

Table S1. Wildfire impacts

Impacts in Evia Island from wildfire at 03/08/2021				
	Unit of measurement		Affected	Total in AOI
Burnt area		ha		50,909.9
Not applicable		ha		11.8
Estimated population	Number of inhabitants		5.639	28.838
Built-up	Residential Buildings	ha	214.4	1,246.3
	Industrial buildings	ha	0.1	0.8
	School, university and research buildings	ha	0.8	3.9
	Sports halls	ha	15.1	18.3
	Cemetery	ha	2.0	4.7
Transportation	Primary Road	km	242.5	427.8
	Secondary Road	km	56.7	127.2
	Local Road	km	314.5	826.1
Facilities	Breakwater	ha	0.0	0.4
	Constructions for mining or extraction	ha	236.4	1,225.6
	Power plant constructions	ha	0.3	0.7
	Sport and recreation constructions	ha	5.7	14.9
	Other civil engineering works not elsewhere classified	ha	0.0	8.7
	Long-distance pipelines, communication and electricity lines	km	25.4	51.3
Land use	Arable land	ha	1,990.6	5,869.7
	Permanent crops	ha	3,495.8	8,358.1
	Heterogeneous agricultural areas	ha	11,327.3	19,799.3
	Forests	ha	27,476.9	34,893.5
	Shrub and/or herbaceous vegetation association	ha	6,208.6	14,194.4
	Open spaces with little or no vegetation	ha	89.0	289.6
	Inland wetlands	ha	50.4	50.4
	Other	ha	283.2	24,730.3
	Coastal wetlands	ha	0.0	134.2
	Impacts in Alexadroupoli Dadia from wildfire at 19/08/2023			
	Unit of measurement		Affected	Total in AOI
Burnt area		ha		72,344.5
Fire Fronts		km		13.6
Estimated population	Number of inhabitants		~ 3,100	~ 95,000
Built-up	Residential Buildings	ha	49.2	2,105.0
	Office buildings	ha	0.0	0.9
	Wholesale and retail trade buildings	ha	0.0	2.8
	Industrial buildings	ha	12.5	264.4

	School, university and research buildings	ha	0.3	18.8
	Hospital or institutional care buildings	ha	0.5	13.7
	Military	ha	40.2	505.5
	Cemetery	ha	0.7	24.3
Transportation	Airfield runways	ha	0.0	160.9
	Helipad	ha	0.0	0.2
	Airfield runways	km	0.0	3.3
	Highways	km	47.3	192.3
	Primary Road	km	11.9	99.8
	Secondary Road	km	18.8	184.1
	Local Road	km	151.7	1,630.4
	Cart Track	km	1,270.9	4,523.9
	Long-distance railways	km	33.1	126.1
Facilities	Dams	ha	0.0	0.1
	Power plant constructions	ha	26.0	112.6
	Sport and recreation constructions	ha	1.9	51.7
	Long-distance pipelines, communication and electricity lines	km	56.5	319.5
	Local pipelines and cables	km	0.0	0.4
	Dams	km	0.4	0.5
Land use	Forests	ha	29,538.9	92,197.5
	Shrub and/or herbaceous vegetation association	ha	28,024.6	72,104.1
	Heterogeneous agricultural areas	ha	7,013.2	24,999.9
	Arable land	ha	5,386.8	55,779.1
	Other	ha	1,011.1	11,654.0
	Permanent crops	ha	924.3	1,910.7
	Pastures	ha	357.3	1,556.9
	Coastal wetlands	ha	63.8	1,557.2
	Open spaces with little or no vegetation	ha	0.0	768.3
	Inland wetlands	ha	0.0	39.1

Impacts in Lesvos Island (Vattera) from wildfire at 23/07/2022

	Unit of measurement	Affected	Total in AOI
Burnt area	ha		2 450,4
Estimated population	Number of inhabitants	118	1 224
Built-up	Residential Buildings	No.	86
	Building point	No.	40
	Unclassified	No.	10
Transportation	Primary Road	km	0.1
	Secondary Road	km	0.0
	Local Road	km	0.1
	Cart Track	km	7.1
Land use	Arable land	ha	34.0
	Permanent crops	ha	433.5
	Heterogeneous agricultural areas	ha	645.1
	Forests	ha	767.8
	Shrub and/or herbaceous vegetation association	ha	546.7

