ABSTRACT

Urbanisation causes the expansion of artificial surfaces. The lack of permeable surfaces with trees and green areas aggravates the problems of extreme weather events by disrupting local water balance, evapotranspiration processes, and water channels. The risk due to extreme weather events is more pronounced in large-size cities owing to the dense concentration of people and infrastructure. The vast amount of data available remotely sensed and otherwise may be used to explain the changing nature of cities.

The research gaps are identified after reviewing the literature on the influence of terrain and streets on urban morphology. This thesis explores whether thriving cities share a particular set of common properties in coupling human-natural systems. Several works have recorded the resemblance between geometries of the street and territorial structure which is re-examined using a global dataset of cities. The analysis uses a large sample of 64 cities representing the urban world. First, a pilot study is performed on four cities to ascertain the influence of terrain on the street network. Next, statistical and spatial analysis is carried out to quantify the spatio-structural similarity between the co-located networks. The analysis reveals patterns that vary with city size and water balance indicators. The results helped formulate the last objective, which assesses the share of vegetated spaces in the locations based on feature values of the co-located networks.

The work reveals that for 43 out of 64 cities the correlation between the street and terrain is significant. The value ranges between -0.2 and 0.2 for large cities, while the absolute value is more than 0.2 for fifty percent of the smaller cities. The values indicate that the influence of terrain on street network wanes as the city grows. Additionally, the work empirically shows that as the share of vegetated areas in cities reduces, extreme weather events increases. The results show how feature values of the co-located networks can act as placeholders for identifying locations to incorporate nature-based solutions.

The city's expansion and transformation are unstoppable. However, it is possible to channelise and organise them to adapt to changes. Here, this thesis derives theoretical and practical insights from empirical analysis of cities representing the urban world.

Keyword: Cities, Streets, terrain, network, greenness index