

## **Problems of dynamic in mediterranean forests**

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**Resumen:** Quézel, P. *Problemas de dinamismo en los bosques mediterráneos. Lazaroa*, 5: 25-32 (1983).

Los ecosistemas forestales mediterráneos constituyen una unidad compleja diferenciada de los del norte y centro europeos por su clima, ecología y uso.

Estos ecosistemas están relacionados con un clima de sequía estival de 1 a 6 meses de duración y las especies peculiares que los componen carecen en general de valor económico. La presión antrópica se ha ejercido especialmente por el pastoreo y además han sido profundamente afectados por incendios durante muchas décadas. Su gran variedad, relacionada con la heterogeneidad bioclimática y edáfica de la región puede explicar el porqué del conocimiento fragmentario en cuanto a su funcionamiento y dinamismo.

Además, sus características ecológicas y edáficas hacen difícil el uso de esquemas y modelos acuñados para los bosques centroeuropeos.

**Abstract:** Quézel, P. *Problems of dynamic in mediterranean forests. Lazaroa*, 5: 25-32 (1983).

The mediterranean forest ecosystems constitute a complex unit which is marked off the Northern and middle european ones by its climate, ecology and management.

The ecosystems are related to a climate with estival drought lasting from 1 to 6 months and the peculiar species which constitute them are generally not worth much.

The anthropic pressure exerts especially by grazing and moreover they have been stricken by dramatic fires for many decades. Their large variety related to the bioclimatic and edaphic heterogeneity of the region can explain why the data concerning their functioning and dynamics are still fragmentary.

Besides, their ecological and pedological characteristics make uneasy the use of schemes and patterns designed for middle european forests.

All the studies about the dynamics of the forest ecosystems in the mediterranean region should take into consideration their specificity of

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structure and ecophysiological requirements as well as the way the man have been using them for 7 or more millenaries. First of all, we shall shortly call up the special features of these forestal ecosystems with respect to the middle european ones, as it has been done, at least partly in some recent reviews (DI CASTRI *et al.*, 1981; MARGARIS and MOONEY, 1981; CONRAD and OECHEL, 1981; QUEZEL, 1982).

This specificity is clearly shown by various factors:

#### 1) *Climatic and bioclimatic factors*

The main feature is a period of summer water deficit, lasting from 1 to 6 months, according to the areas (DAGET, 1977; NAHAL, 1981). The morphological, phenological and ecophysiological adaptations especially the estival rest of the vegetation, are under dependence of the summer water deficit. On the other hand, the amount and the rhythm of rainfall play a leading part in erosion which has the heaviest effects on the upper horizons of the soils and sweeps away large amounts of litters, whether humifield or not (FOURNIER, 1972).

#### 2) *Physionomical factors*

The mediterranean forests have both sclerophyllous trees and large formations of mediterranean conifers the degradation of which leading to shrubby evergreen formations of matorrals (maquis and garriques).

#### 3) *Biological factors*

In opposition to the widely-held opinion (QUÉZEL, 1974) the mediterranean forests have a spread range of main forest species: about 5 sclerophyllous oaks, 12 deciduous oaks, 5 pines, 3 cedars and 10 firs. Moreover there is a lot of micromorphs related to an intensive genecological variability, the economical and ecological interest of which is increasingly pointed out.

#### 4) *Management and conservation*

The mediterranean forests are almost characterized by few productive coppices of varied ages, the low profitability of which induced many Forest departments to take no further interest in them. Besides, due to the wide range of the climatic, edaphic and geographic criteria, they constitute a multitude of ecosystems many of them are currently vulnerable or threatened. Most of them are used as grazing lands. Nevertheless, a growing neglect, almost in the industrialized countries, has turned them into recreational forest devoted to tourism and land-speculation, where fires have been increasingly and dramatically spreading.

