Mountain Range Management and Improvement in Greece

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(This discussion is a condensation of the author's report written in Athens, Greece, for the Greek Ministry of Agriculture. The report also was used to inform the United States Department of Agriculture on range-management problems in Greece.)

THE total area of Greece is 13 million hectares (a hectare = 2.47 acres). Of this total, 23 per cent consists of plains, valleys, and low rolling land; the rest is mountainous land. Sixty-three percent of the mountain area is owned by the State, 22 percent by private individuals, and 15 percent by communities, monasteries, etc. State-owned and community areas are administered by the Forest Service.

Mountainous agricultural land is mostly composed of steep sloping soils which are undergoing severe sheet and gully erosion. Forage production is poor and unsystematized, there being a shortage of irrigation water. Production undoubtedly could be increased by development of irrigation systems and more efficient water conservation. The average ownership of mountainous farming area is 2.5 to 3.0 hectares.

Forests of Greece cover, at present, about 1.9 million hectares (15.02 percent), although forested land immediately after the National Revolution of 1821 amounted to 40 percent. The reduction is the result of overcutting, uncontrolled grazing, clearing of woodland for farming purposes, and forest fires. The present acreage is below the minimum indispensable for timber production and, especially, for watershed protection and flood control.

Grazing is uncontrolled on 61 percent of the total mountainous area. Except for some alpine and subalpine regions, all other grazing land is being overused in one way or another. Excessive use occurs mostly in the middle mountain zone, where year-long grazing prevails. A large part of the mountain slope area has been denuded of its herbaceous and brushy cover by overgrazing. Accelerated erosion and mudrock flows occur every year.

The Overstocking Factor

The numbers of livestock are out of proportion to the grazing area in the mountainous regions of Greece. The overstocking problem, however, was more acute in pre-war time than it is today since the livestock industry has been seriously damaged by the Occupational forces and more recently by the guerrilla-communists.

Pre-war and post-war numbers of livestock are listed below:

	1935–36	1949–50	PERCENT REDUCTION
Sheep	8,335,000	6,337,000	24.0
Goats	5,127,000	3,269,000	36.2
Cattle	986,000	675,000	31.5
Donkeys	402,000	371,000	7.7
Horses	364,000	232,000	36.3
Mules	183,000	146,000	20.0
Buffalo	64,000	57,000	10.9

Of all this livestock, only sheep and goats are of special importance, as far as the unregulated mountain grazing land is concerned. A few cattle are also grazed on some mountainous areas, but horses, mules, and donkeys are generally kept on domestic pastures or are fed with forage and grain.

Specifically speaking, the prewar goat numbers were far greater than the carrying capacity of the goat pastures. Although the grazing capacity of the several types of goat ranges in Greece has not been estimated, we should not be far off if we estimated a pasture area of 1.0 hectare per animal year. On this basis, a total pasture area of 5,000,000 hectares of brushland should be needed for the total goat number.

There are ranges in Greece, as in all Mediterranean countries, which are suited very well to goat feeding only. Although a detailed land use classification has not yet been carried out in Greece, it could be approximately estimated that an area of 1,500,000 to 2,000,000 hectares is suitable to permanent goat grazing. Since, however, some of the mountain watersheds covered by typical goat grazing vegetation have to be protected, it is apparent that no more than 2,000,000 goats maximum could be served by the above area of brushland.

Much mountain grassland is also being overstocked by sheep. The Greek Forest Service has estimated that sheep pastures on some mountain watersheds, amounting to 460,000 hectares, are being overgrazed to such a degree that the range area per sheep month does not exceed 0.8 stremmas (1 stremma = 0.1 hectare).

The Mountain Range Types

Alpine or Pseudo-Alpine Pastures

Alpine grassland covers a large area above the extreme timber growth line up to the top of the mountains. It is not a real alpine region from a phytogeographical point of view because timber line has been disturbed by the destruction of the forests.

Alpine grasslands are characterized by steep slopes with some intervening narrow valleys. Annual precipitation varies from 30 to 40 inches. They lie at elevations from 5,000 to 8,000 feet. Limestone formations prevail over the larger part of these regions. Much of this grassland has undergone moderate to serious erosion. The top soil of some slopes over limestone formations has been washed off. Rocky ground surfaces predominate, interspersed with patches on which good grass is grown. Despite these conditions, alpine pastures are maintained in a better shape than all other mountain grassland because spring water is insufficient and not suitably located to permit the complete use of these summer pastures.

