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CHARACTERISTICS OF ILLEGAL DUMPING SITES ON THE EXAMPLE OF THE TRZEBINIA MUNICIPALITY

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ABSTRACT

Despite the introduction of a common and uniform system of fees for the collection and management of Municipal Solid Waste (MSW) throughout Poland, new illegal waste dumping sites continue to be created in areas not designated for this purpose. The main aim of the work was focused on determine the material composition of the waste deposited (and found) on these wild dumping sites in the Trzebinia commune, as well as to conduct a spatial inventory of these locations. The aim was accomplished through the use of a spcialized questionnaire. In total, 21 illegal dumpling sites were identified, despite the fact that the Municipal Waste Selective Collection Point (PSZOK) is available in the commune. The majority of these illegal landfills were found in areas covered with trees (30.8%) and bushes (42.3%). None of the illegal landfills contained more than 1 Mg of MSW. The average weight of waste deposited in illegal landfills was 98.5 kg per site. The largest proportion of waste found at these illegal sites consisted of demolition and construction waste, such as rubble (34.3%) as well as plastic waste (32.9%). The share of rubble and construction waste increased with distance from buildings. Only four of the twenty-one illegal landfills were removed during the sixteen months of research.

Keywords: *waste management, illegal dumping sites*

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INTRODUCTION

Residents of Polish cities and villages have adapted to the principles of the waste hierarchy introduced by the Waste Act (Journal of Laws of 2013, item 21, as amended). This hierarchy assumes that waste prevention and minimization of the amount of waste are the most important, and only then is waste recovery and recycling, while it considers waste storage as the least beneficial. From April 2021, selective waste collection in Poland households is mandatory. Since July 2013, all Poles pay the so-called waste tax (fees for waste collection and treatment), and yet not everyone complies with the law and some of the Municipal Solid Waste (MSW) they generate still ends up in illegal landfills (Malinowski *et al*., 2015).

Wild dumps or illegal landfills are areas where various types of MSW are illegally and uncontrolled dispose (Ciura *et al*., 2017). Places of illegal waste collection are a problem not only in Poland, but all over the world. An example of this is the Great Pacific Garbage Patch. Ocean currents have led to waste accumulating on the assessment. In 2018, the Patch had an area of 1.6 million km^2 (Aitken *et al*., 2018), which is approximately the area of: Belarus, Poland, the Czech Republic, Slovakia, Hungary, Ukraine, Romania and Moldova combined. In Poland, illegal dumps are often located in a short distance from single buildings, on sparsely frequented forest trails, as well as in ditches, watercourses and areas covered with bushes (Dusza *et al*., 2013; Malinowski *et al*., 2015; Szydłowski and Podlasińska, 2016; Wojtczak, 2015). Places of illegal deposition also occur on the outskirts of cities, but also in protected areas (Malinowski, 2019). Waste clusters also appear in national parks. According to Gajda and Plaza (2008), illegal dumps occur in particularly valuable areas, such as landscape parks or Natura 2000 areas. National parks are also not free from wild landfills. A protected area is a geographically designated area with a unique landscape or significant environmental values that is legally protected. The basic forms of nature protection in Poland are: national parks, nature reserves, landscape parks, Natura 2000 areas, natural monuments, documentation sites, ecological areas and others (Malinowski, 2019). National parks, although they are the highest form of nature protection, are also not free from illegal landfills. In the Bieszczadzki National Park, it was noted that the distribution of waste accumulation on individual trails is uneven. The longer the trail section, the less waste accumulates. This is due to the fact that an average tourist entering the trail can take with him a limited amount of luggage necessary to complete the trail. In the initial phase of the march, there is the greatest probability that he will try to get rid of some of his ballast. This is confirmed by observations made during the research, where most waste was collected at the beginning of the trail, near the ticket offices and around designated parking spaces. Hence, it can be concluded that the most vulnerable to illegal dumps are relatively short trails

and those located in the most attractive tourist areas (Cieśla and Koszelnik, 2016). The main aim of the work was to inventory illegal waste dumps in the Trzebinia commune, in terms of their location, contact with bodies of water, occupied area, waste mass and their material composition. The scope of work included the development of a field research questionnaire, conducting field research and a study analysis of the collected data. The work was not intended to assess the functioning of the waste collection system in the commune, but only to determine the scale of the problem of uncontrolled waste abandonment.

