



National Library of Canada
Collections Development Branch

Canadian Theses on
Microfiche Service

Bibliothèque nationale du Canada
Direction du développement des collections

Service des thèses canadiennes
sur microfiche

NOTICE

The quality of this microfiche is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us a poor photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this film is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30. Please read the authorization forms which accompany this thesis.

**THIS DISSERTATION
HAS BEEN MICROFILMED
EXACTLY AS RECEIVED**

AVIS

La qualité de cette microfiche dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de mauvaise qualité.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, examens publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de ce microfilm est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30. Veuillez prendre connaissance des formules d'autorisation qui accompagnent cette thèse.

**LA THÈSE A ÉTÉ
MICROFILMÉE TELLE QUE
NOUS L'AVONS REÇUE**

A REGIONAL APPROACH TO THE FOREST-GRAZING LAND-USE CONFLICT
IN A MEDITERRANEAN REGION

by

Elias Yanniris

A Thesis
presented to the University of Ottawa
in partial fulfillment of the
requirements for the degree of
Master in Urban and Regional Planning (M.Pl.)
in
SCHOOL OF URBAN AND REGIONAL PLANNING

Ottawa, Ontario, 1980

(c) Elias Yanniris, 1980

© E . Yanniris, Ottawa, Canada, 1980



UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

I hereby declare that I am the sole author of this thesis.

I authorize the University of Ottawa to lend this thesis to other institutions or individuals for the purpose of scholarly research.

Elias Yanniris

I further authorize the University of Ottawa to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

Elias Yanniris

to my wife

leaves move upwards
leaves move downwards
in the forest.

Every moment the forest reinsures itself
with thousands of green actions;
thousands of insects-messengers come and go,
-insects being unaware, acting in the name of life-
insects-pimps, insects-peddlers, insects-goldsmiths,
hammering the gold of pollen, making wedding rings,
betrothing light with flowers, people with trees,
carrying the luggage of Spring to the underground palaces
of the earth.

Later on, a lily rises like a snow-white pediment,
crowning the building of a mystic liturgy.

The sky approves our efforts.

Yannis Ritsos (from the Collection:
"The Architecture of the Trees" - 1958).



PREFACE

This thesis is the result of two years work. To me, however, it is more than just the fulfillment of the requirements for the degree of M.Pl. The thesis became a close companion with whom I had a long and intensive dialogue. During this dialogue I felt many times that I was discussing with Greek islanders; islanders are strange: one can discover in their words, their behaviour, and their perceptions elements which are rooted far back in the past. My dialogue with such a reality slowly revealed to me another Mediterranean which seems to be so close but yet so forgotten.

Today I feel much closer to this world than ever; a world of a striking dynamism; and a world facing many difficulties. To provide a metaphore, the Mediterranean world could be described with three Greek words: PELAGOS, KAYMOS, and METRO. The first word indicates the predominance of the sea the second a desire or an accumulation of unfulfilled wishes; and the third the human scale.

Even more, this thesis has provoked considerable change within myself. Hopefully this change represents a metamorphosis from scientific adolescence to maturity. It also re-

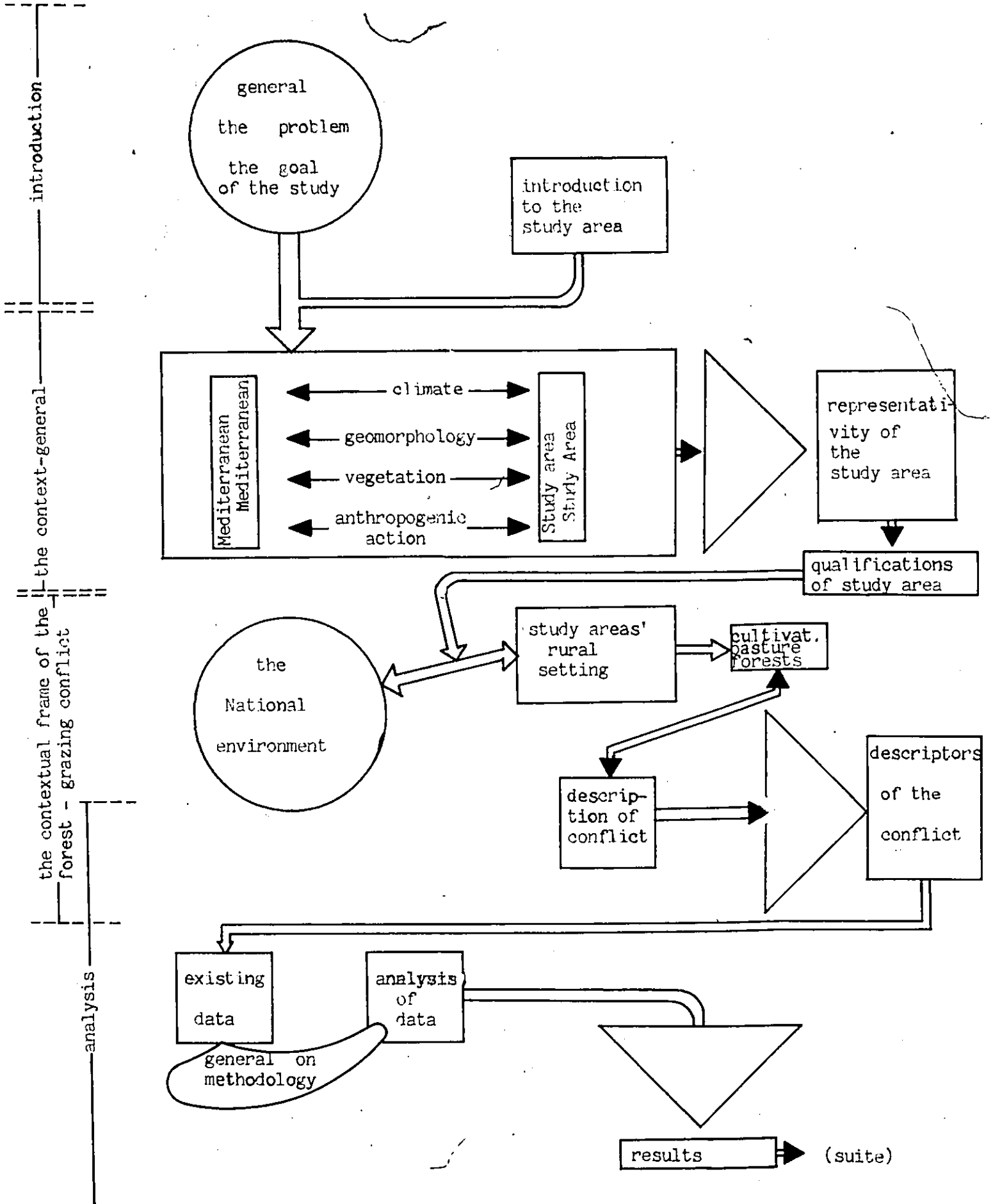
presents a fusion of academic principles with the real world, two things which often do not readily match-up.

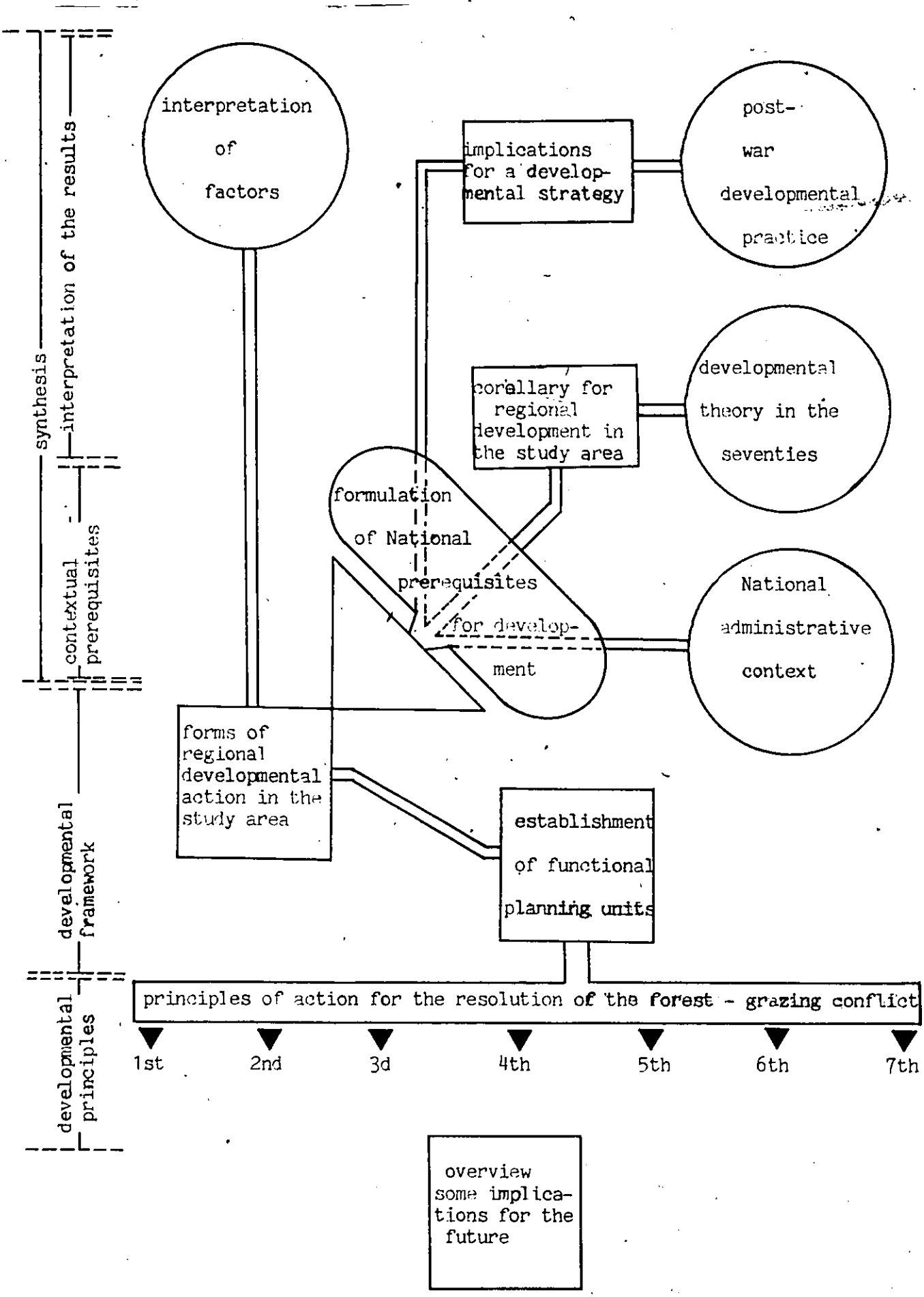
During this work I was continuously receiving encouraging positive feedback in response to my thoughts and hypotheses. In fact, "chain-thinking" was so extensive and so hard to ignore that I had to incorporate much more into the thesis than I initially anticipated. As a result, the study of the forest-grazing problem had to include information and reviews of such issues as the implications of post-war development, a review of some recent aspects of regional developmental theory, as well as a review of some important aspects of the national context, which are influential in the conflict. I tried to avoid the trap of generalizing too much, as best I could. However, I must admit that some bits of information were only indirectly related with the points to which they refer. I found it necessary though, to include them because they fall in the class of "good pieces of information". These bits, as well as many directly related ones, were forwarded at the notes section, to avoid over-congestion of the text. The creation of a second volume was unavoidable. This second volume includes all the maps, tables and figures, which accompany the text. At the end of the second volume the reader will also find the appendices and bibliographical references.

A last word; the results of this study are alarming. They reveal that the existing problems are not simply serious, but also incremental in acuteness and destructiveness. To face these problems, well-established long-term integrated action is needed. Being aware of this, I will truly consider it a great success if this thesis will contribute to a better understanding of the nature of these problems as well as of the consecutive response to these problems of the people involved and the people affected.

NOTE: In order to provide the reader with the format of the thesis to follow, a schematic presentation is shown below.

CONCEPTUAL LAYOUT OF THE THESIS





ACKNOWLEDGEMENTS

Many people contributed to this thesis. I particularly wish to thank Dr. Michel Phipps, Director of the Department of Geography of the University of Ottawa, for his ingenious advisory work to this study. My appreciation to him extends particularly to his consultation technique of providing me with hints, and then letting me to undertake the creative procedure of discovery. I personally find that this approach of supervision is both creative and time saving and I consider myself lucky for having him as a thesis supervisor.

I also wish to express many thanks to my father Constantinos and my brother Yannis for their contribution in the Greek part of the literature review. My father's sharing with me of his experience and knowledge of 30 years in practice as an Agricultural Extensionist in the Ministry of Agriculture is greatly appreciated.

I also wish to offer my gratitude to A. Karaliolios, Forester of the Department of Chios, for contributing in my understanding of the local conditions surrounding the conflict, and to A. Chouliaras, Pasture Scientist of the Ministry of Agriculture, for his valuable contribution in

making available to me basic documents of contemporary pastoral issues in Greece.

Finally, I am grateful to Eric von Brusberg for his great editorial assistance. His comments on the content as a cultural anthropologist and his corrections of the text contributed much to the success of this thesis. I want also to thank George Missios and Maureen De Marco for their corrections of a part of the text.

ABSTRACT

In the Mediterranean region, for over three thousand years, a conflict has developed between grazing areas and forests. Today, this land-use conflict is more acute than ever. There are specific mechanisms through which the conflict expresses itself.

In order to study these mechanisms, a study area was selected wherein the qualifications and features have been assessed and tested. Firstly, the characteristics of the study area were examined within the overall Mediterranean context. Subsequently, a Regional Approach was established based on the fact that forest fires are a specific manifestation of the forest-grazing land-use conflict.

The methodology includes a Factor Analysis implementing a "time" versus "land-use characteristics" matrix, which is of dimensions 15 by 54 (15 years-variables, 54 individual observations). The analysis shows 4 factors as being the most significant for the evolution of the land-use system. The interpretation of these factors indicates the existence of a trend from a traditional rural system to a modernizing system characterized by market-oriented production. Within

such a context the conflict between the forest and grazing areas is identified, and evidence indicates an alarming increase in intensity.

For the resolution of such a conflict new developmental orientations must be pursued. First, certain contextual prerequisites must be fulfilled, at the national level. At the regional (study area) level, a planning process must be implemented. Such planning should be based on local conditions, and must promote the development the traditional land-use patterns. In this way, a dynamic and diverse system will be created in which humans will co-operate with nature rather than fight against it. To this end, this thesis develops specific principles which should be considered in the successful resolution of such conflicts.

TABLE OF CONTENTS

PREFACE v

ACKNOWLEDGEMENTS x

ABSTRACT xii

Chapter page

I. INTRODUCTION 1

 general 1

 the objective of this study 2

 Scope, limitations, and relevance of the study
 to the Planning Process 5

 General description of the study area 8

II. THE MEDITERRANEAN SETTING AND THE TYPICALITY OF THE
 STUDY AREA 12

 Introduction to the Mediterranean Environment 12

 Climate 13

 Geomorphology 15

 Vegetation 16

 The Anthropogenic Impact on the Mediterranean
 Environment 20

 An Overview 20

 Anthropogenic Impact on the study area 24

 Review of Chapter II 29

III. DESCRIPTION OF THE STUDY AREA 31

 Qualifications of Chios as study area 31

 The island's context 33

 Cultivations 35

 Stock-breeding 36

 Forestry 39

IV. THE APPROACH 42

 general description of the conflict: Hypothesis 42

 Forest and Range Fires as Descriptors of the
 Conflict 44

 The existing data 48

 The methodological Procedure 50

 General 50

	The Procedure	52
V.	INTERPRETATION OF THE RESULTS	55
	plane I-II	55
	plane I-III	58
	plane II-III	61
	planes I-IV and II-IV	61
	An overview of the analysis	62
	The land-use system	62
	The land-use system as a framework for the study of the forest-grazing conflict	64
	Factor Analysis and the study of the conflict	65
	The results	66
	Interpretation of the results	66
	Implications of the results	69
VI.	A FRAME FOR SYNTHESIS	70
	Developmental Orientation - Implications	70
	Developmental theory in the seventies	74
	REQUIREMENTS FOR THE Feasibility	77
	National prerequisites for the establishment of regional rural planning	82
VII.	REGIONAL DEVELOPMENTAL ACTION AT CHIOS	88
	GENERAL	88
	The Departmental planning unit	89
	Developmental principles for the Improvement of forest-grazing interactions	90
	General	90
	First Principle: Multidimensional management	91
	Second Principle: Application of appropriate technologies	92
	Third Principle: Integration of Nomadic Pastoralism in the Land-Use System	94
	Fourth Principle: Acceptance and use of fire as a management technique	96
	Fifth Principle: Acceptance of the usefulness of the non-productive forest	98
	Sixth Principle: Use and development of proper flock compositions	101
	Seventh Principle "Applied Research at the Departmental level	103
	Eighth principle: Initiation of an appropriate type of education	105
	An overview of the Regional setting of Chios:	110
	NOTES	115

VOLUME II

TABLES	II	3
FIGURES.	II	31
MAPS	II	60
PICTURES	II	83
APPENDIX	II	90
BIBLIOGRAPHY	II	92

Chapter I

INTRODUCTION

1.1 GENERAL

2
The Mediterranean¹ region is a specific area consisting of countries or parts of countries bordering the Mediterranean Sea (map 1). Although this region accounts only 1% of the earth's land surface, it has played a part in human development out of all proportion to its small size.

1
The natural environment of this region has long been degraded and an aridification process has been at work for centuries² (Hare - 1974, p. 33; Quezel - 1977, p. 9; Tomasselli - 1977, p.51). The climatic and geomorphological particularities are important natural causes of environmental degradation. In conjunction to this, human activity spanning thousands of years has contributed much to such degeneration³.

2
In the Mediterranean region the presence of human settlements over the last four thousand years has been accompanied by a process of adaptation⁴. The outcome is the development of a distinct agro-sylvo-pastoral system⁵ (figure 1) well adapted to the environment. This rural system has various

local expressions. However, no matter what the variations of the rural system were, it proved efficient in sustaining the human population of the Mediterranean, throughout this long period. At times when the population of the area was living undisturbed, the system accommodated variations via such mechanisms as migration and/or changes in human adaptive strategies. During such tranquil periods the local inhabitants of the Mediterranean, being well-rooted to their environment, had in general, a minimal impact on resources.

This tranquil well adapted rural system was very frequently disturbed, interrupted, or even destroyed in many areas by human forces or natural disasters. Among these two, the human factor was predominant. The disruptive activities of conquerors, colonialists, and pirates were a direct cause of human environmental destruction. Another negative effect lay in the careless exploitation of natural resources during the establishment of new societal orders. In addition to this, the sharp population increase and the emergence of the Capitalist Mode of Production during the last two centuries contributed as new emerging factors to the complexity of the overall situation.

1.2 THE OBJECTIVE OF THIS STUDY

Despite this complexity and the dynamism of the Mediterranean region, integrated studies in the structure and func-

tioning of the human-natural aspects of Mediterranean ecosystems have scarcely begun for the Mediterranean region in general⁶. The field of human ecology is particularly weak in such research⁷. As a consequence, decisions on land-use have been and are taken still, without prior sufficient comprehension of their often far-reaching ecological and social-economic effects. Decisions made in this manner further contribute to environmental destruction.

The current situation of the Mediterranean environment is alarming. A report of the UN Programme on Man and the Biosphere is quite explicit on this point:

"...The loss of forest area by uncontrolled fire is still in many regions with mediterranean climate greater than the annually reforested area ... [also] uncontrolled free-range grazing is continuing to have a destructive effect on several mediterranean forest ecosystems in countries, where intensive stock-breeding has not yet reached an adequate level. " (UN MAB, Project 2 - 1974, p. 19).

This scarcity of research and the emerging concern about the environmental problems generated by certain economic developments in the area, led the author towards the study of the interface between human activities and the environment.

Bearing in mind the fact that in the Mediterranean region there is a distinct altitudinal structure of rural practices (fig. 2), the interactions between rural activities and natural vegetation exist in pastoral rather than in arable ar-

eas. These areas are typically located in semi-mountainous and mountainous landscapes. It is the case that when dealing with the spatial aspects of society-nature interactions in the rural Mediterranean environment; one should primarily refer to the interface between forest ecosystems on the one hand and the areas devoted to pastoral activities on the other.

The author believes that an understanding of the mechanisms through which human-environment interactions are taking place in rural contexts is vital prior to any attempt of adopting developmental action. This thesis attempts to gain an insight into the mechanisms through which the spatial interactions between grazing activities and forested areas are taking place in a Mediterranean setting. The study of the forest-grazing land-use conflict is performed by tackling one typical Mediterranean area. This area is the island of Chios, Greece situated off the western coast of Turkey. As will be explained below, this area is representative of both the natural and the typical rural socioeconomic features common to the Mediterranean region.

The purpose of this thesis is to identify and analyse the mechanisms through which the forest-grazing conflict operates. Secondly, this thesis establishes a framework of principles which could serve as guidelines for proper regional developmental action.

1.3 SCOPE, LIMITATIONS, AND RELEVANCE OF THE STUDY TO THE PLANNING PROCESS

This study of the forest-grazing land-use conflict is approached from the human-ecological point of view. As such, this study establishes a set of principles which take into account the human-ecological relationships in the study area's environment. Although in a certain sense the social, political, economic, and cultural connotations are obvious, in general no thorough analysis of these aspects was performed; in other words this study examines the ecological context of the study area, analyses in space and in time the relationships of man and his environment, and finally establishes certain principles which should be incorporated in the Regional Planning Process.

This thesis accomplishes a subset of the considerations which are necessary for planned intervention. This partial accomplishment was due to the following limitations:

1. the development of the island would have required an extensive research; such research would have been at the level of a research institution or a planning agency due to the time and cost requirements of such a task;
2. the study area exists in a context where base data such as land inventory are inexistent or scarce.

In addition a system of information and inventory research is not available;

3. the existence of an unfavourable national context from the planning point of view, bound with inherent inabilities and unpredictability would seriously question any advanced scheme for a Regional Planning Process based on conditional assumptions. The fact that certain national conditions have a negative regional influence in developmental attempts would have impeded the initiation of a fruitful Planning Process if such assumptions were made.

The relevance of this study to the Planning Process is explored below. The stages of a generic Planning Process are normally identified as follows:

1. Review and understanding
2. Goal formulation
3. Problem formulation
4. Possible courses of action
5. Evaluation
6. Selection

7. Implementation and control (Reif - 1973).

A specific schematic representation of these stages is shown in figure 41. In this scheme the shaded area indicates the phases of the Planning Process that this thesis covered from the human-ecological point of view. In this figure two branches are identified as departing from the set 'realities'. The first branch represents the analytical phase. The second the sequence of perceiving the problems and of deciding to intervene. These two branches merge at the goal testing stage (box: Goals OK?).

The study was based on the hypothesis that a forest - grazing conflict exists in the study area. This hypothesis was validated after constructing a geometrical model (with the aid of Factorial Analysis). A re-examination of the existing Goal Fabric was then performed under the light of the model's results. The reader will obtain an even more detailed picture of the stages covered by this study by reviewing the diagram shown in pages viii and ix.

The phases covered by this study are far from being definitive in relation to the formulation of goals and of generating alternatives. It should not escape the reader's attention that it is only one aspect of a very complex reality which was covered here: the human-ecological aspect. Although the human-ecological aspect involves a social-cultural

and a physical-spatial perspective, most of the economical and political aspects was not examined in this thesis. An integral analysis of all the aspects of the study area's reality must be performed prior to the further advancement of the Planning Process.

The next section introduces the basic features of the study area. It is followed by chapter II which provides a general overview of the Mediterranean setting with emphasis at the eastern Mediterranean conditions and the situation of the study area. This will provide the reader with the substantive information to which subsequent analysis will be performed.

1.4 GENERAL DESCRIPTION OF THE STUDY AREA

The island of Chios is located in the eastern Aegean Sea^a. The island's official area is 842 sq. km⁹. Administratively, Chios island represents the Department of Chios along with the two small islands of Psara (40 sq.km.) and Oinoussae (14 sq.km.). The total area of the Department is 904 sq.km., with the island of Chios accounting for 93.1% of this area. A synopsis of the Chios statistical profile is given on Tables 1(a) to 1(e).

The island is mountainous, with Pellinaion (1,297 m), Oros (1,186 m), Marathovounos (796 m), Pigantias (790 m) and

Amani (809 m) as the main mountain masses (map 7). The mountains are located in the northern and central parts of the island.

The total amount of precipitation is sufficient for the local needs; however, the seasonality of this precipitation (figures 5 and 6) does not only require the establishment of specific water-conservation action but also favours the formation of torrents, which rush to the sea along stone-covered beds. In fact, torrential landscapes are commonplace and water erosion is an ancient source of nuisance for the islanders. Today about 3% of the island's surface is already bare rock (map 8), while bare eroded soil covers extensive mountainous and undulating areas (see picture 1). Areas under forests exist at the northern and western sections of the island. Wooded vegetation in the forms of scattered trees, maquis and/or garrigue¹⁰ are found throughout. Such vegetation is found extensively in the northern and central-eastern parts of the island (map 8). These areas are usually associated with grasslands and are used for grazing (map 16; picture 2).

The southern-southeastern parts of the island are mainly level to undulating. Agriculture is the major rural activity with priority given to tree crops: mastic trees, citrus trees, and olives are predominant. Grain is also a major agricultural component (map 8; map 16).

The capital of both the Department and the island is Chios located at the centre of the island's eastern coast (map 6). Chios city is located on the site of the ancient city of Chios and is endowed with a natural harbour. Almost all external communications pass through this city through the recently enlarged harbour and the airport. The second largest settlement in the Department is Vrontados, with about 4,685 inh. followed by Pyrgi with 1,915 inh. (map 23) (Romanios - 1970, p. 1277). The southern settlements are denser than the northern ones (map 9). Accordingly, the island's transportation network is denser in the southern part. Northern Chios has only two road rings encircling the two major mountains; mt. Oros and mt. Amani (map 10).

The economy of the island is based predominately on rural production which is diversified: wine, olives and olive-oil, silk cocoons, figs, citrus fruits, grain and, most of all, mastic are produced in southern Chios. Sheep and goats are raised in the northern part, as well as at Psara island. Fishing is commonplace all along the coast. Almonds and cherries are also produced in the north. Antimony, sulfur, and marble are the main mining activities. The island is also engaged in the tourist industry which thrives almost exclusively in central and southern Chios.

The inhabitants of the island are almost exclusively Greeks. They have developed significant cultural patterns which today can be identified in their attitudes, dances, songs, architectural style, and arts. The islanders are proud for being from Chios and as it usually occurs among islanders¹¹, they have a strong feeling of patriotism. The functioning of politics in the island, in many cases, passes through a network of clientelism as a result of the preservation of past political patterns (Mouzelis - 1978, p. 27). The dominant party at the two most recent elections (1974 and 1977) was that of the "New Democracy" party which has formed the government since 1974.

Chapter II

THE MEDITERRANEAN SETTING AND THE TYPICALITY OF THE STUDY AREA

2.1 INTRODUCTION TO THE MEDITERRANEAN ENVIRONMENT

Familiarity with Mediterranean physical conditions reveals to the researcher a striking diversity that exists at all levels and sectors. However, there is a lack of a systematic classification of this Mediterranean diversity. Among the very few exceptions, one should mention the UNESCO vegetation classification and certain climatological and ecological studies (Dafis - 1976; Quezel - 1977; Tomaselli - 1977).

Quezel grouped the Mediterranean vegetation according to two main traits: a) heterogeneity and b) instability and vulnerability¹² (Quezel - 1977, p. 11). He sub-classified heterogeneity into biogeographical, historical, physiognomical, climatic, bioclimatic, geomorphological and pedological. Furthermore, heterogeneity, combined with genetic, ecological and anthropological factors, causes instability and vulnerability.

The following sections of this chapter are based on Quezel's heterogeneity groups, simplified into climate, geomorphology, vegetation characteristics and patterns, as well as human history.

2.2 CLIMATE

On the basis of climatic similarity, few small areas on the surface of the earth are classified as Mediterranean-lands (about 1%). In brief, these climatic characteristics include a warm to hot and emphatically dry high sun season with high evaporation rates. Contrasting with this is a mild and wet low sun period when the precipitation is more effective.

Mediterranean core areas, on the basis of climatic similarity, are typically centered at about 35 degrees of latitude, on the west side of continents (fig. 39). According to Koppen's classification of world climates the Mediterranean climate belongs to the humid mesothermal zone and, more specifically, to the Dry Summer Subtropical-CS (Stone and Inch - 1963, p.255). The sea is never far from the Mediterranean climate areas, and thus provides an important moderating influence of temperatures, especially in winter.

The Mediterranean climate has a dynamic transitional character; in summer these areas come under the influence of

the sub-tropical high, having the semiarid climate of the region bordering them toward the equator. In winter, with the northerly to southerly shift of wind and pressure systems, the area experiences the conditions of the humid marine climate (ibid, p. 256). This dynamic transitional character of the Mediterranean climatic zone is a unique climatic feature causing particular conditions for the natural ecological balance of the area.

The climatic features of the study area are portrayed in table 2 and Figures 5 and 6, by using one ombrothermic and four climographic diagrams. In Chios island, there is an annual period of at least 3 months of minimal precipitation, usually between May and August. During this period, the island is susceptible to occasional strong, dry winds which come from north-east. As will be explained later on, these strong winds play a very important role as an ecological factor particularly in relation to fires and vegetation distribution.

According to Mariolopoulos, Chios lies in one of the 5 climatic regions of Greece, referred to as the Aegean Sea region. The annual range of temperature in this zone lies between 13.7-19.0 degrees C¹³ (Dafis - 1976, p. 15).

2.3 GEOMORPHOLOGY

Characteristically, the present terrain of the Mediterranean consists of relatively high folded mountains, rising close to the shore, with narrow coastal plains or small discontinuous isolated lowlands. The Mediterranean shore zone exhibits a striking alteration of complex stream-eroded mountains and hills with alluvial plains. Moderate to steep slopes, with thin soils and much bare rock, are commonplace.

Other common features are marine and riverine terraces, indicative of past climatic and marine oscillations and of tectonic disturbances. These events have given rise to the characteristic valley profile of a well defined channel cut into a broad smooth valley floor (fig. 4; picture 3) (Thrower and Bradburry - 1973, p. 40).

There are three important points which must be stressed, and which concern the Mediterranean landforms :

1. the distinctiveness of the present day processes of erosion, which show affinities with geomorphic processes acting in arid lands ;
2. the importance of the paleoclimatic inheritance, referable to the transitional latitudinal position of the Mediterranean climates ;

3. the vulnerability and fragility of the natural equilibrium which is continuously threatened by human intervention (Paskoff - 1973, p. 60).

In the study area, several coastal plains or isolated lowlands among the mountains can be identified (map 11). These plains and lowlands are usually below complex landforms, created on the surfaces of the mountains by extensive torrential erosion. Many areas of the northern part, however, are due to past tectonic disturbances. Sediment deposition from erosion is to be found at the valley floors of the north and almost everywhere in the southern part. The existence of bare rock areas which occupy 3% of the islands surface, as well as the extensive vegetation cover of the mountains by communities of Poterium spinosum (foreground of pictures 2 and 3), are solid proof of the importance which the erosion processes play on the island.

2.4 VEGETATION

Since the patterns of world vegetation are strikingly similar to those of the world's climate, one expects a particularity in the vegetation cover of the Mediterranean areas, formed under the particular conditions of climatic transitionality (for general similarities) and geomorphological features (for local variations). Generally speaking, one can distinguish two major types of biocoenotic communities in the area. The first is formed by sclerophyllous forest or

evergreen coniferous forest. The second derives from the degradation of the climax vegetation cover and favours the extension of pine trees as well as secondary vegetation types (matorral) (fig. 3). However, the Mediterranean vegetation is much more diversified to be classified under these general terms. For instance, although Mediterranean pine forests usually constitute a paraclimactic stage in the northern Mediterranean region, in the hotter and drier zones they constitute real climax formations the lower stratum of which consists of typical garrigue (Tomaselli - 1977, p.56).

The particularity of the plants in the Mediterranean region is also expressed in their biological characteristics under the specific conditions to which they have adapted. Transpiration is reduced by tough, leathery, leaf surfaces (sclerophyllous = sclero [in Greek means hard] + phyllo [leaf]) as developed by the olive and carob trees; or by hairy surfaces, which cut down the exchange of air. Leaf size has been reduced even to the extent of developing green stems and thorns to do much of the photosynthesis (Quercus suber, Poterium spinosum etc).

In terms of forest tree species, coniferous ones are by far the most common. Among them, the most common ones are the pines and, particularly, two systematically close ones; Pinus halepensis and Pinus brutia (maps 9 and 10) (Quezel -

1977, p. 18). On the other hand, sclerophyllous vegetation is composed mainly of various species of non-deciduous *Qercus* (map 2).

In the study area there is only one forest species which is dominant; *Pinus brutia* (see picture 4). The existence of the *Pinus* species on the Island is dated from antiquity, since the Ancient Greeks knew the island itself as Pityos which means "piny" (Karaliolios -1976). The existence of a village on the island which is still today called Pityos, is another testimony of the fact that pines existed in Chios thousands of years ago. It is characteristic of the anthropogenic action on Chios that this village which is named "piny" has no pine trees at all in its landscape (Perris - 1966, p. 12).

The properties of *Pinus brutia* which flourishes between the 36th and the 42nd parallels are: fast growth (table 4a), resistance to prolonged drought (Nicolaidis - 1972), and frugal requirements. These properties make the species a very promising one for reforestation (Urgenc - 1972, p. 117).

Pinus brutia can be found on parent rocks with very poor soil (picture 6). It prefers soils which are cool, light, and fertile. When soils are sufficiently deep and favourable

the species grows up to 2-2.5 metres within 5 years. Its rates of growth can be compared with those of the fast growing forest species of Pinus maritima and Pinus radiata (table 4b) (Urgenc - 1972, p. 117; Gogos - 1976, p. 28). In addition, although Pinus brutia can not survive strong freezing conditions, is more resistant to cold than Pinus maritima, Pinus radiata and Pinus halepensis (Urgenc - 1972, p. 116). In the study area this tree-species is used for the production of firewood, round-wood, and charcoal, as well as for pine-resin production. Pinus brutia should be considered as a species for which expensive efforts to improve it are worthwhile. Table 4 and figure 7 show the high productivity of the species in terms of wood production as having short rotative periods in lumbering.

Although Pinus brutia is the dominant tree species of the island, the floors of the valleys favour the formation of excellent vegetation communities consisting of Junqlans regia, Platanus orientalis, Populus alba, etc. These phytosocieties include also Pteris aquilina and different varieties of climbing plants and other hygrophylous species (Perris - 1966, p. 11).

Tree-forests cover about 10 % of the island (table 14). The rest of the nonagricultural area is covered by maquis and garrigue (table 14). The maquis communities are mainly

composed by Spartium juncenun and various species of Quercus. The garrigue areas are dominated by Poterium spinosum.

In the maquis complexes one should include the agriculturally productive species of Pistacia lentiscus var. Chia, commonly known as Lentisc or Mastic tree (see picture 7). This sub-species is unique to Chios. It flourishes exclusively at the southern part of the island and can be found either wild in the maquis formations or in its domesticated economically productive form alone or in association with olive trees.

According to the vegetation classification of Dafis, Chios has two regionally distinct phyto-societies; Oleo-Ceratonion and Quercion-Ilicis (Dafis - 1976, p. 2 - 8). A representation of these phyto-societies and their sub-regional classes as well as their principal vegetation species is given on figure 8.

2.5 THE ANTHROPOGENIC IMPACT ON THE MEDITERRANEAN ENVIRONMENT

2.5.1 An Overview

The development of pastoral and agricultural civilizations in the Mediterranean is one of the oldest in world history. At first the existing forests which covered practically the entire Mediterranean region were incompatible

with the land-uses of a growing and expanding population. Therefore, along with the rise of these early civilizations, the societal needs and practices led first to an extensive destruction of the region's vegetation, starting from the south and extending ravages northwards (Tomaselli - 1977, p. 33). The Greek and Roman era saw a continuous land clearance of large areas in order to obtain the pastoral and agricultural land needed. However, the early Greek tradition of dedicating forests to public and private worship, followed by similar attitudes during the Roman, Byzantine, and Ottoman times, resulted in the preservation of important wooded areas up to the present (Grispos - 1973, p. 145; Hughes - 1975, p. 50). These areas are of minor importance compared with the vast grazing areas subject for centuries, to fires and overgrazing coinciding with the expansive character of the land-use practices of that time. It is true that the Romans considered pasture as more productive than cultivations (Hughes - 1975, p. 112; Tomaselli - 1977, p. 34). From the 8th century A.D. the Arabs substituted pasture and pastoral nomadism in all the areas under their domination for the existing agriculture (Tomaselli - 1977, p. 34).

By the 16th century, the Mediterranean population reached 60 million and was spread out over a vast area. At that time Campagna in Italy was either semidesert or swampy, the lower Rhone valley, the Tuscan and parts of Sicily were also

swampy. The environs of Ankara were semi-desert and the natural vegetation of Balearic islands, Sardinia, Corsica, Cyprus, and Crete was destroyed (ibid, p. 35). The sharp population increase that came after the 16th century¹⁴ (fig. 10) caused an even greater destruction to Mediterranean vegetation. It was not only the increasing needs of the population and rural practices which are to be blamed; wars, revolutions, conquests, and similar events must be added in understanding the extent of such vegetation degeneration that existed at the beginning of this century.

The 20th century has seen a continued degeneration of vegetation with the expansion of railways and their need for wood, the emergence of pulp and paper industries, and the increasing needs for roundwood. The emergence of tourism and its impact, due to its unplanned spread along with the continuous flow from rural to urban areas; the continuation of traditional rural practices for the sustenance of the needs of a population which doubled within thirty years¹⁴, are additional aspects of this degeneration in the present era. The reader should also take into consideration the damage to natural environment caused by the two World Wars, the Civil wars of Spain (1937) and Greece (1944-49), the Egyptian and Algerian revolutions, the conflict in Palestine, the Turkish invasion of Cyprus and other sporadic warfare between various countries. As a specific example, figure 10 represents

an estimate of the reduction of the tree-forests in Greece from 1500 B.C. to the present (Makryniotis - 1974, p. 13).

The importance of man's impact on the vegetation cover implies consequences on the morphogenesis of the Mediterranean regions. Because of the fragile equilibrium between vegetation and climatic conditions, transformation to arable land is almost always irreversible. There is an increase in torrential flow, causing accelerated rates of erosion¹⁵ favoured by the seasonal contrasts of the Mediterranean climate. Deforestations to obtain grazing and arable land, contributes to an imbalance in the precarious morphoclimatic equilibrium of Mediterranean regions.

Through the course of history fire was the source which had the most detrimental effects causing a disastrous rate of vegetation destruction. However, the catastrophic effects of accelerated erosion and of natural vegetation destruction were lessened in the past in those areas where traditional ancient techniques of Mediterranean agriculture (terracing) were used or where the preservation of the vegetation cover coincided with the interests of the human populations (e. g. resin production) (Grispos - 1973, p. 133).

In general, less degraded vegetation in Mediterranean areas has been preserved:

1. In remote mountainous areas, where precipitation was higher, the population pressures lesser;
2. where cultural patterns created forested areas commonly respected;
3. where the existence of forests has been linked with the survival of the local population.

2.5.2 Anthropogenic Impact on the study area

The author distinguishes 4 major periods in the history of Chios. "First period: 10th century B.C. to 10th century A.D."

The first half of this period is characterized by an early prosperity; the second half by a dark period of decay and external interventions. The prosperous ancient era was associated with an astonishing progress in marine trade, arts and letters, the production of Chian wine, renowned in the ancient world, as well as the development of manufacturing. Chios developed into a gigantic trade centre of both goods and slaves (Cary - 1950, p. 99; Romaios - 1970, p. 1278; Rossiter - 1973, p. 638). The island's major export, wine, was produced primarily in the north-western part of the island. Southern coastal areas were used for agriculture, while pasture was already an integral part of the overall domestic rural economy.

The second half of this period is marked by a gradual loss of prosperity due to the general instability of the eastern Mediterranean at that time. Persians¹⁶, Athenians, Macedonians, Romans, Byzantines, Arabs, the Zacha's pirates, Byzantines for a second time, Genoese, Venetians and again Genoese sequentially dominated the island (Hachette - 1964, p. 770; Americana 1973, cit. "Chios"). The estimated environmental destruction of this period is presented on map 12. "Second period: Genoese Occupation 304-1322 and 1346-1566."

During this period, Chios gradually re-entered a new period of prosperity. The island developed into an important centre along the commercial routes of the Genoese that stretched to the Black Sea. Internally, silk became the most important commercial product of the islanders. The over-exploitative attitudes of the Genoese caused a shift from the ancient diversified economy to a localized development of the resource potential of southern Chios. Strong disparities appeared between the poor mountainous north and the rich south. Moreus and Citrus trees, as well as Lentiscs were forming extensive cultivations which gave rise to important settlements, such as Pyrgi, Mesta, and the castle of Chios city. These Genoese settlements are, today, important assets of Chios' tourist industry (picture 8).

This period of prosperity was also associated with extensive lumbering as well as an increase in agricultural and pastoral activities. Forests were pushed to the inner mountainous parts of the island while localized environmental destruction devastated many coastal areas. The elimination of the forests at eastern and southern Chios is dated at this era (map 13). "Third period: The Turkish Rule 1566-1913."

In the beginning of this period the island developed into an important international financial centre. The role played by the Genoese was passed on to Chian shipowners. The island became an integral part of the Smyrni region¹⁷ (map 6). Internally, the importance of mastic production outranked the importance of all the other products of the island due to the preference that the Sultan showed to it. The bioclimatic limitation of agriculturally productive mastic trees to the south (S.T. - 1975, p. 161) continued to nourish the well established antithesis between the poor north and the rich south.

Although there was a prosperity among the Chian tradesmen and shipowners, the population of the southern part saw a deterioration of its living conditions due to their overexploitation by the local Turk Pashah (Romaïos - 1970, p. 1276). This led to population preferences towards the

northern mountainous areas of the island which were neither economically interesting nor easily accessible by the Turks. The increasing population of these northern communities resulted in a scarcity of resources. These communities had to arrange for a long-term maintenance of their resources. Accordingly, for the first time in the island's history, an extensive system of comprehensive land-use management developed in almost all of the mountainous areas. This system was based on communal land tenure and a series of communal arrangements (Grispos - 1973, p. 129 - 130 and 141 - 143).

The system of communal land tenure, which developed not only in Chios, but also in all the mountainous and semi-mountainous areas of Greece, (Evangelinidis - 1975, p. 327; Mouzelis - 1978, p. 5), became the cornerstone of the local land-use administration. The formation of this system of communal land tenure and of local self-governance developed the wooded vegetation into a renewable resource with minimal rates of depletion.

In Chios island a period of destruction followed the period of prosperity under the Turks. In 1822, after an unsuccessful attempt of the Chians to join the revolution of the Greeks against the Turkish Rule, the Turks massacred about 20,000 people, while about 40 to 45,000 were sent into slavery (Romaos - 1970, p. 1282; Kafentzis - 1977, p. 66 - 67).

The island remained uninhabited for at least 8 years. In addition to this, a destructive earthquake in 1881 caused the death of about 3,560 people and extensive damage to buildings (Romaos - 1970, p. 1284). The island never managed to recover from these major evils, and even today, the destructive impact of these events resides in the consciousness of the islanders. "Fourth period: 1913-today."

From 1913 to the present, Chios has been part of Greece (map 6). In 1922, after the Destruction of Smyrni, Chios experienced a population increase of 12,445 people or 16 % (NSSG, Yearbook 1930) due to an influx of refugees. Thereafter the population continuously declined. It is remarkable, that between 1940 and 1971 Chios had a population decline of about 30 % (table 1(a) and 1(b)).

Although the largest percentage of wealthy Greek shipowners are of Chian descent, the island does not show significant signs of improvement. The opposite is true. The migration outside Greece is very high, arable land is declining, poverty thrives in the mountainous and semi-mountainous areas, militarization of the whole island increases, and there is no apparent alternative to the low-productive traditional economy. The recent growth of tourism has enhanced the islanders' budgets. However, the effect that tourist development can have on backward regions (Sprincova - 1974, p. 138;

Loukitsas - 1977; Patelis - 1977), poses many questions as to the value of such a developmental orientation.

It is within this context, then, that the forest-grazing conflict emerges. Certain phenomena are associated with it: firstly, there is an abandonment of the rural areas, predominantly the mountainous ones, and a steep increase of the forest and range fires; secondly, legislation and governmental action in the rural sector have had and continue to have significant impact on the island. These phenomena, as well as their impact, are analysed in the following chapters.

2.6 REVIEW OF CHAPTER II

The island of Chios is a typical mediterranean area, in light of the following characteristics :

1. Its climate is similar to that of the central Mediterranean (Southern Greece, coastal parts of South-western Turkey, Cyprus, Southern Italy, etc.).
2. The geomorphological and landscape features are also typical in this area.
3. The location of the island is to be found in the middle of the "matorral Mediterranean zone" (map 2).

4. The anthropogenic action on the island has taken place for at least 3,000 years. Through the course of history the distribution and concentration of the populations has had many variations; exogenic influences were and still are very strong.

In addition to these general characteristics, Chios island has one peculiarity; that is, the geomorphological distinction between the mountainous northern part and the level to undulating southern area. This characteristic plays the role a natural separator of rural activities, into cultivations at the south and pastoral at the north. Such localization of activities facilitates the spatial identification of the conflict under study.

Chapter III

DESCRIPTION OF THE STUDY AREA

3.1 QUALIFICATIONS OF CHIOS AS STUDY AREA

In the previous chapter, a review of the representativity of Chios island, as a typical Mediterranean area was presented. However, the qualifications of Chios island as the study area must be checked as well. This is done in the present section.

Chios island, as the setting for the study of the forest-grazing conflict, shows the following characteristics:

1. it is located within the range of the typical mediterranean climate;
2. by being an island, it does not allow for extended and uncontrolled relationships with the external world. In addition, the conditions of territoriality and isolation, within which the island exists, simplify many of these relationships¹⁹. However, there are certain relationships which express the adaptive responses of the island to the national context^{19 20};



3. it possesses a substantial number of grazers, among which goats are the dominant ones;
4. it has substantial forested and range areas, which are covered by relatively few dominant vegetation species;
5. there exists no overgrowth in any one of its non-rural characteristics, such as a large urban centre, extensive tourism or excessive transportation flows. There are no side-effects to the rural natural environment of certain phenomena, such as urban fringe phenomena, destruction of the natural environment because of pollution, tourism, or other non-agricultural causes.
6. finally, in respect to availability of data, the island of Chios consists of a separate administrative area²¹. The island has all the existing statistical information which are published at Departmental levels by the Statistical Service of Greece.

In addition to the above qualifications, Chios island has an apparent regionalization of rural activities; pasture at the north, cultivations at the south. This facilitates the accurate monitoring of the conflict at the interface between pastoral and forested areas. The rectangular, or better,

kidney-like shape of the island also aids in monitoring. For a simplified representation of the regionalization of the rural activities in Chios see map 16 and figure 11. In light of the above characteristics it is apparent that the island of Chios is more than adequate as a study area for this problem.

3.2 THE ISLAND'S CONTEXT

After the dramatic events of 1922 and the destruction of Smyrni Chios island lost its vital links with Asia Minor. This resulted in a general stagnation and deterioration. In the years following 1922 Chios ceased to be an economic crossroad and became territorial or frontier region (map 6). The Greek government, on the other hand, instituted a highly centralized bureaucratic administration instead of aiming to integrate the well established decentralized local administration which existed so successfully for so long. The result was the creation of an administrative system in which any inter-regional issue, in some cases even intercommunal ones, had to go through a long bureaucratic procedure in the central government at Athens (Evangelinidis - 1975, p. 336; Loukakis - 1977, p. 14; Mouzelis - 1978, p.124 - 125).

The fact that the decision makers for the island were shifted to an external centre, and the top-heavy overgrowth (hydrocephalism according to the Greek authors) of the cen-

tral administration resulted in the continuous neglect of the local issues of Chios. The social and economic conditions worsened and a degeneration of the cultural identity of the island followed.

This situation had a particularly strong impact on the northern part, where out-migration and misery became commonplace phenomena. The inter-regional differences are very striking and according to Perris*

"...the visitor, who would be brought suddenly, from the northern part of the island to the southern, will be very much surprised; it will be very difficult for anybody to persuade him, that he is still on the same island " (Perris - 1966, p. 67).

In general economic terms traditional sub-sistence economy is very important but declining. Although such traditional economy has no organic integration with the Capitalist Mode of Production (Mouzelis - 1978, p. 81), the influence of the Capitalist Mode of Production is evident in regard to specific commodities.

In the southern area, there is articulation between Simple Commodity Production and Capitalist Mode of Production. Mastic production, for example, is inter-related with a well established co-operative (Union of Mastic Producers of Chios) and the processing and manufacturing of mastic is

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

done at the co-operative owned factory located in Chios city. This link between the two Modes had a tremendously beneficial impact to the co-operators' revenues (table 22). Similar procedures are followed in citrus fruit production. Recently, market-oriented production of meat became apparent (table 9: columns SLO and GKO). In general, the existing links between the local production and the national economy are either non-existent or loose and highly controlled by external forces, such as middle-men and economic fluctuations in the market system.

As it was mentioned earlier, a spatial duality exists among the rural activities of the island: pasture in the centre and north; harvest crops and fruits in the south. However, it should not escape attention that despite the geophysical, ecological, economic, and historical inter-regional duality in the character of the island, that the island as a whole is marked by the same conditions of marginality and territoriality as the rest of the rural insular and mountainous Greece²².

3.3 CULTIVATIONS

In 1961, the cultivable areas of the Department of Chios were 170 sq.km. or 19 % of the total area. In 1975, they dropped to 130 sq. km²³. or to 14 % of the total area of the Department. (table 6; table 7; figure 12). This decline was

unevenly distributed among the various types of cultivation. For example, between 1961 and 1975, the areas under trees in compact plantations²⁴ increased by 29%, while the areas under crops dropped by 48%, the garden areas by 20% and the vineyards by 14% (table 6; figure 12).

Abandonment of rural areas and out-migration accompany the decline of the cultivable areas. It is characteristic, that the ratio "stremmas of arable land per capita" was already as low as 2.6 in 1961 (Soumelidis - 1961, p. 15) and 2.4 in 1971 (table 7(b)). The quantitative phenomena of abandonment²⁵ must also be associated with the qualitative deterioration of many cultivable areas, such as olive trees and vineyards, something which does not appear in the official statistics.

3.4 STOCK-BREEDING

There are three main systems of stock-breeding in Chios: (1) domestic, referring mainly to the traditional attitude to breed some animals nearby the house; (2) in flock, non nomadic; (3) and nomadic, which refers to a seminomadic form of flock movement. In Chios, there are two principal grazers: sheep and goats. The number of other grazers such as oxen, bulls, and cows, is rapidly declining (table 9; Figure 13). It is difficult to estimate how much surface is dedicated for the grazing needs of all the foraging animals.

However, a numerical assessment will be attempted in the following paragraph for the years 1961 and 1971.

Theoretically, each small animal, such as goats and sheep, needs an annual grazing surface of 0.012 sq. km. (Sideridis - 1977, p. 37). In 1961, there were 96,604 small animals (the coefficient of transformation of big animals to small is taken as 1 to 4) (Papayannopoulos - 1976, p. 99). therefore they would theoretically require 1,159 sq.km. of grazing area. However, the total surface of the island is only 904 sq.km. and the improved pastures account only about 7% of the island's total area²⁶. The grazers have to use the garrigue and maquis areas of the island which are estimated to 212 sq.km. or about 23% of the total area. The insufficiency of these areas necessitates the use of forested (11% of the area) and partially forested areas (23%) as grazing areas. Although the above estimations are very conservative²⁷, they are enough to prove the existence of a very serious land-use conflict²⁸.

The above mentioned calculations are for the year 1961. In 1975, the situation, as will be seen, showed no improvement. The grazing space for the animals of the island is estimated to 759 sq.km. Although this number is far above the grazing areas of the island, it is significantly smaller than the one estimated for 1961. This fact may mislead the

reader to assume, that in the future the number of grazers will reach the carrying capacity of the island's range and no conflict will appear thereafter. However, this is not the case. Firstly, this reduction of grazing demand should be reasonably expected not earlier than the year 1993²⁷ which may be too late. Despite the fact that by 1993 the environmental degradation will already be very serious, the following facts were not considered in the above calculations:

1. The reduction in the number of animals between 1961 and 1975 involves animals which can not graze garrigue, maquis or trees (oxen, bulls, cows, horses, mules, asses). The number of goats remained stable.
2. Between 1961, and 1975 there are changes in the ways of stock breeding, associated with changes of the production mechanism to a stronger market orientation. As it will be established, the rationalization of the production mechanism and the consecutive changes in the uses of land have reduced the grazing options of stock-breeding. For example, the number of Carob trees which are an excellent source of feed, dropped from 51,165 in 1961 to 31,953 in 1975 (figure 15). It is estimated, that the Carob fruits have a similar nutritional value to barley (table 10) (Diapoulis - 1950, p. 30).

Another example of how the present market-oriented stock breeding reduced the resource base of the grazers is revealed in the relationship between cultivated and pastoral areas. In the traditional system, grazing animals consume the harvest residuals²⁹. At the same time they fertilize the fields with their manure. On the other hand, market-oriented cultivations usually adopt the system of crop rotation. In this system, grazers are destructive and undesirable³⁰.

From the above it becomes clear that for the conditions of Chios, stock-breeding is an activity which involves more grazing animals than is the carrying capacity of the grazing areas. Subsequently land-use pressures appear between pasture and the natural environment.

3.5 FORESTRY

In Chios, about 647 sq. km., or 72 % of the area is considered to belong in the natural environment of the island. Agriculture and improved pasture are excluded from these figures. Depending on the vegetation cover, these areas are divided into the following (table 14) :

1. dense tree-forested³¹ areas;
2. areas with scattered trees and/or maquis;

3. areas under garrigue; and,

4. bare rock or bare soil.

In terms of forest exploitation, the following 7 types are present on Chios island.

1. charcoal and firewood production;

2. lumbering for roundwood production;

3. resin production;

4. for grazing of flock animals;

5. for hunting;

6. for collection of various pharmaceutical or aromatic species, such as thyme, oreganon, or mountain tea; and,

7. collection of briar-roots for the manufacturing of pipes.

Table 3 and figure 14 present some aspects of wooded vegetation. Data on the other productive uses of Chios forests are non existent.

A very characteristic point which should be stressed here, is the fact that firewood from agricultural holdings

is very strongly associated with the fire frequencies (figure 16). Notably, the peaks of firewood production from agricultural holdings is highly related with the fires in non-forested areas. A similar, but much weaker relationship, seems to exist between forested areas burned and firewood from forests. It can be supported here, that fires play a significant role in providing the population with ample fuel supplies.

From all the above, it is evident that the various forest types and forest production have strong relationships with other rural activities, especially with animal breeding. Furthermore, some forest uses are incompatible to each other (e.g. resin production vs roundwood production), and others are competitive with other uses (e. g. dense tree-forest versus grazing).

Chapter IV

THE APPROACH

4.1 GENERAL DESCRIPTION OF THE CONFLICT: HYPOTHESIS

The term "land-use system" will be used here as a framework for the operationalization of the forest-grazing land-use conflict. Any land-use system has, according to Farmer and Gibb, three components: activities, people, and locations (Farmer, Gibb - 1979, p. 235). The adoption of this scheme to the land-use system of Chios island gives figures 11 and 17. As it can be seen, the rural sector forms a separate sub-system³². The rural land-use system is represented in figure 18. In this figure it should be noted that although the inter-relationships between the cultivation cycle and the forestry cycle are minimal, the stock-breeding cycle strongly depends on forestry, and to a lesser degree on cultivations. It is here that the forest-grazing land-use conflict originates. However, the present strong dependency of the stock-breeding cycle on the forestry cycle was weaker in the past, due to a stronger association between stock breeding and cultivation. Figure 19 shows the setting of the system's components in the past. As will be explained in the next section, the traditional rural land-use system used fires as a management technique in a regular periodical way. Thus fire was used mainly as a tool which facilitated the

inter-relationships between the grazing and forestry and cultivation cycles. In the past, the rule was to improve the productivity of a particular land-use through quantitative vegetation changes; for example, to eradicate the non palatable species. Transformation from one land-use to another involving qualitative vegetation changes, as is the transformation of forests to arable land or to range took place only when there was an extensive or intensified need for a specific use (periods of social disturbances, war, refugees etc).

Although in the present there are no disturbances similar to those that occurred in the past, the following consideration must be taken into account: since the rural subsystem exists within a societal and natural environment, it is necessarily affected by any change in either of them. This effect may drastically influence the components of the system as well as their functioning. The rural land-use system, however, is expected to have the property of homeostasis³³ or the property of stabilization by self-regulation. Any reduction in the homeostatic capability of the system is reasonably expected to bring modifications to its components leading to a new systemic order or even to the complete destruction of the system. The following chapters present the view that a reduction in the homeostatic capability of the rural land use system took place which accounts for an increase in the conflict under study.

4.2 FOREST AND RANGE FIRES AS DESCRIPTORS OF THE CONFLICT

As it has been mentioned previously, for centuries periodic fires have roared through the chaparral or the forests of the mediterranean region clearing away the old growth, making way for the new, and recycling nutrients through the ecosystem (Smith - 1966, p. 291). When humans came to the chaparral they attempted to change the fire situation. Very frequently they either overcontrolled fire in this type of vegetation in which complete exclusion is impractical, or they allowed the chaparral to overburn.

However, an accumulated experience of thousands of years had taught the local populations how to manage their environment in the best possible way. A traditional, well balanced relationship evolved between humans and their environment. In this relationship, humans learned how and when to burn, where and when to move their animals, what is the most appropriate composition of flocks, and what are their feeding requirements.

This adaptation of the local populations to their environment was frequently affected by external factors, such as wars, general political or social instability, and restrictions to out-migration. Chios is no exception to this rule. On the contrary; the fact that the study area is an island amplifies both adaptations and disturbances. So, as a mea-

sure for the society-nature relationships, the indicator "areas burned" is used. The validity of the hypothesis, that fires of Chios island are an accurate descriptor of the forest-grazing land-use conflict, will be tested in the following paragraphs.

First, it must be understood, that fires in the Mediterranean show a periodicity. This fact is associated with the rates of regeneration of the grazing species after a fire (Papanastasis - 1978). By observing table 12 and figure 20 which represent Chios fires between 1922³⁴ and 1977, one can deduce, that there exists a normal frequency in the occurrence of fires. A closer observation of figure 20 will reveal that the burned areas are increasing. That is, by assuming that they relate to pastoral needs, as will be shown further on, such fires are of increasing magnitude in order to off-set the diminishing vitality of range areas.

As overgrazing takes place, it generates vegetation degeneration and larger more degraded areas need to be burned. Hence the need for burning more areas than before (increasing trends in figure 20). However, the pattern of the fire frequencies is not exactly regular. Many external factors are involved in this. At the top of figure 20, the reader will find a summary of the major national events. It can easily be seen that the irregularity of the diagram of fires

is very strongly associated with these major events. The disturbances of the periodicity pattern are usually in the form of delays (years 1932, 1938, 1946). The aftermath is a "fire explosion" (years 1935, 1942, 1950, 1965, 1974).

As is expected, fires, and particularly the ones of "explosive" character, reduce the fertility of the island. Water depletes the top-soil of extensive areas and erodes the slopes of the mountains. A further attack on the remaining forests and bushes, a massive slaughtering of the excessive grazing animals, or both, may follow.

From the above, and always by assuming that fires and pastoral activities are inter-related, it becomes clear that the fires of Chios are a quite accurate indicator of some internal generative cause sensible to external conditions. It may also be maintained that external influences cause disturbances in the periodicity rather than in the volumes of areas burned.

Furthermore, the assumption that fires are related to pasture, would mean that the areas burned represent the requirements of pastoral activities in order to regenerate the palatable species of the grazing areas and for the incorporation of new grazing areas.

