DESERTIFICATION DUE TO AIR POLLUTION IN ATTICA

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Summary

In this work some productivity characteristics as well as the regeneration capability of two typical mediterranean-type Attican ecosystems are considered in relation to their air-pollution load. It is found that both the primary production and the regeneration of the most polluted area (Korydalos) is strongly eliminated, and this finding is taken as an obvious signal of degradation which is gradually directing the system to a desert situation, due to air-pollution.

1. INTRODUCTION

Air pollution is known to have detrimental effects on plants, usually at the productivity level (1,2,6,8). The perturbation happening is also affecting systems' stability. Recently, in a project dealing with the action of air-pollutants on Attican natural ecosystems (5), we found that in the more stressed areas plant species diversity and productivity are strongly eliminated, while some of the typical plants of these systems appear visual symptoms of perturbations (see Psaras et al., in the same volume).

This paper discusses in more detail the effects of air pollution on some characteristics of the primary production of two experimental sites, selected among a net of stations (5) as the most representative ones. Special emphasis is given on the systems' capability to reestablish themselves through regeneration.

2. EXPERIMENTAL SITES

The selection of the study sites was based on previous data which concerned their productivity characteristics (5) as well as on our macroscopical observations. These sites are Korydalos and Varkiza. The former is found on a slope of Egaleo mountain facing Piraeus and the latter is Varkiza, located on a southern slope of mountain Hymettus, east of Athens.

3. EVALUATION OF THE ORIGIN OF THE STRESS; ENVIRONMENTAL OR ANTHROPOGENIC?

Petrall (7) has tried to compare sociological systems with natural ones. For this reason, he used the percent coverage of each plant species in a plant community as a criterion of its importance value. Analysing many phytosociological tables, he constructed summation curves, where the relative importance of a plant species is accumulated from the least to the most important ones. Using summation curves constructed according to this technique it is possible to distringuish between systems found under natural stress and those subjected to anthropogenic ones.

Figure 1 is revealing summation curves constructed for the Korydalos and Varkiza areas using as a parameter the plant relative coverage.

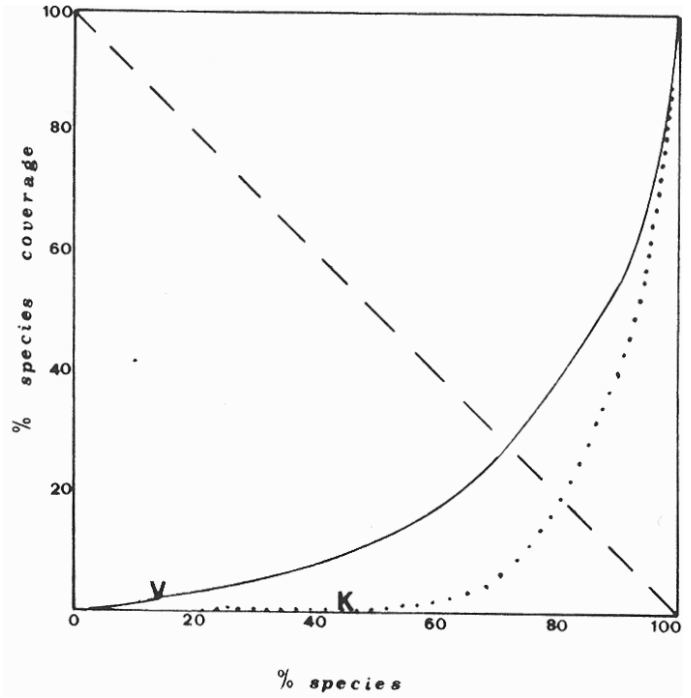

Figure 1. Petrall's summation curves for the two ecosystems studied.
K: Korydalos, V: Varkiza.

Although the results are relative (3), the following remarks can be drawn:

1. It seems that both ecosystems tested are under environmental stress and this is something normal if we consider that these systems are mediterranean ones and they are facing the problem of water shortage.
2. From the shape of the curves we can deduce that Korydalos area is under a severe anthropogenic stress, since the infection point of the curve almost drops to the abscissa. On the other hand, Varkiza reflects the existence of a typical environmental stress, normally occurring in mediterranean-type ecosystems.

