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ARTICLE

"Hot Forests": Spatial Concentration of Forest "Pyro-Terrorism" in Israel

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Abstract
One of the areas in terrorism research that has not been adequately examined is the geographic concentration of pyro-terrorism (PT) attacks. The literature related to the geographical distribution of terror generally focuses on macro-places (continents, countries and regions) and micro-places – "hot spots". However, to our knowledge, the geographical distribution of terror in forests has yet to be studied. The findings of "hot spots" studies have great relevance for law enforcement practitioners. This study examines the spatial characteristics of forest PT and whether there is a concentration of PT attacks in a limited number of "hot forests" that are stable over time. This study examined the entire population of suspected forest PT in Israel between 2008 and 2022 (excluding 2016), totalling 2,297 attacks. The research revealed high spatial clustering of forest PT attacks concentrated in specific "hot forests" and that they were stable over time. In conclusion, the concentration of PT attacks calls for a specialized counterterrorism response, equivalent to "hot spots policing", based on the characteristics of potential terrorist hot forests.

Keywords: forest pyro-terrorism; spatial concentration of terror; terror hot spots; situational prevention of terror; target hardening

INTRODUCTION

One of the areas of terrorism that has not been adequately examined is that of the use of fire as a terrorist weapon in general and forest pyro-terrorism (PT) in particular. Relying on Clark and Newman's understanding that terrorism is a form of crime (Clarke and Newman 2006), criminological theories and practices, which focus on regular crime, greatly contribute to the study of terrorism and assist in developing effective crime prevention tactics and counterterrorism measures (Dugan, LaFree, and Piquero 2005; Perry 2020; Perry, Hasisi, and Perry 2019). Thus, based on the "crime and place" field in criminology, this paper studies the geographic concentration of such forest PT attacks in Israel.

The study of crime and place is among the most rapidly developing fields in criminology, specifically in terrorism research (Brantingham 2011), partly because

many challenges are encountered when seeking to identify the unique profiles of terror offenders (Silke 2003). Clarke and Newman (2006) argued that a greater focus on place and opportunities rather than on the offender could generate significant benefits. To date, dozens of high-quality studies have identified that crime is concentrated in selected places (Eck et al. 2017; Lee et al. 2017). Similarly, new studies have demonstrated that terrorism shares many spatial characteristics with ordinary crime (Hasisi et al. 2020; Perry 2020; Perry et al. 2019). Based on this premise, new strategies, such as hot spot policing and focused deterrence tactics, have been successfully deployed to prevent and reduce terrorism. Some of these studies explore the geographical distributions of terrorism at the macro-level units of analysis: internationally, regionally, nationally and even locally (e.g. Braithwaite and Li 2007; LaFree et al. 2006; LaFree, Miller, and Yang 2013). Perry's study (2020) revealed that similar to regular crime, there is a higher frequency of terror attacks concentrated at the micro-level in specific street segment hot spots and that they were stable over time. Hasisi et al. (2020) examined the spatial characteristics of vehicular terror attacks' "hot routes" and concluded they were highly concentrated.

Besenyő (2019) argued that even though forest fires as a form of terrorism are a worldwide phenomenon, they have not received enough research attention. By examining the spatial characteristics of forest PT attacks, this study follows Besenyő's (2019) recommendation and investigates forest PT in Israel. The study aims to help develop environmental and situational prevention counter-terrorist approaches to combat this form of terror.

The next (second) section will review what we know about the spatial concentration of terror attacks. Every act of crime/terror is determined by the immediate circumstances of the situation (Clarke 1997), which, to a large extent, are shaped by geographic spatial characteristics. Therefore, according to Clarke and Newman (2006), the opportunity related to an attack's circumstances should be analysed. The circumstances related to opportunity will be presented in the third section and divided into four elements, which Clarke and Newman (2006) referred to as the "four pillars of opportunity": target; weapon; tools/training; and facilitating conditions. This section focuses on these "four pillars of opportunity" concerning forest PT attacks. The fourth section will present the applicability of crime concentration to forest PT, while the fifth section will discuss the design of the current study, followed by the presentation of study findings and discussion.

THE SPATIAL CONCENTRATION OF TERROR ATTACKS

According to "rational choice" theory, criminal acts are an outcome of a series of choices in which offenders balance opportunities, risks and potential rewards when deciding whether and where to offend since various places offer different opportunities in terms of suitable targets and the level of guardianship (Cornish and Clarke 1987). Similarly, the "routine activities" theory claims that in addition to a motivated offender, a suitable victim/target and lack of appropriate guardianship are necessary for a crime to occur (Felson 2017).

The perspective that specific places offer unique opportunities over others is substantiated in crime pattern theory, which suggests that offenders feel more confident to offend in environments that they are more familiar with (Levine 2009;

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Turner 2017). Groff et al. (2014) contended that offenders become familiar with potential opportunities through their routine activities, enabling them to become familiar with the settings and the different elements of the environment. Individuals operate daily in what is referred to as an activity space, which typically includes "nodes", "pathways" and "edges". The nodes are specific locations a person routinely visits, such as home, work, "hang out" locations, stores, schools, etc. Commuting between nodes, the individual uses "pathways", which often cross the activity space. The boundaries of the individual's activity space are equivalent to edges in an urban environment, which are unique to each individual's activity space. These "edges" may be represented by pathways, such as major highways (Hasisi et al. 2020). Brantingham and Brantingham (1995) claimed that crime will be more likely to occur when a motivated offender's activity space overlaps with the activity space of a potential victim/target.

Based on the above understanding, many studies have discovered that a large percentage of the total number of crimes in various cities is concentrated in a small number of micro-geographic places (Braga, Hureau, and Papachristos 2011; Brantingham and Brantingham 1999; Pierce, Spaar, and Briggs 1988; Roncek 2000; Sherman, Gartin, and Buerger 1989; Weisburd and Amram 2014; Weisburd and Telep 2012). In a comparison study, Weisburd (2015) found that in larger cities, approximately 50% of crime incidents were concentrated between 4.2 and 6% of street segments, whereas 25% were concentrated between 0.8 and 1.6%. In addition, not only are large proportions of crime concentrated in a small number of places, but there is also a spatial–temporal stability whereby the concentrations remain relatively stable over time (Braga, Andresen, and Lawton 2017; Gill, Horgan, and Corner 2019). Song et al. (2017) explained that the spatial–temporal stability of crime concentration is mostly the result of the spatial characteristics of criminal offences, such as proximity to high-risk areas, land use, urban density and location accessibility. Moreover, studies recognize that there is a significant overlap between ordinary criminals and terrorist offenders, especially as to their rational choice decisions (Clarke and Newman 2006; Dugan et al. 2005; Newman and Hsu 2012; Perry and Hasisi 2015).

Terrorist actions, similarly to regular criminal activities, are constrained by the same types of geographical restrictions (Clarke and Newman 2006; Hasisi et al. 2020; Perry 2020). The geographical and spatial characteristics of a particular target play an essential role in determining its appeal as a potential location for a terrorist attack (Gill et al. 2019; Griffiths, Johnson, and Chetty 2017; Newman and Hsu 2012; Perry et al. 2019; Rossmo and Harries 2011). As mentioned above, when selecting a target, terrorists consider a range of circumstances such as accessibility, distance and the target area, as well as escape routes, the complexity of the journey, opportunities for bringing a weapon to the target, and the terrorist's familiarity with the routes to and from the target (Clarke and Newman 2006; Gill et al. 2019; Perry et al. 2019; Spaaij 2010, 2012).

According to Clarke and Newman (2006), the opportunity that relates to the circumstances of an attack can be divided into four elements, referred to as the "four pillars of opportunity": weapon; target; tools/training; and facilitating conditions. These four elements are essential when carrying out a terrorist attack (Clarke and Newman 2006; Fahey et al. 2012; Perry et al. 2019). The following section presents

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forest PT's four pillars of opportunity, suggesting that engaging in this type of terrorism is a rational choice.

THE "FOUR PILLARS OF OPPORTUNITY" OF FOREST PYRO-TERRORISM ATTACKS

PT in general and forest PT, in particular, could be defined as the use of arson as a method of violence by non-state individuals or organizations to psychologically impact, terrorize and intimidate in order to pressure both the government and the civilian population and to advance political, religious, or any ideological or social motivations (Baird 2006; Bendle 2008; Besenyő 2019; Deshpande 2009). Forest fires are a fairly new form of terrorism, identified in the United States, Israel, France, Spain and Greece (Besenyő 2019; Deshpande 2009). This form of terrorism must alarm us, especially as global terrorist organizations continue to modify their strategies (Bendle 2008).

Thousands of forest PT incidents have been identified in Israel, causing injury to people, loss of property and natural treasures, as well as having a psychological and moral impact on the general population. There are also financial costs resulting from the significant expense of extinguishing the fire, covering the damage caused, and the cost of rehabilitation. A cost analysis conducted in Israel by Levi et al. (2019) concluded that the costs of extinguishing fires caused by suspected forest PT (compared to other causes of fires) are the highest due to the number and severity of fires in this arson category. Analysing forest PT's four pillars of opportunity can shed light on and provide insights into this phenomenon, emphasizing the ability to deal with it more effectively and place-focused.

