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Post-fire resprouting of shrubby species in Mediterranean maquis

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Abstract

The vegetative resprouting of mediterranean maquis shrubby species was examined eight years after fire. Post-fire regeneration occurs through the resprouting of stumps. All species (*Quercus ilex* L., *Phillyrea latifolia* L., *Arbutus unedo* L., *Erica arborea* L., *Pistacia lentiscus* L.) show a rapid growth in the first years after fire, and a decrease already from 4th–5th year.

All the species survived the fire and reconstituted a community similar to that unburned in a relatively short time span.

Nomenclature: Pignatti, S. 1982. Flora d'Italia. Edagricole

Introduction

The ecological effects and the evolutionary role of fire in Mediterranean vegetation have long been studied (Naveh 1975; Trabaud 1976, Trabaud & Lepart 1980; Arianoutsou-Faraggitaki & Margaris 1981; Trabaud & De Chanterac 1985; Westman & O'Leary 1986; Zammit & Zedler 1988; Thanos & Marcou 1989). Mediterranean shrub communities have developed some mechanisms that help them to overcome the action of fire (Arianoutsou-Faraggitaki 1984; Keeley 1986; Westman & O'Leary 1986).

Most sclerophyllous shrubs exhibit a very efficient vegetative regeneration strategy. *Pistacia lentiscus* is one of the most resistent shrubs to fire (Naveh & Dan 1973). All Ericaceae produce vigorous sproots and can also regenerate by means of seeds, for this reason they dominate the early successional stages of burned maquis (Naveh 1974). *Cistus* ssp. play a pioneer role after fire (Thanos & Marcou 1989). Fire activates germination of the dormant seeds lying in the soil, rupturing seed coats and permitting the entrance of water and subsequent imbibition (Arianoutsou-Faraggitaki 1984; Aronne & Mazzoleni 1989). *Cistus monspeliensis* is one of the few species which reproduces exclusively by sexual means (Trabaub & De Chanterac 1975).

This paper analizes the vegetative resprouting of the most typical mediterranean shrubby species after fire.

Study area

The study area is located in the maquis community along the Latium coast, inside the Estate of Castelporziano (S-SW of Rome). It lies on leached with pseudogley soils (Gisotti & Collamarini 1982). Climate is Mediterranean, with strong maritime influence. Mean total rainfall is

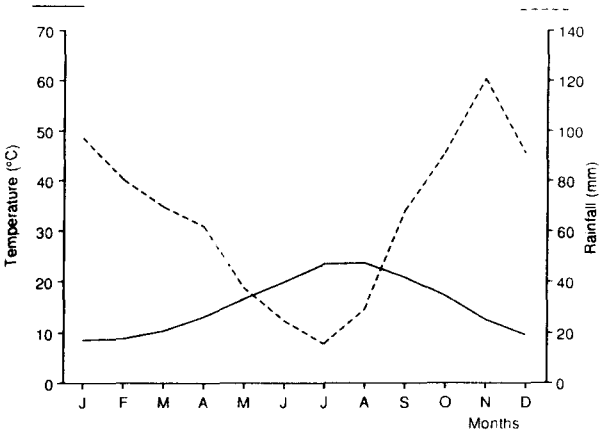

Fig. 1. Climadiagram of Castelporziano (mean 1969–1972; 1981–1990, data of the Station inside the Estate). (—— = Temperature; --- = rainfall).

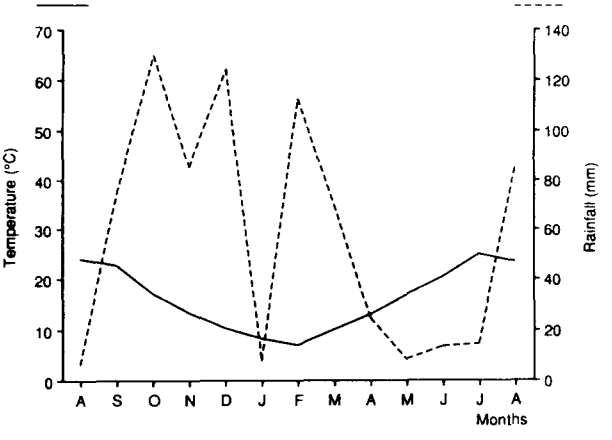

Fig. 2. Trend of temperaure (——) and rainfall (---) from August 1982 to August 1983 at Castelporziano.

of 784 mm, most of which falls in autumn and winter. Dry period is between June and August (Fig. 1). The study area was destroyed by fire in August 1982.

