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Original article

The disappearance of inland dunes landscape – a case study from southern Poland

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ABSTRACT

The paper presents changes in the landscape of inland dunes in one of the basins in the eastern part of Silesian Upland. Based on the analysis of archival maps and historical sources, the former dune landscape of Dąbrowa Basin was reconstructed. The current state of its preservation was determined based on contemporary cartographic materials and field research. It was established that the dunes occur on the floodplain, under-slope flattening, and cuesta escarpment (Ząbkowice Hummock)). The source of aeolian sands was fluvioglacial and alluvial deposits, which, as a result of aeolian transport, were moved to higher and higher morphological levels and stabilized on a substrate of different lithology and age. The impermeability of the bedrock – tills, clays, mudstones, siltstones had a significant influence on the dune landscape. It resulted in the presence of wetlands and peat bogs in the vicinity of most dunes. Consequently, the landscape of the valley was distinguished by a lot of contrast in terms of vegetation - dry pine forests or grassy areas on the dunes and moisture-loving vegetation in their surroundings. However, this landscape was under strong human pressure. Most of the dunes (3/4) have been destroyed in the last hundred years due to sand mining and industrial and residential construction. One of the largest dune fields in the Przemsza River basin and most floodplain and under-slope flattening dunes were utterly destroyed. In addition, an interesting dune at Triassic clays was almost fully exploited, and a rare case on the Silesian Upland where a dune entered the Triassic limestones was partially covered with concrete. There are only 25 dunes in the study area - they deserve protection both as the last fragments of the inland dunes landscape in this part of the Silesian Upland and for historical and natural reasons.

KEY WORDS: inland dunes, drift sands, landscape, human impact, Silesian Upland

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1. Introduction

In the landscape of the European Lowlands, inland dunes and aeolian cover sands are important elements. Their occurrence is related to a broad belt of sandy deposits known as the *European sand belt* (KOSTER, 1988; ZEEBERG, 1998; KASSE, 2002). These dunes were formed in the Late Glacial and were stabilized in the Holocene by forests. In the last millennium, many aeolian forms were blown out due to deforestation, and drift sand fields were created (PYRITZ, 1972; KOSTER, 2009; RAHMONOV & OLEŚ, 2010; DOODY, 2013; DULIAS, 2018).

Inland dunes are a characteristic element in the landscape of central and southern Poland (DYLIKOWA, 1968; WOJTANOWICZ, 1970; NOWACZYK, 1986; SZCZYPEK, 1986; MYCIELSKA-DOWGIAŁŁO, 1987; WAGA, 1994; ZIELIŃSKI, 2016 and others). Most of them occur on sanders, ice-marginal valleys, and river valleys. Due to the varied shapes of the dunes and their significant relative heights (20–30 m), they are an essential morphological element in the plains. A specific ecosystem has been developed within the dune fields, resulting from the alternating neighborhood of dry dune sands with wet wind-blown troughs. Currently, most of the Polish dunes are covered with forests, and a relatively small part (a few percent) is covered with sandy grasslands and separated by drift sands. Due to the good bioclimatic conditions in the dune forests, they

play an important recreational and leisure function (KOBOJEK & KOBOJEK, 2019).

In Poland, many landscapes of inland dunes are under legal protection. The largest and best-preserved forms (not only in Poland but also throughout Europe) occur in the Mazowiecka Lowland, protected within the Kampinos National Park. A unique complex of high dunes presenting various morphological forms is protected here, between which there are stretches of swamps and peat bogs covered with peat and meadow vegetation. Another example is the Area of Protected Landscape of the Dunes of the Toruń-Bydgoszcz Basin (281 km^2), where Poland's largest complexes of inland dunes are protected (ANDRZEJEWSKI & WECKWERTH, 2010). Dunes and related habitats are protected in the Bory Tucholskie National Park and within various landscape parks, nature and landscape complexes, nature reserves, and Natura 2000 areas. Particularly valuable are inland dunes with sandy grasslands (*Corynephorus, Agrostis*), protected, among others, in the Błędowska Desert (Silesian Upland) or the Siedlce Desert (Częstochowa Upland). In terms of nature, moors on vast expanses of dunes used in the past as military training grounds are also important, such as the "Przemków Moorland" Special Protection Area in Bory Dolnośląskie.

