FRENCH FORESTS AND FORESTRY

THEODORE S. WOOLSEY, JR.

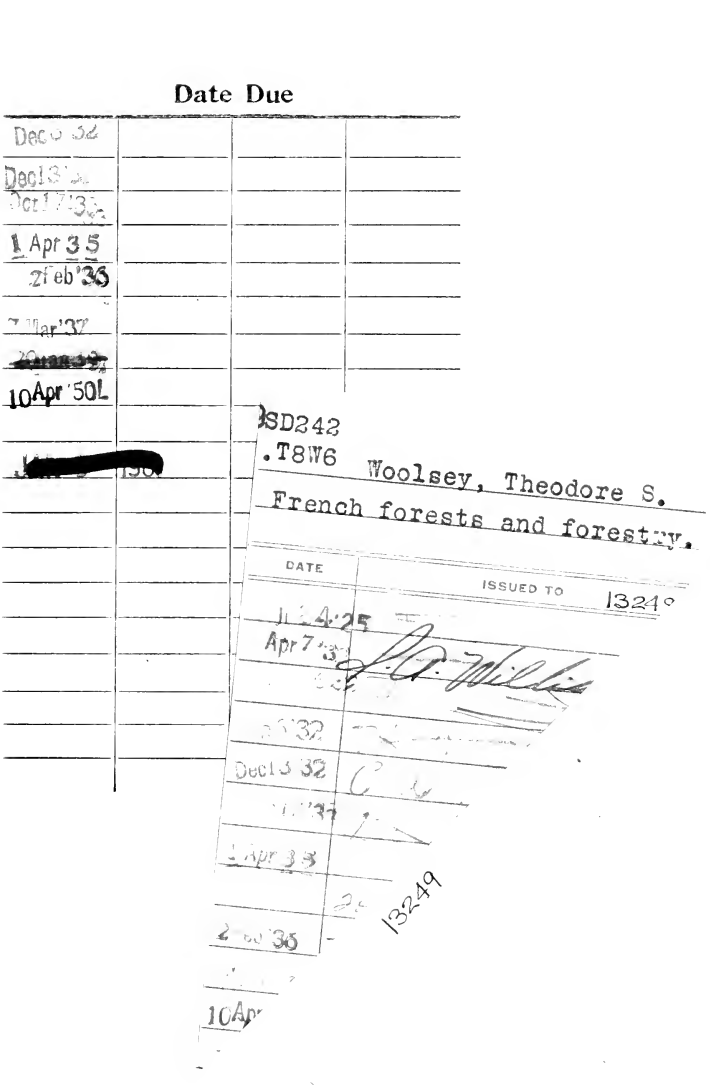
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FIG. 1. — The forester's ideal — wooded slopes, pastures, agricultural land, and interior villages.

FRENCH FORESTS
AND
FORESTRY

TUNISIA, ALGERIA, CORSICA

With a Translation of the Algerian Code of 1903

BY
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To

Bernhard E. Fernow, Henry S. Graves, Gifford Pinchot

In Recognition of their Creation and Development
of a Definite and Comprehensive National
Forest Policy

PREFACE

A KNOWLEDGE of theoretical forestry is as indispensable to
a American forest student as it is to the man of any other
untry who may adopt forestry as his profession. But to be
eful such knowledge must be applied with judgment. The
ire theory of forestry needs for its unfolding and embodiment
nditions which are likewise theoretically perfect. The skill
the trained forester consists not in the mere application of a
rmula, but in modifying what is ideally correct into what
practically desirable. As in every other sphere of human
deavor, what is actually possible in the practice of forestry
ffers very widely from what ought to be possible, but is not.
iccessful practice, in the large, is never theoretically perfect,
id this is most emphatically true in the lands where forestry
new.

American foresters have very much to learn from the in-
nsive methods of forest management and forest production
the Continent of Europe, and particularly in France, Ger-
any, Austria, and Switzerland. Here the fundamental prin-
ples of theoretical forestry may best be studied, and the best
amples of their application to conditions on the ground are
ost readily examined.

In his effort to ascertain how best to harmonize the search
r perfection with the successful achievement of practical
sults, there is no guide so valuable to the forester as the ex-
rience of others under conditions which are at least partially
milar. But the experience of others can serve us as a model
ly when the work done rests on knowledge so pertinent and
ill so sure that their combined effect results in elasticity and
ldness in fitting means to ends; otherwise the lessons to be

learned will flow less from examples to be followed than from mistakes to be shunned.

Here lies the special value of French forest management as against German. The reason why more valuable instruction and more useful example for the American forester is to be found in France than in Germany is because French methods are less rigid, more adaptable, less controlled by arbitrary rule than is the case in Germany. French forest management is the natural expression of the quick and practical intelligence of the French, and this is especially true in its application to the French colonies, where many of the conditions approximate those with which American foresters find themselves obliged to deal.

As a former student of the French Forest School at Nancy, it is a matter of special satisfaction to me that Theodore S. Woolsey, Jr., my friend and fellow member of the United States Forest Service, has undertaken to give Americans an account of forest management by France.

Mr. Woolsey's equipment for his task is unusually complete. His knowledge of the theory and practice of forestry in the United States is such as could result only from thorough training followed by wide experience in the field. Through his work in the Forest Service he has seen the worst and the best of American methods of forestry, and how these work out under the stress of practical, silvicultural, financial, and administrative conditions.

His experience abroad includes not only Continental Europe and the French Dependencies, which latter are described in this book, but also forest management in British India as well. What has everywhere drawn and held his interest is the analogy or the contrast with forest work at home. The present book owes no small part of its value to that fact. Thus in Tunisia, Mr. Woolsey tells us, one of the recognized methods of protection against forest fires is to promote the settlement and occupation of agricultural lands within forest boundaries. So the U. S. Forest Service has done its utmost to encourage a resident population on cultivable lands within the National

Forests, a population personally interested in preventing and extinguishing fires.

In Corsica the lack of sufficient means of transportation has made it necessary to sell timber in amounts large enough, and extending over a number of years great enough, to justify the purchaser in building the indispensable wagon roads for himself. Defective transportation and low prices of timber are often controlling factors with French Colonial foresters, as they are with us.

In Algeria the simplicity, economy, and efficiency of forest administration has peculiar interest for us, while the report of an official commission, which recognized the maintenance of brush cover as of vital importance, carries the thought of an American forester at once to the brush covered National Forests which are so potent in protecting the water supply of southern California.

It is not without real satisfaction that we find ourselves, through Mr. Woolsey's studies, able to realize that here and there we Americans have surpassed in practice the men whose example means so much to us. Thus in Corsica trespass upon forest land still offers one of the most serious problems of forest administration, whereas upon our National Forests of the West, as Mr. Woolsey well points out, trespass is practically a thing of the past. Our methods of grazing control, it is pleasant also to know, lose nothing by comparison with those of the French in northern Africa.

I have often had occasion to advise American forest students to make themselves familiar with the practice of forestry in France and Germany and then to forget it. It is only when such knowledge passes, as someone has said, out of memory into experience, that it becomes really valuable. Such a book as this almost leads me to revise that statement, for it gives us not merely the facts of forest practice, but the reasons which underlie that practice, and the discussion and application of it referred to the forest conditions and problems in our own land. Forest pioneers, like the men whose work this volume describes, have much in common wherever their work may lie, while the

methods devised and practiced in France itself probably cover a wider range of conditions and apply more closely to the needs and the problems of the American forester than those of any other country of Europe.

GIFFORD PINCHOT.

August 15, 1916.

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INTRODUCTION

THE following work embodies the results of a study of the more important phases of forest practice in Corsica, Algeria, and Tunisia. There has been attempted neither a complete investigation of forestry in all its phases nor a summary of all the multitudinous details of administration. The aim has been rather to set forth the essentials of method which may be applied directly in the United States, or which may be indirectly of value to English speaking foresters.

Germany and Austria are quite generally recognized, at the present time, as leaders in forest technique. But from the fact that at least ninety per cent of forests under French administration are regenerated naturally, it follows that the results of French forest theory and administration, with Africa and Corsica, cannot fail to be of patent and wide interest to the forestry profession.

The fixation of shifting sand dunes and their reclamation in the Gironde and Landés, by the sowing of maritime pine; the various methods of turpentine collection; the control of torrents and reboisement in the Alps and Pyrenees; the management of cork oak and the construction of fire lines in Algeria — these are only a few of the special problems which have been solved by French foresters with an ingenuity that merits our admiration as surely as their success commands our attention and suggests a thorough and close study of their methods. Consequently the *extensive* administration in some of France's oversea possessions should prove of interest.

The information presented herein helps to attract attention to the increasingly frequent possibility of using, so to speak, natural rather than artificial means of putting our forest resources to the highest use. If the evolution of forestry in the

United States during the next few years will have been influenced, though ever so slightly, by the facts here gathered, the writer will feel that his work was not in vain.

Generalizations and comparisons between French and American methods have been largely omitted; the idea has been, instead, to describe the methods used and the results. It will be possible for the professional forester to make use of these methods in his own work after carefully weighing and comparing the difference in local conditions. Much the same method of presenting the results of research experiments has been followed by the Forest Service where the results are published in order to influence and guide but not *dictate* future practice. The specialist later on in our forest history can weigh the results obtained in Africa and Corsica with those obtained in the United States and draw deductions. Before many decades the writer believes that America's forest practice will become preeminent; because of our varied forest conditions, wealth of species, and strong personnel unfettered by the narrow precedents of continental forest practice, we shall lead rather than follow other nations. But in the meantime should we not profit by the mistakes and successes of others? Our administrator or investigator should not waste time by duplicating these errors. The difference between the textbook and field methods (even on the Continent) are often very marked. For example if the shelterwood system of cutting has been found disastrous in pure conifer stands, where the fire risk was great, should we not profit by this experience even if such a system is recommended in the standard textbooks? Such a lesson is taught by the results in Corsica. Here the lesson is clear-cut and definite; the philosophy of deduction is unnecessary — it can be grasped and made use of by the practitioner. Even where the inference is less definite the idea and thought of the results obtained is of inestimable value.

When Parade, former director of the Nancy Forest School, described the aim of the forester in the fundamental maxim of silviculture, " Imiter la nature, hâter son œuvre, telle est la maxime fundamentale de la sylviculture," he described, I be-

lieve, the goal toward which American forestry should and will progress.

My thanks are due to the officials of the Service des Eaux et Forêts, who have shown me without exception the utmost courtesy and consideration. Conservateur de Lapasse, formerly in charge of the Thirtieth Conservation, in collaboration with Henry Dundas, English consul at Ajaccio, kindly reviewed the chapter on Corsica. Inspecteur Boutilly, chief of Forestation and Management Plans for Algeria, was reviewing the chapters on Algeria and Tunisia when the great war put a stop to his literary work. Raphael Zon, U. S. Forest Service, made many valuable suggestions after a painstaking review of the manuscript.

I am also indebted to W. P. Lawson, who edited the manuscript and put it in shape for publication, and to many others for helpful suggestions. Both the metric and American systems of measurement have been used so as not to detract from the scientific value of the figures quoted. In giving equivalents of metric units, the nearest approximate value in the American system has been used. Thus "10 feet" is more easily grasped than "118.08 inches" or "9.8425 feet," although each is an equivalent of three metres.

The utmost care has been taken to secure accuracy of detail and to acknowledge in footnotes the sources of important data and conclusions. If errors have, however, crept in, suggestions for corrections and changes will be gratefully received and promptly acknowledged.

It has been thought best to group forestry in Corsica, Algeria, Tunisia, and the Algerian Forest Code in one volume. This is the more desirable, inasmuch as the matter treated may properly come under the head of material illustrative of *extensive* forest methods, while the remaining material, descriptive of methods employed in forests in France proper, will take up the intensive forestry in use there and be published later as a separate work.

T. S. W., Jr.

FRENCH FORESTS AND FORESTRY

CHAPTER I

CONCLUSIONS AND SUMMARY

VALUE OF EXTENSIVE FORESTRY

FOREST students can secure more information of direct application to American conditions in countries where forestry is not intensively organized. There is more of value to the administrator in North Africa and Corsica than in France proper; and more of value in France than in Germany. The reason must be clear. The theory of forestry is now established solidly enough to enable the elucidation of its general principles which hold under ordinary conditions. In a trip through France one sees forest administration under the average conditions. What is difficult to understand are the exceptions to these general rules, whether made necessary by market, climate, species, or cost of administration. Such modifications from general forest usage are admirably illustrated in *extensive* French forestry. In France proper intensive methods have been systematized for more than a century, and radical changes are seldom necessary. In North Africa poor transportation and low prices force the omission of many silvical measures that may be possible in France, and necessitate many radical variations of absorbing interest.

The extensiveness of administration is in the order of conquest. Tunisia, a French protectorate only since 1881 (recognized by the English in 1883), is less extensively administered than

Algeria, which was pacified as early as 1858. Corsica is, to be sure, a French department, ceded to France in 1759, but, on account of the difficulty of lumbering in Corsican pine forests in the rugged mountains, the management is perforce far less intensive than in the Jura, Vosges, or any part of France. A possible exception is found in the extensive cuttings in the southern Pyrenees near Oloron. Tunisia comprises approximately 50,000 square miles; Algeria, 176,000; and Corsica, 3400. The administrative centers are: Tunisia, Tunis (near site of Carthage); Algeria, Algiers, with Oran and Constantine as secondary centers; Corsica, Ajaccio.

TUNISIA

There is much to learn in Tunisia along the lines of extensive organization; permanent improvements; forestation; protection against sand, wind, and climate; fire protection, particularly as relating to fire lines; and modifications of the customary cutting systems made necessary by lack of transportation and low stumpage prices.

In Tunisia there are two types of administration — an intensive form for the valuable cork-oak forests, and a cheaper, less intensive form for the aleppo pine (*P. halepensis*) forests, valuable chiefly for protection against erosion and wind or for a local fuel supply. The organization is not top-heavy; it is simple and aims at the fundamentals of forestry rather than at the minutia covered so thoroughly on the Continent. It naturally follows that the expenditures for fire protection are immeasurably more for the cork-oak forests than for the less valuable aleppo pine.

The protection of the Djerid oases is of particular interest to American foresters, since the theory and practice has a direct application in the United States. These oases are valuable irrigated farms that must be protected against drifting sand, over-grazing, and erosion. On account of the native population, the laws in regard to the use of fire within or near forests are especially strict, but the administration realizes that interior

settlements are of protective value since cultivated land forms admirable fire lines. Settlers living within forest boundaries are an asset when fire must be controlled. There can be no grazing on a forest for six years after a fire, and railroad rights-of-way must be cleared of inflammable débris and, if necessary, additional fire lines constructed parallel to the track. There can be no deforestation in reserved forests, unless the wood is cut for use in protection against erosion, for the improvement of springs, or to stop drifting sand. The grazing control methods, although of wide interest, are comparatively undeveloped as compared with the United States.

Quite a feature of the cork-oak management is the simplicity of regulation. It is very much as if the forester were managing a valuable crop of fruit trees which matured periodically. The approximate equal annual cut is secured by working about the same area each year, but the same cork-oak forest is only worked for bark once in three years. A most important lesson to be gathered from a study of forestry in an arid country is the difficulty of restocking after the original forest has been destroyed, a principle which must apply with equal force in our Southwest. This is to be expected, since the period of drought occurs during the summer months when the plants are less able to withstand lack of moisture than during the cooler weather. The methods of forestation, moreover, have an excellent application in southern California where the winter rains correspond so closely to those in Tunisia. On the more favorable situations, the seed-spot method of sowing is preferred; on the more difficult sites, ball planting must be resorted to, notwithstanding the additional expense. In order to reduce the cost of forestation, spacing as wide as six by eight feet is officially allowed, but, in practice, there are rarely more than 250 seed spots per acre. Sowing or planting just before or during the winter rains is the invariable practice. Thus far the scale of operations has been so small that forestation in Tunisia may still be considered as experimental in character.

The accomplishment in Tunisia since 1885 has been considerable, considering the small appropriations which are available.

The administration is essentially simple, economical, and practical; the budget is based upon the revenue rather than upon an ideal.

ALGERIA

Much the same climatic and topographic conditions found in Tunisia are characteristic of Algeria. Perhaps the most remarkable features of the forest administration are: The unfortunate sales of federal cork-oak forests by Napoleon; the difficulty of preventing trespass and theft; fire protection (although it cannot be said to be uniformly successful); forestation; and the Algerian Code.

Unquestionably, the progress made in Algerian forestry from 1900 on is due to the forest commission that made a careful study of conditions and suggested very radical improvements both in methods of administration and in laws. The results of this study are found in the Algerian Code of 1903, which has been translated (Appendix, p. 161). It is very significant that this commission felt the preservation of existing forests and brush cover of vital importance to the health, prosperity, and habitability of Algeria. The difficulties met with in the early administration are undoubtedly characteristic of all early forest administration: the inclusion of needless agricultural land within forest boundaries; failure to properly consider and educate local sentiment favorable to conservative forest control; a literal rather than practical enforcement of early laws, which in many cases are often ill-adapted to administrative enforcement. Administrative organization must always depend on practicability rather than on theory. This is well illustrated in Algeria by the departure from this standard organization common in France. In France the conservator is in charge of a conservation which is split up into forests under inspectors or assistant inspectors. In Algeria this organization would have been too expensive and it would not have provided suitable positions for men of relatively low rank who were sufficiently advanced, however, to care for the simple administrative needs found in extensive forest management. Accordingly, the present

conservator directly supervises " chefferies," or small forest subdivisions, which correspond closely to one of the detached units administered by American forest supervisors. A specific example is the Coronado National Forest in southern Arizona, where one supervisor has administered what was formerly the Baboquivari, Dragoon, Huachuca, Santa Catalina, Santa Rita, and Tumacacori forests. According to the Algerian form of organization, these different forest divisions would be split up and administered locally by a forest assistant, head ranger, or deputy supervisor, instead of being administered from Tucson as one unit. Another interesting variation in the usual form of organization is the appointment of controllers or general inspectors in each of the three conservations (at Oran, Constantine, and Algiers). Such an officer inspects officials of less than his own rank. Since the military form of organization is current, it means that the general inspectors who, in the regular organization have the title and rank of " inspecteur," cannot inspect a " chefferie " if it is in charge of an " inspecteur " except in cases of emergency. It is interesting to see that the difficult lot of the Algerian forest officer is in part compensated by increased pay and liberal travel and educational allowances; he is granted a maximum of 30 days' leave per year, cumulative up to two years, and transportation for himself and family between France and Algeria. The subordinate force, stationed as they frequently are in out-of-the-way places, must send their children to school in the nearby towns and the Forest Service pays something to defray this increased cost of boarding-school education.

The administration is unquestionably progressive. The development of a new industry such as the turpentine operations in the Aleppo-pine forests around Oran, is worthy of American progress and ingenuity. The silvical treatment of these forests seems practicable and at the same time sufficiently conservative to insure regeneration. After a study of management in Europe proper, one would anticipate rather complicated, impracticable regulation in Algeria, but such is far from the case. What could be simpler or more feasible than the so-called " bundles of management " described on page 71? In the yield of cork oak, the

assessor inexpensively determines with sufficient accuracy what the annual production will amount to. It is parallel to the American forester in New England, who takes, as his criterion in coppice, a yield of a cord per acre per year and then deducts according to the quality of the soil, when estimating the annual growth. Another difference between the methods in France and Algeria is in the sale of cork. In France practically all timber is sold on the stump after it has been marked and the lumbering is entirely at the risk and cost of the purchaser, subject to stringent cutting regulations. In Algerian cork-oak forests the lumbering is done by the government and the cork is not placed on sale until it has been collected at local depots. There is much the same forestation policy that is found in Tunisia. It is believed that the prevention of the destruction of forests is far better than the cure — reforestation. Winter sowing or planting after the rains have commenced is almost universal. The sowing is usually in carefully prepared seed spots in preference to planting, unless the conditions are so unfavorable that the success of sowing would be problematical. They favor local rather than central nurseries which require the expensive and deleterious shipment of planting stock. When difficult planting must be attempted, ball plants are frequently used, notwithstanding the increased initial cost. Contrary to expectations, planting in brush-covered areas was very unsuccessful if part of the growing brush was left standing as a protection against the sun and wind. Success was only secured after practically brushing out the whole area to be planted since, otherwise, intense radiation, extreme heat, lack of air currents, and increased damage from rodents prevented the growth of more than a small percentage of the stock. According to Boutilly, who has charge of the forestation around Algiers, the only method of reducing rodent damage was to thoroughly brush out and clear the land to be sown instead of being content simply to brush out seed spots or strips. With complete clearing " the rodents have no clumps to hide in and almost all leave the area, and the damage is reduced accordingly. Moreover, I have noticed that the young cork-oak plants which are quite tender during youth, . . . especially at the end

of summer, resist the heat better if they are uncovered than they do if they are growing in the midst of brush. I think that this phenomenon is due to the freshness caused by proper aeration." The air circulates better and the plants survive when, otherwise, they would succumb to the heat.

The systematic routine methods of forestation are worthy of study by all American State and Federal forest officers who must cope with arid and difficult sites. Notable plantations have been established at Constantine, Algiers, Orleansville, and Oran. Local species gave the best success, sown in seed spots or grown in essentially local nurseries. The cost of these plantations has been in the neighborhood of 45 to 63 francs ($8 to $12) per acre, and success was only attained after repeatedly stocking areas which had shown initial failure.

Even with stringent fire lines, conscription of fire fighters, and forced coöperation of the civil authorities, and with the concentration of improvement work during the most dangerous part of the fire season (so as to furnish fire fighters in out-of-the-way parts) protection has not been altogether successful. Recently, boundary, secondary, and main fire lines have been constructed at considerable expense. Notwithstanding the clearance of these lines every three years, fires continue. In the technique of fire-line construction, progress has been made, but it appears that instead of clearing lines every three years it would be preferable to clear one-third of all lines, except those less than 15 metres (16 yards) in width, every third year, so that a portion of the line would always be clear of grass and débris. For permanent fire lines, they have unquestionably determined that it is cheaper in the long run to grub brush and trees out by the roots rather than to have the increased annual expense of cutting down shoots and root suckers. The conclusion may be formed, however, that fairly narrow lines along ridges or dry arroyos are of unquestionable value, both as a means of communication and as a vantage point from which to fight fires, notwithstanding the disastrous results from indiscriminate back firing. As in Tunisia, the administration is simple, economical, efficient, and is a credit to France.

CORSICA

Forest administration in Corsica is hampered by an unruly population, by over-grazing, by fires, and, in past years especially, by lack of communication. There are federal, communal, and private forests, and the organization is the same as is found on the Continent. If it were not, however, for the inaccessibility of the Corsican pine, growing at a higher elevation than the maritime pine but below the beech and fir, there would be but little forest wealth left on the island. The great lesson to be learned from a study of Corsican forestry is in the method of cutting the pine. To start with, an application of the shelterwood system resulted in large areas of young even-aged coniferous stands. To be sure, it is theoretically poor technique to reproduce even-aged stands of young pine over large areas where fires are frequent; but technique here was secondary to the practical requirement of large sales. Long-term sales for large amounts were a necessary evil in order to justify contractors in building expensive wagon roads. Much the same solution has been found true in the western United States, where at first the Forest Service limited its sales to less than 30 to 40 million feet (849,521.4 to 1,132,695.25 cu. m.). To-day in order to justify improvements, such as railroads or flumes, sales for from half a billion to a billion board feet have been recommended. Bearing in mind, therefore, the practical sales conditions and the danger from fire, the fairly intensive group selection system with thinnings seems to be an admirable answer to the problem of regeneration. There is no rigidity in the application of the selection system. There are seed fellings, secondary fellings, final clearances, cleanings, and thinnings as with the shelterwood system; but each operation covers an acre or two so that the result is an uneven-aged forest by groups.

The methods of determining the rotation and estimating the yield are similar to those in France; in Corsica, the methods are, however, less intensive. The dangers of over-cutting, owing to slack regulation in past years, are admirably illustrated by many of the Corsican forests where to-day one finds

the growing stock depleted and exhausted. In many respects the sales conditions contained in the sale contracts are similar to those used by the Forest Service, U. S. Department of Agriculture. But there is one vital difference: in Corsica the concession of making sales for large amounts and for terms of years was justified by the resulting improvement in communications. There, such large sales are considered an unquestionable evil but necessary until the transport of small-sales products is made feasible through the construction of permanent logging roads. In the United States steam transportation often precludes the development of a wagon-road system by purchasers, but an attempt is now being made to make current sales contribute towards a permanent road system.

Where the administration seems to have failed is in the proper education of the native population in the value of conservation. It seems almost incredible that out of almost 600 trespass cases, brought in 1911 before the courts, more than half were acquitted. There is marked contrast between this lack of success in preventing, controlling, and punishing trespassers in Corsica with that made by the Forest Service in the western United States where to-day trespass is practically a thing of the past.

CHAPTER II

TUNISIA

INTRODUCTION

General Conditions. — Any examination of forests or forestry in the French protectorate of Tunisia would be incomplete without a brief preliminary glance at the topography of the country and its climatic peculiarities. Only through a knowledge of geographic features of temperature, humidity, winds, and rainfall can one fully comprehend the nature of Tunisia's forest problems and the progress of local foresters in coping with them. Tunisia is bounded on the north and east by the Mediterranean sea, on the south by Tripoli, the Italian Colony; on the west by the Algerian province, Constantine. (Fig. 2.) This territory is situated between 32 degrees and 37 degrees north latitude and 5 degrees and 9 degrees of east longitude and comprises approximately 130,000 square kilometres (50,000 square miles).

Topography. — Tunisia is cut by three chief mountain chains:[1] Khroumirie and Mogod, in the north; high plateau

[1] The statistics given are taken from the Official Indicateur Tunisien, 1912.

and Dorsale, in the center; Matmata, in the south. While the effect of each of these mountain chains is important climatically, the ranges of Mogod and Matmata have perhaps the greatest direct influence of all, from the foresters' standpoint,

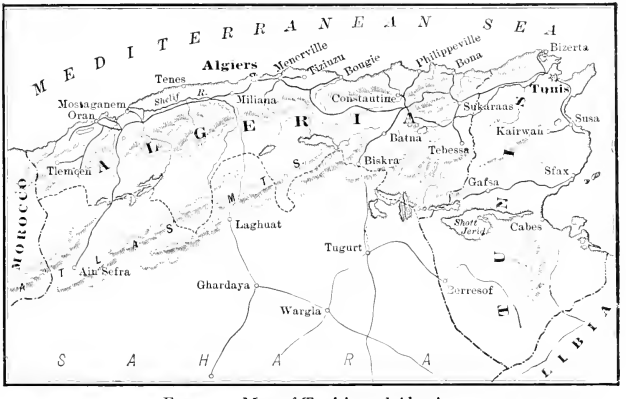

FIG. 2.— Map of Tunisia and Algeria.

by protecting local forests from the devastating dry winds of the desert.

Winds, Temperature, Humidity. — The direction of the winds of Tunisia may in general be predicted in their seasons with reasonable accuracy. In winter the dominant wind is from the northwest; in the spring, from the northwest with a tendency to north. In summer it changes to northeast, especially in the south, where this is the prevailing direction in autumn, though above the Dorsale the autumn winds arise more often from the northwest.

The temperature in Tunisia is high to moderate, in summer reaching an average of 28° C. (82° F.) to 32° C. (90° F.); in winter a minimum of from 3° C. (37° F.) to 8° C. (46° F.). As a matter of fact it varies according to the elevation above sea level as is shown by the following table:

TABLE 1

	Annual.		Winter.		Summer.	
	°C.	°F.	°C.	°F.	°C.	°F.
Ain-Draham	14	57	8	46	19.5	67
Bizerta	18.3	65	14.2	58	22.3	72
Le Kef	16.4	61	10.5	51	22.3	72
Sousse	19.1	67	12.0	54	23.9	75
Gabes	20.3	69	15.3	60	25.4	78
Gafsa	19.1	67	12.8	55	26.0	79
Souk-el-Djemaa	13.5	56	8.3	47	18.8	66
Feriana	16.8	62	11.1	52	22.6	72
Kairouan	19.9	68	11.8	53	25.7	78
Sfax	19.1	67	12.0	54	23.8	75
Touseur	21.8	71	15.4	60	28.5	83

In other words the average annual temperature at the four mountain stations of Ain-Draham, Le Kef, Souk-el-Djemaa, and Feriana is lower than that for the entire province of Tunisia. On the basis of these data the average annual temperature for Tunisia is 18° C. (65.6° F.); the average winter temperature 12° C. (53.6° F.) and the average summer temperature 23.5° C. (74.3° F.).

Humidity in the Khroumirie Mountains (cork oak) ranges from 85 to 100; during the wet seasons and in summer only is it less than 70. On the central plateau (aleppo pine) it varies from 85 to 70 to as low as 55 in summer. At Tozeur, near the desert to the south, average humidity rarely rises above 70 and in summer is below 55, while evaporation varies from 2013 mm. (78 inches) at Biserta on the sea to 2344 mm. (91 inches) at Tozeur, and 2502 mm. (97 inches) at El Djem. It is in this region that conditions are most unfavorable for tree growth.

Rainfall. — The rainfall in Tunisia is torrential and irregular. At Ain-Draham in the Khroumirie Mountains, for example, an extreme of 151.4 mm. (5.8 inches) was recorded for one day, and at El-Feidja, a higher elevation still, 167 mm. (6.5 inches) was reported as falling in the 24 hours.

On the mountains of the north (cork oak) the average yearly rainfall may be from 600 mm. (23 inches) to 1500 mm. (58 inches) with 100 to 120 days of rain; in the high plateau and

Dorsale (aleppo pine) from 400 mm. (16 inches) to 600 mm. (23 inches) with 50 to 80 days of rain, while in the southern oases, such as Tozeur, the maximum is 200 mm. (7.8 inches) with perhaps 25 rainy days.

The distribution of the rainfall is illustrated by the weather records at Zaghouan, bordering the central plateau. A total of 519 mm. (20 inches) for the year, with 73 days of rainfall, showed 28 mm. (1.09 inches) in summer, with only 5 days of rainfall; autumn 121 mm. (4.7 inches) and 18 days of rain; winter 205 mm. (8 inches) and 28 days of rain; spring 165 mm. (6.4 inches) and 22 days of rain.

The amount of precipitation and number of rainy days for the entire year and for different seasons of the year are as follows:

TABLE 2

	No. of rainy days.	Amount of precipitation.		Winter.			Summer.		
				No. of rainy days.	Amount of precipitation.		No. of rainy days.	Amount of precipitation.	
		Mm.	Ins.		Mm.	Ins.		Mm.	Ins.
Ain-Draham	146	1,725	68	115	1,317	52	31	408	16
Le Kef	90	487	19	53	305	12	36	182	7
Sousse	52	463	18	31	317	12	19	146	6
Gabes	39	192	8	23	132	5+	16	60	2+
Gafsa	47	237	8	29	173	7−	18	64	2−
Souk-el-Djemaa	64	492	19	32	308	12−	32	184	8−
Kairouan	51	291	11	30	157	5+	21	134	5+
Sfax	52	355	14	33	190	8−	20	165	7−

For the entire Tunisia the average number of rainy days is 67 with 537 mm. (22 inches) of rainfall. The average number of rainy days in winter is 43 with 362 mm. (14 inches) of precipitation. In summer the number of rainy days is 24 with 175 mm. (6.9 inches) of rainfall.

In the Sahara region the precipitation nowhere exceeds 300 mm. (12 inches). The average temperature is very high. Its maximum reaches 50° C. (122° F.) in the shade. The number of days with temperatures above 30° C. (86° F.) is close to 150.

These records are taken from the meteorological records at Tunis where they have been collected since 1884.

These data for rainfall are typical of conditions in both Tunisia and Algeria. They are especially significant in the former country as showing the extent of the summer drought. Except for this, since the valleys of Tunisia are usually a rich clay admirably suited to agriculture, the country would be an extremely fertile one the year around. As it is, the winter crops alone are amply justifying a constantly increasing colonization.

FOREST CONDITIONS

Forests. — The forests of the regency cover approximately 650,000 hectares (1,606,150 acres), and are divided into two distinct groups by the Niedjerda River. They are distinct, also, by reason of the difference in timber species of the two groups, the value of the timber, and the condition of the stand.

In the north the forests of the Khroumirie are of chief importance. These include the revenue-producing stands of cork oak (*Q. suber*) and zeen (Algerian) oak (*Q. mirbeckii*) of Ouchteta, M'Rassen, Oulad-Ali, Ain-Draham, Chiahia, Ould-Zeen, Frenana, Tabarca, Houamdia, Mekna, and Aindoun. The cork oak is the species of principal value, though the zeen oak, in the richer, moister soils, sometimes attains a diameter of 0.91 metres and over (3 feet and over). It is estimated by the Forest Service that there are 10 million producing cork-oak trees and 40,000 cu. m. (1,412,560 cu. ft.) of zeen oak, excluding branch wood. During the ten-year period ending in 1909 the average cut apparently exceeded the increment. Incidentally, it may be noted that yearly sales amounted to 20,000 cu. m. (706,280 cu. ft.) of zeen oak from 1883 to 1900; 396,000 cu. m. (13,984,344 cu. ft.) of zeen oak was sold for ties, and 30,000 quintaux (6,613,860 pounds) of cork.

In addition to the two chief species — cork oak and zeen oak — there is along the valley bottoms of these forests, alder, willow, black and white poplar, ash, holly, laurel, tamarind, black bryony, and azerolier. The understory is often dense and a possible fire menace appears in heather, myrtle, mastic, cytisus, etc.

The forests of Nefze and Mogod are in the northern group, but of much less value than those described in the preceding paragraph. They are for the most part covered with a scanty coppice of holm oak, wild olive, etc., which ranges in spots into mere brush.

The central plateau forests, as distinguished from the northern group, produce no revenue, but are maintained for the protection of springs and water supply and to fill local domestic needs. They have been denuded by excessive cutting, by grazing, and by burns; indeed, they are still, as they have been in the past, periodically burned over during excessively dry seasons. Their chief species are aleppo pine and holm oak, with a smaller quantity of wild olive, carob tree, thuya, juniper, and cypress. So poor is the condition of these central plateau forests that an official report in the files of the Djebel-Mansour ranger station refers to the areas covered as "ruins of the former forests."

According to data supplied by Zon: In localities above 1000 metres (3281 feet) the soils are composed of hard calcareous rocks unsuitable for agriculture, bare or covered with low shrubs and forests. Below are found pastures. At a height of 600 to 2000 metres (1968 to 6562 feet) above sea level, on the plateaus the cultivation of crops is possible and profitable. In this zone, especially on the northern slopes, are found the best forests. Between the altitudes of 400 and 600 metres (1312 and 1968 feet) the forests are still of good quality but shrubs become evident. Agriculture is still possible in this zone. The lowest zone situated between the sea level and an altitude of 400 metres (1312 feet) is covered with sand dunes, lakes, small rivers, and valleys. The valleys are under crops and vineyards.

Here also grow olive trees and palms. Where the soil and climatic conditions are unfavorable for agricultural crops, they are being used for grazing of cattle. In the lower zone forests are almost entirely lacking and when they do occur are of poor quality. The entire land surface of Tunisia may be classified as follows:

TABLE 3

	1000 hectares.	1000 acres.
Fields and pastures	2,605.7	6,438
Vineyards	3.3	8
Olive plantations	169.2	418
Palms	18.9	46
Date palms	34.1	84
Forested areas	810.7	1,903
Grazing land (prairie)	5,211.5	12,877
Shore dunes 15,650 / Sahara dunes 1,792,000	1,807.6	4,466
Prairie covered with grasses	1,500.0	3,706
Lakes, lagnores, and rivers	1,104.6	2,729
Roads	31.3	77
Total	13,296 9	32,752

These figures give a concrete picture of the actual state of prosperity of the country as evidenced by productive and unproductive land. The area under rood system is especially interesting.

Forest Industries. — Cork is the chief product of Tunisian forests. The cork oak covers approximately from 99 to 100 thousand hectares (244,629 to 247,100 acres) of the 650,000 hectares (1,606,150 acres) which is the estimated sum total of the country's commercial forest area. As "by-products" the cork oak yields also firewood and tannin.

A tree is first barked (for a detailed description of cork-oak management, see p. 66) when it reaches 30 cm. (11.8 inches) in circumference inside bark or 40 cm. (15.8 inches) to 50 cm. (19.6 inches) outside; seedlings reach this size at 30 years and sprouts in 15 to 18. The first peeling costs about 9 centimes ($0.01737) per tree; the average tree in Tunisia produces 5.75 kilos (13 pounds) of cork per crop. The cost of collection is estimated at 3.50 francs ($0.67) per quintal (220 pounds); transport to depots 1 franc ($0.193); transport to shipping point 5 francs ($0.96); baling and preparation 5 francs ($0.96); making a total cost of 14.50 francs ($2.80) as against the average sale price of 30.50 francs ($5.88). From 1895 to 1901, inclusive, 327,000 quintaux (72,091,074 pounds) of cork were sold for 7,165,000 francs ($1,382,845), or an average of 21.91 francs ($4.23) per quintal (220 pounds) for that period. But the

sale figures, from year to year, vary greatly. They have been as high as 35.66 francs ($6.88) per quintal (220 pounds) at the forest depot. When ready for delivery at the ocean shipping point the average price is 45 francs ($8.68) per quintal (220 pounds).

From 1885 to 1908, 32,430 quintaux (7,149,583 pounds) of tannin bark averaged 9.35 francs ($1.80) per quintal (220 pounds) but for the last 8 years the price of the bark of the tree has brought, on the average, the same figure.

The zeen oak is used chiefly for ties, though the saplings make good charcoal. The mature tree of this species reaches a height of 25 to 30 metres (82 to 98 feet) and attains a diameter of one metre (3.3 feet). It resists decay well, despite the alternating dry and wet seasons, but hews badly. The timber formerly brought about 5 francs ($0.96) per cu. m. (35 cu. ft.) standing, but prices have risen of late to 7 and 8 francs ($1.35 and $1.54) per cu. m. (35 cu. ft.) and trees sold recently for 12 francs ($2.32) per cu. m. (35 cu. ft.) in sales at Feidja in the Khroumirie.

The aleppo pine and holm oak are species of distinctly secondary importance, but the pine is used for boxes, crates, mine props, ties, forge charcoal, telegraph poles, firewood, and occasionally planks or boards; it is an excellent secondary wood. The holm oak is used chiefly for fuel.

Progress in Forestry. — A Tunisian Forest Service (Directoire des Forêts) was created in 1883 under the Public Works; by the decree of Jan. 13, 1895, the administration of the forests was transferred to the Agriculture and Commerce "Direction."

The principal revenue derived through the activities of this Forest Service comes, as has been indicated, from the cork-oak and, in part, the zeen-oak forests of the Khroumirie Mountains. Besides administering these productive areas, the functions of the service contemplate the patroling of the other forests where aleppo pine and holm oak are dominant, purely for watershed or climatic reasons, or supervising the cutting of wood for local fuel or for domestic purposes, such as corral or hut poles. Reforestation is undertaken in various localities notably at

Hammam-Lif and Zaghouan, where the project is rather for protection than for commercial purposes. The protection of the oases at the Djerid, and the Dune control at Bizerta and environs, is, too, a notable achievement. As a whole, the methods of forest administration in Tunisia are less intensive than in Algeria, but follow very closely the lines laid down by the older organization.