Two plots (25 m^2 each) representative of the community and structurally homogeneous were identified. Of each species and of each stump (Barbero & Miglioretti 1984; Miglioretti 1986; 1987; Amadori & Gratani 1990), we considered:

- number of shoots, their base circumference and length
- number of the dead shoots and their base circumference
- mean and maximum heigth of shrubs

Table 1. Structural data sampled in 1989 in areas A and B (max circ. = maximum circumference).

Species	N° living stumps	N° dead stumps	N° seedlings	Max circ. living shoots cm	Max circ. burned shoots cm	$\bar{h}$ shoots cm	Max h shoots cm	N° living shoots	N° dead shoots	Basal area cm^2/sqm
					AREA (A)					
Quercus ilex	5			12	40	200	250	80	12	5.7
Phillyrea latifolia	10			10	22	185	260	117	46	7.4
Arbutus unedo	5	1		14	40	180	235	47	16	7.2
Erica arborea	2			10	34	190	235	62	26	4.8
Pistacia lentiscus	3			6	16	140	210	5	5	0.3
						total/sqm		12.4	4.3	25.4
					AREA (B)					
Quercus ilex	4			10	38	200	260	49	10	3.6
Phillyrea latifolia	10	1	7	10	22	190	275	75	63	5.0
Arbutus unedo	5			12	38	230	280	36	36	6.2
Erica arborea	2			9	30	190	260	14	24	0.7
Pistacia lentiscus	3			5		130	175	10	5	0.3
						total/sqm		7.4	5.5	15.8

- number of seedlings
- base circumference and height of the burned trunk skeletons left standing in the area.

In each area two dominant shoots of the following species were selected and cut: *Quercus ilex*, *Phillyrea latifolia*, *Pistacia lentiscus*, *Erica arborea*, *Arbutus unedo*. The age of these shoots was established by the count of growth rings at the base. The elongation process was reconstructed by the count of growth rings at 30 cm intervals, from the base to the top of the shoots.

Results and discussion

Eight years after fire the maquis appears well reconstituted in its structure, the mean height of *Quercus ilex*, *Phillyrea latifolia*, *Pistacia lentiscus*, *Erica arborea* and *Arbutus unedo* varies between 2 and 2,5 m, lower than the height antecedent fire, established by measuring the burned trunk skeletons left standing in the plots studied.

Probably the autumn and spring rainfall following the fire favoured resprouting (Fig. 2). The climatological conditions might have contributed to the better recovery of the burned plots.

Structural data (Table 1) gathered in the plots show that almost all the stumps have resprouted; only one *Arbutus unedo* in area A and one *Phillyrea latifolia* in area B are dead. In area B there are seedlings of Phillyrea. The elevated heights of the shoots show that the species have already expressed most of their capacity for growth in length. Figure 3 shows the number of shoots by circumference class: a high number of shoots occurs in the classes with the smallest circumference, which also exhibit a high degree of mortality (Fig. 4). This suggests that the selection process is not yet complete. *Arbutus unedo*, instead, also shows mortality in the highest classes of circumference and an already normal distribution.

The growth in length curves of the dominant shoots after fire shows that all the species regenerated in the first year. Only *Pistacia lentiscus* shows regeneration also in the second year after fire. The growth in length is marked until the third-fourth year, after which it decreases (Fig. 5, 6). The results confirm, as a whole, that all the species have a good vegetative regeneration after fire, demonstrated by the resprouting of most of the stumps, the first year after fire, and by the rapid growth in length of the shoots. Not only *Pistacia Lentiscus*, *Quercus ilex* and *Erica arborea* are seen to be species resistent to fire, as known in literature (Naveh & Dan 1973; Naveh 1974; Naveh 1975; Trabaud & De Chanterac 1985), even *Phillyrea latifolia* seems to play an important role in the reconstitution process after fire. In fact it shows a high basal area, a high number of shoots and the occurrence of seedlings. Without external interferences they are able to reconstitute a community similar to that unburned. The methodology adopted, helped us to evaluate, a posteriori, the capacity and time recovery of shrubby maquis species after fire.