MATERIAL AND METHODS

The Trzebinia commune is located in the western part of the Małopolska Voivodeship, in Chrzanów County and neighboring the Silesian Voivodeship. The area of the commune is 105.2 km^2, of which agricultural land constitutes approximately 40%, while forests and forest land cover over 44% of the total area of the commune. In the Trzebinia commune there are: the Ostra Góra nature reserve, the Tenczyński Landscape Park, the Dolinki Krakowskie Landscape Park and the Podbuczyna ecological site. There is a Selective Municipal Waste Collection Point in the commune, where residents can store used batteries, electrical and electronic equipment, construction waste and bulky waste. This point is located on the outskirts of the commune and is not popular among residents, which may be one of many reasons for abandoning waste in places not intended for this purpose.

In order to describe illegal waste dumps, a data collection form was used, which was developed in accordance with the model presented in the publication by Ciura *et al*. (2017). Using the form made it possible to systematize the information obtained in the field in order to later describe the location of illegal dumps, identify potential contact with water, determine the distance from buildings, determine the occupied area and assess visibility in a given area. Moreover, the use of the form allowed for the approximate identification of the material composition of the waste. Field work was carried out in three series: from September 8 to October 28, 2021, April 22 and August 10, 2022. During the first series of studies, a search and inventory of illegal waste dumps was carried out. During the research, a measuring roulette was used (to determine the area of the illegal landfill), a camera and a hand-held Garmin GPS receiver (to record the geographical coordinates of the dumps).

A group of waste with an area exceeding 0.5 m^2 was considered an illegal dump in accordance with the studies by Kaszubkiewicz *et al*. (2011), Malinowski *et al*. (2015) and Ciura *et al*. (2017). Every wild dump found was photographed. The area of the landfill [m^2] and its height [m] were determined using a measurement roulette. For each illegal landfill, the approximate mass of collected waste was determined based on the material composition and unit masses

of individual waste determined in the laboratory (e.g. tires, steel wire, rubble, etc.).

The research carried out in series 2 and 3 was aimed at checking whether new waste appeared in previously inventoried illegal dumps, whether there were changes in their characteristics, such as surface area, and whether the landfill was closed. Figure 1. shows the general outline of the field research conducted.

The data collected in the surveys were transferred to the MS Excel spreadsheet program. The results of field research were presented in the form of tables and charts. Wild dumps were analyzed in terms of their location, contact with water, distance from buildings, surface area, visibility in the field, mass and morphological composition of the waste. Formula (1) was used to calculate the share of individual fractions in the total mass of waste deposited in illegal landfills:

$$X_n = \frac{m_n}{m_F} \cdot 100\% \quad (1)$$

where:
X_n - share of individual waste fractions [%],
m_n - the mass of individual waste fractions in a landfill [kg],
m_F - mass of all waste in the analyzed landfill [kg].

