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### Urban greenspace in the spatial structure of Gdańsk

**Abstract.** This paper summarizes the results of work carried out with the aim of designing a system of urban greenspace in Gdańsk. The project is to be used in developing a long-term plan of spatial development for the town. Owing to Gdańsk's location and its intended development, the areas of urban green environment demand enhancement and adjusting to the spatial structure of the town. In order to design the system of urban greenspace it was necessary to recognize the existing green spaces, the current and anticipated number of inhabitants, features of natural environment with the highest complexity of processes, and finally the current and intended development sites.

Recognition of these elements allowed identification of four greenspace subsystems:

1. a subsystem of recreational space;
2. a subsystem of greenspace governed by natural features;
3. a subsystem of greenspace governed by the spatial structure of the town;
4. a subsystem of complementary green areas, governed by neither of mentioned factors.

The system of urban greenspace is made up basically of three parts: the western, the central (parallel to meridians), and the eastern (parallel to meridians), and the eastern (parallel to lines of latitude). Major aims to be met on the way to optimalization of the system are: internal integration of the system's western part and the completion of the central one.

#### INTRODUCTION

This paper aims to present results of the author's work on implementing a long-term spatial development plan for Gdańsk up till the year 2010. Within the next 20 years a considerable expansion of Gdańsk is intended related to the anticipated population growth in certain districts.

Owing to Gdańsk's situation, its development can move in two directions only – towards the west, and in part, to the south. To the east it is limited by the Vistula Delta Area and the Gulf of Gdańsk. Other towns of the Gdańsk agglomeration mark its northern boundary. As a consequence, woodlands of the Three Towns' (Trójmiasto) Landscape Park and agricultural open lands suffer from growing human pressure. Thus there arose a need to prepare an inventory of the existing urban green spaces and areas of countryside in relation to both natural features and the spatial structure

of the town including those elements planned for the future. In this context the existing green spaces have been evaluated. Where appropriate, it has been proposed to establish new areas of green environment or to change the use of the existing ones.

#### METHOD OF DESCRIPTION

To meet the aims presented in the introduction the following elements have been identified:

1. A system of existing green space which should be retained
2. The current proportion of green environment in urban quarters to the anticipated population of the town, indicating the necessity for establishing new green space in residential areas.
3. The existing elements of natural environment characterized by the greatest stability and complexity of ecological processes, to be preserved if possible in an unaltered state.
4. The existing and proposed development sites to be linked by means of green corridors.

A survey was carried out which allowed recognition of the following subsystems of greenspace in Gdańsk:

1. A subsystem of recreational space in residential areas.
2. A subsystem of greenspace characterised by natural features.
3. A subsystem of greenspace conditioned by the spatial structure of the town, comprising buffer areas and green links.
4. The remaining greenspace that does not belong to any of the foregoing subsystems, but which is indispensable to maintain relative ecological balance.

All the recognized subsystems are complementary, thus not separable. Considering their different functions in the spatial structure of the town, it is possible to classify the existing and proposed greenspace in the system of the urban green environment into the following groups:

1. The existing greenspace which meets the desired aims.
2. The existing greenspace which does not meet the desired aims and which needs be restructured.
3. Undeveloped or derelict sites, where the introduction of wildlife or greenspace is highly recommended.
4. Open space (both, agricultural and recreational), where it is recommended to preserve the existing enclaves of green and to create new ones.
5. Development sites, where it is necessary to increase the area of greenspace.

Figure 4 represents areas of the existing greenspace (groups 1-3), and those places in which it needs to be created (groups 4-7).

#### MAIN ELEMENTS OF THE SPATIAL STRUCTURE OF THE TOWN

What characterizes the spatial structure of Gdańsk is the banded distribution of sites serving different functions (Fig. 3).

Towards the very west of the town there is mostly agricultural open land which is now being threatened by considerable development of housing, particularly one-family housing. In future much of the agricultural area is planned for warehousing and small industrial sites.