The validity of this assumption is proven to be true, after observing Maps 8, 17, 18 and 19. From map 17 it derives that fires occur at communities where cultivations represent a minor use of land (less than 30% of the area). By combining Maps 8 and 17, it is apparent that the north-western and the south-western pastoral communities do not have the same number of fires as the other pastoral communities do due to the extensive presence of scattered trees and/or maquis, which usually provide sufficient animal food. The rest of the pastoral communities have extensive garrigue areas which do not provide the same grazing quality and in which non grazing species develop much earlier with overgrazing compared to the maquis and scattered tree areas after a fire. Furthermore, a comparison between Maps 18 and 19 greatly facilitates understanding of this assumption. Indeed, "numerous fires" does not also mean "extensive areas burned". The opposite is also true: "few fires" generally means "extensive areas burned".

In general, fires extend only to areas where pastoralism is the major activity, or forest (which was shown to involve grazing as well) is an important land-use (map 19). Thus, fires and grazing activities are indeed related. Therefore, the above assumption holds true and a cause-and-effect relationship exists between pastoral activities and fires (cause = requirements for grazing space; effect = fires).

In addition to these quantitative appearances of the fire-grazing cycle, it can very well be established, that fires are also associated with the qualitative degeneration of the natural environment. Each time there is a delay in fires which will clear the non-palatable species of an area, overgrazing, forest grazing, or grazing on the steep slopes of the mountains is practiced. The regular occurrence of fires to the already established grazing areas, which are primarily to be found in areas with smooth rather than with steep slopes, eases most of these pressures.

In conclusion, it is evident that fires are a very accurate descriptor of the forest-grazing conflict. Their sensitivity³⁵ to external conditions and to the quantitative and qualitative degradation of the environment is dependent upon the internal requirements of the animal-breeding cycle. That is, it is associated with the grazing areas and their carrying capacity.

4.3 THE EXISTING DATA

The data used in the analysis cover all the principal characteristics of rural production. For a list of the individual observations used, as well as for their abbreviations see table 5. Nine individual observations refer to cultivations (ATO, ACR, AGN, AVN, ATR, AFS, AFP, AGR, APT) (table 6), out of which, four deal with cultivations oriented to-

wards the production of animal food. The inter-relationships between these individual observations is shown in table 8. Twelve individual observations deal with the characteristics of grazing animals (HMA, OBC, STO, SDO, SFL, SNM, GTO, GDO, GFL, GNM, SFT, GFT) (table 9). The relationships between these individual observations are presented in table 8. The productivity of the activity of stock-breeding is represented by sixteen individual observations (SBO, GBO, SLW, SLO, GKW, GKO, SSW, SSO, GGW, GGO, SLT, GKT, SST, GGT, TSS, TGS) (table 9-suite; table 8). The productivity of the wooded vegetation is represented by three individual observations (FWF, FWA, SRP) (tables 3 and 8). Data on fires are classified into three categories: Fires on areas under tree-forests (FOF), on partially tree-forested areas and/or maquis areas (PCF)³⁶ and on areas under garrigue (GAF) (table 13). For each one of these three last categories, there are three corresponding individual observations (FOF, UPS³⁷, UFG³⁷ for areas under tree-forests; PCF, UPS³⁷, UPG³⁷ for partially tree-forested areas and/or maquis areas; GAF, UGS³⁷, UGG³⁷ for areas under garrigue) (table 5). A creation of cross-category characteristics on fires is represented by 3 aggregate individual observations (TAB, TUS³⁷, TUG³⁷) (table 8). Two more individual observations were used as indicators of the degree of modernization of the rural system (NTR, CER) (figure 7).

The numerical data which have been collected for this study have been intensively checked by the author. Aggregations of some of the existing municipal and communal statistics were calculated and compared with the statistics of the whole Department published by the National Statistical Service of Greece. Accordingly, data on agriculture, on forest and range fires, and on the land-uses of the island were evaluated, as well as on the sub-regional particularities of the northern part. In addition, the author held interviews with officers from the General Directorate of the Forestry Service located in Athens, the Forestry and Agriculture Ministerial Branches located in Chios, the National Statistical Service of Greece, the Bureau of Statistics of the Department of Chios, as well as with the Secretaries of a series of communes located at northern and central Chios. Subsequently, a clear idea of the system of collecting the statistical information was obtained and a rationale for the selection and enrichment of data was established.

4.4 THE METHODOLOGICAL PROCEDURE

4.4.1 General

The methodological procedure involves the multivariate technique of Factor Analysis³⁶. A "time" versus "land-use characteristics" matrix is formulated from the statistical data described at the previous section. The matrix is of dimensions 15 by 54 and it represents the evolution of 54 des-

criptors of the land-use system (table 5) the variation of which is observed over a period of 15 years, from 1961 to 1975.

Factor Analysis analyses the linear relationships between the number of variables in the data matrix. It is a grouping analysis technique (Environment Canada - 1977, p. 47), and it groups those items that are most like one another. In this particular application, Factor Analysis is used as a Trend Analysis Technique, known as P-mode Factor Analysis. In a P-mode Factor Analysis the time periods are represented by rows and the individual observations by columns. P-mode is used in Time Series Analysis by economists and planners (ibid, p. 70).

The factoring of the 15x54 data matrix shows which variables are independent over time. Furthermore, it separates the "positive" from the "negative" dependencies of the variables through time according to their factor loadings.

The output of Factor Analysis is as follows:

1. one or more sets of factor loadings or weights for each contribution that a factor makes towards "explaining"³⁹ the variance; and

2. the amount of variance explained by using a statistically acceptable number of factors.

4.4.2 The Procedure

The procedure follows four steps:

1. preparation of the correlation matrix;
2. extraction of the initial factors;
3. exploration of the possibility of rotating the factorial axes in order to obtain more meaningful results; and,
4. projection of the 54 individual variables on the factor axes;

The first step involves the calculation of the correlation between each pair of years (Q-type, P-mode) (table 17). The input matrix of this step is shown in table 15. More specifically, this table shows the 54x15 matrix of Standard Values which are calculated from the data matrix and are used as input for the calculation of the correlation matrix⁴⁰ (table 17).

The second step involves the selection and execution of the most appropriate factoring method. Principal Components

Analysis is used here. The main consideration for the selection of Principal Components Analysis is the fact that,

"...Principal Components Analysis is a relatively straightforward method of transforming a given set of variables into a new set of composite variables or principal components, that are orthogonal (uncorrelated) to each other" (Kim - 1975, p. 470).

The first principal component may be viewed as the single best summary of linear relationships exhibited in the data. The second component is defined as the second best linear combination of variables under the condition that the second component is orthogonal to the first etc. (ibid, p. 470). Table 18 shows the output factor Matrix for the first 6 factors. Table 19 shows, among other statistics, the cumulated percentage of the explained variation for each one of the 15 factors. The reader should note that the first four factors account for more than 75 % of the total variation of the set of data. The interpretation of the first four factors can, therefore, be considered as statistically acceptable.

The advantage of using Principal Components Analysis as factoring method lies in the fact that the main diagonal of the correlation matrix is not altered. This does not require any assumptions about the general structure of the variables. Furthermore Principal Components can be extracted from certain sets of highly correlated variables which can not be processed by the other factoring methods if the correlation matrix can not be inverted* (ibid, p. 479). The pairwise

graphic output of the analysis is presented in figures 23 to 29. A three-dimensional perspective of the first 3 factors is attempted in figure 32 and in constructing a three-dimensional model (pictures 9, 10 and 11).

The third step involves the exploration of the usefulness to rotate the factor axes. In this application the unrotated factors are meaningful because of the nature of the loadings of the variables on the factor planes. Therefore, no further significant information is to be gained by inducing a rotation of the factors in order to maximize the loadings of the variables.

The fourth final step is destined to calculate the projections of the 54 variables on the factor axes. This is done by multiplying the matrix of initial data (table 15) with the coefficients of saturation of each variable on each factor. The results for the first three factors are presented in figures 30 and 31. This final step allows for a more comprehensive interpretation of the results of Factor Analysis. The interpretations of the first four variables which are the most meaningful ones refer to figures 30 and 31 which are obtained from this fourth step.

Chapter V

INTERPRETATION OF THE RESULTS

5.1 PLANE I-II

The study time period 1961-1975 is represented on the plane by three distinctive groups of years: 1961-1967, 1968-1970, and 1971-1975 (figure 23). These three groups are displayed in sequence along axis I. Their location along axis I indicates that the whole set of variables shows an evolutionary trend starting from the group 1961-1967 and ending to the group 1971-1975. The set of these variables-years is expressed by individuals representing the basic features of the rural setting. Therefore, it can be safely presumed, that the whole rural system evolved in such a way that its first stages differ from the last ones. Hence, axis I or factor I represents the general time-trend.

The years 1968, 1969, and 1970 load heavily on factor II. Apparently, the variations of the 54 individuals favoured the formation of a particularity during the years 1968, 1969, and 1970. The fact that such a particularity appears as early as in the second factor reveals the existence of a sudden cause which drastically influenced the whole set of the descriptors of the rural setting. Axis II represents

the maximum variation of the 54 individuals, after minimizing their variations on axis I. Consequently, factor II, represents the change factor; the factor which accounts for the transformation from the first group of years (1961-1967) to the third (1971-1975).

By examining the location of the 54 individuals on the plane I-II (figure 30), one can identify the following traits: two major concentrations of individuals at both sides of factor I; and, a scattered set of individuals situated mainly at the one side of factor II. The two concentrations of individuals at both sides of factor I are associated with the first and third groups of years. A closer observation of the group of individuals which is related with the set of years 1961-1967 reveals that these individuals concern the features of a traditional rural system. For instance, the two individuals HMA and OBC denote a significant existence of animals which serve certain needs of the population such as ploughing, and transportation. In a similar way, the strong presence of domestic sheep and goats, of Carob trees, and of arable land are characteristics of such a traditional system. In this system gardens (AGN) are highly important while the fuel supply for the domestic needs is mainly fulfilled by firewood from agricultural holdings (FWA), and from forests*² (FWF).

The loading of this cluster on one side of factor I is associated with the fact that all of the individuals of this cluster show a general decrease during the study period. This side of factor I can therefore be marked with a negative sign indicating that the group of individuals-descriptors which are associated with it show a decline in the traditional characteristics of the rural system.

The cluster of individuals which is highly loaded on the other side of factor I (the positive side), represents those features of the rural system which are growing. This group reveals the following characteristics:

1. through time, the animal power for rural works tends to be replaced by machine power (NTR as indicator); a trend towards mechanization is apparent;
2. massive production of tree crops (ATR as indicator) was introduced associated with the adaptative response of the production mechanism to a market orientation; apparently, a change in the traditional mode of production occurred;
3. through time, the out-migration from rural areas and the reduction of the closed domestic-oriented system and its complementary form, nomadism, is linked with the increase in non nomadic flock animals (GFL, SFL). Although the total number of sheep and goats remained stable (STO, GTO), it is

remarkable that the number of both lambs and goat-kids sold for slaughtering outside the community strongly increased (SLO, GKO).

From the above it is evident that the basic characteristic of the years 1971-1975 is a trend in the basic features of the rural system towards a modernizing market-oriented system.

The remaining individuals do not form distinct clusters. They belong to two different groups. The first group (1st quarter) includes individuals which describe the fire characteristics of the study area; its position on the plane indicates that forest fires are generally increasing through time. The second group (3d quarter) is composed from individuals describing primarily slaughterings of animals aged more than one year; its location on the plane indicates a strong link with the discrepancies of the years 1968, 1969, and 1970. Apparently, the existence of these scattered individuals causes the statistical shifting of the years 1968-1970 from axis I.

5.2 PLANE I-III

The location of the years of the study period 1961-1975 on the plane I-III (figure 24) is a more detailed articulation of their behaviour. The two groups of years (1961-1967

and 1971-1975) show a parallel path along axis III. There was a uniform continuous evolution of the 54 individuals during these two periods. The period 1968-1970 shows again a transitional character. It is evident that the whole rural system evolved up to a certain point; experienced a crisis, slid into a new evolutionary position; and, thereafter it shows signs of a new continuous evolution.

The relative positions of the individuals (figure 31) are quite explicit in interpreting factor III. They form three groups: (1) a clustered group located nearby the years 1974-75; (2) a medium density cluster situated on the one side of axis I; and, (3) a sparse distribution of individuals which is identified primarily at the 1st quarter on the plane. The cluster located nearby the years 1974-75 indicates an increasing significance in the indices of modernization and in the individuals associated with fires. The second group of individuals is not significant to factor III because of its low levels of loadings on this factor. The third, sparse group involves individuals related with slaughtering of animals. It has a statistical influence on the years 1968-70. These slaughtering occurred in a different way for sheep than for goats. However, during the disturbance period there are significant levels of slaughtered animals aged 1 year and over. It is exactly these slaughtering which signify factor III.

In general, there is a decrease in the fodder production (decrease in AFP, AGR, AFT, ACR, CER, AGN). This reduction is reflected in the strong decrease of the total number of sheep, as well as the numbers of domestic and nomadic grazers. Sheep seem to be particularly sensitive to this reduction in fodder areas. Indeed, the population of sheep and lambs was reduced by slaughterings throughout the whole study period. The rate of decrease of the number of sheep is higher than that of the number of goats during the 1961-1967 period; the same occurred after 1971. This indicates that goats are more stable than sheep and that there is a tendency to replace sheep with goats. What kept the total number of goats in 1975 at about the same levels as in 1961 was the sharp decrease in their number between 1968-1970.

From the above description, one reconfirms the established hypothesis, that goats are more stable than sheep in degraded environments. In this particular case, despite the decline in domestic, nomadic, and total number of goats, the goat-kids born had an overall increase. This is not the case for lambs born. Non-nomadic goats in flock prove to be more efficient than any other form of sheep and goat breeding.

In general, factor III represents the evolutionary factor; the factor of the regular sequential evolution of the

rural system, year after year, in times of non-disturbance or crisis.

5.3 PLANE II-III

The observation of plane II-III will greatly help the reader to understand and conceptualize the positions of the 15 variables in space (figure 25). Here one can clearly see that factor II represents the change or crisis factor. The only variables with significant loadings on this factor are the years 1968, 1969, and 1970.

Factor III, on the other hand, shows clearly its role as the evolutionary factor. So, both the time periods 1961-1967 and 1971-1975, show a sequential trend from the one side of the factor to the other. During these periods, changes do not cease to exist, but these changes do not take the form of a disturbance or crisis.

5.4 PLANES I-IV AND II-IV

Theoretically, factor IV represents the maximum variation of the set of the 15 variables after minimizing the variations on the previous three factors. By observing figure 26, one could establish that factor IV is a more detailed version of factor III. Actually, factor IV implies that the process of sequential evolution of factor III incorporates

secondary variations. It is not, therefore, surprising that the years 1966, 1967, 1971, and 1972 show greater variation on factor IV than the rest of the variables. This simply means that the 1968-1970 crisis did not start suddenly.

Plane II-IV is similarly interesting (figure 28). The years 1962 and 1972 are indicated as having some kind of affinity with the crisis variables (1968-1970). The interpretation of the behaviour of these two years could have been performed by projecting the individuals on the factor plane. This is not done here as it is not significant to the objectives of this thesis. However, it should be noted that this same particularity must have caused their variant positions on figures 23 and 25.

5.5 AN OVERVIEW OF THE ANALYSIS

5.5.1 The land-use system

Any attempt to understand the true dimensions of the conflict must involve the uses of the resources themselves. The activity of stock-breeding in Chios may have many and diversified resources. In fact, a rational diversification existed in the traditional rural system. The rural population was greatly dependent on resources and their variations, however, resources were both scarce and vulnerable. The population had not only to make a rational and full use of them, but also to use them in such a way that their continuity would not fail.

Under these conditions, in addition to the specific practices of the various rural activities, certain social and cultural patterns developed. This fact was the major element which determined the various uses of land and a traditional land-use system developed. In this system the existence of domestic or nomadic animals is determined by the availability and distribution of animal food. For example, some Carob trees on arable land or in the house-yard would not only increase the fertility of the field or improve the shading of the house, but would also provide enough fodder for a few additional animals. Nomadism is another similar example. This practice exploits both the highlands and the residuals of the cultivated lowlands in the best possible way. Nomadism exploits resources which otherwise would have remained un-exploited and gives sufficient time for the range to regenerate. In the traditional rural land-use system, every use of land and every activity was inter-related with the other land-uses or activities in an integrated fashion.

During the 20th century, out-migration increased drastically. This out-migration was quite strong for the study area. Its impact is measured not only in the abandonment of rural areas, but also in the formation of large urban centres and consequently large and demanding markets. However, the majority of the population abandoning the rural areas, originates from the mountainous and semi-mountainous areas.

These areas are exactly the ones in which traditional pastoral activities are practiced. One should then expect a reduction of the traditional character of these areas, a loosening of their traditional land-uses and practices, and a process towards reducing the integrity between rural activities.

5.5.2 The land-use system as a framework for the study of the forest-grazing conflict

Forested and grazing areas are found mainly in the semi-mountainous and mountainous parts of the island. Grazing areas neighbour forests, and in many cases they are found within forested areas. The relationship between these two extends beyond their spatial distribution. Forests are potential grazing areas; and grazing areas may become forests. The most significant factor which is involved in this confronted relationship is the activity of stock-breeding. Any change affecting the resources of stock-breeding is related with the spatial interaction between forested and grazing areas. As an example, an increasing demand for meat or a reduction in the productivity of range due to erosion affect the resources of stock-breeding. Since stock-breeding practices largely depend on grazing, this influence will be expressed in the forest-grazing relationships. Pressures aiming at exploiting the grazing potential of the forests will generate. Such pressures are expressed via such ways as over-grazing, branch-cutting, and burning.

To resume, the conflict between the forested and the grazing areas is expressed within the land-use system. It affects the uses of land, their quality, as well as their state in terms of stability.

5.5.3 Factor Analysis and the study of the conflict

The study of the conflict involves the implementation of the technique of factor analysis. Certain descriptors of the land-use system were selected. They describe all the major characteristics of the rural system. Factor analysis grouped the 15 years of the study period according to their statistical similarity. Furthermore, it generated plots showing which rural characteristics are mostly related with these groupings of years.

The interpretation of these results has to be done in terms of the evolution of the land-use system. It has to find those links which will associate the statistical analysis with reality. So, the interpretation of the behaviour of the rural characteristics of the rural land-use system through time is nothing else than to explain the evolution of the rural land-use system.

5.5.4 The results

The most important characteristic of the rural land-use system is a general evolutionary trend. The early stages of this evolution are associated with a strong presence of traditional characteristics and the last with a strong presence of characteristics of modernization. Evidently the whole land-use system changed. The fashion with which this change occurred is most interesting. Firstly, a sequential evolutionary trend of the land-use system is observed (1961-1967). Secondly, a crisis follows (1968-1970). Thirdly, a new sequential evolutionary trend is established (1971-1975).

5.5.5 Interpretation of the results

The determinants of the crisis period have far reaching implications. At 1967 a dictatorship was imposed to Greece. This fact is critical, for the understanding of the changes which occurred in Chios during the crisis period. This dictatorship influenced the conditions of the study area in three ways:

1. through granting agricultural debts. This measure removed a significant financial burden from the peasants. Such a burden was pressing in particular that part of the population who lived in the poor mountainous and semi-mountainous areas of the country. Con-

sequently, its removal resulted in a strong out-migration flow. Chios felt strongly this flow (map ...). This mass population exit from the island was associated with massive slaughterings of animals aged one year and over. It was also associated with an abandonment of small-holding operations located at the mountainous and semi-mountainous parts of the island which were using traditional domestic practices. A drastic reduction of domestic animals followed.

2. through providing incentives to stock-breeding. The strong out-migration flow was associated with a deficit of meat in the markets. As response, incentives were given aiming at an increase in the animal stock. In Chios, under the new conditions created with out-migration, the only viable increase in the activity of stock-breeding could take place in non-nomadic flock pasture. A constitution of larger flocks followed. This had tremendous implications for the forest-grazing conflict because of the low productivity of the range and a consecutive search for more resources.
3. through oppressing the aspirations of the traditional rural system. This effect took mainly two forms: the implementation of the antipathy of the state to the nomads; and the suppression of the

need to regenerate range through burning. The first resulted in a further reduction of the nomadic animals. The second created an "explosion" of areas burned, in 1970 and 1974.

The third period, identified in the analysis, is marked with strong indices of modernization. It is also characterized by extensive and increasing areas burned. The characteristics of the rural system indicate a sequential evolutionary trend. However, no stability has been achieved in the spatial interactions between grazing and forested areas. Apparently, the transformation of the diversified traditional stock-breeding to primarily non-nomadic in flock demands more resources than the existing range can provide. Since the traditional resources used by domestic and nomadic stock-breeding are diminishing, the only remaining area with grazing potential is the forest. The shepherds practice their traditional technique of burning in an attempt not simply to improve the grazing areas, but to transform the remaining forests to range. Hence, the evolutionary regularity of the last period is mainly characterized by an increase in the flock animals associated with an increase in areas burned.

In current situation, there is a deterioration in the quality of stock-breeding practices. The composition of the

flocks is less diversified than before and grazing patterns are more destructive. In addition, although the system of communal land tenure is very powerful, its role has changed greatly. The communal and municipal councils of the pastoral communities have insufficient financial resources for their programmes. Thus, in many cases, they are not opposed to having the communal forests burned. This would increase the grazing areas, and hence, the community's revenues. In general, a complete destruction of the traditional dynamism and integrity in both the uses of land and the rural activities in general has occurred. The new setting appears to be most unbalanced and destructive with unknown consequences.

5.5.6 Implications of the results

The results obtained from the analysis involve aspects which lay outside the regional perspective. An overall framework must be established prior to the formation of regional developmental orientations. In the following chapter a review of the implications of post-war development; a review of some recent aspects of regional developmental theory; and a review of some important aspects of the national context which are influential to the conflict will be presented.

Chapter VI

A FRAME FOR SYNTHESIS

6.1 DEVELOPMENTAL ORIENTATION - IMPLICATIONS FOR A STRATEGY FOR REGIONAL DEVELOPMENT IN THE STUDY AREA

After the Second World War the dominant models for development split national economies into two parts: agriculture and industry. The orientation of development in dichotomizing economies into these two elements, favoured a specific type of industrial development. As a consequence of such development, industry was seen as opposed to agriculture in the same way that the notion of "modern" is opposed to "traditional", "high productive" to "low productive", "urban" to "rural", "capital intensive" to "labor intensive" and the notion of "manufactured goods producing" to "food producing" (Mehmet - 1978, p. 18). After thirty years of a developmental orientation along these lines, known in the literature as "Big Push" approach, criticism has emerged. This criticism involves, among other things, the basic idea that economic theory by itself never managed to integrate all the determinants of under-development into its scheme. Such an orientation was blind to the realities of the many non-economic variables interveining in economic relations as

externalities³ (Pearse - 1976; One - 1975; Coddington et al - 1971).

This type of development was imposed on post-war Greece⁴. It had the tremendous result of centralizing economic and administrative functions in Athens which related directly to a drainage of resources and rural population towards the Capital⁵ (table 20). This impact was considerably felt in Chios⁶. As early as 1961, the head of the Department of Chios pointed out in a report that out-migration was a serious problem for the island (Pamboukis - 1961, p. 113). Also, in 1965, there was a reported lack of engineers to carry out public works in some areas (Perris - 1966, p. 28). The Capital of the Department, Chios city, did not succeed in receiving decisive pulses of growth from the Nation's Capital. This resulted in a regional polarization between core and periphery. The core became parasitic and stifled the growth of the periphery. Indeed, Athens does not play its role as a Growth Pole and it does not transmit impulses of innovation to Chios⁷ (Growth Centre⁸).

This lack of ability of the National Capital to transmit impulses was associated with a second characteristic of Greek post-war development: the existence of a continuous neglect of physical space in economic decisions. It could be maintained that space, if at all considered, was mainly

identified with the friction that it caused⁴⁹. To justify this neglect, the dominant class introduced the theory of the poverty of the Greek territory and its resources (The theory of "psorokostena", and of "bread, olive, and King") (Yannopoulos - 1974, p. 6). According to this theory, Greece, as having no assets, was in the inferior position to, fatefully accept any side-effect resulting from growth. So it is not surprising that space considerations were only very recently introduced in both the planning literature and the decision making process (Parliament of Greece - 1976; Technical Chamber of Greece - 1978).

Today, incentives are promoted for the location of industrial units to un-congested areas. However, the off-hand way that these measures are applied makes doubtful any real developmental impact in the territorial areas (Vovolinis - 1978, p. 28; Markopoulos, Loukakis et al - 1976, p. 53)⁵⁰. In the case of Chios, as a designated territorial region, if any benefit will derive from the existing incentives, it is gradually being realized that industrial development appears to continue favouring the primate cities; sufficient numbers of firms seem reluctant to move to designated areas so that constant aid is required from the government (e.g. through tax exemptions) (Gilbert - 1974, p. 112).

PROPOSITION: In this case, where Chios, as Growth Centre, is a non-generative city, a suitable strategy must be adopted. This strategy must involve inputs into the rural areas. Here the assumption is that growth from the grass-roots will generate further growth and create a more meaningful symbiotic relationship between core and periphery (Johnson - 1970). Such a grass-roots strategy should primarily stress the attention to: (1) provide an adequate economic infrastructure on the island as a viable component of the national economy and (2) improve the linkages between the island, the capital, and the markets⁵¹ (Stohr - 1974, p. 398).

This structural intervention into the rural areas must consider that not any innovation promotes development. One must not imply that innovations, like new institutions such as co-operatives or banking facilities, are identical with development, nor that they necessarily cause development. Sometimes the opposite may be the case if such new facilities drain income from the region they serve (e.g. through additional middleman functions), rather than raising its level of development. Innovations in certain situations can also have negative side-effects and cause backlashes (ibid, p. 398).

6.2 DEVELOPMENTAL THEORY IN THE SEVENTIES

A COROLLARY PREREQUISITE FOR REGIONAL DEVELOPMENT IN CHIOS ISLAND

A strong criticism on the "Big Push" approach was already established during the first half of the seventies. It was followed by an amalgamation among planners of the belief that Growth Pole Theory is an unbalanced Growth Theory from which both balanced and unbalanced growth policies may derive⁵². The formation of this belief largely contributed to the fact that very few applications of this theory resulted in balanced development. As a result, throughout the recent rural planning literature the concrete concept of "region"; as a fundamental planning unit, emerges as important as ever. Despite the increasing importance of the term "region"; at present there is neither sufficient clarity nor agreement concerning its meaning⁵³. For the purpose of this thesis, the author accepts the notion of the region as a sub-system of the national social-economic-physical system⁵⁴. Furthermore, the basic principle used in developmental action should see the solution of regional problems as an integral part of a general policy aimed at the development of all regions. This general policy must be pointed toward the attainment of national goals for the spatial organization of the economy (Friedman - 1966, p. 4)

It is through the above principles that a peripheral grass-roots strategy may be realized. An important contribution to such a realization has been developed by the Greek researcher Dimosthenis Sideridis. His recent work presents a brilliant planning scheme for the development of the mountainous and insular areas of Greece (Sideridis - 1977). He bases his work on the concept of "resource-shed", as an elementary planning unit for regional and national development. According to Sideridis,*

"Resource-shed is the cell for the improvement of the total restructuring of various land-use types. It is the catalyst of economic development." (Sideridis - 1977, p. 43).

This concept is similar to that which inspired the work of the Tennessee Valley Authority. However, in the context of mountainous and insular Greece, such an approach obtains a completely new dimension: the watersheds⁵⁵ are largely different, and the same holds true for the "pasturesheds" ("milksheds", "meatsheds", "cowsheds", and the like) (map 16). In addition, this concept facilitates the identification of the systemic components of regions.

Establishment of resource-sheds as spatial units and their potential to aggregate into larger units such as sub-regions and regions provides a scheme for identification and

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

quantification of local and regional problems. Thus it enables planners to establish and implement developmental programmes and provides a ready system for feedback and control.

Establishing resource-sheds as planning units should be a first step to the control and elimination of soil erosion. In general, by implementing developmental programmes which operationalize this "shed" concept,*

"...an efficient protection of the natural resources and their ecological environment will be achieved. The productive forces of the earth will be methodically preserved and strengthened according to the propositions of advanced technology⁵⁷. The natural renewable resources, instead of becoming degraded and exhausted, are providing -with the intensity of production⁵⁸- more and diverse products. The expansive character of production becomes intensive⁵⁹ and maximized." (Sideridis-1977,p.51).

The necessity of establishing developmental units is also urged by the "Man and the Biosphere" programme of the United Nations. In specific, the results of the second project of this programme are in favor of,

"...drawing up of plans for the rational management of natural free-range grazing land in the framework of well-defined regional units by means of controlled grazing in rotation⁶⁰ and seasonal or periodic protection of grazing land." (MAB,Project 2 - 1974, p.36).

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

To return to the conditions of Chios; the resource-sheds must firstly be identified; secondly, the aggregation, disaggregation, and integration⁵⁶ conditions of the various resource-sheds must be set.

6.3 REQUIREMENTS FOR THE FEASIBILITY OF THE ABOVE APPROACH -THE FOREST GRAZING CONFLICT IN THE NATIONAL ADMINISTRATIVE CONTEXT

The seriousness and the extent of the forest-grazing conflict is not a local phenomenon concerning only the island of Chios. According to numerous reports, this conflict exists almost everywhere in Greece (Makryniotis - 1974, p. 7; Dimitriou - 1974, p. 379; Lampsidis 1978, p. 19). Hence, it is worthwhile to examine the situation in the national administrative context with which it is associated.

"Pasture, as practiced today in Greece, damages the forest, as well as the cultivations. Concerning this point we can say, that we still maintain certain aspects of barbarism⁶¹"

wrote Mr. Andrianopoulos,* Minister of Agriculture in 1931 (Andrianopoulos - 1931, p.8). At present, the problem between grazing areas and forests is so acute that the vast majority of the articles in the two major Greek forestry journals, "The Forest" and the "Forestry Chronicles", refer to

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

various aspects of the forest-grazing problem and particularly to administrative aspects⁶².

Throughout this century, two opposing groups have developed in forestry administration, associated with the ways and means to be taken in resolving the forest-grazing conflict. The first group supports absolute drastic measures and severe penalties such as exile, long imprisonment, or heavy fines. The second group of foresters takes a holistic perspective which is aware of the origins of the conflict and the necessity for a long-term programme. Grispos, in his book "The Forest History of Greece", explicitly states the following:*

"During the fifteen years between 1922-1936 a confrontation grew in the Forestry Service⁶³ among the senior officers and the younger officers. The first defended a management policy which was oriented towards the protection of forests by police power allowing very few forest activities to justify the existence of the [Forestry] Service. The second group rebutted with a proposal for forest improvement and renewal associated with the multiplication of the productivity of the forest" (Grispos, 1973, p. 355).

The reaction to the "revolt" of these young Foresters by the chiefs of the Service exerted, among other things, administrative penalties and pressures (ibid, 355). The Metaxas military dictatorship which followed insured the power

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

of senior officers. As a result, in 1937 Decree 875/1937 was established. This law was the most radical of all in modern forestry legislation. Its impact lies outside the domain of tree-forest management by involving, for the first time in recent history, the range areas as well. As a result, the ownership of goats was outlawed everywhere in Greece, and during 1939-1940 five million goats were slaughtered in a counter-economic fashion (ibid, 297). The proposer of this law, Petros Kontos, General Director of the Forestry Service, said that the elimination of goats could have occurred over a longer period,*

"...but we have to hurry, because we do not know how short-living this government will be, and we will not find such an opportunity again" (ibid - 297).

The unplanned and wasteful application of such decisions became clear, not only in the famine years during the German occupation, but also after the war when the Ministry of Agriculture found it necessary to import from Turkey a number of goats equal to the number of goats slaughtered during 1939-1940 (ibid, 298).

After the war the dominance of the senior Foresters continued to exist. Their unwillingness to establish an appropriate programme for the Greek forests was tested once again

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

when large amounts of the post-war American aid were assigned to forestry. The American delegation suggested persistently a forestry conference for the review of the existing situation and the setting of guidelines for the future. In such a conference, the body of Foresters would have had the opportunity to establish a comprehensive approach to the forest-grazing conflict. However, the opportunity was lost again. After many delays, a "Meeting" of foresters was called⁶⁴ in 1949 to which the participants were appropriately selected in order to avoid of opposition (ibid, 331).

This meeting was the first and last in the 30-year life of the forestry body. A large amount of American aid assigned to forestry was wasted; the administration of the Forestry Service was unwilling to accept and apply many well founded suggestions⁶⁵. Most of the forestry and range works of this period involved capital investment and kept away from any long-term managerial strategies. Such works resulted in the construction of watertanks, of paths and roads, and of animal shelters.

Despite the continuous reactionary attitude of the Forestry Service Administration, the forestry body was well aware of what was needed. In 1953, the representatives of one national forestry association and five regional ones⁶⁶ submitted to the Minister of Agriculture and to the Press a decla-

ration concerning the practice of Forestry in Greece and the role that the Forestry Service should play. It is worthwhile to quote a paragraph from this declaration:*

"In the future, our forestry policy must be based on the principle that the forest violator, who exists among our mountainous population, is not a phenomenon of social pathology, but on the contrary, a phenomenon which originates from a societal need. Our peasant becomes a violator for the fulfillment of his vital needs and not because he has criminal tendencies. If his needs are fulfilled our mountainous peasant will have no reason to violate the forests and he will cease to do so. For the fulfillment of the peasants' needs in a nationally organized forestry policy an orientation towards the framework of an integrated use of land in our mountainous areas is required" (Grispos - 1973, p. 304).

This declaration clearly indicated that the problem did not lie in some ill-conception of the Foresters, it was rather that the organizational functioning of the Forestry Service was always corroding or disorienting any scientific or managerial advances⁶⁷.

The situation remained the same up to the time when a new military dictatorship was established in 1967. During the seven and half years of this regime, the Forestry Service came to be disbanded; it lost half of its jurisdictions and the peripheral Forestry Departments became subordinate to the Agricultural Service (Editorial - 1976, p. 92). After

*The original language of this quotation was in Greek. The translation is done by the author of the thesis.

the dictatorship⁶⁸ the forest-grazing problem was more acute than ever⁶⁹. For the first time in recent Greek history attention was shifted from fires at the urban fringe to colossal fires which exploded in pastoral areas⁷⁰.

At present, the problem between forested and grazing areas is not even mentioned in the "Programme of Economic and Social Development 1976-1980" of the Ministry of Co-ordination and Programming⁷¹. Expertise for the resolution of the conflict remains within a circle of people, who by profession (Regional Foresters, Forestry Researchers, Planners etc.), are well aware of the regional problems of the country, but whose position does not allow their opinion to have access to decision making. Their proposals never go through the administration as a continuous influx of guidance to the everyday political-administrative functioning of the state (Massavetas - 1977, p. 172).

6.4 NATIONAL PREREQUISITES FOR THE ESTABLISHMENT OF REGIONAL RURAL PLANNING

Ineffective national administration greatly influences the forest-grazing land-use conflict at the regional level⁷². The establishment of planning for the resolution of the regional conflict will fail if certain national conditions remain in their present state. To this end, the following national prerequisite must be met:

A restructuring of the existing contorted organizational situation in the public sector must be implemented⁷³. Such a restructuring must incorporate in its orientation the holistic view that society and nature⁷⁴ are sub-systems of the same whole. Accordingly, problems arising from either sphere are seen in perspective.systems

The implementation of this basic prerequisite should integrate the following objectives:

(1) This reorganization must be executed in such a way that efficient co-operation between all the levels of administration is promoted. atmosphere of co-operation must integrate agencies at the level of Department Administration, municipalities and communes at the local level⁷⁵. A provision of the means for the promotion of regional and local goals must also be guaranteed.

(2) The horizontal co-ordination of all agencies at all levels must be established. At the national level, there is an urgent need for the co-ordination of the policies of the various Ministries. The necessity of the creation of a new Ministry or an authority of the type of TVA should also be considered. Proposals for such a creation have already been introduced in the Greek literature⁷⁶. At the regional level, agencies of the Ministries must be co-ordinated. De-

partment administration could play a co-ordinating role. At the regional level, the existing communal and/or municipal bodies should form sub-regional units based on their common characteristics, needs, and interests. Thus programmes for land-use arrangements, common transportation needs, and common trading of products may be achieved.

The role that rural co-operatives can play, and particularly the ones associated with the pasture production cycle is most significant. They can prove to be key elements in the proper functioning of the horizontal and vertical components of the planning scheme. The international and the Greek literature are very rich on this topic. As an example, it has been widely accepted that in islands, particularly in the Mediterranean, produce can not be exported in a beneficial way except on a co-operative basis (UNESCO MAB, Project 7 - 1973, p. 18). Similarly, in Greece, as early as 1932, the General Director of the Forestry Service proposed a plan of intensified cultivation and stock-breeding in which co-operatives play the essential role (Andrianopoulos - 1931). In 1940, the Minister of Agriculture considered the forest co-operatives as key elements for the promotion of the Forestry Programme of the Government (Kyriakos(a) - 1940). In the same year Dekazos proposed a programme which involved all the aspects of the pastoral problem in Greece; there, extensive reference was done on cheese production co-opera-

tives, dairy farm co-operatives and forestry co-operatives (Dekazos - 1940). These same aspects of Dekazos' programme were accepted by the Supreme Economic Council in its advisory work pasture in Greece (Supreme Economic Council - 1940). In 1955, M. Klemme, delegate of the American Aid programme, underlined the significant role that the forest co-operatives can play in forest fire-protection (Klemme - 1955). In 1961, a report edited by the Head of the Department of Chios supported a scheme for the development of the Department. In that programme the extensive existence of rural co-operatives played a crucial role in developing the rural sector of the Department (Soumelidis - 1961, p. 19; Perdikis - 1961, p. 35; Nomarchial Council of the Department of Chios - 1961, p. 93 - 94). Similar aspects have been recently expressed on many other occasions (Yannopoulos - 1974; Sideridis - 1977; Ministry of Coordination and Programming - 1977).

(3) A third objective concerns the existence of a system of base data and sources. The creation of a system of continuous provision of appropriate and updated data is required prior to the adoption of any planning action. Cartographical, Ecological, Hydrological, Pedological, and other similar data must be collected in a proper scientific way accompanied by a precise, dynamic, and well functioning system of land registry.

The non-existence of such a body of data and the urgent need for its creation has been repetitively requested, not only by individual researchers, but also by such professional associations as the Association of Surveying Engineers, the National Association of Foresters, and the Technical Chamber of Greece (Association of Surveying Engineers - 1976; Technical Chamber of Greece and Association of Surveying Engineers - 1977; Rokos - 1976; Rokos - 1977).

It is characteristic that for the Department of Chios there are differences in data which relate to the total Departmental surface⁹. In addition to this, the only maps of the Department of Chios which can be found are: a vegetation map made in 1959 by the individual estimations of the Forester who was in charge of the Department; a map of the Statistical Service made in 1961 and updated in 1972, in which the forested areas and the road network were inaccurately displayed; a topographical map which is classified as "secret" and is not available to the public. Such topographical maps can be obtained only from the Geographical Service of the Greek Army, after following a procedure of application, certification of the user's identity, and explanation of the intended use of the map.

(4) The previous three objectives are structural. Their operationalization should occur as follows: A planning-pro-

programming mechanism must be set up⁷⁷ which integrates the policy-formulation / policy-implementation / feedback functions of the programmes and their specific plans⁷⁸. The decision making process must be as open as possible to all public bodies and interest groups at all levels and sectors concerned with the decisions to be taken⁷⁹.

At the national level, an appropriate public body must undertake the co-ordination of this mechanism: theoretically, the Ministry of Planning and Co-ordination. This public body must be guided by the following principles:

1. Development must be conceived of, not only as economic and social growth, but also as structural change⁸⁰ (Shachar, Stohr - 1974, p. 829).
2. The nation must be conceived of as a system of integrated sub-systems. (Hilhorst - 1974; Rondinelli, Ruddle - 1977, p. 185; Friedman - 1966).
3. Vertical and horizontal integration are critical. The process of regional development finds its culmination in a situation where spatially distributed and specialized activities are internally integrated and form an integral part of a large whole (Hilhorst - 1967, p. 289).

Chapter VII

REGIONAL DEVELOPMENTAL ACTION AT CHIOS

7.1 GENERAL

Once the prerequisite of a well co-ordinated planning mechanism is established, the following principle must be the cornerstone for development in Chios: The development of the island must consider all the societal sectors as an integral whole. Emphasis must be given to those traditional social and cultural patterns of the local societal system which are of a progressive nature in relation to developmental goals. In order to properly identify such progressive factors, the regional planning agency must minimize: (1) - the non-open forms of decision making and (2) - the imposition of sectoral action which neglects the complexity of reality.

"The fact that such planning and participation is seldom realized, and usually feared, even in most western countries, suggests both the arrogance of most "experts" and the great distance we have to go to learn how to adapt and humanize our own technologies, much less reduce their harmful impacts on cultures" (Dahlberg - 1974, p. 83).

Accordingly, no programme or plan should be developed without providing for the implementation procedures, as well as the provision of a proper feedback flow. These features

should be the elementary blocks for the formulation of evaluation procedures at inter-regional and national levels.

Foresters should play a key role in the whole scheme. According to Fontaine, the eldest forester in the service of FAO,*

"Forestry policy must be co-ordinated with the overall national policy on the environment. At a regional and local level foresters should be the co-ordinators of the activities of the other Ministries and Services involved" (Fontaine - 1971, p. 14).

7.2 THE DEPARTMENTAL PLANNING UNIT

According to Klemme, a readily available planning unit for pasture is the existing administrative unit of commune or municipality (Klemme - 1955, p.35). Indeed, there exists already an administrative infrastructure which is composed by communes and municipalities. Klemme's proposition becomes even more attractive when considering the cultural patterns and attitudes of the local population itself. The long existing communal land arrangements may prove to form an excellent basis for the achievement of the purposes of regional and local programmes. The adoption of communes and municipalities as planning units raises certain points: Firstly, although this approach may very well apply to the central and northern pastoral communities; it may not be ap-

*The original language of this quotation was in French. The translation is done by the author of the thesis.

appropriate for the southern communes of the island which are primarily given to cultivations. Secondly, the concept may not apply in those communes which are primarily tree-forested. Thirdly, the already existing communal boundaries may not respect certain principles of watershed management. Therefore, an elaboration of the planning units according to certain criteria may be required. By departing from the concept of commune boundaries a scheme could be worked out. In this scheme aggregations of whole communities into larger planning units may be performed. Rearrangement of commune boundaries should be minimized. For example, a milkshed may not necessarily have the same boundaries as a timbershed. It may also be the case that only a part of a watershed belongs to a particular planning unit, in which case co-operation between communes at a sub-regional level must be pursued. A schematic grouping of the communities of the island according to their basic land-use activities is shown in map 19.

7.3 DEVELOPMENTAL PRINCIPLES FOR THE IMPROVEMENT OF FOREST-GRAZING INTERACTIONS

7.3.1 General

It is evident that a land-use system must be established in which the activities that take place, the locations that these activities occupy, and the people involved in both the activities and the locations should be integrated. For the rural sector of the island such a scheme is shown in figure

35. In this rural land-use system, the land uses of grazing and forested areas must form parts of an integrated whole. It is in such a land-use system that a sound, comprehensive, and integrated management⁸¹ has a rationale for its establishment. This kind of management, based on an integrated land-use system, should develop under certain principles. In the following sections, certain developmental principles for such a management will be presented. These principles are the result of this thesis analysis. Therefore, they represent the human-ecological aspects of development. Additional research is required for the establishment of a complete set of developmental principles covering all the aspects of the societal and natural systems and their interactions.

7.3.2 First Principle: Multidimensional management

The ecological and spatial factors along with economic, social, and cultural aspects of the rural setting must be constantly considered in managerial action. The social and economic aspects, in particular are very important determinants for the success of the overall developmental effort. As has been pointed out recently by Unesco...

"any discussion of grazing problems in the Mediterranean region must conclude with the admission, that, while additional scientific data may well be useful in grazing control, the social problem of over-stocking and uncontrolled grazing is by far the most serious cause of current devegetation and erosion..." (UN MAB, Project 2 - year, p.36).

This problem is well associated with the economic conditions in Chios. Until alternative sources of income are available to grazers, until stock numbers cease to represent the only means of accumulated capital, and until grazers are taught to understand the relationship between their animals and their environment, no solution can be forthcoming. (ibid, p.36). Any further research or programme implementation will fail if parallel social change does not occur which is supportive of such action² (Soumelidis - 1961, p. 17).

7.3.3 Second Principle: Application of appropriate technologies

Development does not necessarily imply the creation of large-scale economic units with massive or specialized production. For the Mediterranean rural setting, where the natural environment is so variable and complex, there is no base for a general adoption of such development. Contradicting the Mediterranean reality, large scale units implementing high technology were in the mainstream of the developmental efforts of many Mediterranean countries. In Greece, the effects of this approach are potentially capable of destroying the two thirds of the country which is mountainous and/or insular. It should be noted that, according to recent advances in regional developmental theory, development must take place through the adoption and application of small and

intermediate technologies which are scaled to the environment and cultures of the people concerned. The manner in which such technologies are applied is equally important.

Future development requires another approach. An example of application of appropriate technologies for Chios could be the establishment of an intercommunal cheese factory associated with a flexible system for the collection of milk. Such a system may promote the increase of domestic animals and should not drain useful resources to middle-men. The role of the state and its regional agencies in the application of appropriate technologies is essential. It should provide facilities to communes or co-operatives for the provision of the machinery that, for example, a cheese factory and a system for the collection of milk require. The state should safeguard the absorption of the regional production by the markets. At present, the state must contribute to the fulfillment of certain chronic infrastructural requirements of small to intermediate technological levels. The establishment of a network of various flows to and from the rural areas³³ such as by the provision of the appropriate means of production and distribution of animal food or by the intake of the rural production to the markets, are relevant examples.

7.3.4 Third Principle: Integration of Nomadic Pastoralism in the Land-Use System

Although in Chios there exists no nomadism in the true sense of the word, a certain type of semi-nomadism is very significant. Flocks of animals belonging to shepherds of the northern area of the islands exploit the mountainous and semi-mountainous range of the northern villages during the summer and the range of the southern villages during the winter (Perdikis - 1961, p. 26). These flocks can not, in fact, find available resources for the year round so they have to travel for resources. Through time sophisticated patterns of land-use developed in which nomadic animals played an important role. They exploited the mountain range and when leaving for the southern areas they allowed for the regeneration of the highlands. This practice of grazing is a traditional version to what is known among pasture-scientists as rotational grazing. It is preferable to constant or indiscriminate grazing. In the case of Chios, indiscriminate grazing is practiced by the animals in flock, non-nomadic. The reader will be in a better position to assess the grazing impact of nomadic and in flock non-nomadic animals, after observing table 21. In the southern villages, where significant cultivable areas exist, the nomadic animals exploited the harvest residuals of the fields and the autumn and winter grasses of marginal lands. At the same time, they fertilized the fields with their manure. Indeed, the grazing

practices of nomads traditionally utilize the land resources in the best possible way.

The role of the nomadic flocks has been largely misunderstood. The origins of a general antipathy to the nomads are many. The most important reasons being their lack of integration with the post-war developmental schemes of modernizing states. The subsequent reduction of traditional resources and patterns of movement used by nomads has resulted in conflicts between such shepherds and cultivators⁶⁴.

In spite of such a climate of social confrontation, in Chios the existing semi-nomads function through a network of leases with the local communes in the same way as the non-nomadic flocks do. It is not surprising that the Regional Director of the Ministry of Agriculture in Chios wrote in 1961, when attempts for modernization had not yet seriously affected the nomadic patterns, that the basic problem of the nomadic animals is the rational utilization of the grazing areas in order to improve the nutritional conditions of the stock (Perdikis - 1961, p. 30).

In conclusion, in 1975 nomadic sheep and goats accounted 30% of the total number of animals, a fact which must figure predominately in the design and implementation of any scheme of integrated land-use management⁶⁵. The nomads' role could

prove to be very helpful in the implementation of a programme of periodic grazing (e.g. every second year) which would permit the recovery of grazing areas.

7.3.5 Fourth Principle: Acceptance and use of fire as a management technique.

Chios has a fire frequency pattern which shows sudden periodic peaks. The fires which are generated are frequently immense in size and occur under very dry and windy conditions (Karaliolios - 1977). They always involve the range and forest resources of pastoral communities. Cultivated areas are very rarely burned. In addition, the pastoral mountainous population always welcomes them; the inhabitants of these areas know very well the effect that the forest and range fires have, in regenerating annual vegetation and thus maintaining their pastoral yields. One could say that fires as a phenomenon are today, more than ever, a constituent element of the rural pastoral land-use system.

On the other hand, range researchers have proved that fires may have excellent effects of regeneration of the palatable species of the range. Today, the wide awareness of this fact results in an increasing literature on the use of fire as a managerial technique in mediterranean areas (Moohey, Parsons - 1973, p. 91,96; Semple - 1970; Moore - 1966; Warren, Maizels - 1974; Bentley - 1967). However, in the Department of Agriculture of Greece, there still exists a

preservation of the belief that fires are nothing else than the worst thing that can ever happen to national forests and ranges.

From the above, there derives another principle which any developmental action should principally consider: a change in the attitudes towards fire must occur. Ecological applications of fire, as an appropriate technique, must be integrated into the regional developmental programmes. The designers of any programme should not forget that if the implementation of their proposals does not provide for controlled burning in order to provide for the appropriate grazing resources; then, the local population will itself burn both range and forests by necessity.

Here, a cautious consideration must be taken into account: burning must not be the only technique for the increase of the animal food resources; it must be associated with other efforts such as the adequate exploitation of marginal cultivations, the establishment of a system for the production of animal food from the residuals of cultivation, and the promotion of improved pastures through such means, as periodic grazing, fertilization (Chouliaras - 1971) and eradication of the non-palatable species (Abernathy - 1973; Bentley - 1967; Semple - 1970; Selingman, Douer - 1970; Natsis - 1974). The succes of these techniques will eliminate

or at least reduce any individual initiative in the burning of forested and grazing areas. Support of rural populations to the programmes will follow. This will facilitate not only the work of the foresters but also the establishment of effective fire-fighting⁶⁶. Most likely non-accidental fires will be minimized. It is only then, that an appropriate antipyric programme would have a sound basis for its rationalization. Fire-breaks or antipyric zones, an adequate road system associated with them, and a sufficient pool of mechanical equipment may be used as tools for fire-fighting⁶⁷.

7.3.6 Fifth Principle: Acceptance of the usefulness of the non-productive forest

The forests of Chios are not considered as profitable for specific industrial use (Karaliolios - personal interview). They are located in the semi-arid zone and their productivity is considered as low to nil. However, because of this, these forests are usually not considered in government policies. To this Quezel is very critical:

"Forests whose profitability is low or nil should by no means be abandoned by national forestry or agricultural services. Indeed, since these are the most vulnerable forests, it should be recognized, that profitability is secondary to the general problems of development and protection of nature" (Quezel - year, p.28).

These forests are, as Quezel states, of fundamental importance in the Mediterranean region. For the study area the following reasons have been identified as the most important

considerations for the establishment of a reforestation programme:

1. forests provide the only means of ensuring conservation of the soil;
2. They are the main factor in water regulation and protection against the catastrophic flooding, to which certain parts of the island are subject;
3. they are, in addition, a major element in regulating the climate, mainly by equilibrating the general water balance, but also by reducing temperature differences;
4. they protect and increase the fauna of the island, serving as agents for the further development of the already flourishing game;
5. Finally, as a means of providing both harmonious landscapes and leisure amenities, they are an absolute ecological necessity, since tourism contributes to the local economy.

Reforestation⁸⁸ is therefore vital for both the development of the rural areas and the preservation of nature. To this end, a reforestation programme must be established integrated to the overall developmental programme of the island⁸⁹. For the implementation of this programme, Chios

will generally require soil preparation techniques and a judicious choice of the species to be propagated. The most appropriate technique is the establishment of bench terraces; they should be implemented in association with grubbing and the search for the best planting methods. This type of research has given fruitful results in similar environments⁹⁰. Much can be learned by studying the results of other applications of this technique as well as of other similar cases, in California, Algeria, Italy, Cyprus, Israel, Tunisia, and Greece itself. Terracing by mechanical means has also taken place in a systematic, but not extensive way, on the island of Chios itself. The results were successful and fields were given over to cultivation. The soil water-holding capacity increased and erosion was eliminated (Soumelidis - 1961, p. 20).

The selection of appropriate species favours autochthonous varieties. Pinus brutia, in particular has been very frequently mentioned, not only because of its biological and ecological abilities, but also because of its silvicultural properties (Urgenc - 1972, p. 116; Sad - 1972, p. 396; Papanichail - 1970; Papanastasis - 1977, p. 26). A second very important autochthonous tree species is Ceratonia siliqua or Carob tree (table 10, figure 15). Despite its slow growth (figure 36), the frequency, with which it is suggested for reforestation in relation to pasture improvements is surprising (Temple, - 1970; Davies - 1970, p. 465; Tsoumis

- 1939; Papanastasis - 1977, p. 26; Yannakos - 1974, p. 310; Diapoulis - 1950). Carob trees have excellent wood. This attribute seems to be critical in the drastic reduction of the number of Carob trees in mountainous and semi-mountainous areas over the last twenty years (figure 15). A combination of Pines with Carob trees seems very promising since the growth of mixed forests of coniferous and deciduous trees is highly desirable for soil regeneration, pasture improvement, and fire protection (Quezel - 1977, p. 29). Other combinations of trees must also be considered (Zech - 1973).

In terms of the forest non-tree formations, it should be noted, that maquis catches fire extremely easily. However, not all floristic elements of the maquis behave in the same way under fire. Mastic trees, pistachios, carobs, and wild olives which are all endogenous Chian species, are only moderately inflammable and afford considerable protection against soil erosion (Tomaselli - 1977, p. 54). Management practices for regeneration and for provision of food resources for goats should seriously consider this fact.

7.3.7 Sixth Principle: Use and development of proper flock compositions

In terms of the composition of grazing animals, the Department of Chios shows a significant particularity; the number of goats is by far larger, about twice that of sheep.

Little attention has been given in the Greek literature to this fact. However, its implications in the establishment of developmental planning are worth noting.

First, the fact that goats outnumber sheep is an indicator of the conditions of the range. Most of the grazing areas are covered by brushes and shrubs. Sheep cannot graze these areas, and at best they could perform selective and limited grazing. Goats on the other hand are able, and according to many researchers, prefer to graze brushes and shrubs, instead of grasses (Semple - 1970). Therefore, any decision concerning the numbers of the various grazing animal species should seriously consider the natural capabilities of the grazing areas themselves. Second, the high goat population vis-a-vis sheep may be an indicator of further deterioration of the natural environment in the future. The increase in the number of goats during recent years are an indicator of the decreasing ability of sheep to feed themselves. It is believed that in the past the number of goats was much lower than at present and that the difference was filled by sheep. The correspondance between the increasing number of goats and an increasing natural degradation would require any future programme focused on the rural sector of the island to incorporate preservative action for the existing vegetation, and developmental action for stability and improvement of the overall conditions. Alternatively, the most likely evolution, if present conditions continue, is

estimated to follow the paths that figure 37 presents. This path leads to a serious environmental destruction and to the severe disturbance of goat-breeding productivity.

One could combine the above two propositions into one statement: Preservation action is required for the island; this kind of action should be associated with developmental objectives of vegetation improvement and expansion vis-a-vis the grazing requirements of the animal species of the island.

Adequate research has been done on ways to improve the grazing areas which are covered by maquis or garrigue (Natsis - 1974, p. 393 - 397; Chouliaras - 1971, p. 1 - 9; Chouliaras - 1977, p. 1 - 4; Apostolou, Christodoulou - 1972, p. 2 - 7; Milios - 1953, p. 22 - 26; Seliman, Douer - 1970, p. 65; Mooney, Parsons - 1973, p. 106; Bentley - 1967). The results of this research should be evaluated for the island of Chios along with similar research on the biological improvement of the grazing species (Dekazos - 1940; Directorate of Agric. of Chios Dept. - 1956; Perdikis - 1961).

7.3.8 Seventh Principle "Applied Research at the Departmental level"

Many of the objectives and principles described above, require intimate knowledge of the conditions of the department. The disciplines primarily involved in the proposals of this thesis so far, and which do not play at present significant decisive roles in the development of the island, are the following: ecology, associated with natural conservation and vegetation improvement⁹²; social science, linked with the requirement for development along the existing cultural values of the Chians and the social change which is strongly needed for an effective development in such a context; economics, associated with the economic aspects of the overall developmental programme⁹³; and finally, regional planning, as an integrative discipline for the co-ordination of the other disciplines and the working out of the articulation and functioning of the decision-making, programming implementing, and feedback aspects of the developmental programme.

For the knowledge which should be acquired, the establishment of research programmes and possibly of a permanent local research organization is suggested. If the latter is to be the case, one of the major tasks of such an organization should be to implement specific projects, and carry out research and development using peasant biased technologies appropriate to the particularities of the Chian environment and cultural attitudes (adapted from Dahlberg - 1974, p.

83). Such an organization should integrate in its research already existing research programmes and experiments of the local Agricultural Service on the Chian sheep and irrigation improvement, the local Forestry Service on reforestations, and the various cultural associations of Chians.

7.3.9 Eighth principle: Initiation of an appropriate type of education

Although the section concerning education is presented here as an eighth principle, it is in fact strongly related, directly or indirectly, to all principles mentioned so far. However, the strong influential role of education in the development of any society, the present society in particular, raises certain points which need to be framed as a principle.

In a traditional setting, people learn everything they can from other people who have accumulated certain experience going through similar problems. In such setting the societal predictability is very high and a feeling of continuity exists. The island of Chios saw recently fast demographic changes. A sectorial modernization occurred, entailing, among other features, a breakdown of the traditional land-use system which had evolved very successfully over a long period. This deterioration of the traditional patterns is of major importance since it encubates an in-

creasing land-use conflict endangering the natural environment. The outmigration flow and the disintegration of the land-use system resulted in a weakening of the system of transmitting the society's skills, wisdom, and way of life from one generation to another.

The official educational system was established with little attempt to adapt the education to the local conditions. This system saw itself as the sole source of knowledge and its pupils as empty vessels waiting to be filled. This type of education holds teaching to be a different function from learning, and the process of knowing is kept separate from working, and thinking is quite distinct from doing (Tett - 1977, p. 118). Monoeducation and training is applied to the mind of people, as monoarchitecture is applied to their settlements, and as technology is introduced without adaptation. The key element in all these approaches is an ignorance or neglect of the local culture and its variations, the local needs, and the local environmental factors. The allochthonous life-style which follows such influences gives way to a certain kind of growth but not to development. As an educationalist puts it:

"Development is sometimes the name we [in the developed countries] give to the syndrome of our own imbalanced society, by which the rich get richer at the expense of the poor, for everything is sacrificed to economic growth" (Tett - 1977, p. 121).

A new attitude towards education must be obtained and a new educational system must replace the existing one. In principle, the education should aim at the development of the people

a process by which they are able to fulfill themselves as persons and make a contribution to their community. Such education must orient its efforts towards 'experimental' rather than 'cognitive' learning. Usually, educationalists regard 'experimental' learning as possessing the following properties:

1. it has a quality of personal involvement;
2. it is self-initiated for the sense of discovery and of comprehending comes from oneself;
3. it is persuasive;
4. it is continuously evaluated by the learner;
5. when such learning takes place, the element of meaning to the learner is built into the whole experience (Rogers - 1976, p. 509).

In the light of these properties, the educators must first learn about the aspirations of the traditional society, its problems and evolution. It can be supported that, in most cases, one can find among the local population the solutions or the ways to resolve almost all the major problems. What

the local population does need is the availability of means and an integrated methodic way which should come to enrich and valorise the local solutions, as well as to help develop new solutions to accomodate new changes. To fullfill this need should be the goal that the educational system must accomplish.

