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The early July 2021 Arakapas (Cyprus) forest fire

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About

Non-periodic publication of the Post-graduate Studies Program “Environmental Disasters & Crises Management Strategies" of the National & Kapodistrian University of Athens, issued after significant events for the immediate information of the scientific community and the general public. The publication includes also scientific data from various research teams from universities, organizations and research institutes.

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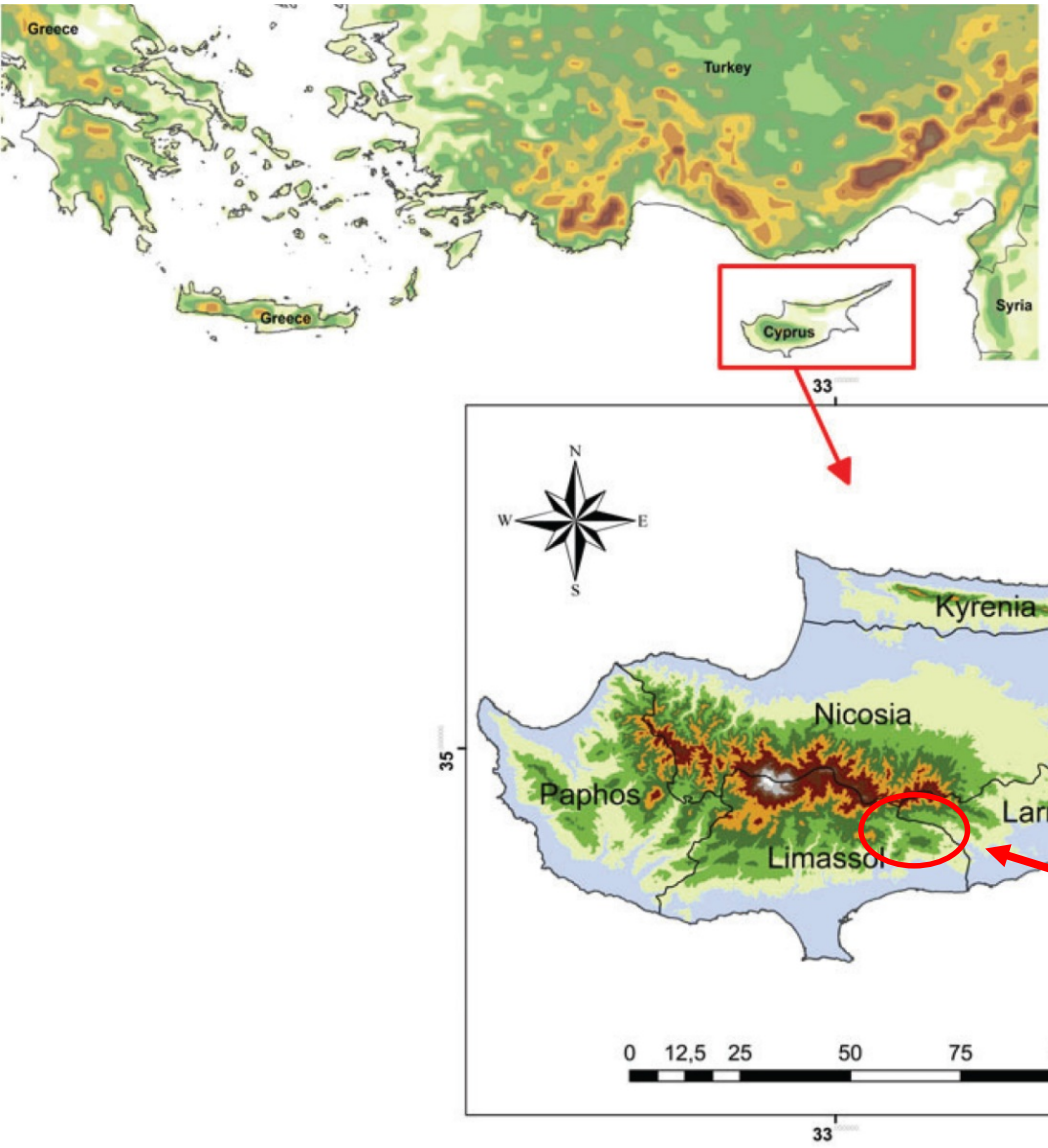
INTRODUCTION OF THE 24st ISSUE OF THE EDCMS NEWSLETTER

The 24th issue of the Newsletter of Environmental, Disaster, and Crises Management Strategies refers to the early July 2021 Arakapas (Cyprus) forest fire. It comprises:

- a brief review of the forest distribution in Cyprus with their dominant species,
- a brief presentation of the major threats for forest ecosystems in the island,
- the forest fire statistics for the period from 2000 to 2019 in the island comprising the number of forest fires and burnt areas as well as recent destructive forest fires in Cyprus,
- the evolution of the early July 2021 forest fire event,
- a detailed presentation of the impact of the early July 2021 forest fire on the population (fatalities and evacuation of threatened communities), on fauna and flora, on buildings, vehicles and infrastructures of the affected area and on livestock based mainly on field surveys conducted shortly after the forest fire by the scientific team of the National and Kapodistrian University of Athens headed by Professor Dr. Efthymis Lekkas,
- the response actions conducted by the involved authorities for fighting the forest fire, including mobilization of the competent authorities, activation of emergency plans, activation of the EU Civil Protection Mechanism and requesting support as well as activation of the Copernicus Emergency Management Service for rapid mapping of the fire-affected area,
- the support measures adopted by the state authorities (presidency and ministries) for supporting the families of the victims and the local population,
- a presentation and a brief analysis of the post-fire hazards with high potential to cause adverse effects and damage to the fire-affected area comprising slope failures, floods as well as erosion and desertification phenomena.

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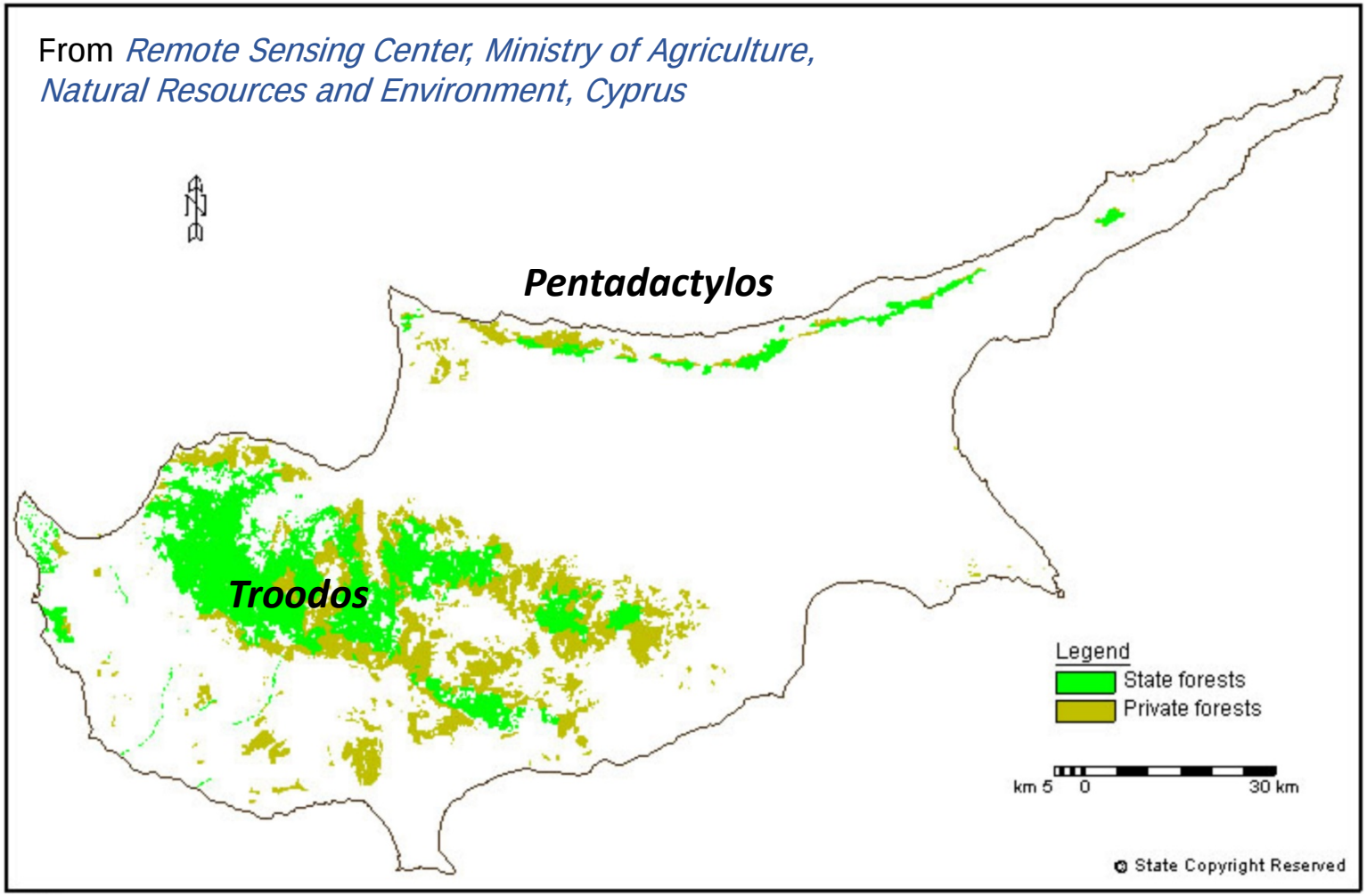
PROVINCES OF CYPRUS



On 3 July, in the afternoon, a fire broke out in the Limassol province. Houses were destroyed and large areas of pine forest and other vegetation were burned in just a few hours. The Arakapas village has been initially evacuated and followed by the communities of Melini, Ora, Odou, Sykopetra, Eptagonia, Ayioi Vavatsinias, and Vavatsinia.

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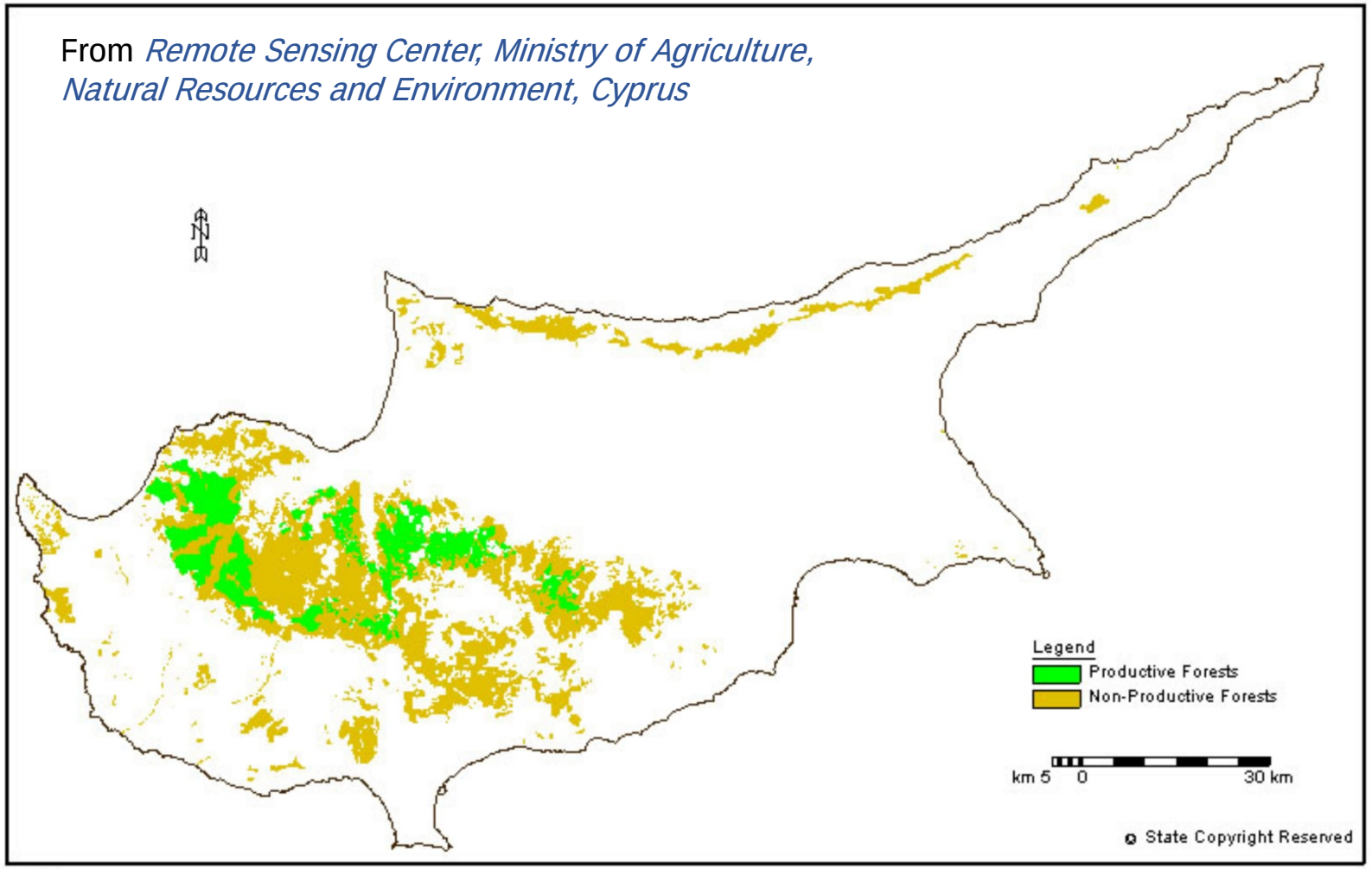
STATE AND PRIVATE FORESTS IN CYPRUS



The distribution of the state and private forests in Cyprus

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PRODUCTIVE AND NON PRODUCTIVE FORESTS IN CYPRUS



The distribution of the productive and non-productive forests in Cyprus

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DOMINANT FOREST SPECIES IN CYPRUS

Area covered by the dominant forest species in Cyprus

Community	State	Private	Total
Pinus brutia	88.790	48.954	137.744
Juniperus phoenicia	5.350	2.940	8.290
Cupressus sempervirens		7.270	7.270
Pinus brutia- Quercus alnifolia	5.870		5.870
Ceratonia siliqua - Olea europaea		5.720	5.720
Pinus nigra	2.640		2.640
Pinus brutia - Pinus nigra	2.330		2.330
Platanus - Alnus spp	430	610	1.040
Eucalyptus spp	137	260	397
Cedrus brevifolia	130		130
Cedrus brevifolia - Pinus brutia	120		120
Quercus infectoria subsp. *veneris*		60	60

The largest part of the forests in Cyprus are composed mainly of pine and ssecondarily by other vegetation comprising junipers, cedars, plane trees and cypress trees among others.

From *NRA-CY (2018)*

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MAJOR THREATS FOR FOREST ECOSYSTEMS IN CYPRUS

Forest Fires are the most catastrophic agent for both forests and other wooded lands in Cyprus.

Grazing and in particular **overgrazing** is an important problem in some of the state forests in Cyprus. Overgrazing leads to vegetation degradation and soil erosion.

Climate Change. Over the last century, a strong increase in the mean summer temperature was recorded for the Eastern part of the Mediterranean basin from the 1950s, followed by a cooling until the mid-1970s. Subsequently a strong warming was observed with 2003 being the hottest summer. A strong decline in precipitation, starting from the early 1960s is evident. These climate changes are associated with over 6000 ha of dieback and secondary insect infestations in Cyprus forests (DoF 2011).

Land use and **Land use changes**, mainly associated with unsustainable touristic development affect private forestland.

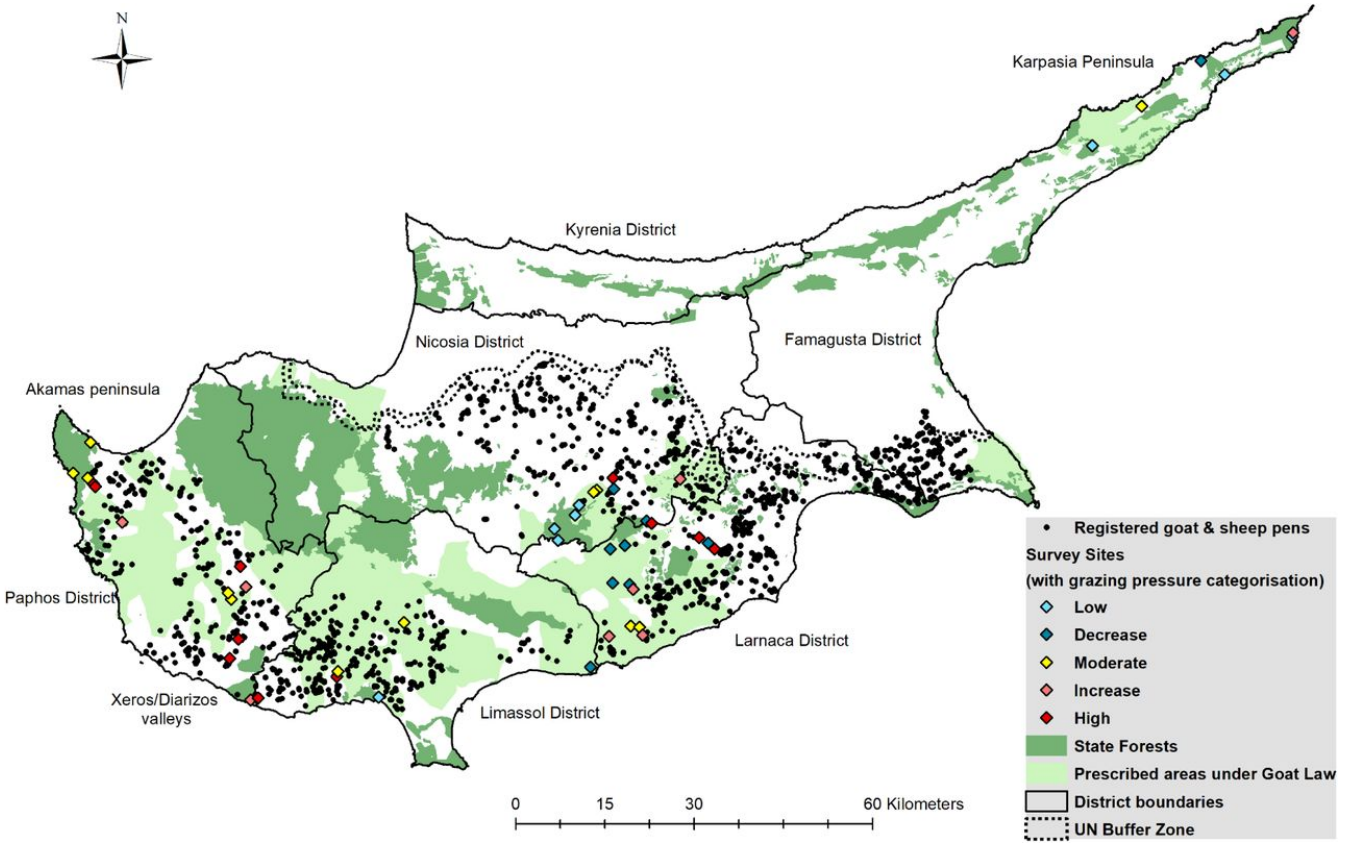


From *NRA-CY (2018)*

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GRAZING

GRAZING PRESSURE OVERVIEW MAP OF CYPRUS

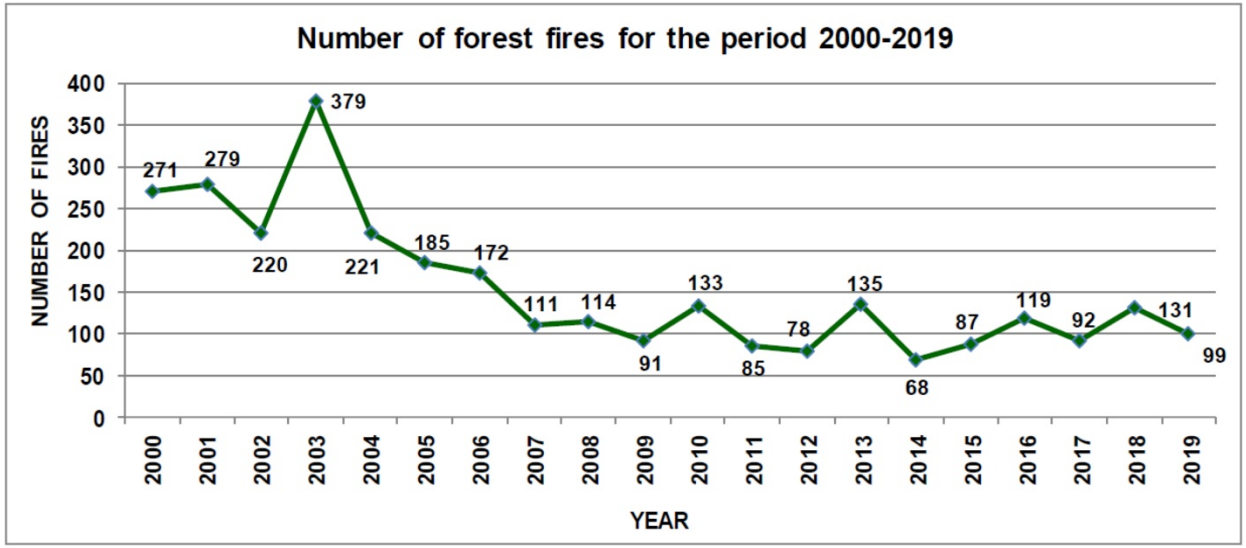


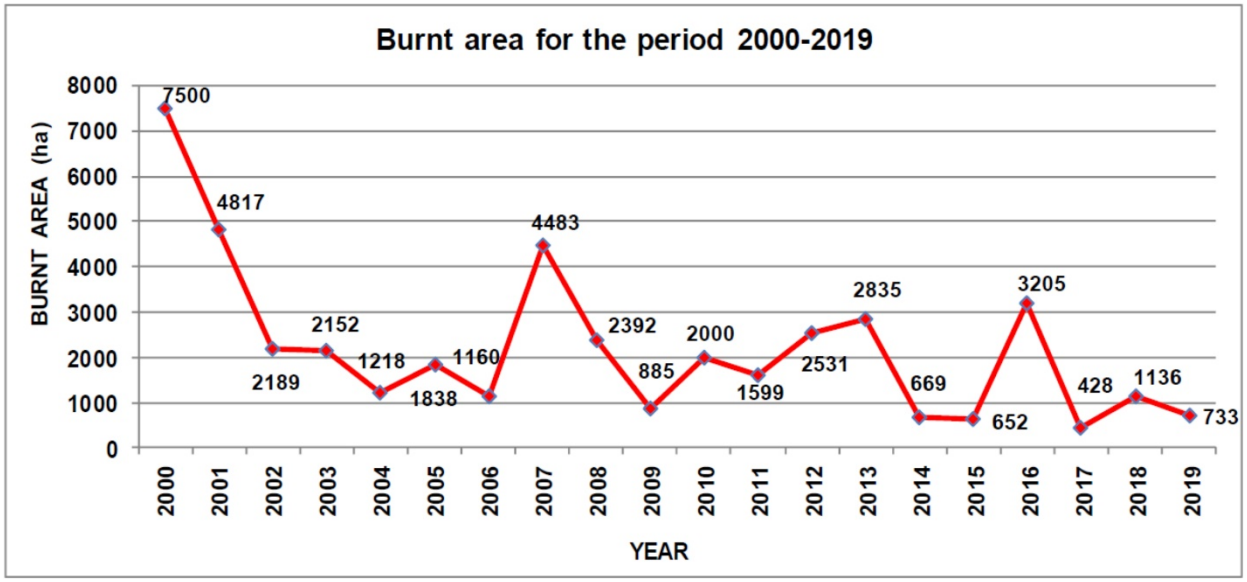
Grazing and browsing by sheep and goats has been an important anthropogenic influence on ecosystems in the Mediterranean region for centuries. Hellicar and Kirschel (2019), in the frame of their study on how grazing and other disturbance factors influence biodiversity in Cyprus, suggested that the best approach for biodiversity management in scrub and open woodland habitats in Cyprus is to keep grazing to a minimum and avoid fires, though a 'no grazing' approach should also be avoided, because absence of grazers would likely increase fire risk (map from *Hellicar and Kirschel, 2019*).

