WILDFIRES AS INCIDENCES OF ECOLOGICAL CRIME: A COMPREHENSIVE EXAMINATION OF THE WILDFIRES IN İZMIR CITY-REGION BETWEEN 25 JUNE AND 5 JULY 2025

ŠUMSKI POŽARI KAO OBLIK EKOLOŠKOG KRIMINALA: SVEOBUHVATNA ANALIZA ŠUMSKIH POŽARA U GRADSKOJ REGIJI IZMIRA U RAZDOBLJU OD 25. LIPNJA DO 5. SRPNJA 2025.

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The wildfires that occurred in İzmir city-region between 25 June and 5 July, 2025, are particularly noteworthy due to their media coverage. The aim of this paper is to contextualize these wildfires by adopting a socio-ecological perspective that categorizes the role of humans at different levels. It also develops a framework to present the damage they cause, together with their ignition points, while considering the crime dimension of each wildfire. For this purpose, each wildfire is contextualized with the support of not only remote sensing (RS) data providing the probable ignition points and exposing the damage caused by the wildfires in terms of total area burned, but also the news revealed in the media facilitating the elucidation of crime dimension of the wildfires. In terms of RS data, while Sentinel 2 data is used for the delineation of wildfire zones via ΔNBR, MODIS and VIIRS data is used for the specification of ignition points and the delimitation of fire isochrones. The delimitation of the wildfire zones exposed that a total of 29,612.73 ha was burned in İzmir city-region during the period studied. The majority of the wildfires whose causes are known stem from urban activities and the problems with the electricity transmission infrastructure are particularly responsible for 25% of all wildfire incidences. Overall, the paper reveals that co-employment of RS data with the news exposed in the media, on the one hand, provides stronger evidence about the ignition location and causes of the wildfires to unveil the suspects, and on the other hand, makes it possible to track the spread direction of each wildfire so that some precautions can be taken in both management of forest areas and spatial planning for prevention of similar kinds of incidences in the future. What is particularly evident from this inquiry into the contextualization of wildfire incidences and their crime dimension is that without a shift to a biophilic ontology it is not possible to tame the Anthropocene.

Keywords: ecological crime; climate change; wildfires; fire news; Sentinel 2; FIRMS

Šumski požari u gradskoj regiji Izmira između 25. lipnja i 5. srpnja 2025. značajni su zbog medijske pokrivenosti. Cilj ovoga rada je kontekstualizacija tih šumskih požara iz socioekološke perspektive određivanjem uloge ljudi na različitim razinama i razvijanjem okvira za izlaganje štete koju su prouzročili zajedno s njihovim točkama paljenja u odnosu na dimenziju kriminala svakoga šumskog požara. Šumski požari kontekstualizirani su uz pomoć ne samo podataka daljinskog istraživanja (DI) koji pružaju vjerojatne točke paljenja i otkrivaju štetu uzrokovanu šumskim požarima u smislu ukupne spaljene površine, već i vijesti objavljenih u medijima koje olakšavaju razjašnjavanje dimenzije kriminala šumskih požara. U kontekstu podataka daljinskog istraživanja, podaci Sentinel 2 upotrebljavaju se za razgraničenje zona šumskih požara putem ΔNBR-a, a podaci MODIS i VIIRS za specifikaciju točaka paljenja i razgraničenje izokrona požara. Razgraničenje zona šumskih požara otkrilo je da je u gradskoj regiji Izmir tijekom proučavanog razdoblja izgorjelo 29 612,73 ha. Većina šumskih požara prouzrokovana je urbanim aktivnostima, a problemi s infrastrukturom za prijenos električne energije odgovorni su za 25 % svih šumskih požara. Rad otkriva da istodobna upotreba RS podataka s vijestima izloženim u medijima s jedne strane pruža jače dokaze o mjestu paljenja i uzrocima šumskih požara kako bi se otkrili sumnjivci, a s druge strane omogućuje praćenje smjera širenja svakoga šumskog požara kako bi se mogle poduzeti neke mjere opreza u upravljanju šumskim područjima i prostornom planiranju radi sprječavanja sličnih vrsta incidenata u budućnosti. Ovo istraživanje kontekstualizacije slučajeva šumskih požara i njihove kriminalne dimenzije posebno ističe da se bez prelaska na biofilnu ontologiju ne može ukrotiti antropocen.

Ključne riječi: ekološki kriminal; klimatske promjene; šumski požari; vijesti o požarima; Sentinel 2; FIRMS

INTRODUCTION

İzmir city-region has climate characteristics consistent with the tectonic characteristics of the Aegean coast dominated by a Mediterranean climate. Accordingly, summers are hot and dry, winters mild and rainy, and springs are transitional, which combined with the soil structure, depending on rainfall and sunshine duration, makes the climate suitable for agriculture (Birdal et al., 2018). However, İzmir is the second-fastest rising city in the Europe–Mediterranean region in terms of climate risks including extreme heat, heavy rainfall, and drought (Kelebek et al., 2021). Although climate change is undeniable, the crime dimension involved in this process requires a closer inquiry into the particular stories of each destructive event. In this context, the wildfires occurring between 25 June and 5 July, 2025 in İzmir city-region especially deserve attention owing to the causes revealed in the media. Although the previous wildfires occurring in Antalya (Ohrili et al., 2022) and Muğla (Beyhan & Koca, 2022) during the summer of 2021 attracted public attention particularly due to the destruction of vast forest areas, their causes didn't receive as vivid media coverage as the recent wildfires in İzmir. There is no doubt that the long-term effect of climate change in the anthropocentric era is the chief factor leading to these disasters. However, such argumentation shouldn't obscure the role of any particular triggering cause in a given wildfire event. Thus, elaboration of the causes for each wildfire incidence as a case of crime is as important as the exposition of climate change's general trend. In this respect, recent wildfires experienced in İzmir city-region serve as a perfect laboratory to contextualize and expose the extent of ecological crime as regards human dimension involved in the process.

The temporal coverage of the study is delimited according to the pattern of news on the media. In Türkiye, particularly in summer times, the amount of news about wildfires peaks for a specific time period. In this context, although the study is based on a limited temporal scope of approximately two weeks, its spatial scope is more inclusive. Instead of designation of the case study region according to normative boundaries (such as province boundaries), in this study it is assumed that a better understanding of the causes of the wildfires can be achieved via a socio-ecological approach confirming the inevitable role of humans in the ecological system. If ecological crime can be considered as a result of human activities, the extent of crime considered can be properly analysed in terms of the regions revealed by the self-containment of the pattern of human activities. Thus, as the first step of this consideration, in this study the wildfires are contextualized with reference to the functional region exposed by the pattern of human mobility. It is for this reason that the study area is mainly designated with reference to greater İzmir city-region revealed in Beyhan (2019). This region covers not only the proper İzmir province, but also Aydın, ten districts of Manisa and one district of Balıkesir.

Formative effect of human factor on the ecological system can be considered at three different but interlinked levels. The first one is the long-term disturbance of ecological system by the activities of humans, which is now encapsulated within the concept of Anthropocene. Path-dependent nature of institutions created by humans and ecological system form the basis for the second level. For an examination of this level with reference to wildfires, Kirschner's study (Kirschner et al., 2023) is instructive. The concept of path-dependence actually has similarities with the concept of fire regimes (FR). In its broadest sense, FR refers to everything related to burning events in a given region and period characterized by a uniform and regular pattern of fires (Krebs et al., 2010). Since a given pattern of wildfire can be considered as part of the socio-ecological system sustaining a specific habitat, the stringent protection of an area from fire can have as devastating an impact on the existing habitat as over burning (Talbot, 1964). In this context, regarding the socio-ecological path dependency, a better understanding of FR can be achieved with the help of the concept of panarchy.

In fact, the concept of panarchy is not new for understanding wildfire events and taking precautions for them (e.g., Higgins & Duane, 2008; Winkler et al., 2022). It is based on the 'theory of adaptive change' whose basic principle is the system's ability to adapt to various changes (such as a wildfire) via four sequential phases; (1) 'exploitation' characterized by a quick populating of the area by numerous species (such as grasses), (2) 'conservation' characterized by the domination of the area by certain species (such as shrubs and woody plants) leading the system to become over-connected, rigid and ripe, (3) 'release' referring to a new disruption (such as a new wildfire because of increasing interconnection between the vegetation growing across forest floors and tree canopies), and (4) 'reorganization' setting the conditions for the subsequent phase of 'exploitation' with reference to innovation and restructuring of the system after the new 'creative destruction' (Higgins & Duane, 2008; Winkler et al., 2022).

As people live very close to the forests and traditional ecological knowledge (such as prescribed/cultural burning) is not properly used, reorganization function is interrupted in such a way that conservation phase tends to result in the extra fuel loads in forest areas close to settlements (Eisenberg et al., 2019; Winkler et al., 2022), which increases the fragility of forests nearby urban areas. In fact, this helps us understand the third level of human factor which refers to the direct involvement of any individual as a triggering factor in huge ecological disturbances such as the ignition of a wildfire that can be considered as a case of ecological crime. Although the rise of Anthropocene is inevitable due to the cumulative causation started by the overall pattern of human activities, the cases of individual ecological crime can be prevented by taking necessary precautions which, in turn, in the medium term, may alter the dynamics of the second level having impact on the first level. In this context, the third level exposing the apparent crime dimension of wildfires is particularly important in terms of the precautions that can be taken for sustaining the ecosystem's resilience. Due to the decreasing capacity of ecological system to adapt to the disturbance, if the system's resilience is exceeded, even a minor disturbance can lead to widespread collapse resulting in a regime shift (Sundstrom et al., 2023).

Although without a regime shift, forests have the capacity to regrow following the wildfire, associated with the climate change the post-fire changes in soil and moisture increase the likelihood of forests' conversion to grassland-bushes or different forest types particularly after the big wildfires characterized by an increase in fire intensity inhibiting the forests' recovery speed (Jiang et al., 2013). Indeed, while intense crown fires result in severe ecosystem damage and retardation of natural regeneration because of the destruction of a remarkable portion of the forest canopy and changes in microclimatic conditions, fire zones influenced by moderate-intensity surface fires preserve an important portion of tree regeneration and exhibit a faster recovery rate thanks to the preservation of the parent trees providing a seed bank and minimal soil disturbance (Zhanguzhina et al., 2025). That's why in an undisturbed regime, more frequent and regular collapses at smaller spatio-temporal scales can prevent culmination of the disturbances to huge scales (Sundstrom & Allen, 2019). However, recent large-scale wildfire events all over the world leave little room for such an outlook, which increases the importance of all possible forms of interventions to buy some time for taking precautions required to prevent these events from cascading up to giant-scale collapses. The systematization of the exposition and prevention of the crime dimension of the wildfire incidences is particularly important for this reason.

Parallel to the involvement of human factor in the ecological system, the crime dimension of the wildfires can also be studied at different scales or levels. A detailed typology for criminological theories from a place-oriented perspective reveals the relevance of ecological scales of macro, meso, and micro (Erdoğan & Erkan, 2021). While in terms of objects studied, macro level refers to a spatial hierarchy ranging from the inter-cities to international scope and a temporal hierarchy ranging from the decades to centuries in terms of structures of society as groups, classes or community; the micro level refers to a spatial hierarchy of individual addresses to street blocks and a temporal hierarchy ranging from the hours to minutes and seconds (Erdoğan & Erkan, 2021). On the base of their overview of sociological/criminological theories imprinted with an urban bias, for Erdoğan and Erkan (2021), the meso level is characterized by intra-city areas and neighbourhoods for a temporal scale ranging from years to days. Overall, the ecological scales of macro, meso, and micro are actually spatio-temporal scales and one can identify overlapping areas between these scales, which is also valid in this study considering the global scale as the macro scale and focusing on the overlapping areas of macro, meso and micro levels.

At the global scale, ecological crime is usually regarded as a result of the harmful actions of powerful elites driven by the politics and priorities of fiscal imperatives (Walters, 2023). This is also true for sub-global scale in terms of forest degradation caused by fires due to a motivation factor imprinted with excessive extraction of forest resources and the conversion of forests into profit-oriented landscapes by the political elites and oligarchs (e.g. Southeast Asia (Ansori, 2021)). Biodiversity loss, climate change, pollution or resource degradation representing the bio-physical and socio-economic consequences of various sources of threat and damage to the environment can be regarded as part of this crime at the global level (Brisman & South, 2020). At the level corresponding to macro scale, ecological crime can actually be defined as 'climate crime' and it can be seen as a result of actions of economically powerful transnational corporations and the political leaders denying climate change and favouring extractivist policies that increase greenhouse emissions and create environmental harm for the sake of power and profit (Bedford et al., 2020; Kramer & Bradshaw, 2020).

Pearson's (2025) inquiry into the role of mafia in the ignition of wildfires in Italy is very instructive in terms of understanding the organized ecological crime dimension of the wildfire incidences at a second level of agents corresponding to an interplay of macro and meso scales. Although organization of mafia is historically characterized by a struggle of dominance for intra-city areas between different illegal groups, it also gains a regional character by extending these relations to a space of inter-cities. By using Lefebvre's theory on the production of space, Pearson's (2025) geographical research elaborates the social reproduction of mafia groups deliberately setting fires, which exposes the fact that the arson in Sicily is part of a longer and deeper series of processes illustrating the transformations of the mafia in the past and present. According to Pearson (2025), in parallel to the transformation of the Cosa Nostra characterized by 'the spatial production of the mafia,' it is impossible to consider wildland arson as a singular crime. The Sicilian Mafia is operationalizing the landscape in new ways exposing not only the evolution in its organizational structure but also its changing relationship with the land.

Compared with the harmful actions of powerful elites and mafia, the roles of local corporate entities and individuals deliberately or unconsciously triggering wildfires form the third level of agents. The analysis thereof corresponds to an interplay of meso and micro scales that receive less attention when elaborating the wildfires as incidences of ecological crime. Nevertheless, this does not mean that they are less responsible for the disturbance of ecological system. At this level, micro scale overlaps with the meso scale in terms of agents involved in the process. On the one hand, there are individuals triggering a wildfire intentionally or accidentally, and on the other hand, it is also observed that some wildfires in certain neighbourhoods in a city or villages in a region can be attributed to the lack of care for which local corporate entities are responsible. Overall, the individual wildland arson, as a negative externality stemming from urban development, can be linked to high levels of carbon dioxide emissions, devastation of threatened vegetation ecosystems, reduced bio-diversity and disruption of water basins (Cozens & Christensen, 2011).

As a response to the ecological crime resulting from the activities of economically powerful transnational corporations, there are suggestions that they should be recognized as entities committing ecocide and be tried by the International Criminal Court (Whyte, 2020). This call can be extended to the second level of actors responsible for ecological crime via a series of organized actions. At the third level, for the wildfire incidents/arson caused/committed by individuals or local corporate entities as a singular crime, some actions are already being taken by each country in accordance with their particular legal system. However, the effectiveness of these measures is questionable. For example, with reference to forest fire-setting in Spain, Salvador (2016) remarks that the lack of accurate information about the causes of forest arson crimes have created a sense of impunity among potential fire starters, which is further compounded by the fact that very few forest fires were started by corporate entities (e.g., local electricity companies).

