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S. Paula, M. Arianoutsou, D. Kazanis, Ç. Tavsanoglu, F. Lloret, C. Buhk, F. Ojeda, B. Luna, J. M. Moreno, A. Rodrigo, J. M. Espelta, S. Palacio, B. Fernández-Santos, P. M. Fernandes, and J. G. Pausas. 2009. Fire-related traits for plant species of the Mediterranean Basin. Ecology 90:1420.

INTRODUCTION

The performance of any species is determined by their life history traits. The combination of current knowledge on life history traits, with recent phylogenetic techniques, allows us to understand plant evolution (Schwilk and Ackerly 2001, Reich et al. 2003, Pausas and Verdú 2005), trade-offs between functional characteristics (Reich et al. 1997, Paula and Pausas 2006), and the different evolutionary pathways between different ecosystems and regions (Vesk and Westoby 2004, Pausas et al. 2004, 2006). Furthermore, with the help of simulation models, life history traits can be used to predict compositional changes due to alternative land uses and land management options, and climatic scenarios (Pausas 1999, 2006, Franklin et al. 2001, Pausas and Lloret 2007, Arianoutsou 2007). This latter point is especially important for fire-related plant traits because, in fire-prone ecosystems, fire regime changes may be more relevant than direct climatic changes (Flannigan et al. 2000, Bond et al. 2005). Additionally, fire regime changes are driven not only by climatic changes but also by land-use changes (Arianoutsou 2001, Pausas 2004). In fact, the lack of plant disturbance responses in the current global vegetation simulation models limits their applicability for predicting future scenarios (Bond and Keeley 2005). For these reasons, great effort is now being made in different regions and ecosystems to compile plant trait information in a systematic way using standard protocols (Weither et al. 1999, Cornelissen et al. 2003, Kleyer et al. 2008). However, such compilations are still lacking in the Mediterranean Basin, one of the world biodiversity hotspots (Cowling et al. 1996, Myers et al. 2000).

The objective of this data paper is to provide the most updated and comprehensive information on fire-related traits for vascular plant species of the Mediterranean Basin. By fire-related traits we refer to traits relevant for plant persistence, regeneration and dynamics in ecosystems subject to recurrent fires. The compilation is based on a large literature review, including grey literature and field and experimental observations. The database is designed to gather as much information as possible, including qualitative, semi-quantitative and quantitative data. Thus, for any given species and trait, different resolutions and degrees of knowledge may be available. One of the challenges in compiling life history information is that the data may vary regionally or with the environmental conditions. Here we create a general life history data set by compiling for each species the information from all available sources, without aggregating the information by species. This allows the user to detect trait variability with species. Data sources are fully documented, that is, for each single value we include a reference or responsible person. When compiling information, a great effort has been made into standardising traits definitions and attributes, and thus the metadata can also be used as a guide for compiling information from other areas.

The scope of this data set is ambitious (14 traits for plants from the Mediterranean Basin). It, of course, does not include all the plants in the Mediterranean Basin, but it does include the most common species, especially the woody species from the northern rim of the Mediterranean Basin. Furthermore, for many species, some traits are not reported in the data set because they are unknown. However, because of the importance of resprouting ability for persisting in fire-prone environments (Bond and Midgley 2003, Pausas et al. 2004), we have considered it a core trait (Weiher et al. 1999); thus, any species with an unknown

resprouting ability was not included in the data set. Similarly, the data set also includes the life form for all plant species, which has proved to be a fundamental criterion towards the hierarchical classification of species into functional groups (Lavorel et al. 1997, Kazanis and Arianoutsou 2004). In addition, the compilation reflects the knowledge gaps on fire traits and thus can be used for addressing further research.

CLASS I. DATA SET DESCRIPTORS

A. Data set identity: Fire-related traits for vascular plant species of the Mediterranean Basin (the BROT database)

B. Data set identification code: BROT_2008.11.txt

C. Data set description:

Principal Investigator: Juli G. Pausas, CIDE, CSIC, Apartado Oficial, 46470 Albal, Valencia, SPAIN (www.uv.es/jgpausas).

