

Landscape transformations and risks for ecosystems of protected landscape areas in the Metropolitan Area of Gdańsk-Gdynia-Sopot

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Abstract. The article is devoted to the issues of ecological and landscape changes taking place in large spatial protected areas (landscape parks and protected landscape areas), located inside and in close proximity to the so-called functional zone of the Gdańsk-Gdynia-Sopot Metropolitan Area. The area is a metropolis with a population of 1.56 million inhabitants. In its central part, in the immediate vicinity (up to 25 km) from the borders of Tri-City, there are 4 landscape parks and 17 areas of protected landscape. High natural and landscape values determine the great interest in these areas, not only as a recreational space, but also as an area of realization of housing and service as well as production functions. The author draws attention to the lack of results of ecological and landscape research on a regional scale (especially in the immediate vicinity of a large, developing metropolis), evaluating the conservation status of protected areas, lack of reliable recognition of threats and the degree of changes in the environment of these areas as well as difficulties with their protection against investment pressure.

Preservation of natural and landscape values of these areas is not a concern of local authorities focused on the economic development and the economic effects of how the communities function. As a result of investment pressures and irreversible impairment, many parts of them are eligible for exclusion from the borders of these areas. The degree of degradation and intensity of changes is a function of the distance from the most densely populated core of the metropolis, investment pressure and directions of urban development as well as natural characteristics of protected areas, predisposing them to fulfilling various functions. The article focuses, in particular, on selected areas of the protected landscape. They are covered by the weakest protective regime and are subject to the strongest changes.

Key words: landscape parks, protected landscape areas, suburbanization, metropolitan area, threats to ecosystems, investment pressure.

1. Introduction

Gdańsk-Gdynia-Sopot Metropolitan Area (hereinafter referred to as “G-G-S MA”). It includes a total of 57 local government units and is inhabited by 1.56 million people, i.e. approx. 68% of the voivodship’s inhabitants, covering 37% of its area (Plan, 2016). The central part of the area, so-called functional zone, is made up of 14 cities

and 19 rural communes. The neighborhood of the cities is subject to strong anthropogenic processes, characterized by rapid spatial and economic development, suburbanization phenomena and significant recreational pressure of the agglomeration’s inhabitants on natural areas. Many urban centers have seen a decline in the number of inhabitants in the last 10 years, while suburban areas are characterized by a strong increase in the number of inhabitants and

the built-up areas. These processes result in the fragmentation of agricultural and forestry land and a fundamental change in the forms of land use. The former agricultural area is occupied by unused, dispersed residential areas, while the large homogeneous agricultural areas have been converted into numerous small plots of land with various formal functions (at different stages of the transformation of forms of use).

This is not without significance for protected natural areas, which are also subject to significant pressure, becoming, in many places, the area of realization of residential and recreational functions. Within landscape parks, the main factor of transformation and degradation is the pressure of tourism, development of infrastructure for tourist traffic and housing development as well as the fragmentation of parks, which has been growing for years due to the growing and laden communication routes. In contrast, in the areas of protected landscape, adjacent to the central part of the metropolitan area, there is a strong and extensive conversion of agricultural land towards built-up areas. Ecosystems and entire landscape units are subject to change and degradation, while the irreversible loss of primary natural and landscape values qualifies numerous areas to verify the legitimacy of their protection. The major differences in the forms of degradation, threats and impacts on protected areas depend primarily on their location in relation to the central part of the metropolitan area, the nature and value of the environment as well as the development policy pursued by local authorities. The aim of this publication is to present the first results of work on the assessment of the conservation status of natural and recreational values as well as to verify the need for the protected landscape areas (hereinafter referred to as "PLA").

