The review of literature is organized in three major sections. The first section discusses the Biosphere and Human Society. The importance of the lawn is illustrated by the economic and technological activities that are generated through products and services that are deemed necessary to maintain the lawn. Descriptions of current practices highlight the effects of lawn practices on the natural environment and the literature relevant to the concerns arising from these practices is reviewed. The use of clothing as a means of protection when applying pesticides is addressed.

The second section discusses Human Experience which includes life conditions and the biopsychic state. Life conditions include the personal (immediate) environment and behavior patterns. The review of literature includes discussion and review of research about meanings, values, and attitudes associated with the lawn and the natural environment.

The third section traces the evolution of the American lawn. It explores the historical roots of the lawn, the beliefs and meanings that have evolved related to the lawn, and the contemporary forces which continue to shape the lawn.
Grass is part of a natural ecosystem composed of plants growing in soil which require sunlight, water, and nutrients. Lawn grass is one of many wild grasses that have been domesticated for human use and can be thought of as a very special type of garden (Sombke, 1994). But lawn grass is not used for food.

The lawn is an artifact of society. Created from a natural occurring plant, it has been modified by humans and invested with meaning and aesthetic value. For many Americans a uniform, weed free, green lawn is essential to being considered a respectable, responsible homeowner.

Turf management, growing grass as an ornamental crop, has undergone constant experimentation and change since the earliest sheep-grazed village commons. Many varieties of grass have been developed to accommodate climatic differences. There are two main types of grasses grown in the United States: cool-season grasses which grow well across the northern and midwestern states, and warm-season grasses, which grow better in the hot, humid southern states. Common Southern grasses that grow in Atlanta, Georgia include bermuda, zoysia, centipede, fescue, and St. Augustine. Midwestern grasses include Kentucky bluegrass, fescue, and perennial ryegrass. Trying to grow an inappropriate grass in an unfriendly geographic, climatic location can cause great frustration, environmental damage, and is ultimately doomed to failure.
It is estimated that in the United States the total area in turfgrass is about 25 million acres or 40 thousand square miles, an area slightly less than that of Pennsylvania (Roberts & Roberts, 1988). Five million of these acres are golf courses, cemeteries, athletic fields, and other open spaces.

Economic Impact

The 1990 EPA National Home and Garden Pesticide Use Survey reported that 66.8 million households have a private lawn (Whitmore, Kelly, & Reading, 1992). These lawns cover an estimated 20 million acres with an average size of about one-third acre. They also estimated the annual retail sales of residential lawn care products and equipment to be $6.9 billion. Hoses, nozzles, and sprinklers to water lawns and gardens accounted for $51.2 million and $19.6 million was spent on grass seed. The average homeowner spent $445 in 1993 on lawn/landscape maintenance (Homeowners spend...1994). And Americans 50 years of age and older accounted for nearly half of all these expenditures on maintenance services. Goldin (1977) calculated that the average residential lawn may cost more per acre to maintain than it does to raise a crop of corn, rice, or sugarcane.

Lawns are generally viewed as only one part of the total landscape design. No studies were found that directly addressed the monetary value of a lawn. A 1986 study, commissioned by the Nursery Products Division of Weyerhaeuser looked at the value of landscaping (Weyerhaeuser Company, 1986). It included original research by the Gallup Organization, Trendnomics, and the National Gardening Association.
Among its findings were:

1. New home buyers and buyers of previously owned homes estimated that landscaping adds 14.9% to the value or selling price of their home on the average.

2. Sixty-two percent of all U.S. homeowners consider landscaping a good or better investment than an investment in other types of home improvements, including kitchen and bathroom remodeling.

3. Ninety-five percent of real estate appraisers agreed that landscaping adds to the dollar value of residential real estate.

If a landscape is well designed, it will mature and become more valuable.

Landscape industry members have suggested that at least five percent of a home’s value should be spent on landscaping. The Associated Landscape Contractors of America estimate that landscaping adds 15% to the value of a home (Evans, 1992).

Advantages and Disadvantages

The advantages of well planned landscaping include reduced air pollution and noise levels, temperature and wind control through proper placement of trees, creation of "green feelings", and human health improvement by using features that ionize the air (Pierce, 1989). But the ideal American suburban lawn that requires minimal grass diversity, control of insects, weeds, and fungus by use of pesticides, additions of fertilization, and irrigation is expensive, labor intensive, and as more and more people are beginning to believe, environmentally unsound.

A frequently repeated claim in the lawn care literature is that through photosynthesis a 50-by-50 foot lawn generates enough oxygen to meet the needs of
a family of four. This statement does not take into account the various kinds of pollution that accompany the maintenance of the ideal American lawn. Annual pollution emissions from lawn utility machines in California are equivalent to the emissions produced by 3.5 million 1991 model automobiles driven 16,000 miles each (Bormann, Balmori, & Geballe, 1993). The EPA estimates that one hour of operating a walk-behind mower puts as many pollutants into the air as driving an automobile for 11-12 hours (Maimgren, 1994). Other potential environmental problems such as chemical run-off and water pollution, grass clippings in landfills, safe disposal of empty pesticide containers and used oil, and unknown health effects of chemical use are of increasing concern.

**Lawn Equipment**

A variety of lawn equipment is needed to maintain the average lawn. Lawn mowers, edgers, clippers, leaf blowers, string trimmers, seeders, fertilizer spreaders, and aerators are considered staples for lawn care. In 1991, the U.S. lawn equipment industry estimated $4.6 billion in sales to both the domestic and international markets. The international markets are primarily Canada and the European Community (U.S. Department of Commerce, 1992).

**Fertilizers**

Fertilizers for lawns are generally a mix of nitrogen, phosphorus, and potassium just as agricultural fertilizers are. By weight only 5 to 10% of the fertilizer sold in the United States is purchased to fertilize lawns, but this market accounts for 25% of the industry’s profits.
Yard Waste

The sheer volume of yard waste in municipal landfills began to be a serious problem in the 1980s. Yard waste, primarily grass clippings, is estimated to make up about 20% of all the garbage generated in the United States (Yard waste...1994). It is the second largest component (by weight) of the municipal solid waste stream. During the summer and fall months, yard waste can constitute 25 to 50% of all municipal solid waste. As of July 1993, 20 states had enacted or had pending legislation to ban all yard waste from landfills.