Since 1894 the annual receipts have varied from 603,000 to 1,337,000 francs ($116,379 to $258,041), and on Dec. 31, 1910, totaled an aggregate of 16,700,000 francs ($3,223,100).

The development work has included the building of 2100 kilometres (1204 miles) of roads and trails; and the clearing of 2975 hectares (7351 acres) of fire lines, at a total cost of 2,380,000 francs ($459,340); also the erection of 63 forest houses and 58 native huts at 3,360,000 francs ($648,480).

In theory all land belonged originally to the Bey, his people acquiring agricultural rights by use. This settlement of agricultural land is strongly favored by forest officers for two reasons: First, because with the forest cut up by agricultural holdings in the valleys, fire lines proper are unnecessary in such locations, and the Forest Service is thereby saved the cost of their construction; and second, a local population is thought desirable because it gives a loyal working class which can be advantageously employed in forest work.

The boundary problem, however, is a difficult and as yet thoroughly unsettled one, owing largely to the number of interior holdings. Originally the boundaries were hurriedly drawn in the office, from highly inaccurate type maps instead of in the field, and while the present administration is attacking the matter in a more efficient manner, it will take from 10 to 25 years longer, in all probability, to adjust and establish the forest boundaries.

ADMINISTRATIVE ORGANIZATION AND LEGISLATION

Forest Service Organization. — The forests are administered by a conservator or director at Tunis assisted by an inspector

(who is also in charge of a circumscription), an interpreter, a ranger, a compiler (editor), and one clerk.

FIG. 3. — French ranger and Arab assistants at ranger station in Tunisia.

The local force is as follows:

Location of headquarters.	Officer in charge.		Assistants.	
			French	Native.
Tabarca	1	Assistant inspector	12	13
Nefze-Mogod	1	Forest assistant	6	7
Ain-Draham	1	Inspector	13	14
El-Feidja	1	Forest assistant	6	7
Tunis	1	Inspector	5	7
Kef	1	Forest assistant	11	12
Gafsa	1	Forest assistant	9	4
Total	7		62	64

It will be noted that the supervisory force is comparatively small and that the number of native guards is approximately equal to the number of French guards and rangers.

The officer in charge is an inspector, assistant inspector, or forest assistant, according to the importance of the area administered and the number of each grade available for local appointment; ordinarily an experienced ranger or guard is

assigned to his office as clerk. In Tunisia each French guard or ranger is usually housed in the center of his beat, together with a native guard, who usually accompanies him when on inspections as a protection against assassination.

The conservator is paid 13,000 francs ($2509) per annum; inspectors, 8000 ($1544), 7000 ($1351), 6500 ($1254.50), and 6000 francs ($1158) in four grades; assistant inspectors, 5500 ($1061.50), 5000 ($965), and 4500 francs ($868.50) in three grades; forest assistants, 4000 ($772) and 3500 francs ($675.50) in two grades, and if assigned to an office as clerk, 3000 ($579); rangers in four grades, 2200 ($424.60), 2000 ($386), 1800 ($347.40), and 1600 francs ($308.80); French guards receive 1500 ($289.50) and 1400 francs ($270.20) in two grades.

FIG. 4. — The Djebel Ranger Station in southern Tunisia. Built on the site of an old Roman military camp.

Besides being well housed a ranger receives fuel or an allowance of 75 francs ($14.48), 200 francs ($38.60) for travel expenses, and 600 francs ($115.80) per year for a horse; the guards receive the same allowance but with only 100 francs ($19.30) for travel. The native guards are ordinarily little more than grooms.

In the cork-oak forests the force is kept employed supervising the state peeling and collecting operations but in the

central plateau the work is very light and much of the time is spent on chores. Typical extracts from a diary[2] are given below, each day being numbered serially:

1. "At station writing letters, the native guard went to Pont du Fabs to cash his salary check."
2. "On a trip in the canton of Telil Esallie and Telil Bonaka informed me that . . . has not moved their camp in accordance with the order received July 29th."

Then follows: "Proces-verbal feuille No. 27" *re* the trespass. (Had camped within 100 metres (109 yards) of the forest.)

3. "Overseeing collection of aleppo-pine seed."
4. "Sunday at the station."
5. "Holiday at the station."
6. "On a trip to Tarf ech Chena, found two carts loaded with poles without permit. Took data about these poles."
7. "At Bon Arada, got the mail, spent the night at Bon Djelida."

Extensiveness of Administration. — For the circumscription of El-Feidja in the cork district of Khroumirie the estimated receipts for 1912 totaled 154,000 francs ($29,722), whereas the expenses totaled 105,678.54 francs ($20,376.66). Thus the net yield for 2000 hectares (4942 acres) was in this instance 48,421.46 francs ($9345.34), or almost $2 per acre per year.

Here the collection of cork is made by the state; the force consisting of one forest assistant in charge, assisted by 6 French and 7 native subordinates.

The expenses at El-Feidja in detail for a typical year are: personnel, 19,716.66 francs ($3805.31); payments for travel, horse upkeep, etc., 10,095.83 francs ($1948.50); fire protection, 1000 francs ($193); first peeling of oak, 6700 francs ($1293.10); collection of cork, 6900 francs ($1331.70); paths, etc., 6300 francs ($1215.90); miscellaneous betterments, 1050 francs ($202.65); *maintenance* of fire lines and protection, 6500 francs ($1254.50); roads, trails, etc., 5685.50 francs ($1097.30); fences and buildings, 719.95 francs ($138.95); plantation and nurseries, 50 francs ($9.65); fire watchers, 1660.80 francs ($320.53); marking, 400

[2] Diary of a ranger at Djebel Mansaur.

francs ($77.20); forest houses, 14,500 francs ($2798.50). This is a total of 105,578.54 francs ($20,376.66). Intensiveness of administration is especially apparent in the cork-oak region, in marked contrast to the extensive management in the central plateau. There the average, under a head ranger and three guards, is 70,362 hectares (173,864 acres) at a total cost of about 10,000 francs ($1930). At the Djerid oases the revenue is also nil with heavy expenses for protecting valuable private property (the date-palm oases).

Legislation. — There is no definite forest code, as in Algeria, but within the past 13 years special forest decrees have been signed by the Bey which apply to wooded federal land. The essential details of this recent legislation are summarized:

A commission[3] was appointed to settle all boundary questions and to fix more definitely the boundaries of bordering holdings in the presence of those interested. A later decree[4] contained protective measures as follows: No lighting of fires from May 1 to November 15 in the interior or within 200 metres (218 yards) of public or private forests, even for burning charcoal or the extraction of tar or distillation of resin, but the director may authorize an exemption from this rule if there is no fire danger during May, October, or November. It is forbidden to set fire for any reason whatever to forests, brush, grass, or woods between May 1 and November 15 and during the rest of the year those burning any vegetation are responsible for any damage and must give eight days' notice to adjoining owners.[5]

For six years after a forest is burned over grazing is forbidden and the following fines are imposed in case of trespass: hog, sheep, or calf, 1 franc ($0.193); cow, steer, goat, or horse, 2 francs ($0.386); camel, 5 francs ($0.965). These rates are doubled if the trespass on a burned area is committed at night.

Steam railways or steam trams are required to keep their

[3] Decree of July 22, 1903.

[4] Decree of July 26, 1903.

[5] This rule was found to be too severe and was modified on July 27, 1911, to permit burning stubble from August 16 to November 15 after making a 15-metre (16 yards) fire line around area, after notifying the local magistrate and the bordering owners of the approximate date of burning at least 15 days in advance.

rights-of-way cleared from June 1 to October 31 when bordering forests, and if considered necessary, in addition, fire lines, 20 metres (22 yards) in width, commencing at the right-of-way boundary, must be cleared of conifers, as well as ordinary brush. If not cleared by the companies they may be established by the Forest Service on authorization of the Governor General and a bill for the work collected from the railway. No industry using fire or any inflammable substance can be established within 500 metres (547 yards) of a forest; nor any tent or brush hut within 100 metres (109 yards). Within reserved forest areas no deforestation is permitted, except when wood is required to protect stream beds against erosion, for improving springs, or for protection against sand.[6]

FOREST MANAGEMENT

Forest Regulation. — There are no working plans for forests in Tunisia. One reason why formal working plans are not required for the intensively managed cork oak is because the inevitable fires would certainly derange any fixed annual yield which might have been prescribed. Since there are no regular fellings for the holm oak or aleppo pine no plans are required for these forests. The cutting of zeen oak often depends on the market rather than on the silvical needs of the species.

The collection of cork is, however, roughly regulated as follows: When the trees on a definite area are barked for the first time a cumulative record is kept of the exact number on each subdivision with the date when peeled; from this record it is possible to predict with a fair degree of accuracy what the crop will amount to each year since the average crop per tree is known from experience. The judgment of the officer must decide whether the average tree for each year is below or above the average in size. There is no record kept of the number of trees of each diameter. Approximately the same annual yield is secured because the blocks are so divided that an equal area is theoretically cropped each year.

[6] Compare these protective measures with those given in the Algeria code, p. 185.

The official record includes: (1) Composition of the lots — number of the block and compartment, number of trees counted at the first peeling, number of trees remaining on a given date (when crop collected), year of first production, remarks. (2) Order of exploitations — number of the blocks, dates of the exploitations and production during 20 years commencing with 1907, age of the bark at the time of exploitation, remarks. (3) Products realized — year, weight of dry cork, price of the sale: (*a*) total, (*b*) per quintal (220 pounds), miscellaneous data. For each compartment of each block a further record is kept headed: (1) Producing — peeled: (*a*) year, (*b*) number of trees; increases: (*a*) year, (*b*) number of trees, year of the crop collection or of the first increase; accidental operations: (*a*) year, (*b*) reason. (2) Collected — year, number of trees, year of the peeling, collection or increase, amounts, price of the sale, remarks.

Silvicultural Systems. — The cork oak is managed on the selection system, as in Algeria, on a rotation of 80 to 100 years and a peeling cycle of 3 years. The cork matures in 8 to 12 years. (See page 60 for Algerian cutting rules.)

The zeen oak is cut under a simplified shelterwood system with a seed felling and a final removal of the seed trees in 15 to 20 years, depending on the local market rather than the progress of seeding. While no definite rotation has been selected, it is expected that 120 years will be required. The scrub oaks and olive are coppiced. The aleppo pine is not regularly exploited.

Grazing. — The only restriction upon ordinary grazing is after a conflagration, when no stock can enter for a period of 6 years under a fixed penalty per head.[7] Grazing is otherwise practically unregulated, except in the Khroumirie where special provision is made for the grazing of hogs. These rights[8] are reserved for local French colonists within the district but are occasionally granted to foreigners (Italians) who have enjoyed the privilege previously and who have been resident for a

[7] For these fines see page 22.

[8] Based on official circular, dated July 30, 1903.

number of years. No one permittee, however, is ordinarily allowed to lease more than 200 hectares (494 acres) of contiguous land.

The areas reserved from grazing are: Ranger-station gardens and fields, land within 300 metres (328 yards) of any ranger station, land cultivated by natives within the forest, recent felling areas, land burned over (for a period of 6 years), land heretofore used by natives. It is clearly understood that the forest administration assumes no responsibility in the case of conflicting claims. The price charged is based on an estimated 10 hectares (25 acres) to each sow (and litter), and amounts to 0.30 francs ($0.06) per hectare (2.5 acres) per year, paid in advance. The boundaries, total areas, and number of stock admitted are authorized in advance by the director for each forest. The permittee agrees to keep stock on the leased area; when building brush huts (gourbis) to pay for poles 20 to 60 cm. (7.9 to 23 inches) in circumference, 1.50 francs ($0.29) each; 60 to 120 cm. (23 to 41 inches), 3 francs ($0.58) per cu. m. (35 cu. ft.) on the stump, and for logs 120 cm. (48 inches) and larger, 6 francs ($1.16) per cu. m. (35 cu. ft.). The right of entry into huts (gourbis) for counting or for taxing purposes is reserved, and revocation of permit is the penalty for excess in numbers. Permittees are bound to repair damage to roads, trails, or timber yards. The right of seizure is reserved if stock is found off the allotment. In accordance with the fire decrees no fires can be lighted in or within 200 metres (219 yards) of the forest unless surrounded by a ditch 1 metre (1 yard) deep and by a wall of dry stones; soil around huts must be cleared within a radius of 25 metres (27 yards) but the permittee in addition is held responsible for all fire damage (or offences), even if caused by his employees after taking these precautions. Concessions are personal, revocable, and nontransferable. In the official language: "At the expiration of the permit the administration reserves the right to auction off the right to graze, to renew the former permits under new rules or to cancel all permits purely and simply" — "but . . . in case of renewal the preference will be given former permittees either to retain their former permits or to change the allotment."

The forest administration absolves itself from the responsibility of providing additional range, even temporarily, in case any allotment is found insufficient. It also states in advance that it will pay no claim arising from a burning of the range, or because of loss or damage in any form, even if caused by act of Providence. Moreover, the administration reserves the right to interpret all questions which may arise in connection with the enjoyment of the grazing. This is similar to the policy followed in the western United States.

PROTECTION AGAINST FIRES AND MOVING SAND

Fires. — Incendiarism is still the chief cause of fire.[9] It is combated with only partial success by the restriction of grazing. The fire protective system in the less valuable forests

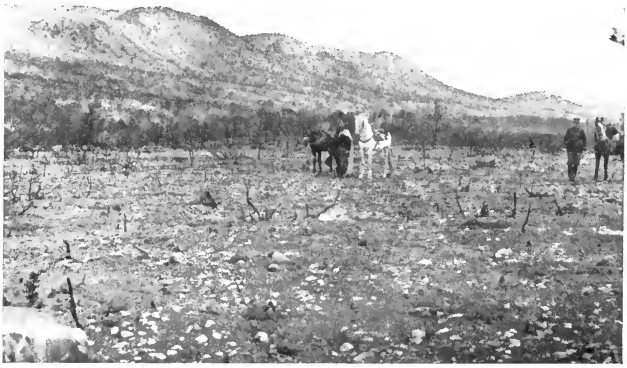

FIG. 5. — The result of fire in an aleppo-pine forest in southern Tunisia. Near the Djebel Mansaur Ranger Station.

of the Central Plateau consists merely of a general patrol, which is not supplemented by fire lines, lookouts, telephones, or by a special protective force. In the more valuable cork-oak forests there are five lookouts, patrols, occasionally tele-

[9] Since the Algerian fire problem will be fully described, only the more important phases of Tunisian protection are given.

phones, and invariably costly fire lines which will be described in detail hereafter.

In the small forest gardens at the oases in southern Tunisia there is no necessity for any kind of protective measures. In addition to the fire lines along railroad rights-of-way the following notice is posted in railroad cars:

> " . . . Travelers are warned that it is forbidden to throw anything on the track and that a violation is punishable with a fine of from 16 to 2000 francs ($3.08 to $386.00) and by an imprisonment of from 3 days to a month. . . . It is especially important to refrain from throwing anything lighted on the track (such as burning matches, ends of cigars or cigarettes, etc.) which could set fire to grass, brush, etc., that might in their turn communicate fire to crops."

While this notice is evidently designed to protect crops, it is also an excellent warning to be posted by all railroads passing through inflammable forests.

Protection of Cork-oak Forests. — The policy of concentrating costly protection on the most valuable forests is followed in Tunisia. The cork oak, after peeling, is easily scorched, and the dense undergrowth makes successful protection doubly difficult and uncertain. There is a considerable difference of opinion, as in Algeria, regarding the details of protection, but the following statement gives a résumé of the director's conclusions in 1912:[10]

> " . . . Experience has shown that the fire lines 20 to 30 metres (22 to 33 yards) wide and only brushed out are almost always ineffective in case of fire, unless all the trees or stems on the fire lines are removed. The only system of protection recognized as (absolutely) certain consists in the complete brushing around trees and stump extraction. Its application was made for the first time in 1895 in various stands of the district of Taborca.
>
> This means of protection has the double advantage of removing the brush, food for fires, of replacing fire lines, and besides, of facilitating the entry of stock into the forests, of creating pasturage and consequently suppressing the agitators who urge the native inhabitants to fire the forests.

[10] L'Indicateur Tunisien, 1912, p. 296.

But if this method of protection is effective it is on the other hand very expensive. It should only be applied to fully stocked forested areas which can compensate by their revenue for the outlay. For the rest of the stands one can only make use of fire lines laid out on the main ridges and dividing the forest in blocks of varying size according to the ground. But these lines must be at least 50 metres (55 yards) wide, must be entirely cleared of every tree, stem bush, shrub, etc., and have in the center an area 10 to 15 metres (11 to 16 yards) wide where all stumps have been removed on which can be built either a good path or a causeway of stones according to the quality and configuration of the soil."

Problems in Protection. — The main problems in protection which have confronted the forest administration in the cork-oak forests are as follows: (1) How to secure successful protection; (2) value, need, and cost of fire lines; (3) their location, width, clearance, maintenance, and the execution of the work by contract.

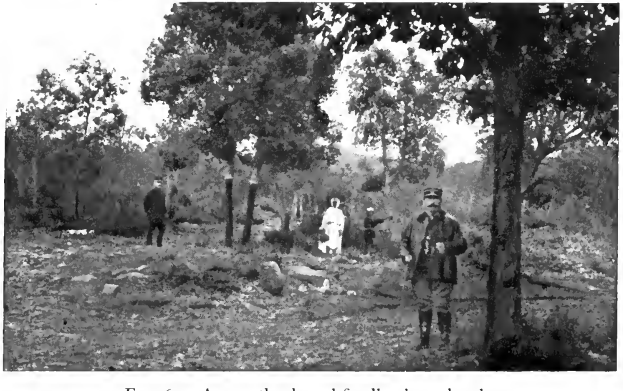

FIG. 6. — A recently cleared fire line in cork oak.

Fire Lines. — With the inflammable underbrush uncleared on the forest as a whole, successful protection can be assured only by the periodical brush removal on the fire lines, which is usually done on a cycle of three years.

Yet even fire lines are by no means a sure prevention against fires nor are fires once under way certain to be arrested by properly laid-out lines, even if fully manned at the time of the conflagration. On the other hand, without fire lines, which are used chiefly to fight from and for ready access, there would be no possibility of successful fighting, and often the lives of the fire fighters would be unnecessarily endangered.

The cost of these fire lines depends on how they are cleared. For ordinary clearing the rates average 80 to 90 francs ($15.44 to $17.37) for the first operation per hectare (2.5 acres) and 8 to 9 francs ($1.54 to $1.74) per year thereafter.

Location. — The location of lines has been around boundaries, along main crests, on ridges, and occasionally through large forested areas following slopes or a main divide. The chief arguments given in favor of ridge fire lines, as opposed to slope or valley lines, are that it is easier and hence cheaper to clear the scantier ridge growth, less valuable ground is lost, there is less danger in checking a fire on a ridge, and a ridge fire line can often be used as a general patrol route and occasionally as a logging road. Auxiliary lines often follow roads or trails on a side slope or valley, but these are designed more as a protection from the carelessness of travelers than as part of the general defense.

Width. — The width of fire lines in Tunisia varies from 10 to 200 metres (11 to 219 yards). There are also lines 20, 50, and 100 metres (22, 55, and 109 yards). Ordinarily boundary fire lines are narrow; 10 to 20 metres (11 to 22 yards) is considered sufficient, since the bordering land is usually under partial cultivation or consists merely of heavily grazed brush land. The widest line cleared — 200 metres (219 yards) — was designed to separate two valuable forests in case of a great fire. Lines designed to divide the ordinary forest and isolate fire are 50 metres (55 yards). In the opinion of the acting director the most serviceable lines are 40 to 50 metres (44 to 55 yards). In his experience he has found 10-metre (11-yard) lines too narrow and 200-metre (218-yard) lines too expensive to maintain. Another officer preferred a width of 40 metres (44 yards)

for a secondary line and 120 (131 yards) for an important division fire line. Along railroad rights-of-way the prescribed width is 20 metres (22 yards) from the track. This belt must be kept cleared of brush and all coniferous trees.

Clearance. — Whether to merely cut the brush, or to grub it out by the roots; whether to fell all trees on the line or only a portion; and how often to clear lines, are among the problems of clearing. In actual practice most of the lines are merely brushed and healthy oaks usually are not felled when they are producing cork in merchantable quantities; but as cork-oak trees become overmature they are cut clean with the ground, so that on most fire lines there is now rather a scattering growth which, in the process of time, will gradually disappear and give way to completely cleared lines. In zeen oak, however, the lines are often kept dense, since this species keeps weeds and underbrush shaded out. *No coniferous species are left on fire lines.*

All lines are cleared every three years and the work is so arranged that the trail and road maintenance can usually be accomplished under the same contract. This arrangement is not altogether satisfactory, because of the rapid growth of the brush and weeds. After one season this new growth seriously impairs the value of the line; the third year it is badly in need of clearing. To clean every year or every other year would entail too great an expense, so that a compromise is made with three-year intervals between brushings. Under present conditions it is usually necessary to clear a line of defense along the fire line in case of an approaching fire, since the fire would otherwise cross.

Theoretically, at least, a better policy would be *to annually clear*,[11] say, one-third of the line along its entire length, so that there would always be an area free from weeds and brush to serve in case of back firing, or as a means to stop a light ground fire from crossing. The main objections raised to this plan was the impracticability of narrow lines, because of the

[11] This scheme has never been tried out, but was suggested by Forest Assistant Charvet at Feidja.

difficulty of clearing a narrow strip, but it was considered worth while trying out on wide fire lines where partial clearance seemed feasible. If an adoption of some such plan could be effective it would solve the maintenance problem of intensive fire lines, which under the system of triennial clearance is costly without being entirely satisfactory.

Contract Conditions. — Contractors clearing fire lines are governed by the following rules:[12] The boundary corners are designated by the forest officers but the contractors must at their own expense run the exterior boundaries between known corners; all brush and trees must be cut level with the ground; all rubbish cut must be disposed of; work must proceed systematically; the material cut belongs to the contractor but it must be either carried away or completely burned in small piles as the clearing proceeds; if the burning cannot proceed the clearing will be stopped; a schedule of damage is given for cork oak injured, a 16-inch tree being assessed at 2.40 francs ($0.46) if just peeled for the first time, 1.20 francs ($23.16) if never peeled, but 4.80 francs ($0.92) if fire killed in burning brush; in addition it must be felled even with the ground. The basis for contract payment is a price per hectare, and the contractor must furnish an account of the area brushed each day, but this is checked by the forest officers and deduction is made for openings if they exceed $\frac{1}{50}$ of the area brushed. In case the forest is burned over by fire owing to clearance the contractor receives no pay whatever for work performed.

Dune and Oasis Protection. — The protection of valuable property from damage by moving sand has been successful both along the coast line, as at Bizerta, and at desert oases as at Nefta, Tozeur, El-Hamma, and El Oudian.

Oases Protection. — In 1885 the French Forest Service detailed Forester Baraban to investigate the question of fixation and afforestation of sand dunes of Tunisia around the oases. Baraban has shown that the movement of the sand dunes in Tunisia is usually different from that in Gascogne.

[12] Cahier des clauses speciales pour les travaux et de débroussaillement et de protection contre l'incendie, approved 1895.

On the shores of Gascogne the sand is brought to the shore by the tides and the movement of the sand is only *in one direction* — from west to east. The dunes of Tunisia are caused by two factors. Some of them are formed under the influence of wind from the sandy areas which always exist in the desert in a mobile state or are found on the shores of the bays and lakes. Others were caused by the breaking up of the soil through cultivation and grazing, and the wind that moves the sand is often from *several directions* which then makes it necessary to protect an oasis *from all sides*. In 1886 the French Government decided the work of fixing the shore dunes and drifting sand around the oases a public necessity.

The oases: Gabes, Tozeur, Nefta, as well as the fixation of the shore dunes near Bizerta and Cap Bon, have been considered among the most urgent ones. The fixation of the sand areas around the oasis Nefta may be considered as typical for the southern part of Tunisia. After many failures the Forest Service has worked out a satisfactory method of stopping and reclaiming the moving sand. The sandy area around the oasis Nefta which was to be reclaimed occupied an area of 420 hectares (1038 acres), while the area of gardens after the completion of the reclamation work reached an area of 800 hectares (1977 acres). Reclaiming the sand dunes around the oasis Nefta cost the government during the first ten years close to 60,000 francs ($12,000). At present the annual cost of maintaining the plantations and keeping the fences in repair is about 3000 francs ($600) a year, not including the cost of protection. The value of some of the oases may be appreciated from the fact that at the oasis Nefta there are growing 240,000 date palms, not counting other crops. The palm plantations extend for a length of 9 kilometres (5.5 miles) from east to west and have a width of about 2 kilometres (1.2 miles). The oasis Tozeur has an area of 400 hectares (988 acres) and has 218,000 date palms which yield 8,500,000 kilograms (18,739,260 pounds) of dates.

At the oases the general principles of dune protection apply, but the detailed methods[13] used are modified to conform with

[13] Based in part upon a description in the Indicateur Tunisien, 1912.

the different conditions encountered. The damage to oases has resulted (1) from sand drifting from a distance, (2) from local overgrazing, and (3) from erosion.

Where the drifting sand is blown from a distance no permanent relief can be hoped for unless the direction of the wind changes. In this case the damage is uniformly from one direction and the drifting sand can be rendered harmless by proper protection. When the sand appears merely as a result of local overgrazing disintegrating a friable soil, it can be readily pre-

FIG. 7. — Typical sand wall topped with date-palm branches in use at Tozeur, southern Tunisia.

vented by excluding all stock from a protective zone, but until the soil is healed by grass and weeds the damage is more difficult to control, because the direction of the local winds is not uniform. The erosion is prevented or diminished by contour ditches and by sand dams, where gullies have already been washed.

The typical desert oasis in southern Tunisia is not a mere spring in the desert, but, in reality, a rich date-palm farm hundreds of acres in area, whose ownership is shared by the residents of bordering villages. The water for irrigation flows from

not one spring but from fifty to a hundred or more at the perimeter of the oases. Therefore, any system of protection against sand, however costly, is fully justified because of the value of the property to be protected.

The work of protection was commenced in 1885, and, according to an official statement,[14] 2139 hectares (5285 acres) have been placed under control at the following oases: Gabes, 76 (187 acres); Tozeur, 539 (1331 acres); Nefta, 426 (1052 acres); El-Hamma, 98 (242 acres); El-Ouidan, 180 (444 acres); and Nefzaona, 8201 hectares (20,264 acres). Up to January 1, 1911, the cost of this protection had aggregated 465,000 francs ($89,745). Labor is paid from 1.20 to 1.30 francs ($0.23 to $0.25) per day of 10 hours.

Sand Drifting from a Distance. — Where damage results through sand drifting from a distance it may be assumed at once that the direction of the wind is uniform. To prevent such damage, when there is a sufficient open area in front of the oasis, sand dams are built some 300 metres (328 yards) from the edge of the cultivated land. While in theory this outer line of defense should be as far away as possible, in practice the distance is usually curtailed by the character of the ground, or by the extra expense of erecting a longer line of defense due to a greater circumference. Often, too, the construction material, as palm branches, for example, is limited, since it must be secured locally.

A second or third line of defense may be necessary to stop the sand which blows over the first wall. The area between this wall and the fields is closed to entry and caravan roads are fenced to confine travel to the least possible area. These areas are enclosed by sand walls 0.80 of a metre (31 inches) high topped by a close palm branch hedge 0.40 to 0.50 metres (16 to 20 inches) high and buried 0.25 to 0.30 metres (10 to 12 inches) in the ground. This is the standard fence at the Djerid oases. It must be repaired at least once a year and always after severe storms.

The best time to build these sand fences is when the sand is moist, so that it can be packed hard to prevent its being drifted

[14] Based in part upon a description in the Indicateur Tunisien, 1912.

by the wind. Occasionally it is necessary to cover the walls with layers of palms to hold the dry sand in place. According to an official inspection report it is necessary either to periodically raise the outside defense hedge, to accumulate as great an amount of sand as possible and thus form a thoroughly stable dune which serves also as a permanent windbreak; or else to build a cordon of brush at the foot of this dune, in the process of formation, in order to make the sand pile up into a rather low plateau which would serve as a base for a great protective dune. In other words, the wind itself is harnessed to pile up a sufficient mass of sand, as a barrier to prevent drifting, by first building a sand wall at right angles to the wind, topped with a palm leaf hedge which holds the particles of sand; then, when this is buried, the operation is repeated and the dune raised to the necessary height.

Sand Drifting from Local Overgrazing. — Where the soil immediately bordering an oasis has been disintegrated by overgrazing the resulting damage can be readily overcome by forming a protective zone closed to stock. This area is fenced with sand walls similar to those described above, occasionally supplemented by barbed wire. When protected, the soil, dry as it is, quickly reseeds; the resulting sod will prevent all drifting. After the movement of sand has been stopped, there often appear the following spring some of the native grasses such as Retama raetam, Aristida pugens, Limoniastrum guyonianum, Atriplex halimus, Nitraria tridentata, peganum Harmale, Zygophyllum album, Calligonum comosum, together with Euphorbia guyoniana and Euphorbia blasamifera. These grasses which are native of the desert, particularly Aristida pugens, are often artificially sown as soon as the movement of sand has stopped.

The shrubs which are being used for reclaiming the moving sand areas in the deserts are Tamarix africana and Tamarix articulata. At first it was thought that Tamarix africana, being of local origin, would grow particularly well. The practice of several years, however, has shown that winds often injure its young shoots and the summer heat dries out the soil to a depth

greater than its roots are capable of reaching within the first few years after planting. At present Tamarix africana is used for planting only on those portions of the dunes which are capable of retaining some moisture during the summer. Experiments are also being carried on with other drought-resistant species, particularly with Acacia eburnea, Acacia decurrens, and Acacia tortilis, of which the latter grows naturally in the valley of Thalah. This species resists droughty years, since its roots penetrate deep into the ground. During the first year, however, this acacia starts with difficulty and requires repeated watering so that its cultivation over large areas is impracticable. The Forest Service is also conducting experiments with Parkinsonia aculeata, a tropical shrub which originates from the deserts of South America, and also with Tamarix articulata which, so far, have given good results.

On the shore dunes to the east of the city of Bizerta the sowing of Imperata cylindrica, Ricinus communis (native), and of Tamarix made under cover of brush gave good results. Other species, such as Acacia, Eucalyptus, Casuarina, and also Pinus halipensis and Pinus maritima, have been tried but without success.

When, owing to the looseness or mobility of the sand, the roots of the natural growth are bared by the wind, it may be temporarily held in place with a brush cover. But frequently despite all precautions, the natural regeneration does not get a hold when once destroyed by overgrazing.

Erosion. — On the short steep slopes of the spring basins, as well as on the reserved areas where the surface becomes so caked that the water cannot be absorbed, dangerous erosion has taken place. This fills the springs with sand in considerable quantities and decreases their flow. When once a ravine has been formed, every torrential rainfall causes serious damage. Any measures designed to prevent this erosion must keep the water from these downpours from collecting in large quantities and from flowing in any volume. To accomplish this it must filter into the soil, a process facilitated by plowing the requisite number of horizontal ditches, aligned exactly on contours.

These ditches must be at least 60 centimetres (24 inches) deep, and the sand of the lower wall must be packed or pounded to prevent erosion by the winds. The theory of spacing the ditches is officially described as follows:

"The horizontal spacing of the two ditches will be such that the amount of water falling between the ditch above and the ditch below can be entirely reservoired in the lower ditch; for example, for a fall of 25 millimetres (0.97 inch), taking the maximum fall for Tozeur, it would be necessary that the distance L between the two ditches should be given by $L \div 0.025 = S$ (S being the cross section of the plowed furrow). If the ditch has a depth of 60 centimetres (24 inches) and a width of 60 centimetres its section is $S = \frac{0.60 \times 0.6}{2} = 0.18$ or $L = \frac{0.18}{0.025} = 7$ metres (23 feet) more or less.

"It thence results that all the water will be retained on the surface of the soil, until it sinks into the sand in the bottom of the ditches, bringing quantities of seed which, placed under the most favorable conditions, ought to germinate the more readily. It must be carefully seen to that the alignment of the ditches should be exactly horizontal; if not, the water collects at one point on the ditch, overruns the bank, and the damage is worse than if nothing had been done."

This is the theory of the operation; in actual practice the ditches soon become partially filled with sand and have to be deepened to prevent the water from overflowing. Nor does the seeding take place naturally as often as might be wished.

"In the case of ravines which are (already) eroded, it is necessary at the start to partially fill them up, usually until the side walls are vertical; profiting by the facility with which the soil can be worked, it is necessary to cave these walls into the ravine . . . in order to obtain a new profile which is well rounded . . . where one can establish several cordons of brush to diminish the velocity of the water. In the bottom of this ravine, in part corrected, dams should be built of palm tree trunks, . . . near together, each built of two palm trees split horizontally . . . ; when these dams, which may easily be destroyed, appear insufficient, there is nothing to do but to increase them. . . . ."

But any system of dams has proved unsuccessful unless the supply of water has been greatly diminished by cutting off the flood water supply. This is accomplished by building contour ditches heading up to the edges of the ravines.

At El-Hamma both the Roads Department and the Forest Service have protected slopes from erosion, but by different methods. The work of the former has not been successful. The methods of the roads department has been to cover a slope with diamond-shaped cordons of brush tied to anchor stakes (see Fig. 8). The brush is spaced 1.2 by 2.1 metres (4 by 7 feet) and 0.1 to 0.15 metres (4 to 6 inches) high with stakes every

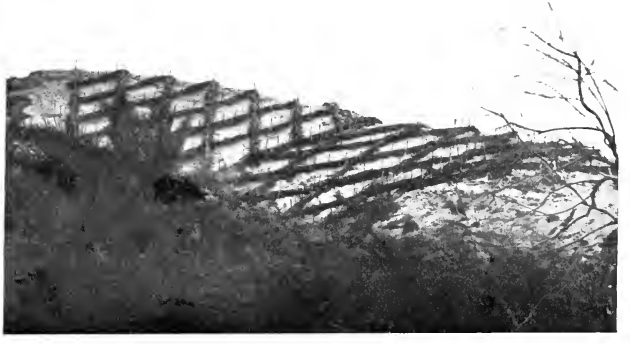

FIG. 8. — Method of protection against erosion at El-Hamma.

0.35 metres (14 inches). This protective cover does not prevent erosion, since the water flows underneath the brush and soon cuts out a small ravine. On an even more difficult 45° slope the local ranger has tried another plan which merits success. The project is designed to protect an important spring used for watering camel caravans, as well as for irrigation. This scheme, which is shown in Fig. 9, consists of a series of parallel artificial hedges built on contour 3 to 4 metres (3 to 4 yards) apart. The hedge is of tamerisk, 40 cm. (16 inches) above the ground,

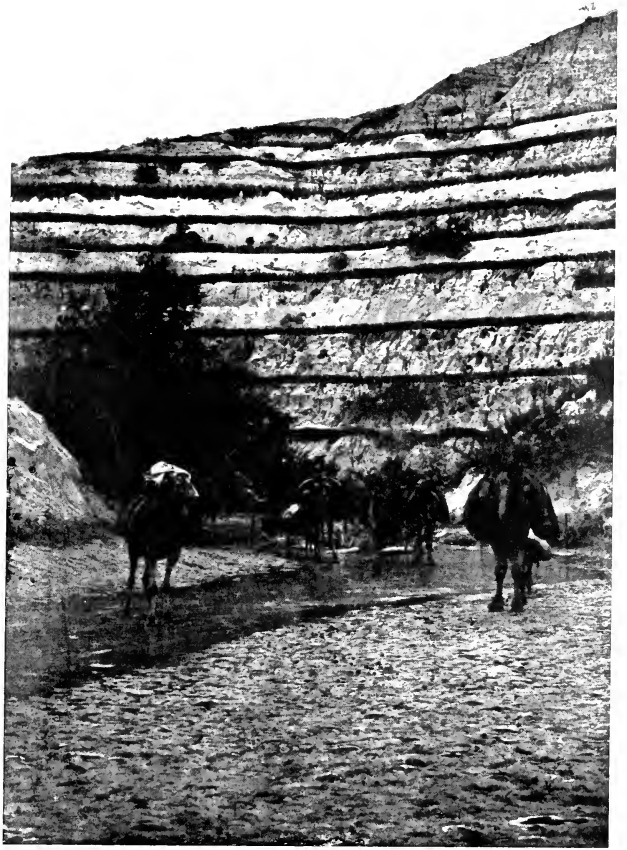

FIG. 9. — Protection against erosion above springs at El-Hamma.

and set 25 cm. (10 inches) deep. It is strengthened by posts every 1.2 metres (4 feet) and smaller posts or stays every 5 to 8 metres (6 to 9 yards). The hedge is wired on each side and the wires joined. The sand washed down on these hedges is retained, and forms a series of horizontal paths or shallow ditches, one above the other, to retain the water. The work costs at a rate of 50 centimetres ($0.10) per running metre (1 yard).

At El-Oudian still another method is used to protect the springs. There the ditches are designed to carry off the surplus water to a point where it will do no harm. The slope is steeper than at Tozeur, but not so vertical as at El-Hamma.

Besides mere protective works, the Forest Service has experimented in the matter of plantations, but they have not as yet been successful, except where they could be irrigated. The only tree (small and crooked at best) which seems to come in naturally on the edges of the desert is the tamerisk (africana). The best shrub seems to be the retem and the best grass the alfa. The tamerisk can be reproduced by shoots 30 cm. (11.8 inches) long and placed 28 cm. (11 inches) in the sand; but on an area of several acres recently every shoot thus set had died.

The following official statement of the problem is perhaps too optimistic:

> " . . . The Forest Service tries to cover the zones of protection with tree species, but has met in this respect serious difficulties. The annual rainfall is only a few centimetres, sometimes almost nothing. The species to be grown must, besides, withstand the burning sirocos which blow during the summer. It is, therefore, necessary that the fibres be as tough as leather and small, to lessen evaporation, a characteristic of all desert plants. The land to be restocked can not be irrigated and sprinkling is only possible on restricted areas for fear of high costs."

Strange to say, some of the railroad right-of-way area in Tunisia has been sown to aleppo pine, an inflammable species; but most of the planting has been with eucalyptus, which has done remarkably well where there was sufficient water. On dry ground the trees were spindling and of little value.

FORESTATION AND BETTERMENTS

Government Forestation Policy. — The government's attitude[15] is favorable to artificial regeneration only so far as is necessary to complete small blanks in a revenue-producing forest. Instead of planting or sowing, the policy is to preserve and improve existing forests by the gradual restriction of harmful grazing, by very conservative cutting, and by the erection of dams to conserve moisture, not only in the soil but in the air as well. Occasionally it has been possible to wound the soil, on ground where natural regeneration has been deficient, in order to assist germination. The two most expensive planting areas are for watershed protection and for climatic and recreation purposes.

In theory resinous species are to be avoided, because of the fire menace; but in practice more aleppo pine has been sown or planted than any other species, because it is found locally and because it withstands droughts. The wild olive, holm oak, carob-tree, piñon pine, thuya, and eucalyptus (chiefly globulus) have also been employed. The olive withstands drought better than any other species and sprouts very readily after being dried out. The holm oak requires slightly better moisture conditions. The carab tree withstands drought well and produces a leafy bush like a tree which shelters the soil. The thuya is excellent for dry soils but grows very lowly. The piñon produces an edible seed and for this reason encourages trespass by the natives. The eucalyptus can only be used on moist ground or where the subsoil is moist; no species of eucalyptus has been found which will withstand droughts unless the roots can penetrate the subsoil water.