2. Materials and methods

The process of assessment of natural and landscape transformations and determination of the types and degree of anthropopression into protected areas (their ecosystems, recreational values, landscape and spatial connectivity as ecological corridors) seems to be very important in the context of assessing the legitimacy of their further functioning. This is a rather difficult task. It requires laborious research and analysis, in particular those essential for the assessment of irreversible loss of primary natural values. This is a fundamental and necessary condition for their possible dismantling or alteration of the borders and their prohibitions. In order to fully and correctly diagnose the condition of space, it is necessary to carry out the multifactorial analysis of environmental components, cultural values, landscape and the state of development and development processes. This requires access to many data resources and time-consuming activities. Due to the longstanding

existence of protected areas and their changes, such analyses also require a retrospective approach. Changes in the natural environment and landscape are the leading factor.

Analysis and monitoring of changes in land use and land cover change (LU / LC) are a widely used method of assessing the degree and pace of changes taking place in the vicinity of large metropolises. These data are often combined with data on changes in the population, changes in the state of the environment (e.g. urban heat island phenomena), or increase in the size of built-up areas and transport networks. Changes in natural ecosystems and agrocenoses are also often assessed. Many observations are used to assess these changes in suburbanised areas (Jat et al., 2008; Zhang et al., 2013; Mallupattu & Sreenivasula Reddy, 2013; Nalej, 2016). Digital techniques and satellite imagery are commonly used in that regard (Maktav et al., 2005; Czochański, 2013; Bagan & Yamagata, 2014; Ahmad & Goparaju, 2016). Meanwhile, for these areas there are no comparative materials available in Pomorskie Voivodeship, as there are no documents describing their status at the moment of establishment. The only material from the 1980s, a study entitled "Protected Landscape Areas of Gdańsk Province" (1984) is very general and refers, basically, only to the basic objectives of protection of particular areas. Topographic maps from the late 1980s are still an indirect reference material, which makes it all the more necessary to analyze the current state of these areas and the ongoing processes of change.

The works on the verification of the protected landscape areas have been planned for a period of 5-6 years and should lead to a new formulation of the system of protected areas, enabling real protection of still preserved natural resources and sustainable development of communes within the metropolitan area. The analyses was based on satellite images, available source materials, including the BDOT 10K database the Forest Data Bank and Natura 2000 areas, archival cartographic materials and scientific research results, field mapping of ecosystem types and the results of the communes' natural inventory – carried out in 1991-2006 by the team of the Office for Documentation and Nature Conservation of the Voivodeship Conservator of Nature.

The works carried out so far included the development and consultation of the research methodology (using the case study method in the selected protected area), correction of vector layers of the terrain cover from BDOT 10K and thematic analyses, their synthesis and proposals of changes in the protected area's range. While characterising the areas, 20 factors were analyzed for each of them – for example, field mapping of terrestrial ecosystems, updating and evaluation of spatial development status, inventory of transport and transmission infrastructure, assessment of natural, recreational and landscape values, assessment of the degree of environmental transformation,

management and recreational usefulness of forests, analysis of spatial and functional relations with the environment. The synthesis is an assessment of the extent to which the statutory criteria for recognition as a protected landscape area are met and further specified in the definition of the area, and defined in Article 23 of the Nature Conservation Act 2004 (Ustawa..., 2018).

3. Metropolitan area and nature conservation

The problems presented in this paper concern protected landscape areas, located within the range of the Metropolitan Area of Gdańsk-Gdynia-Sopot. Formally, the current scope of the Area is defined in the Spatial Development Plan of the Metropolitan Area from 2016. It is a result of the agreement of communes and districts forming such an association from 2015 onwards (Fig. 1). In this area, the functional links and intensity of spatial development clearly differ, dividing it into 3 subzones – a central one (called the core, including the Tri-City), the so-called “functional zone“ of the metropolitan area (encompassing the Tri-City and covering 30 local government units) and a potential functional zone (the remaining area – also 30 units). In fact, the first two zones with the most intense

development, the strongest investment processes and the largest number of inhabitants are the source of the strongest impacts and pressures on space, environment and landscape. The urban centers of the metropolitan areas alone have a total number of over 1 million of them.

