller et al., 1982). Although most approaches focus on the consequences of human behavior as the tool for accomplishing the desired behaviors, careful examination of the context in which the behaviors occur should be performed. Targeting behavioral consequences would lead to planning practices that are developed retrospectively (one of the major problems with current environmental management) rather than prospectively. In addition to that, relying on consequences strategies for behavioral change takes us back to the collective action problem where selective incentives could trigger collective action, but they are rather expensive to be realized in an efficient manner.

Incorporating social marketing into the mix with the behavioral, cultural, and social approaches could increase the success rate of the intervention measures for behavior modifications among outdoor recreationists as well as sustain the desired behavior after intervention measures are removed. One of the main focuses of the intervention effort should be public awareness and stewardship (Geller et al., 1982). There may be individuals who need to have some knowledge (information or facts) and beliefs (values, attitudes, etc.) before they are convinced that the action to change the

behavior is worth the effort. To create awareness of the problem, channels such as signage, prompts, publicity and social events could be utilized. Providing information about the risks of the current behavior and how to perform the desired behavior could enhance the knowledge of the target group, therefore increasing the likelihood of achieving the originally set goals and objectives. Another key element for the success of the intervention program is the individual's belief that the adoption of the new behavior can really make a difference (McKenzie-Mohr & Smith, 1999).

In order for behavior change strategies to be effective, it is not only necessary to predict the occurrence of the behavior and to identify the behaviors that are most relevant to the problem. It is also necessary to determine the barriers to achieving the desired behaviors as well as to acquire knowledge about the values of the individual and/or the organization (Geller et al., 1982). Every problem has a history and is influenced by the norms and values of the group. Therefore, it is essential to understand the culture of the group and its historical roots. Understanding the group culture assists in the process of specifying the factors that are assumed to be associated with the social problem, and also to identify the means of testing these assumptions.

Careful analysis of the situation and the group culture is necessary in order to identify the specific problem and the specific behaviors that cause it. Cultural observations and analysis would not only help in the diagnosis of the problem but would also help in discovering the desires of the affected population. Getting to know the audience and what their values relative to the desired behavior are would enable one to establish realistic goals and objectives (McKenzie-Mohr & Smith, 1999). Since

environmental problems are caused by human behaviors the logical solution should be to seek human behavior changes, which in turn require change in cultural practices. Behavior change approaches look at the behaviors and norms of individuals and organizations, thus creating the need to explore behaviors in the environmental context (Staub & Green, 1992).

Environmental Values and Behavior

The review of literature on environmental values and behavior discusses these two concepts linked together. Values shape much of the individual's intrinsic motivation (Lo, 2006). Cultural values represent the society's guiding principles and have the potential to not only motivate people to act pro-environmentally, but to sustain those behaviors as well (Dutcher, Finley, Luloff, & Johnson, 2007). Studies have shown that values play an important role in behavioral changes, although same values do not influence all types of behavior and definitely not in the same way (Cvetkovich & Earle, 1994; Seligman, Syme, & Gilchrist, 1994; Van Liere & Dunlap, 1978). Karp (1996) for example, demonstrated that values were significantly correlated to some behaviors, such as recycling and political behaviors. Similarly Stern and Dietz (1994) argued that values are related to individuals' willingness to act pro-environmentally. While, most studies have been focused on personal values and their effect on pro-environmental behavior, Oreg and Gerro-Katz (2006) have considered the effect of group and cultural values on environmental behavior. Their model is based on data from 27 countries and proposes that environmental behaviors are driven by cultural values.

Values have been considered as one of the main factors influencing human behavior (Van Liere & Dunlap, 1978). Many attempts have been made to develop a unified model of environmental behavior and to single out other factors influencing environmental behavior (e.g., Oreg & Gerro-Katz, 2006; Schwartz, 1977; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Vlek, 2000). The development of a variety of analytical frameworks such as sociological models, altruism, social marketing models and economic models indicate that the question of what shapes environmental behavior is rather complex in nature and the fate of the unified model still belongs to the future. Nevertheless, there is general agreement among scholars that the work on environmental behavior could be split into two branches – one with a focus on sociodemographic variables (e.g., age, education, gender) and the other with a focus on socio-psychological constructs (e.g., values, beliefs). The variables in the first branch are more or less predetermined and not easily manipulated. It is believed that the variables contained in the second branch are more successful in predicting pro-environmental behaviors (Boldero, 1995; Guagnano, Stern, & Dietz, 1995; Taylor & Todd, 1995). Therefore, intervention measures should incorporate the manipulation of behavioral variables based on the knowledge about human values and beliefs.

The literature on outdoor recreational participation and pro-environmental behavior supports the expectation that exposure to environmental issues through outdoor recreation in general enhances environmental awareness and develops proactive behaviors (Tarrant & Green, 1999; Teisl & O'Brien, 2003). Therefore, participation in outdoor recreation can have a significant positive association with environmental

behavior (Dunlap & Heffernan, 1975) despite the fact that the behavior is affected by the specific type of the outdoor activity. For instance, appreciative activities such as wildlife watching, camping and hiking are associated with higher levels of environmental behavior when compared with activities considered abusive (e.g., snowmobiling and mountain biking). Cottrell (2003) examined variables leading to responsible environmental behavior among recreational boaters in the Maryland area and showed that there is a relationship between professed knowledge and pro-environmental behavior. Thapa, Graefe, and Meyer (2006) identified a positive association between the level of specialization in SCUBA diving and environmentally responsible behaviors among divers in the southwest part of Florida.

However, as Hines, Hungerford, and Tomera (1987) pointed out, predicting responsible behavior is not a simple task and variables involved in this prediction are most likely correlated. In fact Geisler, Martinson, and Wilkening (1977) as well as Pinhey and Grimes (1979) concluded that individual characteristics of the recreationists are more important than levels and types of recreational activity in influencing environmental behavior. To make matters more complicated, Corraliza and Berenguer (2000) argued that environmental behavior depends on the interaction between situational and personal variables. This complexity of variables suggests that outdoor recreational activities should be analyzed individually (at the activity level as well as at the personal and situational levels) to determine their effect on environmental behavior.

Why is there inconsistency in the value-behavior relationship? One of the problems is that only a few studies have examined actual behavior, most examine self-

reported behavior or behavioral intentions. Another problem is that some studies have examined single-act environmental behaviors whereas others have examined repetitive environmental behaviors and this could lead to some unjustified generalizations. Despite this inconsistency, there is general agreement among scholars that values shape individual behavior and ultimately group behavior with respect to the environment (Dietz et al. 2005). Although exploring the relationship between environmental values and behavior is important in the search for behavior based solutions to environmental problems, environmental knowledge is a variable that plays a major role in this relationship and deserves attention.

Environmental Knowledge

Research focused on the correlation between environmental knowledge and pro-environmental behavior shows a definite link between these two variables, although the strength of the relationship varies across studies. While some scholars would agree that only a small part of pro-environmental behavior can be linked to knowledge, others claim the opposite (Cottrell, 1993; Fishbein & Ajzen, 1974; Kaiser, Woelfing, & Fuhrer, 1999; Ostman & Parker, 1987). This discrepancy could be due to the measurement of particular behaviors, which in turn skews attempts to generalize. Also as Hines, Hungerford, and Tomera (1987) pointed out, based on their meta-analysis of 128 studies, knowledge could be split into two categories – knowledge of the existence of the problem and knowledge of behavioral strategies and their effectiveness in modifying the behavior.

In a study exploring the role of social psychological and social structural variables in environmental activism from the forest sector, McFarlane and Boxall (2003) suggested

that knowledge can positively influence behavior. This was also supported by McFarlane and Hunt's work (2006) on forest management where results showed that increased factual knowledge was associated with increased environmental activism. Similar results were found in a study conducted in Norway (Olli, Grendstad, & Wollebaek, 2001) where organized environmentalists and the general population were surveyed in order to identify the correlates to environmental behavior. The authors claimed that political attitudes, environmental concern and environmental knowledge were the correlates most related to environmental behaviors. Gherda's (1998) work on environmental education through hiking suggested that hiking trails are ideal for environmental education and that involvement in outdoor activities creates an awareness of environmental problems by exposing participants to cases of degradation.

Although some scholars do not support the thesis that knowledge affects environmental behavior or claim that the relationship between the two variables is rather weak (Kollmuss & Agyeman, 2002; McKenzie-Mohr, 2000), it is not clear whether this is due to different environmental behaviors being measured. In some cases it could be that actual behaviors were measured whereas in others it could be intended behaviors. Another factor playing a role in the disparity of the results among studies evaluating the relationship between environmental knowledge and actual environmental behaviors could be the discrepancy in the definition of environmental behavior. As Stern (2000) pointed out, environmental behaviors could be divided into two categories – intent-oriented and impact-oriented. The intent-oriented behaviors are perceived as beneficial to the environment, while the impact-oriented behaviors are related to the actual impact on the

ecosystem. This behavioral classification is important because different factors may influence different types of behavior.

To make matters even more complicated, Stern offers further separation of environmental behaviors – behaviors that directly influence the environment and behaviors that indirectly influence the environment. Usually behaviors that have a direct impact on the environment have received more attention since the consequences of them are easily detected. Stern (2000) for example, offers a classification for environmental behaviors in which behaviors are grouped into four categories – environmental activism behaviors, non-activist public-sphere behaviors, private-sphere behaviors, and behaviors in organizations.

A potential problem associated with the controversial link between environmental knowledge and behavior could be the kind of environmental knowledge that has been measured. Measuring knowledge about general ecological principles, about a particular ecosystem, or about a particular subset of a specific ecosystem could result in different conclusions. How does one then generalize the relationship between knowledge and behavior? The classic model of pro-environmental behavior has been based on the assumption that environmental knowledge influences environmental attitudes and attitudes in return influence behavior. The model, however, has undergone several revisions and this is not surprising considering the lack of clarity about what constitutes knowledge and what constitutes environmental behavior.

As Jensen (2002) states, "But instead of throwing the baby out with the bath water, knowledge should still be acknowledged as one-among many-important

preconditions for the development of competence leading to action and behavioural adjustments in relation to the environment" (p. 328-329). Jensen's support for the effect of knowledge on behavior is based on four dimensions on which knowledge is based: (1) knowledge about the effects of our actions, (2) knowledge about the root causes of the damage, (3) knowledge about strategies for change, and (4) knowledge about alternatives and visions. Similarly, Smith and Hellmund (1993) state, "Influencing behavior through education and interpretation is one of the strategies with the greatest potential for long-term success" (p. 115). Also, Simmons and Widmar's study (1990) on motivations and barriers to recycling concluded that lack of knowledge was a major barrier to recycling among individuals with already established positive environmental attitudes.

Although environmental knowledge has the potential to contribute to interventions for behavioral modifications, it is not the only means through which changes can be achieved and have been achieved. In fact, because of the complexity of environmental problems and settings in which those problems occur, in some instances government initiated strategies based on specific laws and regulations might be necessary to complement other ongoing efforts.

Public Policies and Regulation

The conventional approach to dealing with the tragedy of the commons issues has been the adoption of regulations, government laws, and different types of incentives in order to encourage specific pro-social individual behaviors and to discourage antisocial behaviors. The increasing use of regulatory regimes and legal sanctions as tools for environmental management (Uphoff & Langholz, 1998) is consistent with Hardin's

(1968, 1985) call for coercive means to protect the environment. However, there are some obvious limitations, particularly the costs to monitor and enforce the associated laws and regulations (Udehn, 1993). The effectiveness of such regimes is further compromised as participants shift to unsupervised or less-supervised locales. Efforts to drive down demand for recreation on public lands by creating or increasing user fees are politically precarious because fees are exclusionary, which is inconsistent with the public character of public land.

One increasingly widespread strategy for coping with the problem of commons overuse has been to designate natural protected areas (Carrus et al., 2005). This strategy is particularly prevalent in Europe. In effect, it removes areas from the pool of recreational land or severely curtails recreational use of that land. For that reason, it has been unpopular with local residents and communities, especially in highly populated regions, and it fails to address the underlying commons problem because it merely shifts the demand to unprotected areas.

Government agencies in Australia have sought to address those two problems by taking similar but less drastic action (Sun & Walsh, 1998). Two regulatory strategies have been employed. The first adds environmental protection clauses to land leases and licenses; the second requires that users obtain a permit. These two strategies incur the costs associated with regulatory regimes, but they permit a higher degree of recreational land use than would be available if the same areas were designated as protected. However, the efficacy with which these two strategies protect recreational environments has not been determined. Since their effectiveness relies on users willingness to comply

with the terms of protection clauses and permits, efficacy depends on monitoring and enforcement conditions that are either missing or under-budgeted.

Since enforcement of recreational land use regulation depends on compliance and monitoring, the locus of regulatory control matters. Monitoring is more effective, and users are more willing to comply when regulation is locally dictated and locally managed (Ostrom, Feeny, & Picht, 1993; Tang, 1992). This is because locals can adapt and adopt rules to fit local conditions, and because they have a more intimate first-hand familiarity with the environments to be monitored. A number of field studies show that local groups of resource users have created a diverse array of institutional arrangements to manage common-pool resources (Berkes, 1989; Blomquist, 1992; Bromley et al. 1992; Fortmann & Bruce, 1998; McCay & Acheson, 1987; Netting, 1993; Ostrom, Feeny, & Picht, 1993; Tang, 1992). When resources that were previously controlled by local participants were later brought under state or national authority, regulatory control has been demonstrably less effective (Ascher, 1995; Curtis, 1991; Panayotou & Ashton, 1992). For this reason, analysts of environmental policy have advocated self-regulation of environments through active citizen participation (Short & Winter, 1999). On the other hand, the increasing popularity of outdoor recreational sports makes it increasingly difficult politically for local regulatory regimes to restrict use (which is one reason that local control has sometimes been replaced by state or national control). As Ostrom, Burger, Field, Norgaard, and Policansky (1999) point out, local control is most likely to be effective if the resource is not at risk of surpassing its own carrying capacity, and there are valid and reliable systems in place to monitor the condition of the environment. Thus, outdoor

recreational sport environments are not good candidates for local regulation if they are particularly at risk (i.e., most in need of regulation) or if appropriate monitoring regimes are not in place.

An alternative strategy to managing environmental problems associated with sport activities is to manage use levels through booking systems. This was effectively applied as a means to protect the Dancing Ledge climbing area in the UK (Reynolds & Elson, 1996). Through negotiations between the National Trust and the British Mountaineering Council, a booking system was introduced that provided regulated access and charges for groups of climbers, but free access for individual climbers. This reduced the number of users by more than half, thereby decreasing the environmental impact. However, the success of applications like this is due, in part, to the small size of the recreational resource, which facilitates enforcement through monitoring. In larger areas, the prohibitive costs of monitoring increase the risk that users will fail to comply with existing rules.

Rules and regulations have become the dominant approach to the management of outdoor recreational sport environments because they do seem to reduce the risk of a full-blown commons tragedy. They work only at the margins, however, because strict regulation and monitoring are too costly to apply, particularly if the region to be covered is large. Further, in democratic systems it can be politically unfeasible to restrict or deny popular use, even when restrictions or denials are warranted on environmental grounds. These limitations are exacerbated by the time taken to pass relevant legislation or to draft new regulations. Whereas outdoor recreation demand and the environmental degradation

associated with that demand are escalating geometrically, laws and regulations remain relatively stagnant. Consequently, rules and regulations are typically behind the level of need.

Although regulatory regimes are arguably necessary to protect environments for outdoor recreational sport, they are clearly insufficient. The challenge, then, is to combine regulatory practices, as a short-term strategy, with interventions designed to establish environmentally friendly norms and values among outdoor recreational sport enthusiasts. If such norms and values could be established, then participants in outdoor recreational sport would self-monitor and self-regulate.

Based on the review of scholarly work presented in this chapter, it is evident that the problems associated with outdoor recreational sport are well described by both theoretical and empirical work and, without a doubt, have social roots. Therefore, the means for long-term solutions to the problems should be sought in the realm of social science and in particular in the sport subcultures and behavioral modification models, based on voluntary cooperation. Investigating the norms and values of sport subcultures and designing intervention measures leading to the desired behavioral changes have the potential of achieving a long-term solution that is more self-sustainable and financially efficient than the conventional regulatory practices.

The focus of this project is on the sport of disc golf (considered an urban recreational sport), the environmental degradation due to the sport, the problematic behaviors associated with that degradation and the intervention measures having the potential to modify participant behavior in order to lessen the impact from playing the

sport. With the urban population rapidly growing and the continuous increase in demand for outdoor sport recreation, disc golf presents an appropriate case for investigating the relationship between an outdoor recreational sport and the environmental damage caused by the participants in that particular sport.

Disc golf takes place in natural settings with most of them located in city parks. Urban parks offer free access to everyone and usually there is no limitation on the number of daily users. These circumstances could easily lead to a situation where Hardin's tragedy of the commons would develop because of overuse of a limited space by an unlimited number of recreationists. The increasing popularity of disc golf could simply set the conditions for surpassing the carrying capacity of the ecosystem before any measures can be taken to prevent that from happening.

THE SPORT OF DISC GOLF

Disc golf is similar to traditional golf, but instead of clubs and balls players use golf discs. Disc golf offers many of the same pleasures as golf does: fresh air in a beautiful landscape, the camaraderie of friends, and the challenge and excitement of combining personal skills and speed to project an object toward an upright basket with chains. Disc golf provides recreation, challenge and competition for those who love the outdoors and are willing to spend little on equipment. The purpose of disc golf is to complete a course in the fewest strokes. The only equipment one needs is a flying disc, and most disc golf courses are located in municipal parks, which admit players for free or

charge a minimal fee for daily or yearly access.

Disc golf can be played regardless of age or physical ability. The EDGE (Educational Disc Golf Experience) program has been introducing this inexpensive sport to thousands of schools across the United States (Educational Disc Golf Experience, n.d.), at the same time seniors are taking to disc golf as well. Disc golf, for example is an official event in senior games such as the South Carolina Senior Sports Classic. Also, handicap competitions are becoming popular and provide players with an opportunity to compete fairly against others of similar skill levels. Disc Golf United (DGU) is the official handicapping service for disc golf.

Early games of disc golf used targets of trees, trash cans, light poles, chicken wire baskets, and pipes. The game was formalized when Ed Headrick invented the first disc pole hole, catching device; consisting of 10 chains hanging in a parabolic shape over an upward opening basket, US Patent 4,039,189, issued 1975. The first formal disc golf course was designed and installed that same year in Oak Grove Park, (Pasadena, California), by Headrick and was an instant success. He also founded the Professional Disc Golf Association (PDGA) in 1976, which he turned over to the players in 1983 (see Appendix A).

People have enjoyed disc golf for over 30 years and it is one of the fastest growing sports in the world. Figure 2.1 shows the increase in number of courses installed worldwide in the past 32 years, which clearly indicates the exponential growth of this sport.

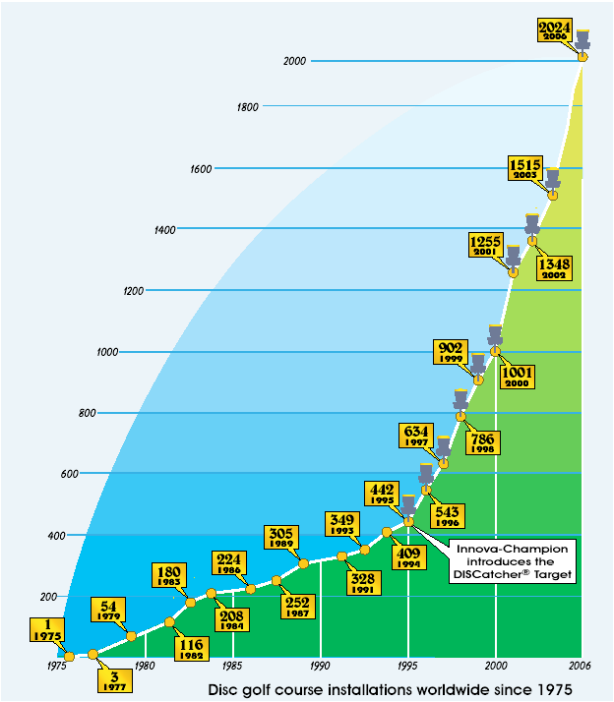


Figure 2.1: Increase in the number of Disc golf courses over the past 32 years worldwide. (Source: http://www.innovadiscs.com)

The Professional Disc Golf Association is a non-profit organization and the governing body for disc golf with more than 20,000 members who live and play in more than 20 countries on 5 continents. The association creates the rules for disc golf and provides members with a magazine called *Disc Golf World News* as well as equipment specifications. Every year the PDGA sanctions competitions for professional and amateur players. Competitors earn points by participating in these events. The points are tabulated by the PDGA and used to determine invitations to the World Professional and Amateur Disc Golf Championships (Professional Disc Golf Association, n.d.).