Seed Spots. — The seed-spot method of sowing is almost invariably used; broadcasting or unprepared soil is never practiced except with aleppo pine immediately after a fire and, thus far, even in that case, merely for experimental purposes.

[15] These conclusions are based on a conference with the acting Director, M. Delacourcelle. The description of methods in use is based on field inspections at Hammam-Lif and Zaghouan.

The seed spots are ordinarily 30 cm. by 30 cm. (12 by 12 inches) and 30 cm. (12 inches) deep whether for sowing or planting. For the olive larger spots are used, often 60 by 60 cm. (23 by 23 inches).

Stock. — There is more sowing than planting, but if the sowing is unsuccessful the soil-field seed spots are immediately planted before they run wild. The aleppo pine is sown 7 to 8 seeds to the spot, and for fail places or very difficult ground 8-month seedlings, grown in terra cotta pots, are fall planted. At Hammam-Lif the olive suckers were left two years in the nursery and then field planted. The piñon and thuya are sown. The oak is sown in bamboo tubes to protect it from rodents. The carob-tree is sown. The eucalyptus is fall planted after being grown in pots for 7 to 8 months. No transplanted stock is used.

All field sowing or planting is mainly in the fall (December to January), after the winter rains have commenced. The soil is then in the best possible condition, so that the plants can make sufficient headway to survive the dry summer months.

Spacing. — In order to keep the expense of forestation as low as possible wide spacing is used. The seed spots are usually irregularly located, so as to give the best possible chances for success and while the spacing is nominally 1.8 to 2.4 metres (6 to 8 feet) in practice there are rarely more than 250 spots per acre.

Field Technique. — On very dry situations the olive shoots may have to be watered, when planted, in order to give them a start, but of course this is out of the question for ordinary forest plantations. After sowing or planting, the surface is left 7.6 to 12.6 centimetres (3 to 5 inches) below the soil surface, in order to hold the rains and let the water sink in. Yet on side hills many of these small spots are washed level with soil after the first winter rains, and this leaves the plants too deeply imbedded. Where losses from drought are anticipated, two or three small rocks are placed at each side of the plant to conserve the moisture and prevent surface drying.

At Zaghouan loss has been experienced because the center of

the seed spot, comprising the soil which has been worked, dries out; this is due to the soft center earth shrinking and losing contact with the walls of the spot. To prevent this, the earth, when replaced in the hole, must be firmly stamped. After sowing aleppo pine at Zaghouan the excess seedlings are destroyed, for the extra stock, it is thought, would merely use up the little available moisture. All nursery stock is grown locally, since shipped stock when tried has invariably given poor results.

Nursery Methods. — Both the nurseries at Hammam-Lif and at Zaghouan are watered during the hot dry summers. Irrigation is carried out every 10 to 15 days, and is then moderate. At the Zaghouan nursery the pots used are 115 millimetres (4.5 inches) deep, 128 millimetres (5 inches) wide at the top, and 58 millimetres (2 inches) at the bottom. The pot is drained by a 6-millimetre ($\frac{1}{4}$-inch) hole. After the ball plant is removed the pots are collected and used over again. No artificial shade frames are built; instead, Indian corn is sown between the seedling beds, to protect the plants during dry weather. This corn grows to be 1.5 metres (7 yards) high and serves as a natural protection. Before sowing the oak acorns in the field they are first germinated in wet sand, then placed in the bamboo tubes at the nursery, and immediately planted. In the past, a cement-walled seed bed was used to protect seed sown from loss by rodents. Before sowing the aleppo pine the seed is soaked in water for at least an hour; otherwise the usual nursery methods are followed.

Failures. — The forestation on arid, difficult land can be accomplished only by persistent effort. Repeated failures and severe loss are to be expected. The percentage of success seems to be dependent entirely on whether the season following the planting is favorable as regards rainfall, for with an unfavorable season even well-executed plantations may show a loss of from 80 to 95 per cent.

Improvements. — As in Algeria (see page 89) the forest houses are constructed of stone, and are ordinarily faced with cement. But in Tunisia there are no uniform plans, although the arrangement of the stables and floor space is similar. A

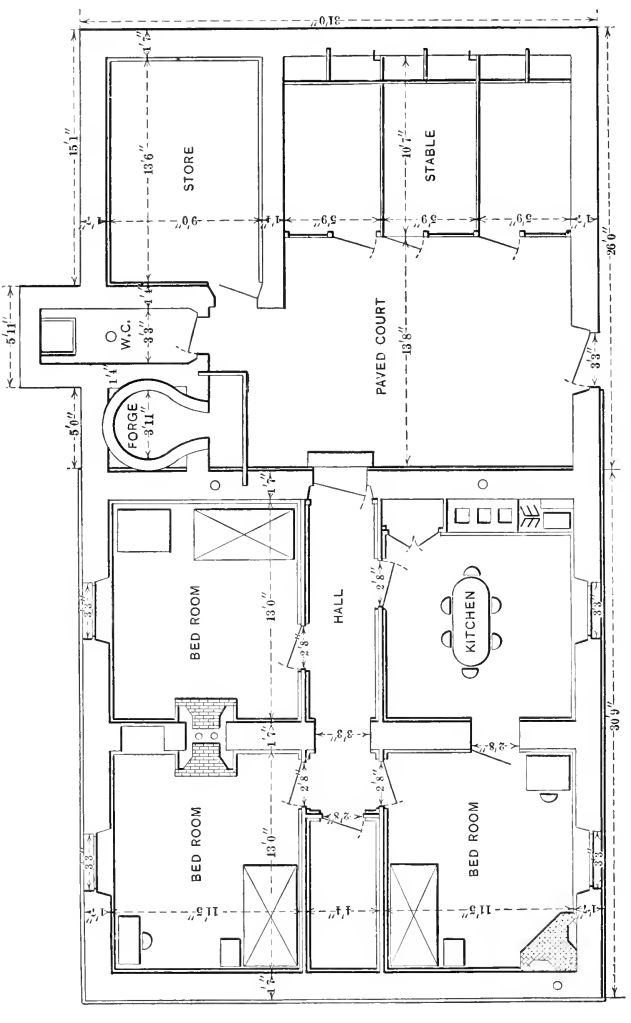

FIG. 10. — Ranger's house, Feidja, Tunisia.

plan[16] is given in Fig. 10 which has been worked out after thorough trial as being eminently satisfactory for a forest guard's house. Every house is furnished by the Service, and a room is always held in readiness for visitors. The official inventory lists furnishings under 1, numerical order; 2, date; 3, kind of article; 4, summary description; 5, where purchased; 6, when first used; 7, original value; 8, condition, with four columns for the entry of the results of different inspections; and 9, remarks. At Djebel Mansaur the cost of the standard equipment totaled 419 francs ($80.87), and included: sheets, pillow cases, table cloth, towels, covers, blanket, folding chairs, tables, wash stand, commode, carpets, mirror, basin, pitchers, pails, bedstead, buffet, desk, kitchen stove, glasses, candlestick, and field medical chest. All of these articles are for the use of visiting officers. In the United States the Government furnishes only a few of them.

A detailed policy has been developed to govern the use of ranger stations. The essentials of this scheme are as follows: they may be used at any time by authorized persons, but visitors must be reported by name, hour and date of arrival and departure, and hospitality must not interfere with official work, nor can it be offered ordinarily for longer than 24 hours at a time. The rates are posted in each room: lodging, 1 franc ($0.193) first night and 0.50 ($0.10) second night; breakfast of coffee and bread, 0.50 ($0.10); other meals 2 francs ($0.39); horse feed 0.60 ($0.11). At these ranger stations the visitor is invariably accorded a warm welcome and the meals, often prepared on short notice, are surprisingly good.

[16] Furnished by Forest Assistant Charvet.

CHAPTER III

ALGERIA [1]

PHYSICAL AND CLIMATIC FEATURES

General. — As in the case of Tunisia, so also in approaching the study of Algerian forest administration proper, a short description of the topography and climate is prefaced, for these factors determine, of course, in large measures, the character of native forest conditions and needs.

It remains only to add here that Algeria, since 1858, has been a French colony, now under the administration of a governor

[1] The problems in Algeria and Tunisia are somewhat similar and to avoid needless duplication only the most interesting features of each forest administration have been described.

appointed by the President of the Republic; and that it has for its boundaries the Sahara desert on the south, on the east Tunisia, on the north the Mediterranean, and on the west Morocco.

Algeria occupies an area of about 456,000 square kilometres (176,000 square miles).

Topography. — Topographically Algeria is divided into four regions: The Tell Atlas, the Hauts-Plateaux, the Sahara Atlas, and the Sahara.

According to an authoritative source these regions are:

"I. The Tell Atlas (Atlas Tellien), the most important part of this territory, consists of two parallel ranges of folded hills of recent origin, which intersect a great basin stretching from the Atlantic to the Bay of Tunis. The highest points of range next the coast are the Traras, 11,359 metres (3727 feet); the Dahra, 1579 metres (5181 feet); the Atlas of Blida, 1629 metres (5345 feet); the Jurjura Chain, 2307.8 metres (7552 feet) in Great Kabylia; and the Babor range, 2034.4 metres (6675 feet) in Little Kabilia. In the interior rises the Tlemcen Group, 1843 metres (6047 feet); the Ouarsenis, 1984 metres (6512 feet); the Jebel Dira, 1809.8 metres (5938 feet); and the Hodna Mountains, 1862.8 metres (6112 feet), which last form the only considerable link between the Tell and the Sahara Atlas. The Littoral, 842 metres (920 yards) in length, with long, precipitous and almost inaccessible stretches, is broken by the bays of Oran, Arzew, Algiers, Bougie, Philippeville, and Bona, but does not possess a single good natural harbor. Flanking the coast, in front of the Tell Atlas, are several ranges of lower hill (Sahel), as the Sahel of Oran, between Lourmel and the mouth of the Cheliff, the Sahel of Algiers, and the Sahel of Collo, while the Edough Group, 1007.9 metres (3307 feet), composed of crystalline rock, forms an independent mountain. The extensive plains behind the Sahels, which at Oran are marshy (Marais de la Macta) and have besides the remains of great salt lagoons, Sebkha d'Oran and Salines d'Arzew, and especially the Mitidja near Algiers, once a bay of the sea, and the Plaine de Bone are the most fertile and richly cultivated parts of Algeria. Tell region embraces an area of 14,000,000 hectares (35,000,000 acres).

"II. *High Plateau.* — The Hauts-Plateaux or Great Steppe, an almost unwatered region, of about eleven million hectares,

was originally a deep depression between the Tell and the Sahara Atlas, which in the course of thousands of years was gradually filled up with the alluvial deposits of mountain-torrents and thus converted into a great and monotonous undulating plain 701 to 1005.7 metres (2300 to 3300 feet) above the sea level. The saline and gypseous is very sterile and only at a few places is adapted for the culture of grain, but has proved suitable for sheep-grazing. In the depressions of the steppe lie a number of extensive shoots or salt lakes, which in summer are dry and recognizable only by their dazzling snow-white incrustation.

"III. The Sahara Atlas (Atlas Saharien) forms the great barrier between Algeria and the desert. It is a 'region of grand and wildly fissured gorges, partly caused by erosion in the pluvial period, of valleys worn by torrents, of lofty plains converted into mountains, and of marine basins now filled up.' (Theob. Fischer.) The chief heights are the Montagnes des Ksour, 2134.7 metres (7004 feet), a prolongation of the much higher Morocco Atlas; Jebel Amour, 1971 metres (6467 feet); the Monts des Ouled-Nail, 1613 metres (5295 feet); and, beyond the depression of the Monts du Zab, 1311.4 metres (4304 feet); the Aures Mountains, 2326.7 metres (7634 feet), which are wooded in their north half. . . .

"IV. The Sahara, which belongs to the Territoires du Sud or de Commandement, governed by the military 'Bureaux Arabes,' consists of the Bassin du Gourara or Bassin de l'Oued Saoura on the west, a plateau 100.6 to 792.4 metres (330 to 2600 feet) above the sea, and of the Bassin du Melrir, named after the Chott Melrir, on the east, lying partly below the sea level."

Climate. — The climate[2] is characterized by two distinct seasons,[3] one wet and one dry, a peculiarity due largely to the nature of the winds. The prevailing winds during the rainy winter season come from the northwest and north, while during the summer east winds are prevalent. Purely local winds due to topography or environment, proximity to the sea, moun-

[2] Les Forêts de l'Algérie par H. L. Lefebvre, 1900, pp. 56–98.

[3] It is of interest that Gsell in Le climat de l'Afrique du nord dans l'antiquité drew the conclusions that, broadly speaking, the climate of North Africa had not changed to any degree since the Roman occupation, notwithstanding the deforestation. E. Huntington, in the Quarterly Journal of Economics, Vol. XXXI, February 1917, p. 173, argues that there have been climatic pulsations.

tains, or desert, of course, do not follow exactly the prevailing wind directions of the season. The winds from the desert, locally known as the "Sirocco," are extremely hot and dry and disastrous to plant life. The changes from east to northwest winds, and vice versa, occur usually in November and in April.

In the coast region the rains commence at the end of September, October, or November, when the strong northwest winds from the Mediterranean begin to blow. They cease in May or early June; but in December, January, and February there are dry spells of from 15 to 20 days. The coast rainfall reaches 1000 mm. (39 inches) at Bone and as high as 486 mm. (19 inches) at Oran.

The Algerian temperature is mild, and except for days when the Sirocco is blowing, rarely exceeds 30° C. (86° F.). The average of the extremes for August, the hottest month, is 28° C. to 33° C. (82° F. to 91° F.); for January, the coldest, the averages are 14° C. to 17° C. (57° F. to 63° F.) never falling below 2° C. to 9° C. (36° F. to 32° F.), or rising above 40° C. to 48° C. (104° F. to 118° F.).

The zone nearest to the sea receives on an average from 1000 to 1200 mm. (39 to 47 inches) of precipitation; other regions — Kabylie, Algiers with the surrounding country, and the northwestern part of the province of Constantine — about 800 mm. (31 inches); other parts only — 500 mm. (20 inches). On the high plateaus and within the Sahara region the precipitation amounts to about 200 mm. (8 inches); farther south rains appear as the exception — once in several years. The northwesterly winds bring the heaviest rains, but only on high plateaus and mountainous sections.

PROGRESS OF FOREST ADMINISTRATION

Forest Situation — General. — The present situation in Algeria, as regards the administration of its forest area, is highly encouraging when compared to what has gone on in the past. As one reflects that the forests will always, with the best management, have to fight for their very existence against the inhos-

pitable climate, considering the early record of general overgrazing, damage from fires, and losses through ill-advised sales of cork-oak lands, one is forced to the conclusion that the recent reform in organization, forest regulations, and administrative methods came none too soon.

It is true that extensive damage from fires continues, in spite of the expensive system of fire lines now maintained. The difficulties still encountered in preventing or punishing grazing trespass is likely to form the chief problem of the forest service for years to come, for the very life of the native population is linked to their pastoral rights — or what they conceive to be such. A great deal can be done to alleviate the damage in this field, however, by teaching grazers to pasture the kind of stock which does least harm.

In addition to the losses from grazing trespass there has been in former years a direct diminution of forest area through the sale of valuable cork-oak lands. The excellent results now obtained by government exploitations of similar areas, where the state reaps the benefits of higher prices and increased per acre production, serve but to emphasize the gravity of the error committed in parting with the lands in question.

To sum up the effect of these early administrative laxities — to use no harsher word — coupled with the necessary clearings for colonization, has been to bring about a serious decrease in the total forest area of the country. One writer estimates that the forested areas near Constantine, Batna, Medea, and Setif have shrunk by from 10 to more than 60 per cent since 1871.

Jonnart's Reforms. — It is possible that a good many of the early difficulties of administration were due to the fact that the Forest Service at first attempted to copy, too closely for local necessities, methods used in France. At any rate, it is certain that in 1902–1909 the criticism of the forest administration became so severe that Governor Jonnart, in 1904, assembled a commission to study the cause of the dissatisfaction and to prescribe remedies. It may be safely stated that modern Algerian forest administration, in its broadest sense, dates from

the assembling of this commission, and is due almost wholly to Governor Jonnart's wise personal direction of its activities. For to the governor's influence, more than to any other one thing, may be traced the extent and the excellence of the sweeping reforms subsequently introduced and carried out.

In his address[4] to the commission Governor Jonnart spoke highly of the Forest Service and at the same time severely criticised the methods too often employed in the past:

"In a country like this," he said, "the forest plays such an important rôle that any one who has a position of the slightest authority should be zealous in the defense of the Forest Service. I know of no administrative body composed of more meritorious, better trained or more honest agents than those of the forest service. I give them willingly this praise, but I blame them for keeping a little too much apart from the other Algerian service, for applying the regulations too uniformly, and for not having developed the flexibility and the means of adaptation so indispensable to an administrative organization, in a colony where it is unpolitic and often dangerous to try to follow at all times, in the footsteps of the fatherland.

"This forest question has held my attention for some time, and I can say that I have been everywhere in Algeria; I have been able to assure myself that the Forest Service has been too often bound by the letter of the laws and regulations, that it has not sufficiently fathomed their spirit nor the higher interests of Algerian policy. My desire is that a permanent "entente cordiale" be established between the Forest Service and the prefects, assistant prefects, and administrators of mixed communes, so that they may work together for the special needs of the population, the preventive measures to be adopted in view of the conflagrations, and the fight against the floods. I wish moreover that formalities and administrative red tape should not complicate things, as if for the sake of mere convention.

"I wish finally that the Forest Service should never lose sight of the fact that the surest way to avoid fires is still to interest the natives in the existence of the forests, and to associate them in their conservation, either by showing a greater leniency, so far as the pasturage of their flocks is

[4] Commission d'Etudes Forestières, 1904, pp. 9–10.

concerned, or by granting them small individual felling areas. I could cite regions where the natives confined between the lands opened for settlement and the forest cannot move, one might say, without risking law suits.

"We have now a more supple forest law; I would like also to see less stiffness and formality in its administration in those specially charged with applying it, and I know the zeal and the patriotism of forest personnel well enough to be convinced that it will seek out with entire devotion and loyalty, in accord with all the members of the commission, the means to improve a situation which causes anxiety (and rightly so) to all those who are interested in the economic development of Algeria. . . ."

Work of Jonnart's Commission. — Inspired by this high-minded, yet politic address, the commission pursued their studies with the main aims of future administration clearly in view. They based this work on the principle[5] that the preservation of existing forests and even of brush cover was important for the public health, the habitability and the prosperity of Algeria, because, as they agreed, the forest influenced the rainfall, assisted the filtration of water and maintenance of springs, lessened erosion and tempered floods, temperature, and winds, at the same time bettering local health conditions. They concluded, therefore, that the forests were of incalculable value, both direct and indirect, in the economic welfare of the entire population and should be maintained by every means in the power of the state.

Taking up afterward the forest situation in detail, the commission determined[6] that one of the chief items of complaint against the Forest Service — the inclusion of agricultural land within forests — was far from justified, and that the maintenance of existing forests[7] was so important that the cost of administration should be considered secondary to the attainment of results. To remedy the existing distrust of the Service and to foster a favorable local sentiment it was felt that the natives[8] must be reconciled to forest administration; partly by educational measures, but also by giving them a working

[5] *Id.* [6] *Id.* [7] *Id.* [8] *Id.*

interest in the forests through the wider [9] use of native laborers. The educational propaganda even included the training of the native children [10] so as to instill in them the knowledge of the value of forests and the necessity for their maintenance.

Administration Changes. — Many of the suggestions and ideas brought out by this commission have gradually been put into effect, with encouraging results. For example, in 1903 the receipts from the forests exceeded the expenditures for the first time, and they have furthermore increased each year since that time.

The new forest code was passed and has proved sufficiently plastic, and far better adapted for local needs, than the old.

The former inspection organization was done away with and replaced by the system of "chefferies," which resulted in a simplified administration with less top-heavy organization and larger salaries.

A system of control was also inaugurated, by placing "controleurs" (general inspectors) at each conservator's office to take up systematic field inspection.

Guards and rangers are now allowed 4 hectares (10 acres) of land, instead of 2 hectares (6 acres), an irrigated garden, and the right to hunt in state forests; while the budget of 1907 granted them a stated allowance per child to help pay the expense of their children's boarding during school sessions.

During Jonnart's term the pay of forest officers was materially increased, rangers receiving 100 francs ($19.30), and guards 60 francs ($11.58) more than formerly. Officers' pay was also raised, so that a comparison of the salaries they now receive with those given to officers of similar grades in France is all in favor of the Algerians. An "office assistant" receives 4800 francs ($926.40), or double the pay for that position in France, while an inspector of the first class gets 8300 francs ($1601.90) instead of 4500 ($868.50) as he would in the mother country.

The Forest Service under Jonnart, in short, prospered exceedingly. His régime marked a new and healthier era in Algerian forest administration.

[9] *Id.* [10] *Id.*

FOREST CONDITIONS

The Forests. — The wooded area in Algeria is estimated[11] to cover 2.8 million hectares (about 7,000,000 acres) of land, which is a total of only 11 per cent of its entire surface as compared with 29 per cent for Europe and 18 per cent for France itself. As a rule the Algerian forest exists now only on land which cannot be profitably cultivated by the natives. The most valuable agricultural land — under crops there are about 3,000,000 hectares ($7\frac{1}{2}$ million acres) — lies chiefly in the large alluvial plains, while the forested areas comprise the gravels, quartzites, volcanic rocks, limes ones, and, sometimes, schists and hard marbles on the slopes of hills and mountains.

The species[12] of Algerian forests are remarkably well adapted to the soil and climatic conditions; small in size and with persistent leaves which prevent, with their thick epidermis, any excessive evaporation. The only species which form continuous stands of any size are the cork oak (*Q. suber*), the zeen or Algerian oak (*Q. mirbeckii*), the "afares" oak (*Q. afares*), the holm oak (*Q. ilex*), the aleppo pine (*P. halepensis*), maritime pine (*P. maritima*), cedar (*C. atlantica*), thuya (*Callistris quadrivalvis*), and juniper (*J. phœnicea*).[13] Other species are distributed by single trees or small groups only, and are consequently of but little economic importance.

A characteristic feature of the forest flora which is worthy of mention is the large number of evergreen species. Most of the broad-leaved species which are not evergreen are scattered singly or in groups. As a whole the flora is similar to that of Spain, Italy, and extreme southern France.

The Most Important Trees.[14] — The cork oak[15] in Algeria grows only on silicious soils formed from decomposed crystalline or volcanic rocks and in sands formed by disintegrated

[11] Les Forêts de l'Algérie, pp. 107 ff.

[12] *Id.*, pp. 12 ff.

[13] The relative average area covered by each species is given on page 56.

[14] Les Forêts de l'Algérie, pp. 81–108.

[15] For the silvical characteristics of cork oak see forthcoming publication of U. S. Forest Service.

sandstone. It extends from the ocean up to an altitude of 1300 metres (4265 feet), but its habitat is on the coast. The zeen or Algerian oak commences to appear with the cork oak at 700 metres (2296 feet) altitude and seeks the richer soil in the valley bottoms or on north slopes. Occasionally it is found mixed with cedar. The "afares" oak commences at 1000 metres (3281 feet) and extends to the limit of vegetation. The holm oak, which is usually found in France on calcareous soil, is ordinarily on the sandstone in Algeria but it is often in mixture with cork oak, aleppo pine, and even with the cedar; although it reached 1800 metres (5905 feet), it rarely forms pure stands above 300 metres (984 feet).

The aleppo pine is the most widely distributed conifer; it is found on the marls and limestone from the sea to the desert and exists on barren and arid soils. The maritime pine is found only near the sea, at low elevations. The thuya thrives at middle altitudes in the mountains. It is usually mixed with aleppo pine, holm oak, or olive. It sprouts well after fires. The juniper is mixed with the aleppo pine, holm oak, and thuya. The cedar is found above 1300 metres (4265 feet) on both limestones and sandstones.

The undergrowth is dense and luxuriant especially in the cork-oak zone, when not kept burned off by repeated fires. The chief species are the cistus, lentisk (*Pistacia lentiscus*), heather, myrtle, and arbute. On the dunes near La Calle an undergrowth is formed by the kermes oak (*Q. coccifera*).

Destruction of Forests — Causes. — Repeated fires have increased the already large areas under brush or "maquis." The destruction [16] of Algerian forests has been caused by fires, excessive cutting and temporary clearings, establishment of heavy free use privileges or rights, decadence of open park-like forests, and excessive grazing, especially by goats. The effect of these abuses are less evident in the cork-oak region between Dellys and Phillipeville, where the vegetative conditions are best; towards the East, where stock is worked on shares, even the cork oak suffers in consequence. On the littoral between Algiers

[16] Les Forêts de l'Algérie, pp. 108–116.

and Oran, in High Plateau, and in southern Constantine, where the soil is less fertile, the damage has been so great that there is real danger of the forests disappearing.

Extent of Forests. — The wooded area in Algeria, as has been stated, is about 2,800,000 hectares (6,918,800 acres), of which some 1,750,000 hectares (4,324,250 acres) are federal and 70,000 hectares (172,970 acres) communal. The area under military control is about 350,000 to 400,000 hectares (864,850 to 988,400 acres). There are approximately 162,000 hectares (400,302 acres) of private cork-oak forest, given in former concessions; but there are no statistics in regard to the species on private holdings.

The 1,750,000 hectares (4,324,250 acres) of State forests comprise approximately the following area (in hectares) by species: Cork oak, 240,000 (593,040 acres); zeen oak, etc., 40,000 to 50,000 (98,840 to 123,550 acres); kermes and holm oak, 400,000 to 500,000 (988,400 to 1,235,500 acres); aleppo pine, 600,000 to 700,000 (1,482,600 to 1,729,700 acres); cedar, 25,000 (61,775 acres); juniper and thuya, 100,000 to 150,000 (247,100 to 270,650 acres); miscellaneous species, such as poplar, elm, ash, olive, maritime pine, etc., 15,000 to 20,000 (37,065 to 49,420 acres). The remainder of the area is open or mere brush land. It must be admitted, moreover, that the greater part of the existing forests are impoverished and that at least 1,200,000 hectares (2,965,200 acres) have been burned over one or more times during the past 40 years. Not exactly a picture of well-preserved forest wealth!

Settlement Policy. — The colonization of agricultural land is encouraged though it is not the policy to clear potential forest land for agricultural purposes. Openings within state forests may be leased, but not granted in fee simple, because theoretically they will some day be planted. The usual annual lease rate is 15 francs per hectare, varying, of course, with the quality of the soil. A settler outside the forest receives free 20, 30, or 40 hectares (49, 74, or 88 acres) of land according to its soil quality, but is not entitled to sell it until after 10 years' residence. Another method of disposing of public

land is to sell it under a contract which provides that after 8 years' residence and bona fide improvement a part of the purchase price will be refunded.

Forest Statistics. — The area[17] of the federal forests, in military or civil territory, managed by the Forest Service, amounted in 1911 to 1,955,419 hectares (4,831,840 acres) which territory was divided into three conservations: Algiers, 465,002 (1,149,019 acres); Oran, 610,599 (1,508,790 acres); Constantine, 879,818 (2,174,030 acres). These yielded in 1910 a gross revenue of 3,835,513 francs ($740,252), more than 3 million ($579,000) of which came from cork-oak operations. In addition material worth 1,131,227 francs ($218,326.80) was given away during the year.

In 1910, the fuel sold totaled 155,088 steres (5,476,787 cu. ft.); logs, 3267 cu.m. (115,370 cu. ft.); ties, 30,292 cu.m. (1,069,731 cu. ft.); poles, 93,773 cu.m. (3,311,499 cu. ft.); tan bark, 31,141 quintaux (6,865,407 pounds), all together worth 638,909 francs ($123,309.44). This comparison illustrates the preponderance of the cork-oak returns over those from wood. In 1883, the total revenue from the combined sources was just under a half million francs ($96,500); 10 years later, in 1893, it was almost three-fourths of a million ($144,750); while in 1903 it reached 3,334,853 ($643,626.65). By 1913 it was estimated to certainly reach four million francs ($772,000).

Production. — Though the revenue from Algerian forests is derived from a number of species, cork oak yields[18] the major part of this total; and even then the present production is only about half of what it should be. Cedar is sold to some extent, but it is just within the past few years that the wood has been in demand. The aleppo pine had not yielded a revenue until the recent experimental tapping, originated by Conservator Laporte at Oran, and described hereafter. The zeen oak has been cut to a considerable extent for cross ties, and the demand has constantly increased. The market for minor prod-

[17] The latest published statistics are for the year ending June 30, 1911, Statistique Générale de l'Algérie, pp. 296–300.

[18] Commission d'Etudes Forestières, pp. 171–173.

ucts is better each year. From these facts the prediction is freely made that a revenue two or three times greater than at present will accrue to the Forest Service before many years.

On the 250,000 odd hectares [19] (617,750 acres) of cork oak the state has about four-fifths in full production (494,200 acres), and an average yield of 75 kilos (165 pounds) per hectare (2.5 acres) is low, considering the capacity of the forest. In 1903 the revenue from cork was about 2.5 million francs ($482,500). Wood, tannin, charcoal, chiefly from zeen oak, holm oak, and cedar returned about 625,00 francs ($120,625) in 1903, about five times the amount sold in 1890 ($24,125). The minor products of the forests, such as hunting, grass, pasturage, etc., are yielding about 120,000 francs ($23,160) annually.[20]

Taking into consideration the fuel, timber, and grazing given away each year this means a production of about 2 francs ($0.386) per hectare (2.5 acres), and it is hoped that this average will reach 6 or 7 francs ($1.16 or $1.35) per hectare within 10 to 20 years. These are totals; the cork-oak areas now produce at least 10 francs ($1.93) per hectare (2.5 acres) per year and showed an increase of double the former figures within 10 or 15 years. The cost of forest administration in Algeria was 1.74 francs ($0.34) per hectare (2.5 acres) per year in 1903 and approximately the same rate of expenditure is still maintained.

FOREST MANAGEMENT

Objects of Forest Management. — Granting as a basic principle that the forests of Algeria should be preserved, it naturally follows that the management must be conservative especially in the case of those forests which show danger of disappearing. The cork-oak forests hardly come under this category, because of the more favorable climatic conditions. In these forests a purely financial gain is sought and the ad-

[19] Commission d'Etudes Forestières, p. 14.

[20] The development of minor industries is encouraged; the grubbing of heather roots (bruyère) for pipes has become quite an industry and a company pays about 1 franc ($0.193) per hectare (2.5 acres) per year for large area concessions from which heather roots can be grubbed.

ministration by reducing the forest yield sees that the market is not depressed by over production, if this seems necessary to attain the desired result. This does not mean that the silvicultural welfare of the forest is neglected, but the financial side of the question is considered first. The management of the remaining species, on the other hand, is based rather on the policy of conservation than on financial returns, with the possible exception of aleppo pine, which is now being tapped in turpentine operations.

FIG. 11. — The transport of cork to a local depot in the mountains near Philippeville, Algeria.

Cork-oak Management.[21] — The method of treatment adopted in managing the cork-oak forests is based solely on the requirements for cork production; the harvest of tannin as a by-product and the matter of regeneration are considered as separate and distinct, as well as subsidiary, problems. The bark is in reality like a fruit crop, where trees bear only after attaining a certain size and continue fruitful only for a certain period Consequently, the selection system is applied; but with a large area it is neither advantageous nor practicable to collect selection crops over an entire forest each year. It has

[21] Based chiefly on the official working plan for Forêt Domaniale des Ouled-el-Nadj, December 10, 1912.

been proved more advantageous to concentrate the yield periodically; and 3 years, a multiple of either 9 or 12, the usual minimum and maximum period for the maturity of any one bark crop, is the interval between harvests.

Cultural Rules. — It is considered more profitable not to peel trees when too young; in the past there has been a tendency to commence with trees 50 m. to 60 m. (20 to 24 inches) in circumference (30 to 40 years old), whereas it is essential on average soil to wait until a tree reaches 70 m. (27 inches) or even 80 m. (31 inches). Under favorable conditions 5 or 6 collections may be expected, since trees continue to bear until 80 to 100 years of age. If collection is allowed to begin when a tree is too young the growth is retarded, the tree yields a furrowed cork of such poor quality as hardly to pay for the cost of collecting, and often results in the death of the tree.

When a tree has once attained merchantable size it is marked for peeling. The bark which results from this first operation has little or no commercial value (liége mâle). Dating from the time this rough primary back crop is removed, it takes on an average a minimum of 1 year and a maximum of 12 years for the merchantable cork to reach 0.025 m. (0.975 inch) (0.028 (1 inch) with epidermis) in thickness — which is the merchantable size. This would indicate an average increase of about 0.0029 (0.11 inch) per year, but in reality the growth in thickness diminishes as the age of maturity approaches.

At the end of 9 years the cork on one-half the trees should reach merchantable size, and the rest by the end of the 12-year period, with a mathematical average maturity of 11 years, although it must be admitted that some trees are ripe after 7 or 8 years where the growth is vigorous. As a rule, however, the more rapid the growth the lower the quality of the cork.

A simple gauge (like a shoemaker's awl) is used to measure the thickness of the cork when marking trees to be cropped. The incision is commenced (usually sawed just to the cambium) at the root collar and vigorous trees can be barked to a height equal to 2.5 times the circumference; in other words, a tree 70 m. (27 inches) in circumference would be peeled to a height

of 1.75 metres (6 feet) above the first incision. If the tree is very thrifty this ratio can be increased from 2.5 to 3, or if not vigorous dropped to as low as 2. Normally the height is 2.5 times the circumference measured at breast height outside the bark. This height can be increased every 18 to 24 years, say with every third crop.

It was formerly the practice to remove only one-half to one-third the total height covered by the first peeling, but it is now considered better to remove at one time all the bark which the tree can produce. After the cork has been peeled 4 to 6 times, over a period of 44 to 66 years, the trees lose their producing capacity and fail to yield enough cork to cover the cost of peeling and collection. It is then that these overmature trees are cut for tannin and fuel.

Since the clearing of underbrush is so expensive that it can ordinarily be attempted only on fire lines or where plantations must be undertaken, and since the cork oak retains its sprouting capacity until a very late date, it is always advisable to cut back trees level with the ground, if they have been damaged by fire.

Aleppo Pine. — Next to the cork oak the aleppo pine has the greatest commercial possibilities of any species in Algeria. If it can, as seems probable, be properly developed to yield resin, this potential value will become a fact.

Conservator Laporte at Oran has started progressive experiments on a practical basis, to determine whether or not tapping is feasible. Work has begun in the "chefferie" of Telegh[22] which comprises some 108,412 hectares (267,886 acres) at an average elevation of 1000 metres (3280 feet) and where in winter snow occasionally reaches a depth of 0.3 to 0.6 metres (1 to 2 feet). The aleppo pine is found here in almost pure stands with an infrequent mixture of holm oak and thuya.

A trial tapping was commenced in 1906 on a commercial scale and is now extensive enough to justify the maintenance of a still. The price fixed by the 1907 concession was 0.05 franc

[22] Exploitations et Gemmage du pin d'alep. Laporte, Revue des Eaux et Forêts, October and November, 1911.

($0.009) per tree per year, payable in two equal installments on July 15 and January 15 of each year.

The contract governing the method of tapping the tree[23] allows a maximum width of 0.09 m. (3.5 inches) for the scar during the first 2 years, 0.08 m. (3.1 inches) the third, and 0.07 m. (2.7 inches) the fourth; a height of 0.55 m. (22 inches) the first, 0.60 m. (24 inches) the second and 0.65 m. (26 inches) the third and fourth marking. A total maximum height for the scar of 2.45 metres (8 feet) is allowed after 4 years; the depth may reach 1 centimetre (0.4 inch). All trees must be at least 0.90 m. (36 inches) in circumference before being tapped. Experiments prior to the initiation of the present working group had already shown that aleppo pine only 0.80 m. (31 inches) in circumference could not be safely tapped, and that 6 years of continuous tapping was too long.

This development of a turpentine industry in an arid country with no means of forest communication has raised certain serious problems, namely, the commercial success is more or less dependent upon good prices for turpentine; the initial expense for road development was considerable, and if the enterprise were to fail the building of the road could hardly be justified on any other grounds; no adequate provision can be made for reproduction; even if regeneration does come in naturally, there will be vast areas of young growth which will yield nothing, and which will constitute a great fire menace; the necessary periods of rest are incompatible with the maintenance of the industry.

These problems may be solved by fixing a rotation suitable for tapping and for the production of wood; exploitation must be arranged systematically and the young stands must be thinned.

Thus, if a 0.90-metre (35 inches) tree were tapped in 1910, 1911, 1912, and 1913 it would be felled in 1914; the same cycle would be carried out in 1914 to 1918, and 1919 to 1922, etc. The effect is that the felling and the first year of the new tapping

[23] The Landes methods are described in a review by the writer published in the Forestry Quarterly Vol. XIV, No. 4, 1916.

would progress simultaneously.[24] The regeneration fellings are not made by clear cutting, as in the Landes, near Bordeaux only trees 0.60 metre (23 inches) and over in circumference being felled, but this diameter limit system is varied according to the amount of existing reproduction on the ground.

As in the Landes, "tapping to death" for thinnings and tapping alive on trees destined to form the final crop is practiced. The yield from 1387 scars (on trees tapped alive with 1 scar) averaged 1.96 litres (2.07 quarts) per year. For trees tapped to death the average of 1326 scars was 1.88 litres (2 quarts).

Treatment. — It might be supposed, after the disasters from fire in even-aged coniferous stands in Corsica — a disaster which followed the use of the shelterwood system — that the selection system would be applied to the aleppo pine in Algeria, but according to a recent working plan:

> "Each[25] of the three working groups will be treated by the shelterwood method. The selection (system), which increases the confusion of ages and renders difficult the removal of the fellings, cannot be considered.
>
> "The surface of each working group will be divided into 'coupons' (small felling areas). The regeneration felling will be laid in succession in each of these felling areas. It will be made by tapping to death during a period which will be determined later.
>
> "In this regeneration felling the trees more than 0.60 metre (23 inches) in circumference must be felled, but those 0.60 metre (23 inches) and below should be kept with existing regeneration. In the felling areas, where the regeneration on the ground is considered sufficient, all old trees will be marked for removal.
>
> "On the other hand, the marking must be conservative in the areas where the stand consists of mature timber only, without young growth already on the ground. Future regeneration presents in reality several uncertainties in stands of this kind."

The working plans officer further states that in very open stands only the dead and dying trees should be removed; in dense stands thinning is accomplished by removing up to half

[24] See page 71 for an explanation of the provision for management.

[25] Part II, Réglement d'Exploitation, Forêt de Takrouma.

the material; the trees reserved should be left near openings; the marking should be light within 20 to 30 metres (22 to 33 yards) of fields and clearings; a zone of 200 metres (218 yards) in width should be reserved from cutting along the southern boundary of the forest.

The concluding instructions are:

"At the same time these regeneration fellings are marked the other felling areas will be cut over by improvement fellings of two kinds.

"1. In the young stands, these fellings will be simple thinnings with the aim of opening up the stand and assuring as rapid a growth as possible.

"2. In the older stands, where the boles may be tapped, it will aim to choose the trees which will form the final stand, and the trees to be cut will be tapped to death.

"3. Finally, on the entire area of the working group not cut over by regeneration fellings, tapping alive will be followed on all trees 1 metre (1 yard) or more in circumference as explained later."