Weapon

The terrorist's weapon and target selection process are guided by carefully considering resources *versus* benefits (Clarke and Newman 2006). Therefore, the choice of arson as a weapon calculates the ease with which one can ignite a forest fire on the one hand and the immense potential damage it could cause on the other. Fire and resulting smoke are powerful weapons that threaten civilians and firefighters and have the potential to destroy vast areas (Besenyő 2019). Terrorists choose this form of attack as it is very destructive and constitutes a fairly low risk of being apprehended and convicted. Therefore, PT can be perceived as providing an opportunity whereby minimal effort can lead to extreme and disastrous results (Baird 2006; Bendle 2008; Besenyő 2019; Deshpande 2009; Marsden, Marino, and Ramsay 2014).

Marsden et al. (2014) quoted *Inspire*, a jihadist magazine, to demonstrate the attackers' point of view regarding the cost suffered by the "enemy" as a result of PT. The jihadist author describes the fires in New South Wales in the south of Australia in December 2002 as the worst event of wildfires in 30 years. A firestorm released heat energy equal to that of 23 nuclear bombs, causing tremendous damage in a horrifying event. Besenyő (2019) quoted the *Inspire* magazine from 2010, which advocated forest fires as part of *jihad*. In 2012 (issue no. 9), the magazine elaborated on how igniting forest fires in America, Australia or Europe could greatly support Al-Qaeda.

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The Cybersecurity and Infrastructure Security Agency (2021) has prepared an action guide to provide information to all first responders, security professionals and the general public in the United States. The guide's goal was to mitigate the use of fire, including deliberately setting forest fires as a weapon of terror. The National Counterterrorism Center, Department of Homeland Security, and Federal Bureau of Investigation (2022) posted a warning about wild-land arson in the United States by foreign terrorist organizations, especially in the West, due to its perceived simplicity and the major human, property, infrastructure, environmental and economic losses such cases of arson can cause. This publication mentions an English-language video released by the Islamic State of Iraq and Syria (ISIS) in July 2020, titled "Incite the Believers", that urged supporters to conduct arson attacks in forests, fields, cities and villages, and to dispose of evidence safely to hinder law enforcement investigations. The video advises to "monitor well for a place where you can set a fire without drawing attention" and "consider that the fire will be so great that efforts made to extinguish it will cost your enemies greatly, and perhaps they will not be able to put it out". A target map at the end of the video recommends areas for forest fires in the western United States (National Counterterrorism Center, Department of Homeland Security, and Federal Bureau of Investigation 2022).

Target

Theoretically, there are unlimited potential targets that can be selected. However, several important characteristics make certain targets more attractive for terrorists (Clarke and Newman 2006; Newman and Hsu 2012). Targets chosen by terrorists are mainly divided into two categories: "hard" and "soft" targets (Asal et al. 2009; Newman and Hsu 2012; Perry et al. 2019). Hard targets have a greater effect yet are more difficult to attack, as they are better defended (e.g. government buildings and military bases). Soft targets, such as accessible areas, roads and public transport, shopping centres, outdoor public events and forests, are more exposed and, thus, facilitate easier attacks.

As mentioned in the previous paragraph, an additional key consideration in the target selection is the accessibility of the target to the attacker, primarily the acquaintance of the attacker with the route and the target area, the distance to the target, potential escape routes, the complexity of the journey and the possibility of bringing a weapon to the target (Clarke and Newman 2006; Hasisi et al. 2020; Spaaij 2010, 2012). Repeated studies have revealed that lone terrorists, who have limited resources (Bakker and De Graaf 2011; McCauley, Moskalenko, and Van Son 2013), are primarily those who tend to choose targets in familiar settings, close to their place of residence, or part of their daily routine (Becker 2014; Brantingham and Brantingham 1993; Gill, Horgan, and Deckert 2014; Hasisi et al. 2020; Newman and Hsu 2012; Perry et al. 2019).

Tools/Training

The third pillar of opportunity – "tools/training" – refers to items, equipment or training needed when preparing for and executing the terrorist attack. Such objects are usually associated with one's daily life (Bakker and De Graaf 2011; Clarke and

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Newman 2006; Meyer 2013). Setting fire to a forest does not require special training; necessary tools (combustible material, matches and a vehicle to reach the specific location) are easily accessible.

Facilitating Conditions

The fourth "pillar of opportunity" – "facilitating conditions" – includes, in addition to the societal and institutional circumstances, the environmental circumstances that enhance the opportunity of the terrorists and increase the likelihood that an attack will succeed (Abadie 2004; Piazza 2006). The right environmental conditions, such as weather conditions, are directly related to the speed of fire spread and are one example of facilitating conditions (Kutiel and Kutiel 1991). These environmental conditions depend on the availability of combustible material, the strength of the wind, and the atmospheric conditions, with an emphasis on low humidity and high temperatures.

Another important facilitating condition is imitating recent successful attacks ("copycat"), which may help offenders overcome obstacles and realize their will to attack. This is even more important for lone actors because of their limited resources. Following and imitating others can be used as a "shortcut" to effective attacks (Gill 2015; Perry, Hasisi, and Perry 2018; Perry et al. 2019), especially when in comparison to members of terror organizations (that have infrastructure), lone attackers lack resources and knowledge. For these reasons, lone attackers repeatedly choose soft targets and relatively uncomplicated means of attack (Becker 2014; Borum 2013; Gill et al. 2014; Spaaij 2010, 2012).

Following the "four pillars of opportunity", it is clear that forest PT is a simple, low-cost means of terror that does not require extensive planning or resources under suitable atmospheric conditions and exploiting the right environmental conditions. Consequently, forest PT can be carried out by a lone attacker. For example, a potential arsonist can drive along a path, stop at certain points, light a piece of paper, throw it out of the car window and continue his journey without being caught. The weather and terrain conditions will play their part in fuelling the fire (Shelef 2016). Both in light of the ease of implementation and the increasing difficulty of achieving significant damage with more conventional means, PT has been identified as one of the "weapons" that a potential terrorist has. Indeed, studies have proven the connection between forest arson and terrorism (Baird 2006; Besenyő 2019; Fighel 2009; Pfeifer 2013).

"HOT FORESTS": THE APPLICABILITY OF CRIME CONCENTRATION TO FOREST PYRO-TERRORISM

The appeal of a forest as a potential terrorist attack target is likely to be determined by its geographical and spatial characteristics, similar to the selection of other terror attack targets (Gill et al. 2019; Griffiths et al. 2017; Newman and Hsu 2012; Perry et al. 2019; Rossmo and Harries 2011). One can assume that pyro-terrorists, similar to ordinary criminals and terrorists, will consider a range of geographical and spatial characteristics when selecting a forest to increase their chances of success. These might include accessibility, distance and the complexity of the journey, as well as their familiarity with the routes to and from the target, including escape routes (Clarke and Newman 2006; Gill et al. 2019; Perry et al. 2019; Spaaij 2010, 2012). These

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geographical and spatial characteristics, which play a role in selecting a forest for a PT attack, are expected to result in a concentration of PT attacks in a small number of forests, similar to the concentration of regular crime and terror in a few places.

Previous studies on terrorism, in general, have attempted to understand why terrorists repeatedly choose certain locations to carry out their attacks. While it was reasonable to assume that these particular hot spots provide the attacker with the opportunity to cause maximum harm, Perry (2020) found that the attacks that were committed in the various hot spot street segments were about half as lethal as the other attacks that did not occur in hot spots. These findings suggest that while causing maximum harm is likely to be an important objective, it might not be the attackers' primary consideration when choosing a specific place to carry out their attack (Perry 2020; Perry et al. 2017). This is likely to be because the preference of many criminals and terrorists is to operate in familiar locations (Farrell and Pease 2001; Perry et al. 2017, 2019; Weisburd and Telep 2012).

Terrorists are expected to minimize the distance to their selected attack site to increase their attack's utility (Bernasco and Block 2009; Clarke and Newman 2006; Gill and Corner 2016; Gruenewald, Allison-Gruenewald, and Klein 2015). Several studies examined terror distance decay patterns and found that they were similar to those of ordinary crime (Becker 2014; Gill et al. 2019; Griffiths et al. 2017; Rossmo and Harries 2011; Smith et al. 2008). As offenders feel more confident attacking in settings familiar to them, they are more likely to commit arson in proximity to either their place of residence (Brantingham and Brantingham 1995, 2003) or activity space.

THE CURRENT STUDY

As mentioned, previous studies have focused on the concentration of terrorism from the global level down to the level of street segments (Perry 2020). There have also been a few studies that focused on forest PT (Baird 2006; Bendle 2008; Besenyő 2019; Pfeifer 2013), yet we are not aware of any research that has dealt with the concentration of forest PT: "hot forests" in the literal sense.

Based on criminological findings on the concentration of crime and terror, this study aims to examine whether similar to the "law of crime concentration", forest PT is concentrated in a few selected forests. Consequently, this study examines the entire population of suspected PT in Israeli forests between 2008 and 2022 (except for 2016), totalling 2,297 attacks.

