

European burn prescriptions

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Abstract

The “Handbook to Plan and Use Prescribed Burning in Europe” is a product of the FIRE PARADOX project. Qualitative and quantitative information relevant to prescribed burning operations in European ecosystems was compiled, organized and synthesised, including knowledge that was dispersed or needed to be formalized. The main emphasis of the handbook goes to prescriptions, i.e. the conditions desired for the burn that will allow reaching the pre-defined treatment objectives. Prescriptions from all around Europe have been gathered, from sub-tropical to boreal environments, and are presented by management objective and vegetation type. Some of the contents were derived purposely, namely prescriptions for specific goals that were generated using models of fire behaviour and effects. Most data concerns the application of fire to mitigate fuel hazard or manage habitats in diverse types of shrubland and pine woodland. Two types of prescriptions are presented, respectively to achieve a broad goal or a specific objective, usually defined in quantitative terms. Included are ranges for the desired weather and moisture conditions and fire behaviour and effects, as well as ignition patterns and interval between treatments.

The handbook is a user-friendly source of information with operational value. It will assist prescribed burning practitioners in their decision-making process, allowing them to benchmark their practice against the recommendations, familiarize with and try prescriptions developed elsewhere for the same management objective and, in the future, provide input towards improvement and refinement. The handbook will naturally find application in prescribed burning training and outreach, and can provide a framework to plan research on fire ecology topics. In the frame of exchanges between regions and countries the handbook is expected to constitute a rapid reference guide for the “outsiders”.

Keywords: Prescribed fire, fire management, fuel management, habitat management

1. Introduction

Prescribed burning is the planned application of fire to achieve forest and wildland management goals. The practice of prescribed burning demands skills and experience and is always under public scrutiny. Such use of fire is expected to be wise, i.e. it should maximize the benefits of burning while avoiding or minimizing its negative impacts. Consequently, prescribed burning is framed by land management goals and site-specific treatment objectives and is conditioned by both environmental and social restrictions. The decision-making and planning process can thus benefit from decision-support tools that will enhance the proficiency of the practitioners.

The inception and adoption of prescribed burning by managers and management organizations is relatively new in Europe and dates back to the early 1980s. The use of prescribed burning use is geographically restricted and its potential to manage wildlands is still largely unfulfilled, especially in forested areas. The political and socio-economic environment is decisive, but there is a need for more basic knowledge and operational guidelines to assist prescribed burning programs. The narrow gap that often separates prescribed burning from traditional burning practices in Europe testifies to the incipient technical development of the former. In contrast with previous European-level R&D projects, in the Integrated Project FIRE PARADOX (Silva et al. 2010) most of the effort on prescribed burning was directed to technological development, training and dissemination, rather than to research. Four products resulted that form the Meta Product ‘Package of Materials for Prescribed Burning Promotion’ (<http://fireintuition.efi.int/products.fire>). The ‘Handbook to Plan and Use Prescribed Burning in Europe’ is one of the products and compiles, organizes and synthesizes both qualitative and quantitative information relevant to prescribed burning operations in European ecosystems. The main emphasis of the Handbook goes to prescriptions, i.e. the conditions desired for the burn and that will allow reaching the pre-defined treatment objectives.

2. Development and contents of the ‘Handbook to Plan and Use Prescribed Burning in Europe’

The Handbook delivers a conceptual framework (Fig. 1) to plan, carry out and evaluate a burn operation, and aggregates and digests knowledge that was dispersed or needed to be formalized. The Handbook components have been developed by (i) examining the available technical information, i.e. burning guides and best practices (e.g. Vega et al. 2001, Fernandes et al. 2002, Scottish Executive Environment and Rural Affairs Department 2008) and prescriptions established by fire managers or researchers for management-ignited fires); (ii) inquiring the agencies and individuals involved in prescribed burning in Europe; and (iii) by using models of fire behaviour and effects to generate burn prescriptions for generic or specific treatment goals. We also took advantage of the wealth of information available from the FIRE PARADOX prescribed burning demonstration sites (Fig. 2).

