

## **THE INCREASE OF IMPERMEABLE SURFACES OVER TIME**

**Amanda Botts**, Department of Earth Sciences, University of South Alabama, Mobile, AL 36688 Email: [amb324@jaguar1.usouthal.edu](mailto:amb324@jaguar1.usouthal.edu)

The goal of my fieldwork was to determine the effect that impermeable surfaces have on the amount of runoff to the Dog River Watershed. My study area consisted of Schillinger Road between Airport Boulevard and Cottage Hill Road. To determine the rate of increase of increase of impermeable surfaces in this area, I obtained aerial photography of my study area pre (1990) and post (2002) urbanization from the Corps of Engineers. I then digitized all impermeable surfaces in that area of land. Next, I compared the total amount of land area covered by impermeable surfaces in each aerial image. From this data, I was able to calculate the percentage of change in the number of impermeable surfaces in this area over a period of 12 years. Through this process, I quickly found that the amount of impermeable surfaces in my study area dramatically increased. Through my research, I hope to make the community more aware of the impact of impermeable surfaces to a watershed. As a result, the city will hopefully begin to choose permeable surfaces more frequently over impermeable surfaces and also tighten landscape ordinances.

Keyword: impermeable surfaces, runoff, Dog River

### **Introduction**

Mobile's urbanization has significantly increased in recent years. From 1980 to 1990, the Mobile metropolitan area grew 7.5 percent. The U.S. census bureau now believes that the city's population has topped the 500,000 mark (City of Mobile, 2007). This metropolitan growth has lead to an increase in impermeable surfaces in the city. Impermeable surfaces are surfaces that will not allow water to pass through. Impermeable surfaces can be separated into two components: people habitat and car habitat. People habitats are impervious surfaces that exist where we live and work. Car habitats are impervious surfaces where we drive and park our vehicles. Fifty-five percent to seventy-five percent of impervious surfaces are car habitat (Center for land use Education).

The addition of shopping centers, homes, restaurants, roads, and other impermeable surfaces has led to an increase in runoff in urbanized areas (Fig.1). Runoff is precipitation that hits an impermeable surface and then leaves an area without entering the soil (Wisconsin Department of Natural Resources, 2005). High amounts of runoff can cause many different problems for a watershed.

Because water encounters fewer obstacles when traveling over cement, water flows more rapidly on such surfaces. Fast-moving water in a watershed can result in water erosion at river bends (Arber, 1943).

Fast-moving water can also carry large amounts of

sediments, resulting in the water carrying the loosened soil at river bends downstream.

High sediment in a stream can inhibit photosynthesis of aquatic plants and raise the temperature of the water (Wisconsin Department of Natural Resources, 2005). When clay particles enter the Dog River Watershed, the saltwater causes the surface charge of the particles to diminish to no charge. The particles then begin to clump together, or flocculate. They eventually flocculate enough so that the particle size is large enough to cause them to settle out and fall to the bottom. This process of clay settling to the bottom of the river causes Dog River to become shallower (Loyola University, 2005).

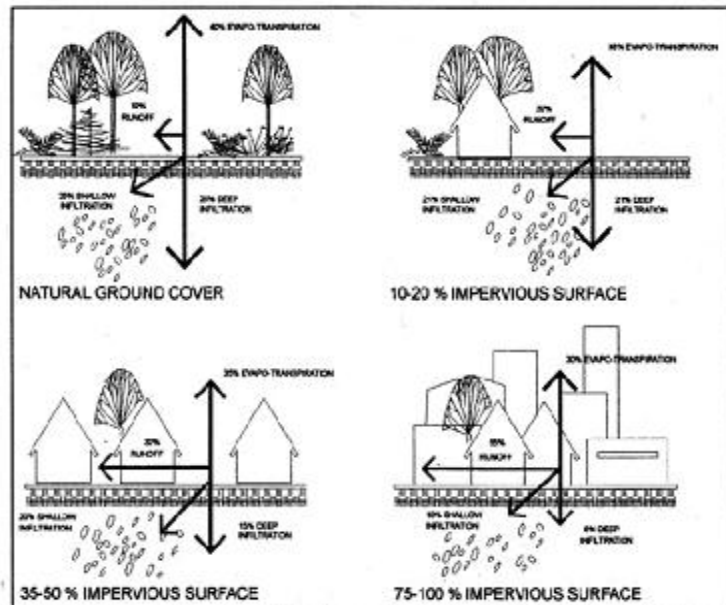


Figure 1. The effect impervious surfaces have on runoff (Center for land use Education, 2002).