Research Questions

Based on the literature about crime concentration in general and terror specifically, this study aims to examine whether the "law of crime concentration", which applies to terror attacks at the street-segment level (Perry 2020), is also applicable to forest PT This study examines PT in KKL-JNF[1] forests as a case study in order to answer the following research questions:

[1]Keren Kajemet LeYisrael – Jewish National Fund (the sole organization in Israel responsible for afforestation).

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(1) Do a significant number of PT attacks cluster in only a few forests?
(2) Have these "hot forests" been a scene/location for a significant proportion of PT attacks over time?
(3) Did the PT attacks that took place in these "hot forests" cause less damage (in terms of the size of the burnt area) than PT attacks that occurred in forests that are not "hot forests", given the preference of many criminals and terrorists to work with what they know and operate in familiar locations?
(4) Do these particular "hot forests" have distinct spatial characteristics that make them more favourable for PT attacks?

Study Population and Research Design

This study focuses on the entire population of KKL-JNF's 274 forests in Israel and explores whether PT attacks occurred in specific "hot forests". It utilizes two KKL-JNF databases collected about forest fires, the first between 2008 and 2015 and the second between 2017 and 2022. In November 2016 there was a large wave of fires in Israel. The person responsible for investigating this wave of fires (at the National Fire and Rescue Authority) claimed that close to 90% of the large, significant fires were attributed to PT (Besenyő 2019; Shelef 2016). That year (2016), a new database was under construction, resulting in data not being collected in an orderly manner for this period. Due to the poor data collection, we chose not to include the 2016 data in our analysis. The two databases included in this study contain information about every forest fire (multiple fire foci in one forest at the same time were counted as one event), dates of the fire, name of forest where the fire occurred, KKL-JNF region, size of the burnt area, and cause of the fire. The cause of the fires is divided into 13 different categories: vacationer negligence; trash burning; forestry work; agricultural work; nature (lightning); mechanical tools (e.g. welding); electrical; criminal; military activity; enemy fire; unknown; suspected terrorist arson; and others.

It is generally accepted to consider a crime as being solved only in cases where a suspect is arrested and when there is enough evidence to convict. Due to the nature of forest PT crime, there are very few incidents in which arsonists are apprehended. Moreover, there are very few cases where there is sufficient evidence against the suspect, proving beyond a reasonable doubt that the fire was maliciously set due to nationalist motives. Consequently, even with a strong suspicion of PT arson, it could not be definitively categorized as a PT attack. Therefore, the term "suspected (PT) arson" is used if two conditions are met:

(1) A fire with special characteristics compatible with PT (for example, several ignition spots near each other).
(2) All other fire causes (vacationer negligence, trash burning, forestry work, agricultural work, lightning, welding, electrical installations, criminal activity, military activity, enemy fire, etc.) were ruled out.

In addition to these categories, there is an "unknown" category in which the investigator did not reach any conclusive conclusions regarding the cause. Of the 10,583 forest fires in the study period, 4,207 were classified as having "unknown"

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causes (39.8% of all fires). Most likely, some of these instances were, in fact, PT attacks. Due to the uncertainty, fires classified with an unknown cause were not counted as suspected PT attacks.

Of the 10,583 forest fires in the study period, 2,297 (21.7 %) were suspected PT attacks. The 2,297 fires examined in this case study are the population of suspected PT attacks. The smallest geographic location unit in most of KKL-JNF's data is the specific forest rather than an exact location within that area, such as a landmark. Therefore, this study refers to forests as the basic unit of analysis. The total number of forests under the supervision of KKL-JNF during this study is 274.

FINDINGS

Did a Significant Number of PT Attacks Cluster in Only a Few Forests?

The 2,297 PT attacks (forests set on fire in one or more sites) took place in 125 out of KKL-JNF's 274 forests. Thus, 100% of all attacks occurred in only 45.6% of the 274 forests. In all, 33 forests endured only one attack, 34 forests between two to five attacks, 15 were set on fire six to 10 times, and 43 forests more than 11. "Moradot Nazeret" Forest had the largest number of PT attacks, totalling 205 events (8.92% of the total PT attacks). "Kfar HaHoresh" had 163 PT attacks (7.1%), "Ben Shemen" Forest had 137 (5.96%), and 134 attacks (5.83%) occurred at "Ezyon" Forest (see Table 1). A total of 27.82% ($n = 639$) of the PT attacks occurred in just four "hot forests", representing 1.46% of the 274 KKL-JNF's forests, while 52.5% ($n = 1{,}206$) of the attacks occurred in just 10 "hot forests", representing 3.65% of the 274 KKL-JNF's forests.

The Gini coefficient is a conventional measure of concentration that varies from 0 to 1. Within spatial concentration, a Gini of 0 would indicate that all events have a perfectly equal distribution, whereas a Gini of 1 would indicate that all events were limited to a single place. The Gini coefficient (G') for the concentration of all PT attacks in the 274 KKL-JNF's forests was 0.86 (see Figure 1), representing an extremely high concentration level. It indicates that the concentration is more than double that of pure randomness.

One might suspect that a positive relationship exists between the size of the forest and the number of PT attacks, whereby the larger the forest, the greater the chance of a PT attack. Figure 2, which presents a scatterplot of all forests and the number of PT attacks they have experienced, suggests that this is unlikely to be the case. It reveals that the larger forests are not characterized by having a large number of PT attacks. A high number of attacks occur in medium-sized forests. To illustrate, the largest "Massu'a" Forest is in 13th place in terms of the number of PT attacks; the second largest forest, the "Yatir" Forest, is only in 73rd place (only three); and "Duda'im", the third largest forest, is in 53rd place. At the same time, the "Moradot Nazeret" Forest, which has the highest number of attacks, is in 23rd place in terms of its size, and the "Kfar HaHoresh" Forest, with the second highest number of attacks, is in 33rd place.

To strengthen the finding regarding the clustering of PT attacks, we performed a sensitivity analysis designed to check if the concentration of PT in certain "hot PT forests" is not accidental but directly related to opportunities to commit PT.

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Table 1. Distribution of Pyro-terrorism (PT) Attacks in Forests Where More Than 10 Events Occurred During the Study Period

No.	Forest Name	No. PT	% out of Total PT	Cumulative % PT	% of 274 Forests	Av. No. Annual PT	Forest size in Sq M
1	Moradot Nazeret	205	8.92	8.92	0.365	14.6	12,166,504
2	Kfar HaHoresh	163	7.10	16.02	0.730	11.6	9,120,423
3	Ben Shemen	137	5.96	21.99	1.095	9.8	24,397,172
4	Ezyon	134	5.83	27.82	1.460	9.6	17,559,998
5	HaKaf-Het	127	5.53	33.35	1.825	9.1	8,266,624
6	Yerushalayim	116	5.05	38.40	2.190	8.3	6,094,525
7	Zippori	92	4.01	42.40	2.555	6.6	10,275,654
8	Bet Keshet	87	3.79	46.19	2.920	6.2	17,253,159
9	Eshta'ol	81	3.53	49.72	3.285	5.8	12,441,812
10	(Netiv) HaLamed-He	64	2.79	52.50	3.650	4.6	1,249,085
11	Zor'a	57	2.48	54.98	4.015	4.1	10,017,789
12	HaHamisha	45	1.96	56.94	4.380	3.2	7,536,911
13	Massu'a	43	1.87	58.82	4.745	3.1	41,806,662
14	Segev	40	1.74	60.56	5.109	2.9	11,521,422
15	Har Tavor	39	1.70	62.26	5.474	2.8	2,573,761
16	Menashe	37	1.61	63.87	5.839	2.6	5,640,275
17	Aminadav	36	1.57	65.43	6.204	2.6	13,009,444
18	Iron	34	1.48	66.91	6.569	2.4	8,332,117
19	Nahshon	34	1.48	68.39	6.934	2.4	6,284,179
20	Betar	32	1.39	69.79	7.299	2.3	7,761,446
21	Yish'i	31	1.35	71.14	7.664	2.2	6,339,879
22	Umm Al-Fahm	30	1.31	72.44	8.029	2.1	4,203,884
23	Me Ammi	30	1.31	73.75	8.394	2.1	4,871,021
24	Balfour	28	1.22	74.97	8.759	2.0	3,992,483
25	Tur'an	28	1.22	76.19	9.124	2.0	12,478,722
26	Haruvit	24	1.04	77.23	9.489	1.7	16,465,091
27	Horashim	23	1.00	78.23	9.854	1.6	2,915,036
28	Modi'in	23	1.00	79.23	10.219	1.6	12,270,927
29	Giv'at HaMore	21	0.91	80.15	10.584	1.5	11,879,562
30	HaKdoshim	20	0.87	81.02	10.949	1.4	24,226,601
31	Megido	17	0.74	81.76	11.314	1.2	16,881,028

(*Continued*)

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Table 1. (*Continued*)

No.	Forest Name	No. PT	% out of Total PT	Cumulative % PT	% of 274 Forests	Av. No. Annual PT	Forest size in Sq M
32	Park Ayalon	17	0.74	82.50	11.679	1.2	6,878,715
33	Lavi	15	0.65	83.15	12.044	1.1	4,580,260
34	Hulda	15	0.65	83.80	12.409	1.1	1,311,785
35	Nahal Limonim	14	0.61	84.41	12.774	1.0	4,896,520
36	Ein Dor	14	0.61	85.02	13.139	1.0	5,787,757
37	Zelafon	14	0.61	85.63	13.504	1.0	1,294,022
38	Biria	13	0.57	86.20	13.869	0.9	19,219,623
39	Matta	13	0.57	86.77	14.234	0.9	14,700,272
40	Shefaram	13	0.57	87.33	14.599	0.9	8,615,285
41	Bareket	12	0.52	87.85	14.964	0.9	2,385,554
42	Bar'am	11	0.48	88.33	15.328	0.8	12,472,921
43	Ahihud	11	0.48	88.81	15.693	0.8	9,230,422

Av. No., average number; Sq M, square metres.