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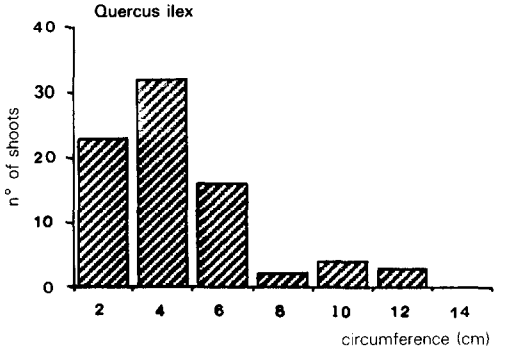
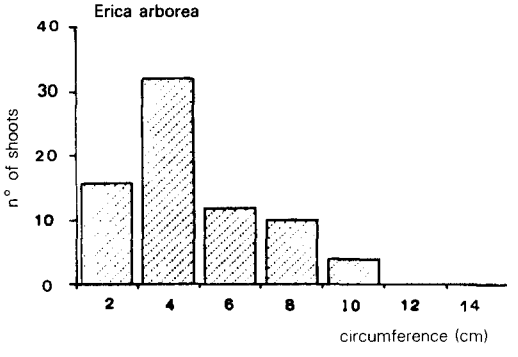
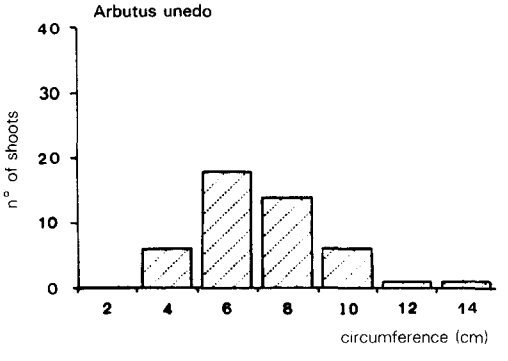
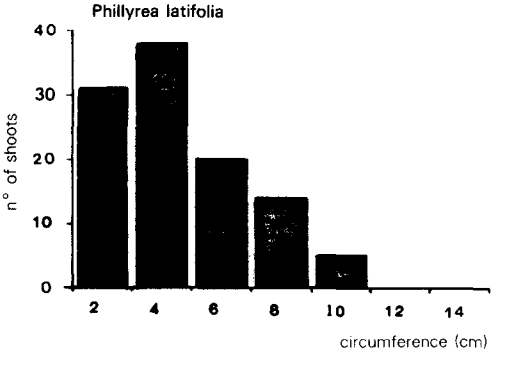
AREA (A)

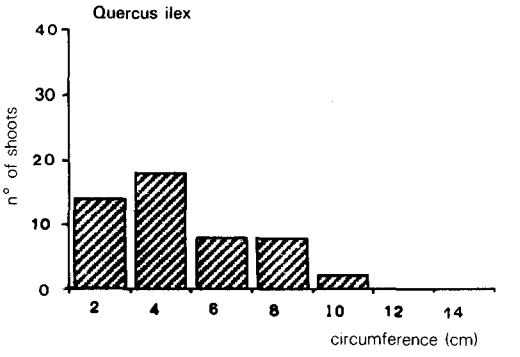

Quercus ilex
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)


Erica arborea
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)


Arbutus unedo
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)


Phillyrea latifolia
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)

AREA (B)


Quercus ilex
n° of shoots
0
10
20
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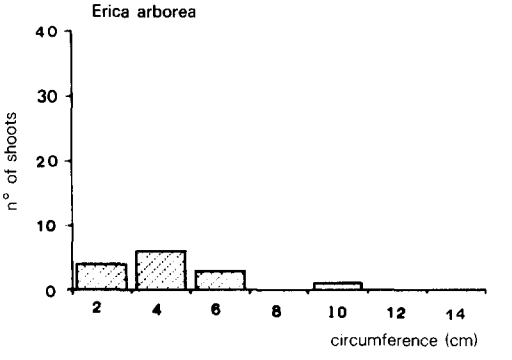
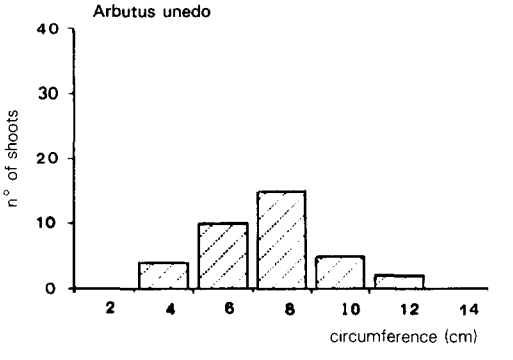
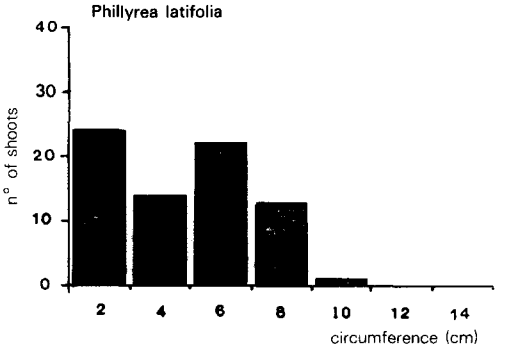
40
2
4
6
8
10
12
14
circumference (cm)