Such a type of education is expected to help the development and amelioration of the relationships between the population and their environment insofar as:

1. it clearly identifies the needs of the community;
2. it develops an approach which departs from these local needs based on the local culture and conditions, as well as on the contextual constraints;
3. learning by doing constitutes the cornerstone of this approach.

To illustrate this point, a strategy aiming at teaching the local herders about the impact of grazing on the natural environment should go along with certain practical demonstrating of how to maintain the pastoral resources. In a similar way, the new educational orientation could promote a certain type of appropriate technology by demonstrating their applicability to the local conditions.

Evidently, such educational scheme must embrace not simply the formal schooling system but in general any learning-training function. In that sense experimental learning could take the form of the establishment of an experimental-demonstration resourceshed, where an integrated land-use system is sought by the following means:

1. by multidimensional management;
2. by integrating nomadic pastoralism;
3. by using burning for renewing the grazing resources;
4. by establishing and proving the validity of protective forests;
5. by using proper flock compositions.

The establishment of such prototype resourceshed will greatly help the experimental learning approach, as well as the involvement in applied research at the local level. The effort of expanding this integrated land-use system should also be under the responsibilities of the proposed educational scheme. Nonformal apprenticeship training may prove to be highly effective in such expansion. There are many examples from many parts of the world where, for instance, a successful farmer or master craftsman communicates his experience or skill (Tett - 1977, p. 127).

To conclude, instead of having a technology and an educational system which condition the islanders' thinking, which neglect environmental constraints, and which deteriorate a well founded way of life, the proposed educational approach would promote the type of development which is best fitted to the local and contextual needs and constraints.

7.4 AN OVERVIEW OF THE REGIONAL SETTING OF CHIOS: SOME IMPLICATIONS FOR THE FUTURE

The study of the problems which are involved in the forest-grazing land-use conflict in Chios reveals certain general facts for the social, cultural, economic, and physical-spatial aspects of both the societal and the environmental settings.

First, the problems are both numerous and critical. They have to do with the regional setting of the island as a whole. The evolution of this setting, which is typically Mediterranean, is strongly influenced by the way with which attempts to modernize the region occur. Despite the sectoral orientation and success of specific efforts, several attempts have already failed. In general these attempts provoke changes which have in principle a destructive impact on the rest of the sectors of the island. Attempts to develop particular aspects of Chios in a sectoral way provoked syn-

dromes which acerbated, not only the conflict between the forested and the grazing areas, but also negativly affected other aspects of the island's life: such as increasing marginal abandonment, reducing labor to critical levels, and increasing social and economic disparities. In addition, the high sensitivity of rural life to national political social and economic changes, indicates that the resolution of regional problems is not feasible under the present developmental orientations of the state.

Certain prerequisites were subsequently explored, from which a comprehensive integrated planning approach may be formed. Such attempts must visualize the island as a system, developing an integrated land-use management scheme for the island.

stock-breeding is, in general, part of a precarious relationship with the natural environment. Historically, it existed within a well-developed land-use system. In the past, the traditional land-system had well defined uses of land. It was also operating in complex land-use patterns which provided many options for human needs. Finally, societal control mechanisms and managment practices have proven to be, very frequently, quite adequate for the preservation of the island's resources for thousands of years. From the above, the reader should not understand, that no environmen-

tal degradation or destruction occurred. However, such destruction was mainly due to the pressures of population increase and to exogenous disturbances rather than to the setting, functioning, and evolution of the traditional local society.

Recently, attempts to modernize the crop production resulted in a reduction of the resource base for stock-breeding. In addition, recent efforts to eradicate nomadism in favour of the formation of intensive stock breeding and non-nomadic flocks created a phenomenon of localized flocks in specific areas. A further reduction of the resource base of stock-breeding was originated in implementing legislation, aiming at protecting the forested areas by means of prohibiting grazing in them.

Forest was in the past a control vehicle accomodating variations in pastoral needs. At present the drastic reduction of the resource base of stock-breeding transforms forest and its grazing potential into an additional resource in the eyes of the inhabitants. As legislation prohibits any access to forest resources, the local population attacks it when and where conditions permit, i.e. during the absence of forest guardians or agrarian policemen, in periods of strong wind, excessive aridity. The patterns of attack to the forests have been identified clearly by the local Forester of

the Department of Chios (Karaliolios - 1977). The stark effect of abandonment, degradation, and degeneration of the lifestyle in the poorer rural areas generates a feeling of despair. No future is foreseen among the inhabitants of these areas. The state is disinterested in them, because their land does not provide a sound base for large scale westernized development. This feeling of inexistence of options for social continuity leaves for the local population of the mountains only one alternative: to gain as much as they can by violating the limits of their resources. This dramatic outcome stops the long established and traditionally well balanced relationship between man and his environment. The cultural values or traditional morals have deteriorated. The past local societal controls have broken down and local inhabitants at large come to justify short term gains at the expense of their resource base. Overgrazing, extensive burning of forested and grazing areas, attacks to cultivated areas, and other similar phenomena occur. All these phenomena are a Chian verification of the well recognized fact that human society can not continue to exist if mankind's sense of continuity fails (Tomaselli - 1977, p. 49).

To conclude, certain factors contribute to the land-use forest-grazing conflict in Chios. These factors are: phenomena associated with the post-war development such as indiscriminate unplanned out-migration,

associated with an increase in poverty of the small and intermediate cultivators and shepherds; phenomena which derive from an hydrocephalic, un-coordinated, and consequently disabled central administration; and phenomena of a rising destructive attitude among the pastoral population towards their environment, an attitude which rapidly becomes an element of their degenerating culture.

The nature of these factors and the conditions within the study area indicate that any sectoral piecemeal approach will fail. Instead, a brave, drastic change is needed with the basic goal of establishing a continuous scheme of planning, programming and implementation. The promotion of such a scheme is clearly a matter of political will. Once such a scheme becomes established and prove its considerations for the inhabitants and their real needs, ample support should be expected from the local population, an absolute prerequisite for the success of any developmental programme.

NOTES

1. To avoid misunderstanding, concerning the meaning of the word "mediterranean" in this thesis Mediterranean is written with a capital letter when the geographical region of the Mediterranean Sea basin is referred to, while mediterranean is written with a small letter when reference is made to mediterranean type features, such as mediterranean type climate or mediterranean type vegetation.
2. Desertification is nothing else, but an extreme aspect of aridification; yet desertification can occur, not only in arid, but in sub-humid, as well as humid climatic zones (Dregue - 1978, p. 11; Hare - 1974, p. 11). So, it is not surprising that, in the mediterranean areas, specifically mediterranean mountain problems relate, not only to the use and control of fire or grazing management, but also to desertification (UN MAB, project 6 - 1973, p. 26).
3. In this thesis, the concern is on short-term environmental degeneration; therefore no reference will be made on the causes of its long-term aspects. In addition, a differentiation should be made between degeneration and degradation; the first will be used for quantitative differences, while the second to describe that a particular setting passed from one grade to a qualitatively lower one.
4. Distinction is made, in this thesis, concerning the terms "process" and "procedure"; the first is used to describe deterministic paths, while the second for on purpose durational intervention.
5. The concept of the agro-sylvo-pastoral system was extensively used before the Second World War for ecological-developmental purposes; after the war it was overpassed by the Big-Push Approach.
6. According to a recent United Nations' report... "it is noteworthy that despite their richness, their variety and their special biological features, the Mediterranean forests have been a sub-

ject of only limited research, and that knowledge of the structure and function of the numerous ecosystems they display is still in its infancy" (UN MAB, Project 2 - 1974, p. 64).

7. One of the most comprehensive and noteworthy studies on Mediterranean human ecology known to the author is that of Kavadias (Kavadias - 1965) which deals with a particular nomadic group of the mainland Greece.
8. Ismir (in Greek Smyrni) is the closest major urban area (see map 6).
9. In 1960, the total area of the Department of Chios was reported as being 891 sq. km. (NSSG - Precensus 1961); in 1965 904 sq. km. (NSSG - Yearbook 1965); in 1971 as 906 sq. km. (NSSG - Precensus 1971); and in 1974 it was reported as being sq. km. (NSSG - yearbook 1974). Here the last displayed figure is accepted as being the most recent estimation available to the author.
10. The following definitions are displayed by Tomaselli, as it concerns the major classes of non-tree wooded vegetation: A matorral is defined as a stand of woody plants, nanophanerophytes or chamaephytes, their size and habitat being either natural or artificial, resulting from degeneration (cutting, burning, grazing); matorral exists in the form of maquis garrigue or grassland. A maquis is a high and thick matorral or, more precisely, a high plant stand generally thick, that is a stand of evergreen sclerophyllous woody plants, the part above the ground not being clearly differentiated as between trunk and foliage, but whose foliage usually extends well down the base;. In the literature it is also met as "matorral denso" and "espinal" in Spanish authors and "chaparral" (from chaparra = *Quercus ilex*, and chaparro = *Quercus suber*), a Spanish term also adopted by English-speaking authors. The word garrigue is derived from the Catalan word "garric" meaning a kermes oak. The garrigue is discontinuous and occurs on a drier soil than maquis. In the literature, it is also met as "average matorral" (macchia bassa), matorral claro, the scrub of English-speaking authors, the "batha" of Eastern authors, the "phrygana" of Greek writers. Grassland is defined as close-cropped herbaceous stands, whose growth is markedly seasonal and based on hemicryptophytes, chamaephytes and geophytes (Tomaselli - 1977, p. 40 - 41).

11. The following propositions have been identified as true for the island of Chios: "The sense of attachment to islands, on the part of both residents and visitors, is notoriously strong by comparison with attachments to non-insular places of comparable size or population"... "The strength of island self-awareness and assertion of insular distinctiveness is a function also (along with physical insularity) of a corporate spirit accentuated in many island communities. A self-assertive consciousness enables islanders to maintain some degree of stability against the environmental vagaries and mainland pressures that constantly threaten them"... "The prominence of island newspapers, community action groups, historical societies and genealogical considerations, to cite a few instances of local awareness, is in striking contrast to less differentiated non-insular localities" (UN MAB, Project 7 - 1973, p. 53).
12. Heterogeneity, as an aspect of diversity is classically understood to favor stability (Pamade - 1974, p. 98; Clapham - 1973, p. 120; Odum - 1959). However, as Quezel himself states... "while in theory these conditions should permit the development of fine well-balanced stands, the bulk of the Mediterranean forests have in fact been devastated by man's uncontrolled exploitation and deliberate degradation over several thousand years, combined with the catastrophic effects of grazing by flocks of sheep and especially goats" (Quezel - 1977, p. 30).
13. It is characteristic that the aridity of this region causes the sky to obtain a unique crystal-clearness with a particular azure color. Today, this climatic feature is a particular touristic asset in many Mediterranean countries.
14. According to figure 12, the Mediterranean had a population density of about 11 inh. per sq. km. at the end of the 16th century, while the present (1960) density estimation is 36 inh. per sq. km.
15. For a recent description of erosion see UN FAO - 1976, p. 86 - 89.
16. During the Greek-Persian wars, Chios possessed a considerable war fleet (Cary - 1950, p. 99). So, in addition to the marine trade fleet which largely contributed to the reclamation of the island's early woods, the lumbering needs of a war fleet should also be considered.

17. During this period, Chios' forests were covering, not only the needs of the local population, but also external demand. The major consumption centre of Chios' lumber was the neighbouring and overpopulated Smyrni, to which the transportation of forestry products was easy and profitable through the sea. When dealing with the problem of environmental destruction one should also consider that Chios was the most important marine base of the Ottoman Empire in the Aegean Sea. In addition to this, Chios was under the Genoese for a longer period than the rest of the neighbouring islands and that during the Turkish occupation the islanders obtained important privileges; the island was, therefore, a safe place to live or, at least safer than many other places around, and many Aegeans used it as a refugee for at least 4 centuries (Grispos - 1973, p. 64).
18. Islands provide unusually favourable conditions for scientists to study ecological, social and cultural aspects of the management of environmental productivity (UN MAB, Project 7 - 1973, p. 14).
19. In such islands, as Chios is, that are integrated into a wider economic system, urgent research is needed, according to the UN MAB programme, to remedy the acute environmental problems that overpopulation, imbalanced land-use, exploitative resource use or uncontrolled tourism have already caused (UN MAB, Project 7 - 1973, p. 15).
20. For example, the variations of lambs and goat kids sold for slaughtering outside the community, involve the impact of the external demand to the pastoral productivity.
21. The two prementioned islands, Psara and Oinoussai, which belong to the same Department represent only 4.4 % and 1.5 % respectively.
22. For an elaboration on such difficulties and problems of territorial and marginal regions see: Sideridis - 1977, p. 25 - 39; UN MAB, Project 6 - 1973, p. 26 - 27; UN MAB, Project 7 - 1973, p. 12 - 19; Patelis - 1977; Patelis - 1978.
23. One should consider the fact that the areas which are statistically defined as fallow increased. Therefore, the levels of abandonment must be even higher.

24. The areas under trees in compact plantations is a statistical class of the Statistics Greece, and is considered as 'cultivations'.
25. For an excellent presentation of the mechanism and implications of abandonment of marginal agricultural land see Papayannopoulos - 1974, p. 303 - 309 and Papayannopoulos - 1976, p. 99 - 104.
26. This 7 % derives after calculating the proportion of areas devoted to the production of animal food. In the analysis, this is referred to as 'areas under fodder plants in general' - AFT (tables 5 and 8). The total grazing surface is larger than the total surface of the island due to the rough topography. However, the fact that many areas are not used for grazing counter-balances this topographic factor.
27. These calculations are based on the assumption that a small animal requires 0.012 sq. km. of grassland per year and on the acceptance of the same ratio equally for the garrigue and maquis areas, while the grazing area required is much more. In addition, the Forester of Chios, A. Karaliolios, during a personal interview with the author, estimated that goats require an annual grazing surface of 0.030 sq. km. and sheep 0.010 to 0.015 sq. km. The average of these two figures is much higher than the figure 0.012 sq. km./small animal/year, on which these calculations were based. And this average will become even higher, if the consideration, that goats are by far more numerous than sheep, will be taken into account.
28. Studies by the US Soil Conservation Service have shown the effect of soil losses from surface runoff on rangeland which had various degrees of grazing. On areas which have good palatable grasses and good density soil loss per year is less than 1000 pounds per acre. On range, where there is a mixture of weeds and grasses with medium density, soil loss is slightly less than 5,000 pounds per acre. On areas, where annual weeds make up most of the vegetation, and there is a low density, soil losses average 15,000 pounds per acre per year. On prairie land with good soil, no loss of soil was measured after a 2 and 1/2 inch rainfall on a 10% slope. On overgrazed rangeland there was a 160 pound loss of soil per acre, while on bare soil there was a 6,800 pound loss of soil per acre from the same 2 and 1/2 inch rainfall (UN FAO - 1976, p. 89).

29. At southern Chios, large beans were cultivated in the traditional system in significant numbers. They were used as dry animal food and, in case of manure scarcity, as fertilizers. A proverb is still in use to express this situation; the field says to the cultivator: "manure me or bean me". This is a small example of the existence of a rural system, where animals play a complementary (but integrated) role in arable areas.
30. State policies have a strong negative influence to the integrity of the rural activities. They are to blame for the particular way, with which the orientation of the rural production towards markets occurred. An example of this influence is the fact that during 1967-1976 the amount of money allocated for the pastoral improvement of Chios was 3,153,800 drachmae (about 100,000 Canadian dollars) and was in its total invested in watering and resting facilities for the grazing animals rather than in improving the grazing capacity of the range (The above figures were given by Chouliaras - Ministry of Agriculture). Similarly, the 1976 - 1980 proposed amount for pastoral improvement was 21,380,000 drachmae and involved the works presented on table 11. As the reader can see, the proposal involves, once again, investment to cells and infrastructure, and not the improvement of the carrying capacity of the range.
31. The terms "areas covered by forests" and "areas partially covered by forests" are used to denote all stands of trees more than 2 m. high, as well as the maquis formations. In the present work, the term 'forests' denotes all areas of wooded vegetation except garrigue.
32. A sub-system is defined as a set of components whose inter-dependencies with one another are stronger than the relationship with other elements outside the sub-system - that is, with their environment (Alexander - 1979, p. 139).
33. 'One of the major characteristics of a system is "homeostasis"' (Farmer, Gibb - 1979, p. 233).
34. This is the year from which data on fires begin to exist.
35. The frequency of the external events is the most important factor for the generation of such a frequency pattern in the forest areas of Chios (figure 20). To understand this the reader should re-

fer to figure 22. Here, there are represented the fires of two hypothetical pastoral communes which consist of an island. At the left, the aggregation of the areas burned does not show any periodicity, because of the difference in the starting points of fires. At the right, the fire frequency pattern of these two communes is shown to start from the same point in time, because of some external reason which caused a delay or an acceleration in the fire frequency of either one of the two communes. This last case, is the case of Chios (figure 20).

36. The existing data do not allow for the separation between maquis and partially tree-forested areas burned.
37. The calculations for the identification of the utilizable areas burned (UPS, UFG, UPS, UPG, UGS, UGG), is given in the appendix.
38. For descriptions and applications of this technique in Urban and Regional Analysis see: Phipps - 1969; Holt, Richardson - 1970; Berry - 1971; Yeates - 1974.
39. The reader should understand a statistical explanation rather than an interpretation of the statistical result.
40. If raw data are used as input, the second step (Factor Analysis) generates meaningless factors because of the large numerical differences between the variables.
41. According to this statement and by considering that the initial data matrix includes composite variables which were calculated from simple ones, and therefore are highly correlated, Principal Components Analysis is the only technique which can be applied here.
42. Although the variable P₁P is far from the cluster of variables on axis I, its loading on factor I is significant (0.65). Its location, however, indicates that this particular variable is associated with both factors.
43. If Gertler's principle is accepted, that... "the regional planner seeks solid anchorage in the scientific study of the relationship of living things to their environment" (Gertler - 1972), then, it can be said that the vast majority of the

post-war planners were really far from following it. Indeed, today is widely understood that the field of Regional Planning is meaningless, if such a "solid anchorage" is not among the planners' perspectives.

44. The following considerations have, in general, been neglected by the Greek Administration: "One very important determinant is land and the uses of land for various purposes"; "The impact of exploitation had caused both chronic and acute degradations in the mediterranean environment"; "Pastoralism, rainfed agriculture and land cleared for industry or housing can all suffer the same kind of acute losses when rare heavy showers or strong dry winds erode in hours soil that has taken centuries to accumulate"; "Chronic degradation may cause less valuable plant species to thrive pastures and gradual loss of nutrients in cultivations" (adapted from: Warren, Maizels - 1974, p. 42). Despite, however, the administration neglect on these issues, many public research agencies and scientists have very frequently focused the attention to such and similar other problems.

45. Through the recent course of development the Greek economy may be growing; a few farmers may be using those much talked about high yielding varieties of wheat or rice. But, for the vast majority these achievements have passed them by. They are not able to pay for irrigation, pesticides or fertilizers. The government may have vastly increased its educational budget for urban schools and expensive universities, the town may have developed new industries, jet aircraft may be landing at the new international airports. But, these things represent what the majority do not have - rural schools, all weather roads, simple improvements to increase the output of food and provide greater security. And the balance between the rural areas, where most people live and the towns has been totally disrupted (adapted from: Kenyon - 1974, p. 7).

46. A summary of the main characteristics and problems of the island is given in table 20 (Modified from: UN MAB, Project 7 - 1973, p. 11). The case of Chios is another verification of similar observations in the Mediterranean. Therefore, it indicates that Chios island may be a typical case study for the whole Mediterranean region. Similar observations based on Growth-Pole Analysis were made in other under-developed parts of the world as well (see: Harvey, Greenberg - 1974, p. 187).

47. Recently Loukakis (1977) proposed a rehierarchization of the Greek settlements as an utmost necessity for development. In his work, among other things, he observed that, while in the period 1951-1961 most of the regions and urban centres of the country had a population increase (with the only exceptions of central-southern Peloponnessos and the Aegean islands, where Chios belongs), during 1961-1971 they showed a different pattern: Regions of intensive population increase (such as Thessaly and Macedonia) had a very serious population decrease which can be found, not only at the rural areas but at the urban centres of these regions as well (Loukakis - 1977, p. 13).

48. UNRISD distinguishes three levels of growth generators: (1) Growth Pole at the upper level; (2) Growth Centre and (3) Service Centres or their equivalent, that is, central villages, market towns, etc. (UNRISD-1968).

49. Recently, the Agricultural Bank of Greece provided incentives for the formation of flocks and thus the increase of meat production, while the Forestry Service was promoting disincentives for the reduction of flocks and the protection of the forests.

50. The above discussion makes it clear that there is a need for new conceptual and organizational approaches. Dahlberg provides such a general framework, in his work "Ecological effects of current Development processes in less Developed Countries" (Dahlberg - 1974).

51. For the promotion of a safe and well-balanced development, Loukakis urges the importance of a rehierarchization of the Greek settlements. The basic elements of his work will be presented here, because of the relevance of his work to the proposals of this thesis. His argument predominately involves the concept of the "region". Furthermore, he states that the role of each settlement should be re-assessed at the local, regional and national levels. For the achievement of these goals, he proposes the following objectives:

- a) First to cede and then to inverse the present rate of growth of the National Capital;
- b) to accelerate the growth of the periphery;

For the fulfillment of these objectives, Loukakis argues the following necessities:

- i) to identify the ground on which the development of each region should be based upon;
- ii) to identify the secondary relationships in production, the productive forces and the potentialities of each region;
- iii) to identify the inter-regional dependencies;
- iv) to estimate the time-period required for the achievement of a state of balanced development.

He also refers on the means to achieve these objectives. Some of them are the decentralization of the public expenditures, the decentralization of the decision-making process and the equality in the treatment of the regions by the various policies. (Loukakis - 1977, p. 17 - 18).

- 52. As Lasuen stated : '...As it stands today, Growth Pole Theory is only partially a conditional theory of growth' (Lasuen - 1974, p. 30).
- 53. Although in Friedmann one can find such terms as 'core region', 'developmental region', 'programming region', 'resource frontier region', there is no definition of the general concept of 'region'. Neither does the basic study in the field of regional analysis methods and regional science (Isard-1960) include a detailed characteristic of the concept of 'region'.
- 54. According to Bourne... "one of the most useful discussions of system properties...is a book on Social Ecology by Emery and Trist (1972)... The basis of their approach is the concept of "complex social systems" - systems which do not submit easily to traditional methods of formal systems theory...Complex social systems may be characterized as (1) adaptive rather than mechanistic systems (a given stimulus A does not automatically call forth a predetermined response); (2) learning systems (which are continually changing their centre of gravity, structure and external linkages in a cumulative response to generative factors); (3) systems which are open to influences deriving from their external (or contextual) environment; (4) systems marked by extreme inter-relatedness among the constituent parts (organizational complexity); and (5) systems in which there is considerable

substitutability or interchange of parts and functions" (Bourne - 1975, p. 16). The properties of these systems, listed above, provide a useful heuristic framework for filling out the conceptualization of the concept of the 'region' as an integral systemic part of a whole. Indeed, if Chios island is viewed as a region, then each one of the above properties obtains important implications. The same occurs when Chios is viewed as a system of regions (e.g. northern, central and southern).

55. According to Sideridis, the specific aspects of a resource-shed are the following ones: (1) watershed; (2) timbershed; (3) milkshed; (4) meatshed; (5) cowshed and (6) fishshed.
56. An example for aggregation desaggregation and integration is presented in figure 33. Here a model for the preservation of the water is devised. The concept has a layout which denotes, not only an hierarchy in scale (such an hierarchy could have been presented by a tree diagram) but also an integration between the different levels. The homocentric cycles are (i.e. all three levels) reached by the various means to achieve the programme (the media, state agencies, army etc), while at the core of the whole programme lies the public (the objective). Much can be said about this early model and even more can be hypothesised. However, in this early model the effort to aggregate desaggregate and integrate is apparent.
57. The term 'advanced technology' is not used here to necessarily signify highly sophisticated technological advances. Intermediate and low technological advances are also included here.
58. "Structural intensity" or "intensity after structural changes" should be understood here, instead of the current intensity (as, for example, is expressed by overgrazing, overburning etc.).
59. Intensity should only be regarded as integrated with the physical, ecological and social milieu to which it will be found. A recent study in Tynisia revealed that intensive pastoralism should be undertaken only where conditions are favourable. State ranches, in which land registration is completed and after the local population has been thoroughly informed and has agreed, may be considered, according to this study, as fulfilling the prerequisite conditions for intensive pastoralism (UN Desertification Conference - 1977, p. 3).

60. see table 21.
61. Hence, according to the Minister of Agriculture at 1931, the shepherds are not "civilized" enough to respect both forests and cultivations; they are of barbaric attitudes. This kind of thinking was, and still is, as we will see later on, dominant in the perceptions and practices of the state officers.
62. Dimitriou 1974, p. 379; Papagiavis - 1974; Editorial (a) - 1974, p. 153; Editorial (b) - 1974, p. 348; Editorial - 1977, p. 139; Editorial - 1975, p. 139; Massavetas 1977; Nakos - 1974; Stassinopoulos - 1975; Stefanou - 1975.
63. Forty four years was the duration of the fight of the Foresters and forest rangers to obtain a permission from the state for the gradual set-up of an autonomous Forestry Service which the state never wished to have (Grispos - 1973, p. 281). This Service was instituted at 1922, and proved to be ineffective and bureaucratic.
64. In this meeting, the discussions which were held were of the following type:
"...the Foresters need photographic cameras for the facilitation of their proof-finding work when examining cases of forest-fires" "...the Forestry Service does not have money for providing the Foresters with cameras". In general, the level of discussion was very low. For the minutes of this meeting see: Proceedings - 1949.
65. One should mention here the excellent work of Mr Marvin Klemme, specialist on forest and range management, and which was presented in his report 'Suggestions for the development of the Greek forests and grazing areas', in 1955. In his report Mr. Klemme suggests the establishment of a land classification scheme, the acceptance of the principle of integrated multiple land uses as official management practice, a well articulated reforestation scheme, and a comprehensive management for grazing. On top of all, he suggested that the management of both the forested and the grazing areas should be a responsibility of an enlarged Forestry Service. (Grispos - 1973, p. 331; Klemme - 1955).
66. They were: 1) Union of Foresters-Public Servants;
2) Association of Foresters of Athens;
3) Association of Foresters of Peloponnessos;
4) Association of Foresters of Thessalia;
5) Association of Foresters of Northern Greece;
6) Association of Foresters of Epiros.

67. An example of this functioning is the case of the Forester Nikos Metaxas. Metaxas was in 1953, advocate of the need for a change of attitudes towards the peasants and their behavior. However, when he took office as General Director of the Forestry Service for the period 1957-1964, he did nothing to improve the situation of the mountainous peasants (Grispos - 307).
68. From 1967 up to 1976, the funds for the improvement of pastures which were allocated to Chios, were 3,153,800 drachmae (32 drachmae = about 1 Canadian dollar) or 0.8% of the total national amount for the same period. (data from A. Choulirias et al - 1975). Although one cannot judge, from this figure, the sufficiency of this amount for the works that pasture needs, it should be mentioned here that this percentage corresponds to the proportional size of the Department of Chios compared with the total area of Greece (0.68%).
69. A Conference organized by the Greek shepherds was held at Iraklio, Crete, on Sept 18, 1978, where it was showed that, among the various origins of the pastoral problems the most important ones are imposed by private land-owners and by the lack of scientists - specialists on pasture. According to a reporter who, covered the Conference, the second point was greatly involved in the discussions; the National territory was divided in two major parts (among agriculturists and Foresters) while the third major land-use, pasture, did not find its equal share due to the prementioned scarcity in pastoralists. So, pasture stayed at the fringe of these two major land-uses, so that today nobody could really tell where the the grazing areas are. (Lampsidis - 1978, p. 18).
70. The phenomenon of forest fires as a consequence of urbanization is also another conflict which involves the land-uses. In addition, it indicates that an overall National and Regional planning is needed, to approach the various land-use conflicts in a wholistic integrated way.
71. The present position of the Ministry of Coordination and Programming is not, of course, easy. In the contemporary Greece, the problems that any government has to face are multidimensional; attempts to establish programmes face criticism and polemics from almost all the parties concerned. It is characteristic, for example, that in the Journal of the Federation of Greek Industries appeared

the argument that the Programme 1976-1980 is worthy for criticism only as a fiction text or as an interesting lecture (Vovolinis - 1978, p. 27). The author of this thesis wishes to stress the point on the multidimensionality and conflicts at the National administrative level rather than to justify any of the two parts involved here.

72. For an excellent analysis on the existing situation see Centre of Programming and Economic Research - 1972, p. 7 - 15.
73. According to Francis, advocate of ecodevelopment (i.e. ecological development), the basic thesis is that the real need for governance is to regulate and reconcile divergent and conflicting interests at two major interfaces of a society: one interface is among individuals (e.g. shepherds - cultivators) and the many organizations comprising a community (e.g. co-operatives - municipalities - perfectorates - regions - Ministries); the second is between the total community and the environment which sustains it. The task for governance at the second interface is to constrain and direct the affairs of the community so that they become and remain environmentally sound, hence sustainable (Francis - 1978, p. 4). The crucial significance of institutional structures and behaviours are very apparent. "Without institutional changes 'ecodevelopment' cannot proceed" (ibid, p. 1).
74. A very successful conceptual representation of the steps that decision-making should follow in a future-oriented society is made by Dansereau and is presented in figure 34.
75. "A much greater understanding of self-regulating social systems is needed. The experiences reported from small-scale 'microsituations', where capabilities of people living in deprived communities were effectively released and directed towards creating social wealth through self-directed work which met their own, group-identified needs, merit much more attention" (Francis - 1978, p. 6). In the context of the Mediterranean one could identify the strong existence of communal administrations which had played, and still play, the role of identification of group needs and of regulating the social system through such means as communal land tenure and communal forests.
76. Sideridis proposes a scheme of either a TVA-type organization at the National level or the creation

of a Ministry of Natural Resources (Sideridis - 1977, p. 72); Similar proposals appeared also in the journal 'Forestry Chronics' (editorial (b) - 1974) and in a memorandum of the Union of Foresters-Public Servants submitted to the Minister of Agriculture (Union of Foresters Public Servants - 1976).

77. At least the Foresters are quite explicit on that: "No matter what are the political goals, ways of economic organization and the system of exploitation of forested areas, the Governments are responsible to plan the continuous provision of goods and services from the forests as productive, protective and recreational" (Congres Forestier Mondial - 1973, p. 490).
78. According to Kokkinidis ... "For the establishment of comprehensive developmental planning, a twofold procedure must be put to work: The 'from top downwards' procedure which investigates the possibilities of the whole economy and provides National and sectoral objectives; the 'from bottom upwards' procedure which has the responsibility of the investigation of the sectoral possibilities, and the preparation and selection of investment projects which will realize the above objectives" (Kokkinidis - 1974, p. 16).
79. Biswas made the following estimation: "Increasing public participation in our decision-making process will probably be beneficial, because, often time in the past, the planners were not aware of the needs and desires of the society, and, consequently, planning decisions have included a rather limited response to new opportunities and lack of sensitivity to public values. However, techniques currently available for effectively integrating public participation in the planning framework are rudimentary and leave much to be desired... There is a need for better understanding of the dynamic relationship between man and his environment so that balanced long-term development and conservation policies can be pursued" (Biswas - 1973, p. 753).
80. As R. Dubos wrote... "in order to introduce the ecological dimension into the concept of development, a double-edged polemic is necessary: against those, who, faithful to the classical and neo-classical tradition in economic thought, manage to forget that all human activities have a physical, energy-related, and thereby ecological foundation

which one can not ignore, as well as against those extreme conservationists who, in the name of protecting nature, would wish all human intervention to cease" (in Sachs - 1977, p. 5).

81. A considerable advancement towards such an approach was presented in the UN Desertification Conference by Warren and Maizels, where integrity of the ecosystem, collaboration with the ecosystem, proper distribution of land-uses, integrity of pastoral ecosystems, cultural alternatives are, among other concepts, elementary blocks in formulating ecological principles in combating desertification (Warren, Maizels - 1974, p. 81 - 83). This approach entails significant corrolaries for the Mediterranean region, since the latter lies in a zone which has, according to Kovda et al., a probability for drought of 50% (map 5) (Kovda et al - 1977).
82. To this end, Foresters should play, along with their classically defined role, significant role in the social and economic dimensions of the forestry problems. (Spurr, Arnold - 1972; Congres Forestier Mondial - 1973). According to its latest definition, forestry has not to do with the forests per se, but primarily with the way, with which forests can possibly serve the people (Congres Forestier Mondial -1973 p. 492). For this forestry education must necessarily broaden towards these disciplines which contribute to the understanding and practicing of the social responsibilities of forestry (ibid, p. 492).
83. For examples on what can be really achieved, in terms of animal food and of energy self-sufficiency see:Efstathiadis - 1977; Koukios - 1978.
84. Semple wrote the following on nomadism: "Unfortunately, nomadic grazing, and particularly nomads, are, often, looked upon as being undesirable. Yet, in many countries with high mountains...the movement of flocks and herds... is a long-and well-established and honoured way of life....It has been contended that under these conditions of nomadic grazing, there has been relatively little deterioration in large areas of arid-grazing-land over many centuries, and one may find considerable areas of the least accessible and most drought-stricken range as being nearly as good a condition as it would have been, if it had never been grazed by domesticated animals. But this delicate balance may be completely destroyed by digging new wells, putting land under irrigation, deterioration

through locating people in permanent sites, producing and maintaining feed reserves, and thus enabling larger herds and flocks to graze the land every year..." (Semple - 1970, p. 127 - 128).

85. Any programme which has as objective to reduce or eradicate nomadism should firstly enable the nomads themselves to maintain themselves through staying in one place throughout the year, or to retain a permanent base, to which they can return every year. Such a programme must be sound in every respect. (Semple - 1970, p. 128).
86. Substantial knowledge has been recently obtained on the behaviour of fires in Greece. Among the most recent works one should mention the following ones: Katsanos (a) - 1970; Katsanos (b) - 1970; Katsanos - 1977; Papanastasis - 1978; Pittas - 1974.
87. Today, another aspect of the extensively discussed so far misunderstanding of the mechanisms which guide the behaviour of the rural land-use system is the fact that expensive firefighting equipment are welcomed by researchers and purchased by the government; the philosophy of "curing" rather than "preventing" is quite apparent. So, the administration, once again, establishes policies, without any prior proper comprehension of the dynamism that exists in the land-use system.
88. "A clear distinction should be drawn between the two concepts of reforestation and plantation. The purpose of reforestation is to replace a forest cover on soils which have been denuded or covered by degenerate vegetation; this cover must be permanent, and all efforts will be concentrated on establishing a mixed stand, well balanced with the environment which will grow into a forest, serving the double purpose of protection and production. The plantation of trees is only one phase of intensive cultivation, in which all technical resources will be used to obtain maximum timber production in the shortest possible time... The most logical place for intensive plantations of trees is abandoned agricultural lands in flat open country or on gently sloping ground. They may well constitute a transitional phase in the restoration of forests" (Morandini - 1977, p. 77).
89. An example of such integration could be the combination of reforestations with resin production; in that way the shepherds of the area of reforestations will be provided with alternative income ac-

tivities (resin production). Ample knowledge and experience is existent on this, not only among the local population, but also in the literature (Bonneau - 1975; Bussy - 1971; Papaioannou - 1954; Laborie - 1978; Papamichail - 1970; Sad - 1972).

90. Gogos - 1975, p. 21; Giacobbe - 1969, p. 167; Grispos - 1973, p. 335; Papanastasis - 1977, p. 26; Timbal - 1971, p. 25; Alexandris - 1976, p. 73; Christodoulopoulos - 1953; Dinard - 1971; Finlayson - 1971; Firat - 1952; Grispos - 1953; Konstantellos - 1954; Kossenakis, Thalassinou - 1952; UN Desertification Conference - 1977; UN MAB - 1977.

91. The wide existence of these species on Chios, as well as of others of similar properties, such as dwarf, fan palms and myrtles, is a significant indicator of the long existence of frequent fires; natural vegetation adapted itself through the process of natural selection to the particularities of the Chian environment in which fires are a constituent human-ecological element.

92. Ecological studies, concerning Chios island could greatly benefit from extensive research which has been done so far at the same latitude in the neighbourhood Turkey (Zech - 1974; Urgenc - 1974; Sad - 1972; etc.).

93. The following principle should be followed in Chios: where investment is meagre it is better to work with the ecosystem than to modify it; where investment is available, higher yields can be achieved by making modifications to the ecosystem, but new strategies must then be evolved to counter degradation (adapted from Warren, Maizels - 1974, p. 82).

A REGIONAL APPROACH TO THE FOREST-GRAZING LAND-USE CONFLICT
IN A MEDITERRANEAN REGION

by

Elias Yanniris

VOLUME II

Ottawa, Ontario, 1980

(c) Elias Yanniris, 1980

PART IV

TABLES, FIGURES, MAPS, PICTURES, APPENDIX, BIBLIOGRAPHY

T A B L E S

* The tables for which there is no reference were formed by data obtained from NSSG, Agricultural Statistics, years 1961 - 1975

Table 1

(a) Population

year	population	year	total popul.	urban	semi-urban	rural
1913	71,660	1961	62,223 (100%)	28,755 (46.2%)	3,576 (5.7%)	29,892 (48.1%)
1920	63,235	1971	53,948 (100%)	30,021 (55.6%)	-	23,927 (44.4%)
1928	75,680					
1940	75,853					
1951	66,823					
1961	62,223					
1971	53,948					

NSSG, Yearbook, 1930, 1965

NSSG, Census, 1961, 1971.

(b) Urban characteristics

year	popul. of Greater Chios*	# of industrial and handicraft establishments	average annual employment
1951	31,047		
1958		1,039	2,210
1961	30,465		
1963		871	1,980
1969		738	1,724
1971	30,621		
1973		691	1,774

* NSSG, Yearbook 1975. ** NSSG, Yearbooks 1965, 1975

(c) Administrative divisions

year	number of eparchies	number of municip.	number of communes	number of settlements
1964	1	3	57	104
1965	1	4	56	104
1973	1	4	56	107
1974	1	4	56	107

NSSG, Yearbooks 1965, 1975.

Table 1 (suite)

(d) Consumption of electric energy (in thousands of Kw)

year	domestic use	commercial use	agricultural use	public and municipal use	street lighting	total
1964	3,129	2,343	210	359	167	6,208
1973	14,108	7,274	784	1,852	1,525	25,483

NSSG, Yearbooks 1965, 1975.

(e) Land-use distribution (sq. km.)

year	landscape	number of administrative units	total area	agricultural	pastures	forests	water	settlement
1961	level	23	185.3	80.5	76.1	0.5	5.2	23.0
	semi-mountainous	16	379.1	51.8	267.3	17.0	3.7	39.3
	mountainous	21	326.6	43.1	184.1	78.0	1.3	20.1
1971	level	23	190.0	77.3	90.5	0.6	4.2	16.5
	semi-mountainous	16	384.0	51.3	276.6	21.6	4.4	17.4
	mountainous	21	332.0	37.8	185.4	80.9	1.3	5.4

NSSG, Census 1961, 1971.

Table 2

CLIMATIC CHARACTERISTICS OF CHIOS ISLAND

year	average temperature (deg.C)			relative humidity (mm.)		
	January	July	November	January	July	November
1964	10.5	28.0	16.0	74	46	71
1965	10.5	27.6	15.3	70	47	70
1966	10.0	27.5	14.8	69	46	70
1967	9.5	27.4	14.3	68	46	70
1968	9.2	27.7	14.8	66	43	78
1969	8.5	25.7	15.5	74	48	73
1970	11.6	27.5	14.9	76	53	73
1971	12.4	24.7	14.4	76	63	71
1972	9.5	26.0	14.5	70	63	66
1973	9.1	27.7	14.8	66	43	78

data from Meteorological Service of Greece

Table 3

PRODUCTION OF WOODS OF CHIOS DEPARTMENT

year	firewood from a- gricult. holdings (tons) (FWA)**	shrubs from pastu- res (tons) (SRP)**	firewood from forests (tons) (FWF)**	roundwood (in cubic meters)	charcoal (tons)
1961	9992*	3900*	3223*		
1962	9992	3900	3223		
1963	6212	3368	1255		
1964	10244	3159	1232		
1965	8734	2359	1274		
1966	9463	2321	1420		
1967	7724	1948	1129		
1968	8693	1329	1233	13	
1969	9751	1183	1384	15	
1970	10267	1112	2588	10	
1971	9211	1015	847	3014	44
1972	7559	885	636	3514	382
1973	6470	795	396	1505	409
1974	6925	708	423	158	515
1975	13057	683	1027	126	538

* estimated

** for explanations see Table 5.

Table 4

(a) PRODUCTIVITY OF PINUS BRUTIA IN FERTILE STATIONS

age	number of trees	hight (m)	waist surface	average diame- ter (cm)	wooded volume of main forest (cub. m)	annual increase (cub. m)
25	1790	11.3	22.3	12.6	132	-
30	1408	13.4	25.9	15.3	160	6.7
35	1112	15.1	28.0	17.9	184	6.9
40	884	16.5	29.2	20.5	204	6.9
45	711	17.7	29.8	23.1	220	6.7
50	588	18.7	30.2	25.6	234	6.4
55	489	19.5	30.6	28.2	246	6.0
60	418	20.2	30.7	30.6	255	5.7
65	364	20.8	30.7	32.8	264	5.3
70	322	21.3	30.6	34.8	270	5.1
75	293	21.8	30.5	35.4	276	4.8
80	270	22.2	30.3	37.8	280	4.6
85	252	22.5	30.1	39.0	284	4.4
90	237	22.9	30.0	40.1	287	4.2
95	225	23.2	29.8	41.0	289	4.1
100	217	23.5	29.6	41.7	291	4.0

after Alemda (Urgenc - 1972)

Table 4 (suite)

(b) FIRST RESULTS CONCERNING THE COMPARATIVE INCREASE OF P. BRUTIA, P. RADIATA AND P. MARITIMA AT LOCALITIES OF THE PARAMEDITERRANEAN TURKEY

places	age	height		
		Pinus brutia	Pinus maritima	Pinus radiata
Aydin - Soke	5	1.34±0.033	1.40±0.059	2.14±0.078
Soke - Ovacik (Citibogazi)	6	3.22±0.010	-	4.46±0.345
Soke - Ovacik (Beypazari)	6	2.63±0.049	2.61±0.043	3.61±0.064
Fethiye - Kemmer	7	4.88±0.173	-	-
(Cipri)	8	-	4.12±0.493	4.19±0.192
Fethiye - Kincilar	8	4.17±0.105	-	4.42±0.175
Fethiye - Dikmen	4	1.01±0.033	0.69±0.043 0.91±0.033	1.47±0.039 1.18±0.046 1.31±0.052
Antalya	8	2.87± -	5.71±0.255 5.51±0.743 4.81±0.256 5.58±0.361	5.67±0.185 5.10±0.234
Mersin - Camalan	4	1.61±0.033	-	2.38±0.058
Adana	4	1.93±0.204	1.13±0.116	1.81±0.159

Urgenc - 1972

Table 5

LIST OF INDIVIDUALS AND ABBREVIATIONS USED FOR THE ANALYSIS OF DATA

#	abbreviation	explanation
1	ATC	total land under cultivations (excluding tallow land) (stremas)
2	ACR	crops on arable land (stremas)
3	AGN	garden areas (stremas)
4	AVN	vineyards (grapes and rasins) (stremas)
5	ATR	areas under trees in compact plantations (stremas)
6	APS	areas under fodder seeds (stremas)
7	AFP	areas under fodder plants for hay (stremas)
8	AGR	areas under fodder plants for grazing (stremas)
9	HMA	total number of horses , mules and asses.
10	OBC	total number of oxen, bulls and cows
11	STO	total number of sheep
12	SDO	number of domestic sheep
13	SFL	number of sheep in flock, non-nomadic
14	SNM	number of nomadic sheep
15	GTO	total number of goats
16	GDO	number of domestic goats
17	GFL	number of goats in flock, non-nomadic
18	GNM	number of nomadic goats
19	SBO	number of lambs born between January 1 and November 1
20	GBO	number of goat-kids born between January 1 and November 1

(suite)

Table 5 (suite)

#	abbreviation	explanation
21	SLW	number of lambs slaughtered within the region
22	SLO	number of lambs sold for slaughtering outside the region
23	GKW	number of goat-kids slaughtered within the region
24	GKO	number of goat-kids sold for slaughtering outside the region
25	SSW	number of sheep 1 year and over, slaughtered within the region
26	SSO	number of sheep 1 year and over, sold for slaughtering outside the region
27	GGW	number of goats 1 year and over, slaughtered within the region
28	GGO	number of goats 1 year and over, sold for slaughtering outside the region
29	FWF	firewood from forests (tons)
30	FWA	firewood from agricultural holdings (tons)
31	SFP	shrubs from pastures (tons)
32	GAF	areas of garrigue burned (stremas)
33	PCF	areas of partially forested areas burned (maquis and/or scattered trees) (stremas)
34	FOF	areas under tree-forest burned (stremas)
35	TAB	total areas burned (stremas)
36	NTR	number of tractors
37	CER	number of Ceratonia siliqua trees (Carob trees)
38	UGG	utilizable areas under garrigue for goats after burned (stremas)
39	UGS	utilizable areas under garrigue for sheep after burned (stremas)

(suite)

Table 5 (suite)

#	abbreviation	explanation
40	UPS	utilizable areas partially covered for sheep after burned
41	UPG	utilizable areas partially covered for goats after burned
42	UFS	utilizable forested areas for sheep after burned (stremas)
43	UFG	utilizable forested areas for goats after burned (stremas)
44	TUS	total utilizable areas for sheep after burned (stremas)
45	TUG	total utilizable areas for goats after burned (stremas)
46	SFT	number of sheep in flock non-nomadic plus nomadic sheep
47	GFT	number of goats in flock non-nomadic plus nomadic goats
48	SLT	total number of lambs slaughtered
49	GKT	total number of goat-kids slaughtered
50	SST	total number of sheep 1 year and over slaughtered
51	GGT	total number of goats 1 year and over slaughtered
52	AFT	areas under fodder plants in general
53	TSS	total number of sheep and lambs slaughtered
54	TGS	total number pf goats and goat-kids slaughtered

Table 6

PROFILE OF CULTIVATIONS OF CHIOS DEPARTMENT

year	total arable land	AT0	crops on arable land	ACR	garden area	AGN	AVN	wine- yards	trees in compact planta- tions	ATR	AFS	AFS	todder seeds	todder plants for hay	todder plants for grazing AGN
1961	171109		117384		6266		2987		44472		8136		12714		3725
1962	168298		114833		6342		2772		44351		9055		13290		3021
1963	158981		104728		6977		2360		44916		9050		10808		4713
1964	155027		98702		6465		2359		47501		10700		9845		3665
1965	154602		100514		6456		2407		45225		12072		11262		4029
1966	148151		93895		6665		2417		45174		11805		10661		2854
1967	145115		83083		6403		2466		53208		11529		9611		2887
1968	141394		76587		5782		2567		56458		10147		10346		2698
1969	136074		73208		5066		2578		55222		10290		10394		2736
1970	136515		68460		5005		2617		60433		7423		11765		2505
1971	127137		61905		4695		2605		57932		7807		10747		2405
1972	81973		30543		4968		2586		43876		4356		5885		1227
1973	127694		57187		4878		2595		63034		8369		8965		2529
1974	129483		59682		4722		2608		62471		8220		9354		2799
1975	131001		60674		4981		2571		62775		8245		9266		2934

Table 7

(a) TOTAL ARABLE LAND OF CHIOS DEPARTMENT: 1918-1961

year	1918	1919	1920	1921	1922	1923	1924	1925	1931	1934	1935
total											
arable land	109660	43286	47906	38099	39045	39568	36368	59552	107467	133728	128440

year	1936	1937	1938	1950	1961
total					
arable land	148142	160483	151201	193336	171109

NSSG, Yearbooks: 1918 - 1925, 1931, 1934 - 1938, 1950, 1961.

(b) ARABLE LAND PER CAPITA

year	1950	1961	1971
ratio	2.9	2.6	2.4

Table 8

RELATIONS BETWEEN THE INDIVIDUALS OF THE ANALYSIS

number** individual equals to

1	ATO	ACR + AGN + AVN + ATR
2	ACR	AGR + APP + AFS + (cereals, pulse, plants for industrial use, etc)
11	STO	APT + (cereals, pulse, plants for industrial use, potatoes, etc)
15	GTO	SDO + (SPL + SNM)
5	ATR	GDO + (GPL + GNM)
38	UGG*	CER. + (mastic trees, citrus trees, etc)
39	UGS*	function of GAP
40	UPS*	function of GAP
41	UPG*	function of PCF
42	UPS*	function of PCF
43	UPG*	function of PCF
44	TUS	function of PCF
45	TUG	UGS + UPS + UFS
46	SPT	UGG + UPG + UFG
47	GPT	SFL + SNM
48	SLT	GFI + GNM
49	GKT	SLW + SLO
50	SST	GKW + GKO
51	GGT	SSW + SSO
52	APT	GGW + GGO
53	TSS	APS + APP + AGR
		SIT + SST
		(SLW + SLO) + (SSW + SSO)
54	TGS	GKT + GGT
		(GKW + GKO) + (GGW + GGO)

* for the calculation of these mathematical functions see appendix

**these numbers correspond to those of Table 5 for fast review of the explanation of the abbreviations

Table 9

PASTORAL PROFILE OF CHIOS DEPARTMENT (NUMBER OF ANIMALS)

year	horses	oxen bulls cows	total sheep	domestic sheep in flock	nomadic sheep	nomadic total goats	domestic goats in flock	nomadic goats
1961	8774	5018	11948	6418	3000	32020	4740	11514
1962	8787	4944	11208	6088	3125	27195	3210	14725
1963	8760	4848	12013	6003	3625	29447	3070	17230
1964	8650	4553	11845	5720	3425	30309	6200	14490
1965	8447	4437	11701	5659	4250	30270	7500	15530
1966	7842	4340	11487	5542	4055	32684	7065	16725
1967	7672	3933	10505	4755	4060	33429	6330	18445
1968	7093	3179	10079	4538	4482	25272	8440	9725
1969	6996	3051	10862	4314	4853	28599	7349	15560
1970	6882	2963	10115	4253	4332	26096	7486	8945
1971	6772	2825	10086	4058	4283	27740	7380	11350
1972	5996	2099	9225	3019	4638	22352	6007	7815
1973	6281	2716	11255	3822	5463	27642	7155	9442
1974	5988	2619	11133	3383	6070	31713	7381	12232
1975	5837	2341	11369	3619	6340	30546	7715	11585

Table 9 (suite)

year	lamps		goat-kids		sheep 1 year and over		goats 1 year and over	
	lamps		goat-kids		sheep 1 year and over		goats 1 year and over	
	born (SBO)	slaught. sold within (SLW)	born (GBO)	slaught. sold within (GKW)	slaught. sold within (SSW)	slaught. sold within (SSO)	slaught. sold within (GGW)	slaught. sold within (GGO)
1961	11827	4565	27879	13167	730	342	1415	1121
1962	10263	4122	23049	9588	1484	310	849	1064
1963	12644	5095	26340	12715	642	285	1439	1073
1964	12300	5086	27000	12358	615	217	1368	1209
1965	12128	5342	28092	12395	717	206	1477	1358
1966	11691	4997	28527	11247	932	246	1731	1099
1967	10634	4947	30748	12113	793	194	1658	1085
1968	10614	4804	25885	11609	1001	435	1349	1264
1969	10651	4578	28666	13790	781	449	2001	1324
1970	10743	4738	28821	12378	752	399	1876	1158
1971	9235	3039	25565	11812	284	229	1063	674
1972	10008	3484	29231	11329	270	319	1495	747
1973	10455	3741	29870	12981	536	101	1254	567
1974	9554	4380	30519	15872	474	125	1188	998
1975	11323	4361	33966	16841	277	101	1192	883

Table 10

COMPARATIVE NUTRITIONAL VALUE OF CAROB-TREE FRUITS (IN %)

100 parts of food include

dry matter	raw elements			digestible elements					nutritional coefficient in relation with starch	nutritional value of starch contained	
	A	B	C	D	E	F	G	H			I
carob fruits	85.0	5.8	1.3	69.0	6.4	4.0	0.7	65.5	3.7	0.97	11.1
barley	85.7	9.4	2.1	67.8	3.9	6.6	1.9	62.4	1.3	0.99	12.0

O'Kellner (in Tsoumis - 1939)

Table 11

DISTRIBUTION OF WORKS FOR PASTURE: CHIOS DEPARTMENT (1976 - 1980)

range for improvement (stremas)	number of animals involved	infrastructurel works	range improvement works	total
annual summer total	oxen- sheep goats	# of watering tanks	# of roads fertillizations	pesti- cides
	bulls- cows	rain- shel- fed	(km) ings	expenses (000 dr)

358,000 - 358,000 - 17,000 11,000 - 20 28 42 - - 21,380

* dr = drachma (Greek monetary unit). 32 drachmae = one dollar (approximately)

Chouliaras et al - 1975

Table 12

TOTAL AREAS BURNED IN CHIOS ISLAND
1922 - 1977

year	area burned (stremas)	year	area burned (stremas)
1922	236	1952	336
1923	59	1953	200
1924	2,807	1954	2,620
1925	500	1955	54
1926	207	1956	955
1927	2,647	1957	150
1928	2,913	1958	1,180
1929	135	1959	5
1930	40	1960	1,325
1931	1,000	1961	1,610
1932	824	1962	368
1933	1,787	1963	358
1934	2,767	1964	315
1935	4,260	1965	8,538
1936	165	1966	4,008
1937	658	1967	1,587
1938	30	1968	300
1939	70	1969	2,900
1940	746	1970	4,495
1941	4,311	1971	162
1942	6,719	1972	2,583
1943	1,268	1973	2,200
1944	369	1974	28,191
1945	80	1975	9,347
1946	160	1976	5,046
1947	0	1977	16,343
1948	50		
1949	3,531		
1950	10,270		
1951	100		

archives of Forestry Service of
Chios Department

Table 13

• AFEAS BURNED BY CATEGORIES OF VEGETATION COVER
1961 - 1977

year	total areas burned (TAB)	garrigue areas burned (GAF)	areas parti- ally covered by trees and maquis areas burned (PCP)	dense forested areas burned (FOF)
1961	1,610	350	350	910
1962	368	170	-	198
1963	358	150	158	358
1964	315	106	15	194
1965	8,538	6,730	-	1,808
1966	4,008	200	2,016	1,792
1967	1,587	1,581	-	6
1968	300	170	-	130
1969	2,900	2,400	500	-
1970	4,495	1,610	1,885	1,000
1971	162	-	9	153
1972	2,583	8	10	2,565
1973	2,200	600	770	830
1974	28,191	20,639	-	7,552
1975	9,347	2,765	3,627	2,955
1976	5,046	2,180	310	2,556
1977	16,343	13,645	273	2,425

Archives of General Directorate of the
Forestry Service; archives of the Forestry

Table 14

DISTRIBUTION OF FORESTS OF CHIOS DEPARTMENT
BY OWNERSHIP AND FOREST TYPE

ownership areas	dense tree-forested areas		partially covered by forests and/or maquis areas		garrigue areas		alpine areas		total
	(streimas) (A)	(%)	(streimas) (B)	(%)	(streimas) (C)	(%)	(streimas) (D)	(%)	
public (55.3%)	11,100	3.1	90,410	25.4	254,950	71.5	-	-	356,460
communal municipal (42.5%)	59,840	21.8	154,350	56.0	61,100	22.2	-	-	215,290
monastery owned (1.8%)	10,750	91.8	-	-	1,000	8.6	-	-	11,750
owned by 3 or more persons (0.3%)	2,000	100.0	-	-	-	-	-	-	2,000
private (0.1%)	650	100.0	-	-	-	-	-	-	650
total	84,340	9.3	244,760	27.0	317,050	35.0	1,000	0.1	647,150
total*		10.6		26.1		23.5			
total**		10.6		(B) + (C) = 58.4 %					
total***		11.4		(B) + (C) = 63.0 %					

Ministry of Agriculture, distribution of forests of Greece
*Calculations from the vegetation map of 1959
**NSSG, 1961 Census
***NSSG, 1971 Census

Table 15

THE NORMALIZED INPUT DATA FILE

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
ATO	1.3990	1.2691	0.8385	0.6558	0.6362	0.3380	0.1977	0.0257	-0.2201	-0.1997	-0.6331	-2.7204	-0.6074	-0.5247	-0.4546
ACR	1.5165	1.4127	1.0018	0.7568	0.8304	0.5613	0.1216	-0.1425	-0.2799	-0.4730	-0.7196	-2.0149	-0.9114	-0.8300	-0.7896
ACN	0.6722	0.7644	1.5341	0.9135	0.9025	1.1559	0.8383	0.0856	-0.7823	-0.8562	-1.2320	-0.9011	-1.0102	-1.1993	-0.8853
AVN	2.5887	1.2656	-1.2697	-1.2759	-0.9805	-0.9190	-0.6174	0.0041	0.0718	0.3110	0.2379	0.1210	0.1764	0.2564	0.0287
ATR	-1.0411	-1.0568	-0.9833	-0.6468	-0.9430	-0.9497	0.0961	0.5191	0.3582	1.0365	0.7110	-1.1186	1.3751	1.3018	1.2414
AFS	-0.5008	-0.0455	-0.0480	0.7693	1.4490	1.3167	1.1800	0.4954	0.5662	-0.8540	-0.6638	-2.3733	-0.3854	-0.4592	-0.4468
AFP	1.3722	1.7034	0.2763	-0.2774	0.5373	0.1917	-0.4120	0.0106	0.0382	0.8265	0.2412	-2.5514	-0.7834	-0.5598	-0.6104
AGR	1.0601	0.1023	1.6697	0.9785	1.4737	-0.1249	-0.0800	-0.3371	0.0382	0.8265	0.2412	-2.5514	-0.7834	-0.5598	-0.6104
HMA	1.2543	1.2660	1.2417	1.1423	0.9590	0.4126	0.2591	-0.2638	-0.2854	-0.5297	-0.7358	-2.3385	-0.5671	-0.1997	-0.0161
CEC	1.3922	1.3200	1.2263	0.9485	0.8253	0.7307	0.3336	-0.4020	-0.3514	-0.4544	-0.5537	-1.2545	-0.9372	-1.2618	-1.3981
STO	1.1640	0.2661	1.2429	1.0320	0.8643	0.6046	-0.5870	-1.1039	-0.5269	-0.6128	-0.7474	-1.4557	-0.8538	-0.9484	-1.2196
SDO	1.5400	1.2360	1.1577	0.8971	0.8409	0.7331	0.0082	-0.1916	-0.1538	-1.0602	-1.0954	-2.1491	0.3231	0.1751	0.4614
SFL	-1.4330	-1.3051	-0.7932	-0.9980	-0.1536	-0.3532	-0.3481	0.0839	-0.4636	-0.0697	-0.1198	0.2435	-0.8511	-1.2555	-1.0381
SNM	1.5917	0.3535	1.2583	1.9890	-0.1174	0.1100	-0.3540	-1.8178	-0.3424	-0.7252	-0.2264	-0.6370	0.2955	1.7092	1.9856
GTO	0.9882	-0.6017	0.1404	0.4244	0.4116	1.2070	1.4525	-1.2353	-0.1390	-0.9638	-0.4221	-2.1975	-0.4544	0.8871	0.5025
GDO	1.4146	0.8641	0.7678	1.1701	1.0175	1.0635	0.3392	-0.4593	-0.7644	-0.6477	-0.7380	-1.9081	-0.9297	-0.7372	-0.4525
GFL	-1.1200	-1.6584	-1.7076	-0.6062	-0.1488	-0.3018	-0.5605	0.1820	0.9738	0.6131	0.3826	0.2137	1.0987	1.4699	1.1694
GNM	1.2236	0.4499	1.1815	0.3812	0.0424	0.8588	1.5364	-1.1858	0.6937	-1.2364	-0.5355	-1.5665	-1.0532	-0.2783	-0.4673
SBO	0.8774	-0.6662	1.6837	1.3442	1.1744	0.7432	-0.3000	-0.3198	-0.2832	-0.1925	-1.6807	-0.9178	-0.4767	-1.3659	0.3800
GBD	-0.1541	-2.0238	-0.7499	-0.4944	-0.0717	0.0967	0.9564	-0.9260	0.1505	0.2105	-1.0499	0.3692	0.6166	0.8678	2.2021
SLW	0.1225	-0.5582	0.9369	0.9231	1.3165	0.7864	0.7095	0.4898	0.1425	0.3884	-2.2224	-1.5386	-1.1437	-0.1618	-0.1910
SLO	-1.0107	0.0475	-0.4816	0.2282	-0.5328	-0.8476	-1.7751	-1.0458	-0.3925	1.9043	1.0451	1.3467	0.4762	0.5994	0.3396
GNW	0.2718	-1.7245	0.0197	-0.1794	-0.1588	-0.7991	-0.3161	-0.5972	0.6193	-0.1683	-0.4840	-0.7534	0.1681	1.7806	2.3211
GKO	-1.4597	-1.1795	-1.3724	-0.3477	-0.5821	-0.0802	0.3596	-0.8778	-0.2967	0.4084	0.2372	1.5804	1.2950	1.3335	0.9822
SSW	0.1506	2.5103	-0.1248	-0.2093	0.1100	0.7828	0.3478	0.9987	0.3102	0.2195	-1.2451	-1.2690	-0.4565	-0.8384	-1.2671
SSO	0.6932	0.4093	0.1875	-0.4158	-0.5134	-0.1585	-0.6199	1.5184	1.6426	1.1990	-0.3094	0.4892	-1.4451	-1.2321	-1.4451
CCW	-0.0234	-1.8840	0.0503	-0.1825	0.1749	1.0076	0.7683	-0.2448	1.8928	1.4830	-1.1824	0.2339	-0.5562	-0.7726	-0.7595