The next zone east, parallel to the meridians, is the woodlands of the Three Towns' Landscape Park and the Otomin Woods to their south. The two complexes are separated by a substantial area of open space to be developed as residential districts, with a number of buildings having already been erected. Consequently, there emerges a vital problem of maintaining green corridors between the two woodland areas.

Another zone is the one made up of residential sites with two main centres: Wrzeszcz-Oliwa, and the City Centre-Gdańsk South. These zones are aligned to latitude. The first is an industrial area (from Nowy Port to Sobieszewo). To the south and east of it extend rural open spaces, primarily of the Vistula Delta Area. The current use of these areas should be retained.

To the north, along the coastline of the Gulf of Gdańsk, a narrow belt of woods and wood parks is situated on dunes. The zone's spatial integrity is disturbed by port installations and industrial sites (Nowy Port-Stogi), mostly within the region of Northern Harbour.

The existing spatial structure of the town can be seen as quite favourable. The ecological living conditions for town dwellers are good and it is possible to reconstruct the destroyed links between urban green spaces.

#### CURRENT STATE OF THE EXISTING URBAN GREENSPACE

The greenspace of Gdańsk can be divided into a number of groups, according to its structure and character:

1. Woodlands and parks:

- the coastal zone, from Świbno to Stogi, and from Brzeźno to Jelitkowo;
- woodlands of the Three Towns' Landscape Park;
- woods surrounding the Otomin Lake (south-western part of the plan area).

2. Parks, lawns and grasslands:

- The area west to the main communication axis of Gdańsk running from the south to the north.
- The greenspace of the Radunia valley and to the north of it.
- The plant life along the Jelitkowski Stream, from the Zoo site to Jelitkowo, in the northern part of the town.
- The eastern part of Wrzeszcz with its extensive parklands.

3. Allotment gardens:

Complexes of ancient green landscapes were preserved only to a small extent in Gdańsk. The best preserved ones can be found along the Jelitkowski Stream in Oliwa, and in the Upper Wrzeszcz and Orunia. Other ancient green spaces have a random and patchy distribution and they do not form any deliberately planned system. The nature of the Strzyża Stream in the district of Wrzeszcz gives an example of the deterioration of an old complex. Owing to substantial stretches of the river being

canalised, it is scarcely possible, if at all, to reconstruct the old systems. However, in accordance with the ecological laws to be considered in town planning, (ANDRZEJEWSKI 1985), maintaining the mobility of flora and fauna, which depends on spatial integrity of environment, it is vital to reconstruct fully the natural systems concerned. These systems should extend either towards the Gulf of Gdańsk, or to the agricultural areas. The natural complement to urban greenspace is the water areas round the Gulf of Gdańsk, lakes – Straszyn, Otomin, Jasień, Osowa, Wysoka – as well as fragments of the running water of Radunia, The Vistula Śmiała, and Martwa. The open space of the Vistula Delta Area and that of the Upland of the Cassubian Lake District play a complementary role.

#### SUBSYSTEM OF RECREATIONAL GREENSPACE IN RESIDENTIAL DISTRICTS

Greenspace in housing estates is usually formal in character. In the case of estates situated at the edge or within a wood, the wood usually takes on the functions of recreational space. However, it is rarely possible to combine recreational functions with allotment gardens. First, their location is often wrong to give good quality grown crops. Secondly, for people who are not the actual holders they provide no access to wildlife. According to the WHO standards (WOJCIECHOWSKI 1987) the area of greenspace in Gdańsk is insufficient. These set the standards of 50 m<sup>2</sup> of urban greenspace and 300 m<sup>2</sup> of countryside per inhabitant. On the other hand, Polish standards speak of a minimum of 8 m<sup>2</sup> per inhabitant, and whenever a town lacks substantial surrounding woodlands, the lower limit is raised to 30–50 m<sup>2</sup> per person.