Due to its specific geographical location – in the vicinity of the coast zone of the Gulf of Gdańsk and at the junction of the Vistula delta, the vast Reda and Łeba proglacial stream valley as well as the surface of the moraine upland of the Kashubian Lake District, and specific features of the natural environment (e.g. strong habitat diversity), the area has high natural, landscape and recreational values. As a result, within the metropolitan area, as many as 21 large spatial forms of nature protection have been defined, including 4 landscape parks and 17 protected landscape areas. These areas constitute one of the basic, regional forms of large-scale spatial nature and landscape conservation. The establishment of these sites dates back to the end of the 1970s and was connected with the desire to improve the conditions for the protection of natural and landscape resources, while at the same time creating the possibility of preserving their economic use – including for the purpose of agriculture and recreational-tourism.

At that time (apart from the specific Coastal Landscape Park), agricultural land and economic forests were the predominant forms of land use. The planned system

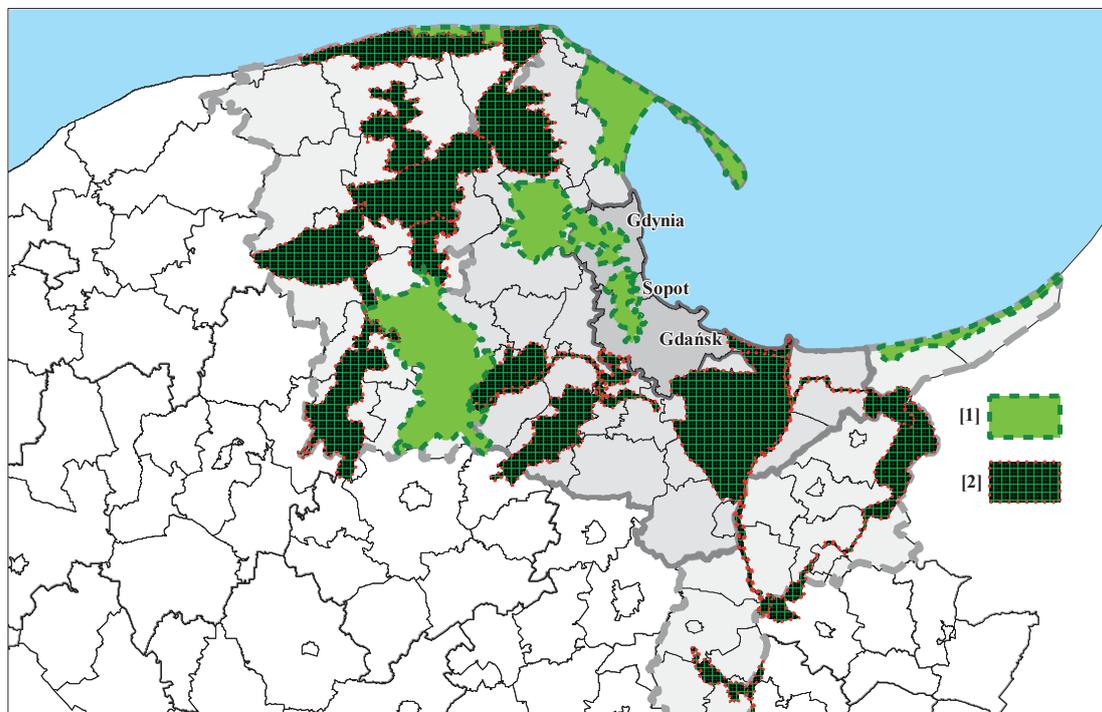


Figure 1. Spatial range of the zones in the Gdańsk-Gdynia-Sopot Metropolitan Area with the location of nature conservation forms (landscape parks [1] and protected landscape areas [2])

of the forms of nature protection (at that time within the boundaries of the Gdańsk Voivodeship) was characterized by spatial connectivity. Landscape parks were assigned a slightly larger protection regime, at the same time establishing appropriate management and surveillance structures for them, while protected landscape areas remained complementary and spatially integrating landscape parks into the regional system of protected areas – in accordance with the ESOCH (Ecological System of Protected Areas) concept in force in the 1980s.