Since only lower-ranking employees were found guilty and no criminal convictions were issued against company executives or senior business personnel, the sense of invisibility of forest arson committed by state and corporate perpetrators is further stressed (Salvador, 2016). Thus, first of all, it is important to recognize each wildfire incidence as a possible case of crime and to address it with reference not only to the third, but also, if possible, to the second level of agents involved in the process. Once a wildfire incident is considered a crime, evidence is needed to charge suspects. Thanks to the media drawing on the public and private monitoring systems employed for security purposes, it is possible to trace the triggering events behind some wildfires. The video records created by these systems facilitate not only finding the suspects of wildfires, but also fixing the location of ignition points. Combined with the remote sensing (RS) data available from different satellites for observation of active fires (AF) and delimitation of wildfire zones via certain indexes, in turn, the location of ignition points unveiled in the media can be employed to ascertain and confirm the suspects. Another important contribution of availability of sub-daily AF data in particular, is the possibility of tracing the spread of wildfires from the ignition points to other parts of the wildfire zone, which can be used for taking precautions to prevent the spread of the periodical wildfires occurring at the same or nearby locations.

In this study, first the news that appeared on media are reviewed to expose the basic causes and location of the recent wildfires in İzmir city-region. This effort is integrated into not only RS methods mentioned above but also, if necessary, geo-referencing techniques making it possible to use drone photos shared in the news for the fixation of the fires' ignition points. In a similar fashion, Corine Land Cover (CLC) data helped us localize the approximate starting location of wildfires as exposed in the media in terms of description provided for the fires' origin and spread. Combined with the availability of DEM data that can also be used for the calculation of real surface area damaged during the wildfires, the spread of each wildfire can be visualized via fire isochrones for better understanding and contextualizing the events concerned, which also provides the critical place sensitive information that can be used for the prediction of fire risk potential of the areas exhibiting similar characteristics observed in the wildfire zones delimited in this study. In turn, these studies can be used in urban and regional planning process to take precautions for prevention of the wildfire disasters, and if necessary, to revise the existing spatial plans.

Within the framework drawn above, the next section outlines the method of analysis used in the delimitation of wildfire zones and tracking the spread of the fires from the point of ignition to the other parts of zones. In this section, initial findings are also presented for characterization of the zones exposed via the conducted analysis. The third section is devoted to the contextualization and elaboration of the causes of wildfires as reported in the media and confirmation of this news with the AF data compiled from FIRMS together with the particular story of each wildfire in terms of ignition and spread of the fire via creation of fire isochrones. The discussion section of the paper links the findings emerging out of third section to the conceptual framework drawn for the level of human agency involvement in wildfire incidents together with a set of implications of the conducted analysis for the required interventions and future research. The last section presents some concluding remarks with particular reference to the contextualization of wildfire incidences and their crime dimension in relation to the possibility of taming the Anthropocene via biophilic ontology.

THE DATA AND METHOD FOR DELIMITATION OF WILDFIRE ZONES AND FIRE ISOCHRONES

Two important issues in the delimitation of wildfire zones are the database used in the analysis and the method of delimitation of the wildfire zones. There are multiple options for the database available for the delimitation of wildfire zones such as Landsat 8 and Sentinel 2 data. Although Landsat 8 Operational Land Imager (OLI) bands have a resolution of 30 meters, Sentinel 2 bands have a resolution of 10 to 20 meters. Thus, Sentinel 2 images technically provide us with a relative higher resolution for the analysis of burned areas compared with Landsat 8 images. Sentinel 2 has also practical advantages in terms of the timely availability of the images related to atmospheric correction which is required to remove the effects of the Earth's atmosphere from the imagery before the calculation of burned areas. Hence, in this study for both technical and practical reasons, Sentinel 2 data are used. For Sentinel-2 data, the raw data obtained from the satellites are first used to prepare Level-1C (L1C) products which are radiometrically and geometrically corrected data with information on the satellite and sun angles. Subsequently, L1C products are processed to create Level-2A (L2A) products with atmospheric correction. Once L2A products are downloaded as described as the first step in Figure 1, the next step in the delimitation of wildfire zones is the employment of an analysis method for the delimitation of wildfire zones. One of the most widely used method for the delimitation of wildfire zones is the calculation of Normalized Burn Ratio (NBR) whose overall accuracy is higher than the other practical indices such as Normalized Difference Vegetation Index (NDVI). For the calculation of NBR, Near Infrared (NIR) and Short-Wave Infrared (SWIR) bands are required. It is known that although in NIR band healthy vegetation has a high reflectance, the burnt areas have a very low reflectance. In the case of SWIR band, the situation is exactly the opposite. These observations reveal that in NIR and SWIR parts of the spectrum the difference between the spectral responses of healthy vegetation and burnt areas peaks, which forms the basis of NBR formula as given below (Equation 1).

$$NBR = \frac{NIR - SWIR}{NIR + SWIR} \qquad (1)$$

From the formula it follows that NBR ranges from -1 to 1. A high NBR value shows healthy vegetation, while a low value signifies recently burned areas. NBR values calculated for the post-fire are subtracted from NBR values calculated for the pre-fire (Equation 2) for calculation of ΔNBR exposing the burnt areas and providing a quantitative measure of the change (Nasery & Kalkan, 2020; Saulino et al., 2020). As Beyhan and Koca (2022) remark, although there are two well-known classification schemes for ΔNBR (the one proposed by the United States Geological Survey (USGS) and the other one proposed by the European Forest Fire Information Service (EFFIS)), there is no vital difference between them. In this study, USGS' scheme is used for the classification of ΔNBR as remarked in the workflow presented in Figure 1. It is known that while burnt areas have positive ΔNBR values, unburnt areas have negative ΔNBR values or a value close to zero. A ΔNBR threshold value of +0.1 is found by Rahman et al. (2018) as appropriate for differentiation of burnt areas from unburnt areas if Sentinel-2 data is used.

$$\Delta NBR = NBR_{prefire} - NBR_{postfire} \qquad (2)$$

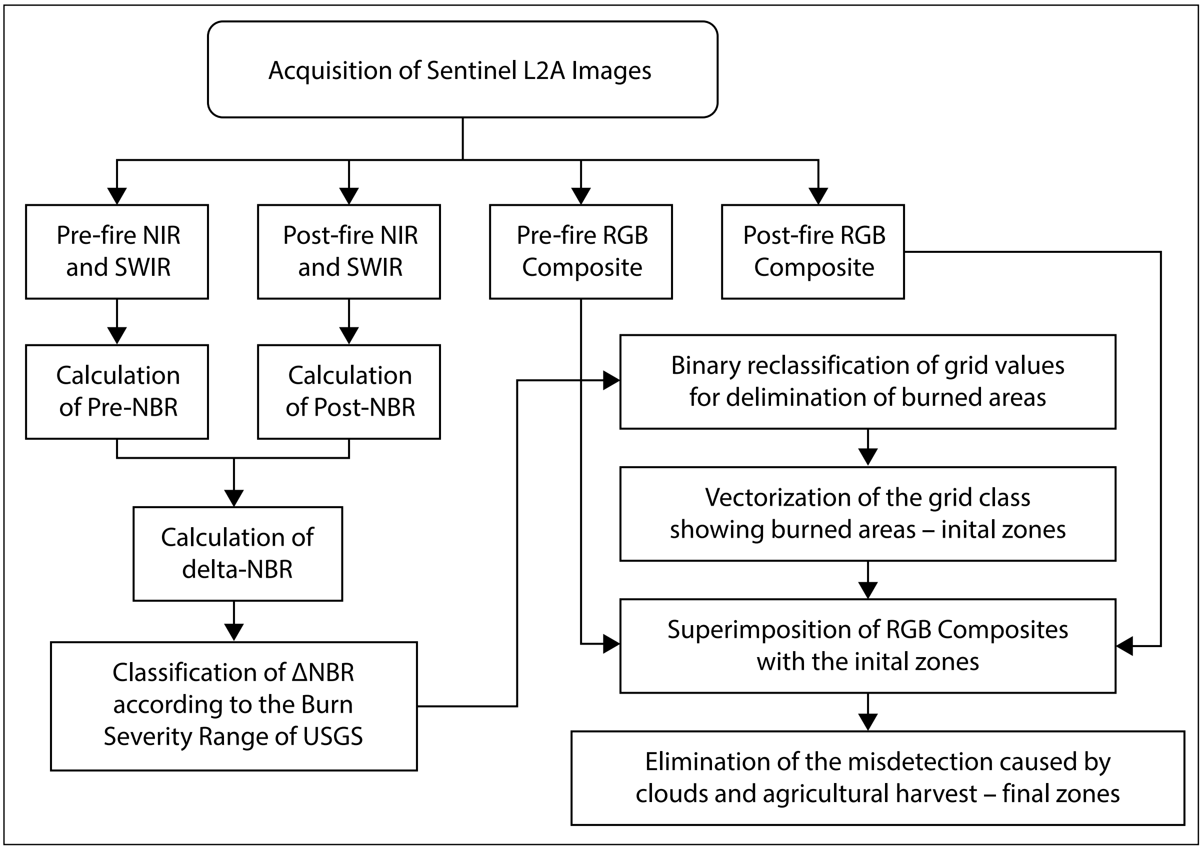

Figure 1 *Workflow used for the delimitation of wildfire zones*

After calculating ΔNBR, in the next stage of workflow the resulting raster grid file is also reclassified with reference to a binary classification (above (1) or below (0) +0.1) for exposition of the burned areas which are subsequently vectorized for initial screening. Before the final stage of the workflow, the resulting vector file is superimposed with RGB composites for the elimination of false classification caused by the clouds and agricultural harvest. For this purpose, a manual inspection is used as the size of study region allows for such an inspection. Following the delimitation of wildfire zones, a series of polygon overlay analyses is also conducted by overlaying the wildfire zones with the layers showing land-cover types and administrative boundaries (Figure 2), which provides us with valuable inputs for not only the amount of burned areas for different types of land cover but also the fixation of ignition points of the wildfires. For example, it is known that some of the wildfires have started in agricultural areas or urban areas and quickly spread to the nearby forest areas. As an intermediate step of post-delimitation workflow, the real surface area of each feature in the resulting overlay layer is calculated by using DEM data, which exposes the actual damage in terms of burned areas in different zones.

For the calculation of real surface areas and also exposition of spread of the wildfires, the Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) Version 3 satellite images providing a DEM of land areas on Earth at a spatial resolution of 1 arc second (approximately 30 meters horizontal posting at the equator) are used. The ASTER GDEM data products are developed as a collaborative effort between National Aeronautics and Space Administration (NASA) and Japan's Ministry of Economy, Trade, and Industry (METI). For the specification of the pre-fire land cover types for different parts of each wildfire zone, CORINE Land Cover (CLC) 2018 vector files are also used. CLC product used by a multitude of users for various purposes including environmental monitoring, land use planning, climate change assessments, and emergency management provides a pan-European land cover in-

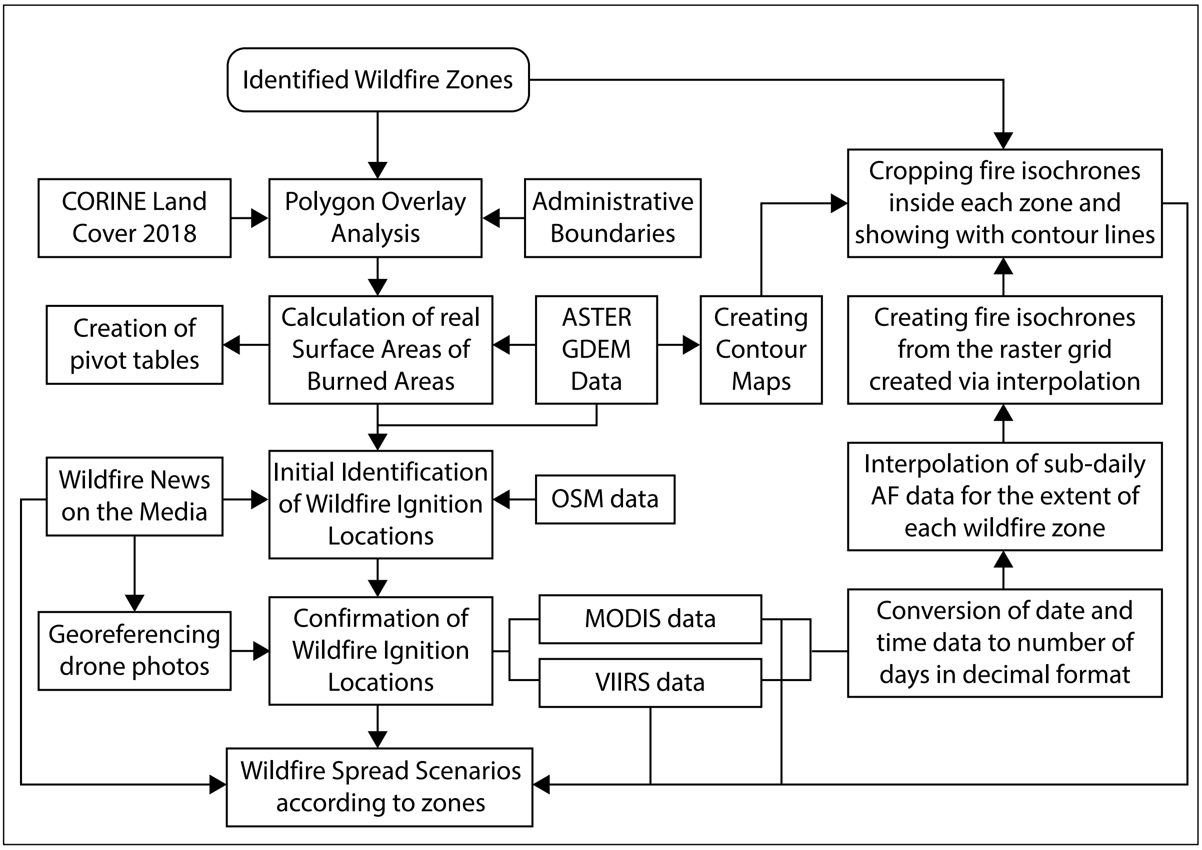

Figure 2 *Workflow used in the characterization of wildfire zones with news and RS data*

Table 1 *Wildfire zones identified within İzmir city-region according to ignition date and area (ha)*