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FOREST FIRE STATISTICS FOR THE PERIOD 2000-2019 IN CYPRUS

Number of forest fires and burnt areas for the period 2000-2019





From *Republic of Cyprus, Ministry of Agriculture, Rural Development and Environment Department of Forests*

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FOREST FIRE STATISTICS FOR THE PERIOD 2000-2019 IN CYPRUS

Number of forest fires and burnt areas for the period 2000-2019

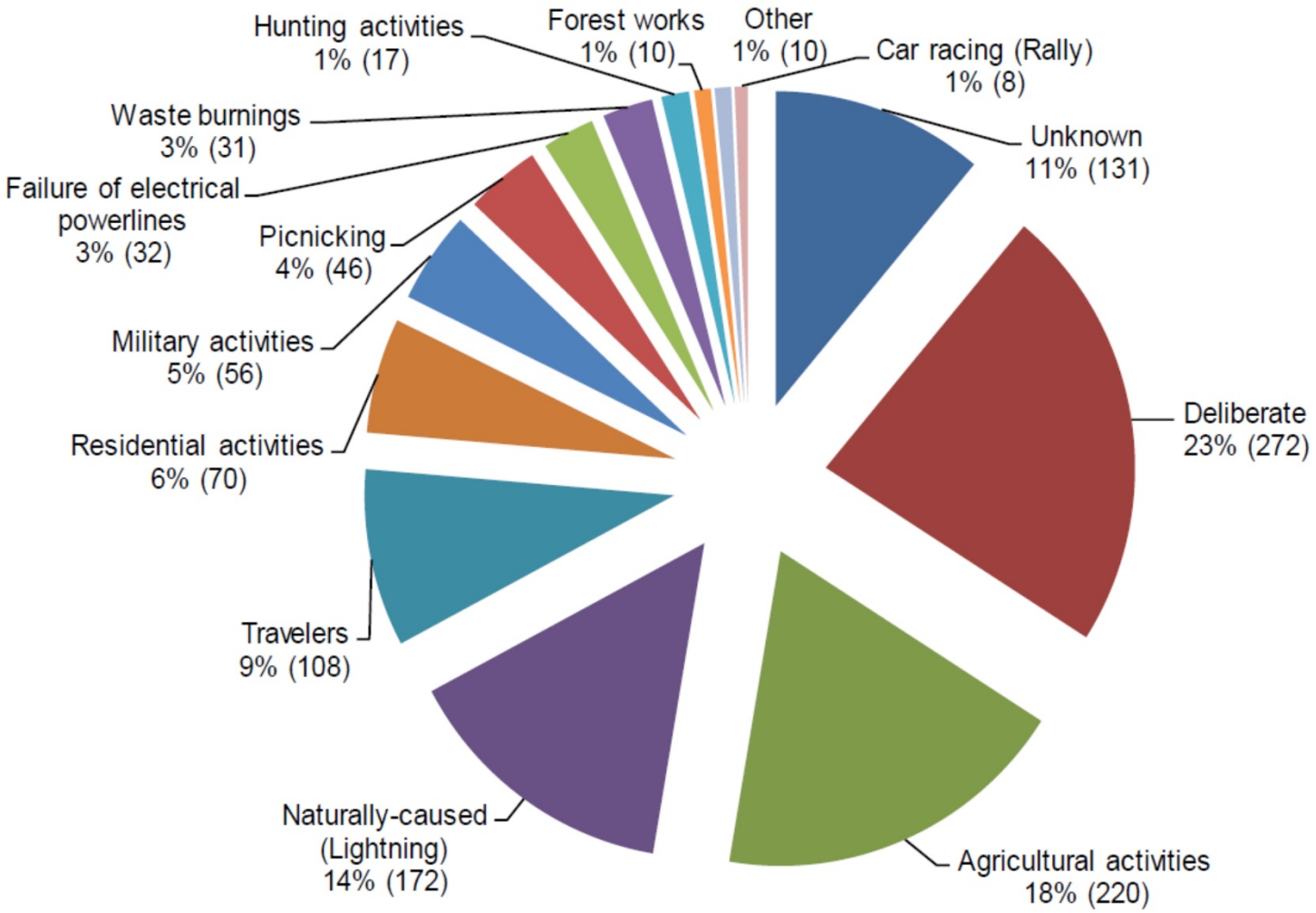
Parameter	Period	State forest (a)	Within the zone of 2 km from the State forest boundaries (b)	Total within the zone of responsibility of the Department of Forests (a+b)	Beyond the zone of 2 km from the State forest boundaries	Total
Number of forest fires	2000 – 2018 (Average for the period)	22	36	58	98	156
	2014 – 2018 (5-year average)	19	48	67	33	100
	YEAR 2018	35	66	101	30	131
	YEAR 2019	30	51	81	18	99
Burnt area (Ha)	2000 – 2018 (Average for the period)	223	203	426	1.873	2.299
	2014 – 2018 (5-year average)	510	162	672	546	1.218
	YEAR 2018	46	315	361	775	1.136
	YEAR 2019	106	128	234	499	733
Average fire size (Ha)	2000 – 2018	10,1	5,6	7,3	19,1	14,7
	2014 – 2018	26,8	3,4	10,0	16,5	12,2
	YEAR 2018	1,3	4,8	3,6	25,8	8,7
	YEAR 2019	3,5	2,5	2,9	27,7	7,4

From *Republic of Cyprus, Ministry of Agriculture, Rural Development and Environment Department of Forests*

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FOREST FIRE STATISTICS FOR THE PERIOD 2000-2019 IN CYPRUS

CAUSES OF FOREST FIRES FOR THE PERIOD 2000-2019

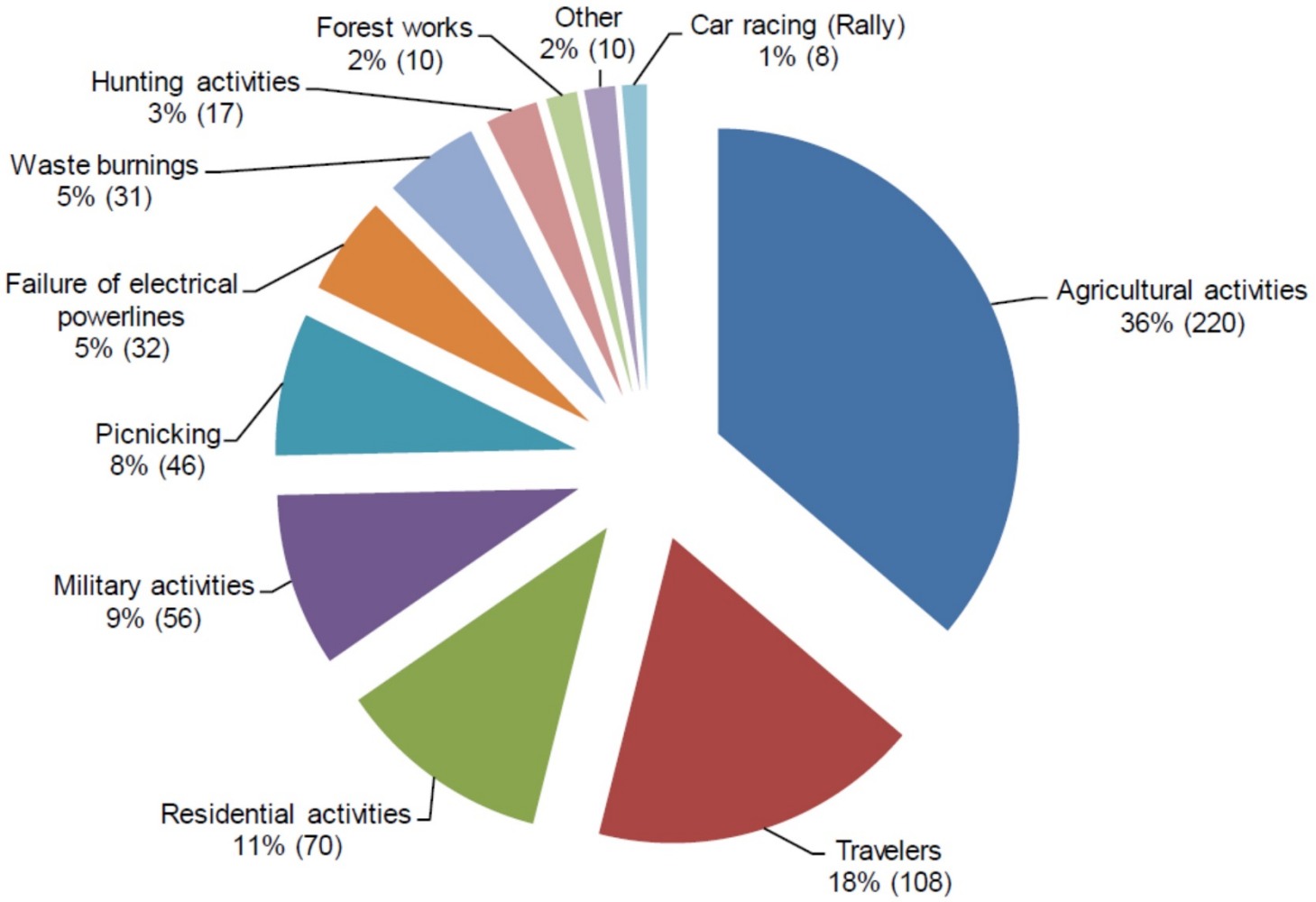


From *Republic of Cyprus, Ministry of Agriculture, Rural Development and Environment Department of Forests*

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FOREST FIRE STATISTICS FOR THE PERIOD 2000-2019 IN CYPRUS

FOREST FIRES INDUCED BY NEGLIGENCE FOR THE PERIOD 2000-2019

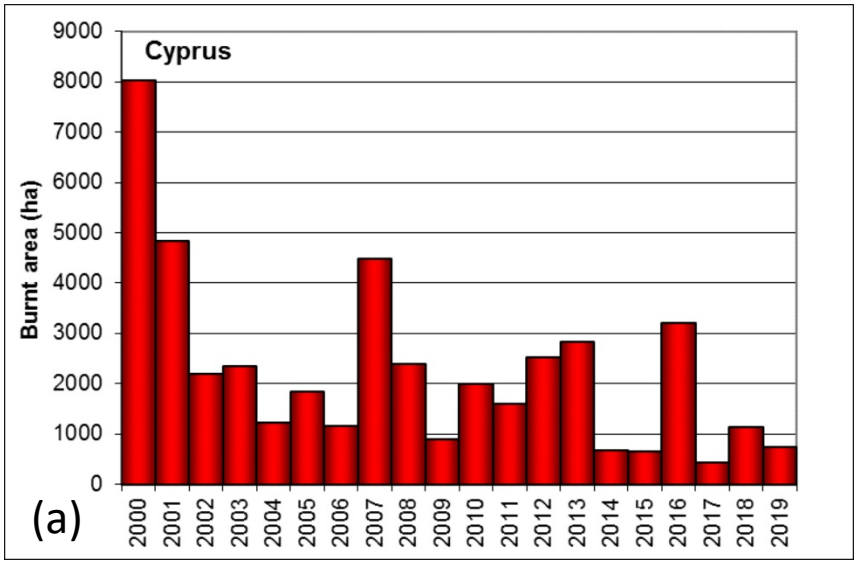


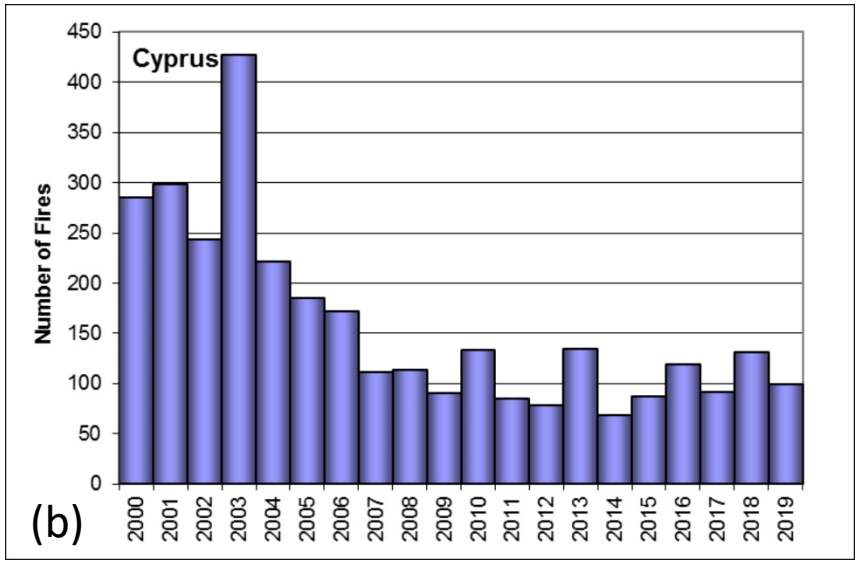
From *Republic of Cyprus, Ministry of Agriculture, Rural Development and Environment Department of Forests*

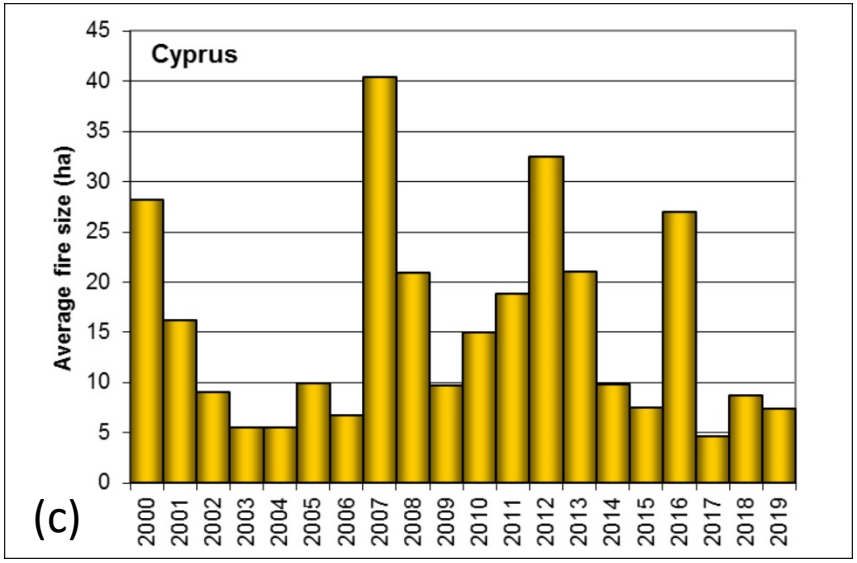
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FOREST FIRE STATISTICS FOR THE PERIOD 2000-2019 IN CYPRUS

FOREST FIRES INDUCED BY NEGLIGENCE FOR THE PERIOD 2000-2019







(a) Burnt areas, (b) number of fires and (c) average fire size in Cyprus from 2000 to 2019.

From *San-Miguel-Ayanz et al. (2020)*; Forest fires in Europe, Middle East and North Africa

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RECENT DESTRUCTIVE FOREST FIRES IN CYPRUS

The recent destructive fires in Cyprus comprises the following events, which are briefly presented along with their occurrence date, the extent of the burnt area, the fatalities and damage to forests and buildings:

2000 Vavla Fire

- 20 June 2000
- Burnt area of 52 km2
- Affected communities: Lagia, Vavla, Ora, Vavatsinia
- No fatalities, no burnt buildings

2001 Messana Fire

- 30 June 2001
- Burnt area of 20 km2
- No fatalities
- Damage to buildings and vineyards

2007 Saittas Fire

- 29 June 2007
- Burnt area of 12 km2
- Damage to about 30 buildings and premises
- Burnt forest and agricultural land

2008 Ora Fire

- 18 June 2008
- Burnt area of 13 km2

2012 Kato Dris Fire

- 12 August 2012
- Burnt area of 16.36 km2
- Affected communities: Kato Dris, Choirokoitia, Lefkara
- No fatalities, no damage to buildings

2013 Choirokoitia Fire

- 19 June 2013
- Burnt area of 10 km2
- Affected communities of Choirokoitia, Vavla, Ora and Ayios Theodoros
- No fatalities
- Damage to the external parts of buildings and farms
- Damage to the water supply network

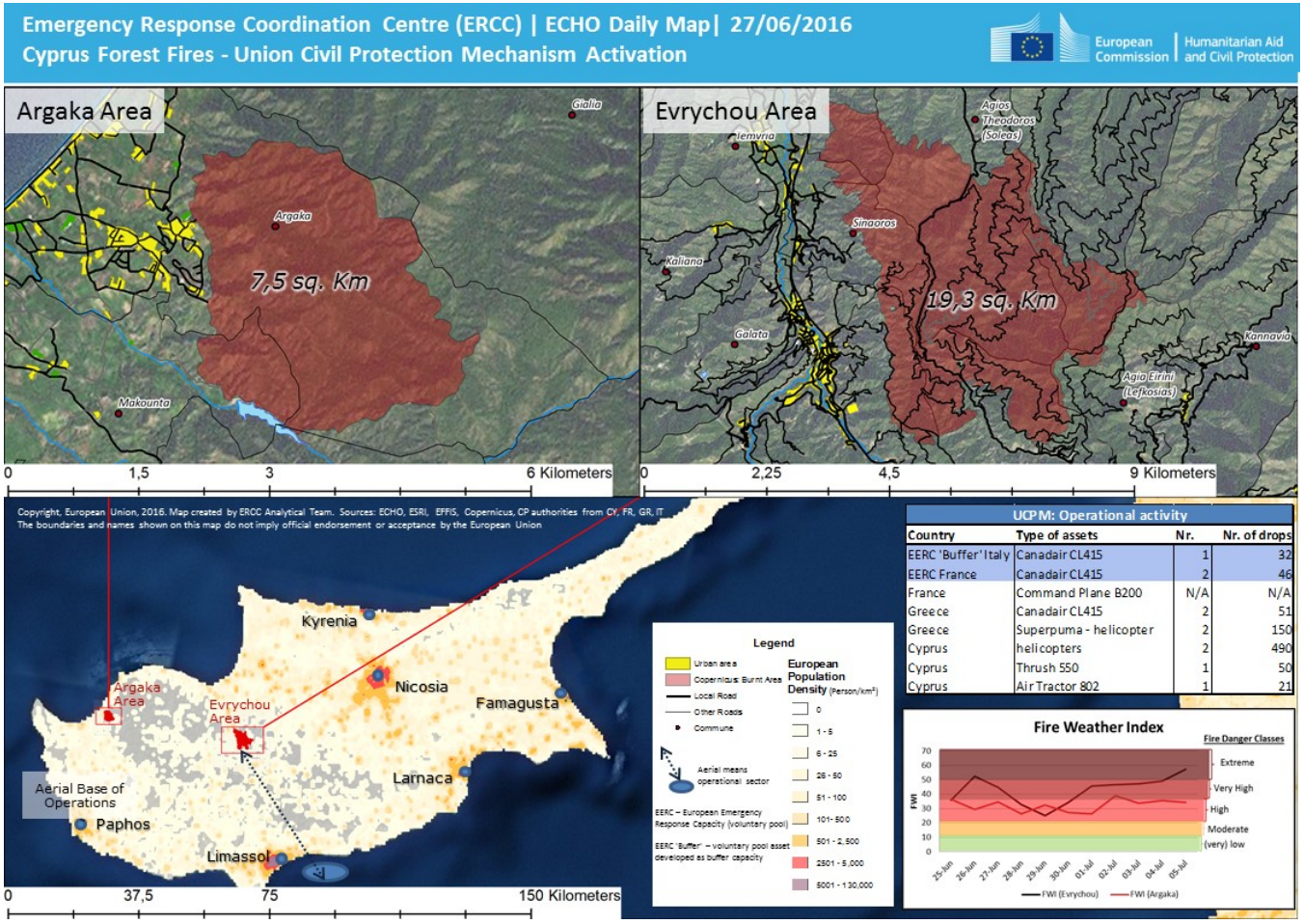
2016 Soleas Fire

- 19 June 2016
- Burnt area of 18,57 km2
- 17,03 km² of state forests and 1,54 km² of private properties
- 2 fatalities (forest firefighters)
- Complete destruction of buildings
- Damage to properties

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RECENT DESTRUCTIVE FOREST FIRES IN CYPRUS

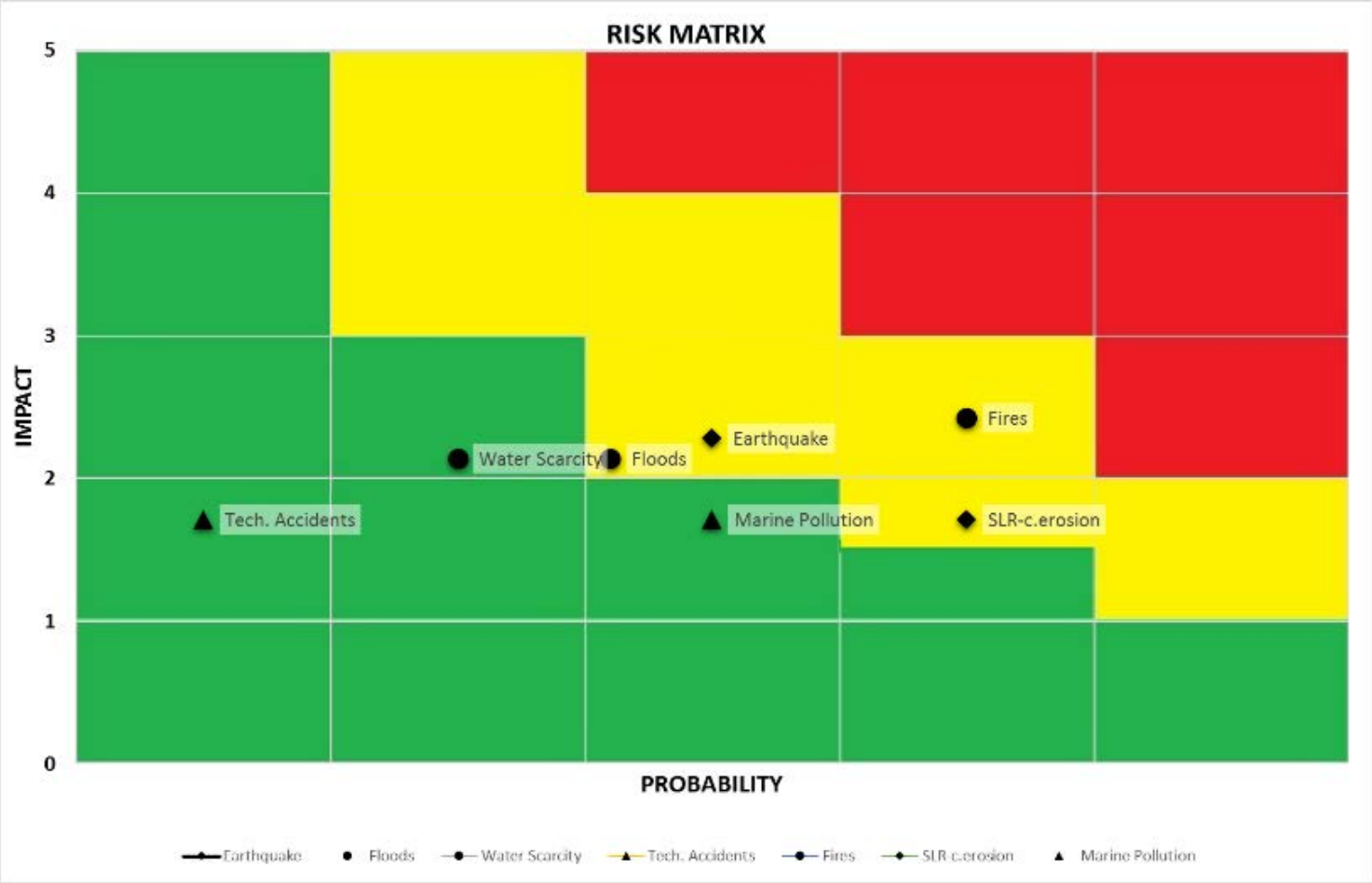
2016 SOLEAS FIRE



The most recent case of destructive forest fire in Cyprus is the 2016 Soleas forest fire, which claimed the life of 2 forest firefighters and burned areas in the western part of the island.

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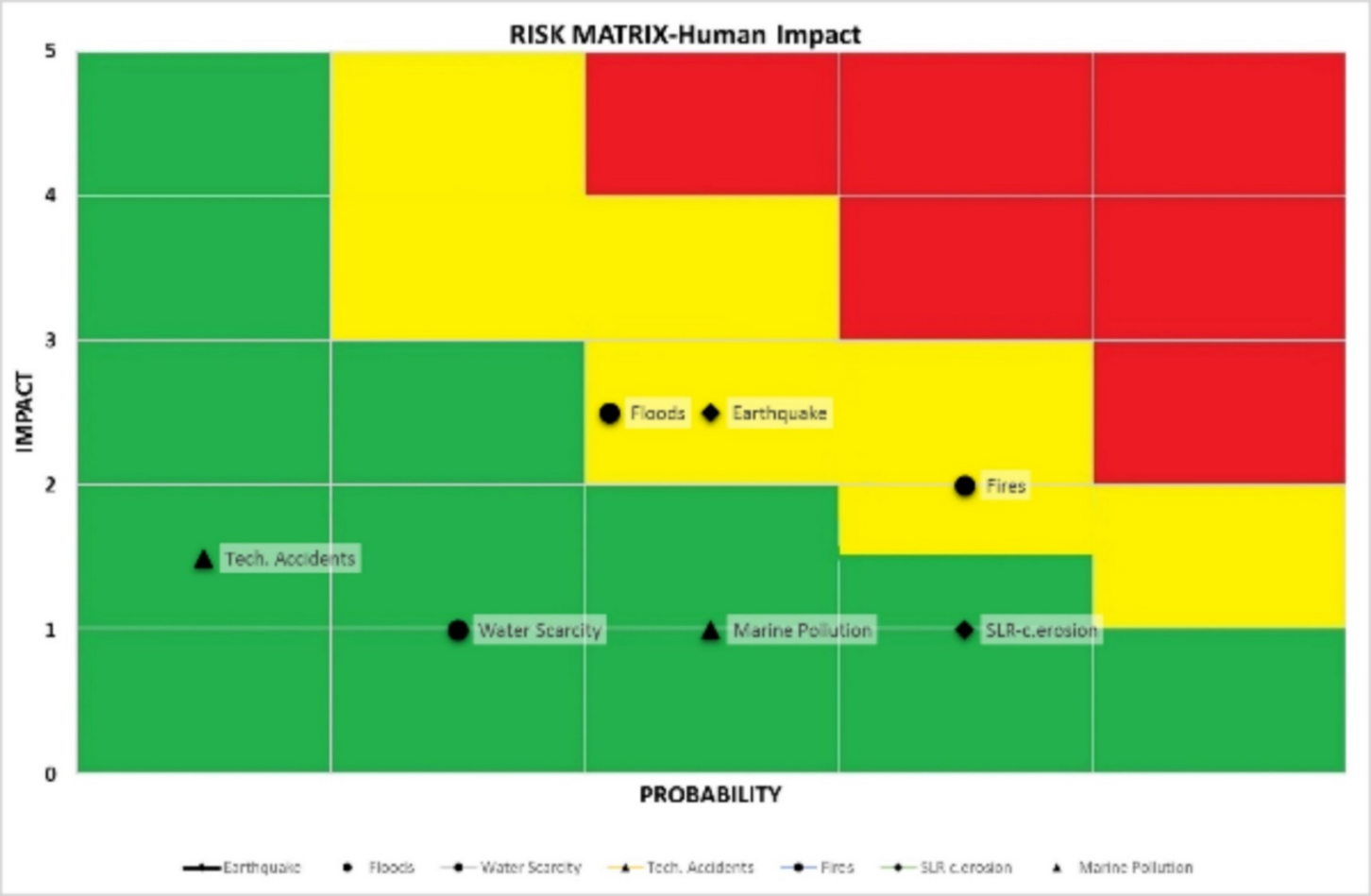
RISK MATRIX FOR THE EXPECTED CASE HAZARDS IN CYPRUS



Integrated risk matrix for the expected case hazard scenarios
[Low risk (green color), medium risk (yellow color), high risk (red color);
Available at: https://aegisproject.eu/wp-content/uploads/2020/10/NRA-National-Risk-Assessment1.pdf]

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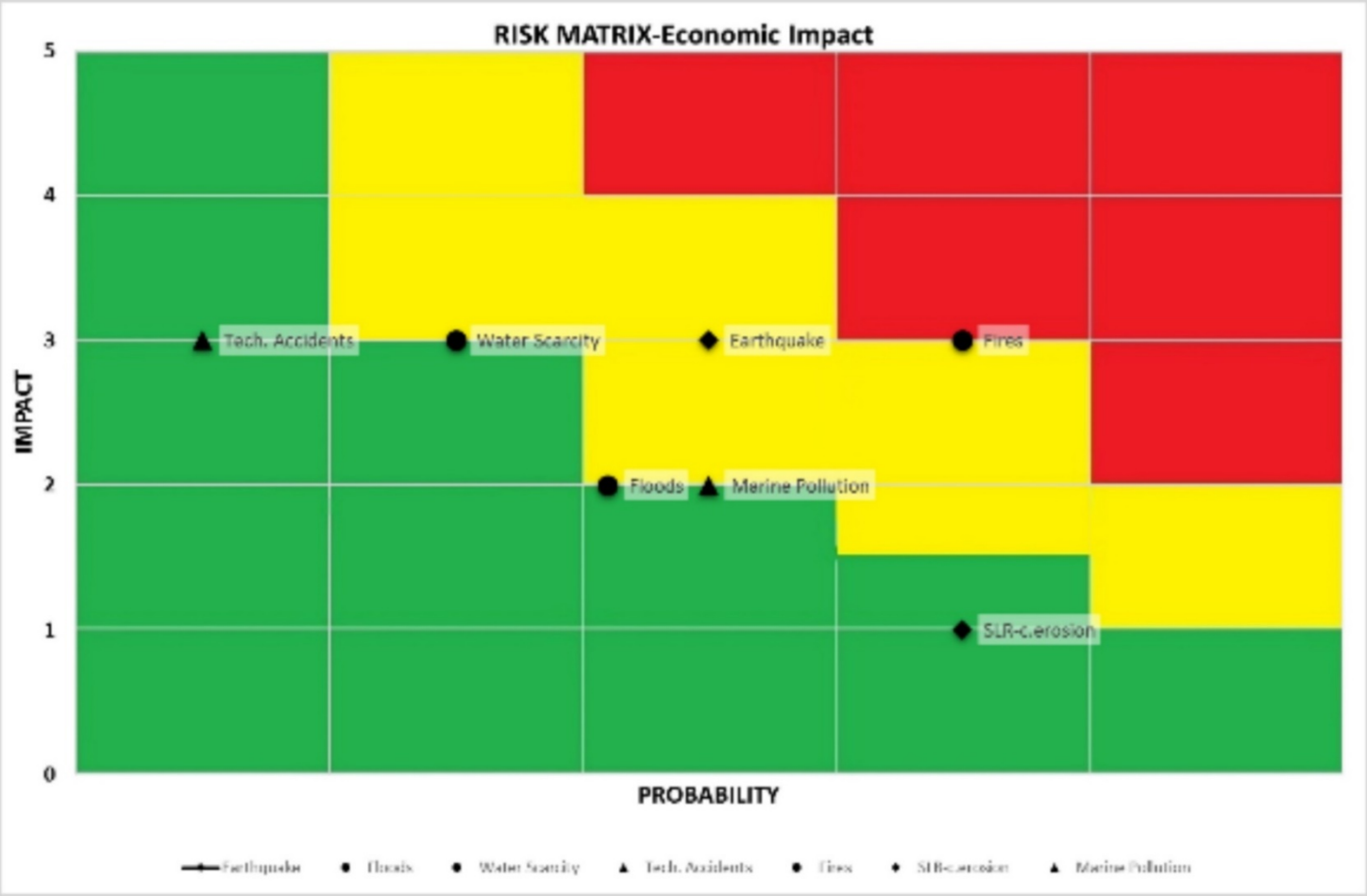
RISK MATRIX FOR HUMAN IMPACT