Accordingly, we examined whether fires caused by factors other than PT were also concentrated in PT "hot forests". We examined the other three major causes of fire (vacationer negligence, trash burning and agricultural work).[2] The findings revealed that the four "hottest PT forests" had a relatively *low* number of fires caused by these three causes mentioned above (see Table 2).

Moreover, when examining forests with the highest concentrations of fires resulting from the three other causes of fires, we found that the Shukada Forest had the highest concentration of fires resulting from agricultural work (7.3%) but was without a single incident of PT; the Menashe Forest had the highest concentration of fires resulting from trash burning (14.2%), while its share in PT incidents was only 1.61%; and the Yerushalayim (Jerusalem) Forest had the highest concentration of fires due to vacationer negligence (12.4%), while the forest's share of PT attacks was only 5.05%.

These findings reinforce the proposition that PT hot forests, when compared to forests suffering from fires due to vacationer negligence, trash burning and agricultural work, do not share the same characteristics of PT forests and constitute a different set of opportunities related specifically to PT.

Was There a Significant Proportion of Repeated PT Attacks in These "Hot Forests" Over Time?

When looking at the "hot forests" that endured 11 or more PT attacks during the 14-year observation period (Table 3), we see that the attacks repeatedly occurred in

[2]More events were needed to include the other eight causes of fires.

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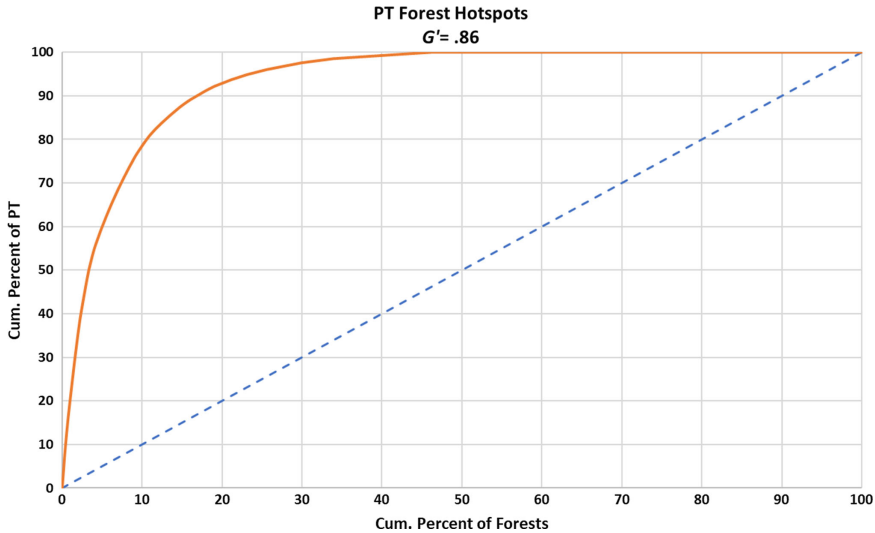

Figure 1. Gini coefficient (*G'*) and Lorenz curve (--) for pyro-terrorism (PT) forest attacks in 2008–2022. Data for 2016 are not included. Cum, cumulative.

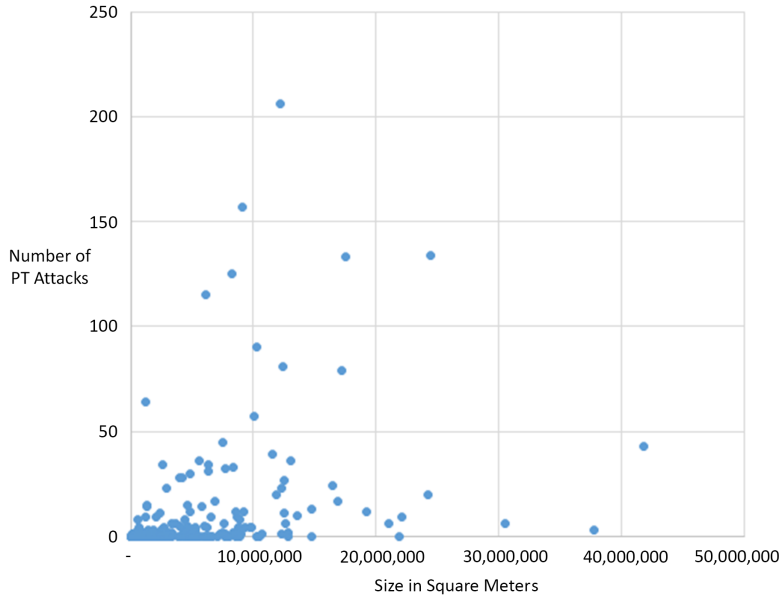

Figure 2. Scatterplot of the number of pyro-terrorism (PT) attacks by forest size.

the same "hot forests" over the years studied. Upon studying the top eight "hottest forests", we found that two forests had at least one attack every year over each of the 14 years, one forest had attacks every year in 13 out of the 14 years, one forest had attacks every year in 12 out of the 14 years, two had attacks every year in 11 out of

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Table 2. Comparison of the Concentration of Pyro-terrorism to the Concentration of Fires from Another Three Causes

	Pyro-Terrorism		Vacationer Negligence		Agricultural Work		Trash Burning	
	%	Cumulative %	%	Cumulative %	%	Cumulative %	%	Cumulative %
Moradot Nazeret	9.0	9.0	0.8	0.8	1.8	1.8	4.7	4.7
Kfar HaHoresh	7.0	16.0	0.2	1.0	0.4	2.2	3.5	8.2
Ben Shemen	6.0	22.0	2.7	3.7	0.7	2.9	0.3	8.5
Ezyon	5.9	27.9	0.7	4.4	2.6	5.5	0.3	8.8

the 14 years, one had at least one fire in 10 out of the 14 years, and one forest experienced an attack in nine out of the 14 years. This finding reveals that PT's attacks were concentrated in a limited number of forests over the years. This concentration was stable over time and not a sporadic episode (see Table 3).

Were PT Attacks in "Hot Forests" Less Harmful than PT Attacks in Other Forests?

In order to examine whether arsonists chose the "hot forests" because they provided opportunities to cause maximum damage, we examined whether the PT attacks in "hot forests" caused more (or less) damage than attacks in forests that had a single PT event. We compared the damage, i.e. the size of the forest burned in forests with a single PT attack, to "hot forests", where most PT events occurred. As mentioned, there were 33 forests with only one PT, meaning they do not meet the definition of a "hot forest". In nine of these forests, there was no information about the size of the damage – the burned area. In one forest that endured a single PT attack, the area burned was atypical (too large), and there was most likely an error in the information provided (15,000 *dunams*, where a *dunam* is equal to 1,000 square metres). Therefore, this particular event was not included in the analysis.

The total area burned in the remaining 23 forests where there was one PT was 1,905.42 *dunams*. This translates into an average of 82.84 *dunams* per fire. These forests were compared with the 23 "hottest" forests, where most PT attacks occurred. An examination of the 23 forests with the highest concentration of PT revealed that the area burned in all 1,694 fires occurring in them was 19,210.34 *dunams*. Therefore, the average area burned by PT was only 11.34 *dunams*. As previously mentioned, Perry's (2020) finding concluded that causing maximum damage was not the main consideration when choosing hot spots for terror attacks in Jerusalem. This is also the case when selecting a forest to carry out the PT.

Do These "Hot Forests" Have Distinct Spatial Characteristics Favourable to PT Attacks?