(suite)

Table 15 (suite)

THE NORMALIZED INPUT DATA FILE

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
CCO	0.2250	0.2091	0.2432	0.5584	1.1222	0.1417	0.2686	1.9233	0.9941	0.3652	-1.4684	-1.1918	-1.8737	-0.2409	-0.6766
FWF	2.0156	2.2156	-0.1836	-0.2093	-0.1624	0.2007	-0.3244	-0.2382	-0.0395	1.2000	-0.6396	-0.8754	-1.1436	-1.1134	-0.4384
FVA	0.5814	0.5814	-1.5336	0.7224	-0.1225	0.2854	-0.6876	-0.1454	0.4465	0.7353	0.1444	-0.7799	-1.3893	-1.1347	2.2963
SRP	1.6842	1.6842	1.2337	1.0567	0.3793	0.3472	0.2313	-0.4928	-0.6164	-0.6766	-0.7587	-0.8682	-0.9450	-1.0186	-1.0398
GAF	-0.4036	-0.4374	-0.4412	-0.4495	0.7919	-0.4318	-0.1724	-0.4374	-0.0185	-0.1669	-0.4694	-0.4679	-0.3567	0.4277	0.2520
PCF	-0.2479	-0.5747	-0.5280	-0.5607	-0.5747	1.3277	-0.5747	-0.5747	-0.1278	1.1854	-0.5663	-0.5653	0.1443	-0.5747	2.8119
FOF	-0.2238	-0.5858	-0.6062	-0.5879	0.2329	0.2247	-0.6835	-0.6204	-0.6865	-0.1782	-0.6087	0.6178	-0.2645	0.1537	0.0161
TAB	-0.3986	-0.5720	-0.5734	-0.5794	0.5689	-0.0637	-0.4018	-0.5815	-0.2184	0.2043	-0.6208	-0.2627	-0.2162	0.3135	0.6819
NFR	-1.1506	-1.1506	-1.0408	-0.9430	-0.8476	-0.7522	-0.4564	-0.1272	0.1590	0.4906	0.6242	0.8136	1.1681	1.3994	1.7835
CER	1.1629	1.3277	0.8398	0.8547	0.8806	0.7512	0.5052	0.2333	-0.0515	-0.3763	-0.9628	-1.2913	-1.1155	-1.6098	-1.3262
UCC	-0.6429	-0.6429	-0.6479	-0.6657	0.4005	-0.2032	0.1567	-0.5202	-0.1122	-0.2174	-0.3695	-0.5716	-0.0276	0.0919	1.5915
UGS	-0.5607	-0.5607	-0.5793	-0.5885	0.5307	-0.0148	-0.3342	-0.4564	-0.2064	-0.1428	-0.4818	-0.6178	-0.5168	2.9304	1.5990
UPS	-0.6637	-0.7108	-0.7813	-0.9478	-0.9621	0.9103	0.2715	-0.0447	-0.5226	1.2909	0.4333	-0.0917	-0.2592	-0.5057	2.7816
UPG	-0.7365	-0.8354	-0.9441	-1.0182	-0.8354	0.8351	0.1521	-0.1850	-0.0229	1.2021	0.2172	-0.2664	0.2104	-0.6663	0.7873
UFS	-0.4973	-0.5488	-0.6416	-0.7381	-0.1792	0.2704	-0.1322	-0.5825	-0.8387	-0.5138	-0.5470	0.1852	0.1357	2.2994	2.0093
UFG	-0.5771	-0.6093	-0.6574	-0.8276	-0.2178	0.1477	-0.1102	-0.3292	-0.5013	-0.5027	-0.6394	0.1014	0.1210	2.2542	2.4261
TUS	-0.6052	-0.6268	-0.6772	-0.7338	0.1755	0.1842	-0.2292	-0.4912	-0.4613	-0.1328	-0.4404	-0.3548	-0.3245	2.5942	2.1213
TUG	-0.6862	-0.7081	-0.7365	-0.8186	0.1316	0.0865	0.0792	-0.4693	-0.2948	-0.1947	-0.4160	-0.3364	-0.3219	2.5357	2.1493
SFT	-0.8915	-1.4044	-0.2911	-0.1472	0.2510	-0.3724	-0.6163	-0.8777	0.3820	-0.4762	-0.2685	-0.2459	1.4892	1.8856	1.0856
GFT	0.3558	-1.1217	-0.2855	-0.1477	-0.0982	0.7363	1.2967	-1.2526	1.8182	-0.8811	-0.2643	-1.6839	-0.2194	1.1421	0.6093
SLT	-0.8058	-0.6013	0.6326	1.3759	1.2238	0.1152	-0.8432	-0.4146	-0.2031	2.2347	-1.5917	-0.5178	-0.8769	0.3748	0.0974
GKT	-0.8441	-1.6882	-0.9157	-0.3274	-0.4749	-0.4677	0.0790	-0.9213	0.1203	0.1884	-0.2904	0.6763	0.9626	1.8212	1.8639
SST	0.3287	2.2082	-0.2408	-0.2961	-0.0592	0.6046	0.1074	1.2763	0.7400	0.5344	-1.1265	-0.9287	-0.8237	-1.0580	-1.4779
CGT	0.1069	-1.2256	0.0563	0.1933	0.7368	0.7263	0.5430	0.9211	1.7691	1.1561	-1.5764	-0.5125	-1.3995	-0.6325	-0.8643
AFT	0.5798	0.7926	0.4334	0.4816	1.3299	0.7002	0.4323	0.2071	0.2690	-0.1957	-0.3932	-2.9469	-0.6881	-0.5509	-0.5315
TSS	-0.4671	0.7288	0.4816	0.9131	0.7902	0.4245	-0.6186	0.3672	0.2430	2.2831	-1.8974	-0.9258	-1.1458	-0.2820	-0.7329
TGS	-0.8510	-1.9015	-0.9315	-0.3087	-0.3837	-0.3777	0.1574	-0.7980	0.3721	0.3558	-0.3144	0.6218	0.7888	1.7798	1.7937

Table 16

MATRIX OF STANDARDIZED VARIABLES

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
ATO	1.2068	1.1622	0.9434	0.7297	0.5733	0.1182	0.2815	0.3648	-0.4838	-0.4016	-0.1362	-1.9238	-0.3804	-0.6354	-0.6749
ACR	1.3242	1.2854	1.1254	0.8577	0.8597	0.4964	0.1538	0.1233	-0.5763	-0.7125	-0.2982	-1.2425	-0.7822	-0.8414	-0.9230
ACN	0.4805	0.7292	1.7187	1.2562	0.9661	1.5033	1.3145	0.4506	-1.3535	-1.1965	-1.2480	-0.1666	-0.8783	-1.2973	-0.9939
AVN	2.3956	1.1592	-1.4062	-1.7174	-1.8111	-2.0105	-1.0332	0.3339	-0.0323	0.2177	1.1925	0.0192	2.5884	-0.1026	-0.3169
ATR	-1.2316	-0.8333	-1.0870	-0.9205	-1.7557	-2.0624	0.1177	1.0714	0.4108	1.2952	1.9129	-0.3763	2.2722	0.6152	0.6554
AFS	-0.6917	0.0344	-0.0446	0.8735	1.7720	1.7756	1.8656	1.0375	0.7325	-1.1938	-0.1827	-1.5861	-0.1862	-0.5905	-0.6691
AFP	1.1802	1.5348	0.3169	-0.4525	0.4274	-0.1295	-0.7017	0.3432	-0.2842	0.8429	1.1955	-1.7627	-0.5973	-0.6594	-0.7903
AGR	0.8681	0.1612	1.8698	1.1385	1.8085	-0.6657	-0.1663	-0.1547	-0.5848	-0.8059	-0.2924	-1.5526	-0.2326	-0.4129	-0.3501
HMA	1.0622	1.1596	1.3928	1.3460	1.0494	0.2445	0.3805	-0.7129	-0.6959	-0.7122	-0.7151	-0.5372	-0.8022	-1.1421	-1.7737
CBC	1.2020	1.2059	1.3756	1.0879	0.8522	0.7832	0.5037	-0.2477	-0.9504	-0.9018	-0.3123	-0.7313	-0.6852	-0.9255	-1.2415
STO	0.9719	0.3217	1.3011	1.2152	0.9297	0.5697	-0.9840	-1.2529	-0.3812	-1.4425	-0.8422	-1.3613	0.7697	-0.1562	0.0336
SDO	1.3477	1.1338	1.2092	1.0354	0.8752	0.7873	-0.0241	0.0536	-0.7590	-0.7797	-0.1373	-0.8316	-0.6816	-1.1358	-1.1071
SFL	-1.6232	-1.2463	-0.8752	-1.3654	-0.5915	-1.0523	-0.5987	0.4482	0.5738	-0.2442	0.6457	0.9371	1.7151	0.8942	1.1326
SNM	1.4023	0.3767	1.4113	2.4187	-0.5381	-0.2679	-0.6762	-2.2753	-0.6730	-1.0378	0.4834	0.2881	0.7356	-0.5344	-1.0215
CFO	0.7963	-0.4428	0.1654	0.4366	0.2421	1.5898	2.3251	-1.4411	-0.3583	-1.2267	0.1854	-1.4165	-0.1913	0.3312	0.0342
CEO	1.2223	0.8148	0.8646	1.3813	1.1357	1.2468	2.5097	-0.3297	-1.3258	-0.9442	-0.2957	-1.1376	-0.7788	-0.7849	-0.6733
GFL	-1.3124	-1.3494	-1.8942	-0.8090	-0.5044	-0.9653	-0.9412	0.5887	1.2631	0.5825	1.4138	0.9084	1.7283	0.7323	0.5220
GNM	1.2315	0.4594	1.3257	0.3818	1.2024	1.2022	2.4424	-1.3702	0.9298	-1.6592	0.0123	-0.8131	-0.9829	-0.4667	-0.6842
SBO	0.6955	-0.4982	1.8854	1.6018	1.2671	0.8044	-0.5211	-0.1320	-0.5814	-0.3929	-1.7314	-0.1827	-0.2189	-1.2114	-0.3567
CBO	-0.2452	-1.6629	-0.8268	-0.7274	-0.4707	-0.2904	1.5052	-0.9981	0.0895	0.4951	-0.7727	1.2583	1.1325	0.3181	1.2929
SLM	-0.2688	-0.4255	1.0531	1.2683	1.5766	0.8776	1.1369	1.0295	0.2771	0.3125	-2.5563	-2.7813	-1.0433	-0.3869	-0.4796
SLO	-1.2012	0.1142	-0.5278	0.3147	-1.1528	-1.8895	-2.9000	-1.1711	-0.7505	2.1459	2.4197	2.0029	0.9589	0.1343	-0.2866
GMW	0.2824	-1.4061	0.0320	-0.2983	-0.5992	-1.0374	-0.5471	-0.5272	0.8147	-0.3636	0.0911	-0.0241	0.5781	0.9421	1.3811
GKO	-1.6499	-0.9386	-1.5226	-0.5416	-1.2235	-0.5900	0.5426	-0.9291	-0.6023	0.2347	1.1821	2.2262	1.9712	0.6372	0.3893
SSW	-0.0408	2.2271	-0.1322	-0.2662	-0.2028	0.8715	0.5236	1.7593	0.3365	0.1050	-1.2683	-0.5426	-0.1939	-0.8523	-1.2767
SSO	0.5015	0.4246	0.2179	-0.6278	-1.1222	-0.7226	-1.2370	2.5026	2.3977	1.2919	0.3572	1.1710	-1.4158	-1.1198	-1.4085
CGW	-0.2196	-1.5430	0.2650	-0.2323	-0.1070	1.2520	1.2017	-0.0226	2.7817	1.6358	-0.9725	0.9279	-0.3171	-0.8251	-0.9327

(suite)

Table 16 (suite)

MATRIX OF STANDARDIZED VARIABLES

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1972	1973	1974	1975
CCU	2.6336	2.4812	2.4571	2.6263	1.2911	-2.2142	2.1750	1.0510	1.3945	2.2924	-1.4802	-2.2156	-2.6393
IVF	1.8229	1.8327	-2.1957	-2.2662	-2.6345	-2.4537	-2.5635	2.2239	-2.2244	1.4215	-2.1459	-1.8432	-2.7385
IWA	2.3697	2.5722	-1.7623	2.8141	-2.5150	2.2291	-2.1462	2.1199	2.5474	2.7425	1.8401	-1.3468	1.7531
SRP	1.4918	1.5184	1.3839	1.2776	2.1914	2.1338	2.2131	-2.2777	-2.2960	-2.2792	-2.3273	-2.7977	-2.9736
CAF	-2.5946	-2.3219	-2.4928	-2.6725	2.8774	-2.1854	-2.2154	-2.2984	-2.1719	-2.2619	2.2511	-2.2725	-2.2572
POF	-2.4394	-2.4197	-2.5735	-2.8114	-2.2126	1.7634	-2.9541	-2.4252	-2.3121	1.2755	2.1572	2.5417	-2.6696
POF	-2.4142	-2.4222	-2.5667	-2.2459	-2.2215	-2.2737	-2.1290	-2.5695	-1.2952	-2.2752	1.2002	2.2422	2.2662
TAB	-2.5896	-2.4173	-2.6323	-2.8451	2.4711	-2.5622	-2.6852	-2.5248	-2.4212	-2.1546	2.4492	-2.2225	1.9927
NFR	-1.3412	-2.2128	-1.1512	-1.2957	-1.6153	-1.7202	-2.7732	2.1459	2.1220	2.4242	1.5150	1.8141	2.6221
CER	2.9626	1.1953	2.9149	2.9217	2.2130	2.8179	2.7774	2.6621	-2.2232	-2.0151	-2.3221	-1.2281	-1.3784
UGC	-2.8317	-2.4765	-2.7354	-2.9114	2.3263	-2.5961	2.2154	-2.4227	-2.3722	2.2722	2.1512	-2.2927	1.7212
UCS	-2.7515	-2.4277	-2.6267	-2.8466	2.4177	-2.4732	-2.5762	-2.3256	-2.4626	-2.3227	2.2914	-2.2681	1.7384
UPS	-2.8545	-2.5364	-2.8618	-1.3210	-1.7612	1.8874	2.4825	2.2642	-2.9517	1.2612	2.4882	2.2522	-2.6224
UPC	-2.9272	-2.6133	-1.2433	-1.3910	-1.5971	2.9622	2.2322	2.2631	-2.1797	1.5622	1.3112	2.6324	-2.7322
UFS	-2.6982	-2.2971	-2.7361	-1.2361	-2.6293	2.2237	-2.2525	-2.5262	-1.4227	-2.7019	2.2761	2.5291	1.2981
UFC	-2.7679	-2.4493	-2.7227	-1.1495	-2.6962	-2.2242	-2.2152	-2.1424	-1.7425	-2.7622	2.8221	2.5199	1.4581
UUS	-2.7962	-2.4644	-2.7458	-1.7327	-2.1261	-2.1922	-2.4272	-2.3754	-2.2569	-2.3122	2.1575	-2.2377	1.5222
UUC	-2.6772	-2.5341	-2.8119	-2.1381	-2.1722	-2.2277	2.2224	-2.2441	-2.5921	-2.2955	2.1945	2.2779	1.4621
SFM	-2.2921	-1.1215	-2.3155	-2.2876	-2.7352	-1.8848	-1.6312	-2.2229	2.4476	-2.7201	2.6591	2.2127	1.2152
GFM	2.1643	-2.2892	-2.2293	-2.2882	-2.5290	2.7227	2.2528	-1.4058	2.6694	-2.2292	2.4257	2.2992	2.5045
SLP	-2.9965	-2.4925	2.7142	1.6422	1.1452	-2.2591	-1.2971	-2.2657	-2.4575	2.5459	-1.5950	2.2232	2.1121
GKT	-1.3247	-1.2752	-1.2116	-2.5158	-1.4654	-1.2462	2.2221	-2.6627	2.2422	2.2681	1.2514	1.5570	-2.2562
ESM	2.1272	1.9679	-2.2455	-2.4762	-2.4522	2.5697	2.1352	2.1552	1.8214	2.4273	-2.6874	-2.6222	-1.3222
CGM	-2.2844	-2.9639	2.3717	2.1422	2.7217	2.7758	2.8381	1.6125	2.5922	1.2472	-1.5725	2.2701	-2.7272
AFM	2.2981	2.7534	2.4922	2.5692	1.5264	2.2671	2.6590	2.2722	2.2722	-2.2922	-2.1922	-2.1922	-2.6532
USS	-2.6582	2.6987	2.5457	1.2937	2.2224	2.2647	-1.2249	2.2522	2.2222	-2.2622	-2.1922	-2.1922	-2.7272
UCS	-1.2416	-1.5582	-1.2292	-2.4922	-2.2322	-1.2322	2.2165	-2.6142	2.2222	2.2712	1.2222	1.2222	2.2222

Table 17

MATRIX OF CORRELATIONS BETWEEN THE 15 VARIABLES

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
1961	1.000	0.712	0.645	0.520	0.346	0.305	0.169	0.001	-0.116	-0.349	-0.245	-0.593	-0.561	-0.616	-0.628
1962	0.712	1.000	0.495	0.408	0.315	0.292	-0.032	0.311	-0.263	-0.125	-0.178	-0.529	-0.584	-0.605	-0.691
1963	0.645	0.495	1.000	0.822	0.698	0.467	0.229	-0.006	-0.190	-0.367	-0.575	-0.630	-0.541	-0.576	-0.682
1964	0.520	0.408	0.822	1.000	0.689	0.407	0.123	-0.070	-0.157	-0.230	-0.495	-0.544	-0.474	-0.584	-0.622
1965	0.346	0.315	0.698	0.689	1.000	0.456	0.248	0.174	-0.122	-0.331	-0.684	-0.670	-0.608	-0.255	-0.552
1966	0.305	0.292	0.467	0.407	0.456	1.000	0.581	0.084	-0.024	-0.232	-0.500	-0.514	-0.525	-0.542	-0.571
1967	0.169	-0.032	0.229	0.123	0.248	0.581	1.000	0.001	0.223	-0.459	-0.277	-0.396	-0.218	-0.199	-0.203
1968	0.001	0.311	-0.006	-0.070	0.174	0.084	0.001	1.000	0.383	0.347	-0.283	-0.144	-0.424	-0.366	-0.365
1969	-0.116	-0.263	-0.190	-0.157	-0.122	-0.024	0.223	0.383	1.000	0.282	-0.078	0.033	-0.074	-0.127	-0.155
1970	-0.349	-0.125	-0.367	-0.230	-0.331	-0.232	-0.459	0.347	0.282	1.000	0.070	0.406	-0.003	-0.122	0.085
1971	-0.245	-0.178	-0.575	-0.495	-0.684	-0.500	-0.277	-0.283	-0.078	0.070	1.000	0.343	0.577	0.284	0.434
1972	-0.593	-0.529	-0.630	-0.544	-0.670	-0.514	-0.396	-0.144	0.033	0.406	0.343	1.000	0.513	0.440	0.467
1973	-0.561	-0.584	-0.541	-0.474	-0.608	-0.525	-0.218	-0.424	-0.074	-0.003	0.577	0.513	1.000	0.524	0.608
1974	-0.616	-0.605	-0.576	-0.584	-0.255	-0.542	-0.199	-0.366	-0.127	-0.122	0.284	0.440	0.524	1.000	0.612
1975	-0.628	-0.691	-0.682	-0.622	-0.552	-0.311	-0.203	-0.365	-0.155	0.085	0.434	0.467	0.608	0.612	1.000

TABLE 18

OUTPUT FACTOR MATRIX (6 FACTORS)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
1961	0.74655	-0.09701	-0.36370	0.34407	0.01539	0.13627
1962	0.69174	0.15720	-0.52955	0.24951	-0.26208	-0.12907
1963	0.86577	-0.22027	-0.10611	-0.17430	0.19178	0.12360
1964	0.78471	-0.17977	-0.14246	-0.28184	0.37318	0.13143
1965	0.76850	-0.16151	0.18940	-0.45750	-0.20795	0.10709
1966	0.65215	-0.09198	0.42045	0.14915	0.15142	-0.52317
1967	0.37478	-0.23457	0.70958	0.43080	0.01101	-0.02557
1968	0.25437	0.79369	0.12885	-0.00915	-0.39943	-0.02594
1969	-0.04998	0.59021	0.51664	0.22155	0.18708	0.48259
1970	-0.30722	0.76732	-0.14558	-0.23880	0.27902	-0.21892
1971	-0.63843	-0.10277	-0.37735	0.50369	0.01100	0.06892
1972	-0.77444	0.18320	-0.08337	-0.16341	0.22560	-0.07355
1973	-0.78070	-0.30188	-0.04404	0.08515	0.19504	0.15912
1974	-0.71592	-0.35784	0.15650	-0.28544	-0.39071	0.17643
1975	-0.80007	-0.26899	0.15460	-0.04081	-0.02353	-0.30860

Table 19

STATISTICS OF FACTOR ANALYSIS

variable	estimated communality	communality	factor	eigenvalue	% of variation	cumul. percentage
1961	1.00000	0.83621	1	6.48856	43.3	43.3
1962	1.00000	0.93124	2	2.10721	14.0	57.3
1963	1.00000	0.89177	3	1.66473	11.1	68.4
1964	1.00000	0.90435	4	1.18455	7.9	76.3
1965	1.00000	0.91657	5	0.82590	5.5	81.8
1966	1.00000	0.92941	6	0.79691	5.3	87.1
1967	1.00000	0.88535	7	0.48509	3.2	90.4
1968	1.00000	0.87156	8	0.42315	2.8	93.2
1969	1.00000	0.93474	9	0.30145	2.0	95.2
1970	1.00000	0.88716	10	0.22001	1.5	96.7
1971	1.00000	0.81912	11	0.20716	1.4	98.0
1972	1.00000	0.72328	12	0.13830	0.9	99.0
1973	1.00000	0.77317	13	0.10961	0.7	99.7
1974	1.00000	0.93034	14	0.04792	0.3	100.0
1975	1.00000	0.83382	15	-0.00055	-0.0	100.0

CLASSIFICATION OF CHARACTERISTICS OF CHIOS ISLAND - PRIORITIES

economic	internally cohesive system but with external influences strengthening;
demographic	subsistence activities dominant population problems not so acute but imminent; emigration, but mainly from outlying islands and mountainous regions
environmental	superimposition of a money economy on to a subsistence base without sufficient agricultural change, leading to destruction of natural vegetation, soil erosion, over-exploitation of animal resources;
conservation	tourist problems mainly localized, but potential environmental damage is serious encourage existing form of stability;
research	restrict introduction of potentially harmful alien species
priorities	find solutions for family planning, problems of poverty, isolation, social stress and environmental damage;
	develop programmes for rational resource management;
	study existing systems of resource use and identify mechanisms that maintain stability

adapted from UNESCO, MAB, project 7 - 1973

Table 21

EFFECT OF INDISCRIMINATE AND ROTATIONAL GRAZING ON THE SWARD

composition of the sward	indiscriminate grazing				rotational grazing			
	1st year	2nd year	3d year	4th year	1st year	2nd year	3d year	4th year
good grasses	65	54	40	27	65	63	59	60
white clover	33	40	48	51	33	34	37	36
weeds	2	6	12	22	2	3	4	1
total	100	100	100	100	100	100	100	100

(Moore - 1966)

Table 22

INCOME REVENUES FROM MASTIC PRODUCTION

year	produced quantity (kgr)	net price of mastic	total net revenue
1955	150,400	71.20	10,708,000
1956	157,720	75.30	11,876,000
1957	147,220	73.50	10,813,000
1958	158,580	73.60	11,671,000
1959	227,600	86.40	19,666,000
1960	219,350	85.60	18,776,000
1961	206,280	90.10	18,586,000
1962	225,480	93.70	21,126,000
1963	308,650	101.20	31,236,000
1964	297,750	102.70	30,682,000

(Perris - 1966)

FIGURES

Figure 1

SCHEMATIC VIEW OF A TYPICAL AGRO-SYLVO-PASTORAL SYSTEM AT THE MEDITERRANEAN REGION

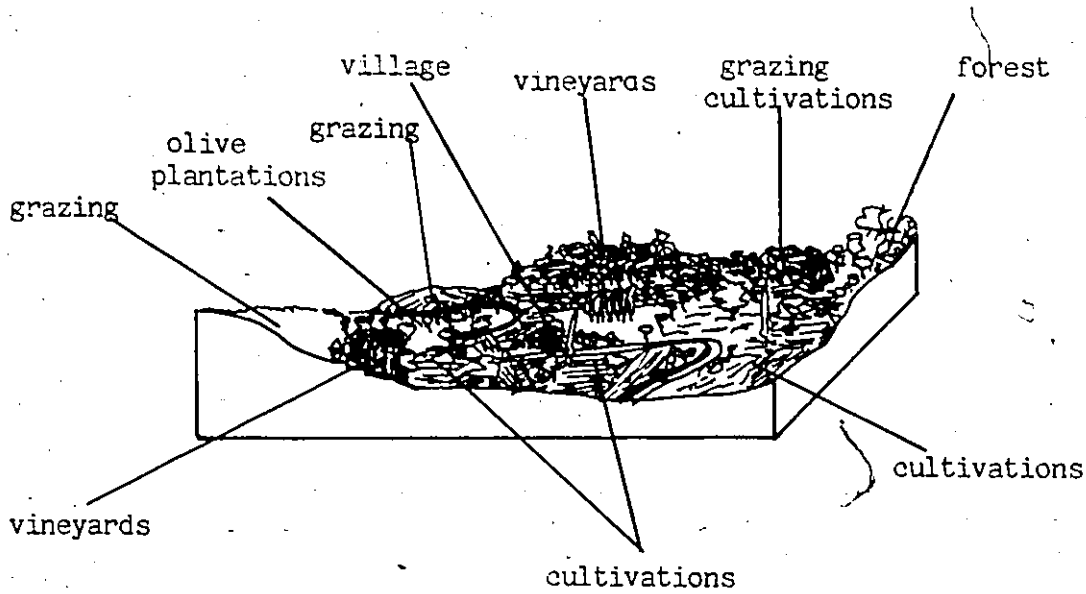
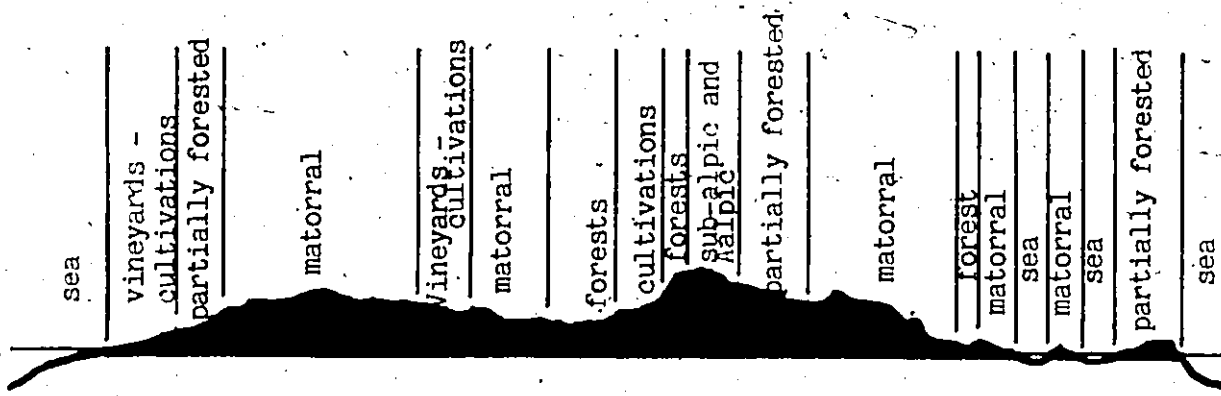


Figure 2

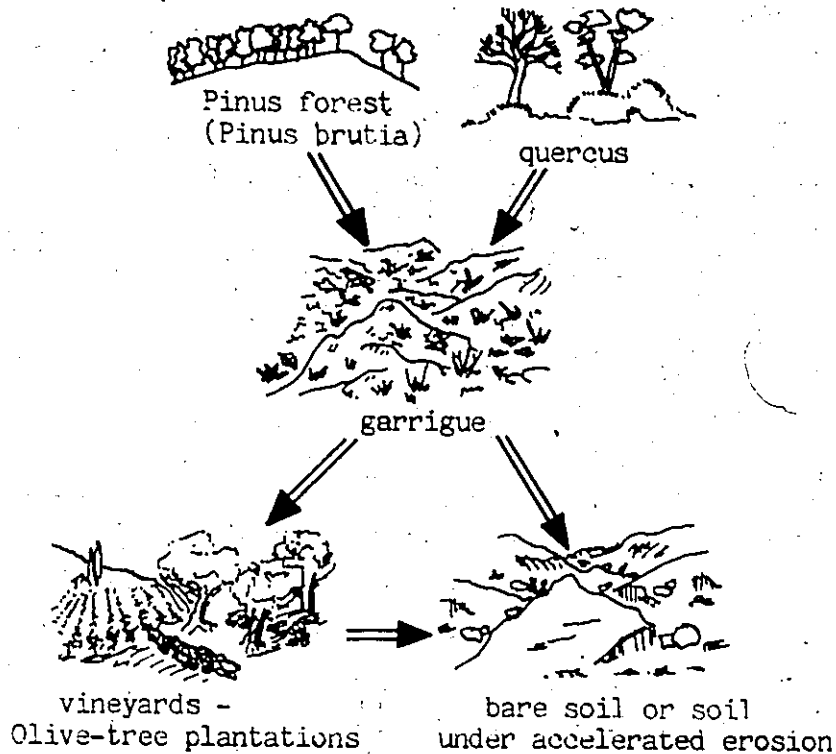
ALTITUDINAL SEQUENCE OF THE RURAL PRACTICES

replacement ecosystem modified ecosystem natural ecosystem



section A/A (see map 7)

Figure 3



SCHEMATIC SUCCESSION OF VEGETATION IN CHIOS ISLAND

(modified' from Ramade - 1974)

Figure 4

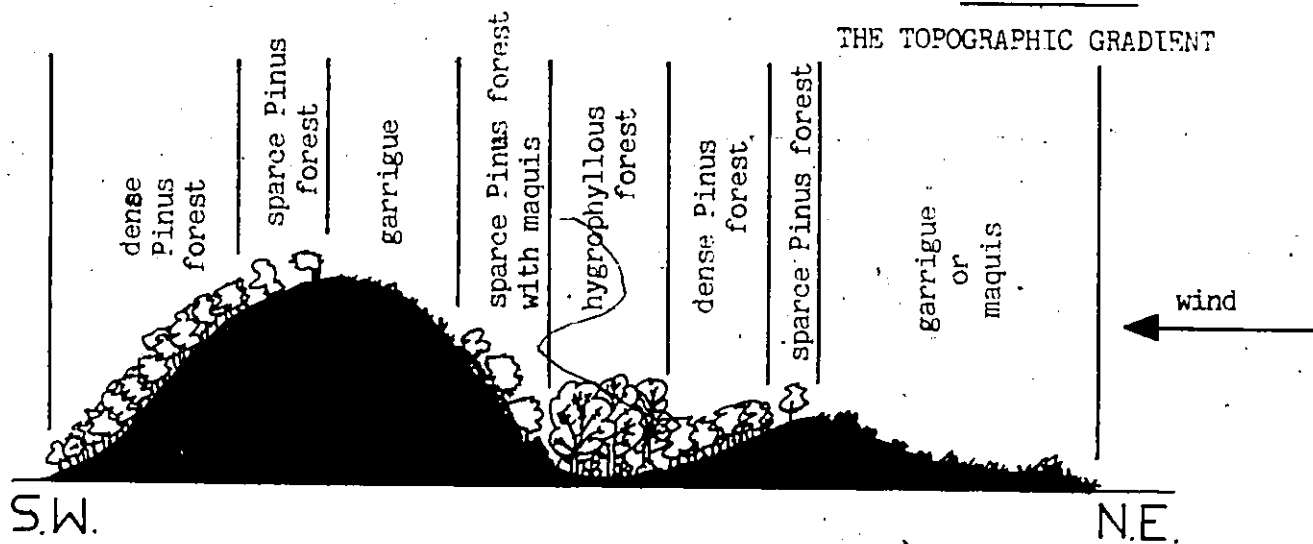
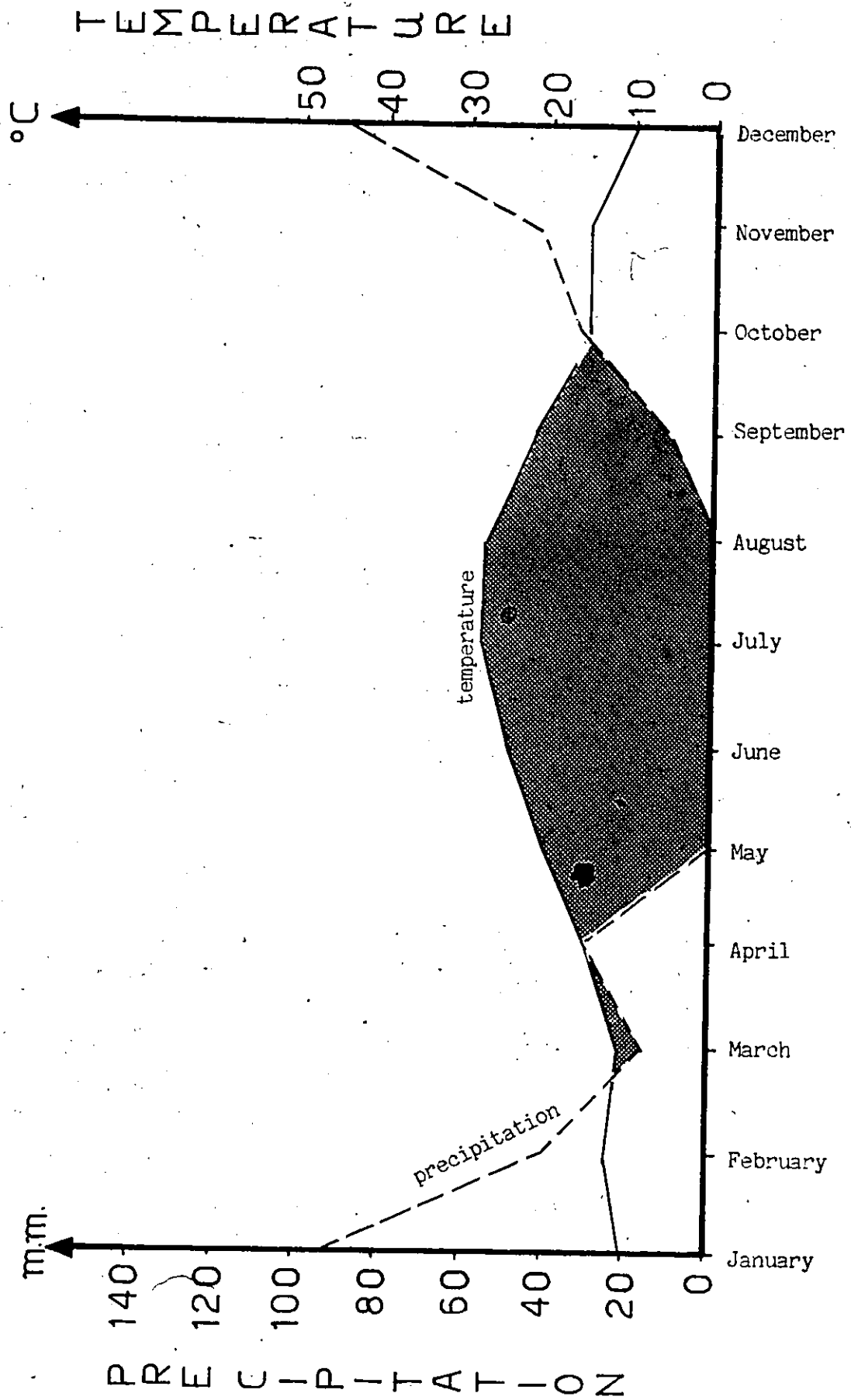


Figure 5

PRECIPITATION - TEMPERATURE DIAGRAM OF CHIOS ISLAND - YEAR 1977



(after Karaliolios - Forester
of Chios Department)

Figure 6

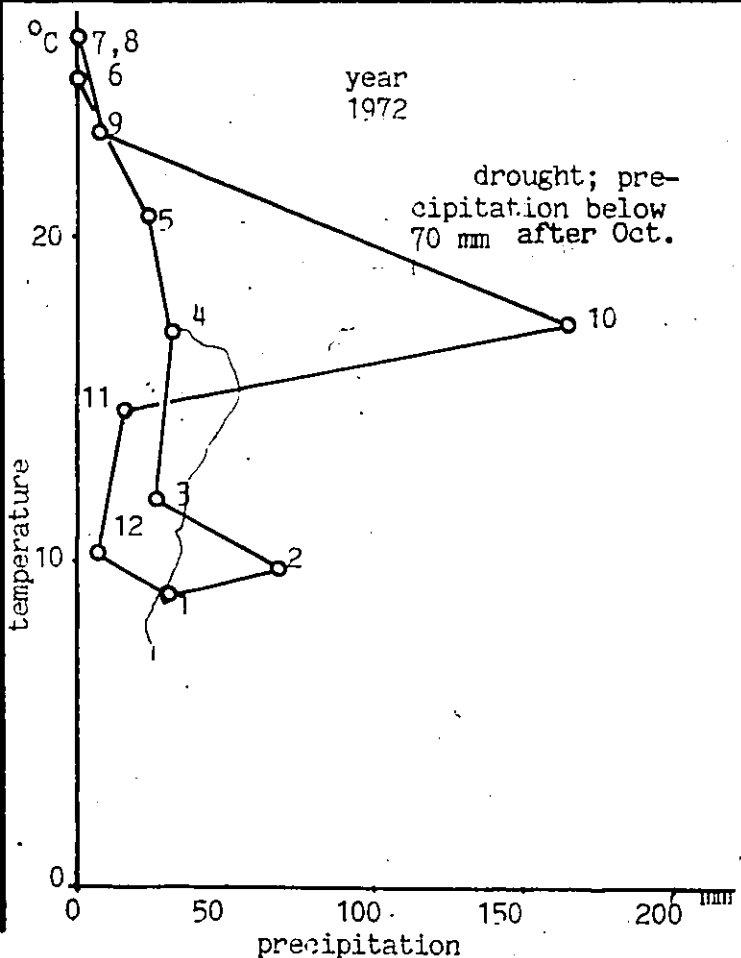
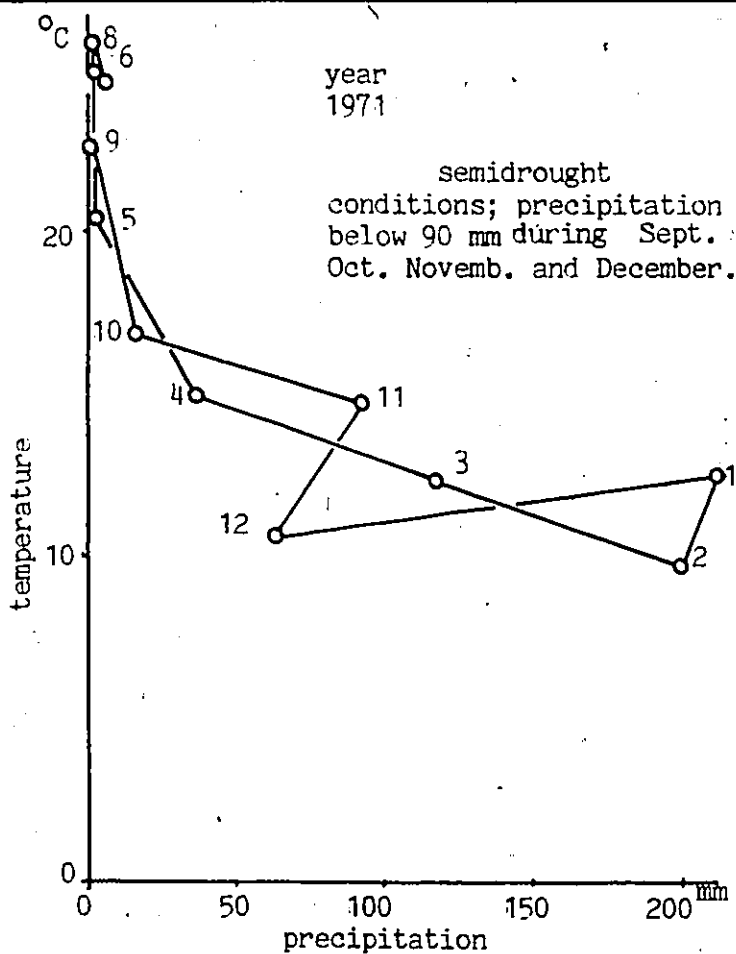
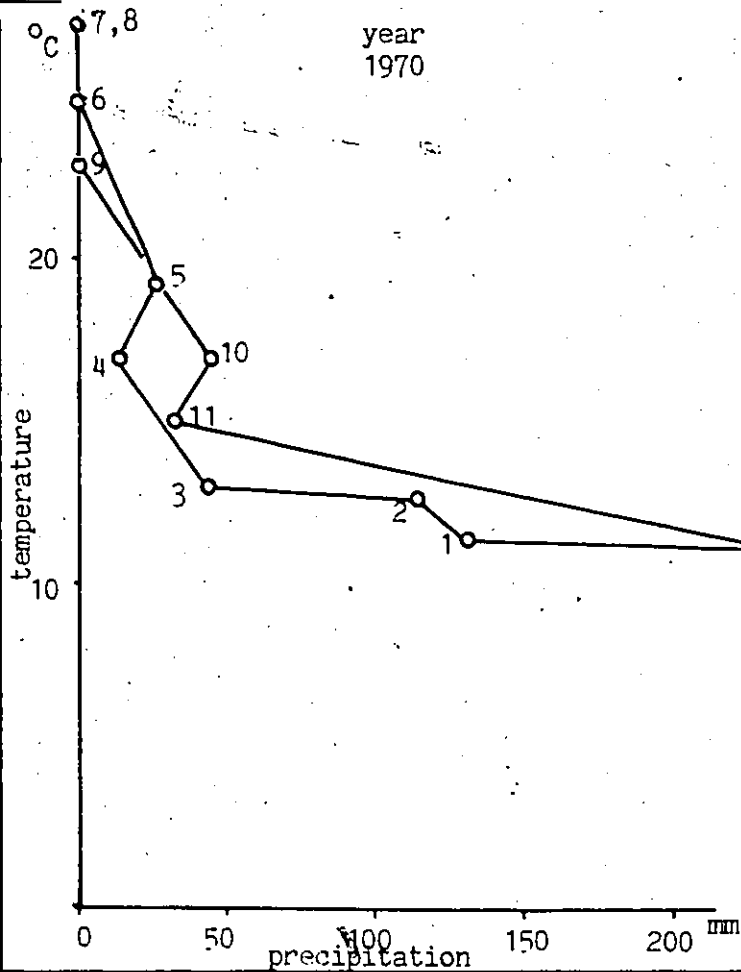
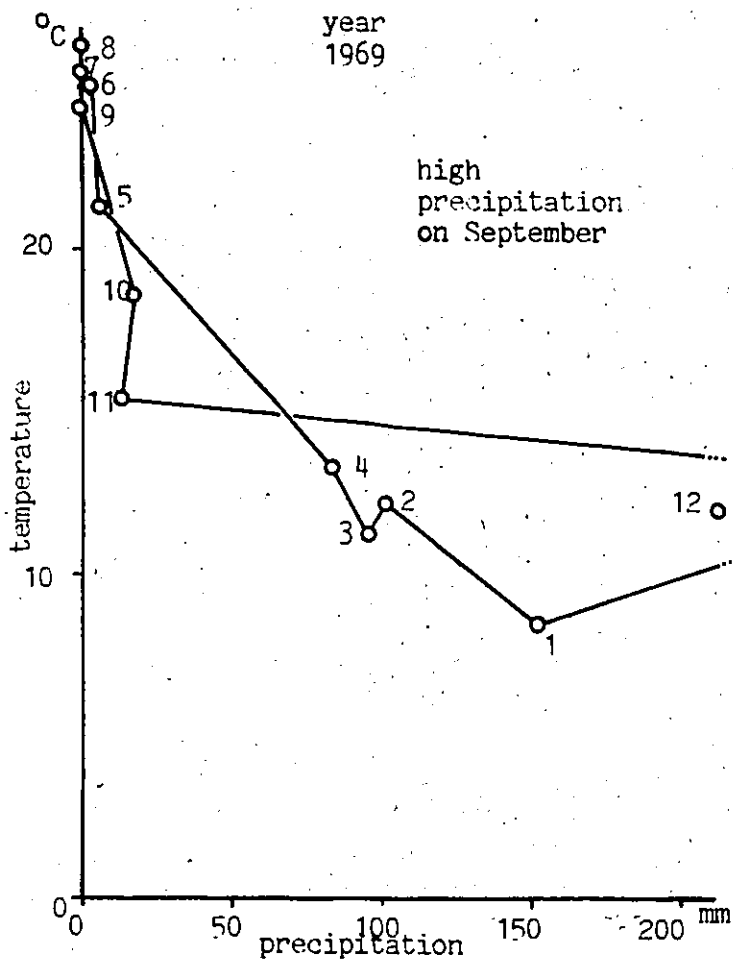


Figure 9

MEDITERRANEAN POPULATION GROWTH

Equations used
$q(t) = q(0) a^{kt}$
$k = c \log_a e$

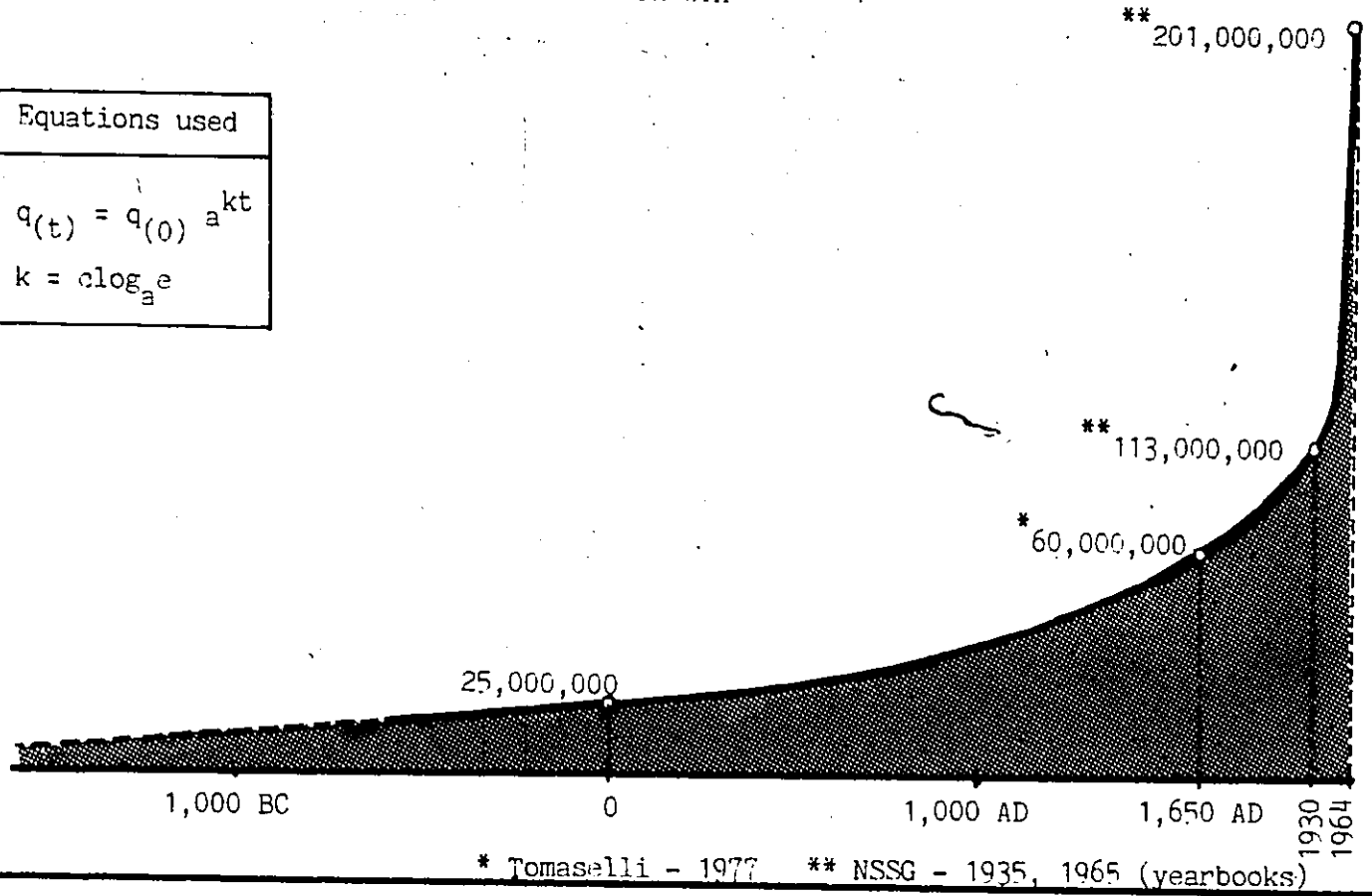
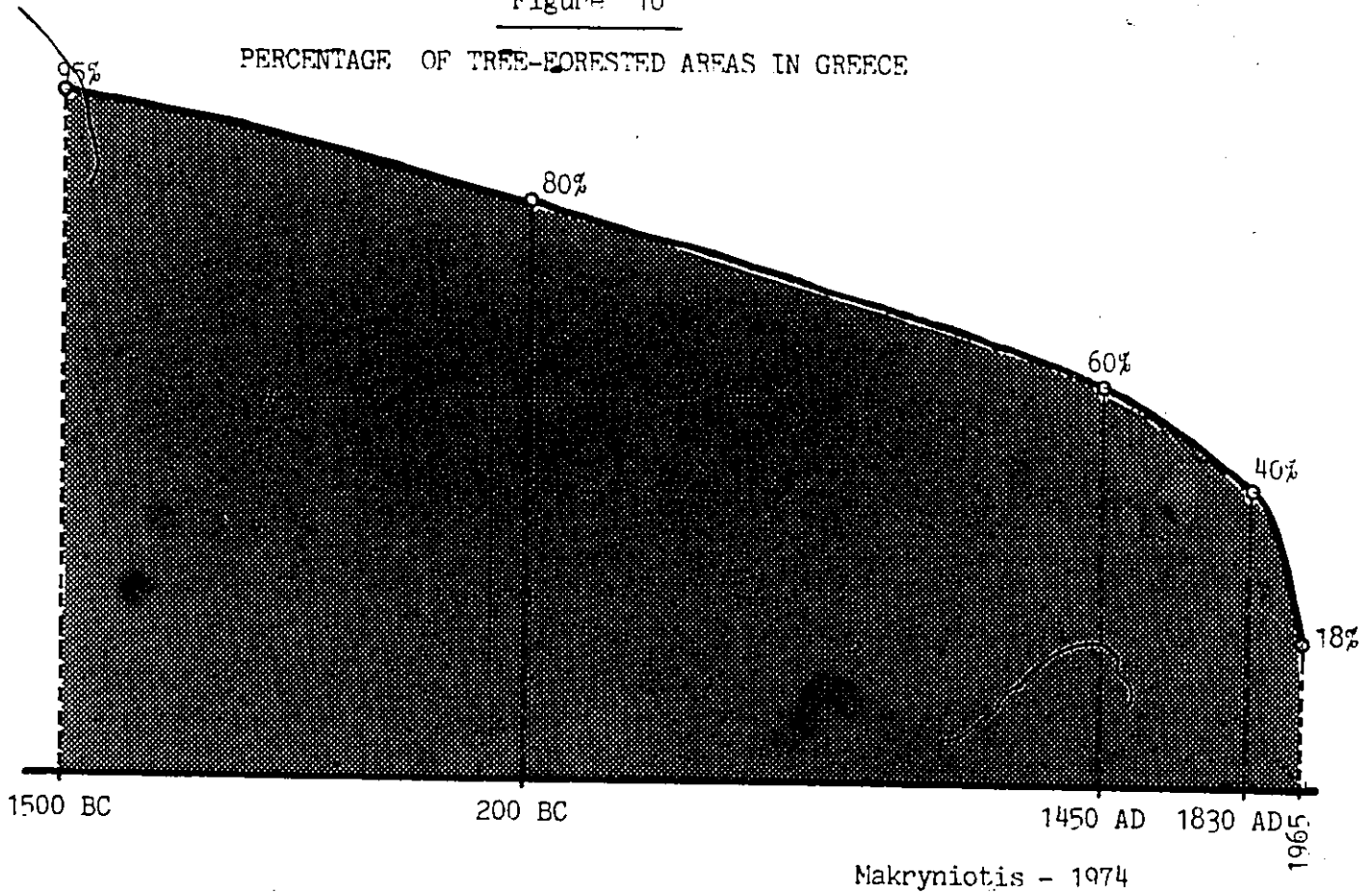


Figure 10

PERCENTAGE OF TREE-FORESTED AREAS IN GREECE



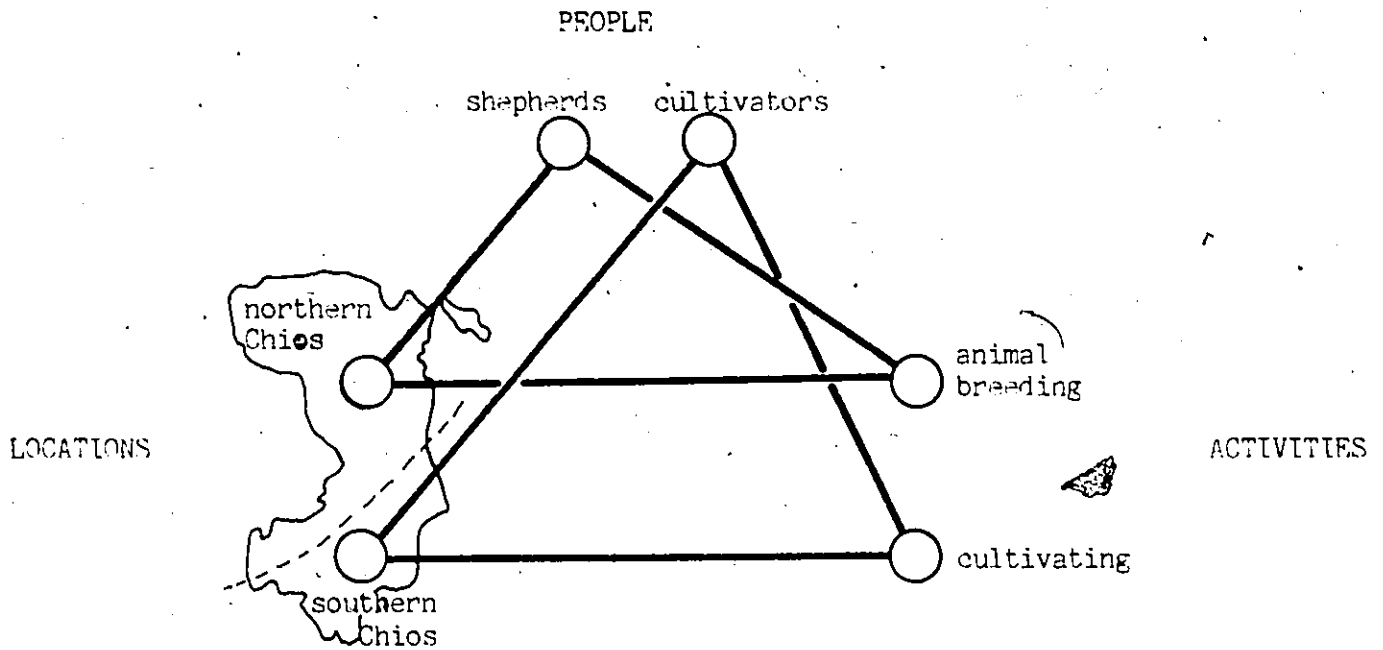


Figure 11

GENERAL SCHEME FOR THE LAND - USE SYSTEM OF CHIOS ISLAND

(model: Farmer, Gibb - 1979)

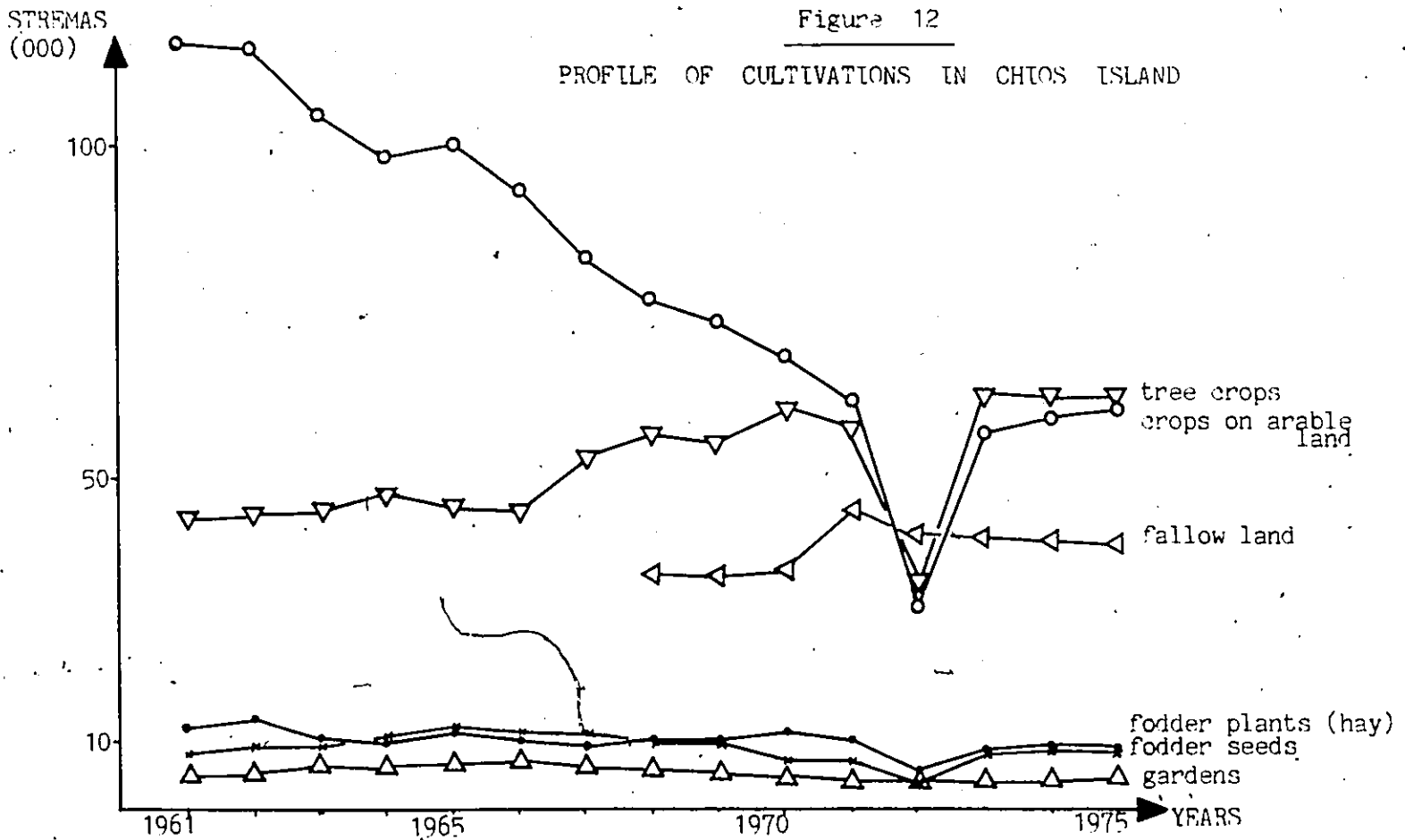


Figure 13

PROFILE OF ANIMAL - BREEDING IN THE DEPARTMENT OF CHIOS

NUMBER OF ANIMALS (000)

