ForestSAT 2016, GOFC-GOLD Fire IT Meeting
17 November, 2016, Santiago - Chile

The Greek National Observatory of Forest Fires

Development of services and their promotion in the Balkan region

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http://fmrs.web.auth.gr/

National Observatory Of Forest Fires

An initiative to establish an **observatory** of forest fires in Greece.

NOFFi aims:

- to develop **products** and **services** related to the **prevention** and **impact assessment** of forest fires in order to **assist** forest fire management.
- to promote the **transboundary** cooperation with neighboring **Balkan** countries through common innovative services.

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National Observatory Of Forest Fires

Services to be developed under NOFFi :

1. A fuel type mapping methodology
2. A burned area mapping service
3. A mid-term forest fire danger index
4. A web-based GIS platform

Implementation agencies - Financing

Supervision:	Ministry of Environment and Energy
Cooperation:	Laboratory of Forest Management and Remote Sensing, AUTh Interbalkan Environment Center
Financing:	Green Fund
Start date:	March 2014
Duration:	42 months

Fuel type mapping

Up-to-date mapping methodology

- Mixed approach mainly based on the analysis of **satellite** imagery; use of existing maps (LPIS-ILOTS, official forest density) as ancillary data
- Capability to easily **update** the final fuel-type map (depends on image availability - no real problem these days)
- **Typical** fuel type classification scheme
- The product is easily **comparable** with other fuel type mapping products such as the JRC FUELMAP and ArcFUEL
- **Descriptive criteria** can be easily added to discriminate specific classes (sub-urban forests, riparian vegetation etc.)

Fuel type mapping

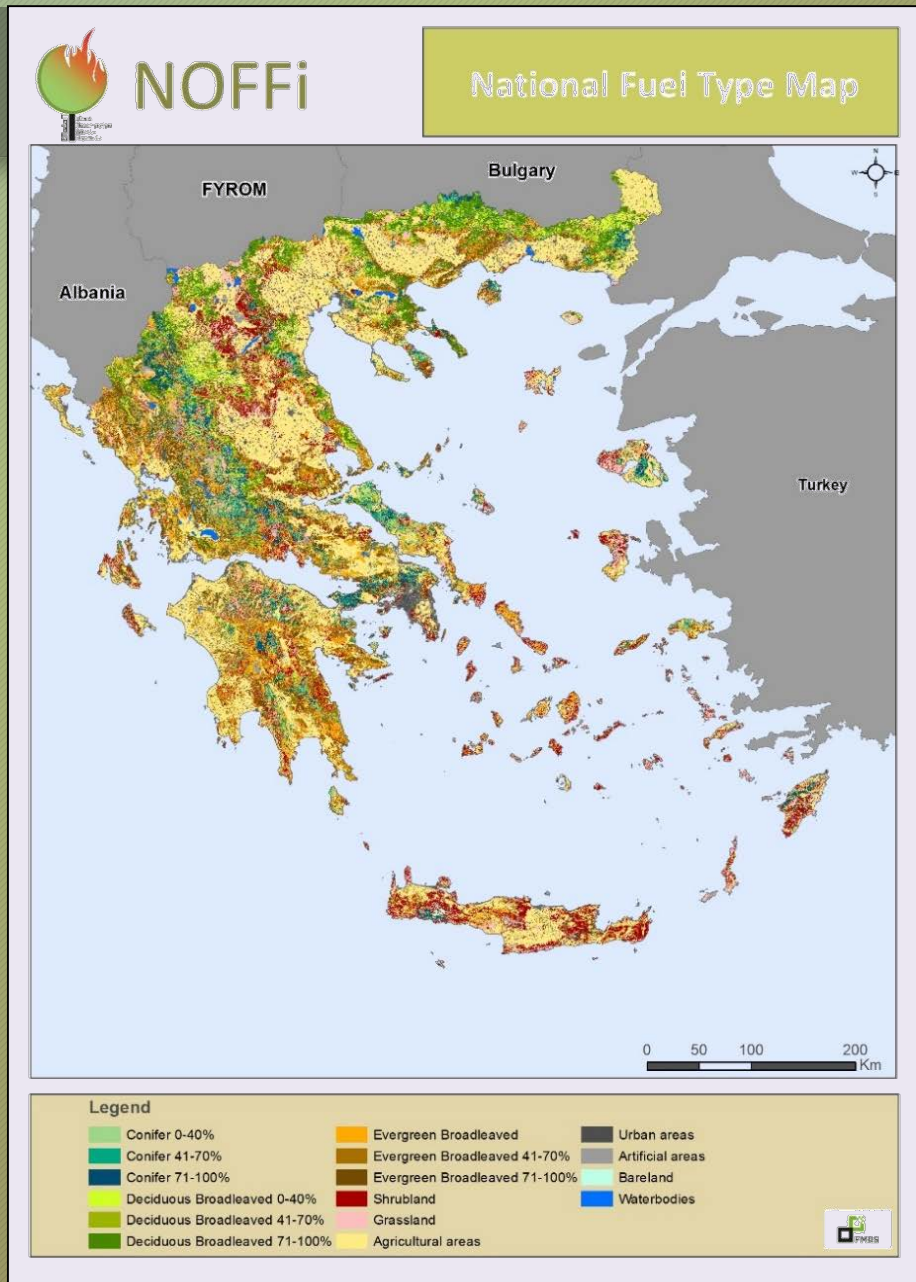
Basic elements of the developed methodology:

- Winter and summer **Landsat 8 OLI** images acquired during 2014-15
- **Object-based** classification approach
- Accuracy assessment based on the **LUCAS 2013** survey

Fuel type mapping

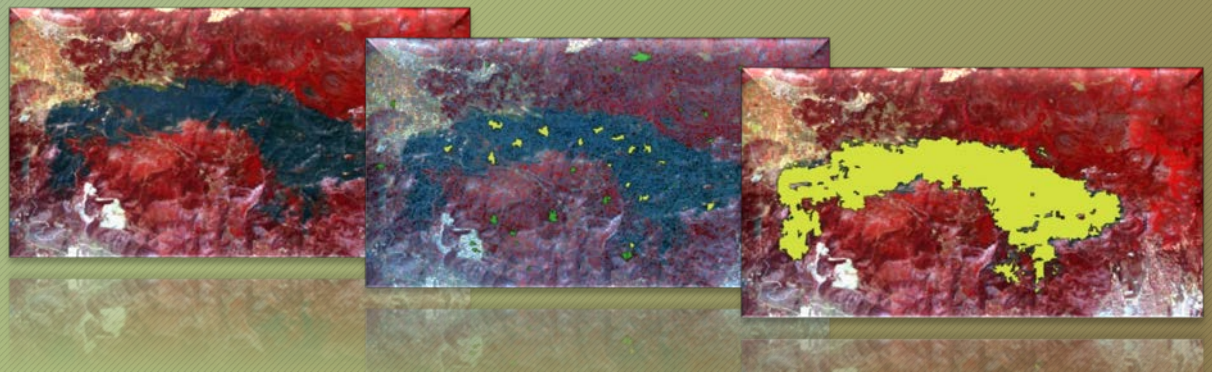
Main points:

