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National Map of Security Threats as a Citizen Involvement Tool for Planning Safer Urban Public Spaces

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Abstract

The National Map of Security Threats (NMST) implemented in Poland in 2016 is a GIS-based tool for digital crime and threat mapping involving citizens in the processes of shaping local security by reporting hazards in their neighbourhood (volunteered geographic information). The map—open for external users—is a source of information about common threats to the safety of human life and health, property, and public order, taking into account their spatial distribution, in the opinion of its users. Among 26 reportable hazards, there are categories related to (1) Traffic, (2) Greenery, (3) Water, (4) Demoralisation and Vandalism, (5) Poverty, (6) Alcohol and Drugs, and (7) Animals. The study aims to investigate which threats reported by citizens are the most represented on the NMST. The study covered data collected based on public access to the map in the period from January–December 2022. The analysis of the results allowed us to conclude that the most common threats belong to the following categories: (1) Traffic, (2) Alcohol and Drugs, and (3) Greenery. While the first two categories are not a surprise for researchers, and their importance is confirmed by other studies, the category of Greenery—its condition, damage, etc.—becomes more and more important, which was not confirmed in previous studies. Recognizing this is crucial to support processes of planning and designing more secure public spaces.

Keywords

citizen participation; GIS; placemaking; Poland; security; urban public spaces; volunteered geographic information

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1. Introduction

Crime and threat mapping is a process that has been going on since at least the 19th century when the first crime map was published in France in 1829. Its authors—Adriano Balbi and André M. Guerry—showed the relationship between the educational level, violence, and property crime in France (Hunt, 2019). Joseph Fletcher (in 1849) and Henry Mayhew (in 1861) produced maps that showed rates of male incarceration and county crime, respectively (Chamard, 2006). In the early 20th century, Clifford R. Shaw and Henry McKay mapped thousands of incidents of juvenile delinquency and analyzed the relationships between delinquency and various social conditions (Shaw & McKay, 1942).

The use of GIS has been another revolutionary step in crime mapping. The GIS, using geography and computer-generated maps, has enabled the police to plan effectively for emergency response situations, determine mitigation, prioritize, predict the future, and analyze past events. GIS helps to identify potential suspects, thereby increasing investigators' suspect base when no leads are evident (Johnson, 2000; Leitner, 2013; Mordwa, 2015; Santos, 2017). Using GIS software helps researchers visualize data, assess human behaviour over geographic space, and follow spatial patterns.

More and more advanced crime mapping methods have been used for several dozen years for imaging, analyzing, and, consequently, preventing and combating crime. The essence of modern mapping is not only the use of GIS and other available tools based on modern technologies but, above all, the involvement of citizens in the data collection process, referred to as volunteered geographic information (VGI), while maintaining the principle of voluntariness and anonymity and allowing universal access to collected data and its analysis. The data collected in this way makes it possible to supplement official reports prepared by the police at both the national and local levels. The analysis of the information obtained and the implementation of programs to improve local security allow the creation of safer public spaces.

1.1. Volunteered Geographic Information

The development of technology provides new tools that allow more and more precise determination of areas requiring the special attention of services and institutions responsible for ensuring the safety of users of public spaces. One of them is VGI, which involves geographic information created by volunteer citizens (Goodchild, 2007). It is an important element of the expansion and modernization of city monitoring, enabling e-participation to improve security. The data is generated by people actively participating in citizen science (Silvertown, 2009), social media (Longley & Adnan, 2016), or on the internet in general, as they all share the common characteristic of the voluntary and non-expert creation of geographic information (Zhang & Zhu, 2018). VGI, as a modern communication tool, represents a paradigm shift in the way geographic information is created and shared, as well as the content and characteristics of geographic information (Elwood, 2008). This is believed to be a novel phenomenon that will have a significant impact on geographic information science and geography and its relationship with society (Goodchild, 2007).