Landscape parks were characterized by fairly high natural and landscape values and naturalness of ecosystems (with a predominance of water and forest ecosystems), while PLA mainly characterized by significant landscape values, with areas used for agriculture dominating. Today, all these areas are subject to strong anthropopression – both as a result of urban development and in the process of development of dispersed development (suburban), recreational facilities, service-production, commercial and communication facilities. As a result of suburbanization, in many places, we have to do with irreversible loss of natural and landscape values, changes in the nature of the land use and loss of numerous natural habitats. These processes are becoming stronger, covering larger and larger areas, degrading protected areas and destroying the spatial connectivity of ecosystems. These processes are analogous to those taking place throughout Poland (Radziejowski, 2011). Many authors pay attention to the processes of change in the neighborhood of metropolitan areas (Zuziak, 2005; Sas-Bojarska, 2007; Lisowski & Grochowski, 2008; Degórska, 2012; Przewoźniak, 2017). In particular, they relate to changes in land use and the growth of chaotic, poorly planned built-up areas. A detailed and important study on these changes and the spatial policy is presented in the Report on economic losses and social costs of uncontrolled urbanisation in Poland (2013).

The described processes are similar in other areas of Poland. They are characteristic, not only for large metropolitan areas, but also for smaller towns (Lisowski & Grochowski, 2008; Szyda, 2013; Gołędzinowska, 2012, 2015). In Poland, the spontaneous development of construction has been very prominent since the early 1990s. This has been manifested in the form of increasingly extensive areas of chaotic suburbanisation (Zuziak, 2005; Solon, 2009; Degórska, 2010). In Europe and around the world, suburbanisation is also a strong process, the nature of which depends on the economic level of the state, the prosperity of its inhabitants and the nature of legal solutions, as well as the urban culture. This phenomenon takes on a diverse character – from the Indian slums, Brazilian and Mexican favelas, to organized, planned, sequential in time and structured suburban forms of major cities in North America and Western Europe (Knox, 1991; Antrop, 2004, Helene, 2006; Jędraszko, 2005). In all cases,

urbanization of areas takes place mainly at the expense of agricultural land, as well as through the elimination of small surface natural ecosystems – trees, natural meadows or wetlands and floodplains. Usually, the intensity of changes and the size of the urbanized area is a function of the distance from the centre and boundaries of the metropolitan area, while the processes taking place are dynamic, complex and multifunctional (Antrop, 2004; Degórska, 2010, 2012; Solon, 2009).

4. Results and discussion

These phenomena are, currently insufficiently researched. There is a lack of monitoring of the state of nature and spatial management, as well as detailed knowledge of the ongoing processes, threats to ecosystems and the condition of protected areas. As landscape parks are currently in the process of preparing their conservation plans and, thus, carrying out a comprehensive assessment of the conservation status of natural, cultural and landscape values, the author's works focused on the areas of protected landscape – determining their degree of investment and changes in land use and assessing the conservation status of natural, landscape and recreational values. These works, undertaken in 2015 and carried out by the team under the direction of the author, are also to allow for a synthetic assessment of the level of threats and changes in protected areas in the environment of Gdańsk-Gdynia-Sopot Metropolitan Area, to identify their locations, assess the state of investments in these areas and allow for verification of their boundaries and existing protective measures. At the same time, they will allow for the evaluation of preserving spatial connectivity in the network of ecological corridors, designated at the regional and subregional level for the entire Pomorskie Voivodeship and indicated in planning documents at the voivodeship level (The concept of the ecological network..., 2014).

Since the establishment of landscape parks and protected landscape areas, not only their legal definitions, have changed, but above all their operating conditions. The last 30 years have been the time of ever-increasing human pressure on the environment of protected areas, an increase in the built-up and communication areas, as well as an increase in the volume of recreation and tourism. The proportions of land use have changed, and the way in which the economy is operated in suburban areas is certainly neither sustainable nor rational. In the pursuit of economic growth, local governments are subject to the pressure of investors, and efforts to develop attractive landscaped areas, in competitively priced conditions (in relation to city centers) result in a widespread occurrence of the phenomenon of suburbanization, in the wider surroundings of the metropolis.

