Evaluation of the ecological role of historic centres. A relationship between buildings and birds.

Context

Cultural heritage assets such as historic buildings, urban fabric and monuments, together with their intangible aspects and interrelationships, are the legacy of past humanity and provide the inhabitants of these cities with a sense of place, identity and well-being [1; 2]. This heritage of historic cities includes monuments and memorial buildings [3], urban landscapes and green spaces [1; 4].

Most historic urban centres are also living communities [5], with city landscapes immersed in a constant transformation process brought about by population growth and development [2]. Over time, however, this transformation leads to severe problems which hinder sustainable development [6], often leading to the exclusion of green areas from urban centres [7]. In environmental terms, notable challenges faced include the increasing rates of habitat destruction and loss of species [8]. As a result, cities designated as historic heritage are considered to be at an advantage, since the fragments of vegetation that they often preserve - parks, squares and gardens - permit the existence of biodiversity [7].

The novelty of this research puts forward the intersection of urban morphology and biodiversity, specifically analysing building form and other elements which encourage the presence of birds. Disciplines such as architecture, biology and environmental sciences are incorporated to combine fieldwork results and geographical and architectural-based analysis. This sheds light on the ecological implications of urban morphology and building shape for stimulating the presence of certain species for the effective management of urban ecosystems.

The city of Castellón de la Plana is located on the eastern coast of Spain, 4 km far from the sea, with a Mediterranean climate. Although in the past this region was predominantly agricultural, over time it has become a services hub as the capital of an industrialized area, leading in turn to the expansion of the city. Due to its history and development, the city has been organized into four distinct zones: the historic centre, the urban expansion, the agricultural zone, and the maritime district.

The chosen study area is located in the historic centre of Castellón de la Plana and its maritime district, *El Grao*. Both areas were selected for their constructive characteristics. While the buildings in the historic centre display Modernist touches on some facades that are still reminiscent of medieval times, the buildings in the *Grao* district are renovated former fishermen's huts. However, both locations have buildings with architectural heritage, close to green spaces. The historic centre is 0.84 km² and the maritime district is 0.32 km². The building composition includes:

- Single-family townhouses
- Residential blocks with several apartments per floor
- Buildings with commercial premises on the ground floor and all other floors devoted to residential use.

Assessment

The assessment of the ecological role of historic centres in Castellón is the result of a four-stage methodology. The research demonstrates how it is possible to analyse the built environment through biodiversity indicators and correlate its density with the presence of the bird species. By analysing the information retrieved from cadastral sources and online applications such as Google Earth and regional cartographic viewers, the information is collected and evaluated with GIS software and statistical correlation. The evaluation of district morphology includes the parameters of biodiversity indicators, such as the typology of buildings, the existence of green spaces, blue infraestructures and functionality. The findings of the study constitute a major contribution, expanding information on the enhancement of biodiversity in historic centres. Three of the bird species identified are selected to analyse their association with the built environment, mainly prompted by the population decline in recent years. Through the distribution mapping, the study finds that the three species rely on the most historic urban fabric and well-established green infrastructures. As a result, the authors have identified three types of habitats related to the basic needs of feeding and reproduction. One- to three-story buildings are those which most promote biodiversity while high-rise buildings do not appear to be associated with large concentrations of birds in this study. Elements such as eaves and balconies facilitate connectivity and movement of avifauna, as do wider streets and green areas nearby.

In terms of the implementation of indicators, the most notable weak point to be addressed in the areas of study is the lack of green spaces. While on the one hand efforts should focus on reaching the figure recommended by the WHO to promote the well-being of inhabitants, biodiversity connectivity should also be improved by providing blue infrastructure elements such as small ponds or fountains. The results demonstrate how, when the management of the built environment is at stake, there is need for a better understanding of the availability of facilities, lay-outs and spaces to enhance biodiversity. As the preservation of historic urban structures can play an essential role in enhancing biodiversity we can conclude that historic buildings and green areas provide specific habitats for several species, while also promoting well-being and preserving the cultural identity of inhabitants.

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