Considering only the human impact, the scenarios with the higher score are for fires, earthquakes and floods, i.e. it is expected that these scenarios will cause the greatest fatalities and injuries to the population (Available at: https://aegisproject.eu/wp-content/uploads/2020/10/NRA-National-Risk-Assessment1.pdf)

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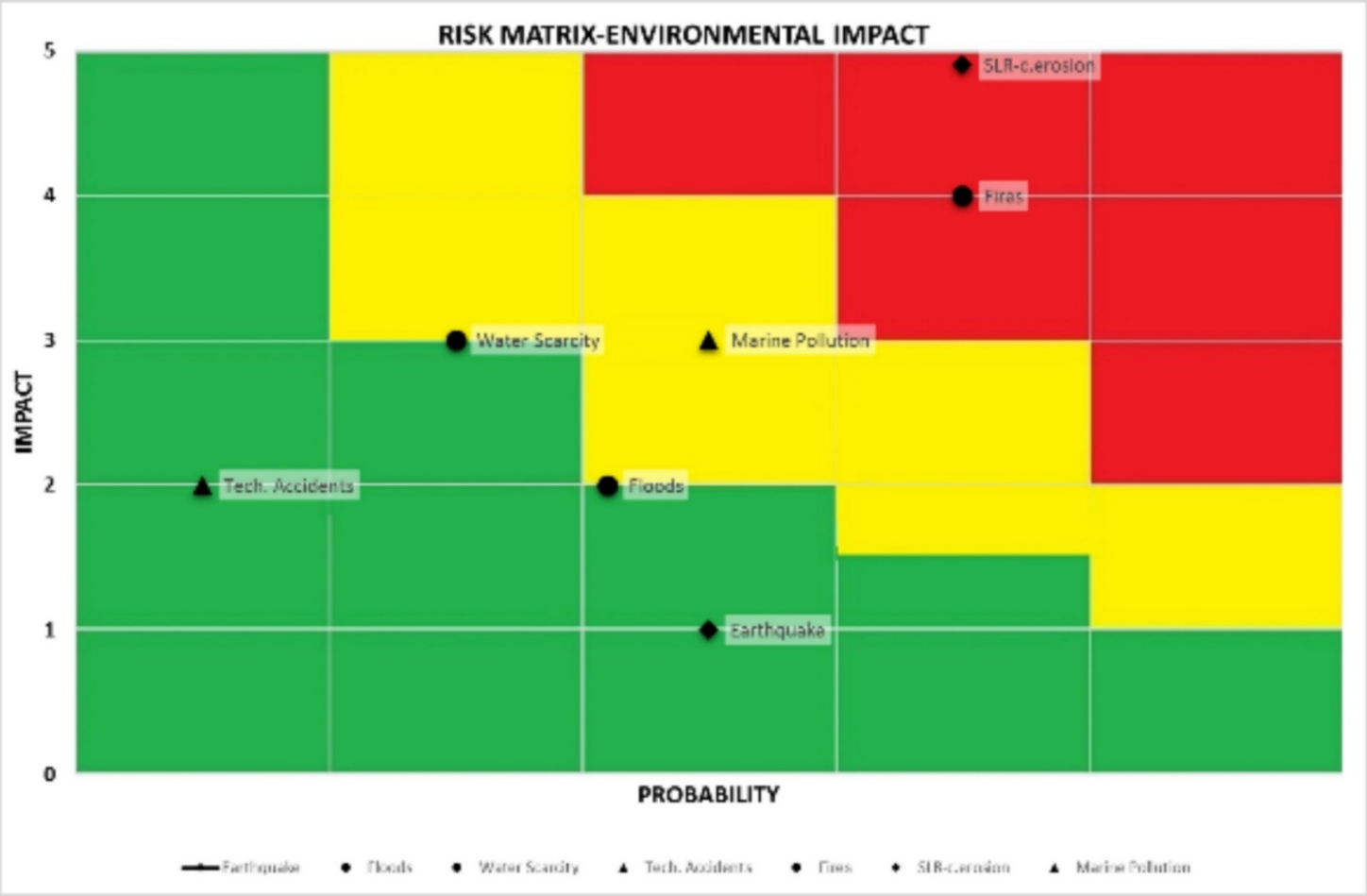
RISK MATRIX FOR ECONOMIC IMPACT



For the case whereas only the impact on economy is considered, the higher score is for the fire scenario, followed by earthquakes. Floods, water scarcity and marine pollution also reach medium level risk. (Available at: https://aegisproject.eu/wp-content/uploads/2020/10/NRA-National-Risk-Assessment1.pdf)

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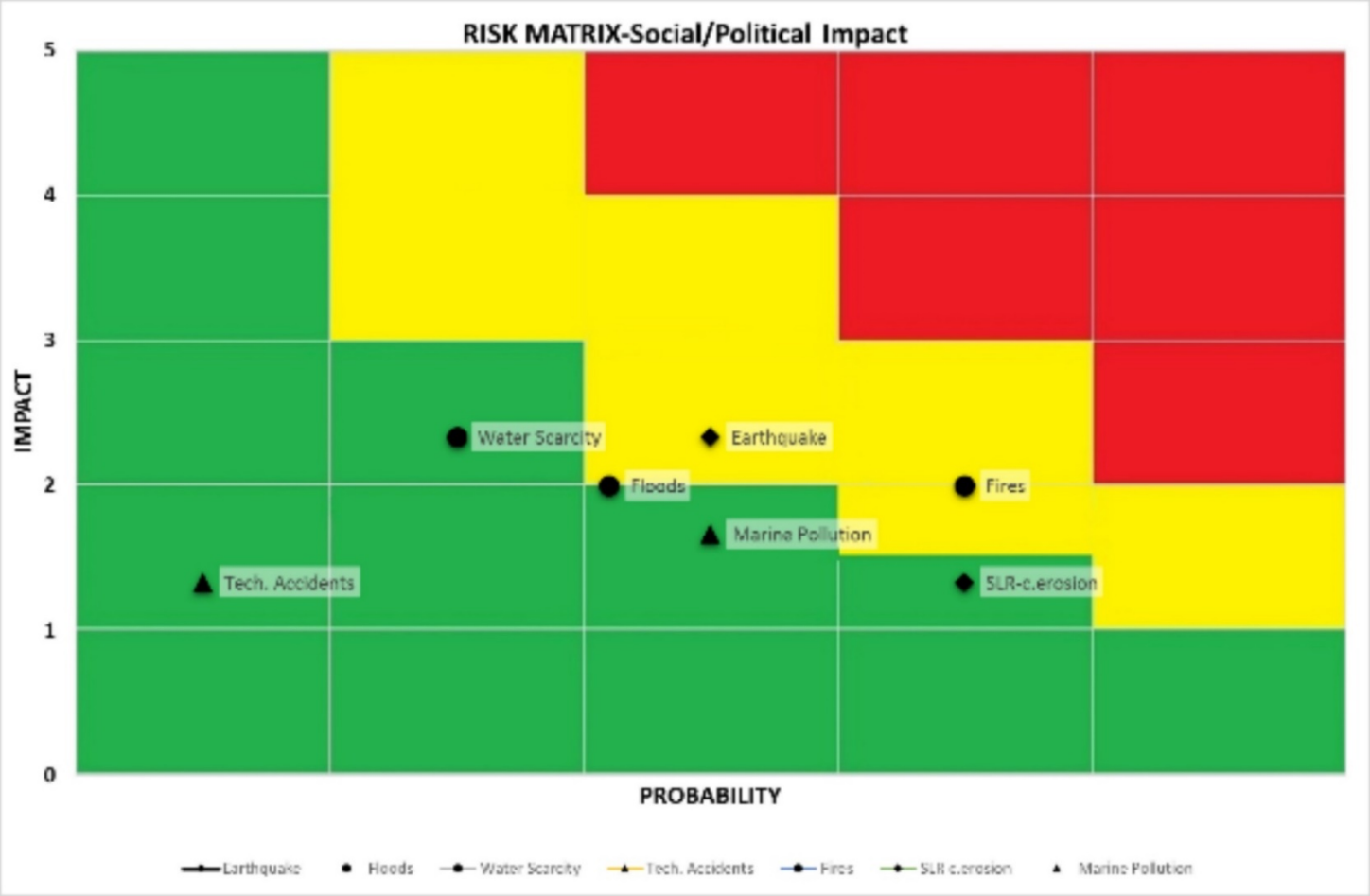
RISK MATRIX FOR ENVIRONMENTAL IMPACT



Considering only the environmental impact, the higher risk level is for sea-level-rise and coastal erosion followed by fires in the forest. Also medium risk level is reached for the scenario of marine pollution. (Available at: https://aegisproject.eu/wp-content/uploads/2020/10/NRA-National-Risk-Assessment1.pdf)

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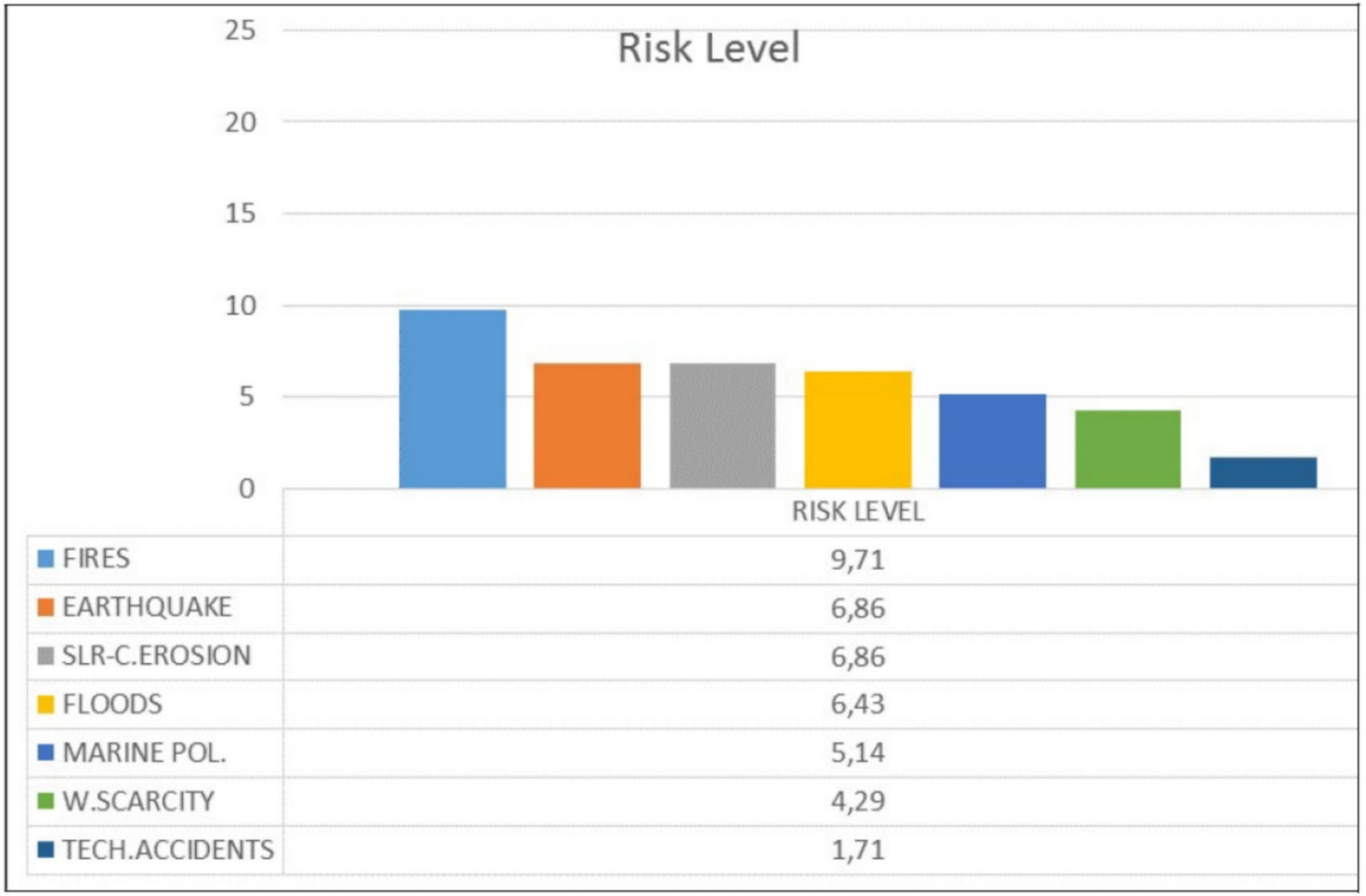
RISK MATRIX FOR SOCIAL/POLITICAL IMPACT



The scenarios involving fires and earthquakes pose the higher risk level although belongs to the defined medium risk zones.
(Available at: https://aegisproject.eu/wp-content/uploads/2020/10/NRA-National-Risk-Assessment1.pdf)

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RISK LEVEL IN ALL PROVINCES OF CYPRUS



In Cyprus, **fires** have the higher risk level (9.71%). **Earthquakes** follow with 6.86 %, **sea level rise and coastal erosion** with 6.86 %, **floods** with 6.43 %, **marine pollution** with 5.14 %, **water scarcity** with 4.29 % and large scale **technological accidents** with 1.71 % (From *NRA-CY, 2018*).

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DOMINANT NATURAL HAZARDS IN CUPRUS PROVINCES

FAMAGUSTA	*KYRENIA*	*LARNACA*
Forest fires	Forest fires	Forest fires
Earthquakes	Earthquakes	Earthquakes
Coastal erosion and sea level rise	Coastal erosion and sea level rise	Coastal erosion and sea level rise
Tsunami	Tsunami	Marine pollution
Floods	Marine pollution	Technological hazards
Marine pollution	Water shortage	Floods
Water shortage		Tsunami
		Water shortage

From *NRA-CY (2018)*

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DOMINANT NATURAL HAZARDS IN CUPRUS PROVINCES

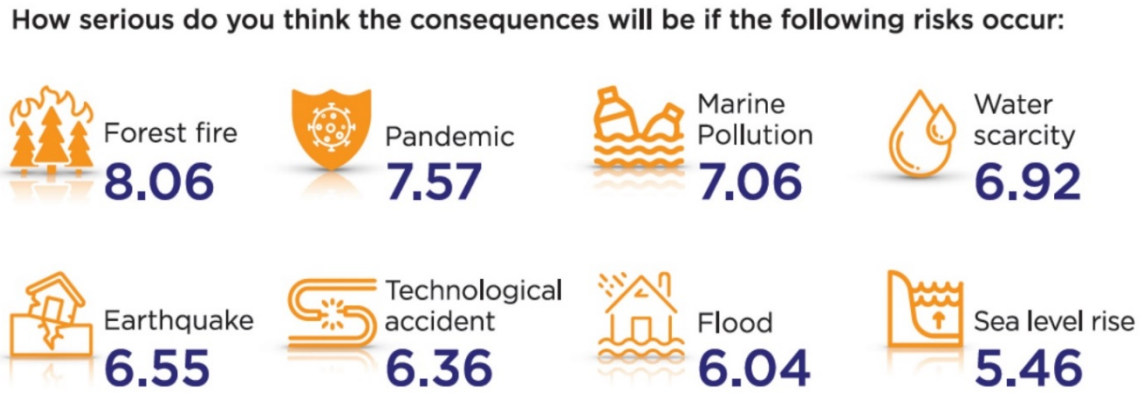
LIMASSOL	*NICOSIA*	*PAPHOS*
Forest fires	Forest fires	Forest fires
Earthquakes	Earthquakes	Earthquakes
Coastal erosion and sea level rise	Floods	Slope failures
Marine pollution	Immigration	Coastal erosion and sea level rise
Technological hazards	Coastal erosion and sea level rise	Tsunami
Floods	Slope failures	Floods
Slope failures	Marine pollution	Marine pollution
Tsunami	Tsunami	Water shortage
Water shortage	Water shortage	

From *NRA-CY (2018)*

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CITIZENS PERCEPTIONS OF RISKS AND RESPONSE TO DISASTERS





As regards the citizens perception of risks and response to disasters in Cyprus, they consider fires to be one of the biggest risks for them today. Furthermore, they believe that the consequences will be very serious if a forest fire occur (From *Civil Defense Force of the Republic of Cyprus*).

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FIRE DANGER FORECAST
FOREST FIRE WEATHER INDEX (FWI) SYSTEM

In 2007, after a test phase of 5 years during which different national fire danger indices were implemented in EFFIS, the EFFIS network adopted the Canadian Forest Fire Weather Index (FWI) System as the method to assess the fire danger level in a harmonized way throughout Europe.

However, given the different climatic conditions in Europe, EFFIS publishes two indicators that provide information on the local/temporal variability of the FWI compared to a historical series of approximately 30 years. These indicators are the ranking, which provides percentiles of occurrence of the values, and the anomaly, computed as a standard deviation from the 30-year historical mean values. These indices are available in the pull down menu of the fire danger section.

Currently, the fire danger forecast module of EFFIS provides access to fire danger indices using numerical weather forecast from two deterministic models i.e. ECMWF (8 km) and MeteoFrance (10 km), and one probabilistic model, the ECMWF Probabilistic model, at 18 km spatial resolution.

ECMWF and MeteoFrance deterministic models

FWI is computed from the ECMWF model (8 km), which provides 1 to 9 days forecasts, and from the MeteoFrance model (10 km), which provides up to 3 days forecasts. The Fire Weather Index is mapped in 6 classes (very low, low, medium, high, very high and extreme). The fire danger classes are the same for all countries and maps show a harmonized picture of the spatial distribution of fire danger level throughout Europe, Middle East and North Africa.

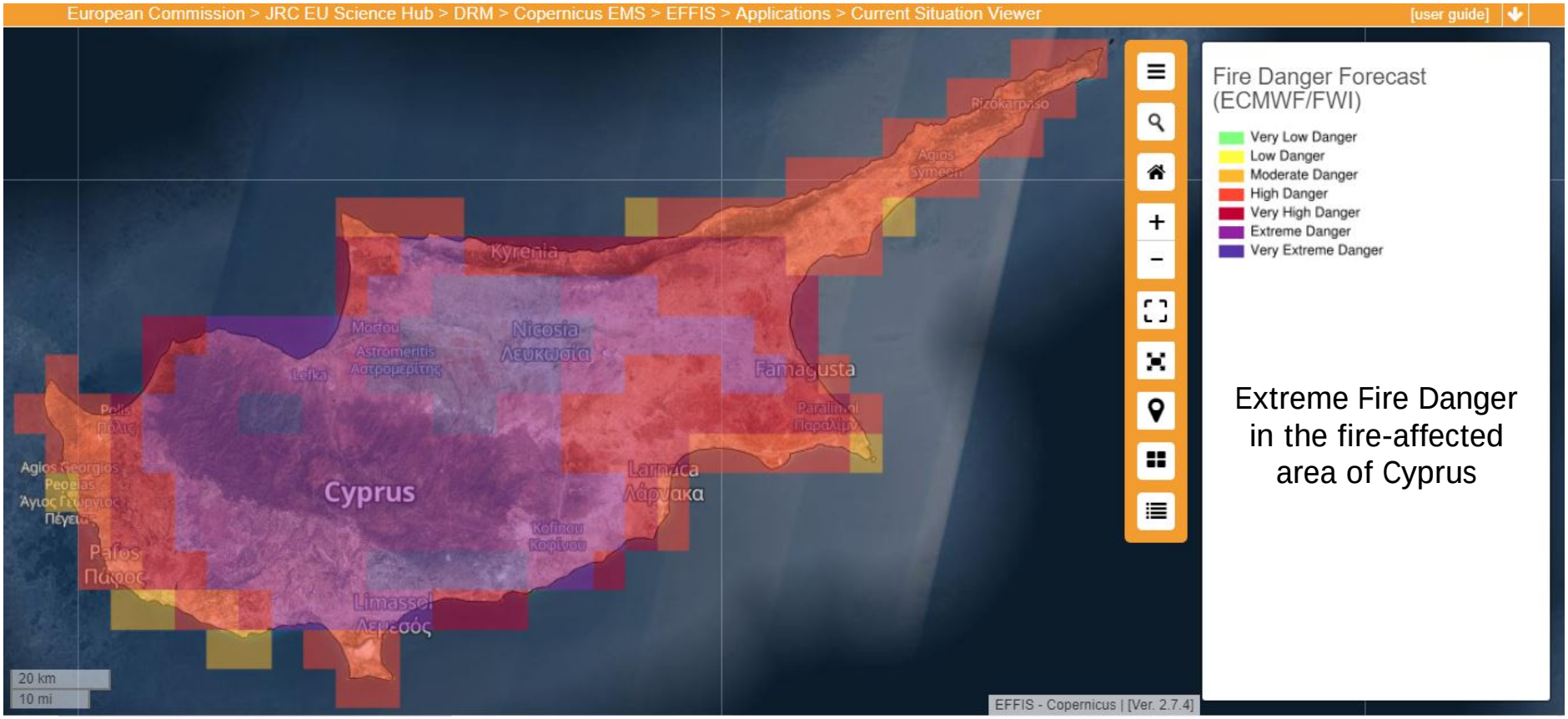
ECMWF Probabilistic model

The ECMWF Probabilistic model provides four fire danger indices: (1) FWI Extreme Forecast Index (FWI EFI), (2) FWI Shift of Tails (FWI SOT), (3) Fine Fuel Moisture Content Extreme Forecast Index (FFMC EFI) and (4) Fine Fuel Moisture Content Shift of Tails (FFMC SOT).



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FIRE DANGER FORECAST
FOR JULY 3, 2021

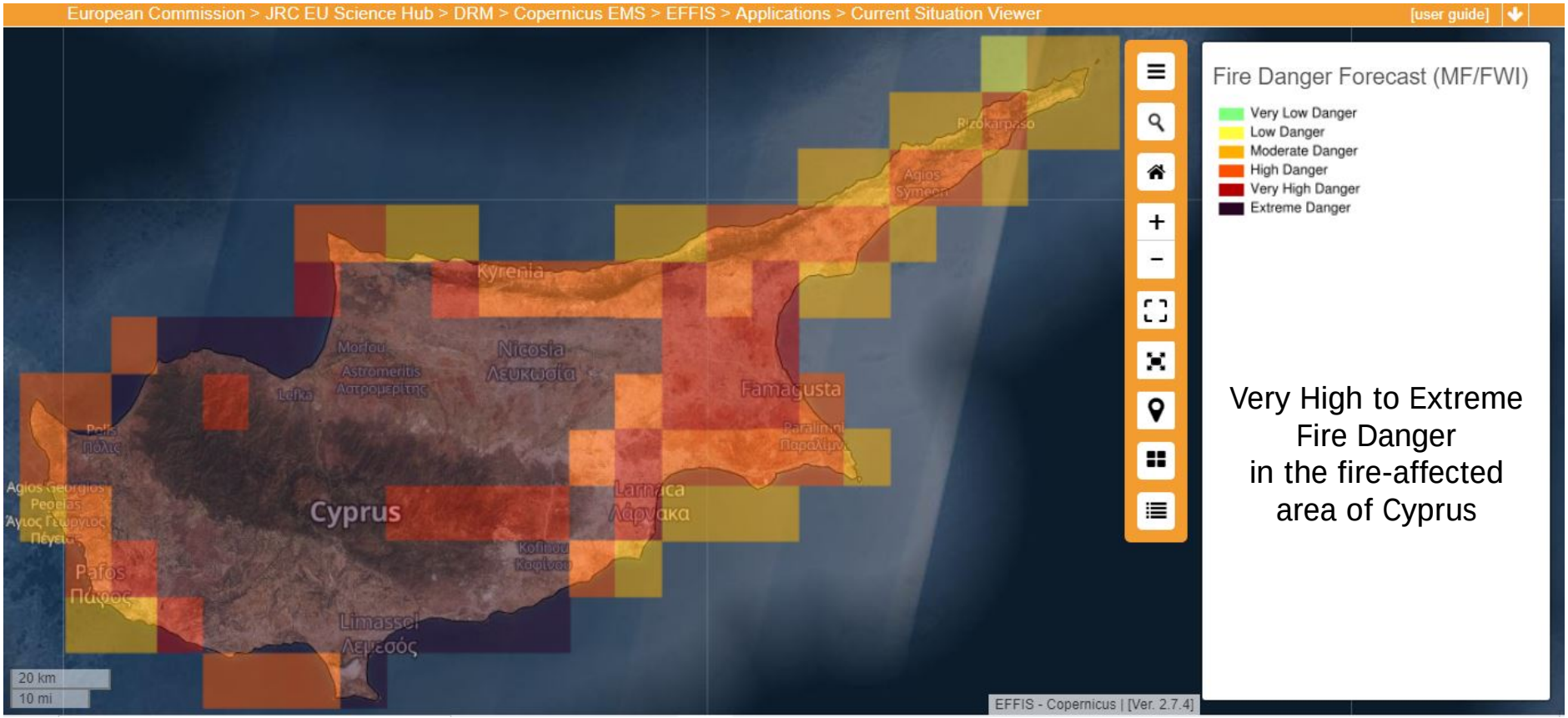


Fire Danger Forecast based on the Fire Weather Index (FWI) computed from the ECMWF model (8 km)
Snapshot from the European Forest Fire Information System (EFFIS)
> EFFIS Applications > Current Situation Viewer
https://effis.jrc.ec.europa.eu/apps/effis_current_situation/

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FIRE DANGER FORECAST
FOR JULY 3, 2021



Very High to Extreme Fire Danger in the fire-affected area of Cyprus

Fire Danger Forecast based on the Fire Weather Index (FWI) computed from the MeteoFrance model (10 km)
Snapshot from the European Forest Fire Information System (EFFIS)
> EFFIS Applications > Current Situation Viewer
https://effis.jrc.ec.europa.eu/apps/effis_current_situation/

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE

EVOLUTION OF THE FOREST FIRE

On Saturday, July 3, 2021 at 13:50 (local time), a fire started in Arakapas community and then spread to several mountainous areas of the Limassol and Larnaca provinces. The communities of Eptagonia, Oras, Melini, Sykopetra, Odos, Agioi Vavatsinias and Vavatsinia were also affected. Up to 10 villages were evacuated for safety reasons.

The task of extinguishing the fire was extremely difficult, due to its large area and especially its very large perimeter. The Fire Department and the Forest Department were working together with both ground and air forces to put out the fire. The Fire Department took over the protection of the affected villages and the Forest Department the forest sector of the area.

In Sunday afternoon, after the effective contribution of firefighting aircrafts from Greece and Israel and the reduction of outbreaks, the Cypriot government announced that the situation along the fire fronts was manageable, while the fire-affected areas of Larnaca and Limassol were declared safe as there was no active front.

Nevertheless, the difficult battle with the re-ignitions continued, while the involved authorities remained on alert, for fear of wind strengthening, something that would make the task of complete fire extinguishing difficult.

The situation came under full control on Monday, July 5, 2021 at 08:00 (local time).



A Google Earth image of Cyprus with the location of Arakapas village, from where the early July 2021 forest fire started

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EMERGENCY RESPONSE ACTIONS
ACTIVATION OF EMERGENCY PLANS

The first message about the fire was received at 13:46, while the first drop of water from the firefighting aircraft took place at 13:56. Four minutes later, at 14:00, the ground forces arrived in the fire-affected area. At around 15:50, the rescEU mechanism was activated. Moreover, all the involved ministers met at the Coordination Center in Athalassa at 16:00 in the afternoon.

Due to the critical situation with the fire in the mountainous areas of Limassol and Larnaca, the Special National Plan "Hephaestus“ was activated and assistance was requested for sending aircraft from abroad. Moreover, after an operations coordination meeting of the involved inter-ministerial Committee and the heads of the involved services, it was decided that the Operational Center should be relocated closer to the fore-affected area and in particular to the Vavatsinias area.

More than 600 people from the Department of Forests, the Police, the Fire Service, the Civil Defense, the Hunting and Fauna Service, the Limassol and Larnaca Province Administrations, the National Guard, the Community Councils and the volunteer teams contributed to fire extinguishing. More than 70 fire trucks, 14 bulldozers, as well as a number of agricultural tractors, excavators and road tankers were employed. The burned area was mapped by a drone of the National Guard aiming to detecting active fire (hot spots, thermal spots) and planning firefighting operations.