However, this picture has to be moderated. Indeed, for all the mediterranean forest ecosystems, we should emphasize some contrasts inducing locally

varying situations. If we consider the vegetation structures (QUÉZEL, 1974), three groups can be distinguished:

— The lower altitudinal level forest ecosystems (thermo-and mesomediterranean): They are mostly sclerophyllous; their productivity is very low and even nonexistent; the risk of fire and the anthropic pressure (tourism, scattering of residences) are extremely high.

— The middle level forest ecosystems (supramediterranean): They are mostly deciduous, their productivity is middle or low; fires are uncommon and the anthropic action varies.

— The upper level forest ecosystems (mountain mediterranean): Constituted by conifers of interest, their productivity is rather high, fires are quite uncommon and the anthropic pressure is moderate.

As for the use by man, we have to emphasize the notable contrast between the forest ecosystems of the Northern mediterranean countries and the Southern and Middle-eastern ones.

In the Northern mediterranean region, the disaffection of the traditional activities, the underpopulation and the increasing disappearance of sheep-grazing induce a natural restauration of the forestal assets —unfortunately uncontrolled— and an invading of brushes which greatly increases the risk of fire.

On the contrary, in the Southern mediterranean region, the uncontrolled overexploitation of forests, related to the increase in rural population, grazing and offenses involves the increasing disappearance of the remanent forestal potentialities.

### **Specific problems related to the dynamics of the forest ecosystems in the mediterranean region**

The estimation of the dynamics of the mediterranean forest ecosystems and, moreover, the adjustment of reliable patterns, do present us with serious problems.

#### *The level of our knowledge*

The complexity of the mediterranean forest ecosystems has not made studies easy. However, some teams, and particularly within the framework of the IBP, have drawn up various biogeochemical statements in the french mediterranean region, specially in *Quercus ilex* (LOSSAINT and RAPP, 1971; ETTEHAD et al., 1973), *Pinus halepensis* (LOSSAINT and RAPP, 1971; RAPP, 1974), *Pinus pinaster* (RAPP and CABANETTE, 1981). Although these data are valuable, they don't allow us to draw valid conclusions about the whole mediterranean region. So, in Marocco, at least 12 special ecosystems related to climatic and edaphic criteria have been evidenced (BARBERO et al., 1981) in *Quercus ilex* forests and we still know nothing whatever about their

dynamics! This aspect have not yet been studied for many major mediterranean trees (for instance: *Quercus calliprinos*, *Quercus suber*, *Pinus brutia*, and the mediterranean *Abies*). For the moment, our knowledge is limited to the problems of structure, edaphoclimatologic requirements and, incidentally, to the forestal production and even biomass. Our lack of information about the sylvicolous concern in the mediterranean forest-ecosystems becomes obvious since no statement is available dealing for instance with the productivity of the major species. Figures often vary in the ratio of 1 to 4 and even 1 to 10 according to the situations or the authors.

Production tables are still nearly lacking. The evaluation of biomasses is only partial and the methods have not yet been quite codified (GRILLAS, 1980; BARBERO, 1981).

Table 1

<i>Species</i>	<i>Author and country</i>	<i>Bracket of productivity (hard-wood) M3/Ha/Year</i>
<i>Pinus brutia</i>	AKMAN, BARBERO & QUÉZEL, 1979 (Taurus)	1-7
<i>Pinus nigra</i> subsp. <i>pallasiana</i>	«idem»	2-8
<i>Tetraclinis articulata</i>	BENABID, 1976 Maroc	0,3-1,67
<i>Pinus sylvestris</i>	MOUNET et SAULENC 1978, Drome (F)	0,4-2,7
<i>Quercus pseudocerris</i>	CHALABI, 1980 Syrie	2,1-7,57
<i>Cedrus atlantica</i>	M'HIRIT Rif-Maroc	1,59-9,8

### *The climatic stresses*

Whereas in the european countries, with a few exceptions, the functioning of the ecosystems keeps on performing throughout the warm period, in the mediterranean region, this functioning is badly disturbed by a summer drought period. This fact is not always evidenced in global statements. Drought tolerance is one of the most striking features of the mediterranean forest ecosystems. This point has been already investigated especially by using sap pressure measurement (AUSSENAC, 1980; BRAESCO, 1980; VALETTE, 1981).