- The final product found to be **very accurate** (OA equal to **92.59%** compared to **7626** LUCAS points)
- The product can be easily **updated** in order to take into account changes due to the following:
  - Wildfires
  - Afforestation of abandoned agricultural areas
  - Deforestation, clearances etc.
- The methodology could **be used** in other countries of the region for which similar ancillary data are available



Burned area mapping service (NOFFi – OBAM)

- **Advanced methodology** with primary focus on the use of high resolution **freely distributed** satellite data, providing burned area maps of **very high** accuracy
- **Innovative** application using **Sentinel-2** data for **operational** burned area mapping at national level (fire season 2016, Greece)
- Implemented as a **QGIS** plugin with the following design principles:
  - ✓ Minimize user interaction → highest possible **automation** of the process
  - ✓ **Accurate** mapping → support official burn perimeter declaration process which is typically done after a fire event by the Forest Service



Burned area mapping service (NOFFi – OBAM)

Basic steps of NOFFi-OBAM:

- Image pre-processing (radiometric calibration, additional spectral features derivation, etc.)
- Segmentation (**Mean-Shift** algorithm)
- Intelligent automated training pattern selection: Labeling by the user
- Advanced pattern recognition techniques for classification (**FuzCoC** feature and **SVM** classification)
- Burned area delineation

Most processes are automated → Requires a user interaction of approx. 30 minutes

Dragozi, E., Gitas, I. Z., Stavrakoudis, D.G., Theocharis, J.B. 2014. **Burned Area Mapping Using Support Vector Machines and the FuzCoC Feature Selection Method on VHR IKONOS Imagery**, Remote sensing 6(12), pp. 12005-12036.

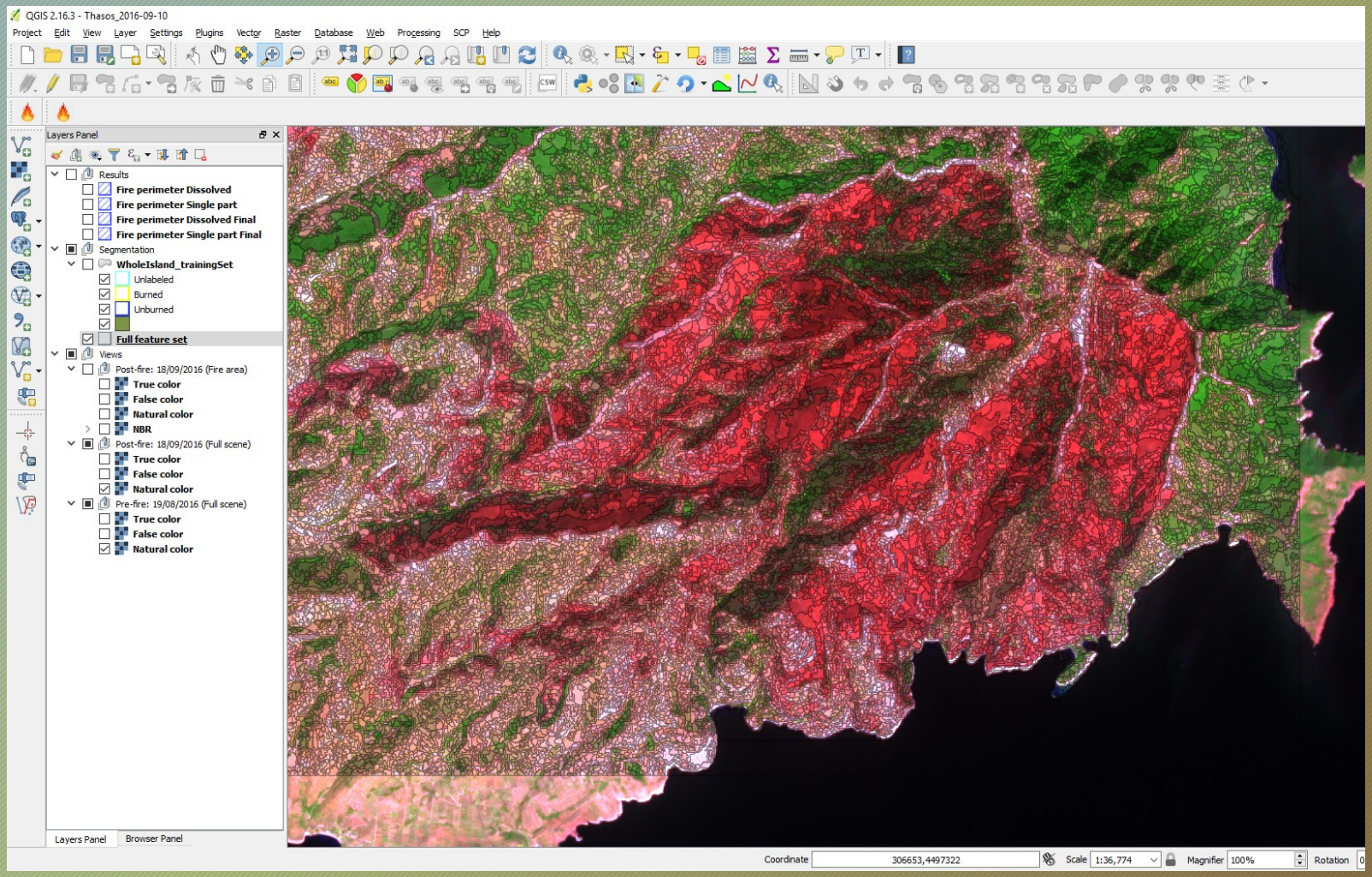
Dragozi, E., Gitas, I. Z., Stavrakoudis, D. G., Theocharis, J. B. (2014). **An Examination of the Effect of IKONOS Pan-Sharpening in Burned Area Mapping Accuracy**, in Proc. 5th Geographic Object-Based Image Analysis Conference (GEOBIA 2014), Thessaloniki, Greece, May 21-24.

Dragozi, E., Gitas, I. Z., Stavrakoudis, D.G., Theocharis, J.B. 2012. **Burned area mapping using very high resolution IKONOS imagery and Support Vector Machines**, in Proc. NASA Science Meeting, GOFC-GOLD and NEESPI Workshop and Regional Conference, Yoshkar-Ola, Russia, 17-22 June. pp: 6 – 14.