The link between criminology and geography, established through the process of geospatial mapping, has raised the rank of spatial location among the factors potentially related to crime (Ratcliffe, 2010). Each public space creates a separate environment, differentiated in terms of its spatial arrangement and the level of formal and informal social control. These features affect the frequency of occurrence of the so-called signs of disorder

(incivilities) and are associated with the greater or lesser vulnerability of space to problems related to crime and public disorder. Knowledge of the hazards associated with the space in which they occur can change the way individuals perceive the urban landscape. Formal and informal information exchange networks, including VGIs based on individual risk experiences, allow the mapping of potentially dangerous areas. This has an impact on day-to-day decisions regarding the visits to and general use of such spaces (Moura de Souza et al., 2022). Geospatial mapping technologies can also be used to develop statistical data to identify areas that are predisposed to generating threats—hot spots and hotlines. These are not accidental areas where more than average crime and public disturbances occur and where people are at higher risk of victimization (Eck et al., 2005; Nasar & Fisher, 1993; Ratcliffe, 2004). They require the special attention of services and institutions responsible for ensuring security. Tools such as VGI allow not only to detect existing particularly dangerous places but also to predict where new ones may appear.

Although there is much discussion in the literature about the representativeness of VGI, referring to the degree to which a sample consisting of VGI observations can represent the underlying population (Zhang & Zhu, 2018), there is no doubt that the identification of threats using this tool is a valuable supplement to data obtained from other sources. The National Map of Security Threats (NMST; Krajowa Mapa Zagrożeń Bezpieczeństwa in Polish) provides support for the police and other uniformed services in the field of mapping crime and threats (Ratcliffe, 2004), giving an in-depth picture in relation to what results from traditionally collected statistical data. It can significantly supplement the knowledge and understanding of different areas of the city in the context of security and facilitate the interpretation of the causes of crime hot spots. It also clearly indicates problems that are particularly important from the point of view of users of public spaces, because they are the ones who take the trouble to report on events considered important and inform about places that, in their opinion, require urgent improvement. The possibility of a more and more precise determination of areas requiring intervention with the use of modern technologies is very important for taking preventive measures (Klaka & Szafrańska, 2017).

1.2. National Map of Security Threats

The NMST was implemented in Poland as a GIS-based tool to involve citizens in the process of creation of local security and a source of knowledge about the perception of personal security of NMST users. It was established in 2016 after 12,000 meetings between police officers and local communities where the greatest threats in the area were discussed (Szyszka & Polko, 2020).

The NMST is an interactive tool (in the form of a mobile application or traditional website) that enables citizens to report online threats in their residential area (Krajowa Mapa Zagrożeń Bezpieczeństwa, 2022). Reports made by citizens are visible down to the exact street and number (if this can be indicated). The map allows for reports to be made in 26 hazard categories, presented in Table 1.

The reporting system used in NMST is assessed as simple and intuitive. The user clicks the "add report" red button, selects the threat type from the list of categories, and then indicates the reported location on the map by clicking on the right place or entering the address. In the report, the user can indicate the time of day or days of the week or if the threat occurs periodically, describe it in detail, and even attach a photo. Each time, the person entering the report is informed that in case of an emergency, the police should be contacted immediately by telephone through the indicated numbers. Each report is fully anonymous.

Table 1. Categories of events to be reported through the NMST.

Category	Hazard
Traffic	— Speeding — Illegal car rallies — Improper parking — Unguarded track crossings — Unguarded railway crossings — Inappropriate road infrastructure — Traffic incidents involving forest animals — Poor traffic organization
Greenery	— The burning of grass — Wild waste dumps — Illegal logging — Destruction of greenery — Driving quads in forest areas
Water	— Unguarded bathing sites — Dangerous places on the water — Drowning
Demoralisation and Vandalism	— Acts of vandalism — Groupings of minors at risk of corruption — The location of dangerous entertainment activities
Poverty	— A homeless person in need of assistance — Begging
Alcohol and Drugs	— Alcohol consumption in prohibited places — The use of drugs
Animals	— Wandering stray dogs — Animal abuse — Poaching

Source: Based on Krajowa Mapa Zagrożeń Bezpieczeństwa (2022).