At the same time, there is no reliable identification of threats and changes in the environment of these areas and no reliable assessment of difficulties in protecting them against investment pressure. The lack of results of comprehensive ecological and landscape research on a regional scale (especially in the immediate vicinity of a large, developing metropolis), which would evaluate the conservation status of protected areas, makes it difficult to make decisions on spatial management and facilitates its chaotic development. Moreover, these areas do not have *de facto* stable financing of nature conservation, which strengthens the processes of their degradation. They are not financed by the state budget, and expenditures from local government funds, at the level of the voivodships, are directed mainly at landscape parks and at the local level on the forms of individual protection – and at the same time these expenditures are very modest. Moreover, expenditure from other funds is usually not channeled to the PLA (Radziejowski, 2011).

In the case of landscape parks, their definition has not changed significantly over the years, while the definition of protected landscape areas has changed, broadening the scope and meaning of this form of nature protection. In 1991, the statutory definition was that the PLA included “landscaping areas with different types of ecosystems”. It was the ecosystem and landscape-based premises that formed the basis for the designation of these areas, while attempting to meet the assumptions of the system and spatial relationship with other protected areas (in the Ecological System of Protected Areas). The amendments to the Nature Conservation Act introduced, in 2004 (Ustawa..., 2018), the current definition of PLA- referred to as “protected areas due to a distinctive landscape with diverse ecosystems, which is valuable in terms of their ability to meet the tourism and leisure needs or their function as ecological corridors” (Article 23.1, § 23.1. Nature Conservation Law, 2004). This very binding definition has provided the basis for defining the premises and scope of evaluation of these areas in terms of preservation of values and meeting the statutory objectives of their establishment.

The preliminary diagnosis of the conservation status of natural and landscape values in large protected areas in the Pomorskie Voivodeship in 2010-2015 (while working on the project of a network of regional ecological corridors) showed that the degree of anthropoppression on protected areas is significantly higher in the vicinity of the Tricity agglomeration and within the boundaries of a predefined metropolitan area. On the basis of criteria related to the impact on the environment and its protection – such as:

- percentage of the area of urbanized and agricultural land;
- percentage of the area covered by other forms of protection (including nature reserves, Natura 2000 areas);

- the location in the functional zone of the metropolitan area;
- existence of spatial conflicts (defined on the basis of information and commune applications);
- investment projects; investment indications in planning documents;
- the existence and exploitation of mineral deposits

22 most problematic areas were selected. They are subject to anthropogenic pressure, threatened by degradation of values, transformed and developed, with a clear loss of natural and landscape values. Out of this group, 14 priority areas were identified as the most vulnerable and problematic (due to conflicting functional functions). These are PLA: Valleys of Radunia, Przywidzki, Kartuski, Otomiński, Szkarpada Valley, Nogat River, Coastal, Żuławy Gdańskie, Dzierżgoń Lakes, Reda-Łeba Proglacial Stream Valley, Łeba valley, Choczewsko-Saliński, Sobieszewska Island and Człuchów Lakes Complex.

From the observations made so far, it appears that the degree of transformation of landscapes and ecosystems of protected areas is a function of their distance from the core of the metropolis (the largest urban areas), directions of development policy conducted by communes within the metropolitan area and characteristics of the natural environment (including the so-called potentials – which are subject to human use). For this reason, the protected landscape areas located directly within the impact of the metropolitan area were chosen first for further research work on anthropoppression in protected areas. Their accessibility in terms of the time it takes from the core of the metropolis (Tricity) is only up to 0.5-1 hours by car and the actual distance up to 30 km from the borders of Tricity. It has been found that the most important influential factors, occurring in almost all areas, are:

- the increase in the built-up areas (compared to the first decade of their existence, it varies from ca. 20% to 120% of their original surface area);
- increase in the number of technical infrastructure facilities and communication areas;
- threat and loss of natural spatial connectivity with neighboring ecosystems;
- degradation and limitation of the spatial range of many ecosystems occupying small areas, including for example moorland, ecotones of coastal zones with reed belt, natural floodplain meadows, sandy grasslands;
- deforestation and elimination of trees and mid-field bushes (including roadside and waterside ones),
- reduction of the wetlands areas;
- setting-aside of agricultural land and its use for non-agricultural purposes;
- increase in the volume of traffic;
- increase in the intensity of tourism and recreational exploration.