	Other	ha	20.3	217.2
Impacts in Gratini village at Rhodopi from wildfire at 21/08/2023				
		Unit of measurement	Affected	Total in AOI
Burnt area		ha		349.1
Estimated population		Number of inhabitants	NA	~ 20
Built-up	Unclassified	No.	4	10
Transportation	Cart Track	km	8.4	19.4
Facilities	Dams	ha	0.0	3.0
Land use	Shrub and/or herbaceous vegetation association	ha	139.9	515.9
	Forests	ha	116.8	436.7
	Heterogeneous agricultural areas	ha	65.5	326.3
	Other	ha	26.9	134.4
Impacts in Sostis village at Rhodopi from wildfire at 21/08/2023				
		Unit of measurement	Affected	Total in AOI
Burnt area		ha		2,482.2
Active Flames		No.		5
Estimated population		Number of inhabitants	~ 250	~ 2.600
Built-up	Communication buildings, stations, terminals and associated buildings	No.	1	1
	Unclassified	No.	0	4
Transportation	Highways	km	0.0	9.3
	Secondary Road	km	1.9	16.5
	Local Road	km	10.3	65.1
	Cart Track	km	46.6	166.5
	Long-distance railways	km	1.7	11.9
Facilities	Power plant constructions	ha	1.1	1.1
	Sport and recreation constructions	ha	0.0	1.4
	Long-distance pipelines, communication and electricity lines	km	1.0	14.2
	Dams	km	0.0	0.1
Land use	Forests	ha	2,054.2	5,102.2
	Arable land	ha	204.3	1,378.9
	Shrub and/or herbaceous vegetation association	ha	191.3	2,771.6
	Heterogeneous agricultural areas	ha	18.0	365.4
	Other	ha	14.4	298.3
	Pastures	ha	0.0	73.6
	Open spaces with little or no vegetation	ha	0.0	261.7
Impacts in Rhodes Island from wildfire at 18/07/2023				
		Unit of measurement	Affected	Total in AOI
Burnt area		ha		17,773.5
Estimated population		Number of inhabitants	~ 750	~ 9.500
Built-up	Residential Buildings	ha	0.0	98.5
	Office buildings	ha	0.0	0.4
	Wholesale and retail trade buildings	ha	0.0	0.9

	Industrial buildings	ha	0.0	9.9
	School, university and research buildings	ha	0.0	1.4
	Hospital or institutional care buildings	ha	0.0	0.1
	Military	ha	0.0	30.5
	Cemetery	ha	0.0	2.1
	Unclassified	ha	0.0	16.8
	Residential Buildings	No.	322	337
	Office buildings	No.	0	1
	Wholesale and retail trade buildings	No.	1	15
	Industrial buildings	No.	0	1
	Public entertainment buildings	No.	1	1
	Museums and libraries	No.	0	1
	School, university and research buildings	No.	0	2
	Hospital or institutional care buildings	No.	0	1
	Other non-residential buildings	No.	152	152
	Non-residential farm buildings	No.	4	12
	Buildings used as places of worship and for religious activities	No.	9	38
	Other buildings not elsewhere classified	No.	0	4
	Hotel buildings	No.	1	68
	Other short-stay accommodation buildings	No.	1	2
	Communication buildings, stations, terminals and associated buildings	No.	0	1
	Unclassified	No.	246	2,786
Transportation	Helipad	ha	0.0	0.1
	Primary Road	km	0.0	17.6
	Secondary Road	km	0.0	194.4
	Local Road	km	0.0	252.1
	Cart Track	km	0.0	1,135.2
Facilities	Settling Basin	ha	0.0	0.4
	Dams	ha	0.0	8.9
	Constructions for mining or extraction	ha	0.0	50.7
	Power plant constructions	ha	0.0	0.7
	Sport and recreation constructions	ha	0.6	15.9
	Other civil engineering works not elsewhere classified	ha	0.0	1.5
	Long-distance pipelines, communication and electricity lines	km	12.6	30.3
	Local pipelines and cables	km	0.5	10.3
	Dams	km	0.0	0.2
Land use	Shrub and/or herbaceous vegetation association	ha	12,950.1	33,956.4
	Heterogeneous agricultural areas	ha	2,468.4	10,096.2
	Forests	ha	1,440.8	6,395.1
	Permanent crops	ha	719.7	5,915.1
	Arable land	ha	140.1	719.3
	Other	ha	35.0	2,740.8
	Open spaces with little or no vegetation	ha	19.4	1,637.7
	Pastures	ha	0.0	26.6
Impacts in Varibobi from wildfire at 03/08/2021				
	Unit of measurement		Affected	Total in AOI