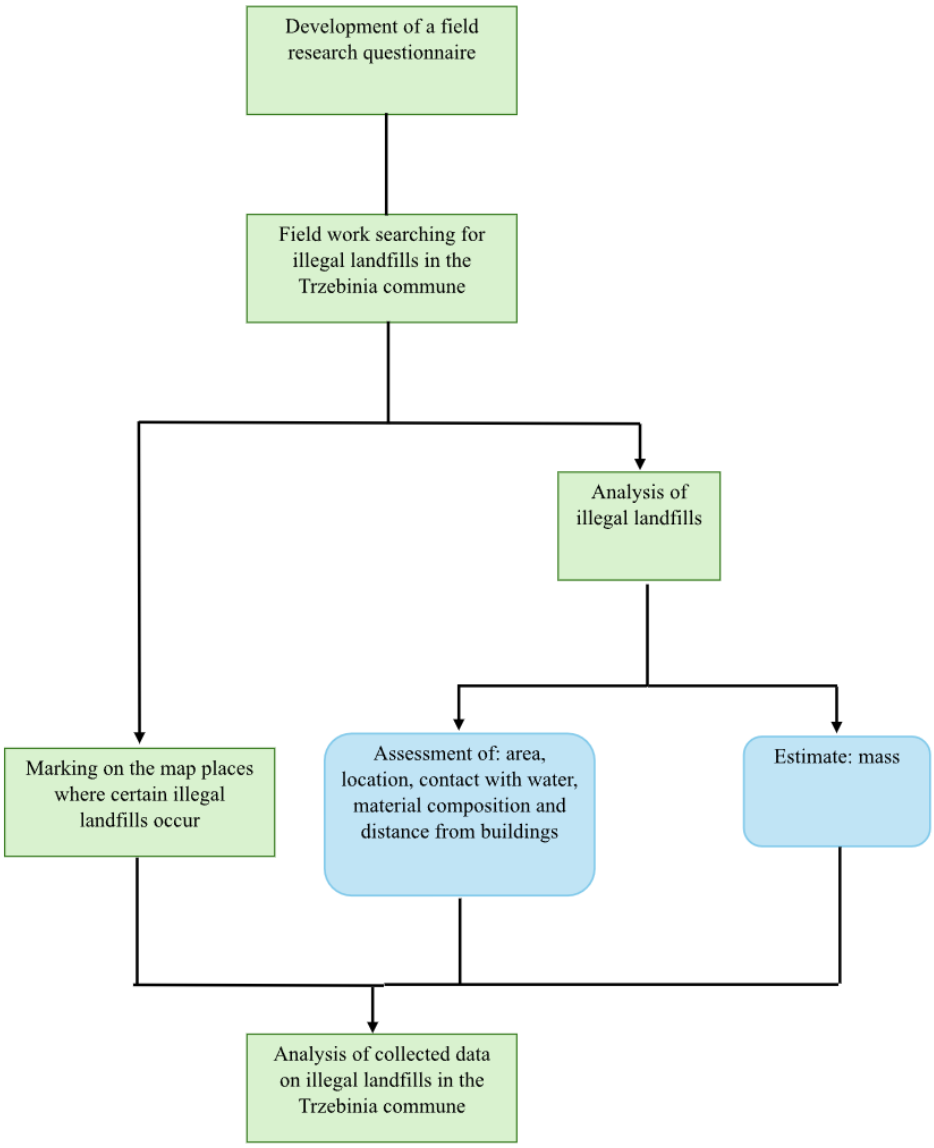

Figure 1. Scheme of conducted research.

Source: own study

RESULTS AND DISCUSSION

In the Trzebinia commune, 21 illegal waste dumps were located (Fig. 2), all in the southern part of the commune. No hazardous waste was identified in any of the examined illegal landfills, including: medicines, light bulbs, paints, greases and oils. Most illegal dumps are located on flat or even terrain (38.1%). Ditches, canals and slopes took second place in terms of the frequency of wild dumps, accounting for 14.3% of the areas examined (Fig. 3). In most cases, landfills were invisible, most often hidden in clumps of bushes and in the forest.

Figure 1. Location of identified illegal dumps in the Trzebinia commune.
Source: own study based on www.maps.google.pl

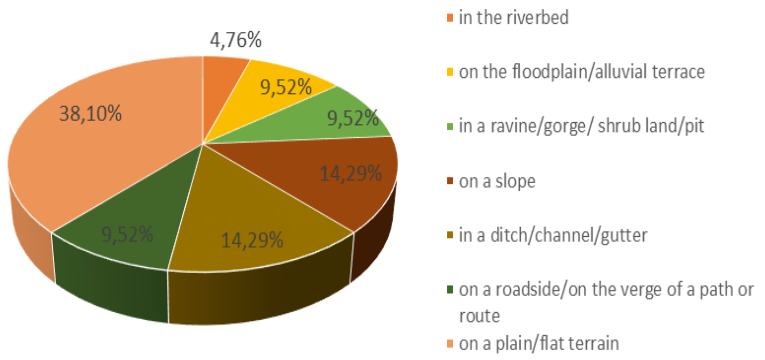

Figure 3. Location of illegal dumps in the Trzebinia commune.
Source: own study

Nearly 15% of illegal dumps had direct contact with the water (Fig. 4). Most illegal dumping sites (38.1%) are located more than 1,000 m from buildings. Slightly less (28.57%) at a short distance (500-250 m) and 33.3% at a very short distance up to 250 m (Fig. 5). In this work, most of the illegal waste was located from 500 to over 1000 m from the buildings, in the study by Ciura *et al.* (2017), most illegal landfills were located in the range from 250 m to 1000 m. However in the research of Szydłowski and Podlasińska (2016), illegal landfills were most often found within 500 m of household buildings.

