



# Natural Resource Conservation: Environmental Impact of Commercial Development

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The urbanization of America continues at an ever increasing pace. Along with the many benefits of urbanization, there are well documented problems such as the negative impact on the environment. The negative impact of commercial development on the environment is not restricted to urban areas, but includes effects on air and water quality in rural areas, which increases the urgency of addressing this problem. Natural resources in the urban environment must be preserved to maintain the environmental life support system, especially clean air and water. These problems are not restricted to the largest cities, although their problems are generally more acute than smaller cities. Environmental deterioration usually starts in small towns and occurs slowly until a major problem occurs. Communities need a well organized effort to preserve the quality of urban natural resources.

The effects of urbanization on our environment are becoming clearer and provide the impetus for concrete steps to minimize the negative effects of development. Significant impacts on the environment, documented during rapid growth in urban areas, include: (1) increased ambient temperature, (2) decreased air quality, (3) increased water run-off, (4) decreased quality of run-off water, (5) altered weather patterns, and (6) loss of aesthetic beauty/character of the community. The factors discussed in this paper contribute to what is referred to as "decreased quality of life."



## **INCREASED AMBIENT TEMPERATURE.**

Commercial development in cities can result in elevated ambient temperatures. This is due to a combination of decreased tree canopy and additional heat generating sources, such as buildings and

exposed parking lots. For instance, the temperature in Atlanta (3) increased 5 to 10 degrees Fahrenheit, from 1987 to 1997. The temperature change has earned Atlanta the designation of "urban heat island."

A primary cause of temperature elevation is the removal of vegetation, particularly trees, during development. In the 13-county metropolitan Atlanta area, an estimated 56 acres of trees are removed each day. In most situations, "clear cutting" is used when selective removal of trees would accommodate development and reduce the number of trees removed. As a result of excessive tree removal, increased air temperature causes higher air conditioning bills and more smog due to the combination of car exhaust and high temperatures. Excessive removal of trees causes increased exposure of buildings and parking lots to direct sun which increases the already elevated temperature.

The economic impact of tree coverage was reported in a recent study by a University of Florida researcher (1). Canopy (tree) cover to electricity usage was compared for Gainesville and Ocala, Florida. Matis found that the leaf area index (the number of square meters of leaves per square meter of ground) in Gainesville was about twice that of Ocala ( 4.61 vs. 2.13). The electricity usage in Ocala homes averaged 1,075 kilowatt hours per month, about 15 percent more than the 940 kilowatt hours for the average Gainesville resident. This translated to an annual savings for the average Gainesville house-hold of \$126.

**DECREASED AIR QUALITY.** As cities grow, an undesirable combination of events occurs leading to a decline in air quality. The number of trees is reduced due to development, and the number



of cars increases due to more people. In effect development reduces our air filters, trees, and increases the amount of pollutants that must be filtered. Much of the harmful pollutants in urban areas, such as ozone, sul-fur dioxide, and nitrogen dioxide, come from vehicle exhausts. Much of the ozone that forms in cities occurs on hot summer days when the heat stimulates chemical reactions in the exhaust of vehicles. Other sources of ozone include power plants, buildings, and lawn mowers.

Trees are critical components of our environmental life support system and are necessary to prevent or minimize the negative combination of high temperature and vehicle exhausts from spinning out of control and causing harmful ozone levels. The American Lung Association estimates that ozone-associated health care costs Americans about \$50 billion annually (3).

Trees improve air quality by providing a cooling effect through transpirational water loss from their leaves and by filtering atmospheric pollutants through their leaves. By decreasing both the temperature and the amount of pollutants in the atmosphere, trees can have a positive effect on air quality. A recent study at Berkeley's National Laboratory found that, if Atlanta lowers the air temperature 2 to 4 degrees Fahrenheit, the city could bring down ozone levels by 10 to 14 percent (3). This is significant since federal highway funds can be withheld from Atlanta and other metropolitan areas because of poor air quality. Ozone is a major contributor to poor air quality in urban areas.

A recent article (4) quantified the ability of trees to remove air pollutants and demonstrates that trees are effective filters of air. Perhaps an appropriate analogy would be the filter for a home air conditioning unit. If you remove the filter for the air conditioning unit, the cooling unit will become clogged with trash and will stop functioning. A similar thing could happen to our lungs if sufficient natural filters (trees) are not maintained. In the cited study, all trees tested were capable of re-moving both large (2.5-10 micrometer diameter) and small (1-2.5 micrometer) particulate material, as well as ionic mate-rial (including those containing sulfate, phosphate, nitrate, chloride, calcium, potassium, magnesium, and sodium). Ionic materials comprise the major exhaust pollutants of vehicles. Trees were able to remove large quantities of each type of material. Of particular interest to Georgians is that conifers

(pines, etc.) were more effective in removing pollutants than were broadleaf trees.

### **INCREASED WATER RUN-OFF.**

Commercial development substantially changes the topography of an area. The land usually starts as a forested area or at a minimum, a clear area with grass and/or other vegetation. The effect of the vegetation and soil is to slow the movement of water and to provide an opportunity for water to enter the ground. Development removes trees and other vegetation that soften the impact of rain. As a result, rain hits the ground with greater force and compacts the soil surface. This reduces the amount of water that can enter the soil and increases water "run-off." In addition, buildings, parking lots, and other impervious structures reduce percolation of water into the soil and promote run-off. The result is large volumes of water entering the storm water system or creeks in a short period of time.