Disc golf has been developed as a recreational sport and Figure 2.2 presents

information on the number of public courses available around the country.

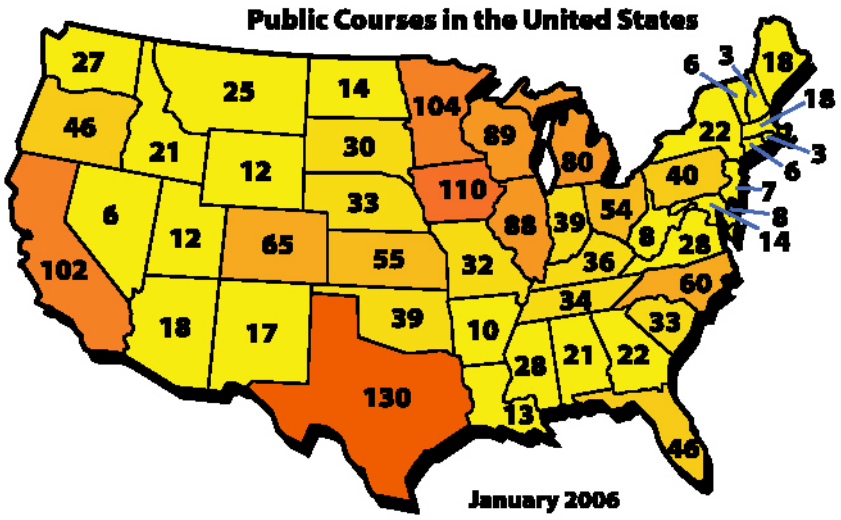


Figure 2.2: Number of existing disc golf courses across the USA as of 2006.

(Source: http://www.innovadiscs.com)

Park departments across the country give permission to local clubs to install disc golf courses and in many instances to maintain them. Local clubs often engage in course clean up and charity work related to their local events. In addition to the numerous weekly and monthly local mini-tournaments, disc golf has two major annual global events – the World's Biggest Disc Golf Weekend which takes place on nearly 200 courses around the world in mid-May and the Ice Bowl which takes place in late January or early February to promote disc golf solidarity and raise funds for local food banks.

Disc golf courses require less maintenance than traditional golf courses, and in addition to that they are shorter and require less land. Disc golfers can feel better about

themselves and their environment knowing that chemical pollutants are not being used to keep their playing fields looking good, nor are acres of trees being clear-cut and wetlands filled in, as is the case for too many golf courses. Beautiful natural settings are essential for disc golf, and as with many other outdoor recreational sports, there are some concerns about environmental degradation due to the sport (LeBlanc, 2006; McCaughan, 2004).

While the review of literature shows that the effects of recreation on the ecosystem have been studied in general, the extent to which a popular urban sport such as disc golf (easily viewed as eco-friendly) affects the environment remains unexplored. Also, considering the potential the study of sport subcultures has for gathering knowledge about individuals and groups, examining the subculture of disc golfers could contribute to the design of intervention measures (if necessary) to modify behaviors associated with ecological degradation. This in turn will expand the scope of managerial practices utilized in the past and will provide for more efficient solutions to the environmental problems associated with sport. Therefore, the following are the guiding questions for this project.

RESEARCH QUESTIONS

This project consisted of four studies the connection of which provided some valuable information not only about the ecological problems associated with disc golf, but also provided valuable information about the means through which we can search for efficient solutions to those problems. The initial step before attempting to modify players'

behavior was to assess whether there were any environmental impacts from disc golf. Therefore, the first study focused on the ecological variables indicating environmental degradation and for that reason the first research question was:

1. What are the ecological impacts from playing the sport of disc golf?

The second study had a behavioral focus and sought out the behaviors that were related to the environmental problems identified in the first study. The following research question provided the direction for gaining some insights about the players' behavioral patterns and to also identify the behaviors linked to the undesired biological consequences:

2. What are the specific participant behaviors associated with ecological degradation on the disc golf course?

The third study investigated the subculture of disc golfers in order to gain some understanding of the values and beliefs of the players as well as their knowledge and understanding about the negative impact disc golf has on the surrounding environment. In order to gather this information, the following question guided the search for answers:

3. What are the characteristics of the subculture of disc golfers that could be employed as the means to achieve pro-environmental behavior?

The fourth study of this project was based on the results from the first, second, and third studies. Its focus was aimed at strategic behavioral modifications designed to

eliminate and/or decrease the frequency of occurrence of undesired behaviors. It generated some guidelines for the applicability of the intervention measures in the search for sustainable managerial practices. This could be valuable to outdoor sport managers as well as to urban planners. Therefore, the question of the fourth study was as follows:

4. What are the effects of a behavioral intervention on players' behavior?

Chapter 3: Assessing the Ecological Impact due to Disc Golf

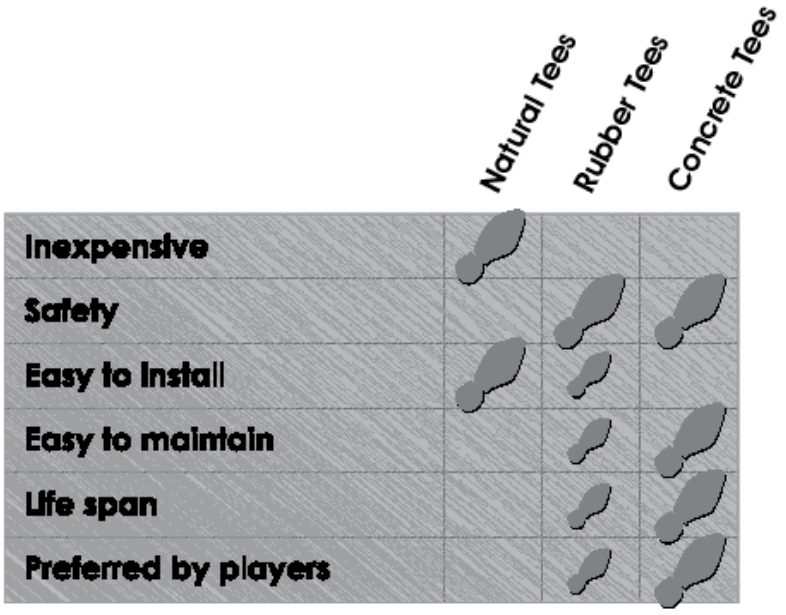
In spite of many environmental advantages disc golf seemingly has over traditional golf (e.g., no chemicals needed to keep the field green, no cutting of trees in order to design the course), there have been some recent environmental concerns associated with the sport (Estrella, 2005; Gascoyne, 2005; LeBlanc, 2006; McCaughan, 2004). For instance, some disc golf courses in California have already been closed because of the environmental problems associated with excessive use and lack of a management plan. More specifically, some of the disturbing concerns are destruction of undergrowth plants because of high foot traffic, damage to the bark of the trees from discs, and soil erosion and compaction. These concerns introduce new challenges to sport managers and planners of outdoor sport activities in urban settings.

In recognition of these environmental concerns the Professional Disc Golf Association (PDGA) founded an Environmental Committee in 1998, with members from all over the world. The primary objectives of this committee are (Professional Disc Golf Association, n.d.):

1. To educate players and course designers about the impacts of existing and proposed courses.
2. To provide specific input, advice, and general expertise in specific locations.
3. To store environmental documents and/or data from courses around the country for use by other course designers or operators.

The PDGA acknowledges that a major concern with disc golf courses is soil erosion and

the most prevalent type of erosion happens near the tees and baskets. Figure 3.1 presents information about the different types of tee designs (graded on a 3-level scale) used in the construction of disc golf courses to minimize environmental damage. In addition to soil erosion, trampling is another concern and the PDGA Environmental Committee has proposed several mitigation and maintenance strategies to decrease the impact. For example, some of the strategies call for installing courses in areas with low foot traffic or replanting with some native vegetation areas with serious foot impact.



Big mark – high grade
Small mark – average grade
No mark – low grade

Figure 3.1: Different types of tee design and their characteristics.

(Source: http://www.innovadiscs.com)

Usually disc golf is played in public parks and another environmental concern is

the tree damage when discs hit trees during the course of a game. The Environmental Committee suggests using stakes to protect the tree trunks and sensitive trees and shrubs. Although the PDGA and its Environmental Committee recognize the possible environmental problems associated with disc golf, they argue that when regular maintenance is performed, environmental effects are minor and no long-term effects should be expected. Regardless of the optimistic belief of no long-term threats, the challenge is to find ways to determine and monitor the impact to avoid last minute fixes and to promote proactive instead of reactive management.

Evaluating environmental impact because of outdoor recreational activities is not new to academia. Based on previous work in the field, there are two possible methods of assessing the environmental impacts – one is through quantitative measurements of the indicative variables and the other is more qualitatively focused and adopts assigning different scores depending on the visual appearance of the particular area of interest. Nevertheless, the reliability of the information obtained through the latter method would likely suffer, especially when data collection is conducted by more than one person. Therefore, to ensure high level of reliability the quantitative approach is more desirable than the qualitative.

Several variables have been used to measure ecological degradation in outdoor recreational activities. A variable often used is human trampling, which is defined as the mechanical destruction of ground level vegetation (Cole, 1995; Liddle, 1975). For example, in a study on sand dune communities Liddle (1991) evaluated the soil and vegetation condition as markers of human trampling. Other variables examined as

indicators of environmental damage are soil compaction and change to vegetation cover (Quinn, Morgan, & Smith, 1980; Thurston & Reader, 2001). Measures of soil compaction and change to vegetation cover were used by Sun and Walsh (1998) who presented an overview of the ecological impacts of recreational activities in Australia and they argued that some of the physical degradations include soil loss and compaction as well as vegetation damage. Similar results were found by Goeff and Alder (2001) in their study on mountain biking in Australia, showing that trail erosion, soil compaction and vegetation damage occur on the trails. Although the majority of measures have been focused on soil and vegetation variables, other variables have been used as well. For example, McMillan, Nekola, and Larson (2003) measured the effect of rock climbing on environment by evaluating the density, richness, diversity and composition of the land snail community in Southern Ontario. In another study on rock climbing, Muller, Rusterholz, and Baur (2004) looked at plant cover and species density in order to assess any ecological problems associated with this sport.

Based on the above review, variables used as indicators for ecological degradation in outdoor recreation could be generally grouped into three categories – mechanical (e.g., measuring soil erosion and compaction), flora (e.g., measuring plant cover) and fauna (e.g., measuring a particular land community). To assess the problems associated with disc golf in particular, the following variables were chosen – soil compaction, soil erosion and vegetation density. These three variables are appropriate indicators of ecological degradation because of the nature of disc golf and the environment in which it takes place.

METHOD

Site Selection

Three parks in the city of Austin, Texas, with designated disc golf courses were the focus of this study – Pease Park, Zilker Park, and Mary Moore Searight Park. All three parks are located in an urban setting and are managed by the city of Austin Parks and Recreation Department, although maintenance of the disc golf courses is mainly carried out through the volunteer work of the disc golf players themselves.

Pease Park. The disc golf course in Pease Park was established in 1989. The course is situated along Shoal Creek and has a scenic trail with many trees as well as some wide open holes and cliffs (see Appendix C). Its length is 1387.75 m (4550 feet) with a total of 18 holes.

Zilker Park. The disc golf course in Zilker Park was established in 1987 (see Appendix D). The course has only 9 holes and its total length is 818.32 m (2683 feet). The baskets at this short and tight course are moved between the North and South site of the park twice a year. When tournaments are organized, the course is expanded to 18 holes.

Mary Moore Searight Park. The disc golf course in Searight Park was established

in 1992 (see Appendix E) and it has 18 holes spread throughout a large wooded area. The course is 1446.00 m (4741 feet) in length and has a few long holes that are scattered throughout the course, but there are also many short holes.

Data Collection

Soil compaction, plant density and soil erosion data were collected from two different types of locations at each of the three disc golf courses: off the course path and around the baskets which are on the course path. Soil compaction, plant density and soil erosion are indicators of ecological degradation. The rationale for choosing two different types of locations at each disc golf course was that environmental problems are expected to differ depending on the walking pattern of the disc golf players and other users of the park. The two different types of sampling locations allowed for comparison of the soil and vegetation condition in areas with different foot impact. The time required to collect the data was three weeks for the vegetation density and two days for the soil compaction, while three months were required to collect the soil erosion data.

Variables

Three variables represented onsite land degradation: soil compaction and erosion, and plant density.

Soil compaction. Soil is a natural body comprised of solids (minerals and organic matter), liquids, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of

energy and matter, and the ability to support rooted plants in a natural environment (United States Department of Agriculture, 2008). Soil compaction occurs when soil particles are pressed together, reducing pore space between soil particles and pushing out the air normally located there. Soil compaction reduces the large pore space, restricting air and water movement into and through the soil, thus limiting root growth. Soil compaction is the primary factor limiting plant growth in urban soils. The decrease or loss of biota can cause further impacts on soil and vegetation because organisms are important agents in promoting the development of soil structure and are critical to the process of nutrient cycling (Flink & Searns, 1993).

Traffic over soil is the major contributor to soil compaction. For example, moist soil can reach 75% maximum compaction the first time it is stepped on, and 90% by the fourth time it is stepped on (Whiting, Wilson, & Card, 2006). Compaction results in decreased rates of water infiltration and eventually leads to increased soil erosion. Soil compaction is one consequence of land use practices that involve trampling (see Appendix B). Knowing about soil density on a site is important because increased density will hinder root penetration. The greater the useable soil volume for plant root growth, the greater a plant's growth potential. There are two main effects of soil compaction: increased soil density to potential root growth, which limits growth levels, and decreased soil drainage. Soil compaction prevents seeds from pushing through the soil. Plants will not receive air and water from compacted soil. Also, living organisms in the soil cannot survive without water, air and nutrients.

Soil erosion. Geological soil erosion has been occurring for some 450 million years and is a natural phenomenon, but it becomes a problem when human activity causes it to occur much faster than under natural conditions. For example when large numbers of hikers use trails or extensive off road vehicle use occurs, erosive effects often follow, arising from vegetation removal due to foot traffic and vehicle tires. When soil is removed at about the same rate as it is formed, problems rarely occur, but when loss of soil occurs at a much faster rate than its formation, serious problems may arise. Soil erosion can occur incrementally and some of the effects of erosion can be masked for many years, making the evaluation process more difficult and management strategies more complex. The main on-site impact from soil erosion is the reduction in soil quality that results from the loss of the nutrient-rich upper layers of the soil, and the reduced water-holding capacity of the soil.

Plant density. When vegetation declines, a prime source of organic litter is lost and the density of soil biota declines as well. A change in soil biota reduces the availability of nutrients to plants and this can result in further lost of vegetation cover. Therefore, plant density can be used as an indicator of loss of vegetation cover. Plant density is often used for monitoring long-term vegetation changes, because of its sensitivity to changes in the adult population. Plant density is defined as the number of organisms per unit area. Plants in trampled areas usually have reduced density, leaf surface, and flower and seed production. These changes can lead to less successful reproduction and eventually to a decrease in cover.

Instrumentation

The diagnostic tool used to measure compressive strength of soil is the penetrometer (DICKEY-john soil compaction tester). It has a pressure gauge and a probe stick with depth markings at 3-inch intervals. The probe is hand driven into the soil and soil compaction is displayed in 50 psi (pounds per square inch) increments up to 400 psi. The penetrometer is designed with the purpose of mimicking a plant root. This type of soil compactor is the more precise instrument for evaluating soil compaction than the pocket penetrometer (designed to measure surface compaction).

Five random numbers, generated using *Femlab,* determined five baskets on each disc golf course around which soil compaction was tested. Measurements were taken at five different spots around each basket. The purpose of this was to ensure that enough directions around the basket were covered, thus averaging out variations due to the players' walking patterns. In addition, soil compaction measures were taken approximately 10 meters away from each basket for the purpose of comparing areas where golfers usually walk with areas where they rarely walk. At each of these comparative locations, five different spots were tested.

Soil erosion was measured by using soil erosion pins inserted into the ground, which is a widely used method for measuring erosion (Hadley & Lusby, 1967; Haigh, 1977; Takei, Kobaski, & Fukushima, 1981). The top of the pin gives a datum from which changes in the soil surface level can be measured. The pins were 20 cm (7.9 in) long and 1 cm (0.4 in) in diameter so that they would not interfere with the surface flow. A metal washer was placed over the pin to ensure a better base from which to measure to

the top of the pin. Prior to recording the eroded soil level, the washer was lowered over the erosion pin and down to the ground surface. The function of the washer was to even out irregularities in the ground surface surrounding the pin. The difference in elevation between the washer's surface and the head of the erosion pin was recorded by a ruler. Measurements were collected 3 months after the initial time of pin placement. Pins were randomly placed within a radius of about 1 m (40 in) around the baskets. The number of the basket where each pin was nailed into the ground was selected by using *Femlab* to generate random numbers. A total of 10 baskets were selected at each of the three disc golf courses. In addition to that, soil erosion pins were placed in approximately 10 meters away from each basket for the purpose of comparing erosion level. A total of 20 pins were placed on each disc golf course, 10 of which were close to the baskets and 10 away from the baskets. Each pin was stamped with a number from 1 to 20.

A common method for evaluating land plant density is the plot method (Brower, Zar, & Von Ende, 1998). A *plot* is generally a rectangle or a square, but circles and other shapes can be used as well. For the sampling of vegetation cover and density, rectangular plots were used, since they yield better results than the other shapes (Doolittle, 2004). Rectangular sample areas are more accurate than square or circular ones, because of the general tendency of vegetation to clump. A plot with a rectangular shape with sides in a 1:2 ratio ($0.71\ m$ X $1.42\ m$) was constructed. The size of the plot in relation to the size of the plants measured is a critical consideration because it can affect the precision and accuracy of the measurements. When determining the appropriate plot size needed to sample the vegetation, the goal was to select a minimum area that would fully represent

the species composition of the community. The dimensions of the plot generally depend on the nature of the vegetation, and for the purpose of evaluating grassland, the dimensions of 0.71 m by 1.42 m (sampling area of 1 m^2) are desirable (Barbour, Burk, Pitts, Schwartz, & Gilliam, 1998).

The location of the center of each plot was determined by randomly choosing a number that represented a basket number on the disc golf course. Random selection minimizes bias by purposefully ignoring the nature of the vegetation and terrain. The random numbers were generated using *Femlab*. The center of the plot was placed at 0, 3, 6, and 9 m away from the basket in two randomly chosen directions. A compass was used to determine the directions. The rationale for choosing two random directions was to eliminate the effect of sunlight on the growth pattern of vegetation. After the plots were marked out, each species was counted within each plot. A substantial amount of time was required for the accurate counting of all plants in each plot. Plots were placed around the basket areas and off the course path. Since the purpose of measuring plant density was to estimate the vegetation cover and not to identify the individual species, monocots and dicots were combined when counted. Species that were touching the edges of the plot were counted as belonging to the sampled area. After collecting the data, plant density was calculated using the equation:

$$D_i = n_i / A$$

Where D_i is the density for species i, n_i is the total number of individuals counted for species i, and A is the total area sampled. Figure 3.2 illustrates the plot

method.

Figure 3.2: Photo illustrating the plot method of evaluating plant density.