Burnt area		ha		9,759.1
Estimated population	Number of inhabitants		25	2.034
Built-up	Residential Buildings	ha	52.2	52.2
	Public entertainment buildings	ha	3.3	3.3
	Multi-functional	ha	14.7	14.7
Transportation	Primary Road	km	2.1	25.6
	Secondary Road	km	1.6	19.9
	Local Road	km	23.0	111.0
	Cart Track	km	63.4	347.6
Land use	Arable land	ha	125.3	1,055.9
	Permanent crops	ha	0.0	1,303.9
	Pastures	ha	19.2	632.3
	Heterogeneous agricultural areas	ha	251.3	1,510.0
	Forests	ha	2,654.8	5,497.7
	Shrub and/or herbaceous vegetation association	ha	6,614.5	15,687.2
	Open spaces with little or no vegetation	ha	94.0	570.4
Other	ha	0.0	459.3	

Impacts in Diavolitsi from wildfire at 03/08/2021

		Affected	Total in AOI
Burnt area	ha		5,106.7
Estimated population		343	16.543
Built-up	ha	24.1	1,633.5
Transportation	km	199.5	2,558.3
Facilities	km	1.6	107.3
	ha	3.9	1,375.5
Land use	ha	5,106.7	72,660.7

Impacts in Gerania Mt from wildfire at 19/5/2021

	Unit of measurement	Affected	Total in AOI
Burnt area	ha		6,647.1
Estimated population	Number of inhabitants	279	5.215
Built-up	Residential Buildings	No.	373
Transportation	Highways	km	0.0
	Primary Road	km	24.1
	Secondary Road	km	14.9
	Local Road	km	17.3
	Cart Track	km	111.6
	Long-distance railways	km	0.0
Facilities	Breakwater	ha	0.0
	Constructions for mining or extraction	ha	0.0
	Power plant constructions	ha	0.0

	Sport and recreation constructions	ha	0.0	0.1
	Long-distance pipelines, communication and electricity lines	km	0.0	30.7
	Berthing Structure	km	0.0	0.0
Land use	Arable land	ha	29.1	363.5
	Permanent crops	ha	323.1	2,504.1
	Heterogeneous agricultural areas	ha	914.0	4,379.2
	Forests	ha	4,140.0	12,087.9
	Shrub and/or herbaceous vegetation association	ha	1,187.4	6,055.8
	Open spaces with little or no vegetation	ha	15.3	134.0
	Inland wetlands	ha	0.0	4.1
	Other	ha	38.2	1,286.7
Impacts in Penteli from wildfire at 19/07/2022				
			Affected	Total in AOI
Burnt area		ha		2,781.7
Estimated population			10.237	197.398
Built-up		No.	2.056	62.691
		ha	0.0	18,633.9
Transportation		km	263.5	2,494.8
		ha	0.0	180.6
Facilities		km	6.1	49.7
		ha	4.7	383.5
Land use		ha	2,781.7	20,058.9
Impacts in Papikio Mt from wildfire at 22/10/2022			Affected	Total in AOI
Unit of measurement				
Burnt area		ha		2,5601.1
Active Flames				
Estimated population		Number of inhabitants		241
Built-up	Residential Buildings	No.	0	1
	Unclassified	No.	0	9
Transportation		Cart Track	km	6.1
Land use	Heterogeneous agricultural areas	ha	0.0	184.5
	Forests	ha	2,387	8,621.8
	Shrub and/or herbaceous vegetation association	ha	172.8	2,278.1
	Open spaces with little or no vegetation	ha	0.0	192.6
Impacts in Parnitha Mt from wildfire at 23/08/2023				
Unit of measurement			Affected	Total in AOI
Burnt area		ha		6 193.1
Estimated population		Number of inhabitants		~ 1 600
Built-up	Residential Buildings	No.	224	1 788
	Office buildings	No.	0	18
	Wholesale and retail trade buildings	No.	0	61
	Industrial buildings	No.	39	70
	Reservoirs, silos and warehouses	No.	0	13