Sites with old housing and well preserved systems of greenspace, eg Upper Oliwa and Orunia, enjoy a relatively favourable situation (over 30 m<sup>2</sup> per inhabitant). In new residential areas, however, the situation is next to disastrous. And so in Lower Oliwa, Lower Wrzeszcz, Piecki and Brzeźno the amount of greenspace per inhabitant is 1–3 m<sup>2</sup>. Substantial woodlands, agricultural land and allotment gardens ameliorate the situation at the outskirts of the town.

The intended residential development of Gdańsk-South will necessitate the creation of new greenspace in the districts of Chełm-Orunia and Lostowice-Kowale. Figure 1 represents the anticipated level of greenspace in residential areas per inhabitant in the year 2010, estimated on the basis of the surface of the existing green spaces against the expected population number. Wherever the rate amounts to less than 35 m<sup>2</sup> per inhabitant it would be desirable to establish new green sites. In case of areas with substantial woodlands, 15–20 m<sup>2</sup> per person is aimed at, whereas in areas deficient in woods it is 25–50 m<sup>2</sup> per person. Creation of the most extensive green spaces seems inevitable in such districts as the City Centre and Chełm-Orunia (about 90 ha each), Lower Oliwa (70 ha), Siedlce, Lower Wrzeszcz and Zaspą (about 50 ha each).

It has been proposed to create new green spaces on waste sites and within major residential areas. Restructuring some allotment gardens complexes, eg in Nowy Port, so that they could be used as parks, appears to be equally important.