In order to deal with the fire, in addition to the ground forces, all the aircraft of the Republic of Cyprus and the British Bases were operating, as well as aircraft and ground means of the National Guard, while assistance has been requested for sending aircraft from abroad. Specifically, during July 3rd, 2 Canadair type aircrafts are expected to arrive from Greece and 2 aircrafts from Israel, while reinforcement was requested with 4 more aircrafts, through the European rescEU mechanism.

The "Icarus 2" Plan, which concerns aircraft operations, was also implemented. A total of 11 flights were conducted through Cyprus including two helicopters from the British Bases, two Canadair aircraft from Greece and two Air Tractor aircraft from Israel. Due to the huge extent of the fire, strong forest firefighting forces remained in the area to deal with possible re-ignitions.

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ACTIVATION OF EU CIVIL PROTECTION MECHANISM
REQUESTING SUPPORT TO TACKLE FOREST FIRES

Cyprus activated the EU Civil Protection Mechanism on 3 July 2021, requesting support in the form of aerial forest fire fighting capacities to tackle forest fires in the Limassol province.

Responding immediately, the EU has rapidly mobilized rescEU aerial fire-fighting assets hosted by Greece and Italy. 2 Canadair firefighting planes from each country contributed to tackling forest fires.

In addition, the European Commission's Copernicus Emergency Management Service was activated to provide damage assessment maps of the affected areas.

The European Union's 24/7 Emergency Response Coordination Centre was in constant contact with the Cyprus authorities to closely monitor the developments and provide any further assistance as necessary.

From https://ec.europa.eu/echo/news/eu-deploys-immediate-assistance-help-cyprus-contain-devastating-forest-fires_en





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BACKGROUND OF THE EU CIVIL PROTECTION MECHANISM

The EU Civil Protection Mechanism strengthens cooperation between and among Member States and Participating States in the field of civil protection, with a view to improving prevention, preparedness and response to disasters. Through the Mechanism, the European Commission plays a key role in coordinating the response to disasters in Europe and beyond.

When the scale of an emergency overwhelms the response capabilities of a country, it can request assistance via the Mechanism. Once activated, the Mechanism coordinates assistance made available by its Participating States through spontaneous offers. In addition, the EU has created the European Civil Protection Pool to have a critical number of readily available civil protection capacities allowing for a stronger and coherent collective response. Should the emergency require additional, life-saving assistance, the rescEU reserve can be sent as a matter of last resort.

To date, all EU Member States participate in the Mechanism, as well as Iceland, Norway, Serbia, North Macedonia, Montenegro and Turkey.

Since its inception in 2001, the EU Civil Protection Mechanism has responded to over 420 requests for assistance inside and outside the EU.

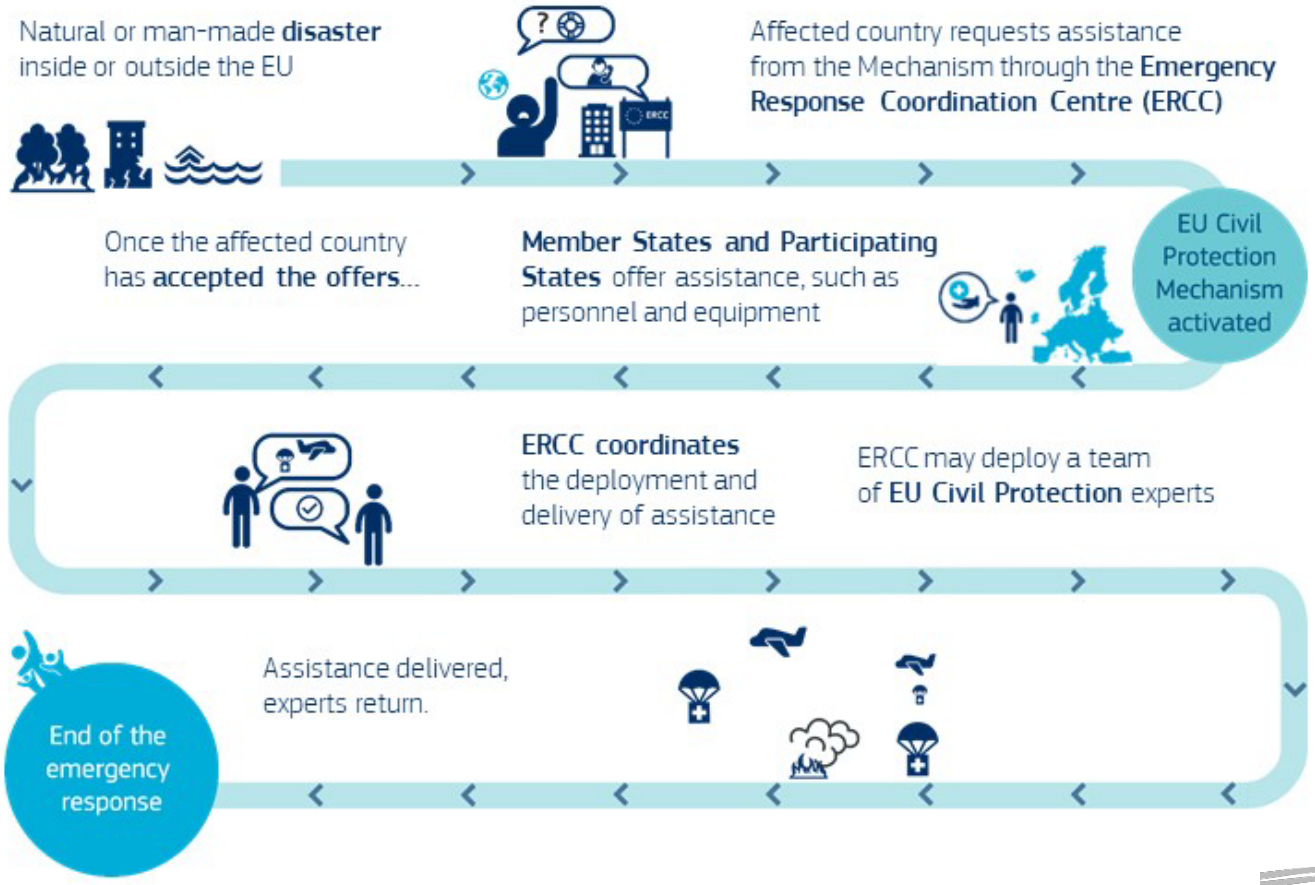
From https://ec.europa.eu/echo/news/eu-deploys-immediate-assistance-help-cyprus-contain-devastating-forest-fires_en






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HOW DOES THE EU CIVIL PROTECTION MECHANISM WORK ?

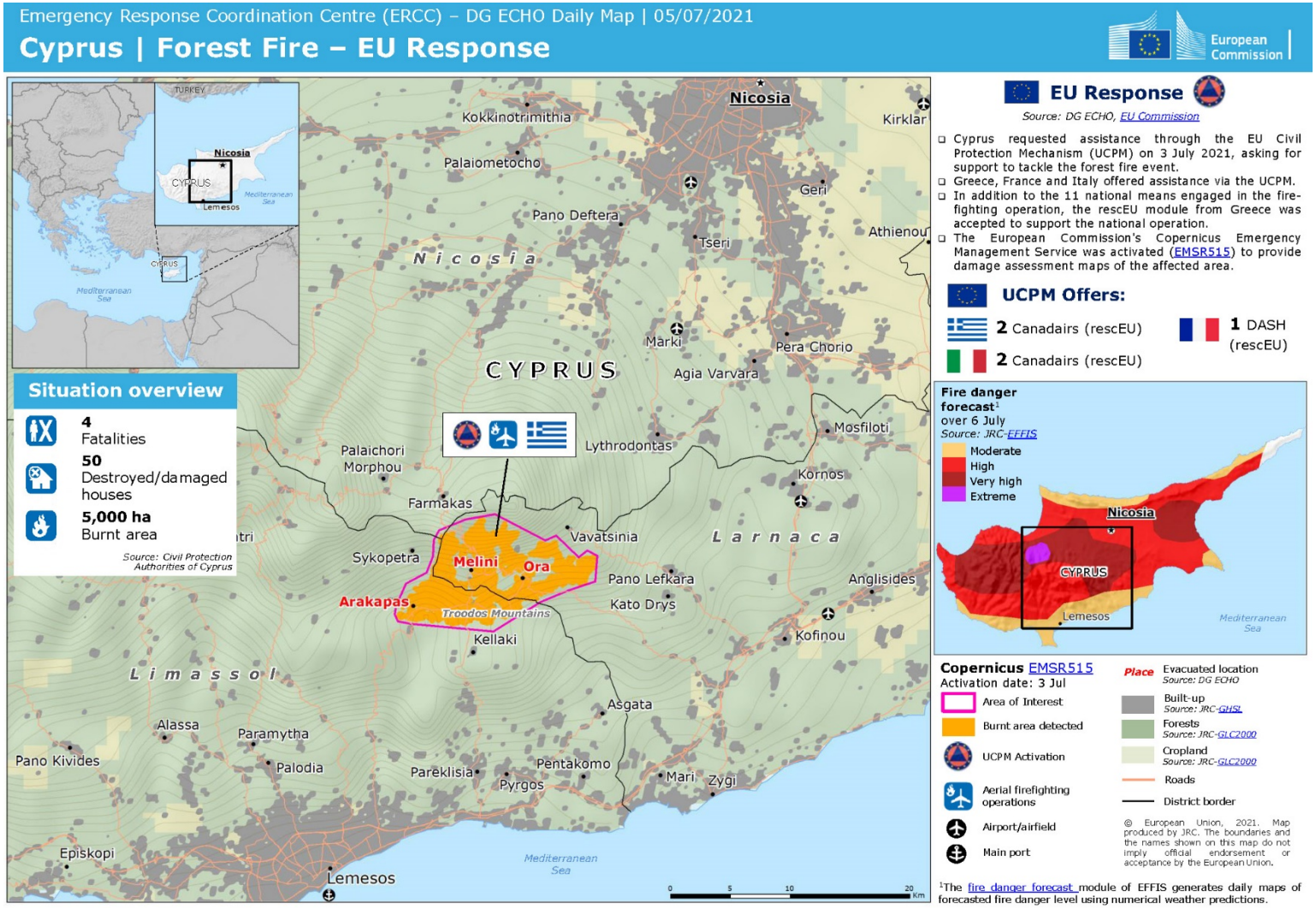


Available at: https://ec.europa.eu/echo/sites/default/files/mechanism_how_en.jpg

European Commission

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EMERGENCY RESPONSE

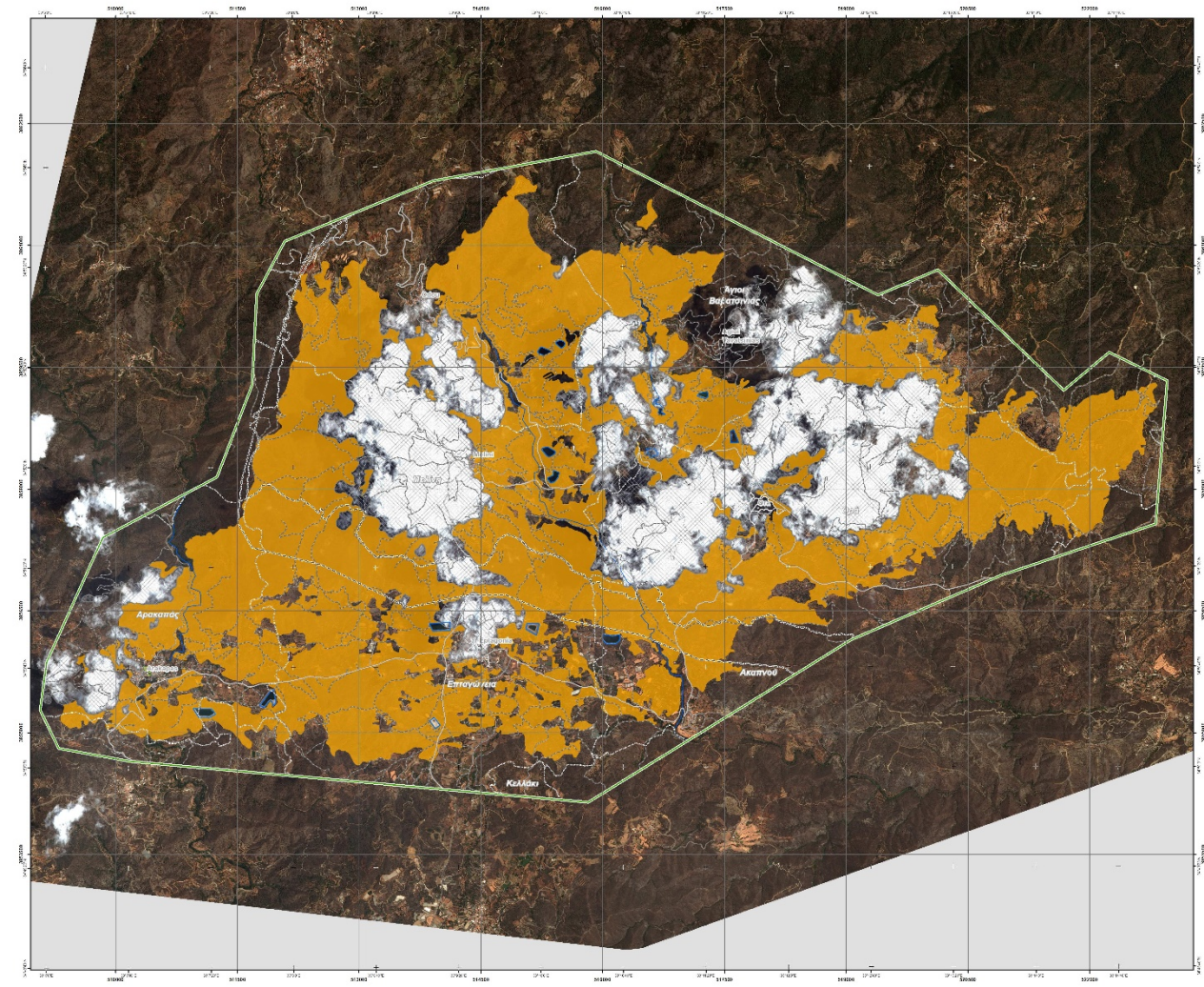


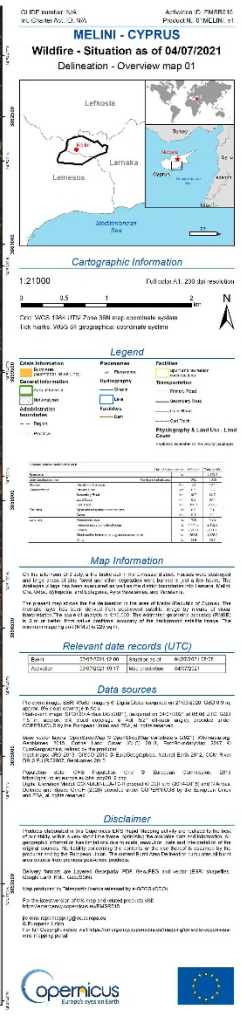
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RAPID MAPPING OF THE FIRE AFFECTED AREA

COPERNICUS EMERGENCY MANAGEMENT SERVICE - MAPPING





Crisis Information

Burnt Area (04/07/2021 08:08 UTC)

General Information

Area of Interest

Not Analysed

Administrative boundaries

Region

Province

Placenames

Placename

Hydrography

Stream

Lake

Facilities

Dam

Facilities

Sport and recreation constructions

Transportation

Primary Road

Secondary Road

Local Road

Cart Track

Physiography & Land Use - Land Cover

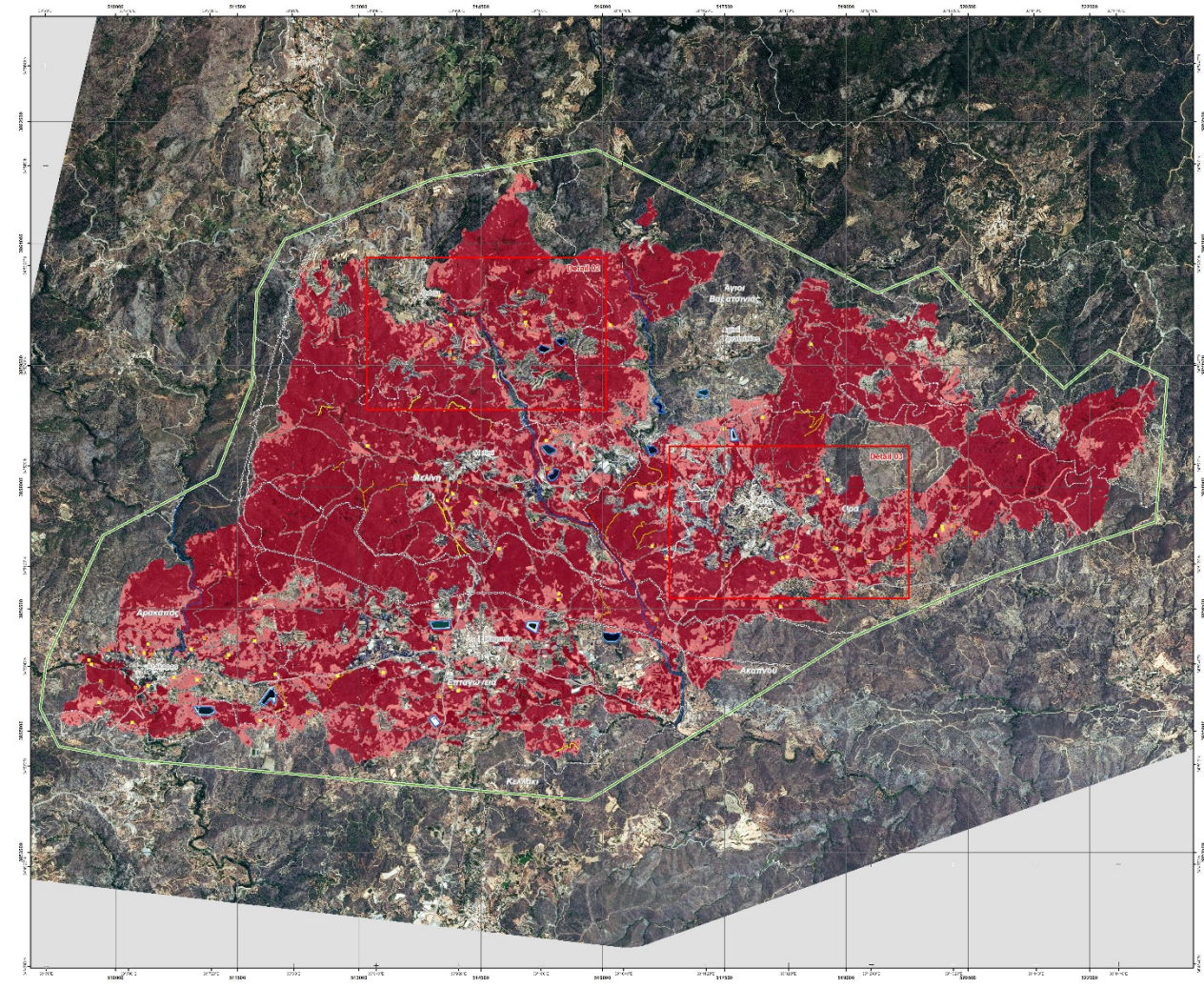
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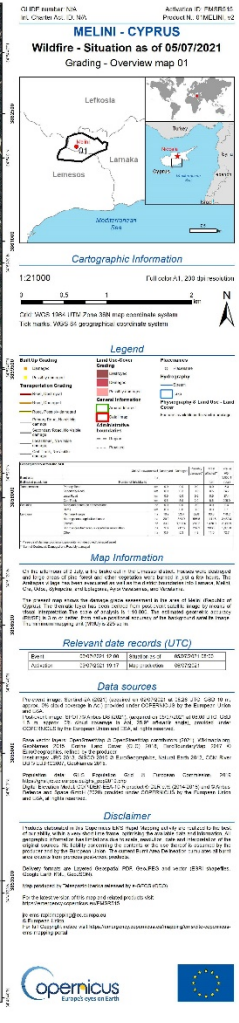
Available at: https://emergency.copernicus.eu/mapping/list-of-components/EMSR515

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RAPID MAPPING OF THE FIRE AFFECTED AREA

COPERNICUS EMERGENCY MANAGEMENT SERVICE - MAPPING





Built Up Grading
- Damaged
- Possibly damaged

Transportation Grading
- Road, Destroyed
- Road, Damaged
- Road, Possibly damaged
- Primary Road, No visible damage
- Secondary Road, No visible damage
- Local Road, No visible damage
- Cart Track, No visible damage

Land Use-Cover Grading
- Destroyed
- Damaged
- Possibly damaged

General Information
- Area of Interest
- Detail map

Administrative boundaries
- Region
- Province

Placenames
- Placename

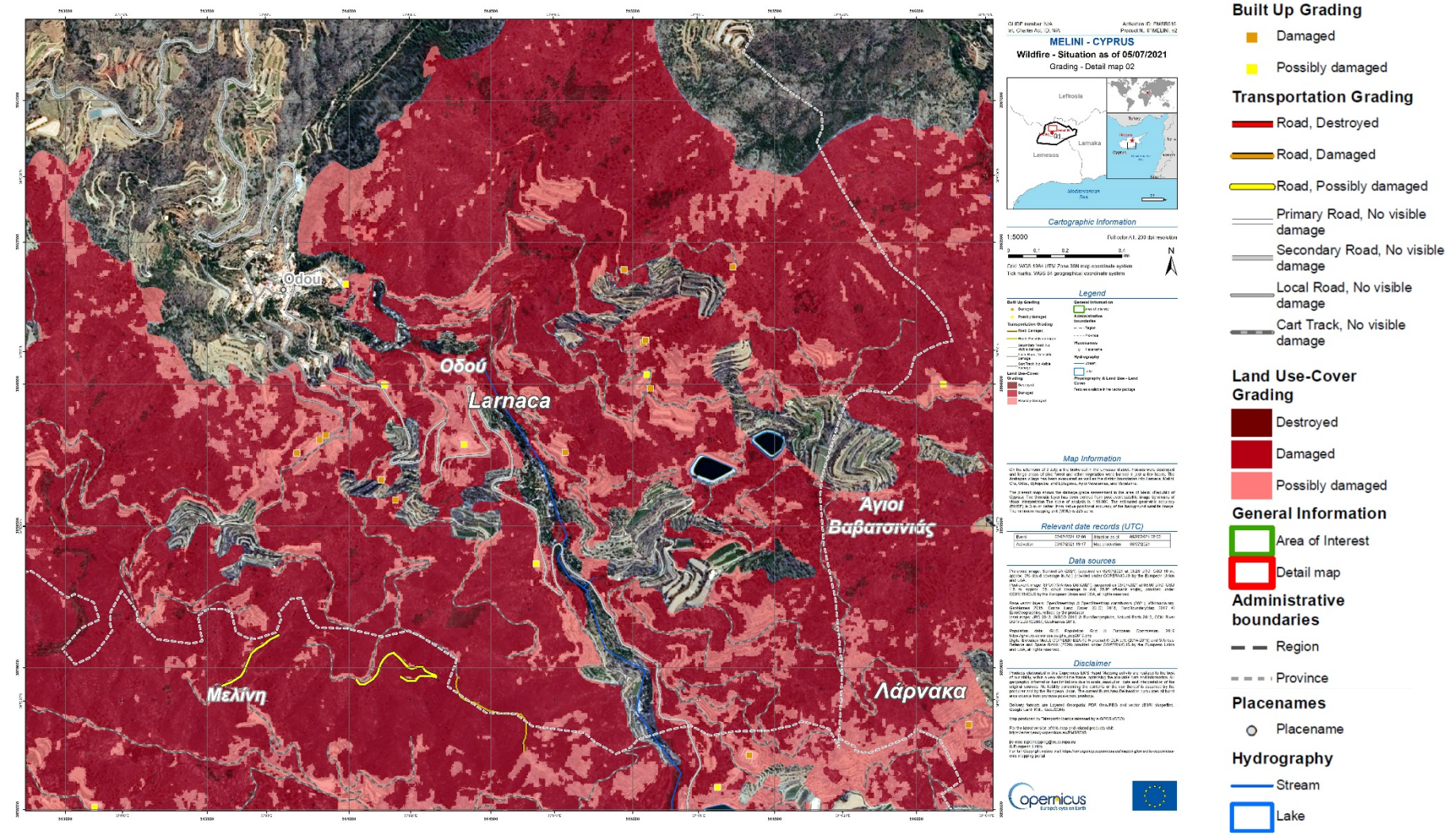
Hydrography
- Stream
- Lake

Available at: https://emergency.copernicus.eu/mapping/list-of-components/EMSR515

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RAPID MAPPING OF THE FIRE AFFECTED AREA

COPERNICUS EMERGENCY MANAGEMENT SERVICE - MAPPING

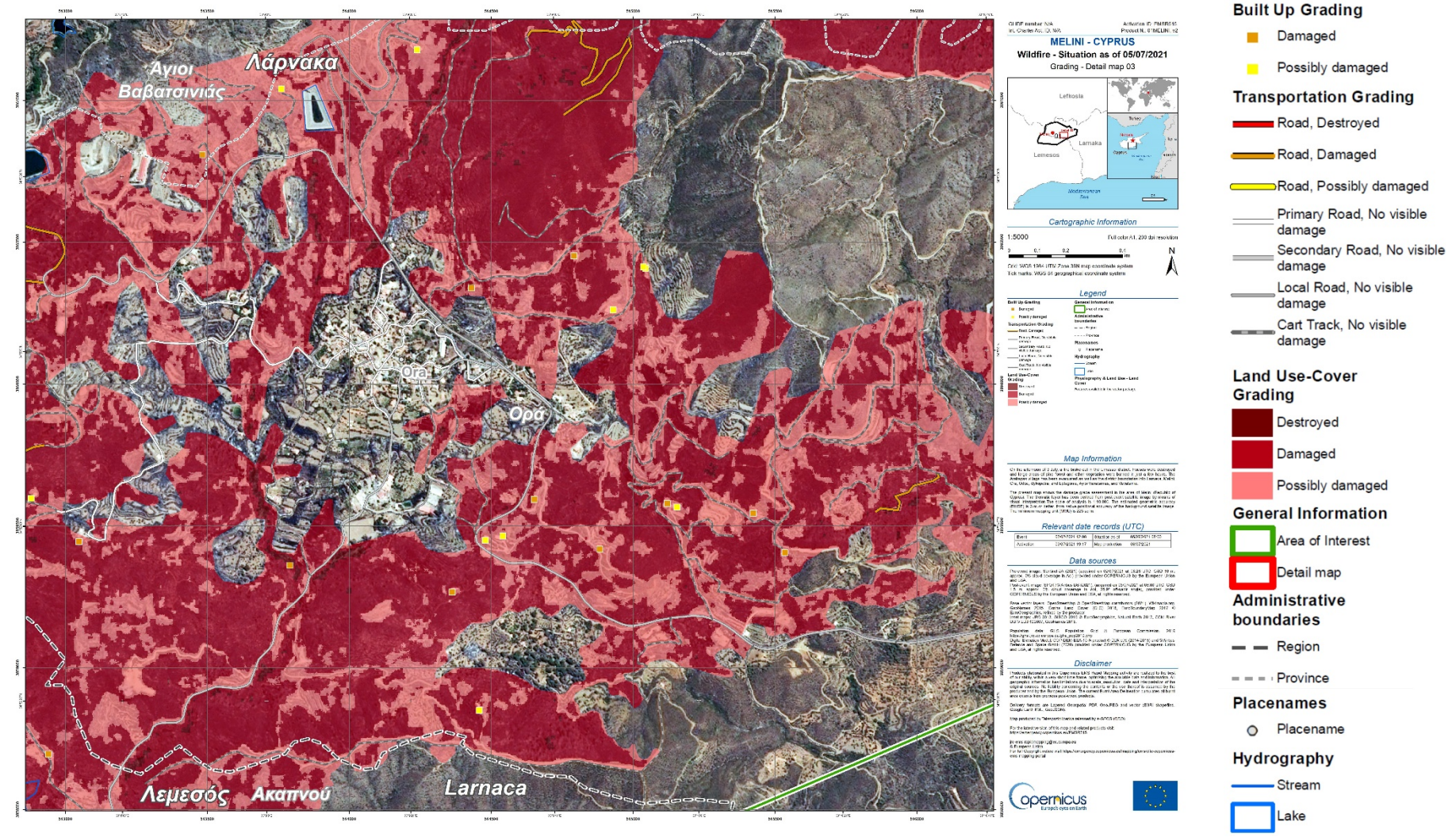


Available at: https://emergency.copernicus.eu/mapping/list-of-components/EMSR515

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RAPID MAPPING OF THE FIRE AFFECTED AREA

