Impervious Surfaces Coefficient Generation Procedure

OVERVIEW
Past techniques for generating impervious surface coefficients have relied on planimetric data to identify impervious features such as road surfaces, parking lots, and buildings. These features are summarized over the 100x100 foot grid cells of the land cover to derive percent impervious statistics per grid cell and by land cover class. Planimetric data is typically acquired at the town level, and the date is dependent on the source data from which it was derived. This can be problematic when trying to apply planimetric data from various towns and dates to a specific date of land cover. In addition, the coefficients can become slightly skewed when applied at the statewide or larger region depending on the density of impervious surfaces in each of the planimetric data layers. The benefit of using planimetric data, however, is that thousands of grid cells can be easily summarized to derive robust percent impervious surface statistics.

The following technique was pursued in an attempt to obtain date specific information regarding impervious surfaces that is evenly distributed throughout the study area. The intent was to eliminate the possibility of skewed data due to assessing only specific towns within the area and related impervious surface densities and to have coefficients specific to a given land cover date. Impervious surface information was generated by randomly selecting sample sites using the 2006 land cover as a guide and digitizing impervious surfaces from high resolution imagery collected in 2006 within the sample site.

PROCEDURE
IDENTIFICATION OF SAMPLE SITES
- From the 2006 land cover (Figure 1a), identify all pixels adjacent to a Developed pixel (Figure 1b).
- Extract those 2006 LC pixels that are adjacent to the Developed pixels (Figure 1c).
- In addition, mask (zero out) the same adjacent pixels from the original 2006 land cover.
- Recode the adjacent pixels in the extracted land cover file from classes 1-12 to classes 13-24 (e.g. class 2 Turf & Grass becomes class 14 Turf & Grass within the adjacent pixel area).
- Replace the recoded land cover pixels into the original land cover (with the masked out pixels) to derive a 24 class land cover map (class 13 has zero pixels because there are no developed pixels adjacent to developed pixels).
- This combined land cover is used for identifying sample points for IS estimation. A stratified random sample of points was identified to serve as sample sites. A minimum of 20 samples for each of the 24 land cover categories (excluding class 0 and 13) was specified. A total of 1250 samples were selected.
- The sample sites were extended to a 300x300 foot area to produce a total of 11,250 pixels (nine pixels per 1250 selected sample sites). An example of two sample sites containing developed (red) and forested (green) land cover are provided in Figure 1d.
This process was performed to try and adequately represent enough impervious surface information in all of the land cover categories across the study area. Otherwise, for example, all deciduous forest sample points might be identified away from developed areas. This forces some non-developed sample points to be identified near development for all land cover categories.

![Figure 1](image1.png)

**Figure 1.** Selection of sample sites.

**DIGITIZATION OF SAMPLE SITES AND PERCENT IMPERVIOUSNESS CALCULATION**

Once the sample sites were identified, all impervious features (buildings, roads, parking lots, etc) were digitized within each site. High resolution imagery available for the area from the year 2006 was used as the base layer. Other years of available high resolution imagery were used for additional reference. Figure 2 provides an example of the digitization of the imagery to identify impervious surfaces. The impervious features were summarized over each of the 100x100 foot pixels within the 300x300 sample site to determine the percent imperviousness for each of the 11,250 sample pixels. The representative land cover for each 100x100 pixel was determined and overall percent imperviousness for each land cover type calculated.
Figure 2. Digitizing of impervious features within the 300x300 foot sample site.

**DERIVE HIGH, MEDIUM, and LOW DENSITY IS ESTIMATES**

2010 Census geospatial data at the tract level was obtained from the US Census Bureau to cover the entire study area. The population density of each tract was calculated using the number of people per tract divided by the area of the tract. Examining the literature, it was determined that the tract density should be divided into the following three density classes:

- High density tracts > 5 people/acre
- Medium density tracts between 1 and 5 people/acre
- Low density tracts < 1 people/tract

Sample 100x100 pixels were assigned to each of the density classes depending on which tract the center of the pixel fell. Once assigned to a density class, percent imperviousness values were re-calculated for each land cover type for each density class. These values became the impervious surface coefficients for use in calculating estimated imperviousness for watersheds.

**IMPERVIOUS SURFACE ANALYSIS TOOL (ISAT)**
The land cover for each date was run in ISAT using the LIS HUC12 watersheds as the analysis unit and the 2010 population density tracts to determine assignment of appropriate coefficients to watersheds.