As mentioned, between the years 2008 and 2022, 27.82% of the PT attacks occurred in just the following four "hot forests": "Moradot Nazareth", "Kfar HaHoresh", "Ben Shemen" and "Ezyon". Geographically, several characteristics can be identified for

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Table 3. Number of Pyro-terrorism Attacks per Year

Index	Forest Name	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	Total
1	Moradot Nazeret	46	43	45	8	1	15	11	6	3	7	11	2	5	2	205
2	Kfar HaHoresh	33	44	35	4	1	8	5	9	8	3	3	2	4	4	163
3	Ben Shemen	16	15	24	12	23	27	10	7					1	2	137
4	Ezyon	8	31	42	9	7	13	4	13	2	3		2			134
5	HaKaf-Het ('The Twenty Eight')	13	26	20	6	9	19	5	23	1		4		1		127
6	Yerushalayim	28	16	33	15	8	11	1		3	1					116
7	Zippori	15	26	17	6	3	2	3	8		3	3	2	4		92
8	Bet Keshet	6	26	19	8	4	3		5	3	2	2	2	6	1	87
9	Eshta'ol	4	3	5	1	3	6	18	41							81
10	(Netiv) HaLamed-He	5	4	25	9	2	8		11							64
11	Zor'a	7	7	3	4	1	7	10	17	1						57
12	HaHamisha	11		17	6	4	1		6							45
13	Massu'a	5	9	5	4	4	12	2	2							43
14	Segev	6	3	1		2	18	4	4	1	1					40
15	Har Tavor	8	7	8	1		1	4	1	1	1	2		2	3	39
15	Menashe	25	1	1		3				5		2				37
17	Aminadav	12	6	14	3				1							36
18	Iron	20	3	4	2	1	1	1		1	1					34
19	Nahshon	3	3	2	4	6	4	10	2							34

(*Continued*)

Table 3. (*Continued*)

Index	Forest Name	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	Total
20	Betar	4	11	6	5	1	2	1	1					1		32
21	Yish'i	6	7	4	2	6	3	3								31
22	Umm Al-Fahm	21	1	4						2	1	1				30
23	Me Ammi	25		2						1		2				30
24	Balfour	2	8	13	1	1		1	2							28
25	Tur'an		4	6	10		1	2			2		1	2		28
26	Haruvit	5	2	5	5	3	1	3								24
27	Horashim	12	6		1	1					1	1		1		23
28	Modi'in	2	4	5	2	3	5		1	1						23
29	Giv'at HaMore			4	8	2	1			1		3	2			21
30	HaKdoshim	4	5	3	2	4			1					1		20
31	Megido	5					1	1	1	5	1	2	1			17
32	Park Ayalon	2	5	4	3		2	1								17
33	Lavi			2	1		2	3	1				3	3		15
34	Hulda	1	4	3	1	1	2	2	1							15
35	Nahal Limonim	5	4			3									2	14
36	Ein Dor		2	6	2	2			1		1					14
37	Zelafon		2	3	1	4	2	1	1							14
38	Biria	1	5	3				1		2	1					13
39	Matta		1	9	1							1			1	13

(*Continued*)

Table 3. (*Continued*)

Index	Forest Name	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	Total
40	Shefaram	7	2	1			1					2				13
41	Bareket		2	2	1	2		1	3					1		12
42	Bar'am			5		3				3						11
43	Ahihud	2	3	3	1	1					1					11

these forests: "Moradot Nazeret" Forest and "Kfar HaHoresh" Forest are part of the Nazareth district and are characterized by old trees planted over a century ago. The forests are surrounded by two large urban areas – Nazareth and Nof HaGalil. The city of Nazareth is the economic, political and media centre of Israeli Arabs. Nazareth and the Arab urban settlements around – Iksal, Yafia, Kfar Kana, Mashhad, Ein Mahal, Ilot and Raina – numbering about 200,000 Israeli Arab residents (i.e. more than a tenth of all Arabs in Israel; see the website of the Israeli Central Bureau of Statistics), is an urban continuum that is adjacent to these forests. Road number 60, the longitudinal path from north to south, ends in Nazareth and crosses the "Moradot Nazeret" Forest. This path is connected to the "Green Line".[3] Moreover, the Palestinian city of Jenin is a central crossing point for the passage of legal and illegal Palestinian workers.

The "Ben Shemen" Forest is one of the first forests planted in the 1920s. This forested area is close to the large population concentrations of the Dan region and the larger Tel Aviv metropolitan area. The forest is located along Road 1, between Tel Aviv and the Jordan Valley, and Road 443, which connects the centre of Israel and northern Jerusalem and the Palestinian settlements around Ramallah. Road 443 is the main daily commuting route for Palestinian labourers and the passage of goods to the centre of Israel from northern Jerusalem and the Palestinian communities located north of Jerusalem.

The "Ezyon" Forest is located adjacent to the Green Line, with its eastern sector located beyond the Green Line, between the Palestinian town of Zurif and the Israeli settlement of Rosh Zurim and the villages of Mata and Neve Michael, south of the city of Beit Shemesh. Road 367 crosses the forest from east to west, functioning as a transit route between Gush Etzion and Beit Shemesh. Palestinian legal and illegal workers also use it.

The high concentration of PT attacks in these four "hot forests" could be classified by two main characteristics related to situational opportunities. The first characteristic is their accessibility and proximity to the forests via main travel artery pathways, providing easy access to potentially radically motivated Arabs. Second, these forests are characterized by old and dry pine trees, ideal for fires. When combined with certain weather conditions, this dry fuel material results in ideal conditions for arson and is perfect for PT attacks. Despite what is claimed in these two hypotheses, it is important to emphasize that there is a need for future in-depth research to examine the unique characteristics of the PT "hot forests" and to assess what makes them more attractive for PT attacks.

DISCUSSION

This research is one of few that has studied forest PT and the first to examine the concentration of PT forest attacks. The KKL-JNF's databases of the 2,297 suspected PT attacks in Israel's 274 forests over 14 years presented a unique opportunity to study the phenomenon. As seen from the Lorenz curve (Figure 1) and Table 1, the 2,297 PT attacks occurred in 125 forests – 45.6% of the 274 KKL-JNF forests. Over a

[3]Israel's borderline before 1967 and today a proximate location of the security fence separating Israel from the occupied territories of the West Bank.

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quarter (27.82%; $n = 639$) of all PT attacks occurred in just four "hot forests", representing 1.46% of the 274 KKL-JNF forests. Lastly, more than half (52.5%; $n = 1{,}206$) of the attacks occurred in just 10 "hot forests", representing 3.65% of the 274 KKL-JNF forests. The observed concentrations at both the 25% and 50% cut-offs demonstrate great consistency with Weisburd's (2015) findings regarding the distributions of crime in street segments in major US cities.

The advantage of the Gini coefficient is that it enables us to compare concentrations between different types of crime or terror attacks. Therefore, the standardization of the Gini coefficient enables us to compare the concentration of forest PT attacks with the concentration of other types of offences/terror in other places. The Gini coefficient of 0.86 for the concentration of all PT attacks in the 274 KKL-JNF forests represents an exceptionally high concentration level, especially for specific types of crime/terror. This finding is quite significant when compared to findings in other studies. Examples of this can be found in a $G' = 0.61$ for terror attacks in Jerusalem (Perry 2020). The Gini coefficient of 0.86 is also higher than non-aggregated individual robberies in the Hague ($G' = 0.72$) (Bernasco and Steenbeek 2017). De Moor, Vandeviver, and Vander Beken (2018) found Gini coefficients of 0.43, 0.54, 0.55 and 0.70 for individual crime types. In another study, Vandeviver and Steenbeek (2019) found Gini coefficients ranging from 0.50 to 0.65 when limiting their analysis to residential burglaries in Antwerp, Belgium, between 2005 and 2016. Studies of aggregated general crime have found Gini coefficients ranging from 0.70 to 0.80 (Bernasco and Steenbeek 2017; Eck et al. 2017; Favarin 2018; Hardyns, Snaphaan, and Pauwels 2019; Schnell, Braga, and Piza 2017; Steenbeek and Weisburd 2016).

Examining stability over time reveals that a significant proportion of forest PT attacks occurred repeatedly in the same small number of hot forests. Similar to previous crime studies, it was hypothesized that the concentration of PT attacks in a small number of "hot forests" would be relatively stable over time and not randomly distributed, which was the case.

The high level of the forest PT attack concentration and its stability over time is explained well by the rational choice perspectives of terror, which find there to be no fundamental differences between the decision-making processes and basic motivations of regular criminals and terrorists (Clarke and Newman 2006; Perry 2020; Perry and Hasisi 2015; Perry et al. 2019). The preferable spatial settings of particular forests increase the probability that they will be chosen as targets. Like regular criminals, terrorists evaluate the opportunity structures of specific places, such as forests, weighing the circumstances in light of the expected outcomes and benefits.

While the 274 KKL-JNF forests include many potential targets, various essential characteristics increase the opportunity for "successful" attacks at specific forests. We have identified two possible main situational opportunity characteristics of the "hot forests": proximity and accessibility of the forests via pathways giving easy access and possible escape routes to potential radically motivated attackers, together with the fact that these "hot forests" consist of highly flammable old trees, resulting in high risk of ignition, especially when combined with dry weather conditions. These two factors may well have been part of the attackers' considerations when choosing these particular "hot forests", making them more attractive for repeated attacks.

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This study found that PT's average area burnt in "hot forests" was only 11.34 *dunams*, compared to 82.84 *dunams* per fire in forests with only one attack. This finding aligns with prior studies (Perry 2020; Perry et al. 2019), suggesting that while causing maximum harm might be an important objective, it is not the primary consideration when choosing a specific place to carry out an attack. Lone actors are most likely to prefer a target with which they are more familiar and locations that present better opportunities to attack.