Reports are marked with colours indicating their status: new (green), verification (yellow), confirmed (red), confirmed and reported to other institutions (violet), confirmed and eliminated (blue), and unconfirmed (grey). A citizen's report registered in the system appears on the map with a "new" status. Within a maximum of two days, it must be examined by the local coordinator appointed at the city (county, district) headquarters level and placed on a threat verification card. The verification may take a maximum of five days, which does not always make it possible to determine the validity of the report, especially in the case of incidental or seasonal events. After verification, the report is assigned a "confirmed" or "unconfirmed" status. Subsequent events from the same category in the same area and added in a short interval automatically receive the "confirmed" status. The data from the reports shows that every day residents indicate on the map over a thousand threats that, in their opinion, have a significant impact on their sense of security. By 5 October 2022, almost 2.5 million threat reports were recorded, more than 51% of which were confirmed by the police and actions were taken to eliminate them (Rachwalska, 2022). During the six years of the tool's operation, a total of 1,131,554 types of threats have been eliminated (Policja, n.d.-b).

Threats are visible on the map for a month from the moment of reporting and then they are archived. Therefore, if they appear regularly over a longer period of time, this means their continuous occurrence and little success of the services in terms of their elimination. The police report that the information posted by users on the map

over the six years of operation made it possible to: issue 100 tickets for incorrect parking in one day in one indicated location in Warsaw (September 2017); identify and arrest a speeding motorist moving at a speed of 119 km/h through a town with a speed limit of 40 km/h (September 2019); liquidate a stolen car holding point in Ostrołęka (March 2020); liquidate an illegal gambling point in Malbork (March 2021); seize 61,000 ampoules of steroids on the premises of an uninhabited property near Warka (March 2022); and arrest the perpetrator of an illegal dump site on Nysa Kłodzka thanks to accidentally discarded jewellery found on the spot (May 2022; Policja, n.d.-a).

Apart from some limitations (Polko, 2022), the NMST is a unique tool that allows citizens to report dangers or hazards in a given area while providing access to at least some of the data collected in this way. They can also follow the status updates and compare their reports with the reports of other map users. With the tool, they have an impact on safety in the neighbourhood and can gather information about its condition. The digital nature of this innovative tool allows for quick and anonymous reports which is an alternative to the visit to a police station.

1.3. Scope of the Study

The aim of the study, the results of which are presented in this article, was to analyse the NMST as a tool based on GIS and using the VGI approach to modern threat mapping using citizen involvement. During the research process, the following hypotheses were formulated:

H1: Residents report clearly selected categories of threats that in their opinion are particularly burdensome and dangerous. The categories of threats with the greatest nuisance include areas such as Traffic, Demoralisation and Vandalism, and Alcohol and Drugs.

H2: Despite its limitations, the NMST is an important source of information on the safety perception of citizens' residences and a useful tool not only for the geolocation of threats but also for building citizens' involvement in creating safer public spaces.

2. Materials and Methods

The study was conducted in the period from January–December 2022. Every three months (January, April, July, October, and then December), on the 15th day of each of the above-mentioned months, data for a given day was collected and entered into a separate table on the NMST. The data is summarized in Table 4 in the Supplementary Material. For further analysis, aimed at showing trends and verifying the research hypotheses, processed data or partial data was used. Each time, the actions performed on the data were marked.

The quantitative method of descriptive statistical analysis, which is appropriate to describe a large amount of collected data and allows to obtain key results regarding the studied phenomenon was used in the study. With this method, the collected raw data can be visualized and understood. To illustrate trends in reporting threats via NMST and responding to them, the mean (mathematical average) value was used. First, the collected data was simplified by presenting the results in the form of a mathematical average (mean) for a given category. This summary is presented in Table 2 and Figure 1. Basic data covered the general number of reports, which was then broken down into: New reports (added within the last 2 days); Reports under

Table 2. Mean values for hazard categories recorded in the NMST in 2022.