In some areas, the dunes were subject to high anthropopressure, as aeolian sands are a valued raw material used in industry and construction. Due to their properties – high silica content, good material segregation, and low admixture content, they are the primary raw material for producing silicate products and cellular concrete (KOZŁOWSKI, 1986). Another "advantage" of dune sands is their presence in convex forms, which significantly facilitates the exploitation.

One of the areas where the aeolian relief was significantly damaged or transformed is the southern and eastern part of the Silesian Upland. As a result of forest clearance, for the needs of first medieval iron and ore smelting, then coal mining, residential and industrial construction, the sandy ground was exposed and re-subjected to aeolian processes (SZCZYPEK ET AL., 1994; RAHMONOV, 2007; DULIAS, 2002; PEŁKA-GOŚCINIAK, 2013). In many places of the Silesian region, vast expanses of drift sands appeared, which one hundred years ago were a distinctive element of the landscape (SŁOWNIK HISTORYCZNO-GEOGRAFICZNY, 1993; NOGA, 1994; DULIAS, 2002). Apart from the most extensive drift sands in Poland in the Błędowska Desert, they occur in many other places in the Silesian region, for example, in the vicinity of Mierzęcice, Siewierz, Dąbrowa Górnicza–Gołonóg or Jaworzno–Długoszyn. The existence of drift sands was noted both in written sources (LEWIŃSKI, 1914; BRONIKOWSKI, 1929; KANTOR-MIRSKI, 1931/1932), and in cartographic materials (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929; MAPA TOPOGRAFICZNA, 1931, 1933). The possibility of industrial use of "ubiquitous" sands was highlighted at the turn of the 19th and 20th centuries – they became the subject of intensive exploitation as stowing sands for hard coal mines. As a result of the enormous demand for this raw material, large sand pits were created in the Silesian basins and valleys, and with them, many dunes and aeolian cover sands disappeared from the landscape. Most of the dunes were removed before they were scientifically examined. Currently, for some areas of the southern part of the Silesian Upland, the reconstruction of the former aeolian relief is possible only based on archival materials; however, the possibility of examining the structural and textural features of aeolian sands and determining the age of dune-forming phases has mainly been lost.

In this work, based on available cartographic and historical materials, the former and contemporary aeolian relief of the eastern part of the Dąbrowa Basin has been characterized. Unfortunately, most of the dunes were under human pressure and have not been preserved to our times.

2. Study area

The Dąbrowa Basin is located in southern Poland, in the eastern part of the Silesian Upland. On three sides – from the north, west, and east it is surrounded by Ząbkowice Hummock, part of the Middle Triassic cuesta (GILEWSKA, 1963) (Fig. 1). The bedrock of the basin is composed of Upper Carboniferous sandstones, mudstones, and siltstones, and in the eastern periphery of Permian clays, siltstones, and conglomerates (SZCZEGÓŁOWA MAPA GEOLOGICZNA, 1967). Ząbkowice Hummock rises high above the bottom of the Dąbrowa Basin (locally over 80 m) and is fragmented by river valleys several dozen meters deep (KARAŚ-BRZOZOWSKA, 1960). The relief of the cuesta reflects the geological structure – the escarpment, made of Middle Triassic resistant limestones and ore-bearing dolomites, descends towards the Dąbrowa Basin as a steep slope. In contrast, the part of cuesta formed in the less resistant Lower Triassic clays has the character of under-slope flattening.

The bottom of the basin is covered with Pleistocene deposits of variable thickness (up to 40 m). They form a clear sandy level lying at an altitude of 300-270 m above sea level and showing a consistent decline towards the south (KAZIUK & LEWANDOWSKI, 1980). At the foot of the slopes, the sandy level is covered by deluvia. The western

part of the Dąbrowa Basin has an undulating relief, while the eastern part, which is the subject of this study, has the character of a vast plain with numerous dunes in the past.