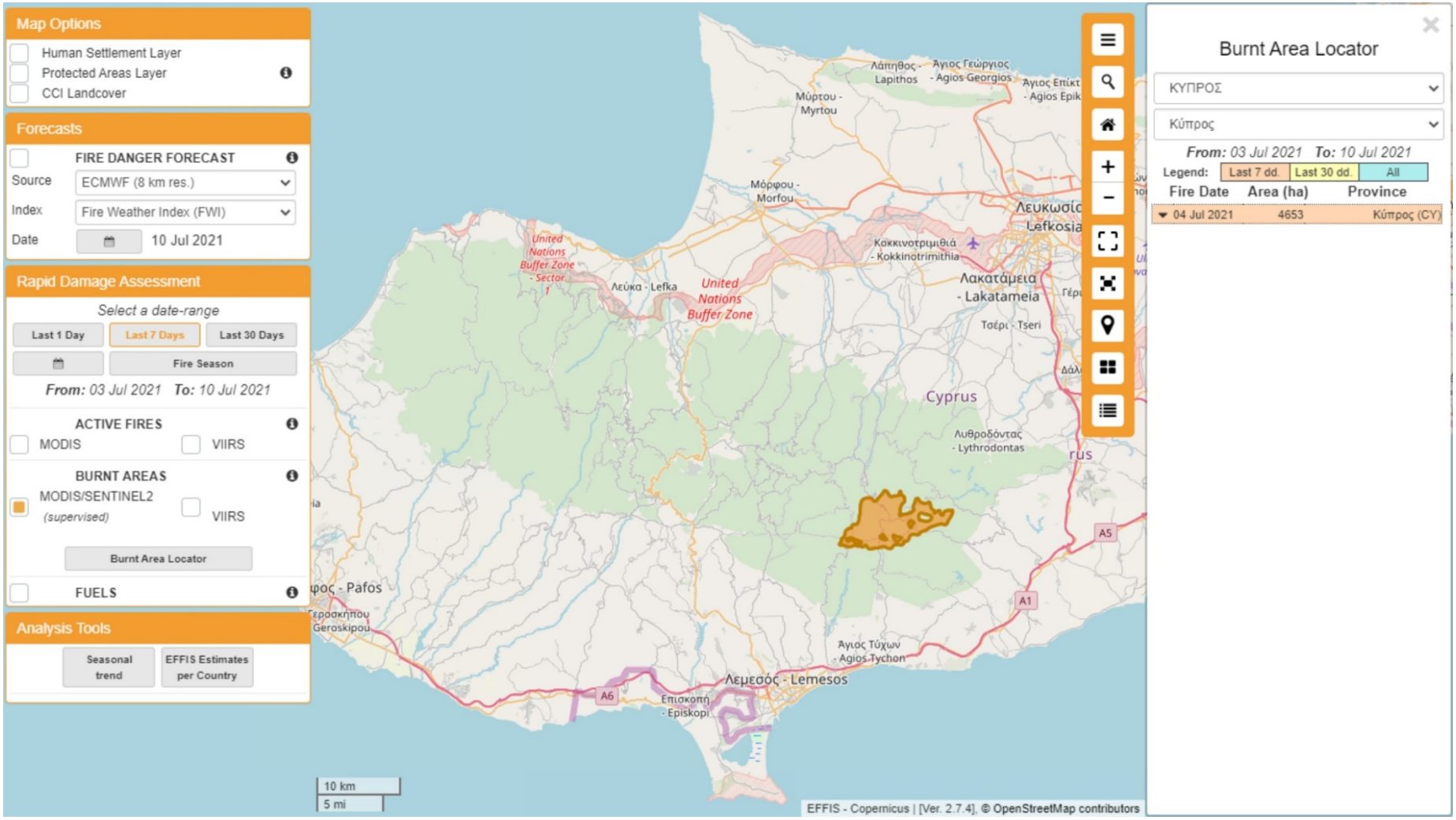
COPERNICUS EMERGENCY MANAGEMENT SERVICE - MAPPING



Available at: https://emergency.copernicus.eu/mapping/list-of-components/EMSR515

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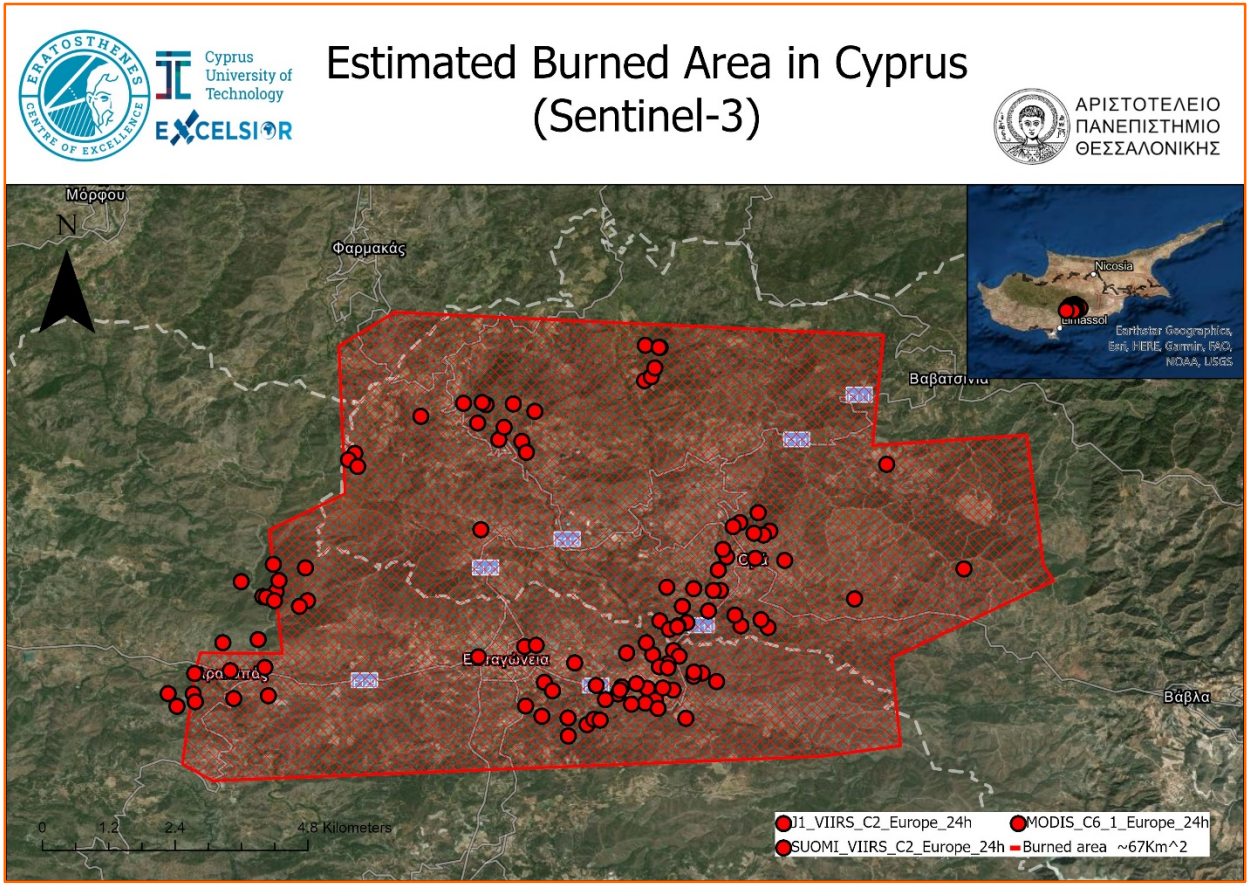
RAPID MAPPING OF THE FIRE AFFECTED AREA
EUROPEAN FOREST FIRE INFORMATION SYSTEM



Available at: https://effis.jrc.ec.europa.eu/apps/effis_current_situation/

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FIRST RAPID ASSESSMENT OF THE FIRE-AFFECTED AREA
BY USING SENTINEL-3 LOW-RESOLUTION SATELLITE IMAGERY

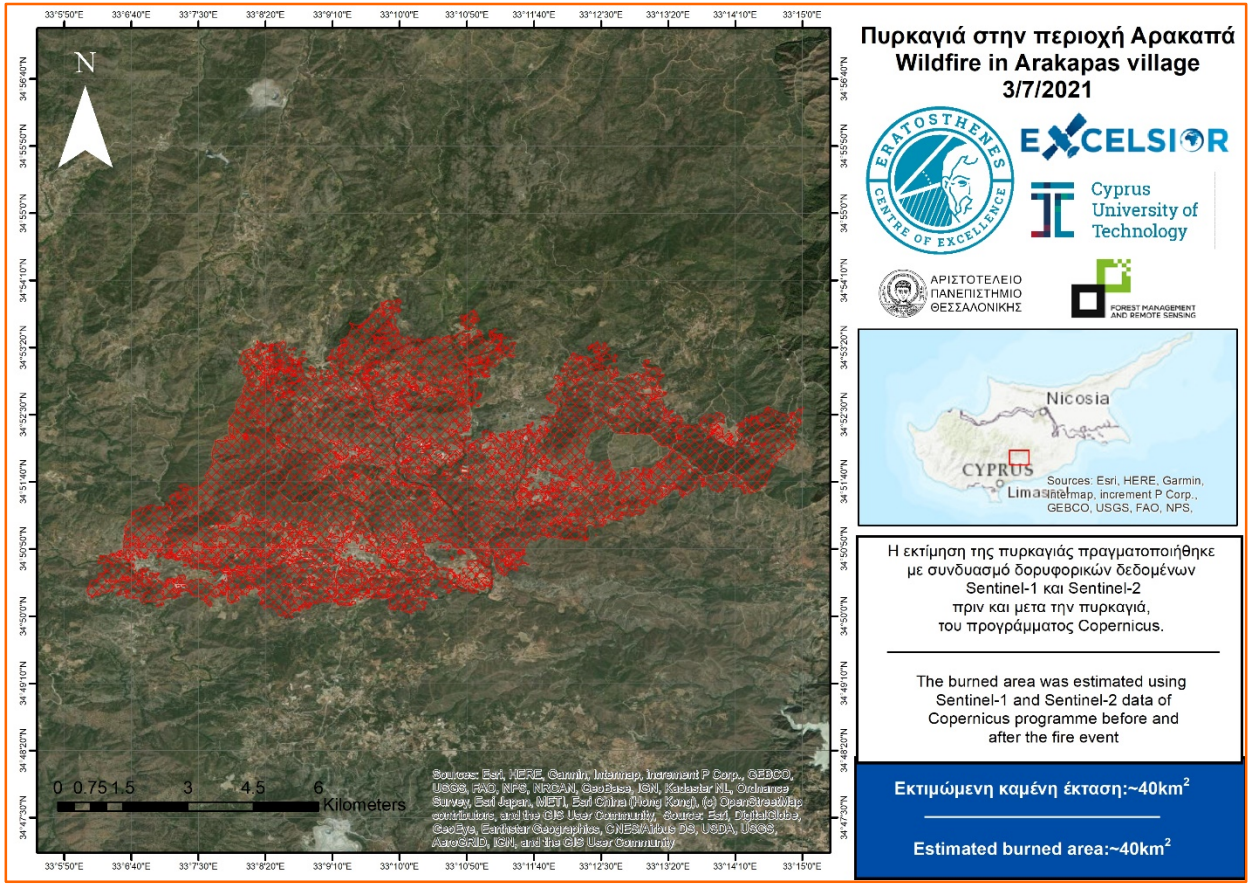


First assessment by the Eratosthenes Centre of Excellence for the catastrophic fire in Cyprus. The Sentinel-3 low-resolution satellite imagery was used to estimate the burned area. Based on these results, the burned area was 67 km^2.

Available at: https://twitter.com/excelsior2020eu/status/1411778721762230272/photo/2

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SECOND ASSESSMENT OF THE FIRE-AFFECTED AREA
BY USING SENTINEL-1 AND SENTINEL-2 SATELLITE DATA

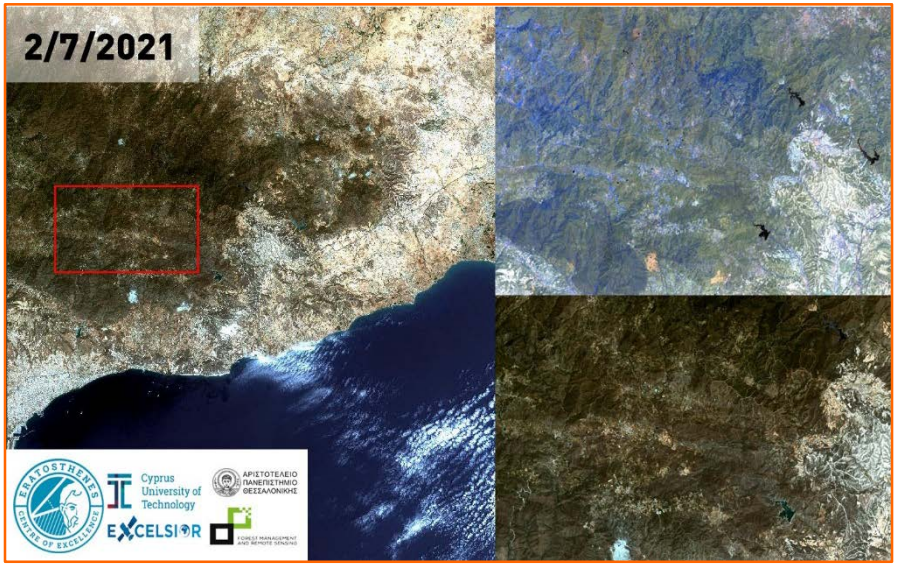


After the first rapid-fire assessment announced on 4 July 2021, a second assessment of the fire-affected area in the mountainous Limassol and Larnaca provinces has been conducted by using Sentinel-1 and Sentinel-2 satellite data. Based on these results, the burned area was 40 km^2.

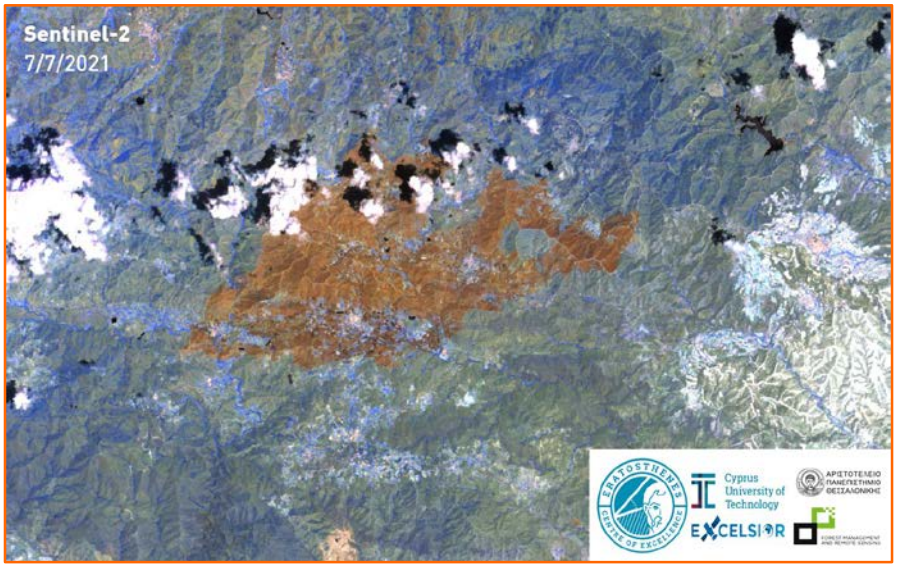
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PRE- AND POST- DISASTER MAPPING
BY USING SENTINEL-2 SATELLITE DATA







Sentinel-2 before (on 2 July 2021) and after (7 July 2021) the forest fire in Cyprus

Available at:
https://twitter.com/excelsior2020eu/status/1413414761073713153

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE

FIRE IMPACT

The fire attributed to human activities burned an area of about 55 km^2 covered with forest vegetation and agricultural crops.

The fire resulted in:

- 4 fatalities
- destruction of private properties comprising residential and commercial buildings, over 50 buildings suffered extensive damage
- damage to the electricity and water supply network
- damage to mobile objects
- losses of livestock
- destruction of farms, small local companies and individual suppliers

The early July 2021 forest fire is considered the most destructive forest fire in the history of the Republic of Cyprus in terms of human and economic losses.

As regards the economic losses, according to official reports of the Ministry of the Interior in Cyprus the economic damage in the Limassol Province amounts to approximately € 1207443, while in Larnaca Province to approximately € 4051232. The total economic losses amount to approximately € 5258675.

In particular, based on the results of the Copernicus Emergency Management Service - Mapping, the early July 2021 forest fire has burnt an area of 3,134 hectares comprising 2,366 hectares of forest and 2,482 hectares of agricultural land and also affected 347 residential buildings.

Just to mention that in the disaster of 2016 in the Forest of Solea, in four days one third was destroyed than in a few hours in the mountainous areas of Limassol and Larnaca, which unfortunately was hit by the destructive fire.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE

FIRE IMPACT

The fire started in Arakapas area and then spread to the mountainous areas of Larnaca and Limassol didtricts. Due to the rapid spread of the fire, the communities of Arakapas, Melini, Eptagonia, Sykopetra, Odou, Ora, Farmakas, Ayioi Vavatsinias and Vavatsinia were evacuated and the residents were guided to stay in safe places.

Based on official reports of the Provincial Governor of Limassol, over 20 buildings and properties suffered damage, several cars and bicycles were burnt.

Based on official reports of the Provincial Governor of Larnaca, 22 houses were destroyed by the fire, in particular 9 in Melini, 1 in Odou and 12 in Ora. Moreover, over 36 cottages were also destroyed including 9 in Melini, 25 in Ora and 2 in Ayioi Vavatsinias. 11 professional premises were also destroyed, in particular 1 in Ayioi Vavatsinias, 4 in Odou and 6 in Ora.

Definitely, the Community of Ora was the worst affected community in the fire-affected area of Larnaca, followed by Melini and Odou communities.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE

LOCATION OF THE FIRE-AFFECTED AREA



Panoramic view of the mountainous areas of Limassol and Larnaca areas affected by the early July 2021 fire. Germasogeia is an eastern suburb of Limassol and a municipality in the Limassol Province of Cyprus. The dam and the reservoir of Germasogeia are clearly observed north of the Germasogeia residential areas. The fire-affected mountainous areas are detected north of the reservoir (Photo credit to *Prof. Dr. E. Lekkas*)

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON POPULATION – FATALITIES





As a result of the fire, 4 fatalities were recorded near the community of Odos. Four Egyptian workers evacuate their premise by car, but on the way it was trapped in the flames. They abandoned it, and tried to escape by foot, but they did not succeed as they were found by search and rescue teams in a burnt area just 400 meters away from the car.

Photo credit to *Stavros Ioannides / Press And Information Office / Republic of Cyprus*

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON POPULATION – COMMUNITY EVACUATION

Based on official reports of the authorities involved in the early July 2021 forest fires in Cyprus, 8 communities had to be evacuated due to the adverse effects of the raging fire:

- Eptagonia, Arakapas, Sykopetra and Akapnou communities of the Limassol Province
- Odou, Ora, Ayioi Vavatsinias, Vavatsinia and Melini communities of the Larnaca Province.

Residents of the affected communities were strongly advised to avoid using some parts of the road network in the affected area comprising the road from Odou to Melini, from Lefkara to Vavatsinia, from Parekklisia to Kellaki, from Akrounta to Dierona, from Choirokoitia to Vavla and from Farmaka to Odou.

Based on the population census of Cyprus conducted in 2011, the population in the affected communities, which had to be evacuated due to the evolving forest fire, is as follows:

- 353 residents in Eptagonia
- 307 in Arakapas
- 213 in Odou
- 206 in Ora
- 131 in Ayioi Vavatsinias
- 120 in Sykopetra
- 81 in Vavatsinia
- 59 in Melini and
- 20 in Akapnou.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON FLORA AND FAUNA

The forests in Troodos are mainly made up of natural forests which renew themselves without the interference of man. The lower altitude areas are covered by the common pine trees (***Pinus brutia***) which extend up to 1200 m, while the southern parts of the forest can reach 1500 m. A large number of smaller trees and bushes take over particular ecological "nests" of the forest ecosystem, which are created according to the altitude zones, as well as other ecological parameters such as geology and moisture.

Near the rivers, there is thick plane tree vegetation (***Platanus odentalls***), hardwood trees (***Alnus orientalis***) and laurel trees (***Myrtus comunis***) which add a variety to the location and offer an ideal refuge for wildlife.

At the lower altitude areas, one can find the wild olive tree (***Olea europoea***) which extends up to 1000 m, the arugulas (***Arbutus andrachne***), with its beautiful color changes extend from 600 m until 1500 m, the oyster (***Rhus coriarla***) and the endemic lagoia (***Quercus alnifolia***) extend from 600 m until 1650 m.

At the higher altitude areas of the forest, the pine tree forest is made up of the black pine trees (***Pinus Wipe***), which reaches until the Chionistra area. It coexists with the psychotropic bushes such as the aoratos (***Juniperus foetidissima***), the wild apple tree (***Sorbus aria***), the wild quince tree (***Cotoneaster racemiflorus***), the barberry (***berberis cretica***), the endemic rasiin (***Genista sphacelata ssp. Crudelis***) and others.

Based on the results of the Copernicus Emergency Management Service - Mapping, the early July 2021 forest fire has burnt an area of 3,134 hectares comprising 2,366 hectares of forest and 2,482 hectares of agricultural land.

More details for the affected flora are not officially available at this time. For the moment, no definite opinion can be expressed about the potential effect of fire upon these plants as a specific field survey should be organized.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON FLORA AND FAUNA

Although large mammals are rare – with the exception of the Moufflon – the fauna of the area is of great ecological value, given the presence of many endemic and endangered species. More than 250 types of birds, about 20 species of mammals and 22 types of reptiles are found on Cyprus. A large percentage of them are detected in the Troodos forests and the surrounding high and low lands.

Regarding the fauna living in the habitats affected by the early July 2021 forest fire, little can be said. However, based on our knowledge, usually, birds fly away, small mammals like rodents also avoid fire by leaving the area, reptiles try to avoid fire, while soil invertebrates usually at this time of the year have vertically migrated deeper in the soil seeking better moisture conditions, so most probably have also avoided fire. Unfortunately, small animals, such as rabbits, were found burnt in several sites of the affected area.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON FLORA





Drone views of the burnt area in Arakapas community from the south (from the road leading from Kellaki to Eptagoneia). In several patches the canopy has remained intact or partially burnt.

Photos credit to *Prof. Dr. E. Lekkas*

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON FLORA



Drone views of the burnt area in Eptagoneia area from the south (from the road leading from Kellaki to Eptagoneia). In several patches the canopy has remained intact or partially burned.

In the background, the mountainous areas of Limassol and Larnaca provinces.

(Photo credit to *Prof. Dr. E. Lekkas*)

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON FLORA



Views of the impact of the early July 2021 forest fire to the landscape and its vegetation
(Photos credit to *Prof. Dr. E. Lekkas*)

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON THE BUILT ENVIRONMENT









The most observed impact on the fire-affected buildings comprised:

- Coloring of plasters through contact with flames
- Superficial deformation of plasters
- Deformation and melting of aluminum shutter frames
- Deformation of zinc plates used in roofing
- Fall of burnt wooden roofs
- Partial or total collapse

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON THE BUILT ENVIRONMENT







Some structures in the fire-affected area were partially collapsed due to the early July 2021 forest fire in the mountainous areas of Larnaca and Limassol.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON THE BUILT ENVIRONMENT









The external cladding of structures comprising houses and warehouses including zinc roof panels, perimeter wall sheets and aluminum shutter frames were deformed and melted by flames and high temperatures developed during the fire. This deformation and melting of the structural and non-structural elements of these structures resulted in their complete destruction.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON VEHICLES





In addition to buildings, the fire also affected mobile objects inside and outside forest areas, including private vehicles parked in the surrounding of buildings.





In Larnaca Province, in total 42 vehicles were destroyed by the fire, in particular 6 in Meli\ni and 36 in Ora.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON POWER, WATER AND TELECOMMUNICATIONS NETWORKS





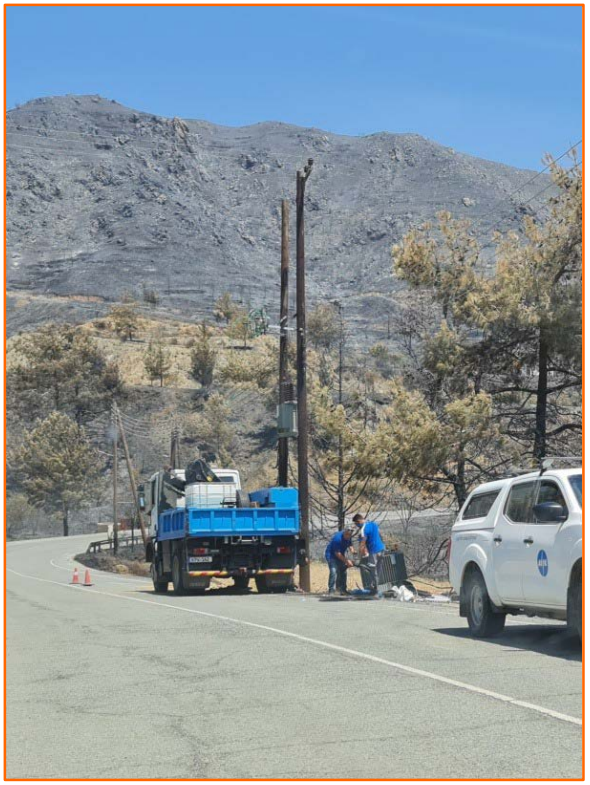


The forest fire caused damage to the electricity supply network, mainly to cables, wooden electric pillars and transformers. As of 6 July 2021, over 250 electric pillars and over 15 transformers were affected by the forest fire and partially or totally damaged (Photo credit to *Stavros Ioannides / Press And Information Office / Republic of Cyprus* and *Euronews*)

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON POWER, WATER AND TELECOMMUNICATIONS NETWORKS







The staff of the Electricity Authority of Cyprus worked tirelessly to repair the damage. They also used several generators in order to supply the core of the affected communities and then their activities were extended to other part of the fire-affected areas.