RESULTS

Statistical analysis of the collected ecological data was performed using SPSS. A *t*-test was used to analyze the soil compaction data. Results indicated that the degree of soil compaction differs significantly between areas around the disc golf baskets and areas away from the baskets. This statistically significant difference was noted in all three sites of study. Results were as follows: Mary Moore Searight Park, $t(10) = 2.31$, $p = 0.04$; Zilker Park, $t(10) = 3.15$, $p = 0.01$, and Pease Park, $t(10) = 3.91$, $p = 0.003$. The mean values of the soil compaction measures in the three parks in close proximity to the disc golf baskets were 2.79 cm (1.10 in) for Pease park, 4.62 cm (1.82 in) for Zilker Park, and 6.78 cm (2.67 in) depth for Mary Moore Searight Park, while away from the baskets the values were 7.54 cm (2.97 in), 9.83 cm (3.87 in), and 14.12 cm (5.56 in) respectively. All soil penetration readings were taken by inserting the penetrometer until the level of

compaction reached 300 psi, which is the level at which it is believed that root growth is greatly inhibited (Penn State - Department of Crop and Soil Science, 2002). Although there is no established precise threshold level for soil compaction which precludes plant growth, a significant increase in the level of soil compaction should be viewed with concern.

Not all erosion pins originally placed into the ground were found at the time of collecting the data. At Zilker and Mary Moore Searight Parks 50% of the originally placed pins were found, while in Pease Park 80% of the pins were located. This is actually an expected rate of recovery, because of some of the problems usually encountered with this method of measuring soil erosion. First, a few baskets were removed from their original location, which served the purpose of a land mark for the location of the pins. Second, during some of the volunteer days a large amount of mulch was spread out throughout Pease and May Moore Searight Parks, thus covering some of the areas where pins were originally placed. Third, some pins may have been simply removed by park visitors. This common problem occurs at times because park users sometimes tend to be curios and are likely to remove some of the pins.

A *t*-test was used to compare soil erosion data collected in close proximity to the disc golf baskets with erosion away from the baskets. Results indicated a significant difference in the level of soil erosion between the two locations, with erosion being at much higher level close to the baskets than away. The significant difference in soil erosion was noted in all three parks. Results were as follows: Pease Park, $t(14) = 4.32$, $p = 0.001$; Zilker Park, $t(8) = 4.03$, $p = 0.004$, and Mary Moore Searight Park, $t(8) = 2.89$, p

= 0.020. The mean values of the soil erosion readings in the three parks away from the baskets were 0.08 cm (0.03 in) for Pease Park, 0.16 cm (0.06 in) for Zilker Park, and 0.16 cm (0.06 in) for Mary Moore Searight Park, while in close proximity to the baskets the values were 0.24 cm (0.09 in), 0.24 cm (0.09 in), and 0.31 cm (0.12 in) respectively. Although there is no established precise rate for soil erosion, which inhibits vegetation cover (consequences from soil erosion depend on the specific site characteristics), an elevated rate of soil erosion should be viewed with concern.

The vegetation cover data collected in each park were analyzed visually using a bar graph. Figures 3.3, 3.4, and 3.5 represent the data collected in Pease Park, Zilker Park, and Mary Moore Searight Park respectively:

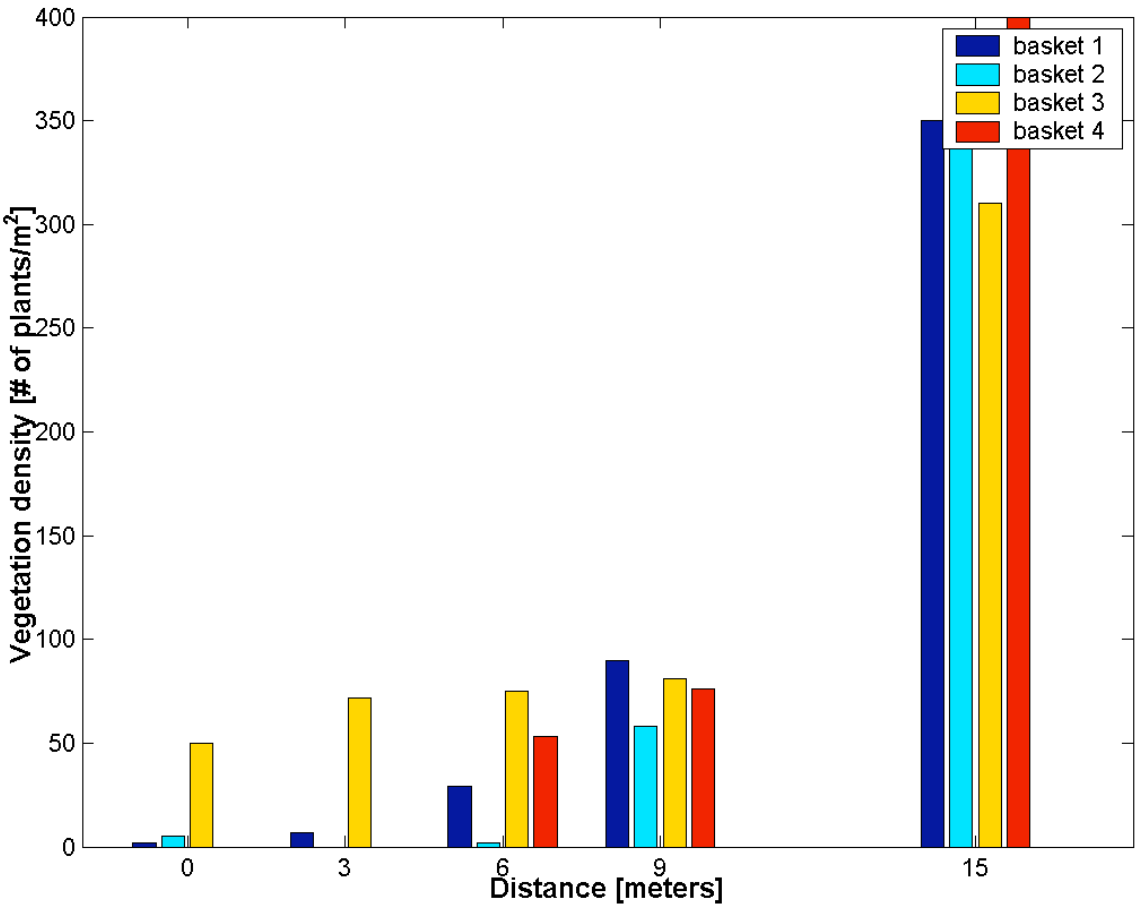


Figure 3.3: Vegetation cover in Pease Park.

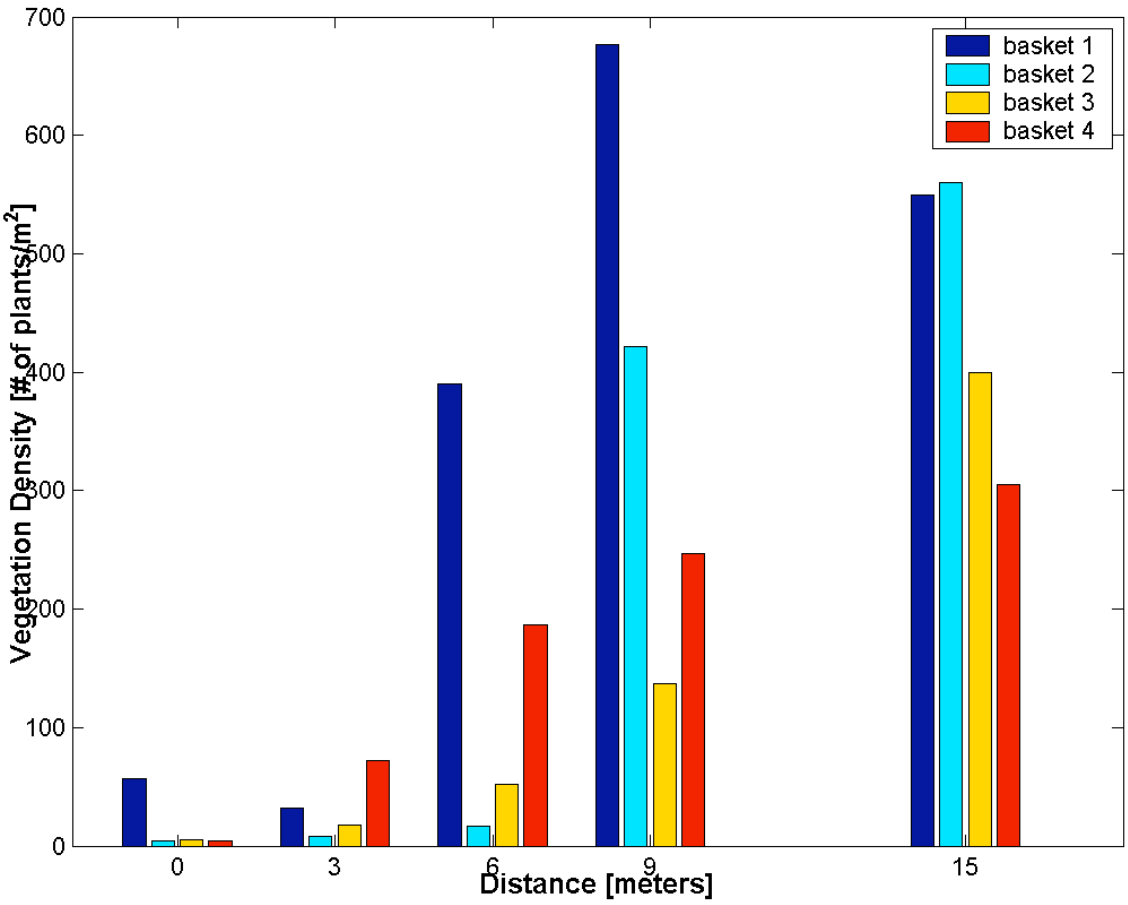


Figure 3.4: Vegetation cover in Zilker Park.

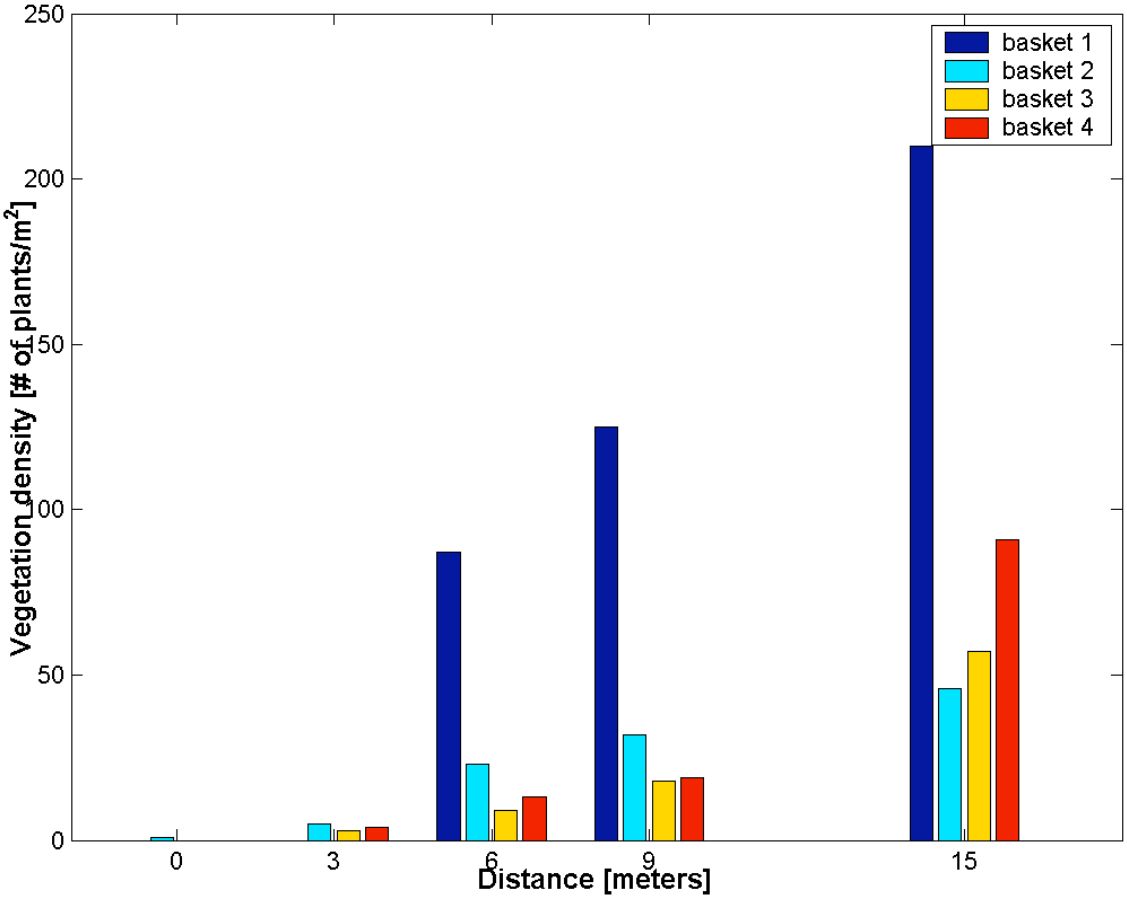


Figure 3.5: Vegetation cover in Mary Moore Searight Park.

The visual representation of the vegetation cover indicates the large difference in vegetation density between the areas located in close proximity to the disc golf baskets and these located farther out. The lack of vegetation cover around the baskets is evident on all three disc golf courses. Figure 3.6 provides an illustration of the lack of vegetation around baskets even after the particular basket was removed and no longer used.

Figure 3.6: Photo illustrating the lack of vegetation around an area where a basket was located.

DISCUSSION

The results of the soil compaction analysis indicate that the soil in areas where disc golf baskets are placed is highly compacted when compared to areas not on the disc golf course. This could be explained by the heavy foot traffic around and in close proximity to the baskets. Regardless of whether disc golfers manage to get the disc into

the basket or not, they have to walk to the basket and pick up their discs. Also, some of the baskets are used as a practice basket, which implies that an enormous number of steps are taken around the baskets. This results in damaging the vegetation cover and compressing the soil upper layers.

Soil compaction due to human trampling is a problem with some severe consequences. Most of the organic material in soil is concentrated in the upper layers and this organic horizon promotes water circulation by increasing the absorptive capacity of the soil and by increasing moisture retention. If soil compaction in the surface layer develops it can increase runoff, which in turn causes increasing soil and water losses. Also, excessive soil compaction impedes root growth and therefore limits the amount of soil explored by roots and results in decreased plant ability to take up nutrients and water.

Similar conclusions have been reported in other studies on outdoor recreational activities. Recreational trampling leads to increase in soil compaction and a decrease in soil organic matter as well as a decrease in plant cover (Cole, 1995; Hylgaard & Liddle, 1981; Kuss, 1986; Sun & Liddle, 1993). More recently, in a study on the effects of experimental trampling on soil and vegetation, Kutiel, Eden, and Zhevelev (2000) showed that only 71 days after they started their experimental treatment of trampling, the depth of soil penetration decreased with increasing trampling intensity. A possible solution to the soil compaction problem could be to relocate the baskets every few months (depending on intensity of usage and geographical conditions) to allow for the soil and vegetation to recover.

Although a natural process affected by heavy rainfall and strong winds, soil erosion is also affected by soil compaction. Soil compaction leads to a decrease in vegetation cover, which eventually leads to an increase in the level of erosion. Based on the results from the soil erosion analysis on the three disc golf courses it is evident that areas in close proximity to the baskets are more susceptible to soil erosion than areas farther away from the baskets. This could be explained by the heavy foot trampling associated with disc golf, which is especially concentrated around the baskets. The effect is exacerbated because baskets are rarely moved around the course path, thus not allowing for sufficient recovery time and causing soil conditions to worsen. The consequences of soil compaction and erosion are reduced plant density and less successful reproduction of grass species, which can lead to less biomass and sparser cover. The danger is in reaching the carrying capacity of the ecosystem before tangible damages are detected and some mitigating measures are taken.

The analysis of the vegetation cover clearly indicated that areas in close proximity to the disc golf baskets were lacking vegetation cover. This could be explained by the fact that excessive walking takes place around the baskets and in close proximity. Excessive walking leads to soil compaction, which in turn slows down the process of vegetation growth. Soil compaction impedes the process of plants absorbing nutrients from the soil, therefore causing a decrease in vegetation cover. The condition of the vegetation cover away from the path of the disc golf courses was much better when compared to the locations around the baskets. Although recreationists still walk in these areas, foot traffic is not as heavy as on the disc golf course.

The relationship between soil and vegetation is reciprocal. In other words, reduction in vegetation makes the soil more susceptible to erosion but at the same time soil erosion leads to a decrease in plant cover. The severity of the problems arises from the fact that park usage due to disk golf is highly concentrated in nature, which leads to both soil and vegetation impacts. These effects are confined to the specific area where disc golf is played. A few meters away from the walking path of the disc golfers, soil and vegetation are likely to be less affected.

The results of this study point at some of the negative effects the sport of disc golf has on the surrounding environment and in particular on the soil and vegetation cover. This, however, does not imply that we are advocating a solution of the environmental problems through eliminating the sport of disc golf altogether. The challenge is to keep the effects within acceptable boundaries without surpassing the carrying capacity of the specific ecosystem. Understanding the factors influencing the amount of impact can assist in the design of preventive measures with the focus being on the factors having the greatest potential to affect the site. Most importantly we need to focus on eliminating the causes rather than the symptoms of the problems.

Managerial practices for solving environmental problems used in the past were mostly focused on restoration and preservation efforts. Although a necessary measure, restoration and preservation practices are rather a short-term solution. Strategies should be aimed at achieving a long-term solution that will provide for sustainable sport. This long-term solution should be sought in the area of human behavior, since human behavior is what mainly causes the ecological degradation. Therefore, investigating the golfers'

behaviors could assist in the identification of problem behaviors linked to the environmental problems. It may be that disc golf players are not even aware of the existing problems. In addition, the time lag between the impact and the identification of its consequences might impede the perception golfers have about the impact of their sport. The next chapter provides an investigation of the behaviors of disc golfers in an attempt to identify any relationship between the ecological degradation and specific behaviors.

Chapter 4: Identifying Problem Behaviors

Don't let us forget that the causes of human actions are usually immeasurably more complex than our subsequent explanations of them.

Fyodor Dostoevsky

Environmental degradation and human behaviors related to the degradation have been the focus of research for more than thirty years (Bechtel & Churchman, 2002; Redclift & Woodgate, 1997; Wohlwill, 1970). In the context of outdoor recreational activities negative environmental consequences due to human impact have been associated with soil and vegetation problems (Cole, 1990, 2004; Farris, 1998) as well as with animal habitat distraction (Cassierer, Freddy & Ables, 1992). Based on the results in the previous chapter, disc golf may be linked to increase in soil compaction and erosion, and to decrease in vegetation cover.

The amount of impact from outdoor recreation is a function of use and environmental characteristics. Different user groups affect the ecosystem differently. For example, horses have been shown to cause substantially more trail erosion than hikers or mountain bikers (DeLuca, Patterson, Freimund & Cole, 1998; Wilson & Seney, 1994). On the other hand, different ecosystems are affected differently from similar user groups and local characteristics should be taken into account. For example, trampling in a small area can result in a significant loss of biodiversity if it happens to be concentrated on the population of a rare plant species (Cole, 1990).

Although factors such as the amount of use and the type of the recreational activity are important, the specific behaviors of the recreationists, whether alone or in groups, are a key factor to consider when attempting to decrease ecological impacts (Geller et al., 1982). More importantly, identifying the problem behaviors associated with particular environmental degradations is an essential step before any behavioral intervention measures are undertaken. In fact, Stern and Gardner (1981) suggest that adopting an impact-oriented approach to identifying the target behaviors is essential in order to successfully change undesired behaviors. For example, interventions to change behavior linked to littering were not designed and implemented until an analysis of the specific behaviors relevant to this environmental problem was conducted (Geller et al., 1982).

Evaluating human behavior in relation to the ecosystem is essential since some behaviors could be logically linked to some of the environmental problems. For example, in a study evaluating residential energy consumption, more than ten behaviors were identified that were associated with high energy consumption and had the potential to be modified (Geller et al., 1982). Therefore, when the objective is to decrease the ecological degradation due to disc golf by modifying the behavior of the players, the first step should be to identify whether any problem behaviors associated with the ecological impact in fact exist. Identifying those problem behaviors can assist in the strategic design of intervention measures aimed at modifying the golfers' behavior. Indeed, the work of Stern (2000) on environmental behaviors supports this view and points to the importance of first identifying the target behaviors and then studying the individuals responsible for

those behaviors.

This chapter describes the approach used to identify the specific behaviors associated with the environmental degradation due to the sport of disc golf. The identification process involved three different stages of behavioral observations. Therefore, the study is organized into three different phases, and a description of each follows.