Increase in the amount of car habitat impervious surfaces affects the quality of runoff that enters a watershed. Impervious surfaces allow many types of pollutants that derive from many sources to accumulate upon them. Runoff carries these pollutants into our watershed and hinders the quality of the water. The rise of runoff caused by an increase of land use and the addition of impervious surfaces contributes more pollution to a watershed (Chesapeake Bay and Mid-Atlantic from Space).

Impermeable surfaces also increase flooding in an area because water is unable to seep into the ground. Hurricane Katrina is a good example of the relation between decreased wetland area in the South and the inability of floodwaters to recede due to the increase of impermeable surfaces (Adams, 2005).

Schillinger Road between Cottage Hill Road and Airport Boulevard in the Dog River Watershed of Mobile, Alabama (Fig. 2) contains plenty of impermeable surfaces. This area of land has seen drastic growth over the past 15 years. It is important to study

this area to see the increase of impermeable surfaces and note that our watershed is being affect by the increase of runoff caused.

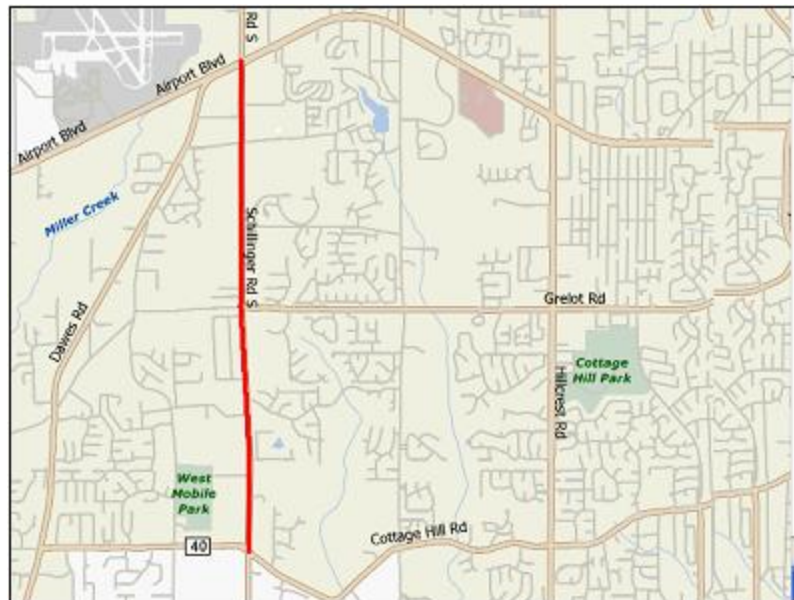


Figure 2. Map of the study area (Map Quest, 2006).

## **Research Question**

What percentage of increase in impermeable surfaces has occurred along Schillinger Road between Cottage Hill Road and Airport Boulevard over the past 12 years?

## **Methods**

In order to determine how much the amount of impermeable surfaces has increased in the past ten years along Schillinger Road between Cody and Airport, I compared data from aerial photography from 1990 and 2002. With the help of the Corps of Engineers, obtaining this data was possible. Digitizing, or electronically outlining, the impermeable surfaces of the study area was necessary to determine the total area of impermeable surfaces in both photographs. I then compared the total area of impermeable surfaces in each photograph to determine a percentage of increase.