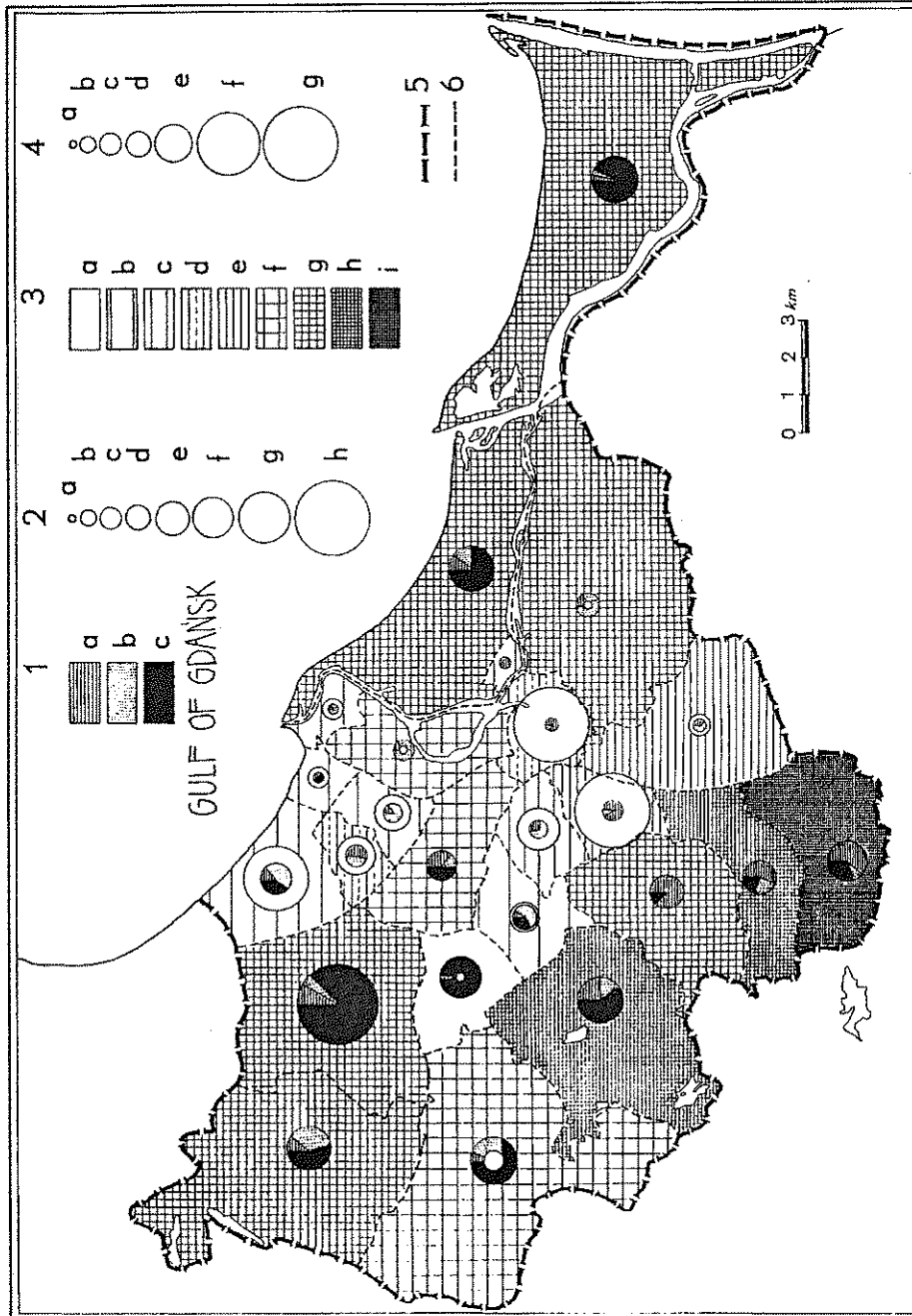


Fig. 1. The areas of urban greenspace in Gdansk and their shortage. 1. Types of greenspace: a - parks, lawns, cemeteries; b - allotment gardens; c - woods and woodland parks. 2. Area of greenspace (in ha): a - 0-20; b - 20-40; c - 40-70; d - 70-150; e - 150-300; f - 300-500; g - 500-1,000; h - 1,000-1,600. 3. The anticipated area of developed green sites in m<sup>2</sup> per inhabitant, in the year 2010: a - 1-2; b - 2, 1-4; c - 4, 1-6; d - 6, 1-10; e - 11-20; f - 21-30; g - 31-50; h - 51-100; i - 300. 4. The shortage of development green areas (in ha): a - 10; b - 15; c - 20; d - 30; e - 50; f - 70; g - 90. 5. Boundary of the study area. 6. Boundary of urban districts.

#### SUBSYSTEM OF NATURALLY DEPENDENT GREEN SPACES

Distribution of this type of greenspace can be governed by geomorphological, hydrological or climatic factors. Within the subsystem the following elements have been identified (Fig. 2):

1. Vegetation protecting the edge of the Upland (from Sopot to Pruszcz Gdański);
  2. vegetation protecting coastal dunes (from Jelitkowo to Świbno);
  3. green environment of the Radunia valley;
  4. green environment along the Vistula (Przegalina – the outflow to the Gulf of Gdańsk);
  5. vegetation protecting the lakes: Otomin, Jasień, Wysoka and Osowa in their catchment areas;
  6. vegetation in valleys of streams running down the Upland to the Gulf of Gdańsk (the Karlikowski Stream, the Jelitkowski Stream, the Jaśkowy Stream, Strzyża).
- The elements described above form a distinct integrated system. The only green spaces that need major reconstruction are those in the valleys of streams running down the Upland to the gulf. A great threat to the vegetation protecting the edge of the Upland is housing and the associated infrastructure developed over the last few years (Morena, Niedźwiednik, Piecki, Chelm). They trigger intense geodynamic processes causing devastation of plant cover – trees, shrubs and ground flora.

#### SUBSYSTEM OF GREEN SPACES GOVERNED BY THE SPATIAL STRUCTURE OF THE TOWN

The components of this subsystem act as green corridors or buffers for sites with different uses, and they either are or should be situated between industrial or warehouse sites and residential districts or agricultural land, as well as linking substantial complexes of existing greenspace.

The major components of this subsystem are (Fig. 3):

1. The town's main axis running from the north to the south, which separates housing estates to the west from industrial sites to the east.
2. The town's main east-west axis, that in its western part links the woodlands of the Three Towns' Landscape Park and the Otomin Woods, in its central part isolates the Old Town from industrial land, and in the eastern part separates industrial development sites from agricultural areas of the Vistula Delta Region.
3. A green corridor in the region of Kokoszki (the western part of Gdańsk) linking in the west the woodlands of the Three Towns' Landscape Park with the Otomin Woods.

