

RANGELAND SURVEY OF MOUNTAINS VORAS AND TZENA IN N. GREECE, FOR THE DETERMINATION OF THE PRODUCTIVITY

PANAGIOTIS PLATIS (*) - DIMITRIOS TRAKOLIS (**) - IOANNIS MELLADIS (***)

Rangelands cover about 5 million ha in Greece or 40% of the whole country.

These areas are grazed by a substantial number of domestic animals, that means about 8 million sheep, 4 million goats and 600,000 cattle, while they provide additional goods and services, such as wildlife conservation, soil protection and outdoor recreation opportunities. The proper management and exploitation of these important resources requires the good knowledge not only their exact size but also their species composition, soil quality, range condition and productivity. The acquisition of this knowledge can be obtained by inventorying their potential productivity in order to facilitate the implementation of improvement and restoration projects.

A useful system of rangelands inventory presupposes their classification in several levels, in order to better exploit their potential productivity. In Greece, four classification levels have been suggested: type, form, series and subtype (Papanastasis, 1989). Type is the highest and largest level, characterized by the general appearance and the physiognomy of the vegetation. The form indicates the leaf and stems' morphology of the dominant vegetation, the series specifies the dominant species, while the subtype the

ABSTRACT

The rangelands of the mountains Voras and Tzena, in N. Greece, have been inventoried with the use of orthophotomaps and Geographic Information Systems (G.I.S.). The classification criterion used was the dominant vegetation. Each inventory unit was classified into types, forms, series and subtypes of range vegetation and was evaluated for its surface area. The information collected included surface areas, vegetation type, soil type, site class, range condition, bioclimate and altitude distribution. The results of the survey of the rangelands showed that the largest proportion of the rangelands surveyed had four site classes, characteristics of good condition and were distributed in the high (801-1,200 m) and very high elevation (>1,200 m) zones. The grasslands (>1,200 m) of mountain Voras and Tzena have the highest productivity among all the types. These areas cover 25% of the total area of the two mountains, satisfying the needs of the grazing animals during the summer period and additionally they are considered as reserves for many species of the fauna and flora of the area.

RÉSUMÉ

Les pâturages des monts Voras et Tzéna en Grèce du nord étaient caractérisés en utilisant des orthophotocartes et des Geographic Information Systems (G.I.S.). Le critère de classification était la végétation dominante. Chaque unité caractérisée était classifiée en types, formes, séries et sous-types de végétation pastorale et la surface estimée. Les informations recueillies concernaient la surface, la végétation, le sol, le bioclimat, la qualité de la station, les conditions du pâturage et la distribution altitudinale. Les résultats montrèrent que la plupart des pâturages caractérisés pourraient être divisés en quatre qualités de la station. Ils étaient en bonne condition et distribués en hautes (801-1,200 m) et très hautes zones d'élévation (>1,200 m). Les prairies (>1,200 m) des monts Voras et Tzéna ont la productivité la plus élevée parmi tous les types. Ces surfaces couvrent 25% de la surface totale de deux monts, satisfaisant les besoins des animaux pendant l'été et en même temps ils sont considérés comme réservés pour plusieurs espèces de la faune et de la flor.

three dominant species (Miles, 1979; Wagner, 1984; Hunter and Paysen, 1986).

Rangelands cover a substantial percentage of the total area of Voras and Tzena mountains. They are located in the north part of Greece, between 41°03' latitude (north) along the border with former Yugoslavia and 22°03' longitude (east). The total area of the mountains is 65,440 ha. Their main part is covered by wildlands consisted of forests and rangelands. In the latter category, the partially forested areas, grasslands and shrublands are included. The main product of these areas is forage for domestic and wild animals.

The survey, classification and evaluation of the rangelands of Voras and Tzena mountains was carried out within the framework of ENVIREG Programme, concerning mainly the recognition and evaly

uation of avifauna biotopes for inclusion in the E.U. Network of the Regulation 79/409. (Platis *et al.*, 1995; Trakolis *et al.*, 1995).

The development of Geographical Information Systems (G.I.S.) in mapping of natural resources for exploitation and rational management gave the opportunity of application of this new technology in the inventory (Platis *et al.*, 1997). The aim of this study was to classify and evaluate the rangelands of mountain Voras and Tzena with the assistance of G.I.S., in order to serve their rational management.

METHODOLOGY

The areas included in inventory represent the total grazed area of the two mountains. We took the advantage of existing orthophotomaps (scale 1: 20,000) pro-

(*) N.AG.RE.F. - Forest Research Institute - Lab. of Range Management, Thessaloniki, Greece.

(**) N.AG.RE.F. - Forest Research Institute - Lab. of Landscape Planning, Thessaloniki, Greece.

(***) N.AG.RE.F. - Forest Research Institute - Lab. of Remote Sensing & G.I.S., Thessaloniki, Greece.

duced earlier by the Forest Service of Greece (Mastroiannakis and Fezidis, 1983).