## **Results**

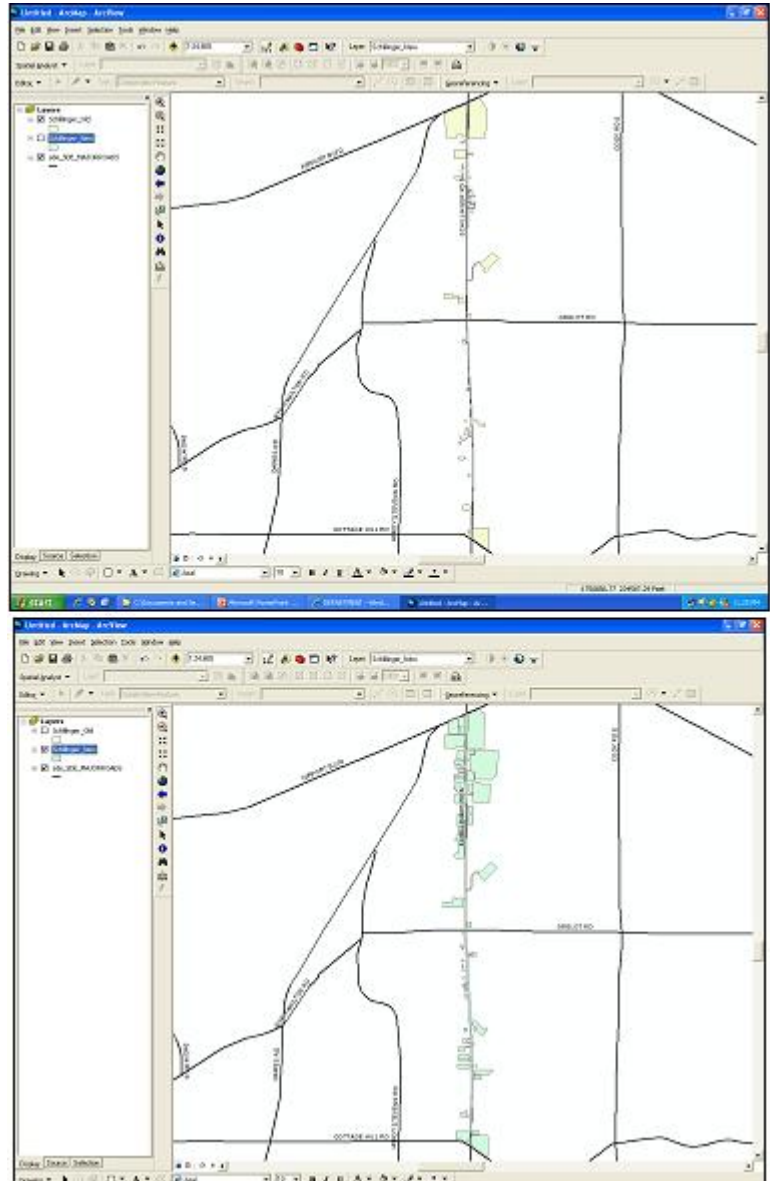
After digitizing the study area of Schillinger Road from the 1990 and 2002 aerial photographs (Fig. 3), the rapid rate of increase has become evident. In 1990, only 73.62 acres of impermeable surfaces existed in the study area. By 2002, the acreage of impermeable surfaces increased to 148.28 acres. The percentage of increase over 12 years of time is 101.4%.

## Conclusion

Through this project, it has become evident how fast the number of impermeable surfaces is increasing along Schillinger Road in Mobile, Alabama. By understanding the negative effects I have presented of run off in a watershed, the City of Mobile should become more aware of the impact of hard surfaces. In many instances, impermeable surfaces are unavoidable. However, the city should begin to choose permeable surfaces over impermeable surfaces whenever possible.

Permeable parking lots would reduce the amount of runoff considerably

and protect the watershed. The city already has an ordinance that requires a certain percent of new development be landscaped rather than paved. To tighten such ordinance laws would be another step in the right direction, and I hope that this study will help our community reach that goal.



*Figure 3. Digitized impermeable surfaces from 1990 (top) and digitized impermeable surfaces from 2004*

Other alternatives to permeable surfaces include soil binders, permeable pavers, enhanced soils, turf, and gravel (Capital Region Watershed District, 2004). Soil binders are materials that are applied to the soil surface to enhance the equilibrium of the soil while preventing water-induced erosion (Stabilizer Solutions, Inc. 2005). Permeable pavers (Fig. 4) are pavers that allow water to percolate through them. They provide a sturdy surface, but allow natural drainage and migration of water into the earth by allowing water to drain through the spaces between the pavers (Concrete Network, 2007). Enhanced soils, turf and gravel also allow a strong surface while allowing water to naturally pass through them. Through this project I hope that it becomes evident that due to an increase of urbanization, Mobile's number of impermeable surfaces is rapidly

increasing. I hope that this project leads to future research of impermeable surfaces in the Mobile area. Performing the same project in the next ten years in the same study area would allow us to see if the percent of increase of impermeable surfaces has improved. Hopefully this project will inform the



*Figure 4. Permeable pavers (Stabilizer Solutions, Inc.(2005)*

community about the negative effects that impermeable surfaces have on our watershed and encourage the use of more permeable surfaces with Mobile's expansion.

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