WZ*	Wildfire ignition location according to descriptions provided in the news published in the media via internet	Ignition date	Plane Area	Surface Area	Rank Size
1	Beyazevler neighbourhood of Gaziemir	2025-06-29	90.86	92.21	15
2	Menemen Asarlık Village	2025-06-27	112.92	118.50	12
3	Yakaköy neighbourhood of Bornova	2025-06-27	187.03	189.10	10
4	From Manisa Çepnidere to Kemalpaşa Halilbeyli Village	2025-07-02	273.57	278.47	9
5	Dereköy neighbourhood of Manisa's Ahmetli District	2025-06-30	767.86	802.35	8
6	Horozgediği neighbourhood	2025-06-25	890.30	913.47	7
	Bozköy neighbourhood	2025-06-26			
7	Zafer neighbourhood's Olduruk area in Buca	2025-07-03	1,537.69	1,553.56	6
8	Tosunlar neighbourhood of Ödemiş District	2025-07-02	2,200.04	2,386.16	5
9	Between Kuyucak and Orhanlı neighbourhoods	2025-06-29	4,688.44	4,930.11	3
10	The fire spread to the Doğankent Site (Seferihisar's coastal zone)	2025-06-29	4,850.85	5,002.24	2
11	Çeşme wildfire zone: an agricultural area in the Ildır neighbourhood	2025-07-02	9,616.47	9,763.34	1
12	From Düzce Village (Seferihisar) to TOKI	2025-07-01	109.00	110.44	13
13	Gözsüzler area of the Camikebir neighbourhood (Seferihisar)	2025-06-29	22.94	22.58	18
14	Alacalı neighbourhood of Tire	2025-06-29	165.53	169.78	11
15	Kızılçukur neighbourhood of Dikili District	2025-06-25	29.53	29.78	17
16	Karaköy neighbourhood of Manisa's Akhisar District	2025-06-28	2,924.84	3,080.66	4
17	Kızılçakır area of Yazıkent neighbourhood in Aydın	2025-06-28	94.487	101.57	14
18	An agricultural field in the upper Eskihisar neighbourhood in Aydın	2025-06-29	43.04	47.60	16
19	An agricultural-scrub area near Kırksakallar neighbourhood in Aydın	2025-07-02	19.92	20.76	19
Sum	Total of all wildfire zones	-	2,8625.31	2,9612.73	-

* Wildfire zone

Source: the author; based on the wildfire news in the media

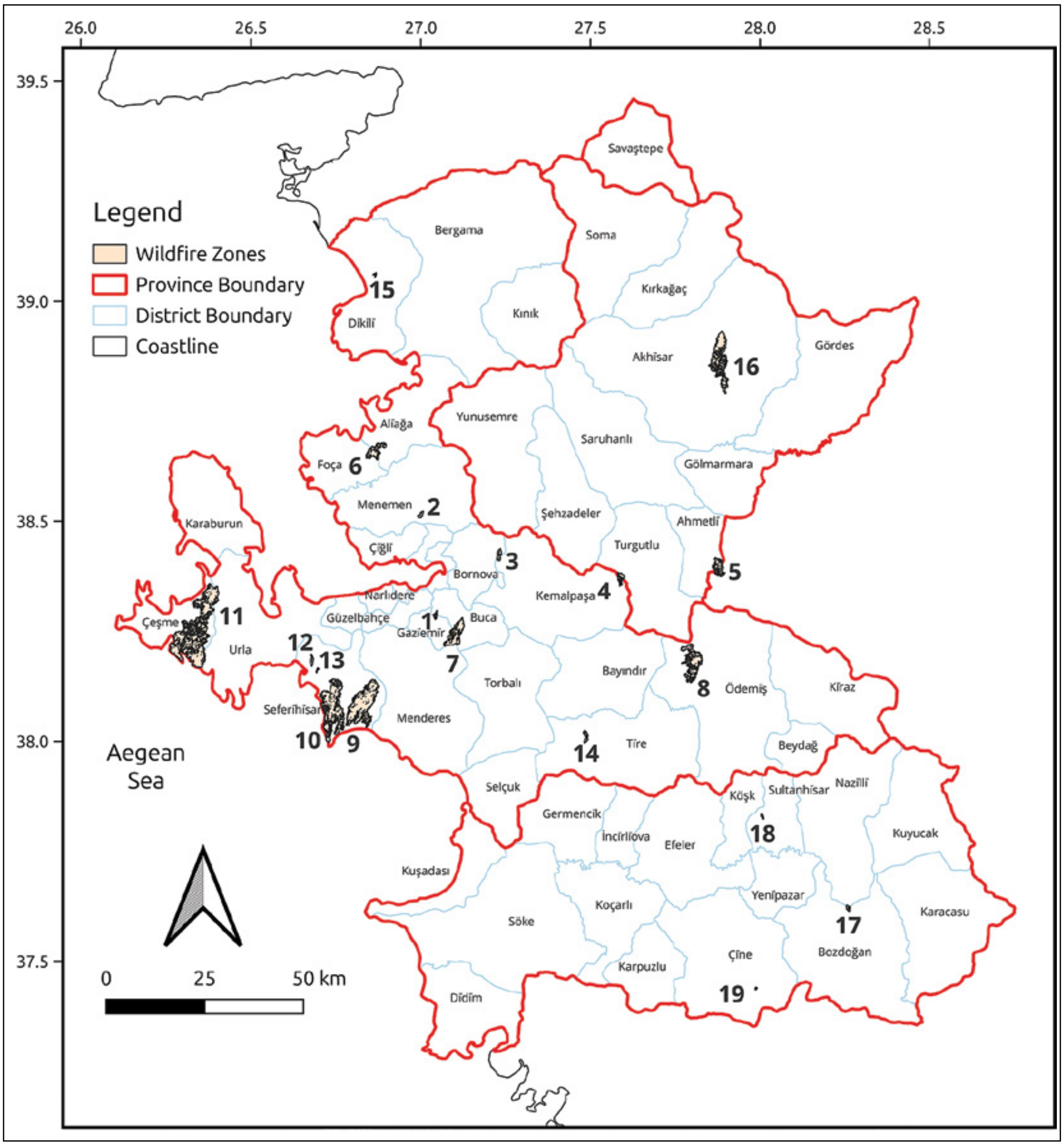

Figure 3 *Wildfire zones identified within İzmir city-region*

Source: the author; based on the analysis conducted in this study by using Sentinel 2 data together with the district & province boundaries obtained from Türkiye's General Directorate

cluding Türkiye and land use inventory for 44 thematic classes that range from broad forested areas to individual vineyards and agricultural areas.

Delimitation of wildfire zones reveals that a total of 29,612.73 ha was burned in İzmir city-region between 25 June and 5 July, 2025 in terms of real surface area (see Table 1 and Figure 3). The largest continuous wildfire zone (zone 11) is Çeşme zone with an area of 9,763.37 ha. Although the respective zone occupies areas (23.28%) also from Urla, the large part of the wildfire (76.72%) is within the boundaries of Çeşme. It is followed by the zone characterized by coastal area of Seferihisar (10th zone) with an area of 5,002.24 ha. Actually, in Seferihisar very close to the zone 10, there is another big wildfire zone (Orhanlı neighborhood of Seferihisar – zone 9) having an area of 4,930.11 ha. Thus, a total of 9,932.35 ha was burned in two very close big wildfire zones mainly covered by Seferihisar, which actually places them together as the biggest recent wildfire region. Although zone 9 also partly occupies areas from Menderes covering 11.54% of the zone, 88.46% of the zone is located within Seferihisar. The fourth biggest wildfire zone (zone 16) is outside İzmir provincial boundaries. It is mainly located in Karaköy Neighborhood of Manisa's Akhisar District with an area of 3,080.66

ha. Following these wildfire zones, there are two other wildfire zones exceeding an area of 1000 ha; the wildfire started (zone 8) at Tosunlar neighbourhood of Ödemiş with an area of 2,386.16 ha and the wildfire (zone 7) ignited at Olduruk area of Zafer neighbourhood in Buca with an area of 1,553.56 ha. Zone 7 occupies areas from not only Buca (49.53%), but also from Gaziemir (41.73%) and Menderes (8.74). As shown in Table 1, each of the other wildfire zones occupies an area less than 1000 ha. Overall, in terms of total burned area, the greatest damage during the period analysed in this study was experienced in Seferihisar district with a total of 9,438.02 ha (32.31% of the burned areas). It is followed by Çeşme (25.59%), Akhisar (10.46%), Ödemiş (8.08%) and Urla (7.75%).

In the next stage, ignition points of wildfires are exposed by locating the information available in media for each wildfire on the map with the help of administrative boundaries and OpenStreetMap (OSM). For the confirmation and detection of wildfires' ignition locations and direction of spread, the data processed and provided by NASA's Land, Atmosphere Near real-time Capability for Earth observation (LANCE) / Fire Information for Resource Management System (FIRMS) were actively used in the study. FIRMS distributes NRT (Near Real-Time) AF data collected from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard Aqua and Terra satellites, and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard S-NPP, NOAA-20 and NOAA-21 satellites. These data are normally updated 6 times daily and usually available within 2-3 hours of satellite observation and reflect a growing tendency for the use of 'analysis ready data,' which reduces the Earth Observation System data pre-processing burden on users by enabling easier and faster analyses (EFFIS, 2018). AFs are calculated according to the thermal anomalies produced by them. If the temperature of the land cover surrounding a potential fire is above a given threshold, the fire is confirmed as an AF. While the MODIS AF and Thermal Anomalies product has a resolution of 1 km, the VIIRS AF and Thermal Anomalies product has a resolution of 375 m.

MODIS product is available from the NASA EOS Terra satellite launched in late 1999 and Aqua satellite launched in early 2002. While Terra has a morning (10:30) overpass, Aqua has an afternoon (13:30) overpass. MODIS AF data has two versions: (1) MCD14DL NRT products that may be subject to geo-location errors or reprocessing but available daily, and (2) standard MCD14ML products becoming available usually after 2 months for replacement of the NRT fire data (NASA MODIS Science Data Support Team, 2025; NASA FIRMS, 2025a). VIIRS product is available from the NASA NOAA Suomi National Polar-Orbiting Partnership (S-NPP) satellite launched in 2011, NOAA-20 (formerly JPSS-1) launched in 2017 and NOAA-21 (formerly JPSS-2) launched in 2022. The temporal resolution of VIIRS products is twice daily. While the nominal (equator-crossing) observation times for VIIRS S-NPP (VNP14IMGTDL) are 1:30 and 13:30, the orbit of NOAA-21 (VJ214IMGTDL) (1:05 and 13:05) is about 50 minutes ahead of NOAA-20 (VJ114IMGTDL) (1:55 and 13:55) with S-NPP orbiting between them, which make it possible for researchers to make observations within approximately 1 hour of one another particularly for mid-latitudes (NASA FIRMS, 2025b; EFFIS, 2018). Although S-NPP AF data has again two versions (1-daily available VNP14IMGTDL NRT products and 2-standard data VNP14IMGTML which is available with a 3-month lag), NOAA-20 and NOAA-21 AF have only NRT versions without the standard quality data: VJ114IMGTDL NRT products for the former and VJ214IMGTDL NRT products for the latter (NASA FIRMS, 2025a).

Even though MODIS instruments were designed with a nominal five-year life, they are still in operation. Availability of VIIRS product provides a continuity of data products relying on Aqua. However, data continuity for the products provided by Terra cannot be achieved if it is taken out of service. When interpreting

MODIS and VIIRS data, it should be kept in mind that the accuracy of AF locations shown on the map depends on the sensor's spatial accuracy (EFFIS, 2018). In this context, actually, as elaborated in the next section with reference to each individual zone, in some zones hotspots correspond to neither the wildfire zone delimited by using Sentinel 2 data nor the ignition points identified according to news compiled for this study from the web. Although a knowledge-based algorithm is applied for determination of AF by considering surrounding land cover categories' extent, hotspot's confidence level and distance to urban areas and artificial surfaces to prevent false detections, some fires may be undetected due to the smoke or cloud and if their size are too small (EFFIS, 2018), which is also confirmed by superimposing wildfire zones with MODIS and VIIRS data in this study. Indeed, for some zones there is no ignition point in MODIS and/or VIIRS. Lastly, some of the hotspots aren't fires as other heat sources are also detected by satellites (EFFIS, 2018). That's why, it possible to encounter many individual hotspots outside the identified wildfire zones, which is also experienced in this study.

AF data compiled from FIRMS contains latitude, longitude, the active fire pixel's brightness temperatures measured in Kelvin, FRP (Fire Radiative Power) usually expressed in MW (MegaWatts), confidence, satellite (A=Aqua, T=Terra, N=Suomi NPP, N20=NOAA-20, N21=NOAA-21), acquisition date and time, and acquisition type (D=Daytime fire, N=Nighttime fire) information (NASA Earthdata, 2025). Among these attributes, confidence level expressed either in % or intervals showing the confidence of existence of a fire within a pixel is particularly important for this study. Although it is available in percentages ranging between 0 and 100 for MODIS data, it is available as intervals ($0\% \leq C < 30\%$ for low, $30\% \leq C < 80\%$ for nominal, and $80\% \leq C \leq 100\%$ for high) for VIIRS data (Giglio et al., 2016; Giglio et al., 2020). Confidence is intended to help users estimate the quality of individual fire pixels (Giglio et al., 2020). While low confidence pixels are daytime fire pixels characterizing areas of Sun glint and lower relative temperature anomaly, nominal confidence pixels are either daytime or nighttime data that are free of potential Sun glint contamination during the day and marked by strong (>15K) temperature anomaly, and high confidence pixels reflect daytime or nighttime pixels greatly exceeding the saturation temperature (Schroeder & Giglio, 2018). In this study, all hotspots with a confidence level equal to or above nominal level of confidence are used for both identification of ignition points and exposition of each wildfire's spread via isochrones.

Employment of MODIS and/or VIIRS AF data for mapping the daily and/or sub-daily progression of wildfires is widespread (Barber et al., 2024; Frantz et al., 2016; McClure et al., 2023; Scaduto et al., 2020; Veraverbeke et al., 2014). Various geospatial interpolation techniques such as kriging, inverse distance weighting (IDW) and natural neighbour can be used for creation of continuous fire progression maps (FPM) (Scaduto et al., 2020; Veraverbeke et al., 2014). Although IDW is a less complex interpolation model compared with kriging, Veraverbeke et al. (2014) remark that it has a performance similar to that of kriging. For a given number of data values (n) and the number of nodes requiring interpolation (m), while the computational and algorithmic complexity of IDW ranges from $O(mn)$ to $O(mn^2)$ thanks to its numerical simplicity and straightforward implementation, kriging's computational and algorithmic complexity ranges from $O(nm+n^3)$ to $O(mn^3)$ as it necessitates the addition of the step of finding and fitting a suitable covariance model prior to the construction of the covariance matrix C (Braham et al., 2014; Henneböhl et al., 2011; Reed et al., 2000). Overall, kriging encompasses three additional operations; (1) the construction of the covariance matrix C, (2) the solution of an n x n linear system and (3) the summation of the weighted data values (Henneböhl et al., 2011). In this study, owing to its simplicity, IDW is designated as the spatial interpolation model for the creation of continuous FPMs for the wildfire zones having adequate AF data. Prior to the availability of sub-daily and abundant AF data from satellites, isochrones were produced through temporal georeferencing of aerial fire photographs (Manzano-Agugliaro et al., 2014).

