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Urban altitudinal zonation analysis of selected building blocks in Bochum

Abstract

The aim of the altitudinal zonation analysis is to obtain an estimation of the "garden structure" in Bochum's residential environment- building blocks. This direct environment provides a variety of Ecosystem Services, which are important for the sustainable transformation of cities (climate adaptation, ecological deterioration, and social justice).

In 55 selected typical building blocks of city of Bochum, the urban altitudinal zonation distribution, and their urban structure type were analysed. Building footprints (floor plan of buildings, without subterranean garages) and the nDSM50 (result of subtracting the aerial image based DSM50 and the LiDAR bases DGM1) in ArcGIS PRO 2.7 were used.
The following assumptions apply, all areas that are not buildings were divided into three altitudinal zones: < 1 m, 1-5 m, > 5 m.
The nDSM50 is clipped onto the selected building blocks and the selected building footprints is cut out. Then, the three altitudinal zones as polygons were extracted from the remaining nDSM50 and the selected building blocks were reassembled.
Finally, the respective percentage of the areas was calculated and transferred to Microsoft Excel for further presentation.

Figure 1 shows, in the selected building blocks the buildings in Bochum have a high mean of 43,5 %, all other values are mean values in percent. The value for the altitude zone < 1 m is 26,7. For the altitude zone 1-5 m it is 13,7. The height level > 5 m is 16,1 in Bochum. The results are urban structural conclusive in terms of urban morphology (Fig. 2).
A further differentiation in urban structure types allows a grouping (Fig. 3).
The building share of "Old Building quarters - block edge development" and "Inner-city residential areas" is 67,7, in the following as collectively referred as dense urban structure type, the remaining less dense types are 32,2. On the other hand, for the altitude zone < 1 m, the dense urban structure types are 15,5 and the remaining types are 31,5. Between 1-5 m, the values fluctuate between 10,5 and 21,0. At the altitude zone > 5 m, the dense urban structure types are 5,5, the remaining types between 15,1 and 27,2. Overall, it can be seen, that the dense urban structure types have little higher altitude zones.
These results are compared with similar analysis of Leipzig or state-wide for NRW.

This altitudinal zonation analysis from Bochum shows, that there is no balance between the altitude zones. In addition, a heterogeneous altitude zone structure promotes general and mental health. Clotheslines and arbours are also negligible for the general result. Adapted height-respecting planting can reduce ecological deterioration and promote social justice.

It is noticeable that there is little high vegetation-trees in dense urban structure types. Climate adaptation measures could start here, as vegetation is a sink for air pollutants. The impulses are described are important to improve the resilience, especially in living environment and thus to be better prepared for future developments.

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In future, the traffic areas should be integrated into the analyses.

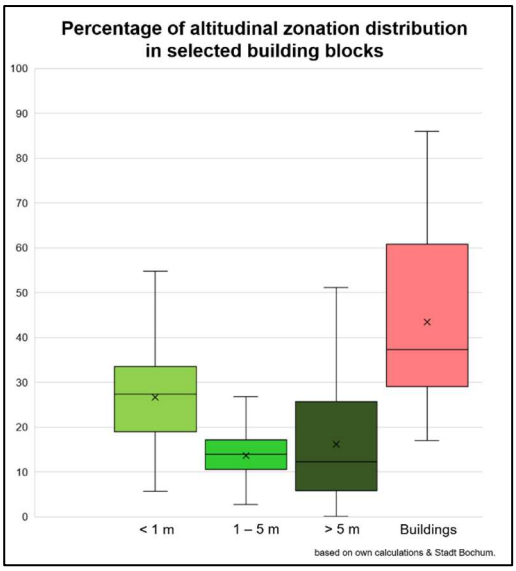

Figure 1.

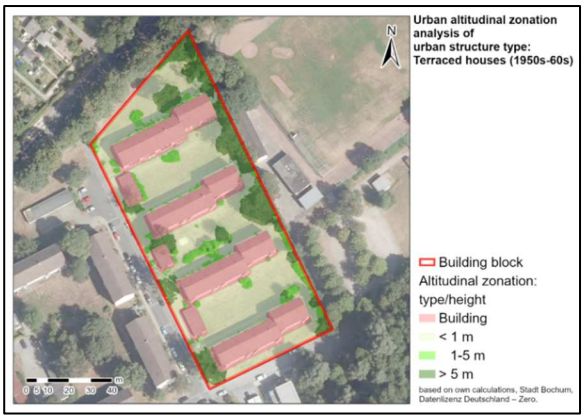

Figure 2.

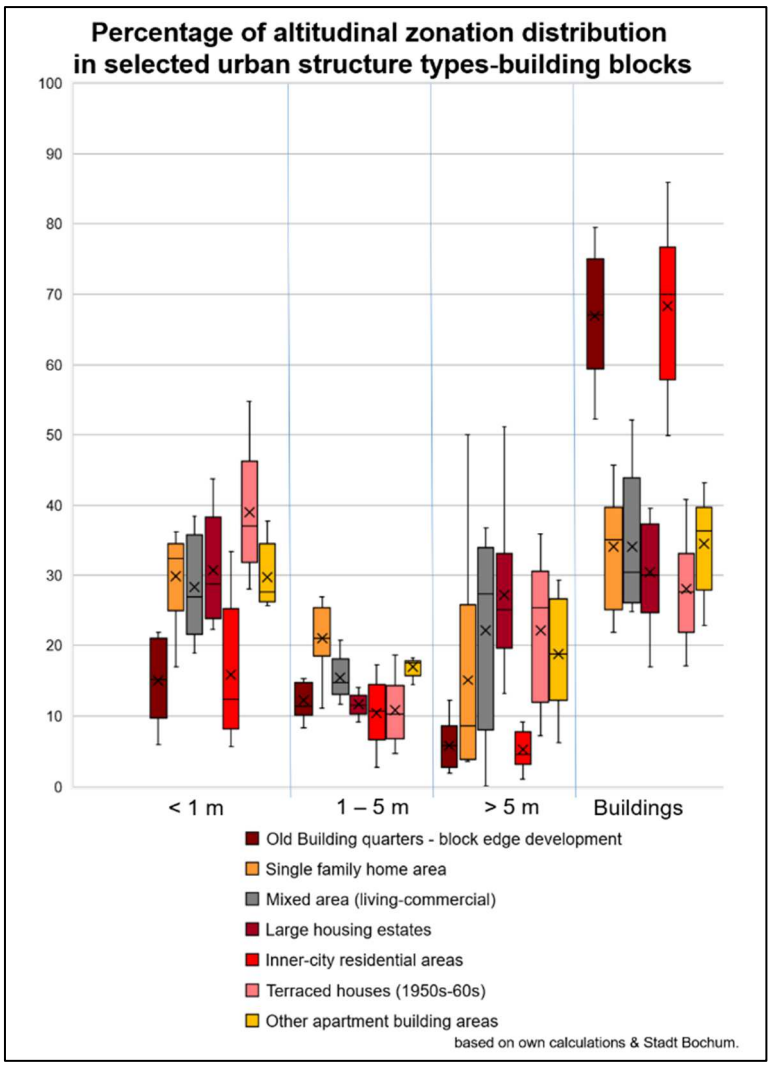

Figure 3.