Dragozi, E., Gitas, I. Z., Stavrakoudis, D.G., Theocharis, J.B. 2011. **A performance evaluation of Support Vector Machines and the Nearest Neighbor classifier in classifying image objects for burned area mapping**, in Proc. 8th Int. Workshop of EARSeL – Special Interest Group (SIG) on Forest Fires, Stresa, Italy, 20-22. October. pp : 84-89

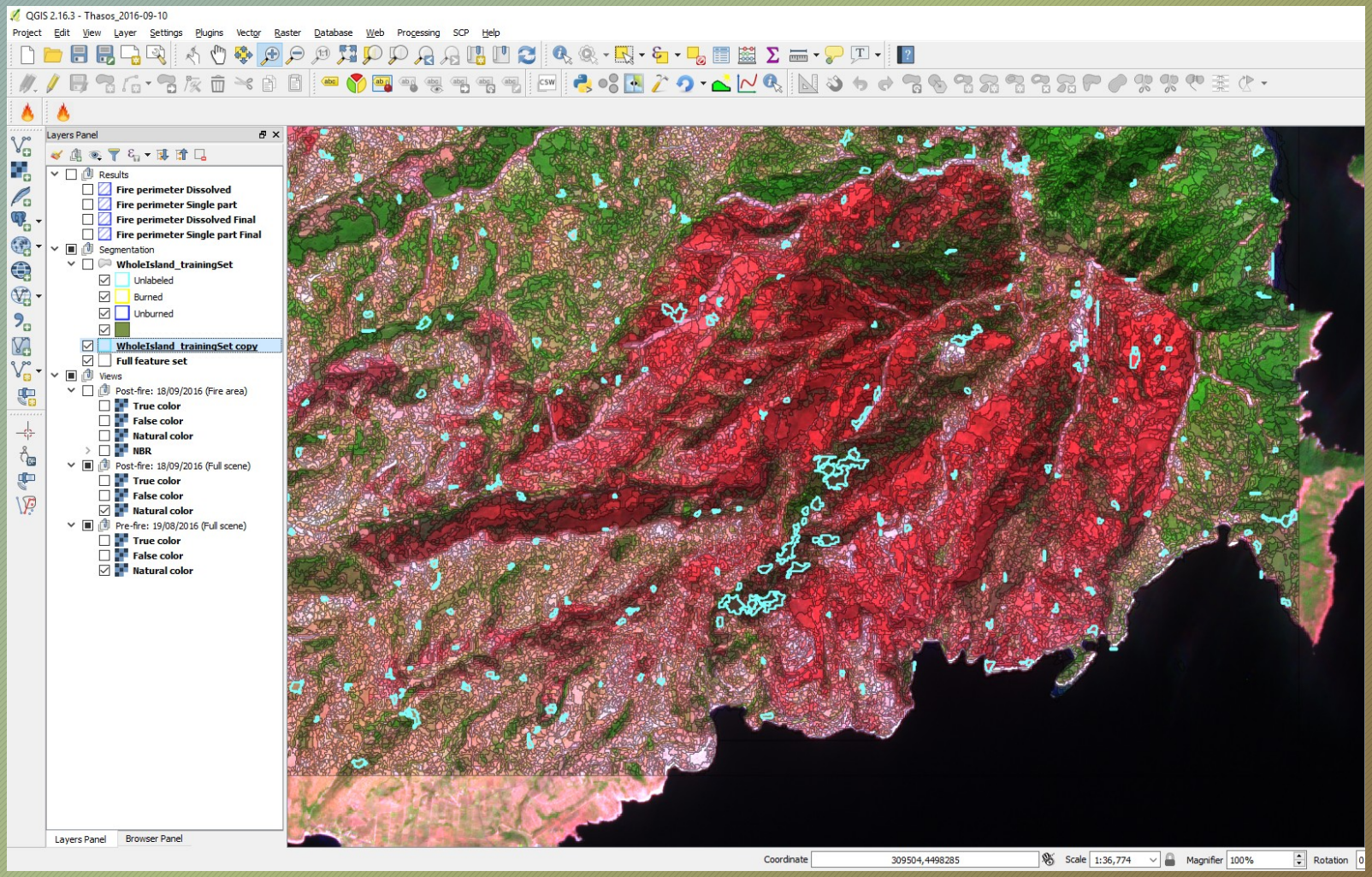
Burned area mapping service (example)

Employment of the service in Thasos (a major fire incident in the summer of 2016): **Image segmentation**



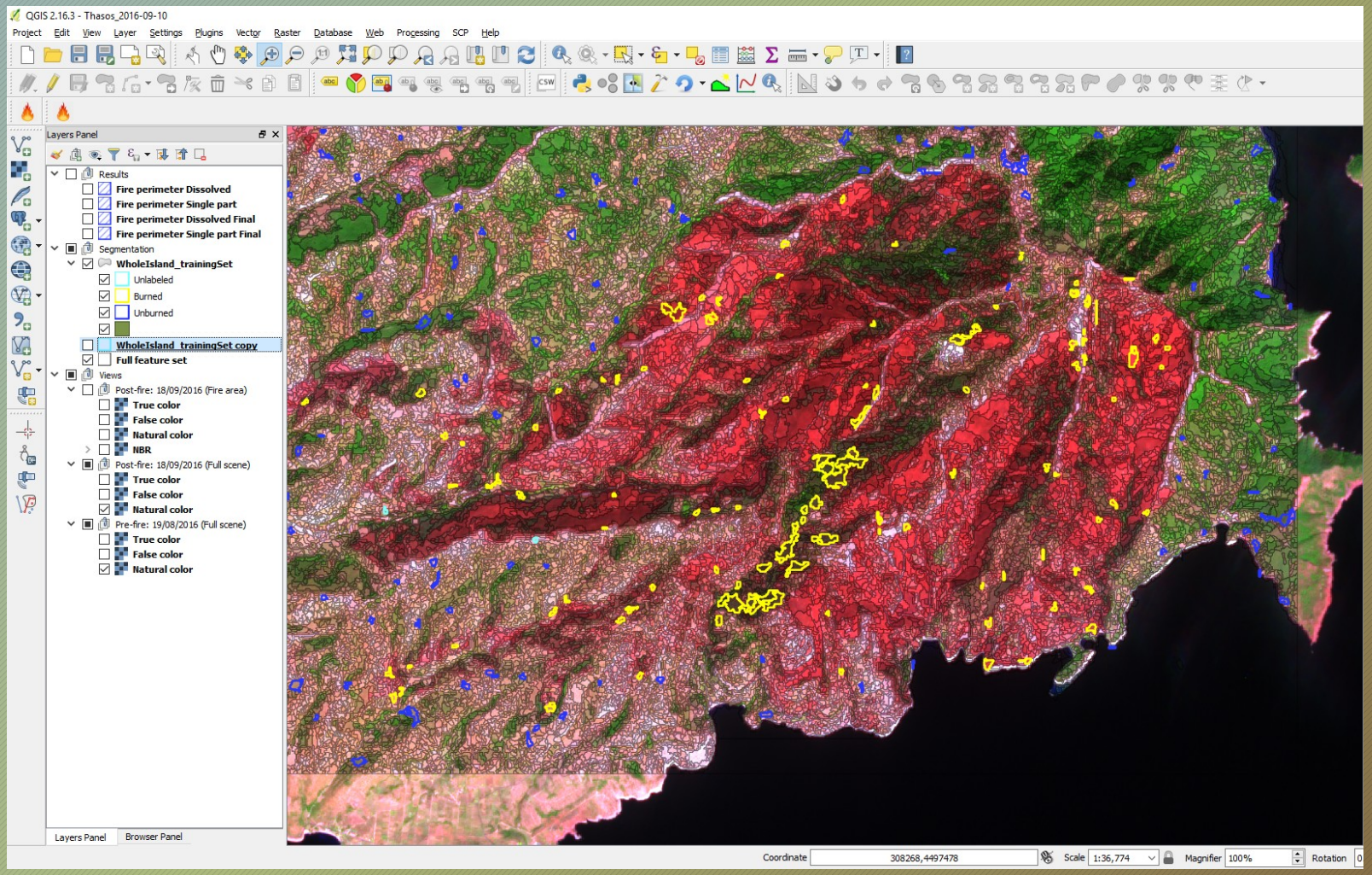
Burned area mapping service (example)