Photo credit to REACTION Be ready. Be there. Be safe.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON LIVESTOCK

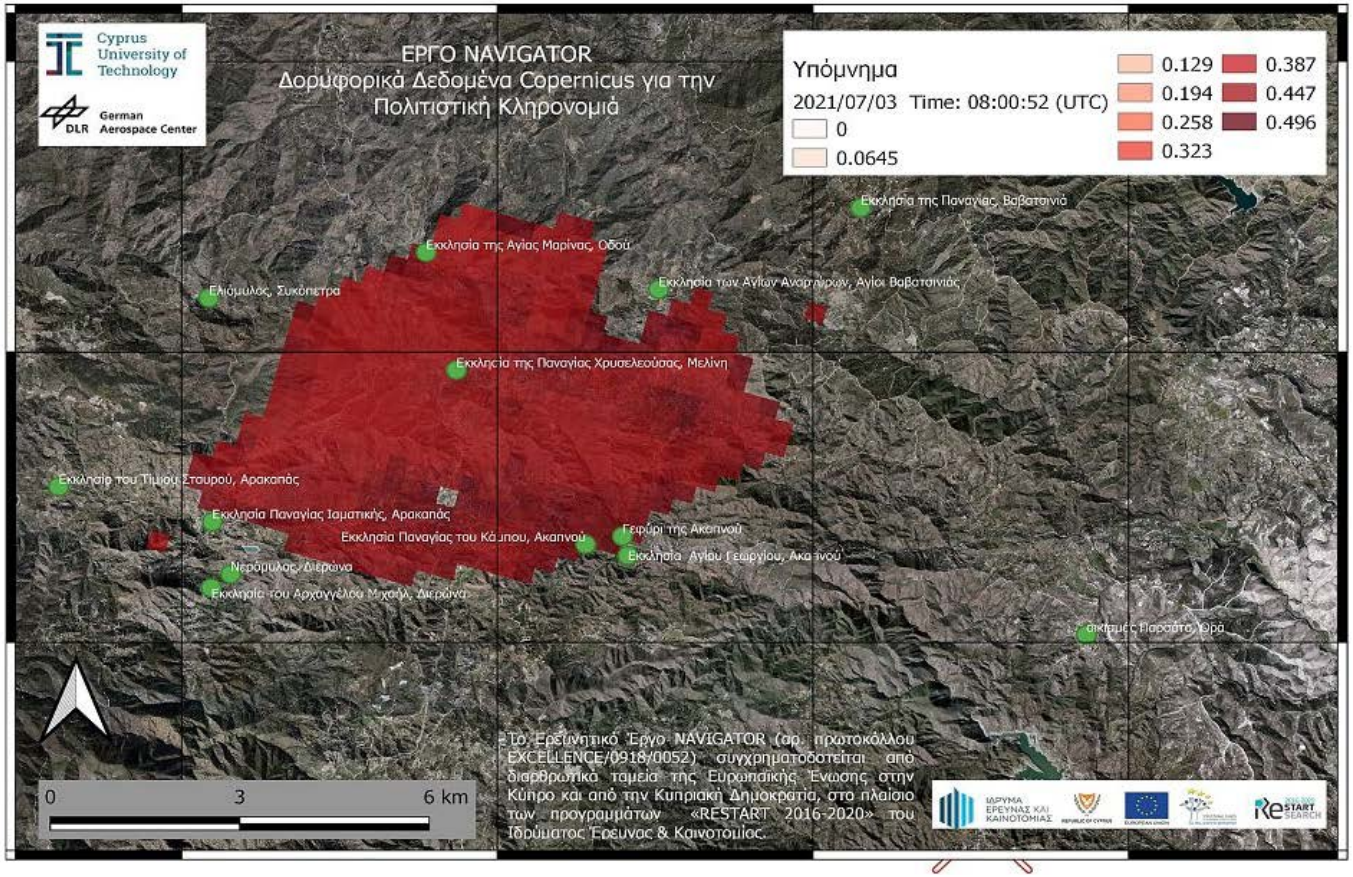




Many domestic animals as well as wild animals were affected by the flames, smoke and high temperatures developed by the fire. A typical example of the adverse conditions created during the fire in the mountainous areas of Larnaca and Limassol Provinces comprises the effects on a poultry farm near Ora community. Chickens were heavily affected by high temperatures developed during the fire and they died due to heat and smoke inhalation. Farmers dispose of about 80000 chickens. The beekeeping of the area also suffered great damage, as more than 600 beehives were completely destroyed by the fire.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMPACT ON CULTURAL HERITAGE



◀ Distribution of cultural heritage sites, buildings and monuments in the fire-affected area and its surroundings. A map resulted from the collaboration between Cyprus University of Technology and the German Aerospace Center in the frame of the Navigator project

The cultural heritage buildings and monuments located in the fire-affected areas comprise temples, ancient settlements as well as water and olive mills. It was found that despite the fact that the flames reached very close to some monuments, fortunately no monument was affected.

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EMERGENCY RESPONSE ACTIONS

PROVISION OF PHYCHOLOGICAL FIRST AID, CONTRIBUTION OF VOLUNTEERS AND DONATIONS

Following the events from the recent fires, the Educational Psychology Service of the Ministry of Education, Culture, Sports and Youth of Cyprus was available for the public to provide psychological support to people who have been directly affected.

In particular, the Educational Psychology Service was at the disposal of teachers, parents and students of the communities affected by the forest fires for providing psychological first aid as well as for the management of the entire situation that has been created.

A huge nationwide mobilization for emergency supplies concentration and donations was recorded by citizens and organized voluntary groups. Emergency supplies were immediately concentrated to the Skarino Coordination Center. From this immediate response, the needs have been met within a short period of time.

The governmental authorities involved in disaster management opened an account to the Central Bank of Cyprus to raise donations and further support the fire-affected population of the mountainous area of Larnaca and Limassol.



The Larnaca Environmental Information Center was turned into Coordination Center for the management of volunteers, the support of residents but also for the collection of emergency supplies for the those in need in the mountainous Larnaca and Limassol areas after the early July forest fire.

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THE EARLY JULY 2021 ARAKAPAS FOREST FIRE
IMMEDIATE MEASURES FOR SUPPORTING THE AFFECTED POPULATION

After the completion of the fire fighting operations in the mountainous areas of Limassol and Larnaca provinces, teams of the Larnaca and Limassol Province Administrations immediately started the assessment of the fire-induced damage in the natural and the built environment.

Police patrols and ambulances stayed in the fire-affected areas during the first days of the post-disaster period until returning to normalcy.

Simultaneously, the involved authorities announced immediate relief measures comprising the following:

- Accommodation of residents in need for emergency sheltering in hotel units
- Gradual restoration of electricity supply in the fire-affected areas and installation of generators where needed until the final restoration
- Completion of the assessment of the damage to residential and commercial properties in few days
- Submission of the relevant reports to the Ministry of the Interior
- Implementation of the financial relief and support measures



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EMERGENCY RESPONSE ACTIONS

MEAUSURES ADOPTED BY THE COUNCIL OF MINISTERS FOR SUPPORING FAMILIES OF VICTIMS

As regards the four people who lost their lives during the early July 2021 forest fire in Cyprus, the President of the Republic and the Council of Ministers has decided as a sign of appreciation of the state the following measures, taking into account the support given to the victims of the 2016 Soleas fire:

- The provision of € 95,000 to each of the families of the four young people and additionally the provision of € 30,000 for each member of their families.

- Moreover, it was decided to grant scholarships to the children of the victims for studies at Higher Education Institutions in Cyprus.

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EMERGENCY RESPONSE ACTIONS

RELIEF MEAUSURES ADOPTED BY MINISTRY OF EDUCATION, CULTURE, SPORTS AND YOUTH

Measures taken by the Ministry of Education, Culture, Sports and Youth to address the adverse effects of the forest fire disaster in the mountainous Larnaca and Limassol:

- Provision of €200 to each student of kindergarten and of elementary, secondary, high and technical schools originating from the affected areas to meet their needs for school supplies for the new school year
- Exemption from payment of tuition fees for the children to attend the public kindergarten
- Inclusion of children from the affected areas in the Free Breakfast Program for students in need of assistance
- Subsidy of the amount required for the offer of a meal at the Unified All-Day School of Choirokoitia

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EMERGENCY RESPONSE ACTIONS

RELIEF MEASURES ADOPTED BY THE MINISTRY OF AGRICULTURE, RURAL DEVELOPMENT AND ENVIRONMENT

The Ministry of Agriculture, Rural Development and Environment adopted the following measures in order to support farmers and producers:

1. Provision of initial financial assistance, which will range from € 10,000 to € 30,000 per beneficiary and will concern professional farmers, with the aim of continuing their professional activity. The total cost is expected to be around € 3,000,000.

2. Provision of financial support of € 100,000 to the Organization of Producers, Fruits and Perishables of Odou area. This organization has a significant number of members, mainly young farmers, who are active in communities that have been severely affected by the fire.

3. Immediate activation of the National State Aid Framework for the reactivation of affected farmers and for the restoration of the environment in areas declared to be fire-affected.

This framework covers farms whose farmers are professional and / or part-time and / or amateur. Beneficiaries will receive aid for the loss of income suffered due to the total or partial destruction of agricultural production and means of production, as well as partial aid for the restoration / replacement of their infrastructure. The same beneficiaries, if they wish, can, alternatively, receive aid for the restoration / replacement of their infrastructure, through the Rural Development Program, under which an extraordinary investment measure will be announced for this purpose.

4. Announcement of an extra investment measure of the Rural Development Program, especially for the area that has been affected by the fire. The measure will cover the installation of new and possibly more modern equipment and infrastructure, replacing those that have been destroyed. This measure, among others, will cover farmers who have been affected by the fire but their industry is not eligible by the Framework (apiaries, aviaries, greenhouses), so that they can receive assistance to restore / replace their infrastructure.

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EMERGENCY RESPONSE ACTIONS

RELIEF MEASURES ADOPTED BY THE MINISTRY OF AGRICULTURE, RURAL DEVELOPMENT AND ENVIRONMENT

5. For further supporting the fire-affected area:

a. The Water Development Department, in cooperation with the Larnaca and Limassol Province Administrations, will take immediate measures to restore the irrigation infrastructure that has been destroyed.

b. The Department of Forests and the Department of Water Development, in collaboration with the Province Administrations of Larnaca and Limassol, will make suggestions and implement actions for erosion and flood protection projects.

c. The Department of Environment will arrange the collection of debris that will result from the fire-affected buildings, in an area that will be agreed with each community and will supervise the transport of these materials to licensed and especially designed sites for managing fire debris. The cost of the fire debris managements will be covered by the State.

6. Under the coordination of the Ministry of Agriculture, Rural Development and Environment and in cooperation with the Ministry of Interior, the General Directorate of European Programs, Coordination and Development, the General Accounting Office of the Republic and the Cyprus Electricity Authority, a request for assistance will be prepared and submitted by the European Union Solidarity Fund, especially to support and strengthen the affected communities and their residents.

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EMERGENCY RESPONSE ACTIONS
RELIEF MEASURES ADOPTED BY THE COUNCIL OF MINISTERS

Due to the severity of the phenomenon and its effects and the urgent need for immediate assistance to the victims, the Council of Ministers, adopting the suggestion of the Ministry of Interior, decided the provision of assistance for damage to homes and businesses using the following approach:

a. For damage up to € 10,000, one-off lump sum equal to the estimated loss will be provided, with a maximum amount of € 10,000.

b. For losses from € 10,000 to € 50,000, in addition to the above one-off lump sum (€ 10,000), an additional 80% of the remaining amount of the estimated loss will be given. For example, for an estimated loss of € 50,000, a total grant of € 42,000 will be provided.

c. For losses from € 50,000 to € 100,000, in addition to the aforementioned € 42,000, an additional amount equal to 50% of the remaining amount of the estimated damage will be granted. For example, in the case of an estimated loss of € 100,000, a grant of € 67,000 will be provided.

d. For losses from €100,000 to € 150,000 in addition to the aforementioned € 67,000, an additional amount equal to 30% of the remaining amount of the estimated damage will be granted. For example, in the case of an estimated loss of € 150,000, a grant of € 82,000 will be provided.

e. In particular, for commercial premises that have suffered losses between € 150,000 and € 250,000, in addition to the aforementioned € 82,000, an additional amount equal to 20% of the remaining amount of the estimated damage will be granted. For example, in the case of an estimated loss of € 250,000, a grant of € 102,000 will be provided.



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EMERGENCY RESPONSE ACTIONS

RELIEF MEASURES ADOPTED BY THE COUNCIL OF MINISTERS

As regards damage to vehicles, financial assistance will be provided as follows:

a. For privately registered vehicles, which are legally registered, financial assistance equal to 50% of the estimated damage will be granted, based on the estimation of the involved authorities, with a maximum of € 5,000 per vehicle.

b. For commercial vehicles / machinery, provided that they are not covered by financial relief measures of the Ministry of Agriculture, 50% of the estimated damage will be granted based on the estimation of the involved authorities, with a maximum of € 10,000 per vehicle.

The beneficiary reserves the right to choose between the measures provided by the two ministries.





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POTENTIAL POST-FIRE HAZARDS






Many parts of the fire-affected area are expected to be more susceptible to slope failures, floods and erosion and desertification in the post-fire period. The need for reassesment of their susceptibility is imparative.

(Photos credit to *Prof. Dr. E. Lekkas*)

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SOIL MAP OF CYPRUS

TECHNOSOLS
- Urbic Technosols

LEPTOSOLS
- Lithic Leptosols
- Calcaric Leptosols
- Gypsiric or Calcaric Leptosols

SOLONETZ
- Gleyic Solonetz

VERTISOLS
- Calcic or Chromic Vertisols
- Chromic Vertisols
- Haplic Vertisols

SOLONCHAKS
- Gleyic Solonchaks
- Gleyic Calcaric Solonchaks
- Stagnic Solonchaks

CALCISOLS
- Leptic Calcisols

LUVISOLS
- Vertic Chromic Luvisols
- Vertic Calcic Luvisols
- Chromic Luvisols
- Chromic Calcic Luvisols
- Chromic Fluvic Luvisols

CAMBISOLS
- Chromic Cambisols
- Calcaric Cambisols
- Eutric Cambisols

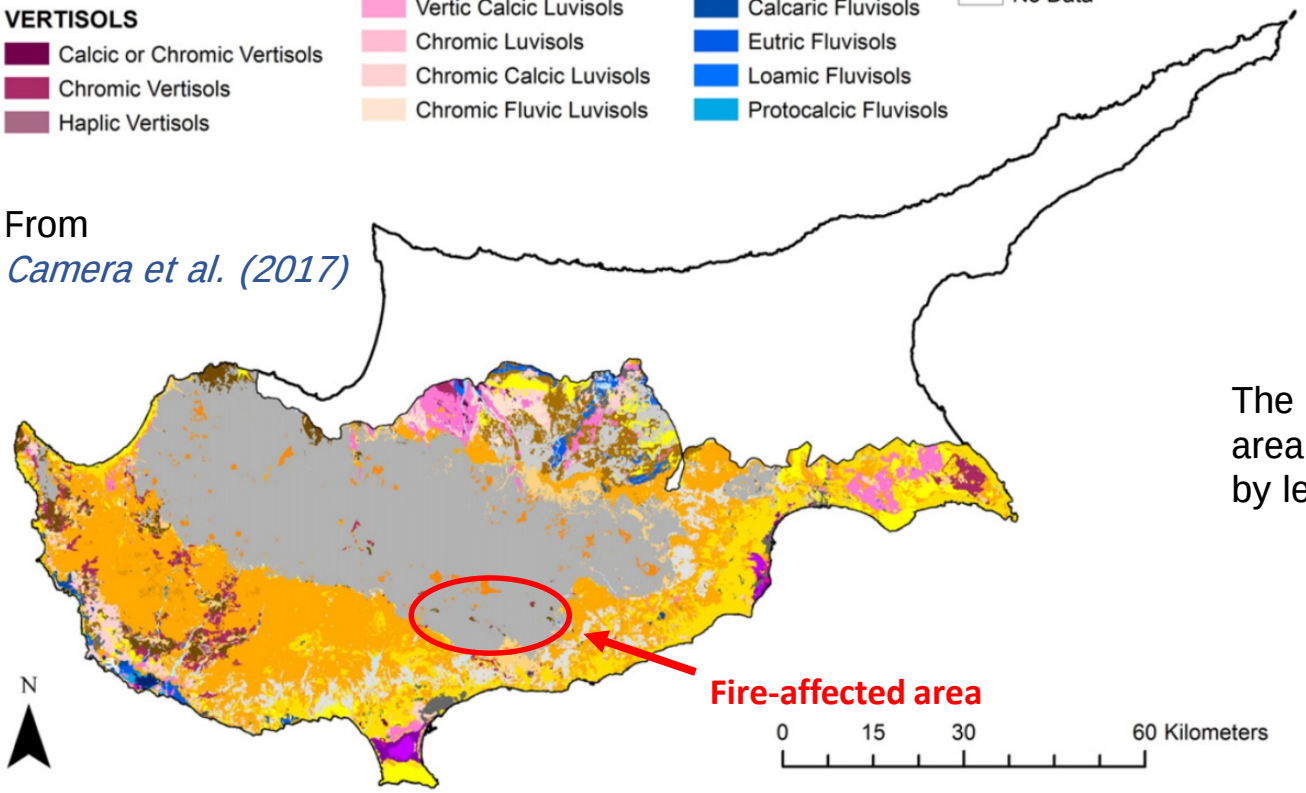
ARENOSOLS
- Protic Arenosols

FLUVISOLS
- Skeletic Fluvisols
- Calcaric Fluvisols
- Eutric Fluvisols
- Loamic Fluvisols
- Protocalcic Fluvisols

REGOSOLS
- Leptic and/or Skeletic Regosols
- Colluvic Regosols
- Gypsiric Regosols
- Calcaric Regosols
- Eutric Regosols

OTHERS
- Water Bodies
- No Data

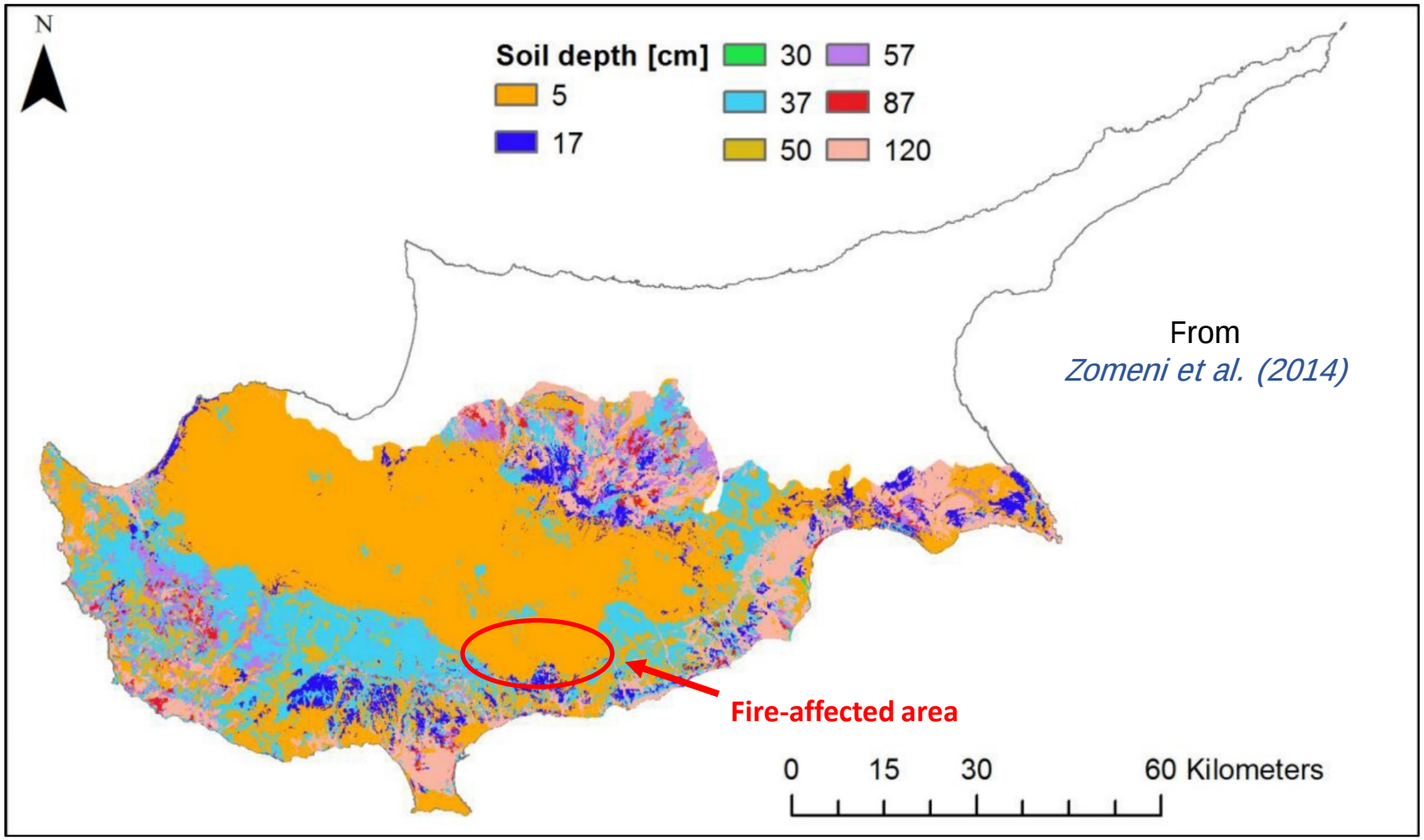
From
Camera et al. (2017)



The majority of the fire-affected area in the red frame is covered by leptosols ...

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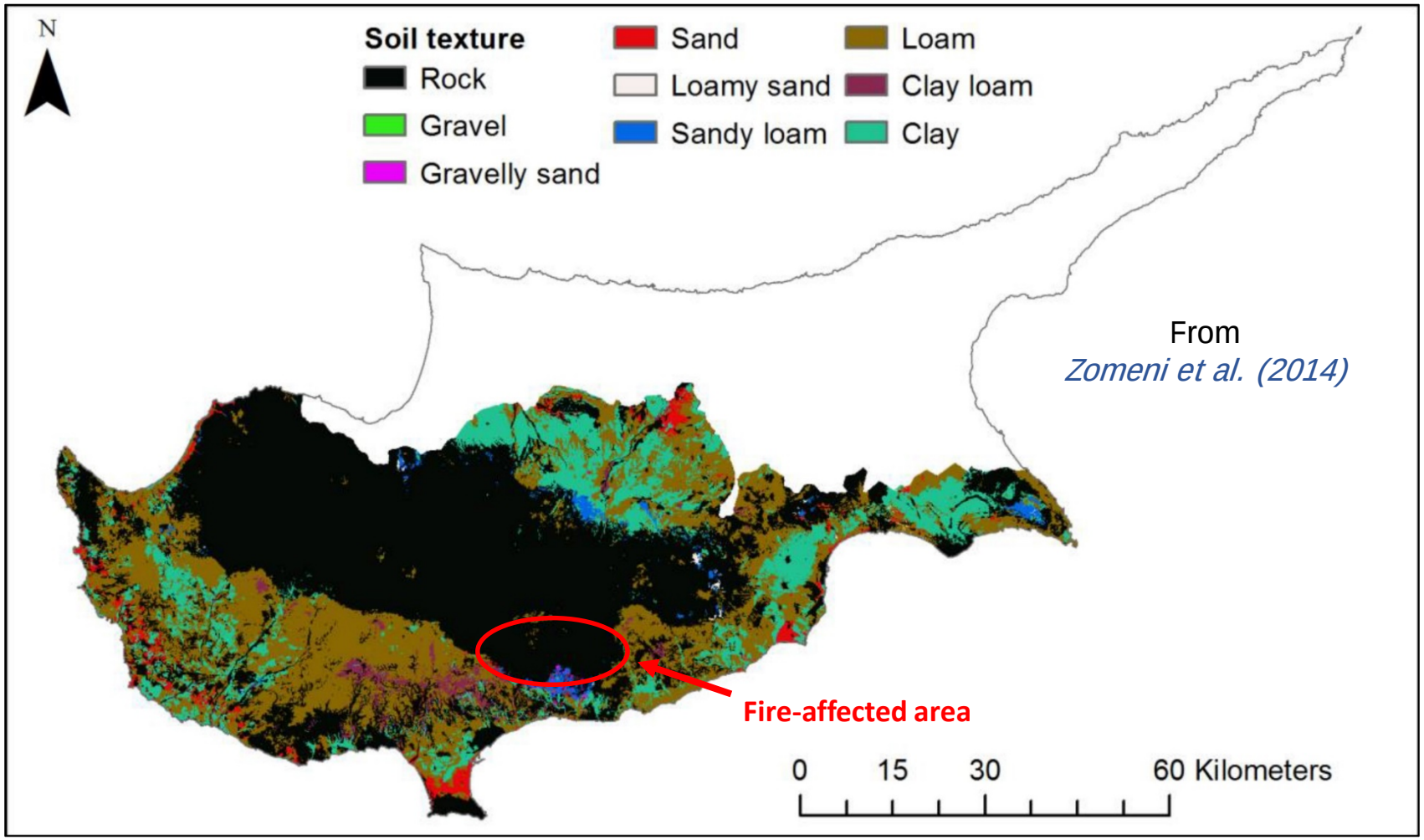
SOIL DEPTH OF CYPRUS



... with depth of 5 cm ...

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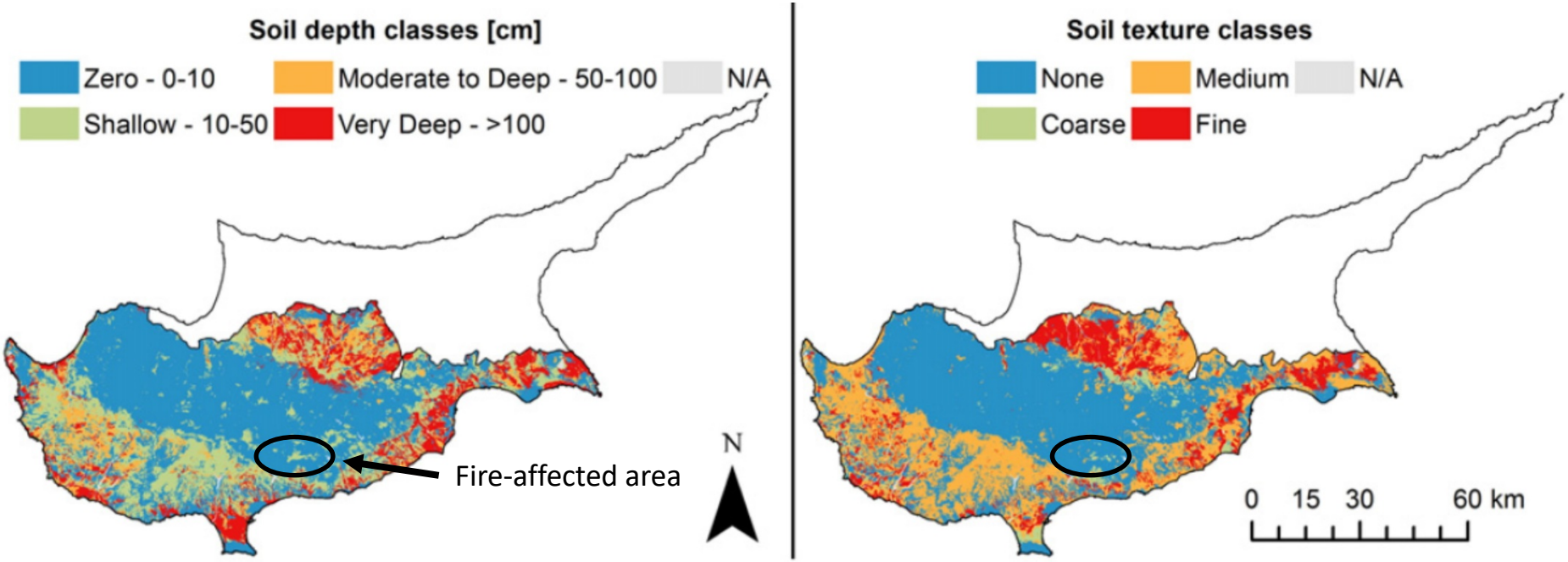
SOIL TEXTURE OF CYPRUS



and its soil texture comprises mainly rock.

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SOIL DEPTH AND SOIL TEXTURE OF CYPRUS



From *Camera et al. (2017)*

The synergy of the soil type, depth and texture has high potential for generating effects such as soil erosion and subsequent desertification in the July 2021 fire-affected area with adverse effects on local population, livestock and vegetation.

