A FIELD DISPATCH FROM THE MEDITERRANEAN

When *Fire* Meets the *Olive Grove*

A single wildfire. Field evidence, UAV photogrammetry and Sentinel-2 burn-severity analysis produced convergent damaged-tree estimates within a 61–73 range. This convergence — without supervised model training — demonstrates EO's operational viability when integrated into Türkiye's institutional damage-assessment framework.

esa → THE EUROPEAN SPACE AGENCY

REPUBLIC OF TÜRKİYE MINISTRY OF AGRICULTURE AND FORESTRY

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CASE FILE · Sağancı Wildfire
11 Aug 2025 · Bergama

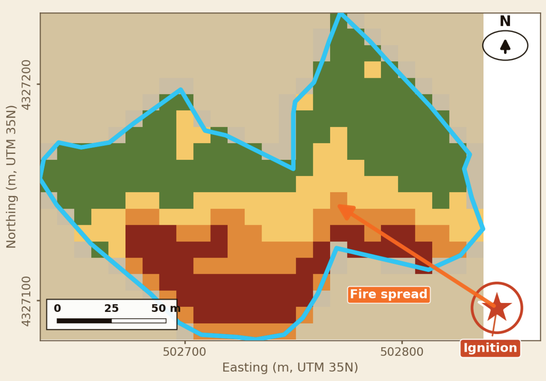
This workflow translates satellite-derived burn severity into ***court-submitted expert evidence*** for institutional agricultural damage assessment.

I. SATELLITE SIGNAL — II. DRONE MAPPING — III. FIELD EVIDENCE — IV. INSTITUTIONAL DECISION

TREES DAMAGED	BURNED AREA	SEVERE THRESHOLD	TREE AGE	SITE VERIFICATION
73 / 169	**0.68** ha	**≥0.25**	**150**–300 yr	**10** Oct
43% · court-accounting	6,830 m² · mapped burn-severity zone	Severe · Med. calibration	Ancient canopy	2025 · expert walk-through

I. The fire, seen from orbit.

SENTINEL-2 ΔNBR · PRE-FIRE MEDIAN VS. 14 AUG 2025



Severity Class
olive-calibrated thresholds

- **Severe** — *ΔNBR ≥ 0.25* — **2.90 da** — *31 field-confirmed*
- **Moderate** — *0.15 – 0.25* — **2.61 da** — *28 field-confirmed*
- **Mild** — *0.05 – 0.15* — **3.32 da footprint** — *14 field-confirmed †*
- **Unburned** — *ΔNBR < 0.05* — **6.93 da**

† Mild footprint (3.32 da) includes transient thermal response; 14 trees physically field-confirmed inside the 6.83 da validation zone.

Parcel 154/6 · Ignition point · Fire spread

Dark red pixels mark severe canopy loss (ΔNBR ≥ 0.25). Orange arrow traces backing-fire path from SE ignition point (star) upslope to NW — against prevailing NE wind.

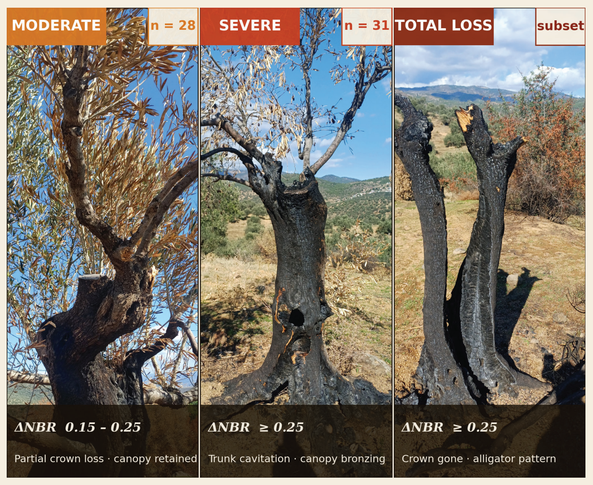
II. Fire spread upslope, against prevailing wind.