A curious feature of aleppo pine seems to be that it exhausts the freshness of the soil more than would be expected, and lowers the surface water quite materially. It is a matter of record that after clear cuttings at Rivoli the water level rose and where extensive plantations were made the water level sank.[26]

Treatment of Other Species. — The zeen oak is cut clear, with groups of seed trees, comprising perhaps 20 per cent of the stand, left for seed. Where single trees are left they are apt to become stagheaded. Probably in many cases the natural regeneration must be assisted by sowing or planting blanks. The product of this species is chiefly ties. No formal rotation has been established.

The forests of cedar have suffered from excessive grazing and from such abuses as lopping for fodder. Moreover, in the past, there has been little or no demand for the wood.[27] Recently,

[26] This corresponds with the results of experiments conducted near Nancy, France.

[27] At the Bardo Museum at Tunis there is a cedar coffin which was found in a cave at Ksour-es-saf, still well preserved, with one or two boards absolutely intact. It is Phœnician and dates from about 300 B.C.

notwithstanding a better market, the cuttings have been in reality light improvement fellings, in which only dead and diseased trees are removed. The reproduction is occasionally

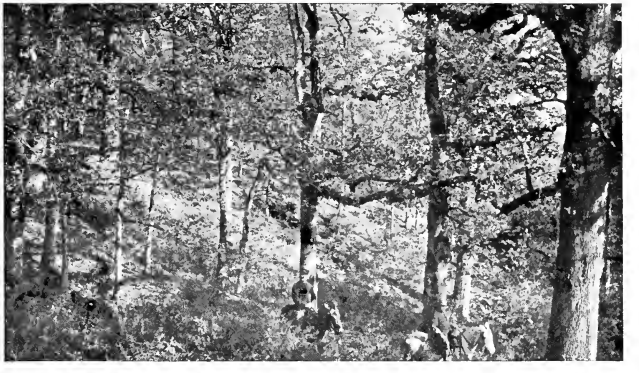

FIG. 12. — Virgin zeen-oak forest in Algeria, Constantine Conservation.

assisted by wounding the soil, particularly where it is covered with sod.

The oaks used for cordwood, such as the holm oak, are generally coppiced. Rotations as high as 54 years have been used, but found too long; 30 years is now recommended as preferable. The coppice method is varied in (*a*) overmature stands and (*b*) with very young poles.

The procedure in each of these methods is as follows: (*a*) Where pasturage has kept young growth from coming in and the remaining stand is mature; instead of an ordinary coppice felling, the stump is removed down to a depth of 50 or 60 centimetres (20 to 24 inches). This frees the large roots, and, instead of having one old stump with a weak sprouting capacity, there are a number of large roots which may yield vigorous shoots or suckers. This is known as the method of "culée noire."

(*b*) On the other hand, when the stand coppiced is only 3 to 5 centimetres (1.2 to 2 inches) in diameter, the young stems

are cut 4 to 5 centimetres (1.6 to 2 inches) above the ground and then hammered and bruised with the axe, to make them sucker freely.

WORKING PLANS

There has been little real need as yet for working plans; mainly for two reasons. First, because the demand for wood was much less than the supply; and second, because the main crop — cork — was really a fruit crop which had to be collected when ripe, and could be readily gauged each year by cropping areas of an equal producing capacity. By the mere working of an area statistics were collected as to yield. Within the past few years, however, an attempt at systematic regulation had been made for a few cork-oak forests, and for the aleppo-pine forests which are being tapped. A typical working plan for each type of forest is accordingly reviewed, in order to give an exact idea of how the problem of systematic management has been solved.

A Working Plan for Cork Oak.[28] — The Algerian working plan for cork oak follows, with some variations, the standard outline used in France. It is summarized as follows:

Part I — (1) Area with portion wooded, openings, and blanks (7,963.67 hectares); (2) Situation; (3) Topography and geology; (4) Climate; (5) Boundaries; (6) Alienations; (7) Rights; (8) Kind and condition of stands (cork oak with some zeen oak, especial reference to reproduction and the growth of cork); (9) Roads; (10) Fire lines and protection (the lines are classified as to whether boundary, 5 to 25 metre (5.5 to 27 yards) lines, or interior, 25 to 30 metre (27 to 33 yards) lines; (11) Forest houses; (12) Trespass; (13) Fires and lookout posts (during the years 1881 to 1911 there were 18 conflagrations, of which 2 were accidental, 13 were incendiary, and the causes of 3 were unknown); (14) Value and price of cork (at the depots it has averaged 23 francs ($4.43) per quintal (220 pounds) with labor at 1.55 francs ($0.30) per day).

Part II — (1) The actual treatment (accorded the cork oak);

[28] For the forest of Ouled-el-nadj, dated December 10, 1912.

(2) The basis of management proposed for cork oak, with a division into working groups; the treatment to adopt; stock taking and yield; general cultural rules; (3) Miscellaneous species.

Part III — (1) Compartment descriptions (the compartments are each from 77 to 285 hectares (190 to 704 acres) in area); (2) Exploitable age; (3) Rotations and divisions; (4) General inventory of growing stock. (This gives by division, canton, compartment, year; number of trees peeled, number of quintaux collected by compartment and by division; average age, *i.e.*, length of years it took the bark to mature; remarks.) (5) Determination of the yield during the first and second periods (the working plans officer concludes that the figures of past collections are sufficiently exact to determine yield on areas now producing and that on areas not yet cropped 2-hectare (5-acre) sample plots will give an indication, although the yield per hectare (2.5 acres) and per year is subject to great variations, due to the necessity of obtaining cork of a minimum commercial thickness, so naturally a sustained yield of 1 quintal (220 pounds) per hectare (2.5 acres) per year cannot be attained, but that ordinarily an average of 0.50 to 0.70 quintaux (110 to 154 pounds) per hectare (2.5 acres) per year will be possible, even counting ordinary openings and blanks.) Thus with cork oak the yield is by area with a quality factor introduced when the number of producing trees per hectare (2.5 acres) are known or estimated; (6) Tannin fellings (only the old trees, which are no longer producing cork are cut for tannin and care is taken not to denude areas which are covered with brush and weeds); (7) General regulation of fellings (the fellings are prescribed for each year by division, compartment, age of bark to be collected, 9 and 12 years; remarks).

Part IV gives betterments such as (1) Working plan divisions; (2) Boundaries; (3) Fire lines; (4) Roads and trails; (5) Forest houses; (6) Brush cutting and restocking. The appendix of the working plan includes the sample plot measurements and a permanent control in the following form: Year, division, canton, compartment, collections by (*a*) number of trees, (*b*) quintaux,

(*c*) price per quintal (220 pounds), (*d*) cost of collection per quintal (220 pounds). Also an account of the trees ("Mises en valeur") barked for the first time by (*a*) number of trees and (*b*) cost per tree; secondary products such as tannin by (*a*) amount and (*b*) price; remarks. These figures are considered very important as a basis for future working plans. Since 1888 the collection and peeling of bark has been done by the government by day labor.

The working plan for the aleppo-pine forest of Takrouina follows the same general outline used in working plans for cork oak. In this forest the yield is also regulated by area with the rotation of fellings, as follows: (*a*) Regeneration; (*b*) Thinnings in young sapling stands, 20 years old, which will probably cost some outlay; (*c*) When the trees are large enough the thinnings will be made by tapping to death the trees which are marked for thinnings; (*d*) Tapping alive during the life of the tree after it attains a proper size.

The author of the working plan states:

> "An average tree of 1 metre (39 inches) in circumference is thus 72 years old; one can therefore assume that the average growth is $\frac{1.00}{72} = 0.139$ (0.547 inch) and that a tree of 80 years would be 80 times 0.0139 or 1.11 m. (43 inches).
>
> We have decided then to fix the exploitable age at 80 and the size for the trees to be tapped at 1 metre (39 inches) of circumference. We propose besides to fix the period for tapping at 4 years, with an additional year for felling."

TABLE 4. — SYNOPSIS OF FELLINGS IN THE "SERIE DE SI AHMED EL MOUSSA"*

Numeral order of the fellings.	Total area, hectares (acres).	Age in 1910.	Area per age class, hectares (acres).	Periods.																	
				1910 to 1914.	1914 to 1918.	1918 to 1922.	1922 to 1926.	1926 to 1930.	1930 to 1934.	1934 to 1938.	1938 to 1942.	1942 to 1946.	1946 to 1950.	1950 to 1954.	1954 to 1958.	1958 to 1962.	1962 to 1966.	1966 to 1970.	1970 to 1974.	1974 to 1978.	1978 to 1982.	1982 to 1986.	1986 to 1990.
1	46.90 (116)	7	40.60 (100)	....	....	....	e^1	.....	e^2	....	e^3	....	m^1	.....	m^2	.....	m^3	....	g	R	.....	.....	.....
		60 to 80	6.30 (15)	R	.....	.....	.....	.....	e^1	....	e^2	....											
2	46.90 (116)	7	33.30 (82)	....	.....	....	e^1	....	e^2	....	e^3	....	m^1	.....	m^2	.....	m^3	....	g	g	R	.....	.....
		60 to 80	13.60 (34)	R	....	....	....	....	e^1	....	e^2	....											
3	48.90 (121)	7	29.50 (83)	....	....	....	e^1	....	e^2	....	e^3	....	m^1	.....	m^2	.....	m^3	....	g	g	g	R	.....
		60 to 80	19.40 (58)	R	....	....	....	....	e^2	....	e^2	....											
4	50.50 (125)	7	16.20 (40)	....	....	....	e^1	....	e^2	....	e^3	....	m^1	....	m^2	....	m^3	....	g	g	g	g	R
		60 to 80	34.30 (85)	R	....	....	....	....	e^1	....	e^2	....											
5	49.20 (122)	7	2.00 (5)	....	....	....	e^1	....	e^2	....	e^3	....	m^1	....	m^2	....	m^3	....	g	g	g	g	g
		60 to 80	47.20 (117)	R	....	....	....	....	e^1	....	e^2	....											
6	48.70 (120)	60 to 80	48.70 (120)	g	....	....	....	....	....	e^1	....	e^2	....	m^1	....	m^2	....	m^3	....	g	g	g	g
7	37.36 (92)	60 to 80	37.36 (92)	g	g	R	....	....	....	....	e^1	....	e^2	....	m^1	....	m^2	....	m^3	....	g	g	g
8	35.67 (88)	60 to 80	35.67 (88)	g	g	g	R	....	....	....	....	e^1	....	e^2	....	m^1	....	m^2	....	m^3	....	g	g

* Exploitations et gemmage du pin d'Alep, Laporte, p. 23.

TABLE 4 (*Continued*). — SYNOPSIS OF FELLINGS IN THE "SERIE DE SI AHMED EL MOUSSA"

Numeral order of the fellings.	Total area, hectares (acres).	Age in 1910.	Area per age class, hectares (acres).	Periods.																				
				1910 to 1914.	1914 to 1918.	1918 to 1922.	1922 to 1926.	1926 to 1930.	1930 to 1934.	1934 to 1938.	1938 to 1942.	1942 to 1946.	1946 to 1950.	1950 to 1954.	1954 to 1958.	1958 to 1962.	1962 to 1966.	1966 to 1970.	1970 to 1974.	1974 to 1978.	1978 to 1982.	1982 to 1986.	1986 to 1990.
9	37.67 (93)	60 to 80	37.67 (93)	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	..	m^1	.....	m^2	.....	m^3	..	*g*
10	36.66 (91)	60 to 80	36.66 (91)	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	..	c^1	.....	c^2	.....	m^1	.....	m^2	.....	m^3	.....
11	36.77 (91)	60 to 80	36.77 (91)	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	..	m^1	.....	m^2	.....	m^3
12	36.17 (89)	60 to 80	36.17 (89)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	.....	m^1	.....	m^2	.....
13	46.04 (114)	60 to 80	46.04 (114)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	.....	m^1	.....	m^2
14	46.62 (115)	60 to 80	46.62 (115)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	.....	m^1	.....
15	47.04 (116)	60 to 80	47.04 (116)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	.....	m^1
16	46.50 (115)	60 to 80	46.50 (115)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2	.....
17	49.65 (123)	60 to 80	49.65 (123)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....	c^2
18	50.18 (124)	60 to 80	50.18 (124)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1	.....
19	50.18 (124)	60 to 80	50.18 (124)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....	c^1
20	49.09 (121)	60 to 80	49.09 (121)	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*g*	*R*	.....	.....	.....	.....

EXPLANATION: *R* — regeneration; c^1 — first thinning by day labor; c^2 — second thinning by day labor; m^1 — first thinning by tapping to death; m^2 — second thinning by tapping to death; m^3 — third thinning by tapping to death; *g* — tapping alive.

The working plan recites the sequence of the four classes of fellings in the forms which follow:

Sequence of regeneration fellings: Small felling area occupied by the timber of each age class; total area of the felling; age of the timber in 1912; felling classed as (*a*) abnormal and (*b*) normal, with under each the age and period when the trees are to be cut by tapping to death; remarks.

Sequence of thinning (by day labor); periods; felling area divided (*a*) into the portion from each felling area and (*b*) total per year; age of the wood at the time of thinning; remarks.

Sequence of thinning by tapping to death; same as preceding.

Sequence of exploitation by tapping alive; periods; small felling areas; notes on work to be done; remarks.

Management Record. — Since there are so few forests under working plans, a substitute has been devised which contains some material usually included in a working plan, besides important statistical data required for annual reports. A part of the record is written on the covers of a specially printed folder and part is on sheets and maps filed within this folder; these folders complete are officially termed "bundles of management."

On each folder is given: Natural region and classification of the surface into mountains, hills, and plains, and by geological formation — altitude, maximum and minimum; stand with the per cent of each species given in tenths; general condition; soil; climate; springs, water courses, influence on the forest; miscellaneous data, such as quarries, mines, etc.; causes of forest devastation, bordering properties, activities of inhabitants, advantages and inconveniences of interior holdings, and the chance for their purchase; digest of damages caused by fires; grazing, fellings, usurpations, and other trespasses. Fire statistics also are shown and these include: date of fires, surface burned over; areas burned; valuation of the damage to the forest, divided into (*a*) cork, (*b*) wood, (*c*) miscellaneous, and (*d*) totals; probable cause of the fire; remarks.

Trespass statistics are set forth in lump figures (estimates) for the period 1884 to 1900 inclusive and commencing with 1901

separate and exact data are compiled for each year. The trespasses are here classified by: grazing; cuttings, including wood and bark; theft of cork (after being peeled by the State); squatting on agricultural land or tampering with boundaries; hunting; minor products; fires; fires set within district (where setting of fires is forbidden); constructions or camps within this district; miscellaneous.

All of the foregoing information is recorded on the outside and inside covers of the folder. Inside the folder there are: maps; abstract of work accomplished, described for the period 1886 to 1900, and by years after 1901; year; nature of work done; paths, roads, and bridges, (*a*) new and (*b*) maintenance; removal of first cork layer; collection of cork; fire protection, (*a*) new and (*b*) maintenance; restocking, (*a*) new and (*b*) maintenance; regeneration; brush cutting, lopping, grafting; management, boundaries, maps; operations relating to felling areas, etc.; totals per year by (*a*) money, (*b*) value of work done by trespassers, (*c*) by contractors and right holders, (*d*) total; remarks.

The receipts are digested by years; section of budget, nature of products by principal products as to whether cork, wood, and bark (ordinary, extraordinary, and accidental); miscellaneous products.

The official force, by forests, is set down, showing the number of employees of each class, and in addition the residence of the ranger in charge of the beat with the area.

These records thus contain all information which those in charge need for administrative purposes and are an admirable substitute for the formal European working plan. The idea could be adopted in the United States.

DISPOSAL OF PRODUCE

Sales. — Shortly after the conquest[29] the cropping of cork oak was commenced; and as early as 1847 the exportation had reached 460 quintaux (101,384 pounds). Since the state did

[29] Commission d'Etudes Forestières, pp. 173–177.

not have the resources with which to conduct the operations, the exploitation was at first placed in private hands, under a lease system. After the fires of 1862–63, some 162,000 hectares (400,302 acres) were ceded outright under the following arrangement: during the first 10-year period there were no payments, during the second 10-year period a payment of 2 francs ($0.386) per hectare (2.5 acres) per year was required with the understanding that at the end of 20 years the lessor would be given the land in fee simple.

According to the decree of Aug. 9, 1864, the cork oak could be leased after public auction for periods not to exceed 90 years, but as a matter of fact most of these concessions were sold outright in 1867 and 1870. By the decree of Feb. 2, 1870, the areas (*a*) burned between Jan. 1, 1863, and June 30, 1870, as well as (*b*) a third of the areas not burned, were given outright to the lessors. The two-thirds of unburned areas were sold for 60 francs ($11.58) per hectare (2.5 acres), payable in 20 annuities; these began 10 years after the sale, at the rate of 2 francs ($0.386) each year of the first 10 years, from 1880, and 4 francs ($0.772) for the last 10 years. The governor was also authorized to give free of charge an area equal to the area burned over, if the grantors had suffered severe losses. If work was not started in 5 years, however, on at least a quarter of the area, then the third part given free could be revoked.

These sales were condemned so severely that in 1876 a system of 14-year leases were tried out, but the working was badly complicated by fires and by failure of the concession holders to comply with the regulations, and the experiment proved a failure. Later, as an alternative, the cork was sold standing at a price per quintal (220 pounds) collected, but half the cork collected disappeared before it could be weighed. When this scheme fell through, therefore, the Forest Service was authorized on July 16, 1891, to collect and sell the cork after collection; this method has continued in force to the present time and is entirely satisfactory. The amount collected has risen steadily; 11,000 quintaux (2,424,400 pounds) in 1892; 31,000 (6,832,400 pounds) in 1897; to 86,000 (18,954,400 pounds) in 1904.

The forest products are now divided into (*a*) principal products and (*b*) miscellaneous products. The principal products include cork, wood, and bark cut under ordinary, extraordinary, or accidental fellings. The principal products are, in theory, sold by public auction standing or by a unit price. If ordinary sales, they can be made by agreement in cases of special authorization by the governor and after a public auction has been held and no satisfactory bids received. Accidental products may be sold by agreement, when they cannot be auctioned, and if there is an unforeseen emergency. The minor or miscellaneous products include the hunt, lease of agriculture land in openings, acorns, grazing of all kinds, collection of alfa, dead wood, stumps, weeds, seeds, fruit, grass, diss, stone, soil, sand, etc. The conservators are authorized to recommend to the prefects the lease of the hunt, agriculture land and quarries (if no phosphates are included), up to periods of a year, if the annual rental is less than 2000 francs ($386). The governor approves leases above this amount for periods of 9 to 18 years. The sale by agreement of so-called minor products is on the basis of a price schedule approved annually.

Sales of cork bark are made at public auction, at the most centrally located town in the conservation. The cork has been previously collected at depots on each forest and divided into piles, which are consecutively numbered. The sales book[30] describes each bark pile as follows: serial number, number of the pile, weight in quintaux, classification of the cork, names of forest and depot, with the number of kilometres of transport to market. It seems to be the policy to make the piles (which are sold separately) small, usually 300 to 500 quintaux (66,120 to 110,200 pounds), and rarely exceeding 800 (176,320 pounds).

The expense of collection is usually 5 to 6 francs ($0.96 to $1.16) per quintal (220 pounds). The removal of the bark costs 2.80 francs ($0.54), the transport 1.60 to 2.30 francs ($0.31 to $0.44), and the remainder is made up of miscellaneous expenses. The judgment of the local conservators is firmly in favor of the

[30] Vente de lièges de Reproduction Recoltés en 1912 Conservation de Constantine, pp. 1–24.

departmental exploitation of cork. For example, during a typical year, the conservator at Constantine collected 95,289 quintaux (21,001,695 pounds) of cork, worth gross 3,274,425.50 francs ($631,964), at a cost of 534,800 francs ($103,216)—a profit to the government 2 to 4 times as great as under the lease or sale system. In addition the silvicultural needs of the forest are more nearly met. Especially where the term is for long periods lessors, in the contract system, have almost invariably failed to live up to the terms of the agreement.

The decree [31] (giving the details for the exploitation, transport, sale, and exportation of cork under present conditions) is mainly designed to prevent theft, and it would seem as if under its provisions it would be practically impossible for successful thieving to be practiced on any great scale. Even owners who wish to collect bark must furnish at least a month in advance, to the proper local official (usually the mayor), the name and location of the stand, the period for collection, the number of trees, and the approximate number of pounds of bark to be collected. This provides opportunity for the state to verify ownership before exploitation. Moreover, the bark cannot be transported without a permit giving the name and residence of the transporter, the number of pounds, and the quality. These permits are temporary and personal and must be produced whenever required by the proper official. Similarly, no sale or export can take place without an inspection of the original certificates showing ownership and origin. All shipments must be described according to the following classifications: (*a*) Raw cork; (*b*) Baled cork; (*c*) Manufactured cork; (*d*) Waste cork (baled fragments); (*e*) Crude bark (first peeling unsuitable for ordinary corks).

The regulations [32] regarding the exploitation, transport, sale, and exportation of tan bark, charcoal, wood, wood ashes, resin products, and sticks for canes are similar to the restrictions placed on cork commerce, and are also designed to prevent theft by making it obligatory on the temporary owner of the

[31] August 20, 1904.

[32] Refer also to the Algerian Code, p. 166.

product to show how and where he secured the material. As an additional precaution no transport is allowed at night without a special permit. The notice of exploitation must be given at least three months in advance. Suitable steps are prescribed to make sure that the forests classified under article 76 of the Algerian Code of 1903 (see page 179) are not denuded. In addition, when the conservator considers it necessary he can prescribe felling rules for private loggers to cover the following points: method of felling; date for working up the felled material; date when the removal must be completed; measures for efficient control; protection against disastrous grazing. If no restrictions are imposed by the conservator within three months after notice, then the owner can go ahead without further permit; certain areas, however, are exempted from the application of these rules.

Free Use. — The free use of dead wood, diss, palms, and mast is personal and ordinarily without special permit. The right holders can take without permit dead fallen wood or dead branches which can be pulled off by hand, fallen acorns, or acorns poled down. The use of axes, etc., in securing ordinary free-use material is formally forbidden.

For building or plow material the mayors, etc., draw up annual lists which are submitted to the local forest officer in charge. These lists give the names and residences of free-use holders, the amount and quality of timber necessary for their personal needs, and a justification of the free grant. After the local officers investigate each case the conservators approve or disapprove, taking into consideration the local needs and the yield of the forest. This class of wood is marked and estimated. The right holders do the felling by groups and the local tribal chief is held responsible for damage. After felling, the proper amounts are divided. The governor may authorize the Forest Service to fell the timber, but the right holders must pay the cost of felling, utilization, and transport, according to a tariff recommended by the Forest Service and approved by the prefect.

Besides group permits, individuals may be granted material by an inspector in emergency cases, such as arise after a fire

or flood. A strict check is kept on the use of the timber for a year following the felling. Each right holder is required to do one day's work, consisting of the maintenance of the forest cut over, in return for each cubic metre (35 cu. ft.), or for each 100 poles of at least 20 cm. (8 inches) in circumference.

THE FORESTATION PROBLEM

Forestation. — In Algeria, as in other countries where vegetation must withstand annual and periodic droughts, the saying: "It is much better to protect the forests that exist than create anew," is doubly true. Yet, just because past generations have not heeded the wisdom contained in this law, it has become imperative for the state, now, to undertake planting on a generous scale. It is true that for the last 30 years Algerian foresters have studied the reforestation problem; yet the forests have continued to decrease, for one reason because there has been insufficient money for extensive planting or sowing. Even under the present more liberal policies, planting or sowing is only undertaken where trees have entirely disappeared, or where there is not the slightest chance for natural regeneration.

Notwithstanding the progress already made, there still seems to be considerable variation in planting methods used in the different regions. Nominally there is a chief of management and reforestation, but under the present organization this officer acts in an advisory capacity and is not in a position to enforce his views as to methods, except on projects which are under his direction — a fact which is unfortunate for the success of planting operations as a whole.

With the wet winters and severe dry summers of Algeria it is universally the policy to plant in the winter after the rains have commenced, usually in December and January. The kind of material used depends on the species to be planted but nowhere are costly 3 and 4 year-old transplants employed as in Germany or Austria. In the case of the coniferous species, as well as the broadleaved species, sowing is preferred to planting, but nowhere is successful sowing possible without thorough

soil preparation, preferably in strips or spots. Owing to a series of past failures there is universal prejudice against the shipment of any plant material except when ball plants can be economically used. Consequently small local nurseries are invariably preferred where water for irrigation can be secured.

Methods.[33] — The planting of aleppo pine is very difficult because the high evaporation seems to dry out the seedling before the roots can take hold. Nearly all the plantations made where plants with bare roots were employed have miscarried. Planting appears to succeed only when ball plants are used. On the other hand, the direct seeding generally succeeds. Seed spots are usually made 0.40 m. square (16 inches) and 2 to 3 metres (2 to 3 yards) apart; a small pinch of seed is sown and covered over with 2 to 3 centimetres (0.8 to 1.2 inches) of fine soil. After sowing, the seed spot is covered with an armful of brush. It is usually a good plan (when the slope permits), to open the spots in advance and let the air percolate the soil for several months. The spot is filled up with earth when seeded.

The cedar usually succeeds by direct seeding on bare soil if it is light and not packed; but it cannot succeed where there is grass or weeds. In order to reforest blanks or openings in a forest of cedar, the ground should be wounded before the seed falls in the autumn. This can be readily done by opening strips 30 to 40 centimetres (12 to 16 inches) wide and 15 to 20 centimetres (5.9 to 7.8 inches) deep. If there are no seed trees, strips such as these can be sown by hand and the seed covered.

The oaks (cork, holm, zeen, etc.) give good results either by direct seeding or by plantations. The latter method is used when, as is often the case, there is danger from rabbits, birds, mice, or rats. For the direct seeding, seed spots are made in the same manner as for aleppo pine; 10 or more acorns are then sown and covered with 4 to 5 centimetres (about 2 inches) of soil and an armful of brush. For plantations, one-year seedlings are usually employed. It has been pretty definitely proved

[33] Much of the information on forestation was furnished by V. Boutilly, "le chef du Service du Reboisement."

that where cork oak is sown or planted on brush-covered ground, this must be completely cleared; if only spots or lanes are cleared the results have been unsatisfactory. These losses are probably due to radiation by the sun and the consequent intense heat, because the air cannot circulate freely. It is also true that where brush is only partially cleared the loss from rodents is far greater than on wholly cleared areas.

The ash is usually planted; the carob tree sown directly; the tamerisk planted by cuttings; the cypress and thuya by ball (motte) plants; the acacia either by planting or direct seeding, but before the seed of this tree is sown boiling water is poured over it and allowed to stand for 24 hours.

TABLE 5. — SOWING DATA ON MORE IMPORTANT ALGERIAN SPECIES[34]

Name of species.	Date seed matures.	Germination vigorous for —	Time to sow.	Date of germination.
		Months.		
Cedar (*C. atlantica*)	Oct.–Nov.	12	Nov.–Feb.	Spring
Zeen oak (*Q. mirbeckii*)	Oct.	6	Nov.–Feb.	Spring
Cork oak (*Q. suber*)	Nov.	6	Nov.–Feb.	Spring
Holm oak (*Q. ilex*)	Sept.	6	Nov.–Feb.	Spring
Cypress (*C. sempervirens*)	Dec.–Jan.	12	Nov.–Feb.	Spring
Aleppo pine (*P. halepensis*)	Sept.	12	End Nov. to 1st Feb.	Spring
Piñon pine (*P. pinea*)	Nov.	12	Jan.–Mar.	3 weeks after sowing
Thuya (*Callistris quadrivalvis*)	Nov.	12	Jan.–Mar.	Spring
Carob tree (*Ceratonia siliqua*)	Aug.–Sept.	12	Soon after maturity	Spring
Juniper (*J. phœnicea*)	Nov.–Dec.	3	Dec.–Jan.	Spring
Olive	Oct.–Nov.	1	Dec.	

Forestation Routine. — In Algeria, when considering the general problem of reforestation with a view to establishing a new project, the reasons for the undertaking must first be explained, it must be shown then how the openings originated, their extent described, and the opportunity for natural restocking estimated. Besides a regular description of the altitude, slope, soil, and soil cover, a critical review must be given justi-

[34] Manuel du Planteur d'arbres en Algérie, 1910. Ligue du Reboisement de l'Algérie, pp. 42–43.

fying the species, the methods, the time of sowing or planting, and the method of executing the work, as, for example, by advertisement, contract, agreement, or day labor; finally and most important of all, the results of similar work under similar conditions must be summarized with a close estimate of the cost.

Before the actual field planting is approved, a report is submitted showing (1) how the ground will be prepared; (2) amount of seed or number of plants, their source, age, and spacing; (3) method to be used in sowing or planting; (4) areas and amounts; (5) analysis of cost with a recapitulation showing area to be stocked and the total cost. These data are used in preparing the budget.

For each nursery the annual work is forecasted by: (1) preparation of the soil; (2) seed, method, species, amounts, source; (3) transplanting or suckers; (4) maintenance; (5) extraction, packing, transport; and (6) miscellaneous. The estimates are classified by these headings, divided into (*a*) labor and (*b*) material. After the year's expenditures the amounts are reported as having been spent under the above classification.

The resources of each nursery are recorded by: (1) name; (2) area; (3) species; (4) age; (5) total amount; (6) quantity necessary for the requirements of the service; (7–9) amount available, transplanted, and not transplanted; (10) under "remarks" the date of transplanting may be recorded and the requirements of local owners for planting stock noted.

Experimental Planting. — Perhaps the most instructive work in Algerian forestation has been the systematic experiments carried on to solve the aleppo-pine reproduction problem. While the experiments themselves are limited to aleppo pine, the methods are of general application. Half-hectare (1-acre) plots were sowed in October, 1910, under the following conditions:

1. No soil preparation; debris and cones distributed evenly over the cutting area; cost 2.50 francs ($0.48) for the half hectare (1 acre).

2. Fifteen kilos (33 pounds) of aleppo-pine seed sowed broad-

cast before felling; debris regularly distributed after exploitation; cost 14.40 francs ($2.78).

3. Debris distributed and burned; 15 kilos (33 pounds) of aleppo-pine seed then sowed; cost 21.90 francs ($4.23).

4. Special manuring and sowing; too expensive to be practical; cost 78.05 francs ($15.06).

5. After felling, strips 5 metres (5.5 yards) wide and 5 metres (5.5 yards) apart were mattocked to a depth of 10 cm. (4 inches). Then 7 kilos (15 pounds) of aleppo-pine seed per hectare (2.5 acres) were sown and covered with debris; cost 29.31 francs ($5.66).

6. After felling, furrows were plowed 30 to 35 cm. (12 to 15 inches) wide and 5 metres (5.5 yards) apart; vegetation had to be removed by hand before the ground could be plowed; 6 kilos (13 pounds) of aleppo-pine seed were then raked into the soil and covered with debris; cost 23.31 francs ($4.50).

7. Same as 6, only by seed spots 30 by 40 cm. (12 by 16 inches), 3 metres (3 yards) apart, and 25 to 30 cm. (10 to 12 inches) aleppo with 10 kilos (22 pounds) per hectare; cost 51.35 francs ($9.94).

8. Similar to 4; cost 89.05 francs ($17.19).

9. Exotics from Mexico were sown as in 5 and 7. The species chosen were pinus edulis, montezumæ, pseudostrobus, and patula.

These experiments [35] are to be continued and in the official records are shown graphically for each month, since the date of sowing, on the basis of number of plants per seed spot, or per square metre. The sowing took place under unfavorable conditions, because in 1910 there were no rains between May and the end of December, when there was a heavy fall of snow, so that germination did not commence until February and March, 1911; further germination took place in December, 1911, and January, 1912, and after the rains at the end of August and September, 1912.

The conservator has made the following deductions from the

[35] Statement and graphic records on cross-section paper by Conservator Laporte, dated March, 1913.

experiments: 1. Sowing should be early in the fall to profit by the autumn germination, since the early plants are better able to stand the drought of the next summer. 2. The amount of seed sown can safely be reduced 25 per cent. 3. The brush cover used was too heavy, for on certain areas it suffocated the seedlings where the air could not circulate quite freely; yet a brush cover seems necessary to protect the seedlings against birds and rabbits, and to shade them from the sun. (Compare with Boutilly's conclusions, page 6.) 4. The cones from debris seem to open slowly, but the seed apparently retains its germinating power.[36]

The results of each experiment by plots were as follows: 1. Regeneration incomplete but future crop seems assured. 2. Results satisfactory. 3. Complete failure because the debris was burned too completely; the seed sown was not protected from the sun and was devoured by the birds. 4. Resulted in failure on the sandy soil, mediocre on clayey lime soil; too expensive to be practical. 5. Very mediocre results on sand, satisfactory on clayey lime soil. 6. Results very satisfactory. 7. Failure on sand, satisfactory on clayey lime soil, but the results are below 5 and 6 and the cost higher; therefore, this method should rarely be used. 8. Mediocre, cost heavy.

Thus methods 1, 2, 5, and 6 have thus far given the best results; namely, scattering the debris after an ordinary felling; sowing broadcast before exploitation; prepared strips seeded after felling; furrows seeded after felling. No. 7 succeeded, but cost more than furrows or strips. These experiments are suggestive of what might be accomplished, through similar operations, in the United States.

Forestation Projects. — At Constantine the conservator has undertaken some difficult forestation. Here seed spots are used, 30 by 30 centimetres (12 by 12 inches) and 40 centimetres (16 inches) deep, preferably prepared 3 or more months before sowing or planting. The two principal species used are cork oak and aleppo pine. With dry soil, where acorns are sown,

[36] The aleppo pine is like lodgepole pine inasmuch as its cones open readily after a light fire and seed prolifically.

each spot is artificially drained. At least 6 to 9 acorns, treated with alumina, are planted in each spot, since some loss is expected from rats, rabbits, and partridges. Wide spacing, 5 by 5 metres (5.5 by 5.5 yards), is recommended in order to reduce the cost per hectare (2.5 acres) to 150 francs ($28.95). On the same soil, 8-months-old aleppo-pine seedlings, raised in a purely local nursery, were planted on mounds prepared in advance. From 3 to 4 seedlings were placed in the same mound, as a precaution against total loss. The entire planting site was protected by a cleared fire line. During a favorable year 75 to 95 per cent of the stock survives, but during a drought less than one-half remains alive; and curiously enough the best success has been obtained along the ridges where the air can circulate. The object of the planting is an endeavor to modify the climate of Constantine rather than to raise a commercial forest.

At Bainen, near Algiers, forestation has been undertaken on a large scale since 1880, partly to furnish a recreation forest and partly to temper the Algiers climate. The cost of this planting has averaged at least 100 francs ($19.30) per hectare (2.5 acres), notwithstanding the fact that fagots from the brush cleared sell for 2 francs ($0.386) per 100. It is chiefly cork oak and aleppo pine, although some eucalyptus (globulus and red gum), piñon, and juniper have been tried on a small scale. The eucalyptus is limited to the best soils.

The cork oak and aleppo pine are sown and planted in strips 0.80 metre (31 inches) wide and 2 to 2.5 metres (2 to 3 yards) apart. These strips run on contours, so as to collect and hold all surplus water; 2 to 3 acorns are placed in each hole, but only one aleppo-pine seedling 1 year old. No brush cover is used. The young stands are cut by 10-metre (11-yard) fire lines, which, by the way, should have been planned before the plantation was begun, instead of being cut through the young sapling stands. Certain stands have been pruned as a further protective measure.

At the Bois de Boulogne nursery at Mustapha Superieur, above Algiers, 1-year cedar seedlings have been raised. The Eucalyptus (globulus) is transplanted, two months after sowing,

into pots, and when 1 year old, is set out in the forest, but watered when planted. One-year aleppo-pine seedlings, and 1-year cypress seedlings are also successfully grown. In this nursery there were also Acacia lophantha, pycnantha, and melanoxylon, which are rapid in growth, drought resisting, and excellent for holding soil on steep slopes.

Perhaps the most difficult planting problem in Algeria is at Orleansville, where the annual rainfall is less than 500 mm. with a dry season extending from March 1 to October 1, coupled with 45° to 48° C. (113° to 118° F.) of heat and dry sirocco winds. The soil cakes badly and is easily dried out. This forestation was begun by the Army, for health and climatic reasons, as early as 1852. The results prove clearly that in a dry climate, where trees have to fight against adverse natural conditions, high costs and repeated failures are the rule, with periodic success only during favorable years.

The nursery is situated in the middle of an area already reforested, where the trees form an excellent windbreak. The aleppo-pine seedlings are raised on mounds 20.3 centimetres (8 inches) high, with subsoil irrigation between the rows.

In the Kefofsa canton the ditch method is used on slopes, for by this plan water is collected and held in the ditches till it penetrates the soil. The planting ditches, 3 metres (3 yards) apart, run on contours. They are 60 cm. (23 inches) wide and 60 cm. (23 inches) deep, but after the best of the soil is filled in a depression 20 to 30 cm. (8 to 12 inches) below the surface remains. The plants are usually set near the south side of this depression, to gain shelter from the sun. The ditches must be weeded for the first two years, sometimes twice a year.

On the tops of hills, for example in the Sidi Bagdad canton, and where the ditch method cannot be used because of surface rock, spots are made about 61 cm. (2 feet) in diameter and 60 cm. (23 inches) deep, and spaced 3 metres (3 yards). The average cost is 160 francs ($30.88) per hectare and usually 50 per cent success can be counted on, but with a winter drought and frosts alternating with the hot midday sun, the loss may be complete. With very dry ground the local inspector would

FIG. 13. — Bird's-eye view of an important plantation near Orleansville, Algeria.

FIG. 14. — Near view of Orleansville plantation illustrating wide spacing used in the contour furrow method of planting. Evidently an exact contour has not been followed.

prefer the use of pots, but this is too expensive; the main losses with seedlings are due to the evaporation of the leaves before the roots can get a hold, and where feasible the young plants are thoroughly watered when set out. The chief species employed are: aleppo-pine seedlings; olive seed; carob-tree seed. Autumn sowing or planting is usually before the rains set in.

At Aran 98 per cent of the forestation has been accomplished by the use of aleppo pine. Here the brush is cleared in the spring by strips and the soil left fallow until the autumn, when the seed is sown. It is covered with a layer of soil 5 to 6 centimetres (about 2 inches) thick, and a protective cover of brush.

The specifications[37] for reforestation of 180 hectares (444 acres) in the forest of Bon Rahma (chefferie of Mostaganem) were: complete brushing of strips, 2.50 metres (3 yards) wide, separated by uncleared strips 10 metres (11 yards) wide. Sown: 122 kilos (268 pounds) of aleppo pine, 100 kilos (220 pounds) of maritime pine, 150 kilos (330 pounds) of miscellaneous species, or about 8 kilos (17 pounds) per hectare (2.5 acres).

The seed is sown broadcast on the strips cleared and is lightly worked 5 to 6 centimetres (about 2 inches) into the soil. The cleared strips are then covered with brush. The total cost is estimated at 9625.20 francs ($1857.66), or little more than 53 francs ($10.23) an hectare (2.5 acres). On a near-by mountain where the soil was very dry, they had to use aleppo-pine ball plants. The local conservator's office recommends leaving aleppo-pine seed for a few seconds in boiling water prior to sowing. For dry clayey ground they are using the olive; for marls the thuya; for sandy soils the aleppo pine and Phœnician juniper.