Category/Hazard		Number of reports (general)	New reports (added within last 2 days)	Reports under verification	Confirmed and eliminated reports	Unconfirmed	Confirmed	Confirmed % of all reports	Eliminated % of confirmed reports
Demoralisation and vandalism	Acts of vandalism	~1,337.6	~38.2	~186.6	~345.4	~105.2	~1,066.8	79.75	25.82
	Groupings of minors at risk of corruption	~1,441.4	~36.8	~959	~464.2	~117.8	~1,074.2	74.52	32.20
	The location of dangerous entertainment activities	~165.8	0	~1.4	~2.2	0,4	~165.8	100	1.33
Water	Unguarded bathing sites	~1.8	~0.2	~0.2	~0.2	~0,2	~1.14	63.33	11.11
	Dangerous places on the water	~128	~0.8	~5.2	~14	~4.2	~117.6	91.87	10.94
	Drowning	0	0	0	0	0	0	—	—
Greenery	The burning of grass	~52.2	~4.2	~13.6	~12.6	~6.4	~37	70.88	24.14
	Wild waste dumps	~4,293.2	~62.8	~196.6	~1,162	~219	~3,750.4	87.36	27.07
	Illegal logging	~106.4	~5.4	~25.8	~11.4	~24.8	~50.2	47.18	10.71
	Destruction of greenery	~289.4	~8.8	~60.2	~123.6	~32	~200.6	69.31	42.71
	Driving quads in forest areas	~259.4	~14.4	~33.2	~31.2	~42.4	~199.6	76.95	12.03
Traffic	Speeding	~25,693.8	~533	~1,354.4	~9,778.4	~985.8	~23,664.8	92.10	38.09
	Illegal car rallies	~584.8	~50.4	~113.8	~212.2	~154.8	~319.6	54.65	36.29
	Improper parking	~16,825.2	~328.4	~1,128.2	~5,233	~981.8	~14,985.8	88.92	31.10
	Unguarded track crossings	~28	~0.6	~2	~9.4	~1.8	~21.8	77.86	33.57
	Unguarded railway crossings	~30.8	~0.4	~2.4	~6.8	~1	~21.8	70.78	22.08
	Inappropriate road infrastructure	~8,706.6	~131.4	~328.2	~1,621	~224.6	~7,873.6	90.43	18.62
	Traffic incidents involving forest animals	~61.4	~0.8	~3	~23.8	~3.6	~55	89.58	38.76
	Poor traffic organization	~2,365.6	~33.6	~108.4	~228.6	~112	~2,118	89.53	9.66

Table 2. (Cont.) Mean values for hazard categories recorded in the NMST in 2022.

Category/Hazard		Number of reports (general)	New reports (added within last 2 days)	Reports under verification	Confirmed and eliminated reports	Unconfirmed	Confirmed	Confirmed % of all reports	Eliminated % of confirmed reports
Poverty	A homeless person in need of assistance	~220	~5	~20.4	~68.2	~17.8	~187.4	85.18	31.00
	Begging	~192.6	~8	~28.8	~67.4	~18.6	~158.2	82.14	34.99
Alcohol and Drugs	Alcohol consumption in prohibited places	~6,475	~205	~468.4	~2,436	~321	~5,849.4	90.34	37.62
	The use of drugs	~0.2	0	0	0	~0.2	0	0	—
Animals	Wandering stray dogs	~703.2	~21	~62	~184.6	~94.8	~496	70.53	26.25
	Animal abuse	0	0	0	0	0	0	—	—
	Poaching	~63.2	~3.4	~13.6	~18.2	~15.4	~37	58.54	28.79

