INTERNATIONAL WORKSHOP/
COLLOQUE INTERNATIONAL/
COLLOQUIO INTERNACIONAL

QUERCUS ILEX L. ECOSYSTEMS : FUNCTION, DYNAMICS AND MANAGEMENT
ECOSYSTEMES A *QUERCUS ILEX* L. : FONCTIONNEMENT, DYNAMIQUE ET GESTION
ECOSISTEMAS DE *QUERCUS ILEX* L. : FUNCIONAMIENTO, DINAMICA Y GESTION

ABSTRACTS / RESUMES / RESUMENES

organisé par

Centre d'Ecologie Fonctionnelle et Evolutive (CEPE L. Emberger) CNRS, Montpellier (France)
&
Centre de Recerca Ecologica i Aplicacions Forestals (CREAF), Universitat Autonoma de Barcelona (Spain)

17-21 September 1990
Montpellier, France, 17-19 September 1990
Barcelona, Spain, 20-21 September 1990

EFFECTS OF FIRE ON "QUERCUS ILEX L." FOREST SOILS FROM PRADES MOUNTAINS (CATALONIA, NE SPAIN)

ALCAÑIZ J.M.* ARIAS X.*, JOSA R.**, SERRASOLSAS I.***, SOLÉ A.**** and VALLEJO V.R.***
* CREAF, Universitat Autònoma de Barcelona, Bellaterra
** Lab. Sòls, Escola d'Agricultura de Barcelona.
*** Dep. Biologia Vegetal, Universitat de Barcelona.
**** Institut Jaume Almera, CSIC, Barcelona.

Forest fires are one of the main risk factors of desertification on mediterranean ecosystems. Burned forest soils could be affected by nutrient losses, by biological degradation, and by changes in physical properties resulting in modified water balance. The importance of short-term environmental hazards in the post-fire ecosystems regeneration has been emphasized (De BANO & CONRAD, 1978; WALKER et al, 1988). This paper shows some results of the first year of an integrated study on the effects of an experimental forest fire upon soil physical, chemical and biological properties.

EXPERIMENTAL DESIGN AND FIRE CHARACTERISTICS

A fire of medium intensity was simulated in a 800 m2 experimental plot of 40-60 years old holm oak forest. All vegetation was previously cut down and trunks and big branches removed. Remaining branches and leaves (87.2 Mg/ha fresh weight) were uniformly distributed over the soil surface and burned. Fig.1 shows the evolution of temperature during the combustion phase. Organic level of soil reached a maximum of 300 C, but at a depth of 2.5 cm temperature did not exceed 60 C. At 0, 0.5 and 1 m above soil surface, temperatures often went beyond 600%C. Front fire potential was estimated to be 9350 cal/cm/s which can be considered a medium value.

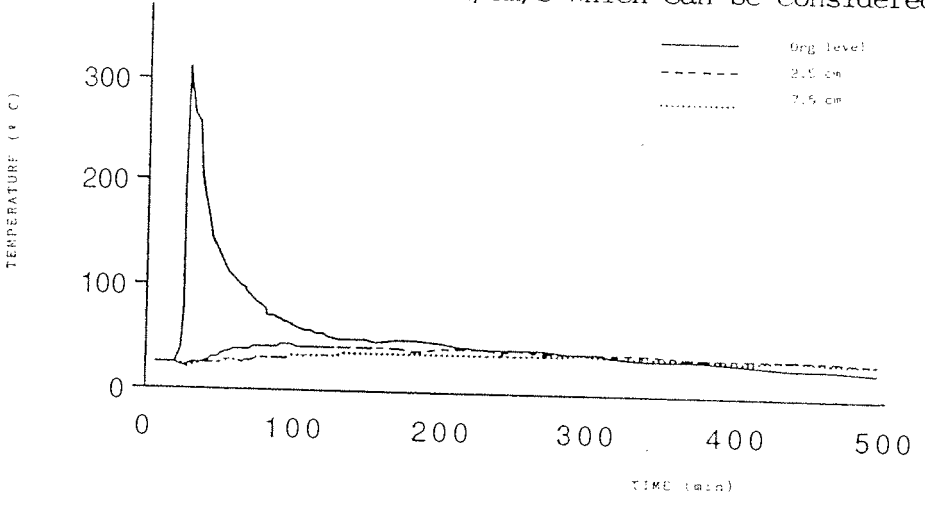

Figure 1. Soil temperature evolution in the experimental fire.