The Hamiz reboisement area[38] is being forested with cork oak and aleppo pine. Some 10 to 12 cork-oak acorns are sown in seed spots 50 centimetres (20 inches) square and 50 centimetres (20 inches) deep, spaced 4 metres (4 yards) apart. The brush is cleared on an area 2 metres (2 yards) square around each spot, and must be cut back after 2 to 3 years to

[37] Devis Descriptif, travaux neufs, Bon Rahma.

[38] Information furnished in the field by Ranger Henri Chazalette.

prevent suppression. In more recent operations the brush is cleared on the entire area, instead of by narrow strips or by seed spots; when this is done there is less damage from mice and rats and the air can circulate better, for even when the oak acorn is treated the rats wait until it germinates and then return to devour the young cotyledon. The aleppo pine is also sown in similar spots since the results of plantations were found unsatisfactory.

MISCELLANEOUS ACTIVITIES

Research. — The North African Forest Research Station was established by the Governor General's decree of Dec. 29, 1911. The station is under the direction of the conservator for the province of Algiers, who is also director of forests. The officer in charge of the station is also charged with the administration of the Algiers District, but is given a supplementary pay of 1500 francs ($289.50). No need here is felt for a complicated organization, at least until the formative period is over. The field of work includes not only Algeria, but Tunisia and Morocco.

The general objectives[39] of the research studies are to conserve and increase the forested area, to increase the revenue from federal forests, and to collect and publish the results. With this in view a number of specific lines of work have already been determined upon:

1. Forest meteorology: systematic observations in the different forest regions in order to determine the climatic requirements of the different types, especially as regards humidity. 2. Forest soil: a study of how the different species are influenced in their distribution by the various soils. 3. Reproduction: how to extend forest areas by natural means and the factors influencing natural and artificial regeneration. 4. Increase in cork-oak production: a study of how the producing capacity of cork-oak forests can be increased and the quality improved, as well as a study of diseases. 5. Management: growth of

[39] Bulletin de la Station de Recherches Forestières du nord de l'Afrique, Dec. 5, 1912.

trees and stands, establishment of sample plots to study the effect of spacing, thinnings, etc., construction of volume tables, experimental development of secondary industries, such as resin production. 6. Scientific ecological studies. 7. Accumulation of a library, data on each species for reference, natural history collections. 8. Arrangement and publication: the bulletins, whenever they are original and when valuable data are available, will be published at irregular intervals, and will be prepared for free distribution in Europe and in America.

Forest Museum. — The Algerian Forest Service has equipped an admirable Forest Museum at Algiers, lodged in a rustic log building. The exhibits include: local faunæ, with a number of hides and horns, stuffed birds, an excellent herbarium, wood products, manufactured and crude cork, polished tree sections, maps and graphic charts, models of ranger stations, and photographs and stereoscopic motion pictures of the foresters at work. The official catalogue gives information in regard to the forests of Algeria. The advertising value of such a museum as this is at once apparent.

Grazing. — There are two distinct grazing zones. One includes the coast zone of Constantine and Kabylie, where the rainfall is sufficient to allow the forests to recover rapidly from grazing damage. Here the fire is the greatest danger to such continuous stands. The other, much more important, includes all the forests of the High Plateau and the rest of Algeria, where, owing to the small rainfall, the forests are damaged even by moderate grazing.

These forests are grazed free under rights or under paid permits, and out of some 1.7 million hectares (4,200,700 acres) only 700,000 hectares (1,729,700 acres) are closed to entry, because of fires, recent fellings, and overgrazing. Yet there is need for still larger areas for stock; consequently the natives must be taught to keep the ordinary grazing areas in as productive a state as possible. The enormous amount of trespass means that a greater patrol force must be maintained.

Under present conditions the tax on goats is too small in comparison with cattle, being 0.25 franc ($0.05) each, where the

average value per head is 12 francs ($2.32), as against a tax of 3.33 francs ($0.64) for a steer worth 80 to 100 francs ($15.44 to $19.30). To discourage this form of grazing, the rate on goats should, therefore, be increased as was done so successfully in Bosnia and Herzegovinia.

In all there are some 1.1 million hectares (2,700,000 acres) open to grazing and of this area sheep are allowed on 600,000 hectares (1,500,000 acres).

Owing to abuses of the privilege the gathering[40] of alfa in the High Plateau was forbidden from March 1 to July 1, and for the Tell from January 16 to May 15. On slopes bordering the deserts and chotts (salt water lakes) the country is divided into three zones, two of which are closed to harvest each year. The collection is restricted to rolling or level land. Where damage has been done collection is forbidden on sand. The gathering of alfa can be only by hand or by small sticks, and its use for fuel is forbidden. This policy, the result of experience, serves to illustrate the need of precautions where an industry denudes soil that is thus rendered liable to erosion by wind or water.

Forest Houses. — Three distinct types of forest houses are constructed by the Forest Service in Algeria. In constructing a house of the first type, the ground floor plan allows for two adjoining bedrooms, a small room for the inspecting ranger, a hall, kitchen, a large room for visiting officers, and a loft for storage. It opens into a walled courtyard, which could be used for defence in time of war, and which surrounds a forge, tool room, loft, cellar, and stable. This arrangement, which has been found especially convenient, is shown in Fig. 10.

A second type has a courtyard arrangement similar to the first, but only two adjoining rooms in addition. These are within a hall and run parallel with the kitchen. This second arrangement is now flexible and is only suited for one employee.

A third plan provides for two families and is virtually two one-family houses separated by a masonry wall which cuts the courtyard in two, so that each family has its separate abode.

[40] Decree of Aug. 20, 1904; see Arts. 134, 139, 140.

One section contains the officer's and the other the rangers' quarters; each wing has, besides, two bedrooms and a kitchen.

All these permanent houses are built of stone, cement, tiles, and iron, which renders them fireproof and requires the minimum of repairs. The cost of each of the three types averages: (1) 11,000 to 12,000 francs ($2123 to $2316); (2) 15,000 to 17,000 francs ($2895 to $3281); (3) 25,000 to 26,000 francs ($4825 to $5018).

Trespass. — Trespass has been the bane of the Algerian Forest Service, because it has taken up a great part of the forest officers' time when it was required for much needed constructive administration. One of the contributing causes to this unfortunate situation is the attempt made to enforce legislation which is not adapted to local conditions. As a result the vast number of indicted trespass cases have so clogged the wheels of administration that prompt action cannot be depended upon. As late as 1903 even the fines imposed could not be collected.

The 1903 code has been better suited to local conditions and has given more adaptable and flexible penalties. Yet by the most recent published statistics[41] there were 29,707 current trespass cases, classed as follows: grazing, 13,034; wood and cork, 7232; crude bark, 143; illegal settlement, cultivation, and boundaries, 864; hunting, 234; minor products, 719; fire, 653; lighting fires in or near forests contrary to law, 530; abandonment of lookout posts, 1502; construction or camping within prohibited distance, 396; miscellaneous, 351; denuding private forests, 369; violation of the forest decree of Aug. 20, 1904, 3672.

In order to unify and standardize the methods used in handling trespass cases, and to supplement official instructions and decrees, a trespass handbook was published[42] in 1910. But with a native population unused to restraint in grazing and in the use of wild land, it will be years before the trespass situation is satisfactorily settled.

[41] Statistique Générale de l'Algérie, 1910, p. 299.

[42] Recherche et Constatation des Délits Forestières et de chasse, par A. Lanoir, 1910.

FIRE PROTECTION AND CONTROL

Fire Protection. — As in Tunisia (see page 26) fire protection is concentrated on the valuable cork-oak forests, but in Algeria stands of other species as well are being placed under intensive protection; the aleppo pine, for example, which is being developed to yield a revenue from turpentine. Notwithstanding the efforts which have been made to curtail fire damage, the annual loss is still considerable, and most fires, even now, are caused by incendiarism. During the year 1910 the general statistics of Algeria show a total of 482 fires on 24,294 hectares, (60,030 acres), causing a damage of 411,287 francs ($79,378.39), of which 97,212 francs ($18,761.92) of damage was on private forests.

The Algerian climate is chiefly responsible for the extremely dangerous fire conditions that prevail, because of the prolonged droughts during the hot months, and the inflammable conditions of the underbrush during these periods.

Preventive Measures. — To supplement the fire laws given in the Algerian Code (see Appendix, especially Arts. 123, 125 126, 127, 128, 129, 132, 136, 139, and 140), the Governor of Algeria approved, August 20, 1904, special regulations; the more important provisions have been digested under these headings:

(1) Use of fire; (2) setting fires; (3) organization of patrol service; (4) general rules.

(1) Use of fire: From July 1 to October 31 every building where fires are lighted, within 200 metres (218 yards) of a forest, must be surrounded with a cleared fire line 25 metres (27 yards) wide. Temporary camps, etc., must also be encircled by a dry stone wall 1 metre (40 inches) high, with but one opening not to exceed 80 centimetres (31 inches) in width, or with a ditch 50 centimetres (20 inches) deep, and an earth wall of the same height. Mine furnaces may be established and steam road rollers used only upon special authorization. Railroads will be informed what rights-of-way must be cleared in accordance with Article 132 (see page 193).

(2) Setting fires: From November 1 to June 30, no vegetation may be burned within a kilometre (1094 yards) of a forest, without formal request made at least 8 days in advance. If within 200 metres (218 yards) of a forest, the local official may grant permission to burn brush only after recommendation by the proper forest officer, who prescribes also suitable precautions, such as fire lines, watchers, area to be burned at one time, time to set fire, etc. The officer sent to control the operations can stop the burning or impose additional precautions at any time, in case of high wind. From July 1 to October 31, no brush burning can be permitted within a kilometre (1094 yards) of a forest. An exception may be made where brush is piled, even within 500 metres (546 yards), under the same conditions imposed within the 200-metre (218-yard) zone from November 1 to June 30. Commencing with October 1, the conservation may recommend more lenient provisions. Whenever brush clearing by firing is carried out within 4 kilometres (2.5 miles) of the forest, supervision is necessary after 8 days' notice. Native officers are required to report violations of these regulations.

(3) Organization of patrol service: From July 1 to November 1, special native watchers are levied on local right holders and neighboring tribes. All able-bodied natives are liable. Their duties consist of notifying the proper official of fire, or if possible, to put out any fires discovered. This watch service must include, night and day, 2 men on foot and one on horseback, or, if the lookout point is inaccessible, three men on foot.

In the cork-oak region patrol crews of 5 men, fully equipped with fire-fighting tools, must be provided; these are under the orders of the local forest officer. Lookout-points and patrol routes are established by the Forest Service. In case of rains and upon the recommendation of the conservator, the work of these crews may cease on October 1.

(4) General rules: The procedure for enforcing these rules, as well as a list of the officers who are responsible, are given.

To clinch the provisions of this decree a circular [43] of instructions explains the need of coöperation between the Forest Service

[43] Circulaire du 4 Juin, 1907.

and the local officials. The conservators are required to report to the governor, through the prefect or the generals commanding divisions in which forests are under military control, the trips taken in the forests by local officials and the arrangements made for controlling fires. Natives must be fully informed of all fire regulations, since ignorance does not excuse or repair damage. Definite instructions are laid down in regard to provisioning fire fighters. In exposed regions a central lookout station, commanding the others, has been found efficacious, but telephone lines are only established in cases of exceptional danger.

Another plan which has been put into effect is to concentrate improvement work during the dry season, when the workman can be used for fire fighting. The railroad rights-of-way, in that plan, are put under surveillance, to make certain that the required fire lines are cleared. Assistant prefects, mayors, administrators, and Forest Service officers must report their patrol trips directly to the governor; leave between the dangerous fire season is only allowed in case of sickness. Military detachments, during the critical season, supplement the forest personnel and work in coöperation with them. In case of conflagrations immediate telegraphic advice is sent in case additional help is required.

Those reporting on fires are cautioned not to exaggerate damages; all details must be personally investigated and a preliminary report must first be despatched giving the general direction of the fire, kind of forests burned, attitude of local residents, assistance given by them, and protective measures taken. The final report of inquiry includes: (*a*) General data on the fire; (*b*) Damage caused; (*c*) Conduct of local residents and their assistance in putting out the fire; (*d*) Causes of the fire. It is especially emphasized in the circular summarized that rapid action in bringing fire trespassers to court will have the best possible effect on stamping out this evil.

Fire Lines. — The basis of the Algerian fire-protective scheme is the system of fire lines. These are ordinarily built along crests or ridges, but also follow wagon roads and paths which

contour the hills. They are rarely, if ever, in ravines, except when a boundary happens to follow the bed of a stream. Their width is 5, 10, 15, 20, 25, 30, 40, 50, 100 (5, 10, 16, 21, 27, 32, 43, 54, 109 yards) and even 300 metres (328 yards), according to the problems presented; along railroads the official width is 20 metres (21 yards) on each side. Boundary lines are ordinarily 10 metres (10 yards) wide, but in well-wooded country may

FIG. 15. — Cork oak after the cork has been removed, on a ridge fire line in Algeria, Constantine Conservation.

be as high as 25 (27 yards); these are constructed half on each of the adjoining properties.

In theory main fire lines are 100 metres (109 yards) and secondary lines 25 or 50 metres (27 or 54 yards), according to the value of the stand. But this standard is flexible. At La Calle, where dangerous conditions exist in valuable cork oak, there is a line 300 metres (328 yards) wide. Yet in the Oran conservation, where there is but little cork oak, there are no lines whatever wider than 50 metres (54 yards), and out of a total of 386,164 metres (422,313 yards) of lines there are classified as follows in metres and yards:

TABLE 6

Width.		Total length.		Width.		Total length.	
Metres.	Yards.	Metres.	Yards.	Metres	Yards.	Metres.	Yards.
5	5	1,538	1,682	25	27	36,724	40,162
10	11	84,524	92,436	30	33	95,745	104,708
15	16	43,253	47,302	40	44	19,238	21,039
20	22	89,987	98,411	50	55	15,155	16,574

It is an invariable rule in Algeria to clear the lines once every 3 years; but there are lines where the brush is only cut level with the ground and others where the roots are extracted.

An official note prepared for me by Conservator Laporte of Oran, dated March, 1913, states: " . . . These fire lines are opened on the ridges which are found in the interior of forests so as to localize the conflagrations and to make it possible to stop the fire when it arrives at one of these lines. . . ." The fire lines are made (1) either by simply cutting level with the ground the woody vegetation which is found on its surface; or (2) by completely uprooting these trees. This latter class of line takes less upkeep, when the sprouts coming from stumps overlooked are rare, but it costs much more to open. The fire lines made by simple clearings are far less expensive, but the growth of suckers and shoots require a periodic upkeep which occasions a considerable expense. In these fire lines, all trees, including the undergrowth, are cut off or pulled up; though occasionally, on lines of a considerable width, a fine tree well separated from the others may be left when it is encountered. It is, however, an exception to the general practice.

Table 7 gives the fire lines in the Oran conservation:

TABLE 7. — TABULATION OF FIRE LINES IN THE CONSERVATION OF ORAN, ON STATE FORESTS, JAN. 1, 1913

Name of forest.	Area, hectares (acres).	Chief species.	Fire lines.			Remarks.
			Length, metres (yards).	Width, metres (yards).	Cost of construction, francs (dollars)	
Louza	3,933 (9,718)[1]	Aleppo pine	6,650 (7,272)[2]	20 (22)[2]	2,147.29 ($414 43)	Stump extraction
Guetarnia	9,473 (23,407)	Aleppo pine with thuya	6,500 (7,108)	20 (22)	3,200 00 ($617 60)	Stump extraction
Baudens	6,933 (17,131)	Aleppo pine with thuya	7,125 (7,791)	40 (44)	4,315 82 ($838 74)	Stump extraction
			4,800 (5,249)	30 (33)	2,436.00 ($470 15)	
			19,965 (21,833)	20 (22)	3,219.38 ($621 31)	
			3,800 (4,155)	10 (11)	760 00 ($146 68)	
Moxi	788 (1,947)	Aleppo pine with thuya	977 (1,068)	40 (44)	622.08 ($120 06)	Stump extraction
Temra	8,838 (21,838)	Aleppo pine with thuya	6,456 (7,158)	40 (44)	3,956 50 ($763 60)	Stump extraction
			14,445 (15,797)	20 (22)	4,630 50 ($893 68)	
Bou Yetas		Aleppo pine with thuya	(8,085)	20 (22)	2,756 70 ($532 04)	Stump extraction
			7,393			
			17,480 (19,116)	10 (11)	2,836 85 ($547 51)	
Kounteida	4,261 (10,528)	Aleppo pine with thuya	6,800 (7,436)	15 (16)	2,747 48 ($530 26)	Stump extraction
Toumiet	16,687 (41,233)	Aleppo pine with thuya	7,000 (7,655)	30 (33)	4,038 55 ($779 44)	Stump extraction
			1,950 (2,132)	20 (22)	1,218 20 ($235 11)	
			6,800 (7,436)	15 (16)	2,748 48 ($530 45)	
Slissen	35,849 (88,582)	Aleppo pine with thuya	4,680 (5,118)	40 (44)	1,419.86 ($274 03)	Stump extraction
			24,485 (37,712)	20 (22)	9,018 91 ($1740 65)	
			7,003 (7,658)	10 (11)	1,146 06 ($221.19)	
Planteurs	688 (1,700)	Forestation of aleppo pine	3,340 (3,652)	25 (27)	3,320.00 ($640 76)	Stump extraction
			607 (663)	15 (16)	970.00 ($187.21)	
			3,122 (3,414)	10 (11)	1,534 00 ($296 06)	
			1,038 (1,135)	5 (5½)	468.00 ($90.38)	
M' Silah	958 (2,367)	Cork oak	2,697 (2,949)	50 (55)	5,921.00 ($1142.75)	Stump extraction
			1,752 (1,103)	20 (22)	750 00 ($144 75)	
			23,410 (26,694)	10 (11)	3,612.00 ($697 12)	
			500 (546)	5 (5½)	50.00 ($9 65)	
Carried forward	102,547 (253,393)		193,775 (211,912)		69,873 66 ($13,485 62)	

[1] (Acres.) [2] (Yards.)

TABLE 7 (*Continued.*) — TABULATION OF FIRE LINES IN THE CONSERVATION OF ORAN, ON STATE FORESTS, JAN. 1, 1913

Name of forest.	Area, hectares (acres).	Chief species.	Fire lines.			Remarks.
			Length, metres (yards).	Width, metres (yards).	Cost of construction, francs (dollars).	
Brought forward	102,547 (253,393)	. . . .	193,775 (211,912)	. .	69,873 66 ($13,485 62)	
Djabel Khâar . . .	1,369 (3,284)	Forestation of aleppo pine	4,240 (4,636)	25 (27)	530.00 ($102 29)	Simple clearing
			2,010 (2,198)	25 (27)	502.00 ($96 86)	Extraction of stumps
			3,100 (3,390)	20 (22)	620.00 ($119 66	Extraction of stumps
			2,260 (2,471)	15 (16)	169.00 ($32 62)	Simple clearing
			3,170 (3,466)	10 (11)	630.00 ($121 59)	Stump extraction
Mouley Ismail . . .	6,405 (14,120)	Thuya, miscellaneous, lentisks	1,747 (1,910)	20 (22)	263.00 ($50 76)	Simple clearing
			10,881 (11,902)	10 (11)	663.00 ($127 96)	Simple clearing
			9,751 (10,663)	15 (16)	869.00 ($167 72)	Simple clearing
Nesmoth . . .	6,405 (14,120)	Cork oak, holm oak	3,100 (3,390)	15 (16)	527.95 ($101 89)	Stump extraction
Tenileld.	7,399 (16,312)	Aleppo pine	6,465 (7,070)	10 (11)	539.07 ($104 04)	Simple clearing
Doni Thabet. .	4,028 (8,880)	Aleppo pine	6,720 (7,349)	25 (27)	3,306 60 ($638 17)	Extract. of stumps on 2835 m. (3100 yds.). Simple clearing on 3885 m. (4248 yds.).
Zid el Moumus. .	4,888 (10,776)	Aleppo pine	9,039 (9,885)	25 (27 34)	4,965.48 ($958.33)	Stump extraction
			4,080 (4,461)	15 (16)	1,013.52 ($195.61)	Stump extraction
Sefionn . . .	5,894 (12,994)	Aleppo pine	5,615 (6,140)	30 (33)	3,900 00 ($752 70)	Stump extraction
			9,855 (10,777)	15 (16)	3,451.30 ($666.10)	Stump extraction
Touzizine . .	11,948 (26,340)	Aleppo pine	2,060 (2,252)	30 (33)	800.00 ($154 40)	Simple clearing
			11,375 (12,439)	25 (27)	5,754 80 ($1,110 67)	Extract. of stumps on 6940 m. (7589 yds.). Simple clearing on 4435 m. (4850 yds.)
Zegla	56,678 (124,953)	Aleppo pine	34,310 (37,521)	30 (33)	19,082.47 ($3682 92)	Stump extraction
			2,750 (3,007)	30 (33)	1,661 53 ($320.67)	Stump extraction
			1,850 (2,023)	10 (11)		
			4,750 (5,194)	10 (11)	1,664 13 ($321 17)	Stump extraction
Takrouma	2,219 (4,892)	Aleppo pine	11,263 (12,317)	30 (33)	8,336 73 ($1608 99)	Stump extraction
Beni Mathar	9,600 (21,164)	Aleppo pine	27,947 (30,563)	30 (33)	14,664 27 ($2,830 20)	Stump extraction
Hafir	10,043 (22,141)	Cork oak on 4000 h., holm oak and thuya on rest	12,458 (13,624)	50 (55)	22,338 10 ($4,311 25)	Stump extraction
Zariffet	989 (2,180)	Cork oak	1,590 (1,738)	10 (11)	450.90 ($87 02)	Stump extraction
Totals	230,523 (508,215)	. . . . .	386,164 (422,352)	. . . .	166,576 51 ($32,149 27)	Stump extraction on a total length of 341,697 metres; (373,683 yds.). brush merely cut on 44,467 metres (48,629 yds.)
Averages	. . . . .	. . . . .	c. 44 f. per m. ($0.078 per yd.)	. . . .		

The foregoing table has given in considerable detail a tabulation of the fire lines of different widths in the Conservation of Oran. Through the courtesy of the conservator at Constantine, the original record sheets for three inspections (Bougie, Bône, La Calle) were secured in 1912. A tabulation of these sheets is given in Table 8, which follows:

TABLE 8. — SUMMARY OF FIRE LINES IN ALGERIA, CLASSIFIED BY INSPECTIONS AND WIDTH

Width of fire line.		Length of fire lines.					
		Bougie.		Bône.		La Calle.	
Metres.	Yards.	Metres.	Yards.	Metres.	Yards.	Metres.	Yards.
2.5	3	.....	.....	10,098	11,043	.....	.....
3	3	26,684	29,182	.....	.....	.....	.....
5	5	.....	.....	47,164	51,579	63,093	68,999
10	11	72,280	79,046	37,562	41,078	171,642	187,710
12	14	.....	.....	2,825	3,089	7,000	7,655
15	16	2,390	2,614	.....	.....	9,050	9,897
20	22	35,275	38,577	14,965	16,366	33,667	36,819
25	27	.....	.....	118,069	129,122	420,340	459,688
30	33	64,757	70,819	.....	.....	74,270	81,222
40	44	40,775	44,592	.....	.....	4,950	5,413
50	55	17,947	19,627	60,462	66,122	3,250	3,554
60	66	.....	.....	.....	.....	2,610	2,854
100	109	800	875	.....	.....	.....	.....
200	219	.....	.....	.....	.....	10,565	11,554
250	273	.....	.....	.....	.....	7,000	7,655
300	328	.....	.....	.....	.....	10,780	11,789

A careful study of the foregoing table shows clearly that there is no similarity in the policy of the width of fire lines in the three inspections (supervisorships). In Bougie the popular width seems to be 10, 30, 40, and 20 metres (11, 33, 44, and 22 yards), while in Bône and in La Calle the 25-metre (27-yard) fire lines predominate, with 5 and 10 metre (5.5 and 11 yard) lines of secondary importance, but in La Calle there are more than 75,000 metres (82,020 yards) of 30-metre (33-yard) lines, while in Bône there are none. Evidently, the width has depended more or less on the ideas of the inspector in charge and upon the year in which the lines were constructed. The tendency seems to be to construct narrower lines and to have

them more thoroughly cleared than in the past. In the inspection of Bougie, the lines on nine forests (aggregating 35,451 hectares) (87,599 acres) had 6,095,262 square metres (7,289,933 square yards) of fire lines or an average of 172 square metres (206 square yards) per hectare (2.5 acres). This means that for each hectare of forest there was, theoretically, an equivalent of 36 running metres (39 running yards) of fire line 10 metres (11 yards) in width. An examination of the original sheets shows a still further peculiarity. As explained, the lines are either brushed or cleared of brush supplemented by stump extraction. In Bougie, on the nine forests referred to, 63,280 metres (69,204 yards) of 10-metre (11-yard) lines were cleared of stumps, and, in addition, the entire length of 20-metre (22-yard) lines enumerated in Table 8. No stumps had been extracted prior to 1904 and the lines, where the stumps were extracted since then, were solely trail fire lines (Chemins-tranchées). On the other hand, in the Bône inspection, the lines included boundary fire lines, trail fire lines, etc., and the stumps had been extracted on all classes. In La Calle, the stumps had been extracted on about half the lines, the narrower ones comprising chiefly those designed for trails. This diversity of policy denotes clearly that the French Service of Waters and Forests in Algeria has had to experiment with the width of fire lines. This alone explains the dissimilarity in the different inspections. The form which follows illustrates the records which are kept for all fire lines.

SAMPLE OF FIRE LINE-RECORD IN ALGERIA

Inspection of La Calle,
Ranger District of Carf.

Status of fire lines in the Forest of Bou Hadjar.

Fire lines.	Character of line (*D* or *S*).[1]	Length, metres (yards).	Width, metres (yards).	Year of construction.	Years of maintenance.													Remarks.
					1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	
No. 2. Trail fire line. From boundary 29 to boundary 68.	*S*	6,000 (6562)	25 (27)	1904									1			1			

[1] *D* = simple brushing. *S* = stump extraction.

Back-firing. — As a result of experience there is, on the part of Algerian foresters, a decided prejudice against back-firing, a method of fire fighting which was, in the past, badly abused. The commission reported: [44]

> "We believe it worth while to note the great danger which arises when back fires are lighted to fight conflagrations. Back fires require a number of favorable circumstances which are rarely present in actual practice; they presuppose also long experience on the part of those using them, a quality which is rarely acquired. It is going too far when each native, each neighbor, each mayor or administrator, or each forest employee should assume the right of starting a new fire under the pretext of backfiring and of saving his hut, his property, his commune, or his beat. The (forest) administration should give the strictest orders that the provisions of the law on this subject must be rigorously observed by all. . . ."

Fire Lines — Conclusions. — Are fire lines as now used in Algeria really worth the cost? After talking with local officers my conclusion is that fire lines are necessary, but that well-cleared narrow lines are more practical than wide lines necessarily expensive to maintain. A narrow line is sufficient to stop the ordinary fire when the wind is not violent; with a serious wind even a wide line will not avail. Lines should, so far as possible, be combined with the roads and trails used in the business of export. Large areas of even-aged inflammable stands should be avoided. Often agriculture can be encouraged so that farm lands will separate stands. One of the main reasons why lines have been cleared arises from the desire to make the public feel that energetic steps are being taken to combat fires which have become a national calamity.

ADMINISTRATIVE ORGANIZATION

Forest Organization. — The Governor General is at the present time virtually at the head of and in complete control of the forest organization of Algeria. It is true that the officers of

[44] Commission d'Etudes Forestières, p. 138.

the Service are loaned to him, theoretically, by the Secretary of Agriculture at Paris, but any action taken in regard to them, or to their standing, such as promotion, demotion, etc., is taken at the request and upon the recommendation of the governor. This arrangement gives far better results and a more efficient working corps than any other of the various schemes tried out since the inception of the Service.

And these changes have been sufficiently numerous. To begin with, the Service was under military control for a time, then, later on, it was transferred to the Department of the Minister of Agriculture at Paris. On Sept. 27, 1873, it was attached [45] to the Governor General's office, but on Aug. 26, 1881, it was again placed under the home Minister of Agriculture. On Sept. 24, 1886, the power of the Governor General in forestry matters was considerably increased, and on Dec. 31, 1896, the Forest Service was put in his charge, with employees directly under him and officers loaned by the Secretary of Agriculture, as stated. This is the plan that maintains to the present time and which has given more general satisfaction than any of the other arrangements tried.

The Directions. — Under the general government the administration is divided into seven "directions" (departments): Interior, Finances, Agriculture, Eaux et Forêts, Public Works, Railroads, and Native Affairs. The Forest Service is in charge of a director (who also acts as conservator of the Algiers conservation), assisted by an inspector and assistant inspector; the necessary clerks for all officers are recruited from employees who are not well suited for field service. There are three conservations or districts, with the following force:

[45] Pp. 165-166, Recueil de la Législation Forestière Algérienne, V. Boutilly.

TABLE 9

Name and location of conservation.	Supervisory force.	Divisions (inspections).	Districts (chefferie).	Ranger districts.	Guard's beat.
Algiers	1 conservator (also director) 1 inspector (on office duty) 1 inspector (controller)	0	12	47	242
Oran	1 conservator 1 inspector (on office duty) 1 inspector (controller)	0	8	33	103
Constantine	1 conservator 1 inspector (on office duty) 1 inspector (controller)	2	8	68	323

The comparative[46] size in hectares and acres (in parentheses) of administrative units in France and Algeria are as follows:

TABLE 10

	Algeria.	France.
	Hectares (Acres).	Hectares (Acres).
Conservator	600,000 (1,482,600)	100,000 or $\frac{1}{6}$ (242,100)
Chief of service (supervisor)	106,000 (256,926)	33,000 or $\frac{1}{3}$ (81,543)
Chief of canton (ranger)	39,000 (96,369)	7,400 or $\frac{1}{5}$ (18,285)
Guard	3,000 (7,413)	515 or $\frac{1}{6}$ (1,277)

In addition to the force listed there are 204 native guards who are used as field interpreters and messengers. French officers are usually accompanied on their field trips by these native guards, partly for convenience, and partly as a precaution against assassination.[47]

[46] Commission d'Etudes Forestières.

[47] Each year quite a number of forest officers are shot from ambush owing to the ill feeling engendered through the performance of their duties, especially trespass investigations.

The Chefferies. — On January 1, 1906, the old system of "inspections" and "cantonments," like that used in France, was replaced[48] in Algeria by small forest districts (chefferies) directly under the conservator. These chefferies are administered by an inspector, assistant inspector, or forest assistant, according to the importance of the station. In important chefferies the chief is assisted by an auxiliary, who is usually an assistant inspector or forest assistant (garde général). Young officers are always trained as auxiliaries, but in case they show no special aptitude as administrators, they are kept as office assistants during the remainder of their official career. In other words, the office of "inspection" between the conservator and the cantonment was done away with. Two of the old-style units were retained in especially important groups of forests in the cork-oak region of the Constantine conservation, but these also, in time, will be dispensed with.

Statistical. — It is interesting to compare the number of employees in the Service in 1881 with the roll in more recent years. The following table gives the number of officers, French guards and rangers, and native guards, by indicated intervals:

TABLE 11

Year.	Officers.	French guards and rangers.	Native guards.	Total.
1881	79	486	180	795
1889	65	511	182	758
1895	64	782	180	1026
1898	66	811	200	1077

It will be noted that the supervisory force has decreased,[49] presumably so that the survivors may receive larger salaries; the native force has remained about stationary, while the French subordinate force was largely increased.

[48] Decree of November 16, 1905.

[49] According to the La Classification des Archives, 1906, the filing is divided into 10 general sections which are subdivided into parts; the parts are divided into divisions. The section classification is: 1. Legislation and organization; 2. Personnel; 3. Forest domain; 4. Exploitation; 5. Concessions; 6. Equipment and improvements; 7. Accounts and statistics; 8. Trespass; 9. Fires; 10. Miscellaneous.

The Controller. — At the time when the chefferie organization was adopted, a new position — that of inspector (controller) — was created. The controllers are really general inspectors under the director of the Forest Service, but also under the orders of the conservators. They make general inspections in the chefferies, but ordinarily do not inspect officers of equal rank. They report directly to the conservators, occasionally act in the place of conservators, but may take very important problems of a serious nature to the director. Notwithstanding the extra allowance for travel and the fact that they are not burdened with routine, the position is not generally popular, because they must spend a large part of their time away from their families. But, on the whole, the creation of this rank has strengthened the organization. For the inspectors are wholly free from local influence and have no administrative preference in the problems reported upon.

In the language of the Enabling Act: [50]

> "A certain number of inspectors may be charged with control and placed for this purpose either under the governor, the government, or the office of the conservation; or they will have as a task the inspection of chefferies, or the study of important problems. Only under exceptional circumstances will these inspectors make inspections in any chefferies administered other than by assistant inspectors of forest or forest assistants."

Reforestation Service. — The reforestation and management service under an inspector at Algiers covers all three conservations and in theory is attached to the director's office. For convenience, however, it is under the conservator of the Algiers conservation who, it will be remembered, acts as director. When the chief makes a report on a matter in another conservation, it is sent to the director through the conservator in charge.

A research station (see page 87) has been created and the inspector in charge of the Algiers chefferie has been nominated as chief under the orders of the local conservator.

[50] Art. 3, Decree of November 16, 1905.

In Time of War. — The Forest Service personnel is expected to coöperate in guarding the coast, the frontier, and the means of communication; or to defend settlers or military posts; or join with columns. In case of war forest officers and men are at the command of the general commanding the nineteenth army corps. The men will be given the following corresponding grades: forest assistant (attached to office) = second lieutenant; assistant inspector = captain; inspector = batallion chief; conservator = lieutenant colonel; rangers = petty officers; guards, first class = corporal or brigadier; guards, second class (French) = soldier of first class; native guards = soldier of second class. These officers keep their Forest Service uniform in time of war, and during peace they are furnished with a complete armament.

Salaries. — The gross salaries in Algeria are much better than in France. They have been increased by a rather complicated system of special supplements [51] and in addition the organization [52] has been so arranged that officers of low rank can direct forests under the chefferie organization. The supplements referred to are: for colonial services the conservator receives 3600 francs ($694.80) additional pay, the inspector 2400 francs ($463.20), the assistant inspector 1800 francs ($347.40), the forest assistant 1400 francs ($270.20), and the forest assistant on office duty, 800 francs ($154.40).

Bonus on Algerian Service. — All officers receive a bonus of 1000 francs ($193.00) for service in Algeria; this carries with it the obligation to remain 4 years, and, in default of this service, a pro rata refund must be made. Inspectors serving as "controllers" receive 3000 francs ($579.00) more each year to assist in paying for an office; conservators receive 3600 to 4000 francs ($694.80 to $772.00), and other officers in charge of districts 1000 francs ($193.00). When on tour conservators receive 25 francs ($4.82) per day (for auto and travel the conservator of Constantine receives 6000 francs ($1,158.00)), and those in charge of districts 15 francs ($2.89) ; the latter receive

[51] Decree of November 16, 1905, and circular of August 31, 1904.

[52] See page 104.

an additional 800 francs ($154.40) annually for the maintenance of a horse or automobile, or if their maintenance is impracticable, the same amount is paid on expense accounts for any form of transportation. Officers assigned to bureaus receive a total idemnity of 1500 francs ($289.50); employees 500 francs ($96.50). Any one who collects money as treasurer receives one-fifth of 1 per cent of the amount collected.

When on special duty off their districts conservators receive per diem 20 francs ($3.86), inspectors 10 francs ($1.93), and rangers 8 francs ($1.54); but when on bureau detail only 4 francs ($0.77). For railroad fare conservators receive 0.125 franc ($0.02) per kilometre (0.621 mile), inspectors, etc., 0.09 franc ($0.017); for carriages conservators receive 0.60 franc ($0.115) per kilometre (0.621 mile), and others 0.25 or 0.50 and 0.30 franc ($0.048 or $0.096 and $0.058) respectively for horse hire. In addition all officers are allowed 1 month leave on full pay per year, or 2 months every 2 years, but receive free mail-boat transportation to France for themselves and families.

The policy of allowing a higher rate of living expenses for the more important officials is always followed; this seems logical; the conservator, for example, may reasonably be expected to spend more when on inspection trips than would a forest assistant.

Employees Classified by Length of Service. — There are two classes of employees: (1) those who served before 1901, who receive the same salary as given in France plus a supplement of 300 francs ($57.90) for rangers and 200 ($38.60) for guards; and (2) those who entered the service after 1901, who receive a combined salary and supplement as follows: rangers in three classes receive 1600, 1500, and 1400 francs ($308.80, $289.50, and $270.20) and two classes of guards 1200 and 1100 francs ($231.60 and $212.30). A large number of rangers and guards are lodged, but those who have to live in quarters receive an allowance for this purpose of 200 francs ($38.60).

Both guards and rangers receive 500 francs ($96.50) a year for horse feed and 4 hectares (10 acres) of land for a garden. First-class native guards receive 600 francs ($19.30) allowance

in lieu of lodging in case no station is available; second-class guards receive 550 francs ($106.15) and those in the third class 500 francs ($96.50). Exceptionally good men who have served at least 10 years may receive 10 francs ($1.93) per month additional.

An employee is given 300 francs ($57.90) for horse equipment and uniform when entering the service. Native interpreters (chaouchs) attached to the three conservators' offices and to the Algiers inspection (supervisors') office receive 600 francs ($115.80) per year and 300 francs ($57.90) in lieu of residence.

By his decree of July 11, 1904, the Governor of Algeria established a body of native Forest Service horsemen recruited from men 22 to 30 years old, who understood French. They are paid 400 francs ($77.20) and are given the same allowances which the native guards receive.

Promotions — Discipline. — Promotion[53] made July 1 and January 1 can be sanctioned after at least 2 years' service in the lower grade; no one can be made an assistant inspector or conservator unless he has served at least 5 years in the lower grade. Advancement in the lower grades is based half on seniority and half on choice, but an inspector is judged 75 per cent on choice and only 25 per cent on seniority. Appointments to still higher grades are entirely on choice without any reference whatever to seniority. Such promotions are due to choice in the fullest sense because they are made by a large committee rather than by a few high officials. This committee includes the officials above the rank of conservator — two conservators nominated by the Secretary of Agriculture, and two representatives for each of the grades of inspector down to ranger. The members of the committee receive, 10 days in advance, personal data on each candidate.

In finally deciding upon advancement the deliberations are secret and are by secret ballot with majority rule. The discipline is on a similar basis, and formal action by a committee is only taken after formal deliberations.

[53] Presidential decree of August 30, 1912.

The promotions and discipline of employees is based on the same policy, but the committee for promotion is headed by the conservator instead of by the Secretary of Agriculture. Members of the subordinate force are only promoted to be officers after formal examination. Men who on the contrary cannot handle a forest or district are used as office men and trained as high-class administrative clerks.

FOREST LEGISLATION

Legislation. — The Forest Code[54] of 1827 was applied in Algeria after the conquest, but was supplemented by the laws of July 17, 1874, and Dec. 9, 1885, to cover more thoroughly the local fire and rights problems. Owing to continued criticism of the forest administration under these laws a commission was appointed in 1892 to study the needs of the colony and to suggest the modifications necessary to make the Code of 1827 more closely applicable to local conditions. The commission found this impracticable, and, instead, recommended an entirely new law, which was finally promulgated on Feb. 21, 1903.