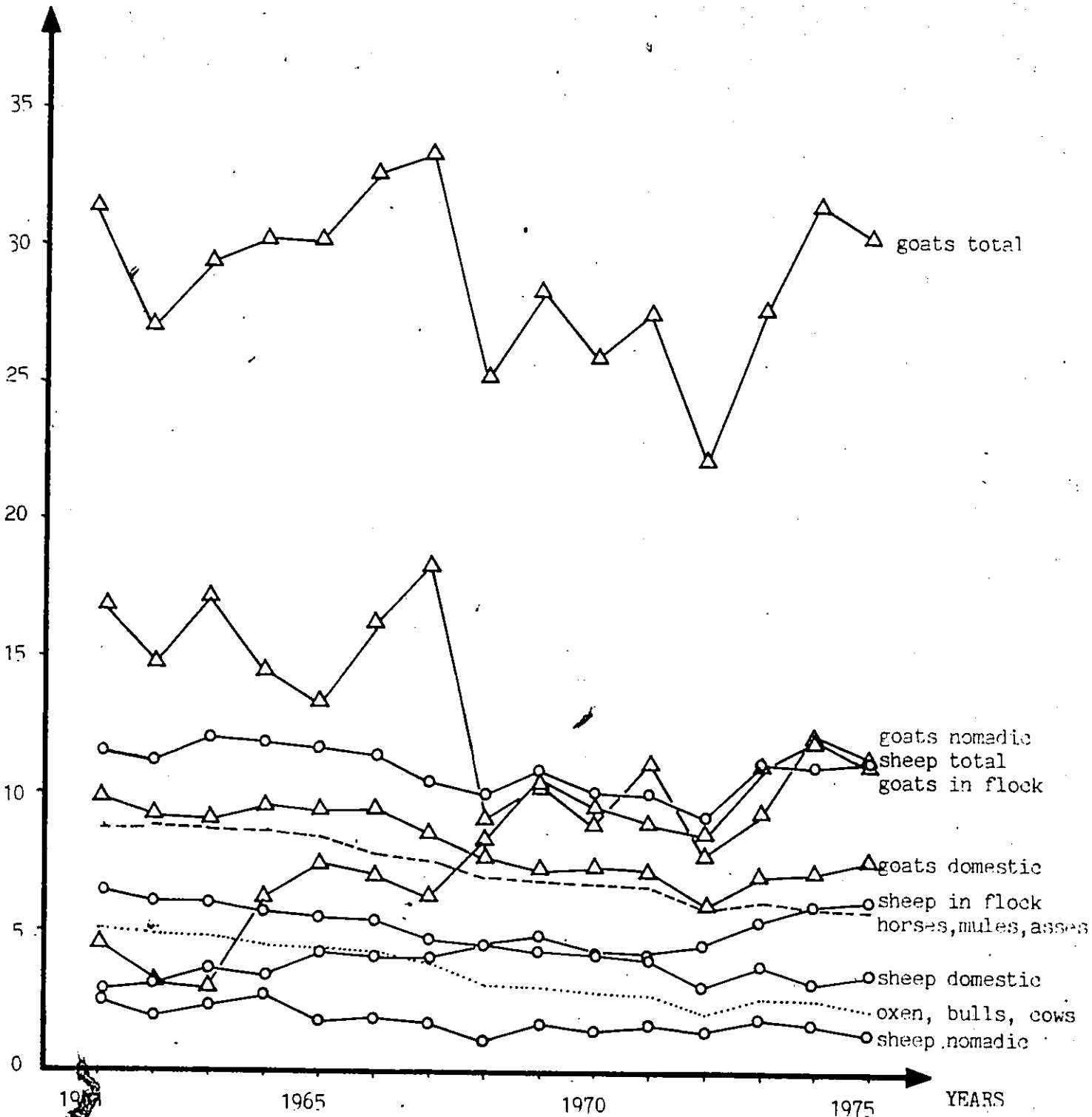
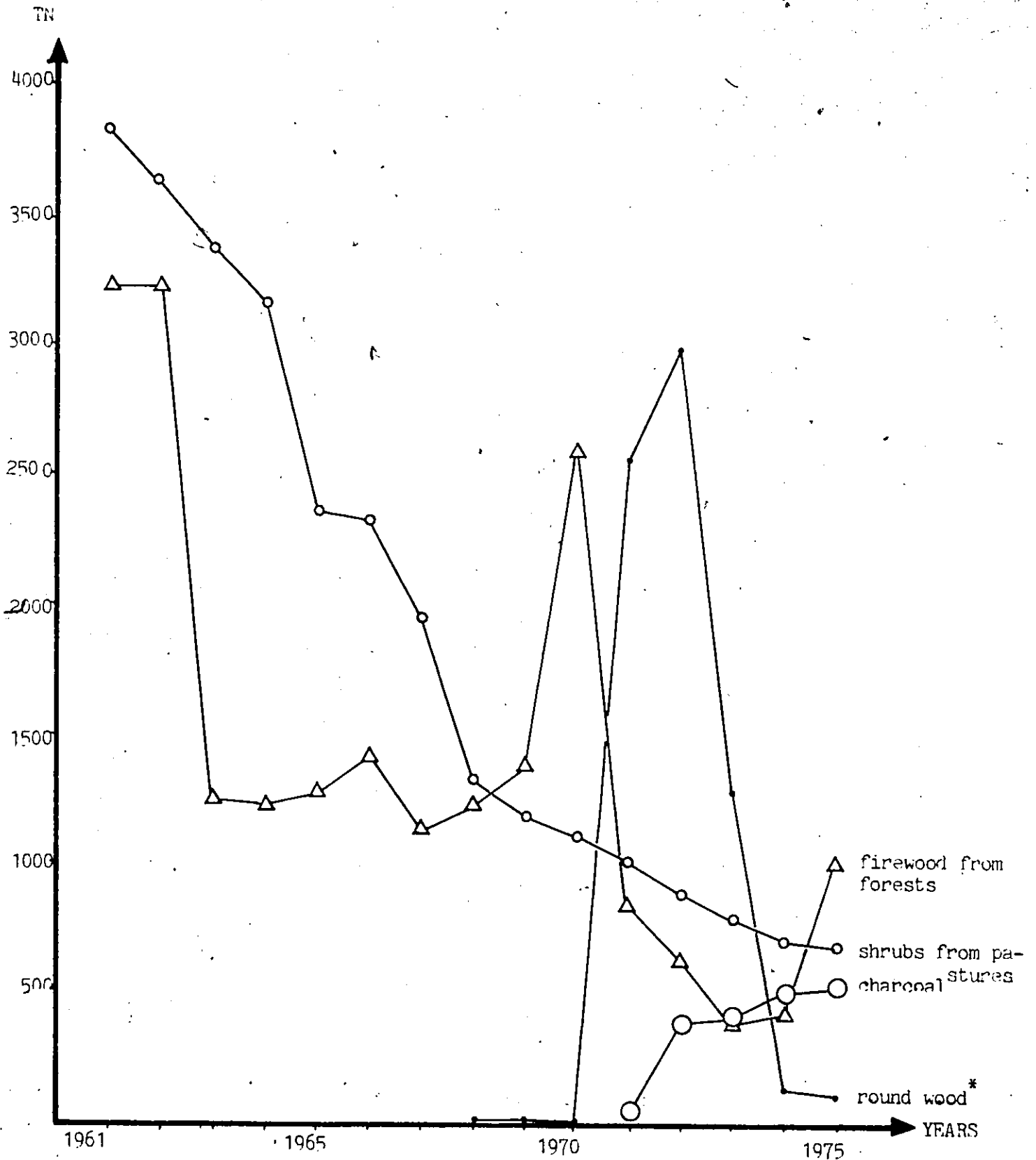


Figure 14

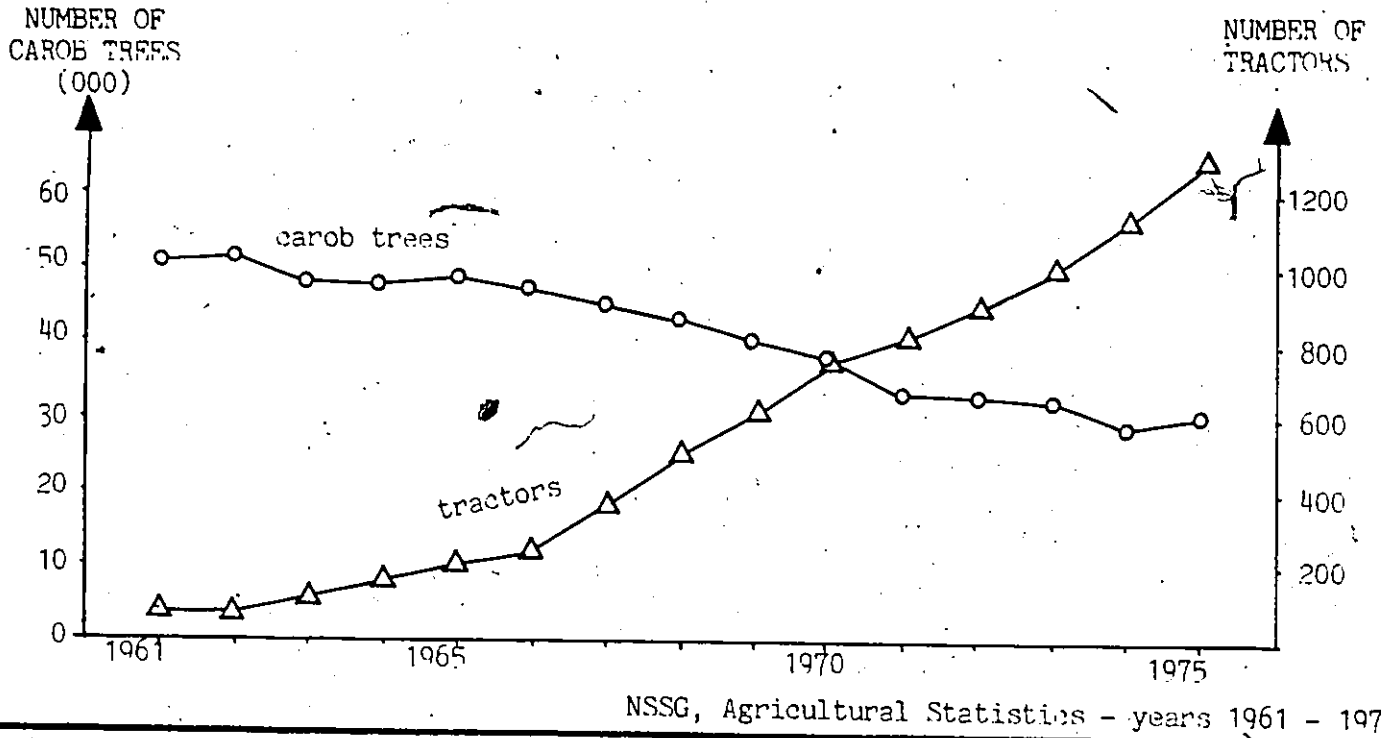
WOOD PRODUCTION PROFILE OF THE DEPARTMENT OF CHIOS



* The round wood production was originally given in m³. To calculate the corresponding tons the volume was multiplied by 0.85 (spec. weight of wood)

Figure 15

NUMBER OF CAROB TREES (CERATONIA SILIQUA) AND NUMBER OF TRACTORS IN THE DEPARTMENT OF CHIOS



AREAS BURNED (00)

Figure 16

FIREWOOD FROM AGRICULTURAL HOLDINGS AND NON-FORESTED AREAS BURNED

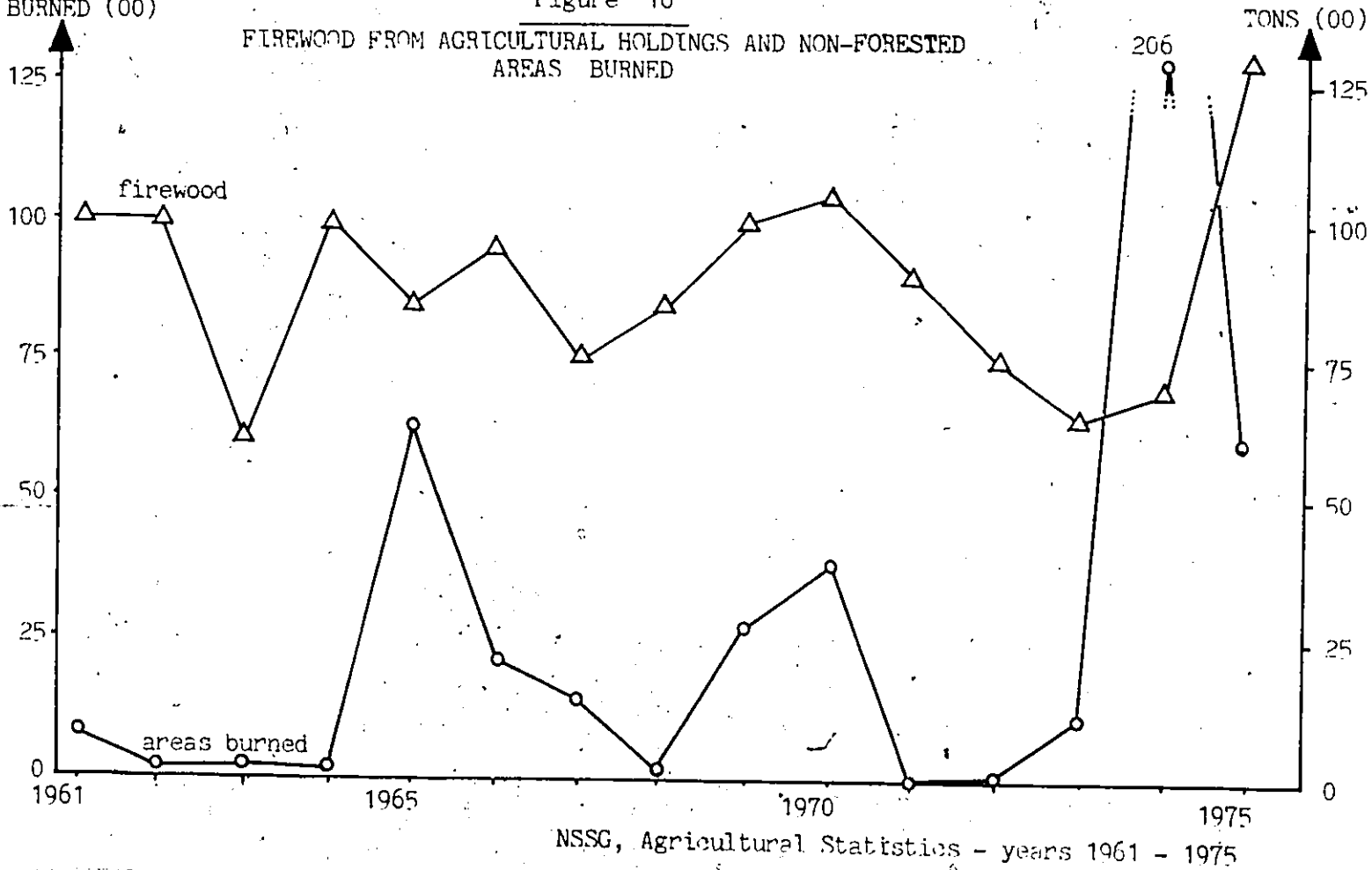


Figure 17

THE PRESENT LAND - USE SYSTEM OF CHIOS ISLAND

PEOPLE

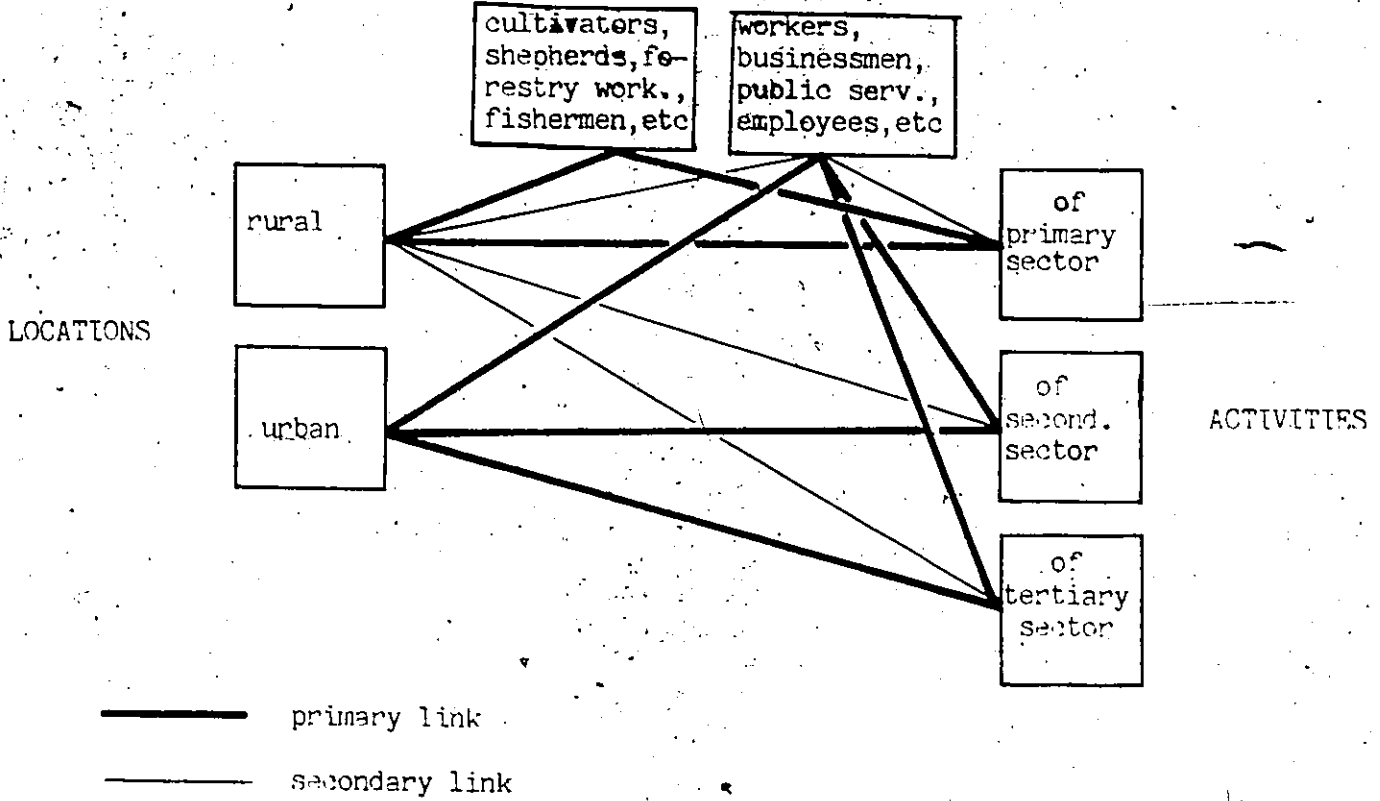


Figure 18

THE PRESENT RURAL LAND - USE SYSTEM OF CHIOS ISLAND

PEOPLE

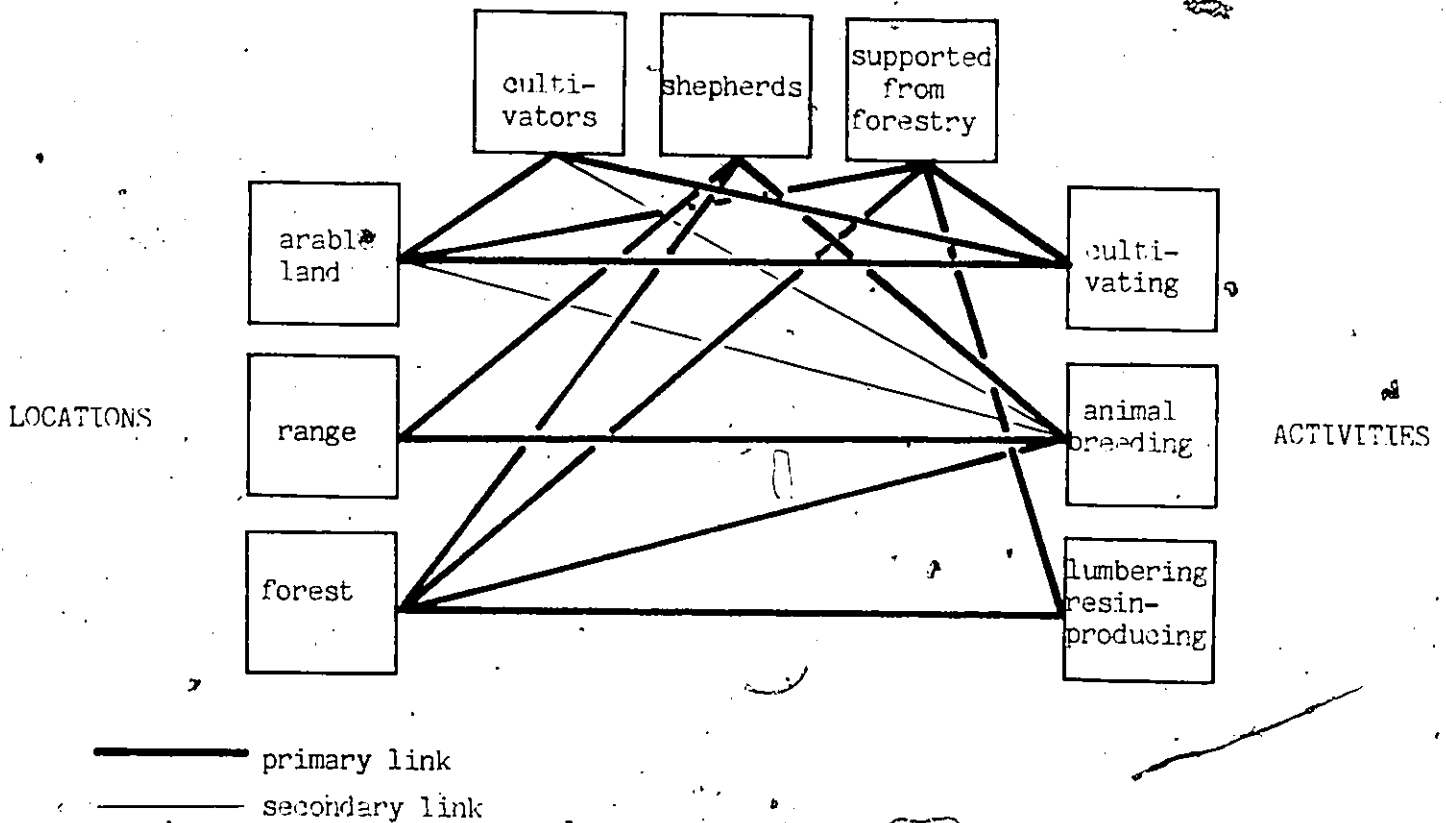
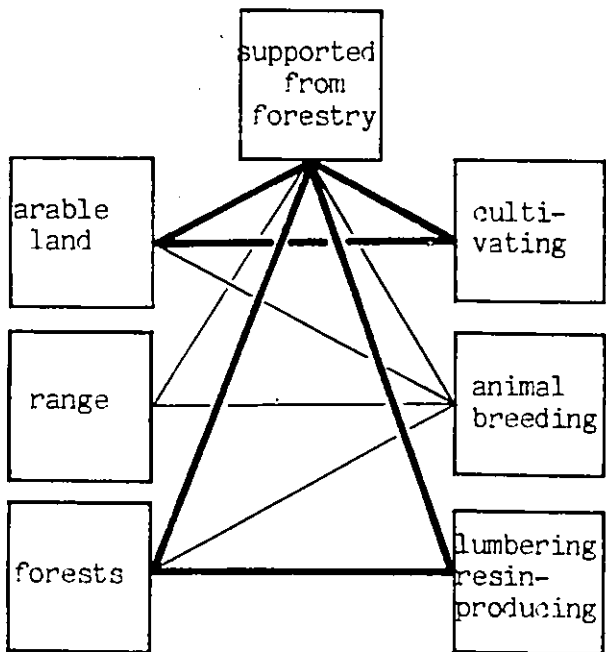
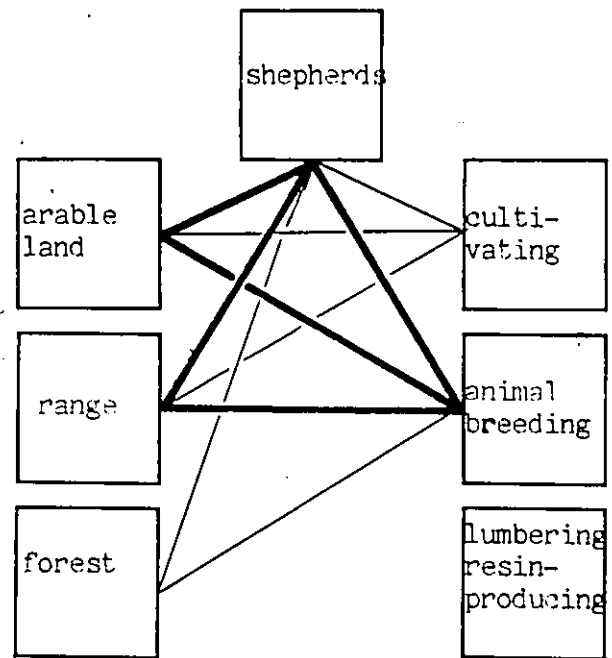
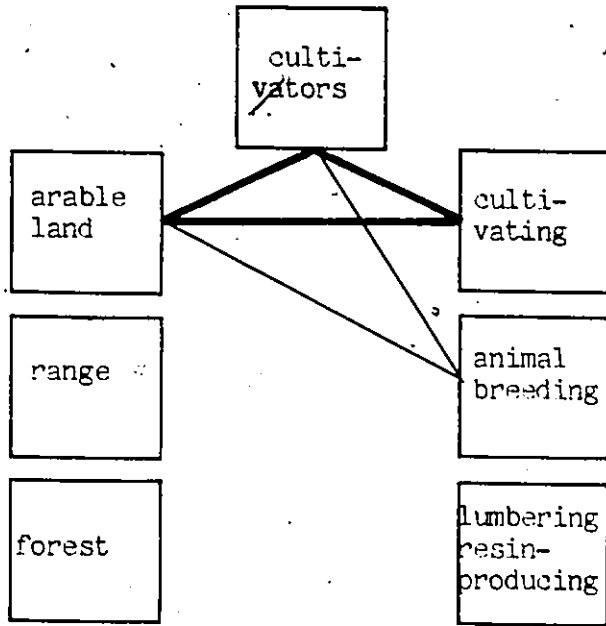


Figure 19

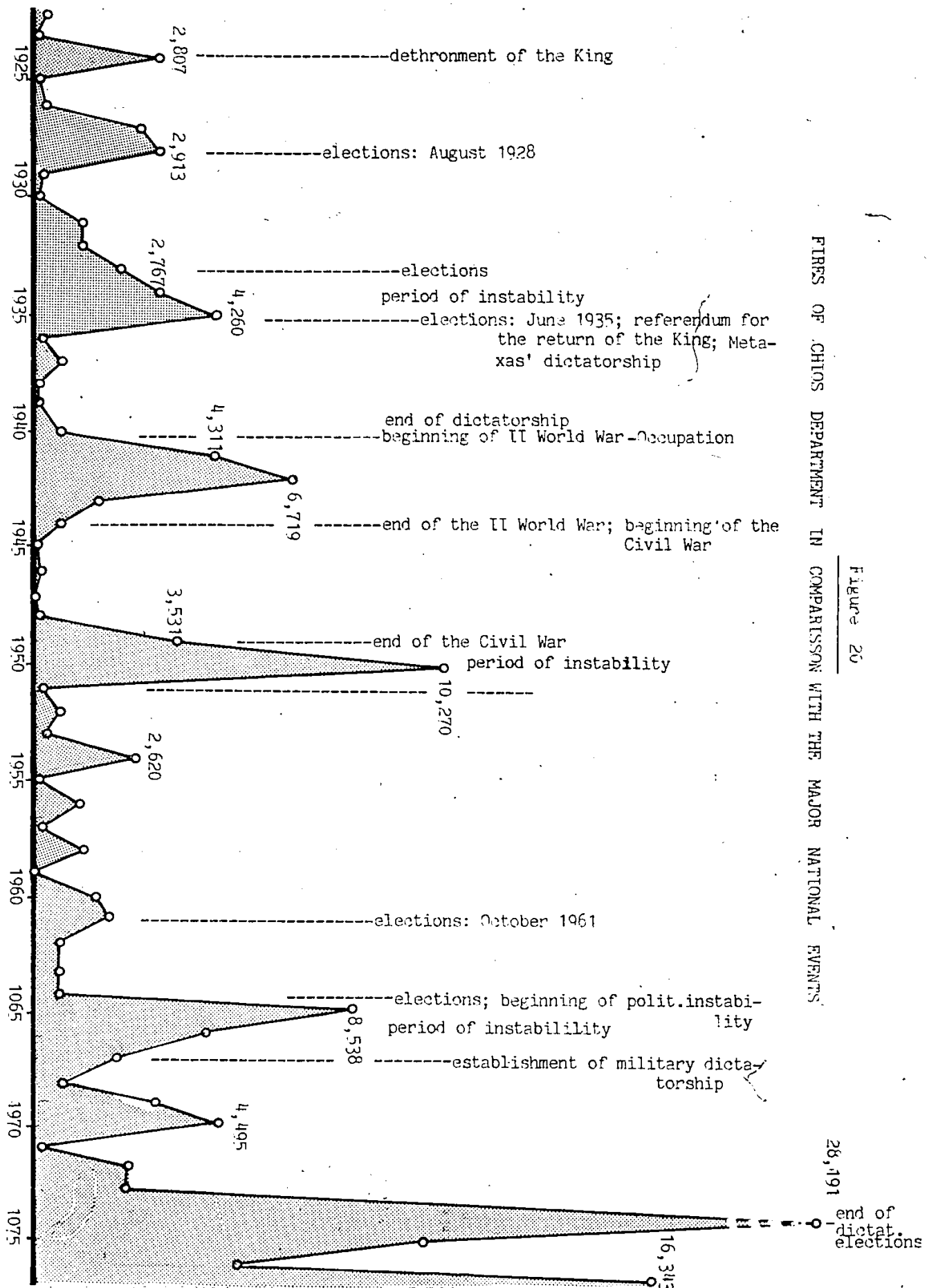
THE TRADITIONAL RURAL LAND - USE SYSTEM OF CHIOS ISLAND



— primary link
— secondary link

TREES OF CHIOS DEPARTMENT IN COMPARISON WITH THE MAJOR NATIONAL EVENTS

Figure 20



STRFIMAS

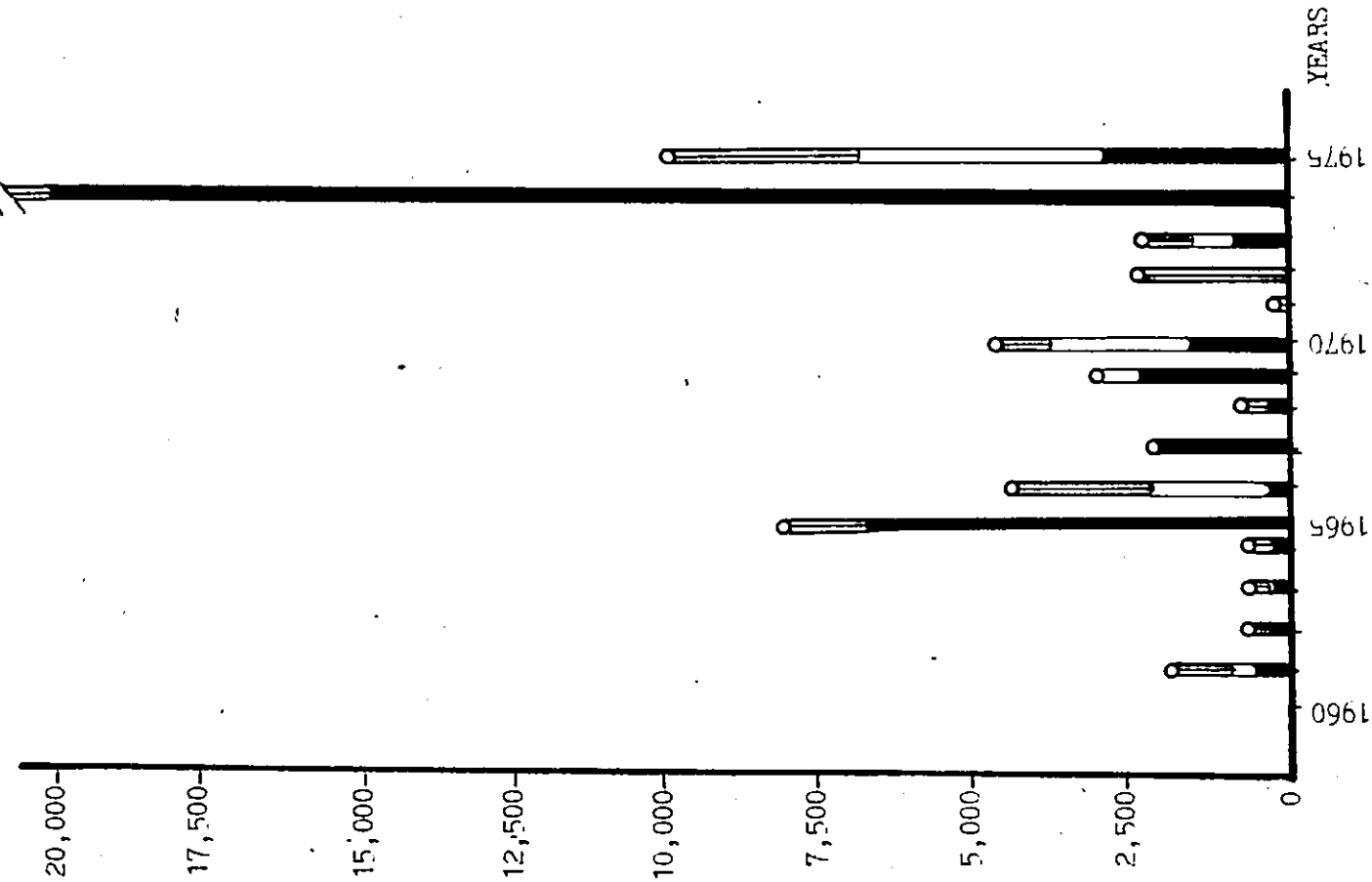


Figure 21

FIRES OF THE ISLAND OF CHIOS

- matorral areas burned
- ▨ partially tree-forested areas burned
- ▤ tree-forested areas burned

Figure 22

HYPOTHETICAL EXAMPLE OF SUPERPOSITION OF FIRE FREQUENCIES

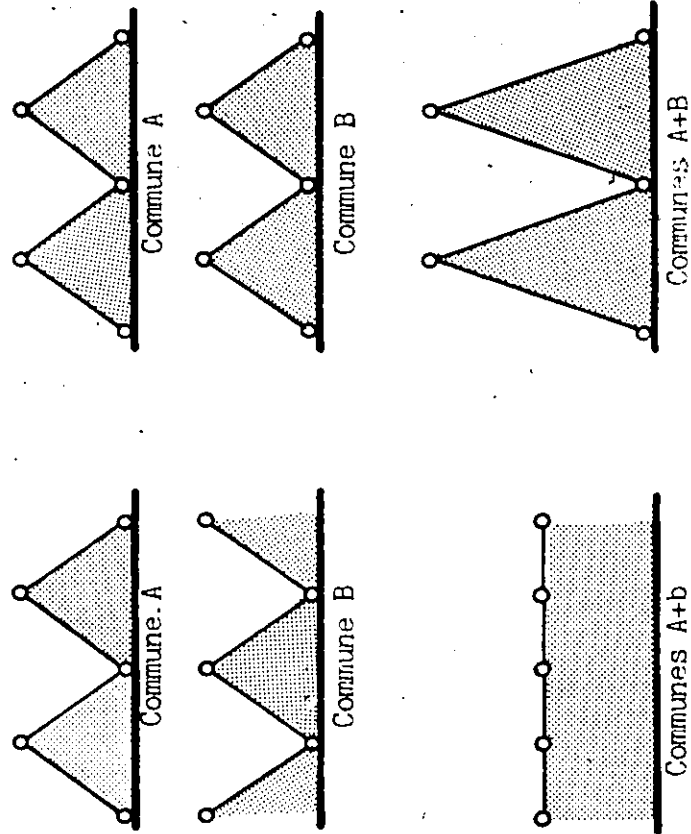
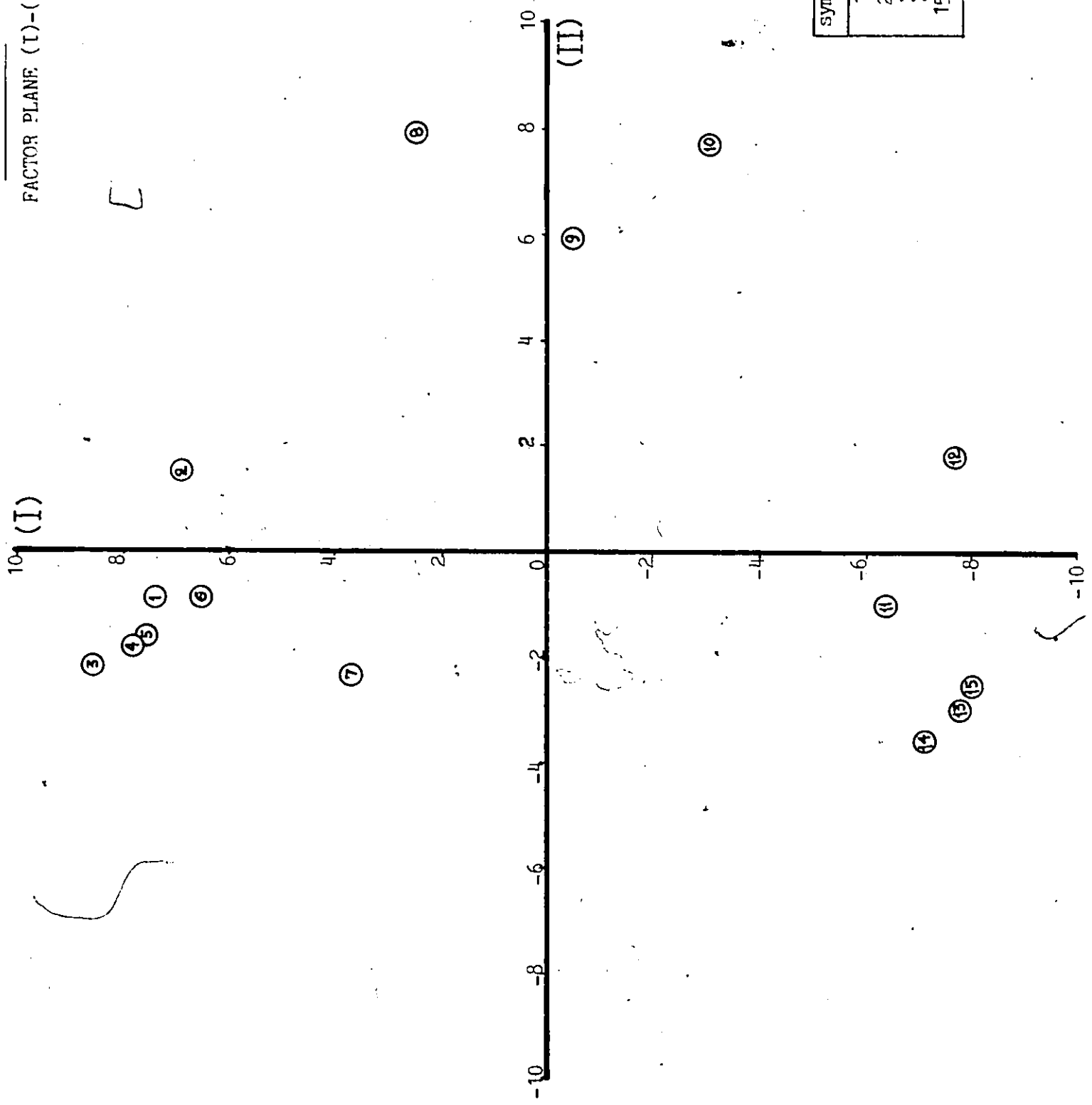


Figure 23

FACTOR PLANE (I)-(II)



symbol	year
1	1961
2	1962
:	:
15	1975

Figure 24

FACTOR PLANE (I)-(III)

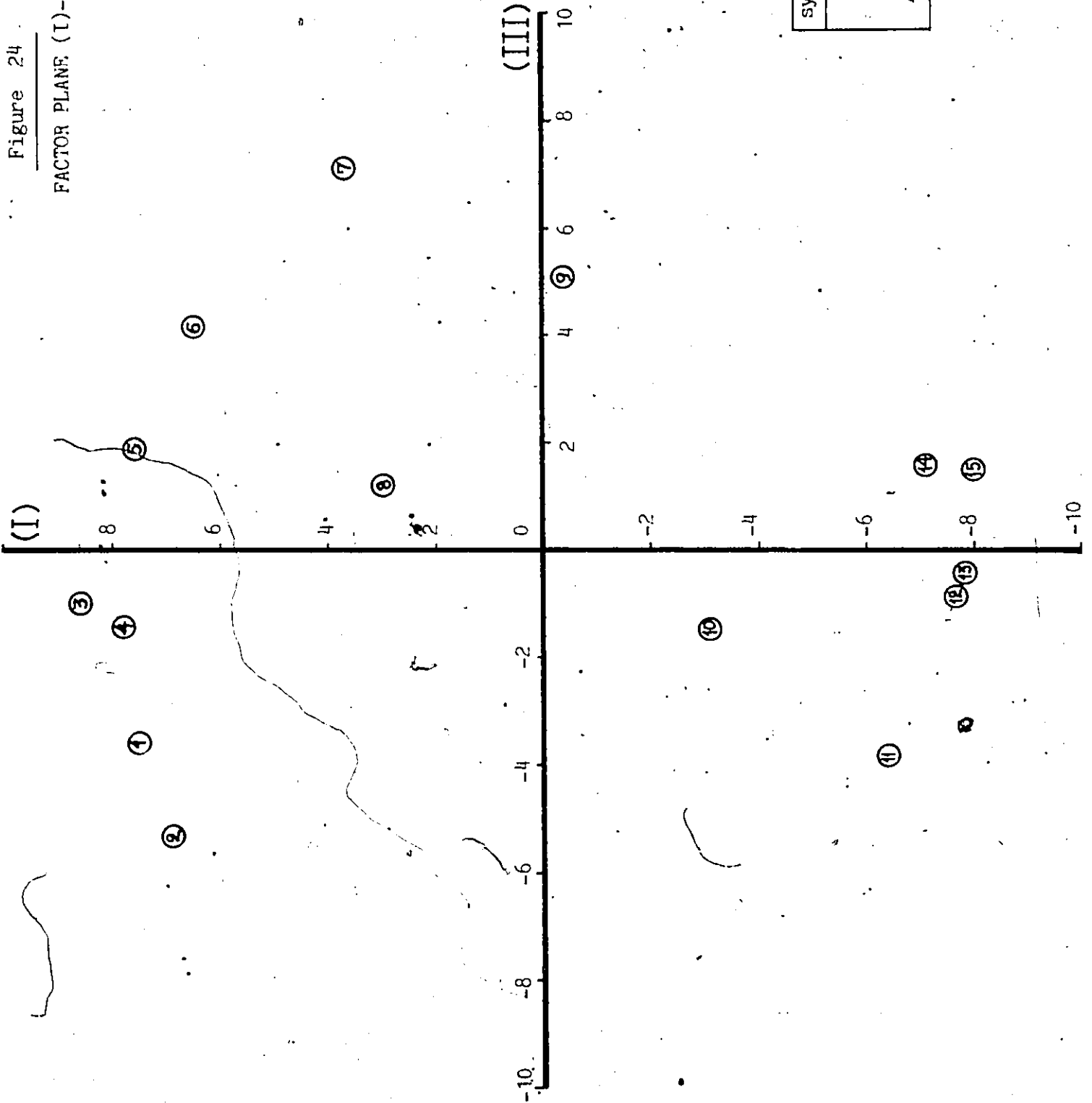


Figure 25

FACTOR PLANE (II)-(III)

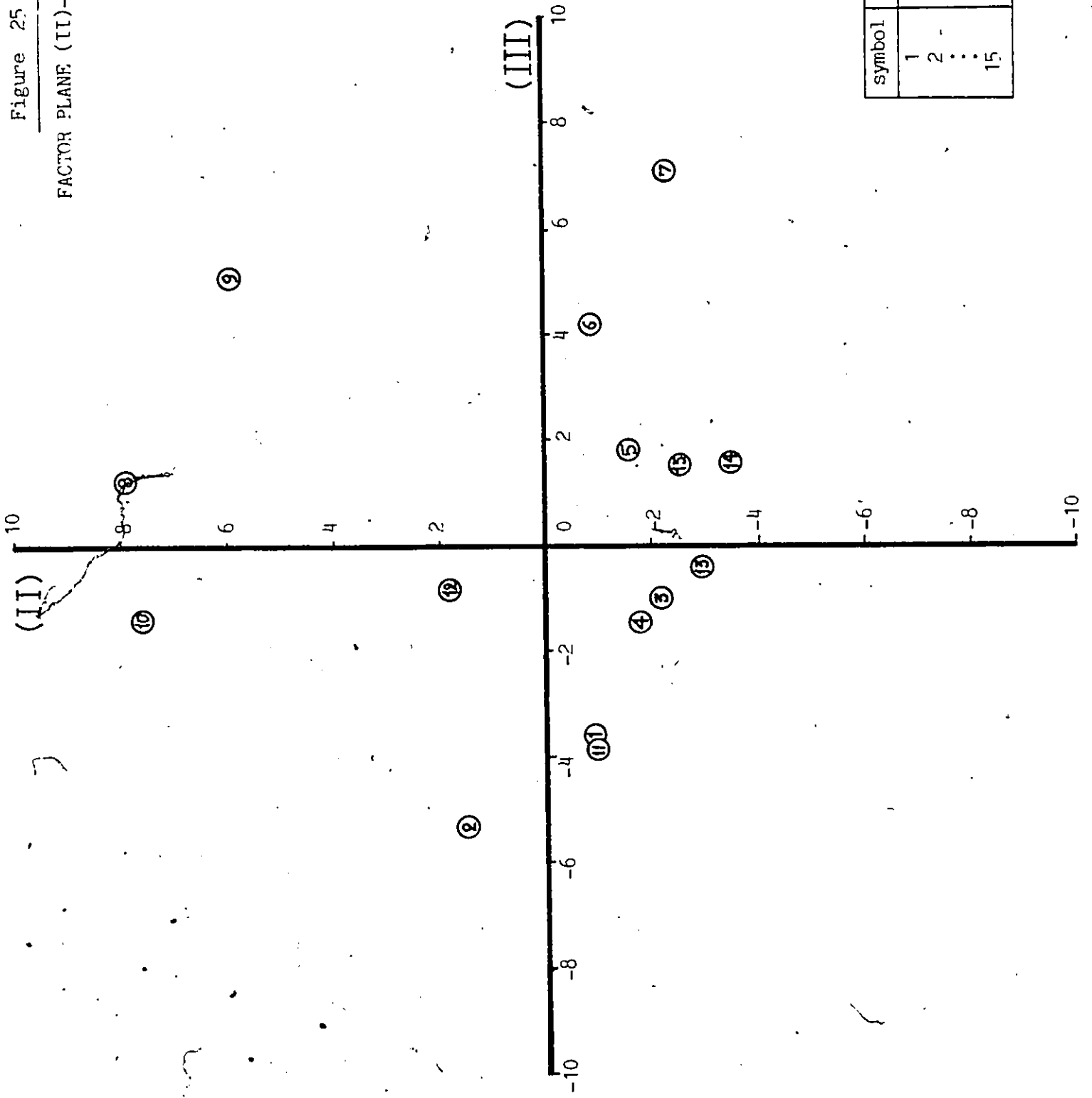


Figure 26
PLANE (I)-(IV)

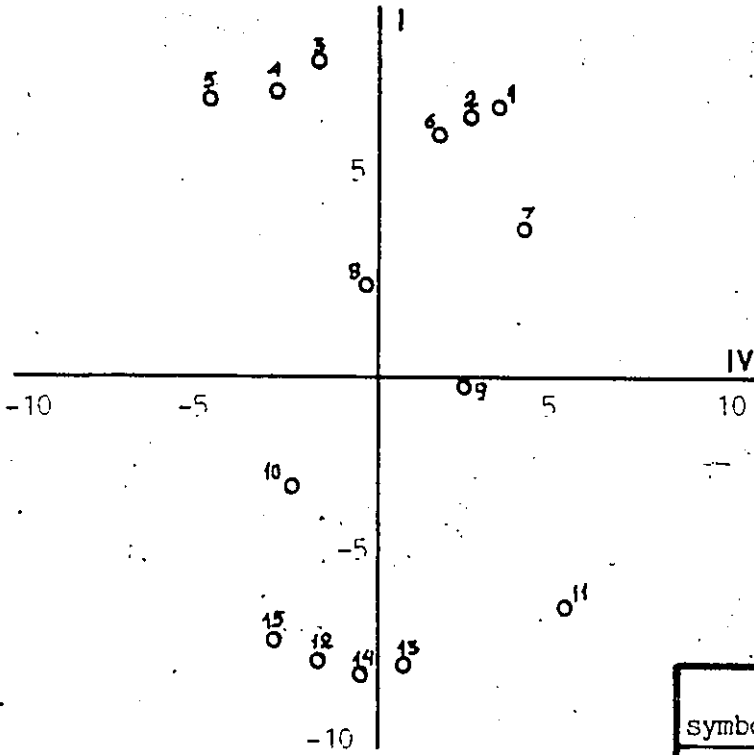
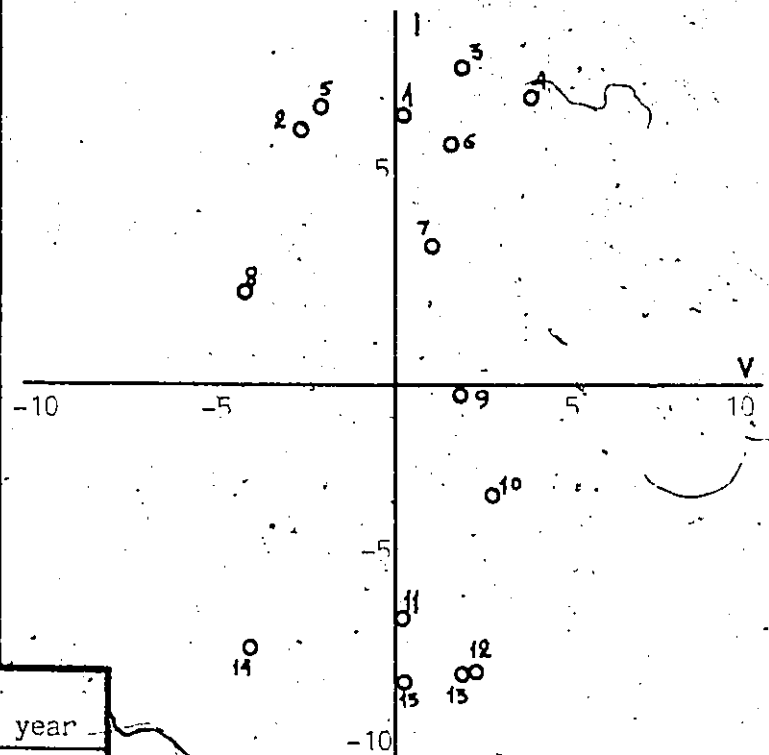


Figure 27
PLANE (I)-(V)



symbol	year
1	1961
2	1962
⋮	⋮
15	1975

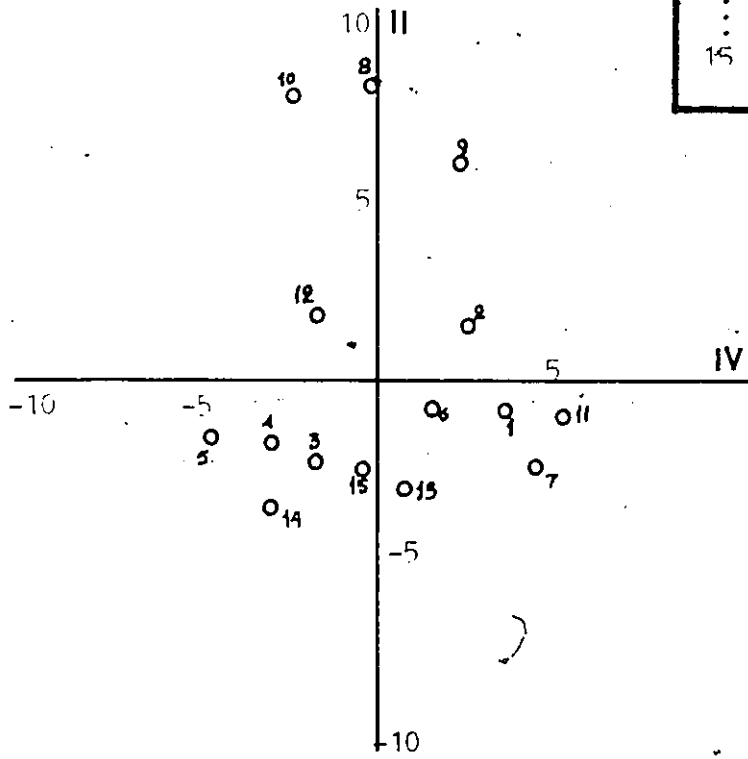


Figure 28
PLANE (II)-(IV)

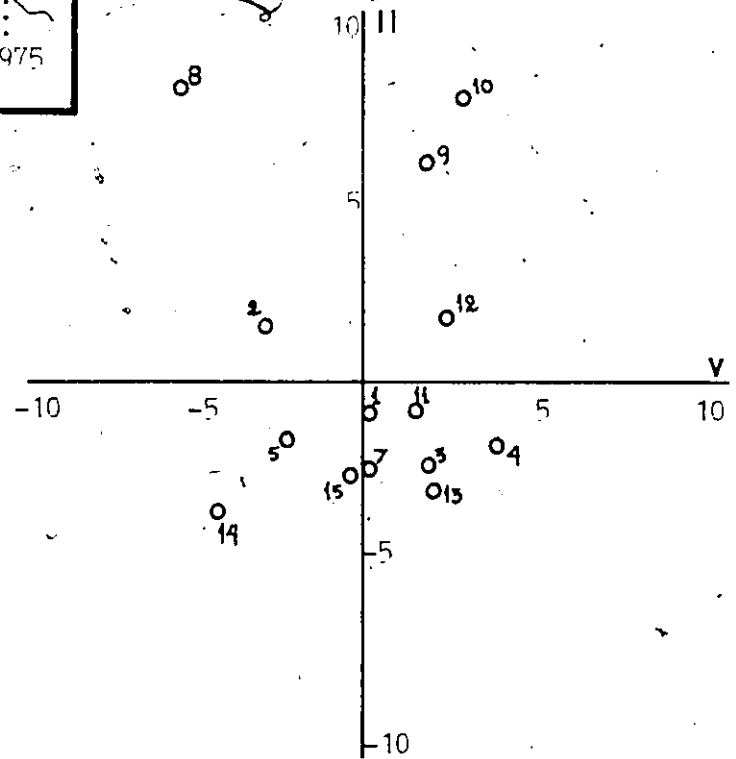


Figure 29
PLANE (II)-(V)

Figure 31

VARIABLES AND PROJECTED INDIVIDUALS ON THE FACTORIAL PLANE (I)-(III)

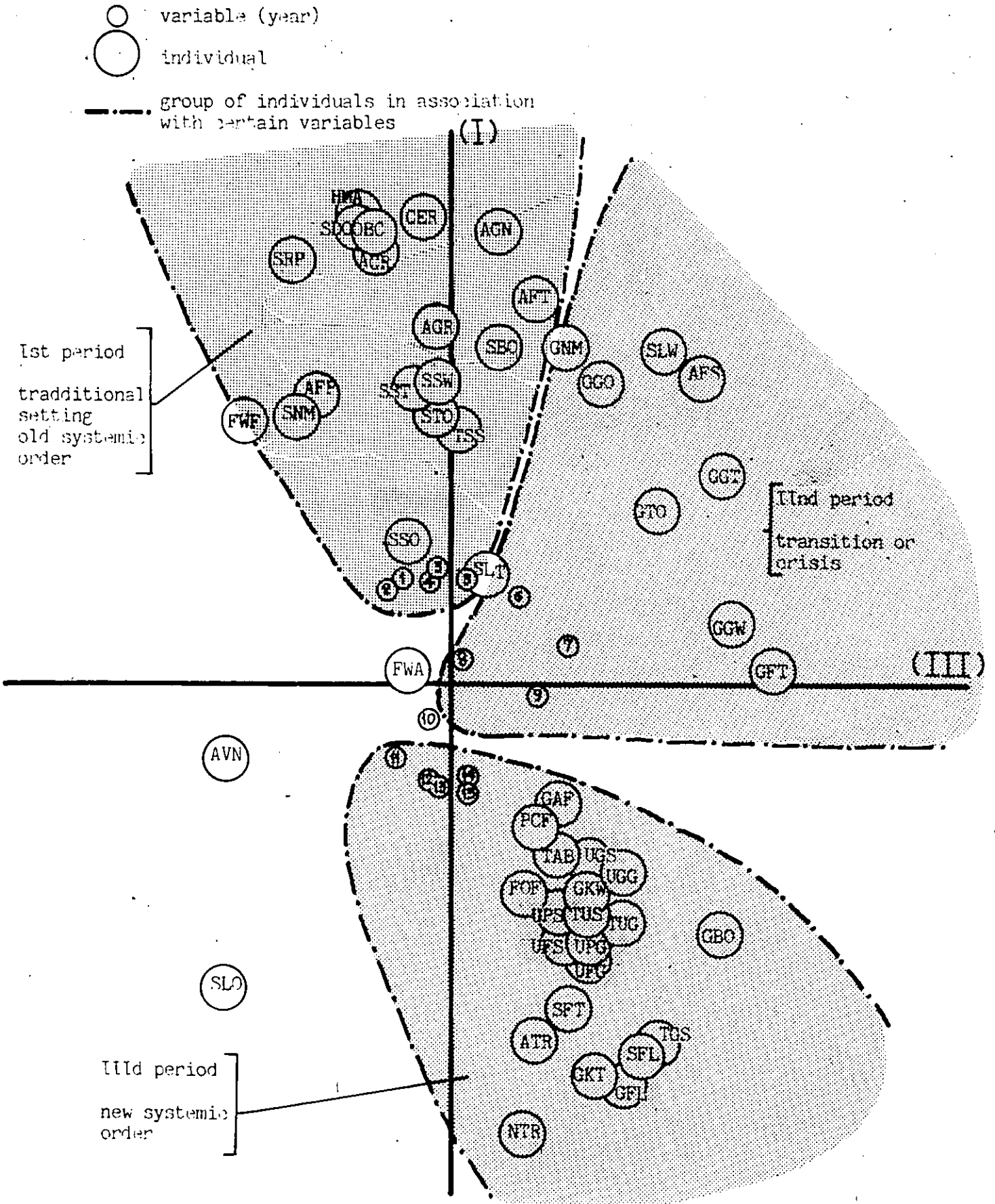


Figure 32

THREE-DIMENSIONAL AXONOMETRIC VIEW OF THE 15 VARIABLES - FACTORS I, II AND III.