Thanks to the availability of RS data at appropriate spatial and temporal resolutions, FPMs showing fire isochrones can be easily produced. In many case studies, FPMs created by using interpolation techniques closely matched the actual observations made in the field (Veraverbeke et al., 2014), which proves their usability in mapping fire progression by employing AF data. Although in some studies only one of the AF products (MODIS or VIIRS) distributed by FIRMS is used (e.g., Veraverbeke et al., 2014), some of the studies draw on both products by pooling VIIRS and MODIS (e.g., Barber et al., 2024). The potential of aggregating MODIS and VIIRS AF data is particularly important for sub-daily fire mapping, which was also performed in this study. Interpolation of AF data provides us with a raster grid showing the fire arrival times that can be used to produce vector files showing the fire isochrones (spread zones) according to the sub-daily intervals (calculated in hours or minutes).

For the production of FPMs in this study, first a model script that can be used to merge downloaded .shp files representing VIIRS and MODIS data was produced in QGIS, a Free and Open-Source Software (FOSS) for GIS. Subsequently, another model script was produced for the creation of a raster grid showing the arrival time of fire in each pixel for each wildfire zone. For this purpose, date data was converted into a decimal number representing the date concerned in terms of number of days. The resulting number is multiplied by 100 before the calculation of IDW interpolation. After the production of raster grid created via IDW interpolation, the contour lines actually representing isochrones are produced for a specific interval value defined for the zone concerned. In the last stage of the model, the numerical values representing these contours are converted back to date format in terms of hours and minutes for the visualization of FPMs.

In addition to AF data from satellites, fire news are also used for identification of active fires (EFFIS, 2018). One such example is fire news section of European Forest Fire Information System (EFFIS). Unfortunately, it is observed that only one piece of fire news is available at the respective website (Firenews Viewer, 2025) in relation to a fire occurring before the period studied in this study for Türkiye. One of the important limitations of this system seems to be identification of fire locations from the news. In this study, this difficulty was overcome by the employment of various sources including not only fire news but also OSM and CLC data for geo-locating the fires' ignition points. The next section addresses this process for each wildfire delimited in this section in order to expose the match between the fire ignition locations revealed in the media and the AF locations compiled from FIRMS, which provides us with critical information not only for confirmation of fire narratives, but also if applicable, for resolving and contextualizing the crime dimension of each wildfire.

THE NARRATIVES AND CAUSES OF WILDFIRES AS REPORTED IN THE MEDIA AND THEIR CONFIRMATION WITH REMOTE SENSING DATA

While overviewing news published on the web, the first ignition location of each wildfire is ascertained by benefiting from both wildfire zone map delimited in the previous section and descriptions provided for each wildfire in the media. In this process, not only OSM and administrative boundaries but also CLC data and geo-referencing tools are used if necessary. After geo-locating the fire, the date of occurrence and cause of the wildfire are compiled from the news. The resulting information are given in Table 2. In this section, individual story of each wildfire is elucidated for the contextualization and confirmation of fire progression via AF

Table 2 *Date of occurrence and causes of wildfires according to the news*

WZ*	Date	Description of the cause and/or starting point of fire according to the news	News source
1	06.29	The fire broke out in a garbage dump in Beyazevler neighbourhood of Gaziemir.	İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü (2025) İzmir'de yangın Otokent Galericiler Sitesi'ne sıçradı (2025)
2	06.27	The fire started at night in Menemen Asarlık.	İzmir Hakkında (2025) Menemen Havadis (2025)
3	06.27	The fire broke out in Yakaköy neighbourhood during renovations on the roof of a house, when sparks, driven by the wind, it first spread to the house's grounds and then to the forest.	40 derecede kaynak yaptı, yangın çıktı! (2025)
4	07.02	The fire started in an electrical transformer in a field near the rural Çepnidere neighbourhood of Turgutlu, Manisa. It quickly spread over a wide area including Halilbeyli neighbourhood in İzmir.	Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı (2025) Manisa'da çıkan (2025)
5	06.30	The fire started in a garbage dump in the Dereköy neighbourhood of Manisa's Ahmetli district and spread to a forested area.	Ahmetli orman yangını (2025) Ahmetli'deki orman yangını (2025)
6	06.25	The forest fire broke out in the Horozgediği neighbourhood of Aliağa due to a power line. It was intensified by strong winds and spread across a wide area, crossing the border into Foça.	İzmir'in Aliağa ilçesinde (2025) İzmir'de ateş çemberi (2025)
	06.26	The fire originated from garbage burned without permission by an individual near the industrial facilities in the Bozköy neighbourhood and quickly spread to the surrounding forest area.	Aliağa'da yangınla (2025) Aliağa'da alevler (2025) Alevlerle 11 saatlik mücadele (2025)
7	07.03	The sparks from an unlicensed construction site that cut and welded iron in Olduruk area (Kaynaklar area) of Zafer neighbourhood caused the fire.	Buca'da yanan ormanlık alan (2025) İzmir Buca'daki orman yangını (2025) Buca'da orman yangını (2025)
8	07.02	The forest fire broke out in Suçıktı and Tosunlar neighbourhoods because of electrical wires.	Ödemiş yangınında (2025) Ödemiş'te yangının nedeni (2025) Rapor çıktı (2025)
9	06.29	The forest fire broke out in a forested area between Kuyucak and Orhanlı neighbourhoods. The fire was believed to have been caused by an electrical wire.	İzmir'de yangın kabusu (2025) İzmir'deki Yangının Boyutu (2025)
10	06.29	The fire broke out probably as a result of unextinguished cigarette butts thrown or accidentally dropped by a person near a residential area in the Tepecik neighbourhood of Seferihisar and spread to a part of the factory at the Ozer Turer Farm in the area.	İzmir'de Son Dakika (2025) Oluşum Haber (2025a)
11	07.02	The fire started in an agricultural area in the Ildır neighbourhood and spread to the forest. Governor Elban stated, 'We believe the fire started on a power line.'	İzmir Çeşme'de korkutan yangın! (2025) İzmir Çeşme'de orman yangını (2025) İtfaiye Raporladı (2025)
12	07.01	The fire began in Düzce Village and quickly spread due to strong winds. The cause of the fire has not yet been determined.	Düzce'de yangın (2025) Seferihisar'da alevler durmuyor (2025)
13	06.29	The fire broke out in the Gözsüz-ler area of the Camikebir neighbourhood in Seferihisar.	Oluşum Haber (2025b)
14	06.29	The fire broke out in a scrub area near the Alacalı neighbourhood for an as yet unknown reason. Driven by strong winds, the flames quickly reached the centre of the neighbourhood.	Tire'deki yangın yerleşim alanına sıçradı (2025) Yerel Güç Haber (2025)
15	06.25	Kızılçukur neighborhood of Dikili District	Egeli Duysun (2025)
16	06.28	The fire started in a forest area near the Karaköy neighbourhood of Manisa's Akhisar district because a beekeeper in the area used smoke to calm the bees.	Akhisar'daki orman yangınına müdahale (2025) Akhisar'da yangın sürüyor (2025)
17	06.28	The fire broke out in the Kızılçakır area of Yazıkent neighbourhood in Bozdoğan.	Aydın'da saatlerdir süren orman yangını (2025) Manisa ve Balıkesir'de yangın sürüyor (2025)

WZ*	Date	Description of the cause and/or starting point of fire according to the news	News source
18	06.29	The fire ignited in an agricultural field in the upper Eskihisar neighbourhood for an as yet unknown reason. Although it was brought under control, it restarted in the same area.	Aydın'da ziraat alanında çıkan yangın (2025)
19	07.02	The fire broke started in an agricultural & scrub area near the Kırksakallar neighbourhood of Aydın's Çine district for an as yet unknown reason.	Aydın Çine'de ziraat ve makilik alanda yangın! (2025) Aydın'da yangın (2025)

* Wildfire zone

Source: the author; based on the wildfire news in the media

hotspots and particularly crime dimension involved in each fire, which reveals the potential of co-employment of news and RS techniques together with GIS.

The biggest wildfire zone as exposed in the previous section is wildfire zone 11. According to the news it was reported that the fire started in an agricultural area in the Ildır neighbourhood of Çeşme and spread to forest and shrubland (İzmir Buca'daki orman yangını, 2025; Muğla Metropolitian Municipality, 2025). İzmir Governor Süleyman Elban, regarding Çeşme fire, stated that they believe the fire started from a power line on the base of the initial assessment made by technical teams and the statements of eyewitnesses (İzmir Çeşme'de orman yangını, 2025; Sağol, 2025). The ignition location was also confirmed by the İzmir Fire Department in a fire report stating that the fire was caused by a short circuit in the power lines located in some of the plots in the area (İtfaiye Raporladı, 2025). The fire that spread to Alaçatı neighbourhood was brought under control on 4 July. Based on these descriptions and information, as the ignition point of fire, agricultural areas within Ildır neighbourhood and wildfire zone concerned are searched on the map and a big red node with yellow boundaries is placed on the map for the starting point of fire according to news (Figure 4).

Subsequently, a continuous FPM is produced by using IDW and AF data compiled from both MODIS and VIIRS products having a confidence level equal to or above nominal level of confidence. Figure 4, which also shows the earliest ignition points (First Points according to AF data) with a 20-meter contour interval in the wildfire zone, confirms the statements reflected in the news as for the origin of the wildfire concerned. Indeed, AF data confirms the ignition of the fire in agricultural land (complex cultivation patterns) and its quick

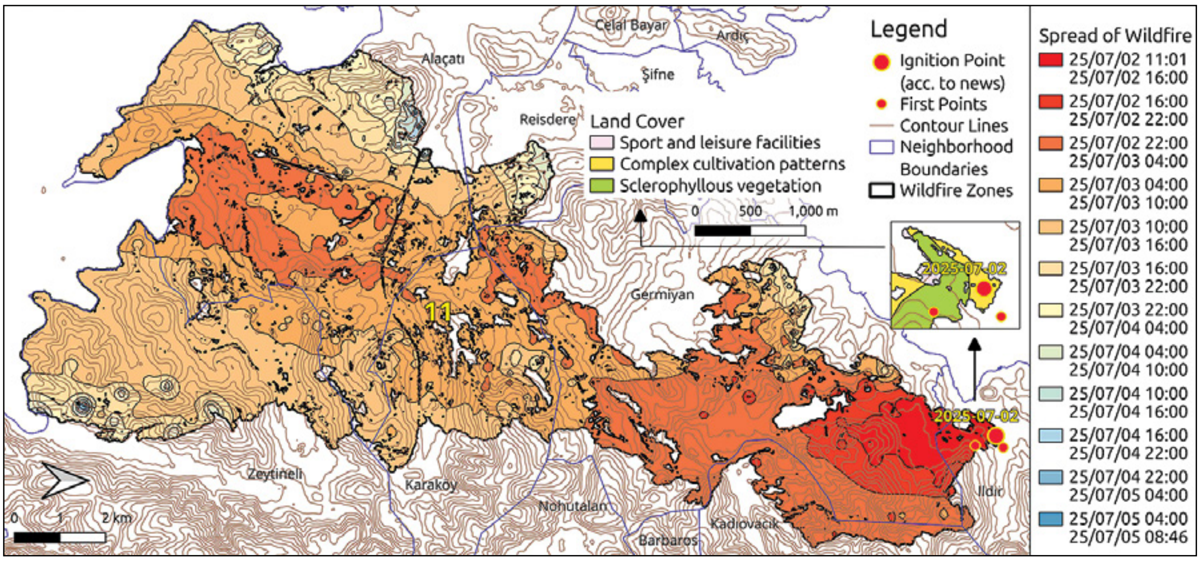

Figure 4 *FPM produced for wildfire zone 11 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

spread to nearby forest area. The spread of the fire from north (Ildır) to further south (Alaçatı) and its control on 4 July is also successfully exposed via the interpolation of AF data within the boundaries of wildfire zone. Sağol (2025) remarks that parallel to Çeşme wildfire, namely Foça fire and Seferihisar wildfire were also allegedly been caused by a power line. However, according to both news and AF data, there are multiple sources of fire ignition for the wildfire zone 6, also covering fire named by Sağol (2025) as Foça, and in the case of Seferihisar, there are multiple wildfire zones (two big zones (9 and 10) and two small zones (12 and 13)) isolated from each other.

Indeed, in some zones there are multiple ignitions points whose spread areas merge with each other. One such zone is the wildfire zone 6 (Figure 5). The wildfire first broke out in a forest area in the Horozgediği neighbourhood of Aliağa and it was intensified by strong winds spreading across a wide area crossing the border into Foça (İzmir'in Aliağa ilçesinde, 2025; İzmir'de ateş çemberi, 2025). The first ignition point's location is fixed, according to news, administrative boundaries and CLC data. Parallel to Çeşme wildfire, by assessing the initial findings for the cause of first ignition point Governor Elban stated that they believe the fire started again from a power line (İzmir'de ateş çemberi, 2025).

Following a 22-hour firefight in Aliağa, flames began to rise again in Aliağa. This time fire broke out near industrial facilities in the Bozköy neighbourhood and spread into the forest (Aliağa'da yangınla, 2025; Aliağa'da alevler, 2025). This second fire in the zone originated from garbage burned without permission by an individual near the industrial facilities in the Bozköy neighbourhood and the suspect who allegedly caused the fire was detained by gendarmerie officers (Aliağa'da alevler, 2025; Alevlerle 11 saatlik mücadele, 2025). The location of the fire can also be confirmed by CLC data.