Abstract: Plant trait information is essential for understanding plant evolution, vegetation dynamics and vegetation responses to disturbance and management. Furthermore, in Mediterranean ecosystems, changes in fire regime may be more relevant than direct changes in climatic conditions, making the knowledge of fire-related traits specially relevant. Thus the purpose of this data set was to compile the most updated and comprehensive information on fire-related traits for vascular plant species of the Mediterranean Basin, that is, traits related to plant persistence and regeneration after fire. Data were collected from an extensive literature review and from field and experimental observations. The data source is documented for each value. Since life history traits may vary spatially or with environmental conditions, we did not aggregate them by species; i.e., traits and species are repeated in different records if they were observed by different researchers. Life history traits included in the data set are: life form, resprouting ability (after fire, after clipping or after other disturbances that remove all the aboveground biomass), resprouting bud source, heat-stimulated germination, other germination cues, seed bank location and longevity, post-fire seedling emergence and survival, maturity age of resprouts and saplings, and seed mass. Several traits are unknown for many species; consequently, the data set reflects the state of the knowledge on the topic. However, since the ability to resprout is a trait of paramount relevance in fire-prone environments, it was considered a core trait in the data set, and thus species whose resprouting capacity was unknown were not included. Life form is also provided for all taxa. The structure of the database allows different levels of information (and accuracy) for each entry, and thus some traits may include different types of data (quantitative, semiquantitative or categorical) from different sources.

The data set is structured in 8263 records and 11 columns, obtained from 301 published and unpublished sources of information. It includes 952 taxa determined at specific or infraspecific level, that comprise 859 species, 384 genera and 79 families. Although this is the most comprehensive datasets of fire-relevant plant traits for Mediterranean species, there is still a considerable need for observations and experiments, especially in little-studied Mediterranean areas, such as northern Africa.

D. Key words: database; fire ecology; fire-stimulated germination; fire traits; functional traits; Mediterranean Basin; Mediterranean ecosystems; post-fire response; resprouters; resprouting ability; seeders; traitbase.

CLASS II. RESEARCH ORIGIN DESCRIPTORS

A. Overall project description

Identity: Fire-related traits for vascular plant species of the Mediterranean Basin (the BROT database)

Originators: Juli G. Pausas, CIDE, CSIC, Apartado Oficial, 46470 Albal, Valencia, SPAIN

Period of study: 2003–2007

Objectives:

1. to understand plant responses to fire in the Mediterranean Basin

2. to detect knowledge gaps on fire traits and plant responses to fire in the Mediterranean Basin

3. to understand the evolutionary pathways of plant traits in the Mediterranean Basin

Abstract: same as above. This data is not a subset of a large program of study

Sources of funding: EUFIRELAB project (European Commission EVR1- 2001-00054), SINREG project (Spanish Government, REN2003-07198-C02-02/GLO), PERSIST project (Spanish Government, CGL2006-07126/BOS) and CIRCE project (European Commission IP 036961)

B. Specific subproject description

Site description: Data were obtained for species from a variety of habitats, geologies, hydrologies, etc. The spatial extent of this data set is the Mediterranean Basin; it includes data from the following countries: Algeria, Cyprus, France, Greece, Israel, Italy, Morocco, Palestine, Portugal, Spain, and Turkey.

Experimental or sampling design: Data were obtained from published sources and from many experiments and observations made by the authors. See Research Methods below.

Research Methods: Data were obtained from published sources and from many experiments and observations carried out by the authors. The source, that is, the full reference (for published information) and the site characteristics and responsible researcher (for unpublished references) is given for each single data value. The source information is coded in the column SourceCode and the full references are given below (Class IV.B.5).

In order to standardise the diverse information into a common format, we have established and defined a number of categories for each trait (see Class IV.B.2). In addition, to minimise the loss of information from the references, we have designed the database to admit qualitative, quantitative, or semi-quantitative data (see Class IV.B.3) on a given trait. This also reflects the state of our knowledge regarding each trait. For instance, the data on resprouting capacity (RespFire) may be quantitative (e.g., proportion of adults

resprouting), semi-quantitative (e.g., no, low, high) or categorical (no, yes), depending on the available information.

Each data value has also an associated parameter (Method) that reflects the general methodology of data; this can be considered an indicator of the accuracy of the data. Method has been classified as: measure, experience, compilation, general reference (Class IV.B.4). The first and second are considered the most accurate information, while the others are less accurate. General references are usually local floras.

Taxonomy: species names were homogenised following the European Science Foundation - European Documentation System (ESFEDS 1996), which is largely based on Flora Europaea (Tutin et al. 1964-1980). When some important taxonomical updates had been carried out or when some species were missing in the ESFEDS database, the following criteria were used: Talavera et al. (1999) for Genisteae; Greuter et al. (1984-1989) for Cistaceae, Dipsaceae, Pinaceae, Euphorbiaceae, Echium, Thymus and Coridothymus; Pankhurst et al. (2007) for Rosaceae; and Grovaert and Frodin (1998) for Fagales (Fagaceae, Betulaceae). Family names follow the Angiosperm Phylogeny Group standards (Bremer et al. 2003).