Apart from the elements described, several other complexes of green environment exist governed by the spatial structure of the town.

With the exception of the main north-south axis, running primarily through residential and industrial areas, which needs to be restructured and densely planted, all the remaining elements included in the subsystem either are or should be situated on agricultural or undeveloped land. In order to serve their functions properly the green spaces should be planned and managed.

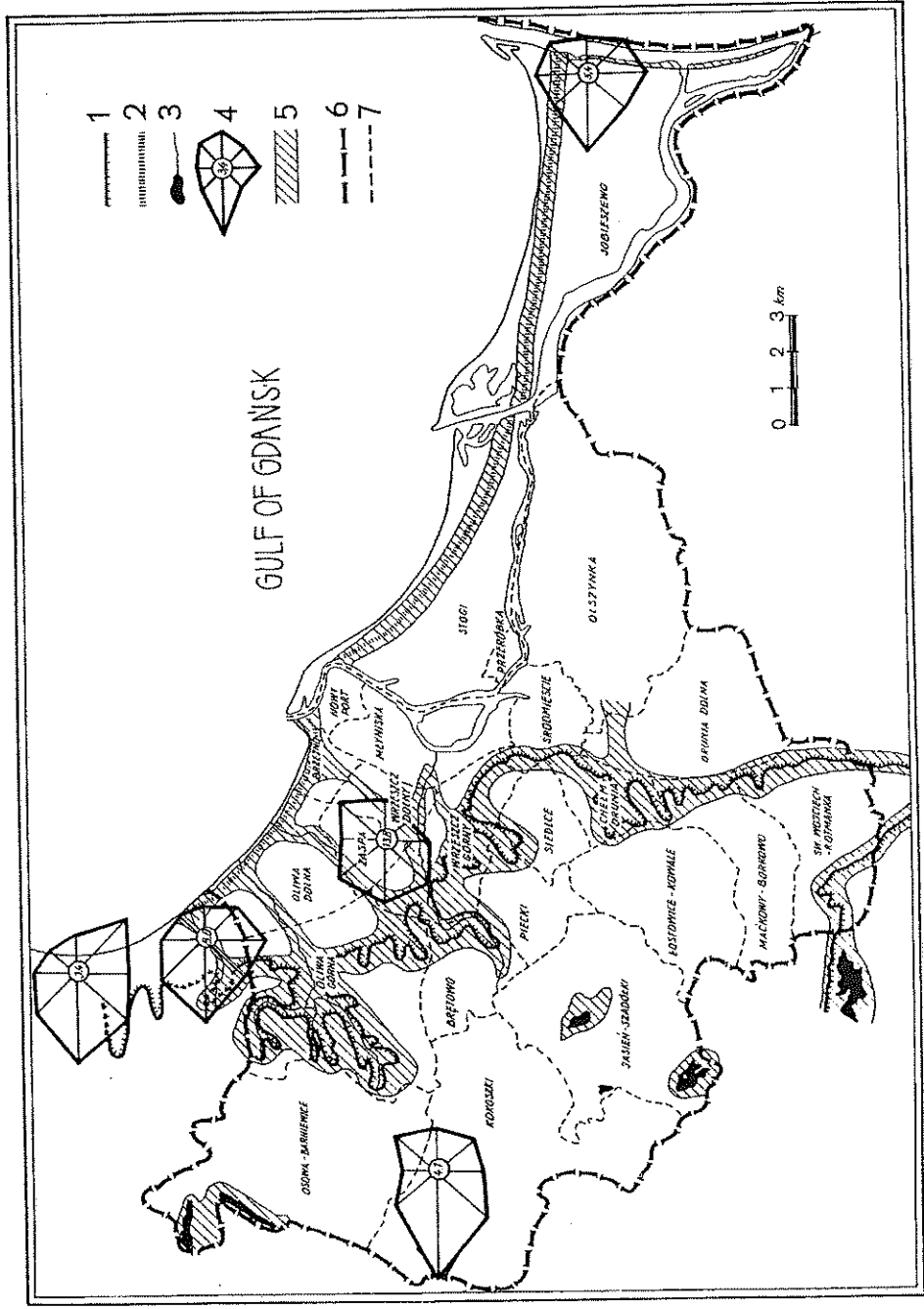


Fig. 2. Subsystem of greenspace governed by natural features. 1. Upland edge zone. 2. Zone of coastal dunes and lakes. 3. Main streams and lakes. 4. Wind roses. 5. Main areas of greenspace governed by natural features. 6. Boundary of the study area. 7. Boundary of urban districts.