Automated training sample selection



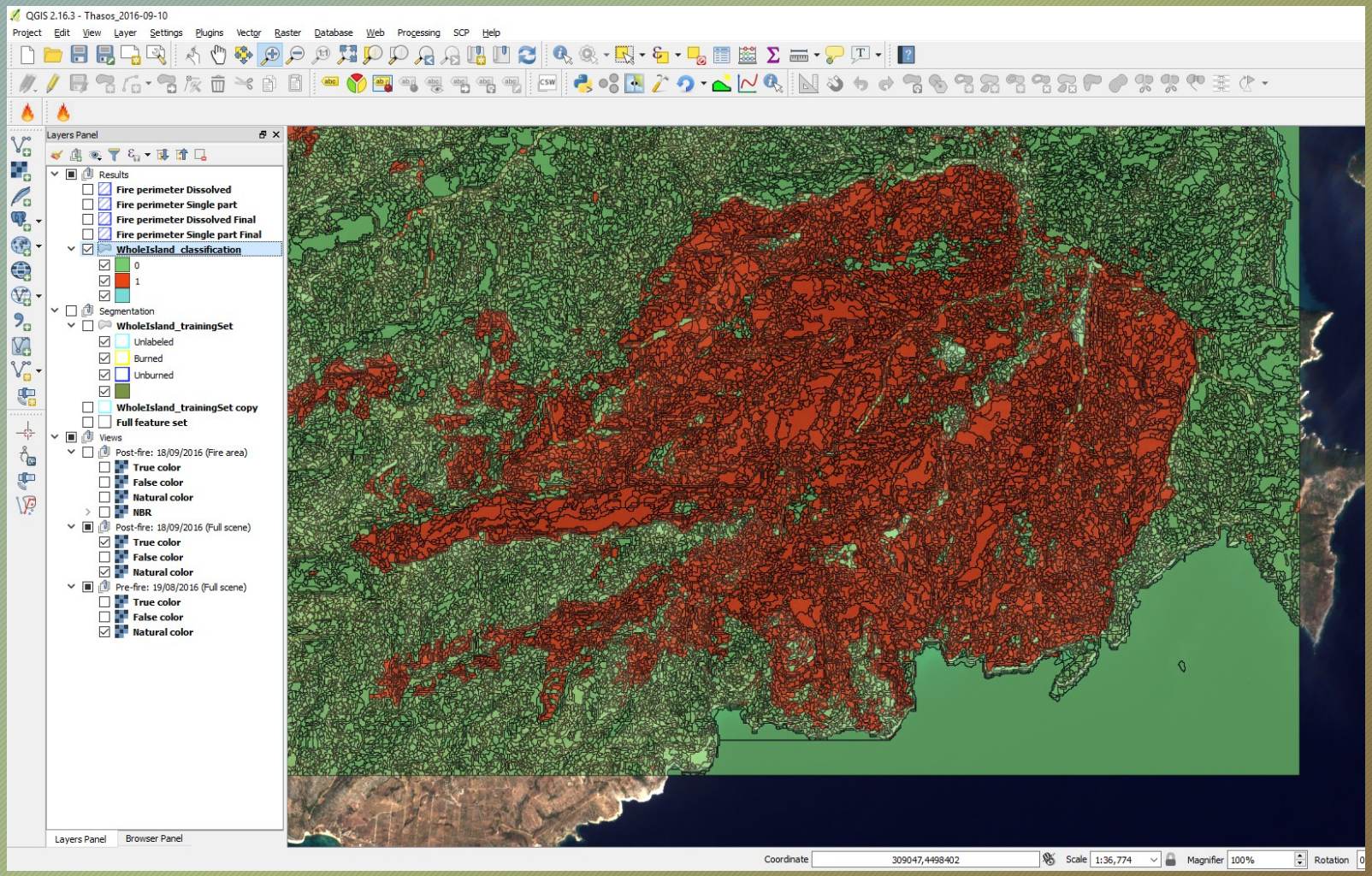
Burned area mapping service (example)