Individual homeowners and municipalities have been encouraged to compost and use clippings for mulch. Recycling yard waste not only saves time but also money in disposal costs. But yard waste composting is also being scrutinized for potential harmful effects due to pesticide residue. A recent study commissioned by the Massachusetts Department of Environmental Protection reported that while pesticide residue was present in the clippings, they are typically found in low levels (they registered in parts per billion). Workers at composting sites have not reported any skin rashes or other extraordinary events (Code, 1991).

Water

Lawns need water to grow. An average acre of lawn needs more than 27,000 gallons of water each week. It has been suggested that Americans routinely overwater by 20 to 30%. While the amount of water needed varies greatly by region of the United States, lawn care increases water use by as much as 30% in the summer (The Earthworks Group, 1989). As water becomes increasingly valuable, many communities are taking a hard look at the water
used on lawns. Lawn watering restrictions are frequently a priority when a region is enduring a drought.

**Groundwater concerns.** Groundwater contamination by chemicals is also of major concern. Groundwater comprises 96% of the world's total water resources. Ninety percent of rural residents and 50% of people in the United States rely on groundwater as their drinking water source.

The far reaching effects of chemicals are illustrated by findings from a study done by Nations and Hallberg (1992) who sampled rainfall for pesticides in three areas in Iowa: two rural localities and an urban area. Fourteen pesticides, ten herbicides and four insecticides, were detected from October 1987 through September 1990. Samples from the urban site had detections of the same agricultural chemicals found at the rural sites, but in lesser quantities. In addition to the herbicides, three of the four insecticides detected in rainfall were found only in urban samples. Concentrations were greater at sampling sites near fields where pesticides are applied.

The EPA has found that pesticides and nutrients are present in urban runoff, but are not as prominent as metals such as lead (U.S. EPA, 1983). Lunsford (1994) reports that phosphorous from the run-off of fertilizers continues to a problem in the midwest. It is believed that the impact of phosphorous is greater in surface water than ground water. Creating a buffer zone of 50-100 feet near lakes and ponds where fertilizers could not be used is recommended.

Studies looking at the movement of chemicals in turfgrass are ongoing. Watschke and Mumma (1989) report that studies examining the movement of
pesticides and nutrients on runoff areas and sloped turf have not detected any pesticides in as low as a part per billion. Watschke concludes that well-managed turfgrass has a positive impact on water quality. Dense, quality turfgrass stands affect the overland flow process to such a degree that runoff is insignificant and inhibits percolation of fertilizers and pesticides into the groundwater.

Morton, Gold and Sullivan (1988) reported that total inorganic-N losses in percolate average from 3.1 to 13.1% of the amounts applied to sloped experimental lawns maintained under high and low input irrigation and chemical management. Gold, Morton, Sullivan & McClory (1988) found no significant leaching of two herbicides, 2,4-D and dicamba, from simulated home lawns with a sandy loam soil. Petrovic (1993), in a review of studies looking at leaching, reported that pesticide leaching is highly dependent on soil texture and the time from application to the first significant precipitation event. Lawn fertilization was found to have only a minor impact on nitrate levels in groundwater where other land uses like corn production and septic tanks have resulted in high nitrate levels. Niemczyk and Filary (1988) have studied vertical mobility of pesticides in soil. The study included nine insecticides and evaluated their vertical mobility to the first, second, fourth and in some cases tenth inch below the thatch. They reported that insecticides applied to turf with thatch pose little or no potential for downward mobility. Harrison, Watschke, Mumma, Jarrett, & Hamilton (1993) measured very low levels of runoff from sloped turfgrass plots. Their data suggests that under normal rainfall conditions the quantities of dissolved
pesticides and fertilizer nutrients in runoff and percolate transported from turfed sites are low.

Mechenich and Shaw (1994) surveyed residents of two subdivisions with private wells and septic systems in central Wisconsin about their use of various household and lawn chemicals. Of the 139 respondents, 109 reported fertilizing their lawns an average of 1.8 times per year. Nine participants reported never fertilizing their lawns and ten reported using a commercial lawn service. When asked about the amount of fertilizer they used, 74% said they used the amount specified on the bag, 18% said they used more, and two users said they did not read the instructions on the bag. Approximately half (n = 68) of the residents reported applying a mixture of broadleaf weed killer and fertilizer on their lawn. An average use rate of 1.2 times per year was reported. Thirty one participants reported never using this type of product. Crabgrass killer was applied once a year, on average, by 31 users. The most commonly used lawn and garden insecticides were diazinon (51 users), malathion (16 users), and carbaryl (17 users). The majority reported using less than one cup of undiluted product per year, but some used more than 10 cups per year. When asked about the severity of groundwater contamination in their subdivisions and in the county, 63% stated it was "serious" and 13% ranked it as "very serious." When asked about water contamination sources the study found there was, in general, no relationship between opinion about contamination sources and one's own chemical use practices. The majority of the respondents (67%) identified agriculture as the cause of the problems.
Pesticides

The use of pesticides on lawn grass began after World War II as chemical companies turned their research efforts toward peacetime uses of chemicals. By 1991 the world market for pesticides reached nearly $35 billion (U.S. Dept. of Commerce, 1992). The professional and consumer markets for pesticides in the United States were each estimated to represent about $1.1 billion in sales at the manufacturers' level in 1991 (Hodge, 1993). Insecticides accounted for approximately 75% of the total consumer market; the remaining 25% included herbicides, fungicides, and rodenticides. Herbicides accounted for a little less than half of the professional market; insecticides for approximately 30%, and fungicides, rodenticides and other the remaining 20%. The agricultural market was estimated to be about $4.9 billion in sales.

Currently there are about 45,000 pesticide products marketed in the United States. Public Citizen's Congress Watch (Weiss, 1989) reported that of the 40 pesticides that the EPA estimates comprise over 95% of chemicals used by lawn care firms:

1. Twelve are suspected human carcinogens.
2. Twenty one have been shown to cause long-term health effects in lab animals or humans.
3. Twenty have been shown to cause short-term damage to the central nervous systems of humans.
4. Thirty six cause eye, skin or throat irritation in humans or animals.
5. One has been completely tested and reviewed by the EPA for its full range of long-term health effects.

In 1988, more than 700 million dollars worth of pesticides, about 67 million pounds, were sold for use on American lawns (U.S. General Accounting Office,
Chemical lawn care sales were estimated at $1.7 billion in 1993 (Roche, 1993). The average American lawn is treated with five to ten pounds of pesticide per acre (Schultz, 1993).