Erica arborea
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)


Arbutus unedo
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)


Phillyrea latifolia
n° of shoots
0
10
20
30
40
2
4
6
8
10
12
14
circumference (cm)

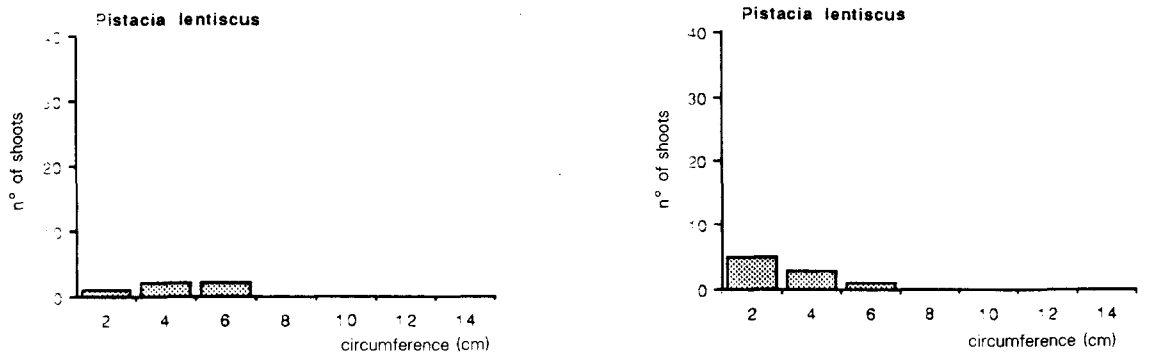


Fig. 3. Number of shoots in circumference classes for the species in areas A and B.

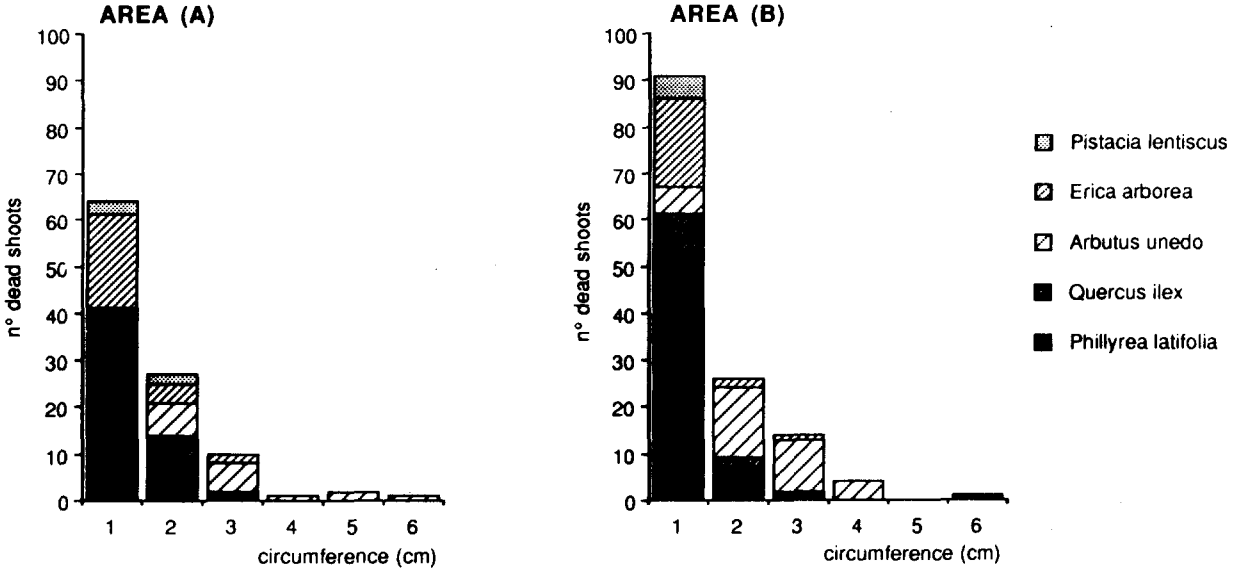


Fig. 4. Number of dead shoots in circumference classes in areas A and B.