Project personnel:

Principal investigator: Juli G. Pausas

Main associated investigator: Susana Paula

Contributors: Margarita Arianoutsou, Dimitris Kazanis, Çagatay Tavsanoglu, Francisco Lloret, Constanze Buhk, Fernando Ojeda, Belén Luna, Jose Manuel Moreno, Anselm Rodrigo, Josep M. Espelta, Sara Palacio, Belén Fernández-Santos, Paulo M. Fernandes.

CLASS III. DATA SET STATUS AND ACCESSIBILITY

A. Status

Latest Update: July 2008

Latest Archive data: November 2008

Metadata status: The metadata are complete and up to date.

Data verification: The quality of the data has been carefully reviewed by the authors. Data has undergone substantial checking throughout the initial analysis. All data values present the associated source (a reference or a researcher responsible).

B. Accessibility

Storage location and medium: Ecological Society of America data archives. An original data file exists on the author's personal computers.

Contact person: Juli G. Pausas, CIDE, CSIC, Apartado Oficial, 46470 Albal, Valencia, SPAIN. Phone: +34 96 122 0540, Fax: +34 96 127 0967, E-mail: juli.g.pausas@uv.es, URL: www.uv.es/jgpausas/

Copyright restrictions: None

Proprietary restrictions: None

Costs: None

CLASS IV. DATA STRUCTURAL DESCRIPTORS

A. Data Set File

Identity: BROT_2008.11.txt

Size: 11 columns and 8263 records (not including header row)

Format and storage mode: ASCII text, records delimited by newlines, columns delimited by tabs. No compression scheme was used.

Header information: Headers describe the content of each column and are: ID, Family, Taxa, Trait, Data, DataType, Method, SourceCode, Region, Redundancy and Comments.

Alphanumeric attributes: mixed

Special characters/fields: The column Taxa includes the authority of each taxon, and in some cases it contains an apostrophe (').

Authentication procedure:

. The sum of column Data for DataType = quantitative is 87225.

. The number of characters in the whole dataset is 792567 (excluding separations between columns and headers).

B. Variable information

1. Column definition

Column name

Brief definition

Storage type

ID Unique identifier Alphanumeric

Family Taxonomic family of species, following the APG II (APG 2003) Character string

Taxa Full name of the species (or subspecies), including authority Character string

Trait Name of the traits considered (traits list and definition described below). Character string

Data The actual data, corresponding to the life history trait. Units and categories for each trait are described below. Mixed. Numeric for DataType = quantitative, Character string otherwise.

DataType Type of data (categorical, semi-quantitative, quantitative, range) as defined below. Character string

Method Measure, experience, compilation, general reference (defined below) Character string

SourceCode Code for the source (published or unpublished references) from which the data have been obtained. See below for the complete list. Character string

Region Region of the Mediterranean Basin where the observation/experiment has been performed. Codes described below. Character string

Redundancy Code indicating possible redundancy (see below) Character string

Comments Additional comments in free format (see below) Character string

Only Redundancy and Comments include empty entries; the other columns have entries for all rows.

2. Traits: units and categories

The traits and the corresponding attributes and units are defined as follows (trait code in brackets):

Life Form (LifeForm): morphology of the whole plant, which is related to its size. The categories considered are:

- Tree: very tall woody plant, frequently with one main primary stem and the canopy rarely reaching the ground.

- Large shrub: large shrub or small tree. Tall woody plant that under optimal conditions may reach arborescence structure.

- Shrub: woody plant (typically less than 1.5 m tall), frequently multi-stemmed and/or the canopy reaching the ground.

- Liana: woody (or slightly ligneous at the base) climber.

- Scrub: dwarf woody plant (typically less than 50 cm in height).

- Perennial forb: perennial broad-leaved herbaceous plant.

- Perennial graminoid: perennial grass-like plant.

- Annual forb: annual broad-leaved herbaceous.

- Annual graminoid: annual grass-like plant.

- Variable forb: annual, biennial or short-perennial forb.

- Variable graminoid: annual, biennial or short-perennial graminoid.

- Geophyte: herb that persists during the unfavourable period as bulb, rhizome or other subterranean storage organ.

Resprouting Ability after Fire (RespFire): resprouting ability one year after being ca. 100% scorched or burned by fire. For quantitative information, it represents the average proportion of adult plants that resprout (%). For qualitative information, the following categories are used:

- No: with no resprouting ability.