Labelling of the training patterns by the user



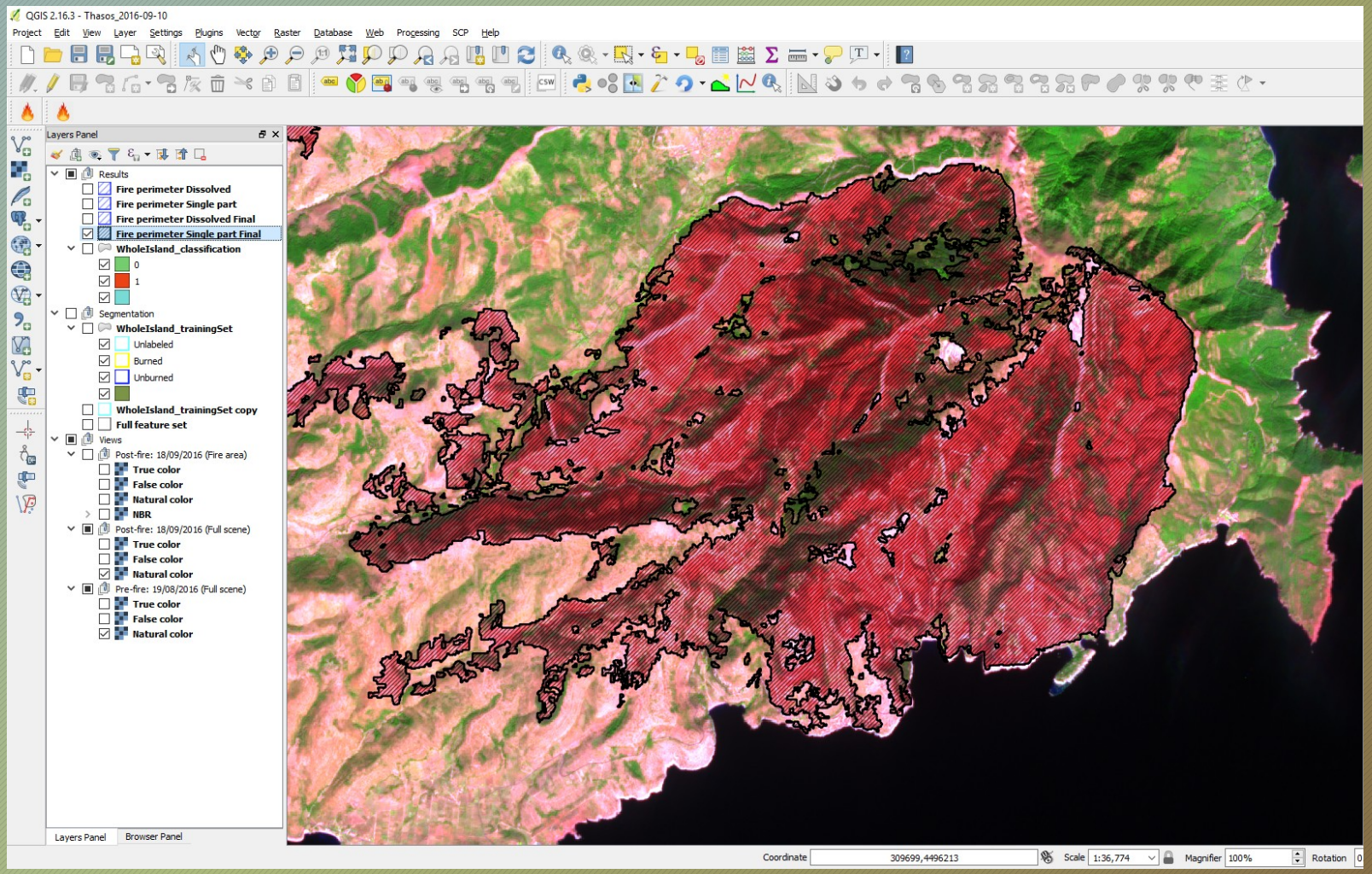
Burned area mapping service (example)

SVM classification



Burned area mapping service (example)

Burned Area delineation



Burned area mapping service

NOFFi-OBAM was operationally employed during the **2016 fire season**, mapping 34 large fires using **Sentinel-2** imagery

- Results demonstrate the **effectiveness** of the developed methodology/service in all cases including **complex landscapes** (sparse low vegetation, agricultural fields, etc.) and burn scars with complex **spatial patterns.**

- Immediate future work - new developments:
  - fully **automated** Sentinel-2 image downloading and pre-processing,
  - use of MODIS for hot-spot identification and approximate perimeter delineation,
  - automated **cloud and shadow screening** (Fmask algorithm for Sentinel-2)