The New Code. — "Whatever may be its faults," Guyot considers it "a remarkable monument, since private and public interests had to be reconciled." It comprises the following parts in the order enumerated: I. Forest Regime; II. Waters and Forests Administration; III. State Forests, 1, boundaries; 2, management; 3, auctions of bark-felling areas and sales by agreement; 4, exploitation; 5, check of cutting area; 6, auctions and rentals of grazing, mast, miscellaneous forest products, and agricultural land; 7, wood rights in state forests; 8, expropriation; IV. Communal and Public Institution Forests; V. Joint Tenancy Forests; VI. Private Forests, Reforestation Areas, and Clearings; VII. Police and Conservation of Woods and Forests, 1, provisions applicable to all woods; 2, provisions applicable only to forests placed under forest administration; VIII. Prosecutions for Misdemeanors and Offences, 1, prose-

[54] Commentaire de la Loi Forestière Algérienne, par Ch. Guyot, pp. 5–11.

cution undertaken in the name of the Waters and Forests Service; 2, prosecutions for misdemeanors and offences in woods not under forest administration; IX. Penalties and Sentences Applicable to Woods and Forests in General; X. Execution of Judgments, 1, judgment concerning misdemeanors and offences in woods under forest administration; 2, judgments concerning misdemeanors and offences committed in woods which are not under forest administration; XI. General Provisions.

This example of a forest code, where local conditions are, in many respects, similar to the western United States, contains so much of interest that it has been translated and is given in full in the Appendix, page 161.

The new law is simpler,[55] easier to understand, less severe, and much more flexible than the old. Important innovations which are worth mentioning specifically are: the prosecution for deforestation; use of fire; lookout posts; transport of cork, etc.; and the closing of areas to pasturage after forest fires on the ground burned over. The governor felt that the restriction of abusive cutting on mountain slopes was so important that the dangers of deforestation [56] should be fully explained as often as possible.

[55] Governor's circular letter of March 13, 1903.

[56] The comparatively small amount of deforestation, considering the past 2000 years of abusive use, is locally explained by the frequent plagues and wars which cut down settlement and changed the highly populated districts into mere wastes and thus gave the forests a chance to recover.

CHAPTER IV

CORSICA

INTRODUCTION

Early History. — Between 160 and 260 B.C., the Roman, Lucius Cornelius Scipio,[1] first invaded what is now known as the Island of Corsica. From his advent war followed war, almost without cessation, until, in 1759, the island was ceded to France by the Republic of Genoa. The treaty of Versailles, which conveyed title, provided that Corsica's forests should be attached to the royal domain, to the communes, and to certain specified public institutions.

Later on, in 1796, the English under Hood captured Corsica, but the conquest was soon abandoned, and the rule of France has been to all intents and purposes uninterrupted since the cessation of the island to that power. Forest problems crop out from time to time in the history of this period. As early

[1] The History of Corsica, I. H. Caird, p. 1.

as 1763,[2] the French general, Dumouriez, advised that in view of its value the timber of the island should be marked for felling. When the Consulta met at Corte in October, 1764,[3] the people were forbidden the free use of timber without a permit, a measure passed, however, to protect the forests from the French rather than from the local population. From 1759, the year in which Corsica was annexed to France, to as late as 1824, the forests were administered in a more or less haphazard fashion, by diverse administrations, the Eaux and Forêts, Nancy and Domaines. Since the latter date, they have been placed under and managed by a consistently technical administration.

Forest Problems. — Seneca, after his banishment to Corsica, was perhaps not in a frame of mind to judge his new friends fairly, but his taunt:[4] "Their first law is to revenge themselves, their second to live by plunder, their third to lie, and their fourth to deny the gods," has come down to us in history as the dictum of a great and famous man. Whether it could be taken as corroborative evidence or not, the fact is apparent to-day that local forest users are lawless and extremely difficult to control. Fire, excessive grazing in its most objectionable form — by goats — and minor[5] trespass still furnish as knotty problems to the forest administrators of the island as they have in the past.

Fires, especially, have been so disastrous that a change from the shelterwood to the selection system has become a necessity. To-day, in federal forests, grazing is practically unrestricted, although absolutely contrary to the forest code. And when, in 1834, an attempt to regulate grazing was made, armed opposition arose to the enforcement of the law. While the island is well settled (by the census of 1911,[6] there are 33

[2] The History of Corsica, I. H. Caird, p. 182.

[3] *Id.*, p. 155.

[4] *Id.*, p. 1.

[5] See trespass, p. 154.

[6] Notes prepared by de Lapasse, conservator of the 30th conservation who kindly reviewed and corrected the chapter on Corsica, assisted by the H. M. Consul at Ajaccio, The Hon. Henry Dundas.

inhabitants per square kilometre (0.3861 square mile) as compared with 73 for France), still the impossibility of controlling fires and grazing has practically dictated the character of the silvicultural measures in force.

These will be taken up in detail, but before considering the present administration and forest management, a word about Corsica's climate and topography.

Situation. — The island is situated[7] between 43° 0′ 42″ and 41° 21′ 4″ north latitude and between 6° 11′ 47″ and 7° 11′ 6″ east longitude.

Area and Topography. — It is 183 kilometres (113 miles) long by 84 (52 miles) wide with a double mountain chain running along its length. Its total area is 872,182 hectares (2,155,161 acres) with 490 kilometres (304 miles) of coast line. The mountains are abrupt and often precipitous; because of their rapid descent, a drainage by torrents, rather than by rivers. The east coast is level with areas of alluvial plains, but the west coast is rocky and cut by bays. Monte Cinto, in the northwest quarter of the island, rises to 2709.5 metres (8890 feet) elevation. The prevailing rock is grey granite which disintegrates slowly. There is considerable limestone at the lower elevations.

Climate. — Paul Joanne gives three climatic zones:[8] (1) The maritime zone, extending to 580 metres (1903 feet) with an estimated rainfall of 700 to 900 millimetres (27 to 35 inches) at Ajaccio; rarely below 0° C. (32° F.) and never over 33° C. (91° F.) of heat.

(2) A hill zone extending to 1750 metres (5741 feet) with 4 metres (13 feet) of snow in the winter, at an elevation of 1162 metres (3812 feet) at Vizzavona.

(3) An Alpine zone, with 8 months of winter; the hot and dry fire season extends from May to September.

The Forests. — Most of the easily accessible areas, formerly forested, are now covered with dense brush locally known as "maquis"; written "macchie" by the natives. The valuable

[7] Géographie du département de la Corse par Paul Joanne, sixième édition.

[8] Compare with forest zones, p. 115.

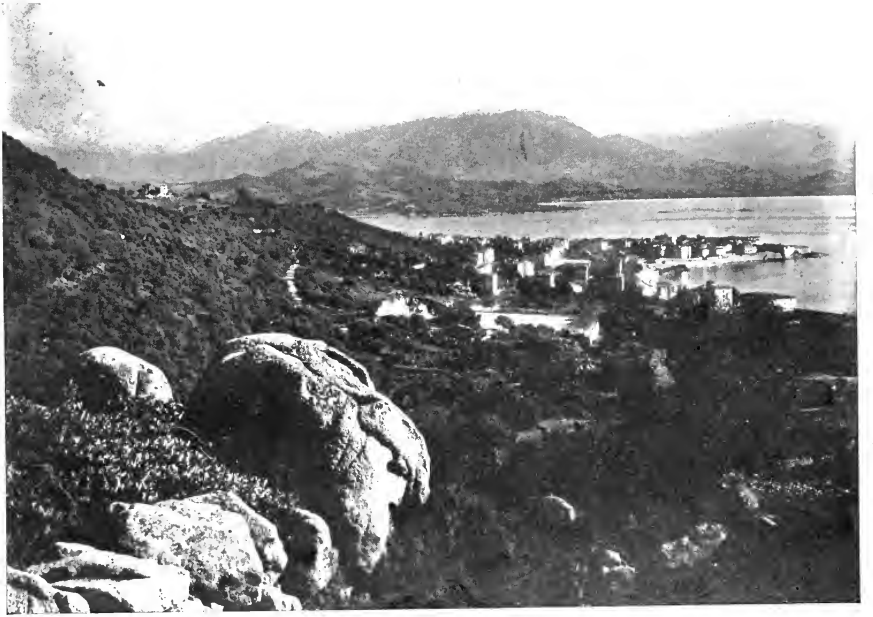

FIG. 16. — The "maquis" or brush of the lower slopes of Corsica resembles the chaparral of southern California.

forests are Corsican pine (*P. laricio*), mixed with maritime pine (*P. maritima*) at its lower limits, and forced back by beech and fir at extreme elevations.

The following forest zones are locally recognized:[9]

(1) 0 to 500 metres (0 to 1640 feet) chiefly agricultural land and maquis, but also cork oak (*Q. suber*) (near Porto-Vecchio), holm oak (*Q. ilex*), and vert oak (*Q. ilex*).

(2) 500 to 1000 metres (1640 to 3281 feet) maritime pine and chestnut.

(3) 1000 to 1800 metres (3281 to 5915 feet) Corsican pine, with beech in the high central valleys and fir at a few elevated points.

FOREST CONDITIONS

Forest Area. — In 1878 the official records[10] put the total forested area at 209,177 hectares (516,876 acres), but in December, 1912, this area had fallen to[11] 132,215 hectares[12] (326,703 acres) under management, and 42,400 hectares (104,770 acres) of private forest, or a total of 174,406.05 hectares (430,957 acres). This decrease during the past 3 decades is chiefly in private forests, and has been occasioned by excessive cutting coupled with grazing and fire. Of the area now classed as forested, there are 34,079 hectares (84,209 acres) of blanks, mostly rocky summits above timber line; this leaves actually stocked with trees some 140,536 hectares (347,264 acres), or 16 per cent of the total area, as against 24 per cent for 1878. The location of the federal forests is indicated upon the accompanying diagrammatic map (Fig. 17).

The Species. — The chief local species,[13] in the order of the area which they cover, are as follows: Holm oak, Corsican pine, maritime pine, beech, and cork oak. The distribution in federal

[9] Unpublished notes by de Lapasse compare with Paul Joanne's climatic zones.

[10] Unpublished official report, unsigned.

[11] Report of Prefect, dated December 31, 1911, p. 94, gives 132,006.05 hectares.

[12] Unpublished notes by de Lapasse.

[13] The data on species are partly from unpublished notes by de Lapasse supplemented by field notes by the writer.

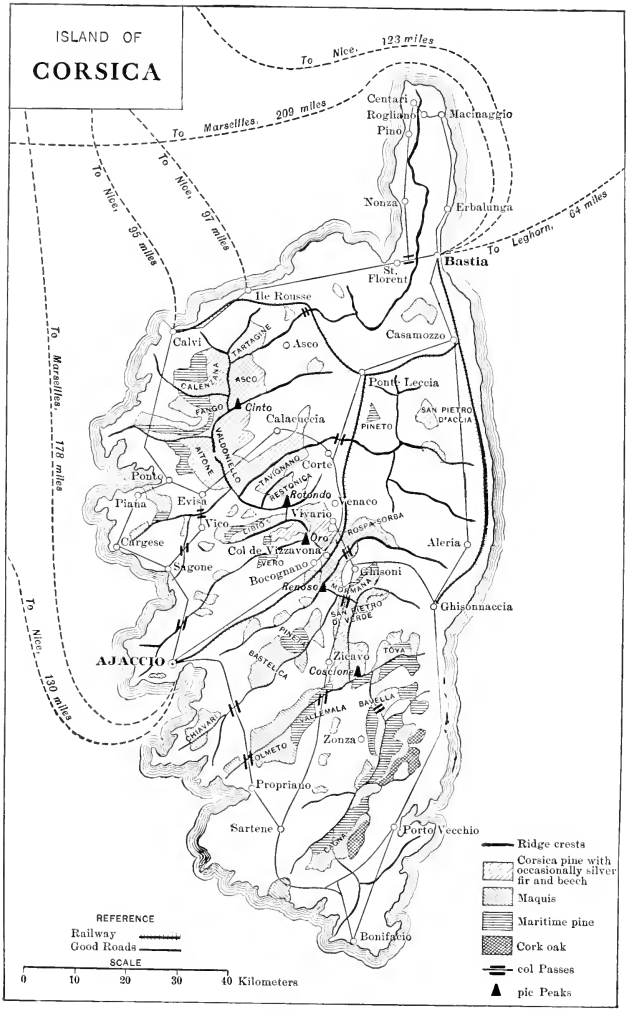

FIG. 17. — Forests managed by the Waters and Forests Service in Corsica.

FIG. 18. — A ranger station and stand of Corsican pine in the Forest of Aitone, Corsica.

and communal forests, including both those under management and those for which no working plans have been made, is as follows:

TABLE 12

Class of Forests.	Holm oak.	Corsican pine.	Maritime pine.	Beech.	Cork oak.	Miscel. species.	Totals.
	Relative per cent of area occupied by each species.						
Federal	20	39	28	10	....	3	100
Communal	30	28	12	20	....	10	100
Private forests and communal forests not under forest management	33	9	30	6	8	14	100
Average	28	25	23	12	3	9	100

Corsican Pine. — By far the most important timber tree is the Corsican pine, which has usually grown in pure, even-aged stands, though in mixture with maritime pine at its lower range and with beech and occasionally fir at its upper limit. Notably in the forest of Vizzavona the beech seems to be driving the pine out of the higher valleys.

The largest forests of Corsican pine are Aitone, Valdoniello, Asco, Tavignano, Marmano, Melaja, Verde, and Vizzavona. The pine reaches 45 to 50 metres (148 to 164 feet) in height, and is sometimes 2 metres (6.5 feet) in diameter; but it is very slow in growth, especially after 200 years, and takes 350 years or more to grow to a breasthigh diameter of 0.90 to 1 metre (2.9 to 3.3 feet). Trees have been found 900 to 1000 years of age and still sound. In old age the crown is mushroom shaped.

A number of stump counts were made to gather rough data on the rotation. The figures which follow were collected by the writer in recent cutting areas:

TABLE 13

Diameter, breasthigh.		Total age, years. (10 years allowed for stump height.)	Remarks.
Metres.	Inches.		
0.28	11	90	Still growing rapidly.
0.46	18	92	Still growing rapidly.
0.48	19	115	Still growing rapidly.
0.66	26	160	Still growing well; suppressed for first 30 years but showed remarkable recovery.
0.74	29	270	At 145 years growth slowed up.
0.74	29	260	
0.97	38	550	At 160 to 200 years growth slowed up.
0.99	39	480	At 175 years growth slowed up.
1.02	40	500	At 200 years growth slowed up.

These figures are too scanty to allow of deducing reliable conclusions, but it is significant that the trees are growing rapidly up to 160 to 200 years, while after that age the rings often cannot be counted without a magnifying glass.

The wood of the Corsican pine is used for lumber and dimension stuff. During the years 1856 and 1872 trees were tapped for resin because of the high prices prevailing during the American Civil War. They produced a good quality of resin but gave a scanty flow, and the results to-day show that this tapping killed a good many of the mature trees and slowed up their growth.[14] The average mature and over-mature stand of Corsican pine closely resembles the western yellow pine stands in Arizona and New Mexico, except that the tree does not grow in such typical groups.

Maritime Pine. — The maritime pine is found pure or in mixture with holm oak and Corsican pine. It is of rapid growth and attains a large size. In the forest of Marmano a 0.99-metre (39-inch) tree was found 20 metres (666 feet) high and containing $3\frac{1}{2}$ good 4.9-metre (16-foot) saw logs. In the same forest trees 0.7106 and 0.7369 metre (28 and 29 inches) in diameter and 115 and 125 years old, respectively, were both rotten at the heart.

[14] The results of this tapping raises doubts as to the advisability of tapping western yellow pine on dry soil in the States of Arizona, New Mexico, Utah, Colorado, etc., for silvical reasons and whether it is wise to start a new industry dependent on high prices for its success.

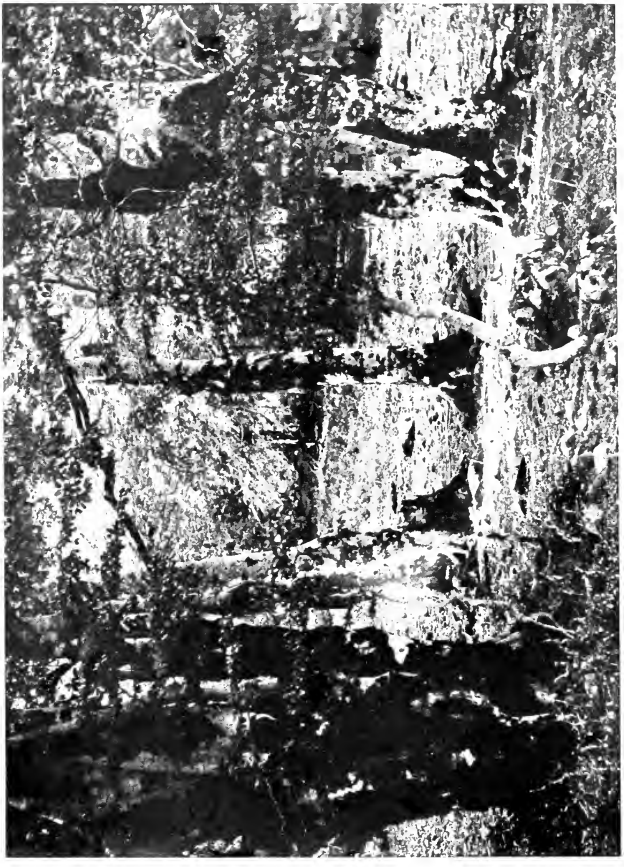

FIG. 19. — Beech forest of poor quality near Vizzavona, Corsica.

The tree was tapped in 1862 to 1872, and operations were recommenced on a large scale in the forest of Zonza in 1908. A local distillery has since been erected at Zonza.

The most important forests of maritime pine are Zonza, Calenza, Pastricciola, Vero, Pineta, Solenzara, Marghese Vallemala.

Beech. — Beech is found in the high valleys above 1300 metres (4290 feet), pure or in mixture with Corsican pine and fir. The largest areas are in the forests of Coscione, Biançone, Cerotte, St. Antoine, San Pietro-di-Verde, all in the valley of Taravo; in the valley of Ese, in the forests of Querceta and Punteniello; in the valley of Fiurmorbo, in the forest of Marmano; and in the valley of Vecchio, forest of Vizzavona. The beech is encroaching on the Corsican pine, which is unfortunate, because it is a slow grower and is often rotten at the heart. It is cut to some extent for variety stock, but chiefly for cordwood.

Holm Oak. — The holm oak, while it covers a large area, has not the financial importance of the Corsican pine, because it is used only for charcoal, fire wood, and for tannin. It is found chiefly in the plains and lower hills, often in mixture with maritime pine.

Cork Oak. — The cork oak is pure, or with holm oak, but the most important forests are in private ownership. The forest of Cagna is the chief of these. The growth of this tree is rapid and it is much sought after. In 1908 the total production of cork amounted to 6085 quintaux (1,341,511 pounds).

The cork[15] is sold on the tree, for periods of 18 years, instead of being collected by federal day labor, as in Algeria. The cork may be removed from the time the sap rises until August; but only cork having a thickness of 23 millimetres (0.91 inch) on nine-tenths of its area may be peeled. Trees above 0.50 metre (20 inches) in circumference may be peeled, the measurement being outside the bark at 1 metre (39 inches) above the ground. The tree must be peeled, cleanly, from the ground up to a height equal to twice the tree's circumference, outside bark, and only branches measuring at least 60 centimetres (24 inches) in cir-

[15] Cahier des charges, Adjudication de la Récolte du Liège, pp. 13–5, approved March 4, 1909.

cumference, 1 metre (39 inches) from the trunk, can be peeled, and then only 3 years after the trunk bark has been collected. Trees are considered mature and ready for felling when after 18 years the cork measures at least 23 millimetres (0.91 inch), or when the trees are burned by fire. The contractor must, moreover, assume all responsibility in case trees are burned, wind-thrown or killed by act of Providence.

Fir. — The fir (abies) is found in a few scattering groups on the higher mountains. Perhaps the largest commercial body of fir is on the north exposures in the forest of Aitone. It is also found in considerable quantities in the forests of Libio, Punteniello, and Pietrapiana; there are a few trees in the forest of Valdoniello.

Chestnut. — The chestnut is not important in federal or communal forests. It is grown for its fruit, which is baked and eaten by the peasants and also fed to the stock. Recently a very serious problem[16] has arisen in connection with the production of this wood. In 1902 some 80,000 steres (2,825,120 stacked cubic feet) or 240 hectares (593 acres) of chestnut forest was cut for tannin; in 1911 to 1912 this had risen to 200,000 steres (7,628,000 stacked cubic feet), corresponding to 600 hectares (1482 acres); and since in 1910[17] the total area under chestnut was estimated at only 48,787 hectares (120,552 acres), increased fellings might readily menace the peasants' food supply. From the fact that the tannin value of the average tree is only worth 5 or 6 chestnut fruit crops, de Lapasse calls the deforestation "Killing the goose that lays the golden eggs." As a remedy he strongly advocates the policy of forbidding deforestation by law and a heavy tax on tannin. The past results from paying cash for plantations have been imaginary, so reliance on this measure (tried with equally deplorable results in the western United States with the timber-culture law) is discouraged. The chestnut blight disease which has caused so much damage, and which has encouraged the cutting for tannin, is to be combated by trying to introduce an immune species.

[16] Letter from Conservator de Lapasse in the Rapport du Préfet, 1912.

[17] La Corse Agricole, April 10, 1911.

Other Species. — Rowan oak is also found in Corsica, as well as birch, linden, ash, aspen, common alder, green alder, sycamore, maple, etc., all of secondary importance.

Undergrowth. — The more important undergrowth is: strawberry tree, tree heather, mastic tree, buckthorn, viburnum, bay, juniper bush, box tree, broom or jennet, cistus, etc. Of these the heather is the most considered, from the forester's viewpoint, because of the fire menace it creates when growing under Corsican pine on southern exposures.

ADMINISTRATIVE ORGANIZATION AND FINANCES

Organization. — The entire island of Corsica comprises the 30th conservation with an official forest area of 132,006 hectares (326,185 acres). It is administered by a conservator[18] stationed at Ajaccio.

There are now five inspections with the following areas:[19]

TABLE 14

	Hectares and acres of forests.				Totals.	
	Federal.		Communal.			
	Hectares.	Acres.	Hectares.	Acres.	Hectares.	Acres.
Ajaccio	6,186	15,285	17,331	42,824	23,517	58,110
Bastia	14,711	36,350	16,972	41,937	31,683	78,288
Chiavari	7,343	18,144	15,121	37,364	22,464	55,508
Corte	10,126	25,021	17,055	42,143	27,181	67,165
Sartene	8,465	20,917	18,696	46,197	27,161	67,114
Totals	46,831	115,717	85,175	210,465	132,006	326,185

Present Force. — Of these, strictly speaking, Ajaccio and Chiavari are "chefferies," designed for an isolated area of forests where the inspector himself has a mere ranger district to administer. With the other regular inspections the inspector has no district, but merely supervises all districts. The present aggregate force[20] includes: 1 conservator, 1 assistant inspector

[18] The conservator in 1912 was M. de Lapasse, an efficient officer and a charming man, nominated as conservator at Bordeaux in 1913.

[19] Unpublished official records furnished me by de Lapasse.

[20] The essential statistics of the forests under the forest regime are given in the Appendix, p. 209.

acting as chief clerk, and 4 clerks; 5 inspectors and 5 clerks, 4 assistant inspectors who are ranger district (cantonment) chiefs, 4 forest assistants, 24 rangers (1 communal) and 114 assistant rangers ("guards") of whom 56 are communal. The area per unit in 1887 and 1911 in hectares and acres (in parentheses) is shown below:

TABLE 15

Unit.	No.	1887.[21]	No.	1911.
Inspection	4	30,441.78 (75,222)	5	(3 inspections) 26,400 (2 chefferies) (51,891)
Cantonment	11	11,069.74 (27,353)	10	13,200 (32,617)
Ranger district	23	5,294.22 (13,082)	24	5,500 (13,590)
Guards beat	128	951.80 (2,352)	114	1,158 (2,961)

[21] Unpublished official report dated 1887, complete statistics on the forests of Corsica are given after page 209.

Pay. — The pay of the superior force is on the same basis as in France, with the following supplements: Conservator 1200 francs ($231.60); inspector 1000 francs ($193); assistant inspector 800 francs ($154.40); forest assistant 600 francs ($115.80). The rangers receive no supplements; the guards are paid from 60 to 70 francs ($11.58 to $13.51) a month with quarters, fuel, garden, and extra pay for calipering and for marking when working off their beat. While the guards' salaries are perhaps one-seventh what is paid an assistant ranger in the United States, the requirements as to quality and quantity of work do not approach our standards.

Work and Duties. — The year's work perhaps could be compressed into what we should consider 2 months' service. An American federal forester would say that there were at least twice too many guards. As one guard remarked, "We would rather have better pay and more work; even doing nothing is fatiguing if one must remain on official duty." During the slack season the guards make cleanings, and put in their time on station maintenance by painting, repairing, and

puttering at odd jobs. During the fire season a few extra guards are hired to divide their work between trail improvements and duty at look-out points.

In Corsica, where local feuds are not uncommon, it is the practice to lodge two or more guards and rangers together; this is for mutual protection as well as because of the solitary life on the isolated ranger stations. Some unfortunate administrative errors have been caused by the assignment of subordinates to forests where they were related to the users and the practice is avoided now so far as practicable.

Administrative Notes. — As to intensiveness of administration, Corsica stands midway between Algeria-Tunisia and France proper. It is rather surprising to find, however, that (as in France) the conservator (district forester) is weighed down with office duties and spends but 10 per cent of his time in the field.[22]

Supervision. — When on field duty the conservator is allowed 20 francs ($3.86) a day as per diem to cover all expenses, including railroad fare. An estimate of the days to be spent in the field is made at the beginning of the fiscal year and money alloted on that basis is only allowed at the rate of 20 francs ($3.86) per day spent in the field, but if the estimated number is surpassed, no additional compensation is possible. This unfortunate limitation in per diem money undoubtedly curtails inspection. The system would work admirably, if only the number of days per diem corresponded automatically to the number of days spent on inspection; at present there is insufficient field inspection by the conservator. The results of inspection are immediately put into effect and *at the end* of the field season are compiled into an informal annual report which is forwarded to Paris. A comparison of the reports for 1910 and 1911 (dated Feb. 8, 1912) shows that in practice no exact outline is followed. A digest of the 1911 report[23] follows:

[22] In 1888 the conservator spent about 60 days on inspection trips; in 1911 and 1912 but 37 and 43.

[23] Conservator de Lapasse's report for 1911.

I. Personnel and general service: brief review of cases, changes, resignations, etc.
Attitude: general remarks on quality of work, whether men enter into politics.
Office inspection: condition of records.
Payments: whether communal salaries have been promptly paid.
Coöperation: amount of aid given to local people in distress.
Lodging at ranger houses: review of tourists and others lodged and fed.
Conservator's tours: review of inspection and argument in favor of more field work, *i.e.*, a larger expense allotment.
II. Fellings: yield in products.
Fellings: careful and detailed review of cuttings visited.
Working plans: progress made, inspection of plans completed, work for next year.
Tapping: results of operations.
Sales: review and summary.
III. Betterments.

A. Improvements paid for in cash.

Digest of expenditures by major headings such as working plans; roads and trails; planting, etc.
Reforestation: description of results and costs.
Roads and trails.
Water supply.
Forest houses.
Destroying insects.
Fire protection

B. Improvements effected by forest employees' labor.

Betterments proposed for 1912.
IV. Trespass: review of more important cases.
V. Hunting.
VI. Fish culture.

Finances. — For the fiscal year 1911 the following expenditures were approved:

TABLE 16

	Francs.	Dollars.
Personnel:		
Officers	84,731	16,353.08
Federal rangers and guards	92,905	17,930.66
Communal rangers and guards	47,137	8,097.44
	224,773	42,381.18
Miscellaneous: [24]		
Improvement and maintenance	31,777	6,132.96
Working plans and sales	2,665	514.34
Federal forest impositions	17,923	3,459.14
Miscellaneous expense	1,460	281.78
	53,825	10,388.22
Grand totals	278,598	52,769 40

[24] In 1910 the allotment was 52,555 francs ($10,143.11), and in 1911 it fell to 32,151 francs ($6205.23); 1912, 24,330 francs ($4695.69).

The receipts for the same year were 640,144 francs ($123,647.79), divided as follows:

TABLE 17

	Francs.	Dollars.
Federal forests:		
Timber sales	79,008	15,248.54
Miscellaneous	12,306	2,375.06
	91,314	17,623.60
Communal forests:		
Timber sales	505,674	97,595.08
Miscellaneous	43,156	8,429.11
	548,830	106,024.19
Grand totals	640,144	123,647.79

The expenditures on betterments [25] for 1910 and 1911 show not only the amounts spent but also give an exact idea of what is classed as improvements:

[25] Annual reports for 1910 and 1911.

TABLE 18

	1910.		1911.	
	Francs.	Dollars.	Francs.	Dollars.
Working plans	1,098	212.91	130.00	25.09
Freeing seedlings	490	94.57	240.00	46.32
Maintenance of trails	5,813	1,121.91	7,432.58	1434.49
Maintenance of houses	2,164	417.65	2,812.72	542.86
Water development	1,829	353.00	1,349.64	260.49
First aid (medical relief)	.....	.....	132.00	25.48
Fences	417	80.48	1,246.91	240.65
Planting (Chiavari)	37,422	7,222.45	14,956.00	2,886.51
Fire protection	3,322	641.15	3,593.59	693.57
Exterminating caterpillars	.....	.....	258.00	49.79
Totals	52,555	10,144.12	32,151.44	6,205.25

WORKING PLANS AND CULTURAL METHODS

Working Plans. — The first working plan was made in 1840 for the forest of Valdoniello; it provided for a long-term sale, but there were no offers.

The early plans were in reality mere stand summaries, including an estimate (often inaccurate) of logs in cubic metres and firewood in steres. A feature of early plans was the final review by the conservator; one plan, it is true, was perfunctorily approved, but others were reviewed at some length. It seems an excellent plan to require a definite review of the main provisions of a working plan by the conservator rather than a perfunctory signature. The compartment descriptions included data on area, boundaries, slope and aspect, soil, stand by species, age and growth, with descriptive notes on logging routes. An example of a compartment [26] description is given below; it is officially termed "record of reconnaissance."

Compartment L. — Canton Arza.

Area 20 hectares (49 acres). Age { Lower story: 60 years. / Old trees: 150 to 200 years.

The soil of this compartment is a sandy loam, quite deep. Moreover, because of the dense stand, it is fresh and covered

[26] Bavella plan of Jan. 6, 1855, pp. 17–18.

with a sufficiently thick bed of humus. It is in good condition for growth. The stand consists of very even-aged Corsican pine poles of about 60 years. This stand of poles is topped all over the compartment by quite a number of old trees which should be cut to free the underwood, for the understory is dense and only a few old trees can be cut at one felling.

A slightly later working plan [27] followed this outline:

Name, location, climate, boundaries, area, quarries, drainage, game, forest houses, roads and trails, topography and soil, species and their condition. Rights, trespass, patrol, marketing timber, sale, price, minor products. Forest description emphasizing soil and stand, recapitulation (a general review of the stand). Under the general felling plan is included data on the system of cutting, "chances," rotation, periods and periodic block, formation of the first periodic block, special regulation of felling for the first period, sequence of fellings, yield, reserve (of growing stock or yield), carrying out the working plan. Recent working plans in Corsica follow more closely the methods and outlines used in France.

Object of Management. — The early authors of working plans based their recommendations upon the need of disposing of the overmature trees (excess growing stock in many cases), the practical logging requirements necessitating a large cut on account of the high cost of road construction and in order to regularize the stands for management under the shelterwood system. What strikes one as rather unfortunate is the almost total lack of accurate local growth study upon which to base conclusions. In order to secure large cuts no systematic attempt has been made to secure an annual sustained yield; a periodic cut has usually been recommended.

System of Cutting — Shelterwood. — The shelterwood system of cutting was first selected as being best adapted to the Corsican pine. There were extensive areas of even-aged stands, the top story often mature and over-mature. What could be more natural than the prompt removal of these old trees in order to free the understory and to secure a large cut? These methods,

[27] For the forest of Marmano, dated Feb. 4, 1860.

in fact, were adopted, and were in part successful. A working-plans officer writes:[28]

> "Most of the first periodic block can be considered regenerated, and, with the exception of a few areas, there is nothing to do but go ahead with the final felling of the large trees which prevent the development of the seedlings."

Yet the same writer records that since 1860 the forest has a very irregular aspect because of windfalls which followed fellings. From the silvical standpoint the former management is criticised[29] because of "the enlargement of the felling areas of mature timber which have transformed the shelterwood method into poorly arranged selection fellings" and because of "the omission of suitable measures to insure regeneration and to protect the young seedlings."

In the Marmano forest:[30] "The pine stands have the appearance of an old, high forest in need of regeneration; the fires have run over the entire forest and the butts of almost all the large trees are charred by fire; timber of average size and saplings are almost entirely lacking . . . the forest has never been regularly cut over." It is thus certain that the dangerous fire conditions were well appreciated before the shelterwood system was adopted.[31]

In the early working plan quoted the system was described as consisting of natural seeding and thinnings, with the modification from the usual shelterwood method, however, that the customary secondary felling should be omitted.

Failures. — In a later, revised plan[32] for the Marmano forest, it is concluded that the shelterwood system has proved a failure because of fires; that for this reason it is necessary to retain some of the large timber on the ground; thus "the localization of age classes presents a serious danger in the conifer forests of Corsica, where there are always conflagrations."

[28] Working plan for Valdoniello forest, Dec. 20, 1900, p. 15.

[29] *Id.*, p. 19.

[30] Marmano working plan, Feb. 4, 1860, p. 4.

[31] Yet it is stated that a light ground fire on good soil often favors reproduction.

[32] Marmano working plan, Dec. 5, 1907, pp. 13-14.

FIG. 20. — A heavy selection cutting in the Forest of Aitone.

The results[33] of the shelterwood system in the forest of Aitone were also unsatisfactory: the regeneration was poor, the fir came in to the exclusion of the pine, the valuable merchantable stand had been seriously diminished, and there was need for artificial regeneration. Rather a pessimistic outlook!

In the forest of Vizzavona,[34] again, the regular regeneration fellings were unusually successful, but in 1866 the young stands left after the fellings were completely wiped out by fire. The forest was once more burned over in 1896.

Selection System Adopted. — As early as 1887[35] these failures were so apparent that the selection system was considered more rational. Yet at that time in the federal forests there were 18 working groups of regular high forest and 2 of selection; in the communal forests there were 7 working groups of regular high forest, 1 of selection, and 1 of coppice.

Advantages. — The main reason for the change was that with the selection system the fire danger is less grave. Aside from direct loss in wood and other products the working plans were entirely invalidated by the fires and in a day rendered obsolete.

Moreover, as stated in the last Marmano working plan, the selection system which is proposed is better for the soil in high mountain areas, it will assure regeneration because it keeps the forest in a perpetual state of regeneration, it will permit the carrying out of thinnings at the time of the main fellings; and the large trees retained will be an insurance against the complete failure of natural regeneration, or in case of fire.

The conclusions of the present conservator were, that:

> "The high forests of the island are chiefly (84 per cent) composed of light-demanding species: holm oak, Corsican and maritime pine. It would therefore seem that the proper treatment to adopt . . . would have been that adapted to a regular high forest (thinnings with regeneration by successive concentrated fellings). In reality this method has been applied; but, for non-silvical reasons it has been aban-

[33] Aitone working plan, Sept. 19, 1890, p. 7.

[34] Vizzavona working plan, 1868.

[35] Unpublished report in official files, 1887.

doned. The fires, unfortunately so frequent in Corsica, were really disastrous and deadly for young even-aged regular stands obtained by the high forest method; their destruction often made blanks of great area in the stands. On the other hand the treatment in irregular or selection high forest (where the reproduction is secured by scattered fellings) leaves all over the forest mature seed trees, which, because of thick bark, can resist the fire. Young growth killed by fire is thus replaced entirely by nature.

"It is for this reason that the selection system has been adopted finally in Corsica for all species, instead of the regular high forest."

Application. — The selection system finally adopted is essentially a group selection, or, as it was named by de Lapasse, the "Ecumoire" (a perforated ladle used by cooks for skimming soup) system of cutting, where little holes are made in the stand. It is regular enough to warrant thinnings and yet irregular enough to avoid the extreme fire dangers of even-aged stands.[36] An unpublished official description of the system in use is as follows:

"Since every pine is essentially a light-demanding species, in order to obtain natural regeneration it is necessary to open up the soil quite freely, because a cover is not necessary for the seedlings. The stand which results from these pretended selection fellings does not necessarily have any similarity with the theoretical selection high forest; it is formed of large patches of timber of the same size, often of the same age, which follow each other irregularly. The size of the opening necessary to give all the light required for the development of the seedlings depends on the slope, the total height of the stand, and on the condition of the soil. It cannot be fixed in advance, but the canopy may be freely interrupted, since the entrance of dangerous winds need not be feared."

But perhaps the most complete official description of the present selection method is given in the Aitone working plan, Art. 8, dated Nov. 30, 1907. Here the degree of regularity aimed at is well described:

[36] Valdoniello working plan, Dec. 20, 1900, pp. 6-7.

"The volume of trees 0.35 metre (14 inches) and over in diameter, however realized, shall be counted against the yield. The forest agents shall be free to use whatever method seems satisfactory in estimating the fellings. If it consists, however, of the chief or accidental yield, they will have to use the volume tables which were used in estimating the growing stock.

"The fellings will remove:

"(1) All the trees that are dead, defective, overmature, or completely decayed.

"(2) Trees measuring less than 0.35 metre (14 inches) in diameter which are not required.

"(3) Small trees without any future.

"The agents should not lose sight of the fact that the selection method should not be considered as an empirical process in which one is limited to recruit the yield from dead trees, those overmature or of large size. . . . It includes the same operations as the method of regular high forest (seed fellings, secondary, final, cleanings, thinnings).

"That which differentiates the two methods is that with the shelterwood system the same kind of operations follow consecutively and are consequently massed in a district . . . while that in the selection system these operations are scattered over the whole area of the forest in little spots. It therefore follows that the fellings protect one another, so to speak. Do not imagine therefore that the selection system confines itself to realizing the large timber alone. It is necessary, within the perimeter of each felling area, to practice all the essential cultural operations; to free the young growth, to thin the stands that are too thick, to cut out the trees with no future and never to lose sight of the fact that the really profitable growth is that which takes place in the trees destined to remain until the end of the rotation. At the same time one must avoid the tendency to regularize the stands by allowing any particular age class to dominate a large area just as one must avoid breaking the cover systematically to give it the aspect of a selection forest when managing a regular high forest of good growth."

Only one official reference to the size of the openings to be made has been found:

[37] ". . . in the stands of Corsican pine it will be best, whenever the density of the stand will permit it, to proceed

[37] Marmano working plan, Dec. 5, 1907, p. 14.

by removing groups of trees so as to cut up the stand into openings of 0.03 to 0.04 hectare (0.074 to 0.098 acre) so that the seedlings of this species will receive the light they require."