The categories land cover types selected from the orthophotomaps for the present study were:

- the abandoned farms for more than 5 years,
- the grasslands with woody species making no more than 10% of the plant cover,
- the evergreen sclerophyllous shrublands with shrubs no more than 5 m high,
- the deciduous shrublands with shrubs no more than 5 m high and
- the partially forested areas with crown cover less than 40% and timber stock less than 100 m³/ha.

The classification criterion of rangelands was the dominant plant species (Whittaker, 1962), while the basic classification unit was the "range". Every "range" was classified according to the type, form, series and subtype where it belonged. The subtype (within an area of at least 10 ha) was used as the smallest classification unit in the production of the main map (scale 1: 20,000). More information about the methodology of inventory and the classification system is available in earlier work by Papanastasis *et al.* (1986) and Papanastasis (1989).

Subsequently, the orthophotomaps including Voras and Tzena mountains were digitised and all the relative information was recorded in a data base (Stone *et al.*, 1994) and several thematic maps were reproduced, making use of the potential of G.I.S. (Cowen *et al.*, 1995).

The final product consisted of colored maps (scales 1: 20,000 and 1: 50,000), where the types, series and subtypes with their respective area, the site class, the range condition and the soil type were shown. In the present work, only the results concerning the rangeland types and series are reported.

RESULTS - DISCUSSION

The total area of mountains Voras and Tzena, including all vegetation types, was found to be 65,440 ha (**table 1**). On both mountains, forest had the highest cover percentage (59.86%), with rangelands (shrublands and grasslands) coming second (34.33%). Rangeland covered almost the same area on Voras and Tzena, but grasslands were three times more on Voras than on Tzena (**table 1**). Agricultural land had 4% cover or 2,608 ha, while the

Table 1 Land use of mounts Voras and Tzena.

Land cover	Area (ha)		Total	%
	Voras	Tzena		
1. Forests	32,525.43	6,642.86	39,168.29	59.86
2. Rangelands				
-Shrublands	5,104.34	1,216.72	6,321.06	9.66
-Grasslands	12,102.02	4,042.92	16,144.94	24.67
3. Agricultural land	1,980.23	628.01	2,608.24	3.98
4. Rocky places	573.76	623.71	1,197.47	1.83
Total	52,285.78	13,154.22	65,440.00	100.00

rocky outcrops covered the remaining 1.83% of the total area.

The total studied area was classified in five types (**figure 1**). The largest ones was grasslands and the evergreen sclerophyllous shrublands, followed by deciduous shrublands, partially forested areas and finally by the abandoned farms with a small percentage (**table 2**). The above **tables 3, 4, 5** and **6** suggest that majority of the grazed area on Voras and Tzena mountains belongs

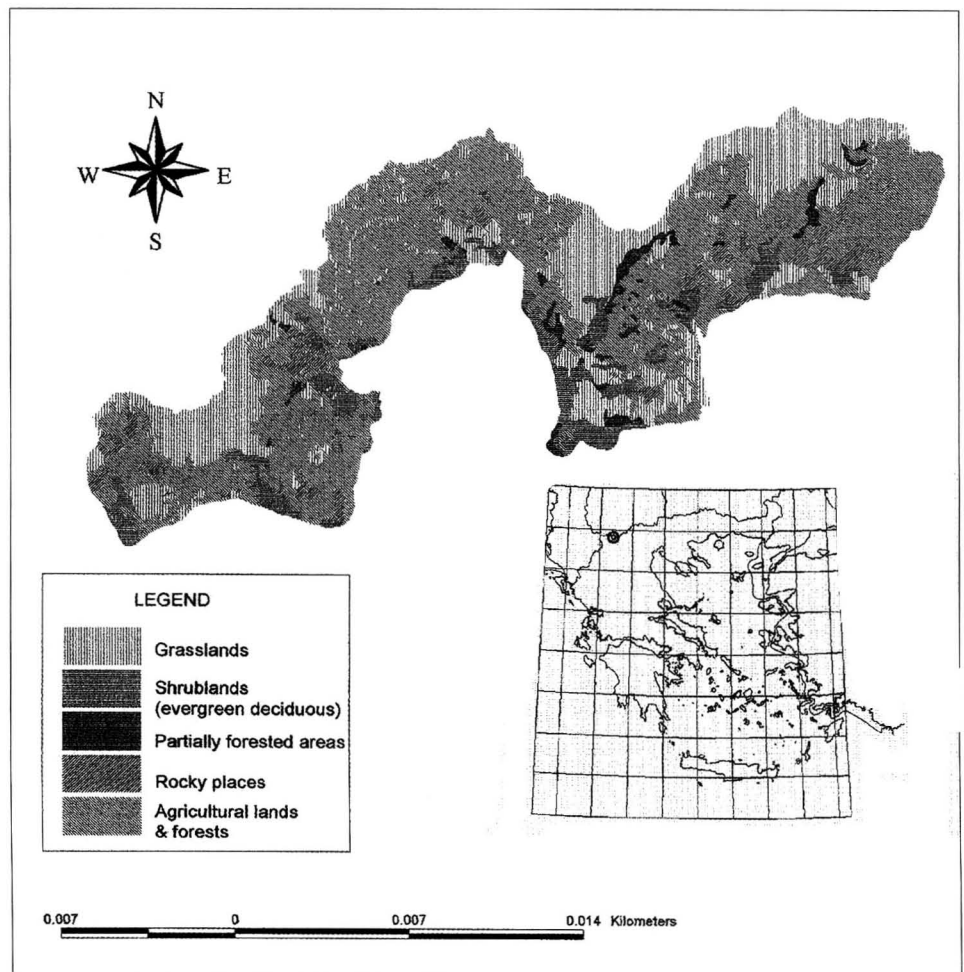


Figure 1 - Rangeland types of mountains Voras and Tzena in N. Greece.