PHASE ONE - METHOD

Setting

The same three parks used as study sites for the ecological assessment presented in the previous chapter (Pease Park, Zilker Park, and Mary Moore Searight Park) were the sites of interest. All three parks are public and no written permission was required for the researcher to enter the parks and use them as research sites. Since human subjects were involved in this study, the necessary Institutional Review Board protocol was followed and was in exempt status due to the minimal risk for the subjects; therefore informed consent was not required. Data collection took place in the three parks because these were the settings relevant to the phenomena being studied. The sample for this study consisted of disc golf players who were observed while playing. Data were collected by the researcher and two assistants, the training of whom will be discussed later.

At each course, an open area was selected as the location for data collection since

it allowed for a large area to be observed, as opposed to choosing an area with many trees, where natural obstructions could interfere with the observation process. The researcher ensured that the chosen location for the observations did not interfere with the flow of the game. The researcher and the assistants took the role of passive observers and did not participate in the game, which provided for an experience as an outsider. Playing the role of an outsider was important, since it decreases possible reactivity in the players' behavior. Knowing that one has been observed could affect the way in which they would normally behave in a given situation (Breakwell, Hammond, & Fife-Schaw, 1995).

Design and Procedure

In order to identify behaviors related to the game of disc golf, the method for collecting data was field observations (Bernard, 1998; Bogdewic, 1999; Werner & Schoepfle, 1987). The major strength of using field observations as the method of collecting data is in that it provides for observing the phenomena in its natural setting, and there is no time delay between the occurrence of the behavior and the actual observation (Breakwell et al., 1995).

The researcher and the two trained assistants collected the data. The training of the assistants started with two meetings in the researcher's office. During these meetings the basic rationale and purpose for the study were explained. Although assistants were provided with information about the general purpose of the study, they were not informed about the fact that the ultimate purpose of the study was to identify problem behaviors

associated with the ecological degradation due to disc golf. The rationale for that decision was two-fold. First, assistants participated only in the first stage of field observations, where the purpose was to gather information about any behaviors related to disc golf. Second, not pointing out the ultimate purpose of the study (i.e., identifying problem behaviors associated with the negative impact on the environment) reduced observational bias.

Verbal guidelines about the procedures for data collection were presented, and the assistants were supplied with some readings relevant to the methodology. The assistants were told to look for behaviors that might be related to the game of disc golf. They were also advised not to participate in the game, since participation would detract from their ability to observe their surroundings. In addition to that, they were instructed not to socialize with the players and keep their role as passive observers. A follow up meeting provided for any questions to be answered and for any confusion to be clarified. The next step in the training process was to visit the assigned parks with each assistant and to take field notes. This was done individually and independently. That is, the researcher and the assistants were sitting in close proximity but notes were taken without any communication with each other. Afterwards notes were discussed. The purpose of the discussion was to identify whether any behaviors were park specific. In other words, to identify whether some behaviors were occurring at one park and not at the other two parks. Notes were not coded since the purpose was to gather general information about any behaviors taking place at the disc golf courses that were related to the game. Also, since the field observations at this phase did not involve any behavioral ratings and

behavioral categorizations, the issue of inter-rater reliability was not applicable.

Schedule of Park Visits

Regular visits to the parks were scheduled for a period of three weeks during the month of March. Visits were scheduled with the purpose of observing disc golf and identifying behaviors related to the game. On the average three to four visits weekly were scheduled to each of the three parks. Parks were visited on Monday, Wednesday, Friday, and Sunday during the first week of observations. During the second week visits took place on Tuesday, Thursday, and Sunday. The schedule for the third week was the same as the first week. The choice of visiting during the week and weekends helped eliminate any possible weekday or weekend variance. That is, this schedule ensured that if any particular disc golf groups were only visiting during the weekend, their behaviors were observed. The same rationale applied for any possible groups visiting only during the week or on certain days of the week.

The length of each observation session was two hours, which provided sufficient time to observe a variety of behaviors associated with the sport of disc golf. All visits took place during daylight hours, since disc golf courses did not have any lights installed to provide for playing in the dark. The time of the observations varied from park to park, however, visits to each park were scheduled during the same time of the day: mornings for Zilker Park, early afternoons for Pease Park, and early evenings for Mary Moore Searight Park. Since the purpose of the behavior observations at this stage was to observe disc golfers' behavior in general, the time variation among the observation

sessions in the three parks should not have distorted the data. Data could have been affected by the schedule if the purpose of the observations was to evaluate a specific behavioral intervention. But in this study the scope was not behavioral intervention. When interventions are implemented it is important to have some consistency in the schedule of visits. A total of ten visits were conducted in each of the three parks during this stage of the field observations. There was only one rainy day, during which visits were cancelled.

Analysis

The data collected through field observations were analyzed adopting the approach described by Werner and Schoepfle (1987). This approach consists of three steps of analysis: descriptive, focused, and selective. The data collected during the first phase of this study was analyzed using the descriptive approach. The descriptive analysis is useful when one has little knowledge about the particular social situation. The essence of the descriptive analysis is to point at the behaviors related to the phenomena of interest, which in this case was the sport of disc golf. This approach was appropriate since the researcher and the assistants had little knowledge about disc golf, although they occasionally have observed the sport being played.

RESULTS

A total of 14 behaviors related to disc golf were identified during the first phase

of this study and results are listed in Table 4.1. Selection was based on the judgment of the observer since the researcher could not find pre-established selection criteria in the literature. Only actual observed behaviors are included in the table. Some behaviors that might have been present are not listed if they were not observed. For example, although the players smoked, they were not observed throwing cigarette butts on the ground. On the other hand, some observed behaviors were not included if a connection with the game was not established. For example, players often took their T-shirts off during the game, but the researcher could not specifically identify whether this particular behavior was related to the sport or it occurred because the weather was warm.

Behaviors observed during disc golf
1. Smoking
2. Using the trash can as a target to practice
3. Hitting trees during the course of the game
4. Stretching
5. Drinking beer, water, soda, etc.
6. Dragging bags with disc golf equipment on the ground
7. Crossing the creek at places not designated for that purpose
8. Carrying a cooler
9. Trampling
10. Pulling a stroller with disc golf equipment
11. Throwing rocks at trees to retrieve discs
12. Using trees as targets to practice
13. Climbing trees to retrieve discs
14. Walking a dog alongside while playing
15. Crossing the creek at designated places

16. Carrying bags with disc golf equipment
17. Arguing and loud talking
18. Flirting
19. Showing off

Table 4.1: Behaviors observed during a game of disc golf.

During a game of disc golf, players were observed drinking, however, not eating. This seems normal since liquid intake is common during sport participation. Some players were observed eating before or after the game, but never during the actual game itself. Behaviors common to most park users such as walking are not included in the observations. However, highly specific behaviors such as the technique used before teeing off, when players repeatedly take a few steps back and forth at the same spot, which leads to trampling was identified as a behavior related to disc golf.

The behaviors listed in Table 4.1 represent behaviors observed during a game of disc golf. This however, does not imply that this is the complete list of behaviors that usually occur during the game. Depending on the course setting and golfers' personal characteristics, the list might differ in a different setting. For example, one might look at a disc golf course located in an area without a creek, or at a course where players are not allowed to have their dogs with them. Other behaviors such as walking to the car or eating a sausage were observed, but they were not related to the game and therefore not included in the list. After identifying the behaviors associated with disc golf, the next step in this study was to determine whether any of these behaviors could be linked to the

ecological degradation.

PHASE TWO - METHOD

Setting

The same three parks remained the sites for the second phase of this study. At this stage, however, assistants were no longer involved in the data collection, since the data collection was not as extensive as during the first phase.

Schedule of Park Visits

Regular visits to the parks were scheduled for a period of three weeks during the month of March and the beginning of April. Visits were scheduled with the purpose of observing the behaviors identified during the first phase of the study, and with the purpose of identifying whether some of them could be linked to the environmental problems associated with disc golf. On the average three to four visits weekly were scheduled to each of the three parks, with the visit distribution remaining the same as the one during the first phase.

The length of each observation session was two hours. All visits took place during the day, with visits to Zilker Park taking place in the morning, visits to Pease Park were scheduled in the afternoon, and Mary Moore Searight Park was visited in the evening. A total of eleven visits were conducted in each of the three parks during this stage of the field observations. There were no sessions cancelled because of inclement weather.

Analysis

During this stage of the field observations data were analyzed using the focused approach described by Werner and Schoepfle (1987). The aim of the analysis was to narrow down the broad list of behaviors related to disc golf to a list of behaviors that could potentially be associated with the ecological degradation. In order to provide for a more meaningful analysis, the researcher also engaged in a few casual conversations with some of the players. The purpose of the conversations was to gather more information about behaviors that seemed rather irrational. For example, before a throw a player would take about 6-8 steps back and forth, which would lead to trampling. The casual conversations helped to better understand the meaning and purpose of this behavior.

Results from an earlier study in this project focused on the ecological degradation due to disc golf, were used as the criteria to classify the behaviors as either potentially harmful to the environment or not. More specifically, each behavior was reviewed in relation to soil erosion and compaction, and in relation to vegetation cover, since increased soil erosion and compaction as well as decreased vegetation cover were the problems of interest associated with disc golf.

RESULTS

Based on the analysis, behaviors were grouped by the researcher into two different groups – behaviors potentially harmful to the environment and behaviors not associated with significant ecological degradation. The grouping was based on both a

rough estimate of frequency of occurrence and the level of ecological impact associated with the particular behavior as discussed in the analysis section. Table 4.2 represents the classification of the two groups.

Behaviors potentially harmful to the environment	**Behaviors not associated with significant ecological degradation**
Climbing trees to retrieve discs	Drinking beer, water, soda, etc.
Throwing rocks at trees to retrieve discs	Smoking
Trampling	Stretching
Using trees as targets to practice	Carrying a cooler
Hitting trees during the course of the game	Walking a dog alongside while playing
Dragging bags with disc golf equipment on the ground	Using the trash can as a target to practice
Crossing the creek at places not designated for that purpose	Pulling a stroller with disc golf equipment
	Crossing the creek at designated places
	Carrying bags with disc golf equipment
	Flirting
	Arguing and loud talking
	Showing off

Table 4.2: Group representation of behaviors associated with ecological degradation and behaviors not associated with significant ecological degradation.

An examination of the behaviors listed as not associated with significant ecological degradation could in fact raise some concerns. For example, one might think that having a cooler could be associated with some trampling effects. However, the design of the coolers that players carried with them did not have wheels and were not dragged on the ground; they were hand-held or carried over the shoulder, therefore did not have a negative impact. Another potential concern could be the behavior associated with pulling a stroller with disc golf equipment. Although the wheels have some impact

on the vegetation, when compared to the behavior of dragging heavy bags on the ground, the magnitude of the impact was minimal, due to the small surface area touching the ground and the fact that rolling is more forgiving than dragging. When looking at the list with behaviors identified as not associated with ecological degradation, one should keep in mind the criteria used to determine the essence and magnitude of the impact (i.e., significant increase in soil erosion and compaction, and substantial decrease in vegetation cover).

The behaviors listed as potentially harmful to the environment were associated with tree and vegetation damage, and with soil erosion and compaction. Although these behaviors were linked to the negative impact disc golf has on the ecosystem, some of them were to a certain degree essential to the game. The casual conversations with the players, during this second phase of the study, helped clarify the purpose and meaning of some of the behaviors. For example, taking several steps back and forth over the same vegetation area before a throw is associated with trampling. This particular behavior, however, was identified as intrinsic to the game, since it was associated with the specific technique of playing disc golf. Other behaviors such as hitting trees during the course of the game were rather out of the control of the players due to weather variables (e.g., wind direction and velocity). Such considerations would play an important role in the selection process described in the next phase of this study.

PHASE THREE - METHOD

Setting

The settings remained the same during this phase of the study and included all three parks: Pease Park, Zilker Park, and Mary Moore Searight Park.

Schedule of Park Visits

Similarly to the other two phases, park visits took place over a three-week period during the month of April. Visits were scheduled with the purpose of observing the behaviors associated with ecological degradation, and with the purpose of identifying which specific behaviors would be the target of the intervention program. On the average three to four visits weekly were scheduled to each of the three parks, with the visit distribution remaining the same as the one during the first and second phases of the study.

The length of each observation session was two hours. All visits took place during the day, with visits being scheduled at the same time of the day as the visits during the earlier phases. A total of eleven visits were conducted in each of the three parks during this stage of the field observations.

Analysis

During this stage of the field observations data were analyzed using the selective approach described by Werner and Schoepfle (1987). The aim of the analysis was to narrow down the list of behaviors associated with the ecological impact to a list of behaviors that would be the target of the intervention program. The analysis entails

contrasting behaviors in order to determine the pool of behaviors to be modified. The criteria for contrasting behaviors were based on the perceived magnitude of the environmental impact of the particular behavior. In addition to that, the purpose and the meaning the particular behavior had for the disc golfers were considered as well. Changing behaviors that are intrinsic to the game would lead to modifying the nature of the game, and would encounter considerable player resistance.

Although, a precise count of the frequency of occurrence of each of the seven potentially harmful behaviors was not conducted during this stage of the project, field notes indicated that climbing trees to retrieve discs, throwing rocks at trees to retrieve discs, and crossing the creek at places not designated for that purpose occurred on the average between one and two times during this phase. The remaining four behaviors occurred on the average five to seven times during any given observation session.

RESULTS

During the second phase of this study a total of seven behaviors were identified as behaviors potentially harmful to the environment. However, based on the analysis from the third phase, only four behaviors were identified as the behaviors of further interest. They were as follows: (1) dragging disc golf bags on the ground, (2) using trees as targets to practice, (3) trampling, and (4) hitting trees during the course of the game. In fact, only the first and second behaviors were identified as problem behaviors to be targeted by the intervention program, while the third and fourth behaviors were identified as problem behaviors to be used as comparative behaviors during the intervention. The rationale for

this choice was based on the fact that the third behavior was essential to the game, and the fourth behavior was to a certain degree out of the control of the golfers.

Trampling is defined as excessive walking (Cole, 2004) and does occur often during a game of disc golf, especially in the areas around the baskets and the tees. Trampling damages vegetation cover, displaces soil organic horizons as well as compacts soil (Liddle, 1997). Its usual occurrence was observed right before teeing off, when some players would take a few steps back and forth before throwing the disc. In fact, it occurs every time each player tees off, making it one of the most frequently observed behaviors.

Hitting random trees on and around the disc golf course happens as a part of the game due to weather conditions (strong wind) and players skills (accuracy of throw). Although the frequency of hitting trees during the course of the game could potentially be decreased by improving the disc golfers' playing skills, the weather factor will remain. The behavior is to a certain degree beyond the control of the players; consequently intervention measures will not be aimed at this behavior.

Each of the three disc golf courses had a practice basket located in close proximity to the starting tee, but at times the practice basket was crowded with many players trying to warm up and get ready for the game, which caused other players to use the surrounding trees as targets for practice. Repetitive hitting of the trees causes damage to the bark of the trees. Therefore, this behavior exaggerated the damage already caused to the trees from being unintentionally hit during the course of a game because of the accuracy of the players' throwing skills and/or strong wind. Because of its frequency of occurrence and its non-essential nature to the game, this behavior was identified as one that could be targeted for intervention.

The design of most bags had a strap to wear over the shoulder, but sometimes the bags were dragged on the ground instead of being carried over the shoulder. Bags were usually stacked with 10-15 discs (each disc weights on the average 160-180 grams), a bottle of water, a towel, and sometimes a fold-out chair and an umbrella. Dragging the bags on the ground causes further impact in addition to the impact from foot traffic.

Using trees as targets to practice and dragging bags on the ground were not identified as behaviors essential to the game. Therefore, logically the focus of any intervention program should be aimed at modifying the behaviors associated with environmental problems having a high frequency of occurrence, and not being intrinsic to the game.

DISCUSSION

The findings of this study suggest that some disc golfer behaviors are linked to the environmental problems associated with the sport. The questions to ask then is why such problem behaviors arise? What purpose do the problem behaviors serve? For example, the excessive walking that takes place before each throw is considered as a part of the technique used in disc golf and also serves the purpose of a ritual. As some players indicated during the casual conversations, this ritual distracts the golfers from increasing anxiety and provides them with a sense of control. Therefore, although a problematic behavior, the excessive walking before a throw, if changed might in fact modify the nature of the game.

The behavior associated with dragging heavy bags with disc golf equipment on the ground instead of carrying them over the shoulder could have contributed to the conditions causing a decrease in vegetation cover. This specific behavior did not serve any particular purpose essential to the game and could be possibly explained by laziness or by simply being tired. Therefore, dragging disc golf bags on the ground might be eliminated if golfers are aware of the consequences the behavior has on the environment.

Hitting trees during the course of the game is not something golfers do intentionally or have complete control over. However, an effort to improve playing skills and throwing accuracy could decrease the number of times trees are hit. Another behavior associated with tree damage is the use of trees as practice targets. Disc golfers need to spend some time warming up and practicing before they start a game. Usually it is achieved through the use of a designated practice basket in close proximity to the starting tee. Practicing throws before the game serves the purpose of a mental preparation for the game ahead because it is comprised of movements related to the game and it also increases the confidence level of the players. Although a potential solution to the insufficient number of practice baskets could be to install more baskets, funds for that purpose were very limited. In fact, the Austin Parks and Recreation Department did not have any funds for that purpose, since the management of the disc golf courses was left to the players themselves, as indicated during casual conversations with some of the players, and later confirmed by an employer of the Recreation Department. Therefore, increasing the players' awareness about the impact discs have on the trees had the potential to eliminate and/or decrease the occurrence of this behavior (Geller et al., 1982).

When analyzing problem behaviors associated with ecological degradation, it is important to note that desired environmental behaviors would differ based on the local ecosystem characteristics (Monroe, 2003). Therefore, future research should pay attention to those characteristics, and carefully analyze the factors affecting local conditions. Planners and managers need to consider the specific elements of the ecosystem when designing intervention measures, because not all desirable behaviors may be attainable when taking into consideration local characteristics. This will require an interdisciplinary approach based on the collaborative effort of scholars from different areas.

Environmental problems are not only associated with the nature of human behavior but also with the context of recreational use in which they occur. Therefore, as Stern (2005, p. 10785) argues, "The best way to change behavior depends on the behavior and its context", and that work on environmentally significant behavior should be a top priority for research. Future endeavors should explore the context in which behaviors occur, which could contribute to the design of effective interventions with long-lasting effects. It is essential that the effort to change the problem behaviors identified in this study does not alter the reason why people play the game of disc golf, and are consistent with the context in which the game is played.

While it is important to identify problem behaviors and to determine whether disc golfers recognize them as such, it is also important to look at the barriers for achieving the desired behaviors and the effort necessary to eliminate the problem behaviors (McKinzie-Mohr & Smith, 1999). A potential barrier identified for the behavior

associated with dragging bags on the ground, could be the weight of the bag. This, however, would be hard to modify by decreasing the weight of the bag since players carried many objects in their bags such as disc golf equipment, umbrellas, drinks, and small plastic chairs. Raising the players' awareness about the consequences of this particular behavior could considerably minimize the frequency of its occurrence. Using trees as practice targets, however, had a barrier arising from the insufficient number of practice baskets and the fact that players were not aware of the tree damage. Installing a few more practice baskets on the disc golf course could decrease the occurrence of this behavior, but financial resources were limited. Therefore, providing players with some knowledge about the potential damage this behavior has to the trees could decrease the likelihood of players using trees as practice targets.

In addition to identifying target behaviors and the barriers that golfers need to overcome in order to make the necessary behavior changes, it is also important to adopt an intent-oriented approach with the goal of determining players' beliefs and values (Stern, 2000). Therefore, the logical direction in which to start the search for solutions should be to identify whether any particular values have the potential to be used as the means to achieve the desired outcomes. Having a firm sense of the values and beliefs of the disc golfers could help us understand why they play the game and what they value about disc golf. Specific knowledge about the values related to disc golf can add in the search of the particular channels through which intervention should be sought (e.g., social marketing techniques, persuasive messages, visual versus verbal approaches) and can provide information about the willingness players have to commence the necessary

change. Conducting an ethnographic study of the subculture of disc golfers could provide this information and could offer some knowledge about the particular characteristics of the subculture, which in turn could explain some of the behaviors and assist in the design of the intervention measures (Bumstead & Boyce, 2005). In fact, as Berry (2000) points out that culture and human behavior are closely linked. In other words, cultural characteristics determine to a certain degree human behavior and in turn human behavior modifies cultural characteristics.