**Homeowner's use.** Numerous pesticides are commonly used both inside and outside American homes. The EPA estimates that 69 million American households, or more than 85% of the nation's total families, store and use pesticides (Lang, 1993). Research exploring the use of pesticides in the home environment began in the late 1960s and early 70s. The majority of studies that have looked at homeowner's pesticide use have combined inside and outside usage. For a review of this research see Appendix B. These studies show that homeowners, in general, do not read labels, do not follow commonsense safety precautions, do not know what products commercial applicators have applied, and believe pesticides do good and rarely think that they do harm.

**Health risks.** Many questions remain unanswered about short-term and long-term health risks associated with pesticide use. The focus of current research about pesticides has changed from how much and what is used to the environmental and health effects associated with the use of these products. The lack of a national database in the United States impedes an accurate counting of the incidence of death and injury from acute pesticide poisoning. Chronic health effects such as cancer, deterioration in neurologic functions, immune effects, and reproductive and birth defects are sources of concern and controversy. An area of great uncertainty is the effect of pesticides on infants and children. (See Appendix C for a review of literature related to pesticides and health.)
The degree of risk resulting from human exposure to pesticides and other chemicals is a hotly debated issue and is likely to continue for some time. Interpretation of the same data by scientists produces divergent viewpoints about the significance and implications of the information. Whitford (1993) writes, "Since there are no scientific absolutes people are left to drawn their own conclusion about the risks and benefits, based on their perceptions and knowledge of the facts" (p. 9).

One reason the task of determining benefits and risks is so difficult is that research shows that individual often demonstrate unrealistic views and behaviors toward hazardous activities. Most of the current literature dealing with risk perception has focused on people's abilities to estimate the likelihood of technological, health, and environmental hazards. This research indicates that people are reasonably accurate in estimating the risk of fatal injury, but they tend to overestimate the likelihood of infrequent causes and to underestimate the likelihood of frequent causes (Fischhoff 1985; Fischhoff, Slovic, Lichtenstein, Read, & Combs 1978; Lichtenstein, Slovic, Fischhoff, Layman, & Combs 1978).

Lawn care technicians appear to be a group who may be especially at risk from the use of lawn chemicals. Lawn care workers engage in tasks that result in exposure to pesticides and many other potential carcinogens such as diesel fuel, organic solvents, gasoline, metal fumes, paints, zoonotic viruses, microbes, and fungi. Children and other bystanders may also be at risk from exposure to lawn chemicals.
Lawn care exposure. A ChemLawn company study reported that an evaluation of the health of 100 applicators who applied pesticides for at least nine years showed no long-term adverse health effects attributable to the applicators' work with chemicals. It was estimated that these applicators were exposed more than 10,000 times what a homeowner can expect, and 100,000 times what a next door neighbor can expect (Nightline debate...1991).

Leonard & Yeary (1990) measured occupational exposure to four insecticides and two fungicides by 151 tree and shrub applicators who used hand-held equipment when spraying pesticides. The study was conducted for three consecutive years: 1985, 1986, 1987. Inhalation exposures were reported not to exceed any governmental recommendations or manufacturer defined acceptable levels for the products studied. Based on these results and the study conditions, they supported the recommendation that respirators need not be worn during the mixing, loading, and application process for the pesticides that were studied.

Yeary and Leonard (1993) continued to address inhalation exposure in application of pesticides to urban lawns, trees, and shrubs. Air sampling was conducted of the breathing zone air of applicators (n = 200), indoor air of pesticide warehouse facilities and offices (n = 82), indoor air of residential properties (n = 82), and ambient air of residential properties (n = 55). Results indicated that pesticides were not detected in 80% of the 500 samples collected. When detected, the time weighed average (TWA) values were generally less than 10% of any established or suggested standard.
Hurto and Yeary (1993) reviewed current research dealing with exposure to pesticides for both the applicator and the bystander. Applicator research shows that skin exposure is the most significant route of absorption on reentry to treated areas and for pesticide applicators. The highest exposure levels are to the lower portion of the body, including legs and groin area. Since hands only represent five percent of the body area, wearing gloves may not make that much difference if significant exposure has occurred to the feet and legs.

This review reported that indirect bystander exposure to turfgrass pesticides may occur in several ways. Indirect bystander exposure usually occurs through contact with dislodgeable foliar residues. This is generally defined as the pesticide fraction remaining on foliage that has the potential to be transferred to skin of animals or humans who come into contact with the pesticide-treated foliage. Total residue of pesticides found on turfgrass foliage was reported to range from 25 to 65% of the applied rate. This range was affected by pesticide formulation, turfgrass cultural practices, and environmental conditions. Within a day of application dislodgeable residues were usually less than 10% of the applied rate. One to 3 days after application three percent of the applied rate was detectable and less than one percent after seven days. Liquid spray results in more potential exposure than granular applications. They also reported that the few studies that have looked at spray drift and volatilization show exposure to be minimal.

A unique study by Leonas and Yu (1992) identified the deposition patterns that spraying a liquid would produce on clothing worn by homeowners using
typical lawn and garden equipment. Results from this study showed that the deposition pattern and level of exposure were dependent on the type of equipment used for application. A low volume backpack sprayer and Dial-A-Garden® sprayer produced significantly higher levels of deposition than a Sprayette®, ordinary backpack sprayer, rotary/broadcast spreader, and drop spreader. The two dry spreaders resulted in the least exposure with little exposure above the knee. For all types of equipment, the areas of greatest deposition were the feet, lower and upper legs, and the hands. Deposition was greatest on the front vs the back of the garment.

**Protective clothing.** For both homeowners and professional applicators a major source of protection from pesticide exposure has been identified as protective clothing. Studies indicate clothing provides a physical barrier that reduces pesticide penetration (Branson, Ayres, & Henry, 1986; Laughlin, Easley, Gold, & Hill, 1986; Raheel, 1987, 1988; Staiff, Davis, & Stevens, 1982) and can reduce dermal absorption (Davies et al., 1982; Nigg, Stamper, & Queen, 1986).

Slocum, Nolan, Shern, Gay, and Turgeon (1988) developed and tested protective clothing for lawn care technicians. Three volunteer company employees worn the experimental clothing while performing their regular duties. Three employees worn the regular company uniform. Results of biomonitoring showed that the protective clothing significantly reduced the amount of pesticide absorbed relative to the regular uniform.