- Low: resprouting capacity only after low fire severity; in general, low resprouting vigour and/or high mortality.

- High: resprouting capacity at low and high fire severity; in general, high resprouting vigour and/or nil or low mortality.

- Yes: with some resprouting capacity (non-quantified).

- Variable: high variability observed between populations or sampled areas (at local or regional scale).

Resprouting Ability after Clipping (RespClip): resprouting ability one year after being ca. 100% clipped. For quantitative information, it represents the average proportion of adult plants that resprout (%). For qualitative information, the following categories are used:

- No: with no resprouting ability.

- Low: few and/or weak sprouts.

- High: abundant and/or vigorous sprouts.

- Yes: with some resprouting capacity (non-quantified).

- Variable: high variability observed between populations or sampled areas (at local or regional scale).

Resprouting Ability after Disturbance (RespDist): resprouting ability after an undefined disturbance that remove most of the aboveground biomass. See RespClip for units and categories.

Bud Source (BudSource): location of bud bank for resprouting. Categories considered are:

- Epicormic buds: stem buds (protected by the bark).

- Apex: apex on stems protected from fire by leaf bases.

- Root crown: transition point between main stem and root.

- Lignotuber: ontogenetically programmed (i.e., inherited character) woody swelling at or below ground level. Based on embryological and/or anatomical features.

- Burl: non-ontogenetically programmed (e.g. stem coalescence) woody swelling at or below ground level.

- Lignotuber or burl: woody swelling at or below ground level with unspecified origin (no distinction between lignotuber and burl is reported).

- Rhizomes: non-swollen horizontal stem growing near the soil surface and including below-ground (rhizome sensu stricto) and aboveground (stolons) stems.

- Roots.

- Rhizomes or roots: rhizomes, roots or both (specific bud source is unknown).

- Storage organs: non-woody storage organs, normally modified stems as bulbs, corms or tubers.

- Others: other bud sources, including those not clearly specified (e.g., stump).

Heat-Stimulated Germination (HeatStimGerm): the most intense heat treatment (i.e., seed exposition to dry heat >= 50ºC), of those tested, that significantly increases seed germination versus the control. For studies where differences were not statistically tested, the criteria in Paula and Pausas (2008) is used. Three heat intensities are considered: Low (L: <100ºC for <= 5min), Moderate (M: <100ºC for > 5min or >= 100ºC for <= 5min), High (H: >= 100ºC for >5min) or unknown (unk). The heat intensities tested in each experiment are indicated after the slash (/LMH), with an underscore when the corresponding heat intensity is not tested (e.g., M not tested: /L_H). Note that in many studies, post-treatment seed viability is not considered or not specified in the original reference, and thus it can lead to misinterpretation of treatment effects. Categories and corresponding notation as follows:

- yes/unk: stimulated germination is produced after exposure to heat of unspecified intensity.

- high/###: stimulated germination after exposure to High heat intensity when ### treatments were applied (### refers to L, M and H respectively).

- moderate/###: the highest heat intensity that stimulates germination is Moderate after testing for ### (### refers to L, M and H respectively).

- low/###: the highest heat intensity that stimulates germination is Low after testing for ### (### refers to L, M and H respectively).

- unaffected/###: germination is not stimulated after any heat intensity tested and at least one of the treatments does not affect seed germination (### refers to L, M and H respectively; unk, if unknown).

- inhibition/###: inhibited germination (i.e., lower germination than in the control) in all heat treatments tested (### refers to L, M and H respectively; unk, if unknown).

Other Cues (OtherCues): germinative response after exposure to boiling water (blw), smoke (smk), ash (ash), charcoal (cha) or nitrogenous compounds: KNO3 (NC1), NaNO2 (NC2), NH4Cl (NC3), NH4HOC3 (NC4), NH4NO3 (NC5). The fire cue tested is indicated in the abbreviated form (three characters) after the slash (/#). Thus, the categories and corresponding notation are as follows:

- Stimulation/#: germination of the treated seeds is significantly higher than the control (# refers to the treatment codes indicated above).

- Unaffected/#: germination of treated seeds equals the control (# refers to the treatment codes indicated above).

- Inhibition/#: germination of the treated seeds is lower than the control (# refers to the treatment codes indicated above). For studies where differences were not statistically tested, the criteria in Paula and Pausas (2008) is used.