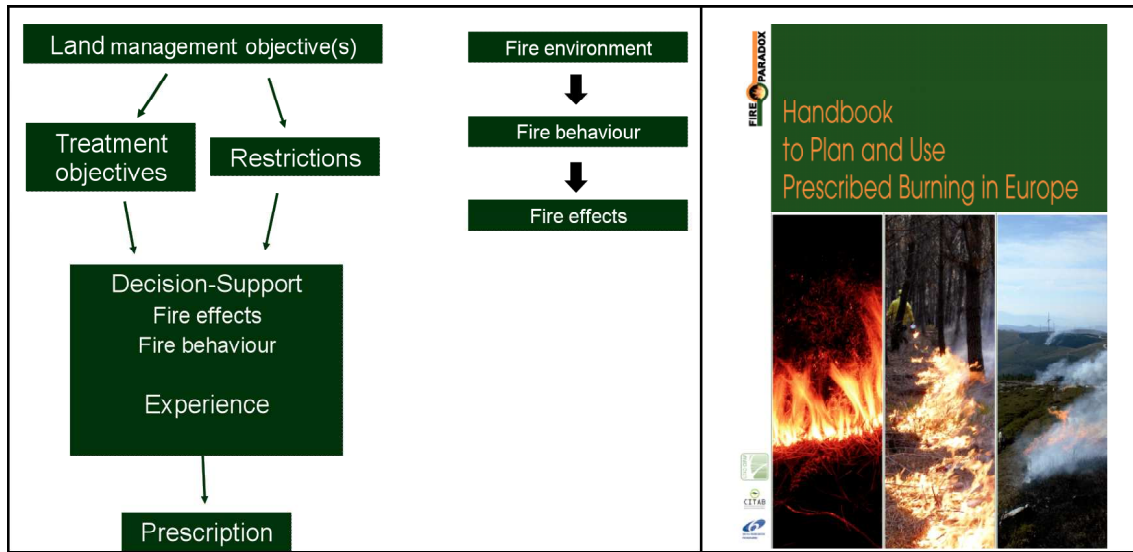



Fig. 1. A framework to plan prescribed fire (or towards a more exact use of fire), left, and cover of the handbook, right.

The Handbook gathers prescriptions (see e.g. in Fig. 3) from all around Europe, from sub-tropical (Canary islands) to boreal (Sweden) environments. The information is organized and presented by management objective, vegetation type and country or region. Most data respects to the application of fire to decrease fuel hazard or to manage habitats for pastoral or nature conservation purposes in diverse types of shrubland and pine woodland. Included in the Handbook are ranges for the desired weather and moisture conditions and fire behaviour and effects, as well as ignition patterns and the return interval for the treatments. Two types of prescriptions are presented, respectively:

- to achieve a broad goal, e.g. renew pastures;
- or to attain a specific objective, usually defined in quantitative terms, e.g. reduce fuel load by 70%.



FIRE PARADOX

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FIRE PARADOX – Network of Prescribed Burning Demonstration Sites

Prescribed Burning Demonstration Sites - Site Description and Objectives

Local Site Name: Perímetro Florestal de Entre Vez e Coura

Country:	Region:	Location:
Portugal	Minho (NW Portugal)	Labruja, Ponte de Lima

Unit No./Admin. Unit:	Owner:	Site area (ha):
Perímetro Florestal de Entre Vez e Coura	Community land managed by Forest Services	1000

Coordinates:	Map / Aerial photo	
Latitude: 41° 51' 43.20"N	Longitude: 8° 36' 29.02"W	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (Please attach)

First established:	Area(s) burnt (ha):	Fire return interval (or time since last burn, or next burn planned):
1993	270	5 yrs

Prescribed burning objective:
 Wildfire prevention and understory fuel load reduction in maritime pine plantations.

Specific Treatment Objectives:	Objectives reached?
(a) Increase resilience to fire of Pinus pinaster stands.	<input type="radio"/> Yes
(b) Reduction of undercover shrubs and litter (L layer) of pine stands	<input type="radio"/> No
(c) Reduction of fuel load in shrublands around forest area	Specify:

Desired burn conditions to reach objectives (optional or if necessary as general prerequisite)

Surface wind speed (km/h): 3 - 6	Wind direction: S-SE-SW
Relative humidity (%): 31 - 63	Soil moisture: > 150%
Days since last rainfall 4 - 12	Fine dead fuel moisture content (%) 15 - 21

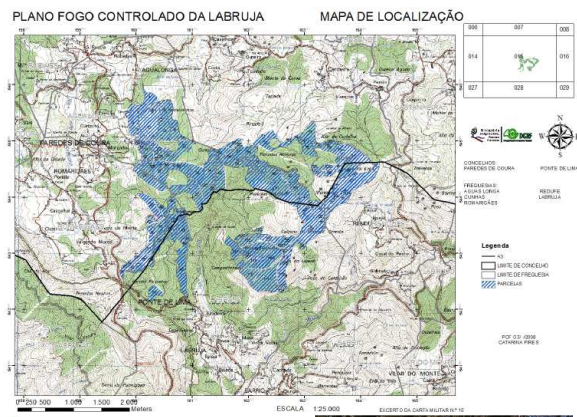




Fig. 2. Documentation of a prescribed fire demonstration site in NW Portugal *Pinus pinaster* stands.