Concern for workers’ health and research on the effectiveness of protective clothing lead the EPA to promulgate the 1992 Worker Protection Standard.
Under this standard agricultural workers and pesticide handlers must wear personal protective equipment (PPE) as specified on the pesticide label. PPE is defined as coveralls, respirators, protective eyewear, and chemical-resistant suits, gloves, footwear, aprons and headgear. Long and short-sleeved shirts, long and short pants, shoes and socks and other items of regular work clothing are not defined as PPE but could be worn in the absence of specific label directions. Thus depending on the product used and method of application, a variety of protective clothing and equipment may be required.

Heightened public concern about chemicals in the environment, reports of illness from long-term, low-level exposure to pesticides, Federal regulatory trends, and the litigious nature of society encourage companies to make the work environment as safe as possible, and to establish a record of concern for worker health. Yet while several types and styles of protective garments are now available commercially, the use of protective clothing and equipment for applicators has not been widespread in the lawn care industry.

Company attitudes toward use of protective clothing and equipment may be rooted in concerns about the image and nonverbal messages protective clothing communicates. Trade literature shows an awareness of the role of work clothing in nonverbal communication, particularly with respect to promotional and public relation messages. Applicators' uniforms are discussed as a "billboard" that "shows who you are and tells customers about your services" and "reinforces your company's - and your - professional identity" (Uniforms can showcase...,
1990). It may be that company officials believe protective clothing presents a negative image.

If this is the case, lawn care companies face a difficult dilemma, e.g. how to provide employees with clothing and equipment that offer more protection without increasing public perception of health and environmental risk associated with their products or services. The company is challenged to choose uniforms that will provide improved protection without generating concern for product safety among those who see employees at work.

While there is an extensive body of nonverbal communication research, there is no published research that will assist companies in evaluating nonverbal messages of safety or danger associated with work uniforms. Uniforms of a number of groups have been studied to determine the meaning they have to the public or to clients. These groups include police (Gundersen, 1987; Joseph, 1986; Singer & Alan, 1985), nurses (Brown & Goldsten, 1968; Hawkins, Claghorn, & Zentay, 1966), and religious orders (Reidy, 1967). Professional clothing of counselors (Amira & Abramowitz, 1979; Roll & Roll, 1984), teachers (Chowdhary, 1988), and business women (Dillon, 1980; Forsythe, Drake, & Cox, 1984; Scherbaum & Shepherd, 1987) have also been studied. This body of literature provides information about the visual cues that suggest authority and power, approachability and interaction, credibility and competence, and other personal qualities. Studies indicate that there may be one salient piece of a uniform that viewers use as a cue, for example the policeman’s hat (Volpp & Lennon, 1988) or a nurses’ cap (Lafferty & Dickey, 1980).
There is also some basis for reasoning that perceptions of an individual's clothing may be the basis for an extended inference to the group or city. Workman and Johnson (1989) found that the manner in which cabdrivers dressed influenced visitors perceptions of the city. Nicely dressed drivers elicited a more favorable impression.

No studies of perceptions of lawn care uniforms were located in the published literature. One trade article suggests that negative perceptions of protective clothing exist. During the presentation of findings from a series of consumer focus groups dealing with lawn care, Culpepper said, "Unfortunately, people see protective clothing and equate that with danger" (Study determines..., 1994). It may be that conventional wisdom in the industry promotes avoidance of anything that looks protective.

Two studies were located that specifically addressed the homeowner's use of protective clothing. Rucker, Grieshop, Peters, Hansen, & Frankie (1988) collected data from 415 California residents via a mail questionnaire. Close to one half of the respondents said they wore some type of protective equipment and/or clothing when applying pesticides. The most frequently listed item was gloves, mentioned by about 24% of the group. Very few other items of protective clothing were mentioned as being worn. When asked what they did with the clothing after wearing it to apply pesticides, 22.7% said "nothing" and 74% said they "washed it". Reasons given for not wearing protective gear included the expense and possible social ridicule involved in use of these kinds of items,
perceived protection by the government, and belief that there was little danger associated with using such low dosages of the products.

Harris, Solomon, & Stephenson (1992) studied the effect of protective clothing with regard to exposure to the herbicide 2,4-D with a group of home gardeners (n = 22) and bystanders (n = 22). Bystanders were individuals living within the household who did not apply the herbicide. Half the applicators wore protective garb which included clean coveralls, gloves, and rubber boots. The non-protective group worn clothing of their own choice (typically long pants, running shoes, and short sleeved shirts). Analysis of urine collected from homeowners for 96 hours following applications found the highest exposures occurred in the nonprotected group and were consistently associated with spills. No residues of 2,4-D were detected in bystanders’ urine samples. Residues of 2,4-D were detected in five of the 76 air samples taken during the home applications. Recommendations were that homeowners can reduce exposure by using rubber gloves, overalls, and rubber boots in all phases of the application process.

A second study looking at 2,4-D exposure was conducted with 10 volunteers who were immediately exposed after turf spraying and a second group of 10 volunteers who were exposed 24 hours after application (Harris & Solomon, 1992). Each group of 10 volunteers were divided into two groups: one wore long pants, t-shirts, socks and shoes and the second wore shorts, t-shirts and went barefooted. Immediately after exposure plots were sprayed the first group of volunteers undertook a 60 minute exposure session, walking and sitting on the
grass for timed intervals. At the end of the session volunteers washed their hands and ate a picnic lunch but did not shower or otherwise decontaminate their skin for 6 hours. Twenty four hours later a the second group of volunteers began their 60 minute exposure session on the same plot. Volunteers alternated walking and sitting or lying for 5 minute periods throughout the 60 minutes. Air samples and urine collections were used to measure the exposure to the herbicide 2,4-D. Three people who wore shorts and were barefooted and contacted the turf immediately after the 2,4-D application had detectable residues in their 4-day urine samples. Dislodgeable residues of 2,4-D taken during the exposure sessions showed a rapid decline from 1 hour following application (8%) to 24 hours following application (1%). The authors recommended that people can reduce exposure to non-detectable chemical levels by staying off treated turf for 24 hours or until after rainfall or irrigation.