Average Seed Bank Longevity (SeedBankLong): period during which seeds remain viable in the (soil or canopy) seed bank as inferred from: vegetation and soil seed bank comparison (veg), experimental seed burial (bur), age of serotinous cones (ser), seed dormancy (dor) or unknown methods (unk). The method used is indicated after the slash (/#). When this trait is inferred from the presence of the species in the vegetation and in the soil seed bank (veg), the following key is used (based on Thompson et al. 1997):

Plants in the vegetation	Seeds in the soil	Maximum depth	SeedBankLong
Absent	Present	Any	persistent/veg
Present	Present	0-2	transient/veg
Present	Present	2-5	persistent/veg
Present	Present	>5	long-term/veg

The categories and notation are as follows:

- transient/#: seeds germinate in the first favourable season after dispersal. Generally, seed bank longevity is <= 1 yr (no persistent seed bank).

- persistent/#: seeds do not germinate in the first favourable season after dispersal. Generally seed bank longevity is > 1 yr (could be longer but it is unknown).

- short-persistent/#: > 1 and <= 5 yr.

- at least short-persistent/#: longevity at least > 1 and at least <= 5 yr (could be longer but it is unknown).

- mid-persistent/#: at least > 5 yr (could be longer but it is unknown).

- long-persistent/#: at least > 15 yr.

- very long-persistent/#: at least >= 30 yr.

Seed Bank (SeedBank): location of persistent seed bank (longevity > 1 yr). Categories are:

- Soil: soil persistent seed bank.

- Canopy: canopy persistent seed bank (serotiny).

Post-fire Seedling Emergence (SeedlEmerg): average seedling density per pre-fire mature individuals emerging during the first year after fire (seedlings/mature), or alternatively, one of the following categories:

- No: no post-fire seedling emergence.

- Low: number of seedling lower than the number of pre-fire mature individuals.

- High: number of seedlings higher than the number of pre-fire mature individuals.

- Yes: seedling emergence (quantitative data not available).

- Variable: high variability observed between populations or sampled areas (at local or regional scale).

Post-fire Seedling Survival (SeedlSurv): proportion of seedlings surviving first dry season after fire (%), or alternatively, one of the following categories:

- No: no post-fire seedling survival.

- Low: survival < 25%.

- High: survival >= 25%.

Age at Maturity of Resprouts (MatResp): average age of resprouts at first successful reproduction (in years), i.e., when most of the resprouting plants produce the first seed crop, or alternatively, one of the following categories:

- Early: <5 yr.

- Medium: 5-10 yr.

- Late: >10 yr.

Age at Maturity of Saplings (MatSap): average age of saplings at the first successful reproduction (in years), i.e., when most of the saplings produce the first seed crop (excluding saplings from plantations), or alternatively, one of the following categories:

- Early: <5 yr.

- Medium: 5-10 yr.

- Late: >10 yr.

Seed Mass (SeedMass): average dry weight of seeds (including some single-fruited seeds such as achenes or caryopsis) in mg, or alternatively, one of the following categories:

- Very light: < 3 mg.

- Light: >= 3 and < 30 mg.

- Medium: >= 30 and <300 mg.

- Heavy: > 300 mg.

3.Types of data

Because the database includes different types of data, even at the trait level, the 6th column (DataType) defines the type of data as follows:

- Quantitative: a number (integer or floating).

- Semi-quantitative: ordered qualitative variable (e.g., low, medium, high).

- Range: two quantitative values, indicating the range observed .

- Categorical: non-ordered qualitative variable.

The above types may also, in turn, be conditional (quantitative conditional, semi-quantitative conditional, etc.) and indicate that the data entry has the value and a condition. Here are two examples:

. HeatStimGerm = “low/L_H”: germination stimulated by low heat in an experiment where only Low and High heat intensities were tested (as defined in the Data definition, IV.B.2, above). That is, it is unknown whether it would be stimulated by a moderate heat intensity treatment; it was not stimulated by a high heat shock.

. OtherCues = “Stimulation/smk”: germination stimulated by smoke treatments (i.e., germination after smoke treatment was significantly higher than the germination in control conditions).

4. Method

The 7th column describes the general methods of gathering the information, and it is related to the accuracy of the data. It has the four following possible values:

- Measure: published or unpublished data obtained from an experimental design in which the data is, at least, one of the objectives of the study.

- Experience: published or unpublished data from visual (rough) estimation or personal experience.

- Compilation: published data compiled from different sources (including experience, published data, ...)

- General reference: published data obtained from a general publication such as a Flora.

5. Code for the sources

The 8th column provides a code that refers to the data source (SourceCode). Complete references are listed below. Note that the references include published articles, grey literature and personal communications; in the latter, the e-mail of the data provider and a brief description of the study area are also included.