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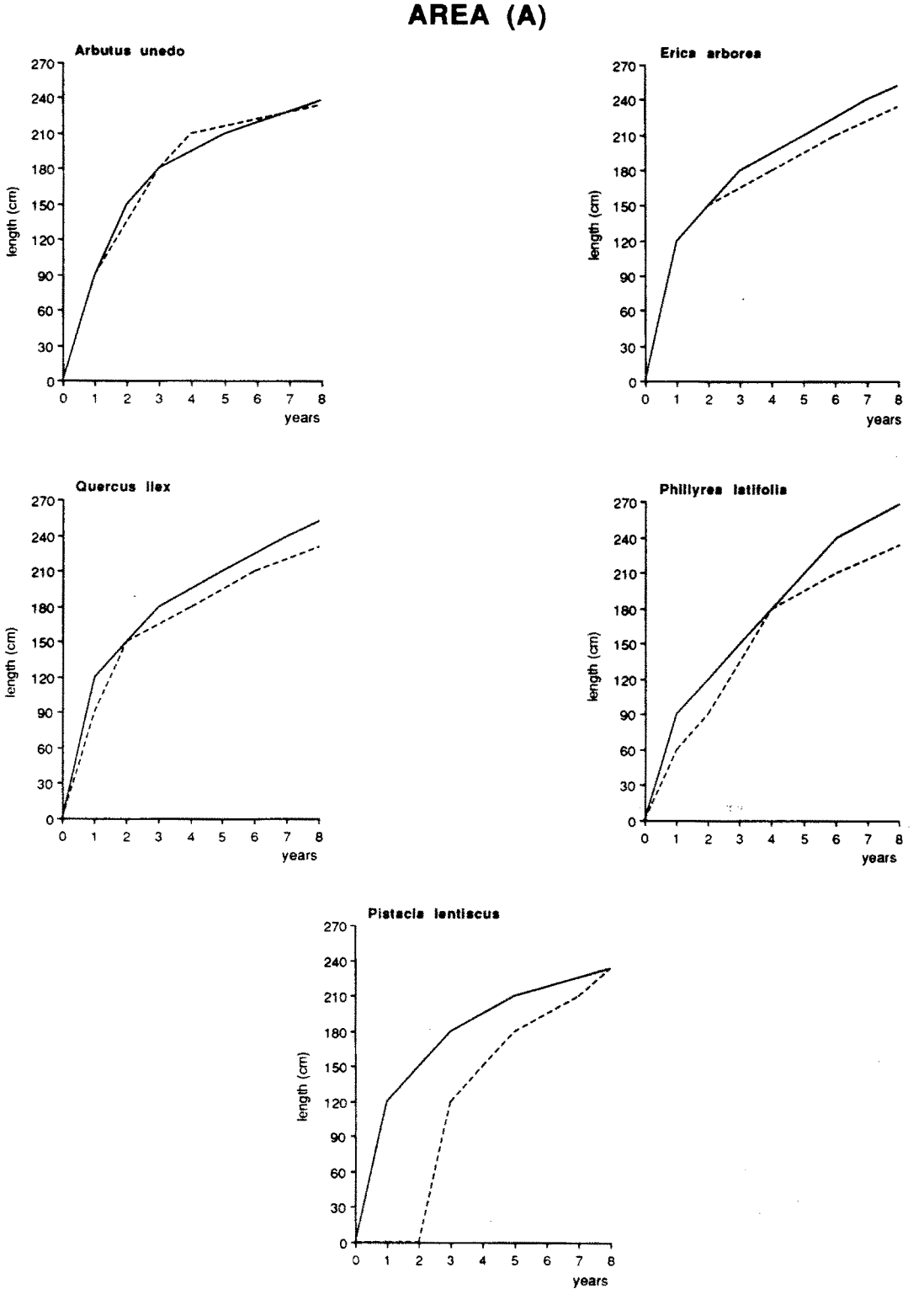

Fig. 5. Elongation process during the years after fire for the two dominant shoots (—— and – – –) sampled for each species in area A.

