

Mediterranean Fuel Maps Geodatabase for Wildland & Forest Fire Safety

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The Project

ArcFUEL delivers a complete, up-to-date, methodology for Fuel Classification Mapping (FCM on a Web-Geodatabase) based on "readily available" data, harmonized, accessible & interoperable according to INSPIRE principles, for the Mediterranean Region. The methodology is demonstrated via solid pilots in: Greece, Portugal, Italy and Spain

Problem targeted

Effective Forest Fire (FF) Management requires knowledge of Fuel Classification Maps (FCMs) that are poorly available in Mediterranean countries since:

- They are produced only at local or regional scale, without any regular updates and no standardized methodology.
- They are not produced via a standard structure or harmonized according to INSPIRE.
- They are heterogeneous as produced via different methods at different dates

Therefore available FCMs cannot support the systematic use of FF modeling at operational levels (prevention, suppression planning) of FF management.

"**ArcFUEL**" aims to cover this gap, and:

- Standardizes a "production flow" producing FCMs.
- Develops an INSPIRE procedure for FCMs production.
- Produces pilot FCMs for Greece & Portugal (full countries), Italy & Spain (pilot regions).

FCMs for Forest Fire Management

Forest vegetation is considered as a Fuel. The structure and status of the Fuel-complex govern the dynamics of a fire. This is the reason why Fuel Models and their spatial patterns (i.e. FCMs) are significant for FF Management Actions during all four phases of the FF lifecycle:

- I. Awareness phase (prior to the fire): requires pre-emptive methods to assessing FF Risks to minimizing impacts (environment, people). FF Risk is related to FCM: Risk Assessment is calculated as a function of several sub-indices as Fire Ignition & Propagation, Index of Fire Intensity, and flammability, all related to Fuel Models.
- II. Emergency phase (during the fire): requires for reliable real-time information, risk identification-prioritization and fast decision making. FF Simulation is related to FCM
- III. Impacts phase (after the fire): FF increase Risk of Flood. Risk of Flood is related to FCM, strongly related to Fuel Models.
- IV. Dissemination phase (lesson learnt): Dissemination when accumulating knowledge from past FF disasters, fire statistics, and Fuel Models used (e.g., linked to Corine Land Cover).

ArcFUEL Technology

Mathematical modelling/simulation of a fire front propagation in wildland forest & woodlands, requires spatial input parameters the most essential being topography, meteorology and forest vegetation. These parameters enable GIS-based fire simulators (e.g., ArcFIRE, 2011) to assessing fire pattern, growth-rate and behaviour. In turn, this knowledge is used in fire management, risk planning, prevention and mitigation decision-making.

ArcFUEL delivers forest fuel maps for wildfire propagation modelling, and as such, it delivers a complete and up-to-date methodology for Fuel Classification & Mapping based on *readily available data* INSPIRE interoperable at European scale. **ArcFUEL** is purposeful in the Mediterranean with its acute forest fire problems, thus has been applied and validated in Greece, Portugal, Italy and Spain.

Realistic predictions of fire growth ultimately depend on the availability, consistency and accuracy of input data-layers, compulsory to execute spatially-explicit fire behaviour models (Keane et al 1998a, Finney 1998). In this case:

- Topography and meteorological data is usually available at local, national, and global EU-scale to the fire management authorities for several applications.
- Maps of forest fuel type distribution are lacking at all spatial levels, a fact also related to the lack of standardized classification of forest fuel types which would support development of relative maps.

Recently the JRC funded FUELMAP (FUELMAP project, 2011) that provides a first approach to standardized forest fuel typology and to map of the distribution of such forest types in Europe. In 2012 the JRC revised the forest fuel types of FUELMAP, thus defined a new typology of Forest fuels, which is used as background in ArcFUEL.

The lack of updated *forest fuel maps* is key obstacle when introducing forest fire simulation applications in operational fire management, despite the literature richness and software technologies as FireGIS (Gonçalves, 1994), G-FMIS (Eftichidis et al 1998), (Lopes et al., 2002), and ArcFIRE (Bonazountas e al, 2011). ArcFUEL addresses the aforementioned need by establishing an integrated map production chain, based on a fuel mapping approach presented herewith.

ArcFUEL delivers a consistent fuel mapping methodology based on existing spatial data sets, easily accessible earth observation data, compatible with the JRC forest fuels typology. The ArcFUEL methodology and workflow advance in six technology-steps:

1. Definition of the fuel map classification scheme
2. Use of existing datasets for the mapping of the main forest fuel classes
3. Use of multi-temporal LANDSAT Thematic Mapper (TM) images for the distinction of fuel classes with different seasonal characteristics
4. Refinement of the produced fuel classes based on canopy cover density data
5. Merging of all produced map layers in a single layer
6. Further sub-classification of the produced maps based on the ECOREGIONS data

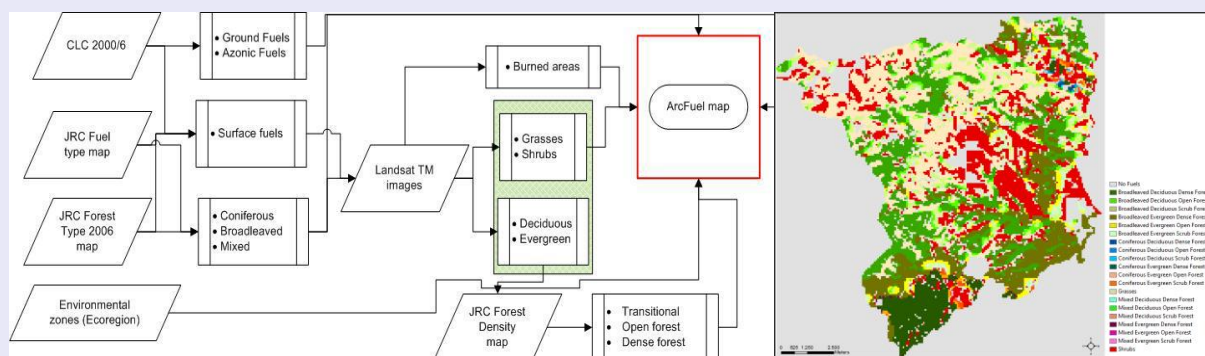


Figure 1: Workflow of the ArcFUEL development process

Figure 2: ArcFUEL classification schema