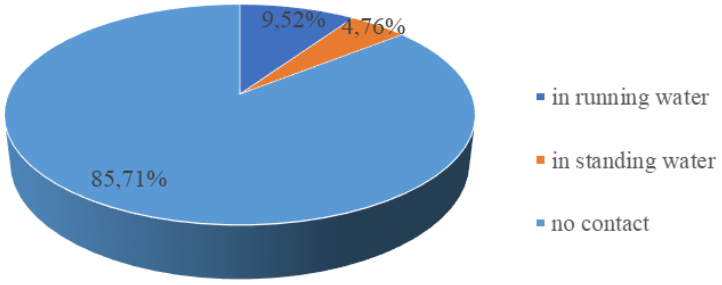

***Figure* 4.** Contact of illegal dumps with water.
Source: own study

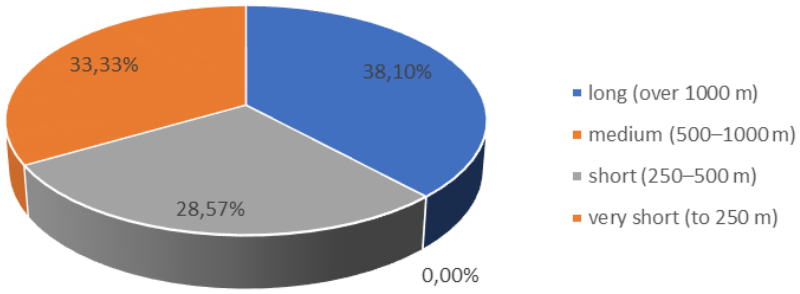

***Figure* 5.** Distance of illegal dumps from buildings in the Trzebinia commune.
Source: own study

Most of the identified illegal dumps in the Trzebinia commune were scattered, while in the Olsztyn commune most (almost 70%) of illegal waste dumps were concentrated (Ciura *et al*., 2017). In most cases, in the commune we analyzed where illegal dumps were located, it was characterized by good accessibility allowing access by passenger car (71.43%) (Fig. 6). The remaining locations are areas with certain terrain difficulties, including: terrain, forest density and others. Landfills with a small area of 1 to 5 m^2 constitute as much as 71.43% of all illegal dumps. The second most common area of illegal dumps was medium-sized (5-10 m^2) (of all illegal landfills examined, they accounted for 19.05%) (Fig. 7). The estimated mass of waste left on a small area is 1,315 kg, which constitutes 63.59% of the mass of all waste in discovered landfills. However, the landfill with a very small area had the lowest weight of all waste, the total weight of waste was 26 kg.