The effective season of plant growth and, consequently, the period of profitable grazing is 100 to 120 days, i.e., from late May to early October. As a rule, however, premature grazing prevails on much of these pastures.

Range in the Forestry Zones

Below the alpine region the forestry zone covers an area of about 3 million hectares. Beech, fir, black pine, and oak forests occupy about 40 percent of this area. Open woodland—pastures intermingled with forest—occupy about 13 percent, and grassland comprises the remaining 47 percent. Much of this land, now grazed, was originally covered by forests, composed mostly of fir and oak.

Limestone prevails throughout the beech and fir zone. This zone contains extensive areas of steep slopes that formerly were covered by forests, grasses, and other forage plants, but the vegeta-

tion has now been seriously depleted (Fig. 1). Some very good pastures interspersed with the forested area indicate precipitation varies from 25 to 35 inches. The growing period of the forage plants lasts 120 to 160 days.

FIGURE 1. Steeply sloping mountain grassland in northern Greece formerly covered by beech forest. Overcutting, overgrazing, and unfavorable soil conditions have resulted in severe sheet and gully erosion.

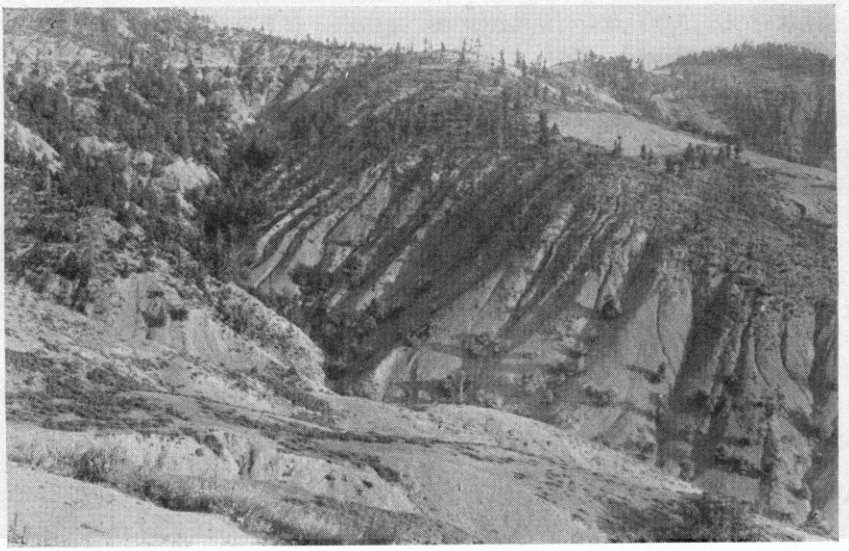

FIGURE 2. Seriously eroded steep slopes in central Greece. Only remnants of deciduous oak forest remain.

the former conditions of the vegetation. Water is generally abundant, but it is unfavorably located. Average annual

Quite different are the geologic, soil, and land use conditions in the zone of the oak forests. Flysch, schist, and crys-

talline metamorphic (gneiss, mica-schists) formations are found there. Overcutting, overgrazing, and very easily eroded geologic formations (Flysch) prevail over a large part of central Greece (Fig. 2). Many villages and, consequently, many farming tracts are interspersed with the forested and range area. Thus, a complicated problem of forestry, range, and farming soil conservation and development is faced in this region. Because of the growth of the population an overpressure is caused on the land. As a result, the oak forests are suffering from grazing, from cutting leafy branches for fodder, and from land clearing for cultivation purposes.

Chalepian Pinė and Evergreen Sclerophyl Zone

Total area of this zone is about 5,000,000 hectares, i.e. one-half of the Greek mountainous land. Chalepian pine or the Aleppo pine (*Pinus halepensis*) and chaparral forest occupy only 12 percent of the area. Some 18 percent represents the goat pasture, and 30 percent is depleted brushland used for both sheep and goat grazing. The balance of 40 percent (1,600,000 hectares) is characterized as grassland. Except for the chaparral forested land, which is used for fuel timber production, other chaparral area is composed of typical goat pastures.

Evergreen-sclerophyl formation (chaparral) is composed of many species. Among them evergreen oak (*Quercus coccifera*) predominates on the limestone soils, though *Arbutus* and *Erica* predominate on gneiss, granite, and schist soils.