SourceCode Full reference

Abad1996 Abad, N., R. N. Caturla, J. Baeza, C. Bladé, F. Vieira, E. Carbó, A. Valdecantos, A. Bonet, I. Serrasolsas, R. Guàrdia, J. Raventós, J. A. Alloza, A. Escarré, J. Bellot, and V. R. Vallejo. 1996. Regeneración

de los montes quemados. Pages 51-148 in R. Vallejo, editor. La restauración de la cubierta vegetal en la Comunidad Valenciana. Fundación Centro de Estudios Ambientales del Mediterráneo, Valencia, Spain.

Albarracin Madrigal, J., C. Hernando, and M. Guijarro (incendio@inia.es) - Albarracín (SE spain). Mediterranean climate with continental influence; phytoclimatic region following Allué 1990: VI(IV)1.

Alberdi2002 Alberdi, L., and Y. Cavero. 2002. Effect of fire on the understorey species of a Quercus ilex L. subsp. ballota (Desf.) Samp. forest in Navarra, Spain. Pages 25-32 in L. Trabaud and R. Prodon, editors. Fire and biological processes. Backhuys Publishers, Leiden, The Netherlands.

Alonso1992 Alonso, I., E. Luis, and R. Tárrega. 1992. First phases of regeneration of Cistus laurifolius and Cistus ladanifer after burning and cutting in experimental plots. International Journal of Wildland Fire 2:7-17.

Alvarez2005 Alvarez, R., L. Valbuena, and L. Calvo. 2005. Influence of tree age on seed germination response to environmental factors and inhibitory substances in Pinus pinaster. International Journal of Wildland Fire 14:277-284.

Alvarez2007 Alvarez, R., L. Valbuena, and L. Calvo. 2007. Effect of high temperatures on seed germination and seedling survival in three pine species (Pinus pinaster, P. sylvestris and P. nigra). International Journal of Wildland Fire 16:63-70.

Andres2002 Andrés, C., and F. Ojeda. 2002. Effects of afforestation with pines on woody plant diversity of mediterranean heathlands in southern Spain. Biodiversity and Conservation 11:1511-1520.

Anorbe1990 Añorbe, M., J. M. Gómez-Gutiérrez, M. A. Pérez-Fernández, and B. Fernández-Santos. 1990. Influencia de la temperatura sobre la germinación de semillas de Cytisus multiflorus (L'Hér) Sweet y Cytisus oromediterraneus Riv. Mart. Studia Oecologica 7:86-100.

Arianoutsou1979 Arianoutsou, M. 1979. Biological activity after fire in a phryganic ecosystem. PhD thesis (in Greek with an English summary). University of Thessaloniki, Greece.

Arianoutsou1980 Arianoutsou, M., J. Diamantopoulus, and N. S. Margaris. 1980. Fire behaviour of Ceratonia siliqua. Portugaliae Acta Biologica. Série A XVI:67-74.

Arianoutsou1981a Arianoutsou, M., and N. S. Margaris. 1981. Early stages of regeneration after fire in a phryganic ecosystem (East Mediterranean). I. Regeneration by seed germination. Biologie - Ecologie méditerranéenne 8:119-128.

Arianoutsou1981b Arianoutsou, M., and N. S. Margaris. 1981. Producers and the fire cycle in a phryganic ecosystem. Pages 181-190 in N. S. Margaris, and H. A. Mooney, editors. Components of productivity of Mediterranean climate regions: basic and applied aspects. Dr. W. Junk, Dordrecht, The Netherlands.

Arianoutsou1982 Arianoutsou-Faraggitaki, M., and N. S. Margaris. 1982. Phryganic (east Mediterranean) ecosystems and fire. Ecologia Mediterranea VIII:473-480.

Arianoutsou2000 Arianoutsou, M., and G. Ne'eman. 2000. Post-fire regeneration of natural Pinus halepensis forest in the east Mediterranean basin. Pages 269-289 in G. Ne'eman and L. Trabaud, editors.

Ecology, biogeography and management of Pinus halepensis and P. brutia forest ecosystems in the Mediterranean basin. Backhuys Publishers, Leiden, The Netherlands.

Arnan2007 Arnan, X., A. Rodrigo, and J. Retana. 2007. Vegetation type and dryness drive the post-fire regeneration of Mediterranean plant communities at regional scale. Journal of Vegetation Science 18:111-122.

Arroyo1990 Arroyo, J., and T. Marañón. 1990. Community ecology and distributional spectra of Mediterranean shrublands and heathlands in Southern Spain. Journal of Biogeography 17:163-176.

