












Short description of the Portuguese fuel models classes (Fernandes et al., 2009) and a corresponding example picture. Fuel models are organized in three groups: **F** (litter); **M** (mixed: litter and understorey vegetation); and **V** (understorey vegetation, shrubland or grassland).




GROUP	#	CODE	DESCRIPTION	EXAMPLES	
F (Litter) - The fire behaviour is driven by the litter layer	211	F-EUC	Eucalypt litter	Eucalypt plantations	
	212	F-FOL	Litter of deciduous or evergreen hardwoods (2-5 t/ha)	Deciduous oak forests, chestnut, birch and beech. Dense sclerophyllous forest, namely of cork oak and holm oak	
	213	F-PIN	Medium- to long-needle conifer litter (4-7 t/ha)	Pine forests of <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. halepensis</i> , <i>P. radiata</i>	

	214	F-RAC	Short-needle conifer litter. The amount of woody debris can be substantial (4-6 t/ha)	Forest stands of <i>Pseudotsuga</i> , <i>Cedrus</i> , <i>Cupressus</i> , <i>Chamaecyparis</i> , <i>Pinus sylvestris</i> . Other highly-packed litters cab be included, e.g. <i>Acacia</i> spp.	
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M (mixed) - Both litter and understorey vegetation have significant coverage and drive the spread of fire	221	M-CAD	Deciduous litter and a shrub understory, usually with plenty of live fuel (8-17 t/ha)	Oak, chestnut, birch, and beech stands	
	222	M-ESC	Evergreen sclerophyllous hardwood litter and a shrub understory (7-17 t/ha)	Cork oak and holm oak forest stands	
	223	M-EUC	Eucalypt litter and a shrub understory (9-18 t/ha)	Eucalypt forest plantations	


	224	M-EUCd	Discontinuous eucalypt litter with or without a shrub component (1-4 t/ha)	Young or recently harrowed eucalypt plantations	
	225	M-F	Litter and a fern understory	Forest stands, regardless of species	
	226	M-H	Litter and a grass understory (2-5 t/ha)	Forest stands, regardless of species	

	227	M-PIN	Litter from medium- to long-needle conifers with a shrub understory (8-18 t/ha)	Forest stands of <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. halepensis</i> , <i>P. radiata</i> , <i>P. nigra</i>	
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V (understorey, shrubland or grassland) - Fire behaviour is controlled by shrubs or woody vegetation in the shrublands	231	V-Ha	Tall grassland (>0.5 m) (2-4 t/ha)	Lawns, meadows, pastures, recent fallow land. Cereal croplands. Reeds. Agroforestry systems.	
	232	V-Hb	Low grassland (<0,5 m) (~1 t/ha)	Lawns, meadows, pastures, recent fallow land. Cereal stubbles. Agroforestry systems.	
	233	V-MAa	Tall shrubland (>1 m) with substantial dead and/or fine foliage (12-27 t/ha)	Heaths, gorses, old broom shrublands; young acacia stands. Open or young forest stands, regardless of the species, with a shrub layer made up of those species. Dense natural regeneration of pines.	





	234	V-MAb	Low shrubland (<1 m) with substantial dead and/or fine foliage (7-14 t/ha)	Heaths, gorses, brooms, junipers shrublands. Open or young forest stands, regardless of species, with a shrub layer made up of those species	
	235	V-MH	Low (< 1 m) and green shrubs, often discontinuous and with grass	Shrubland up to 3 years since the last fire	
	236	V-MMa	Tall shrubland (>1 m) poor in dead fuel and/or with relatively coarse foliage (10-19 t/ha)	Shrublands of broom, <i>Cistus</i> spp., <i>Quercus coccifera</i> and other sclerophyllous Mediterranean species. Young Hakea stands. Brambles. Open or young forest stands, regardless of species, with a shrub layer made up of those species	

	237	V-MMb	Low shrubland (<1 m) with little dead fuel and/or with relatively coarse foliage (4-8 t/ha)	Shrublands of broom, <i>Cistus</i> spp., <i>Quercus coccifera</i> and other sclerophyllous Mediterranean species. Young <i>Hakea</i> stands. Brambles. Open or young forest stands, regardless of species, with a shrub layer made up of those species	
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Fernandes, P., Gonçalves, H., Loureiro, C., Fernandes, M., Costa, T., Cruz, M. and Botelho, H. (2009). Modelos de combustível florestal para Portugal, in Actas do 6o Congresso Florestal Nacional. Sociedade Portuguesa de Ciências Florestais; SPCF: Lisboa, Portugal, 2009. [online] Available from: [https://www.researchgate.net/profile/Paulo-Fernandes-6/publication/261708410\\_Modelos\\_de\\_Combustivel\\_Florestal\\_para\\_Portugal/links/00b7d53524bec08267000000/Modelos-de-Combustivel-Florestal-para-Portugal.pdf](https://www.researchgate.net/profile/Paulo-Fernandes-6/publication/261708410_Modelos_de_Combustivel_Florestal_para_Portugal/links/00b7d53524bec08267000000/Modelos-de-Combustivel-Florestal-para-Portugal.pdf) (Accessed 23 August 2021).




The NFFL American fuel models (Anderson, 1982) were used to represent two distinct vegetation types not included in the Portuguese fuel models.

NFFL Fuel models	4	NFFL 4	Very dense regeneration of maritime pine with a height of 3-6 m (~32 t/ha), typically 5-15 years old	
	11	NFFL 11	Downed and dead woody slash from logging, often interspersed with herbaceous vegetation (~28 ton/ha). Forest stands/plantations after harvest or heavy pruning and thinning or coppicing.	

Anderson, H. E.: Aids to determining fuel models for estimating fire behavior, USDA Forest Service, Intermountain Forest and Range Experiment Station. [online] Available from: <https://www.nwccg.gov/sites/default/files/training/docs/s-290-usfs-aids-to-determining-fuel-models.pdf>, 1982.

Another National Fuel Models classification (Cruz, 2005) was used to represent other exploitation wood residuals, with lower fuel load than the one from NFFL, as is for example the case of selection of poles in eucalypt plantations.

1	RESE-01	Downed and dead woody slash from the selection of poles in eucalypt forest plantations	
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Cruz, M. G.: Guia fotográfico para identificação de combustíveis florestais – Região Centro de Portugal.,Coimbra, Portugal, 38p, 2005.