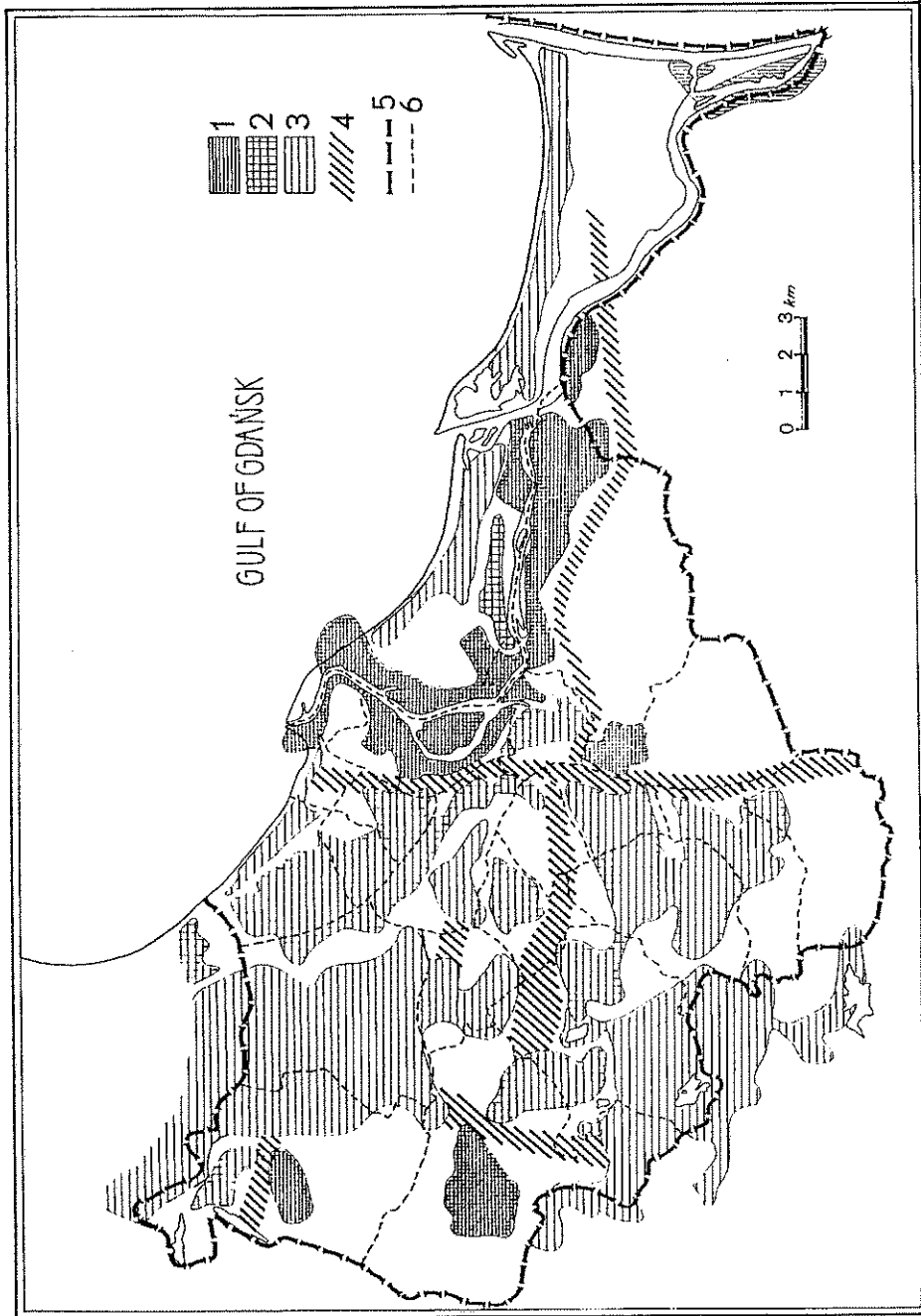


Fig. 3. Subsystem of greenspace governed by spatial structure of the town. 1. Existing and intended industrial-storage sites. 2. Existing and intended residential areas. 3. Woodlands. 4. Major greenspace complexes governed by spatial structure of the town. 5. Boundary of the town. 6. Boundary of urban districts.