- extreme changes in harmony of the landscape (aesthetics and spatial order, creation of dominant landscape and strange architectural forms, substandard building structures, creation of illegal or temporary landfills);
- the surveying division of agricultural land into small plots for construction purposes;
- strong development of suburbanization in the form of investments in construction facilities – for residential, industrial, public purpose, service, commercial, recreational, communication.

The difference between landscape parks and protected landscape areas in terms of usage is revealed quite clearly, although of course, with the preservation of specificity of particular areas. In the landscape parks: Kashubian, Coastal, Mierzeja Wiślana and Tricity, forest areas dominate. However, due to the location of the Coastal Park – including the waters of the Puck Bay, the largest area is covered by sea waters, while forests cover the largest area of terrestrial ecosystems. On the other hand, agricultural land is the predominant or significant form of land cover and land use in the protected landscape areas. Only in the Przywidzki PLA are 58% of them forest areas, with a secondary share of arable land. The work that is currently carried out in the scope of evaluation of changes in land use, preservation of ecosystems and landscape analyses allows for a closer assessment of changes within the boundaries of 4 PLA: Radunia Valley, Przywidzki, Szarpawa River and Żuławy Gdańskie. Their current status is shown in Table 1.

The pressure to invest the space within the boundaries of PLA is very, clearly connected with the neighborhoods

of urban areas in the central part of the metropolitan area. The biggest transformations take place in PLA Radunia Valley, adjacent to the strongly developing Żukowo urban centre. This area is further presented as an example of the analysis of anthropoppression phenomena on the areas formerly characterized by a high degree of naturalness and currently undergoing major transformations. In the area of this commune and the town, housing development is rather chaotic. It develops on the land that had been under agricultural use in the past, and large areas of development were created within the boundaries of the PLA. The residents of Gdańsk and Gdynia move here, building their homes and commuting to the centre of the metropolis.

4.1. Case study – PLA Radunia Valley

Undertaking research on the processes of functional and spatial changes occurring within the boundaries of the protected landscape areas, the first case study was prepared in order to develop and test the evaluation methods. For this purpose, PLA Radunia Valley was selected as it met all the requirements of high natural and landscape values and at the same time a strong anthropoppression in the vicinity of the direct influence of the metropolitan area.

Case study – as a research method, which involves many assessment methods in order to diagnose the phenomenon in the deepest possible way, based on many variables and their interrelationships, seems to be a good approach for the needs of a comprehensive assessment of threats and changes taking place in protected areas. The first focus was on identifying the diversity of anthropogenic interactions on particular ecosystems and their reactions (susceptibility)

Table 1. Structure of land use/land cover (LU/LC) in selected protected landscape areas

LU/LC	PLA Radunia Valley	Przywidzki PLA	PLA Szarpawa River	PLA Żuławy Gdańskie
Area of PLA	3340 ha	10888 ha	4296 ha	30092 ha
Build-up and communication areas	9.9 %	3.8 %	2.5 %	4.1 %
Agricultural area	40.5 %	34.0%	82.2 %	89.1 %
Forests, woodland and planned greenery	42.4 %	58.2 %	6.2 %	3.5 %
Wetlands, beaches, dunes	0.1 %	0.1 %	2.8 %	0.4 %
Surface waters	7.1 %	3.9 %	6.3 %	2.9 %

Source: own elaboration based on BDOT 10K, verified in the field.

to these interactions. Subsequently, environmental components, ecosystem diversity, spatial development status, recreational development status, infrastructure, cultural values and 15 other variables were examined.