	Public entertainment buildings	No.	0	16
	Museums and libraries	No.	0	1
	School, university and research buildings	No.	0	37
	Hospital or institutional care buildings	No.	0	5
	Other non-residential buildings	No.	1	1
	Non-residential farm buildings	No.	0	71
	Buildings used as places of worship and for religious activities	No.	0	22
	Other buildings not elsewhere classified	No.	0	8
	Hotel buildings	No.	0	11
	Communication buildings, stations, terminals and associated buildings	No.	0	25
	Unclassified	No.	12	21 309
Transportation	Airfield runways	ha	0.0	281.4
	Helipad	ha	0.0	0.3
	Airfield runways	km	0.0	1.9
	Highways	km	0.0	90.3
	Primary Road	km	0.0	19.8
	Secondary Road	km	10.0	160.1
	Local Road	km	34.9	1 788.2
	Cart Track	km	80.3	825.4
	Subway	km	0.0	4.0
	Long-distance railways	km	1.0	179.1
Facilities	Settling Basin	ha	0.0	8.5
	Constructions for mining or extraction	ha	19.8	208.6
	Power plant constructions	ha	1.3	3.3
	Sport and recreation constructions	ha	1.3	173.2
	Other civil engineering works not elsewhere classified	ha	0.0	253.1
	Long-distance pipelines, communication and electricity lines	km	9.6	151.5
	Dams	km	0.0	0.0
Land use	Shrub and/or herbaceous vegetation association	ha	3 354.8	14 614.8
	Forests	ha	1 971.2	13 277.2
	Pastures	ha	263.7	633.3
	Permanent crops	ha	200.1	215.8
	Other	ha	196.0	10 729.1
	Open spaces with little or no vegetation	ha	171.8	1 370.8
	Heterogeneous agricultural areas	ha	35.5	3 286.5
	Arable land	ha	0.0	447.5

Table S2. Correlation test for Burned area and Soil moisture

t = -3.9285, df = 25, p-value = 0.0005952

alternative hypothesis: true correlation is not equal to 0

95 percent confidence interval:

-0.8081035 -0.3107605

sample estimates:

cor

-0.6178147

Table S3 Correlation test for Number of Fires and Soil moisture

t = -3.4807, df = 25, p-value = 0.001853
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
-0.7816411 -0.2443762
sample estimates:
cor
-0.5713326

Table S4. Correlation test for Burned area and Soil moisture after removing linear trends

t = -3.2684, df = 25, p-value = 0.00165
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
-0.7531160 -0.2930735
sample estimates:
cor
-0.5892635

Table S5 Correlation test for Number of Fires and Soil moisture after removing linear trends

t = -3.1419, df = 25, p-value = 0.00223
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
-0.70181360 -0.2105959
sample estimates:
cor
-0.518837

Table S6. Correlation coefficient of the detrended SMAP root zone SM and in-situ SM after removing linear trends

t = 5.2968, df = 28, p-value = 1.233e-05
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
0.4659519 0.8508648
sample estimates:
cor
0.707461

Table S7. Correlation coefficient of the detrended SMAP surface SM and in-situ SM after removing linear trends

t = 7.2688, df = 28, p-value = 6.505e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
0.6323910 0.9051087
sample estimates:
cor
0.8084665

Information on the delineation of fire affected areas

The data used to record the burned areas comes from the European Space Agency's (E.S.A.) Sentinel-2 satellites each carry a single multispectral instrument (MSI) with 13 spectral channels in the visible/near infrared (VNIR) and shortwave infrared spectral range (SWIR).

With the use of these instruments and the image recording on the above channels two basic image products are produced for our work as shown below:

A. The CIR (or Color Infrared RGB composite) where the use of the infrared spectrum in imaging dominates and thus the live vegetation appears in red and the absence of vegetation in dark to black. The spatial resolution in this data is 10μ/pixel, i.e. the Pixel (square pixel) is 10 meters side (pixel area = 10x10 = 100m²)

B. The SWIR (or Short Wave Infrared RGB composite) where the thermal infrared spectrum is used where vegetation appears green, while its loss and especially a burnt area dark reddish. The spatial resolution in this data is 30m/pixel, i.e. the pixel (square pixel) is 30 meters in side (pixel area = 30x30 = 900m²)

With a combination of these data, the estimation of the burnt area in the Department of Business Informatics & Geospatial Analysis of the Directorate of Informatics & Communications of the Greek fire brigade headquarters (D.B.I.G.A) is done in the following ways:

a) with the method of photointerpretation in cases where the pattern of the burnt area is not complex enough, the manual delineation of affected areas is applied. Thus, the interpreter with the use of digital media and digitization on the screen delineates the burnt area as it appears in the image. In this method, the subjective factor of perception and working methodology of the human – photointerpreter may affect the results.

b) By classifying a digital image based on the methodology of object-oriented image classification. (Image classification based on Object Based Image Analysis - OBIA), where the way of identifying burnt area is automated to the maximum extent by using pattern recognition algorithms and "assigning" parts of the image to a specific class (e.g. in our case = burnt area).

With this method, the pixels are aggregated into groups-objects with similar (spectral - chromatic) characteristics and then the objects enter the various classes, in our case the burnt area. The system operator a) adjusts the parameters that make up the grouping of pixels on discrete objects and b) indicates the classes of classification (one of which is necessarily the burnt area) by selecting a sample of objects belonging to them and c) selects the algorithm that will best classify the set of objects that make up the image into the classes that have been defined.