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LANDSLIDE SUSCEPTIBILITY

EUROPEAN LANDSLIDE SUSCEPTIBILITY MAP VERSION 2 (ELSUS v2)

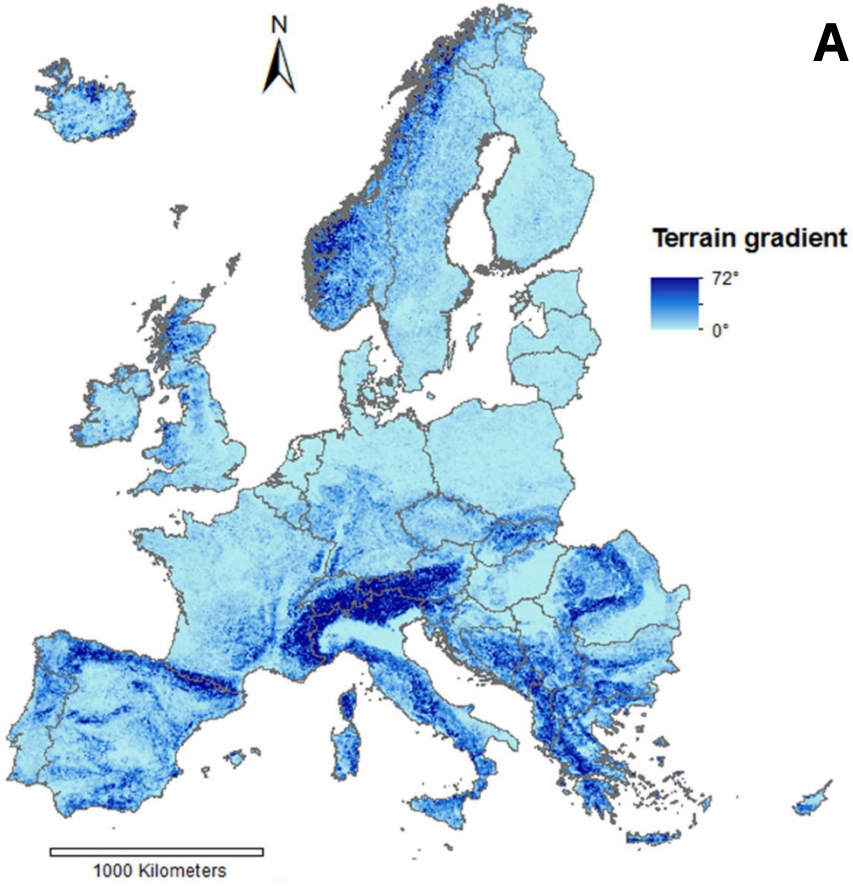
ELSUS v2 shows levels of spatial probability of generic landslide occurrence at continental scale. It covers all European Union member states except Malta, and several neighboring countries. The map has been produced by regionalizing the study area based on elevation and climatic conditions, followed by spatial multi-criteria evaluation modelling using pan-European:

- slope angle,
- shallow sub-surface lithology, and
- land cover spatial datasets
- as the main landslide conditioning factors.

In addition:

- the location of over 149,000 landslides across Europe, provided by various national organizations or collected by the authors, has been used for model calibration and map validation.

From *Wilde et al. (2014)*

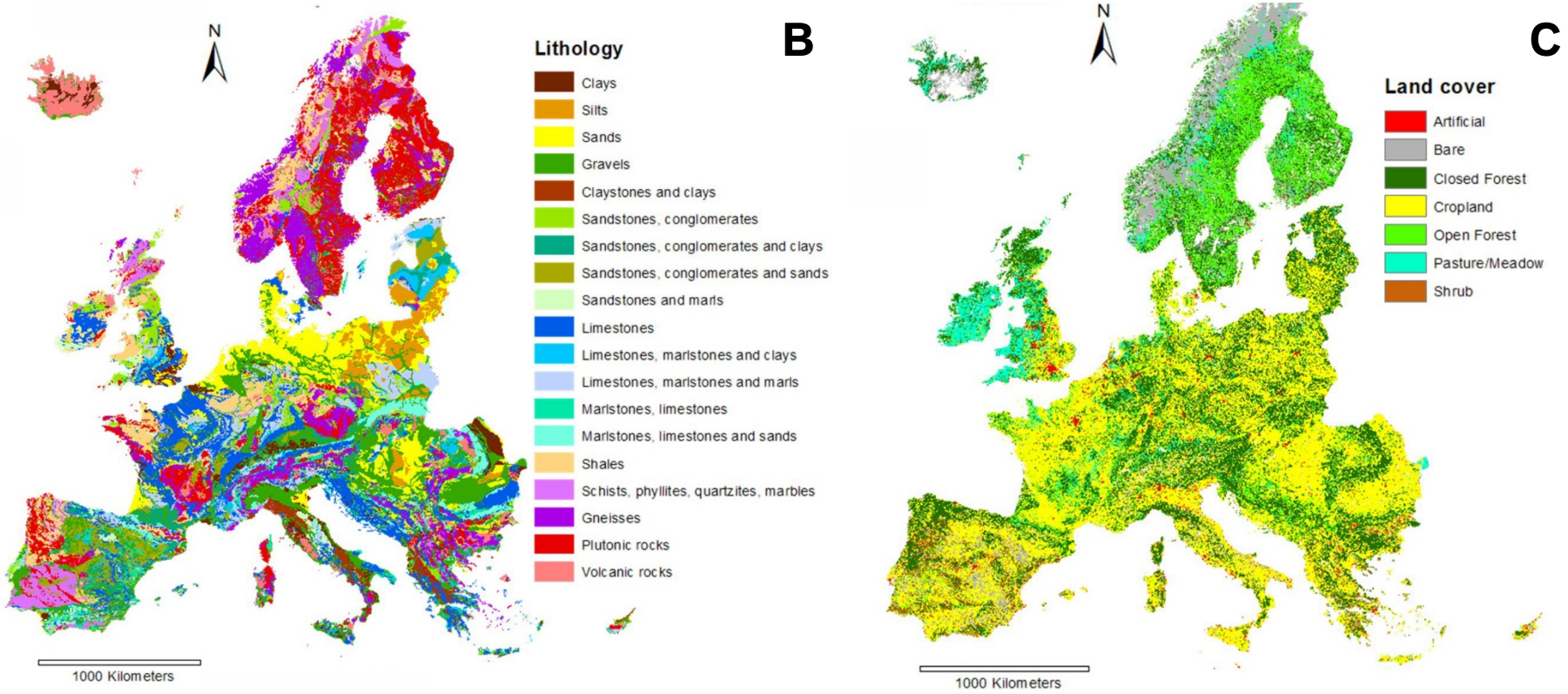


Thematic information used for ELSUS V2:
(**A**) Terrain gradient from EU27 DEM
From *Wilde et al. (2014)*

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LANDSLIDE SUSCEPTIBILITY

EUROPEAN LANDSLIDE SUSCEPTIBILITY MAP VERSION 2 (ELSUS v2)

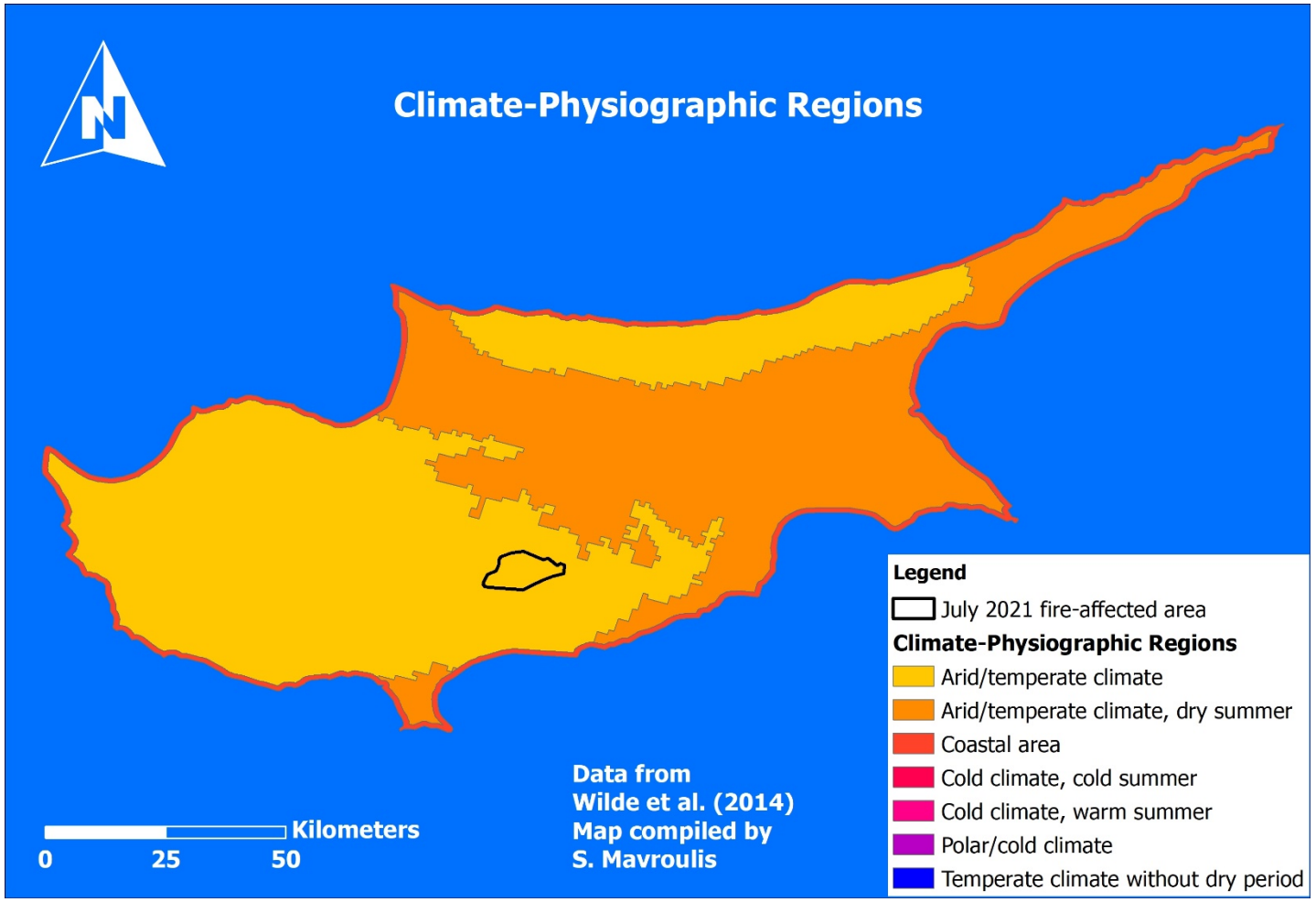


Thematic information used for ELSUS V2
(**B**) Lithology from the International hydrogeological Map of Europe (IHME)
(**C**) Land cover from GlobCover data set (ESA, 2010).
From *Wilde et al. (2014)*

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

CLIMATE-PHYSIOGRAPHIC REGIONS

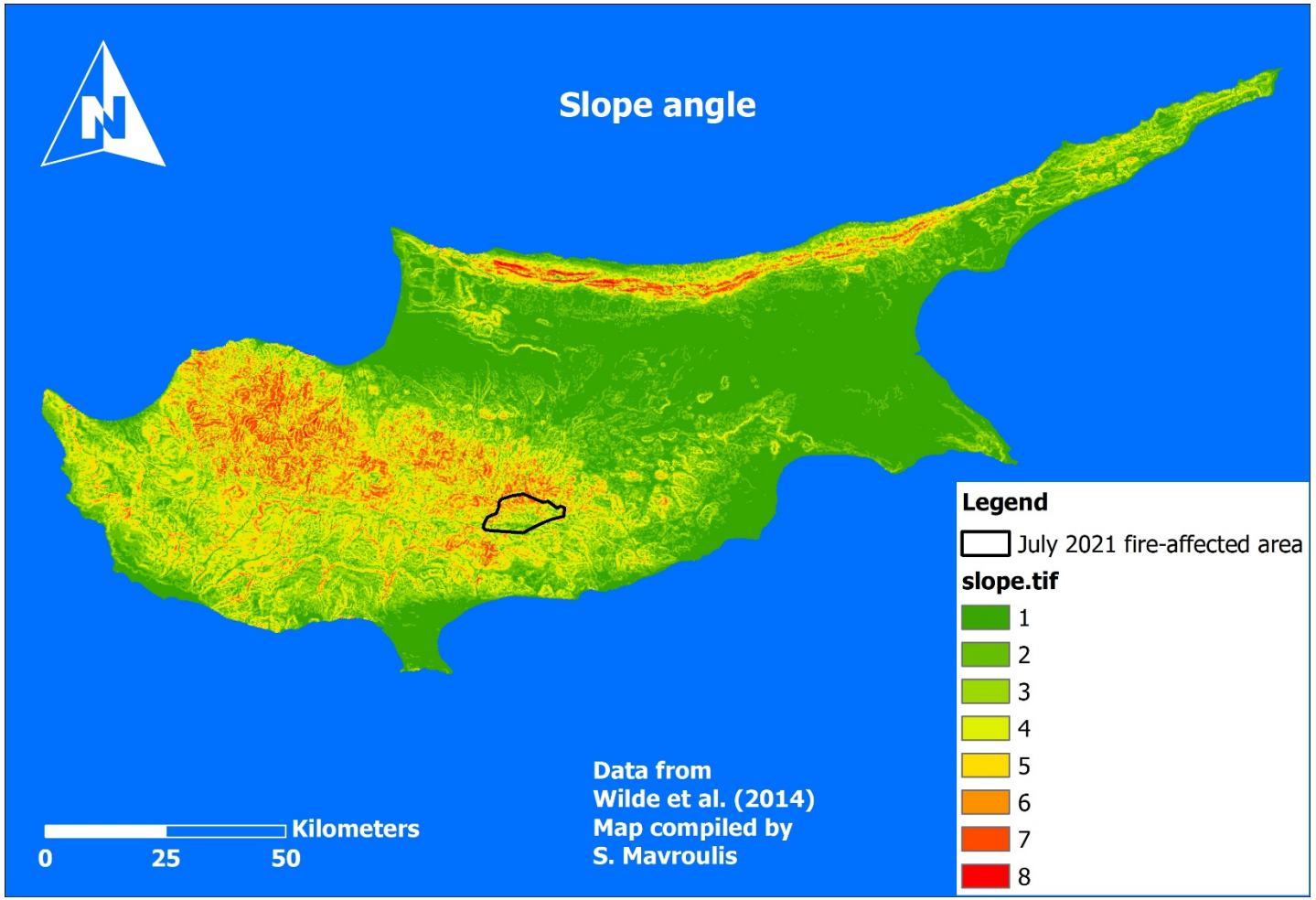


Based on the *European Landslide Susceptibility Map (ELSUS v2)*, which presents the landslide susceptibility at continental scale derived from heuristic-statistical modelling of landslide conditioning factors using also landslide location data, the fire affected area is characterized by arid/temperate climate.

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

SLOPE ANGLE

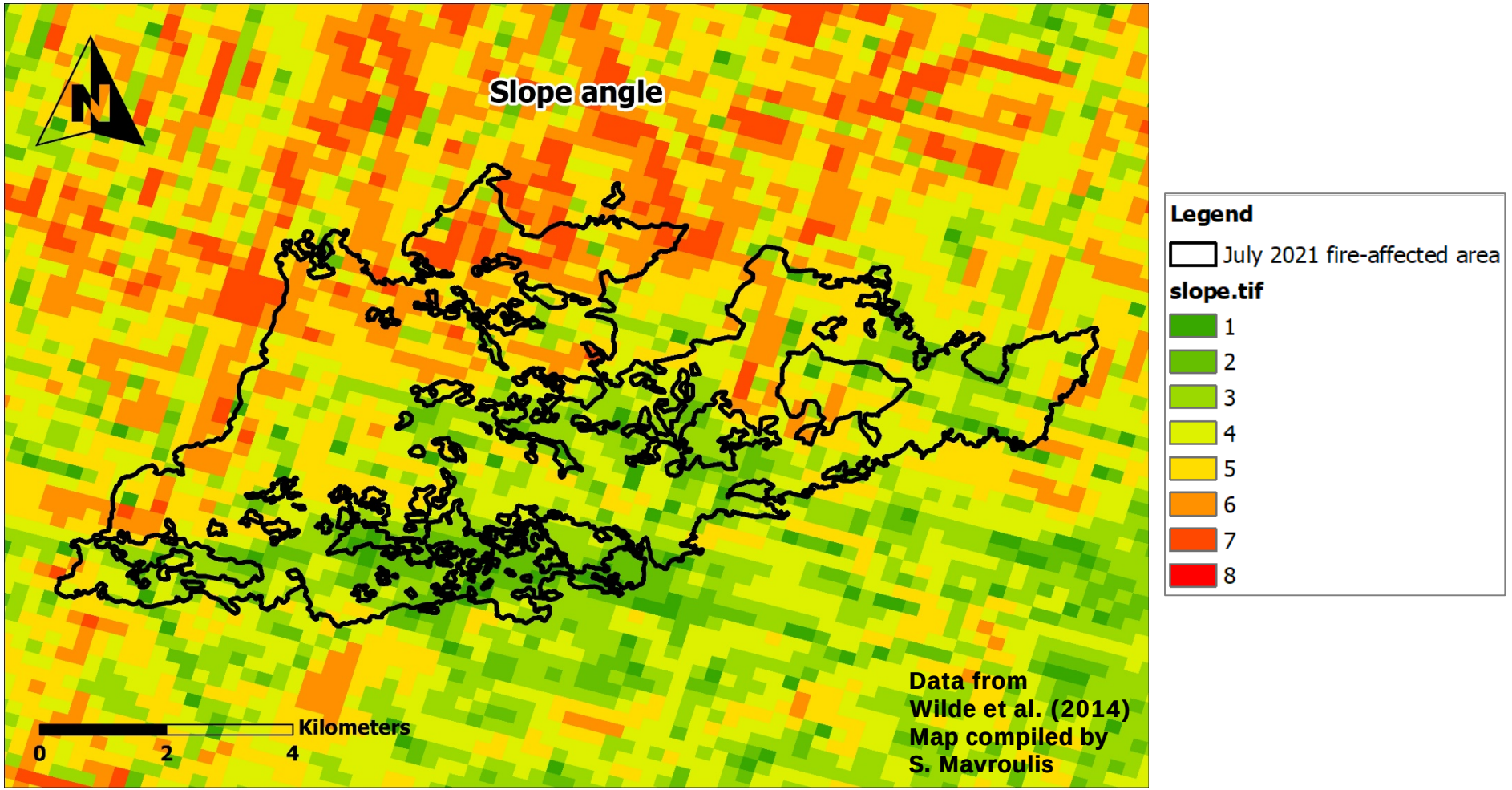


Slope angle coding: **0** = no data; **1** = 0°; **2** = 1°-3°; **3** = 4°-6°; **4** = 7°-10°; **5** = 11°-15°; **6** = 16°-20°; **7** = 21°-30°; **8** = 31°-82°

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

SLOPE ANGLE

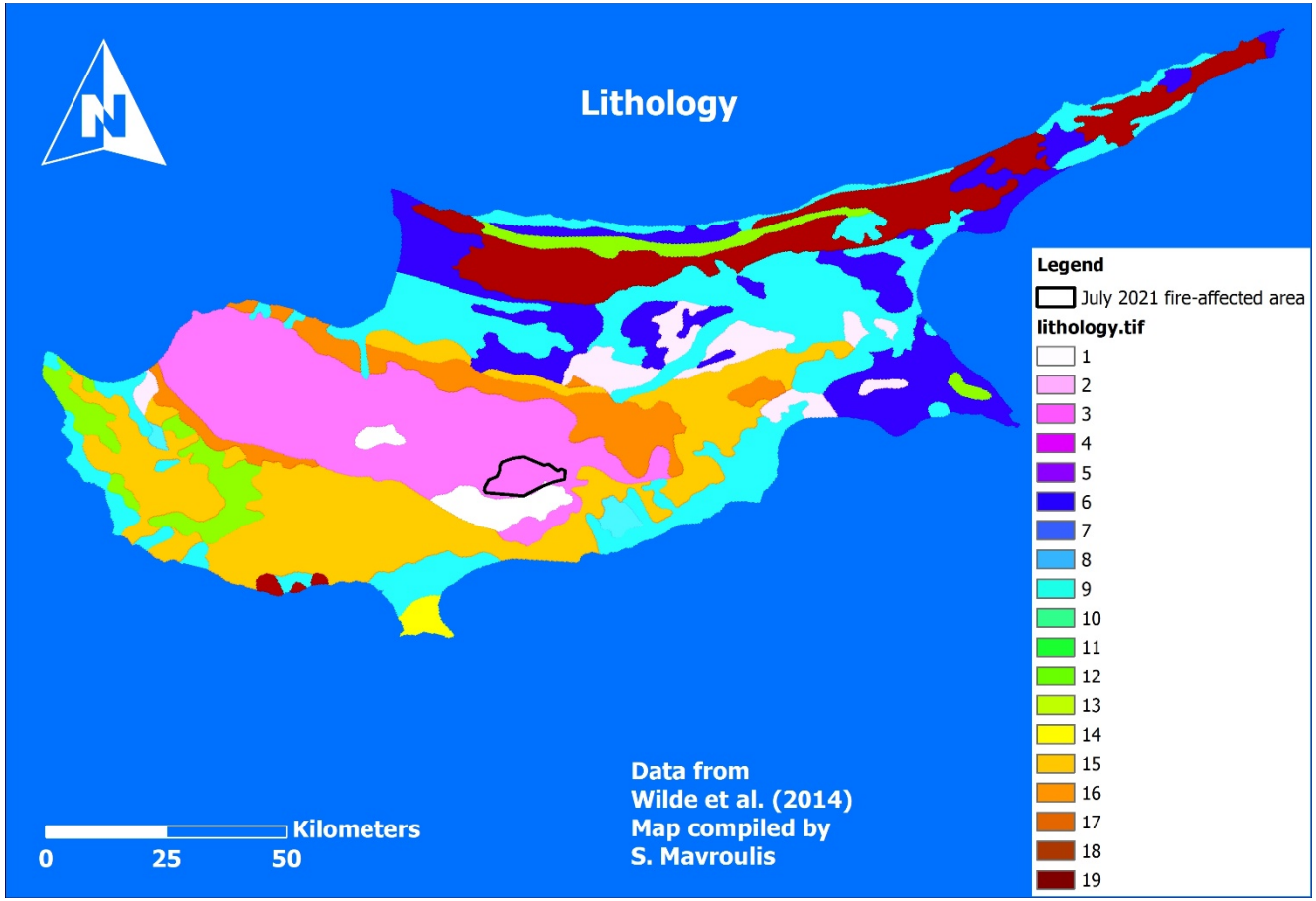


The northern part is characterized by intense refiled with high values of slope angle (Slope angle coding: **0** = no data; **1** = 0°; **2** = 1°-3°; **3** = 4°-6°; **4** = 7°-10°; **5** = 11°-15°; **6** = 16°-20°; **7** = 21°-30°; **8** = 31°-82°)

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

LITHOLOGY



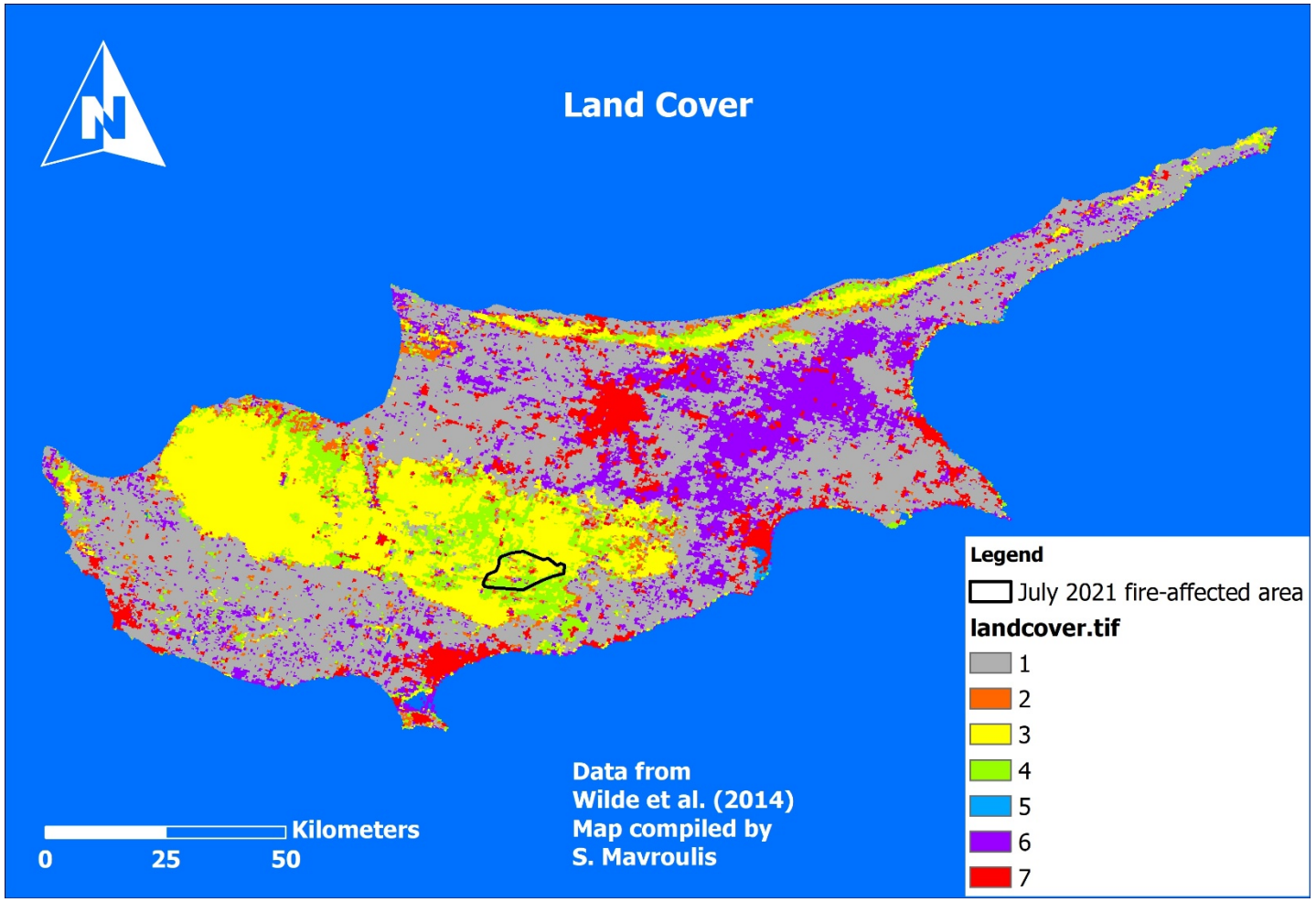
The affected area is mainly composed of shales

Lithology coding: **1**: schists, phyllites, quartzites and marbles; **2**: shales; **3**: plutonic rocks; **4**: gneisses; **5**: sandstones and conglomerates; **6**: sandstones, conglomerates and sands; **7**: limestones; **8**: sandstones, conglomerates and clays; **9**: gravels; **10**: sands; **11**: sandstones and marls; **12**: limestones, marlstones and clays; **13**: clays; **14**: marlstones and limestones; **15**: marlstones, limestones and sands; **16**: limestones, marlstones and marls; **17**: volcanic rocks; **18**: silts; **19**: claystones and clays