3. Materials and methods

The research was carried out in several stages. After collecting the available archival cartographic materials, their content was analyzed in terms of the presence of dunes and drift sands. The source of information were mainly the sheets of the Map of Zagłębie Dąbrowskie, scale 1:10 000, issued in 1929, but presenting the terrain situation from 1925 (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929) and sheets of the topographic map with a scale of 1: 25,000, issued by the Military Geographical Institute in the 1930s (MAPA TOPOGRAFICZNA, 1931, 1933). The state of aeolian forms in the last 90–80 years was verified using newer topographic maps – poviat topographic map in scale 1: 25,000 (MAPA TOPOGRAFICZNA POWIATÓW, 1960) and a topographic map on a scale of 1: 10,000 (MAPA TOPOGRAFICZNA, 1994), as well as based on contemporary orthophotomaps and direct field visions. The results of own research have been supplemented with information contained in the works: LEWIŃSKIEGO (1914), BRONIKOWSKIEGO (1929), KARAŚ-BRZOZOWSKIEJ (1960), GILEWSKIEJ (1963), KAZIUK & LEWANDOWSKIEGO (1980), DULIAS (2000a). Historical studies were also a source of information (SŁOWNIK HISTORYCZNO-GEOGRAFICZNY, 1993; NOGA, 1994).

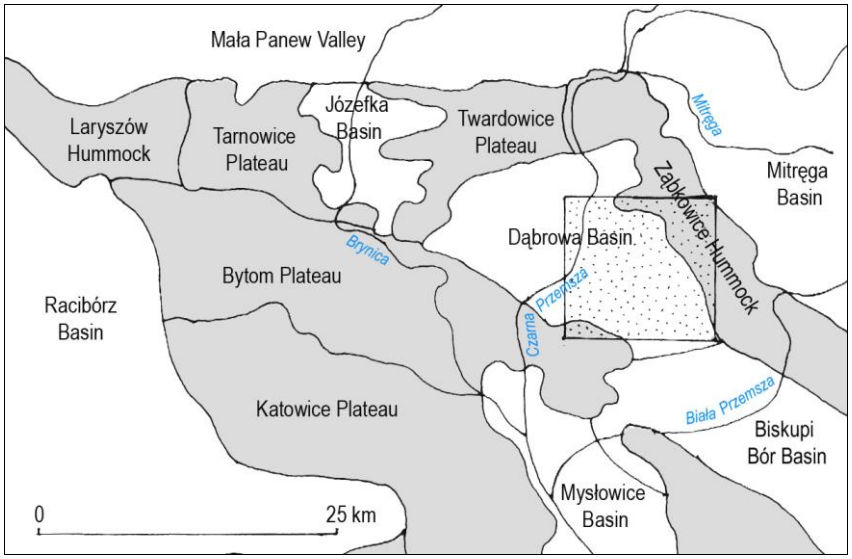

Fig. 1. Location of the study area on the background of the geomorphological units (after Gilewska 1972, changed)

4. Results

In the eastern part of the Dąbrowa Basin, dunes and aeolian cover sands occur in various geomorphological situations, except for the Holocene floodplain, where they are absent (DULIAS, 2016). The study results are presented concerning the following elements of the relief: 1) the floodplain, 2) under–slope flattenings, and 3) the cuesta escarpment.

4.1. Dunes on a floodplain

Gołonóg Trzydziesty. To the northwest of the Gołonóg Trzydziesty estate, there were about ten small dunes covered with grass (Fig. 2). Most of them were oblong, up to 5 m high and up to 250 m long. There was a drift sand field with about 3 hectares to the north of these forms. All dunes were removed during the exploitation of stowing sands (ENCYKLOPEDIA DĄBROWY GÓRNICZEJ, 1996).

Piła Ujejska. In the vicinity of Piła Ujejska, on the forested floodplain of Trzebyczka, there is a large dune about 1 km long and 5–6 m high (Fig. 2). In its substrate, there are fluvioglacial sand and gravel deposits of the Odra glaciation. However, impermeable Permian clays lie at a shallow depth beneath them; therefore, there are wetlands in the vicinity of the dune, including a bog protected as an ecological site „Antoniów Swamps." Along the top of the dune, there are shooting ditches from the Second World War.