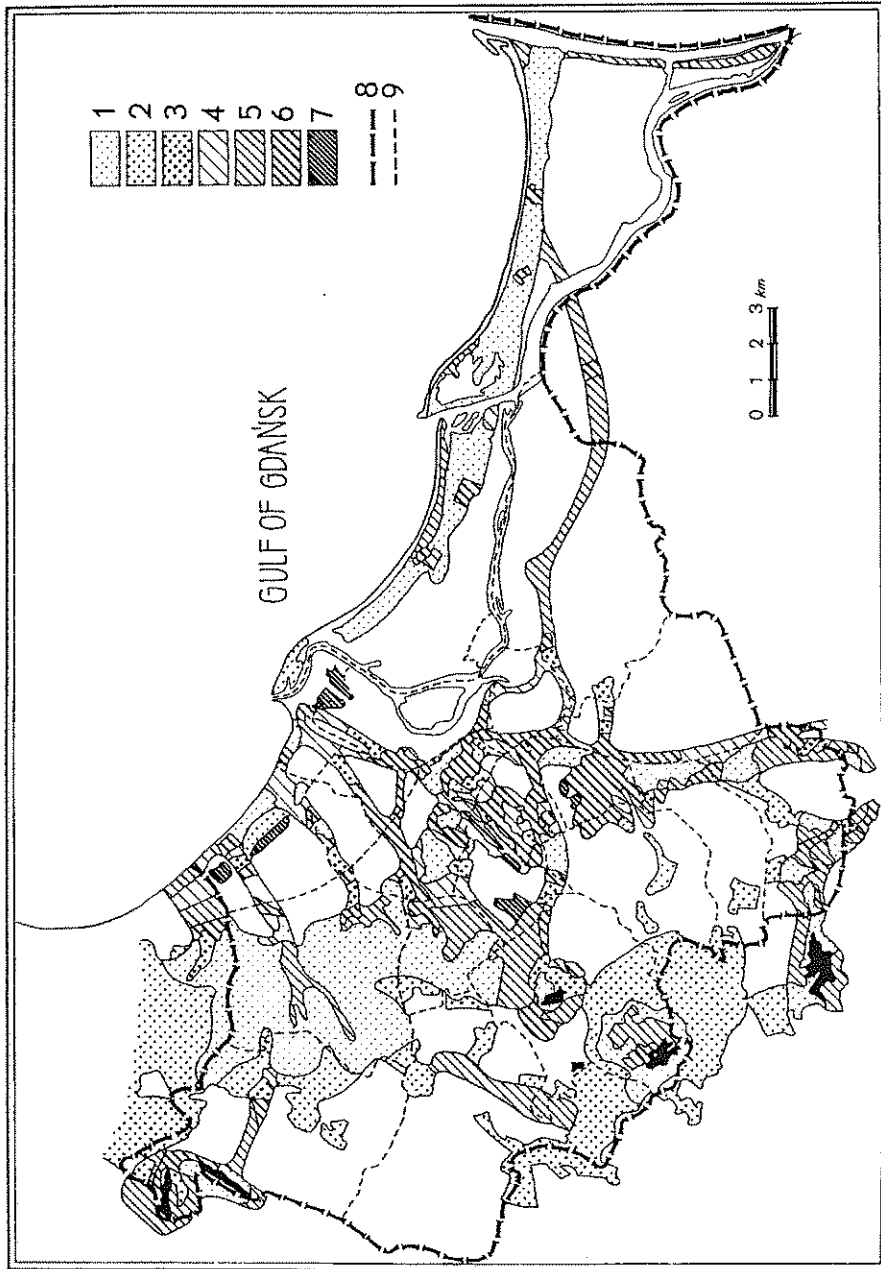


Fig. 4. Synthesis of greenspace system in Gdansk. 1. Existing areas of official greenspace which serve the desired functions. 2. Existing areas of unofficial greenspace. 3. Existing areas of official greenspace which fail to serve the desired functions and thus needing redevelopment. 4. Undeveloped sites to be used for establishing parks. 5. Open land, where it would be advisable to retain or introduce networks of large and medium greenspace. 6. Residential and industrial sites, where it would be advisable to develop large and medium greenspace to the maximum extent. 7. Substantial residential areas with the possibility of developing recreational greenspace. 8. Boundaries of the study area. 9. Boundaries of urban districts.

#### OTHER URBAN GREENSPACE

The existing areas of green environment shaped by neither of the factors already specified complete the urban greenspace system in Gdańsk. This is greenspace identified for retention and conservation owing to its beneficial influence on Gdańsk residents through its aerosanitary and recreational functions. Preservation of these green spaces is desirable.

The main areas belonging here are (Fig. 4, signature 2):

1. An extensive part of the Otomin Woods in south-western part of the described area.
2. Western part of the Three Towns' Woods together with allotments along the Three Towns' by-pass.
3. Arable land along the Orunia Stream in southern part of the town.
4. Parkland on Westerplatte.

#### SYNTHESIS OF GREENSPACE SYSTEM IN GDAŃSK

The existing and proposed areas of urban greenspace in Gdańsk are represented by Fig. 4. Maintaining the flora should be a priority on sites included in the system, even if this is in conflict with the current land use. Moreover, the density and extent of planting should be the highest possible that the current land use allows. Only in exceptional cases can destruction of the site's natural vegetation occur.

Wherever it exists the plant life should be retained and managed. The greenspace should be restructured only where it fails to serve the desired functions, as in the case of allotment gardens bordering heavily industrialized sites which have been converted into high parkland playing the role of buffer greenspace. Undeveloped or degraded sites, after their initial reclamation, should only be used for establishing areas of countryside. On open agricultural areas it is vital to preserve or restore a network of communities of trees and shrubs, of ponds and swamps as well as wide field margins. All these are valuable habitats of many plant and animal species. Increasing the area of greenspace in residential and industrial areas demands serious treatment of the issue in detailed plans of development and their proper implementation.

#### CONCLUSIONS

The system of greenspace in Gdańsk consists basically of three strands:

1. The western one – spreading from the north to the south, comprising the woodlands of the Three Towns' Landscape Park, the Otomin Woods and numerous allotment gardens.
2. The central one – extending from the north in a southerly direction, including allotment gardens, parks, arable land and woods spreading from Brzeźno, through the Town Centre, to Pruszcz Gdański.
3. The eastern one – spreading from the west eastwards, with woods on dunes, from Northern Harbour to Świbno, with the ornithological reserve "Birds Paradise" incorporated.

In order to complete the system the following aims have been established:

1. Internal integration of the western strand achieved through linking the woodlands of the Three Towns' Landscape Park and the Otomin Woods.
2. Completing the central strand's northern part, through establishing new parklands in the districts of Nowy Port, Brzeźno, Młyniska, the City Centre and the Lower Wrzeszcz.

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