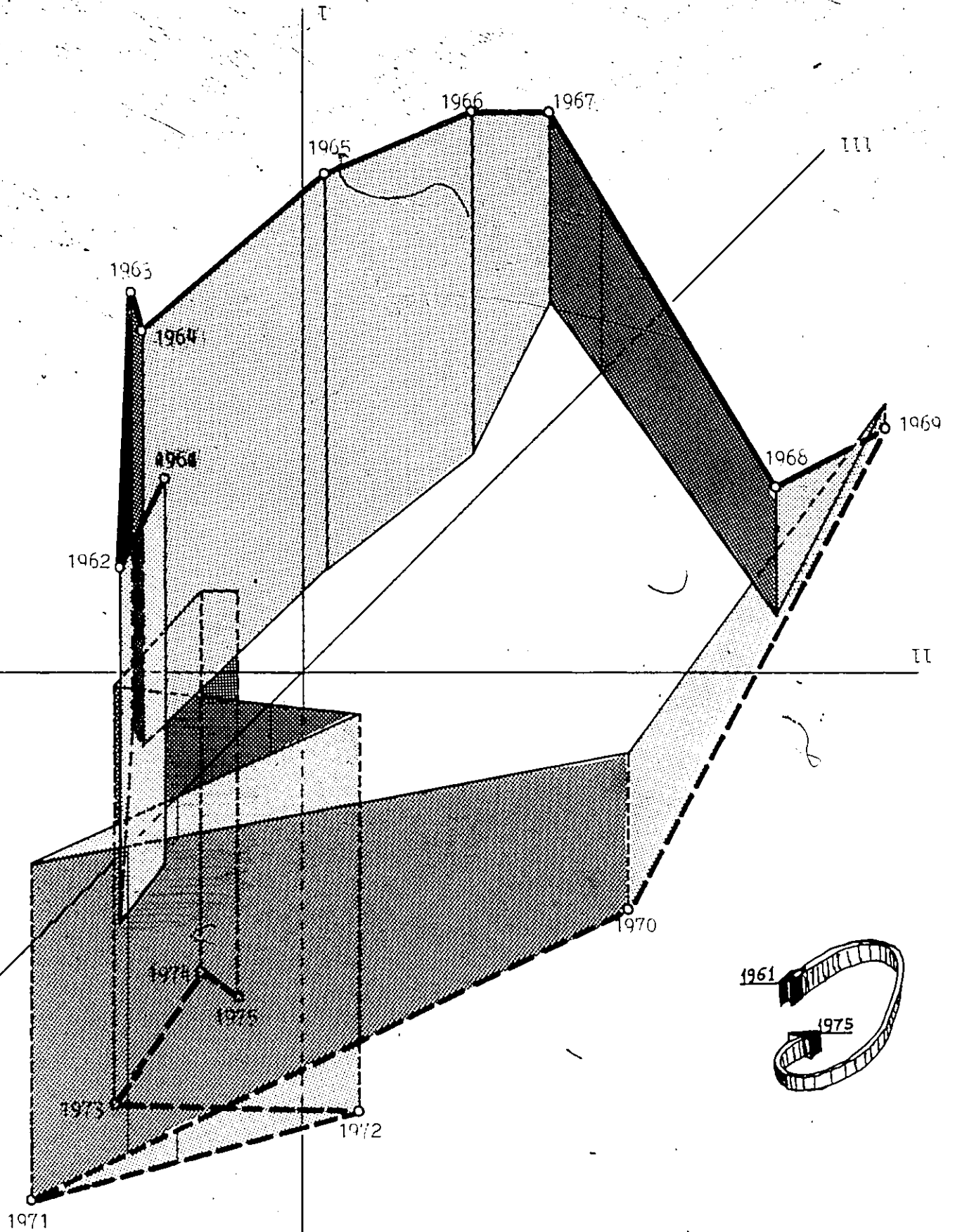
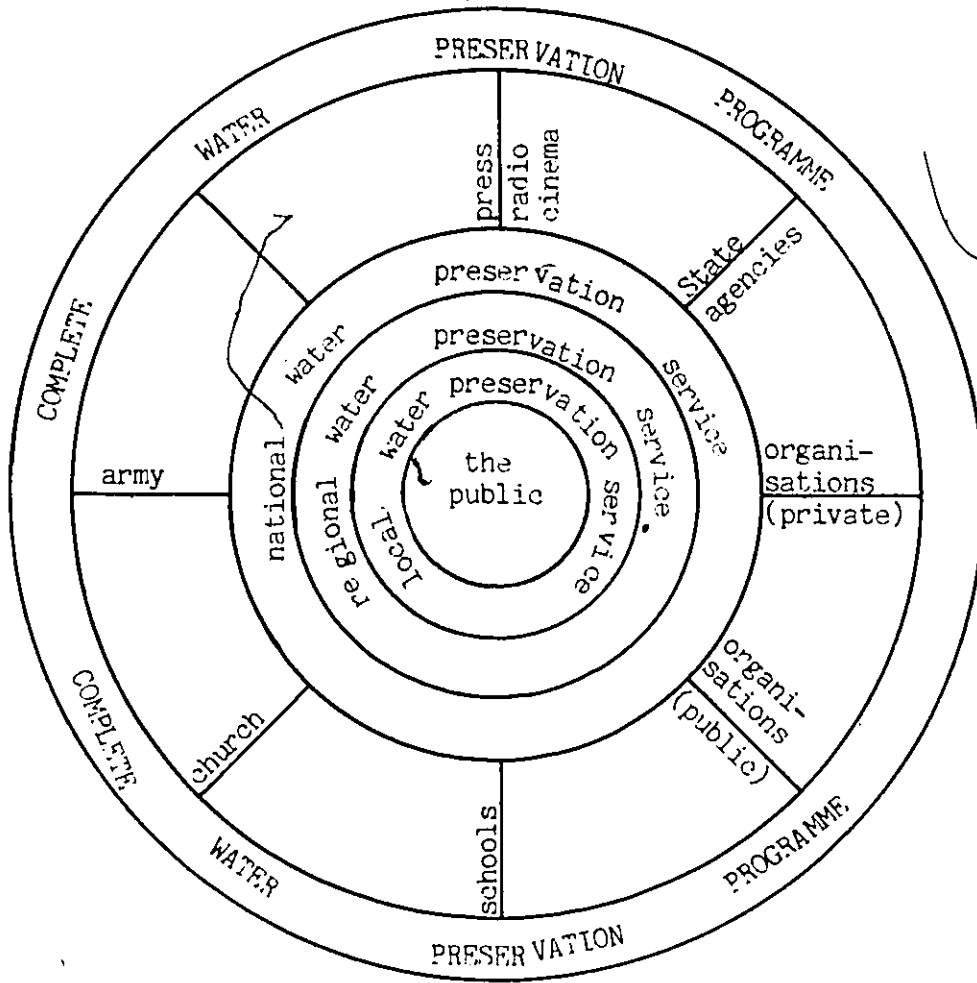


Figure 33

A MODEL FOR THE PRESERVATION OF THE WATER



Papathanassopoulos - 1963

Figure 34

OBJECTIVE, PLAN, IMPACT AND THE CONCATENATION OF DECISION-MAKING CRITERIA IN THE PRESENT PRACTICE AND IN A FUTURE ORIENTED POLICY

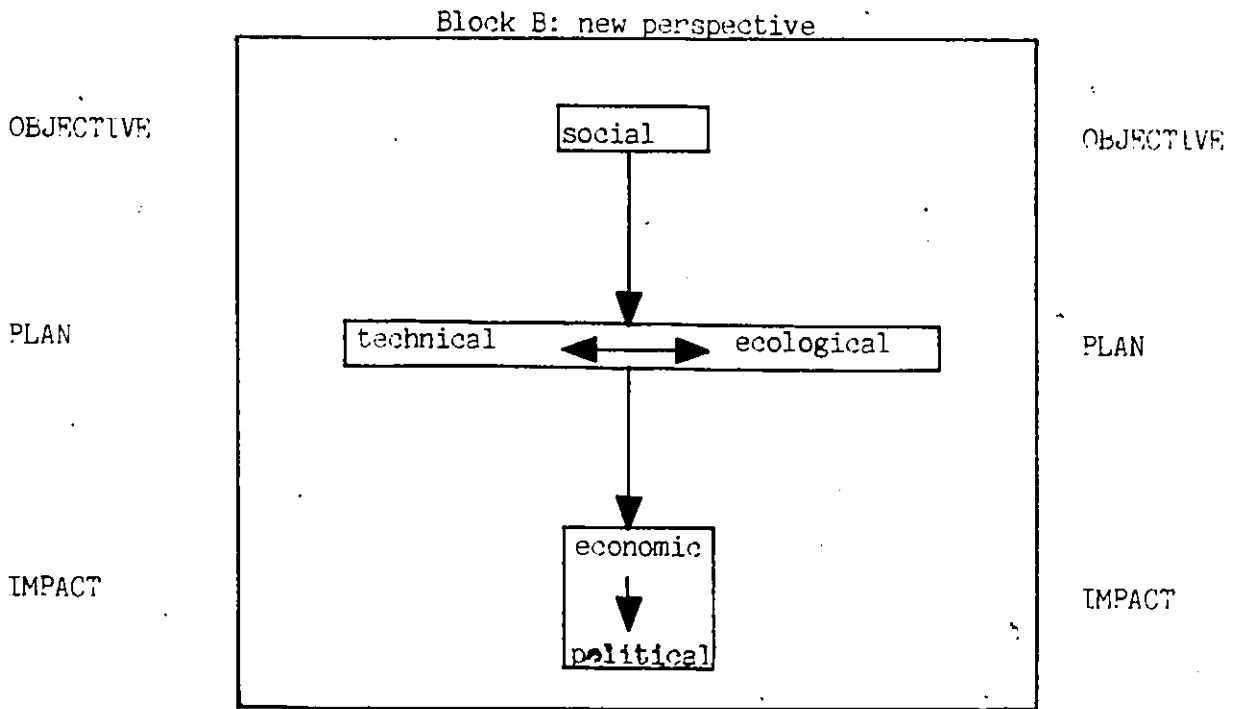
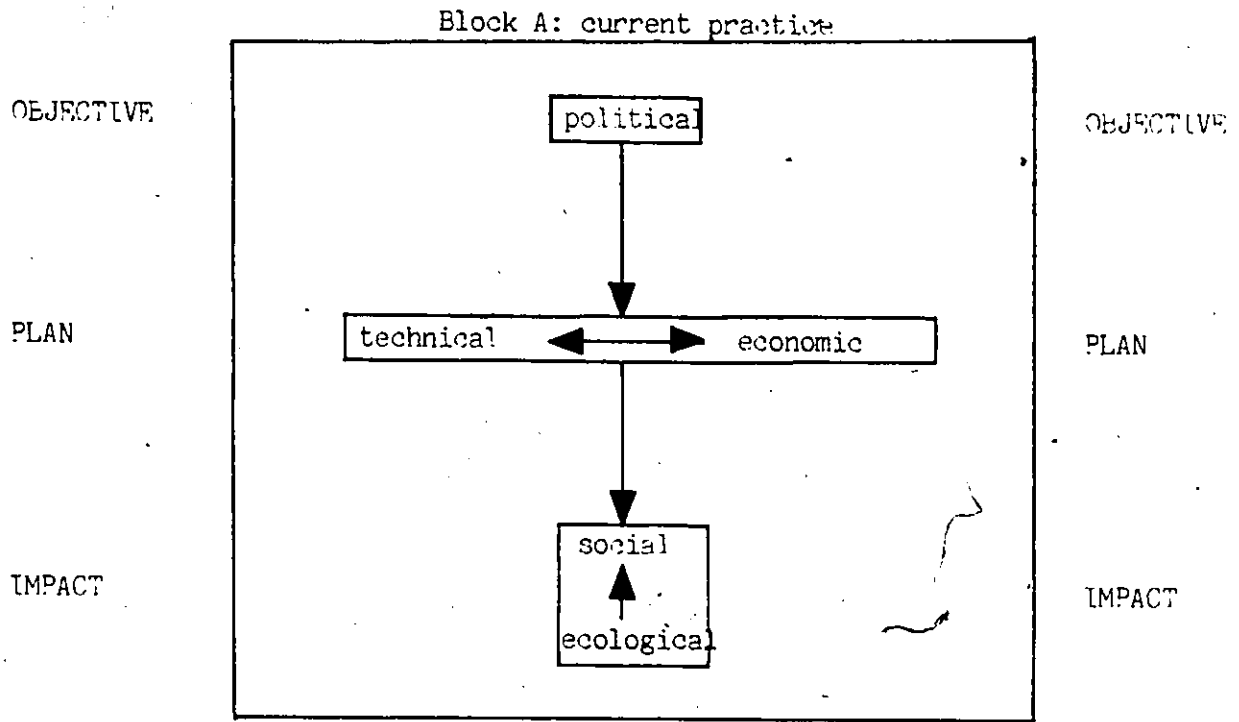


Figure 35

A PROPOSED ANIMAL - BREEDING SYSTEM : EMPHASIS ON CREATING OPTIONAL CYCLES FOR ANIMAL - BREEDING

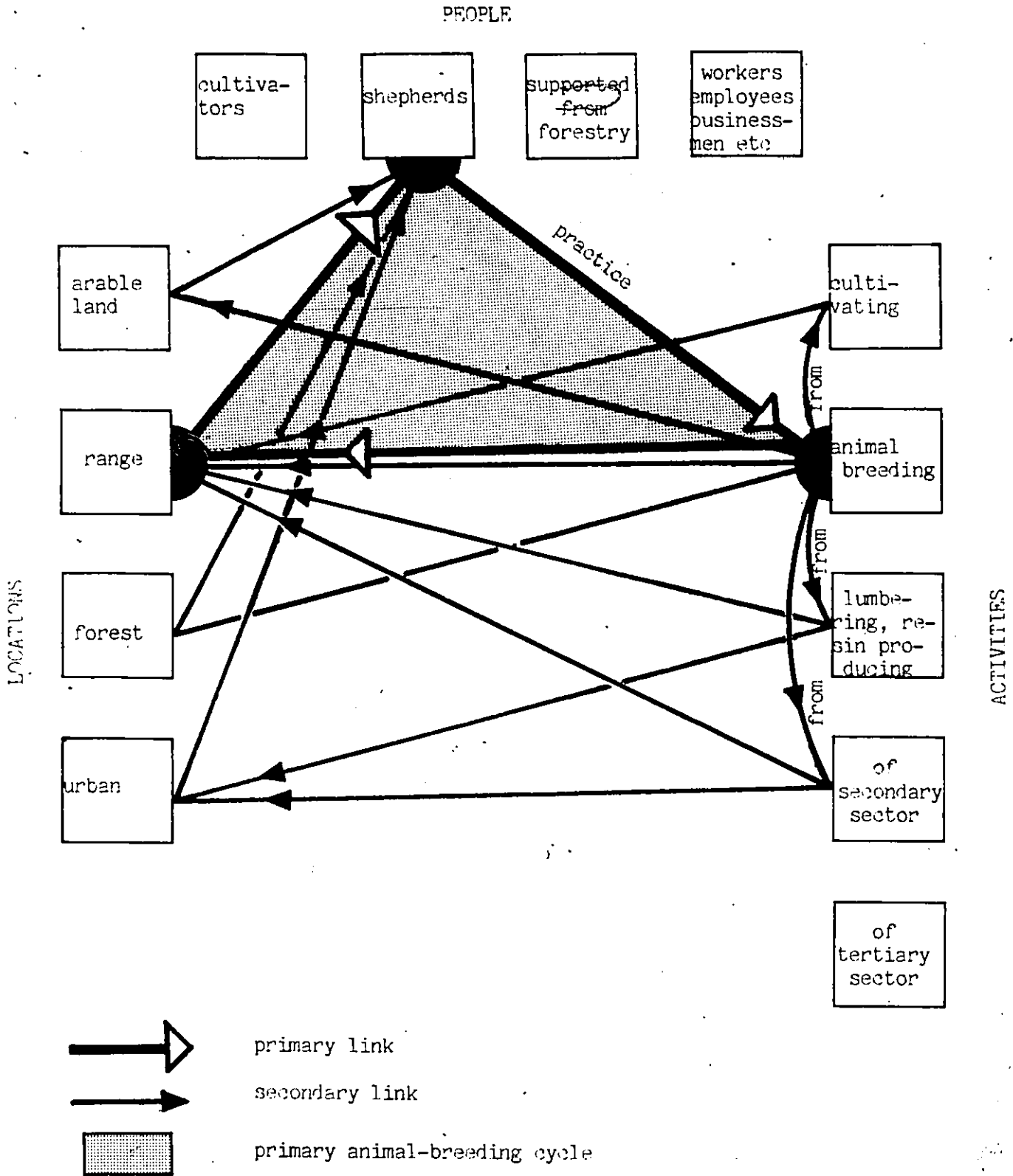
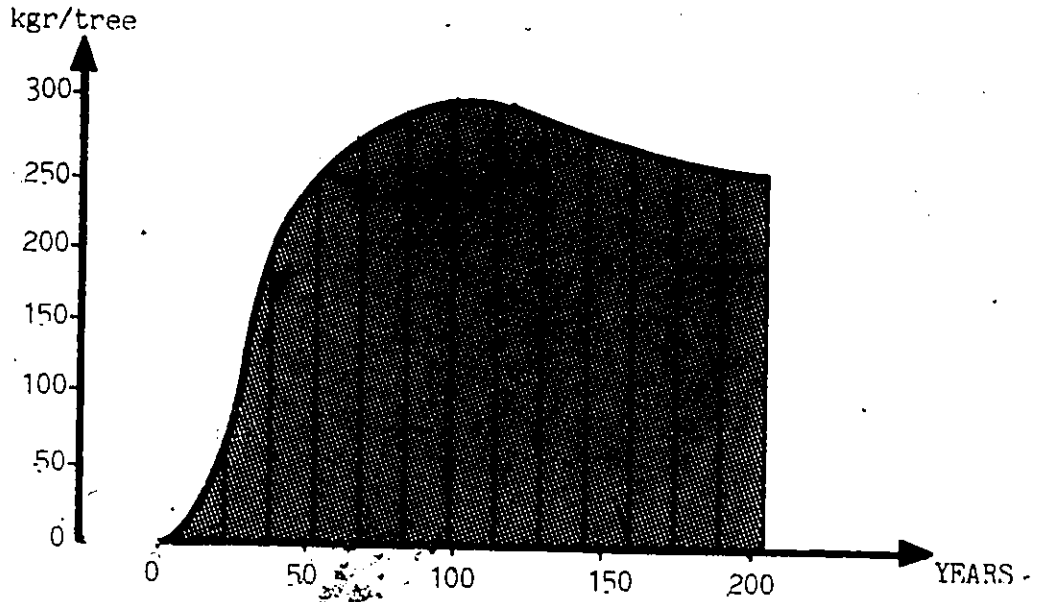


Figure 36

PRODUCTIVITY OF CERATONIA SILIQUA (CAROB TREE)



data after Diapoulis - 1950

Figure 37

REGRESSION CYCLE OF UNCONTROLLED GOAT-GRAZING

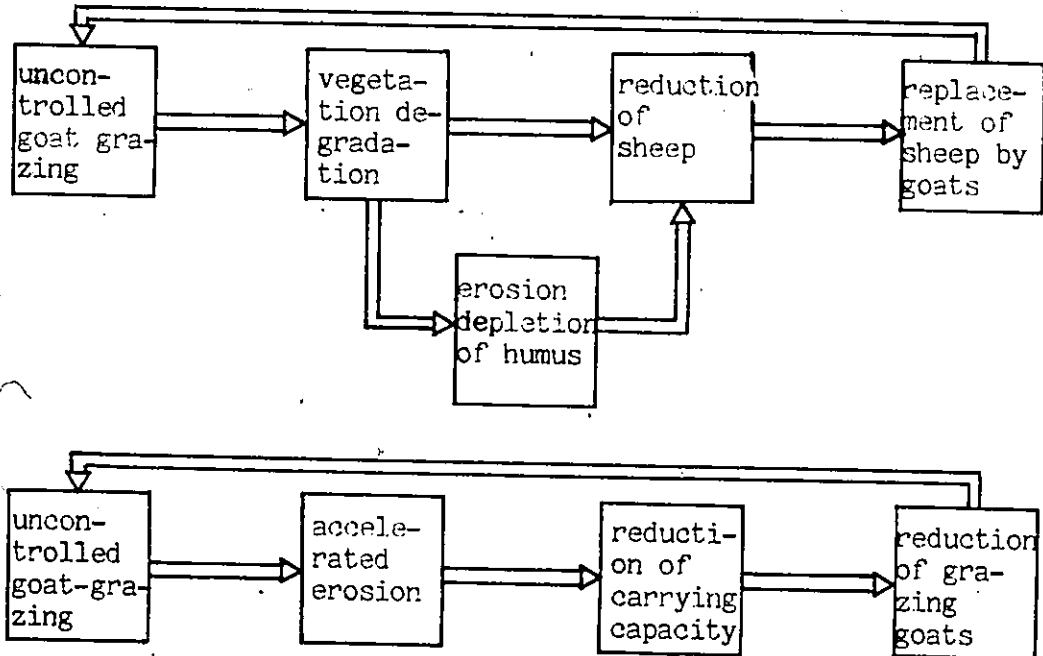
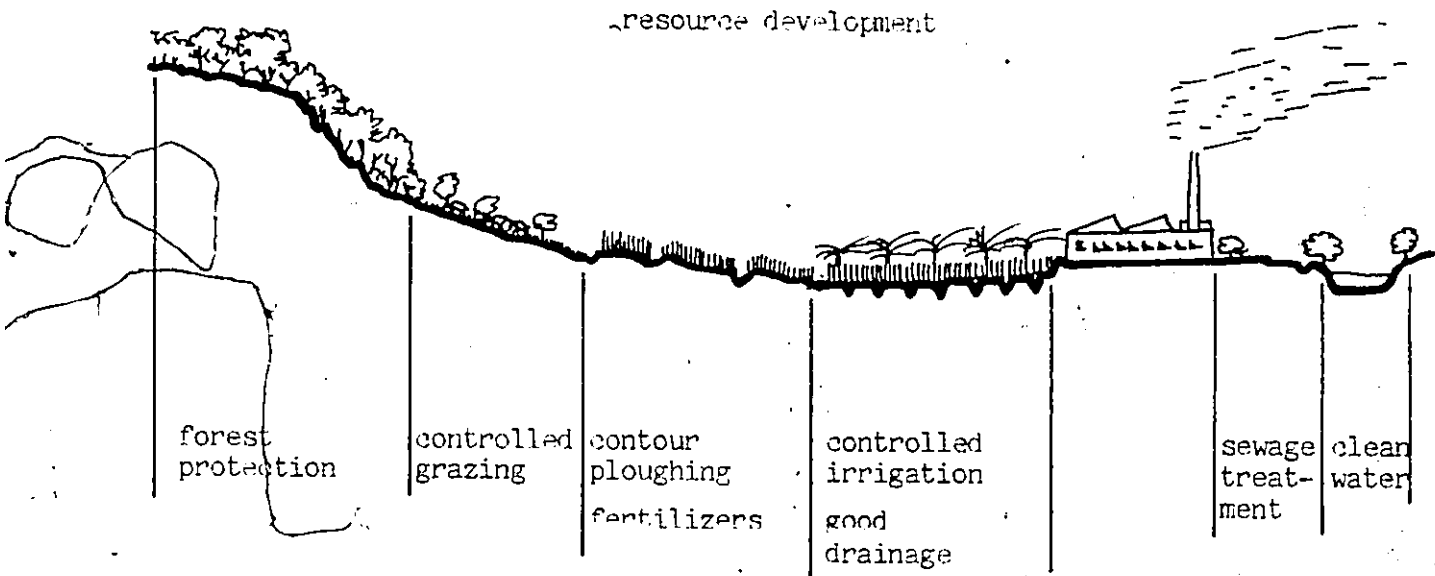
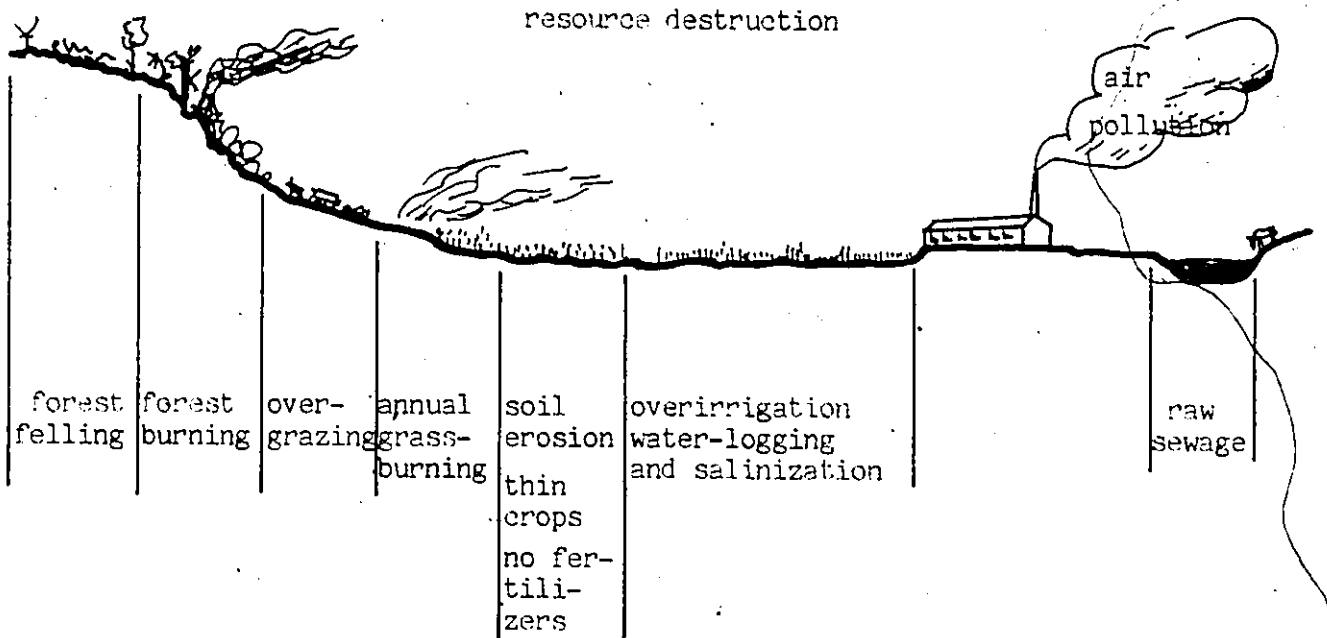


Figure 38

ASPECTS OF RESOURCE DEVELOPMENT AND RESOURCE DESTRUCTION IN A WATERSHED

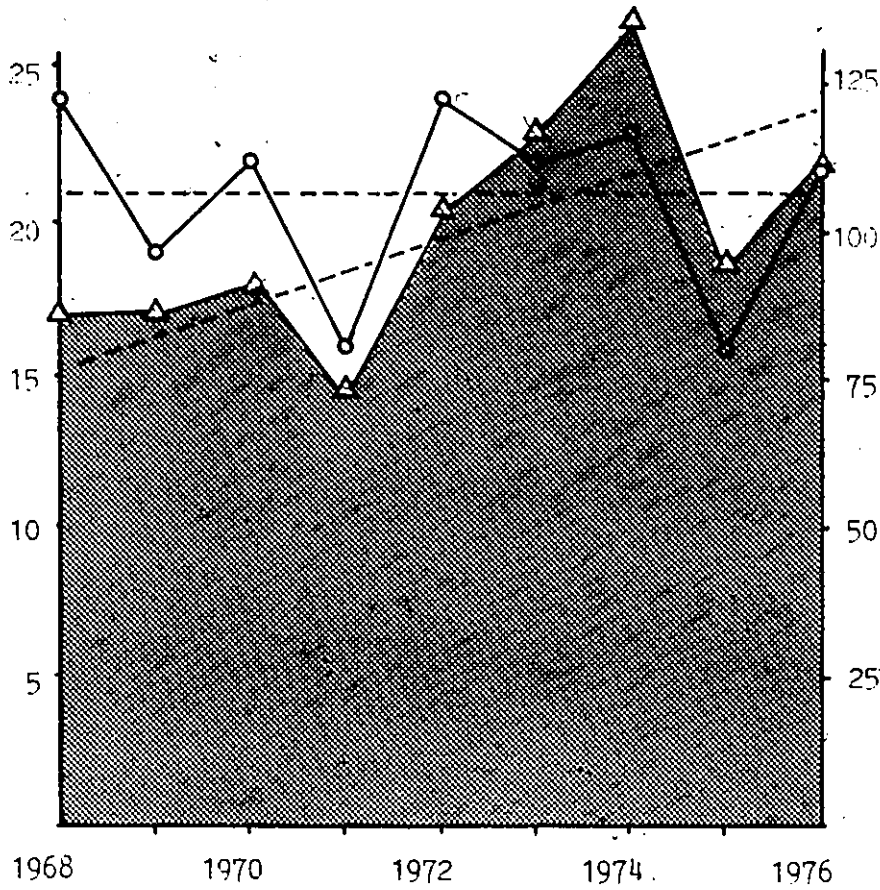


after Pereira (Tewfik - 1977)

Figure 39

of shepherds

animals/shepherd



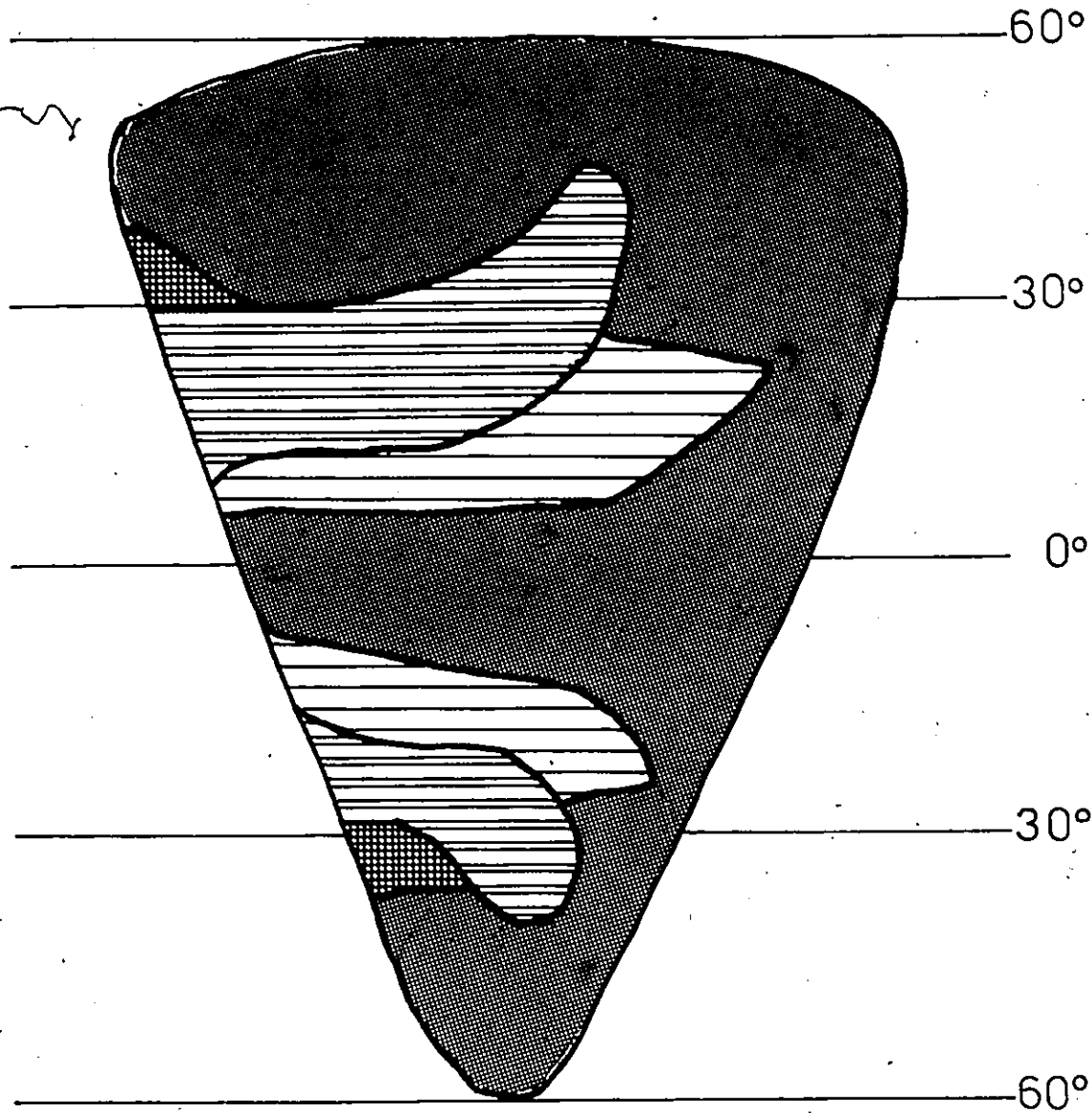
- number of shepherds
- △—△ number of animals per shepherd
- average

1968 - 1974 communal rent of range = 8 drachmae/sheep or goat
 1975 - 1976 communal rent of range = 16 drachmae/sheep or goat

data from the accounting books of the Municipality of Kardamyla

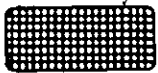
Figure 40

VEGETATION DISTRIBUTION IN AN HYPOTHETICAL CONTINENT

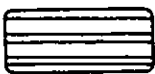


Thrower, Bradburry - 1973

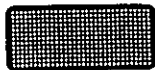
I N D E X



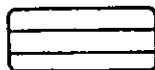
Mediterranean lands: low sun; precipitation maximum



Dry lands: evaporation exceeds precipitation

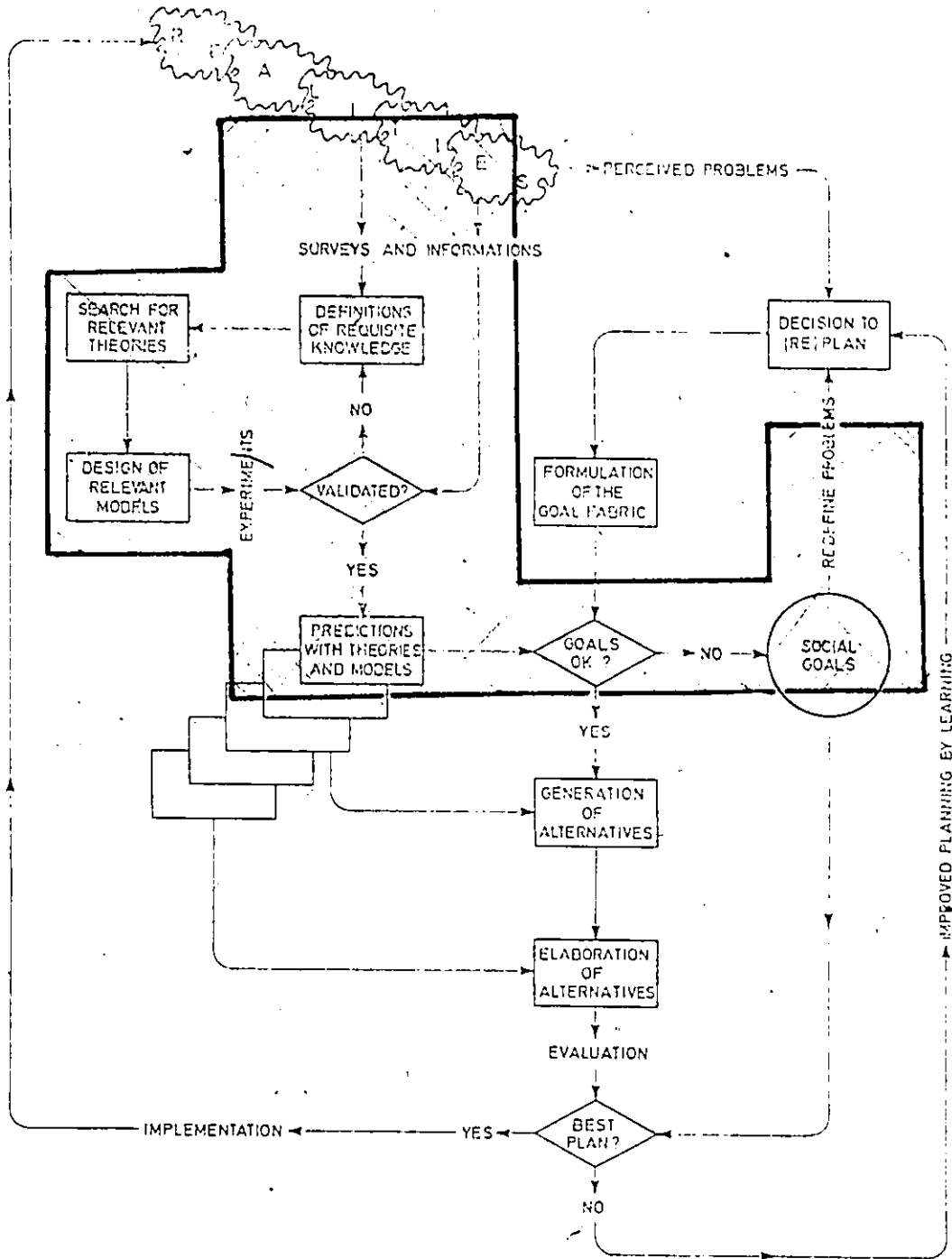


Humid and Subhumid lands: precipitation throughout the year

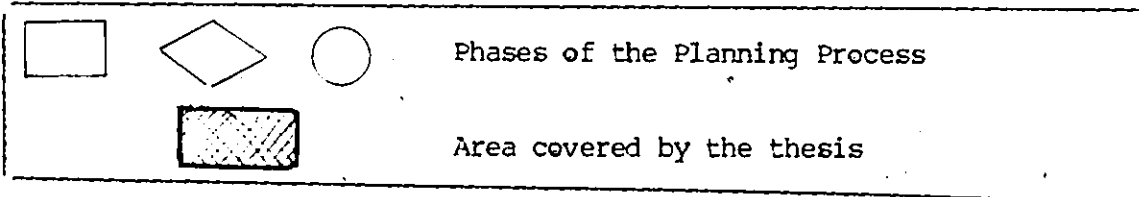


Savanna lands: high sun; precipitation maximum

FIGURE 41: Thesis relevance to the Planning Process



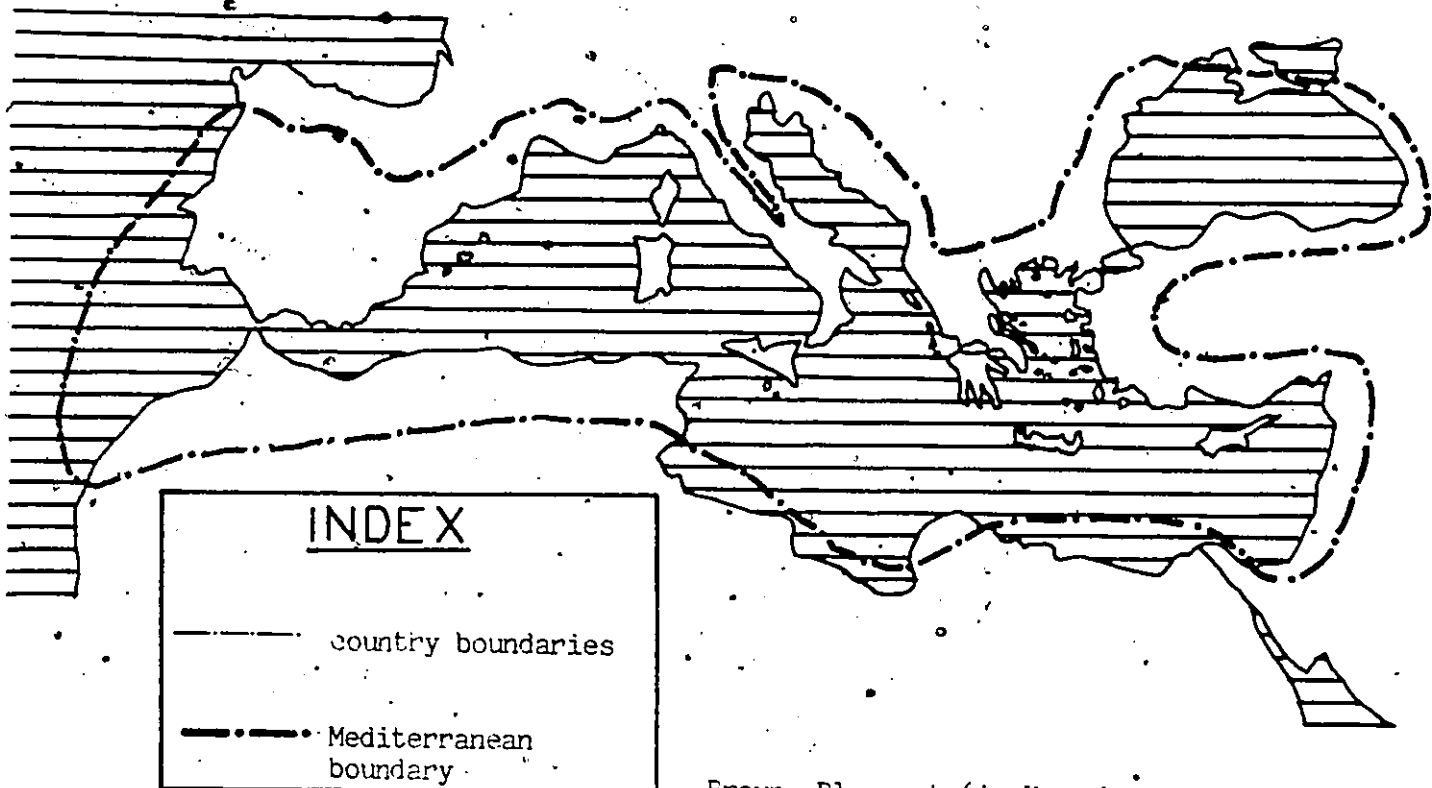
LEGEND



M A P S

MAP 1

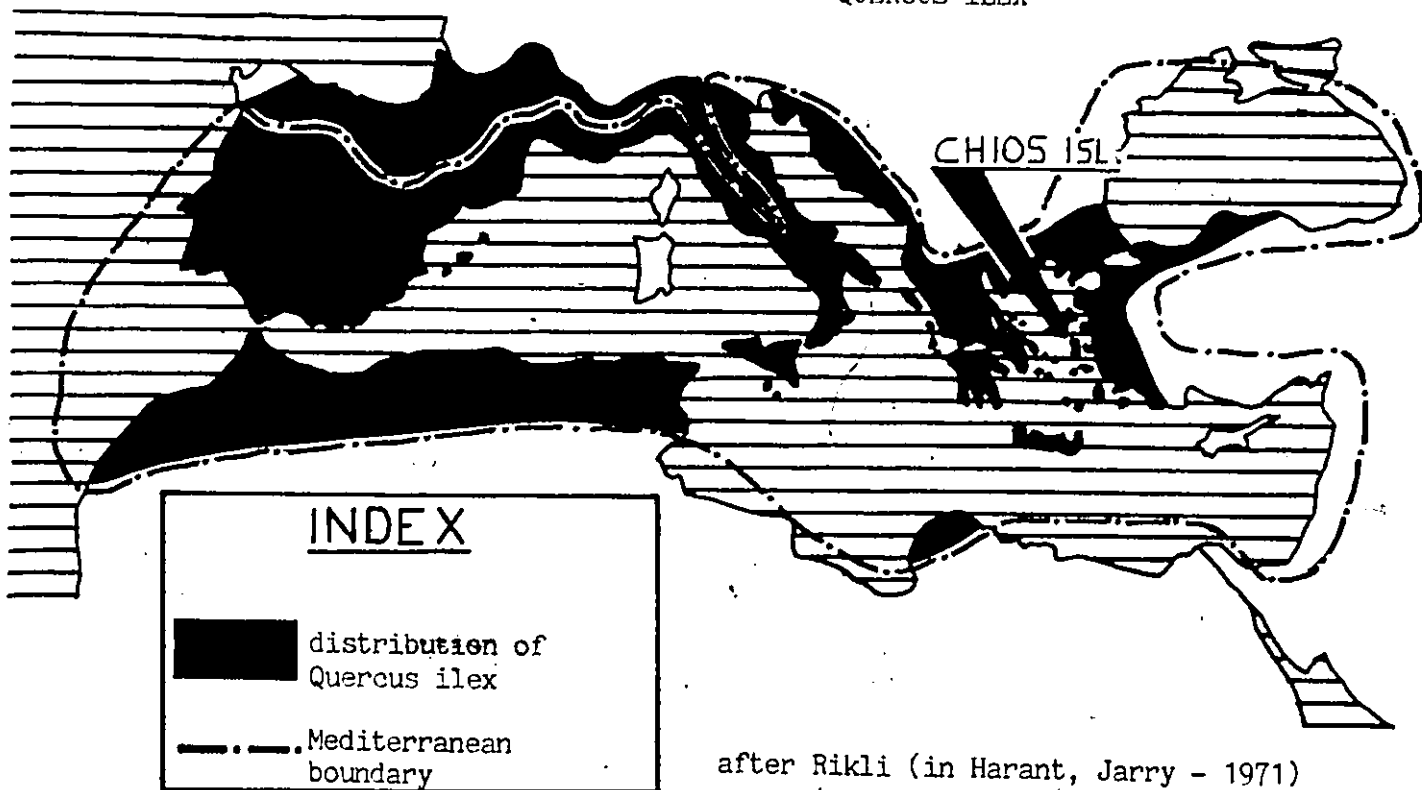
THE MEDITERRANEAN REGION



Braun, Blanquet (in Harant, Jarry - 1971)

MAP 2

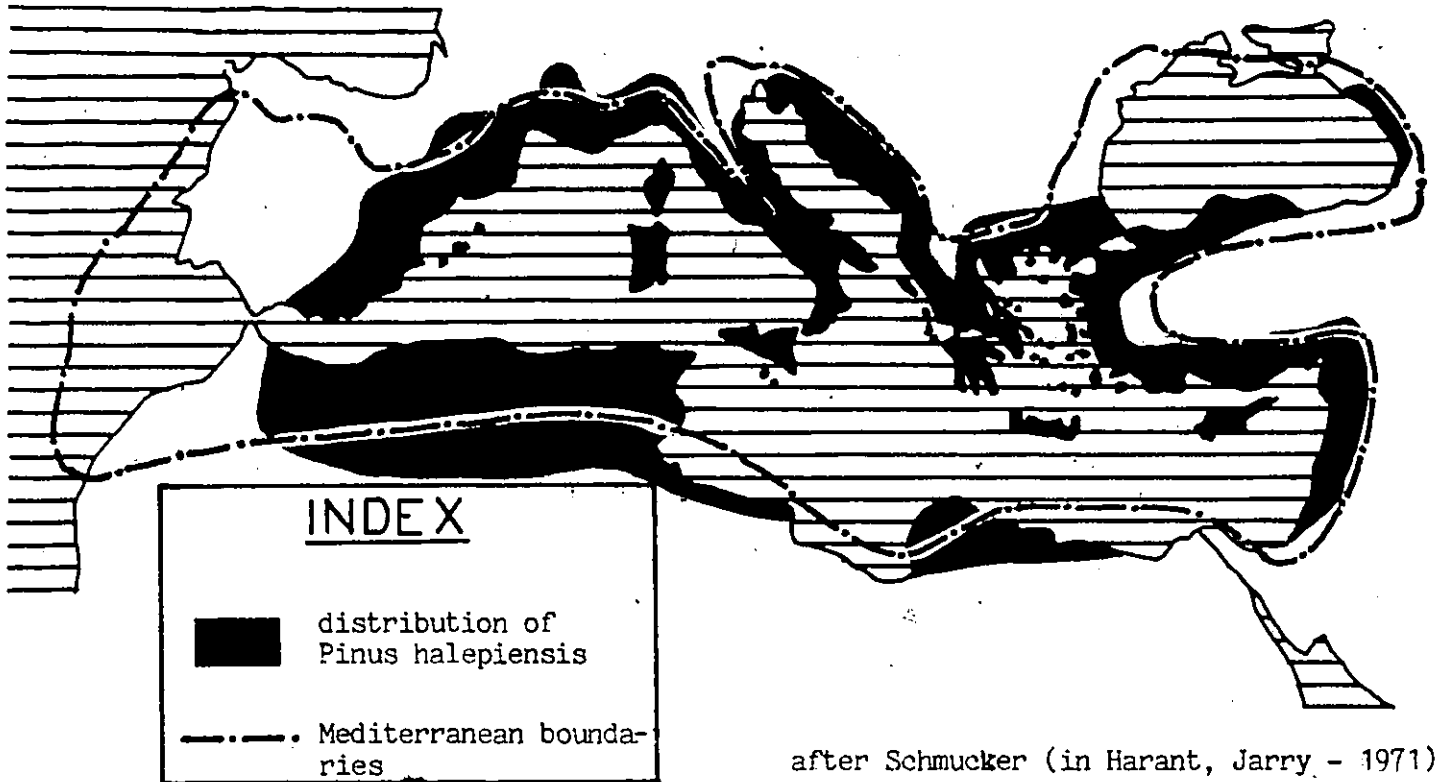
DISTRIBUTION OF QUERCUS ILEX



after Rikli (in Harant, Jarry - 1971)

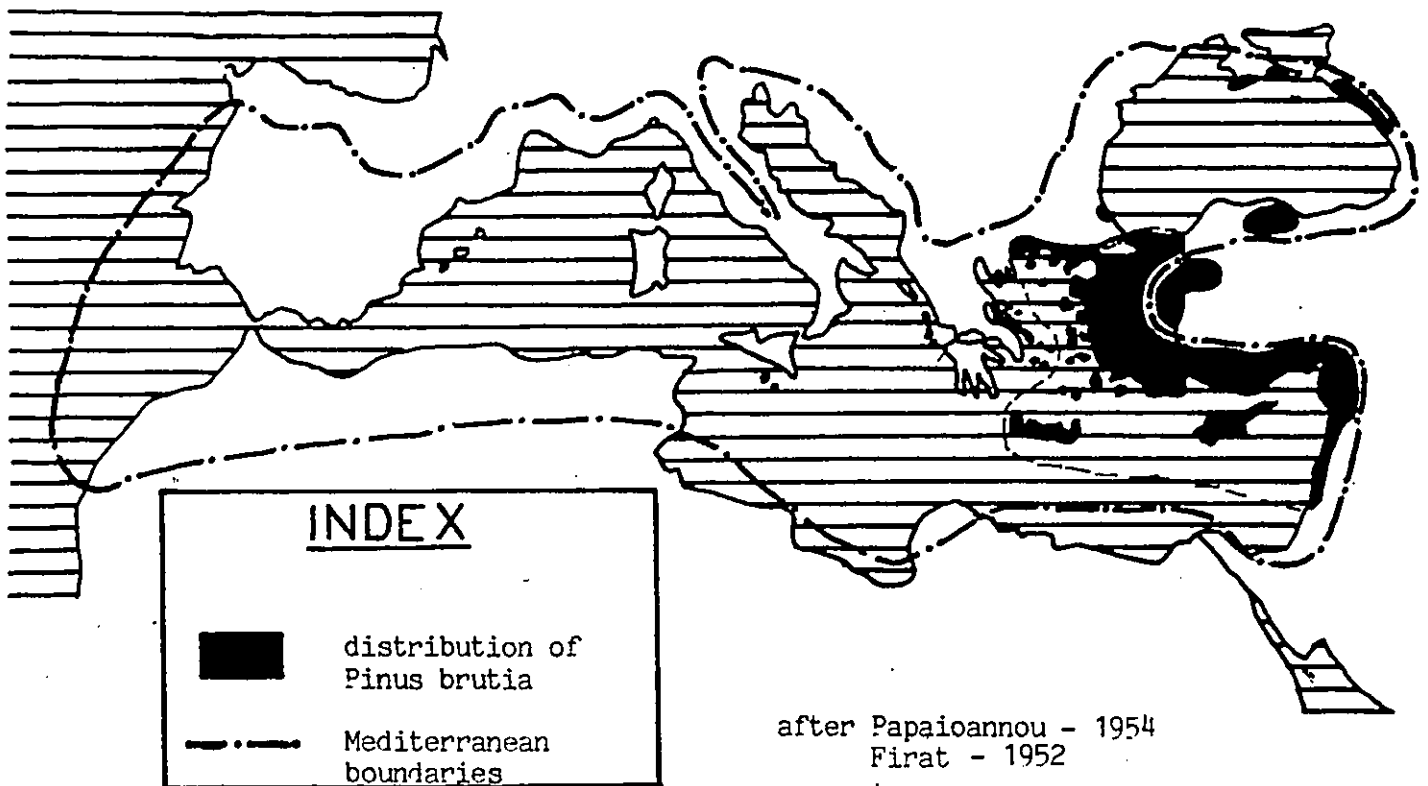
MAP 3

DISTRIBUTION OF PINUS HALEPENSIS



MAP 4

DISTRIBUTION OF PINUS BRUTIA



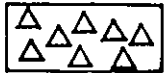
MAP 5



fairly frequent drought; drought probability 30-50 %



mountainous steppes, xerophytic open forests, scrubs and savannas; drought probability more than 50 % (this class is a subset of the next one).



very frequent drought; drought probability 50-75 %



absolute predominance of drought; drought probability 100 %



shifting and semi-stabilized dune sands in deserts

after Kovda, Rozanov, Onischenco - 1977

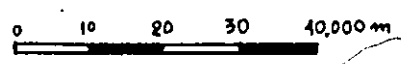
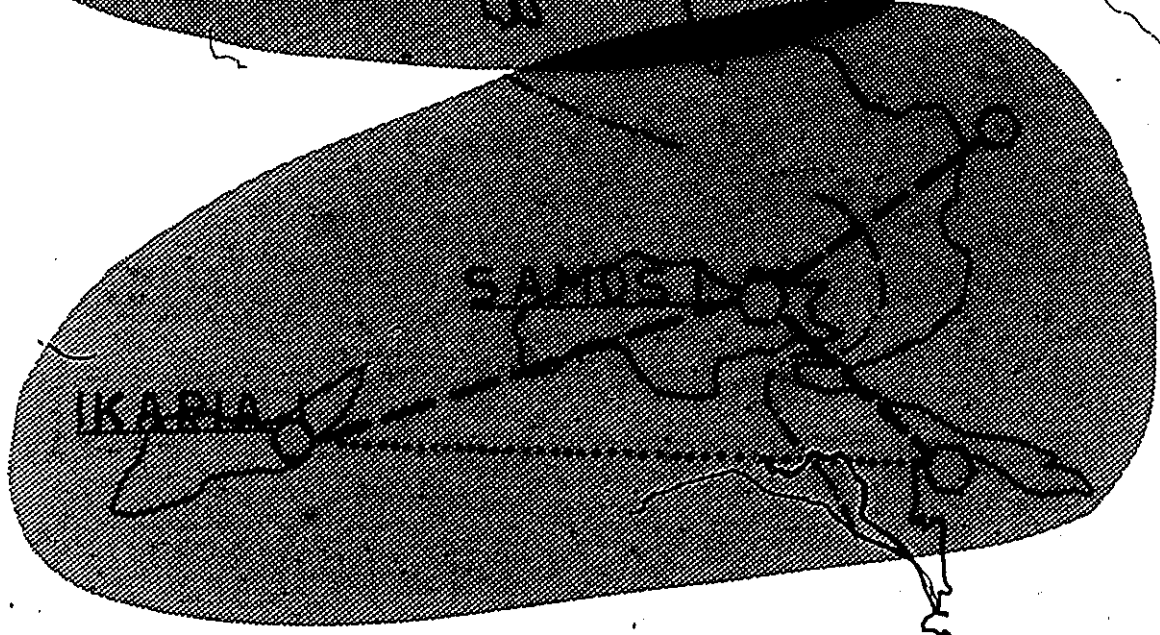
M A P 6

WESTERN
GREECE

A
E
G
E
A
N
S
E
A

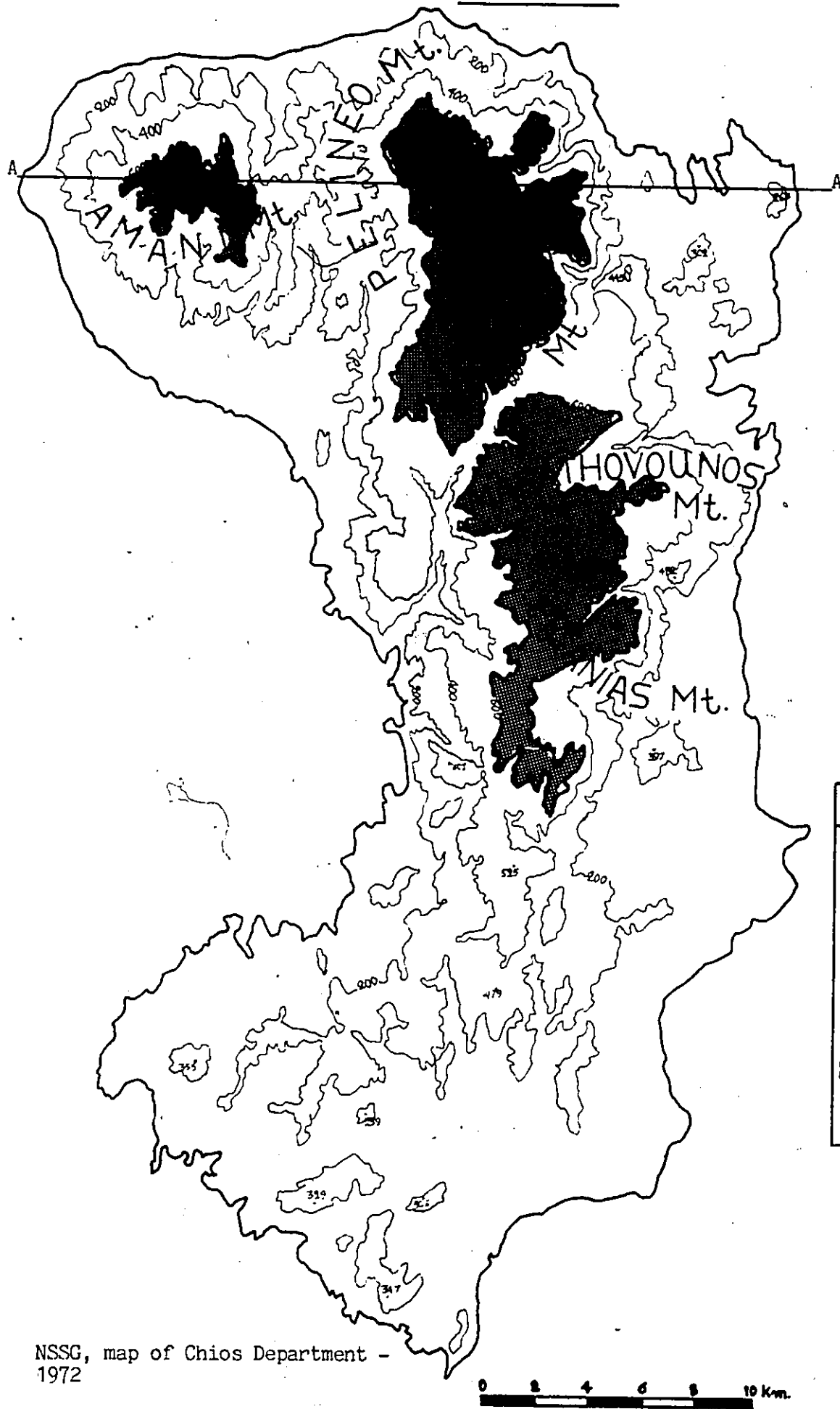
INDEX




- Major urban centre
- past major link between urban centres
- past secondary link between urban centres
- past integrated region
- present national boundaries



MAP 7

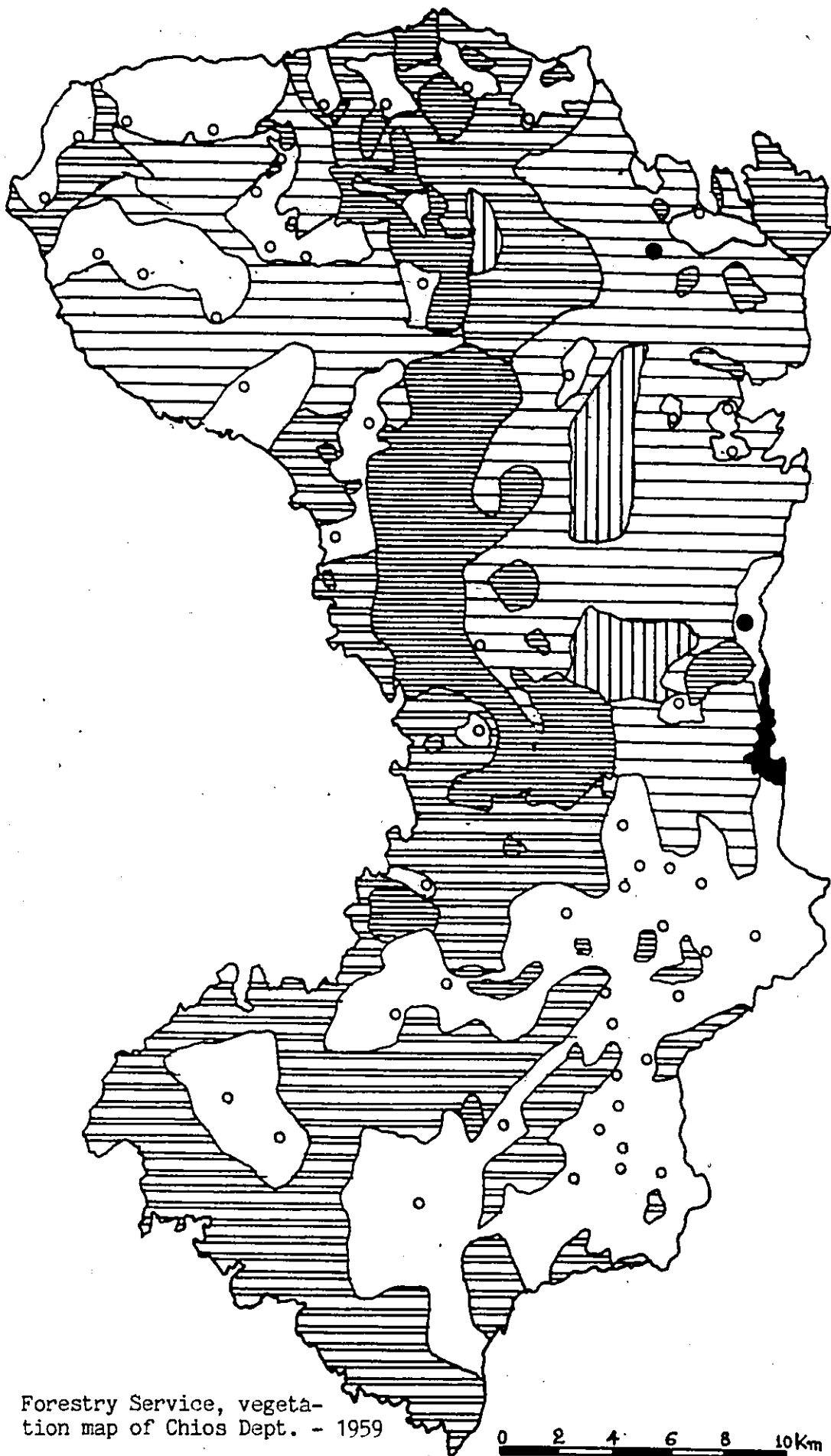
THE TOPOGRAPHY OF CHIOS ISLAND


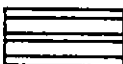
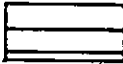






INDEX	
	200 and 400 metres contour line
	600, metres and above contour line
	areas of altitude grt. than 600 m.