EFFECTS OF FIRE ON SOIL PROPERTIES

Almost all plant biomass and some 45% of the forest floor organic matter disappeared by direct combustion. Ashes covering soil surface were mixed during the first year after the fire with residual and scorched forest floor and some mineral soil from erosion.

Nutrient losses by combustion or volatilization were very important for N: a 65 % of the total N present in the biomass deposited and in the forest floor. Otherwise, only a 0.5% of the remaining N from organic horizons was exported out of the plot the year after the fire by leaching and erosion. Ecosystem regeneration could be severely limited by N shortage.

Litter decomposition did not show great differences between burned and control plots, weigth loss amounted 15-20 % one year after fire.

Field soil respiration, including root respiration, is higer in burned and control plots (fig 2, data from G.Fusté), but differences started the spring after fire, and with great fluctuations. This fact can be explanaited by different microclimatic conditions, ash fertilization, and the growth of annual herbaceous plants in burned plots compared to natural forest. Soil respiration levels are the same range as those reported by RAICH & NADELHOFFER (1989) for forest ecosystems at similar latitude and very close to Quercus ilex forest in France (BILLES et al., 1971, LOSSAINT, 1973).

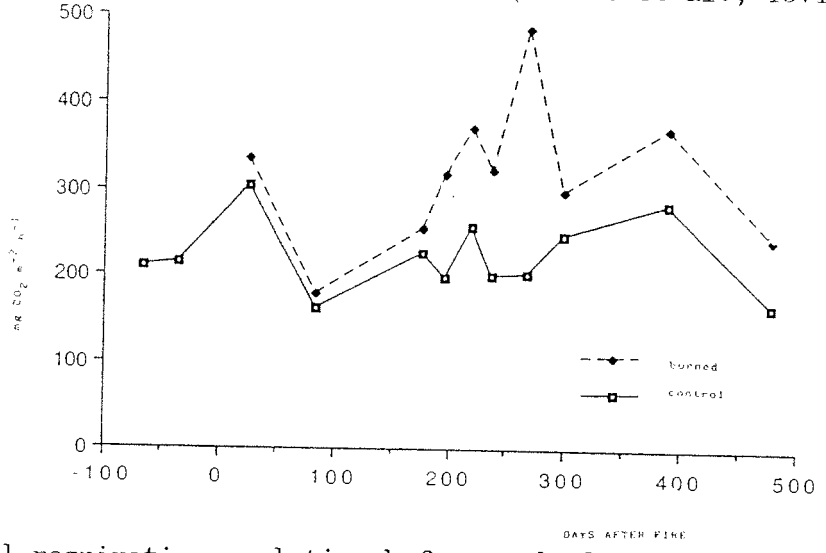

Figure 2. Soil respiration evolution before and after the fire.

Surface levels has been down 3 cm due to the destruction of the organic horizons during burning. Another cm has gone down by surface compactation and redistribution of ashes and mineral particles.

REFERENCES

BILLES, G.; LOSSAINT,P. & J.CORTEZ, 1971.- L'activité biologique des sols dans les ecosystèmes mèditerranées. I Mineralization du carbone. Rev.Ecol.Biol.Sol.,VII 4, 375-396.

DeBANO, L.F. & CONRAD, C.E. 1978.- The effect of fire on nutrients in a chaparral ecosystem. Ecology, 59, 489-497.

LOSSAINT, P. 1973.- Soil vegetation relatioships in Mediterranean ecosystems of southern France. In F. di Castri and H.A. Mooney, eds. Mediterranean type ecosystems: origin and structure. Springer-Verlag, New york USA. pp 199-210.

RAICH, J.W. & K.J.NADELHOFFER, 1989.- Belowground carbon allocation in forest ecosystems : global trends. Ecology, 70(5), 1346-1354.

WALKER J. & RAISON R.J. & P.K. KHANNA, 1988.- Fire. In:Russell I.S.& Isbell R.F. (eds). Australian soils. The human impact. Univerity of Queensland Press. Chapter 8. pp188-216.