The following chapter describes the subculture of disc golfers and provides valuable information about their values and the cultural characteristics through which we can achieve behavior change.

Chapter 5: The Subculture of Disc Golfers

If you are a successful participant observer you will know when to laugh at what your informants think is funny; and when informants laugh at what you say it will be because you meant it to be a joke.

H. R. Bernard, 1988, p.148

In order to change human behavior, we have to motivate the process of change. This could be achieved through understanding the behavior as a manifestation of the variables related to the group's unique cultural characteristics. Cultural studies investigate the values, norms and beliefs of people and how they affect their lives (Kim & Sherman, 2007). Behavioral research acquiring cultural knowledge is crucial if solutions for sustainable development are to be found (Milfont, Duckitt, & Cameron, 2006). These efforts require a people-oriented approach and in depth knowledge about the values and beliefs of the specific culture and/or subculture. In fact, studying cultures has been identified as one of the vehicles for overcoming environmental problems not only at the local but at the global level as well (Vlek & Steg, 2007).

The study of subcultures and the practical importance of such inquiry have received considerable attention (Donnelly, 1981; Donnelly & Young, 1988; Wilbert, 1991). Subcultures provide the appropriate setting in which knowledge about members' characteristics could be enhanced (Wheaton, 2007). Shared values and beliefs cultivate shared experiences, social interaction, and mutual affirmation and support among

members. Thus, each subculture becomes a potential lever for shaping behaviors among those who identify with the particular subculture. Subcultures have proven to be successful in leveraging sport products and services to participants and fans (Green, 2001). In fact, social marketing techniques targeted at particular sport subcultures (cf. Andreasen, 2006) and interventions designed to modify the subculture (cf. Poole & Van de Ven, 2004) can be used to create desired norms and values.

Consumer behavior knowledge has been advanced by addressing the marketing relevance of subcultures, where cultural characteristics determine consumers' preferences, and in turn consumers are seen as cultural producers (Arnould & Thompson, 2005). Consumer culture research indicates that human activities based on consumption promote shared values and beliefs (Kozinets, 2002). Sport consumer subcultures have been studied with various objectives. For example, sport subcultures have been explored with the goal of understanding consumers and the way their lives are organized (Schouten & McAlexander, 1995), for the purpose of understanding sport tourism as the celebration of subculture (Green & Chalip, 1998), and with the aim of illustrating the marketing benefits which leveraging sport subcultures have on promoting sport events (Green, 2001).

Consumer ethnography explores the behaviors, attitudes and culture of a particular group to better understand what customers want and how they make their decisions (Zukin & Maguire, 2004). It has applications in the study of subcultures where consumer categories are created and strategies based on those segments are prepared. Indeed, ethnographic techniques have been successfully employed to study the marketing

relevance of subcultures in building brand community (McAlexander, Schouten & Koenig, 2002), to determine how consumer culture plays a role in forming collective identities (Zukin & Magiure, 2004), and to specifically study sport subcultures (Crosset & Beal, 1997; Schouten & McAlexander, 1995).

In addition to utilizing cultural knowledge for marketing purposes, such knowledge has been used to promote environmentally friendly consumer habits (Schuhwerk & Lefkoff-Hagius, 1995). Although cultural characteristics have received some attention as means to promote pro-environmental behaviors, they remain underutilized as a resource for initiating behavior change. Investigating the values and beliefs of disc golfers in relation to disc golf could provide understanding of the means through which behavior modifications could be achieved. Such knowledge is important because values and beliefs extend beyond the sport activity as they encompass matters linked to lifestyle, personal identity, and group membership (Trendafilova & Chalip, 2007). In fact, shared beliefs and values cultivate a common identity, which nurtures group effort (Brewer & Kramer, 1986; Kollock, 1998; Kramer & Brewer, 1984). Therefore, values can play an important role in behavioral changes in situations where collective action is necessary for achieving the desired behaviors.

Identifying problem behaviors associated with environmental degradation is a necessary but insufficient step toward finding solutions to environmental problems (Stern & Gardner, 1981). Knowing who the disc golfers are and understanding their beliefs and values is essential for the design of a successful intervention program. It is important to determine what players have in common and what values they share. Individuals who

can relate to each other and have similar values are more likely to act cooperatively toward a common goal (Sally 1995; Van Vugt, 2001). Therefore, exploring the various ways in which values and beliefs are expressed within the subculture of disc golf could prove beneficial in the effort to eliminate the problem behaviors associated with the sport. The ethnographic study presented in this chapter provides some useful knowledge about the world of disc golf.

METHOD

In order to understand the subculture of disc golf players, I employed the ethnographic method of being a passive participant. Ethnography is the traditional research method utilized for the purpose of exploring and describing groups and subcultures in their natural setting (Agar, 1996; Hill, 1993; Spradley, 1975, 1980). Ethnographic studies can provide some valuable knowledge and important insights into the behavior and experience of a particular culture (Agafonoff, 2006; Arnould & Price, 2006). The research method employed in the investigation of the subculture of disc golfers consisted of field observations and informal interviews as well as casual conversations conducted between March and August of 2007.

Setting

Before the start of this project, I was somewhat familiar with the sport of disc golf. I had visited disc golf courses in the past and had watched people play the game. I

began visiting Pease Park, Zilker Park, and Mary Moore Searight Park in Austin, Texas with the initial purpose of becoming more familiar with the environment and the players. My usual place for observing was by the starting tee. Sometimes disc golfers casually approached me and started a conversation, while other times I approached them and initiated a conversation. I was open about the purpose of my visits and the nature of my endeavors, and all players accepted me in a friendly manner. They were willing to help in any way they could. As they became more accustomed to my presence, they started introducing me to their friends, who were disc golf players too. They also started offering to let me borrow their disc golf equipment and to provide me free disc golf lessons. I was able to develop friendly relations with two of the players (one still playing and the other one retired) while still maintaining some distance, and recruited them as key informants. Both key informants were very helpful in introducing me to other players, thus making the initial contact between a female researcher and a predominantly male sport subculture much easier. One of the key informants let me borrow two disc golf magazines, so that I could learn about the sport from printed sources.

I also attended many of the mini-tournaments organized in the three parks on a weekly basis. Pease Park had weekly tournaments on Thursdays and Saturdays, Mary Moore Searight Park had some on Fridays, and Zilker Park had tournaments on Thursdays. Visiting the parks during these mini-tournaments allowed me to interact with competitive players in addition to the players who I had already interacted with during my other visits to the park. I either visited before the tournaments started or after the tournaments were over, which were more suitable times to talk to players, rather than

during the actual tournaments when everyone was focused on the game. My visits lasted for about two hours. There were no organized or informal social gatherings in which disc golfers participated, except for the social events that took place before and/or after mini-tournaments. During my fieldwork, the Waterloo disc golf club in Austin hosted the 17th annual Capital of Texas Open disc golf tournament, which is ranked among the top 50 tournaments in the United States, and I was able to interact with six of the players who came to compete in this tournament. I only observed the tournament for two hours on Saturday (the tournament lasted for three days).

I connected with disc golf players in all three parks with three purposes: (1) to engage in conversations, (2) to observe how the game is played, and (3) to look at the relationship between players and the environment. My main objective was to learn about the values, beliefs and feelings of the disc golfers about their sport and the surrounding environment. I was also interested in discovering if there was any discrepancy between the actions of the players and their understanding of the impact their sport had on the environment. I was curious to find out the disc golfers' willingness to make adjustments and modify behaviors in order to improve the condition of the park and the disc golf courses in particular.

Design and Procedure

In order to gather data and attain the above objectives, I took field notes, and conducted two informal interviews and numerous conversations (exact counting was not recorded), which occurred during the course of the observations. This provided for an

opportunity to create some personal involvement, which is critical in doing ethnography (Agar, 1996). The informal and unstructured interviews as well as the conversations were conducted with players available in the parks at the time of my visits, and varied in length depending on the time available to the players. Some conversations lasted only a few minutes while others were about 15 minutes long. Some of the conversations were on a one-to-one basis, while others were conducted in groups. The size of the group varied from two to eight players. The informal interviews and conversations were not structured and had a rather free-flow format. For example, some of the questions that I asked were: (1) How would you describe the community of disc golfers, (2) What are some of the reasons why you come to play in this park, (3) What do you find attractive about disc golf, and (4) What is the purpose of the few extra steps players take before a throw. Informal interviews and conversations were not recorded on the spot; however, notes were written up as soon as I got back to my car in the parking lots of the parks. This provided for avoiding memory errors. All interviewees were assured that their anonymity would be protected. The identities of the players were kept confidential and no indicators were recorded that could lead to personal identification. I was the only person who had access to the data.

I did not participate in the game. Most of the times I set in the area of the practice basket and around the starting tee, since these were the locations with the largest number of players where social interactions took place. On a few occasions I followed the players to learn about the specific obstacles on the course, and how players approached them.

Analysis

My field notes contained my own reflections about what I had observed on the courses as well as players' quotes. The data based on the informal and unstructured interviews and conversations were analyzed for themes and patterns and were coded using standard protocols for analysis of qualitative data (Sands, 2002; Spradley, 1980). Notes and quotes I had written down were read numerous times and each time emerging patterns and cultural themes were recorded. Themes were data driven; they were inductively discovered from the raw information. The analysis was conducted after all data were collected from the interviews and conversations rather than analyzing them on a daily and/or weekly basis. This prevented me from being biased in the identification of new themes and from the premature confirmation of existing ones (Bryman & Burgess, 1994). Based on the identified patterns, five themes gradually emerged. The first theme, lack of knowledge and awareness about the surrounding environment and the damage the sport of disc golf causes, was not directly linked to values of the subculture of disc golfers. However, it deserves some attention, because it indicated that increasing the knowledge and awareness about the relationship between the environment and the consequences of playing disc golf could contribute to achieving the desired behaviors. The second theme, sense of ownership and attachment to the park players play in, was linked to the high value golfers placed on the park and the sport. The third theme, willingness to donate time as volunteers to maintain disc golf courses and keep disc golf as a recreational sport, was linked to the sense of ownership and the value players placed

on the socializing that took place at the course. The fourth theme, family and fun oriented atmosphere, provided valuable information about the value disc golfers placed on the time spent together and their perception of the park as their home. The last theme, male dominated sport, offered some insights about a subculture dominated by males and about the effect of the behavior of the golfers on female players. The first theme split into two branches: tree damage, and soil erosion and compaction. The second and third theme had some common characteristics, which are discussed in the results section.

RESULTS

Before a detailed discussion of each of the identified themes, I present a brief description of the disc golf players, based on my field observations and interactions with the golfers. Knowing who these individuals are would assist to better understand the emerging themes.

The Subculture of Disc Golfers

A concise way to describe the subculture of disc golfers to the unfamiliar reader would be by presenting this extract from the researcher's field notes:

> There were 15 players who all appeared Caucasian, except for one who appeared to be Hispanic, and 12 of them were not wearing shirts. Some wore denim or khaki shorts, others wore denim jeans. It seemed like they did not care much about their appearance since some of them had their shorts and/or jeans pulled down quite a lot. They were all males, and some had cans of beer in their hands, while a few others were smoking. They appeared to be in their early- and mid-twenties. Some were talking

> loudly and even using foul language that I could hear from where I was sitting. There was not a single female player out there. Each player had a bag with disc golf equipment and more than half of them carried a cooler. Some wore tennis shoes, some wore hiking shoes, and some simply wore flip-flops.

As this extract indicates, the subculture of disc golfers is predominantly male. Players had very casual appearance with the majority of them not wearing shirts regardless of age and physique. A large number of the disc golfers smoked and drank beer while playing and/or socializing with other players. Players usually carried bags filled with discs and in some instances small coolers containing drinks. In rare cases some golfers had their dog walking alongside.

Having these initial observations and impressions about the disc golfers, one might expect that they would show some resistance to outsiders. My personal experience proved exactly the opposite, although I was a female researcher in a male dominated subculture. Players were friendly towards me regardless of whether I was there to simply watch them play or I wanted to learn how to play the game. They were interested in getting to know me as much as I was interested in getting to know them. I received a surprising response from the players when I told them that I am a foreigner and was born in a small country in Europe – they wanted to learn about my country and how to say "cheers" in my native language (Bulgarian). After teaching them how to say "nazdrave" (Bulgarian for "cheers"), they would greet me with it every time I visited the group.

Disc golfers presented themselves as laid back and outgoing. They seemed friendly to the outsider and easy to approach. Starting a casual conversation with them

was not a problem regardless of whether one had any knowledge about the game. Players were in general cooperative and eager to provide information.

Now I return to the themes recognized in the data analysis and a discussion of each follows:

Lack of Knowledge and Awareness

The words of most disc golf players in the study seemed to indicate that the players were not very aware of the damage they caused to the surrounding environment through playing their sport. Since they interact so closely and frequently with nature, one would logically expect them to be much more aware of the impact of their actions on the ecosystem. However, field observations and notes from interviews and conversations indicated that this was not the case. The following discussion focuses on three particular environmental issues – tree damage, soil erosion and soil compaction. I first focus on the tree damage and the way players felt about this issue.

Tree damage. Due to the essence of disc golf and considering the environment in which it takes place a concern is the tree damage caused by discs when they hit trees during the course of a game. This leads to damage to the bark of the trees, which eventually destroys the tree. In fact, The Environmental Committee founded by the Professional Disc Golf Association suggests using stakes to protect the tree trunks and sensitive trees and shrubs. All three disc golf courses, the focus of this study, were located in areas with many trees, since the presence of trees makes the game more interesting and challenging for the players. Due to the nature of disc golf, players' skill

levels, and weather conditions (e.g., wind velocity and direction), discs frequently hit trees. This, however, did not seem to bother the players. In fact, when a player with a few years of disc golf experience was asked what his thoughts were about tree damage in the instances when discs hit trees, he replied:

> Yeah, those trees have seen a lot of hits but they're pretty tough. They're oak trees and oak trees don't die that easily. They may look like they're in bad shape but they're not.

Similarly, another player stated:

> I think most of those trees are cedar trees and they're supposed to be pretty sturdy. They won't break that easily.

Both interview excerpts clearly show the lack of knowledge and awareness among players about the ecological damage to the trees as a result of playing disc golf. A second point that stands out is the lack of knowledge in identifying the tree species in particular. It is evident how some players thought trees were oak, while others thought they were cedar. This indicates the confusion players had about the tree species in the park.

During one of the visits to Zilker Park, two players were observed playing very competitively and hitting the trees very often, and after one strong but unsuccessful throw of the disc one of the players hit a tree and commented:

> I don't care if I break the trees; that's how it goes.

The statement above is also an indicator of how players perceived hitting trees as a part of the game, thus seemingly placing more importance on the game rather than on the

environmental consequences of their actions. In another instance, when I asked a player why he thought that hitting the trees with the discs does not affect the trees, he replied:

> I don't think the disc can damage the tree unless you keep hitting the tree at exactly the same spot or unless the tree is hit from all directions. No, I don't think it's damaging to the trees.

Similarly, a long-time disc golfer was convinced that trees are pretty tough and are barely affected by the discs:

> Yeah, sometimes a disc will hit a tree, but I don't think it's that bad. To be honest I have never seen a tree being knocked down by a disc [laughs].

This quote illustrates that disc golf players acknowledge the fact that trees are hit, but at the same time they are not convinced that this is damaging the trees.

In my attempt to better understand why disc golfers did not find tree damage to be a big issue, I asked a player what his thoughts were about the collision between the disc and a tree. He answered that his discs have lasted for years, and whatever material they are made of, they do not break. He also pulled about ten different discs out of his bag and started hitting the ground really hard to show how durable they were. His actions indicated that the player was more concerned about his discs rather than about the tree damage caused by the discs. To him, damage was more associated with the discs rather than with the trees.

In Pease Park, a tree has a trunk that branches and a disc golf basket is located right at the center of it. When asked whether or not this was bad placement of the basket since the likelihood of hitting the tree is very high, a player replied:

> Well, actually because of the location of that basket, in the middle of the tree, it makes it easier to get the disc in. All you need to do is to aim at the

> tree and if the disc hits the tree it bounces back and falls into the basket, so it's kind of an advantage that the tree is there.

Again, this quote shows that players were more concerned about the game and the factors affecting the outcome of the game than about the environment. This also indicates that golfers focused on disc golf and ignored the preservation of the environment in which the sport takes place.

During field observations, I noticed that some players used the trees as practice targets when the designated practice baskets were too crowded, meaning too many players were practicing at them. While interviewing a long-time disc golf player, I asked if using trees as practice targets was something common in disc golf. The response I received was as follows:

> Sometimes, when there are not enough baskets to practice, we'll tie a ribbon around a tree and use it as a practice basket.

The above quote illustrates the fact that players found this damaging practice to be considered something normal and a part of the game.

For some players the fact that they have been playing for many years and were visiting the park on a regular basis made them believe that they have a solid knowledge about the environment. According to a veteran player, trees were not dying because of the hits they get from the discs but because of the ball-moss growing on the trees. When I tried to explain to him that in fact ball-moss is not a parasite sucking nutrients out of the trees, he refused to agree and insisted that his personal experience and observations showed otherwise. This shows the resistance some players had towards accepting the impact disc golf has on the surrounding environment. The general population of disc

golfers was lacking the knowledge and awareness about the actual damage their actions caused to the trees.

Soil erosion and compaction. There have been some disturbing concerns about the condition of the soil in places where disc golf is played (Estrella, 2005; Gascoyne, 2005; LeBlanc, 2006; McCaughan, 2004). High foot traffic, associated with disc golf, leads to soil compaction, which in turn leads to destruction of plants. The lack of vegetation cover favors conditions for soil erosion. In fact courses in California have been closed due to soil erosion. Disc golfers showed a lack of knowledge and awareness about the condition of the soil in the parks where they played and more specifically soil erosion and compaction. Although a natural process, soil erosion is increased due to the essence of the game, because as part of the game most players take a few steps back and forth before throwing the disc. These extra steps cause vegetation damage, which in turn leads to soil erosion and compaction problems. When a golfer was asked how he felt about the condition of the soil in the park and particularly about erosion, he responded:

> Erosion is a natural process and this is a flood zone and has been a flood zone for many years…it is not the disc golf that causes erosion…it is the flooding that takes place here…and yeah, there maybe some problems with trampling, but it is not that bad.

His response indicates that he refuses to acknowledge human impact on the soil. To him, whatever causes the soil erosion is due to Mother Nature and not humans. Similarly another player seemed to be convinced that erosion has been there for years and that the introduction of disc golf to the park did not amplify the problems:

> Since the park opened we had soil erosion problems…it is not because of the disc golf…we always had erosion problems.

During the course of the field observations some disc golfers were noted to drag their heavy bags filled with equipment on the ground instead of carrying them over their shoulder. Although seemingly harmless this behavior causes additional impact on the vegetation and therefore more soil compaction problems, which in turn leads to a decrease in the vegetation cover and ultimately to soil erosion. When a player was asked about this particular behavior, his response was:

> Well, the bags are kind of heavy, but they are not that heavy…and it is not like a 300-pound person walking [laughs].

Interestingly some players acknowledged the soil problems, but attempted to blame other users for the erosion and compaction:

> If it wasn't for all the other people using the park…like people jogging, walking their dogs, riding their bikes, you know…even riding their horses…yeah, there was a guy that sometimes rides his horse in the park…I don't think we would have had these soil erosion problems.

It is apparent how golfers would either deny that their sport causes soil problems or would try to look for some other explanations unrelated to the game of disc golf. This could be explained by the fact that for the most part soil erosion and compaction are not immediately visible. The problem with this type of environmental degradation is the time lag between the time of the actual damage and the time the damage has been detected, which makes the impact not immediately tangible. People in general tend to notice sudden changes in the surrounding environment much easier compared to changes that occur slowly and incrementally over time.

Sense of Ownership and Attachment

Although the three parks are managed and maintained by the Austin Parks and Recreation Department, the disc golf courses are not managed by the city, and government funds are not allocated for the management and maintenance of the courses. This leads to the disc golfers being responsible for the management of the courses, which in turn leads to the development of sense of ownership and attachment to the park. As one player said:

> This is our home. This is our park. We take care of it.