Antoniów. On the Trzebyczka floodplain in Antoniów (Fig. 2), there is an oblong dune, several meters high and 400 m long. In its bedrock, under cover of fluvioglacial deposits, there are Permian clays and siltstones. Several dozen years ago, the dune was intensively blown out, which is why it was stabilized with a pine stand. Soon, the dune

will be destroyed as a large estate of detached houses is being developed in its immediate vicinity.

Nowy Antoniów. On the Trzebyczka floodplain, dunes also occurred in Nowy Antoniów (Fig. 2). At the beginning of the 20th century, some dunes were blown out (KANTOR-MIRSKI, 1931/1932). The longest (700 m) and the highest dune (over 8 m) were almost 75% exploited. The bottom of the "rest" of the dune is Lower Triassic clays (SZCZEGÓŁOWA MAPA GEOLOGICZNA, 1967) (Fig. 3). Except for one dune, all the others were liquidated during the development of Osiedle Młodych Hutników.

Bielowizna. Dunes in Bielowizna occur partly on the Trzebyczka floodplain and partly on the under-slope flattenings of Ząbkowice Hummock (Fig. 2). These forms are up to 8 m high and have quite irregular shapes. The dune complex is directly adjacent to the housing estate. The dune field is wooded and is a popular recreational spot.

Sikorka. A vast area of drift sands occurred in the central part of the Trzebyczka valley near Sikorka (MAPA TOPOGRAFICZNA, 1931; KARAŚ-BRZOZOWSKA, 1960) (Fig. 2). In the 1940s, they covered an area of 42 ha. The genesis of drift sands goes back to the Middle Ages. According to KANTOR-MIRSKI (1931/1932), around 1457, the village of Sikorka and the surrounding forests were wholly burnt down – probably then the sands took on a drifting character. Currently, they are marked in morphology as low, irregular „bumps".

Łęknice-Babia Ława. Aeolian deposits were found in the vicinity of Łęknice and Babia Ława (Fig. 2). In the 1920s, most of the sands were blown out (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929). The largest area of drift sands (15 ha) was on the floodplain of Babia Ława, where the sands were shaped like a barchan due to a large lake (1.3 ha). The area was a "sand island" among vast wetlands. The wetlands are related to tills from the San glaciation (KAZIUK & LEWANDOWSKI, 1982). Drift sands occurred here until the 90s of the twentieth century. Today it is an area overgrown with birch groves and successively developed with single-family houses.