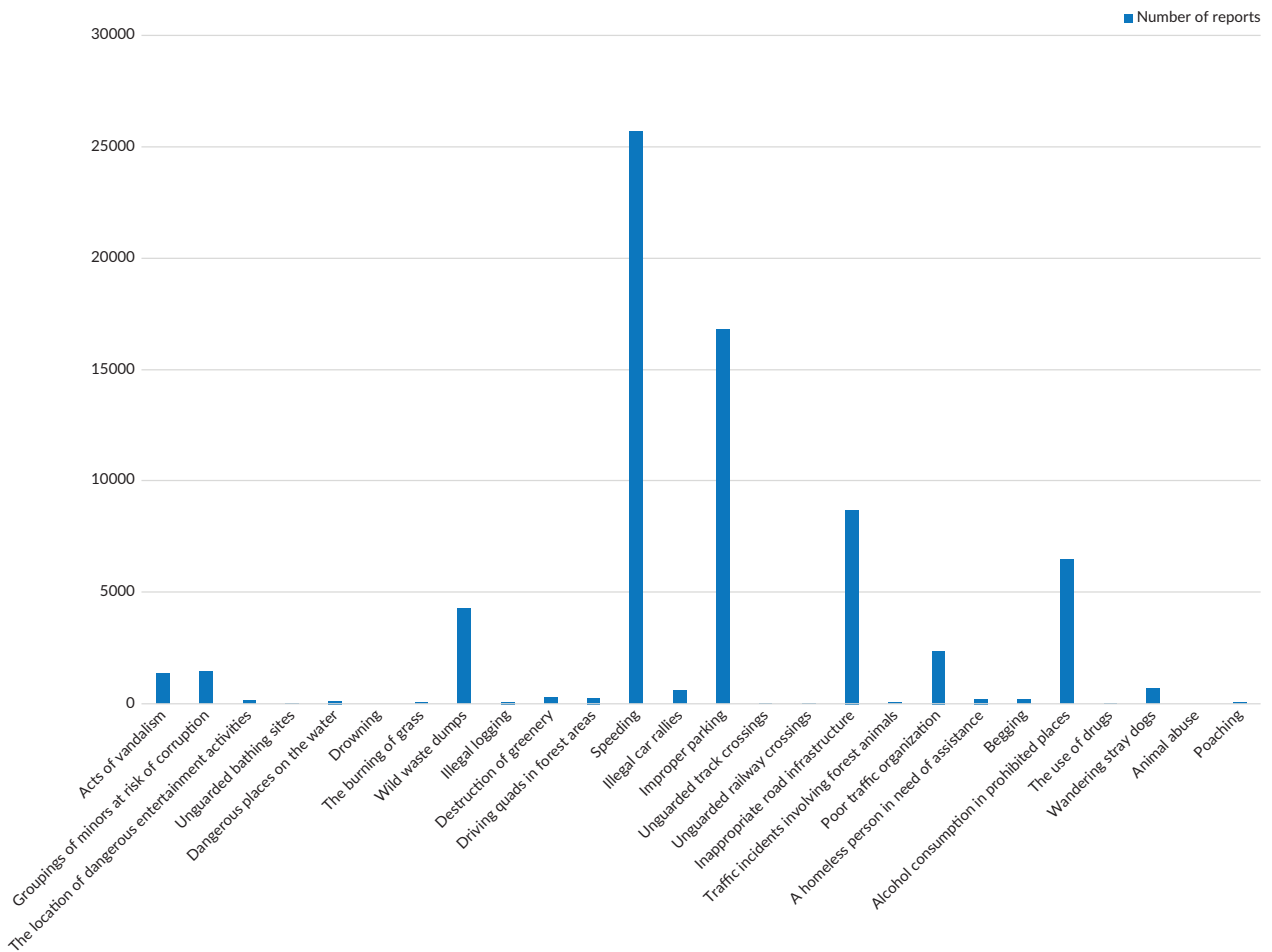Source: Based on Krajowa Mapa Zagrożeń Bezpieczeństwa (2022).

Figure 1. Average values for hazard categories recorded in the NMST in 2022. Source: Based on Krajowa Mapa Zagrożeń Bezpieczeństwa (2022).

verification; Confirmed and eliminated reports; Unconfirmed; Confirmed (including confirmed % of all reports); and Eliminated % of confirmed reports. This list made it possible to indicate the types of threats most frequently reported by citizens.

3. Results

The collected data made it possible to determine that two out of 26 types of threats reported using the NMST were not reflected at all in the data collected during 2022. They were drowning from the Water category and animal abuse from the Animals category. Due to the lack of reports in previous years, both of these types of threats have been removed from the options available for reporting after the NMST update in 2023. Data analysis shows that the five most frequently represented types of threats: speeding, improper parking, and inappropriate road infrastructure from the Traffic category; alcohol consumption in prohibited places from the Alcohol and Drugs category; and illegal dump sites from the Greenery category account for a total of 88.53% of all reports. Therefore, these are the dominant problems among those noticed by residents in 2022 and considered by them as important for improving the safety of urban public spaces.

Also noteworthy is the high percentage of confirmed reports. It ranges from 58.54% for a threat such as poaching to 100% in the case of the location of dangerous entertainment activities. In the case of 15 out of 24 types of threats (excluding the two above-mentioned threats with no reports), the percentage of confirmation of reported cases exceeded 75%. This means that citizens report real problems that they consider important in their environment and take the NMST seriously as a source of information and, at the same time, as a tool for shaping local security and public order.

