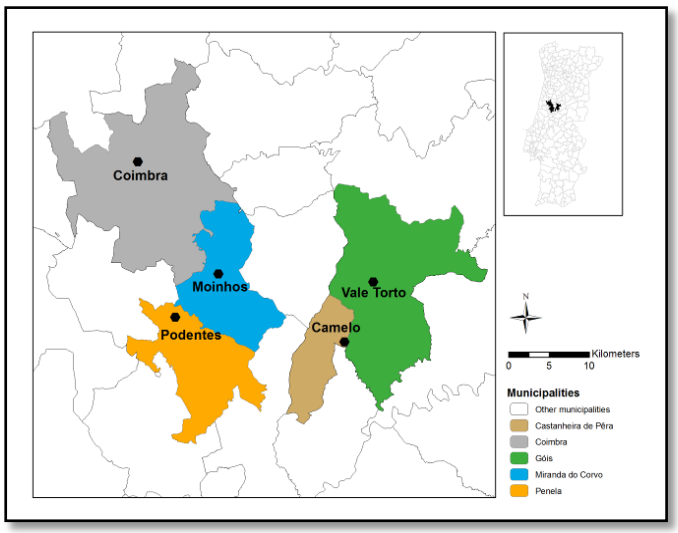
2b PORTUGAL– GOIS: PRESCRIBED FIRE

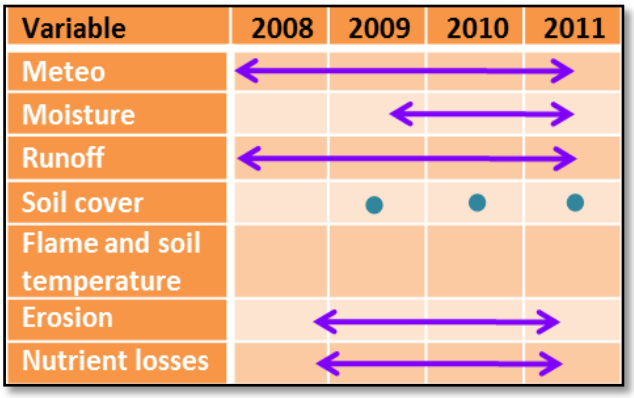
Like many Mediterranean countries Portugal suffers from forest fire due to its dry and hot climate. The problem is not only degradation of forest and the emission of carbon dioxide to the atmosphere but it also increases soil losses and pollution of water and air. The Vale Torto area near Góis in Portugal was burned by several fires in the 1970s and the early 1980s. Similarly the Camelo catchment near Góis also suffers from forest fire with the recent fire taking place in July 2008. In order to reduce soil losses caused by wild fire and to minimise the amount of flammable materials an experiment was applied which uses a technology called prescribed fire.

THE EXPERIMENT: CONTROLLED BURNING IN SPRING



To compare the effect of prescribed burning with that of wild fire four sites were selected: Two sites in Camelo catchment and Vale Torto area close to in Góis, both haviong similar conditions with respect to geology (schist and quartzite), relief, vegetation, soil and climate. The two other sites were located in Podentes and Moinhos study sites. The Podentes site is in a limestone area.

For studying the effect of wild fire and prescribed fire following data were used: Wild fire in Camelo study site (3.3 ha) in early summer 2008 comprising scrub vegetation representing a fuel load of 65 t/ha (Photo below left); Vale Torto, submitted to an experimental fire (9 ha) with a lower fuel load (23 t/ha) in February 2009 (Photo below right); Podentes subjected to a prescribed fire in April 2009. In Podentes, the forestry service burned a smaller area (2 ha) comprising scrub vegetation on calcareous bedrock with fuel load of 70 t/ha. In Moinhos an area of 95 ha was burnt in September 2009 where eucalyptus were planted. To study the effect of forest fire, field study was carried out to collect data on soil moisture, infiltration, suspended sediments and nutrient contents. In addition to



collecting data on soil, Vegetation recovery monitoring was also carried out using vertical-photography of plots of size 0.25m.

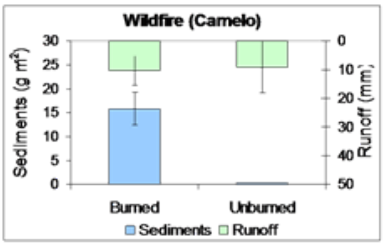
In addition, a lysimeter was also used to assess fire impact on soils started during 2010. During the experimental lysimeter fire flame temperature was assessed using an infrared heat sensor, that shows temperatures values of over 700ºC.