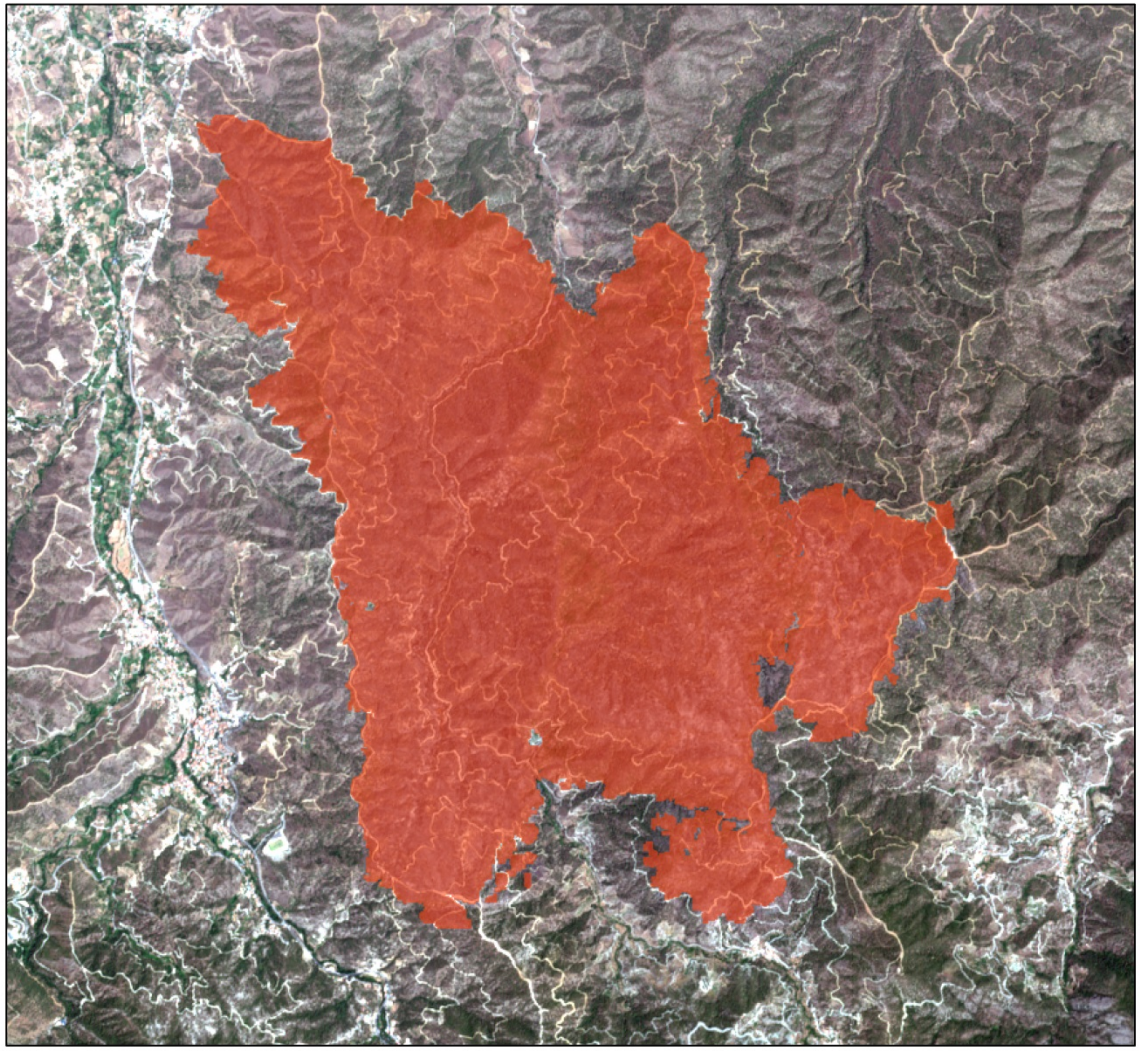
Burned area mapping service

- During the 2016 fire season the results were **provided** to the following users:
  - the General Secretariat for Civil Protection,
  - the Central Forest Service,
  - the Fire Service,
  - local Forest Service departments and
  - other stakeholders (WWF-Hellas, NGOs)

- **Examples of collaboration** with neighbouring countries:
  - The service was used in Cyprus for the mapping of two major wildfires (Soleas and Agraka) in collaboration with CUT
  - Mapping of a large fire that started in fYROM and crossed the borders with Greece

- Ongoing collaboration with the **EFFIS team** for comparison and evaluation.

Burned area mapping service



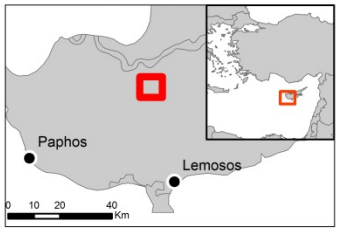
NOFFi

Burned Area Mapping Service
NOFFi-OBAM

SOLEAS - CYPRUS

Fire Incident
19.06.2016

Scale 1:20.000



Burned area (1868.20 ha)

Background:

Sentinel-2 satellite image (10m)
Acquisition date 28.06.2016

Cartographic information:

0 0.25 0.5 1 Km

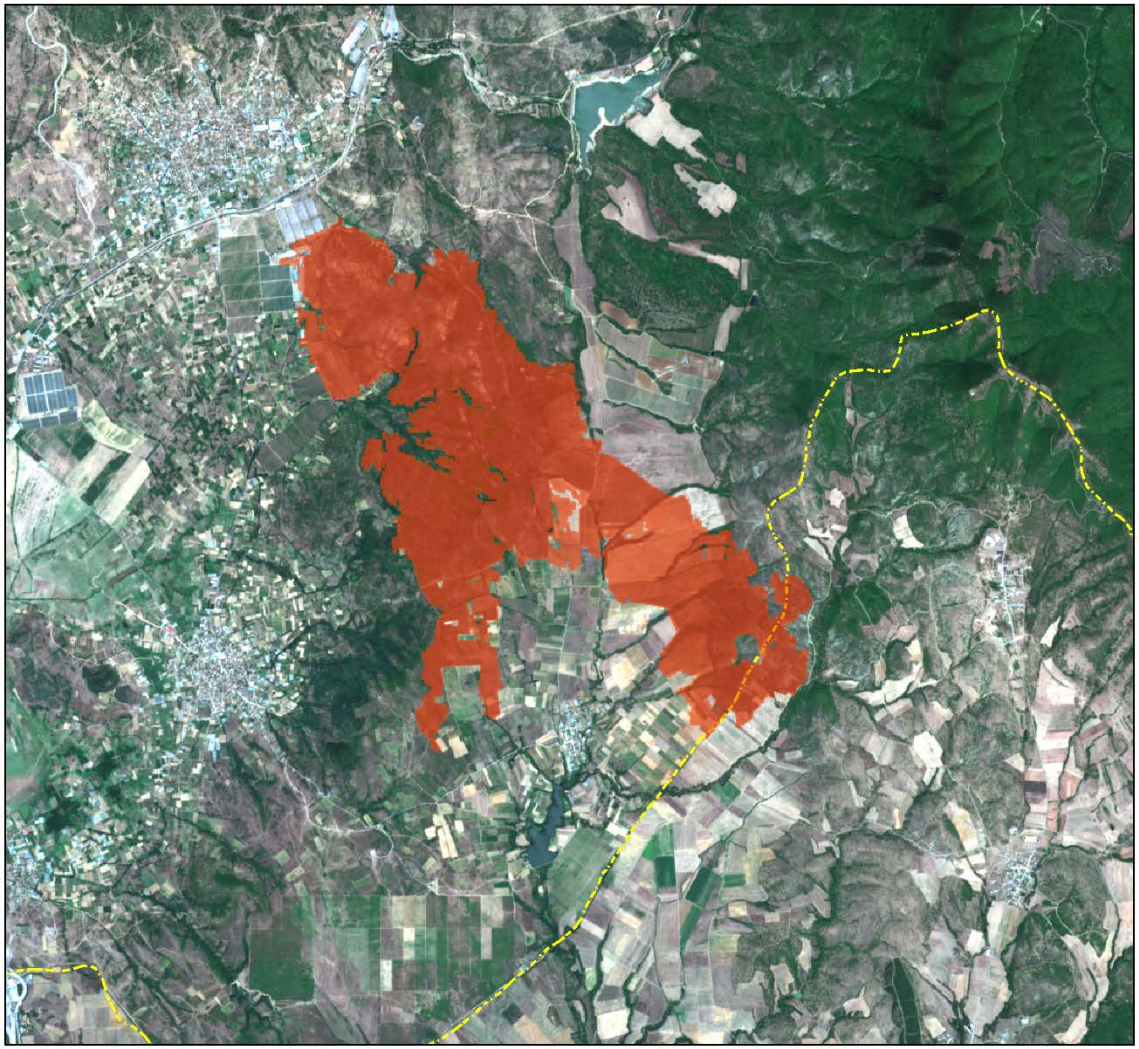
N

Projected Coordinate System:
UTM Zone 34 North, Datum: WGS 84

This mapping has been produced in the context of the research project "National Observatory of Forest Fires – NOFFi", which is being developed by the Laboratory of Forest Management and Remote Sensing of AUTh in collaboration with the Directorate General for the Development and Protection of Forests and Rural Environment of the Hellenic Ministry of Environment and Energy.