The summary made it possible, as already indicated above, to isolate the key types of threats and the categories to which they belong. The most common type of reports appearing on the map are those related to speeding. The average for 2022 indicates 25,693.8 cases of reports visible on the map. This is more than 1/3 of all reports (36.69%). According to police data for the six years of operation of the NMST (October 2016–October 2022), this type of threat was reported the most often of all and covered 743,467 reports, of which more than half, i.e., 431,572, were confirmed. Thus, it can be indicated that citizens—guided by their subjective sense of security—consider speeding by car drivers to be the most serious threat in their neighbourhood. The detailed summary (Table 3) shows that the percentage of confirmed cases did not fall below 85% and even exceeded 96% in the selected months of 2022.

The second place was taken by another threat belonging to the Traffic category—improper parking. The average for 2022 indicates 16,825.2 reported cases visible on the map. This constitutes almost 1/4 of all threats reported by residents in all categories in the year in question (24.03%). According to police data, for the period of 6 years of operation of the NMST, a total of 588,552 reports were made in this category, of which 296,585—also more than half, as in the case of speeding—were confirmed. The percentage of confirmed cases did not fall below 82%, and in the selected months of 2022, it even exceeded 95%.

The third place among the most frequently reported threats was taken by inappropriate road infrastructure, also belonging to the Traffic category. The average for 2022 indicates 8,706.6 reports visible on the map. This represents 12.43% of all notifications in all threat categories. According to Police data, for the period of 6 years of map operation, a total of 147,358 reports were made in this category, of which 80,344 (more than half) were confirmed. The percentage of confirmed cases did not fall below 88%, and in the selected months of 2022, it even exceeded 93%.

The next two types of risk most frequently reported by citizens are included in the Alcohol and Drugs and Greenery categories. Alcohol consumption in prohibited places was ranked fourth after traffic hazards. The average for 2022 shows 6,475 reported cases visible on the map. This represents 9.25% of all reports. The detailed summary (Table 3) shows that the percentage of confirmed cases did not fall below 74%, and in the selected months of 2022, it even exceeded 97%. The fifth place among the reported threats was taken by Illegal dump sites. The average for 2022 indicates 4,293.2 reports visible on the map. This represents 6.13% of all reported cases. The percentage of confirmed cases did not fall below 81%, and in the selected months of 2022, it even exceeded 92%.

An important observation resulting from the collected data is the effectiveness of the police and other services in the area of eliminating the dangers reported by residents. While the collected data confirms that residents treat the map seriously and report real threat situations (as evidenced by the high percentage of reports confirmed by the police in the five types of threats discussed), their elimination is not as effective

Table 3. Top five most featured threats on the NMST in 2022.

Category/Hazard		Month of 2022	Number of reports (general)	New reports (added within last 2 days)	Reports under verification	Reports confirmed and eliminated	Unconfirmed	Confirmed	Confirmed % of all reports	Eliminated % of confirmed reports
Traffic	Speeding	I	23,281	404	1,155	12,599	653	21,069	90.49	59.79
		IV	25,084	460	1,830	7,380	1,367	21,432	85.44	29.42
		VII	25,671	556	1,233	8,990	789	24,356	94.88	35.02
		X	27,890	567	1,432	9,980	897	25,789	92.47	35.78
		XII	26,543	678	1,122	9,943	1,223	25,678	96.74	37.46
	Improper parking	I	15,731	295	895	7,135	724	13,817	87.83	51.64
		IV	15,942	304	1,249	4,379	1,181	13,209	82.86	27.49
		VII	16,789	332	1,344	3,443	879	14,356	85.51	20.51
		X	16,899	257	997	4,422	1,002	15,678	92.78	26.17
		XII	18,765	454	1,156	6,786	1,123	17,869	95.22	36.16
	Inappropriate road infrastructure	I	7,899	78	228	1,905	178	7,415	93.87	25.69
		IV	8,657	125	380	1,215	283	7,870	90.91	14.03
		VII	8,976	112	443	1,332	223	7,765	86.51	14.83
		X	8,994	133	367	1,888	241	7,986	88.80	20.99
		XII	9,007	87	223	1,765	198	8,332	92.51	19.59
Alcohol and Drugs	Alcohol consumption in prohibited places	I	6,688	136	294	3,684	232	6,026	90.10	61.13
		IV	5,440	118	639	1,513	614	4,069	74.80	27.81
		VII	7,890	345	768	2,345	180	7,680	97.34	29.72
		X	6,890	223	343	2,651	346	6,345	92.09	38.48
		XII	5,467	203	298	1,987	233	5,127	93.79	36.34
Greenery	Wild waste dumps	I	3,932	66	165	842	65	3,636	92.47	23.16
		IV	4,737	51	263	1,598	232	4,191	88.48	33.73
		VII	4,232	67	178	1,238	221	3,789	89.53	29.25
		X	4,567	78	254	987	345	3,890	85.18	21.61
		XII	3,998	52	123	1,145	232	3,246	81.20	28.64