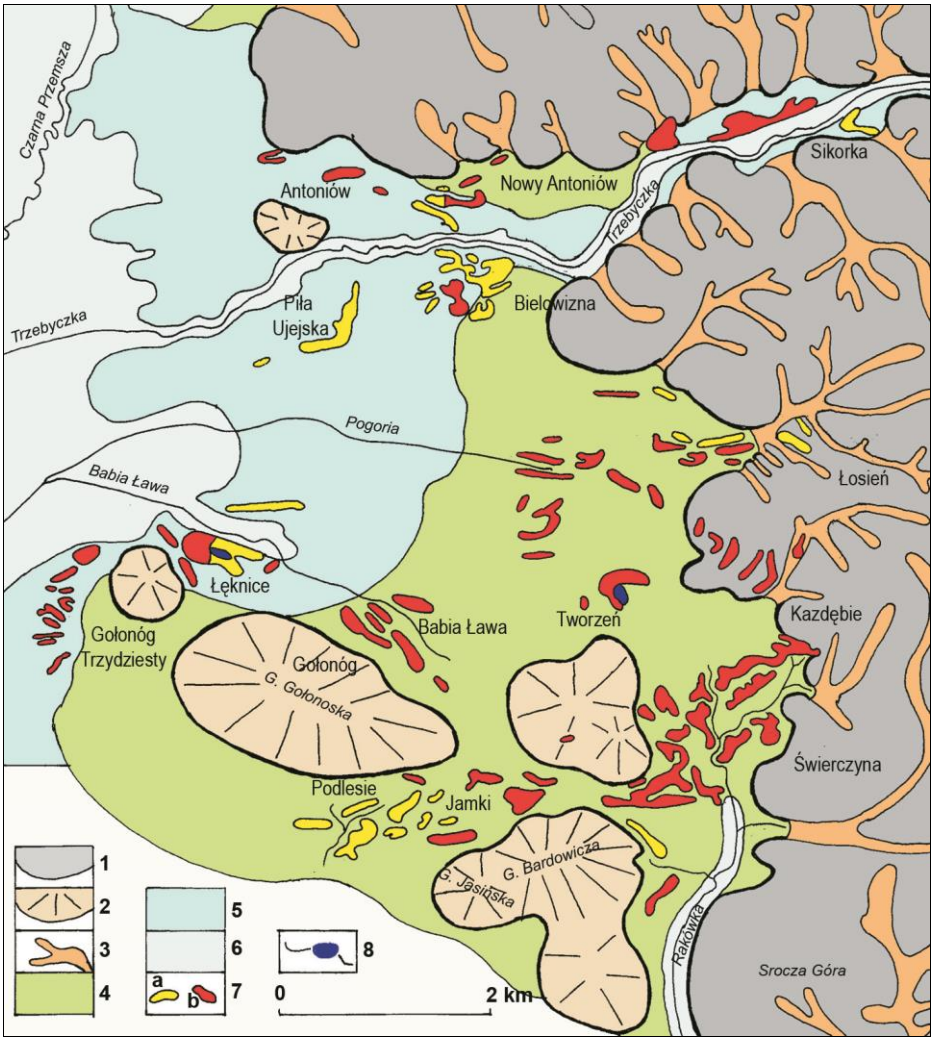

Fig. 2. Existing and liquidated inland dunes in the eastern part of the Dąbrowa Basin on the background the main elements of relief
Explanations: 1 – cuesta escarpments, 2 – outliers, 3 – valleys, 4 – under-slope flattening, 5 – floodplain (lower), 6 – floodplain (higher), 7 – dunes: a – existing, b – liquidated, 8 – rivers and water reservoirs

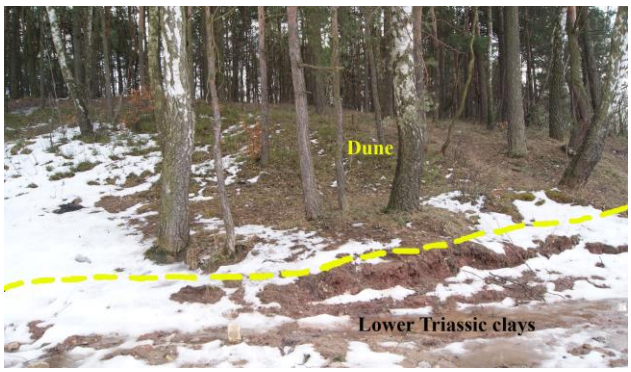

Fig. 3. Dune in Nowy Antoniów – aeolian sands lying on the Lower Triassic clays

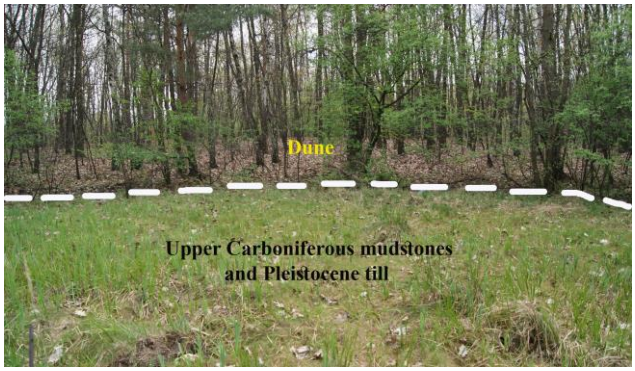

Fig. 4. Dune in Podlesie–Jamki – aeolian sands lying on the Upper Carboniferous mudstones and Pleistocene till