In order to arrive at a recording, we need to have a satellite image from the Sentinel-2 satellite that allows us to make a correct estimate.

This image must be at least clear of clouds. Depending on the season, such an image may be available from 2-3 to 15 days after the end of an event.

In D.B.I.G.A. for "big" wildfires the recording is done as quickly as possible based on the above, while for "small" wildfires there is a recording of 2 months outside fire season and for every month within fire season.

For the "major" wildfires, however, there are two other main official sources of mapping the burned area

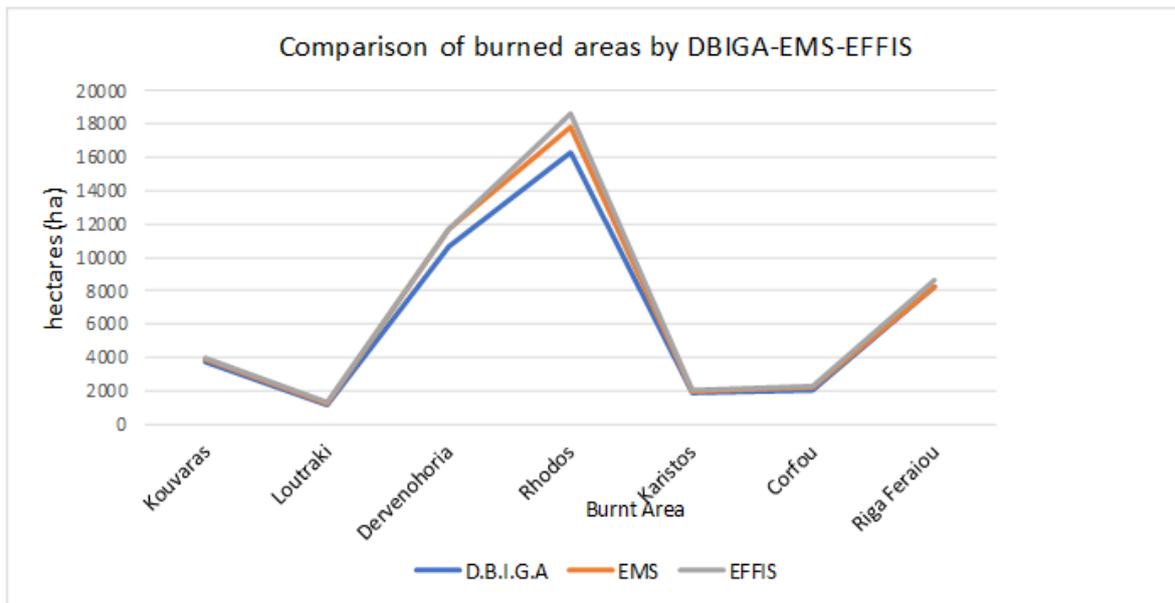
A. The Copernicus Emergency Management Service, which is activated by the General Secretariat of Civil Protection and creates cartographic products of the burnt area during the course and at the end of the incident. As stated in the outputs of this service, they result from satellite images of higher resolution than that of the Sentinel-2 data, usually from Airbus data, such as Pleiades -1A with a spatial resolution of 2m and with a recording method of photo interpretation or sometimes semi-automatic sorting; It is easy to identify the methodology and data used from the metadata of the EMS map.

B. The EFFIS system which systematically collects data on wildfires. This system also reports burnt area per event. In the following Figure it is evident that this system always overestimates the burned area, since it is also based on an estimate of the area based from low resolution MODIS data (pixels 1000x1000m)

Below we provide a comparison of burnt areas from incidents of the current fire season, according to the above systems and with our work at the D.B.I.G.A.

BURNT AREA	BURNT AREA BY D.B.I.G.A (in ha)	BURNT AREA BY EMS (in ha)	BURNT AREA BY EFFIS (in ha)	D.B.I.G.A VS EMS (%)	D.B.I.G.A VS EFFIS (%)
Kouvaras	3693	3863	3931	-1.7	-2.38
Loutraki	1136	1195	1272	-0.59	-1.36

Dervenohoria	10606	11696	11662	-10.9	-10.56
Rhodos	16247	17826	18626	-15.79	-23.79
Karistos	1898	1966	2063	-0.68	-1.65
Corfou	2056	2183	2295	-1.27	-2.39
Riga Feraiou	8259	8261	8634	-0.02	-3.75



It appears, therefore, from the above table and graphs that the difference in the estimation of the burnt area based on the three existing sources is limited. We argue that the results provided by DGIBA are the most accurate ones, as they rely on a variety of approaches and they are also checked by the Greek Fire Service using in-situ verification.