The chaparral is composed of evergreen tall shrubs, deciduous tall shrubs, and short shrubs. Most desirable among these species are the evergreen oak and *Phillyrea media*. Heavy goat grazing (Fig. 3) has almost caused the disappearance of the legumes: *Coronilla*, *Colutea*, and *Medicago arborea*.

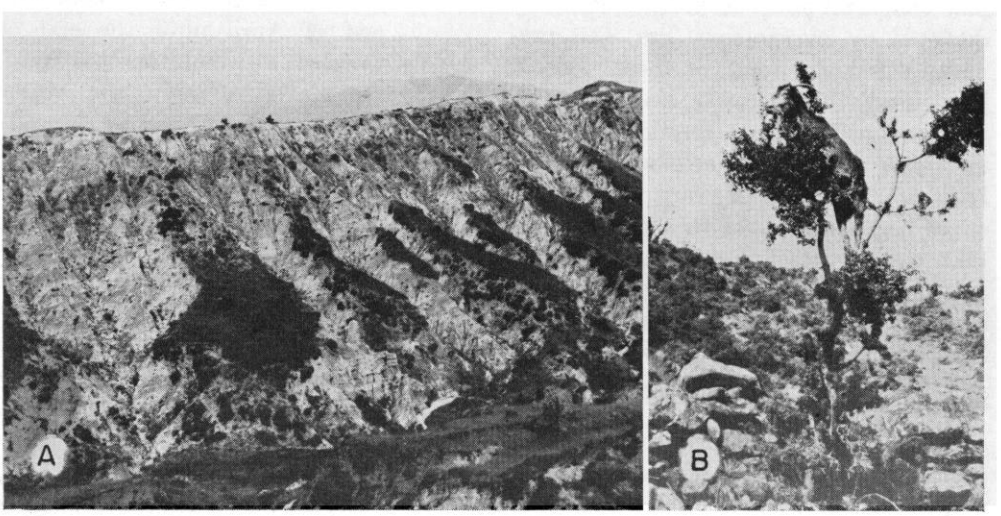

FIGURE 3. RESULTS OF GOAT OVERGRAZING. A. Tremendously gullied slope in northern Greece, formerly covered by evergreen-sclerophyl formation. Depleted by goat overgrazing. B. Goat browsing in top of tree in Greece.

Unlawful brush-range fires occurring every year have destroyed a large acreage of these pastures. Sheep operators used to burn brushland in order to increase or to make more accessible the forage

species used by sheep. Brush fires in the past, having repeatedly occurred on the same region, have caused entire loss of the soil. Rocky surfaces now remain over large areas. This takes place particularly on the summer dry regions made up of limestone. The higher temperature during the fire alters the limestone into something like lime. Thus, root systems are damaged and consequently the sprouting becomes very poor. In addition, sprouts coming from burned plants are usually overgrazed. The result is a gradual disappearance of desirable shrubs and an increase of the less valuable species. Repeated fire, for instance, occurring on chaparral-covered gneiss, schists, and granite soils, where the less desirable species *Arbutus* and *Erica* predominate, cause the disappearance of the evergreen oak.

The grass pastures of the chalepian pine-chaparral zone have been seriously depleted by overgrazing, fire, and premature grazing. Some of these regions, particularly those with southerly exposures on limestone formations, have lost their top soil by erosion extending back over hundreds of years. Herbaceous cover has deteriorated to such a degree that only brushes, weeds, and unpalatable grasses are grown. Approximately some 20 percent of these grasslands have lost 75 percent of their top soil.

Special Aspects of the Range Problem

Range problems in Greece show some peculiarities and complications which make solution difficult.

1. The overlapping lawful rights over the range by the State and the mountain communities results in overstocking of range by lessees, since leases do not specify number of stock or time of grazing. The leases are made for 1 year. The State, however, in order to protect the livestock business, has established a moratorium for both duration and grazing rent. The moratorium is also applied on private range land, resulting in continuous arguments between the lessees and the land owners.
2. Generally speaking, stock breeders have no conception of overstocking. This is also true of some animal husbandry specialists of the country who fail to realize the severe loss incurring every year to the soil resources due to overgrazing.
3. The uneven distribution of livestock ownership. There are in Greece three categories of pastoral livestock business.
   a. The nomad livestock owners, who have no permanent residence and rarely own any lands; their flocks are on the high mountain grazing ranges from about the end of April until the end of October, at which time the flocks are moved down to the winter range on the chaparral (maqui) zone or on some remnant plain pastures. It has been estimated that in the prewar period there were 15,000 nomad families having about 2,500,000 sheep and goats.
   b. The big livestock owners in the village communities having up to 300 sheep and goats. They are entirely dependent upon livestock business and comprise about 10 percent of the mountainous livestock raisers.
   c. The small livestock owners in the villages, having up to 100 sheep or goats and being mainly dependent on agriculture but with supplementary income from livestock.
4. Isolated tracts of farming land,