Coppice. — In 1911[38] two-thirds of the communal and federal forests under working plans were high forest (selection) and but one-third in coppice. The same general coppice methods are applied as in France proper. In Corsica the coppice is managed chiefly for charcoal and fire wood; holm oak is favored against other species. Private coppice is cut at irregular intervals on short rotations without waiting for silvical maturity; perhaps this explains in part why one-third the island is covered with mere brush or maquis.

Marking Corsican Pine. — Were it not for the extensive grazing by goats it is certain that with successful fire protection, regeneration of Corsican pine would be simple, barring periodic droughts during the summer season. Being a light-demanding species the tree is well adapted in theory to the shelterwood system. However, we have cited the reasons why a group selection method of regeneration has been given the preference. But the key note to the system, as applied, is that the cuttings are irregular and in small patches, with periodic thinnings (which in the past have been sadly neglected) in the poles. According to recent inspections[39] the marking has been too heavy, particularly in the protection zone, and local inspectors are advised to resist the insistent demands from communes for heavy fellings.

Two 0.40-hectare (1-acre) sample plots were laid out in the Valdoniello forest in a mature stand of Corsican pine, where there was no regeneration because of overgrazing; in general appearance the stand was identical with the optimum mature western yellow pine stands on a rich soil in Arizona or New Mexico. It is significant that less than one-fourth the volume was marked for cutting, whereas of the western yellow pine growing on drier soil at least two-thirds has been usually cut.

[38] Unpublished notes by de Lapasse.

[39] Annual report for 1910, de Lapasse.

TABLE 19. — CUTTING

Diameter breasthigh.		Acre *A*.		Acre *B*.	
Centimetres.	Inches.	Marked.	Unmarked.	Marked.	Unmarked.
35.56	14	1	5	1	10
43.18	17	1	8	2	7
50.80	20	1	5	.....	5
58.42	23	.....	9	.....	5
66.04	26	1	8	.....	4
73.66	29	1	5	1	3
81.28	32	.....	1	.....	.....
88.90	35	.....	1	.....	.....
96.52	38	.....	.....	1	.....
104.14	41	.....	.....	.....	.....
111.76	44	.....	.....	1	.....
Totals ...		5	42	6	34

This was virtually a light improvement cutting, with the addition of a few of the best veterans.

It is always possible to mark heavier at the next felling and the present tendency is unmistakably toward lighter marking, owing to the object lessons of past sales where too many trees were removed.

An inspection of the Valdoniello forest cutting justifies the following deductions as to marking: where the stand is open though mature, but with poor regeneration, only fungus infected or defective trees are cut; on a ridge trees are usually left for seed until they are actually dead or dying; along roads trees are left for shade and for scenic purposes, one inspector going to the extreme of leaving a few dead trees that he thought added to the picturesqueness of a rural highway.

On a slope where the regeneration had come in on fully three-fourths of the area, one-half to three-fifths of the scattering overstory was cut. The removal included mature and defective trees. Yet many mature trees shading regeneration were left in accordance with the policy of irregularizing the forest as a fire protective measure. One of the unfortunate features of marking, in Corsica (as in other parts of Europe), is the yield limitations which often hinder the application of correct silvical marking. The problem often arises: given a cut of 400 cubic metres (14,125 cu. ft.), which should be distributed over an area of 27 hectares (66 acres), what trees shall be cut?

FOREST REGULATION AND YIELD

Rotation. — The first plan for the Marmano forest (1860) fixed the rotation for Corsican pine at 125 years, but this was established not on the rate of growth, but rather on the regeneration requirements and was admittedly transitory. In 1890 the rotation for the forest of Aitone was still 160 years, and in 1855 the working-plans officer [40] wrote:

> "The growth of the Corsican pine is vigorous up to 100 or 120 years; it will stand quite a long time further before showing marked signs of declining vigor at 160 or 180 years. It is at this age only that the tree commences to have a little sapwood and to be valuable for trade; it should be cut before 200 years to have sound material. A hundred and sixty years will be just a normal rotation for the Corsican pine."

The first rotation established for the Valdoniello forest was 120 years. The results of these short rotations, 120 to 160 years, have proved unsatisfactory. They have resulted in overcutting; insufficient time has been allowed for the growth of trees to a merchantable size, and trees after 120 years are in most cases occasionally liable to complete destruction by fire. From the year 1907 all the rotations for Corsican pine have been placed at 360 years,[41] the time, it is estimated, a tree reaches 0.00 to 1 metre (0 to 3 feet) in diameter; but counting rotations in force before 1907 they vary from 240 to 360 years. It is claimed that trees of this size must be furnished by federal or communal forests to supply the demand for large timbers.

On account of the rough and mountainous character of the higher ridges there is usually in each forest a protection block where no definite rotation can be applied. According to the Aitone working plan, dated Nov. 30, 1907, no rotation is given for the Corsican pine because . . . "their preservation on

[40] Bavella working plan, Jan. 6, 1855, Part III.

[41] This is probably the longest official rotation for a conifer on record; judging from the few stump analyses made this rotation is at least a century or a century and a half too long; owing to past overcutting the French deemed it a wise policy to increase the growing stock by using long rotations. This decision was backed up by the demand for large-sized trees and because of the greater immunity of such trees from fire.

the stump is indispensable to prevent slides, avalanches . . . it therefore results that a physical felling system should be applied." . . . "yield by area". . . . "biennial fellings"; in the words of the working plan, "The new working plan put in force will diminish the yield materially . . . the new state of affairs will have the great advantage of giving to this forest the rest which it needs," the latter condition being due to past overcutting.

Periods. — With the present 360-year rotation the Valdoniello plan makes 15 periods of 24 years each, and they propose to cut 0.399 "of the available volume in each compartment." In the Aitone forest, with the same rotation, there are 3 periods of 120 years each, and the yield is cut in triennial fellings.

Yield. — Owing to the past excessively short rotations, the necessity for road development through large sales and to fires, and because on some forests the pick of the merchantable timber has been culled, the yield (even including a reasonable diminution of the excess growing stock) has been exceeded. For some time all sales on the Vizzavona and Bavella forests have been necessarily suspended. The cut in the past [42] has been applied in two ways: where feasible by annual or periodic sales in accordance with the working-plan prescriptions; in other cases at irregular intervals on special recommendations because of an emergency, on account of windfall or overmature timber. These methods have usually given excellent results.

Overcutting. — The error of overcutting has also been occasioned by other causes. In the forest of Aitone, for example, the working plan [43] criticises the past treatment because the yield has been seriously exceeded.

> "A yield much too large, and based on wood suitable for lumber, and not on the total volume, including branches and tops, has been taken.
>
> "The absence of a protective zone carefully planned,[44] which

[42] Unpublished official report in files, dated 1887.

[43] Valdoniello working plan, Dec. 20, 1900, p. 19.

[44] The present protective zone comprises 3029.5 hectares (7486 acres) of which 14.5 hectares (35 acres) of openings can be restocked, but 1938.3 (4789 acres) are unproductive rocks.

has permitted the executive officers to locate fellings area in the parts altogether too elevated, where the regeneration will be problematic."

In 1840 there were listed 391,591 cubic metres (13,828,644 cu. ft.) of saw logs and 707,079 steres (24,969,758 stacked cu. ft.) of fuel; in 1896 the total growing stock was 567,217 cubic metres (20,030,701 cu. ft.). For the 13 years prior to 1900 the yield in francs was 25,079.09 ($4840.26) but the 1900 working plan (Part V) reduced the allowable annual yield to 11,746 francs ($2266.97), or less than half. The precaution had been taken to caliper the defective and sound trees separately, to drive home the past error of cutting the yield from the best timber.

In explaining the necessary reduction in cut the 1907 Marmano plan reviews the past yield:

1858 to 1870	3000 cubic metres (105,942 cu. ft.) excluding[45] tops and branches.
1871 to 1882	2114 cubic metres (74,654 cu. ft.) excluding tops and branches.
1883 to 1907	483 cubic metres (17,057 cu. ft.) excluding tops and branches.
1908	767 cubic metres (27,086 cu. ft.) excluding tops and branches.

Some forests, according to de Lapasse, were deliberately overcut in order to pay for the road system, but these have now recovered. One of the greatest drawbacks was the poor market, which apparently made it necessary to leave unsound trees standing because only the best timber could be sold.

Production. — The production for the forested area amounts to but 0.950 cubic metre (33 cu. ft.) per hectare per year for the total areas. The annual production may be summarized:[46]

[45] Tops and branches are usually calculated at 10 per cent of the stem; but the unsound trees are estimated to contain only one-fourth their total volume in merchantable material.

[46] Furnished by de Lapasse; see also statistics, page 209.

TABLE 20

Class of forest.	Firewood.		Lumber.		Total.	
	Cu. m.	Cu. ft.	Cu. m.	Cu. ft.	Cu. m.	Cu. ft.
Federal forests	16,902	596,877	12,405	438,069	29,307	1,034,946
Communal forests	45,180	1,595,486	8,695	307,055	53,875	1,902,541
Private and communal forests not under management	32,755	1,156,710	17,566	620,332	50,321	1,777,042
Totals	94,837	3,349,073	38,666	1,365,456	133,503	4,714,529

Yield Calculations. — An example of how the yield is calculated is quoted from the 1907 Marmano plan, where the relationship between the old and average timber is not far from the normal proportion of $\frac{5}{8}$ to $\frac{3}{8}$, namely:

$$\frac{61{,}000.89 \text{ (old timber)}}{38{,}389.72 \text{ (average timber)}} \text{ or } \frac{61}{38},$$

whereas the normal proportion should be $\frac{62}{37}$.

"To obtain the annual yield in the pine block during the first period it is (accurate) enough to divide the volume of the old wood, Corsican pine, by $\frac{1}{3}$ the rotation, or 120. This yield is then $\frac{61{,}000.89}{120} = 508.333$ or 508 (17,939 cu. ft.) in round figures.

To this is added a cut of 259 cubic metres (9146 cu. ft.) of maritime pine, making a total cut of 767 cubic metres (27,085 cu. ft.) including branches, as against 3000 cubic metres (105,942 cu. ft.) in 1870, excluding branches."

The details of yield regulation in French selection forests will be discussed in a later volume, entitled American Forest Regulation.

SALES METHODS AND CONTRACTS — TURPENTINE LEASES

Timber and Wood Sales. — The essential features of the methods of selling timber in France will be described in detail in a forthcoming publication.

The same methods are used in Corsica where all sales of importance are auctioned, even the long-term sales for large

amounts which are made only in Corsica, Tunisia, Algeria (French China), and in parts of the Pyrenees where there is a poor demand owing to lack of communications.

Sales Contract Conditions. — The sales contract conditions in Corsica (approved in 1909) follow very closely those given in the standard sales circular for France proper; the differences are minor ones and are due to different local conditions. Owing to the amount of dead wood and windfalls during a long sale period special provision is made:

"ART. 20. The standing dead wood or snags within the felling areas which may not have been marked for felling because of advanced decay, and the wood resulting from roads and fire lines, shall become a part of the sale. The 'maquis' (brush) is also included, except in high forest felling areas marked for cutting. So far as these latter fellings are concerned, the 'maquis' shall not belong to the purchaser unless definitely mentioned in the special contract and in the sales circular.

"ART. 21. Unless otherwise stated in the sales circular and in the advertisement, the windfalls and dead wood within the perimeter of the felling area during the logging shall belong to the contractor when their (aggregate) volume does not exceed $\frac{1}{10}$ the volume of the yield from the felling, and he shall be bound to take them under the conditions enumerated in Part VI to follow, and to pay for the portions which have a commercial value, at prices indicated in the special clauses. The contractor shall be bound to take, under the same conditions, the stems bent by the wind or damaged by any cause aside from exploitation, which shall be shown him by the Waters and Forests agent."

According to Art. 25 the purchasers are obliged:

"1. To limb clean with the bole all trees felled and to cut level with the ground the stems and the 'maquis' broken, bent or overturned by the felling or skidding.

"2. To regularly pile all wood, whether bole or branches, cut up or capable of being split into billets measuring more than 0.50 metre (20 inches) in circumference at the small end.

"3. To remove and pile in the same way all wood less than 0.50 metre (20 inches) at the large end, the chips from felling, splitting or cording, the twigs, bark and other debris as well as the stems and the 'maquis' cut clean with the ground."

And by:

"ART. 26. The purchaser will have the right to peel (trees) standing, but with the following restrictions:

"1. To cut before peeling, at the foot of each of the trees marked for felling, an annular notch 0.10 metre (about 4 inches) above the ground extending just to the wood.

"2. To fell these trees at or below the notch so that the bark of the stump will wholly adhere to the circumference of the stump surface.

"3. To finish the felling before the first day of March following the date of peeling."

The privilege of tapping for resin is granted free:

"ART. 27. Unless otherwise indicated in the bill of sale and in the minutes of sale, the pine marked for felling can be tapped for resin without any special charge."

On account of the great danger from fires, clearing around points of special hazard is obligatory:

"ART. 32. The purchasers will be bound, before starting any fire on these areas, to grub and completely clear the soil of all inflammable material at least 2 metres (7 feet) wide around these areas, and to take besides every precaution prescribed by the Waters and Forest agent with a view of preventing (forest) fires. It is forbidden to have any lighted forge or to light any fire outside the huts during the period between the 15th of June and the 15th of September inclusive. Any violation of this article will render the contractor liable to the penalties prescribed by article 148 of the forest code."

As in France the purchaser is required to pay for trees damaged during logging, but in Corsica a much lower scale of prices is levied because the prevailing stumpage rates are correspondingly less:

"Trees from 6 to 11 cm. (2.4 to 4.3 inches) inclusive, 0.10 franc ($0.019) per 10 cm. (3.9 inches) of circumference; from 12 to 19 cm. (4.7 to 7.5 inches), 0.20 franc ($0.038); from 20 to 29 cm. (7.8 to 11.4 inches), 0.35 franc ($0.067); over 29 cm. (11.4 inches), 0.50 franc ($0.096)."

It is evident from clauses 39 to 41 which follow that the road systems on Corsica forests are far from complete; in fact one

of the justifications of the long-term sales for large amounts is the need of road development which falls to the purchaser as a part of the purchase price of the timber:

"ART. 39. The roads and trails shall be built on solid ground, following the alignment which will be previously bench marked by the cantonment chief; the roads cannot be covered over with split wood or with chips after the commencement of the work of alignment by the forest agent.

"The bridges to be built or repaired shall be constructed with impregnated (tarred) wood, supported by masonry abutments or piers; yet, under certain exceptional circumstances, reserved for the approval of the conservator, the contractor may be permitted to lay the floor on rows of piles and wooden buttresses.

"ART. 40. The trees to be felled in order to open up logging roads shall first be designated by the Waters and Forest agent in charge and marked with his hammer, and will belong to the purchaser who will be bound to take them and pay for them when they have a commercial value, according to the prices fixed in the sales circular and in the record of sale and under the conditions given in Part VI below.

"The wood necessary for the construction or repair of bridges, for the maintenance of ways or corduroying road beds shall come from trees marked for felling, either in the felling areas to be cut over or on the rights of way of the roads and logging trails; in default of wood from these sources, suitable to be used for this purpose, the purchasers may be authorized, under the same conditions mentioned above, to take the trees which shall be judged necessary, outside of the felling area, in the stands bordering the construction to be done.

"ART. 41. All roads shall always be free and (so that) they can be put at the disposal of the purchasers of near-by felling areas, without any other obligation on their part except to repair the damages resulting from their logging."

Owing to the long hauls, lower prices, and lack of market for low quality fuel much debris must be burned in the woods as a fire protection measure:

"ART. 42. The purchasers shall have the option of leaving on the felling area trees limbed and topped, billets and large refuse coming under No. 2 of Article 25. They may also

be relieved of removing the refuse falling under No. 3 of said article, but they must in that event burn them.

"This burning can only take place during the period comprised between October 1 and May 31. It shall take place on areas designated by the local Waters and Forests agent or by his representative and on dates which he will fix.

"The purchasers must take all necessary precautions to prevent the spread of fire or any damage whatever either on live stumps, in young growth, or to reserved trees. He shall be held responsible for the damages that the burning may occasion, even when they may have been done in the presence of or under the superintendence of Waters and Forests officers or employees."

What must amount to a considerable obligation is the responsibilities of purchasers in case of fire, lack of road facilities, or any act of Providence which might interfere or stop the marketing of products which they had previously bought and paid for:

"ART. 46. The purchasers cannot claim any indemnity, reduction, or refund because of the impracticability, drainage, or poor condition of the roads and trails, either Forest Service or public, nor because of any steps which may be taken by competent authorities with a view to the preservation, upkeep, or betterment of routes.

"ART. 61. The purchasers cannot claim any indemnity or refund in the event of a fire or when any other act of Providence may have damaged or destroyed the products of their felling areas or even when it may have hindered or suspended the exploitation or logging."

The classification and joint measurement of the product, when sales are made on the unit basis, is an interesting feature. According to the first paragraph of Clause 53 evidently there are occasional differences as to the correctness of scale.

"ART. 52. The products (classified) by sizes and merchantable quality and in addition those destined to be utilized (locally) by the contractor, shall be valued according to their contents in solid cubic metres or in piled steres and shall be paid for at prices fixed for each class by the special clauses of the sale.

"ART. 53. The scaling will be done by the cantonment chief always in company with the purchaser or his representative duly notified. A record (scale report) shall be prepared which shall be signed by the Waters and Forest agent and the officiating inspector as well as by the purchaser. If the purchaser is not present nor represented during the scaling or if he will not sign (the report), this shall be (duly) noted.

"The scale report shall be submitted for the approval of the conservator and when approved, the amounts due from the purchaser will be settled. The volume of the products classed as unmerchantable, of no value and without a use. should be figured on the scale report as given free."

Sales for Large Amounts. — So far as can be learned from official sources, the main drawback to the sales for large amounts is that in a number of cases they have resulted in overcutting; their main justification has been road development. Bearing in mind that Corsica was settled over 2000 years ago it is not strange that an island people with no coal resources should have drawn heavily on available timber supplies both for fuel and construction. The very remoteness of the Corsican pine stands, however, which has saved them from utter destruction, now makes the marketing of the timber a matter of expense and difficulty — insurmountable obstacles to small sales where no one contractor could be held responsible for the necessary road development. The present conservator, M. de Lapasse, does not believe in these large sales, but admits their necessity until the road system is developed for each forest.

Example of a Long-term Sale. — The special conditions[47] for the last large sale were approved by the Secretary of Agriculture, Jan. 21, 1910, and the auction was held at Corte, by the conservator, July 25, 1911, nearly a year and a half later. The printed circular gives the special conditions that supplement or modify those of the general sales circular for Corsica. It also includes an exact estimate of the trees marked for felling; by compartments there is listed for each important species (and whether sound or unsound) the number of trees and volumes

[47] A translation of these conditions is given in the Appendix, p. 214.

in cubic metres by 4-inch (101.6 millimetres) diameter classes. A summary on the same basis is given for the total cutting area, including the 15 compartments. The aggregate volumes are also classified by (*a*) lumber, (*b*) dimension stuff, and (*c*) cordwood. This estimate forms the real basis for the sales price, and, of course, all marked trees are carefully calipered, yet the trees that are fungus infected are estimated as yielding only one-fourth their total volume in saw material.

For this sale the resin yield per tree and per year is estimated at 1.25 litres (1.3 quarts) for maritime pine and 1 litre (about 1 quart) for Corsican pine. Two sets of maps accompany the clauses and estimate — a location map showing the sale with respect to transportation on a scale of 1:100,000; a compartment map on a scale of 1 : 40,000, showing the boundaries and drainage. The road to be constructed by the purchaser, 16,000 metres (17,498 yards) in length, is estimated to cost 500,000 francs ($96,500) and it is expected that it will take 5 years before profitable logging can be commenced.

The total of 125,058 cubic metres (4,416,298 cubic feet) of merchantable logs and 60,101 metres (2,122,407 cubic feet) of cordwood actually sold for 225,000 francs ($43,425), but the contractor had to pay stamp and registry charges of 5716 francs ($1103.19) and besides obligated himself to build roads costing 500,000 francs ($96,500). This corresponds roughly to paying a lump sum in advance for stumpage at 15.55 francs ($3) per thousand board feet or over 12 francs ($2.32) per cubic metre (35 cubic feet) ($0.066 per cubic foot) standing.

The minimum price in such sales is made upon the basis of neighboring sales, but the auction price itself may fall below the estimate, as in the Ascò sale where there was no bidding.

To estimate the stumpage value of any particular sale, the forest officer figures the cost of putting the timber on the market and deducts this from the estimated returns. In long-term timber sales in Corsica, the contractor's profit is figured at 20 per cent, on account of the unusual risk; this is double the contractor's profit allowed in France.

A sample estimate of the stumpage value is given below.[48] It is merely an exceedingly simple estimate of the sale value of the material with the cost of putting it on the market deducted. These stumpage value estimates are often high; in one case the total value was estimated at 480,000 francs ($92,640) or 2.60 francs per cubic metre ($0.014 per cubic foot), whereas the price realized was 350,000 francs ($67,550) or 1.90 francs per cubic metre ($0.01 per cubic foot).

Corsican Pine.—

53,635 trees, 111,338 steres (30,717 cords) lumber.

Maritime Pine.—

12,494 trees, 13,720 steres (3785 cords) dimension stuff.

(And for the two 90,151 steres (24,872 cords) of firewood.)

TABLE 21

	Francs.	Dollars.
Sale price:		
111,338 steres at 8.50 francs	946,373.00	.....
(30,717 cords at $5.94)	.....	182,649.99
13,720 steres at 5.00 francs	68,600.00	.....
(3,785 cords at $3.45)	.....	13,239.80
90,151 steres (24,872 cords), no value	.....	.....
	1,014,973.00	195,889.79
Deduct:		
Contractors' profit of 20 per cent	202,994.60	39,177.96
Felling, 160,000 steres at 2.50 francs	4,000.00	.....
(44,142 cords at $1.74)	.....	772.00
Fines, stamp rights	100.00	19.30
Registry	120.00	23.16
	207,214.60	39,992.42
	495,113.40	95,557.89
3 per cent of this for administration	14,853.60	2,866.75
	480,259.80	92,691.14

i.e., 3.80 francs per cubic metre ($2.69 per cord).

The interesting features of this sale may be summarized as[49] follows:

The timber was sold standing with no guarantee as to estimate, nor insurance against total loss from acts of Providence, but provision is made for the sale on a unit basis of additional

[48] Based on official report for the Asco sale.

[49] Based on official "cahier des charges" for the Asco sale.

trees necessarily cut during the operations; a volume table is given to show how they will be calculated; payments are essentially in advance of cutting; the period is 18 years for ordinary felling and 20 years where the trees to be felled are first tapped, and no further extensions of time are permissible.

Cutting in any one compartment (really treated as separate sales) must ordinarily be finished within three years. An extension of time may be secured, provided the extensions for any one compartment do not exceed two years. The principle of charging an extra rate for a longer cutting period seems especially interesting. Since all trees had to be marked before the special circular was issued or the sale made, there is provision for a remark in case the imprint "A. F." (administration forestière) is becoming obliterated.[50]

The risks the purchaser must run during exploitation must be heavy, because the government repeatedly shuns the responsibility not only for faulty estimates, acts of Providence, such as fires, storms, avalanches, floods, windfall, insect attack, but also for damage to roads or delays in road construction and even in the event of the possible denial of special use privileges.

The purchaser is to be granted, if there is no objection, the necessary permits for special road construction, bridges, buildings and the like, but every improvement except temporary houses and logging or sawmill equipment becomes the property of the commune. For example, the purchaser may be obliged to build a substantial bridge on concrete foundations, yet this must be turned over free to the commune, when the sale is completed.

As in France, two methods of tapping are recognized in this sale: (*a*) tapping to death when an area is formally opened for felling and (*b*) tapping alive in compartments where cutting is not in progress. In (*a*) there are no restrictions as to methods but in (*b*) the following are the essential rules to be followed: only one face is allowed at a time; this face must be begun above the root collar and continued vertically; its maximum length

[50] One of the rangers is authority for the statement that if a mark is lightly burned over the imprint will show for 30 or more years.

may be for the first year 60 centimetres (24 inches), "and each of the following years 70 centimetres (27 inches) provided the total height of the face does not exceed 3.40 metres (4 yards)" at the end of the 5-year tapping period. The maximum widths are 9 centimetres (4.54 inches) the first year, 8 centimetres (3.14 inches) the second, third, or fourth and 7 centimetres (2.75 inches) the fifth. The incision below the cambium must not exceed 1 centimetre (0.39 inch). New faces must, if possible, be on the opposite side of the tree. Where the full tapping term cannot be enjoyed the conservator has the privilege of modifying the maximum heights and widths. The season for regular tapping is March 1 to October 31.

Special Rules. — In order to insure that the employees of the purchaser take a keen interest in observing the rules, it is provided that any individual may be excluded from the sale area for trespass, poaching, or insubordination.

A feature of long-term sales which has perhaps an interest is the possible change in management during a sale lasting 20 years. Suppose the purchaser is 40 years old at the time of the sale, he has only 74 chances in 100 of living to see the sale completed, according to the American mortality tables in use by the Equitable Life Insurance Co. If the successful completion of the sale depends on, let us say, three partners, the ratio against success is trebled. But subsequent managers cannot complain that in Corsica the conditions of the sale were not fully explained beforehand, because the sale circular is very complete and all the regular cut is marked before the auction.

Ordinary Sales Data. — As the best example of the data furnished bidders before an ordinary auction the conservator picked out the following:

"ART. 9. — Forest of Valdoniello. Communal property of Albertacce. Maneville Canton — Poggi beat at Ciatterino.

"*Block 1.* Compartment K (part). Management felling area No. 12. Lot 1 (North).

"Selection felling including 300 Corsican pine, 2 of which are windfalls, marked for felling, on the root and bole, with the federal marking hatchet, to wit:

" *Diameters* —

30[51] (11.8[52])	40 (15.7)	50 (19.7)	60 (23.6)	70 (27.6)
80 (31.5)	90 (35.4)	100 (39.4)	110 (43.3)	120 (47.2)

" *300 Corsican pine* —

(Number of trees corresponding to above diameter classes.)

26	73	45	44	34
33	15	20	7	3

" *Estimated products:* — Timber, 528 cubic metres (18,646 cubic feet) of logs (of which 33 cubic metres (1165 cubic feet) have come from 57 fungus infected trees). Firewood: 1546 steres (54,595 cubic feet). Total volume 1559 cubic metres (55,054 cubic feet). The dry trees, to the number of 25, are valued only as fuel.

" *Boundaries.* — N. Manevelle ravine, dividing line between H. — E.: forest road No. 9 — S: San Pietro ravine. — O: rest of compartment.

" *Removal.* — Forest road No. 9.

" *Charges.* — None."

After a Sale. — After a sale the forest is often considerably damaged. The practice of skidding and hauling long lengths (for which there is a keen market) damages reproduction and skins the boles of trees left, when the logs are skidded or worked down steep slopes.

The utilization is far from complete, but the Service has no pecuniary interest here, since the usual sale is on the stump and full payment is required before cutting. Stumps are chopped rather high, and tops are not completely utilized. Occasionally the cutting area resembles the old-time American slash with lots of merchantable timber left for fires, and with poles topped by the fall of the veterans. The brush is now piled and where left to rot is practically decayed and reduced to humus after 4 or 5 years.

On some areas the very primitive method of hand-saw cutting is employed in the woods, in which case the damage to standing timber is much less. Where the logs are sawed by hand the timbers are packed out on donkeys or mules to the nearest road. The road hauling is by mules or oxen.

[51] Centimetres. [52] Inches.

1912 Stumpage Prices. — The official prices on the stump for the year 1912, as cited in the timber sale circulars for the different inspections, give fuel prices at 1.40 to 2 francs ($0.27 to $0.39) per stere (36 cubic feet) for holm oak, 1 to 1.20 francs ($0.19 to $0.23) for beech, and 20 centimes ($0.04) per stere (35 cubic feet) for Corsican or maritime pine. Sawlogs are estimated at 2 to 3 francs ($0.39 to $0.58) for broadleaves, mostly beech, 4 to 4.50 francs ($0.77 to $0.87), and in one case 7 francs ($1.35) for maritime pine; 10 per cent more for fir than for maritime pine; only 5 to 6 francs ($0.96 to $1.16) for small-sized or poorly located fellings in Corsican pine, but 13 francs ($2.51) for splendid sawtimber near a main road in the forest of Valdoniello. In the villages ordinary timbers sell for 60 to 70 francs ($11.58 to $13.51) per cubic metre (35 cubic feet), or 12 to 14 francs ($2.32 to $2.70) per "canne." A "canne" consists of 2 planks 0.25 metre (9.8 inches) wide, 2.5 metres (8.2 feet) long and 4 cm. (1.6 inches) thick; they figure 4.3 to 4.5 cannes to the cubic metre (35 cubic feet).

Turpentine Operations. — The rights[53] to tap alive 53,849 maritime pine trees in the forest of Zonza sold for 15,350 francs ($2962.55) in 1908 for the 5-year period 1909 to 1913. Unfortunately, because of labor troubles, only 18,000 trees, or one-third of the stand, were tapped in 1909; but in 1913 the lease was in full swing and was being profitably operated. The company has installed a local still at Zonza, to save the 30-mile wagon haul and ocean shipping expense on the raw product.

One of the most promising features of the lease is the apparent immunity from fires which this area enjoys. It is known that many of the local citizens are personally interested in the operating company and consequently the villagers make every effort to keep out fire. The small area of maritime pine which prevents a larger enterprise, and the hilly country which increases the difficulty of tapping and collecting the resin, are two important drawbacks.

The yield[54] has been satisfactory, but less than in the Landes. In 1910, 19,000 pines (each with one face) yielded 41,600 liters

[53] Conservator's annual reports for 1910 and 1911.

[54] Conservator's reports for 1910 and 1911.

(43,958 quarts) of resin or 2.2 liters (2.3 quarts) per tree (Landes average 2 liters (2.1 quarts) per tree), while 6000 trees yielded 0.32 of a liter (0.34 of a quart) per tree, giving an average of 1.75 liters (1.8 quarts) per tree. In 1911 the average was 1.78 liters (1.9 quarts) per tree. Taking a price of 115 francs ($22.19) per barrel of 340 liters (359 quarts) (average price in the Landes for 1910) the gross yield of this Zonza sale should be $\frac{43,520}{340} \times 115$ francs ($22.19) − cost of 45 francs ($8.68) per barrel = 5760 francs ($1111.68).

The same methods that are applied in the Landes for maritime pine are followed in Corsica,[55] except that the width and length of the faces has been varied to a small extent as follows:

TABLE 22. — 5-YEAR PERIOD,[56] ZONZA FOREST, 1909–1913

Years.	Faces in centimetres and inches.			
	Height.		Width.	
	Centimetres.	Inches.	Centimetres.	Inches.
First	60	23.6	9	3.54
Second	60	23.6	8	3.15
Third	65	25.6	7	2.76
Fourth	65	25.6	7	2.76
Fifth	70	27.6	6	2.36
	320	10′ 6″		

TABLE 23. — 4-YEAR PERIOD,[57] ZONZA FOREST, 1912–1915

Years.	Faces in centimetres and inches.			
	Height.		Width.	
	Centimetres.	Inches.	Centimetres.	Inches.
First	60	23.6	9	3.54
Second	65	25.6	8	3.15
Third	70	27.6	8	3.15
Fourth	85	33.5	7	2.76
	280	9′ 2 3″		

[55] The bar should be as wide as the face for tapping alive. The faces should be placed first on the north, then west, then south, then on the east side of the tree.

[56] Office records of conservator.

[57] Vente d'une Coupe de bois avec extraction de resine, approved Jan. 30, 1912.

There seems to be little chance for profitably tapping the Corsican pine. The ground is hilly and under the selection system only scattered trees are marked for felling. These alone could be tapped to death, and because of its slow growth and inability to heal wounds quickly the advisability of tapping alive is seriously questioned.

Minor Industries. — The extraction of pine stumps for turpentine is encouraged and a very low price has been established: 2 francs ($0.39) per stere (35 cubic feet).

The roots of tree heather are grubbed out for pipe wood. About 13 tons were exported from Bastia to England [58] in 1911; they sell for 5.50 francs ($1.06) per 100 kilos (220 pounds). During 1910 over 54,430 quintaux (6000 tons) of raw roots were extracted.

The collection of seed, as in France, can be made only by members of the rangers' or guards' families for sale to the administration.

OTHER FOREST ACTIVITIES

Reforestation. — The only attempt at reforestation on a large scale is at Chiavari; and this has not been entirely a success. The partial failure has been because they have endeavored to sow an entire area to cork oak, whereas only the richer soils were suitable. Moreover, the acorns were set too deeply in the ground; 12.6 centimetres (5 inches) instead of 2.5 or 3.8 centimetres (1 or 1.5 inches). They have learned from this failure that large-scale planting operations should only be attempted on the basis of careful plans, drawn up by practical planting experts.

The only other sowing on the island has been tried in a Corsican pine burn in the forest of Vizzavona, where it cost 3700 francs ($114.10) to sow 50 hectares (123 acres) by seed spots 1 metre (39 inches) by 0.50 metre (19 inches) in size. The results here also have been unsatisfactory.

[58] H. M. Foreign Office Diplomatic and Consular Reports; 1910, p. 7; 1911, p. 5.

Trespass. — The forest users are apparently lawless and hard to control. Trespass cases, when suits must be brought to enforce the collection of damages, make enemies for the Service.

During my trip frequent and flagrant open grazing trespass was noted; also the destruction of signs, lopping birch for goat feed even along a central road (forest of Valdoniello), tapping pine for resin to be used as medicine, and the theft of green wood for fuel in the forest of Valdoniello, where the head ranger permitted the use of dead and down fuel without the formality of a permit.

It is true, however, that trespass is gradually decreasing. In 1886 there were 12 violations of the law in federal and 7 in communal forests per 1000 hectares (2471 acres), or an average of 9.5; in 1911 this average had fallen 20 per cent.

A comparison is given in the following table for the years 1886 [59] and 1911 [60]:

TABLE 24

Kind of trespass.	1886.		1911.	
	Number.	Per cent.	Number.	Per cent.
Fellings (and wood)	281	28	297	36
Grazing	654	63	275	33
Fire	.....	.....	20	2
Miscellaneous	98	9	117	14
Fish	.....	.....	120	14
Totals	1033	.....	829	.....

As a corollary to this record, in 598 actions brought in 1911 (think of the official work the report and preparation of these cases must have consumed!) 314, or 52 per cent, were acquitted.

Fire Protection. — Compared to the intensive fire protection along the Cote d'Azur, between Cannes and Toulon, the protective methods in use in Corsica are crude. Grazing trespass, even in federal forests, is winked at in order to induce the local population not to set fires, but no systematic edu-

[59] Official report dated 1887.

[60] Rapport de Préfect, 1912, p. 98.

cational campaign has been waged, such as would be carried on in the United States under similar conditions.

The patrol is kept up during the fire season, from May to September, but telephone lines, regular lookout towers, tool boxes at danger points and other details of modern fire protection are entirely lacking. In 1910 there were 6330 metres (6922 yards) of fire lines brushed out; they are officially considered to be of unquestioned value, but too expensive under past conditions. There[61] have been some 7 and 10 metre (8 and 11 yard) lines, but wider lines — at least 20 metres (22 yards) — are now favored by the conservator. These few lines have been cleared with trespass labor.

The acreage[62] burned over in 1910 was 10 hectares (25 acres) in communal and 90 hectares (222 acres) in federal forests; in 1911 the area burned over was 23.25 hectares (57 acres) in communal and 108.12 hectares (267 acres) in federal forests. In the past[63] there have been periodic conflagrations which have resulted (during unusually dry seasons) from incendiarism, burning brush, personal vengeance against the guards after lawsuits, camp fires followed by high winds. The former preventive measures[63] are summarized as patrol and policing, coupled with the disposal of debris.

As explained under "System of Management" the adoption of the shelterwood system followed by even-aged stands was the direct cause of much damage, partly because the periodic blocks were too large. But during early sales the omission of brush disposal caused incalculable injury. To-day the brush, chips, and debris are piled after fellings and are then burned, provided this can be done without harm to young growth.

The main problem in Corsican fire protection seems to be not to guard against ordinary fires, but rather against those extraordinary conflagrations which take place periodically during seasons of drought. It is for this reason that the sacrifice has been made of using the selection system with a light demanding species.

[61] Conservator's report for 1910.

[62] Especially in the forests of Bavella and Zonza.

[63] Unpublished report in official records.

Grazing. — Since grazing in federal forests is forbidden by law there are no restrictions as to methods of handling, such as have been formulated, tried out, and proven of value in the western United States. Under the conditions which exist in Corsica, where the livelihood of so many depends on the products of goats, sheep, cattle, and pigs, special laws recognizing the necessity for restricted grazing would have given better results than the present system of allowing the entry of stock *sub rosa*.

Official records place the number of animals using the communal mountain forests and grazing grounds above timber line (June 15 to September 15) at 31,000 horses, 62,700 cattle, 198,000 sheep, and 197,600 goats. It is apparent from these figures, that the industry must be reckoned with. The present trespass is committed when crossing forests in going to and from these mountain pastures, but the crossing is merely a flimsy pretext for pasturing excluded areas.

Below the Corsican pine belt grazing is yearlong. The usual rates (paid as a communal tax) are as follows: Horses and cattle, 1 to 2 francs ($0.19 to $0.38) per year; sheep, 0.10 to 0.25 franc ($0.02 to $0.05); goats 0.25 to 1 franc ($0.05 to $0.19); pigs (very much like the "razorbacks" of the Appalachians) only from November 1 to March 1, 1 to 2 francs ($0.19 to $0.38).

However, a gradual improvement is taking place. There are now better roads and good boat service from France, and drainage of swamp lands is receiving public attention.[64] But even now, the grazing methods are essentially primitive. Both goats and sheep are grazed on an estimated area of pasturage and fields of 57,646 hectares (142,433 acres). Considering the amount of stock grazed, it is clear that this open area is not sufficient. The forests must be pastured, if stock is to be maintained in good condition; according to recent figures, the following must be provided for: 260,000 sheep, 180,000 goats, 69,000 cattle, 28,300 horses and mules, 84,000 hogs, making a grand total of 621,300.

[64] Le Régime Pastoral de la Corse. Societé Forestière de Franche Comte et Belfort, XI, 8, pp. 600–613.

Since the range outside the forests is not sufficient, it means a good deal of crossing by stock from winter to summer grazings and vice versa. There is urgent need either for the development of more grazing area or else a reduction in the number of stock. As late as 1852 there was actual armed conflict over grazing rights. This illustrates that the problem is not a simple one and must be handled with great tact.

Quarters. — The ranger stations usually include: one or more houses, a shed or small barn, outhouse, water system, and fenced garden. Separate rooms are provided for inspecting officers, for the ranger, and for each guard. The quarters are commodious; at the Aitone forest house[65] there were no less than 8 rooms on the second floor, kept vacant for the use of officers on inspection — a dining room, kitchen, small study (in the hall), and 5 bedrooms. The ranger was assigned a kitchen, combined living and dining room and bedroom, and each of the three guards also averaged three rooms. Plenty of storage space is provided.

Besides these quarters there are detached houses with only one or two rooms, located at strategic points as refuges or dinner camps for calipering or marking crews, improvement laborers, and the like.

At the Aitone forest house the equipment provided for the inspecting officers' quarters, of which the ranger is custodian, was inventoried at 2201 francs ($424.79) and included complete kitchen and table service, beds and bedding, and generous furnishings. These quarters are, on written permission from the conservator, put at the disposal of visitors for a few days; yet, as the conservator's order states, the houses are not to be regarded as hotels.