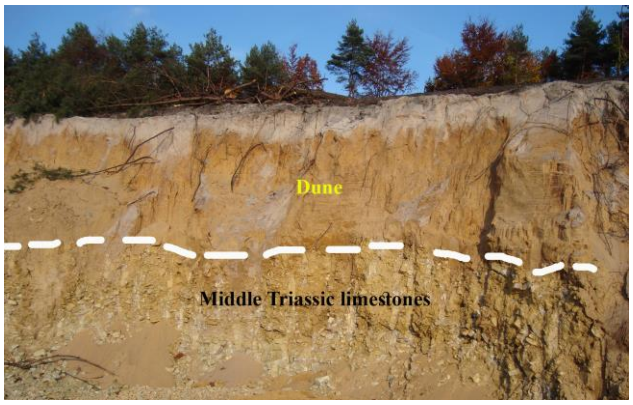

Fig. 5. Dune on the cuesta escarpment in Łosień – aeolian sands lying on the Middle Triassic limestones

4.2. Dunes on under-slope flattening

There were numerous dunes on under-slope flattening along Ząbkowice Hummock. Apart from the above-described dunes in Bielowizna, several other areas have been identified: Gołonóg–Babia Ława, Kazdziebie–Świerczyna, Tworzeń–Pogoria, Podlesie–Jamki, and Nowy Antoniów.

Gołonóg–Babia Ława. At the beginning of the 20th century, on the flattening near Góra Gołonoska outlier, there were dunes blown by the wind – longitudinal and directed from NW to SE (Fig. 2). The highest form was 10 m high. The total area of the drift sands was 11 ha (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929). Currently, this area is primarily built-up.

Podlesie–Jamki. The dune complex in the vicinity of Podlesie and Jamki is situated on under-slope flattening between Góra Gołonoska and Góra Bardowicza and Jasieńska (Fig. 2). In the dune bedrock, tills (San glaciation) occurs in some places, while in others – Upper Carboniferous mudstones (SZCZEGÓŁOWA MAPA GEOLOGICZNA, 1967; KAZIUK & LEWANDOWSKI, 1980) (Fig. 4). Due to the impermeability of the ground, the dunes are surrounded by wetlands. Aeolian forms are about 5–7 m high and about 300–600 m long. One of the dunes has been fully built-up (Jamki), and several others have been almost wholly exploited.

Kazdębie–Świerczyna. The largest dune complex in the Dąbrowa Basin was located near Kazdębie and Świerczyna (Fig. 2). However, only one of the dozen or so large dunes has survived (a cemetery was established there at the beginning of the 20th century). In the 1930s, the two largest dunes adjacent to the Góra Bardowicza from the northeast were exploited – in the 1960s, the sandpit had about 35 ha (MAPA TOPOGRAFICZNA, 1960). The remaining dunes were wholly destroyed during the construction of the largest Polish steelworks – Huta Katowice (MAPA TOPOGRAFICZNA, 1994). The morphometric features of the dunes in the Kazdziebie-Świerczyna region can only be reconstructed on the basis of MAPA ZAGŁĘBIA DĄBROWSKIEGO (1929). They were forms of various shapes – longitudinal, transverse, arched, parabolic. There were numerous wetlands in their vicinity because in the substrate, at a shallow depth, there are impermeable deposits, both Permian clays and siltstones, as well as Lower Triassic clays. At the beginning of the 20th century, the described area was attractive in the landscape, as the vast area of about 100 hectares of great dunes was not covered with forest. The dunes were about 10–12 m high (maximum 16–18 m). The largest forms were almost 1 km long, so LEWIŃSKI (1914) recognized them as one of the largest Przemsza River basin.

Tworzeń–Pogoria. Several dunes existed on the under-slope flattening between Tworzeń and Pogoria (Fig. 2) at the beginning of the 20th century. One of them had the shape of a barchan, forced by the existence of a lake with an area of almost 2 ha (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929). The dune surrounded the lake from the west and north, rising about 5 meters above the water table. There were wetlands in the vicinity of the form because the ground is made of impermeable Lower Triassic clays, covered only with a small thickness of Pleistocene deposits. Unfortunately, all dunes were destroyed during the construction of Huta Katowice.