Source: Based on Krajowa Mapa Zagrożeń Bezpieczeństwa (2022).

(see Table 3). The police can boast of the greatest successes in the case of destruction of greenery (42.71%). Significant elimination effectiveness also applies to such threats as traffic incidents involving forest animals (38.76%), speeding (38.09%), alcohol consumption in prohibited places (37.62%), illegal car rallies (36.29%), and begging (34.99%). The lowest effectiveness in eliminating threats was noted in the case of the location of dangerous entertainment activities (1.33%). An important observation also seems to be that even with relatively high effectiveness (30–40%) in the case of threats that are particularly numerous on the map, the number of reported cases does not drop drastically. This probably means that their occurrence is resistant to the current operation of the services, or that the presence of other circumstances causing their reappearance is also important (e.g., a general problem with the number of parking spaces, road infrastructure facilitating speeding, an attractive location for begging, etc.).

4. Discussion

As a result of the conducted research process and the analysis of the collected data, it was possible to verify the hypothetical assumptions. Residents did indeed clearly indicate specific threats, which proves their importance in shaping local security. These are speeding, improper parking, inappropriate road infrastructure, alcohol consumption in prohibited places and illegal dump sites, which together account for 88.53% of all reports. The threats indicated as the most serious and significant represent three categories. The most important is the Traffic category, which includes as many as three of the five threats most frequently reported by citizens. The problems and threats posed by both speeding and improper parking turn out to be the most burdensome for residents in the area of their residence. This is not surprising, because everywhere in urbanized areas, road traffic is a challenge, especially if inappropriate road infrastructure is also a problem. The importance of these factors in shaping the sense of security is confirmed by many studies (Balasubramanian & Bhardwaj, 2018; Corner-i, 2018; Indzior, 2021; Pljakić et al., 2022; Sheykhfard et al., 2021).

The next most numerous categories of threats represented on the map are Alcohol and Drugs and Greenery. The high position of behaviours such as alcohol consumption in prohibited places is also not surprising: it often generates disturbances, fights, destruction of infrastructure or littering, which is a source of further threats. The Greenery category turned out to be more important, although not very significant, with the total mean number of reports for 2022 amounting to 2,944.8 cases, which is 7.14% of all reported threats. The high position of this category was not expected, but it should be noted that many problems in urban green areas start with what is known as *visible signs of depreciative behaviour*, such as wild waste dumps (Bogacka, 2020; Kimic & Polko, 2022; Maruthaveeran & van den Bosch, 2014, 2015). Demoralisation and Vandalism, which were listed in H1 as the third category, turned out to be numerically insignificant: the mean for 2022 shows 2,944.8 reports visible on the map, which is 4.2% of all threats reported in all categories. Thus, H1 was partially confirmed.