Similar feelings were expressed by another player:

> We love our park and the course here and we really don't like other people walking on it because it's interfering with the game and it's dangerous.

The above response also indicates that golfers did not welcome other park users on the disc golf course. This could be because the park has a designated area for other outdoor activities such as trails for walking dogs and riding bicycles, and having people walking on the disc golf course could in fact interfere with the game and in some instances be rather dangerous.

When players were asked how the disc golf community manages to keep the courses and to maintain them, a veteran golfer replied:

> Players donate money and buy the baskets. The city does not buy them. We love this park and we don't want the city to do anything even if something breaks. We take care of the course and we organize volunteer days.

This excerpt indicates the strong feelings players had developed about the park and the disc golf course in particular. It also shows how the sense of ownership and attachment

has led to golfers willing to volunteer their time in order to keep the course well maintained. They seemed to enjoy the responsibility of being in charge of the course.

Willingness to Volunteer

Closely related to the sense of ownership and attachment was the golfers' desire to donate time to keep the disc golf courses in good condition. During the course of this study I was able to visit one of the parks on a day scheduled for some volunteer work. Workers were provided with food and drinks as well as with some of the necessary equipment to clean the disc golf course. When asked why they volunteer, a golfer responded:

> Well, because this is my park and I play here and I like it a lot, and you know, because no one else will do it, no one else really cares. It's good for the community…players clean up the park.

When asked how many people usually respond to a volunteer day, a player answered:

> Many people come to help. We have had about 100-120 volunteers sometimes.

I was interested in finding out what exactly the process of recruiting volunteers was and how the players managed to organize such an event. Interestingly, the experience of another player indicated that the number of volunteers is not always large and that at times only a few golfers show up:

> Usually when we decide to have a volunteer day we start telling people three weeks prior to that day and we don't call people or e-mail them. It's more like word-of-mouth. Last time we had a volunteer day there were only eight or nine people that showed up but we all stayed until we got the work done, and there were three people that weren't even disc golf players…but you know, they were friends of some of the players.

During a conversation with a player, he pointed out that although the general impression might be that the city is taking care of the disc golf courses, it is actually the golfers who volunteer their time and spend hours beautifying the courses:

> The volunteers are actually the ones doing the work. They move and install the baskets. They spread out the mulch in the park. They spend many hours working hard…Oh, they are fanatics!

This excerpt also indicates the high level of commitment players have towards keeping the courses well maintained and their strong dedication to invest time and effort in that process.

Other players indicated their willingness to volunteer time as well, but at the same time they expressed unwillingness to help with the maintenance of the disc golf courses located in other parks:

> I like volunteering but I will not go and volunteer at Pease Park because this is my home. This is my park. I'm not going to help them clean up their shit.

It is evident how the sense of ownership and attachment plays a role in the desire to volunteer.

Although the Austin Parks and Recreation Department is not in charge of the disc golf courses around the city and does not allocate money for maintenance, a friendly relationship exists between the golfers' community and the Parks and Recreation Department as indicated by the following statement:

> It's actually us, the Waterloo Disc Golf Club, that manages the disc golf course in the park, but the city helps us organize tournaments. Look, they made these signs for the upcoming event next week, and we're having a volunteer day tomorrow to get the course ready for the tournament.

Based on my personal observations and casual conversations with the players it seemed like the relationship between the sense of ownership and attachment and the willingness to volunteer was reciprocal. The more golfers developed sense of ownership and attachment to the park and course they played at, the more they were willing to devote time and sources to keep the courses well maintained. The more time they spent taking care of the courses, the stronger their sense of ownership and attachment became.

Family and Fun Oriented Atmosphere

To the disc golf players, family atmosphere was not necessarily associated with the traditional family with children; it was rather associated with the closeness among the players and the friendships they have developed through the game of disc golf. Players enjoyed the time spent together not only playing disc golf, but also socializing with other players. When asked what they like about disc golf, some of the responses I received were:

> It's fun, it's free and it's great to be outside.
>
> I do it casually. It's just a lot of fun.
>
> Anyone can do it. It beats the hell out of sitting at home.

The above statements indicate the enthusiasm players feel about disc golf due to the fact that it takes place outside, it is free and fun, and does not require any special skills.

For some other players going to the park and playing disc golf was still a family recreational activity in the traditional sense as it could be seen from the quote below:

> I come here with my kids...they absolutely love it…Homeless people aren't hanging out in the area as much as they used to…it's because the area is thick with disc golfers now and it's like…you know…we are a family.

A close examination of this extract also illustrates the credit golfers assign to themselves for running away the homeless people from the area, thus making it more family attractive.

There was general agreement among players that disc golf offered the family type of environment, where one could not only go and play the game, but could also socialize with others while having a drink or two, forgetting about daily problems. For one player, disc golf had even more special meaning as it could be seen from the information he shared with me:

> Disc golfers are like one big family. I actually met my wife of 8 years playing on a disc golf course. Now together we are playing disc golf.

The analysis above is certainly consistent with my own observations and experience with the population of disc golfers. They all seemed to enjoy the social experience through the sport and the opportunity to get together either to play or simply to spend some time with friends. To them disc golf was not purely an outdoor activity; it was a close family where one could feel comfortable and relax.

An interesting observation related to the family oriented atmosphere experienced by disc golf players was the fact that the majority of players were male. Although society associates the traditional family atmosphere with members of both genders, sport historically has been associated with male dominance and viewed as an arena for developing masculinity. This association, however, has been linked more with organized

and competitive sports and not as much with recreational sports. Therefore, the gender issue in disc golf deserves some attention.

Male Dominated Sport

Considering the relative simplicity of disc golf and the inexpensive equipment required to play, one would expect that the sport would be popular with people from both genders. After months of fieldwork and observations, I was surprised to see only a few females playing the sport. When a male player was asked whether he had seen females play, his response was:

> Well, women play too, but not as many as guys. Actually a couple of weeks ago there was a big only women tournament, but I can't remember the city. They had a lot of really good players there, all women.

For the most part male players agreed that disc golf is not as popular for females as it is for males, and when challenged to speculate with an explanation for that fact, a long-time player suggested:

> Hmmm, there are a few sometimes, but I guess they play somewhere else or close to where they live.

Another golfer offered a different explanation:

> Girls are not that physically strong and skillful as guys are, but we have seen a few girls play.

Similarly a female player remarked:

> This is my second time playing with my husband, but I am not doing very well [laughs]…I can't throw as far as the guys…so, I guess I should bring my camera next time and just walk around and take pictures.

While the above excerpts suggest the physical difference as the apparent reason why

females do not play disc golf as much as males do, interestingly, a male player suggested a psychological reason:

> Girls are intimidated by the guys and that is why there are not too many girls playing the sport.

I was able to interact with some of the female players I met during the course of this project and was surprised to find out that some felt the same way as male players did about the small number of females participating in disc golf. The quote below illustrates this similarity:

> Girls don't play much the sport, because they are not that strong and can't throw that far.

Another female golfer offered a different answer to my question why disc golf is not that popular among them:

> Girls are more impatient than guys and they tend to quit quickly if they are not getting better and improving. If you see a few girls around the disc golf course, it is because they are carrying their boyfriends' coolers [laughs]…and not because they are playing.

Although the population of male golfers considerably outnumbers the population of female golfers and there were some feelings of discomfort on the side of the females participating in a male dominated sport, it seemed like the relationship between the two genders was hospitable and amicable. The following extract illustrates that:

> It's a male sport and girls don't feel comfortable…but I have seen guys trying to teach girls how to play and usually they [guys] are very encouraging and nice.

A veteran male golfer expressed an interesting opinion about the low number of females playing the sport:

> Girls are discouraged to play, because the guys who teach them how to play don't know how to explain the game to them…they [guys] maybe good players, but don't know how to coach disc golf.

My own observations about disc golf being a male dominated sport are supported by the statements from both genders as well as by data from the Professional Disc Golf Association. According to the available data, females represent only about 8% of the disc golfers' population whereas males are about 92% (Professional Disc Golf Association, n.d.). The gender issue in disc golf raises interesting questions about this emerging sport, its construction, and the ways it might be reinforcing gender differences. While on one hand it seems that the male population of golfers is fairly convivially oriented towards the female population, on the other hand females feel somewhat uncomfortable and are hesitant to join the sport.

DISCUSSION

Although the gender issue in disc golf will not be used in the design of the intervention program for behavioral change, it deserves some attention. The topic of sport in relation to the construction of gender has been widely discussed (Curry, 1991; Messner, Duncan, & Jensen, 1993), but the focus has mainly been on organized and professional sports. Newly emerging sports such as disc golf, in-line skating and mountain biking have received little attention (Anderson, 1999). Exploring further the nature of the relationship between genders could deepen our understanding of the social ties and friendships developed through participation in disc golf and the different values males and females place on them. Analyzing the gender issues in disc golf could

contribute to the understanding of some of the underlying principles that influence gender construction and reinforce notions of gender differences. This is important because new and emerging sports such as disc golf could be sites for the construction of masculinity, similarly to organized sports, where beliefs of gender differences are reinforced. This assumption is supported by Anderson's (1999) study on the subcultures of snowboarders.

Current findings about the subculture of disc golfers do not imply that the subculture will not endure any gender changes in the future. In fact, male dominance may be a temporary phenomenon and the number of female participants may approach these of male in the near future. A comparison with the history of snowboarding, another outdoor recreational activity, which emerged in the late 1960's and early 1970's (about the time disc golf was born), reveals a similar pattern in gender participation. Snowboarding started as a male dominated sport and it was not until a few years ago when the female phenomenon in snowboarding was recognized (Thorpe, 2005). It is possible that disc golf is still in transition from being an apparently male dominated sport to being equally enjoyed by both genders. Perhaps a historical trend analysis of different outdoor recreational sports would be beneficial for better understanding of some of the gender tendencies.

Based on the findings about the gender issue in disc golf and the lack of awareness about the consequences some behaviors had on the environment, one could make an interesting case for further investigation. In fact, these two issues show some common trends. For example, to an outsider the behaviors of the disc golfers do not seem to be inviting, especially to the opposite sex. On the other hand, the analysis of the

gender issue indicated that male players were excited about having females play along, and were willing to offer help in teaching the rules of the sport. Female players indicated that although they felt intimidated by the predominantly male presence in the sport, they felt very welcome when trying to learn how to play. This could indicate that male golfers might not be aware of the consequences of their behaviors not only on the environment, but also on the people watching them play. In both instances the outcome is a rather negative effect contrary to the desires of the disc golf players.

The results of this study suggest that the sport of disc golf attracts participants because it not only provides the opportunity for the players to play a sport they enjoy, but it also provides an environment for social interactions. Disc golfers seem to seek more than simply participation in a recreational activity; they seek the social atmosphere associated with disc golf and the friendship with other players. Being a member of the disc golf subculture provides a sense of community, which is highly valued among players. These findings are important because they provide insight into the meaning disc golf has for the players. Results are consistent with other work on sport subcultures indicating that participating in sport provides for more than simply the opportunity to play (Green & Chalip, 1998). When designing an intervention program for changing the problem behaviors, emphasis should be placed on the value disc golf has as an environment which provides for social interactions and community development.

The community of golfers appeared to value the time spent together having fun as a group and the friendships they developed, which in turn developed the feeling of belonging to one big family, as it could be seen from the following quote:

> We are like a family…have you seen the show Cheers...yeah…we are like the people in that show. I could have gone to the gym, but I decided to come here and relax and spend time with these people…they are my family.

Similarly another player shared:

> This is a social get together for us…we have been doing it for 14 years and we absolutely love it…this is our family…it is a family atmosphere…we drink and we talk.

Disc golfers valued the socializing that takes place in the park and the family oriented atmosphere. The family oriented atmosphere could have contributed to the interpretation of the park as their home. This in turn, led to the golfers' willingness to protect their home (park) and to donate time and resources in order to continue to provide for the conditions necessary to play the sport.

The population of disc golfers was very diverse and laidback, and did not express adherence to any strict norms of conduct. I did not encounter at any time during my observations any form of policing of undesirable and unacceptable behaviors. It seemed that "anything goes" was the accepted rule. Individuals were never encouraged or discouraged to act in a certain way, and this also applied to environmentally damaging behaviors.

The majority of golfers were not aware of the ecological impact disc golf causes on the surrounding environment and the specific behaviors associated with this impact, but the strong attachment they had to their park and the disc golf course in particular has the potential to be used in the design of behavioral interventions. The work of Ryan (2005) on public attachment to urban natural areas supports this view. It is believed that

people with a strong attachment to natural areas have the potential to promote stewardship for natural area preservation. This notion of place attachment could be incorporated into the design of a campaign aimed at modifying some of the problem behaviors associated with the negative impact disc golf has on the environment.

The issue of strong attachment to the park is related to the high value players placed on disc golf and the park (the disc golf course in particular), and in return the high value placed on the sport contributed to the attachment. While attachment could be used as lever to modify behaviors, its power is rather weak when compared to the power of value. Even though strong attachment to the park could motivate players to donate time and resources to maintain the disc golf course, the high value placed on the sport and the park as their home has a greater potential for influencing behaviors.

Disc golfers indicated the value they place on being outdoors and on the natural environment. One would then expect that they would have a better understanding of the consequences of their actions on the surrounding environment. As it turned out a strong false belief was prevalent among them that their behaviors, such as dragging bags on the ground and hitting trees with discs, could not possibly lead to ecological degradation. This belief plays a key role in resolving a contradiction that would otherwise arise between the value they place on the park and the value they place on the game of disc golf. For example, tree targeting during warm-up, which involves repetitively hitting the trees, is not an indication of a lack of environmental values if the player does not perceive this behavior as harmful to the tree. Therefore, disc golfers are not facing the dilemma of choosing one value over the other if playing the game is not in their eyes at the expense

of the park.

One can see the critical part played by the lack of awareness among most golfers about the consequences their sport has on the surrounding environment. A variety of different approaches, however, such as prompts, modeling, and rewards exist and have been proved to be effective in the effort to increase environmental awareness (Lehman & Geller, 2004). The work of Stern (2005) on environmentally significant behavior suggests that increasing individuals' awareness about the consequences of their actions on something they highly value could in fact motivate people to make behavioral changes.

Disc golfers expressed a strong sense of ownership of the park they play in, which in turn was tied to their willingness to invest time and resources to keep the sport in the future. This in turn has implications for managers, pointing at the importance of knowing the values of park users and their perception about the surrounding environment, which could contribute to better understanding of the human-nature relationship (Sasidharan, 2002). Knowledge about this relationship and the values of the recreationists could make program planning for management of natural resources more effective and efficient. It could also contribute to the development of intervention measures for achieving the desired behaviors by emphasizing the sense of ownership disc golfers have about the park and by emphasizing the importance of their effort in preserving the sport of disc golf.

The significance and utility of the disc golf subculture (and subcultures in general) is expressed in its power of explaining certain behaviors, which in turn could

contribute to establishing and modifying behaviors necessary for sustainable sport. The utility of the subculture depends on the depth of our knowledge about the way the subculture evolves and changes over time. Although the study of subcultures has a long history, the work presented in this chapter calls for a revised approach to the study of sport subcultures. More particularly, in the past sport subcultures have been studied with the main purpose of leveraging sport events (Green, 2001), learning more in depth about spectators and consumers' characteristics (Wheaton, 2007) or with the purpose of understanding deviant behavior in the sport context (Sugden, 2007). While such endeavors have substantially contributed to the theory of subcultures and in particular sport subcultures, the potential sport subcultures have for addressing environmental problems in the sport context has been underutilized.

The challenge for the future would be to find ways for fostering maintenance of desired environmentally friendly behaviors over a long time period, thus producing lasting behavior change based on intrinsic motivation and shared subcultural values. Interventions could be designed to modify the subculture and create the desired norms and values. Shared norms and values cultivate a common identity, which nurtures group effort (Brewer & Kramer, 1986; Kollock, 1998; Kramer & Brewer, 1984). The challenge then is to formulate interventions that can socialize participants (and, where appropriate, spectators) into the desired beliefs and values, and to use those beliefs and values to prompt environmentally friendly behavioral norms. In order to formulate interventions, sport subcultures and variations among them must be better understood. Evaluation of interventions based on that knowledge can test resulting theories about subcultures in

sport and the relations between subcultures and environmental consciousness, and what is learned in the sport context may even have value in other settings.

Chapter 6: Intervention for Behavioral Change

The investigation of the subculture of disc golfers clearly indicated that players were lacking knowledge about the negative consequences playing disc golf had on the environment. This finding calls for an educational approach to address the problem. Different approaches have been used to increase environmental knowledge such as written or verbal messages, television commercials, demonstrations (Geller, 1992) but the choice for this study was a prompt in the form of a brochure. Prompts have shown to be successful in promoting environmental behaviors under the following conditions: (1) when the desired behavior is specified, (2) when the prompt is placed in close proximity with the opportunity to emit the desired response, and (3) when the desired behavior is relatively convenient to emit (Geller et al., 1982). Care was taken to ensure that all three conditions were met in the intervention strategy.

While providing relevant information is one of the most widely used means to promote pro-environmental behavioral change, because it increases problem awareness (Staats, Harland & Wilke, 2004), research also indicates that educational approaches are not necessarily effective in promoting environmental behaviors (Zelezny, 1999). It is believed that education could be a successful strategy in this study since the main barrier for achieving desired behaviors among the community of disc golfers was the lack of

awareness and knowledge. Previous work has suggested that human behavior modifications to achieve environmental sustainability can be accomplished by addressing individual and group knowledge about the environment through information strategies (Vlek & Steg, 2007).

Hungerford and Volk (1990) identified three categories of variables that contribute to pro-environmental behavior: entry-level variables, ownership variables, and empowerment variables. Entry-level variables include such variables as environmental sensitivity and knowledge. Ownership variables include understanding of the environmental problems and identification with these problems. Empowerment variables give individuals the sense that they can make a change and contribute to resolving the environmental problems. A well thought out intervention program should include all three variables in order for the intervention to be successful. Therefore, our call for behavior change should address the particular form in which such variables are expressed within the subculture of disc golfers.

Behavior change is most effectively achieved when barriers to the activity are identified prior to the design of the intervention (Kassirer & McKenzie-Mohr, 1998; McKenzie-Mohr, 2000). In the specific case of disc golf, the major barrier was the lack of awareness and knowledge about the environmental consequences of playing disc golf. Therefore, finding the appropriate channel for distributing valuable information to the disc golfers about the relationship between the environment and their sport should serve the purpose of eliminating the barrier to achieving the desired behaviors.

Programs to foster sustainable behavior usually include a communication component. The impact of communications upon behavior can vary dramatically based upon how the communication is developed and what kind of message is used. For a message to be effective it needs to introduce new information into the individual's old cognitive structure. In general, two-sided messages have an effect on people who are knowledgeable about the topic, whereas one-sided messages have an effect on individuals who are less knowledgeable (Cushman & McPhee, 1980; McKenzie-Mohr, 2000). Disc golfers were not aware of the environmental consequences disc golf had on the surrounding environment; therefore, the intervention effort incorporated a one-sided message.

Another important element in the design of a persuasive message is to ensure that the message does not portray a fearful situation. People in general do not like to think about fearful situations and sometimes they tend to deny a message based on such information (Oskamp, 2000). In fact, the work of Durdan, Reeder, and Hecht (1985) on antilittering indicates that positively worded messages are more effective than negatively worded ones. Also, previous work shows that people remember specific, clear and concrete information best (Costanzo, Archer, Aronson, & Pettigrew, 1986; Geller et al. 1982; Oskamp, 2000). Messages that make specific and concrete recommendations are expected to be more effective because they appear simple to the individual and are easy to perform. The work of Pratkanis and Greenwald (1993) on persuasive communication supported this view and also pointed out the importance of the message being positive and well-placed. It is essential to place the message close in space and time to the

behavior, otherwise the message may not be remembered and may not trigger the desired behavioral modification.

The challenge with environmental problems, however, is that they are large in scale and people feel like they can do little on their own. What hinders the success of behavior interventions is that the majority of the environmental problems are difficult to quantify and the common belief is that there are no immediate solutions. Work on environmental communication appeals shows that the message should clearly indicate the belief that players can and have the resources to solve the problem, thus pointing to the significance of the individual action (Obermiller, 1995). This is consistent with the empowerment variables described by Hungerford and Volk (1990) which are essential for the achievement of pro-environmental behaviors.