UAV ORTHO · SEPT–OCT 2025 · 2.25 CM GSD · NE WIND · 28 KM/H

Yellow arrows: ERA5 wind at ignition time (NE · 28 km/h from 49°). Orange arrow: fire spread NW, ~90° oblique to wind — indicates slope-driven backing fire. Dark red star: likely ignition zone (transmission line corridor, ~37 m S of parcel)

III. Field evidence: three severity classes.

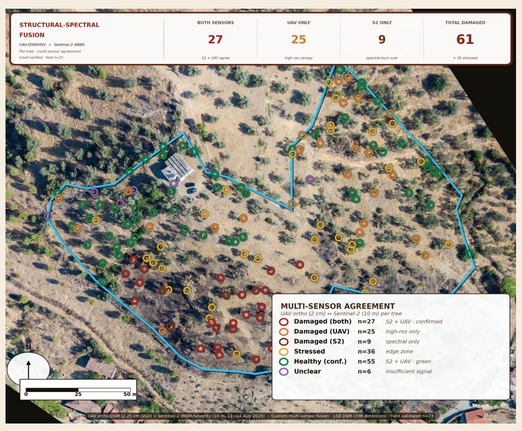
PHOTO-DOCUMENTED SITE VERIFICATION · 3 SEVERITY GRADES

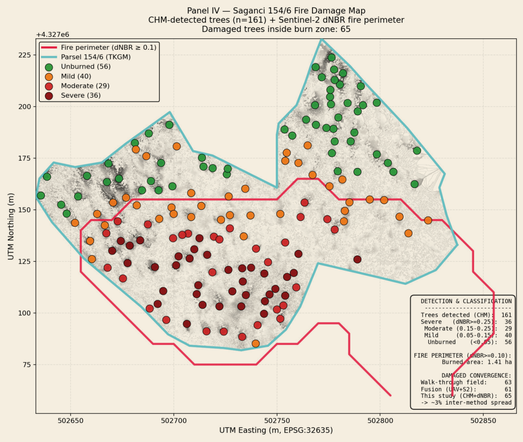


Mild class (n = 14, ΔNBR 0.05–0.15) documented at plot scale; close-up examples shown above are for moderate and severe damage.

IV. Per-tree fusion: UAV × Sentinel-2.

STRUCTURAL-SPECTRAL FUSION · 161 CHM CANDIDATES · MULTI-SENSOR AGREEMENT





CHM-detected tree candidates (n=161; 95.3% completeness against the 169-tree manual reference) were classified by per-tree Sentinel-2 dNBR sampling. Strict damaged trees, defined as Severe + Moderate, totalled 65. Methodologically distinct benchmarks included field walk-through evidence (n=63), UAV×S2 fusion (n=61), and the court-accounting inference (n=73), with all estimates falling within a 61–73 damaged-tree range. No supervised model training was applied.

Methodological note — The CHM workflow detected 161 tree candidates against a 169-tree manual reference. The eight missing trees were concentrated in the eastern sparse transition zone, where low-canopy olive trees were locally under-detected by the photogrammetric DTM. This boundary condition did not affect the main damaged-tree convergence.

The *methodological anatomy* of the assessment.

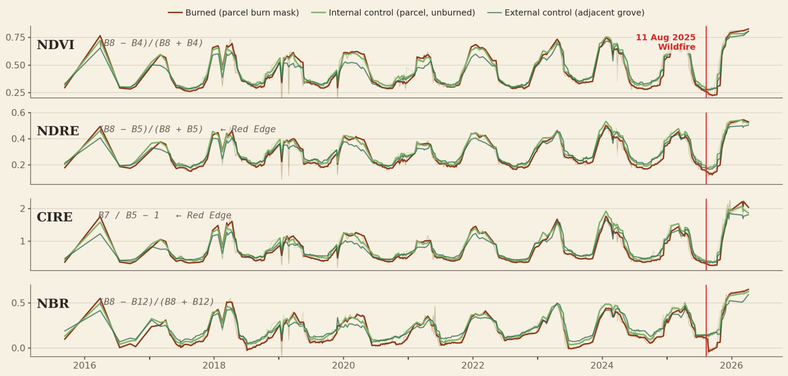
DAMAGE CLASS	TREES	VALUATION METHODOLOGY
Total Loss ΔNBR ≥ 0.25	**31**	*Marietti 12+12 yr capitalisation* — Yargıtay 5. HD 1/3 presumption · TÜİK indexation
Moderate ΔNBR 0.15–0.25	**28**	*5-yr rehabilitation horizon* — Mediterranean broadleaf rehabilitation curves
Mild ΔNBR 0.05–0.15	**14**	*1-yr loss + 2-yr maintenance* — Sub-canopy stress · cambial injury validated
Total trees	**73**	**Institutional damage assessment finalised 10 Oct 2025**