Summary

Grass is a natural occurring organism that grows in the soil and requires sunlight, water, and nutrients. Grass has been modified and changed to create an artifact: the ideal American lawn which is a uniform, weed free, green, thick, stand of grass cut to a prescribed height. These lawns require inputs of water, chemicals, special kinds of equipment, and human energy and time to maintain them. The existence of the ideal American lawn is supported by multibillion dollar industries that supply products necessary to the care of the lawn: seeds, equipment, fertilizers, pesticides, and protective clothing/equipment. A service industry has evolved that is dedicated to caring for the lawn. Positive outputs
from the lawn grass include oxygen from photosynthesis, erosion control, and cooling. Negative outputs include grass clippings in landfills, pollution from gasoline engines, empty pesticide containers, used oil, real and potential groundwater contamination, and unknown health and environmental effects from the chemicals used on the lawn.

**Human Experience and the Total Environment**

The study of relationships between the natural environment (nature) and people's psychological and biological behaviors is truly multidisciplinary. Investigators in agriculture, anthropology, biology, forestry, geography, health, history, interior design, landscape architecture, natural-resource management, psychology, recreation, sociology, and urban planning have all contributed to the growing body of literature.

**Environmental Aesthetics**

Sadler and Carlson (1982) call the field of study which explores humans' relationships with nature, "environmental aesthetics". They write

We all interpret, in one way or another, the positive and negative features of the physical settings we occupy, pass through, and visit. The aesthetic effect of places and landscapes is an important dimension of this pervasive sensory ecology. A sense of beauty or even harmony enhances our lives; a sense of blight or discordance correspondingly diminishes them. It is almost impossible to prove scientifically these kinds of effects on well-being, but the general principle is widely accepted (p. 1).

They point out that all environments, natural or man-made, evoke feelings and have aesthetic dimensions. They view aesthetic quality as an amalgam of physical properties and social values. Therefore, environmental aesthetics includes
"storied meaning as well as the structured appearance of place and landscape" (p. 5).

Included in the field of environmental aesthetics is environmental psychology which focuses on aesthetic response and covers the scenic preferences and visual assessments of the lay public (Sadler and Carlson, 1982). Since the environment is experienced through all human senses, research should examine environmental affect in relation to all the senses. But the visual experience is typically the most important to humans so many studies have relied upon visual perceptions and used slides or photographs as the basis for the outcome ratings.

Kaplan (1978) described the drive to seek out nature as the "green experience". This is not necessarily dependent upon the color green. She wrote:

The green experience then, refers to the encounter with natural environment, and especially the unspectacular, everyday natural environment that comes in a variety of colors and guises...The natural environment matters to people...not only in the infrequent escape to far-flung poster places, but in its potential availability and accessibility as a renewable and renewing resource (p. 186).

Miller (1988) suggests that families move to the suburbs in search of nature.

Appendix D reviews literature related to environmental aesthetics. Findings from these studies suggest the "green experience" is strongly preferred among humans. Nature may be an intrinsic need, which is sought out for itself and not acquired to be exchanged for something else. Human preference for nature may be innate. But preferences appear to change with age and experience and there are differences between males and females.
Among urban settings those containing nature are most preferred. Unmanaged nature is relatively less preferred than landscaped areas. Trees are a highly-valued component of urban nature. Satisfaction with one's immediate environment is increased when trees, grass, shrubs, and flowers are present. The expression of preferences appear to differ with social class. Natural environments, as well as sustaining life, appear to provide inner peace and facilitate improved mental health and recovery from physical illness.

Meaning

Nature is invested with rich and powerful meanings, symbols, values, and beliefs. The meaning of nature is shaped and formed by the ecological conditions under which people live (i.e., rain forests, mountains, plains, or deserts), the historical context of the particular culture, the cultural and social structures, and the values and beliefs systems of the culture.

Brown (1972) argues that to know the world in any significant sense is first and foremost to understand it in terms of what it means. Rapoport (1982) focuses on meaning as central to the various levels of nonverbal communications from the environment to people. Environmental elements organized in space ranging from walls to people, become "indicators of social position, ways of establishing group or social identity, and ways of defining situations within a specific culture which in turn lead to expected behaviors in the settings (p. 181-182). Blumer (1969) suggests that meanings are built up by people "through an interpretation of objects, situations, or the actions of others" in a social context (p. 84).
Meaning of the Lawn

Meinig (1979) writes, "Every mature nation has its symbolic landscapes. They are part of the iconography of nationhood, part of the shared set of ideas and memories and feelings which bind a people together" (p. 164). Houses and their surrounding yards are important elements in these landscapes.

Houses and the grounds that surround them are "warehouses of personal experience" (Lawrence, 1985, p. 118). Houses are part of the language of gestures that individuals use to communicate with each other and to control the amount and type of information that others receive (Sadalla, Vershure, & Burroughs, 1987). Altman and Gauvain (1981) found that in many cultures, houses are situated in accordance with environmental, climatic, cosmological, and religious influences. The siting of American houses does not appear to be influenced by any of these factors. They state:

American middle-class suburban tract homes are usually located in the middle or rear part of a lot, with some separation, in the form of a lawn, between the home and a public street.... Landscaping the front yard is a traditional American vehicle for achieving individuality and uniqueness; enormous amounts of time, energy, and money are invested in the cultivation of grass and shrubbery in a never-ending cycle of fertilizing, watering, and cutting...The fronts of American homes and yards not only express identity, but they also depict the bonds of a family with the community (p. 293).

The American residential lawn is much more than grass. It is viewed by society as a reflection of the attitudes and values of individuals and families making a home together. Cooper (1974) describes one’s home as a symbol of self and self-identity. The exterior of the home is seen as a symbol of self which is presented to the outside world. Franck (1974) describes how new homeowners
begin to consider their new residence their home only after they have personalized it with their own belongings.

The lawn and yard reflect the personal tastes of the homeowner. A recent survey found that 33.5% of new homeowners enlist the service of landscape or lawn care companies within the first six months of moving into their new home (New homeowners...1991). Gauvain, Altman, and Fahim (1983) found that expressions of individuality were tempered with the awareness that the front yard also needed to conform to the neighborhood standards of taste and sociability.

Ramsey (1938) wrote in her book, Landscaping the Home Grounds

Naturally, we want our home grounds to appear to the best advantage, for the passer-by judges our homes by the way the grounds are planted and cared for. Few see the interior of our homes but every passer-by sees the exterior" (p. 17). She echoes others in her directive, A man's home may be his castle, but his front yard belongs to the public...The universal practice of establishing building lines and setting the house back from the street has created the typical American front yard. Custom has prescribed the leaving of the front yard open, providing a view of the house and grounds...The homeowner should always keep in mind that it is his duty to do everything in his power to make his street more attractive (p. 54-55).