Capturing run-off water is a very expensive proposition. A goal during development should be to minimize the amount of impervious area and capture water at the point of impact. Intercepting water near the point of impact is cheaper than developing elaborate storm water systems. The pervious or Green Space area reduces the amount of run-off. Therefore, communities should set targets for the amount of Green Space. In Georgia a new "Green Space initiative" passed by the 2000 legislature sets a target of 20 percent.

### **DECREASED QUALITY OF RUN-OFF**

**WATER.** The quality of water in the streams and rivers of Georgia is deteriorating. Water that does not percolate into the soil will eventually flow into the water sheds and waterways of Georgia. Rain water that hits the surface is usually clean, unless we have high levels of atmospheric pollutants. When clean water impacts the ground in natural areas, much of it percolates into the soil and eventually into the water table. Water that does not percolate will flow toward low areas after it is filtered by grass and other vegetation.



Urbanization increases the amount of rain striking impervious surfaces such as roof tops and asphalt parking lots. The rain washes surface material, such as dirt and petroleum

products, into the surrounding streams. This causes high levels of particulate material and chemicals in Georgia streams. Streams are important sources of drinking water, irrigation water and wildlife habitat. Development should occur in a manner to ensure clean water entering Georgia streams.

Rain water also washes the pollutants from the air before they enter the water-ways. Vegetative areas are essential to filter the water before it enters watersheds. To manage run-off water quality, we must also manage that amount and location of Green Spaces in developing urban areas. Cleaning water through vegetative filters helps avoid the higher cost of artificial filtration.



**ALTERED WEATHER PATTERNS.** In the advanced stages of urbanization in large cities like Atlanta, altered vegetation can lead to altered weather patterns (3). The time to take steps to prevent this is at the early stages of growth in a city. In Georgia,

middle size cities, such as Albany, Macon and Augusta, and smaller cities, such as Valdosta and Dalton, should implement conservation measures now. A few prudent steps in the early stages of city development can avoid later drastic measures.

Elevated temperatures during the past 10 to 13 years due to excessive tree removal have caused Atlanta to influence its own weather. University of Georgia scientists were able to link the formation of thunder-storms during a nine-day period directly to the increased summer temperature radiating from man-made surfaces in Atlanta. An indicator of “self-made” storms is that they occur in the early morning hours rather than the typical summer afternoon showers. These heat islands can also alter the rainfall patterns in adjacent areas. Therefore, the negative effects of urban heat islands is not confined to urban dwellers. Altered weather patterns, such as rainfall, could be detrimental to agricultural interests and homeowners in adjacent areas.



### **LOSS OF AESTHETIC BEAUTY/ CHARACTER OF THE COMMUNITY.**

The removal of large quantities of trees can drastically alter the appearance and character of a community. Many communities in Georgia are characterized by their canopy (tree) cover. This includes the mixed hardwoods of Atlanta,

coastal live oaks of Savannah and Brunswick, and majestic long leaf pines of Valdosta. Numerous small communities in Georgia are enriched by the trees planted many years ago by early settlers. This rich heritage gives communities aesthetic beauty and the environmental cleansing aspects of the tree cover.

In many cases trees add value to residential and commercial property. It is not unusual for a single large tree to add \$1,000 to \$2,000 to the value of a home or business. In several studies across the country, a well landscaped property adds an average 15 percent to the value of the property (2). This value usually far exceeds the initial costs of landscaping. Therefore, a well landscaped property is one way to add significantly to property value and to improve the quality of the environment.

In addition to the monetary benefit of a well landscaped property, there is the important psychological aspect. Trees “soften” the appearance of their surroundings, cool the air, and provide a tranquil environment where people are more relaxed. Trees also provide habitat for wildlife and the soothing sounds of birds and other creatures of a total forest ecosystem.

The loss of canopy cover has recently been documented in several communities around the country, and the loss has been significant (5). Watson defined heavy tree canopy as trees covering more than 50 percent of the land while developed area was defined as land with tree coverage less than 20 percent. In Seattle, from 1972 to 1996, the amount of land with heavy tree cover shrank from 10 percent to 5 percent, and developed area increased from 81 percent to 92 percent. In Washington, D.C., from 1973 to 1997, land with heavy tree cover went from 37 percent to only 13 percent, and developed area increased from 51 percent to 72 percent. In Atlanta, from 1974 to 1996, the area with heavy tree cover went from 47 percent to 26 percent, and developed area increased from 44 percent to 71 percent. In all these cities, the area of heavy tree cover was reduced by about 50 percent during a 20-year period. All of these cities have air pollution problems.

**A CALL TO ACTION:** The preservation of trees in communities usually requires the development and implementation of some type of Tree and Landscape Ordinance. These ordinances are an important tool to set community standards regarding how development should occur. They become part of the law and provide incen-

tive for developers to maintain the environmental life support system during development. They also designate standards for saving trees during development and for planting of new trees. A properly constructed ordinance can address the six areas of environmental degradation described in this paper. A Tree and Landscape Ordinance can be developed and proposed by ordinary citizens. Citizens willing to volunteer their time can help manage development and enhance the quality of life for the community.

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