Wildfire zones mostly covered by Seferihisar also deserve attention owing to their proximity to each other. As elaborated in the previous section, wildfires zones 9 and 10 follow-

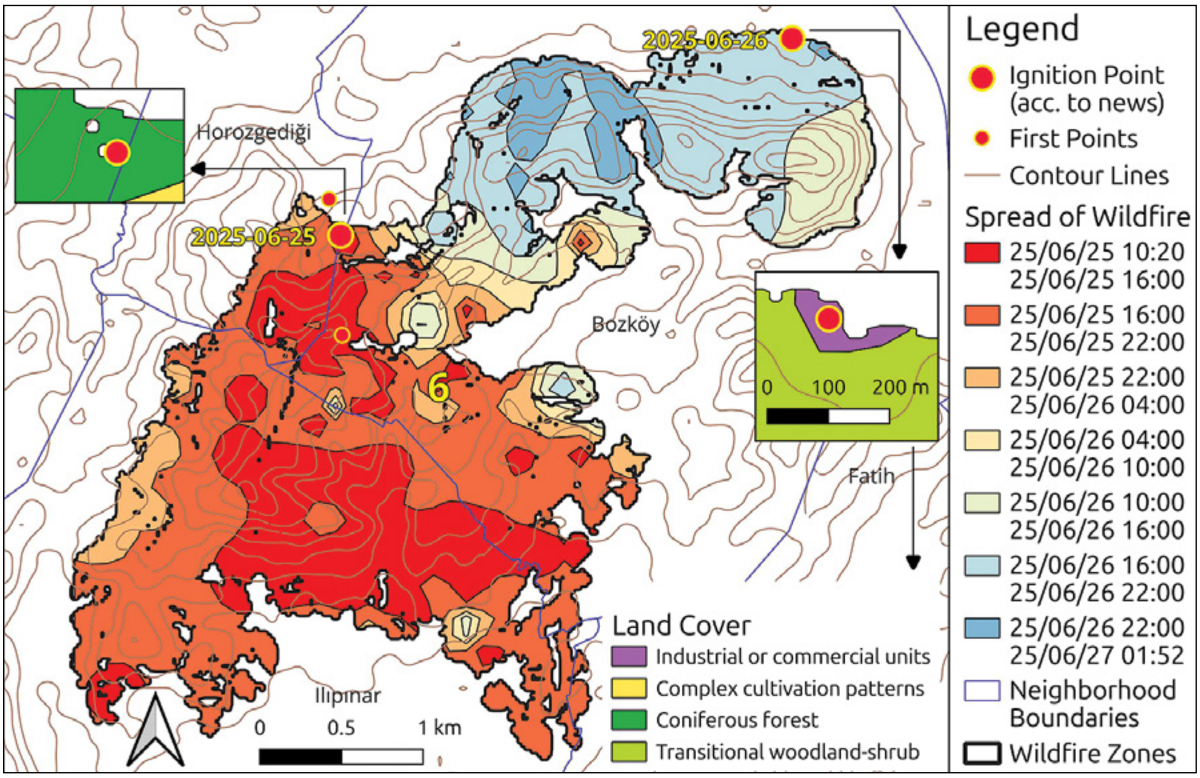

Figure 5 *FPM produced for wildfire zone 6 in combination with ignition points, according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

ing the wildfire zone 11 (Çeşme) in terms of their size are very close to each other, which led to their joint analysis in this study (Figure 6). Ignition point for wildfire zone 9 is in a forest between Kuyucak and Orhanlı neighbourhoods (İzmir'de yangın kabusu, 2025; İzmir'deki Yangının Boyutu, 2025). In this study, a small area covered by a coniferous forest at the northern part of the zone 9 just between Kuyucak and Orhanlı is considered to be ignition point of the fire. This location overlaps with the earlier ignition points (First Points) of the fire according to AF data. According to the fire narratives, due to stormy wind whose speed ranges from 70 to 117 kilometres per hour, the fire leaps into Doğankent Complex of summer houses in a relatively remote area covered by the wildfire zone 10 (İzmir'de yangın kabusu, 2025; İzmir'deki Yangının Boyutu, 2025).

Although the fire narratives lead us to think that the ignition point of zones 9 and 10 are the same, FPM produced for the zones on the base of AF data exposes that there is another ignition point for the zone 10 towards the north of the zone concerned between the boundaries of Tepecik and Turabiye neighbourhoods. The topography of the region also makes it difficult to directly connect these ignition points. When the dominant wind direction which is from north to south for İzmir is considered, it follows that the fire in the zones 9 and 10 started at the northern parts of the zones in First Points as suggested by the FPM. Indeed, it is possible to find two other pieces of news for the starting point of the wildfire zone 10; one at the Instagram account of İzmir'de Son Dakika (2025) stating that a fire broke out near a residential area in Tepecik neighbourhood of

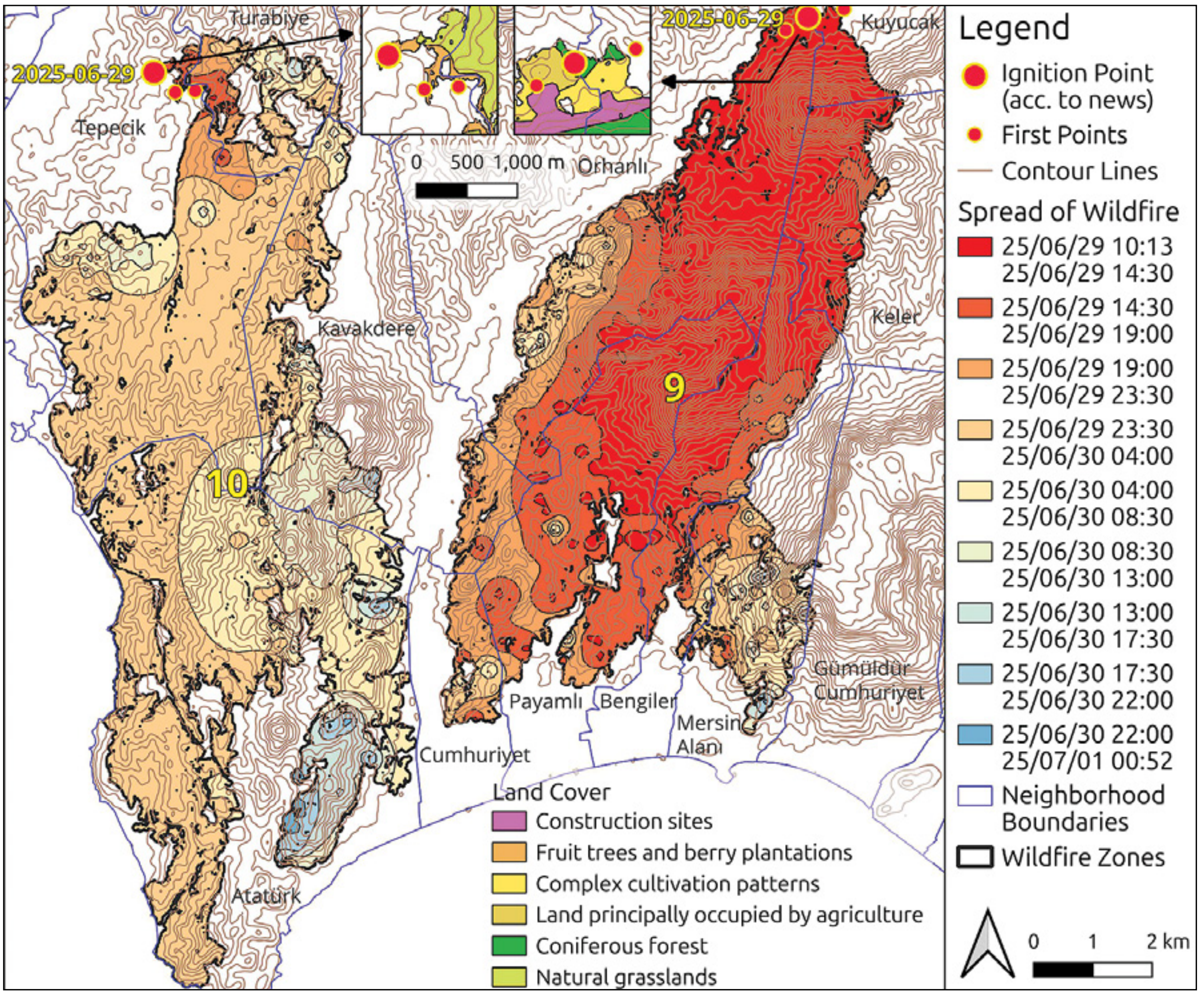

Figure 6 *FPM produced for the wildfire zones 9 and 10 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

Seferihisar, and the other one at the Instagram account of Oluşum Haber (2025a) describing that the fire spread to a factory at the Ozer Turer Farm located in Tepecik. At the northern part of the zone concerned, there is only one such location covered by fruit trees and berry plantations close to a residential area and Turer Farm. According to the fire report published on 8 August, 2025, the fire may have started as a result of unextinguished cigarette butts thrown or accidentally dropped by an unidentified person or persons igniting flammable grass (Yangın raporu, 2025). As for the wildfire zone 9, İzmir Governor Elban stated that the fire was believed to have been caused by an electrical wire (İzmir'de yangın kabusu, 2025; İzmir'deki yangınlar elektrik, 2025).

Meaningful sub-daily FPM can be produced only if there are adequate number of points in AF data. If the number of points is very limited, it would be better to present the data as it is. Two other fires (wildfires 12 and 13 close to each other) in Seferihisar exemplify this case (Figure 7) together with one (wildfire 15 in Kızılçukur) in Dikili. According to the narratives, wildfire 12 started in a maquis shrubland for an unknown reason around noon on 1 July, 2025 in Tepecik area of Düzce Village and it quickly spread due to strong winds approaching only 500 meters from TOKİ residences in the area (Düzce'de yangın, 2025; Seferihisar'da alevler durmuyor, 2025). Compared with the zone 12, news for the wildfire zone 13 are limited. There are some news on the Instagram account of Oluşum Haber (2025b) informing us about the fact the fire broke out in the Gözsüzler area of the Camikebir neighbourhood in Seferihisar and that it was rapidly advancing towards the village Sığacık residential complex.

When the AF data is mapped on land-cover, the ignition point of wildfire 12 is marked as shown in sclerophyllous vegetation area in the northern direction close to Düzce village. Although AF data available from MODIS and VIIRS confirm the direction of the ignition point, they belong to a time 3 days after the incidence. For the wildfire zone 13, there are more consistent AF data from both MODIS and VIIRS. The colour inside the circles representing AF data shows the brightness temperatures of the active fire pixel measured in Kelvin. Compared with the other zones, there is only one piece of news for the fire in the wildfire zone 15 on the Instagram account of Egeli Duysun stating that forestry teams are fighting forest fires in Dikili, Çandarlı, Yeni Foça, Kızılçukur and Kozak (Egeli Duysun, 2025), which is confirmed by two AF points available for the zone from VIIRS.

In spite of limited number of AF data, sub-daily FPMs can also be produced for similar kinds of wildfires. In this context, the maps produced for two small fires occurring in Aydın can be seen in Figure 8. In the wildfire zone 17, the

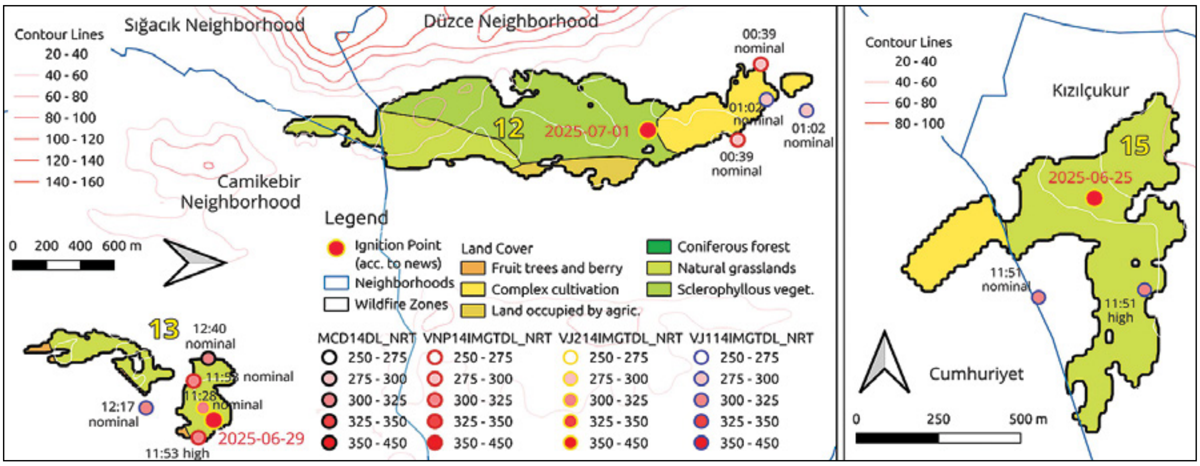

Figure 7 *AF data for wildfire zones 12 and 13 together with wildfire zone 15 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

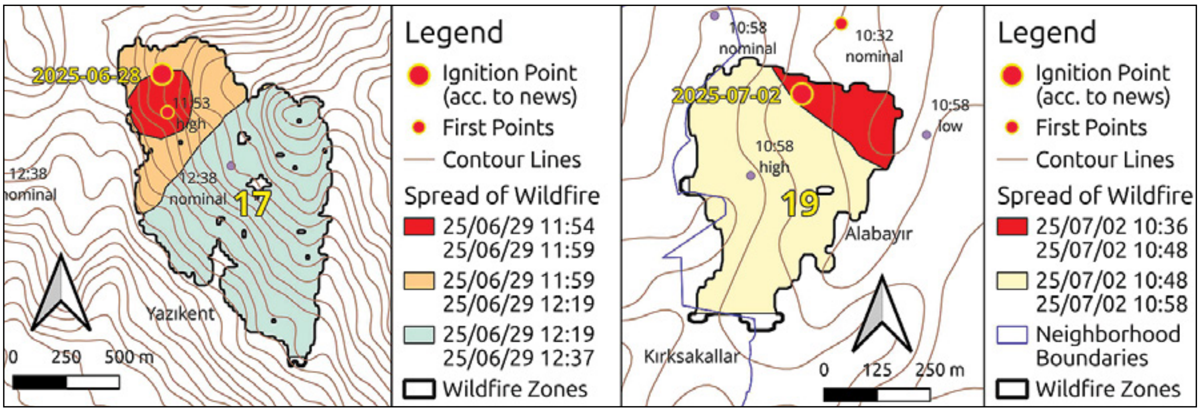

Figure 8 *FPM produced and AF data for the wildfire zones 17 and 19 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*
Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

blaze began in the Kızılçakır area (upper part – northern direction) of the Yazıkent neighbourhood in Aydın's Bozdoğan District and it was brought under control after nine hours of fighting (Aydın'da saatlerdir süren orman yangını, 2025; Manisa ve Balıkesir'de yangın sürüyor, 2025). Besides, the fire in the wildfire zone 19 broke out in an agricultural field and scrub area in the upper part of the Kırksakallar neighbourhood of Aydın's Çine District for an as yet unknown reason (Aydın Çine'de ziraat ve makilik alanda yangın!, 2025; Aydın'da yangın, 2025). In the case of the wildfire zone 17, three AF points are available as presented in Figure 8 with small dots in association with the observation time and level of confidence. Two of these points fall inside the wildfire zone delimited according to Sentinel 2 data. For the wildfire zone 19, although there are 4 AF points compiled from FIRMS, only one of them falls inside the zone. Nevertheless, other points are very close to the zone concerned.