The front yard is viewed as the more formal "parlor", while the backyard is the place for family activities, the "living room".

The use of the house and its surrounding grounds as a means of self-expression is probably most characteristic of middle- and upper-middle-income families. Becker (1977) writes

It is primarily for the middle class, where it is accepted as a given that the house is a safe place, that more attention is paid to the house as a means of self-expression and self-realization. People concerned about the cold, plumbing, and rats do not have the luxury of worrying about the image of their home (p. 18).
The meaning and symbolism evoked by lawns is very powerful. Individual homeowners who have attempted to plant wildflowers or encourage a "natural" lawn have met resistance and in some cases lawsuits (Lowen, 1991; Unmowed lawn...1991). Exceptions do exist. The city of Madison, WI has incorporated "natural" lawns into its city regulations. Subject to review and approval, a homeowner can cultivate natural growth beyond the 8 inch maximum height normally enforced by the city (Russell, 1979).

But as Michael Pollan (1991) writes

To stand in the way of such a powerful current is not easily done. Since we have traditionally eschewed fences and hedges in America, the suburban vista can be marred by the negligence - or dissent - of a single property owner. This is why lawn care is regarded as such an important civic responsibility in the suburbs, and why, as I learned as a child, the majority will not tolerate the laggard...That subtle yet unmistakable frontier, where the crew-cut lawn rubs up against a shaggy one, is a scar on the face of suburbia,...an intolerable hint of trouble in paradise (p. 55-56).

Values. Beliefs. and Attitudes

According to Karl Mannheim (1936) the ideas, values, and attitudes of a given group are embedded in the social conditions under which the group lives. Persons, bound together into groups

strive in accordance with groups to which they belong to change the surrounding world of nature and society or attempt to maintain it in a given condition. It is the direction of this will to change or maintain, of this collective activity, which produces the guiding thread for the emergence of their problems, their concepts, and their forms of thought (p. 78).

This suggests that people are socialized and, to some degree, pressured to act or behave in accordance with the attitudes and values agreed upon by the social groups to which they belong. The expression of these values, beliefs, and
attitudes through action, or behavior, is an expression of the ideology of the group.

The relationship of humans to nature is complex and paradoxical. In the case of something so broad and omnipresent as "nature" or "natural environment" the values, beliefs, and attitudes associated with it are often taken for granted. Few people are aware of how they are influenced by cultural and physical conditions from the far past that are very different from today.

Values refer to preferred end states (i.e., freedom) and preferred ways of doing thing (i.e., being honest) (Rokeach, 1985). Values represent a link among a person's emotions, motivations, and behavior. Attitudes and behavior are sometimes thought to be caused by values.

Beliefs are the information that a person has about a person, object, or issue. They may be factual or based on personal opinion. Olsen, Lodwick, and Dunlap (1992) argue that when beliefs change, values change; beliefs precede values within mental constructs. People may adopt new values that contradict their current beliefs and go to great efforts to justify their new values in terms of old beliefs. They write

Because beliefs logically precede values and are taken for granted as expressions of reality that are beyond debate, they would appear to be the most fundamental components of cultures...They constitute the foundation that supports all other shared cultural ideas, including values, goals, norms, customs, and rules (p. 180).

They emphasize the need to study belief systems in order to understand public policies and governmental programs.
Prown (1993) proposes that there are two levels of beliefs. The first is comprised of surface beliefs, beliefs of which people are aware and which they express in what they say, do, and make. The second level of belief is hidden. He states that

a culture's most fundamental beliefs are often so widely understood, so generally shared and accepted, that they never need to be stated...Indeed, there may be beliefs of which the culture itself is not aware, and some of them may be so hard to face that they are repressed (p. 3).

Attitudes and beliefs are closely intertwined and often very difficult to separate. Attitudes are lasting, general evaluations of people, objects, or issues (Petty & Cacioppo, 1985). They have traditionally been defined in terms of cognitive, affective and conative facets (McGuire 1969, 1985, 1989). However, researchers have rarely operationalized attitudes in terms of this definition. As a result there has been an attempt to define attitudes formally to conform to typical research usage. The field of social psychology currently defines attitudes as "an evaluative response toward an object" (Tesser & Shaffer, 1990, p. 512). The conative domain refers to the actions or behavioral tendencies of an individual regarding a person, object, or issue (Borden & Schettino, 1979).

Environmental Attitudes

A basic question in attitudinal studies is the extent to which attitudes are related to actual behavior. Chaiken & Stangor, in their 1987 review of attitudinal research, suggest there are two general conclusions relative to the extent to which attitudes are related to actual behavior. The first is that the specificity of attitudes and behavior must be equated before the relation between
the two will be manifest (Ajzen & Fishbein, 1980). This means general attitudes (in terms of the action, target, context, and time) correlate with general behavioral tendencies, whereas specific attitudes correlate with specific behaviors.

The second conclusion of attitude research is that attitudes influence behavior to the extent to which they are activated or made accessible (Fazio, 1986). When an individual's attitudes are primed and thus processed in a more controlled and intentional fashion, the relation between attitudes and behavior is enhanced.

According to Shetzer and his colleagues (1991) the implications of these findings for environmental attitude research are that (a) attitudes will predict environmental behaviors when both are measured at similar levels of specificity and (b) attitudes that are made salient to individuals are more closely related to behavior. For a review of literature related to environmental attitudes see Appendix E.

Given the nature of most environmental threats, individuals are responding within a social context. Therefore, environmental concerns are socially embedded. Connerly (1986) and de Haven-Smith (1988) found that personal determinants of attitudes seem to be related via belief systems to the social categories the individual occupies and the effects of the resource or hazard in question on group and individual interests. Normative influences can exert a strong force over behavior. Social norms may prevent people from acting the way they would like to based upon their attitude or encourage them to act in a way that contradicts an attitude. For example, it is socially unacceptable to
litter. People may respond positively to a question about littering because littering is viewed as socially irresponsible. In actual practice they may well be "litterbugs".

Lawn Care Attitudes

Two studies are reviewed that have looked at attitudes related to the lawn. Other research was located but were in-house studies done by private companies and were not available for public review. A recent Gallup poll added some additional information about lawn attitudes.