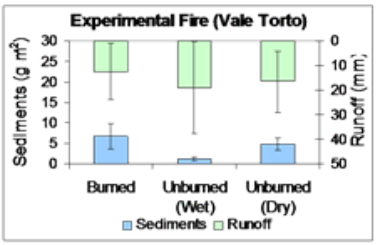
RESULTS

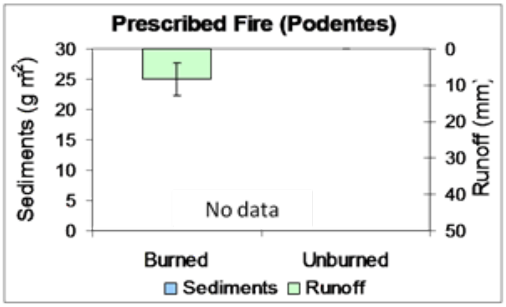
	Infiltration rate (mm/h)			Infiltration capacity (mm/h)		
	Burnt	Unburnt	ratio	Burnt	Unburnt	ratio
Bare soil		7.50			13.85	
Q. coccifera S	10.45	13.80	0.76	30.26	30.56	0.99
P. lentiscus S	15.05	22.39	0.67	29.64	31.13	0.95
A. unedo S	7.99	12.09	0.66	11.89	32.45	0.37
Average	**11.16**	**16.09**	**0.69**	**23.93**	**31.38**	**0.76**
Q. coccifera N	25.47	41.03	0.62	26.87	46.13	0.58
P. lentiscus N	28.94	29.42	0.98	30.25	31.76	0.95
A. unedo N	16.23	24.57	0.66	16.62	30.10	0.55
Average	**23.55**	**31.67**	**0.74**	**24.58**	**36.00**	**0.68**
Whole area	**15.81**	**21.14**	**0.75**	**21.94**	**29.14**	**0.76**

The result shows an increase in soil water repellence after burning which is not shown by the unburned area. Burning intensified soil hydrophobicity (compared with the unburned site) probably due to enhanced drying and high temperatures during the fire. Studies carried out in the effects of ash in Podentes study site revealed that water repellence depends on plant species and to some extent also on slope aspect. The ash from *A. Unedo* shows major water repellence behaviour as compared to ash from other shrub species (Quercus coccifera, Pistacia lentiscus).

Fire also influences soil infiltration. The study shows reduction of soil infiltration by about 25 per cent. Highest decline of infiltration capacity was observed in the burnt shrub species, *A. unedo*, which has also high soil water repellence value. This could be related to different surface litter and root systems of plant species. The results also show higher infiltration capacities on limestone area as compared to the area with schist bedrock. On schist sites, the fire had no discernible impact on runoff, and the average runoff coefficients for the burned sites were 24% Camelo, 29% Vale Torto and 8% Podentes.







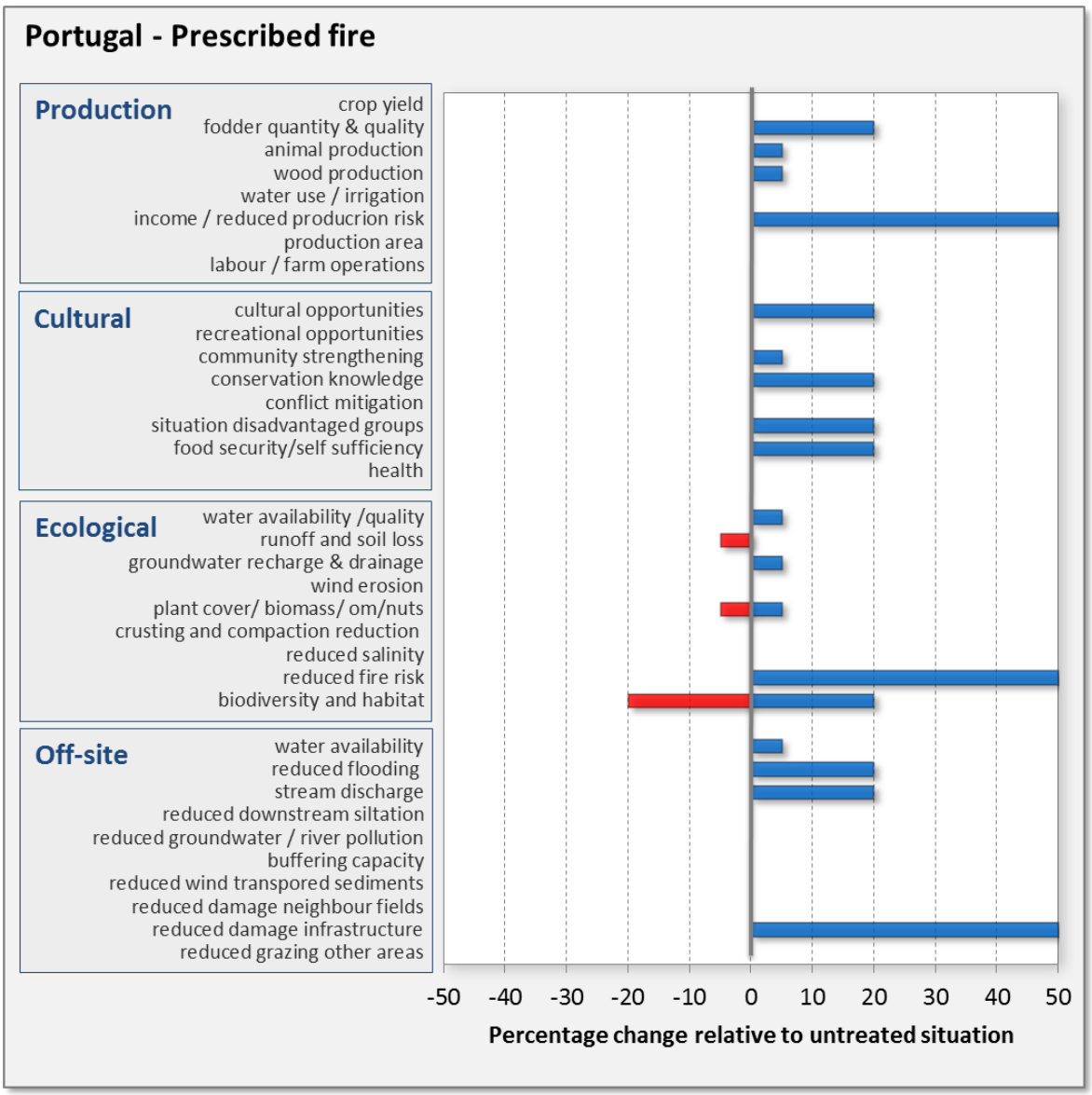
In case of soil losses, the schist study site shows a significant increase of soil loss for both cases: wild fire versus un-burned area (3.8 g m^{-2} vs 0.1 g m^{-2}), and