In the 1980s, there was hardly any development in the area under study, and most of the areas, except for forests and surface waters, performed agricultural functions. Over the last 30 years, a significant increase was noted in the built-up and communication areas, including an increase in the size of the large area development and the extension of the road network. These changes, according to the communes in which the PLA is located, are presented in Tables 2 and 3. The smallest changes in the built-up area occurred in the town of Żukowo and amounted to approx. 30%, while the largest in the city of Pruszcz Gdański – and it amounted to almost 122 %. The biggest influence on the growth of the area was caused by single-family apartment buildings, scattered throughout the area and large-area buildings such as supermarkets, shopping malls, production and service plants. The growth of the space of large-

area objects is the lowest in the town Żukowo – it amounted to approx. 11%, and the largest in the rural commune Żukowo 83.6% (Table 2). Smaller values were recorded in the city of Pruszcz Gdański and in the village commune of Kartuzy – approx. 44%. The areas that significantly underwent the process of conversion of functions are former agricultural lands (both arable land and grassland). Woodland and mid-field meadows were affected to a large extent, while forest communities were partially lost, and the communities at the bottom of the valley were ecologically diversified (natural floodplain meadows, scrubland and rushes). In some cases, the relief of the site was radically transformed (Fig. 2).

For many years in rural areas of communes there has been a process of setting-aside of agricultural land, division into construction plots (even up to 600 m²), arming the area with electricity, trade, next drafting the administrative decision documents on the conditions of development, and finally the development of separate plots of land. The creation of local spatial development plans in which

Table 2. Change of the built-up area between 1980 and 2015

Commune	1980	2015	increase	increase
	ha			%
Kartuzi	24.93	36.17	11.44	45.1
Kolbudy	143.87	211.04	67.17	46.7
Pruszcz Gdański	82.5	183.02	100.89	121.8
Somonino	87.27	123.45	36.61	41.5
Żukowo (rural territory)	107.58	162.84	55.66	51.4
Żukowo (town)	49.07	64.04	14.97	30.5

Source: Own study based on topographic materials and satellite images.

Table 3. Change of the surface of large-area buildings

Commune	1980	2015	increase	increase
	ha			%
Kartuzi	7.2	10.37	3.17	44.1
Kolbudy	35.63	44.51	8.88	24.9
Pruszcz Gdański	11.49	16.56	5.07	44
Somonino	13.16	16.96	3.8	28.9
Żukowo (rural territory)	14.54	26.7	12.16	83.6
Żukowo (town)	15.68	17.46	1.78	11.3

Source: Own study based on topographic materials and satellite images.

large agricultural areas are designated for housing development does not improve the situation. Apart from individual developments, these areas are now being developed by building companies, which significantly intensify the development of space. In most of the PLA areas there are buildings not only in dispersed or concentrated form, but more and more buildings appear within the protective zone of buildings, i.e. within 100 m distance from the shoreline of rivers and water reservoirs. In most cases, this process is carried out with the approval of the Regional Directorate for Environmental Protection (either on the basis of the implementation of previous LSDPs, or as investments for public purposes, or as revitalization of pre-existing buildings, and ultimately also as a building authority).

The analysis of the diversity and conservation status of terrestrial ecosystems made it possible to identify 27 “types” of ecosystems, including specific ones – such as built-up and communication areas. The characteristic feature of the Radunia Valley is its distinctiveness in the landscape, with deep-cut, eroded river valley, with forest and shrubbery ecosystems associated with preserved river beds and oxbow lakes. Spontaneously developing forests of various species composition have a significant share in the area, e.g. alder and willow meadows in the valley bottom as well as birch wood, aspen and pine stands and units with domination of a common maple. It is symptomatic and non-specific in the scale of the voivodeship and the Pomeranian Lake District. Due to the spontaneously

progressing secondary succession in economically abandoned areas, this has not yet been developed. Non-forest ecosystems account for a significant share of permanent grassland – meadows and pastures with varying degrees of moisture (with a predominance of hydrogenic water) and economic use, as well as thermophilic communities, e.g. dry sand grasslands, often associated with active or idle railway lines passing through the area or forming boundary sections.