The DowElanco lawn study. In 1993, DowElanco Specialty Products, Indianapolis, IN commissioned a qualitative study to explore benefits and perceptions of homeowner lawn care (DowElanco, 1993). A total of six in-depth focus group interviews were conducted around the United States. The two sessions in both Columbus, OH and Atlanta, GA were made up of (a) homeowners using a lawn service (1st group) and (b) do-it-yourself homeowners (2nd group). The session in Philadelphia, PA included a mix of renters and owners of units without a lawn. The Salt Lake City, UT group was made up of homeowners who only mowed and/or added fertilizer. The study participants included 29 males and 29 females ranging in age from 30-60 years with incomes over $35,000 who were the primary lawn care decision maker. DowElanco was not identified as the sponsor of the study.

The focus group participant had been identified as the primary lawn care decision maker but when asked who did the actual yard work, it was reported that it was the household member that had the most time available. The gender
of that person was not identified.

Two broad categories of lawn use were identified. The first was labeled the aesthetic/value category. Lawns were viewed as a means of increasing the value of the home, contributing to the enhancement of the neighborhood, providing the owner visual pleasure from the surroundings, and a place to watch nature - the change of seasons, things growing. Philadelphia respondents without lawns believed that people with lawns invested time and money in them because a lawn reflected on the homeowner.

The second use category was for physical activities within a private setting. The lawn provided a safe place for children to play, a productive way to keep children less involved with TV and Nintendo, a place for socializing with and entertaining of neighbors and friends, a playing field for sports, an exercise area, and a place for pets to run around.

Homeowners were reported as being very verbal about expressing strong positive feelings regarding their lawns. Emotional benefits derived from lawns included: having one's own space in which to do what one wanted, a sense of control over the immediate surroundings, a place where one could spend quality time with family, a place where one could work outside, a means to "get away" from daily demands and pressures, and a place that provided self-satisfaction, a sense of accomplishment and relaxation. Some respondents expressed the belief that a lawn reflected on them personally.

Environmental benefits of lawns included erosion prevention, oxygen generation, and cooling. When probed on this area, participants acknowledged
that environmental benefits were not "top-of-mind" responses. They were secondary to use and emotional benefits.

Respondents did express some negatives about their lawns. Lawns were characterized as expensive to maintain, time consuming, and a lot of work. However the majority of the respondents felt lawns were worth it. The focus groups expressed the opinion that the standard for an acceptable lawn was high, it should be a "clean, well-manicured, pest-free, lush lawn."

They believed that this desirable condition was most likely to be achieved with the use of chemicals. Respondents expressed uncertainty and unease about the use of chemicals but generally speaking, for this group of homeowners, moderation and proper usage were viewed as the key to safety. The opinion was also expressed that if these products were approved and available for general use they must be safe. At the same time, participants acknowledged that if alternatives to chemicals were available and as effective, they would use them. County extension agents and universities were believed to be the most credible sources for information about lawn chemicals.

The focus group moderator emphasized in the report that the entire issue of lawns was one of high emotion. The written report could not capture the intensity of the comments. Lawns are very important to homeowners.

The PLCAA study. The Professional Lawn Care Association of America (PLCAA) in Marietta, GA commissioned a focus group study during the summer of 1993 to explore homeowner attitudes and practices regarding lawn care and the impact of signs used to notify homeowners of service applications. Three
focus groups were conducted with homeowners in Baltimore, MD and three focus groups with homeowners in Boston, MA. In each city one focus group was made up of homeowners who used a professional lawn care service and two groups with do-it-yourself lawn care homeowners. Twenty seven individuals participated in the Boston groups and twenty six in the Baltimore groups. Each group was made up of a mix of men and women, parents of children under the age of ten, pet owners, and owners of homes with different sized lawns.

Findings from the six focus groups include:

1. The majority of homeowners were interested in the appearance of their lawn. Homeowner interest ranged from moderate to self-described "fanatical". Very few participants were content with just a mowed lawn. There were substantial variations in what people were willing to do and spend in order to achieve the desired appearance. Health concerns were mentioned along with discussion about the cost of lawn care service.

2. Word of mouth appeared to be the single most influential factor in people's selection of a lawn care service.

3. Participants expressed little interest or desire for information about the products used in lawn care.

4. General concern about the safety of lawn care chemicals was greater among homeowners who did not use professional services. Chemicals were often cited a reason for not using a service or for discontinuing a service previously used. Most concerns focused on liquid chemicals and sprays. The general view was that granular products may be safer.

5. Health risks to children and pets and the goal of achieving an attractive lawn were mentioned more often as concerns than concern about risk to the environment.

6. Awareness and understanding about various terms such as integrated pest management, organic pesticides, and other words were very limited. Many
people said organic pesticides are better but few thought they were worth payment of a higher price.

7. Nearly half of the lawn care customer respondents believed that professional application of pesticides is safer (n = 9 of 19 respondents). Almost no noncustomer believed this (n = 2 of 37 respondents).

9. Demographic variables such as age and gender did not seem to affect response very much.

1994 Gallup Poll. Respondents to a recent Gallup Poll (n = 1665) rated the benefits of a property which had a well-maintained lawn and landscaping (PLCAA, 1994). Results showed that the benefit chosen by 45% of the respondents was that of helping to beautify the neighborhood. Other benefits included providing a place of beauty and relaxation for the family and friends (chosen by 38.6%), enhancing property values (chosen by 38.6%), reflecting positively on its owners (38.4%), providing safe, high quality play area for children (chosen by 26.7%), and an exercise area for pets (chosen by 12.7%). Environmental benefits such as purifying and cooling the air and filtering water were near the end of the list of benefits. The poll also indicated that people living in rural areas tended to rate the environmental benefits of a lawn higher than their suburban or urban neighbors.

Summary

All cultures have invested nature with rich and powerful meanings, symbols, values, and beliefs. It appears that humans have a deep, perhaps innate, intrinsic need for nature. In American culture, the lawn appears to play a role in meeting this need. Houses and their surrounding landscapes are important
symbols with meaning and value a part of them. Americans' front yards provide a visible picture that represents the family's life and values and make a statement about one's place in the community. Neighborhood norms and society's messages about the lawn are two psychosocial/intangible variables that are part of the immediate environment. Norms and messages are aspects of the human situation that are influenced by beliefs, attitudes, and values.

Studies that have looked at lawn care attitudes and activities report that American homeowners perceive the lawn as a source of pleasure, beauty, and economic benefit. Homeowners experience both mental and physical reactions to the lawn (biopsychic state). Both real life conditions and perceptions are important influences on the biopsychic state.