Table 2 Rangeland types of mounts Voras and Tzema.

No.	Type	Area	
		in ha	%
1	Abandoned farms	1,544.20	2.42
2	Grasslands	15,600.80	69.44
3	Evergreen shrublands	3,300.00	14.69
4	Deciduous shrublands	1,601.00	7.13
5	Partially forest areas(*)	1,420.00	6.32
Total		22,466.00	100.00

(*) Crown cover < 40%, timber stock < 100m³/ha

Table 3 Site classes of mounts Voras and Tzema.

No.	Site Class	Area	
		in ha	%
1	Good(*)	8,065.80	35.90
2	Fair(**)	12,602.90	56.1
3	Poor(***)	1,797.30	8.00
Total		22,466.00	100.00

(*) Soil depth > 30 cm, slope(usual) 0-15%
 (**) Soil depth 15-30 cm, slope 15-30%
 (***) Soil depth < 15 cm, slope > 30%

Table 4 Range conditions classes of mounts Voras and Tzema.

No.	Class	Area	
		in ha	%
1	Good	7,413.80	33.00
2	Fair	11,682.30	52.00
3	Poor	3,369.90	15.00
Total		22,466.00	100.00

Table 5 Distribution of rangelands in elevation zones of mounts Voras and Tzema.

No.	Elevation Zone	Area	
		in ha	%
1	0-600 m	2,650.50	11.80
2	601-800 m	2,825.30	12.56
3	801-1,200 m	2,210.10	9.84
4	>1,200 m	14,780.10	65.80
Total		22,466.00	100.00

to the fair site class (56%), while the good site class has a quite high percentage (36%). Also, 33% of the studied area has good range condition, with the higher percentage (65.8%) located in the sub-alpine zone (> 1,200 m). The characteristics of range condition classes were: at least 70% of plants are desirable, more than 2/3 of the ground is covered with litter, shrubs less than one me-

Table 6 Distribution of rangelands in soil classes of mounts Voras and Tzema.

No.	Soil Class	Area	
		in ha	%
1	Metamorphic rocks	9,661.40	43.00
2	Hard limestone	5,616.50	25.00
3	Acid igneous rocks	4,493.10	20.00
4	Basic igneous rocks	2,246.00	10.00
5	Alluvial soils	440.00	2.00
Total		22,466.00	100.00

ter high and less than 40% cover, no evidence of erosion (Good) – at least 40% of plants desirable, 1/3 to 2/3 of the ground covered with litter, shrubs less than one meter high and less than 70% cover, no evidence of accelerated erosion (Fair) – less than 40% of plants desirable, less than 1/3 of the ground covered with litter, shrubs more than one meter high and more than 70% cover and evidence of accelerated erosion (Poor) (Papanastasis, 1989). In relation to the soil type, the majority of soils are derived mainly from the metamorphic rocks (43%) and secondarily from the weathering of hard limestone (25%).

Abandoned farms cover an area of 544.2 ha and belong to the first site class. The range condition is fair and they are located mainly in the low and intermediate elevation zone (> 800 m). This type is found quite often on metamorphic rocks, on both mountains.

Grasslands cover an area of 15,600.8 ha and the majority of them belongs to the first and second site classes (75%) with their range condition being mainly fair (66%). They are chiefly located on the high and sub-alpine zones (87%), on metamorphic rocks (44%) and hard limestone (33%), as well (unpublished data).

The grasslands which are characterized by the dominance of the cold-season grasses of *Agrostis alba* L., *Dactylis glomerata* L., *Festuca gracea* ssp. *Pawlowskiana* (*F. varia*), *F. valesiaca* L., *Sesleria latifolia* L., *Stipa bromoides* (L.) Dorf., etc. and by the shrubs *Juniperus nana* Wild., *Daphne oleoides* Schreb. and *Acantholimum echinus* (Boiss.), are expanded in most of the area. They are found in elevation higher the 800 m and the majority of them has a good site class with good and fair range condition.

Evergreen shrublands amount to 3,300 ha. The majority part of them belongs to the second site class (65%) with fair range condition (58%), located in the intermediate and high elevation zones (80%), on metamorphic rocks (50%) and on soils derived from weathering of hard limestone (35%). The series of *Quercus coccifera* L., *Juniperus oxycedrus* L., *J. communis* L. and *J. nana* Wild. were identified.

Deciduous shrublands have an area of 1,601 ha. The majority belongs to the second site class (68%), with