Nowy Antoniów. To the north of Nowy Antoniów, two small dunes directed SW-NE and entered an under-slope flattening at an altitude of 310–315 m above sea level. (Fig. 2). They are up to 200 m long and about 3 m high. According to KARAŚ-BRZOZOWSKA (1960), under dunes are występują Pleistocene deluvia. Both aeolian forms were built-up with single-family houses.

4.3. Dunes on the cuesta escarpment

Aeolian sands also entered the slopes of Ząbkowice Hummock. Between Tworzeń and Łosień, several longitudinal dunes ranged from 200 m to 500 m long and up to 4 m high (Fig. 2). They ranged from 335 to 340 meters above sea level. In the upper part of one of the dry valleys, there were drift sands with an area of about 1.8 ha (MAPA ZAGŁĘBIA DĄBROWSKIEGO, 1929). All these forms were removed during the construction of Huta Katowice. However, two dunes on the northern outskirts of the steelworks near Łosień and a small field of aeolian cover sands have survived.

Łosień. The dunes in the vicinity of Łosień (Fig. 2) are small but situated high – 330–340 m above sea level. In 2014, they were cut by a new road towards Tucznawa. Aeolian sands, up to 5–6 m thick, lie directly on the Middle Triassic limestones or weathering deposits (Fig. 5). It is a rare situation on the scale of the Silesian Upland. A fragment of the dune has been reinforced with concrete blocks from the side of the new road.

5. Discussion

In the Silesian region, aeolian sands were exploited both on a small scale by individuals, for example, the dunes near Błędów-Rudy in Mitręga Basin, and during large-scale exploitation by large enterprises, for instance in Biskupi Bór Basin ("Szczakowa" sandpit) or Mysłowice Basin ("Maczki-Bór" sandpit) (DULIAS, 2010). In the eastern part of Dąbrowa Basin, mining of stowing sands caused the destruction of relatively few dunes on the floodplain, mainly in the vicinity of Gołonóg Trzydziesty. The most significant loss of dunes was related to the construction of Huta Katowice, and to a lesser extent, to the small-scale exploitation of single forms, for example, in Nowy Antoniów. Single-family houses were built on many smaller dunes because, at the beginning of the 20th century, the vast areas in the eastern part of the Dąbrowa Basin were wet; therefore, dry dunes were a valued place for development. The best example of this is the hamlet of Jamki, whose buildings are limited only to the dune and perfectly reflect its former oblong shape. Only one dune has survived in the area of Kazdębie-Świerczyny, which is entirely used as a cemetery.

Out of about 100 dunes occurring in the Dąbrowa Basin at the beginning of the 20th century, only 25 forms remained, i.e., about 75% of them disappeared from the landscape. The area of dunes decreased by 80%. Dunes in the Dąbrowa Basin and its border with Ząbkowice Hummock occur in three morphological situations – floodplain, under-slope flattening, and cuesta escarpment. Therefore, they are located at an increasing height – from 265 m above sea level in the western part to 340 m above sea level in the eastern region. This fact alone makes this area interesting from a scientific point of view. The source of the material is sandy Pleistocene deposits. Still, due to aeolian transport, the dunes have stabilized on a very different substrate, both in terms of lithology and age. They are alluvia from Vistula and Odra glaciation, fluvioglacial deposits from the Odra glaciation, tills from the San glaciation, Lower Triassic clays, Middle Triassic limestones, Permian clays and siltstones, as well as Upper Carboniferous mudstones. Locally, the bedrock of the dunes is made up of Pleistocene deluvia. It is an exceptional situation, as it seems even in Poland scale, for aeolian processes to take place in such diverse natural conditions in a small area. Another example is Częstochowa Upland, where dunes also occur in different morphological situations but on a more homogeneous substrate – Upper Jurassic limestones, San glaciation sands, and Vistulian loess (DULIAS, 2000b).