As elucidated in the previous section, in some wildfire zones there is no AF data from FIRMS. Two such zones exist in this study; 4th and 14th wildfire zones. In the case of 4th wildfire zone, although there are AF data towards the north of wildfire zone within a distance 2-3 km to the zone for the start day of fire and the subsequent day, there is no AF data inside the zone. Nevertheless, existence of fire can be confirmed by the news and Sentinel 2 data. Actually, the fire ignited in the rural Çepnidere neighborhood of Turgutlu, Manisa, driven by the wind, it spread to the Halilbeyli neighborhood of Kemalpaşa in İzmir damaging many cattle farms in the area (Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı, 2025; Manisa'da çıkan, 2025). The damage caused by the fire can be confirmed in the map showing the land-cover types inside the zone (Figure 9). Progression of the fire from Manisa's rural area covering

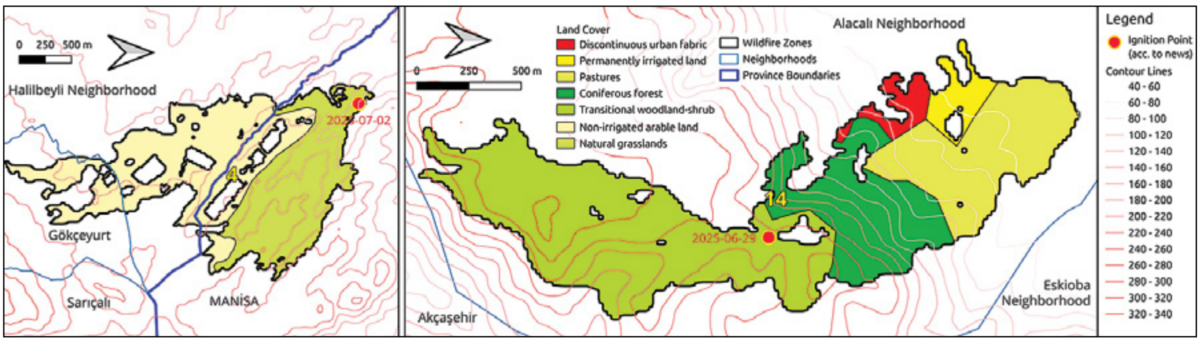

Figure 9 *The wildfire zones 4 and 14 in combination with probable ignition points according to news confirmed with CLC and administrative boundaries*
Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

natural grasslands to arable land in Halilbeyli exposes the damage caused in the farms. In the news it was reported that the fire started in an electrical transformer in a field near the rural Çepnidere, which unveils the probable location of ignition point (Son dakika! Turgutlu'da başlayan yangın İzmir'in mahallesine ulaştı, 2025).

In parallel to zone 4, although there is an AF data towards the north of the wildfire zone 14 within 3-4 km distance to the zone concerned for the previous day of start of fire, there is no AF data again inside the zone. However, the existence of fire can be confirmed again by the news and Sentinel 2 data. According to news, the fire broke out in a scrub area near the Alacalı neighbourhood for an as yet unknown reason, and driven by strong winds, the flames quickly reached the neighbourhood centre where evacuations were initiated as the fire threatened homes and livestock barns (Tire'deki yangın yerleşim alanına sıçradı, 2025; Yerel Güç Haber, 2025). Based on this description, a probable ignition point can be placed for the fire in transitional woodland-shrub near the Alacalı (Figure 9).

In some zones, although there are many AF points or an adequate number of them, they do not properly overlap with the wildfire zone. Two such zones are the wildfire zones 1 and 7. In spite of these limitations, FPMs are also produced for these zones to get a sense of spread of the wildfires in the respective zones. It is reported that the wildfire in the zone 7 (Figure 10) is caused by sparks from an unlicensed construction site that cut and welded iron in the Olduruk area of Zafer neighbourhood of Buca (Buca yangını havadan görüntülendi, 2025; Buca'da orman yangını, 2025; Buca'da yanan orman-

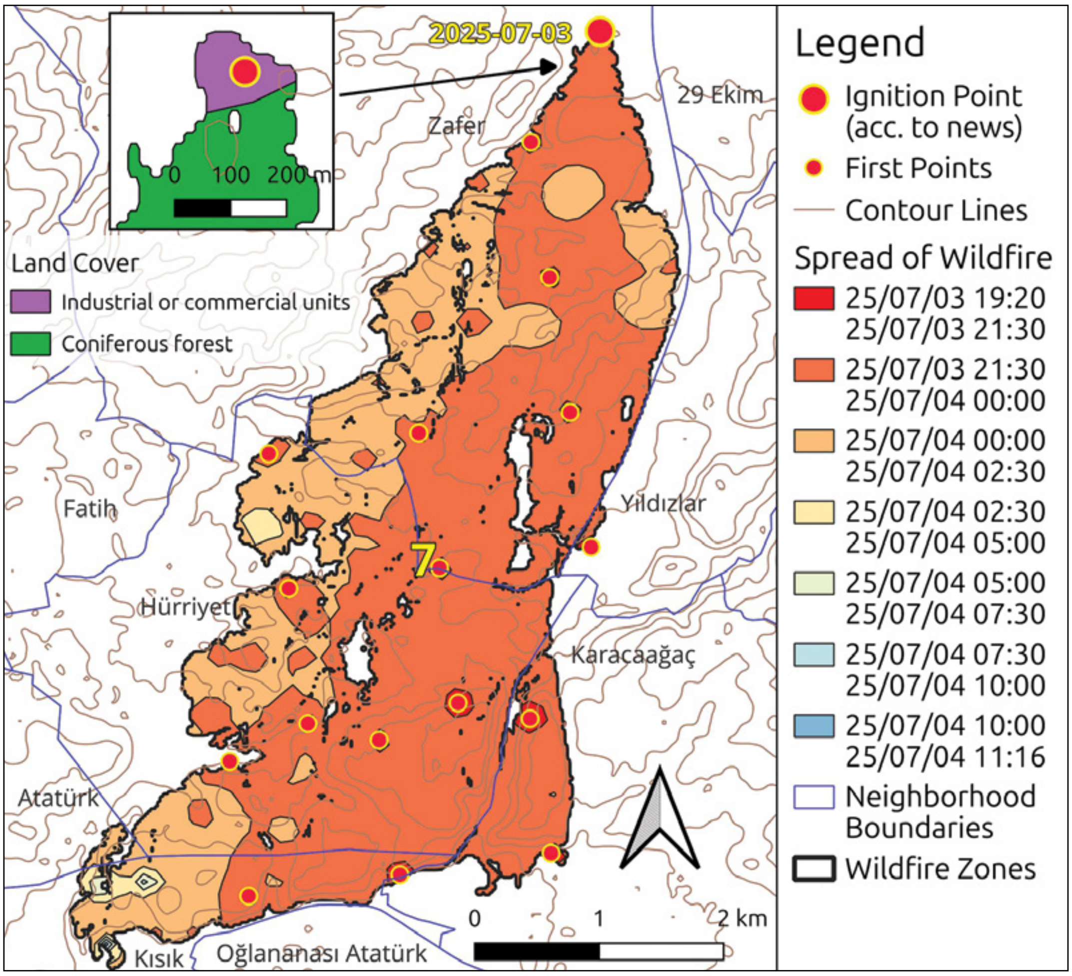

Figure 10 *TFPM produced for the wildfire zone 7 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

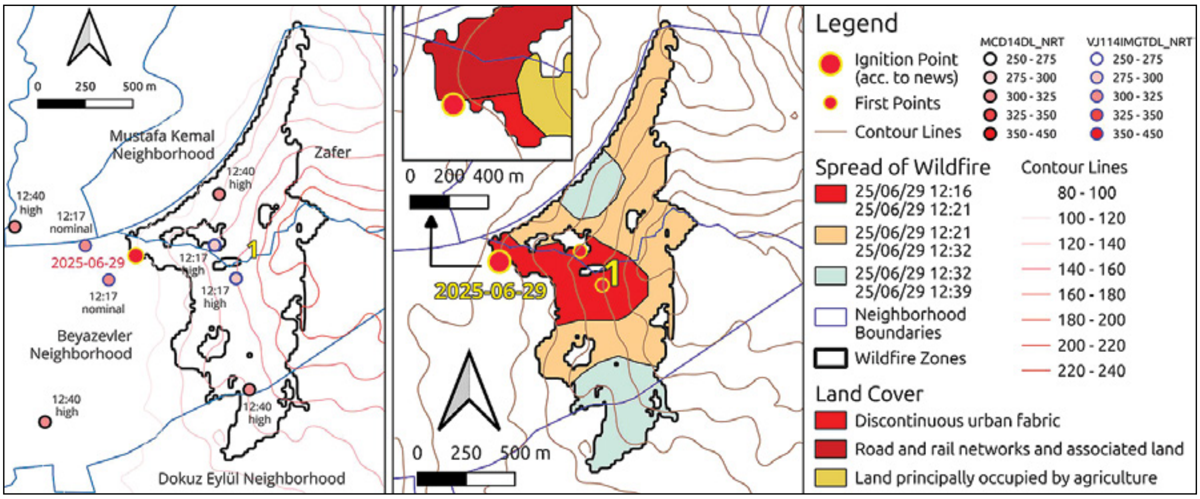

Figure 11 *AF data and FPM produced for the wildfire zone 1 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

lık alan, 2025; İzmir Buca'daki orman yangını, 2025). As part of an investigation, two suspects were taken into custody for allegedly causing the fire while working with a spiral windmill in the area (Buca'da orman yangını, 2025; İzmir Buca'daki orman yangını, 2025).

Unfortunately, due to strong wind, the fire quickly grew by spreading to a nearby grassy-trash area and then to the red pine forest advancing toward İzmir-Aydın highway and Kısık industrial site covering a wide area (Buca'da yanan ormanlık alan, 2025; İzmir Buca'daki orman yangını, 2025). Among the other wildfire zones occupying an area over 1000 ha, the wildfire in the zone 7 is characterized by quick spread of the fire and multiple locations of sub-sequent ignition points which are seemed to be caused by the strong winds. This is also evident in the map from the isochrones showing the sub-daily progress of the fire according to intervals calculated in hours and minutes. The fire's first ignition point can also be confirmed with land cover data. As described in the news, the fire's ignition point is placed at the northern part of the zone in land-cover category corresponding to industrial or commercial units.

Compared with the wildfire zone 7, the wildfire zone 1 is small (Figure 11). The fire broke out in a garbage dump in the Beyazevler neighbourhood of Gaziemir, and driven by the wind, the flames quickly spread to the forested area and then to the nearby Otokent dealership complex, where numerous vehicles were burned to ashes (İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü, 2025; İzmir'de yangın Otokent Galericiler Sitesi'ne

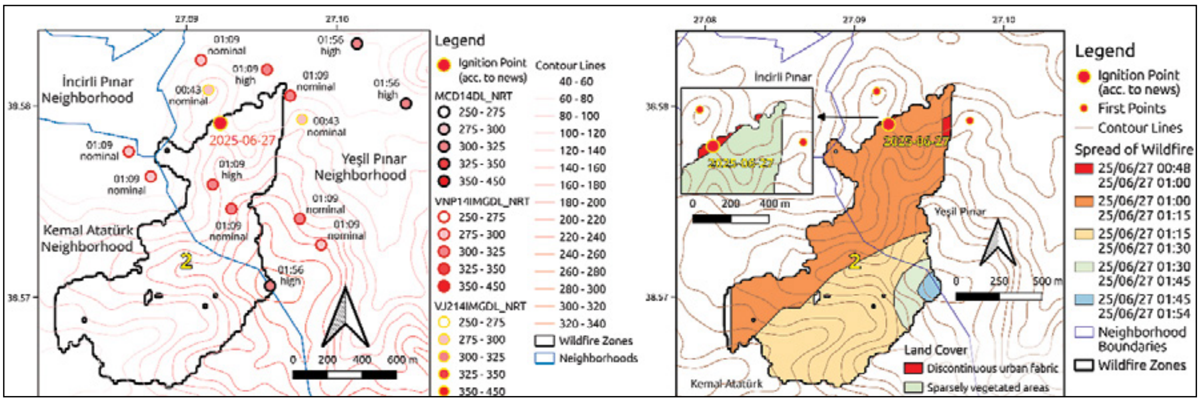

Figure 12 *TAF data and FPM produced for the wildfire zone 2 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

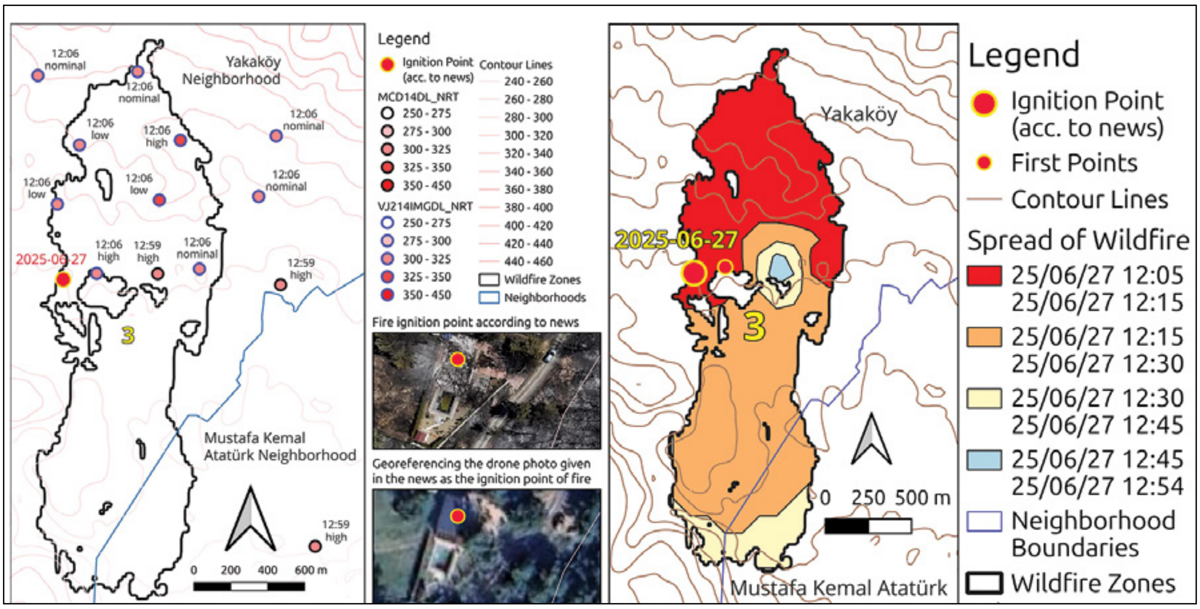

Figure 13 *AF data and FPM produced for the wildfire zone 3 in combination with the ignition point according to news confirmed with a drone photo and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