Since 2017, there has been a significant decrease in PT attacks. In the conversations we had with officials at KKL-JNF, they suggested two main reasons for this. The first is the large wave of fires that occurred in November 2016, where, as mentioned, it will take years for the huge areas burned to become mature forests once again. This, of course, reduces the opportunity to carry out PT attacks in these places. The second reason is a significant change in the work procedures of the KKL-JNF and the National Fire and Rescue Authority. Over the last three years, advanced technological measures have been introduced to detect, identify and launch forces, including drones, mobile observation poles and advanced thermal scanners that can detect a fire during the day. A new procedure that has been introduced enables firefighting planes to respond immediately upon detection of a fire, even before the arrival of ground forces, in order to prevent the fire from spreading. These factors obviously greatly affect the opportunity to perform successful PT attacks and increase the chance of exposure.

Policy Implications

As certain spatial characteristics of "hot forests" increase the situational opportunities for PT attacks, modifications to "hot forest" characteristics could contribute to preventing and reducing future PT attacks. This aligns with Clarke and Newman's (2006) argument that counterterrorism through situational prevention is one of the most effective preventative measures. There is robust evidence that place-based interventions can be effective without displacing crime to nearby areas (Braga, Papachristos, and Hureau 2010). In the few studies that have examined the effectiveness of place-based interventions in counterterrorism (in addition to overall effectiveness, e.g. Lum, Kennedy, and Sherley 2006), no evidence of significant displacement of attacks was found. Situational opportunities in alternative locations, which did not receive place-based interventions, were already perceived as less favourable (Hsu and Apel 2015; Perry et al. 2017). In line with the above findings, attackers would not be likely to displace their PT attacks to other forests. It should be emphasized that the situational approach does not overlook offenders or their motivations (Braga et al. 2017), and in the long run, it is important to reduce terrorist motivations. However, minimizing the opportunities for attacks is more feasible by implementing situational prevention methods such as hot spot policing (Perry and Hasisi 2015; Perry et al. 2017). Integrating different strategies, namely by minimizing opportunities via problem-oriented policing in hot spots, is very effective in crime prevention. Effective situational crime prevention measures of target hardening have also prevented terror attacks in Jerusalem (Perry 2020; Perry et al. 2019).

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Based on the current study's findings, implementing preventative measures (target hardening), such as obstacles and electronic surveillance devices when focusing on the four chronic "hot forests", can make a significant impact on forest PT attacks. Another preventative tactic might be replanting the burned "hot forests" with less flammable trees.

Study Limitations

As previously mentioned, the term "suspected (PT) arson" (rather than "PT arson") is used since it is difficult to arrest suspects and compile a full body of evidence that proves guilt beyond a reasonable doubt. At the same time, the term "suspected (PT) arson" was used only in cases where the investigation results and the intelligence and the scene's characteristics unequivocally indicated that this was indeed a case of a forest PT attack. Moreover, the number of cases classified as unknown was large (39.8% of all fires), reinforcing the assumption that investigators were not quick to classify a fire as a PT attack. They classified PT attacks only when they were convinced it was a PT attack. They preferred to classify as unknown in cases where they were unconvinced.

Another limitation is that the KKL-JNF data do not provide information that determines the exact location of the igniting spot, thus resulting in using the entire forest as the geographic location unit. Such information would have greatly improved the geographic analysis of crime and place.

Future Research

To further strengthen the findings of this research, a trajectory analysis should be employed to examine whether the concentration of forest PT incidents in certain forests is statistically significant and not merely a result of stochastic variation. This method can present a more robust, data-driven assessment of the likelihood of repeated PT in the same forests. Future research should also examine the significance of the difference in the size of the area unit between the forests (as a large polygon) and street segments, as well as the difference in the density of road networks in the context of the law of crime concentration. As mentioned, future research should also focus on the unique characteristics of PT "hot forests" to ascertain what makes them more attractive for PT attacks.

CONCLUSIONS

The concentration and stability over time of the PT attacks in the 274 KKL-JNF forests are consistent with the findings of Weisburd (2015) regarding the distributions of crime in street segments in major US cities. In fact, the findings demonstrate a tremendously high concentration level, especially for non-aggregated individual crime/terror types.

The phenomena of "hot forests" concentration and its stability over time are well explained by the rational choice perspectives of terror since terrorists, similar to ordinary criminals, evaluate the opportunity structures of specific places, in our case forests, and weigh the circumstances in light of the expected outcomes and benefits.

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In line with prior studies (Perry 2020; Perry et al. 2019) and the rational choice perspective, the findings suggest that the opportunity structures (cost–benefit) of specific places, and not causing maximum harm, is the primary consideration when choosing a site to carry out an attack. Therefore, counterterrorism through situational prevention is one of the most effective preventative measures for terrorism in general and PT in particular.

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References

Abadie, A. 2004. "Poverty, Political Freedom and the Roots of Terrorism." *American Economic Review* 96(2):50–6.

Asal, V. H., R. K. Rathemeyer, I. Anderson, A. Stein, J. Rizzo, and M. Rozea. 2009. "The Softest of Targets: A Study on Terrorist Target Selection." *Journal of Applied Security Research* 4(3):258–78.

Baird, R. A. 2006. "Pyro-Terrorism – The Threat of Arson-Induced Forest Fires as a Future Terrorist Weapon of Mass Destruction." *Studies in Conflict and Terrorism* 29:415–28.

Bakker, E. and B. De Graaf. 2011. "Preventing Lone Wolf Terrorism: Some CT Approaches Addressed." *Perspectives on Terrorism* 5:43–50.

Becker, M. 2014. "Explaining Lone Wolf Target Selection in the United States." *Studies in Conflict and Terrorism* 37(11):959–78.

Bendle, M. F. 2008. "Australia's Nightmare: Bushfire *Jihad* and Pyro Terrorism." *National Observer* (79):8–22.

Bernasco, W. and R. Block. 2009. "Where Offenders Choose to Attack: A Discrete Choice Model of Robberies in Chicago." *Criminology* 47(1):93–130.

Bernasco, W. and W. Steenbeek. 2017. "More Places than Crimes: Implications for Evaluating the Law of Crime Concentration at Place." *Journal of Quantitative Criminology* 33(3):451–67.

Besenyő, J. 2019. "Inferno Terror: Forest Fires as the New Form of Terrorism." *Terrorism and Political Violence* 31(6):1229–41.

Borum, R. 2013. "Informing Lone-Offender Investigations." *Criminology and Public Policy* 12(1):103–12.

Braga, A. A., M. A. Andresen, and B. Lawton. 2017. "The Law of Crime Concentration at Places: Editors' Introduction." *Journal of Quantitative Criminology* 33:421–6.

Braga, A. A., D. M. Hureau, and A. V. Papachristos. 2011. "The Relevance of Micro Places to Citywide Robbery Trends: A Longitudinal Analysis of Robbery Incidents at Street Corners and Block Faces in Boston." *Journal of Research in Crime and Delinquency* 48(1):7–32.

Braga, A. A., A. V. Papachristos, and D. M. Hureau. 2010. "The Concentration and Stability of Gun Violence at Micro Places in Boston, 1980–2008." *Journal of Quantitative Criminology* 26(1):33–53.

Braithwaite, A. and Q. Li. 2007. "Transnational Terrorism Hot Spots: Identification and Impact Evaluation." *Conflict Management and Peace Science* 24(4):281–96.

Brantingham, P. 2011. "Crime and Place: Rapidly Evolving Research Methods in the 21st Century." *Cityscape: A Journal of Policy Development and Research* 13(3):199–203.

Brantingham, P. and P. Brantingham. 1995. "Criminality of Place." *European Journal on Criminal Policy and Research* 3(3):5–26.

Brantingham, P. J. and P. L. Brantingham. 2003. "Anticipating the Displacement of Crime Using the Principles of Environmental Criminology." *Crime Prevention Studies* 16:119–48

Brantingham, P. L. and P. J. Brantingham. 1993 "Nodes, Paths and Edges: Considerations on the Complexity of Crime and the Physical Environment." *Journal of Environmental Psychology* 13(1):3–28.

Brantingham, P. L. and P. J. Brantingham. 1999. "A Theoretical Model of Crime Hot Spot Generation." *Studies on Crime & Crime Prevention* 8(1):7–26.

Clarke, R. V. 1997. "Introduction". Pp. 1–43 in *Situational Crime Prevention: Successful Case Studies*, edited by R. V. Clarke. Guilderland, NY: Harrow and Heston.

https://doi.org/10.1017/cri.2024.8 Published online by Cambridge University Press

Clarke, R. V. and G. R. Newman. 2006. *Outsmarting the Terrorists*. Westport, CT: Praeger Security International.

Cornish, D. B. and R. V. Clarke. 1987. "Understanding Crime Displacement: An Application of Rational Choice Theory." *Criminology* 25(4):933–48.