Attica Kazanis, D., M. Arianoutsou, and P. Andriopoulos (dkazanis@biol.uoa.gr) - Hilly and mountainous areas in Attica (Greece). Primarily Pinus halepensis Mill. communities and secodary phryganic srublands. Altitude of the study sites varies from 170 to 660m asl. Typical Mediterranean climate with annual precipitation varrying from xerothermic conditions (ca. 300 mm) to 500 mm. Typical fire regime with fire frequency >50 years for P. halepensis forests and >20 for phrygana has changed within the last 15 years. Several cases of fire interval less than 15 years have been encountered (even 3 years in one case!).

Azcarate2002 Azcárate, F. M., A. M. Sánchez, L. Arqueros, and B. Peco. 2002. Abundance and habitat segregation in Mediterranean grassland species: the importance of seed weight. Journal of Vegetation Science 13:159-166.

Baeza2001 Baeza, M. J. 2001. Aspecto ecológicos y técnicas de control del combustible (roza y quema controlada) en matorrales con alto riesgo de incendio dominados por Ulex parviflorus (Pourr.). PhD Thesis. Universidad de Alicante, Spain. http://www.cervantesvirtual.com/FichaObra.html?Ref=5920.

Baeza2002 Baeza, M. J., M. De Luís, J. Raventós, and A. Escarré. 2002. Factors influencing fire behaviour in shrublands of different stand ages and the implications for using prescribed burning to reduce wildfire risk. Journal of Environmental Management 65:199-208.

Baeza2003 Baeza, M. J., J. Raventós, A. Escarré, and V. R. Vallejo. 2003. The effect of shrub clearing on the control of the fire-prone species Ulex parviflorus. Forest Ecology and Management 186:47-59.

Baeza2004 Baeza, J. 2004. Mejora de pastizales y control del combustible con gran acumulación de necromasa en áreas cortafuegos. Ecología de la germinación de Ulex parviflorus y gestión de aulagares. Bases para la gestión del matorral en el ZAU de Biar mediante pastoreo controlado. Pages 81-88 in Programa de I+D sobre restauración de la cubierta vegetal. Reunión de coordinación 2004 (technical report).

Baeza2006a Baeza, M. J., and V. R. Vallejo. 2006. Ecological mechanisms involved in dormancy breakage in Ulex parviflorus seeds. Plant Ecology 183:191-205.

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Gibraltar Ojeda, F. (fernando.ojeda@uca.es) - North side of the Strait of Gibraltar (S Spain). Ca. 3000 Km² area, mainly on Oligo-Miocene sandstone mountains dominated by evergreen Quercus suber woodlands, open heathlands become abundant on summits and exposed ridges and semideciduous

Quercus canariensis forests occupy valley bottoms. Mild Mediterranean climate (oceanica influence and frequent humid easterly winds; Ibarra 1993). Mean annual rainfall 600-1700 mm (locally, up to 2200 mm). Mean fire return interval is 20-25 years (locally up to 5 years). Most data on heathland species come from specific experimental studies carried out in Sierra del Niño and Monte Murta.

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Portugal Fernandes, P. (pfern@utad.pt) - Northern and Central Portugal mountains. Above 400 m elevation. Communities dominated by Erica umbellata and Pterospartium tridentatum are quite important in the landscape and occupy poor, acidic, siliceous soils. They are also prevalent in the understorey of pine forests and occur with various degrees of importance in Ulex shrubland and other types of heathland. Data of Quercus suber collected in Q. suber stands (never exploited for cork) with a Cistus ladanifer dominated understorey. Sub-atlantic and Mediterranean-Iberian-Atlantic, annual rainfall >700 mm, mean annual temperature 10-16 ºC. Meso-Mediterranean and supra-Mediterranean zones. Mean fire size in shrub-dominated landscapes is 7 ha, fire density is 0.45/km²/year. Fire return interval typically varies in the range of 5-20 years. Where grazing pressure is higher fire returns every 3-5 years (approximatelly 5% of the landscape), Erica umbellata declines and herbs increase. Prevailing season of the fires: July-October and February-April.