The technological solutions to plan prescribed fire operations vary across Europe. General burning windows consisting of ranges in weather conditions or in fire danger rating indexes (like in Sweden, Germany and Portugal) are commonplace. In Catalonia, Spain, 12 standard prescriptions are individualized on the basis of fuel availability and wind speed. USDA Forest Service fire simulation tools (e.g. Scott and Reinhardt 2001) are used in Spain to prepare site-specific prescriptions, which include sets of values (minimum, preferred, maximum) for weather conditions, fuel moisture contents, fire behaviour characteristics and selected fire effects. In Portugal, the PiroPinus tool (Fernandes 2003) was developed to assist in planning and evaluating the results of prescribed underburning in maritime pine (*Pinus pinaster*) stands.

Pinus sylvestris

Vegetation type:
Pinus sylvestris

Management objective:
Conservation, restoration

Specific management objective:
Change forest structure to a more open condition; change forest composition towards pine-dominated or broadleaved-dominated

Country / Region:
Sweden / Vasternorrland

Prescription elements	Range	Optimum
Burn season	June-August	Variable ^a
Fire return interval (yrs.)	40 - 60	
Weather-related variables:		
* Wind speed (km hr ⁻¹)	2 - 35	7 - 18
* Air temperature (°C)	18 - 30	<25
* Relative humidity (%)	≥ 7	> 35
* FFMCI	80 - 90	
* DMC	20 - 65	^a
Fire behaviour		
Rate of spread (m hr ⁻¹)	10 - 500	50
Flame height (m)	0.3 - 4	0.7
Byram's fire intensity (kW m ⁻¹)	10 - 20 000	300
Ignition pattern	Point ignition, strip-headfire	

Pinus sylvestris

Observations and supplementary information
^a Late season burns, i.e. drier conditions are preferred when achieving fire objectives mortality is a priority.

6 | Handbook to Plan and Use Prescribed Burning in Europe

Handbook to Plan and Use Prescribed Burning in Europe | 7

Fig. 3. Extract from the 'Handbook to Plan and Use Prescribed Burning in Europe', with the Swedish prescription for *Pinus sylvestris* underburning.

3. Conclusion

Prescribed burning practitioners are the main target of the 'Handbook to Plan and Use Prescribed Burning in Europe' and can benchmark their practice against the recommendations, familiarize with and try prescriptions developed elsewhere for the same management objective and, in the future, provide input towards improvement and refinement. In the frame of exchanges between regions and countries the Handbook is expected to constitute a rapid reference guide for the 'outsiders'. Educational organizations and environmental consultants will also benefit. The Handbook will naturally find application in prescribed burning training and outreach, and can provide a framework to plan research on fire ecology themes. Finally, the Handbook is in itself a tool to disseminate the wise use of fire across Europe.

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References

- Fernandes, P.M. 2003. Sistema de apoio ao planeamento, execução e avaliação do fogo controlado em pinhal bravo. In: O Estado da Arte em Modelação da Floresta – o Caso Português, Actas da I Jornada Técnica de Modelação Florestal. ISG, CIGest, Lisboa. pp. 33-34.
- Fernandes, P., Botelho, H., Loureiro, C., 2002. Manual de Formação para a Técnica do Fogo Controlado. UTAD, Vila Real.
- Scott, J.H., Reinhardt, E.D., 2001. Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior. USDA Forerst Service, Rocky Mountain Research Station, Res. Pap. RMRS-RP-29. Ogden, UT.
- Scottish Executive Environment and Rural Affairs Department, 2008. Prescribed burning on Moorland: Supplement to the Muirburn Code: A Guide to Best Practice. Scottish Government, Edinburgh.
- Silva, J.S., Rego, F., Fernandes, P., Rigolot, E. (Eds.), 2010. Towards Integrated Fire Management – Outcomes of the European Project Fire Paradox. EFI Research Report 23. European Forest Intitute, Joensuu, Finland.
- Vega, J.A., Pérez-Gorostiaga, P., Cuiñas, P., Fontúrbel, T., Fernández, C., 2001. Manual de Queimas Prescritas para Matogueiras de Galicia. Colección Técnica Medio Ambiente. Xunta de Galicia, Pontevedra.