Greenbelts – Planning Instruments and Landscape Structure – a European Perspective

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Introduction

Since 100 years the concept of planning tools addressed to control the urban sprawl has concentrated on open space protection around metropolitan cities. This has been applied using various green structures i.e.: belts, hearts, wedges or system of protected open spaces. The common element of these tools to control the urban sprawl is open spaces protection. Numerous applications in different natural and economic conditions create great potential for planners to adapt the concept (Cieszewska 2012, Cieszewska, Adamczyk 2014). Open spaces that preserve unbuilt part of metropolis fulfil four main functions: productive, environmental, recreational and ecological. The main question posed by the authors of this paper is how has the metropolitan region that applied greenbelt concept achieved the ecological function. We analysed eleven metropolitan areas where the greenbelt concept has been already applied, or where there is an intent to adopt the aforementioned concept in order to find out a potential of ecological function in planning polices and landscape structure. The studied metropolitan regions are: Berlin, Frankfurt, Copenhagen, London, Manchester, Paris, Rome, Stockholm, Vienna, the Randstad – the green heart of the Netherlands, and Warsaw, as the only case where the grennbelt concept is planned.

Background/Literature Review

In metropolitan areas the conditions of living organisms are considered due to human needs. However, maintain a healthy environment requires the preservation of the valuable ecosystems and their connectivity. The most valued ecosystems are those of relatively low anthropogenic transformation, which are characterized by a diversity of species close to natural habitats (Perlman, Milder 2004, Bryant 2006). Most of these ecosystems are already protected as biodiversity – in European Union mostly as Natura 2000 sites (Maes et al., 2013, 2015). Contemporary understanding of the ecological function indicates that besides preserving the areas where the organisms live, it is necessary to maintain the possibility of their movement (Forman 1995, 2014). Such conditions provide ecological linkages.

Both the protection of biodiversity and ecological connections in metropolitan areas is of particular importance due to the dynamics of the development and landscape changes. Protection goals here seem to coincide with the planning tool as the concept of greenbelt.

Biodiversity and ecological connectivity of metropolitan areas have been analyzed by Bryant (2006), Marull and Mallarach (2005), Parcerisas et al., (2012), Marull et al., (2010), but not yet related to greenbelt concept.

Goals and objectives

The aim of the paper is to compare the potential of ecological function within eleventh of European metropolitan areas with applied different approach to greenbelts areas arrangement, and furthermore to compare it to the Warsaw case, where presently there is an intent to introduce this planning tool in metropolitan areas. For all metropolitan areas, we have checked first, the existing biodiversity, and also connectivity potential within the buffer zone of 20 km marked from the dense built-up areas. In parallel, we have verified planning documents for these areas, in order to find out how goals and policies contributing to setting up the greenbelts refere to ecological functions.

Method

According to a literature review, the analyses of landscape structure and ecological functions are linked (Gustafson 1998, Antrop 2000 Bryant 2006, Aguilera 2008, 2011). The potential for ecological function within the greenbelt areas was explored using comparable data on land use and land cover (LULC) available from Corine Land Cover Database (CLC) (Copernicus 2015). According to the literature (Maes et al., 2013, 2015) the following classes were considered: natural and semi-natural areas (NSN), forests and scrub and/or herbaceous vegetation associations, sparsely vegetated areas, also wetlands and water bodies. From the agricultural areas only the class of land principally occupied by agriculture, with significant areas of natural vegetation, has been included. The percentage of these areas was calculated within the green belt area. Also the potential for maintaining connectivity was assessed using Nearest Neighbor (NN) measure (Mc Garigal and Marks 1995) aggregated for the whole area: the Mean value was used to explore overall tendency for connectivity, the Standard Deviation to obtain the information about the differences between the NN values.

To assess the spatial integrity of the areas covered by these patches the core area analysis was performed. The areas remaining after excluding the areas within the internal buffer of 1000 metres were considered as inner habitats, providing evidence of the spatial integrity of the areas with the potential for ecological function.

The second category of the areas compared within this study was protected areas with the Natura 2000 status (EEA 2014), considered as biocentres.

To compare appplied planning tools we have verified information via literature and planning documents about ecological role of each greenbelt like instrument as well as proposal made for Warsaw.

Results

The results of the analyses (Figures 1-3) confirm that significant differences of the potential for maintaining ecological function within the compared metropolitan areas are observed. The following groups may be distinguished:

— Stockholm, Berlin, Frankfurt and Warsaw - with the highest percentage of the NSN with a tendency to maintaining connectivity, and relatively evenly distributed across the whole greenbelt area. The lowest share of these areas is protected in Stockholm, despite the largest potential. Berlin and Frankfurt show the greatest integrity of NSN patches.

— Vienna and Manchester with significant parts of NSN existing in one main part of the greenbelt, with existing tendency to the connectivity. Most of these areas are also protected.