4. PRODUCTIVITY CHARACTERISTICS

As it is stated in the introduction, air pollution has a direct effect on productivity level. Table I contains data dealing with productivity characteristics of the two selected studying areas. The information drawn from these data are strong evidence of degradation of the Korydalos system. For example, the total above-ground plant biomass is almost 40% lower in Korydalos, comparing to that of Varkiza, while the same is true also for the relative portion of the green biomass. The low percentage of the green biomass, means of course minimization of a photosynthetic tissues, which make the ecosystem active and productive. Furthermore, considering that tissues appear serious structural damages (see Psaras et al., in the same volume), the result is more severe.

Table I. Productivity characteristics of the two ecosystems studied.

	Korydalos	Varkiza
1. Total above-ground biomass ($g.m^{-2}$)	152.0	245.0
2. Plant cover (%)	50.0	44.0
3. Ratio of 1/2	3.0	5.6
4. Green parts (%)	27.7	44.3
5. Leaf Area Index ($cm^2.m^{-2}$)	3078.0	9254.0

5. SYSTEMS' REJUVENATION

The next step of our effort was to find whether the ecosystems are affected from the air pollution up to the level of their regeneration capabilities. For this reason we estimated the age distribution patterns in both studying areas, using as a testing plant a typical woody one, usually dominant in these ecosystems. The plant is the subshrub *Euphorbia acanthothamnos* and the method followed was the measurement of its canopy diameter and its mathematical relation with age (4).

Figure 2 makes clear that a serious perturbation is going on in Korydalos ecosystem, since the age classes 0-5 years is strongly eliminated, while on the other hand this is not valid in the Varkiza case. where a real age pyramid occurs. This fact means that the Korydalos ecosystem is loosing its vigour and it is gradually transformed to a senescent system with no young individuals, finally lacking rejuvenation.

Another very interesting point is that the age classes 5-10 years in Korydalos area are of the same order with those of 0-5 years in Varkiza and this actually suports the idea that at least 5 years ago air pollution started affecting Korydalos site. It is really peculiar, but the trigger of all political crises and people's environmental awareness connecting with air pollution coincide timely with this finding.

6. SOME GENERAL REMARKS

Without doubt our findings could be characterized as preliminary, but they do support the idea of an evercoming desertification in some of the heavier air polluted natural Attican ecosystems both on the productivity level as well as on their reproduction mechanisms. It seems that either the seeds cannot germinate or the young seedlings are not able to survive in this changed environment.

Apart of the completness or not of these data, and provided that before them we knew nothing, we consider them as very interesting and significant, since they consist the first steps in a direct action for the future management, which in nowadays is strongly needed.

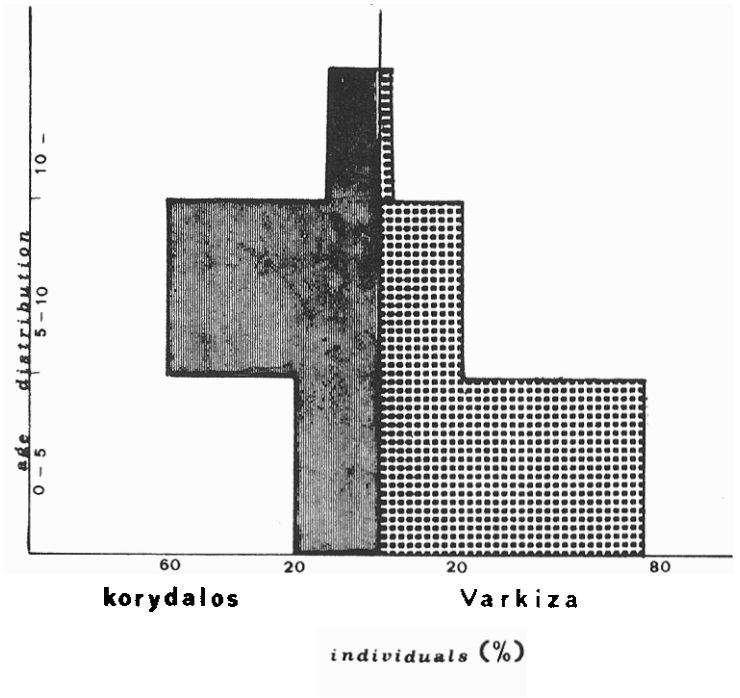

Figure 2. Age distribution of *Euphorbia acanthothamnos* Individuals. Classes 0-5, 5-10 and 10- years.

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