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

LAND COVER

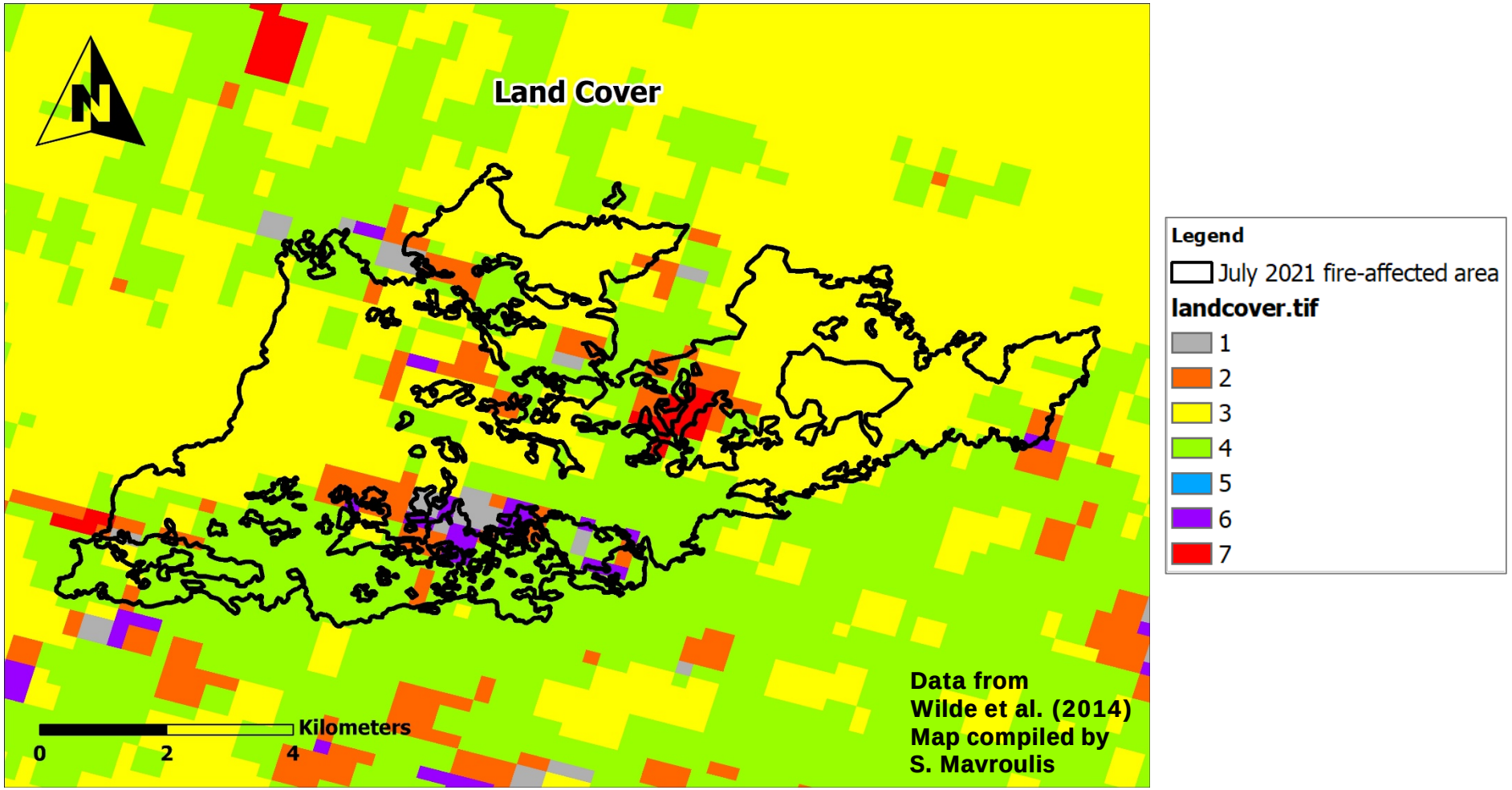


Land Cover coding: **1**: cropland; **2**: open forest; **3**: closed forest; **4**: shrub; **5**: pasture/meadow; **6**: bare; **7**: artificial

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LANDSLIDE SUSCEPTIBILITY AND MAIN CONTROLLING FACTORS

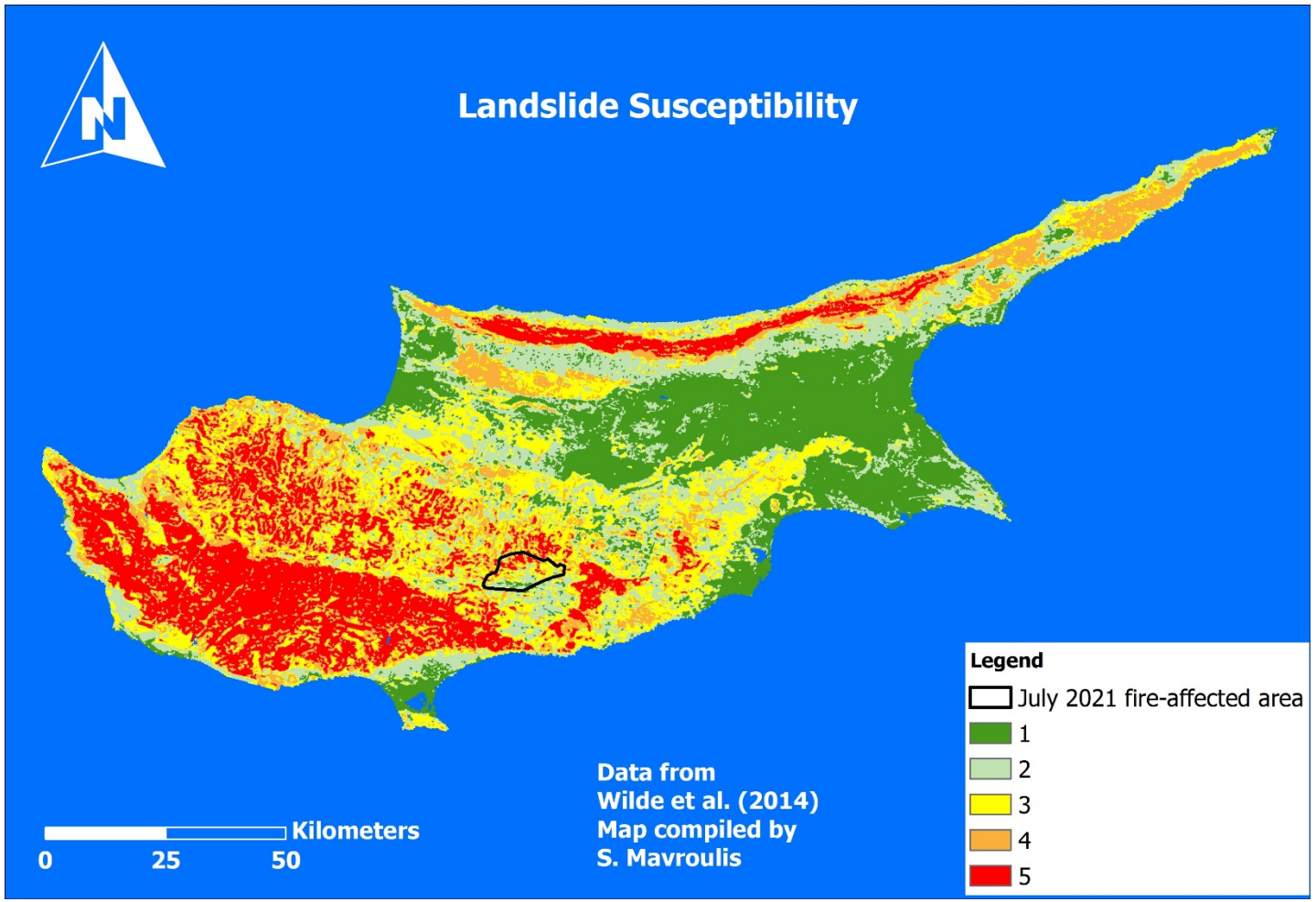
LAND COVER



The fire affected area is mainly covered by forests and shrubs

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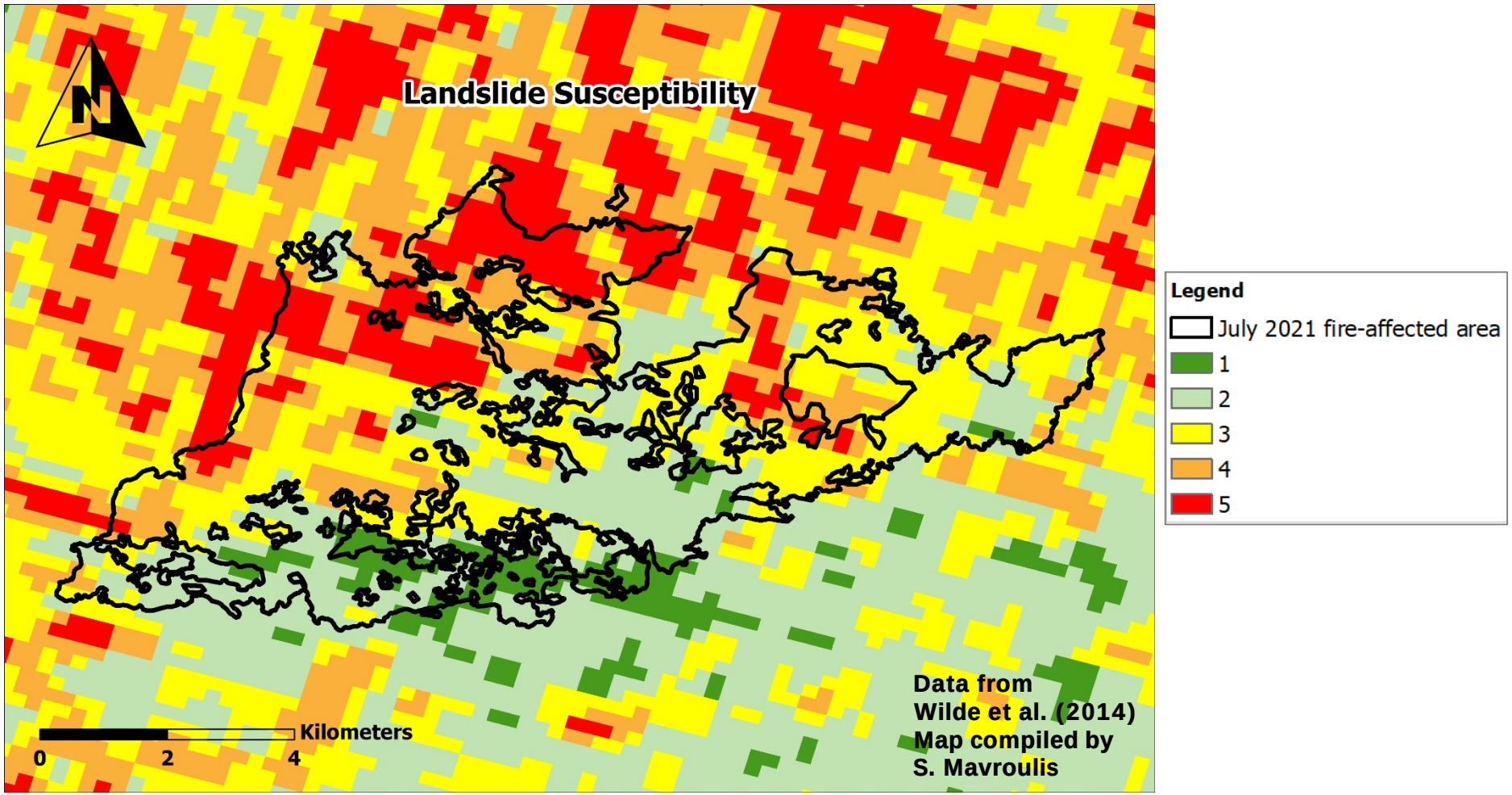
LANDSLIDE SUSCEPTIBILITY



Landslide susceptibility coding: **1**: very low; **2**: low; **3**: moderate; **4**: high; **5**: very high

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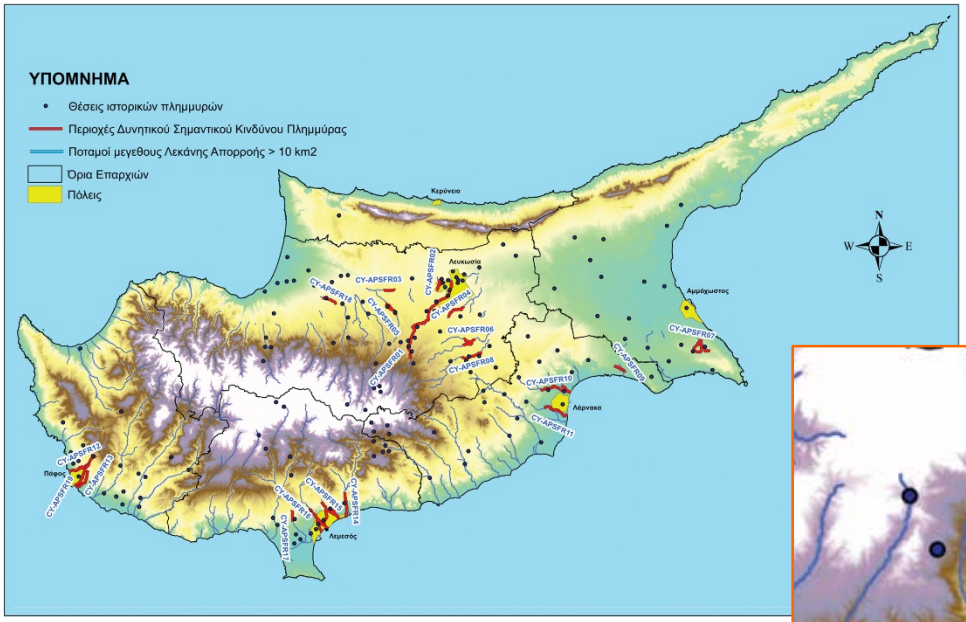
LANDSLIDE SUSCEPTIBILITY



As a result, the northern part of the July 2021 fire-affected area is characterized by high and very high landslide susceptibility, while in the southern part the susceptibility is lower, ranging from low to very low. The fire effects have the potential to further increase the susceptibility to all extent of the affected area.

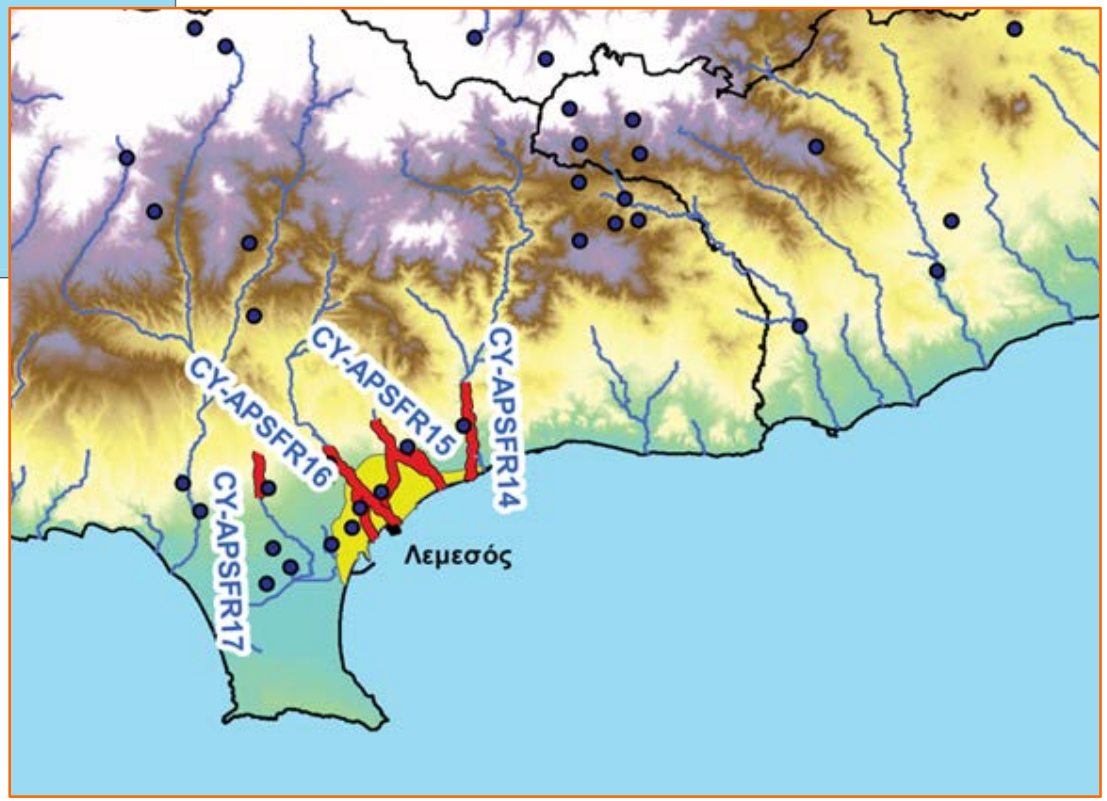
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FLOOD HAZARD AND RISK



Maps illustrating areas of potential significant flood risk

(From *Civil Defense of Cyprus*: https://civildefence.com.cy/en/floodmaps/)



The **black dots** correspond to historical flood events, while the **red lines** represent areas of potential significant flood risk. It is clear that the area downstream of the fire-affected area is defined as of potential significant flood risk before the fire. The fire impact in the upstream mountainous areas of Limassol and Larnaca could further increase flood risk in lowlands.

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FLOOD HAZARD AND RISK

AREAS OF POTENTIAL SIGNIFICANT FLOOD RISK

Area Code		River name	Area Name
Description	Map		
CY-APSFR01	CY-APSFR01	Pedieos	From Politiko to Nicosia
CY-APSFR02	CY-APSFR02	Klimos	Egkomi, Ag. Dometios
CY-APSFR03	CY-APSFR03	Merika river branch	Kokkinotrimithia
CY-APSFR04	CY-APSFR04	Kalogeros	Strovolos and Latsia Industrial area
CY-APSFR05	CY-APSFR05	Merikasand branches Koutis and Katouris	Paliometoho and Ag.Trimithias
CY-APSFR06	CY-APSFR06	Almiros-Alikos	Dali Industrial Area
CY-APSFR07	CY-APSFR07	River entry and Paralimni Lake	Paralimni
CY-APSFR08	CY-APSFR08	Yialias	Nisou, PeraChorio, Dali
CY-APSFR09	CY-APSFR09	Ormidia River	Ormidia
CY-APSFR10	CY-APSFR10	Archaggelos- Kamitsis	Aradippou - Livadia
CY-APSFR11	CY-APSFR11	Kamares River	Kamares Larnaca
CY-APSFR12	CY-APSFR12	Koshinas	Mesogi, Paphos, Chlorakas
CY-APSFR13	CY-APSFR13	Limnarka	Paphos city
CY-APSFR14	CY-APSFR14	Germasogeia River	Germasogeia
CY-APSFR15	CY-APSFR15	Vathias River and Vathias branch	Mesa Gitonia, Ag. Athanasios, Limassol East area
CY-APSFR16	CY-APSFR16	New and old Garyllis river	Poleimidia, Ag. Antonios
CY-APSFR17	CY-APSFR17	Marketos stream - Ypsonas	Ypsonas
CY-APSFR18	CY-APSFR18	Komitis	Astromeritis
CY-APSFR19	CY-APSFR19	Vasilikos stream, Paphos	Paphos city



The Germasogeia River, located downstream of the July 2021 fire-affected area, and the adjacent areas have been already included in the areas of potential significan flood risk. The river has high potential to cause flooding during the post-fire period (Table and figure available at: http://www.moa.gov.cy/moa/WDD/wfdf.nsf/page04_gr/page04_gr?opendocument)

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POTENTIAL POST-FIRE HAZARDS AND RISKS

IMPARATIVE NEED FOR AN IMMEDIATE MULTIPARAMETRIC AND INTERDISCIPLINARY RESEARCH

The fire burned partially the drainage basins of Vasilikos, Germasogeia and Maroni Rivers. The upcoming hydrometeorological and erosion processes are characterized by high potential for considerably affecting the environment of the mountainous Limassol and Larnaca areas, making the wider area susceptible and vulnerable to new destructive effects.

The potential post-fire hazards comprise:

- **increased soil erosion and runoff,**
- **increased failures along natural and road cut artificial slopes,**
- **greater flooding and debris flow potential during or after rainfalls and storms and**
- **increased risk of hazard trees falling**

The number of floods and slope failures and the subsequent erosion in the area is expected to increase as a result of the fires and the destabilization caused to the local ecosystem and in particular due to the significant reduction of forest and shrub vegetation in the area. In order to prevent these phenomena, the need to maintain the existing flood and erosion works and the implementation of new ones is considered imperative.

Additionally, it is estimated that hot summers in the next few decades will occur more and more frequently in Cyprus, due to climate change, resulting in the risk of more and raging fires, which in turn will be accompanied by a long period of increasing floods and slope failures in the fire-affected areas.

It is necessary to conduct **an immediate multiparametric and interdisciplinary research in the fire-affected areas dealing with the adverse geoenvironmental effects of the fires** in the mountainous areas of Larnaca and Limassol provinces and comprising post-fire assessment of the susceptibility of the affected areas to floods, slope failures and erosion and the restoration of the ecosystem.

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POST-EVENT MEETINGS AND FIELD SURVEYS
FOR ASSESSMENT OF THE GEOENVIRONMENTAL IMPACTS IN THE FIRE-AFFECTED AREAS






Post-event meetings of involved authorities for implementation of actions for the mitigation of the geoenvironmental impact of the early July 2021 forest fire in the affected areas

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POST-EVENT MEETINGS AND FIELD SURVEYS
FOR ASSESSMENT OF THE GEOENVIRONMENTAL IMPACTS IN THE FIRE-AFFECTED AREAS

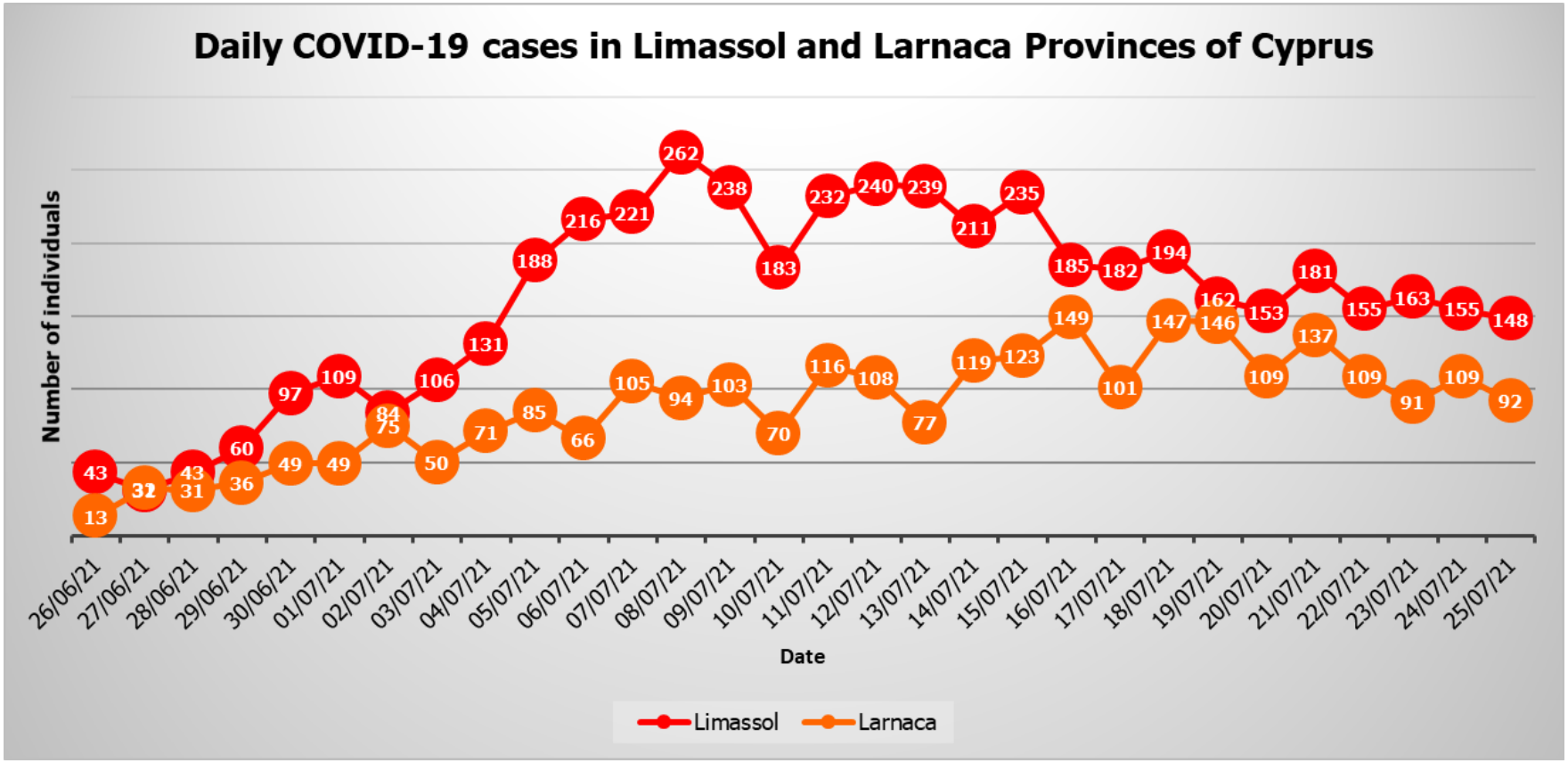





Field surveys in the areas affected by the early July 2021 Arakapas forest fire in order to assess potential post-fire hazards and risks

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EVOLUTION OF COVID-19 PANDEMIC IN THE FIRE-AFFECTED PROVINCES



The graph illustrates the evolution of the COVID-19 cases in Limassol and Larnaca Provinces, which were affected by the early July 2021 Arakapas forest fire. Taking into account the official announcements of the Ministry of Health of Cyprus regarding new COVID-19 cases, it is concluded that there is an increase of cases in both provinces in the first five days after the fire ignition and a subsequent decreasing trend in the following days. However, the increasing trend is not associated with the adverse effects formed by the early July 2021 forest fire.

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CONCLUSIONS

- The studied 2021 Cyprus forest fire started on 3 July in Arakapas area and then spread to several mountainous areas of the Limassol and Larnaca provinces. The spread of the fire was rapid and the task of tackling it very difficult due to its large extent and the large perimeter. The situation came under full control on 5 July.
- Due to the rapid spread of the fire, the communities of Arakapas, Melini, Eptagonia, Sykopetra, Odou, Ora, Farmakas, Ayioi Vavatsinias and Vavatsinia were evacuated and the residents were guided to stay in safe places.
- The fire burned an area of about 55 km^2 covered with forest vegetation and agricultural crops.
- The impact of the fire comprises:
    - 4 fatalities
    - destruction of private properties comprising residential and commercial buildings, over 50 buildings suffered extensive damage
    - damage to the electricity and water supply network
    - damage to mobile objects
    - losses of livestock
    - destruction of farms, small local companies and individual suppliers
- In Limassol province, over 20 buildings and properties suffered damage, several cars and bicycles were burnt.
- In Larnaca province, 22 houses were destroyed by the fire. In addition, over 36 cottages were also destroyed including 9 in Melini, 25 in Ora and 2 in Ayioi Vavatsinias. 11 professional premises were also destroyed, in particular 1 in Ayioi Vavatsinias, 4 in Odou and 6 in Ora.
- The Community of Ora was the worst affected community in the fire-affected area of Larnaca, followed by Melini and Odou communities.

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CONCLUSIONS

- As regards the evolution of the COVID-19 pandemic in the fire-affected areas, no increase was observed in the daily recorded COVID-19 cases.
- The emergency response actions included not only mobilization of the state authorities involved in disaster management but also the activation of the EU Civil Protection Mechanism for support in tackling the forest fire.
- The measures for supporting the local population and the victims were mainly based on measures adopted and relief provided to the population affected in previous similar cases (e.g. the 2013 Soleas fire)
- The adopted measures included mainly provision of financial assistance for damage to homes, businesses and vehicles
- The potential post-fire hazards comprise:
    - increased soil erosion and runoff
    - increased failures along natural and artificial slopes
    - greater flooding and debris flow potential during or after rainfalls and storms
    - increased risk of hazard trees falling
- The synergy of the soil type, depth and texture has high potential for generating effects such as soil erosion and subsequent desertification in the July 2021 fire-affected area with adverse effects on local population, livestock and vegetation.
- The northern part of the July 2021 fire-affected area is characterized by high and very high landslide susceptibility, while in the southern part the susceptibility is lower, ranging from low to very low. The fire effects have the potential to further increase the susceptibility to all extent of the affected area.
- The fire impact in the upstream mountainous areas of Limassol and Larnaca has the potential to further increase flood risk in lowlands.

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CONCLUSIONS

- In order to prevent these phenomena, the need to maintain the existing landslide, flood and erosion works and the implementation of new ones is considered imperative.
- It is necessary to conduct an immediate multiparametric and interdisciplinary research in the fire-affected areas dealing with the adverse geoenvironmental effects of the fires in the mountainous areas of Larnaca and Limassol provinces and comprising post-fire assessment of the susceptibility of the affected areas to landslides, floods and erosion and the restoration of the ecosystem.

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The early July 2021 Arakapas (Cyprus) forest fire



Cyprus, 2021