— Paris, London and Rome are the areas where the NSN patches are small with a low share of inner zones. The overall connectivity is low in these areas. That corresponds to a relatively low share of protected terrestrial areas.

— Randstad is the area with the lowest proportion of the NSN patches, but the significant area under protection. The NN distances are the largest and much differentiated there.

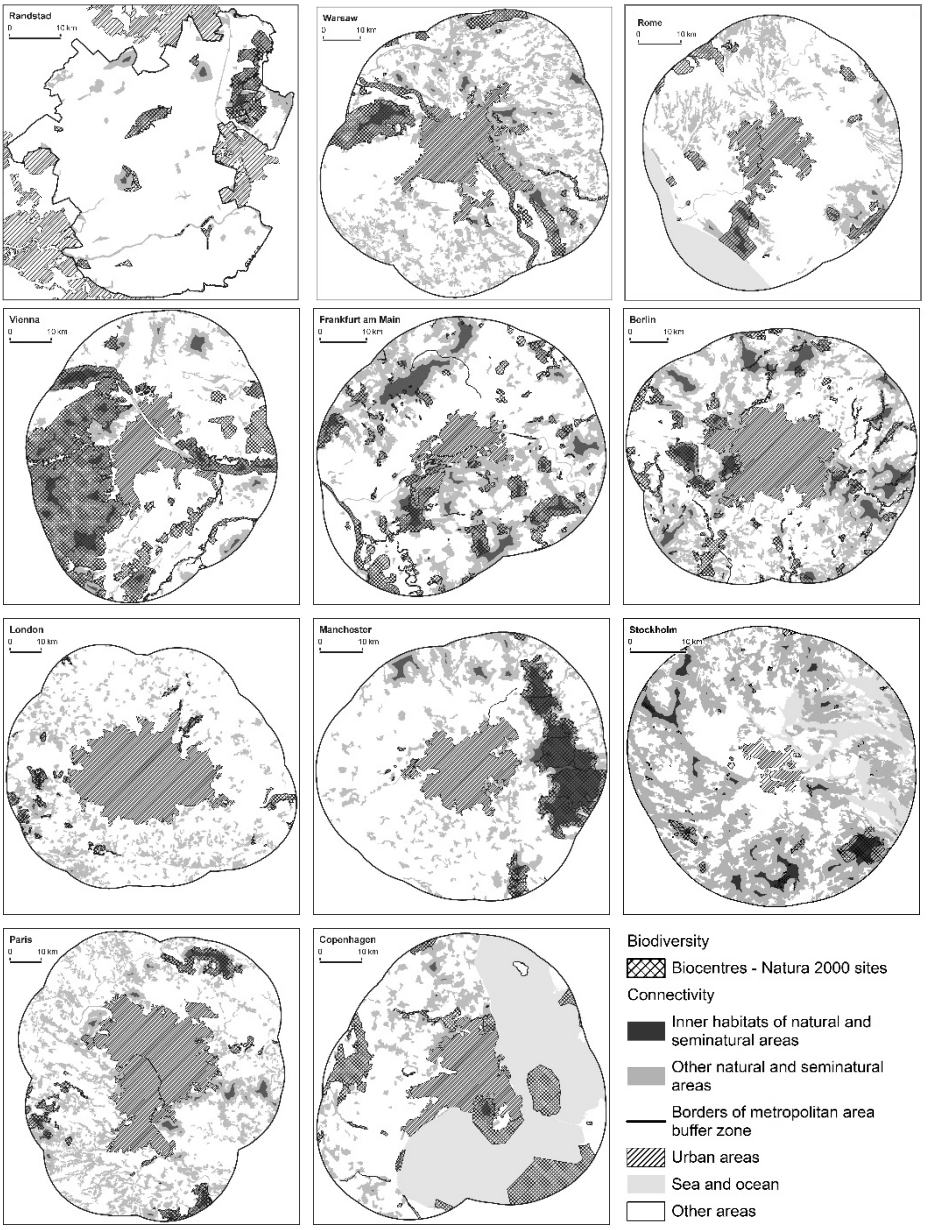

Figure 1. Biodiversity, ecological connectivity of metropolitan buffer zones

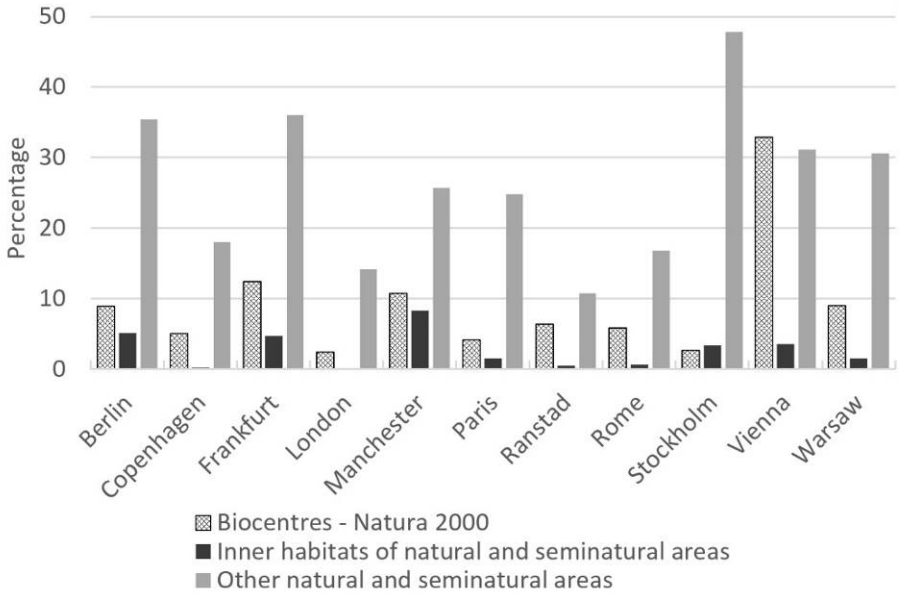

Figure 2. Percentage of the analysed elements among metropolitan buffer zones

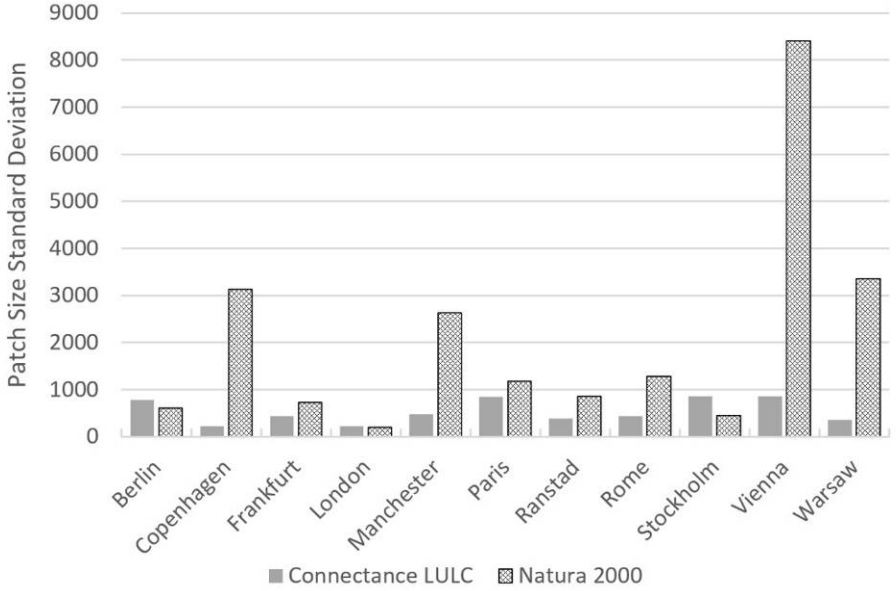

Figure 3. Selected connectivity measures of the analysed elements among metropolitan buffer zones

Comparison of applied planning instruments shows that only few of ten metropolian areas highlights ecogical aspects as an important element of greenbelt. In most of them other functions, such as production (mainly agriculture) and recreation or even landcsape value, are more important. Three approaches can be indicated:

— Stockholm, Vienna, Rome, Frankfurt am Main and Warsaw belongs to group where in the planning instruments that protect open spaces of metropolitan area ecological function is highlited.

— Copenhagen and Berlin represent metropolis where biodiversiy and connectivity within greenbelt like instruments are important but not the key one.

— London, Manchester, Paris and the Randstad are in the group where ecological function is not indicated within greenbelt policy.

Conclusion

The potential to protect biodiversity cannot be directly related to these metropolitan areas with applied greenbelts. The highest potential for ecological connectivity occurs in the surrounding of Stockholm, Frankfurt, Berlin and Vienna, but lower in London, Paris, Rome and Randstad. Only a few greenbelts indicate the green network or 'connectivity' as an important element of the applied planning tool. This kind of structures is present in a landscape pattern with connected elements important due to their habitat role and also linkages between them. Such solution one can find in the buffer of Rome and Frankfurt. Nevertheless, the protected areas in both metropolitan areas cover only small number of hectares. The lowest ecological potential occurs in the green heart of the Netherlands, where protected area consists of productive agricultural land. Also, the loss of connectivity is visible. Therefore the share of protected areas, in the meaning of the most valuable landscapes within the analysed buffer zones, one can find the highest in Randstad and Copenhagen while the lowest in Stockholm. This result indicates the relatively small relation between the declared ecological function of greenbelts and the actual landscape structure within analyzed buffer zones. While goals and policies found within the analyzed documents promote the ecological connectivity and protection the most valuable areas, the physical landscape structure presents quite a different picture.

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