prescribed fire versus un-burned area (1.6 g m^{-2} vs 1.2 g m^{-2}). In case of Vale Torto the increase in soil erosion after the fire was so significant. Soil loss results in Vale Torto site show a distinct increase (upto 8 -15 times) as compared to pre fire periods. In Camelo site, soil losses per unit contributing area are on average 1-2 orders of magnitude higher (2.2 t/ha for the first year after the wildfire, and 3.6 t/ha for the whole 19-month monitoring interval up to March 2010) compared with prescribed fire.

The lysimeter data shows that the top soil (0-2cm depth) temperature during fire varied spatially, average temperature was around 250ºC, but in some places it reached 450ºC. At the sub-surface layer (2-5cm), soil temperature during the fire was around 60ºC which indicates that organic matter will be burnt only in the top 2 cm of soil.

HOW WELL DOES IT WORK?

The results are evaluated from a production, socio-cultural and economic point of view. The bars express the estimated or measured percentage of change with respect to the reference situation. This change can be positive (blue) or negative (red). Note that this evaluation is based on the experiments, on the long term experience of the coordinating team in this area and on consultations with the farmers.



STAKEHOLDER'S OPINIONS

Prescribed burning is increasingly used as a tool for landscape management, in order to increase diversity and reduce forest fire risk.

To perform prescribed burning, one has to get approved in a special fire management course, the means to perform it are only possible with the involvement of local authorities, which became involved in the Vale Torto experimental fire.

The stakeholders were responsible for getting all the permits and perform the prescribed burning. They followed up the recovery of the burn area. involved

The Benefits are the improvement of pastures for grazing and the reduction of forest fire risk.

Prescribed fire is probably the most cost effective technique for landscape management, it is an old practice that was forbidden during 60 years, and therefore has the adherence of local stakeholders.

We expect a reduction on fire frequency and the diversification of local economy due to an increasing on grazing, bee keeping, cheese production, etc.

CONCLUSIONS

▸ Prescribed burning, during the wet period seems to have less impacts on the soil and vegetation than the summer wildfires, therefore it is suitable as a land management technique.

▸ It has a reduce cost/effect rate, especially when compared with other techniques.

▸ Can be used to promote higher landscape diversity and therefore promote biodiversity.

▸ The landscape diversity can induce a higher diversity of economic activities, therefore increasing the appeal of mountain areas, by improving the local community's livelihoods.

Leading scientist:

Dr. Antonio Dinis Ferreira
Escola Superior Agrária de Coimbra
Bencanta
P-3040-316 Coimbra
Portugal
Fax: +351 239802979

➜ Contact address: ALTERRA, Soil Science Centre/ Coen Ritsema, P.O. Box 47, 6700 AA Wageningen, The Netherlands
Phone: +31 317 48 65 17
Fax: +31 317 41 90 00

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Unit of Management of Natural Resources
Head of Unit *Pierre Mathy*, Project officer *Maria Yeroyanni*