The NMST is a unique crime mapping tool because it differs from the traditional way of collecting data from the police. The innovation of this map comes from the involvement of citizens (i.e., VGI) directly reporting threats to the system, as a new practice. This allows to gather knowledge about events subjectively recognized by citizens as burdensome and affecting their sense of security (Bieniek-Ciarcińska, 2022), even if their statistical significance is low. This type of tool cannot be considered the only or dominant source of knowledge about threats, but at the same time, its omission may expose the formations responsible for ensuring security to the loss of some important information about the perception of security in the

neighbourhood. The use of citizens for security/insecurity mapping is a new trend, appearing so far mainly in situations of natural disasters or large-scale technical failures. The NMST format makes it a unique tool for constantly collecting information about threats and the process of responding to them, which distinguishes it from other tools described in the literature. The subject of security in this tool is an individual perceiving threat in a subjective way, which consists of security community building, including differentiating threats into subjective and objective categories, the social construction of threats, common identity, the mutual responsibility of given entities, and others (Stawnicka, 2018). The uniqueness of the Polish solution requires its in-depth analysis in terms of its disadvantages, advantages, limitations, and opportunities for further development. The undoubted advantages of the NMST tool include a modern (online), easy-to-use, and anonymous way of reporting threats by respondents as part of their joint commitment to shaping local security. Its advantage is also that the reports are immediately visible to other map users, who can compare their perceptions of safety in a given area with the feelings of other residents. The visibility of reports made by others can encourage more intensive responses to inappropriate incidents. It can also be information about problems in a given district (or lack of them) for potential new residents. It is also an indicator of civic activity in a given region.

The NMST also has some limitations that can be considered as their disadvantages. First of all, there is no open access to all the collected data from the beginning of the tool's (map's) existence—it can only be obtained directly from the police, and only after submitting a query. When using the map, you can only see the current data from the last month. Secondly, the list of categories from which reports can be selected is closed and limited to only 26 types of threats. This prevents citizens from reporting other real dangers affecting their sense of security, such as littering the space (Hilborn, 2009; Polko & Kimic, 2022; Robinson et al., 2003), contamination with dog faeces (Bedimo-Rung et al., 2005; Corti et al., 1996), and many others. Although the police update the list on an ongoing basis and at the same time declare that new types of threats may be added to the menu in NMST during the evaluation process of this tool, this scope has not been extended as part of the last update in 2023. This limits the set of relevant data. Thirdly, there are no openly available statistics on the reporting profile (gender, age, place of residence, education, etc.), which the police do not disclose. The above-mentioned limitations of the NMST tool are important both from the point of view of its user (limited list of threat categories) and the analytics of data collection (no data on the social characteristics of those reporting threats). Lack of access to them was also a limitation of the presented research. For the improvement of the NMST, the police should also allow access to archival reports for comparative research purposes. It would be, for example, important for the assessment of the seasonality of selected hazards, which requires collecting data in different months of the year over a longer period. Evaluation of the effectiveness of permanent elimination of threats would, in turn, require the police to provide data on the re-reporting of the same threat in a given location. The police have this information, but it is not shared. Finally, it should be considered to collect basic data on those reporting threats, such as age, gender, or education, while maintaining the anonymity of the report. They would provide deeper knowledge about the profile of citizens involved in shaping local security. Despite the indicated limitations of the presented tool, the NMST is an important supplement to knowledge about security, giving a subjective perspective of residents, difficult to find in police statistics, but crucial for building safer public spaces, which confirms H2.

5. Conclusions

Crime mapping, or in other words mapping undesirable events, is not a new way to fight threats. However, it is developing nowadays through the engagement of citizens as volunteer evaluators of safety in the neighbourhood. The NMST is an innovative solution that serves not only to get information about security perception but also to involve residents in the co-creation of local security. In order to fully use the potential of this tool and eliminate its current limitations, the observations and suggestions resulting from the presented research should be used to expand the catalogue of threats, collected categories of information, and a greater scope of their public disclosure, especially in the comparative context. Extending access to new information will enable further research, primarily on the effectiveness of the tool in the process of eliminating threats, including the quality of police work, dynamics, including the seasonality of threats, reporting profiles, which may be part of broader research on citizens participation in shaping local security. Taking into account the lack of scientific literature in the discussed field, focusing mainly on the presentation of tools or solutions without their comprehensive evaluation, research on the use of VGI-based solutions to obtain geolocalized security data should be conducted in many directions, taking into account technical progress in the collection of information provided voluntarily by citizens.

Conflict of Interests
The authors declare no conflict of interests.

Supplementary Material
Supplementary material for this article is available online in the format provided by the authors (unedited).

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