Structural relief had a significant influence on the course of aeolian processes in the Dąbrowa Basin. It manifested itself in directing the wind along the base of the outliers and valleys and up the cuesta escarpment. Similar relationships were found, for example, for Częstochowa Upland (SZCZYPEK, 1986). The dune's surrounding landscape was significantly influenced by the impermeability of the dune substrate – tills, clays, mudstones, an siltstones. It resulted in the presence of wetlands in the vicinity of most dunes. Consequently, the landscape of the Dąbrowa Basin was distinguished by a lot of contrast in terms of vegetation – dry pine forests or grassy areas on the dunes and wetland–peatland vegetation in their surroundings. The presence of natural lakes near the dunes (Łęknice, Tworzeń) was exceptional, considering the Silesian natural conditions. The landscape contrasts were especially noticeable during drift sands widespread in the first half of the 20th century.

The aeolian relief of the studied area was under pressure from human activity. One of the largest dune complexes in the Przemsza River

basin was destroyed, with most dunes on under-slope flattening and floodplain (Fig. 2). In addition, an interesting dune on clay substrate in Nowy Antoniów was almost fully exploited, and a rare case in the Silesian Upland where a dune entered the Triassic limestone bedrock was partially covered with concrete. The remains of aeolian relief in Dąbrowa Basin are interesting and deserve protection, not necessarily legal, but protection against destruction. Noteworthy is the complex of low dunes in the Podlesie-Jamki area, the dune in Piła Ujejska with shooting ditches from the Second World War, the outskirts of the dune in Nowy Antoniów formed on Lower Triassic clays, the dune in Antoniów (protection against buildings) and the dunes in Bielowizna (DULIAS, 2016).

On the Silesian Upland, the aeolian relief is protected only in the Błędów Desert (SZCZYPEK ET AL., 1994; RAHMONOV, 2007). Several decades earlier, when a desert landscape characterized this area, the demands for its protection did not find a proper response. It was only in the period of progressive overgrowing of the desert that its values were appreciated and protected as an ecological site and Natura 2000 area. For the vicinity of Siedlec Janowski on Częstochowa Upland, the demand for the protection of drift sands occurring here as a documentation site was made by DULIAS (2004). In the area of former dune sands exploitation (about one km^2), we can observe aeolian sands, from under which limestone rocks protrude (SZCZYPEK, 1992). It is probably the last drift sands area on Częstochowa Upland. The example of Dąbrowa Basin, where most of the dunes disappeared from the landscape in less than a hundred years, shows that aeolian relief should be more widely included in nature protection projects.

The disappearance of the landscapes of inland dunes is manifested mainly in the areas located on the periphery of the *European Sand Belt*, where there are fewer dunes, smaller in size, and the morphology is less varied. However, it does not mean that these landscapes are less valuable than landscapes with classically developed dune complexes in central Poland. Due to its location in the areas with the structural relief and outcrops of pre-Quaternary bedrock, dunes here occur in various geomorphological and lithological conditions. Dune landscapes are less extensive here but are surrounded by more contrasting landscapes of non-aeolian origin.

6. Conclusions

Dunes in the eastern part of the Dąbrowa Basin occur on the floodplain, under-slope flattening, and cuesta escarpment. Sandy Pleistocene deposits – fluvioglacial and alluvial were the source of the dune material. As a result of aeolian transport, the dunes stabilized on a diverse substrate, both in terms of lithology (sands, tills, clays, mudstones, siltstones, limestones) and age (Holocene, Pleistocene, Triassic, Permian, Carboniferous). The sands were blown by winds from the western sector and moved to higher and higher morphological levels (265–340 m above sea level). Moreover, the dunes "entered" the cuesta escarpments, into the valleys and matched the older relief. Most of the dunes (75%) were destroyed due to the construction of Huta Katowice, sand extraction, and progressive urbanization. In the first half of the 20th century, many of the dunes were drift sands with a total area of 75 hectares. The landscape of the eastern part of the Dąbrowa Basin was then distinguished by considerable contrast. The dunes that have survived to our times deserve protection as the last elements of the former aeolian relief and historical reasons (shooting ditches from the Second World War period) and natural (maintaining the geo- and biodiversity of the area).

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