The Radunia Valley area and its surroundings are characterized by a significant mosaicism of water-forest and meadow ecosystems, and the physiognomy of the area changes quite rapidly at the interface between the bottom of the valley (including water reservoirs) and the urban areas of Żuków and Pruszcz Gdański. The landscape is enriched by retention reservoirs and agricultural land interlaced with willow bushes and small alder patches. In the middle part of the valley, the predominant types of community are: hillside oak-hornbeam forests, willow and alder meadows, riparian forests with oak-elm-ash, ash-alder and elm-ash, spring alder trees, beech-oak forest and beech forests. Although they should be treated as forests under strong anthropopressure, they are also valuable natural communities that deserve protection because of their importance as an ecosystem (Łonkiewicz, 1996).

The old river beds and eutrophic natural water reservoirs with *Nympeion*, *Potamion* macrophytes should also be regarded as valuable on a regional scale. The meanders and



Figure 2. Strong alterations of the terrain relief and degradation of valley and coastal ecosystems within the Radunia Valley Protected Landscape Area, within the city boundaries of Pruszcz Gdański (photo: J. Czochański)

old river beds of Radunia are accompanied by reed stands, which differentiate between belts of high rushes (from the water side) and sedge rushes (from the land side). Further on there are moss-sedge communities and humid meadows. It is a layout typical of valley landscapes with old river beds and eutrophic reservoirs (Herbich ed., 2004). In the valley extensions, called basins, we observe the predominance of hydrogenic meliorated valley meadows, with a significant share of shrub communities (willows), rushes, trees (mainly alder trees) and small patches of forest remains.

Undoubtedly, the most valuable part of the PLA is the Ravine of Radunia River, which is also protected by a nature reserve and a special Natura 2000 habitat protection area (PLH 220011). The river flows here in a stony ravine, meandering, in the vicinity of high escarpments of a ravine up to 40 m high. The bottom of the valley and the slopes are partially covered with deciduous and oak-hornbeam forests and fragments of the bottom are filled with wet floodplain meadows. A total of 537 vascular plant species, including many rare and mountainous species, were found there. Seven habitat types of Annex I and three species from Annex II of the Habitats Directive have been identified in the Natura 2000 area.

5. Conclusions

The undertaking works on the assessment of the conservation status of natural, landscape and recreational values in the areas of protected landscape of the Pomorskie Voivodeship results both from the need to preserve the remaining, often valuable areas and ecosystems as well as from the proper shaping of spatial development processes of communes, which enable the preservation of the existing values of protected areas. The strong development of the Gdańsk-Gdynia-Sopot Metropolitan Area has an impact on numerous landscape parks and protected landscape areas in its vicinity. The development of suburban areas, typical for Poland, with developing suburbanization, spatial disintegration of natural systems and degradation of ecosystems and landscape values, enforces verification of forms of protection existing for over 30 years.

The surface area of approx. 10% to 30% of the area of protected landscape areas surrounding the metropolitan area has irretrievably lost its original values – and hence the object and objectives of protection for which they were established. The agrocenosis was transformed to the greatest extent, especially in the vicinity of Tri-City. In many places, willow shrub communities as well as mid-field bushes and mid-field strips of trees were also degraded. In the vicinity of watercourses and water reservoirs, anthropopressure is clearly visible in the areas of riparian forests, natural wet meadows, peat and marsh ecosystems and coastal zones with reed communities.

However, it should be emphasized that despite many adverse anthropogenic impacts, the conservation status of natural and landscape values in many (often small surface areas) fragments of the PLA should be considered satisfactory. Contrary to the initial expectations, formulated before undertaking the fieldwork, the conservation status of PLA's assets, despite the fact that it is generally described as average, is much better than expected. Thus, it is still appropriate to continue their protection, although they require verification of legal protection area.

The phenomenon of suburbanization in the vicinity of metropolitan areas, types of processes and directions of changes taking place in the environment have been confirmed many times. The current situation and speed of changes requires planning and designing of landscapes, which, further on, requires a detailed understanding of the processes of changes (Antrop, 2004). Currently, the identification of the intensity of changes, depending on the local specificity of the space as well as the size and detailed scope of changes in particular types of ecosystems and landscapes, should be considered as important directions of research. These directions of research still appear to be quite interesting.

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