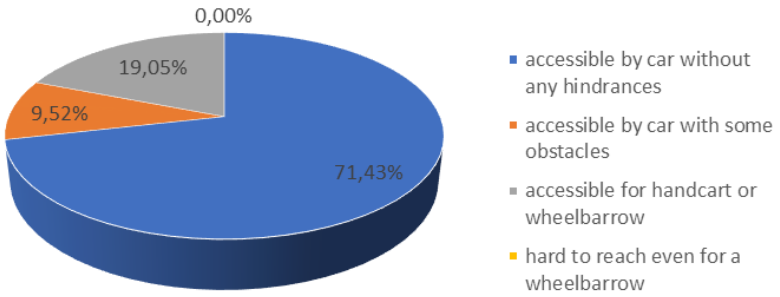

***Figure* 6**. Accessibility of an illegal dumps.

Source: own study

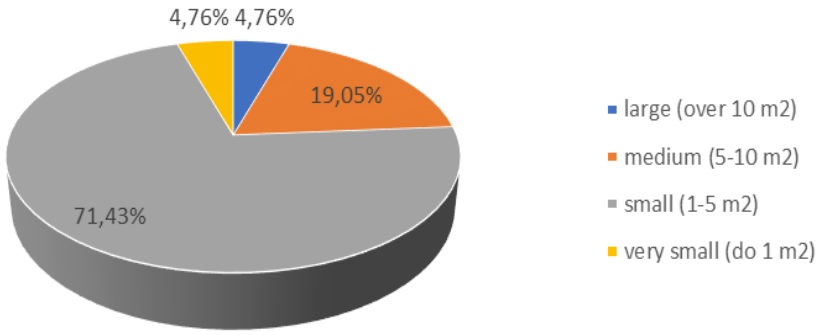

***Figure* 7.** Area of illegal dumps in the Trzebinia commune.

Source: own study

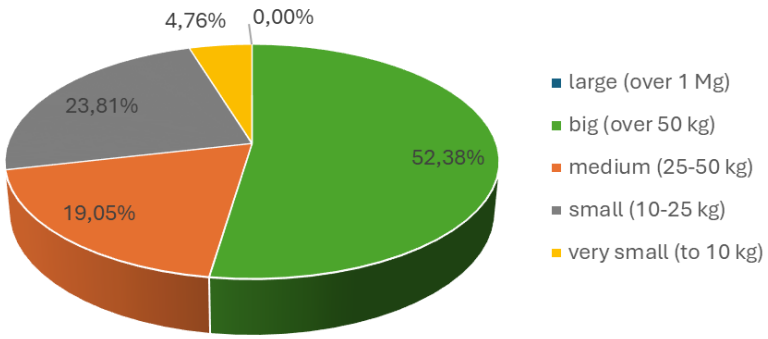

***Figure* 8.** Estimated mass of waste deposited on illegal dumps located in the Trzebinia commune.

Source: own study

In terms of the qualitative composition of waste, the largest share was made up of rubble debris (34.33%) and rubber waste (32.88%) (Fig. 9). The next waste with the largest share were plastics - foils, nets and bags. No medicines, household chemicals, electronic equipment, batteries, accumulators, etc. were found in any of the landfills. The total weight of waste deposited in illegal landfills was 2,068 kg. The largest mass of waste deposited in an illegal dump was 480 kg, which constituted 23.21% of the total mass of waste in illegal landfills. This landfill consisted mainly of rubble.

Figure 10 shows photos of selected illegal garbage dumps in the Trzebinia commune. The results of the analyzes partially confirm the observations of Zabłocki *et al*. (2011) and Malinowski *et al*. (2015), who found that small illegal landfills mainly deposit PET bottles (polyethylene terephthalate), glass bottles and metal cans, while larger landfills contain rubble (construction and renovation waste).

