

Impervious Surfaces Maps

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Objective

Impervious surfaces maps (ISM) are land cover maps that show the distribution of man-made structures such as paved parking lots and roads, driveways and rooftops that are needed for hydrologic on environmental studies. ISMs are used to provide a measure of urban development and produce an input parameter to hydrologic models.

User Community

The user community for impervious surface information consists of local government managers and engineers, consulting firms, utility companies and private citizens.

Product Development

The development of impervious surfaces maps started during the Synergy I program and had the benefit of additional Ikonos data over the same area covered earlier in the year 2000. This new dataset obtained under different sensor data acquisition geometry, sun illumination conditions and environmental conditions created the opportunity to evaluate the changes in accuracy assessments of image classification results. The urban areas create special challenges to impervious surface mapping because of the presence of vegetation and buildings and their shadows in the scene. Depending on the sun position and the location of impervious surfaces it is possible to underestimate impervious surfaces because of tree canopies along a sidewalk or near a building or long shadows changing the spectral characteristic of impervious surfaces. The development of this product indicated the need for an evaluation of satellite data acquisition parameters and the characteristics of the area of interest prior to initiating the supervised classification of the data.

Experience of User Community

The results of impervious surface mapping within Columbia City limits have had a significant positive impact in the Department of Public Works. The City of Columbia has a land preservation ordinance (Ord. No 13590 § 1, 2/15/93; Ord. No. 14212 § 1, 9/19/94) establishing a stormwater utility fee that is charged to the occupant or owner of each parcel of developed land within the city that is based on impervious area. Residential users are charged a flat fee and non-residential users are charged a flat fee when the impervious area is equal or less than 10,000 sq. ft and \$0.04 per each additional 100 square feet.

The stormwater utility fees are a considerable contribution to the budget of a city with an approximate population of 100,000 like Columbia. Impervious surface mapping done for two dates 4 months apart in 2000 indicated that after review of the results by the Department of

Public Works in November 2001 there were an additional 324,207 sq. ft of non-residential impervious areas that are not being assessed. This oversight corresponds to a \$129.68 per month loss in revenue for the city. Another way to appreciate the income loss to the City of Columbia is to consider that the four-month lost revenue represents a present worth value of \$17,849 when considering the next 20 years and a 6% interest rate.

Potential Activities for Synergy III

The benefits of ISMs for urban management justify the development of the methodology to enable the automatic detection of estimated impervious area changes. During Synergy III ISMs will be the implemented as web-based tool available to the user community.



Figure 1. Top: Non-residential sites in southeastern Columbia that had impervious surface area changes between April and September 2000 (red outlines). Bottom: Detailed image of the Lemone Industrial Park site (City parcel No. 17702000100501.00) where 68525 sq. ft are assessed (green outline) according to city records but where a paved area of 121,297 sq is not assessed including an area already in place in April (blue outline) and a new paved surface observed in September 2000 (red outline).

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