A growing body of research suggests that American beliefs and attitudes about human interaction with the environment are changing to a "new environmental paradigm" (Appendix E). This paradigm suggests that humans were not created to rule over nature but must live in harmony with the natural world and act with prudence and care in an attempt to prevent permanent damage to the natural ecosystem. Yet for American homeowners, the use of lawn chemicals is deemed necessary and appropriate.

The Evolution of the Ideal American Lawn

American Attitudes Toward Nature

White (1967) argues that North American attitudes toward nature have been dominated by a Christian, white, Western European perspective. Both technology and modern science are distinctly Western in origin and can be traced
to the Judeo-Christian traditions that have shaped the growth of Western civilization. In the Judeo-Christian view humans are special, made in God’s image, and set apart from the rest of creation.

And God blessed them and God said to them "Be fruitful and multiply and fill the Earth and subdue it; and have dominion over the fish of the sea and the birds of the air and over every living thing that moves upon the Earth." Genesis 1:28.

The ancient Hebrew social organization was tribal, seminomadic, and patriarchal. Their primary allegiance was to the group rather than to the land or any particular place (Crownfield, 1973). They moved from place to place, raising their sheep, with minimal regard for the long term effects that their passage had made upon the environment. Crownfield argues that this migratory approach to life has permeated thinking about the relationship between nature and humans and it has had a profound impact on Western attitudes toward both nature and our concept of time. He writes, "The present is to be negated, left behind, abandoned with all its problems and defects...the problems of the present are going to be resolved in a dramatic, interventionist future" (p. 59).

Many people today believe that technology or new energy resources will ultimately solve our ecological problems (Ashmore & Tumia, 1975; Borden, 1984/85). Burke (1985) has observed that this view of life inevitably leads to a technology that has as its goal, not stability, but constant change. This view of humanity’s relationship with nature (embodied in the Dominant Social Paradigm) makes it incredibly difficult to get people to change environmentally destructive
behavior. They strongly believe that a miraculous divine force will intervene on their behalf and set things right (McAndrew, 1993).

As a result of this orientation, early American settlers worked to bend nature to human will rather than to adapt their lifestyles to the natural surroundings. Tuan (1974) writes that to American settlers, the wilderness was threatening - a place to be "reclaimed and redeemed" (p. 63). The majestic eastern forests were quickly felled to make way for pastures, cattle, fields, and crops. Anglo-American settlers attempted to replicate the more humid eastern environment in the Arizona desert (Saarinen, 1988). In the early 20th century, those who moved to the dry climate in order to alleviate their allergies defeated this purpose by planting and growing the same plants and shrubs to which they were allergic.

This linear, noncyclical view of existence contrasts with many nonWestern traditions, such as those developed in India (Zimmer, 1951) and by North American Indians (Waters, 1963). For North American Indians harmony exists in the world only when the sources of power - humans, animals, places, and spirits - work together (Tuan, 1974). But even American Indians actively altered the environment to suit their needs (Williams, 1993).

Smith (1993) disputes these viewpoints. He argues that while humankind has made mistakes, "attacking our biblical world view to solve environmental problems may well be like the hermit who burned his house down to kill a rat" (p. 15). Smith credits Ralph Waldo Emerson, John Muir, Henry David Thoreau, Lynn White, Jr., and other transcendentalists with founding a "nature religion."
Nature theology sees nature as God, the earth as sacred and endowed with feelings, rejects progress and science, and views human management of nature as a desecration of the sacred.

Smith believes that it is very easy to confuse an appreciation of nature with a worship of nature. He emphasizes that while the Judeo-Christian ethic gives humans the right to use the earth and its creatures for food, clothing, and shelter it also gives humans the responsibility of caring for the earth. He believes that humans can learn from their mistakes and that making use of new knowledge is better than abandoning all attempts to manage nature.

A Brief History

The emergence of the ideal American lawn can be traced to the pleasure gardens of medieval Europe. The climatic conditions of England made the growing of grass very easy and English settlers brought both the seed and the ideal of grass which has grown into today's contemporary lawn. Thomas Jefferson's belief that every man should own property has found ultimate expression in America suburbia. The growth of the suburbs gained momentum after the Civil War. Americans left the dirty, crowded, disease ridden cities created by the Industrial Revolution in order to live closer to nature in rural surroundings. The real and perceived benefits of living in the country were readily embraced by the populace. With the advent of the automobile, American suburbia became the dominant landscape form and the single family home the dwelling of choice.
Zoning laws and 25 foot setbacks from the street became standard in large cities in the late 1800s. These setbacks provided areas that could be landscaped with grass, flowers, trees, and shrubs. By the turn of the century restrictions and covenants were being written into deeds, mandating architectural and landscaping controls.

The lawn became both a barrier and unifier. "A verdant moat separating the household from the threats and temptations of the city. It serves as a transition from the public street to the very private house" (Jackson, 1985). And according to Olmsted also "unified the whole neighborhood, giving a sense of completeness, greenness, and community" (Kelly, 1981).

As the 20th century advanced other societal changes strengthened the importance of the ideal American lawn. The game of golf and the development of grasses for the golf course set a standard for the homeowner to emulate. A population that was living longer with better health and greater discretionary income allowed people more time to work in their yards. Americans began traveling more and visited areas where grass looked better than their own at home. The invention of color television brought pictures of lush, green lawns from other places into the living room.

Men have generally been the person in charge of the lawn and women have taken care of the garden and flowers. The changing role of women decreased the time spent in the family garden and often these unused plots were planted in grass. The increasing pace of modern life resulted in less time to be devoted to the maintenance and care of the lawn. The emergence of the lawn care service
industry paralleled these developments. (See Appendix F for a more complete review of the history of the lawn.)

Summary

A critical component of the biohistorical approach is understanding the historical context of a phenomena. Judeo-Christian teachings have stressed the idea that humans are created in God's image and placed on Earth to rule over nature. This ethic has resulted in a great deal of unintentional destruction of the natural ecosystem.

The evolution of the ideal American lawn has been strongly influenced by the British. The pollution that accompanied the Industrial Revolution hastened the flight of families from the cities. Technological developments that resulted in the automobile, lawn mower, and synthetic chemicals have made is easier to maintain a lawn. Societal changes in terms of better health and greater longevity and changes in family roles and recreation activities have contributed to the growth of the lawn. The emergence of the lawn care service industry provided Americans with an easier way of developing and maintaining a high quality lawn. The use of chemicals, fertilizers and pesticides, on residential lawns continues.