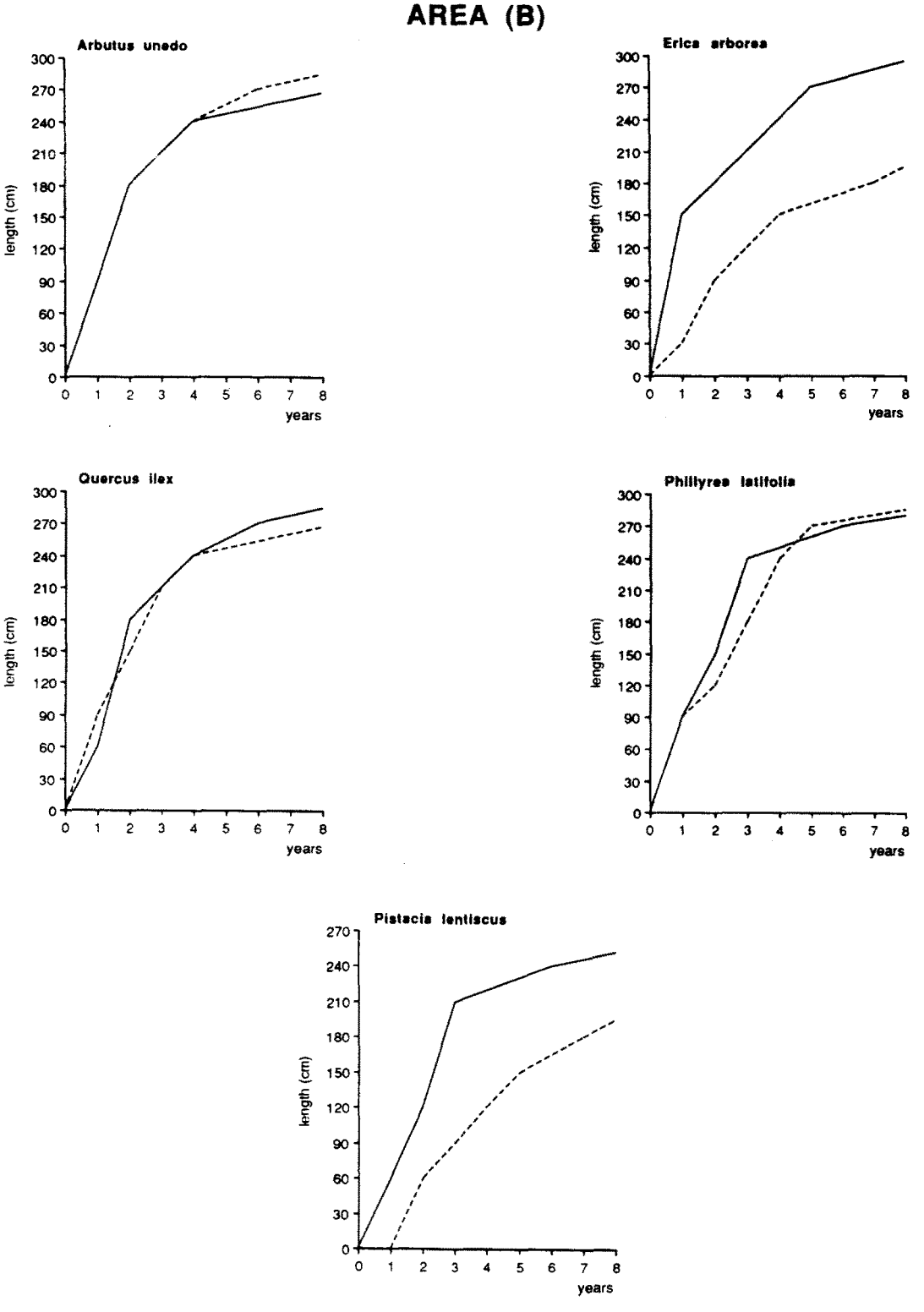

Fig. 6. Elongation process during the years after fire for the two dominant shoots (—— and – – –) sampled for each species in area B.