MAP 8

VEGETATION MAP OF CHIOS ISLAND



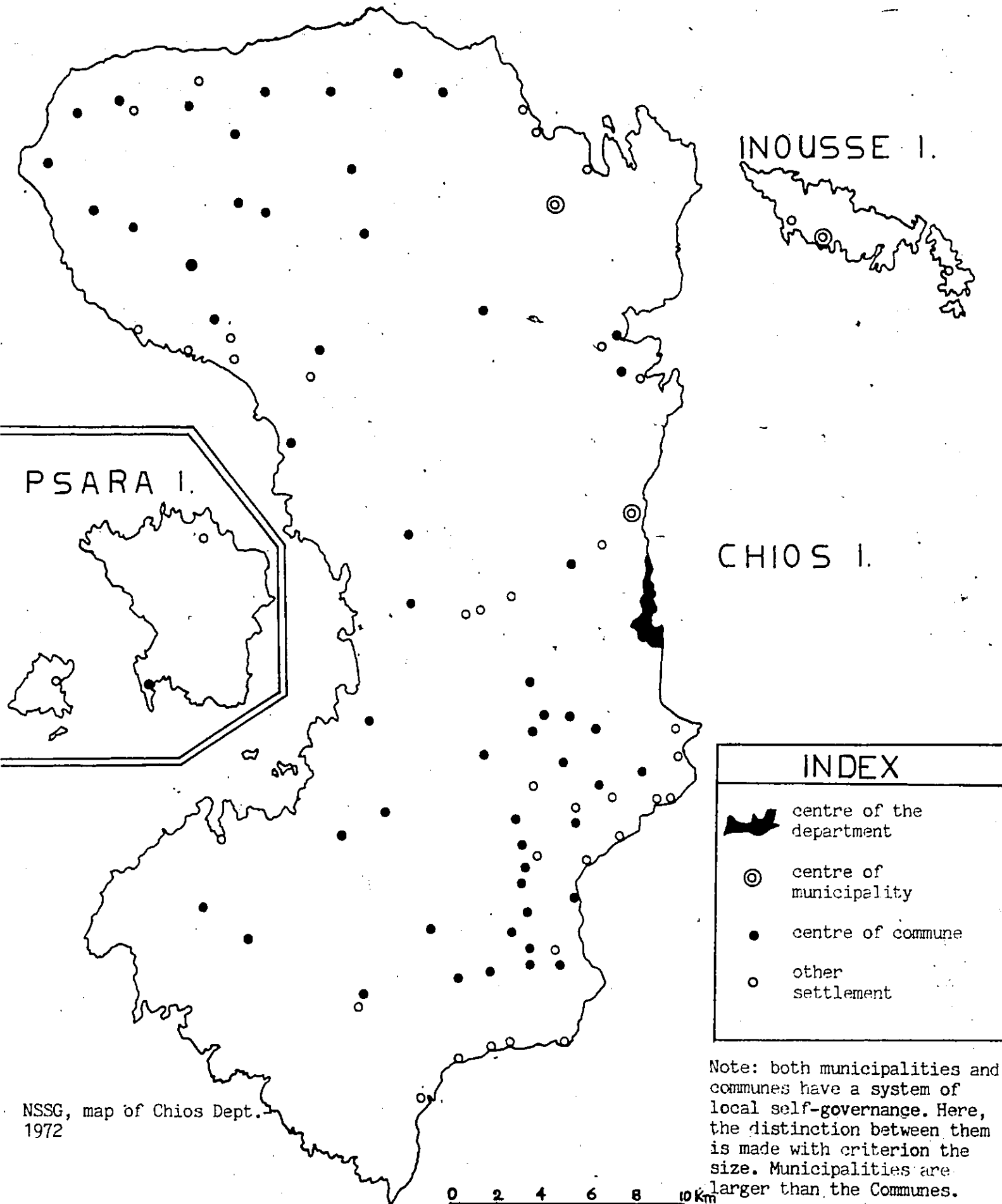
INDEX	
	areas of dense tree-cover *
	areas of sparse tree-cover and/or maquis areas
	garrigue areas
	areas of bare rock or bare soil
	areas under cultivations
	Municipality
	centre of Commune

Forestry Service, vegetation map of Chios Dept. - 1959

0 2 4 6 8 10Km

MAP 9

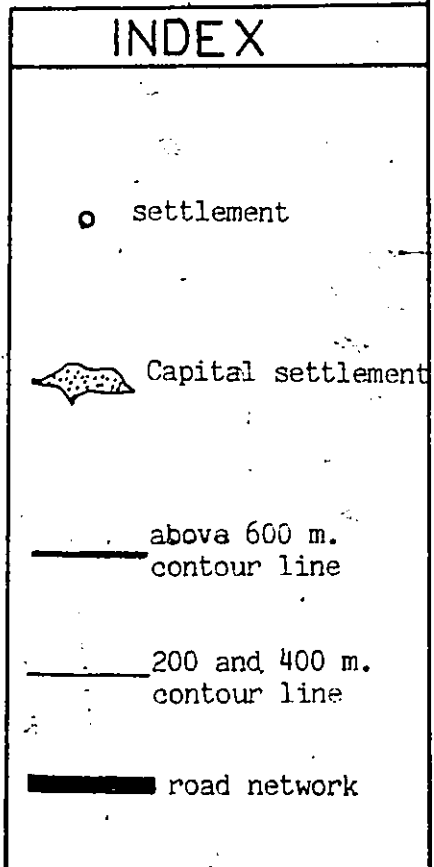
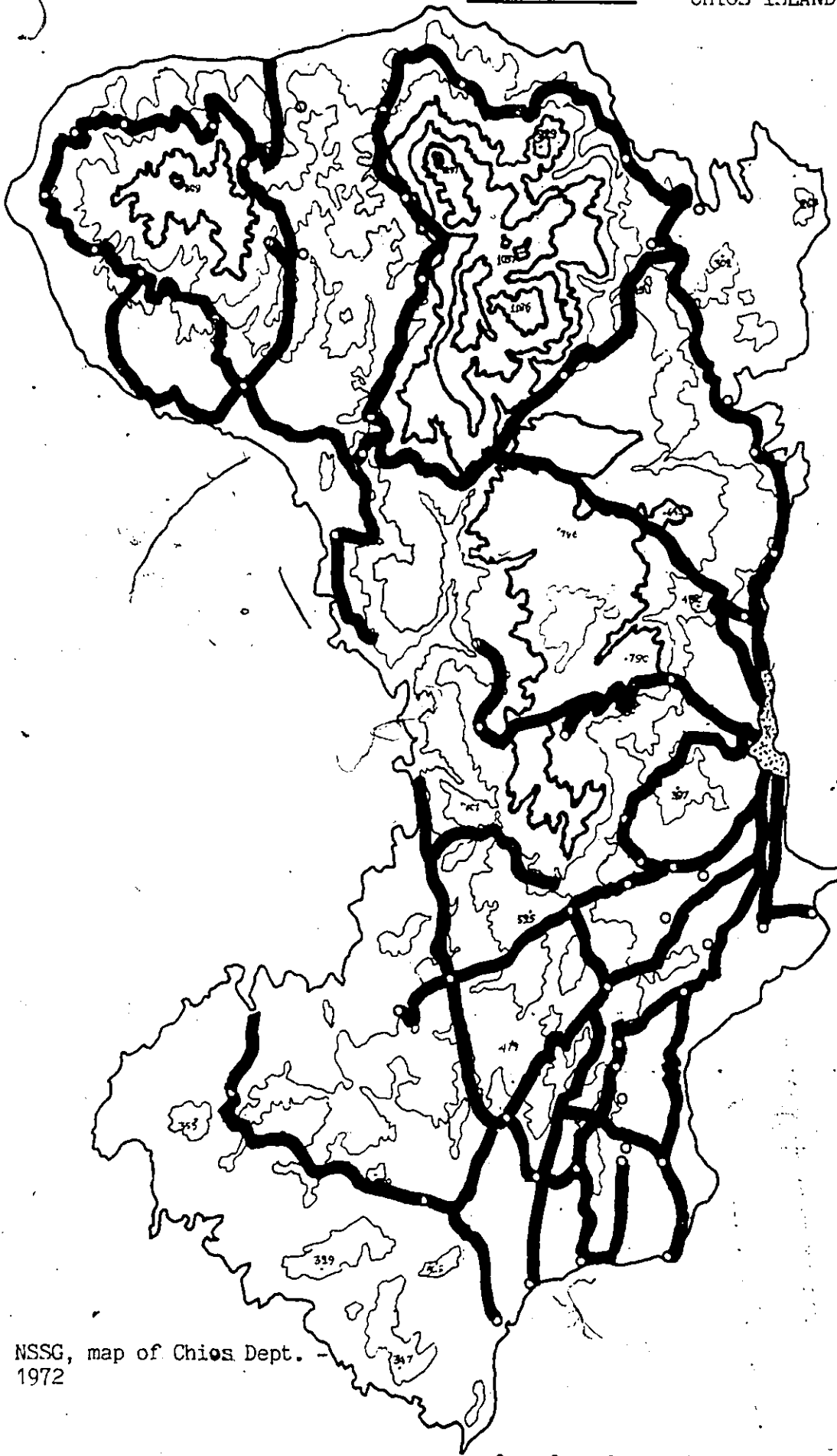
SETTLEMENT PATTERN OF
CHIOS DEPARTMENT



NSSG, map of Chios Dept.
1972

MAP 10

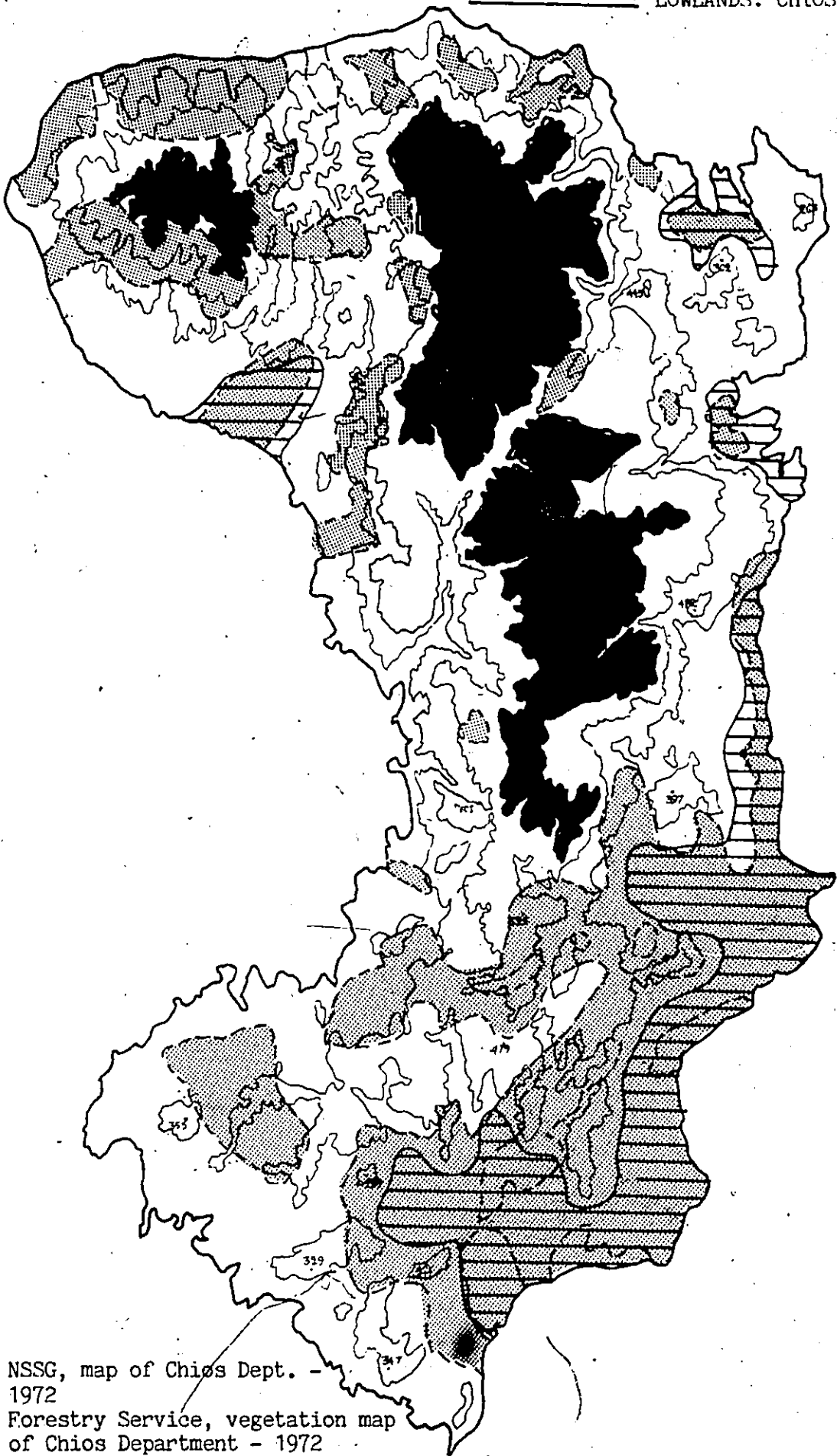
ROAD NETWORK OF
CHIOS ISLAND



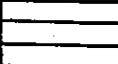




NSSG, map of Chios Dept. -
1972



MAP 11 CULTIVATED LANDS IN COMPARISSON WITH
LOWLANDS: CHIOS ISLAND



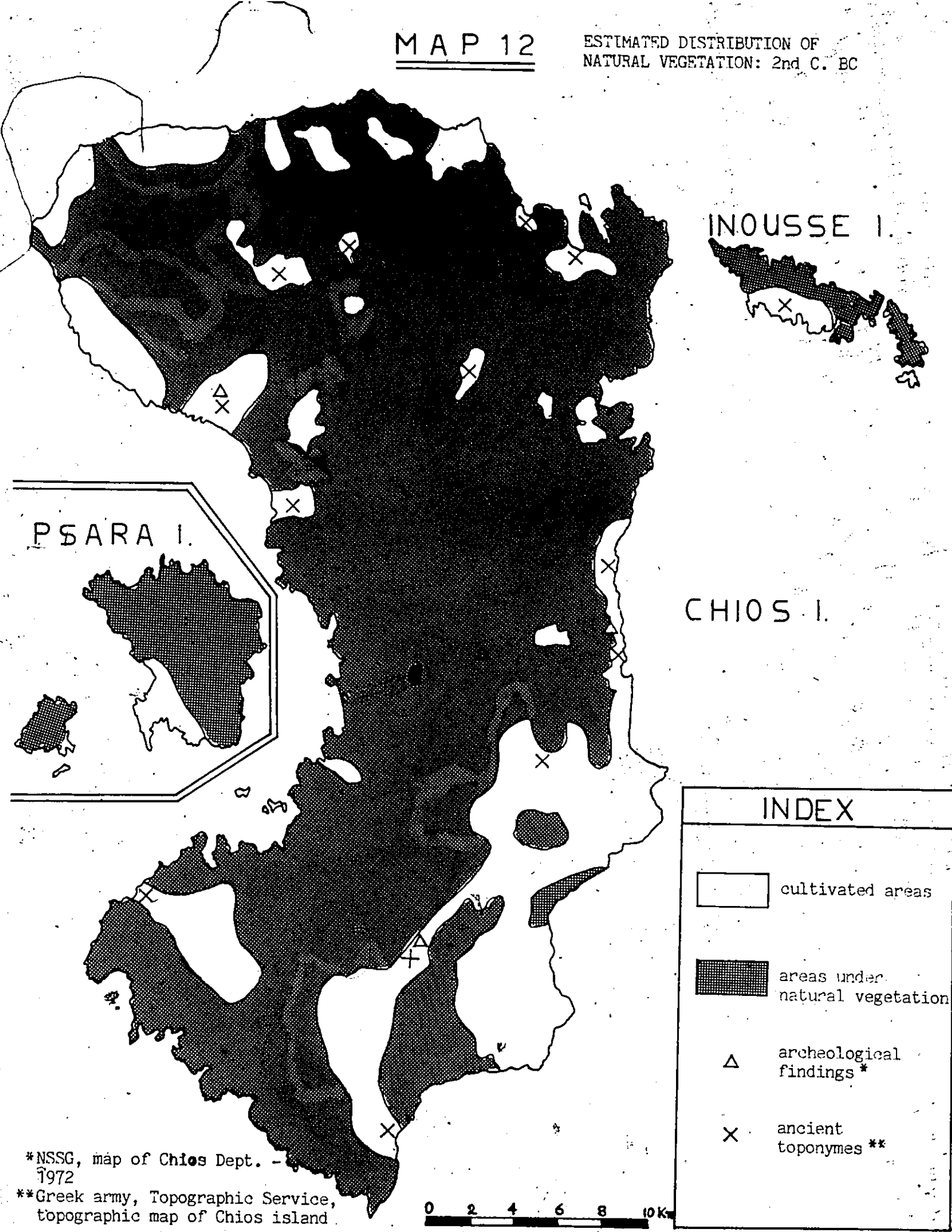
INDEX	
	200 and 400 m. contour line
	above 600 m. contour line
	lowlands
	cultivated areas
	areas above 600 m. of altitude

NSSG, map of Chios Dept. - 1972
Forestry Service, vegetation map of Chios Department - 1972



MAP 12

ESTIMATED DISTRIBUTION OF
NATURAL VEGETATION: 2nd C. BC



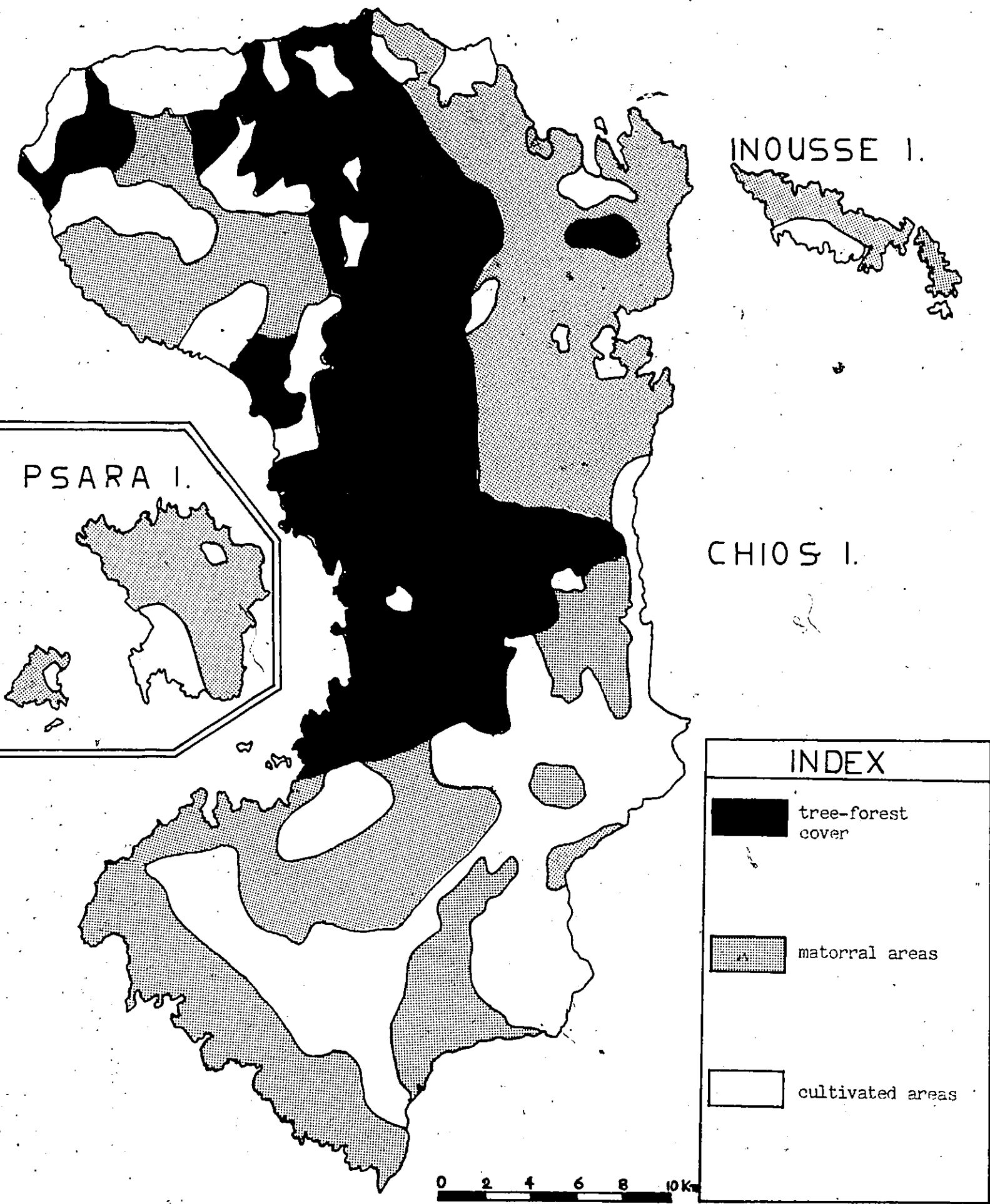
*NSSG, map of Chios Dept. - 1972

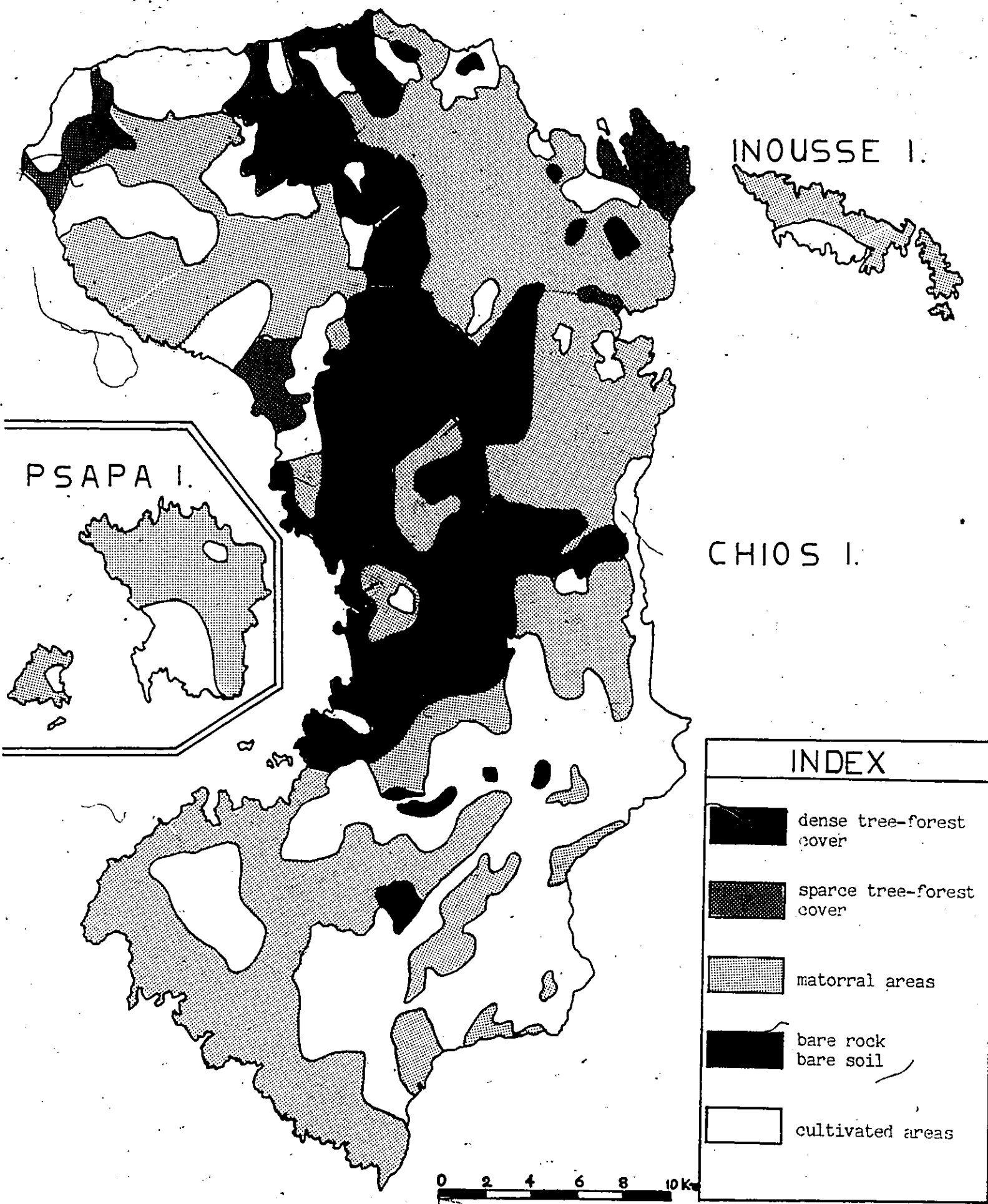
**Greek army, Topographic Service, topographic map of Chios island.

0 2 4 6 8 10K

MAP 13

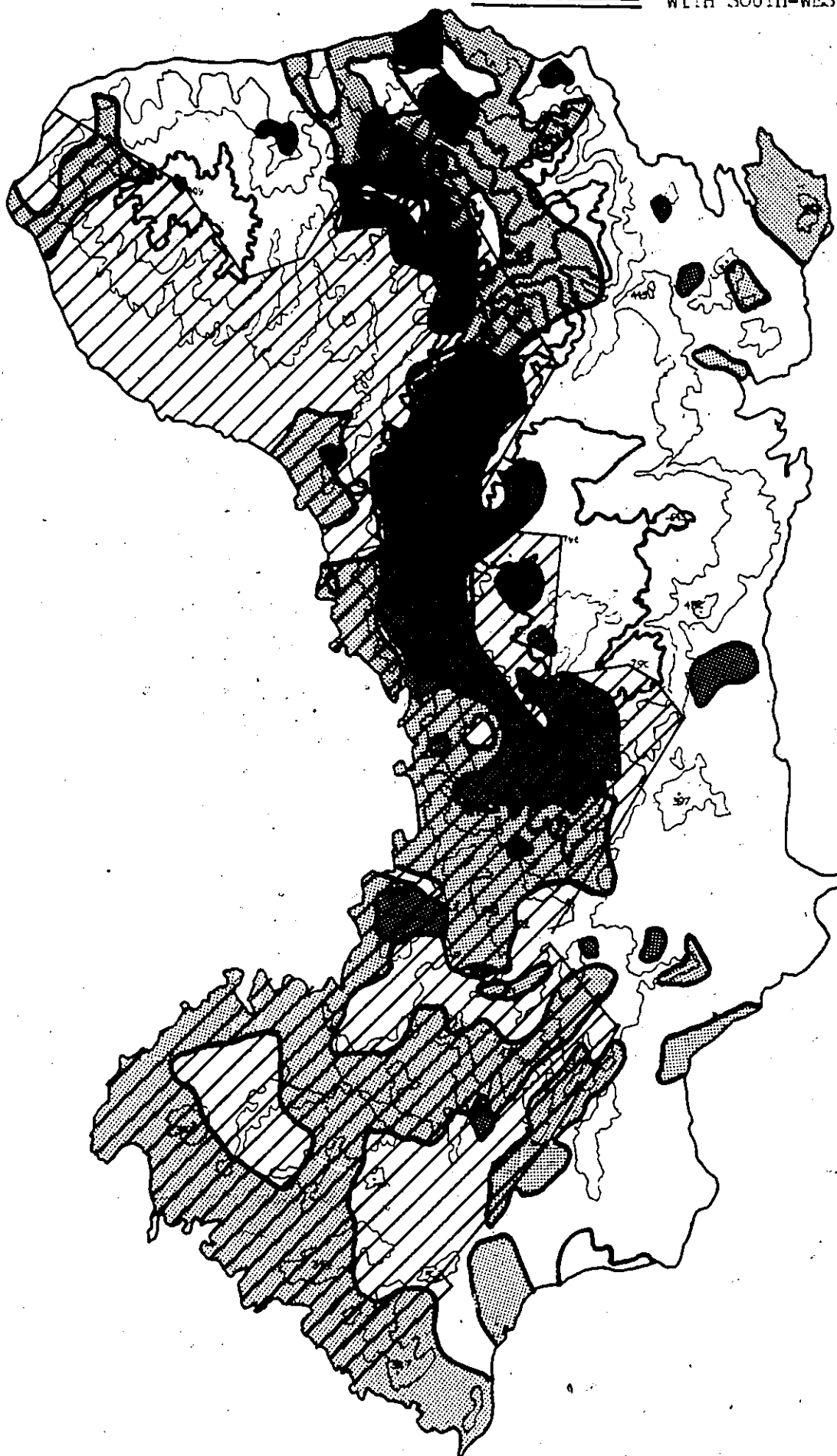
ESTIMATED DISTRIBUTION OF
NATURAL VEGETATION: 13th c. AD





MAP 15

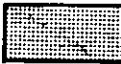
RELEVANCE OF TREE-FOREST VEGETATION
WITH SOUTH-WESTERN ORIENTATION OF SLOPES





INDEX

— 200 and 400 m.
contour line

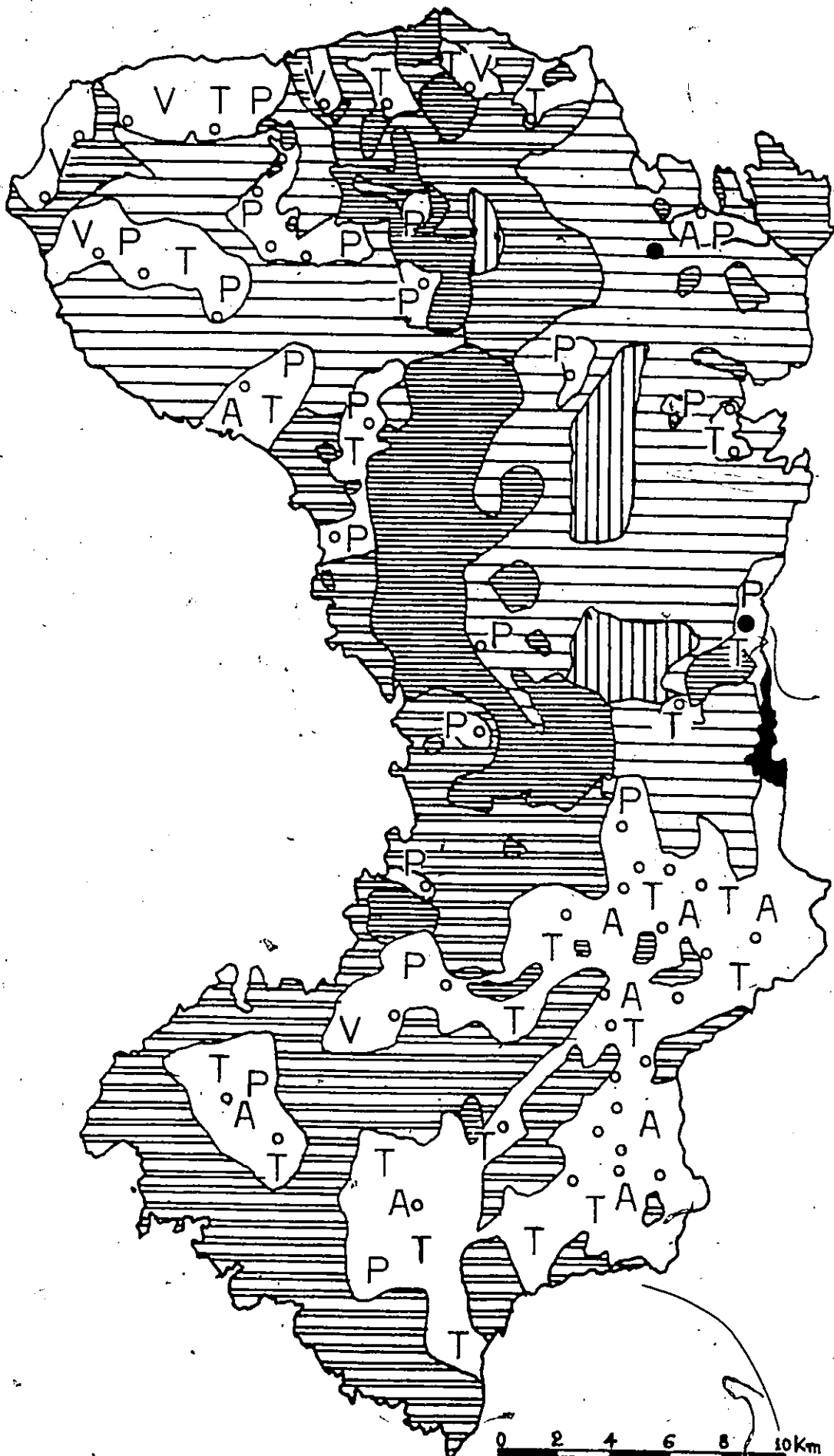
— 600, 800, 1000 and
1200 m. contour l.


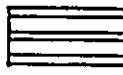
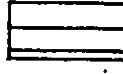

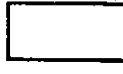
 areas of scattered
trees and/or
maquis areas

 areas of dense
tree-cover

 areas of south-
western orienta-
tion

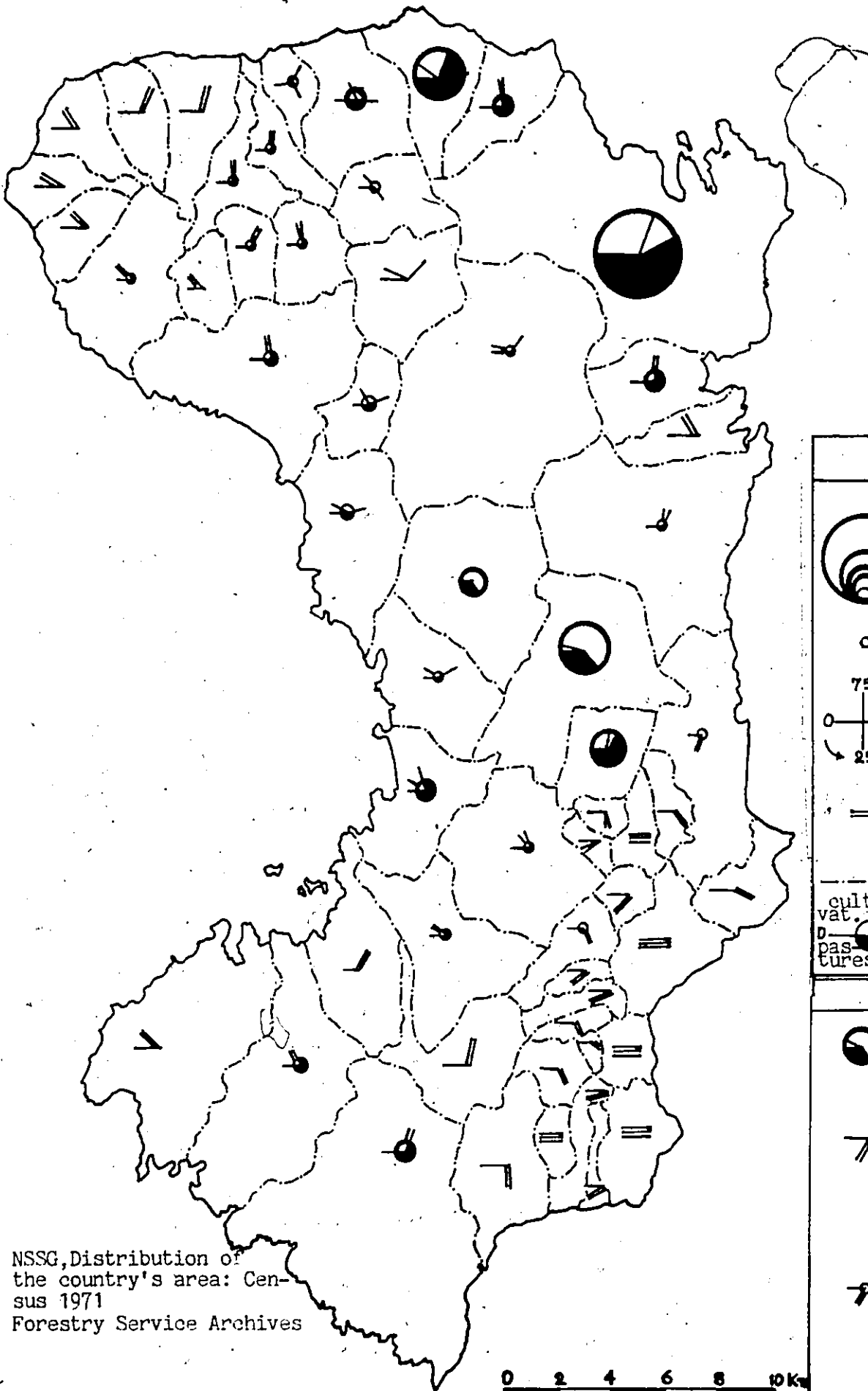
0 2 4 6 8 10 Km.



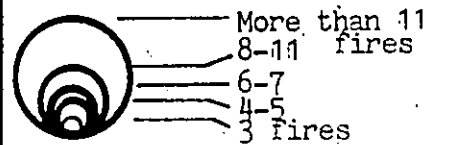
INDEX	
A	cultivations on arable land
V	vineyards
T	tree-crop cultivations
P	areas whose the population practices pasture
	areas under tree-cover grt. than 75%
	areas under tree-cover less than 75%
	matorral areas
	bare rock bare soil
	cultivated areas
●	centre of municipality
○	other settlements

MAP 17

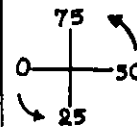
DISTRIBUTION OF RURAL LAND-USES AND OF NUMBER OF FIRES DURING THE STUDY PERIOD



INDEX



○ 1-2 fires



starting point and direction of percentages for each rural land-use

≡ 0% of angle; this land-use is not present

--- community boundary
 0-100 sequence of the forests land-uses
 pastures

EXAMPLES

● 6-7 FIRES
 about 30% pasture
 55% forests, 15% cultivations

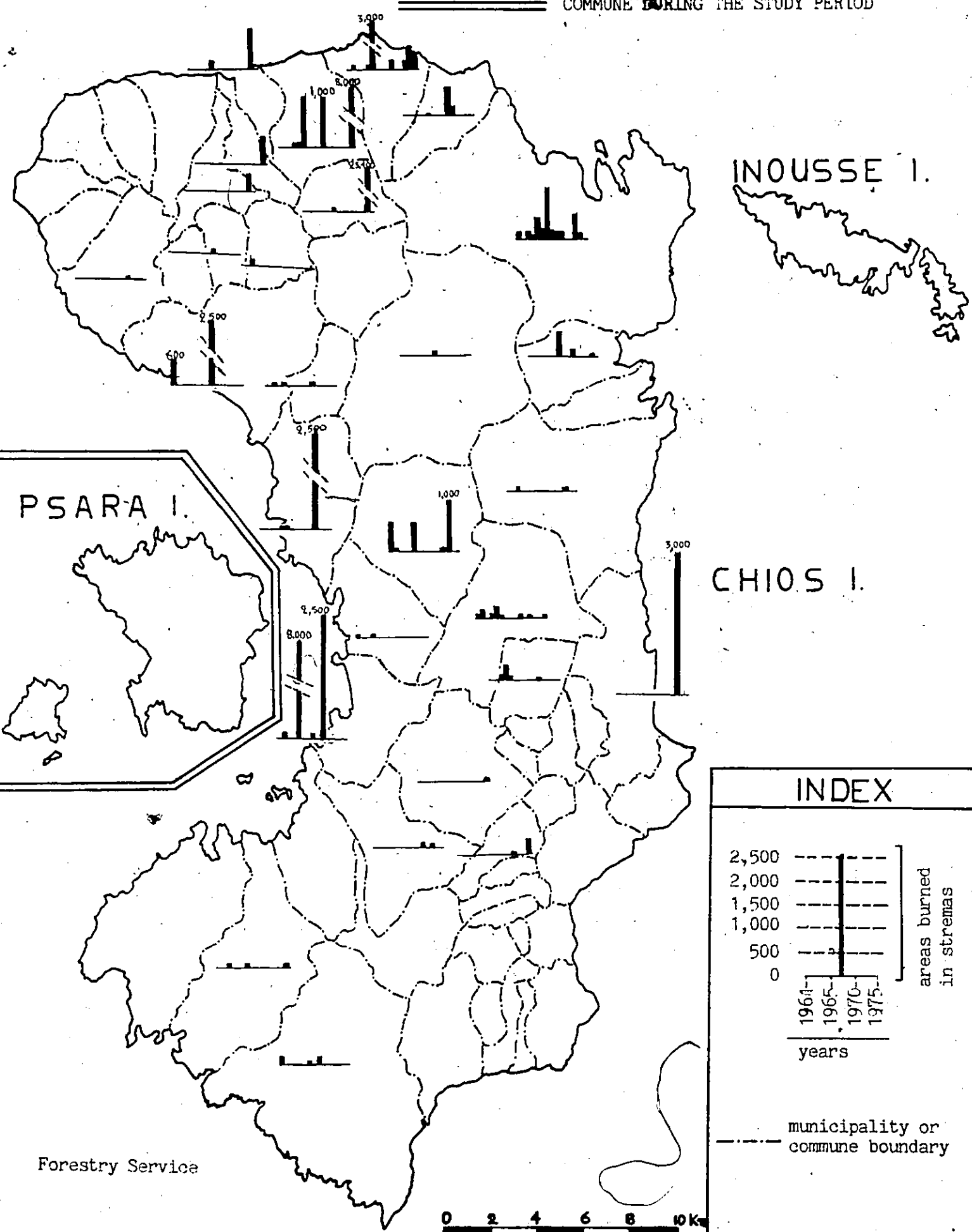
7 No fire
 about 20% pasture,
 0% forests,
 80% cultivations

7 1-2 FIRES
 about 15% pasture,
 0% forests,
 85% cultivations

NSSG, Distribution of the country's area: Census 1971
 Forestry Service Archives



MAP 18 AREAS BURNED FOR EACH MUNICIPALITY OR COMMUNE DURING THE STUDY PERIOD

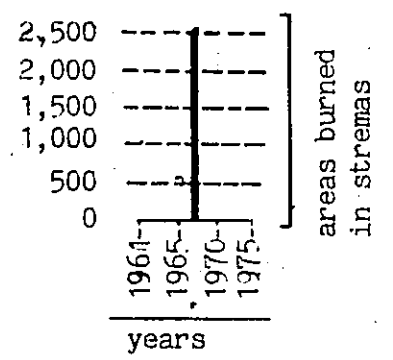


INOUSSE I.

PSARA I.

CHIOS I.

INDEX



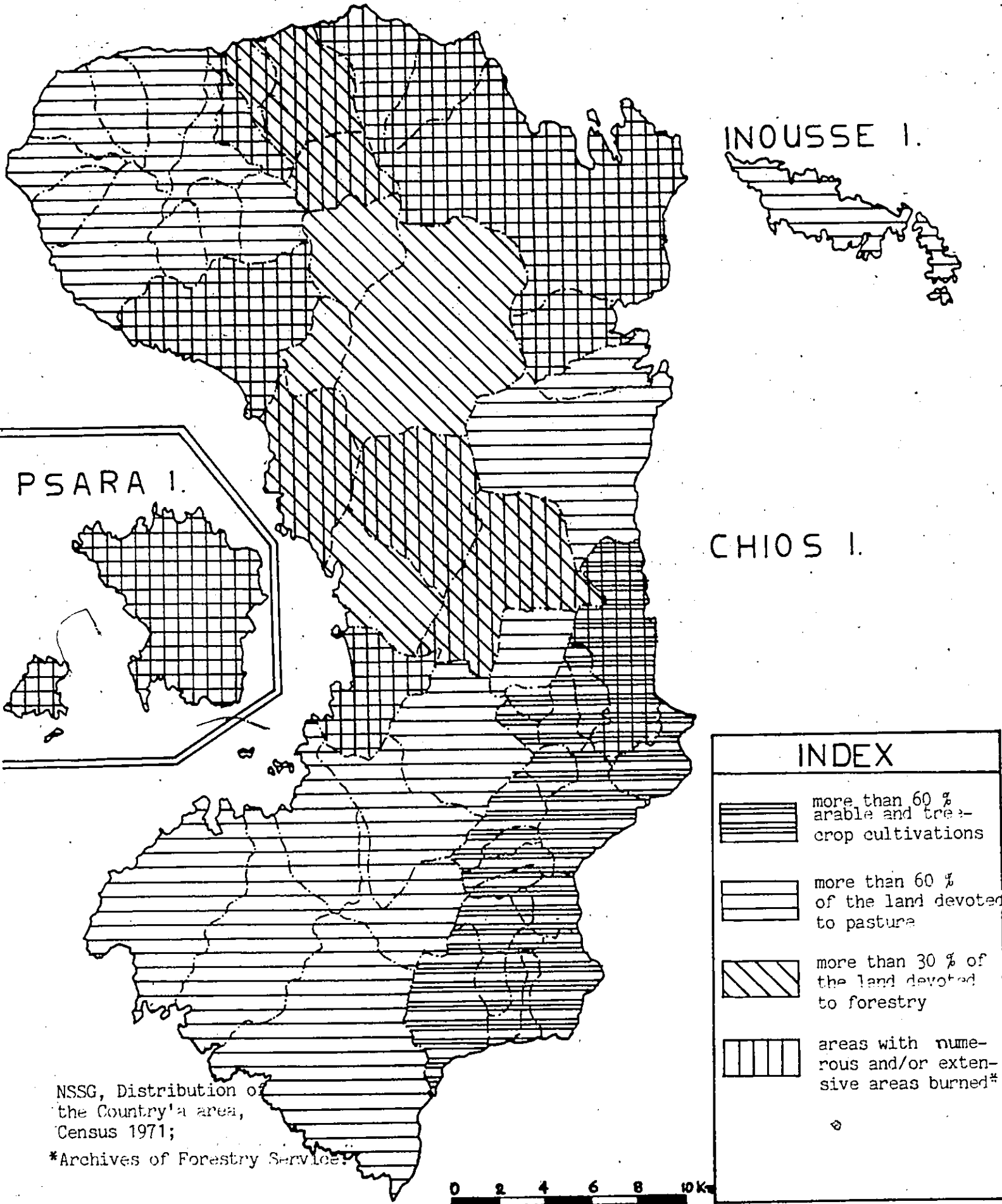
--- municipality or commune boundary

Forestry Service

0 2 4 6 8 10 Km

MAP 19

PATTERN OF PRINCIPAL LAND USES
IN CHIOS ISLAND AND FIRE PATTERN

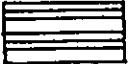
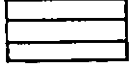
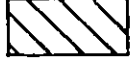



INOUSSE I.

PSARA I.

CHIOS I.

INDEX

-  more than 60 % arable and tree-crop cultivations
-  more than 60 % of the land devoted to pasture
-  more than 30 % of the land devoted to forestry
-  areas with numerous and/or extensive areas burned*

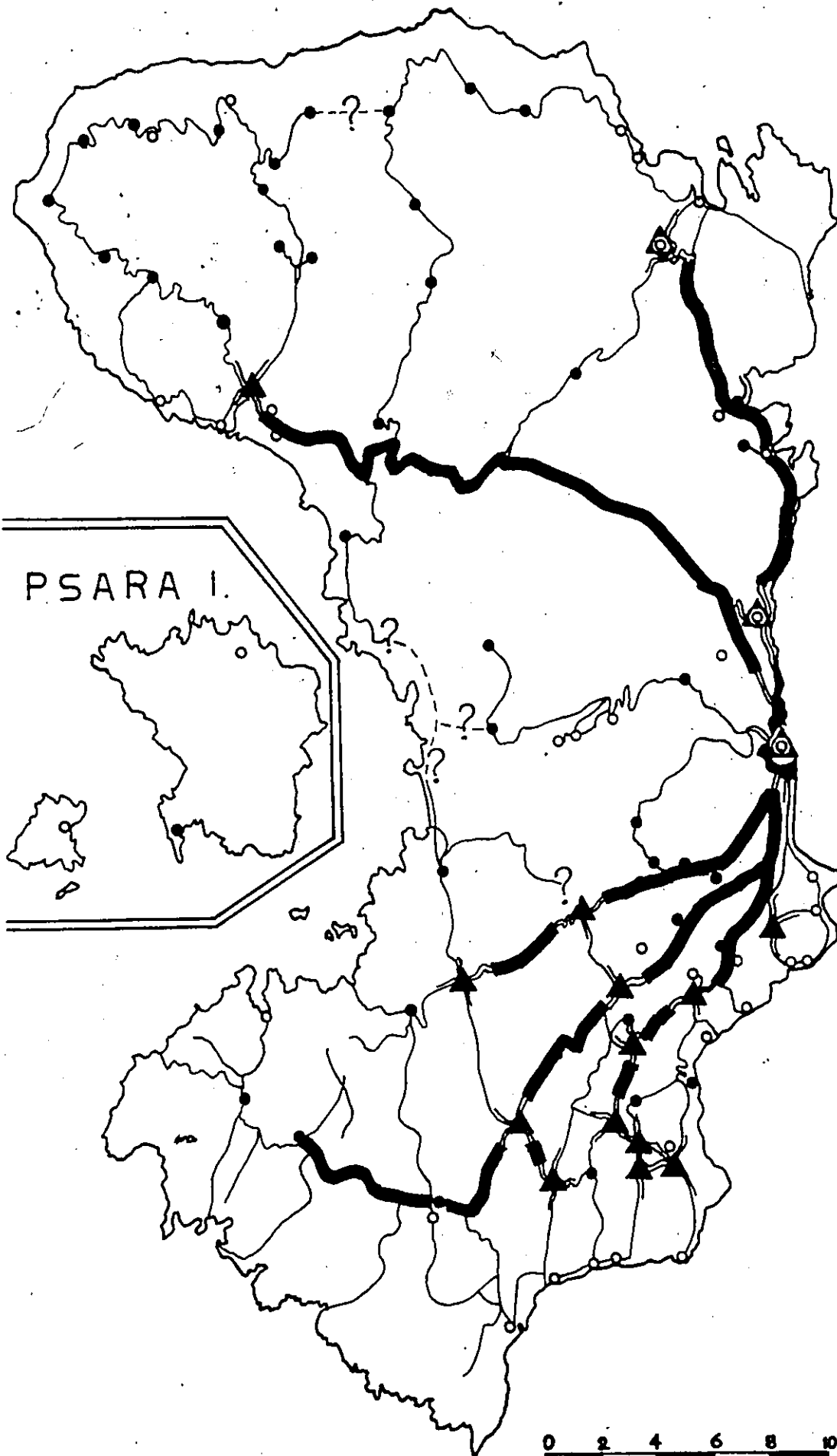
NSSG, Distribution of the Country's area, Census 1971;

*Archives of Forestry Services.



MAP 20

ROAD NETWORK HIERARCHY



INOUSSE I.











PSARA I.



CHIOS I.

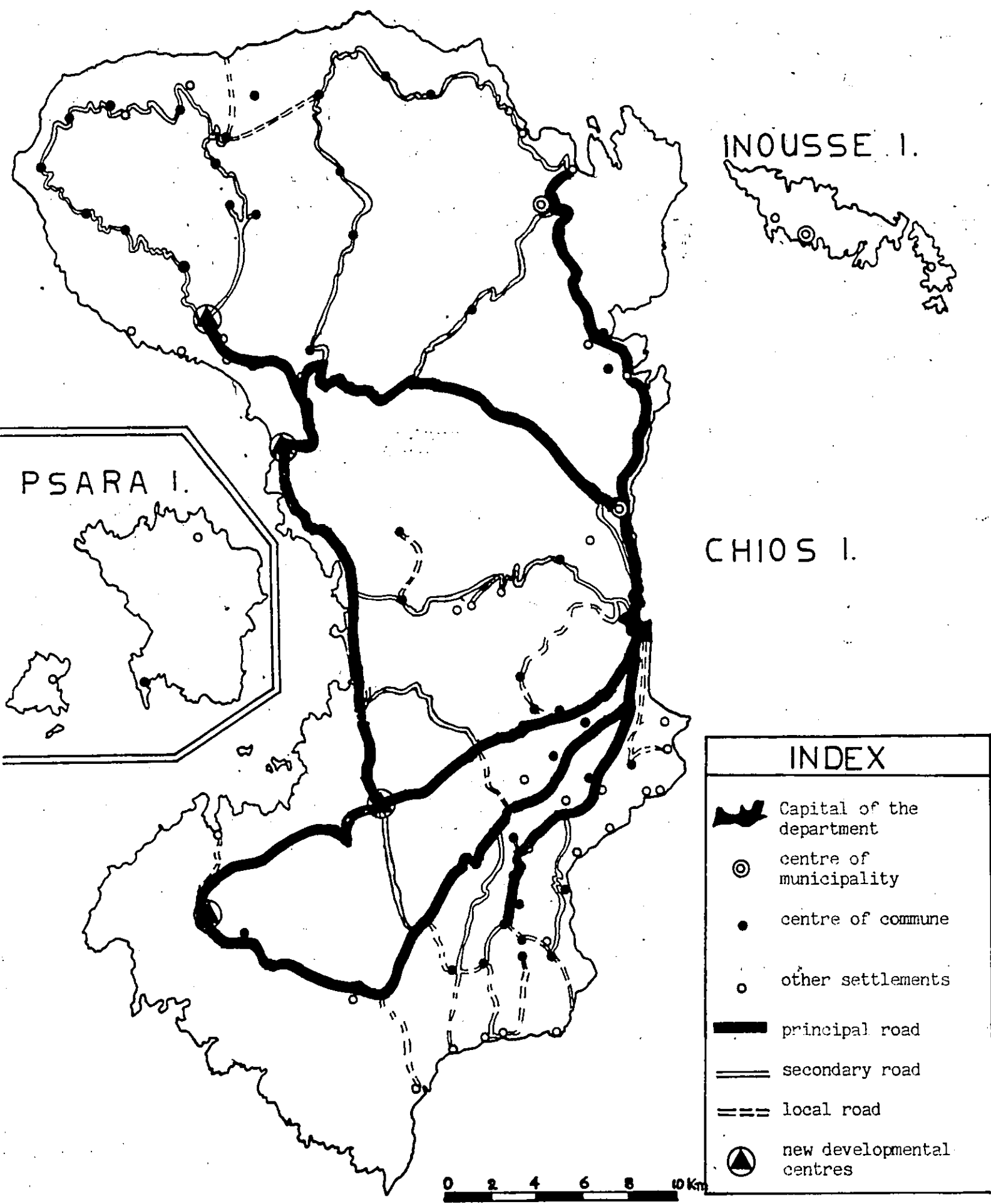
INDEX

-  Capital of the department
-  centre of municipality
-  centre of commune
-  other settlements
-  secondary road
-  crossroad settlement
-  principal road
-  inexistent links



MAP 21

PROPOSED REHIERARCHIZATION OF THE ROAD NETWORK OF CHIOS ISLAND











INOUSSE I.

PSARA I.

CHIOS I.

