Using a genetic algorithm to investigate the spatial arrangement of low impact development facilities: a case study of National Taiwan University campus.

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With urban development, surface runoff and peak flow in cites continuously increase and the insufficient capacity of the sewer system induces more and more urban flooding problems. Low Impact Development (LID), one of the source control strategies, uses functionally equivalent hydrologic landscape to improve the ability of infiltration and retention so that the hydrologic condition of the urban surface can be more returned to the pre-development state. Although LID is a kind of the source control strategies, previous studies seldom focus on the spatial arrangement of LID in an urban watershed but only focus on the mechanism units of LID facilities or simple case studies of its implications. This study took the main campus of National Taiwan University (NTU) as a case study. We combined SWMM and a genetic algorithm (GA) to simulate under 36 different rainfall scenarios. The program optimizes installed area size of LID in each sewershed with two different budgetary constraints. By this way, we can know what kind of watershed allocation of LID is more effective for reducing peak flow. In addition, statistical and hydrologic methods are used to analyze the results of optimization. Through analyzing the mechanism of a single unit of LID and optimizing the installed area size of LID in each subcatchment, we can find out how LID reduce peak flow from the microscale and the macroscale. This mechanism of LID also corresponds to the analysis results from optimization, which elaborated that the first priority of setting LID is located at the midstream of the main line where the peak flow concentrates on the peak outflow of the basin rather than before it or after it. In the end, we suggest a LID spatial arrangement strategy for the reference to further city planning.

Keywords: Low Impact Development (LID), Optimization, Genetic Algorithm (GA), SWMM, Urban Hydrology, Urban Drainage