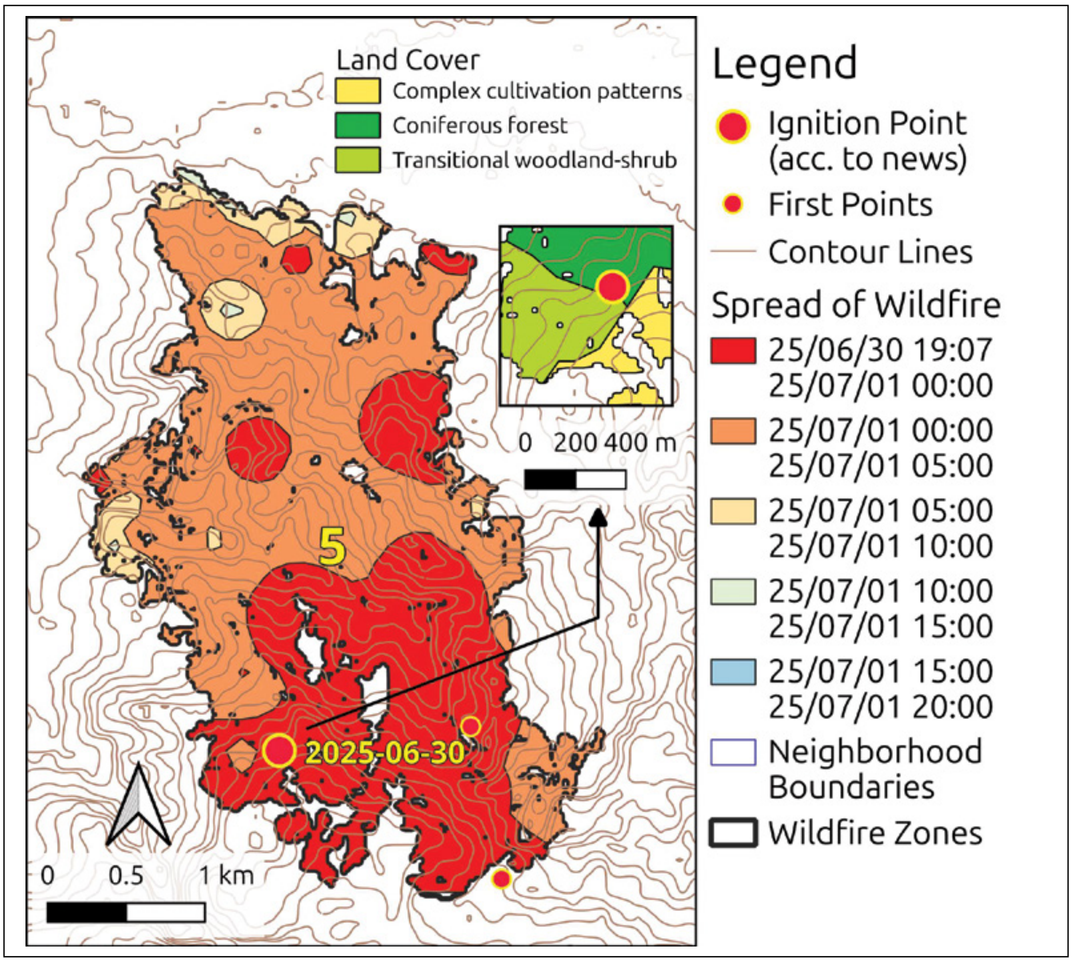

Figure 14 *FPM produced for the wildfire zone 5 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

sıçradı, 2025). One person was detained as part of an investigation launched into the fire by the Chief Public Prosecutor's Office (İzmir'deki yangın galericiler sitesinde onlarca aracı küle döndürdü, 2025).

The starting point of the wildfire zone 1 is very close to urban area, which can be confirmed by land cover data covering the ignition point determined according to the news and distribution of AF points falling outside the zone, but inside urban area. Figure 11 is also illustrative for the limitation of inadequate number of AF points partly overlapping with the wildfire zone boundaries in the creation of FPM for the zone concerned. Nevertheless, it gives us a sense of progression of the fire.

Some other small wildfire zones are also characterized by agglomeration of AF data in a certain part of the zone. Two illustrative examples are the wildfire zones 2 and 3. According to news, in the wildfire zone 2, the fire started at night (on 27 June, 2025) in Menemen Asarlık (İzmir Hakkında, 2025; Menemen Havadis, 2025). On the base of AF data agglomerated at the northern part of the zone, an FPM with an interval of 15 minutes is produced (Figure 12).

The third wildfire broke out in Yakaköy neighborhood of Bornova during roof renovations under welding at 40 degrees Celsius which caused the sparks to spread first to the property and then to the forest, which created devastating effects for those losing their homes and vehicles (40 derecede kaynak yaptı, yangın çıktı!, 2025). The drone photo of the property causing fire during renovations is used for fixation of the fire's ignition point in the zone 3 via geo-referencing the respective photo (Figure 13). It is observed that AF data are again agglomerated in the northern part of the zone.

In contrast to these cases, wildfires occupying relative larger areas at the eastern part of İzmir city-region such as the wildfire zones 5, 8 or 16 are characterized by availability of relatively abundant and homogeneous distribution of AF data parallel to the big wildfire zones at the western part of the city-region (as exemplified by wildfire zones 9, 10 and 11). Although smaller than these wildfires, the wildfire zone 18 in Aydın has also a homogeneous distribution of AF data. In the wildfire zone 5 (Figure 14), the fire broke out in a garbage dump in the Dereköy neighbourhood of Manisa's Ahmetli District and spread to a forested area (Ahmetli orman yangını, 2025; Ahmetli'deki orman yangını, 2025).

The fire in the wildfire zone 8 (Figure 15) started in the Suçıktı and Tosunlar neighbourhoods of Ödemiş because of electrical wires, and spread over a wide area, first covering the villages of Tosunlar and Suçıktı, and then Üzüm-

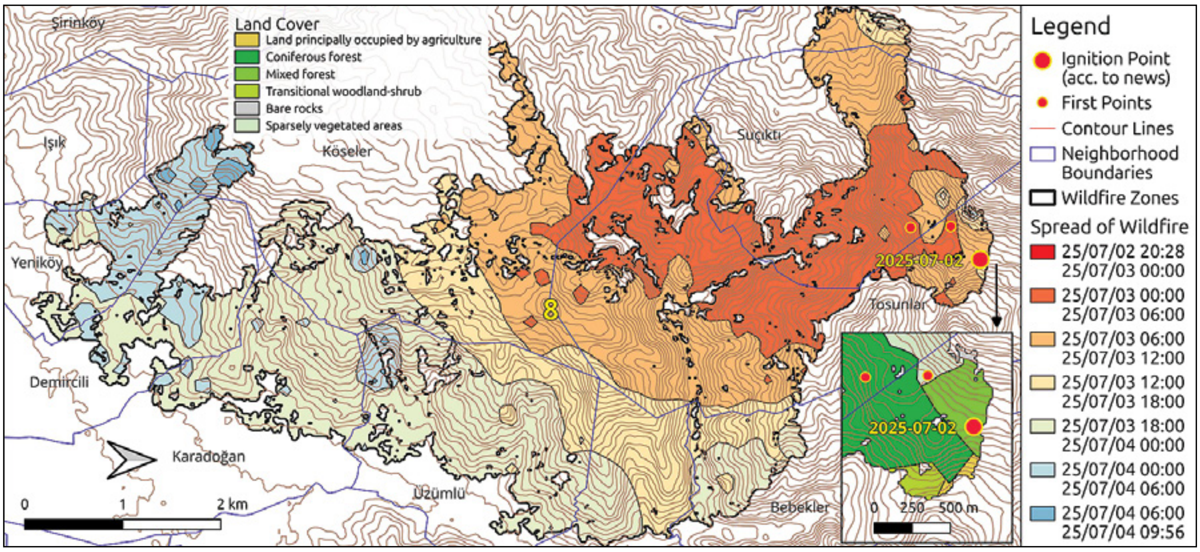

Figure 15 *FPM produced for the wildfire zone 8 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

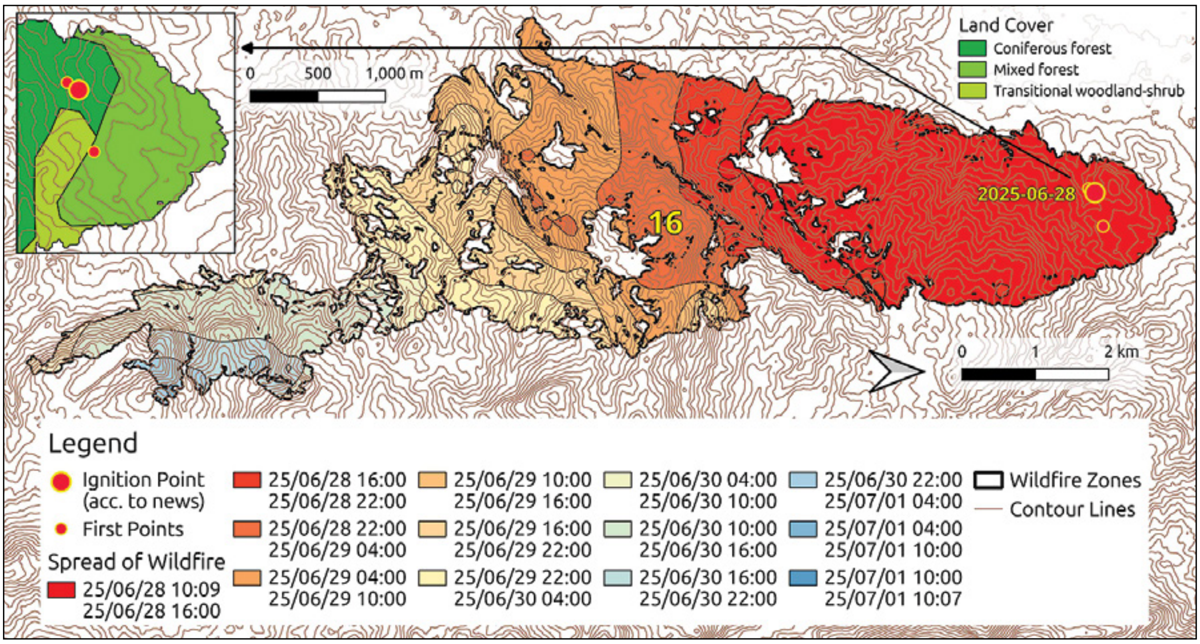

Figure 16 *FPM produced for the wildfire zone 8 in combination with ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

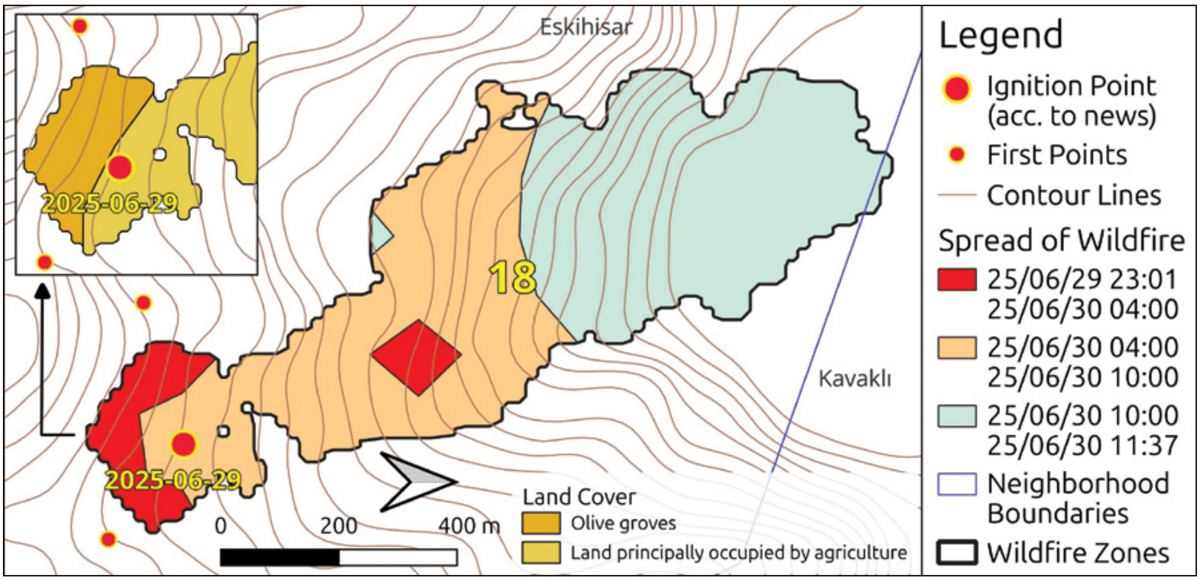

Figure 17 *FPM produced for the wildfire zone 18 in combination with the ignition point according to news confirmed with CLC and administrative boundaries*

Source: the author; based on the analysis conducted in the study by using fire news, Sentinel 2, MODIS, VIIRS, ASTER-GDEM and CLC data together with administrative boundaries

lü and Köseler, due to strong winds (Ödemiş yangınında, 2025; Ödemiş'te yangının nedeni, 2025; Rapor çıktı, 2025). Description of the progression of the wildfire in the news exactly corresponds to the FPM produced for the wildfire 8 zone associated with administrative boundaries in Figure 15.

According to the news, in the wildfire zone 16, the fire allegedly started in a forest area near the Karaköy neighbourhood of Manisa's Akhisar District because of a negligent beekeeper trying to create smoke to calm the bees in the area, and it spread rapidly due to the strong winds resulting in the evacuation of many villages, as a precaution (Akhisar'daki orman yangınına müdahale, 2025; Akhisar'da yangın sürüyor, 2025). The suspected beekeeper was arrested on charges of causing the fire by negligence (Akhisar'daki orman yangınına müdahale, 2025, Akhisar'da yangın sürüyor, 2025). As it is evident from Figure 16, the ignition point of the fire corresponds to a forest area in CLC data.

The description provided for the progression of the fire in the news is also completely in line with the FPM produced on the base of AF data. The fire in the wildfire zone 18 (Figure 17) broke out in an agricultural field in the upper Eskihisar neighborhood of Aydın's Sultanhisar District for an as yet unknown reason, and it spread due to the wind (Aydın'da ziraat alanında çıkan yangın, 2025). The ignition point defined according to news in compliance with CLC data and administrative boundaries corresponds to the First Points showing the earlier AF points.

DISCUSSION

The causes of the wildfires analysed in this study are imprinted with some dominant reasons as evident from the previous sections (Table 3). Although for 40% (8) of the wildfires analysed no cause is given in the news, it is reported that five incidences (25%) are related to electricity transmission infrastructure. The next remarkable cause is the uncontrolled activities in garbage dumps (15%). In two cases (10%), it is reported that the wildfires ignited because of sparks from the renovations on the roof of a house and an unlicensed construction site. There is no doubt that the role of urban activities constitutes the reason for the majority of cases (more than 50% of all cases and more than 90% of the cases whose causes are known). Among the incidences there is only one case that seems to stem from a rural activity as exemplified in the case of the wildfire zone 16 where the fire was ignited because of a beekeeper using smoke to calm the bees. Wildfires caused by accident, negligence, or intentionally constitute 88% of forest fires in Türkiye and the remaining portion is caused by lightning, one of the most important natural causes of the wildfires (Türkeş & Tolunay, 2023).