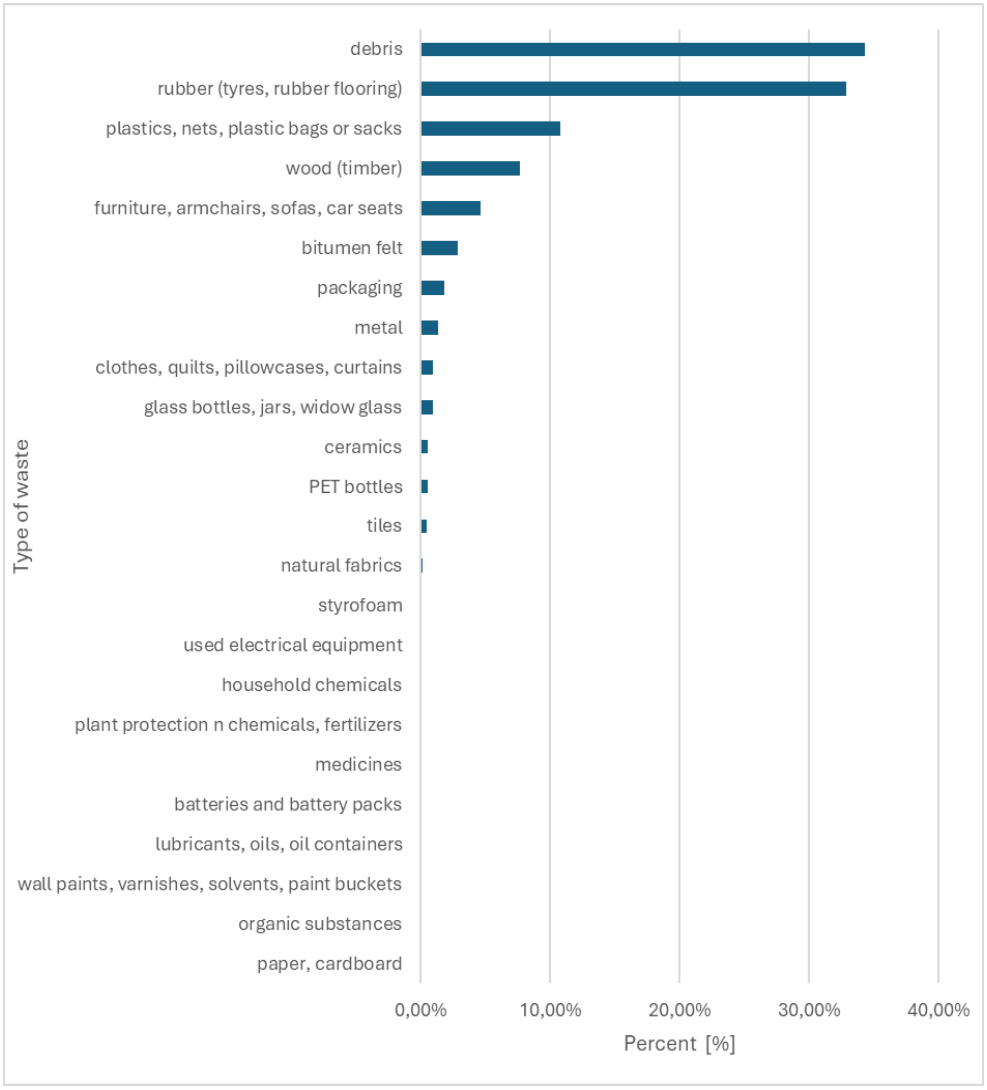

***Figure* 9.** Material composition of waste from illegal dumps in the Trzebinia commune.

Source: own study

***Figure* 10**. Inventoried illegal dumps in the Trzebinia commune.
Source: own study

Table 1 presents detailed information describing the mass of waste in the selected location, the dominant waste and the mass of waste suitable for recycling. Waste that can be recycled includes natural fabrics, glass bottles, jars, glass, rubber (tires, rubber floors), packaging and plastics, nets, bags and plastic

bags (source). Table 2 presents detailed information about illegal dumps in terms of their area and material composition.

Table 1. Detailed data of illegal dumps in the Trzebinia commune.

Location of the waste	Dominant waste	Dominant waste		Amount of waste for recycling	
		[kg]	[%]	[kg]	[%]
in the river bed	plastics	15	71,43	21	100
on the flood terrace	rubble	120	52,86	24	10,57
in the gorge	rubber waste	20	44,44	34	75,56
on the slope	plastics / furniture	70	29,79	156	66,38
in a ditch/canal	plastics	55	30,90	94	52,81
on the roadside	wood	120	47,24	54	21,26
on flat/even terrain	rubble	470	42,42	615	55,51

Source: own study

Table 2. Detailed data of illegal dumps in the Trzebinia commune.

Area	Dominant waste	Dominant waste		Amount of waste for recycling	
		[kg]	[%]	[kg]	[%]
big (>10 m²)	rubble	70	57,38	42	34,43
average (5-10 m²)	rubber waste	640	82,15	521	86,12
small (1-5 m²)	rubble	497	48,67	414	31,48
very small (<1 m²)	rubber waste	16	61,54	26	100

Source: own study

CONCLUSIONS

The conducted research showed that despite the common fee for municipal waste collection and the PSZOK operating in the Trzebinia commune, illegal dumps are still being created there. As part of the analyses, exactly 21 objects of this type were inventoried. The analysis of the collected data allowed us to conclude that:

- Rubble and rubber waste dominated in landfills, they constituted approximately 67.2% of the total mass of waste in illegal dumps, the smallest part was natural fabrics - 0.15%,
- No hazardous waste was found in the material composition of tested landfills,
- Waste that could be recycled accounted for 48.5%,
- Over a period of 16 months (from October 2021 to January 2023), one new wild waste dump side was created in the Trzebinia commune (included in the analyses), and 4 of them were cleaned up,
- Most often, wild landfills were created on flat ground and in clumps of bushes or in the forest,
- Illegal waste dumps are located in publicly accessible places and almost 72% of them are accessible by car.

In January 2023, guides from the Inter-municipal Association of Municipal Waste Management Trzebinia-Libiąż-Chrzanów were sent to residents of the Trzebinia commune about: good practices in waste management, proper waste segregation and waste that should be disposed of at the Selective Municipal Waste Collection Point (PSZOK). This gives hope for improvement in counteracting illegal dumps through educating residents.

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