interspersed, especially with the yearlong ranges, complicate range management. Much range land is also intermingled with the forested area. Special consideration should be given to artificial reseeding of mountainous abandoned farm land, which comprises vast areas on the middle and lower slopes. Artificial reseeding to establish dry pastures will be the best way to improve these areas, since they have been seriously depleted through unsound farming practices and overgrazing.

The Range Management Program

Land Policy Measures

Governmental Land Policy must aim to:

1. Solve the problem of mountainous land use readjustment. This is the most important work to be undertaken. It will be the basis of an integrated, long-term, land reclamation project. This project must comprise agricultural soil conservation and development, the reforestation of an area of about 1,500,000 hectares, and range management.
2. Work out a program of grazing rights regulations, based on sound range management practice.
3. Gradually eliminate goat grazing on commercial forests. Many of the existing goats could be replaced by angora goats or other high yielding stall goats. The introduction of the brown-alpine cattle, which are very suitable for the middle zone of oak and chestnut forest, could be of utmost importance, as far as reducing the number of goats is concerned.
4. Place sheep grazing on the forests under control, by reducing excessive stocking, in order to prevent damage to the forests and to insure sound and permanent sheep grazing on the forests. Attempts must be made to replace sheep by the alpine-brown cattle.
5. Place entirely under protection from grazing some depleted watersheds for erosion and flood control. It has been estimated that mountain watersheds on an area of 2,000,000 hectares must be placed under improvement. Nine projects are being carried out now with E.C.A. funds on the most seriously depleted watersheds of the country—25 percent of this area must be protected from any kind of grazing.
6. Place under administration and management all other mountainous grass and brush pastures.

Legislation providing for elimination of goat grazing from the commercial fir, black pine, beech, and oak forests has been established since 1937. But these drastic measures have not entirely been applied because of the breaking out of World War II and the unfavorable conditions which followed during the Occupation and the recent guerrilla war situations.

Range Management Administration

The Greek Forest Service in cooperation with the Range Management Division of E.C.A. Mission in Greece is planning now the first projects of organizing national forest and grazing districts for range management purposes. The first district is being developed in the Mount Olympus region.

A program of intensive water conservation and development on the mountainous area would create vast opportunities for the establishment of artificial pastures, thus increasing the availabilities of fodder production and insuring considerably higher and better nutrition standards of the animal population.

To the extent possible, fodder produc-

tion should be encouraged in the lowlands.

Such a policy would help in solving the acute problem of overstocking the natural mountain ranges. In this connection the Extension services will be called upon to play an important role by undertaking the big responsibility of disseminating among the mountain villagers and the livestock operators modern methods and practices in fodder production and range management.

An intensive range research program should be applied. Range research will determine the nccessary understanding of overgrazing as an important factor of depletion in Greece; it might also help in solving the problem of the management of the watersheds inasmuch as range influences are involved. Of particular interest is research on the best form of management of limestone watersheds, which are mostly covered by typical goat pastures (evergreen sclerophyl formations). Finally, range research should tackle all problems (technical) related to range management and improvement. The experience of the United States Department of Agriculture on range management and improvement will help the Greek Ministry of Agriculture very much in the first steps of their attempt in organizing range management in Greece.

THE ELEVENTH COMMANDMENT

Thou shalt inherit the holy earth as a faithful steward conserving its resources and productivity from generation to generation. Thou shalt safeguard thy fields from soil erosion, thy living waters from drying up, thy forests from desolation, and protect thy hills from overgrazing by the herds, that thy descendants may have abundance forever. If any shall fail in this stewardship of the land, thy fruitful fields shall become sterile stony ground or wasting gullies, and thy descendants shall decrease and live in poverty or perish from off the face of the earth.—*Dr. W. C. Lowdermilk.*

(*"The Eleventh Commandment", written and broadcast over the radio by Dr. Lowdermilk in Jerusalem during June, 1939, was dedicated to the Palestinian Jewish villages whose good stewardship of the earth inspired this idea.*)