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Salamanca Fernández-Santos, B. (belenfs@usal.es) - Various sites with matorral in the province of Salamanca. (1) Above 1400 m. Cytisus balansae forming dense monospecific stands occuping vast areas. The climate is Mediterranean mountainous, hyperhumid and cold. The soils overlay granitic bedrock and are shallow and acid. Traditionally the matorral is periodically burned (now every 5-8 years) in order to facilitate the growth of grasses. The mainly study area is Sierra de Bejar (W of Central System). (2) Various sites with matorral dominated by Cytisus multiflorus, mainly in the NW of the provice. Climate is subhumid Mediterranean, with mean annual precipitation between 600-750 mm and a pronounced summer drought. Soils are sandy and acid. These areas are extensive open holm-oak woodlands and set-aside agricultural land, where C. multiflorus constitutes monospecific matorral formations. The matorral is periodically burned, every 6-10 yr. Altitude ranges from 680 to 850m a.s.l. (3) Climate is humid Mediterranean, with

mean annual precipitation >1000 mm and a pronounced summer drought. Soils are sandy and acid. These areas are extensive open oak woodlands, with matorral species. The matorral is frequently burned. Altitude ranges from 800 to 1200 m a.s.l.

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Valencia Pausas J. G., and S. Paula (juli.g.pausas@uv.es) - Valencia (E Spain). Mainly lowland communities (avoiding top mountains, etc). Mediterranean climate with two main distinctive bioclimatic zones: a thermo-Mediterranean zone right next to the coast (mean annual temperature: 17-19 ºC; vegetative period: 12 months) and a meso-Mediterranean zone a bit inland (mean annual temperature 13-17 ºC; vegetative period: 9 - 11 months). The precipitation regime is mainly dry (annual precipitation from 350 to 600 mm) with precipitation concentrated (>60%) in spring and autumn. About 55% of the forest landscape did not burn during this period 1978 and 2001, ca 30% burned once only, 14% burned twice, and very small areas burnt 3 or more times. About 11% of the forest land has suffered recurrent fires with fire intervals shorter than 15 years (in the last 23 years; Pausas and Abdel Malak 2004).

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6. Region

The 9th column refers to the region of the Mediterranean Basin where the observation or experiment was performed or from where the seeds were collected. Five regions are considered, three in Mediterranean Europe, one in Mediterranean Asia and another in Mediterranean Africa:

W – North West: Iberian Peninsula, south of France and Balearic Islands.

C – North-Central: Italian Peninsula and surrounding islands (Sicily, Sardinia, Corsica).

E – North East: from Trieste to Istanbul, that is, Croatia, Albania, Former Yugoslavic Republic of Macedonia, Greece, and surrounding islands.

M – Mediterranean Middle East (Asia): from Istanbul to the Sinai Peninsula. That is, Anatolian Peninsula, western Syria, Lebanon, Palestine, Israel and Cyprus.

S – Southern rim of the Mediterranean sea (North Africa), that is, Morocco, Algeria and Tunisia.

U – Unknown, or unclear in the original source, or from more than two of the above regions.

7. Redundancy

The 10th column indicates rows that are strongly related (indicated with the same code in this column); these are references for a given species in which there is a high chance that the information in one of the references was obtained from another. These cases are very difficult to identify, but are indicated when suspected, as it may help in understanding and processing the data.

8. Comments

For some data, a brief comment may be included in the 11th column. These comments or clarifications may be provided by the author (f.a.), that is, they are indicated in the reference, or by the data compiler (f.c.).

CLASS V. SUPPLEMENTARY DESCRIPTORS

A. Data acquisition

Data forms: n/a

Location of completed data forms: n/a

Data entry/verification procedures: Data were introduced in a spreadsheet from published references and personal experience. The main compilers (Paula and Pausas) reviewed all individual datasets to homogenise criteria and to detect inconsistencies. Initial analysis was performed to detect further inconsistencies.

B. Quality assurance/quality control procedures: see Authentication procedure (Class IV).

C. Related material: n/a

D. Computer programs and data processing algorithms:

The file can be read using different statistical, database or spreadsheet software. Here is the command line to read it in R version 2.7 (R Development Core Team 2007):

```
read.delim("BROT_2008.11.txt")
```

E. Archiving: n/a

F. Publications using the data set: The full data set has not yet been used in any publication. Several papers used a small subset of the data:

Paula, S. and J. G. Pausas. 2006. Leaf traits and resprouting ability in the Mediterranean basin. Functional Ecology 20:941-947.

Verdú, M., and J. G. Pausas. 2007. Fire drives phylogenetic clustering in Mediterranean Basin woody plant communities. Journal of Ecology 95:1316-323.

Paula, S., and J. G. Pausas. 2008. Burning seeds: Germinative response to heat treatments in relation to resprouting ability. Journal of Ecology 96:543-552.

Pausas, J.G., and M. Verdú. 2008. Fire reduces morphospace occupation in plant communities. Ecology 89: 2181-2186.

G. History of data set usage: n/a (the data has not yet been used by any secondary user)

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