All these methods come up against the following problem: how can we carry

out reliable estimations of the various types of evapotranspiration (CALVET, 1981) and particularly the actual evapotranspiration?

### *The edaphic stresses*

The mediterranean forest ecosystems are quite uncommon on mature zonal soils but they usually settle on truncated or even eroded soils or on fossil fragmented soils such as «terra rossa», so that productivity as well as biogeochemical statement may show a large heterogeneity, even inside very small experimental spots. The mediterranean forest ecosystems are actually related to the hydric statement of each individual, according to its rooting and water-availability. Moreover, the transferts of materials by erosion give rise to a lost of biological materials and nutrients. It is difficult to estimate the actual total amount of this lost.

### *The biotic stresses*

They are mainly effective on the level of the vegetation structures and the upper horizons of the soils. The sclerophyllous or coniferous mediterranean forests constitute complex ecosystems where the arborescent stratum is associated with various understory vegetations, sclerophyllous too, which play a prominent part in the dynamic of the ecosystem. These understory vegetations contribute, according to the edaphoclimatic conditions, to a share ranging between 20 % and 70 % of the total biomass; so, we have to take them into consideration when establishing statements. In fact, it'll be better using a methodology similar to the one proposed for mattorals (FEUILLAS, 1979; BARBERO, 1981) or californian chaparrals (PILLSBURY and KIRKCEY, 1981) than using the methodology classically commended for forest ecosystems.

On the other hand, summer drought causes the mineralisation process of the litters to be very late (THINON, 1978) and even absent. Those litters will get at last swept away by wind or erosion or ruined by fires.

### *The anthropozoogenic stresses*

They are the most preponderant among the present mode of utilisation of the mediterranean forest ecosystems. If we shall mention only as a reminder the direct part played by man in the forests regarded as recreational areas, we have to emphasize the effects of grazing and fires in forests. On the other hand, problems linked to the industrial pollution are yet very limited or generally absent.

In the mediterranean forest ecosystems, the biological material has always been traditionally used for forest pasture. We shall not deal with the leading part played by forest pasture in the stability of these ecosystems (LE HOUEROU, 1980) but we shall emphasize its outstanding importance in their dynamics. Indeed, in most of the mograbin countries, some 10 to 40 % of the

annually produced biological material is grazed by cattle. The part reverting to the soil and its efficiency in the biogeochemical cycles yet remains difficult to rate (losses due to shifting, secondary productivity, etc...).

Fire does much greater damage and this problem cannot be over-emphasized in the mediterranean forest ecosystems owing to its dramatic increase in the last decades (it has been increasing fourfold between 1930 and 1980). Since the beginning of the century, about the quarter of the mediterranean forests have been destroyed or affected by fires. Thus, this factor has to be taken into consideration in every program aiming at testing the stability and the evolution of the mediterranean forest ecosystems. That implies on the one hand accurate understanding of the dynamics of the vegetation with respect to the frequency of fire (TRABAUD, 1980; BARBERO and QUÉZEL, 1981) and, on the other hand, drawing up special patterns integrating the fire-risks, the structures of vegetation, their inflammability and combustibility as well (DELABRAZE and VALETTE, 1977).

### CONCLUSION

The above reflexions evidence the special characteristics of the mediterranean forest ecosystems. The priorities are not identical with those of middle and northern european forests. Thus, a great deal of fundamental studies have to be achieved in order to get quite good understanding of the dynamic processes. A close international cooperation has become a more imperious necessity than ever for starting indispensable research programmes and coordinating the existing ones. This cooperation does already exist, especially through FAO and UNESCO or teams such as «Sylva mediterranea» or GRECO 43 (Ecology of the mediterranean forests) but should be widely strengthened.

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