3rd Science for the Environment Conference
Aarhus Denmark 1-2 October 2015

USING COST-BENEFIT ANALYSIS AND BUILDING COMPACTNESS TO DETERMINE THE MOST EFFECTIVE BUILDINGS TO INSTALL GREEN ROOFS IN HARRISBURG, THE UNITED STATES OF AMERICA

Gon Park
Korea Cadastral Survey Corporation, South Korea

ABSTRACT

In 2013, the City of Harrisburg, Pennsylvania, announced a "Greening Plan," which included a framework for green roof installation. The established framework does not include a detailed green roof construction plan. Thus, this study assessed which buildings in Harrisburg would have the most cost-effective building shape upon which to install green roofs. By using three-dimensional building information and calculating building compaction and four cost-benefits of green roofs, project lifespan cost-benefit data were determined for a selection of buildings in the downtown Harrisburg area. Three-dimensional (3D) models of 23 buildings were produced with Google SketchUp software. Important statistics including energy savings, air quality improvement, urban heat island effects, impervious area runoff reduction, and roof lifespan, were calculated. These calculations determined the overall monetary benefit of a green roof project in relation to traditional roofs over a planned time period by utilizing the "Net Present Value" method. Though most of the research behind green roofs is based on roof areas, this study used 3D properties of buildings to assess the effect of green roofs on energy consumption through cooling. To ascertain how compactness controls building temperature, this study observed four physical models for 92 days to determine the relationship between compactness and temperature fluctuations. Results suggest energy savings are a major benefit of green roofs and buildings that have lower compactness have more energy savings from installing green roofs. Additionally, although the study area is confined to the City of Harrisburg, these same calculation methods can be applied to other cities by changing baseline information such as energy costs, climate data, and impervious surface data. This study is an important step in suggesting the most cost-efficient buildings for green roof installation in cities around the world.