Cybersecurity and Infrastructure Security Agency. 2021. *Fire as a Weapon: Action Guide*, 4 December 2021, retrieved 12 March 2024 (https://www.cisa.gov/sites/default/files/publications/Fire%20as%20a%20Weapon%20Action%20Guide_Final%20508%20%2804.12.21%29v.2_1.pdf).

De Moor, S., C. Vandeviver, and T. Vander Beken. 2018. "Are DNA Data Valid Sources for Studying the Spatial Behavior of Unknown Offenders?" *Science and Justice* 58(5):315–22.

Deshpande, N. 2009. "Pyro-Terrorism: Recent Cases and the Potential for Proliferation." *Studies in Conflict and Terrorism* 32:36–44.

Dugan, L., G. LaFree, and A. R. Piquero. 2005. "Testing a Rational Choice Model of Airline Hijackings." *Criminology* 43(4):1031–65.

Eck, J. E., Y. Lee, S. O, and N. Martinez. 2017. "Compared to What? Estimating the Relative Concentration of Crime at Places Using Systematic and Other Reviews." *Crime Science* 6:8.

Fahey, S., G. LaFree, L. Dugan, and A. R. Piquero. 2012. "A Situational Model for Distinguishing Terrorist and Non-Terrorist Aerial Hijackings, 1948–2007." *Justice Quarterly* 29(4):573–95.

Farrell, G. and K. Pease. 2001. "Editors' Introduction: Why Repeat Victimization Matters." Pp. 1–4 in *Crime Prevention Studies*, Vol. 12: *Repeat Victimization*, edited by G. Farrell and K. Pease. Monsey, NY: Criminal Justice Press.

Favarin, S. 2018. "This Must Be the Place (To Commit a Crime). Testing the Law of Crime Concentration in Milan, Italy." *European Journal of Criminology* 15(6):702–29.

Felson, M. 2017. "Linking Criminal Choices, Routine Activities, Informal Control, and Criminal Outcomes." Pp. 119–28 in *The Reasoning Criminal: Rational Choice Perspectives on Offending*, edited by D. B. Cornish and R. V. G. Clarke. London: Routledge.

Fighel, J. 2009. "The Forest *Jihad*." *Studies in Conflict and Terrorism* 32(9):802–10.

Gill, P. 2015. *Lone-Actor Terrorists: A Behavioral Analysis*. London: Routledge.

Gill, P. and E. Corner. 2016. "Lone-Actor Terrorist Target Choice." *Behavioral Sciences and the Law* 34(5):693–705.

Gill, P., J. Horgan, and E. Corner. 2019. "The Rational Foraging Terrorist: Analysing the Distances Travelled to Commit Terrorist Violence." *Terrorism and Political Violence* 31(5):929–42.

Gill, P., J. Horgan, and P. Deckert. 2014. "Bombing Alone: Tracing the Motivations and the Antecedent Behaviors of Lone-Actor Terrorists." *Journal of Forensic Science* 59:425–35.

Griffiths, G., S. D. Johnson, and K. Chetty. 2017. "UK-Based Terrorists' Antecedent Behavior: A Spatial and Temporal Analysis." *Applied Geography* 86:274–82.

Groff, E. R., R. B. Taylor, D. B. Elesh, J. McGovern, and L. Johnson. 2014. "Permeability across a Metropolitan Area: Conceptualizing and Operationalizing a Macrolevel Crime Pattern Theory." *Environment and Planning A: Economy and Space* 46(1):129–52.

Gruenewald, J., K. Allison-Gruenewald, and B. R. Klein. 2015. "Assessing the Attractiveness and Vulnerability of Eco-Terrorism Targets: A Situational Crime Prevention Approach." *Studies in Conflict and Terrorism* 38(6):433–55.

Hardyns, W., T. Snaphaan, and L. J. R. Pauwels. 2019. "Crime Concentrations and Micro Places: An Empirical Test of the 'Law of Crime Concentration at Places' in Belgium." *Australian and New Zealand Journal of Criminology* 52(3):390–410.

Hasisi, B., S. Perry, Y. Ilan, and M. Wolfowicz. 2020. "Concentrated and Close to Home: the Spatial Clustering and Distance Decay of Lone Terrorist Vehicular Attacks." *Journal of Quantitative Criminology* 36:607–45.

Hsu, H. Y. and R. Apel. 2015. "A Situational Model of Displacement and Diffusion Following the Introduction of Airport Metal Detectors." *Terrorism and Political Violence* 27(1):29–52.

Kutiel, H. and P. Kutiel. 1991. "The Distribution of Autumnal Easterly Wind Spells Favors the Rapid Spread of Forest Wildfires in Mount Carmel, Israel." *GeoJournal* 23(2):147–52.

LaFree, G., E. Miller, and S. M. Yang. 2013. "Terrorism in Indonesia, the Philippines and Thailand, 1970 to 2008." *Security and Peace* 9(2):77–86.

https://doi.org/10.1017/cri.2024.8 Published online by Cambridge University Press

LaFree, G., N. Morris, L. Dugan, and S. Fahey. 2006. "Identifying Global Terrorist Hot Spots." Pp. 98–114 in *Tangled Roots: Social and Psychological Factors in the Genesis of Terrorism*, edited by J. Victoroff. Amsterdam: IOS Press.

Lee, Y., J. E. Eck, S. O, and N. N. Martinez. 2017. "How Concentrated is a Crime in Places? A Systematic Review from 1970 to 2015." *Crime Science* 6:6.

Levi, S., D. Disney, M. Shechter, and G. Naman. 2019. "The Causes of Fires in Forests and Groves in Israel and the Cost of Firefighting." *Ecology and Environment*, 42–8 (in Hebrew).

Levine, N. 2009. "Introduction to the Special Issue on Bayesian Journey-to-Crime Modelling." *Journal of Investigative Psychology and Offender Profiling* 6(3):167–85.

Lum, C., L. W. Kennedy, and A. Sherley. 2006. "Are Counterterrorism Strategies Effective? The Results of the Campbell Systematic Review on Counterterrorism Evaluation Research." *Journal of Experimental Criminology* 2(4):489–516.

Marsden, S., D. Marino, and G. Ramsay. 2014. "Forest *Jihad*: Assessing the Evidence for 'Popular Resistance Terrorism'." *Studies in Conflict and Terrorism* 37(1):1–17.

McCauley, C., S. Moskalenko, and B. Van Son. 2013. "Characteristics of Lone-Wolf Violent Offenders: A Comparison of Assassins and School Attackers." *Perspectives on Terrorism* 7(1):4–24.

Meyer, S. 2013. "Impending Lone-Wolf Attacks: Lessons Derived from the 2011 Norway Attacks." *Crime Science* 2(1):1–13.

National Counterterrorism Center, Department of Homeland Security, and Federal Bureau of Investigation. 2022. "Mitigating the Threat of Terrorist-Initiated Arson Attacks on Wildland–Urban Interface Areas." 27 January 2022, retrieved 12 March 2024 (https://www.dni.gov/files/NCTC/documents/jcat/firstresponderstoolbox/124s_-_Mitigating_the_Threat_of_Terrorist-Initiated_Arson_Attacks_on_Wildland-Urban_Interface_Areas.pdf).

Newman, G. R. and H. Y. Hsu. 2012. "Rational Choice and Terrorist Target Selection." Pp. 227–50 in *Countering Terrorism: Psychosocial Strategies*, edited by U. Kumar and K. Mandal. New Delhi: Sage Publications India.

Perry, S. 2020. "The Application of the 'Law of Crime Concentration' to Terrorism: The Jerusalem Case Study." *Journal of Quantitative Criminology* 36(3):583–605.

Perry, S., R. Apel, G. R. Newman, and R. V. Clarke. 2017. "The Situational Prevention of Terrorism: An Evaluation of the Israeli West Bank Barrier." *Journal of Quantitative Criminology* 33(4):727–51.

Perry, S. and B. Hasisi. 2015. "Rational Choice Rewards and the Jihadist Suicide Bomber." *Terrorism and Political Violence* 27(1):53–80.

Perry, S., B. Hasisi, and G. Perry. 2018. "Who is the Lone Terrorist? A Study of Vehicle-Borne Attackers in Israel and the West Bank." *Studies in Conflict and Terrorism* 41(11):899–913.

Perry, S., B. Hasisi, and G. Perry. 2019. "Lone Terrorists – A Study of Run-Over Attacks in Israel." *European Journal of Criminology* 16(1):102–23.

Pfeifer, J. W. 2013. "Fire as a Weapon in Terrorist Attacks." *CTC Sentinel* 7(6):5–7.

Piazza, J. 2006. "Rooted in Poverty? Terrorism, Poor Economic Development, and Social Cleavages." *Terrorism and Political Violence* 18(1):159–77.

Pierce, G. L., S. Spaar, and L. R. Briggs. 1988. *The Character of Police Work: Strategic and Tactical Implications*. Boston, MA: Center for Applied Social Research, Northeastern University.

Roncek, D. W. 2000. "Schools and Crime." Pp. 153–65 in *Analyzing Crime Patterns: Frontiers of Practice*, edited by V. Goldsmith, P. G. McGuire, J. H. Mollenkopf, and T. A. Ross. Thousand Oaks, CA: SAGE.