Table 3 *Wildfire zones (WZ), the generalized cause of the fires and the statistics for AF points*

WZ	Date	Cause of the fire	AF used	AF inside zone	AF used per ha
1	06.29	garbage dump	8	5	11.53
2	06.27	unknown reason	14	7	8.46
3	06.27	sparks from the renovations on the roof of a house	16	8	11.82
4	07.02	electrical transformer	-	-	-
5	06.30	garbage dump	80	73	10.03
6	06.25	power line in forest	164	133	5.57
	06.26	garbage burned by an individual near the industrial facilities			
7	07.03	sparks from an unlicensed construction site cutting iron	332	258	4.68
8	07.02	electrical wires	499	447	4.78
9	06.29	power line - electrical wire in forest	660	597	7.47
10	06.29	as a result of unextinguished cigarette butts thrown	361	326	13.86
11	07.02	power line in an agricultural area	1239	1143	7.88
12	07.01	unknown reason	-	-	-
13	06.29	unknown reason	5	4	4.52
14	06.29	unknown reason	-	-	-
15	06.25	unknown reason	2	1	14.89
16	06.28	because of a beekeeper using smoke to calm the bees	384	341	8.02
17	06.28	unknown reason	3	2	33.86
18	06.29	unknown reason	22	18	2.16
19	07.02	unknown reason	4	2	5.19

Source: the author; based on the wildfire news in the media and the analysis conducted in the study by using Sentinel 2, MODIS and VIIRS data

While the wildfires caused by the lightning is also important in the ignition of fires, for the studied region and era no such reason is reported in the media as the cause of a given wildfire. Nevertheless, according to the official statistics compiled by the General Directorate of Forestry it is known that 5.83% of the wildfires in Türkiye were caused by lightning in 1997 (Orman Genel Müdürlüğü, 2025). Although this ratio increased to 19.12% in 2024, on average 11.79% of the wildfires in Türkiye between 1997 and 2024 were caused by lightning. The reflection of these statistics on the total area burned is somehow different. Indeed, in 1997 lightning was responsible for the destruction of 37 hectares of forest area corresponding to the only 0.59% of the total area of forests burned in the same year. While this ratio increased to 2.67% in 2024, on average the lightning was responsible for the destruction of only 1.78% of the forest areas burned in Türkiye between 1997 and 2024. It is important to remark that lightning is usually the sole natural cause of wildfires, which again reveals the importance of human factor in the ignition of wildfires.

In parallel to observations revealed in this study in relation to the wildfires caused by the failures in energy transmission lines, the official statistics exposed that the share of power lines system failures as a cause in the total number of wildfire incidences tends to increase over time; it increased from 3.27% in 2012 to 4.44% in 2021 (Atmiş et al., 2023). Compared with the lightning and their share in the total number of wildfire incidences, the ruptures or failures of energy transmission lines have a more devastating impact on the forest areas in terms of total area burned over time. Although in 2012 the forest lost caused by the rupture or malfunction of power transmission lines was 80 ha corresponding to only 1.13% of total forest area lost in the same year, this amount increased to 4,536 ha corresponding to 29.23% of total forest area lost in 2023 (Orman Genel Müdürlüğü, 2025).

In fact, power lines system failures under extreme wind conditions led to multiple ignitions owing to the fact that they cross a broad geographic area, which resulted in explosive wildfire growth as observed in the US state of California in 2007 and the Australian state of Victoria in 2009 (Mitchell, 2013). In parallel to these catastrophic wildfires, in the fire narratives compiled from the news for the case of İzmir, it is observed that the strong wind seems to be part of the story not only in terms of the fire spread but also its ignition. As Mitchell (2013) remarks, ignitions from power lines are the only wildland fire cause that increases with wind speed. Thus, although the sprawl of urban areas and uncontrolled activities in urban fringe areas create a potential threat to forests because of the increasing probability of fire ignition, this study reveals the role of proper maintenance of technical infrastructure of electricity distribution network in the prevention of wildfires. In particular, this is an issue of planning and maintenance of the respective system, and in general, proper implementation of the spatial decisions taken in urban and regional plans prepared for the city-region concerned.

In relation to the declared cause for the wildfire zone 11, BirGün's headline, 'the greed for profit is burning,' by Sağol (2025) is particularly illustrative for the main motive behind the ecological crime dimension of the wildfires stemming from electricity distribution network. Mahir Ulutaş, Chairman of the Board of Directors of the Chamber of Electrical Engineers (EMO), stated that electricity distribution lines, which occasionally cause fires, are now operated by private distribution companies after privatization, and that maintenance and repair work is contracted out to subcontractors with less technical expertise to maximize profits (İzmir'deki yangınlar elektrik, 2025). Ulutaş emphasized that electricity systems require constant maintenance, and before privatization, there were personnel who visited and checked the lines for maintenance purposes, but the personnel were purged after privatization (İzmir'deki yangınlar elektrik, 2025). Nonetheless, in many advanced countries corporate entities such as electricity companies are assumed to handle vegetation and minimize the risks of the wildfires stemming from their operations.

Yet, neo-liberal economic system relies on profit driven instinct limiting the agents in fulfilling their social responsibilities even though they may be defined in their contracts. In this context, privatization of electricity distribution network and profit driven approach of private sector seems to prevent them from taking necessary precautions for prevention of wildfires caused by power lines or other components of the electricity distribution network. As remarked above, regular cleaning and inspection of the area beneath power lines is extremely necessary. Combustible materials should be monitored along the routes of power lines passing through forests, intersections, and residential areas, ensuring that thin combustible materials are removed from these routes. Environmental protection zones and health protection zones of power lines and other sectors occupying forest areas should also be defined according to universal standards by ensuring that relevant sectors (electricity generation and transmission, mining, etc.) comply with protocols and agreements in forest areas allocated for non-forestry purposes. Spatial adjustments for these sectors should be a topic of research in city and regional planning studies.

Overall, any service left incomplete by distribution companies with diminished technical capacity and competence can lead to fatal accidents and fires. Although, between 2014 and 2023, the rate of fires caused by power lines was at most 5 percent, the rate of area burned in fires ignited by this cause is quite high reaching to 29.2% in 2023. (Güngöroğlu et al., 2025). In parallel to these findings, it was calculated in this study that according to the information compiled from the news for the recent wildfires in İzmir city-region, the electricity distribution network is responsible for more than 60% of the total burnt areas even though the share of wildfire incidence number linked to the respective network is 25% of the incidence total. According to data from the Turkish Foresters Association (TOD), an average of 94 fires broke out annually in the Aegean region over the last decade due to power transmission lines, burning 5,215 hectares. However, the penalties imposed by the General Directorate of Forestry on energy companies haven't been made public (Sağol, 2025).

As suggested at the beginning of the study, agents involved in the creation of wildfires can be analysed at different levels. Direct involvement of individuals in the ignition of a wildfire is exemplified in the cases of the wildfire zones 3, 6 (the second ignition point), 7, 10, and 16 (25% of all cases). In some of these cases, the suspects responsible for the fire were immediately identified and detained by the officers. However, in the case of fires reported to be originated from the electricity distribution system, it is observed that the suspects were not individuals but corporate entities (local energy companies) assumed to run and maintain the system concerned. According to Gediz Electricity Distribution Inc. which operates the electricity distribution service in İzmir, there is no concrete evidence that the fires originated from power lines (İzmir'deki yangınlar elektrik, 2025). However, after the official report by the İzmir Metropolitan Municipality Fire Department revealed that the forest fire in the Ildır neighborhood of Çeşme was caused electrically, Çeşme residents, along with the İzmir Bar Association and environmental NGOs, filed a criminal complaint against Gediz Electricity Distribution Inc. (İtfaiye Raporladı, 2025). It is clear that without certain penalties on the part of agents causing fires and compensation for the victims of wildfires, socio-ecological system cannot be sustained.

A special attention should be paid to compensation dimension due to its complexity. Although a careless person who causes a forest fire by lighting a fire in a campsite is definitely guilty, it is unlikely to obtain compensation by suing the perpetrator, as losses can run into millions of US dollars and most people do not have the commensurate resources (Babrauskas, 2024). In a similar fashion, while the victim of a wildfire ignited by a power outage will likely sue the electricity company and receive compensation, the victim of a wildfire triggered by a lightning strike, on the other hand, has no one to sue. Thus, if fires are started accidentally, the current system does not contain sufficient incentives to minimize the costs of tort litigation, nor does it include appropriate measures to ensure a fair distribution of costs in many countries (Babrauskas, 2024). Furthermore, if it is considered that big wildfires often occur in high wind conditions and sometimes as a result of foreign objects being blown into power lines by the wind, it is unrealistic to expect the entire electrical infrastructure to perform satisfactorily up to its design limits. Thus, the legal system should also be changed to encourage fire safety behaviour and ensure a more equitable distribution of cost burdens.

Fixation of the ignition points of fires has merit not only for the confirmation of the probable causes of the fires in terms of, for example, overlapping between power lines and ignition area, but also exposition of the role of topography and land cover in the spread of the fires concerned. For example, in some of wildfire narratives the actual source of the fire in a zone is confused with a nearby zone (for example, it is epitomized as if the source of fire in the zone 10 is the same with the one in the zone 9). Production of FPMs and subsequently fire isochrones together with the land cover data provides us with a more accurate description of actual dynamics and ignition points, which in turn, provides us with a more consistent and concrete story for the spread of each fire. In this context, outcomes of this study have also potential implementations in several areas such as modelling the fire spread for different locations in İzmir city-region, planning of forest road network and forest watchtowers, and also residential roads that should be reevaluated to ensure their adequacy in ensuring access for evacuation and firefighting vehicles in the event of a fire hazard.

In many studies conducted for assessment of the wildfire risk susceptibility and potential of certain regions, a spectrum of parameters including the role of topography and climatic conditions in the ignition and spread of the wildfire is used. In the majority of the studies, it is recognized that the higher the surface's steepness, the higher the fire spread rate, and subsequently, the greater the vulnerability of the forest to fire (Boboulos & Purvis, 2009; Çetin et al., 2022; Dupuy, 1995; Viegas, 2004). Indeed, all big wildfires occupying an area over 2000 ha and exposed in this study are characterized by steep terrain. Although the slope can both reduce and increase the influence of the wind, it is also known that the wildfire spreads faster upslope than downslope, which stems from the fact that flames are tilted closer to the surface and warm air rising up the slope results in drying out of the combustible materials because of preheating (Durlević et al., 2025; Vujović et al., 2024). In this context, the analysis of the rate of spread (ROS) of fire constitutes another domain of research for the prediction of fire behaviour. The isochrones produced in this study can be used for the calculation of ROS in future studies focusing on the fire risk assessment of particular areas in İzmir city-region. As Boboulos & Purvis (2009) remark, the statistical models built for ROS can be used to assess the risk for spreading of the fire by considering specific terrain features and climatic data in a particular geographic area.

In these models and forest fire risk analysis, the aspect indicating the compass orientation of the slope is also actively used (Djabri et al., 2023; Durlević et al., 2025; Vujović et al., 2024). Again, it is no accident that the majority of the wildfires analysed in this study is characterized by the southern direction exposed to more solar radiation compared with the other directions. Combined with the predominant wind direction which is from north to south in the study region, a detailed examination of topography and climatic conditions including precipitation, temperature, wind speed and concentration of sunlight, the subsequent studies may benefit from the outcome of this study instead of assigning a fixed weight to the role of topographic (slope and aspect) and climatic factors in the respective models. It is within this context that the results of this study are also valuable in terms of conduction of similar type of future studies for İzmir city-region.

In this context, as a rough measure of the resolution of FPMs produced in this study, the total number of AF points used in the production of fire isochrones can also be seen in Table 3. It is observed that for huge wildfire zones on average one AF point is available per 5-15 ha area of burnt land. It increases to 34 ha for small wildfire zones. This also implies the usability of AF data for big wildfires in combination with other technological instruments in the monitoring and prevention of wildfires. The impact of global warming on fires as a result of climate change is undeniable. However, with today's technology, such as drones or artificial intelligence applications, remote control of, for example, power lines can easily be done for the prevention of big wildfire disasters. In this respect, AF data in fact can be used in combination with drones so that the fires can be identified and intervened timely.

At this point, spatially continuous FPMs at a daily or sub-daily interval provide us not only with important insights about the role of availability and distribution of fuel, local topography and weather (such as moisture content) in fire spread as they directly influence the capacity of landscape to carry fire, but also combined with other basic maps such as land cover, they help us estimate fire arrival time for finding missing hotspots. Timely and accurately produced FPMs also help us establish a fire monitoring and management system in NRT that can provide us with critical decision support for on-field firefighting efforts (Scaduto et al., 2020). In this regard, the aggregation of AF data is particularly important for rapid initial fire perimeter delineation, and thanks to the availability of NRT FPM from satellite observations, continuous aerial observations by aircraft are not required any more.

CONCLUSION

Although, in our anthropocentric era, the long-term impact of climate change is the primary factor leading to disastrous wildfires, this should not obscure the role of a specific trigger in any given wildfire incidence. In this study, the wildfires occurring in İzmir city-region between 25 June and 5 July, 2025 are used as a laboratory to examine the damage caused by them and to contextualize the crime dimension for each wildfire incidence. When all these incidences are considered within the framework of panarchy, it becomes evident that global climate change makes the ecological system more vulnerable to the small individual disturbances whose effects are amplified due to the current state of the change characterized by a cumulative process of causation. What is evident from the discussion section is that the exposition of suspects of wildfires may not automatically result in the compensation to the fire victims, be it humans or other living organisms.

In this respect, two issues gain importance; (1) establishment of a more equitable distribution of cost burden and (2) promoting a behaviour valuing all living organisms. For the former characterized by practical concerns, the insurance system can be improved to absorb the costs associated with wildfire liability. However, the latter seems to require a shift in the ontological conceptions that may trigger changes in the third level cascading up to a 'wonderful world' in the first level. In this context, it is argued that if the current wildfire prone world is a result of the Anthropocene placing the 'Anthropos' at the centre of geological narratives, it can only be reversed by a transition to a more biophilic world. For such a transformation, as Carvalho & Riquito (2022) remark, a shift is required from existing ontologies favouring a world model characterized by extractivism, dualism and human exceptionalism to the ontologies characterized by pluriverses recognizing the heterogeneous clamour of human and non-human agency via recognition of intimate entanglement of politics, aesthetics and affect. That's why, in this paper, as a concluding remark a new ontology is proposed; biophilic ontology.

It is within this context that the panarchic conception of the role of individual actions of humans exposes the importance of the third level human factors in terms of initiation of a reverse cycle. Circular effect making the world wildfire-prone can only be interrupted with the strategic decisions favouring a biophilic intervention into and conception of the socio-ecological system in which we live. The change at the first level of human factor on ecological system depends upon the change at the second level characterized by the path-dependency of socio-ecological system as illustrated in the case of concept of fire regime. Once the fire regime is restored with biophilic interventions parallel to the other socio-ecological cycles, we may have some hope to tame the Anthropocene.

Supplementary Materials: Models developed in QGIS for the delimitation of isochrones will be available together with other models developed for calculation of NBR and polygon overlay.

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