It should be stressed out that the burned area perimeter delineated using satellite imagery by the NOFFi-OBAM service represents an estimation of the true burned area –valid for the date and time of the satellite image acquisition– and cannot in any case substitute the official affected area perimeter defined by the public authorities legally responsible for that task.

Burned area mapping service



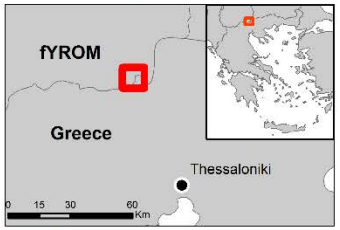
NOFFi

Burned Area Mapping Service
NOFFi-OBAM

FYROM / GREECE

Fire Incident
04.08.2016

Scale 1:20.000



Burned area (880.63 ha)

Background:

Sentinel-2 satellite image (10m)
Acquisition date 12.08.2016

Cartographic information:

0 0.5 1 2 Km

N

Projected Coordinate System:
UTM Zone 34 North, Datum: WGS 84

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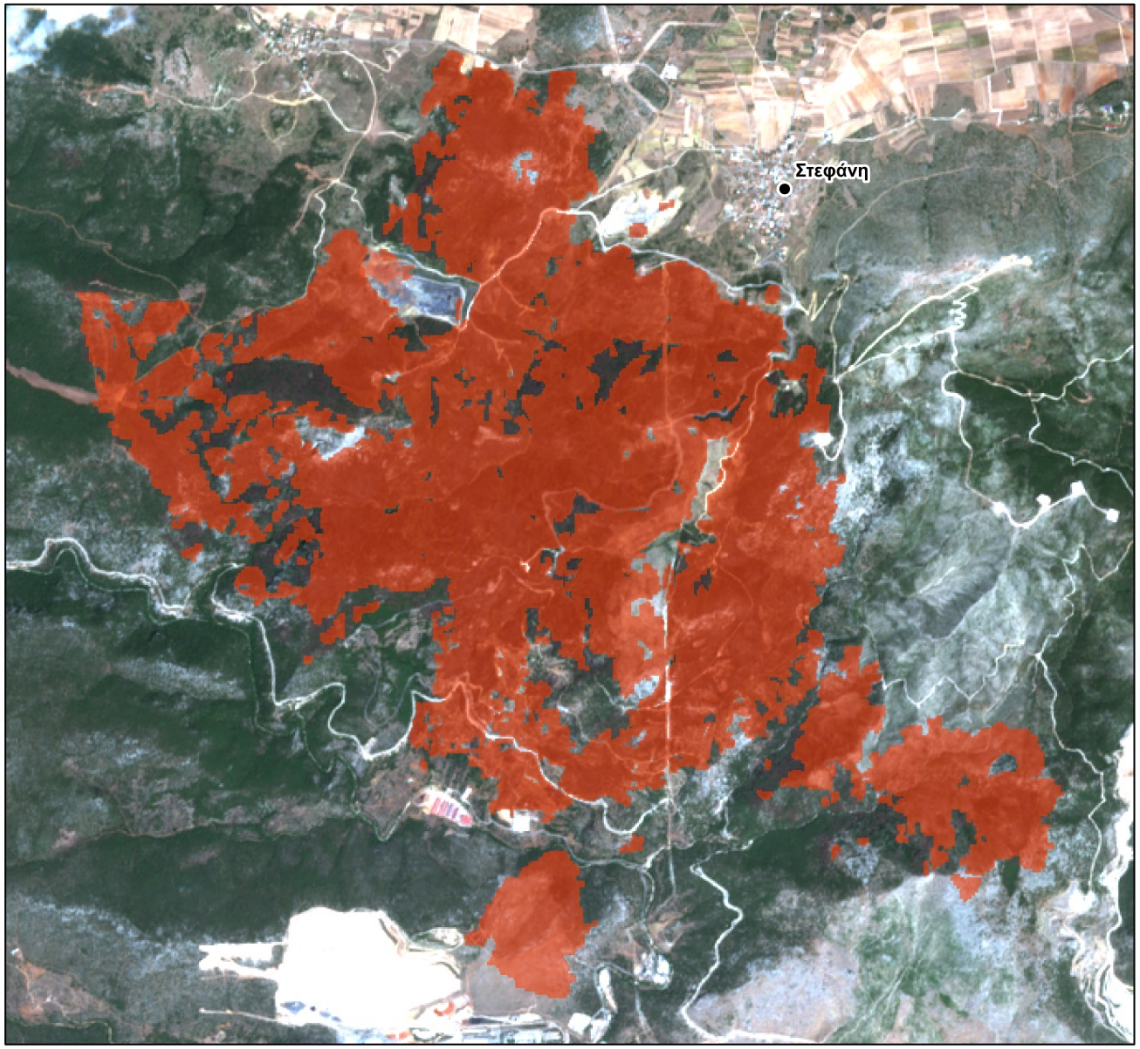
Burned area mapping service



ΕΠαΔαΠ
Υπηρεσία Χαρτογράφησης Καμένης Έκτασης NOFFi-OBAM

ΔΕΡΒΕΝΟΧΩΡΙΑ - ΒΟΙΩΤΙΑ

Πυρκαγιά
25.06.2016

Κλίμακα 1:20.000

Καμένη έκταση (1017.86 εκτάρια)

Υπόβαθρο:

Δορυφορική εικόνα Sentinel-2 (10μ)
Ημερομηνία λήψης 10.07.2016

Χαρτογραφική πληροφορία:

0 0.25 0.5 1 Χλμ

N

Προβολικό Σύστημα Συντεταγμένων:
UTM Zone 34 North, Datum: WGS 84

Η χαρτογράφηση εντάσσεται στο πλαίσιο του ερευνητικού προγράμματος "Εθνικό Παρατηρητήριο Δασικών Πυρκαγιών – ΕΠαΔαΠ", το οποίο υλοποιείται απο το εργαστήριο Δασικής Διαχειριστικής και Τηλεπισκόπησης του ΑΠΘ σε συνεργασία με την Γενική Διεύθυνση Ανάπτυξης και Προστασίας Δασών και Αγροπεριβάλλοντος του Υπουργείου Περιβάλλοντος και Ενέργειας

ΚΕΔΕΚ

Διευκρινίζεται ότι η περίμετρος της πληγείσας έκτασης, όπως έχει αποτυπωθεί μετά από ανάλυση δορυφορικών εικόνων, μέσω της υπηρεσίας NOFFi OBAM, απεικονίζει την κατάσταση κατά την ημέρα και ώρα λήψης των εικόνων από τους δορυφόρους και σε καμία περίπτωση δεν είναι δεσμευτική και δεν υποκαθιστά την οριοθέτηση πληγείσας έκτασης από τους αρμόδιους φορείς και υπηρεσίες με βάση το ισχύον θεσμικό πλαίσιο.