Rossmo, D. K. and K. Harries. 2011. "The Geospatial Structure of Terrorist Cells." *Justice Quarterly* 28(2):221–48.

Schnell, C., A. A. Braga, and E. L. Piza. 2017. "The Influence of Community Areas, Neighborhood Clusters, and Street Segments on the Spatial Variability of Violent Crime in Chicago." *Journal of Quantitative Criminology* 33(3):469–96.

Shelef, R. 2016. "The Lessons and Opportunities Following the Wave of Fires." in *Fire and Water*. National Fire and Rescue Authority, November 2016 (in Hebrew).

Sherman, L. W., P. R. Gartin, and M. E. Buerger. 1989. "Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place." *Criminology* 27(1):27–56.

Silke, A. 2003. "Becoming a Terrorist." Pp. 29–53 in *Terrorists, Victims and Society: Psychological Perspectives on Terrorism and its Consequences*, edited by A. Silke. Chichester: John Wiley & Sons.

https://doi.org/10.1017/cri.2024.8 Published online by Cambridge University Press

Smith, B. L., J. Cothren, P. Roberts, and K. R. Damphousse. 2008. *Geospatial Analysis of Terrorist Activities: The Identification of Spatial and Temporal Patterns of Preparatory Behavior of International and Environmental Terrorists*. Washington, DC: U.S. Department of Justice, May 2008, retrieved 13 March 2024 (https://www.ojp.gov/pdffiles1/nij/grants/222909.pdf).

Song, J., M. A. Andresen, P. L. Brantingham, and V. Spicer. 2017. "Crime on the Edges: Patterns of Crime and Land Use Change." *Cartography and Geographic Information Science* 44(1):51–61.

Spaaij, R. 2010. "The Enigma of Lone Wolf Terrorism: An Assessment." *Studies in Conflict and Terrorism* 33(9):854–70.

Spaaij, R. 2012. *Understanding Lone Wolf Terrorism: Global Patterns, Motivations and Prevention*. London and New York: Springer.

Steenbeek, W. and D. Weisburd. 2016. "Where is the Action in Crime? An Examination of the Variability of Crime Across Different Spatial Units in The Hague, 2001–2009." *Journal of Quantitative Criminology* 32(3):449–69.

Turner, S. 2017. "Delinquency and Distance." Pp. 127–42 in *Principles of Geographical Offender Profiling*, edited by D. Canter and D. Youngs. London: Routledge.

Vandeviver, C. and W. Steenbeek. 2019. "The (In)Stability of Residential Burglary Patterns on Street Segments: The Case of Antwerp, Belgium 2005–2016." *Journal of Quantitative Criminology* 35(1):111–33.

Weisburd, D. 2015. "The Law of Crime Concentration and the Criminology of Place." *Criminology* 53(2):133–57.

Weisburd, D. and S. Amram. 2014. "The Law of Concentrations of Crime at a Place: The Case of Tel Aviv-Jaffa." *Police Practice and Research* 15(2):101–14.

Weisburd, D. and C. Telep. 2012. "Spatial Displacement and Diffusion of Crime Control Benefits Revisited: New Evidence on Why Crime Does Not Just Move Around the Corner." Pp. 142–59 in *The Reasoning Criminologist: Essays in Honour of Ronald V. Clarke*, edited by N. Tilley and G. Farrell. New York: Routledge.

TRANSLATED ABSTRACTS

Abstracto

Una de las áreas de la investigación del terrorismo que no se ha examinado adecuadamente es la concentración geográfica de los ataques de piro-terrorismo (PT). La literatura relacionada con la distribución geográfica del terrorismo generalmente se centra en macro-lugares: continentes, países, regiones y micro-lugares: "puntos calientes". Sin embargo, hasta donde sabemos, la distribución geográfica del terror en los bosques aún no se ha estudiado. Los hallazgos de los estudios sobre "puntos críticos" tienen gran relevancia para los profesionales encargados de hacer cumplir la ley. Este estudio examina las características espaciales del bosque PT y si existe concentración de PT Ataques en un número limitado de "bosques calientes" que se mantienen estables en el tiempo. Este estudio examinó toda la población de presuntos PT en Israel entre 2008 y 2022 (excluido 2016), totalizando 2.297 ataques. La investigación reveló una alta agrupación espacial de ataques PT concentrados en "bosques calientes" específicos y que se mantuvieron estables en el tiempo. En conclusión, la concentración de los ataques PT requiere una respuesta antiterrorista especializada, equivalente a una "vigilancia policial en los puntos críticos", basada en las características de los potenciales bosques calientes terroristas.

Palabras clave: piro-terrorismo forestal; concentración espacial del terror; puntos calientes del terrorismo; prevención situacional del terror; endurecimiento del objetivo

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Abstrait
L'un des domaines de la recherche sur le terrorisme qui n'a pas été suffisamment examiné est la concentration géographique des attaques pyro-terroristes (PT). La littérature relative à la répartition géographique de la terreur se concentre généralement sur les macro-lieux : continents, pays, régions et micro-lieux – « points chauds ». Cependant, à notre connaissance, la répartition géographique de la terreur dans les forêts reste encore à étudier. Les résultats des études sur les « points chauds » sont d'une grande importance pour les praticiens de l'application des lois. Cette étude examine les caractéristiques spatiales de la forêt PT et s'il y a une concentration d'. Attaques PT dans un nombre limité de « forêts chaudes » stables dans le temps. Cette étude a examiné l'ensemble de la population forestière suspectée de PT. en Israël entre 2008 et 2022 (hors 2016), totalisant 2 297 attaques. La recherche a révélé un regroupement spatial élevé des forêts PT attaques concentrées dans des « forêts chaudes » spécifiques et qu'elles étaient stables dans le temps. En conclusion, la concentration de PT attaques nécessitent une réponse antiterroriste spécialisée, équivalente à une « surveillance des points chauds », basée sur les caractéristiques des forêts chaudes potentiellement terroristes.

Mots-clés: pyroterrorisme forestier; concentration spatiale de la terreur; points chauds de la terreur; prevention situationelle de la terreur; durcissement des cibles

抽象的
目标：恐怖主义研究中尚未得到充分研究的领域之一是火爆恐怖主义（PT）袭击的地理集中度。 有关恐怖地理分布的文献一般集中于宏观场所：大陆、国家、地区和微观场所——“热点”。 然而，据我们所知，森林中恐怖活动的地理分布仍有待研究。 “热点”研究的结果对于执法人员具有很大的相关性。 本研究探讨了森林 PT 的空间特征。 以及是否存在 P. T 浓度。 有限数量的“热森林”中的攻击随着时间的推移而保持稳定。
方法：本研究检查了疑似森林 PT 的整个种群。 2008 年至 2022 年（不包括 2016 年）期间，以色列共发生 2，297 起袭击事件。
结果：研究揭示了森林 PT 的高度空间聚类。 攻击集中在特定的“热森林”，并且随着时间的推移保持稳定。
结论：P. T 的浓度。 袭击需要根据潜在恐怖分子热点森林的特征，采取专门的反恐应对措施，相当于“热点警务”。

关键词： 森林纵火恐怖；恐怖空间集中；恐怖热点；态势防范；强化目标。

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خلاصة

الأهداف: أحد مجالات أبحاث الإرهاب التي لم يتم فحصها بشكل كاف هو التركيز الجغرافي للهجمات الإرهابية اليمينية (PT). وتركز الأدبيات المتعلقة بالتوزيع الجغرافي للإرهاب بشكل عام على الأماكن الكلية: القارات والبلدان والمناطق والمناطق الصغيرة. "الأماكن - "المناطق الساخنة". ومع ذلك، على حد علمنا، لم يتم بعد دراسة التوزيع الجغرافي للرعب في الغابات. إن نتائج دراسات "المناطق الساخنة" لها أهمية كبيرة بالنسبة للعاملين في مجال إنفاذ القانون. تبحث هذه الدراسة في الخصائص المكانية للمناطق الساخنة" Forest PT وما إذا كان هناك تركيز لهجمات PT في عدد محدود من "الغابات الساخنة" التي تكون مستقرة مع مرور الوقت.

طرق البحث: فحصت هذه الدراسة جميع سكان الغابات المشتبه بها في إسرائيل بين عامي 2008 و 2022 (باستثناء عام 2016)، والتي بلغ مجموعها 2297 هجوما.

النتائج: كشف البحث عن تجمعات مكانية عالية لهجمات PT تركزت في "غابات ساخنة" محددة وأنها كانت مستقرة مع مرور الوقت.

الاستنتاجات: إن تركيز هجمات PT يدعو إلى استجابة متخصصة لمكافحة الإرهاب، تعادل "مراقبة المناطق الساخنة"، بناء على خصائص الغابات الساخنة الإرهابية المحتملة.

الكلمات المفتاحية: الإرهاب الحراري للغابات; التركيز المكاني للإرهاب; بؤر الإرهاب الساخنة; الوقاية الظرفية للإرهاب; تصلب الأهداف.

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