Results from previous studies indicate that the type of information that is useful for behavior change is the type that focuses on long-term effects (Stern, 1976; Thompson & Stoutemyer, 1991). It is critical that the message captures the attention of the targeted audience. The targeted audience not only needs to be aware of the link between the undesired behavior and the specific ecological problem, but also needs to be aware of the appropriate ways of behaving so that the problem can be avoided.

Three key points are crucial for the success of the intervention program:

1. Ensuring that individuals can see the link between inappropriate behaviors and the specific environmental problems associated with disc golf.
2. Designing a clear message pointing out the desired behaviors that will

lead to a decrease/avoidance of the problems.

3. Promoting a sense of commitment among recreationists.

Following these guidelines and emphasizing the significance of the individuals' contribution increases the probability of an intervention program to succeed and to have a long-term effect (Stern, 2005).

METHOD

Design and Procedure

The first step in designing the intervention program for behavioral change was to identify the target behaviors and to record the frequency of occurrence of these behaviors. This enabled the researcher to obtain an objective record of the target behaviors (dragging bags on the ground and using trees as practice targets) before the intervention program was actually implemented. The same procedure was followed for the comparative behaviors (trampling and hitting trees during the course of the game). The occurrence of the problematic and comparative behaviors was recorded again after the completion of the intervention program in order to evaluate the success of the intervention. This procedure can be briefly described with the following steps (Staub & Green, 1992, p.252):

1. Define the target behavior to be changed.
2. Observe the target behavior.
3. Record occurrence of the target behavior.

4. Intervene with a program to change the target behavior.
5. Test the impact of the behavior change intervention by comparing records of behavior before and after the intervention.
6. Evaluate whether the program was cost effective and whether the program should be implemented on a larger scale.

Both groups of behaviors, problem and comparative, were observed for three months, with the purpose of establishing a baseline before the implementation of the intervention measure. Continued repeated measures provided for a stable baseline so that later on changes due to the intervention were readily discernible (Geller et al., 1982). Frequency of the undesired and comparative behaviors was recorded. Since the frequency was the response dimension of interest, the *tally method* was used for the data collection. Weekly visits to the parks were scheduled with each park being visited three times. Each on-site visit lasted for two hours. Observation sessions were scheduled at the same time of the day, between 3 p.m. and 6 p.m., due to the working schedule of the researcher. A total of thirty observation sessions in each park were conducted.

Each of the four observed behaviors was operationally defined and coded as follows:

DB: *Dragging bags on the ground* – dragging a bag (of any size) with disc golf equipment on the ground while walking, regardless of the surface of the bag in contact with the ground.

TP: *Using trees as targets to practice* – aiming a disc at the tree trunks in the process of warming up, with an actual contact between the disc and the tree taking place.

T: *Trampling* – repetitive (more than two) foot steps taken back and forth at the tee off designated locations.

TH: *Hitting trees during the course of the game* – any occurrence of a contact between a disc and a tree in the process of playing the disc golf course.

For the purpose of establishing a baseline for both problematic and comparative behaviors and for the purpose of evaluating the success of the intervention, the multiple baseline design (A-B design) was employed (Hersen & Barlow, 1976; Kratochwill, 1978). The multiple baseline design is a time-series model designated as an A (baseline) and B (treatment). Multiple baseline design involves the systematic application of staggered A-B phases so that treatment is introduced in one situation while baseline measures continue in another. The purpose of this staggered introduction of the intervention measure is to use each setting as a control unit, thus making possible to assign the success of the behavioral change to the intervention itself and not to other factors. To use A-B design, only repeated measurements of the problem are necessary before the intervention (B) and then repeated measurements during the treatment period. The analysis is simply a comparison of the two sets of measurements. When employing multiple baseline design, observed behaviors should be independent (Geller et al., 1982). In another words, a change in one behavior should not influence a change in the other.

The specific type of multiple baseline design used in this project was a multiple baseline design across behaviors and across different environmental settings since observations took place at three different disc golf courses and four different behaviors were observed. Multiple baseline design has been widely used for the evaluation of behavioral modification treatments in education and clinical psychology as well as in the area of behavioral environmental problem solving (Geller et al., 1982).

Brochure Design

The intervention consisted of the distribution of a brochure containing information about ecological problems associated with disc golf with the purpose of educating the golfers about their actions (see Appendix G). The information in the brochure pointed out at the two undesirable behaviors (dragging bags on the ground and using trees as targets to practice) associated with the degradation, and also addressed the players' ignorance about the effect these behaviors had on the environment. This information was presented verbally and visually. Special emphasis was placed on the fact that disc golfers highly valued their sport, and the content of the brochure appealed to their strong sense of ownership and attachment to the park. The organization of the information in the brochure was presented in a problem-solution fashion. The focus was on the problem and the steps necessary to solve the problem.

Influencing behavior through increase in the knowledge recreationists have about the impacts of their activities has the potential for long-term success. For example, trampling cannot be completely eliminated but can be reduced if there are shifts in individuals' behavior. The design of the message contained in the brochure was based on

the method described by Bettinghaus and Cody (1987), which consists of the following sequential steps: attention, need, satisfaction, visualization and call to action. In addition to that, the guiding principles applicable to the design of persuasive messages described earlier in this chapter were followed and incorporated into the design. After the design of the brochure was completed and before the start of the intervention the researcher consulted with two experts in the advertising field to ensure that the brochure was designed appropriately.

Site Selection and Sample

All three disc golf courses were the sites where baseline measures were recorded and the intervention measure was implemented. The primary purpose of the baseline measurement was to have a standard by which the subsequent efficacy of the intervention could be evaluated. After achieving a baseline in all three parks, the brochure was distributed in Pease Park first, while baseline data collection continued in the other two parks. The researcher visited the three courses six to seven times for a week between 3 p.m. and 6 p.m., which was consistent with the time frame of collecting the baseline data prior to the intervention. The brochure was personally handed out to the disc golfers and any questions players had were answered at the time of the distribution. This provided for some immediate feedback about the intervention. As soon as change was noticed in the frequency of behavioral occurrence among the players in Pease Park, the brochure was distributed in Zilker Park. The same procedure was followed for Mary Moore Searight Park, where the brochure was handed out after the frequency of occurrence of the problematic behaviors changed in Zilker Park. The sample consisted of disc golf

players at all three courses whose behavior was observed for two hours at the time of the visits.

After the distribution of the brochure, post-intervention observations were conducted during the same time of the day as the baseline observation with the purpose of determining the frequency of occurrence of the problem and comparative behaviors. The purpose of collecting data on the comparative behaviors was to detect the occurrence of events that affect the variables related to the game. For example, if the number of occurrence of undesired behaviors drops due to a decrease of the number of disc golf players using the course, the same drop will be observed also in the frequency of the comparative behaviors.

RESULTS

The traditional approach for analysis of multiple baseline research data involves visual examination of the data. Visual analysis involves the interpretation of the trend and variability of behaviors occurring during baseline and intervention conditions. Trend refers to the rate of increase or decrease of the best fit line for the dependent variable (i.e., slope). Variability refers to the degree to which behaviors fluctuate around the mean or slope. Change is determined based on the sufficient magnitude change obvious to the eye. Jones, Weinrott and Vaught have pointed out that in fact visual assessment is more conservative than statistical analysis (as cited in Kratochwill, 1978). Figure 6.1 summarizes the behavioral observation results from all three parks, where the vertical

orange line indicates the time of the introduction of the intervention.

The examination of the graph in each park shows overall consistency in the two comparative behaviors (trampling and hitting trees during a game of disc golf) during all three phases, although day to day fluctuations are noticeable. The fluctuations could be caused for example by the different number of players observed during park visits. The data representing the two undesired behaviors shows stability during the first and third phase, although the average rate of occurrence differs between those two phases. It is noticeable how the frequency of occurrence changes during the intervention phase, which could indicate a treatment effect. On the average, comparative behaviors were observed among 50% of the players at each visit, whereas problematic behaviors occurred on the average among 25% of the players. There were no players who performed more than one of the four behaviors under investigation or who repeated a particular behavior.

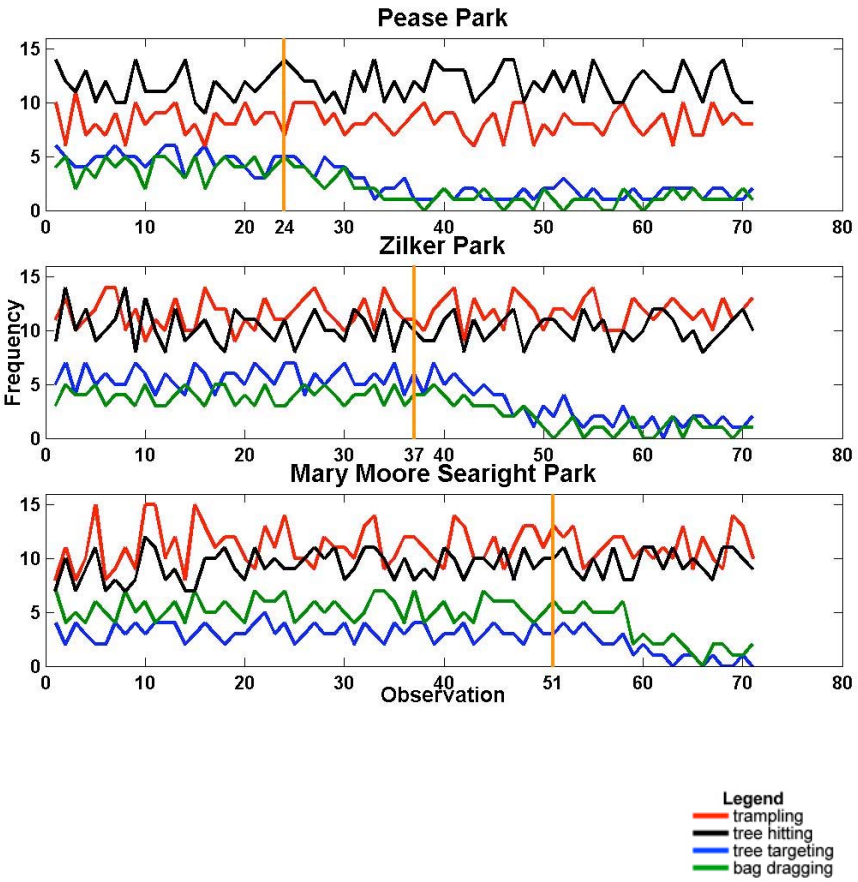


Figure 6.1: Frequency of occurrence of problem and comparative behaviors.

If the intervention was not successful, one would expect to see a similar pattern in all four behaviors being observed before and after the implementation of the treatment. However, a visual examination of the results indicates that this was not the case. Sometimes it is possible that external factors could affect only the target behaviors. In order to eliminate this possibility, the intervention measure was implemented in a staggered fashion in the three parks. This provided for each park to be a control unit for the other two parks. Therefore, behavioral changes in the undesired behaviors were

attributed to the intervention.

Further evaluation of the data indicates that at each of the three disc golf courses the baseline was stable before the intervention was introduced. After the introduction of the intervention, a drift in the baseline is noticeable which indicates a decline in the frequency of occurrence of the problem behaviors while the frequency of the comparative behaviors remains the same. It is noticeable that the changes in the frequency of behavior occurrence during the intervention phase show some delay, which could be attributed to the fact that the intervention brochure was distributed in each park for a week and some time is necessary for disc golfers to make the necessary changes and to also bring awareness to other players. However, the visual examination of the diagram suggests strong treatment effect. The lagging of the treatment in each park also assists in the determination of whether the change in frequency of behaviors occurring after the intervention was introduced could be attributed to the intervention, therefore providing validation of the treatment as the cause of the behavior changes.

Inspection of the data graphed in Diagram 6.1 indicates that a smoothed-line analysis would be appropriate for obtaining more information about the success of the intervention measure. The line representing each behavior is split into three segments since we are looking at baseline, intervention and after-intervention results to determine whether the program was successful. Kratochwill (1978) suggests that this is the appropriate technique when analyzing data in interrupted multiple base line designs. Therefore, additional analysis using the method of first order polynomial fit was employed in order to determine the trend of the change. A summary of these results is

presented in Figure 6.2.

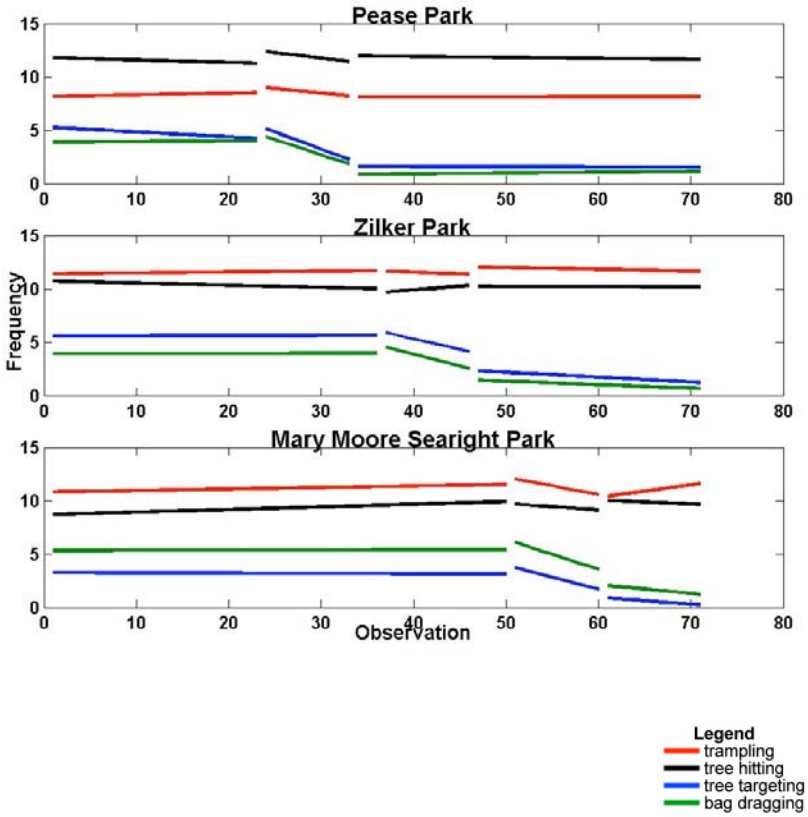


Figure 6.2: Linear fits of frequency of occurrence of problem and comparative behaviors during baseline, intervention and after-intervention phases.

A close examination of Diagram 6.2 indicates that the slope of the best fit line for the comparative behaviors in each park remains approximately zero, whereas the slope of the best fit line for the problematic behaviors during the intervention phase shows a downward trend. It is also noticeable that the slope of the best fit line for the problematic

behaviors during the after-intervention phase indicates a steady trend and is practically approaching zero. This slope analysis points to further evidence of the success of the intervention measure.

When analyzing frequency of behaviors and the effect of the intervention program, it is useful to investigate the mean values of the frequency of behavioral occurrence before and after the intervention (Kratochwill, 1978). Therefore, Figure 6.3 summarizes the results for all mean value lines in each park for both problematic and comparative behaviors.

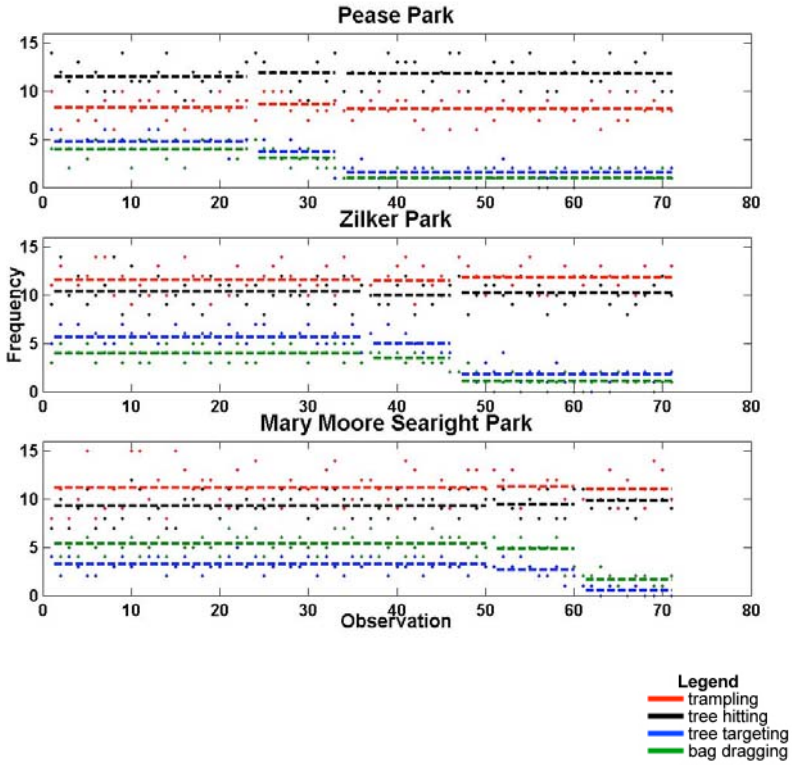


Figure 6.3: Mean value lines of occurrence of problem and comparative behaviors during baseline, intervention and after-intervention phases.

An inspection of the graphs in all three parks indicates that although the mean value varies for the duration of the study, it is relatively steady during each phase – baseline, intervention and after-intervention. It is visible that the mean value changes over time, and in fact decreases during the intervention time and even more during the after-intervention phase. This supports the success of the intervention and indicates that the desired behavior change was indeed achieved.

To support the visual results, linear regression lines were fitted to the data, and the resulting equations are presented in Appendix F.

DISCUSSION

The success of the intervention program could be attributed to several factors. First, the desired behaviors did not require much effort and were not difficult to perform. This led to the belief among players that they actually have the abilities to perform the behaviors. Previous research has indicated that contextual factors such as individual opportunities and personal abilities affect environmental behavior (Poortinga, Steg, Vlek, & Wiersma, 2003; Stern, 2000). Also, the work of Pelletier (2002) suggests that educational approaches are in fact effective when behaviors are relatively simple.

Second, increasing the knowledge of the golfers about the consequences of their behaviors on the surrounding environment contributed to the elimination of the barrier, thus allowing the occurrence of the desired behaviors. Lack of information and

knowledge could be a serious internal barrier to action because often the connection between the specific behavior and the environmental consequences is not easily identifiable to the individual (Gardner & Stern, 1996).

Third, the high value golfers placed on disc golf and their willingness to make the necessary changes in order to preserve the game contributed to the success of the intervention. The combined effect of increased knowledge and awareness along with simplicity in outlining the desired behaviors is what made the behavioral modification attainable. In fact, the work of Gardner and Stern (1996) supports this view, pointing out the effectiveness of communication approaches that outline specific actions individuals can take to solve problems and the importance of intervention programs clearly identifying those actions. Findings in this study are also supported by Bord, O'Connor, and Fisher (2000) who argue that accurate knowledge is the strongest predictor of behavior change.

Fourth, the intervention program was designed with the purpose of targeting the antecedent rather than the consequent conditions of an individual's behavior. Such design has proven to be effective in manipulating behavior when the intervention focuses on variables such as personal commitment and place attachment (Dwyer, Leeming, Cobern, Porter, & Jackson, 1993). The key in this process is the development of intrinsic behavior controls since rewards and penalties (considered extrinsic controls) are rather cost ineffective. In this case the intrinsic consequences of improving the conditions of the park and disc golf course in particular were sufficient to motivate the behavior change.

The positive results from the intervention may be an indicator that outreach by planners and managers into social and psychological disciplines is necessary. One should recognize and utilize expertise in these fields when designing and implementing planning programs that include complex human behavior change. Also, other similar strategies such as signs and displays designed to educate recreationists about how to minimize their impact on the environment have been utilized in previous studies and have shown to be successful (Cole, 1993; Oliver, Roggenbuck, & Watson, 1985). Sport managers and urban planners can benefit from the implementation of certain behavioral intervention programs even before any ecological degradation has been detected and carrying capacity has been exceeded. This, however, assumes that they know well their targeted audience and the characteristics of the subculture of which outdoor participants are members.