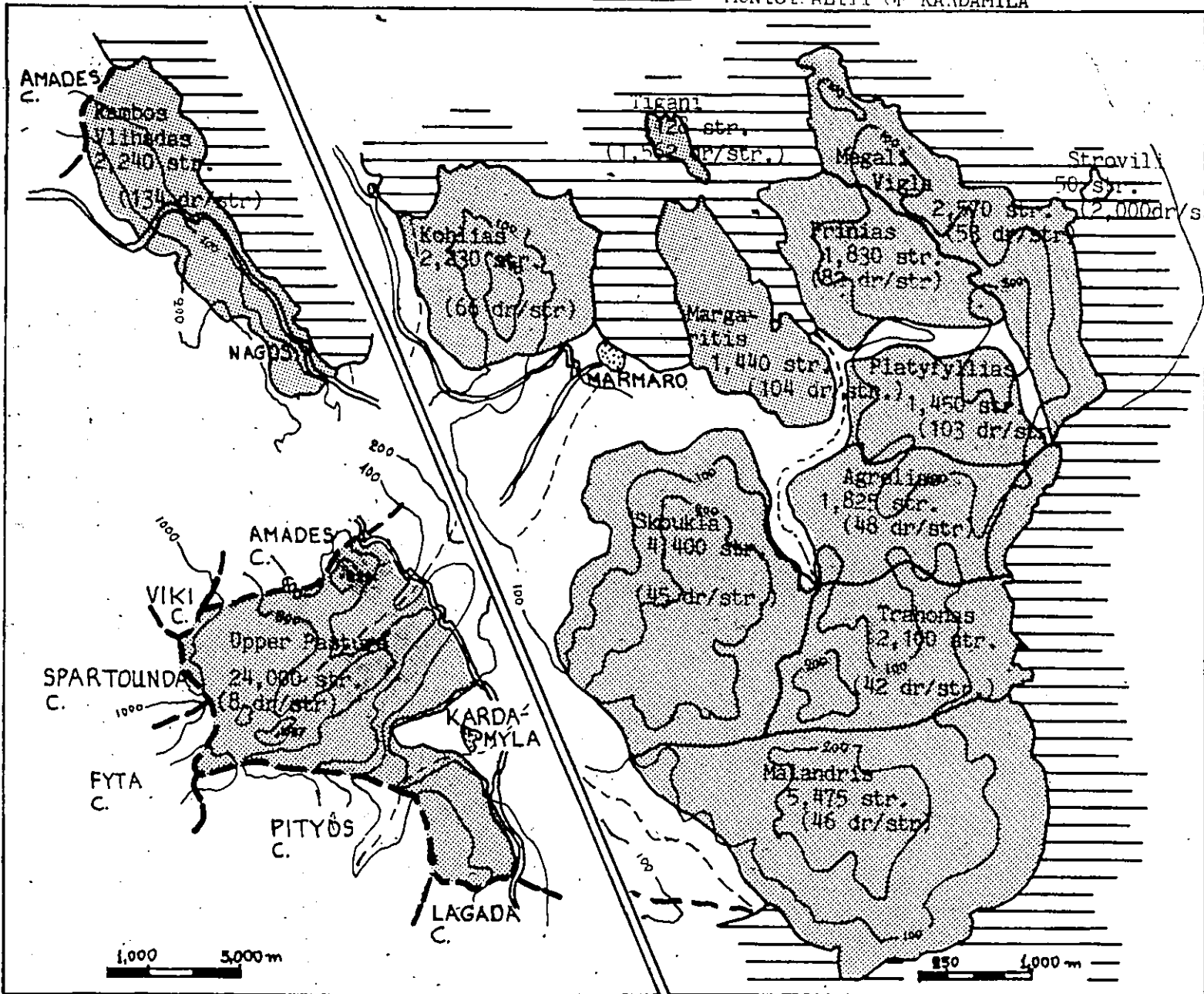
INDEX

-  Capital of the department
-  centre of municipality
-  centre of commune
-  other settlements
-  principal road
-  secondary road
-  local road
-  new developmental centres

0 2 4 6 8 10 Km

MAP 22

LAND USE PATTERN IN THE
MUNICIPALITY OF KARDAMYLA



(Amolohitis - 1961)

INDEX

road

settlement

FYTA
C.

name of neighbouring
commune

sea

boundary

torrent

100 m. contour

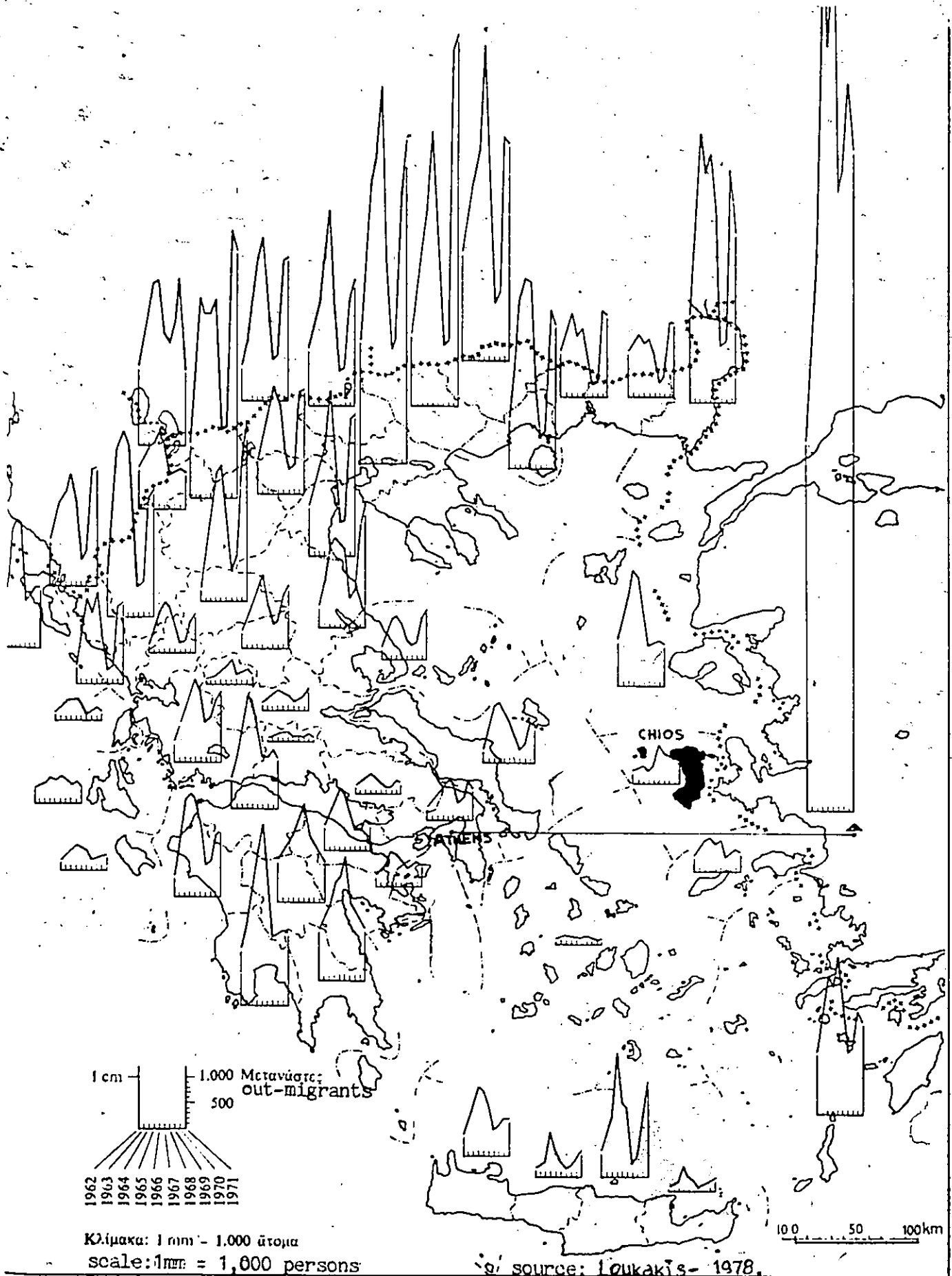
200 m. contour

Municipality owned areas
used for pasture

private properties (arable
and tree-crop cultivations)

MAP 24

OUT-MIGRATION BY DEPARTMENT
YEARS: 1963 - 1972.



1 cm
1.000 Μετανάστες
500
out-migrants
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971

Κλίμακα: 1 mm = 1.000 άτομα
scale: 1mm = 1,000 persons

100 50 100km

source: Loukakis - 1978.

P I C T U R E S



PICTURE 1

Bare eroded land covers extensive areas of northern Chios.

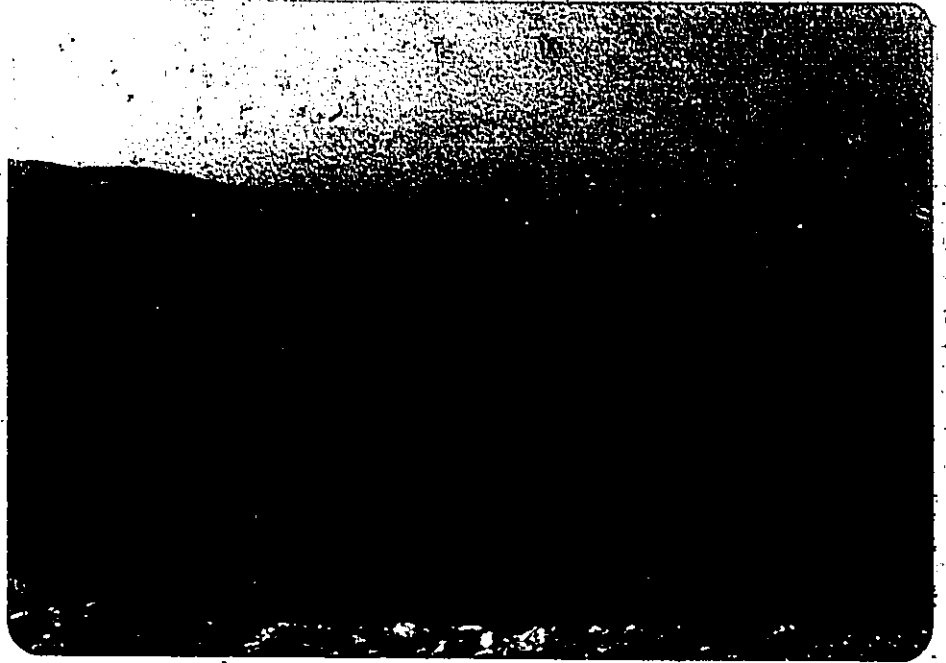
(Western view from Kabia).

PICTURE 2

Foreground: *Poterium spinosum*.

Middle: Burned forest and patches of unburned forest. Note the orientation of the burned areas.

(Northern view from Phyta).



PICTURE 3

Characteristic valley profile in Chios, of a well defined channel cut into a broad smooth valley floor.

In the foreground *Poterium spinosum* on gravel.

(North-western view from Karve)





PICTURE 4

A patch of forest nearby the municipality of Kardamyla, on a southerly-westernly oriented slope. Mt. Oros is visible at the back. (Site Laka in Kardamyla)

PICTURE 5

The limit of the forest at Pelineo Mt. These sub-alpic areas are used for grazing. (Site between Kabia and Spartounda.)



PICTURE 6

Forest of Pinus brutia on rocky soil. (Karye, after Nea Moni)





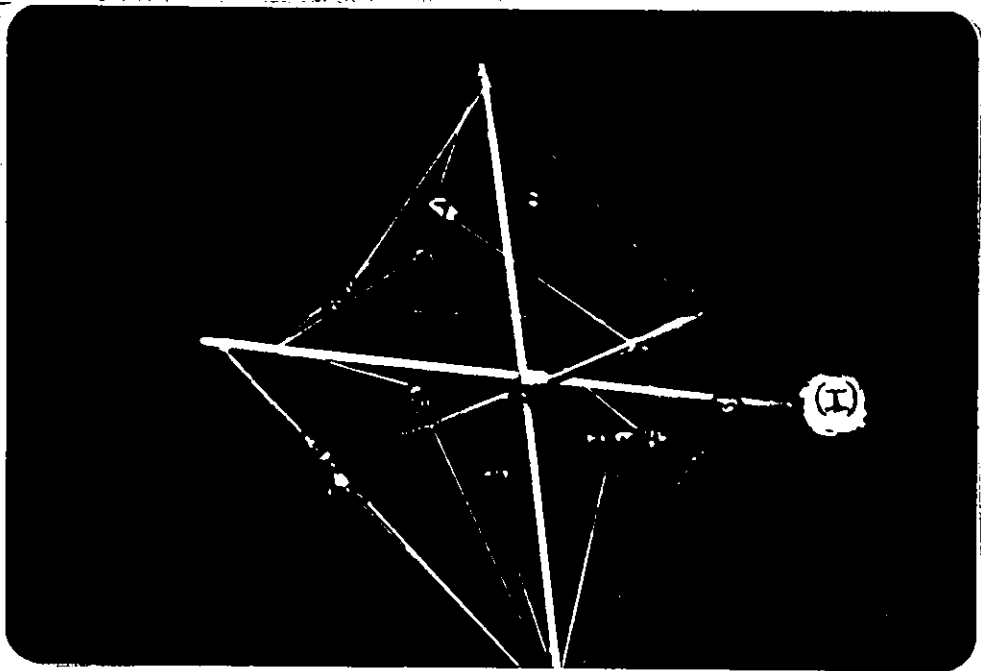
PICTURE 7

Chian girls collect mastic from domesticated Pistacia lentiscus var. Chia or mastic tree. Such trees are bioclimatically limited to south-eastern areas.



PICTURE 8

Genoese architecture at Pyrgi, southern Chios. Such settlements are an important asset for tourism.

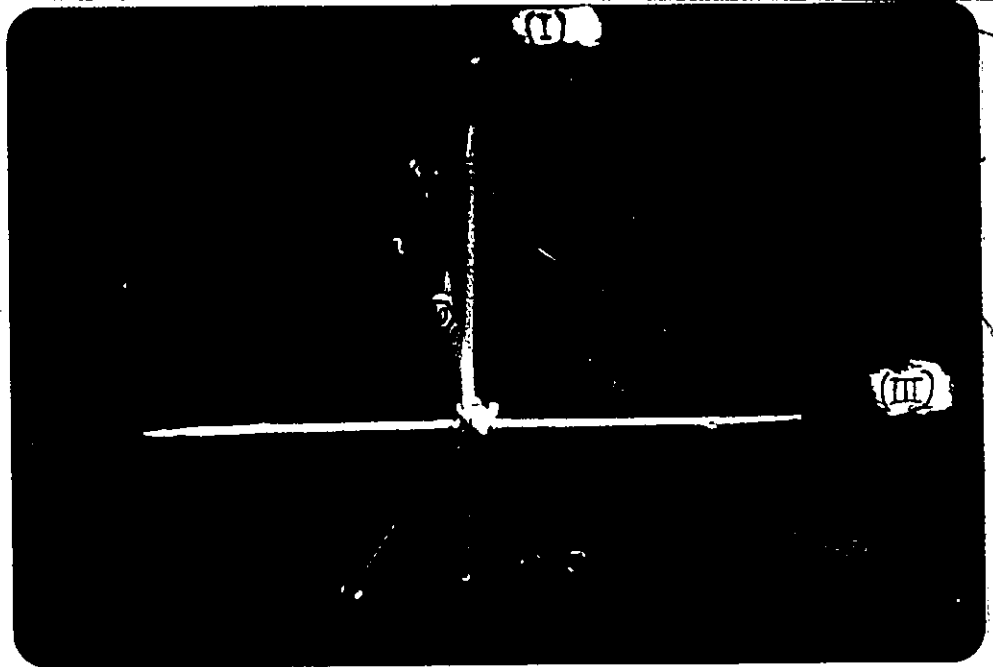


PICTURE 9

Three-dimensional view of the 15 years-variables in relation with factors I, II, and III.

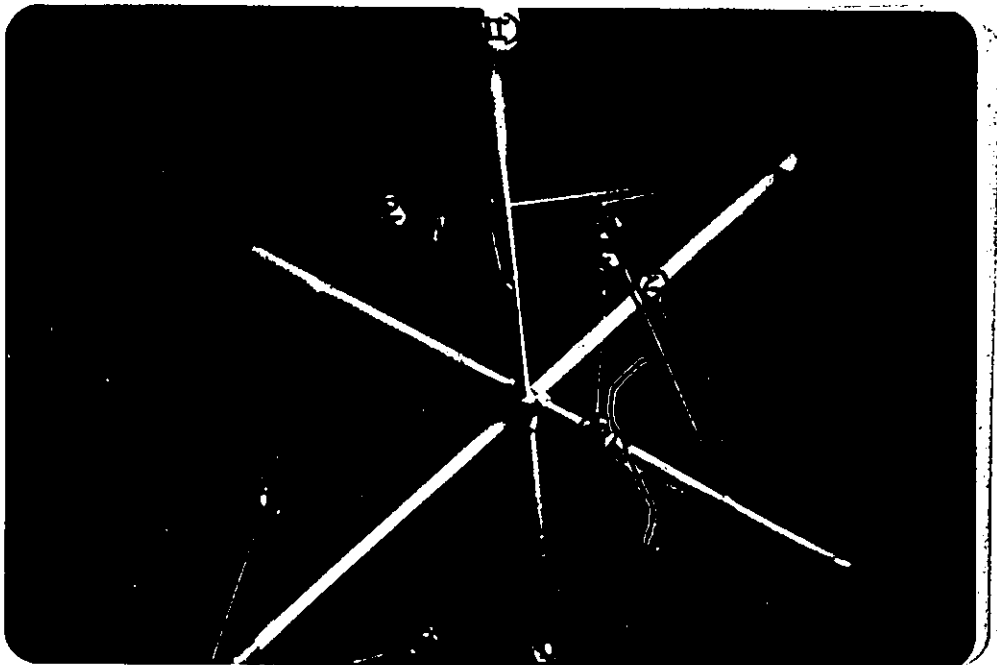
PICTURE 10

A three-dimensional view of factors I, II, and III, with the axis of factor II perpendicular to the page.



PICTURE 11

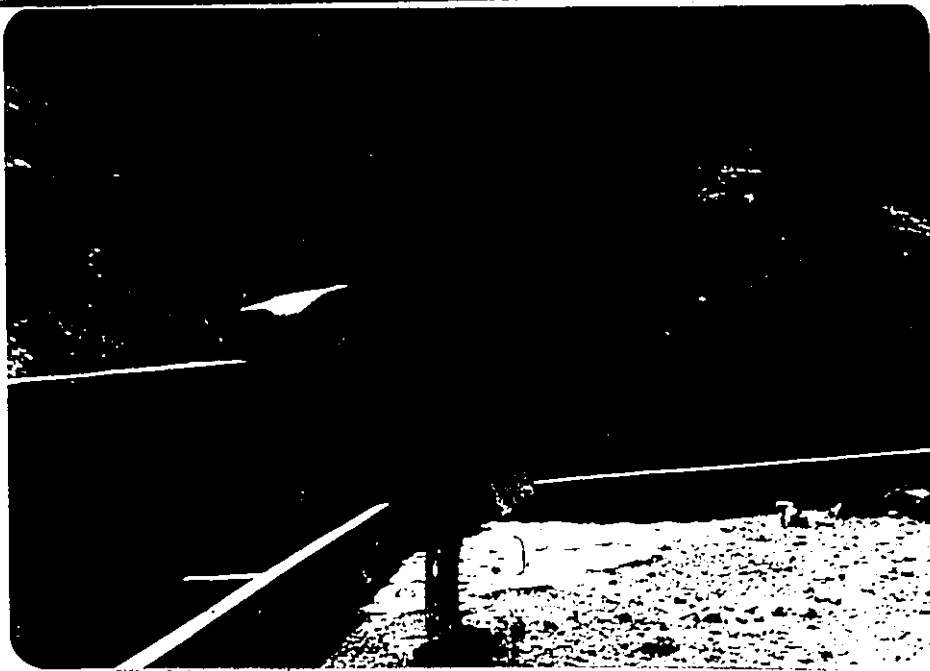
Another three-dimensional view of factors I, II, and III.





PICTURE 12

Vegetation cover ten years after a fire. At the background trees burned. (Site Agrelías, Kardamyla)



PICTURE 13

Typical structure for the watering of animals. It is visibly situated nearby the road for advertising rather than practical purpose. The founder's name appears always at the front. On the walls signs advertise various political parties for the elections of 1977. (Site between Kardamyla and Amades)



PICTURE 14

General view of Kardamyla, a typical pastoral community.



PICTURE 15

Burned area the same year that the picture was taken (1977). The garrigue formations remained intact. (Site Margaritis, Kardamyla)



PICTURE 16

General view of an area burned at 1977. The total stremas burned are more than 25,000. (North-eastern orientation, between Viki and Kabia)



PICTURE 17

Pinus brutia on poor, rocky soil. According to the forester of Chios, the root of this species was found to extend at a depth of 13 m.

Appendix A

CALCULATION OF THE 'INDIVIDUAL OBSERVATIONS' UGS, UGG, UPS, UPG, UFS, AND UFG

According to table 8, all the individual observations the code of which begins with the letter "U" are some function of the observations which refer on areas burned. The necessity and the logic for the creation of these "U" observations is presented below.

The existing data on areas burned provide a raw image of the phenomenon of fires. They show the yearly burned surface. However, the effect of a fire in regenerating the grazing areas extends beyond these yearly limits. Sheep and goats may graze certain areas burned for more than three years. Therefore, as it concerns sheep and goats, various areas burned obtain a specific importance; that of utilization of these burned areas by sheep and goats.

Certain constraints were considered for the calculation of such an utilization: firstly, fires regenerate the herbaceous vegetation of the range; such regeneration has been observed as diminishing after three years (Papanastasis - 1978; Mconey, Parsons - 1973); secondly, garrigue replaces herbaceous vegetation faster than maquis or trees, and the same holds true for the maquis vis-a-vis tree-formations; thirdly, fires in Chios indicate a periodicity of about 6 years; and, fourthly, goats are capable to graze wooded vegetation while sheep can not. These four points consist the constraints for the manipulation of the observations POF, PCF, and GAE, in order to construct indices of utilization of burned areas for sheep and goats.

The calculation was further based of the following assumptions: (1) The need for a range fire appears after: 4 to 5 years for garrigue; 6 years for partially tree-forested and maquis areas; and, 7 to 8 years for tree-forested areas. (2) In garrigue areas burned a sheep can graze all the burned area during the year of the burning; and, half of a burned area after one year (UGS) (the encroaching wooded vegetation is estimated to cover half of the area after one year [Papanastasis - 1978.]). Goats can graze the same areas during the first and the second years, and about half of the burned area during the third year (UGG). (3) In partially tree-forested and maquis areas burned, a sheep is estimated to be

able to graze all the burned area during the same year after a fire; two thirds during the first year after a fire; and, half of the burned area during the second year (UPS). Goats can graze the same areas during the same year after a fire and the two consecutive years, and one third of the burned area during the fourth year (UPG). (4) In tree-forested areas burned, a sheep can graze the whole burned area in the same year after a fire; four fifths of the burned area during the next year, and two fifths of the area during the third year (UFS). Goats can graze all the burned area during the same year of a fire; four fifths of the area during the first year after the fire; three fifths during the second year; two fifths during the third year; and, one fifth of the forested area burned during the fourth year after the year in which the ~~fire~~ has occurred.

To conclude, the "utilization" observations used in the analysis, have the following mathematical relationships with the observations GAF, PCF, and FCF:

individual	equals to...
UGS	$[GAF(t)] + 1/2 [GAF(t-1)]$
UGG	$[GAF(t)] + 1/2 [GAF(t-1)] + 1/2 [GAF(t-2)]$
UPS	$[PCF(t)] + 2/3 [PCF(t-1)] + 1/2 [PCF(t-2)]$
UPG	$[PCF(t)] + 2/3 [PCF(t-1)] + 1/2 [PCF(t-2)] + 1/3 [PCF(t-3)]$
UFS	$[FOF(t)] + 4/5 [FOF(t-1)] + 2/5 [FOF(t-2)]$
UFG	$[FOF(t)] + 4/5 [FOF(t-1)] + 3/5 [FOF(t-3)] + 1/5 [FOF(t-4)]$

BIBLIOGRAPHY

1. Abernathy G., et al, Brush eradicating, basin pitting and seeding machine for arid to semiarid rangeland, JOURNAL OF RANGE MANAGEMENT, No 3, 1973, pp. 188-192.
2. Adrianopoulos A. G., Forest, Agriculture and Pasture, AGRIC. BULLETIN, July - Sept. 1931 .*
3. Alexander E. R., Policy Analysis, ed. Catanese A. J., Snyder J. C., INTRODUCTION TO URBAN PLANNING, McGraw Hill, New York, 1979.
4. Alexandris S., Contribution to the investigation of causes resulting in drying out of coniferous plantations in terraced soils, The Forest, No 73 - 74, 1976, pp. 24 - 33.**
5. AMERICANA ENCYCLOPEDIA, Vol. 6, cit. CHIOS, Americana Corp., New York, 1973.
6. Amolohitis P. LAND USE MAP OF THE MUNICIPALITY OF KARDAMYLA OF CHIOS DEPARTMENT, (Map prepared for the Nomarchia of the Department of Chios), November 1961.
7. Apostolou A., Christopoulou M., CONTRIBUTION OF THE MOUNTAINOUS GRAZING AREAS IN THE DEVELOPMENT OF PASTURE (3d presentation), 3d Student Forestry Seminar, Thessaloniki, 1972. (Archives of the Technical Chamber of Greece).*
8. Aschman H., "Distribution and peculiarity of Mediterranean Ecosystems", MEDITERRANEAN TYPE ECOSYSTEMS, Ecol. Studies Vol. 7, Springer-Verlag, New York, 1973.
9. Association of Surveying Engineers of Greece, SUGGESTION FOR THE BILL 248/76 ON THE CREATION OF LAND REGISTRY SYSTEM, Technical Chamber of Greece, Documentation Centre, No 024, Athens, 1976.*
10. Batty, M., "On Planning Process", ed. Goodall, B., Kirby, A., RESOURCES AND PLANNING, Pergamon, Oxford, 1979.
11. Bentley, J., CONVERSION OF CHAPARRAL AREAS TO GRASSLAND, Forestry Service, Berkeley, California, 1967.

12. ed. Berry B. J. L., Comparative Factorial Ecology, ECONOMIC GEOGRAPHY, June (Supplement), 1971, pp. 209 - 367.
13. Biswas, A. K., Socio - Economic Considerations in Water Resources Planning, Water Resources Bulletin, No 4, 1973.
14. Bonneau M., Les Enrichissements risquent - ils de diminuer la Fertilité des sols ?, Revue Forestière Française, No 3, 1973, pp. 259 - 268.
15. Bourne L. S., URBAN SYSTEMS: Strategies for Regulation, Clarendon Press, Oxford, 1975.
16. Bussy J., La Genne et les Produits Résineux en France, Revue Forestière Française, No 3, 1971, pp. 377 - 384.
17. Canadian Hunger Foundation, Brace Research Institute, Appropriate Technology Primer, Eristics, No 259, 1977, pp. 360 - 367.
18. Cary M., THE GEOGRAPHIC BACKGROUND OF GREEK AND ROMAN HISTORY, Clarendon Press, Oxford, 1950.
19. Centre of Programming and Economic Research: Committee on Agriculture, EVOLUTION IN THE SECTOR OF AGRICULTURE - Final Report, Long - Term Programme (1970 - 1985), Athens, 1972.*
20. Chouliaras A., SUMMARY REPORT ON THE METHODS OF IMPROVEMENT AND EXPLOITATION OF GRAZING AREAS (Fertilization of Grazing Areas from the Air), Institute of Animal Improvement and Management, Yannitsa, 1971.*
21. Chouliaras A., Spontis D., Droucalis I., Karantonis C., Vassilopoulos A., REPORT ON THE PROGRAMME OF IMPROVEMENT AND EXPLOITATION OF THE PASTURES OF GREECE, (Working Committee composed by the 314092/ 5223/ 13 - 9 - 75 Decision of the Vice - Minister of Agriculture), Athens, Dec. 1975.*
22. Chouliaras A., USAGE OF BRUSHLANDS, Ministry of Agriculture, 4 - 5 - 1977 (Internal report of the Ministry of Agriculture).*
23. Christodouloupoulos A., "The Reforestations in Cyprus", The Forest, No 21, 1953, pp. 37 - 45.*
24. Clapham W. B. Jr., NATURAL ECOSYSTEMS, MacMillan, New York, 1973.

25. Coddington A., Opschoor H., Pearce D., "Limites de l'Analyse des Coûts - Avantages appliquée aux Programmes qui ont une incidence sur l'environnement", in OCDE, PROBLEMES. D'ÉCONOMIE DE L'ENVIRONNEMENT, (Compte - Rendu du Séminaire tenu à l'OCDE au cours de l'été 1971), OCDE, 1971.
26. Congrès Forestier Mondial, Revue Forestière Française, (édition spéciale pour le Congrès tenu en Argentine en 1972), 1973, pp. 417 - 496.
27. Dafis S. A., CLASSIFICATION OF THE FOREST VEGETATION OF GREECE, Ministry of Agriculture, Athens, 1976.*
28. Dahlberg K. A., "Ecological effects of current Development Processes in Less Developed Countries", in eds. Vann A. and Rogers P., HUMAN ECOLOGY AND WORLD DEVELOPMENT, Plenum Press, London, 1974, pp. 71 - 92.
29. Dansereau P., HARMONY AND DISORDER IN THE CANADIAN ENVIRONMENT, Canadian Environmental Advisory Council: Occasional Paper No 1, Environment Canada, Ottawa, 1975.
30. Davies W., "The Carob Tree and its Importance in the Agricultural Economy of Cyprus", Economic Botany, No 4, 1970, pp. 460 - 470.
31. Decazos P. A., "The Problem of Pasture in Greece", Agricultural Bulletin, July 1940.*
32. Departmental Council of Chios, "Recommendations of the Departmental Council on the Contemporary Problems of Chios", ed. Pamboukis P. K., CHIOS AND ITS CONTEMPORARY PROBLEMS, Greek Bank of Commerce, Athens, 1961, pp. 90 - 97.*
33. Di Castri F., "Soil Animals in Latitudinal and Topographical Gradients of Mediterranean Ecosystems", eds. Di Castri F. and Mooney H. A., MEDITERRANEAN TYPE ECOSYSTEMS, Springer - Verlag, New York, 1973, pp. 172 - 189.
34. Diapoulis C. A., CERATONIA SILIQUA, L., WITH EMPHASIS IN GREECE, Ministry of Agriculture, Athens, 1950.*
35. Dimitriou M., "Our Forests Diminish Every Year", Forestry Chronics, No 10 - 11, 1974, pp. 379 - 380.*
36. Dinard A., "Influence du Reboisement sur les Ressources en eau en Afrique du Sud", Revue Forestière Française, No 3, 1971, pp. 401 - 406.

37. Directorate of Agriculture of Chios, THE SHEEP OF CHIAN RACE, Panchiaki, Chios City, 1956.*
38. Dregne H. E., "Desertification: Man's abuse of the Land", Journal of Soil and Water Conservation, No 1, 1978, pp. 11 - 14.
39. Editorial (a), "The Antipyric Forest Fight", Forestry Chronicles, No 5 - 6, 1974, p. 153.*
40. Editorial (b), "The Cry of the Pen: New Mountainous Forest Policy", Forestry Chronicles, No 10 - 11, 1974, pp. 347 - 352.*
41. Editorial, "To save the Forests from the Fires", Forestry Chronicles, No 6, 1975, pp. 139 - 141.*
42. Editorial, "A new Ministry is needed: the Ministry of Forests and Environment", Forestry Chronicles, No 4 - 5, 1976, pp. 91 - 94.*
43. Editorial, "The diminishing of Forests", Forestry Chronicles, No 6, 1977, pp. 139 - 143.*
44. Editorial, "On the Incentives to the Cooperatives", Bulletin of the Federation of Greek Industries, No 389, 1978, p. 4.*
45. Efstathiadis N., "Forest - Tree Foliage Utilization", The Forest, No 75 - 78, 1977, pp 34 - 38.**
46. Environment Canada: Lands Directorate, OR-OS REFERENCE SYSTEM COMPONENT III, Environment Canada, 1977.
47. Evangelinidis M., "Regional Development - Core Periphery Relations; The Greek case", Greek Review of Social Research, No 24, 1975, pp. 310 - 340.
48. Farmer W. P., Gibb J. A., "Land - Use Planning", ed. Catanese A. J. and Snyder J. C., INTRODUCTION TO URBAN PLANNING, McGraw Hill, New York, 1979.
49. Finlayson W., "Les Forets de Cypre et la Silviculture Cypriote", Revue Forestiere Francaise, No 3, 1971, pp. 345 - 352.
50. Firat F., "The Economic Conditions of the Turkish Forestry", The Forest, No 20, 1952, pp. 52 - 60.*
51. Fontaine R., "The Forestry Sector in Today's Setting", Unasylva, No 100, 1971, pp. 9 - 14.

52. Forestry Service, Department of Agriculture of Greece, VEGETATION MAP OF CHIOS DEPARTMENT, prepared by the forester of Mytilini, February 24, 1959.
53. Francis G., ENVIRONMENT AND DEVELOPMENT - PHASE III, PROSPECTIVE AND ECODEVELOPMENT: STRATEGIES FOR ACTION, (Report of a workshop Dec. 1 - 3, 1977), Environment Canada - Canadian International Development Agency, Ottawa, 1978.
54. Friedmann J., REGIONAL DEVELOPMENT POLICY, Cambridge, Mass., 1966.
55. Gertler L. O., REGIONAL PLANNING IN CANADA: A Planner's testament, Harvest House, Montreal, 1972.
56. Giacobe A., "Rimboschimenti in Sicilia", L' Italia Forestale e Montana, No 3, 1969, pp. 167 - 168. (French and English Summary).
57. Gilbert A. G., "Growth Poles - The instant solution to Regional Problems ? ", ed. Thoman R. S., VOLUME I: METHODOLOGY AND CASE STUDIES, (Proceedings of the Commission on Regional Aspects of Development of the IGU), IGU, 1974, pp. 111 - 128.
58. Gogos A., "On the method of development of seedings in paperpots for silviculture", THE FOREST, No 71 - 72, 1975, pp. 21 - 36**.
59. Grekiotis P., "Observations on the expansion and Biological Composition of the Vegetation of the Country: A Phytogeographical Perspective", THE FOREST, No 25 - 28, 1954, pp. 44 - 47 *.
60. Grispos P., "General Review from a Field-Trip at the Cyprus Forests", THE FOREST, No 21, 1953, pp. 5 - 36.*
61. Grispos P., FOREST HISTORY OF CONTEMPORARY GREECE, Ministry of National Economy, Athens, 1973.*
62. Hachette World Guides, GREECE, Hachette, Paris, 1964.
63. Hare K. F., CLIMATE AND DESERTIFICATION, UN Desertification Conference, Nairobi 1977, UN code A/CONF/74/5
64. Harrant H., Jarry D., "The Thickets and Woods of the Mediterranean Region", ed. Eyre S.R., WORLD VEGETATION TYPES, MacMillan, London, 1971, pp. 174 - 185.
65. Harvey M.E. Greenberg P., "Spatio-Temporal Growth Trends in a Developing Country: The case of Sierra Leone", in Helleiner P. M., Stohr W., SPATIAL ASPECTS

OF THE DEVELOPMENT PROCESS: VOLUME II, Proceedings of the Commission on Regional Aspects of Development of the IGU), IGU, 1974, pp. 185 - 214.

66. Hilhorst J. G. M., "Regional Development Theory: An attempt to Synthesise", SERIES MINOR, Institute of Social Studies, Vol XV, 1967, p. 28 (in Raay H. G. T. Van, 1974, p 195).
67. Holt R. T. Richardson J. M. Jr., "Competing Paradigms in Comparative Politics", ed. Holt R. T. Turner J. E., THE METHODOLOGY OF COMPARATIVE RESEARCH, The Free Press, New York, 1970, pp. 21 - 72.
68. Hughes J. D., ECOLOGY IN ANCIENT CIVILIZATIONS, University of New Mexico Press, Albuquerque, 1975.
69. Johnson E. A., THE ORGANIZATION OF SPACE IN DEVELOPING COUNTRIES, Harvard University Press, Cambridge, Mass., 1970.
70. Kafentzis E., HISTORY OF RECENT YEARS OF GREECE, Educational Book Printing Organization (OEDB), Athens, 1977.*
71. Karaliolios A., "The forests of Chios through the centuries", THE PEOPLE (O LAOS), (Chian newspaper), ?, 1976.*
72. Karaliolios A., "Care to the Forests: Recommendations to the shepherds", THE PEOPLE (O LAOS), (Chian newspaper), May 31, 1977.*
73. Katsanos (a) A. M., A COMPARATIVE STUDY OF FORESTS ON AN ANNUAL BASIS FOR THE PERIOD 1965 - 1969, Ministry of Agriculture, Athens, 1970.*
74. Katsanos (b) A. M., BEHAVIOUR OF FOREST FIRES, Ministry of Agriculture, Athens, 1970.*
75. Katsanos A. M., "The behaviour of fires in the various types and forms of our forests", FORESTRY CHRONICS, No 7 - 8, July August 1977, p. 177 - 180.*
76. Kavadias G. B., PASTEURS NOMADES MEDITERRANEENS - Les Saracatsans de Grece, Gauthier Villars, Paris, 1965.
77. Kenyon P., "The nature and extend of world poverty", in eds Vann A. and Rogers P., HUMAN ECOLOGY AND WORLD DEVELOPMENT, Plenum Press, London, 1974, pp. 1 - 16.
78. Kim Jae-On, "Factor Analysis", in Nie N.H., Hull C. H. et al, SPSS: STATISTICAL PACKAGE FOR THE SOCIAL SCI-

ENCES, second ed., MacGraw-Hill, New York, 1975, pp. 468 - 514.

79. Klenne M., SUGGESTIONS FOR THE DEVELOPMENT OF GREEK FORESTS AND GRAZING AREAS, Athens, 1955.*
80. Kokkinidis G., "Developmental Planning within one sector of the Economy", THE FOREST, No 63 - 64, 1974.**
81. Konstantellos A., "Greek reforestation techniques" (paper presented at the 4th Conference of the joint Sub-Commission on Mediterranean Forestry Problems (Proceedings), THE FOREST, No 25 - 28, 1954, pp. 84 - 92.*
82. Kossenakis G., Thalassinos D., "Soil Conservation in Algeria", THE FOREST, No 18, 1952, pp. 23- 29.*
83. Kossenakis G., "Resin Cultivation in Greece" (Paper presented at the 4th Conference of the joint Sub-Commission on Mediterranean Forestry Problems (Proceedings), THE FOREST, No 25 - 28, 1954, pp. 93 - 101.*
84. Koukios M., "The Energy role of Agricultural Residuals (The Photosynthetic Exploitation of Solar Energy)", Proceedings of the Conference of the Technical Chamber of Greece on the Contemporary Problems of the Greek Economy, Athens, May 1977, TECHNICAL CHRONICS, May - June 1978, pp. 41 - 49.*
85. Kovda V. A., Rozanov B. G., Onischenko S. K., SCHEME OF ARIDITY AND DROUGHT PROBABILITY, UN Desertification Conference, Nairobi, 1977.
86. Kyriakos (a) G., FORESTRY POLICY: PAST AND PRESENT, Ministry of Agriculture, Athens, 1940.*
87. Kyriakos (b) G., OUR PASTURE, Ministry of Agriculture, Athens, 1940.*
88. Laborie J., "La politique de reboisement des terres liberees par l' Agriculture en France et dans la C.E.E.", These de Doctorat, Universite de Toulouse, 1972. from THE FOREST, No 79 - 80, Jan - Jun 1978, p. 69.*
89. Lampsidis G., "Grazing Areas and Shepherds" (Conclusions from the Pasture Conference, Iraklio - Greece, Sept. 1978), JOURNAL OF THE ORGANIZATION OF AGRICULTURAL INSURANCE, (O.G.A. - monthly review), No 9, Sept. 1978, pp. 18 - 20.*
90. Lasuen J. R., "A generalization of the Growth - Pole notion", in ed. Thoman R. S., VOLUME I: METHODOLOGY AND CASE STUDIES, Proceedings of the Commission on Regional

Aspects of Development of the International Geographic Union, I.G.U., 1974.

91. Loukakis P., "Rehierarchization of the Network of the Settlements of the Country: Basic Goal in the Efford for Regional Development", TECHNICAL CHRONICS, No 12, 1977, pp. 12 - 40.*
92. Loukitsas P. J., THE IMPACT OF TOURISM ON REGIONAL DEVELOPMENT: A COMPERATIVE ANALYSIS OF THE GREEK ISLANDS, Cornell University, Ithaca, New York, 1977.
93. Makryniotis L., "The Forest as an Important Factor from the Point of view of Economy, Hydronomy, Soil Protection and Environment", THE FOREST, No 63 - 64, 1974.**
94. Markopoulos A., Loukakis P., Papadodimas N., Sarandakos D., Tsakonas V., Papagrigoriou S., Diamandopoulou G., "Criteria for Spatial Allocation of Industries", TECHNICAL CHRONICS, No 8 - 9, 1976, pp. 51 - 61.*
95. Massavetas G., "The Forest Fires", FORESTRY CHRONICS, No 7 - 8, 1977, pp. 171 - 175.*
96. Mehmet O., ECONOMIC PLANNING AND SOCIAL JUSTICE IN DEVELOPING COUNTRIES, Croom Helm, London, 1978.
97. Milios I., ELEMENTS OF MANAGEMENT AND IMPROVEMENT OF PASTURES, Ministry of Agriculture, Directorate of Agricultural Extension, 1953.*
98. Ministere d' Agriculture, "Production Agricole de la Grece: 1955 et 1956", BULLETIN AGRICOLE, troisieme periode, treizieme fascicule, Athenes, 1958.
99. Ministry of Agriculture, DISTRIBUTION OF FORESTS IN GREECE, National Press, Athens, 1964.
100. Ministry of Coordination and Programing, PROGRAMME OF ECONOMIC AND SOCIAL DEVELOPMENT 1976 - 1980, National Press, Athens, 1977.*
101. Mooney H. A., Parsons D. J., "Structure and Function of the California Chaparral - An Example from San Dimas", in eds Di Castri F., Mooney H. A., MEDITERRANEAN TYPE ECOSYSTEMS: ORIGIN AND STRUCTURE, Springer-Verlag, New York, 1973.
102. Moore I., GRASS AND GRASSLANDS, Collins, London, 1966.
103. Morandini R., "Problems of Conservation, Management and Regeneration of Mediterranean Forests: Research Priorities", in UN Man and the Biosphere Programme (M.A.B.),

MEDITERRANEAN FORESTS AND MAQUIS: ECOLOGY, CONSERVATION AND MANAGEMENT, Technical Note 2, UNESCO, Paris 1977, pp. 73 - 79.

104. Kouzelis N. P., MODERN GREECE: FACETS OF UNDERDEVELOPMENT, Macmillan Press, London, 1978.
105. Nakos N., "Why forests are burned and how they revenge us", FORESTRY CHRONICS, No 8 - 9, 1974, pp. 288 - 290.*
106. Natsis A., "Transformation of Brushlands to Grasslands", FORESTRY CHRONICS, No 10 - 11, 1974, pp. 393 - 397.*
107. Nicolaidis M., "Drought Resistance of some Conifer Species", THE FOREST, No 57 - 58, 1972, pp. 44 - 53.**
108. NSSG: National Statistical Service of Greece, ANNUAIRE STATISTIQUE DE LA GRECE: 1930, Imprimerie Nationale, Athenes.
109. NSSG: National Statistical Service of Greece, ANNUAIRE STATISTIQUE DE LA GRECE: 1938, Imprimerie Nationale, Athenes.
110. NSSG: National Statistical Service of Greece, RESULTS OF THE CENSUS OF AGRICULTURE OF GREECE: 1950, National Press, Athens, 1958.
111. NSSG: National Statistical Service of Greece, DISTRIBUTION OF THE COUNTRY'S AREA BY BASIC CATEGORIES OF LAND-USE, Pre-Census data of the Agriculture - Livestock Census of March 19, 1961, Vol C:1, Athens, 1962.
112. NSSG: National Statistical Service of Greece, AGRICULTURAL STATISTICS OF GREECE: 1961, Crop areas and number of trees, Vol 1 C:2, Athens, 1962.
113. NSSG: National Statistical Service of Greece, AGRICULTURAL STATISTICS OF GREECE: 1961, Crop and Livestock production and number of domesticated animals, Vol 2 C:3, Athens, 1962. AGRICULTURAL STATISTICS OF GREECE: 1962, Crop areas and number of trees, Vol 1 C:4, Athens, 1964.
114. NSSG: National Statistical Service of Greece, AGRICULTURAL STATISTICS OF GREECE: 1962, Crop and Livestock production and number of domesticated animals, Vol 2 C:6, Athens, 1964.
115. NSSG: National Statistical Service of Greece, AGRICULTURAL STATISTICS OF GREECE (Cultivated areas, Irrigated

Crops by categories, Number of Trees and Agricultural Machinery, Crop and Livestock Production, Number of Domesticated, Production of Certain Forest Products years 1963 to 1975.

116. NSSG: National Statistical Service of Greece, DISTRIBUTION OF THE COUNTRY'S AREA BY BASIC CATEGORIES OF LAND-USE, Pre-Census data of the Agriculture - Livestock Census of March 14, 1971, Vol C:23, Athens, 1975.
117. NSSG: National Statistical Service of Greece, MAP OF THE DEPARTMENT OF CHIOS; edition 1961 (revision 1972), NSSG, 1972.*
118. NSSG: National Statistical Service of Greece, STATISTICAL YEARBOOK OF GREECE, Athens, years 1965, 1974.
119. Odum E., FUNDAMENTALS OF ECOLOGY, 2nd ed., W. B. Saunders Co., Philadelphia, 1959.
120. One Hisao, "Social Costs and Environmental Capacities", ENVIRONMENT, REGIONAL SCIENCE AND INTERREGIONAL MODELING, Proceedings of the International Conference on Regional Science Energy and Environment, Lourain, May 1975, Springer-Verlag, Berlin - New York, 1976.
121. Pamboukis P., "The emigrant Chians and their Contribution to the Development and Progress of their Motherland", in ed. Pamboukis P., CHIOS AND ITS CONTEMPORARY PROBLEMS, Greek Bank of Commerce, Athens, 1961.*
122. Papagiavis G., "Complete awareness for Monitoring and Fighting Forest Fires", FORESTRY CHRONICS, No 8 - 9, 1974, pp. 259 - 262.*
123. Papaioannou J. K., "Hybridism of Paramediterranean Pines: Impact on Resin Production, with emphasis to Greece", Paper presented in the 4th Conference of the joint Sub-Commission on Mediterranean Forestry Problems, THE FOREST, No 25 - 28, 1954, pp. 104 - 107.*
124. Papanichail P., EXPERIMENTS OF RESIN EXTRACTION ON PINUS BRUTIA OF THE FOREST PLATANIA OF RHODES ISLAND, Institute of Forestry Research, Athens, 1970.*
125. Papanastasis V., "Range Development in Cyprus and Israel Provides Valuable experience for Improvement of Rangelands of Southern Greece", THE FOREST, No 75 - 78, 1977, pp. 26 - 33.**
126. Papanastasis V., "Early Succession after a Fire in a Maquis - type Brushland of Northern Greece", THE FOREST, No 79 - 80, 1978, pp. 19 - 26.**

127. Papathanassopoulos P. A., BEFORE THE END OF THE WATER..., Typaldos, Athens, 1963.*
128. Papayannopoulos A. D., "Forestry and the Dynamic Forest Character of Marginal Lands", FORESTRY CHRONICS, No 8 - 9, 1974, pp. 303 - 309.*
129. Papayannopoulos A. D., "Unsuccessful Census leads to Improper Pastoral Policy", FORESTRY CHRONICS, No 4 - 5, 1976, pp. 99 - 104.*
130. Parliament of Greece, "Minutes on the Parliamentary Discussion on the Bill on Regional Planning and Environment", MINUTES OF PARLIAMENT, Meetings of May 19, 1976 and May 27, 1976, Parliament of Greece, Athens, 1976.*
131. Paskoff R. P., "Geomorphological Processes and Characteristic Landforms", eds Di Castri P., Mooney H. A., MEDITERRANEAN TYPE ECOSYSTEMS, Springer-Verlag, New York, 1973, pp. 53 - 60.
132. Patelis J., "Problematics on Tourist Development of the Mountainous Regions of Epiros", TECHNICAL CHRONICS, Oct. Nov. Dec. 1977, pp. 115 - 117.*
133. Patelis J., "Elements of the Greek Rural Space", TECHNICAL CHRONICS, No 8, 1978, pp. 82 - 105.*
134. Pearce D. W., ENVIRONMENTAL ECONOMICS, Longman, London, 1976.
135. Perdikis Ch., "On the Development of Chios Pasture", ed. Pamboukis P. K., CHIOS AND ITS CONTEMPORARY PROBLEMS, Greek Bank of Commerce, Athens, 1961.*
136. Perris N. Z., NORTHERN CHIOS, Chios, 1966.*
137. Phipps M., RECHERCHES SUR LA DISTRIBUTION GEOGRAPHIQUE DE L'UTILISATION DU SOL, These de Doctorat, Toulouse, 1969.
138. Pittas A., "The Antipyric zones for the control of forest fires", FORESTRY CHRONICS, No 5 - 6, 1974, pp. 186 - 190.*
139. Pittas A., "On the problems of the Northern Villages of Chios", ed. Pamboukis P. K., CHIOS AND ITS CONTEMPORARY PROBLEMS, Greek Bank of Commerce, Athens, 1961, pp. 37 - 44.*
140. Proceedings of the meeting of Foresters, Athens, Oct. 1949, THE FOREST, No 11 - 12, 1949.*

141. Quezel P., "Forests of the Mediterranean Basin" in UN Man and the Biosphere Programme (M.A.B.), MEDITERRANEAN FORESTS AND MAQUIS: ECOLOGY, CONSERVATION AND MANAGEMENT, Technical note 2, UNESCO, Paris, 1977, pp. 9 - 32.
142. Raay H. G. T. Van, "Some recent trends in thinking on Regional Planning", in ed. Thoman R. S., VOLUME I: METHODOLOGY AND CASE STUDIES, Proceedings of the Commission on Regional Aspects of Development of the International Geographic Union, I.G.U., 1974.
143. Ramade B. F., ELEMENTS D' ECOLOGIE APPLIQUEE, Ediscience, Paris, 1974.
144. Reif, B., MODELS IN URBAN AND REGIONAL PLANNING, Intertext, New York, 1973.
145. Rogers, C. R., "Freedom to Learn Theory", ed. Sahakian., W. S., LEARNING: SYSTEMS, MODELS, AND THEORIES, Rand McNally College Publishing Company, Chicago, 1976.
146. Rokos D., "Cadastral Surveys and Land-Use and a Fundamental Infrastructure for Physical Planning", TECHNICAL CHRONICS, trimestral edition, No 3, 1976, pp. 37 - 44.**
147. Rokos D., "The inadequacies of Greece in Basic Infrastructural Studies and the E.E.C.", TECHNICAL CHRONICS, Sept. 1977, pp. 67 - 74.*
148. Romaios C., GREECE: Volume: Folklor and Traditions over 4,000 years, Giovanis, Athens, 1970.
149. Rondinelli D. A., Ruddle K., "Integrating Spatial Development", EKISTICS, No 257, 1977, pp. 184 - 194.
150. ed. Rossiter S., THE BLUE GUIDES: GREECE, Ernest Benn Ltd., London, 1973.
151. Sachs I., ENVIRONMENT AND DEVELOPMENT - A NEW RATIONALE FOR DOMESTIC POLICY FORMULATION AND INTERNATIONAL COOPERATION STRATEGIES, Environment Canada - Canad. Intern. Develop. Agency, Ottawa, 1977.
152. Sad H., "Le Gemmage sur Pinus brutia et les resultats obtenus en Turquie", REVUE FORESTIERE FRANCAISE, No 5, 1972, pp. 396 - 397.
153. Seligman N., Dour G., "Development of the tree story and ground cover in Pine plantations of lower Galille and the Menashe hills", LA - YAARAN, No 3, 1970, pp. 65 - 79. (From THE FOREST, No 61 - 62, 1973, pp. 47 - 48).*

154. Semple A. T., GRASSLAND IMPROVEMENT, Leonard Hill, London, 1970.
155. Shachar A., Stohr W., "Final report: Colloquium on Regional Inequalities of Development", ed. Thoman R. S., VOLUME I: METHODOLOGY AND CASE STUDIES, Proceedings of the Commission on Regional Aspects of Development of the International Geographic Union, I.G.U., 1974.
156. Sideridis D. P., RESOURCE SHED (PLOUTOKRITIS): The Key for the Development of the Mountainous and islandic areas, National Union of Forestry Technologists, Athens, 1977.*
157. Smith R. L., ECOLOGY AND FIELD BIOLOGY, Harper and Row, New York, 1966.
158. Soumelidis A., "On the Development of Chios Agriculture", ed. Pamboukis P. K., CHIOS AND ITS CONTEMPORARY PROBLEMS, Greek Bank of Commerce, Athens, 1961, pp. 15 - 24.*
159. Sprincova S., "Functional changes in Agricultural Settlements in a Backward Region", in eds Bencze I., Bova G., REGIONAL STUDIES: METHODS AND ANALYSES, (Selected papers admitted at the I.G.U.'s European Regional Conference - Budapest), Akademiai Kiado, Budapest, 1974.
160. Spur S. H., Arnold K., LE ROLE DES FORESTIERES FACE AU CHANGEMENTS ECONOMIQUES ET SOCIAUX, (Rapport sur la Consultation Mondiale sur l'education et la formation Forestieres), FAO/SWR/TE 65, Rome, 1972.
161. S. T., "The Mastic Brush of Chios" FORESTRY CHRONICS, No 6, 1975, p. 161.*
162. Stassinopoulos C., "Contribution in the investigation on the Prevention and Suppression of the Forest Fires of Attica, and generally on the Formation of the Evergreen and broad-leaved", THE FOREST, No 69 - 70, 1975, pp. 23 - 41.**
163. Stefanou A., "Festival of forest Fires", FORESTRY CHRONICS, No 6, 1975, pp. 149 - 152.*
164. Stohr W., "Summary of Topic I: Concentration and Transmission of Development Process in space", ed. Hel-leiner F. M., Stohr W., VOLUME II: SPATIAL ASPECTS OF THE DEVELOPMENT PROCESS, (Proceedings of the Commission on Regional Aspects of Development of the International Geographic Union), I.G.U., 1974.

165. Stone W. G., Inch R. S., GEOGRAPHIC FUNDAMENTALS, MacGraw Hill, New York, 1963.
166. Supreme Economic Council, "Advisory Opinion of the Supreme Economic Council on the Problem of Pasture in Greece", AGRICULTURAL BULLETIN, July 1940.*
167. Technical Chamber of Greece and National Greek Union of Surveying Engineers, "The Land Registry of Greece", TECHNICAL CHRONICS, No 7 - 8, 1977, pp. 24 - 27.*
168. Technical Chamber of Greece, "Issues on Regional Planning: The Bill 360/76", TECHNICAL CHRONICS, (Volume Dedicated to Regional Planning Issues), January 1978.*
169. Tett, C. R., "Education Systems: Appropriate Education and Technology for Development", ed. Congdon, R. J., INTRODUCTION TO APPROPRIATE TECHNOLOGY. Toward a Simpler Life-Style, Rodale Press, Emmaus, PA, 1977.
170. Tewfik M., "A Pilot Project for the Khors - Eastern Sudan", EKISTICS, No 258, 1977, pp. 268 - 276.
171. Thrower N. J. W., Bradburry D. E., "The Physiography of the Mediterranean Lands with Special Emphasis on California and Chile", eds. Di Castri F., Mooney H. A., MEDITERRANEAN TYPE ECOSYSTEMS, Springer-Verlag, New York, 1973, pp. 37 - 52.
172. Timbal J., "Application des Techniques Ecologiques aux Reboisements en Tunisie", REVUE FORESTIERE FRANCAISE, No 1, 1971, pp. 25 - 37.
173. Tomaselli R., "Degradation of the Mediterranean Maquis", in UN Man and the Biosphere Programme (M.A.B.), MEDITERRANEAN FORESTS AND MAQUIS: ECOLOGY, CONSERVATION AND MANAGEMENT, Technical notes 2, UNESCO, Paris, 1977, pp. 33 - 72.
174. Tsoumis I. G., "The Stock Breeding System of Greece", AGRICULTURAL BULLETIN, June 1939.*
175. UNESCO Man and the Biosphere Programme (M.A.B.) EXPERT PANEL ON PROJECT 6: IMPACT OF HUMAN ACTIVITIES ON MOUNTAIN ECOSYSTEMS, (Salzburg Jan. 29 - Feb. 4, 1973), (Sc. 73/Conf. 615/2), Paris, 1973.
176. UNESCO Man and the Biosphere Programme (M.A.B.) EXPERT PANEL ON PROJECT 7: ECOLOGY AND RATIONAL USE OF ISLAND ECOSYSTEMS, Final Report, (Paris, June 26 - 28, 1973), (Sc. 73/Conf 616/4), Paris, 1973.

177. UNESCO Man and the Biosphere Programme (M.A.B.) EXPERT PANEL ON PROJECT 2: ECOLOGICAL EFFECTS OF DIFFERENT LAND-USES AND MANAGEMENT PRACTICES ON TEMPERATE AND MEDITERRANEAN LANDSCAPES, Final Report, (Paris, April 16 - 19, 1974), (Sc. 74/Conf 660/5), Paris, 1974.
178. UN FAO, LAND DEGRADATION, FAO-Soils Bulletin 13, Rome, 1976.
179. UN Desertification Conference, SYNTHESIS OF CASE STUDIES OF DESERTIFICATION - Region of Oqlat Merteba, Tyndisia, (A/Conf. 74/4), UNESCO, 1977.
180. UN Man and the Biosphere Programme, REGIONAL MEETING ON INTEGRATED ECOLOGICAL RESEARCH AND CONSERVATION ACTIVITIES IN THE NORTHERN MEDITERRANEAN COUNTRIES, Final Report, (Potenza, Oct. 27 - 31, 1975), Unesco, 1977.
181. Union of Foresters Public Servants, "Memorandum of the New Administration of the Union of Foresters Public Servants to the Minister of Agriculture on the Formation of a New Organization of the Ministry of Agriculture", FORESTRY CHRONICS, No 4 - 5, 1976, pp. 125 - 127.*
182. UNRISD, A REVIEW OF RECENT AND CURRENT RESEARCH CONDUCTED AT THE INSTITUTE, Research Paper No 1, UNRISD, Geneva, 1968.
183. Urgenc S., "Croissances Initiales compares de Pinus brutia, Pinus maritima et Pinus radiata en zone Mediterranee Turque", REVUE FORESTIERE FRANCAISE, No 2, 1972, pp. 115 - 117.
184. Vovolinis S. A., "To face the Truth", BULLETIN OF THE FEDERATION OF GREEK INDUSTRIES, No 372 - 373, 1978, pp. 27 - 28.*
185. Warren A., Maizels J. K., ECOLOGICAL CHANGE AND DESERTIFICATION, UN Desertification Conference, Nairobi 1977, (A/Conf 74/7), UNESCO, 1977.
186. Yannakos N., "Cyprus Forestry", FORESTRY CHRONICS, No 8 - 9, 1974, pp. 310 - 317.*
187. Yannopoulos T., REASONS FOR THE ABANDONMENT OF OUR VILLAGES, Athens, 1974.*
188. Yeates M., AN INTRODUCTION TO QUANTITATIVE ANALYSIS IN HUMAN GEOGRAPHY, MacGraw Hill, New York, 1974.
189. Zech W. et al, "Acacia Cyanophylla as a nurse for Pines in Afforestation work on the Mediterranean Coast of An-

atolia, Turkey", FORSTWISSENSCHAFTLISHES CENTRALBLATT,
Vol 3, 1973, pp. 111 - 119. (From FORESTRY ABSTRACTS,
Vol 4, 1974, p. 155.

* In Greek.

** In Greek with English or French summary.