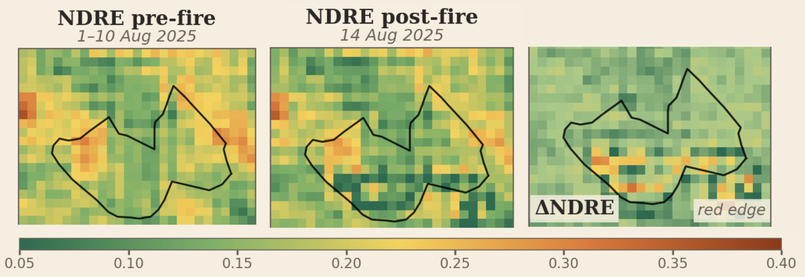
SCIENTIFIC FRAMEWORK

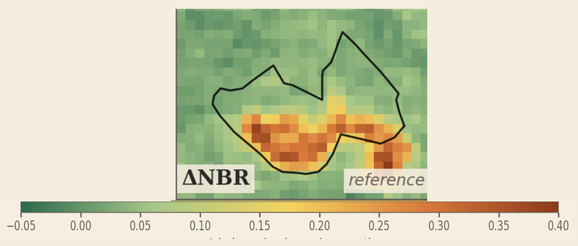
Thresholds — Field-calibrated for Mediterranean evergreen broadleaf (*Olea europaea*). Olive's waxy cuticle compresses dNBR dynamic range vs. conifer defaults; per-tree validation against cambial injury and crown loss.

V. Red Edge diagnostic — pre/post fire spectral response.

Sentinel-2 · 4 indices · 3 ROIs · 11 Aug 2025 wildfire (vertical line) · 8-month post-fire trajectory







THRESHOLD SENSITIVITY
Sentinel-2 ΔNBR area vs. field-classified tree footprint

ΔNBR	EO area	Field area	Δ	Field class
≥ 0.25	**3,272 m²**	2,852 m²	**+14.7%**	Severe (n=31)
≥ 0.15	**5,750 m²**	5,430 m²	**+5.9 %**	Severe + Mod (n=59)
≥ 0.05	**9,491 m²**	6,715 m²	**+41.4%**	All + sub-canopy (73)

KEY RESULT *EO area at ΔNBR ≥ 0.15 reproduces the 59-tree institutional footprint within 5.9 %.*

Three *Findings*

CONCLUSIONS · POLICY IMPLICATIONS

01

EO operates inside the institutional framework.

Four methodologically distinct estimates converged within a 61–73 damaged-tree range on Parcel 154/6: field walk-through evidence (n=63), UAV×S2 fusion (n=61), CHM+dNBR strict classification (n=65), and court-accounting inference (n=73). No supervised model training was applied; literature thresholds were checked against parcel-level field evidence.

02

Fire behaviour, decoded by geometry.

ΔNBR traced NW propagation against NE wind — inconsistent with head-fire dynamics. Combined with alligator-skin carbonisation and V-pattern geometry, this is **consistent with backing-fire driven by slope-effect chimney**, converging on the transmission-line corridor as a likely ignition area.

03

The Mediterranean needs a standard.

As fire frequency intensifies, the region needs **standardised EO-based damage accounting**. Free Sentinel-2 data, open-source ODM pipelines, and valuation frameworks (Marietti capitalisation, TÜİK indexation) make this replicable across any CAP or institutional monitoring system.

METHODOLOGY · FOUR-STEP INTEGRATED WORKFLOW

STEP 01 — **Sentinel-2 Burn Analysis** — Pre-fire median 1 Jul–10 Aug 2025 / post 14 Aug
→ **STEP 02** — **Multi-Temporal UAV Survey** — Sept + Oct 2025 (2 dates, 27 images) · ODM/SfM
→ **STEP 03** — **Site Verification** — Court expert site inspection · photo
→ **STEP 04** — **Institutional Report** — Marietti 12+12 capitalisation · TÜİK index ·

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