The results of this study also provide for some hope that similar effective behavioral modification strategies could have implications at the regional and/or national level in solving environmental problems associated with sport and related activities. However, different subculture knowledge will be the prerequisite for such strategies to be successful. In addition, experts from different areas need to collaborate in this effort; not only environmental psychologists, but ecologists and members of environmental groups must work together as well in order to acquire this knowledge. Their expertise and experience can assist in quantifying the ecological damage, thus making the intervention programs more credible and persuasive. In some cases it could be that several behaviors are associated with ecological damage, therefore designing and implementing a system which identifies the environmental impact of each one would be crucial for the aim of the

intervention efforts. Although multiple behavior changes are the optimal goal, in reality such multiple changes are hardly ever accomplished.

The behavioral approach to solving environmental problems is not new to scholars and practitioners. Government agencies have used and are still using behavioral approaches to change human behavior, but the focus is/has been mostly on disincentives and penalties such as fines for littering or for polluting water (Staub & Green, 1992). The problem with these types of approaches is that in order to achieve and sustain behavior change, it would require a large number of law enforcement personnel, which makes these approaches cost-ineffective. Also, such approaches are often based on post-evaluations and provide for a reactive approach to solving the problems instead of a pro-active approach. Therefore, behavioral approaches based on shared values and beliefs have the potential for achieving more enduring changes and a sustainable sport future.

Chapter 7: Integrated Discussion and Implications

The focus of this research project was on the sport of disc golf as an illustrative example of the environmental challenges facing the field of sport management. The findings from the four studies point to the direction in which long-term solutions should be sought. The goal was to evaluate the relationship between the sport and the environmental setting it takes place in and to search for a solution that is more cost effective when compared to the traditionally used approaches in solving environmental problems associated with human activities. Findings offered valuable information about the potential subcultural values have to be the lever for behavioral interventions and to enable self-policing of target behaviors.

The four studies show that Hardin's (1968) tragedy of the commons can hold true in sport, but the studies also suggest that the tragedy is not inevitable in this context. In fact, the presence of social contingencies provides the means through which environmental problems could be tackled without relying on rules and regulations as the sole solution. This in turn allows not only for achieving desired outcomes, but also for exploring the conditions under which individual efforts can trigger collective action.

A crucial part in the search for sustainable behavioral modifications is not only the identification of the problem behaviors, but also the identification of the barriers and facilitators for achieving the desired environmental behaviors. Barriers could be either institutional or personal and the essence of the barriers would affect the choice of the

intervention strategy. For example, Blake (1999) has grouped barriers to pro-environmental behavior into three groups: (1) individuality (e.g., laziness and lack of interest), (2) responsibility (e.g., lack of efficacy and lack of trust), and (3) practicality (e.g., lack of time and money). The findings of this project are consistent with the first group of barriers identified by Blake, and indicate that the main barrier to achieving the desired environmental behaviors among golfers was the lack of knowledge about the consequences playing disc golf had on the ecosystem. Future research should focus on the other two groups of barriers, and on any possible interrelation among the variables identified in each group. Investigating the discrepancy between individuals' awareness of environmental problems and the actual behavior, and focusing on the factors which either hinder or facilitate the desired environmental behaviors could make efforts more efficient and effective (Kollmuss & Agyeman, 2002).

The concern for the impact of humans on nature and nature on humans has influenced the development of a new field in ecology and natural resources - recreation ecology, the aim of which is to seek and understand the human-nature ecological relationship in recreation context, including identification of recreational impacts on ecosystems and the landscape, the influence of use-related and environmental factors, and the roles management can play in modifying these factors (Cole, 1990; Kuss, Graefe, & Vaske, 1990). Indeed, Folke, Hahn, Olsson, & Norberg (2005) have proposed an ecosystem-based approach to solving environmental problems, where the role of humans as a part of the solution is emphasized. The investigation of the subculture of disc golfers and the findings of this project indicate the significance of such approach and point to the

need of incorporating the social and natural sciences in the search for the solution to a sustainable sport future.

Behavior change approaches for solving environmental problems are not new to academia and were first applied in the 1970s (Geller, 1992). This project builds on this knowledge by applying these behavioral change approaches in the realm of sport, utilizing the potential sport subculture characteristics have to be the means for achieving the necessary changes. Fostering a subculture of conservation and preservation should be a priority for planners and managers if we are to achieve environmental sustainability in sport. The results of this study contribute to the field of environmental psychology, which is a sub-discipline of psychology. Environmental psychology deals with two major questions. The first one concerns the effect of the natural environment on people and the second one concerns the effect of people on the environment. Most scholarly work conducted in the past has focused on these two questions. The contribution of this project to the field of environmental psychology is in that it not only raises the question of "How can we modify human behavior to benefit and save the environment, particularly in the sport context", but also offers a viable solution to it.

The findings of this research project also fit well into and contribute to another sub-discipline of psychology – applied behavior analysis, which is based on the work of Skinner (1938). In fact, the approach used in the project is consistent with the work conducted by behavior analysts in the area of solving environmental problems, which is targeting undesired behaviors first and then expecting that attitudinal change will follow as a result of the behavior modification (Geller, 1986, 1989). Results are also consistent

with the work of others (Geller et al., 1982) who believe that behavioral modification is the cost effective approach to solving large scale environmental problems.

If we can understand what makes people passionate about the environment, we can understand the psychological mechanisms capable of fostering protective environmental policies and behavior. Research has determined that environmentally sustainable behavior requires a strong community identity because both personal and collective identities determine whether the values of sustainability are adopted (Pol, 2002; Van Vugt, 2001). Strong attachments to nature can contribute to the formation of group identities in environmental contexts and nature-oriented activities can elicit strong social connections.

To simply try to continue to rely only on existing policies and regulations would be a crucial mistake. Environmental policies and regulations in general do not account for ecosystem dynamics and differences at the regional and national levels. In attempts to solve environmental problems, federal, state and local governments have traditionally used penalties in the form of fines or different laws and ordinances for the implementation of which, however, extensive enforcement is necessary, thus making this approach rather cost-ineffective. Legislation and regulation address the problem's symptoms, but they do not attack its underlying social dynamics. As Hardin (1968) so aptly demonstrated, the tragedy of the commons derives from the social dynamics of common-resource use. If we are to enable long-term sustainable change in the ways that the commons are used, then we clearly need to change the underlying social dynamics of that use. Changing the environmental values and norms of sport subcultures is intended

to achieve that goal.

This project suggested the direction in which to go in the future, and presented viable alternatives for sport and natural resource managers in the development of a comprehensive sport management system plan in order to meet the challenges facing their field today. Sport managers need to rely on policy and regulations as the short term-solutions, but they also need to incorporate behavioral modification interventions, based on the knowledge about environmental and human values. Sport management and planning agencies should learn how to balance ecological and community objectives without compromising the environment and the recreationists' interests and demands. Knowledge about the ecological conditions of the area where recreational activities are taking place is the cornerstone to developing an effective intervention program for behavioral change. In fact as Folke and colleagues (2005) point out, "Addressing only the social dimensions of resource management without an understanding of resource and ecosystem dynamics will not be sufficient to guide society toward sustainable outcomes" (p. 443).

The fundamental challenge is not to simply point at the environmental degradation associated with sport activities, but to determine the means through which individuals can be motivated to avoid the tragedy of the commons. Each sport context will require different approaches depending on the type of activity, setting and participants. It is important to identify the best combination of intervention measures in order to ensure effective management of the environmental problems as well as to identify the interventions appealing to various types of sport participants, which will

require in depth studying of the specific sport subculture. It is also crucial to ensure consistent monitoring and assessment of the success of the intervention program in order to make the necessary adjustments in a timely manner. Continuous success even at a slow pace could establish a pattern of confidence and self-esteem (Crocker & Park, 2004), competence and community empowerment (Dreier, 1996), which are useful for the long-term success of behavioral intervention efforts.

The findings of this project point to the underutilized potential sport subcultures have to provide valuable knowledge about specific characteristics of the subculture that could be successfully incorporated into interventions aimed at solving environmental problems. By incorporating the sociocultural domain in the search for solutions to the environmental problems associated with outdoor recreational sports, sport managers can pursue effective tools for managing those environments - tools that do not incur the high costs associated with enforcement of rules and regulations. In fact, research indicates that common-pool resources are least likely to become overexploited and degraded if they are managed through social norms and conventions (Berkes, 1989; Bromley & Feeny, 1992; Jodha, 1992). Although change of that kind is likely to take some time, as did creation of a norm proscribing littering for example, this strategy offers a long-term solution to complement short-term legislative and regulatory stop gaps. The good news is that the presence of definable subcultures among sport participants establishes the necessary basis for undertaking the necessary interventions. This has the advantage that it enables efficient management of resources without high monitoring expenditures, while at the same time developing a sense of empowerment and ownership.

Knowing how different values are expressed within the subculture could shed some light on the processes involved in the evolution of subcultures. Sport subcultures are not stagnant in nature, but they rather undergo different stages. In fact, Sasidharan (2002) pointed out that understanding recreational activities and the environment in particular within the context of culture could provide for some insights into how cultural characteristics change in the context of recreation. Understanding the ways in which values and beliefs of sport participants vary within a particular sport subcultures could contribute to the more efficient way of utilizing sport subcultures as the means to solve environmental problems. More work needs to be done to explore the variation in values at the different stages of subculture formation as well as to determine how well defined sport subcultures are.

The important message to carry is three-fold. First, based on the knowledge about specific human values, desired behaviors could be achieved through the leverage of subcultures, without relying on laws, restrictions, and sanctions. This in turn could lead to the development of new and environmentally friendly values, which eventually could trigger cultural changes. Second, successful behavior change to reduce environmental damage in fact is achievable, therefore increasing the effective carrying capacity of the ecosystem. Third, strategies based on traditional natural resource management tools might still be needed, depending on the specific recreationist characteristics and on the particular ecosystem requirements.

Appendix A: Historical Facts about Disc Golf

1970's - Disc enthusiasts introduce the concept of disc golf. "Object Courses" using anything from lamp poles to fire hydrants as targets begin to crop up in the Midwest and East Coast.

1971 - The first "Frisbee Club" is formed in Rochester, NY; disc golf played on a regular basis.

1973 - Flying Disc World becomes the first magazine for disc sports.

1975 - Installation of the first permanent disc golf course in Oak Grove Park, La Canada, California. Wham-O introduces the World Class 119g disc, a marked improvement in discs for competitive sports.

1976 - Ed Headrick patents the chain-style disc golf target and organizes the Professional Disc Golf Association (PDGA)

1977 - The first PDGA tournaments are held in Mobile, Alabama and northern New Jersey; the modern era of disc golf competition begins.

1982 - The PDGA becomes a player-run organization to schedule tournaments and formalize the rules of play. Harold Duvall wins the first PDGA World Disc Golf Championship.

1983 - Dave Dunipace of INNOVA-Champion Discs invents the modern golf disc, a plastic flying disc with a beveled edge rim for greater distance and accuracy.

1984 - Disc Golf World News begins publication; the first magazine of disc golf.

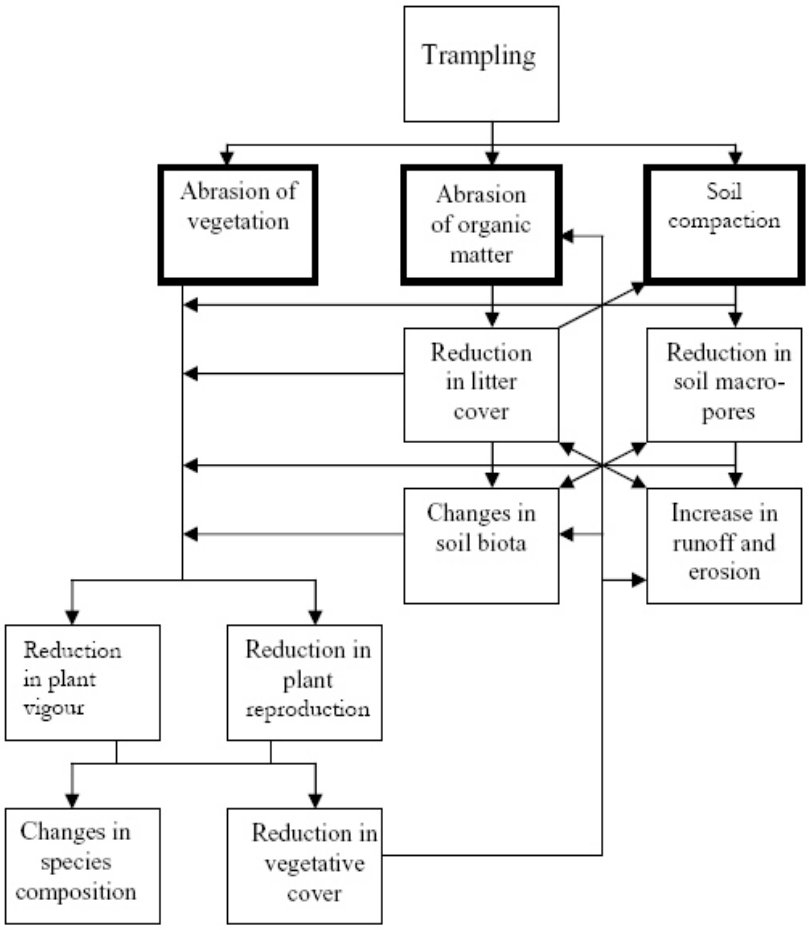
1985 - The World Flying Disc Federation organizes the first "World Championships" held outside of the United States, in Helsingborg, Sweden. Players from 21 countries attend. Around the world, players continue to lobby park departments and college campuses for more disc golf courses. By the end of the decade, permanent disc golf courses are installed in the United States, Canada, Europe, Australia, and Japan.

1990 through 1998 - Ken Climo of Clearwater, Florida wins an unprecedented, nine world championships establishing himself as the greatest disc golfer to have ever lived.

1993 - Lavonne Wolfe establishes the PDGA Hall of Fame. The PDGA begins to

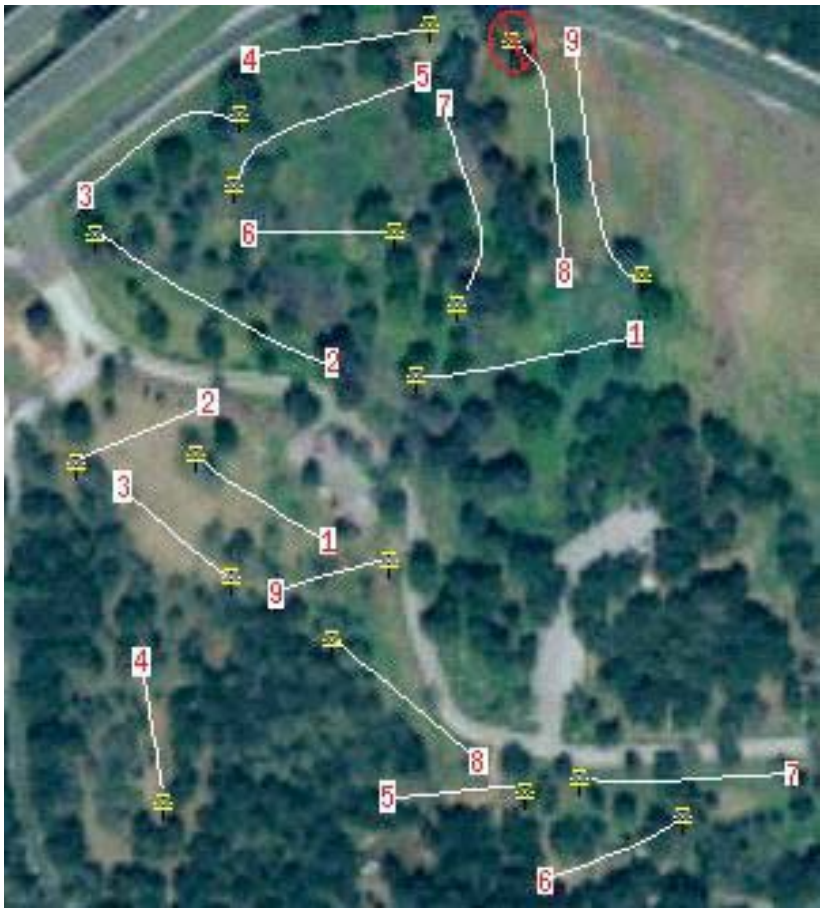
chronicle the history of disc golf.

Appendix B: Trampling Effects on Vegetation and Soil



Appendix C: Disc Golf Course in Pease Park

Appendix D: Disc Golf Course in Zilker Park



Appendix E: Disc Golf Course in Mary Moore Searight Park

Appendix F: Equations Representing Least-square Regression Lines

Pease Park	Zilker Park	Mary Moore Searight Park
$AX(t) = -0.05t + 5.30$	$AX(t) = 0.002t + 5.57$	$AX(t) = -0.02t + 3.26$
$AY(t) = -0.32t + 5.47$	$AY(t) = -0.19t + 6.47$	$AY(t) = -0.22t + 3.93$
$AZ(t) = -0.002t + 1.62$	$AZ(t) = -0.045t + 2.35$	$AZ(t) = -0.64t + 0.93$
$BX(t) = 0.006t + 3.89$	$BX(t) = 0.001t + 3.92$	$BX(t) = 0.001t + 5.33$
$BY(t) = -0.28t + 4.67$	$BY(t) = -0.22t + 4.73$	$BY(t) = -0.28t + 6.33$
$BZ(t) = 0.007t + 0.86$	$BZ(t) = -0.033t + 1.47$	$BZ(t) = -0.082t + 2.13$
$CX(t) = 0.015t + 8.17$	$CX(t) = 0.009t + 11.40$	$CX(t) = 0.01t + 10.80$
$CY(t) = -0.08t + 9.07$	$CY(t) = -0.03t + 11.67$	$CY(t) = -0.16t + 12.20$
$CZ(t) = 0.002t + 8.10$	$CZ(t) = -0.016t + 12.01$	$CZ(t) = 0.12t + 10.29$
$DX(t) = -0.02t + 11.81$	$DX(t) = -0.02t + 10.74$	$DX(t) = 0.03t + 8.67$
$DY(t) = -0.10t + 12.47$	$DY(t) = 0.07t + 9.60$	$DY(t) = -0.06t + 9.73$
$DZ(t) = -0.009t + 11.96$	$DZ(t) = -0.002t + 10.23$	$DZ(t) = -0.036t + 10.04$

Behavior A - Tree targeting

Behavior B - Dragging bags

Behavior C - Trampling

Behavior D - Tree hitting

Segment X - Pre-intervention

Segment Y - Intervention

Segment Z - Post-intervention

t - Observation session

Appendix G: Intervention Brochure

Disc golf can damage our environment, and YOU CAN HELP!

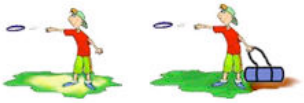
- Avoid unnecessary or excessive trampling of vegetation.
- Carry, don't drag, your disc golf bag.
- Don't use trees for target practice.
- Encourage other disc golfers to do the same.

WHY?

Disc golf is a great way to get out and enjoy nature. Unfortunately, we are unintentionally destroying the environment on our disc golf courses. Unnecessary walking in one spot and dragging heavy bags on the ground causes soil to become compressed. Eventually the soil erodes and grass and other vegetation disappears. The game can also cause tree damage, which happens when trees are used for target practice.

The area around disc golf baskets is especially vulnerable to the compression and erosion of soil, which in turn leads to a decrease in vegetation cover, as seen below. It takes a long time for the vegetation to recover.

Compressed soil and lack of vegetation around a former disc golf basket location.



Although soil erosion occurs naturally, heavy foot traffic on disc golf courses intensifies soil erosion problems, as you can see in the photos below.

Soil erosion around disc golf baskets.

Trees are also at risk. Although trees look stronger and more resistant to damage than other vegetation such as grass, discs are heavy enough to break off pieces of bark.

Using trees for target practice causes tree damage that can eventually kill the tree.

Disc golf is possible in these conditions, but we can care for our courses better to enjoy the sport for many years to come.

What can you do?

- Avoid unnecessary or excessive trampling of vegetation.
- Carry, don't drag, your disc golf bag.
- Don't use trees for target practice.
- Encourage other disc golfers to do the same.

This is our park, and its future is in our hands!

Let's save the park and our disc golf course!

TO THOSE WHO

LOVE DISC GOLF

HOW YOU CAN HAVE FUN PLAYING AND SAVE OUR PARK TOO!

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