FMRS

Burned area mapping service

ΕΠαΔαΠ

Υπηρεσία Χαρτογράφησης Καμένης Έκτασης NOFFi-OBAM

ΦΑΡΑΚΛΑ - ΕΥΒΟΙΑ

Πυρκαγιά
30.07.2016

Κλίμακα 1:20.000

Καμένη έκταση (2565.02 εκτάρια)

Υπόβαθρο:

Δορυφορική εικόνα Sentinel-2 (10μ)
Ημερομηνία λήψης 02.08.2016

Χαρτογραφική πληροφορία:

0 0.5 1 2 Χλμ

N

Προβολικό Σύστημα Συντεταγμένων:
UTM Zone 34 North, Datum: WGS 84

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FMRS

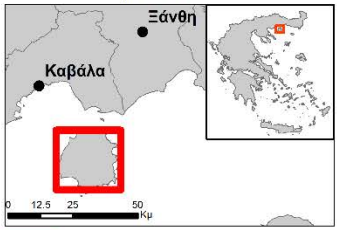
Burned area mapping service

ΕΠαΔαΠ
Υπηρεσία Χαρτογράφησης Καμένης Έκτασης NOFFi-OBAM

ΘΑΣΟΣ

Πυρκαγιές 10.09.2016

Κλίμακα 1:20.000



Καμένη έκταση (7522.33 εκτάρια)

Υπόβαθρο:

Δορυφορική εικόνα Sentinel-2 (10μ)
Ημερομηνία λήψης 18.09.2016

Χαρτογραφική πληροφορία:

0 1 2 4 Χλμ N

Προβολικό Σύστημα Συντεταγμένων:
UTM Zone 35 North, Datum: WGS 84

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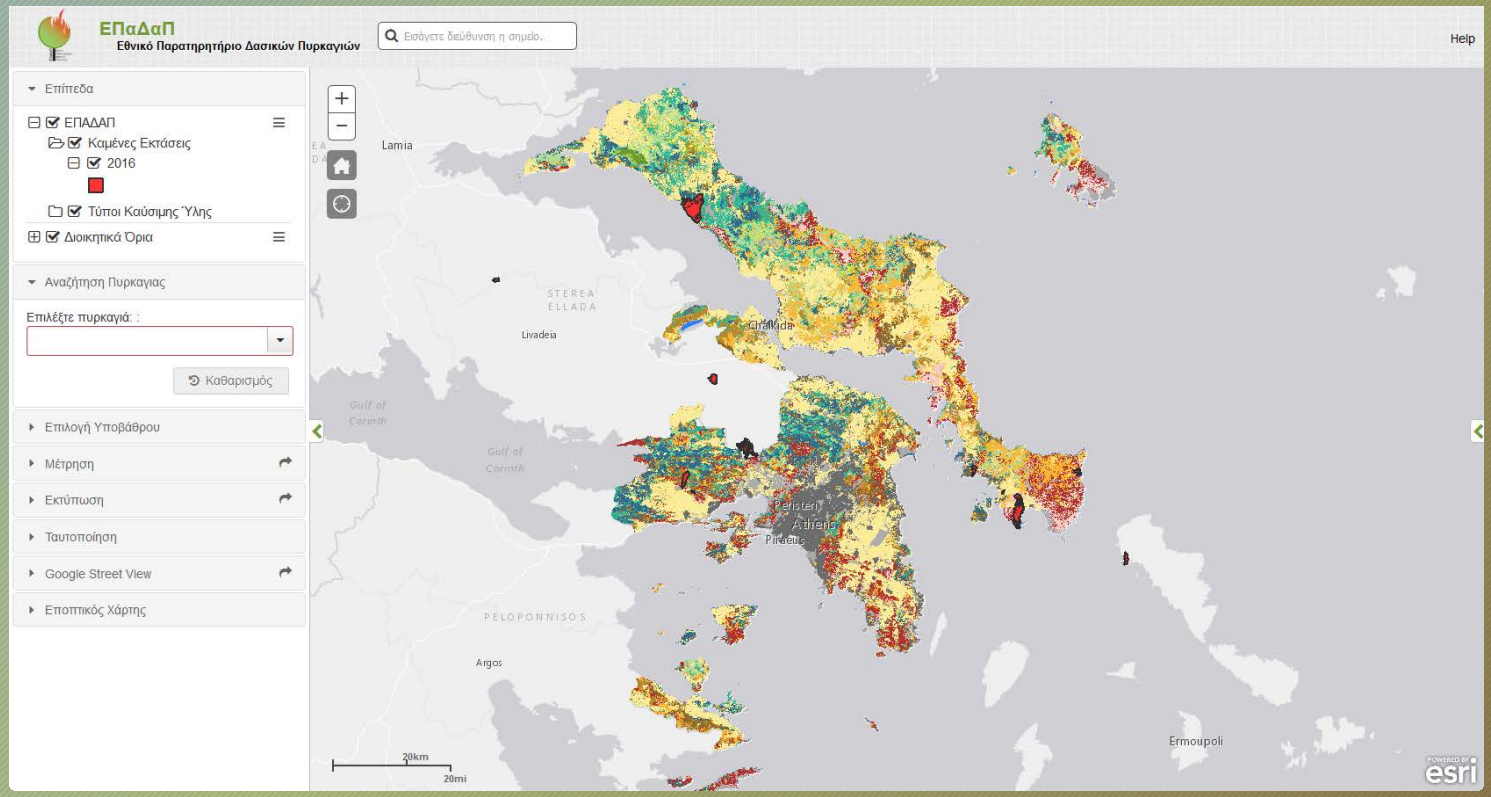
Mid-term fire danger index

- (Under development)
- Dynamically updated mid-term fire danger estimations (8 days ahead)
- Solely based on remotely sensed data (Ts, NDVI, etc.)
- Close collaboration with European entities that developed similar products (PREFER FP7 project)

Web – based GIS platform

- **Instant access** to NOFFi products
- Public Participation GIS tool **(PPGIS)**
- More information: **http://epadap.web.auth.gr/**



Transboundary cooperation

- The Interbalkan Environment Centre (i-BEC) network is used for the **promotion of the products and services** to neighboring **Balkan** countries as well as for **knowledge transfer** to regional and national stakeholders.

- NOFFi envisions the establishment of an **inter-Balkan** network for **collaborative forest fire management**, through:
  - the development of compatible products and services for fire prevention in the Balkan region,
  - assistance in designing cross-border impact mitigation measures,
  - communication between the relevant national authorities in protecting the common forest resources

Thank you for your attention

http://epadap.web.auth.gr/

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