Official charges are posted: 4 francs ($0.77) a day for the cantonment chief, 5 francs ($0.96) for other forest officers, and 6 francs ($1.16) per day for ordinary visitors. The 6 francs ($1.16) per day is divided as follows: breakfast, 0.50 franc ($0.10); lunch or dinner, 2 francs ($0.39); lodging, including linen, lights, and heat, 1.50 francs ($0.29).

[65] The name "forest house" seems more precise than the term "ranger house" or "ranger station" used in the United States.

A visitor's record is maintained to guard against any abuse in the renting of quarters. This includes name, rank, address, signature, date of arrival and departure, with a column entitled "remarks" for a record of articles broken or damaged.

These houses are usually exceedingly well located with southern exposures, are provided with an excellent water system, and are conveniently placed with regard to the work, particularly with a view to watching the removal of timber along main outlets. Yet the Papaja house in the Valdoniello forest, within 9.1 metres (30 feet) of the main road, has been found to be too close for comfort.

According to the conservator's report for 1911 the houses are generally well maintained,[66] except when the guards' wives are away, but the gardens are often allowed to run down.

Roads and Trails. — The roads and trails are usually maintained in good condition, but their location leaves something to be desired. A forest road, it seems, should be laid out in the first place to facilitate logging, rather than as a means of egress to another valley for the general public. Again, an expensive trail, merely to divide one block from another, even if it is convenient for patrol, should be subordinated to logging trails of permanent value.

Frequently the grade of both roads and trails is too easy; an 8 per cent trail 5 miles long is certainly less desirable than a 12 per cent trail with only 4 miles to walk. The same principle applies to roads with interminable windings.

The standard width for foot paths is 1 metre (1.1 yards) and for mule trails the same width, but with a widening to 1.3 metres (1.4 yards) on the turns. A path 1 metre (1.1 yards) wide on easy ground costs by contract 0.40 to 0.50 franc ($0.08 to $0.10) per running metre, but if by day labor the cost with supervision runs up to 2 ($0.39) and even 3 francs ($0.58). For trail in rocky difficult ground the contract price is 2 to 2.50 francs ($0.39 to $0.48).

[66] The maintenance is easy because they are constructed of stone; they have cost from 9842 to 35,930 francs ($1899.51 to $6934.50), according to the space provided.

In the forest of Aitone distances from the forest house were painted on rocks. For example $\frac{2}{3}$ means 2 kilometres 300 metres (1 mile 755 yards).

A favorite system of preventing erosion on steep trails is to place a row of flat rocks 7.7 or 10.2 cm. (3 or 4 inches) wide angularly across the trail with a very slight depression behind.

There seems to be no standard method of painting compartment letters; usually they are on a tree trunk after the bark has been smoothed. Occasionally one sees the lettering on rocks. The background is usually battleship grey with black letters, or white with black or red letters.

Uses. — As compared with the liberality of the United States federal leasing system the forests of Corsica are practically closed to use. Road rights-of-way, it is true, are readily granted as in France, but the alignment must always be made by the forest officer. The only uses granted are those which arise in connection with the disposal of timber, and, with the exception of sawmills, no formal permits were noted. Yet the utmost precaution is taken to see that roads, trails, or bridges constructed by contractors are built so as to permanently better communication. After the use by the purchaser all road, trail, and bridge improvements become the property of the commune or government. The quality of the construction work is carefully supervised, and it is only under exceptional circumstances that contractors are allowed to build wooden bridges; cement pillars at least would be required.

Before the issuance of a permit to install a sawmill, the following procedure must be adhered to: A written request from the permittee, a report by the forest officer, including a location map; approval by inspector and conservator. The usual special clauses [67] required are as follows:

1. The authorization will terminate March 1, 1914.
2. It is granted free.
3. The areas will be designated by the local Waters and Forests agent.
4. The contractor must cover the smokestacks with a

[67] Decision No. 3965, July 25, 1912, conservator's office records.

metallic screen, fine enough to prevent the egress of sparks, and must take all the precautions which shall be prescribed by the Waters and Forests agent. He shall also be bound to comply with the relating laws and regulations.

5. All the buildings and living quarters attached to the sawmill shall be free for the use of the agents and employees of the Waters and Forest agent, who may pass the day and night alone or accompanied, without the assistance of a public officer or witness. To facilitate these visits a key to the locked door of the cabins or workshops, if they are locked, shall be sent by the permittees to the local guard.

6. Messrs. X shall be bound, each time that they wish to haul to the sawmill or its premises, trees, billets or logs, to send to the local ranger a detailed statement showing the source, number, and the skidway (where the wood comes from). This statement will be made in duplicate, one copy of which, signed by the officer who approves it, will be returned to the permittee. The wood enumerated will be identified and marked free of cost by the local guard, within 5 days after notification.

7. On expiration of the permit the permittees must, within 15 days, put the place in its original condition, fill up holes which may have been dug for setting the mill; dispose of the sawdust which may interfere with growth; and replace the soil on the entire area occupied. In case of violation of these conditions, it will be possible to proceed against them (at their expense) as given by Article 41 of the Forest Code independently of Article 4 of the same code.

APPENDIX

THE ALGERIAN FOREST CODE[1]

PART I — FOREST REGIME

ART. 1. In Algeria the following are placed under forest administration[2] and are dealt with according to the provisions of the present law:

1. Woods and forests belonging to the State.
2. Woods and forests of communes or sections of communes, which come under the condition provided for in Art. 79.

[1] Translated by Miss Nora Duff and edited by the writer; so far as possible the literal translation has been rendered to illustrate the explicit language of the code.

[2] The "régime forestier" refers of course to the Algerian Waters and Forests Service.

3. Woods and forests of public institutions, which come under the same conditions.
4. Woods and forests in which the State, communes, or public institutions have proprietary rights conjointly with private individuals.
5. Ground, either covered with brush or bare, the reforestation of which has been recognized and declared to be of public benefit, under the conditions indicated in Part III, Art. 76, and in Part IV, Arts. 107, 108, 109.

The following are likewise placed under forest administration, but only provisionally:

1. Woods and forests presumably belonging to the State in virtue of Art. 4 of the act dated June 16, 1851.
2. Woods and forests which are in litigation either between the different classes of owners mentioned above, or between one of these owners and private individuals.

The woods and forests within the territory under military control are placed under the forest administration, but dealt with as the Governor General shall direct or according to any regulation passed by the government council.

Part II. — Waters and Forests Administration

Art. 2. The officers[3] of Waters and Forests employed in Algeria form part of the staff of the Home Waters and Forests and are subject to its laws and regulations especially as concerns promotion.

They perform their duties under the authority of the Governor General of Algeria.

The promotions in grade and class are decided upon in accordance with the recommendations of the Governor General and according to grades, either by a decree based on the recommendation of the Minister of Agriculture, or by a resolution by the Minister of Agriculture.

[3] The words "agents" and "préposés" have been taken to signify "officers" and "employees" to distinguish between the superior supervisory and the subordinate ranger force. Those having at least the rank of forest assistant (garde général) are locally referred to as officers. See p. 101 for data on organization.

ART. 3. The subordinate force is recruited according to state regulations. Natives who have served in the French Army or Civil Service, and the sons of the native employees, can be admitted as native forest guards when twenty-two years of age if they can show a knowledge of the French language; they will be nominated by the Governor General of Algeria.

ART. 4. An appointment in the Waters and Forests Service [4] is inconsistent with any other, either administrative or legal.

ART. 5. The officers and employees of the Waters and Forests Service can only enter into office after having taken oath before their home district court, and after having had their commission and the certificate of their oath registered at the record office of the district court, under whose jurisdiction they will exercise their duties.

In the event of a change of residence, which will place them under another jurisdiction of the same standing, another oath need not be taken.

ART. 6. The imprints on the marking hatchets, or instruments employed in marking trees, etc., used by the Waters and Forests officers and employees shall be registered at the record office as follows:

Marks of marking hatchets or those with which officers and employees are provided: at the record office of the district court under whose jurisdiction they will exercise their duties.

Those of the standard national marking hatchet: at the record office of the district court, and at the court of appeals.

PART III. — STATE FORESTS

SECTION I. — BOUNDARIES

ART. 7. In territories whose ownership has been proved or settled by the application of the law of July 26, 1873, or that of April 28, 1887, or that of Feb. 16, 1897, the general or partial

[4] In this code the Algerian Waters and Forests Service is variously referred to as: l'administration des Eaux et Forêts . . . Service des eaux et forêts . . . so these terms have been rendered: Waters and Forests Service, since official publications always use the title "Service des Eaux et Forêts."

settlement of boundaries will be effected in accordance with the provisions in the following articles.

ART. 8. The separation of the State woods and forests, and bordering properties can be requested either by the Woods and Forests Service or by the border owners.

ART. 9. The separation act shall be commenced, either by the State or by the border owners, according to the usual methods.

Nevertheless it shall be suspended, while decisions upon partial or lesser actions are given, if the Service binds itself to give a decision within a period of six months, in proceeding with the general delimitation of the forest.

ART. 10. When the general boundaries of a State forest are to be established, this delimitation shall be announced two months in advance by an order of the prefect. This order shall be posted and published in the neighbouring communes, and posted at the domiciles of owners of border property, or at those of their farmers, guards, or agents.

After this lapse of time, the officers of the Waters and Forests Service will proceed with the boundary work, whether bordering owners are present or not.

ART. 11. The report of the boundary work shall immediately be filed at the secretary's office of the prefecture, and an abstract at the office of the secretary of the sub-prefect, which is connected with each division. Notice shall be given by an order of the prefect, published and posted in the neighbouring communes. Interested parties can thus take note and enter their protests within a year from the day on which the order shall have been published.

The Governor General shall declare whether he approves, or if he refuses to confirm this report in whole or in part. His declaration shall be made public in the same manner as the report.

ART. 12. If, after these lapses of time, no protests have been raised by the bordering owners against the boundary report, and if the Governor General has not signified his refusal to confirm it, the delimitation shall be final. The officers of the Waters and Forests Service shall proceed in the pre-

ceding months to mark the boundaries in the presence of the interested parties, who shall be duly summoned by an order of the prefect, as is prescribed in Art. 10.

Art. 13. In case of disputes arising, either during the delimitation or in consequence of objections raised by bordering owners, in pursuance of Art. 11, they shall be brought by the interested parties into competent courts, and the delimitation shall be suspended until after their decision.

Owners of border property shall have recourse to the courts if, in the case provided for under Art. 12, the Waters and Forests officers refuse to carry out the boundary marking.

Art. 14. When the separation or settlement of the boundaries shall be affected by simply setting corners, the expenses shall be shared equally. When it shall be effected by planting hedges, these shall be carried out at the expense of the petitioner, and made entirely on his land.

Art. 15. In territories whose ownership has not yet been settled or established, the notices which the department has to make to the border owners, their farmers, guards and agents, will be replaced by a general publication by means of the public crier in the villages and markets, and by official notifications, addressed at least a fortnight in advance to the mayor of the commune, and to the native assistant of the donar, president of the djemae.[5]

In this case the expense of the boundary marking shall be divided equally between the owner of the forest and the petitioner or defendant.

SECTION II. — MANAGEMENT

Art. 16. All the woods and forests of the State domain are subject to forest management regulated by decree.

Art. 17. No extraordinary felling whatsoever shall be made in the State woods, nor any felling in the reserved fourth, or of stands reserved by the management for growth to high forest, without a special decree, under penalty of the sales being de-

[5] "Temporary village constructed by Arab shepherds" or "fraction of a tribe in Algeria."

clared null and void, except in the case of an appeal from the purchaser, if it takes place, against the officials or officers who shall have ordered or authorized such fellings.

This special decree shall be inserted in the law-notices.

SECTION III. — AUCTIONS OF BARK, FELLING AREAS, AND SALES BY AGREEMENT

ART. 18. No ordinary or extraordinary sale shall take place in the State woods, except by public auction, announced at least fifteen days in advance, by notices affixed in the principal towns of the department, in the commune where the woods are situated, in the neighbouring communes, and in the place where the auction is held.

The Waters and Forests Service shall be authorized by special decree of the Governor General of Algeria, to make at one and the same auction, the sale of several felling areas of the same cutting series, on condition that the periods for felling and for payment shall not exceed five years.

At the completion of the operations, all the road and canal making and all the bridges or tunnels built for transport or for felling purposes shall become the property of the State without any indemnity whatever.

ART. 19. Sales by mutual agreement can always be authorized in the following cases:

1. If there is an appeal of urgency on account of accidental or unforeseen needs.
2. When forest products could not or cannot be sold by means of public auction.

ART. 20. Any sale, concluded otherwise than by public auction outside of the cases provided for in the preceding article, shall be considered as a secret sale and declared null and void.

ART. 21. Any sale, although transacted by public auction, shall be declared null and void in the same way, if it has not been preceded by public notices as prescribed under Art. 18, or if it has been made in other places, or on another day than those which shall have been indicated on the notices already published, or on the notices of withdrawal.

ART. 22. Any disputes which may arise during auctions either as to their validity, or as to the solvency of those making bids or giving securities, shall be decided immediately by the official presiding at the auction.

ART. 23. The following are not allowed to take part in sales, either personally, or by persons acting for them directly or indirectly, either as principal bidder, or as a partner or surety:

1. Officers and employees of the Waters and Forests Service throughout the Republic, the officials charged with presiding or taking part in the sales, and the collectors of the felled products throughout the territory where they exercise their functions. In case of conviction of an offence they shall be punished by a fine which shall not exceed a quarter or be less than a twelfth of the total amount obtained by the auction, and they shall be liable to imprisonment and the prohibition contained in Art. 175 of the Penal Code.
2. The relations and connections in direct line, the brothers, brothers-in-law, uncles, and nephews of the officers and employees of the Waters and Forests Service throughout the territory for which officers and employees are commissioned.

In case of infraction of rules and regulations they shall be subject to a fine equal to that laid down in the preceding paragraph.

3. The counsellors of the tribunal, the judges, the officers of public departments and recorders of district courts in the entire area (arrondissement) in their jurisdiction.

In case of conviction, they shall be liable to all damages should any occur.

Any auction that shall be made contrary to the provisions of this article shall be declared null and void.

ART. 24. Any secret association or negotiation between dealers in wood, cork, or other forest products, tending to lower or disturb the biddings, or to obtain the products at a lower price, will lead to the application of the penalties cited under Art. 412 of the Penal Code, in addition to all damages,

and if the auction has resulted in favour of the secret association, or the parties to the aforesaid negotiation, it shall be declared null and void.

The cases provided against to be declared null and void under Arts. 20, 21, and 23 form part of the regulations for public safety as well as those set forth under the present article.

ART. 25. No verdict or ruling shall be admitted unless it is made immediately after the auction, before those assembled are dispersed.

ART. 26. In case of the purchaser failing to give bail or the securities required by the specifications within the prescribed time it shall be declared forfeit by order of the prefect, and a new auction of the felled timber shall in consequence be proceeded with, in the manner prescribed above.

The original purchaser shall be held responsible for the difference between his price, and that of the re-sale, if there is any.

ART. 27. Every bid shall be considered final the moment it has been uttered; under no circumstances can it be outbid.

ART. 28. The auctions of the cutting areas shall be transacted in accordance with the regulations in force in the State, save only in respect of an order from the Paymaster General of the Treasury.

ART. 29. At the time of the sale by auction purchasers are expected to take up their residence in the place where the sale shall be held; in default of which, all subsequent proceedings will be communicated to them in due form by the secretary of the prefecture or sub-prefecture, according to the "arrondissement" in which the auction shall have taken place.

ART. 30. Every action against a purchaser conveys the right of summary execution upon him, his associates and sureties for the payment of the initial purchase price of the auction as well as incidental expenses.

ART. 31. All purchasers of felled timber and forest products, and the beneficiaries of sales by agreement, above 200 francs in value, shall furnish security either in cash or in transferable securities guaranteed by the State or by the Colony, which shall be fixed by the specifications or by agreement.

Nevertheless the aforesaid securities may be dispensed with if they present other securities recognized as solvent.

ART. 32. The sureties are liable jointly and severally and in the same manner, for the payment of damages, refunds, and fines that the purchaser may have incurred.

SECTION IV. — EXPLOITATION

ART. 33. After the auction or the approval of the sale by agreement no change can be made in the location of the felling area, and no tree or portion of a tree shall be added thereto under any pretext whatever under penalty to the purchaser or beneficiary of the sale, of a fine equal to three times the value of the wood not comprised in the auction or sale, without renouncing the claims on the restitution of the wood, or of its value.

The provisions are applicable to cork and to tan-bark. The officers of the Waters and Forests who shall have permitted or tolerated such additions or changes shall be fined in the same manner, and shall be liable to prosecution and penalties for malpractice and speculation, if there has been any.

ART. 34. The purchasers by auction [6] or by agreement shall not commence logging or felling areas or removal before obtaining a written permit to fell from the local officer of Waters and Forests, under penalty of prosecution for trespass.

ART. 35. The purchaser by auction or by agreement may have an agent or sales-guard, who shall be approved of by the inspector or agent of Waters and Forests holding the office of "Chief of Service," and shall be sworn before the justice of the peace.

If the felling area or areas that the sales-guard is charged to watch are situated in the districts of several justices of the peace, the oath delivered before one of them shall be registered at the record-office of the other justices of the peace.

This sales-guard can draw up reports in regard to the sale and within a hundred-metre zone around it.

[6] Literally: "The highest bidders or beneficiaries of sales by agreement."

These reports shall be subject to the same formalities as those of the employees of Waters and Forests, and shall be received in evidence until contrary proof is forthcoming.

ART. 36. The purchaser by auction or by agreement, if this provision is included in his contract, shall be bound to deposit with the local Waters and Forests officer and at the record office of the court of the arrondissement, under penalty of a fine of not less than 25 francs ($4.82), and not more than 100 francs ($19.30), the mark of the hammer, blaze, stamps, or other instrument to be used to mark the trees, wood, cork, or bark of his purchase. The purchaser by auction and his associates can only have one mark for one purchase, nor shall they mark with it products other than those purchased at the said sale, under penalty of a fine of 100 to 500 francs ($19.30 to $96.50).

ART. 37. The purchaser by auction or by agreement shall be bound to preserve all the trees marked or designated as reserved, the number of which shall be indicated in the marking record, without their being permitted to exchange these for other trees which they might have left standing.

ART. 38. The fines incurred by the purchasers by auction or by agreement, in virtue of the preceding article, for felling or removing reserved trees shall be from 2 to 200 francs ($0.386 to $38.60) each, without renouncing claims for (civil) damages.

The restitution shall be effected in kind, if the adequate (marked) trees can be given, and the Waters and Forests Service require it.

If it is a question of trees having a circumference of less than 2 decimetres (8 inches), the fine shall be from 0 franc 10 centimes ($0.0193) to 2 francs ($0.386) each whatever the dimensions may be.

ART. 39. The purchasers by auction or by agreement shall not fell, or remove any wood, bark, or cork, before sunrise or after sunset unless they have obtained a special permit from the Forest Service under penalty of a fine of not less than 20 ($3.86) or more than 100 francs ($19.30).

ART. 40. Unless the report of the auction or sale by agreement contains an express authorization to the contrary, they are forbidden to peel or bark standing any of the trees purchased, under penalty of a fine of 50 to 500 francs ($9.65 to $96.50). The bark and the wood that has been peeled, shall be seized as security for damages, the amount of which shall not be less than the value of the trees peeled or barked in trespass.

ART. 41. The purchasers by auction or by agreement shall be obliged to conform exactly to the terms of their contract or of their agreement, not only as regards the method of felling the trees, the peeling of cork or bark, and the cleaning of the felling areas, but also for the time during which the felling of the wood and the clearing of the ground, or removal of the cork or bark, shall be effected.

In default of their fulfilling these conditions they will be liable to a fine of 50 to 500 francs ($9.65 to $96.50) and to the damages assessed at a minimum of 10 per cent of the value of the products. The aforesaid products can be seized up to the amount due as guarantee of the fine and the damages incurred.

In case of failure to cut or remove within the time fixed by the regulations for the auction or sale by agreement, or the extension of time allowed by the conservators, the court at the request of the Waters and Forests Service shall confiscate the timber still standing, or felled, which shall remain the property of the State.

ART. 42. In case the purchasers by auction or by agreement fail to carry out within the stated time, and according to the manner prescribed by the regulations, the work therein enumerated (designed) to bring the cork oak into full bearing or protect the stands from fire, to remove and cord the branches trimmed, to clear the felling areas of briars, brambles, and weed growth, to repair the logging roads, ditches, or fences, this work shall be executed at their expense, at the convenience of the Waters and Forests officers by authorization of the prefect who shall thereupon approve the expense accounts, and render a writ of execution for payment against the purchasers.

ART. 43. The Waters and Forests officers, or employees to whom they delegate these duties, shall inform the purchasers by auction or by agreement, in writing, the places where pits, kilns, or temporary and moveable furnaces can be established for the use of the products of the felling area, as well as sites for camps and workshops. They shall not be placed elsewhere, under penalty of a fine of 10 to 50 francs ($1.93 to $9.65) for each pit, kiln or furnace, camp or workhouse, constructed contrary to these provisions.

ART. 44. The transport of the products shall be made on the roads indicated in the specifications, or on those authorized during the felling, and those who make new roads shall be liable to a penalty of 20 to 100 francs ($3.86 to $19.30), in addition to damages if any are incurred.

ART. 45. All purchasers by auction or by agreement, their agents and workmen, are forbidden to light fires elsewhere than in their dwellings or workshops, under penalty of a fine of 10 to 100 francs ($1.93 to $19.30), without prejudice to the claims for damages resulting from the offence.

ART. 46. The purchasers by auction or by agreement shall not place on their sales areas products similar to those upon which the contest is based, under penalty of a fine of 50 to 500 francs ($9.65 to $96.50).

ART. 47. If in the course of the felling or clearing, reports are drawn up with regard to trespass or felling violations, these may be acted on without waiting for the official check of the sales area. Nevertheless, in the case of insufficiency of any first report upon which no sentence has been pronounced, the Waters and Forests officers shall be able at the time of the check of the sale area to take up, in a fresh report, trespasses and violations.

ART. 48. The purchasers by auction or by agreement shall be responsible from the date of their permit to fell, until they are definitely exempt, for all offences against the Forest Code committed within their felling area and in a zone 100 metres (109 yards) in breadth beyond it, if their agents or sales-guards do not report such offences within five days to the Waters and Forests officer.

They are equally responsible and personally liable for the payment of fines, and for making restitution in cases of misdemeanour or offences committed under the same conditions of time and place, by their agents, sales-guards, workmen, woodcutters, teamsters, and any other employees whatever.

SECTION V. — CHECK [7] OF CUTTING AREA

ART. 49. The check of each sale area shall be undertaken within six months immediately after the day upon which the period allowed for the clearing up of the felling areas has expired. After the lapse of these six months, the purchaser by auction or by agreement shall be free of any charges for the felling of timber if the administration has not carried out the check.

However, any person who shall have terminated the felling and clearing of his lot, before the expiration of the time agreed upon, shall be able to summon the Service to proceed with the check by a special judicial notice to the local Waters and Forests officer and may be discharged, if there have been no proceedings against him within the period of six months to date from the day of the notification.

ART. 50. The purchaser by auction or by agreement, or assignee, shall be bound to assist at the check; for this purpose he shall be notified in writing a fortnight in advance, the day fixed for the verification being stated.

In case of his failing to present himself, or to delegate a representative, the report shall be considered as having been drawn up in the presence of both parties.

ART. 51. After the lapse of a month from the termination of the work, the Service and the purchaser by auction or by agreement may require the annulment of the report, in case of irregularity or false statement.

For this purpose they shall present themselves before the council of the prefecture, who shall judge the case.

[7] Literally the translation of "récolements" is "verifications," but the word "check" is more generally used in the United States.

ART. 52. In case of the annulling of the report the Service shall be able in the following month to rectify the mistakes by means of a fresh report. At the expiration of the time allowed under Art. 51, and if the Service has raised no opposition, the purchaser by auction shall be free of the charges of the felling of timber.

SECTION VI. — AUCTIONS AND RENTALS OF GRAZING, MAST, MISCELLANEOUS FOREST PRODUCTS, AND AGRICULTURAL LAND

ART. 53. In State forests, declared exempt and free from rights for wood, mast or hog grazing and pasturage [8] can be put up to auction for a maximum period of three years.

The formalities prescribed under Section III of the present Part for the sale of wood felling areas shall be observed at those auctions.

Before proceeding with the public auction, the cession of grazing rights by means of a sale by mutual agreement shall be offered to the neighbouring communities. In case of a refusal of the offer by these, the aforesaid rights shall be put up to auction, starting with the price previously put forward for sale by agreement.

The Service is equally authorized to treat for a sale by agreement in the case of the failure of the auctions.

ART. 54. The purchasers by auction or by agreement shall not be allowed to bring into the forest a larger number of animals than that which shall be determined in the specifications,[9] under pain of the maximum penalty established by Art. 177.

ART. 55. The purchasers by auction or by agreement shall be bound, if it is thus prescribed in the specification, to have the animals they bring into the forest marked with a sign (brand) specified in the terms of the sale, under the penalty of the fine established in Art. 177.

There shall be no question of trespass, if it has not hitherto been possible to mark the animals found in the forest, pro-

[8] The word "Parcours" here signifies grazing by all kinds of stock.

[9] "Cahier des charges"; see p. 177 for an example.

vided they have been declared to be at the service of the Waters and Forests Service.

The maximum fine shall be imposed in the case of a repetition of the offence.

ART. 56. If the animals are found outside the leased districts or the prescribed routes of travel, the purchaser by auction or by agreement shall be punished according to the penalties prescribed in Art. 177. The herder shall be besides condemned to a fine of one to 5 francs ($0.19 to $0.96), and in case of a repetition of the offence, to imprisonment for one to five days.

ART. 57. Save in the cases set forth in the specifications, purchasers by auction or by agreement are forbidden to fell trees, or to carry away acorns, fruit, or seed from the forests, under penalty of the maximum fine prescribed under Art. 118.

In case of a repetition of the offence they can however be sentenced to imprisonment for three days or more.

ART. 58. The alfa [10] and other diverse products of the forest shall be disposed of by auctions or by sales by agreement subject to the routine prescribed under Arts. 18 and 19.

The provisions for carrying out the sales shall be determined by a decree of the Governor General.

Violations against these provisions shall be punished by fines prescribed by this law.

ART. 59. The Governor General of Algeria, upon the recommendation of the conservators of Waters and Forests shall have the power to authorize the lease for a maximum period of eighteen years, of open land, blanks, or the cleanings existing in the federal forests.

This lease shall either be put up to public auction or made by means of mutual agreement.

SECTION VII. — WOOD RIGHTS IN STATE FORESTS

ART. 60. Only those shall be permitted to exercise any right [11] whatever in the State forests whose rights upon the

[10] A native grass valuable for fodder.

[11] The term "droit d'usage" is primarily the right to gather wood in any forest, but often also includes the right to pasturage, etc.

day of the promulgation of the present law shall have been recognized as established either by acts of the government or by decision of the courts, or definite decrees, or shall be recognized as such at the moment of the application of the senatorial decree, actually promised in consequence of official or judicial requests, or which should have been promised subject to the provisions of the law of Feb. 16, 1897, relating to landed property in Algeria. Nevertheless the rights which the natives enjoy by virtue of tradition shall be maintained until the application of the senatorial decree.

ART. 61. In future no granting of rights shall be made in the State forests of any nature and under any pretext whatever.

However, in case of absolute necessity, and in the measure laid down with due regard for pre-existing rights, a decree of the Governor General, made on the recommendation of the government council, shall concede to natives displaced for purpose of colonization, rights in the forests of their new territory equivalent to those enjoyed in the first place.

ART. 62. The rights by which the State forests are burdened can be wiped out by means of working plan *decrees* or redeemed by means of a grant of land or a money payment, if the other measures are inapplicable. The working plan shall be approved of by decree.

The rights other than those of pasturage can be besides redeemed by means of "*cantonnement.*" [12]

The conditions of this redemption shall be determined by agreement, and, in case of disputes, shall be settled by the courts.

ART. 63. The redemption of the rights of pasturage can only be claimed by the administration in territories where the exercise of those rights is an absolute necessity to the inhabitants of one or of several communes or fractions of communes.

If this necessity is disputed by the Waters and Forests Service, the parties shall present themselves before the council of the

[12] Apparently there is no equivalent for "cantonnement" in English, but it means the act of giving over to those who have common rights, a piece of forest land, where they can exercise these rights.

prefecture which after an inquiry shall give judgment, save in the case of application to the State council.

ART. 64. The action for procuring a deed of exemption from rights belongs only to the government, and not to those possessing rights.

ART. 65. In all the State forests which are not exempt by means of "cantonnement" or indemnity conformable to Arts. 62 and 63 above, the exercise of rights can always be reduced by the Service, according to the condition and yield of the forests and shall only take place in conformity with the provisions set forth in the following articles.

In case of disputes arising as to what the forests yield and their condition, recourse shall be had to the council of the prefecture.

ART. 66. Whatever may be the age or the species of timber, those enjoying rights may only exercise their rights of pasturage in the cantons which shall have been declared open by the Waters and Forests Service, except in cases of recourse to the council of the prefecture, and this, notwithstanding all adverse occupancies.

Owners of cattle found outside the limits of the cantons shall be punished according to the penalties set forth in Art. 177.

ART. 67. Every year, before August 1, the Waters and Forests officers shall inform the mayors of the communes and private persons, who individually have rights, of the cantons declared free, and the number of cattle which shall be admitted to the pasturage.

The mayors shall be bound to issue public notices of the same in the communes where common rights are held, and, before October 1, to draw up the individual list of the right holders, with the division amongst them of the number of animals allowed.

The exercise of the rights of pasturage can be only allowed to those given in this list.

ART. 68. The right holders in any case can only enjoy the rights of pasturage for their own cattle.

The herds, other than those used for exploitation, belonging

to cattle dealers, even if those dealers are right holders, as well as herds on shares, are excluded from the benefits of rights.

ART. 69. The roads by which cattle may go and come from pasturage shall be designated by the Waters and Forests officers. These roads shall be considered as having at least a width of 20 metres (22 yards).

If these roads cross any coppice, or young growth of high forest which is not enclosed, ditches or enclosures may be constructed at the joint expense of right holders and the Service, and in accordance with the directions of the Waters and Forests officer, in order to prevent the cattle from straying into the woods.

ART. 70. If the right holders bring a greater number of cattle into the forest than the number fixed in accordance with Art. 67, for the excess number, the penalties uttered under Art. 177 shall be enforced.

The maximum fine shall be enforced in the case of herds on shares or those belonging to cattle dealers being discovered in portions of the forests reserved to right holders.

ART. 71. All right holders are forbidden to bring sheep, goats, or camels into the forests or intervening land under penalty to the owners of such stock of the maximum fine set forth under Art. 177, but the right of indemnity is reserved to those who have a title, or a possession which gives a title.

In addition the herder can be fined from 1 to 5 francs ($0.19 to $0.96), and, in case of a repetition of the offence, he can be imprisoned for one to five days.

The Governor General may, however, by an order given by the Government Council, authorize the pasturage of sheep in certain forests.

He shall also be able, in urgent cases, to throw open the closed areas to the temporary use of herds.

Under exceptional circumstances the introduction of the goats of right holders into the (fire) lines of State Forests can be authorized.

ART. 72. The commoners who have any sort of a right to free timber can only take such timber after permission has

been granted them by the Waters and Forests officers, under penalty of the fines carried by Part IX, for wood cut in trespass.

ART. 73. The Waters and Forests Service is authorized to provide the right holders with timber, either collectively and on given dates or individually and according to circumstances.

The method of issuing these permits shall be determined by an order of the Governor General.

Violations against the provisions of this order shall be punishable by fines varying from one to 100 francs ($0.19 to $19.30).

ART. 74. Right holders are forbidden to sell the wood or other products granted to them, or to employ them in any manner other than that for which the rights have been granted to them, under penalty of a fine of 10 to 100 francs ($1.93 to $19.30).

ART. 75. As under Art. 635 of the Civil Code, the right holders can be made to contribute — in proportion to their rights — to the upkeep of the forests in which they enjoy their rights.

Orders from the Governor General shall fix the amount of the contribution, which shall be payable by the right holder in his discretion either in money or in days work, and shall be received (or else collected) as a direct tax.

SECTION VIII. — EXPROPRIATION

ART. 76. The expropriation of land which must be reforested or reclaimed, shall be recognized as necessary, and shall be declared a measure of public utility, under the following[13] circumstances:

1. For the maintenance of lands on mountains or slopes.
2. For protecting the soil against erosion by rivers or torrents.
3. To ensure the existence of springs and water courses.
4. To render stable the coast dunes and those of the Sahara, and for protection against the erosion of the sea, and drifting of sand.
5. For the defence of territory in the frontier zone which shall be determined by a regulation of the civil authorities.
6. For the sake of public health.

[13] Compare with the wording in Art. 99.

If the declaration of public utility is pronounced, the expropriation shall proceed in conformity with Algerian legislation.

Art. 77. The expropriation of interior holdings within federal forests can be declared of public utility and proceeded with as stated in the preceding article.

Art. 78. When the State forests are not accessible by means of the highroad or are not sufficiently accessible for felling purposes, a right-of-way [14] across the neighbouring properties can be demanded, on payment of an indemnity proportionate to the damage caused.

Roads opened, or railroads established for felling purposes in the State Forests, can be declared of public utility and the expropriation of ground shall be pronounced as stated under Art. 76. (See footnote 19, p. 187.)

Art. 106. The study of the surroundings with a view to reafforestation in view of the provisions of Art. 76 of the present law, and all the formalities previous to the declaration of public utility, shall be effected by the Waters and Forests Service under orders given to that effect by the Governor General.

Art. 107. The declaration of public utility shall be pronounced according to the procedure provided by Algerian legislation.

Art. 108. Owners whose property shall be included within a reafforestation district shall enjoy their rights over the same until the moment when these properties are acquired by the Waters and Forests Service. Such acquisitions can be made either by agreement, or by expropriation, or by means of an exchange.

Part IV. — Communal and Public Institution Forests

Art. 79. Submission to forest control, as set forth under Art. 1, shall only be pronounced so far as the woods of communes, public sections [15] of communes, or public institutions are concerned, when these woods are considered fit for regular exploitation by the administrative authority, on the recom-

[14] Or right of eminent domain.

[15] "Section" is an electoral division under the French Republic.

mendations of the Water and Forest Service. These recommendations shall be communicated previously to the municipal councils and to the officers of public institutions, who shall be consulted in regard to them.

Submission to forest control shall be pronounced by decree. And the same forms shall be proceeded with for all the separate parts of the code and all the woods concerned.

ART. 80. Ground even when not covered with trees shall be put under forest control, if it belongs to communes or public establishments, under the conditions provided for under Art. 76, and if its reafforestation is recognized as being of general profit.

ART. 81. Communes and public institutions cannot undertake any clearing in their woods without special and express authorization by the Governor General; any persons who have such fellings shall be liable to the penalties declared under Part VI against private individuals for offences of a similar nature.

ART. 82. Properties in the communal woods can never be divided up amongst the inhabitants.

But when one, or several communes, or sections of communes, possess jointly a wood, each one of these holds the right to demand a subdivision.

ART. 83. Communal woods, or the woods of public institutions are inspected and governed by the Waters and Forests Service.

In order to indemnify the State for the costs of administration and inspection a sum of 10 centimes ($0.02) per franc ($0.19) shall be paid for the benefit of the Treasury (in addition to the total sum) on the sale or transfer of all forest products either principal or accessory.

ART. 84. The ordinary, as well as the extraordinary sales of felling areas shall be proceeded with by the Waters and Forests officers, in the same manner as for State woods.

The sale by auction comprising several successive felling areas and the transfer by mutual agreement can only be effected with the assent of the municipal council or of the officers of public institutions.

The auction can only take place in the presence (the hereafter

mentioned people having been duly summoned) of the mayor, or of a deputy for the woods of the communes, or of one of the officials of the public institutions.

Any sale or cutting made contrary to the injunctions of the present article shall render the person giving or consenting to such an order liable to a fine of 100 to 1000 francs ($19.30 to $193.00) without prejudicing claims for damages. Sales thus effected shall be declared null and void.

ART. 85. The invalidation and prohibition provided under Article 23 for the sales of wood which the department has confided to them shall be applicable to mayors, deputies, or collectors of the communes as well as to officers and collectors of public institutions.

In case of offence they shall be liable to the penalties prescribed under the aforesaid article, and the sales shall be declared null and void.

ART. 86. The felling areas of communal woods designed to be exploited by the residents or divided in kind between them, and the felling of other forest products, can only take place after the permit has been granted previously by the Waters and Forests officers under conditions set forth by orders from the Governor General, given in conformity with Art. 73, all of which shall be under penalty of being considered a trespass, if not conformed with.

ART. 87. The acts relating to felling areas and permits for standing trees in accordance to the conditions of the preceding article shall be endorsed, stamped, and registered on the debit side of the account and duty shall only be collected on them in case of judicial action.

ART. 88. If there is no contrary claim, the division of the fuel right whether for fuel or for building purposes shall be made in one of the three following ways:

1. Either by hearth, that is to say by the head of a family or of a household, being truly and regularly domiciled in the commune before the publication of the list.
2. Or half by the head of a family, and half per head of the population under the same conditions of residence.

In the two preceding cases, only an individual really in actual charge and care of a family or possessing a district household in the place where he lives or takes his food shall be considered as the head of a family or household.

3. Or by inhabitant, being truly and regularly domiciled in the commune before the publication of the list.

Every year, at the May session, the municipal council or the municipal commission shall determine which of these methods of allotment shall be applied.

They shall also decide on the sale of the fuel rights, in whole or in part, for the benefit of the communal treasury.

In this last case the sale shall be made by public auction, under the direction of the Waters and Forests Service.

Any other methods of allotment are (hereby) abolished. Foreigners who fulfill the requirements mentioned above can only share in the allotment after having been authorized to establish their domicile there, in conformity with the laws and regulations applicable to Algeria.

ART. 89. The inhabitants of communes and the officials or employees in public institutions cannot introduce, or cause to be introduced into the woods belonging to these communes or public institutions, sheep, goats, or camels under the penalties set forth in Art. 177.

ART. 90. The means afforded to the government to free the State forests from all rights under Art. 62, to expropriate the interior holdings under Art. 77, and to expropriate ground necessary for the purpose of constructing roads for felling purposes under Art. 78, are applicable, under the same conditions, to communes and public institutions for the woods which they own.

ART. 91. All the provisions (with the exception of Art. 74) contained in Part III, Section VII, upon the exercise of rights in State woods, are applicable to communes and public institutions for use in their own woods, as well as to the rights with which they may be burdened, except as modified in the present part (of the law).

Part V. — Joint Tenancy Forests [16]

Art. 92. All the provisions of the present law, relating to the preservation, and to the administration of the woods which form part of the State domain, as well as the prosecution of crimes and offences committed in the woods, are applicable to the woods in joint tenancy mentioned under Art. 1 of the present law, save for the modifications given in Part IV, for woods of communes and public institutions.

Art. 93. No felling area, ordinary or extraordinary, no exploitation or sale, can be made by joint owners under penalty of a fine equal to the total value of the wood so felled or sold; all sales thus effected shall be declared null and void.

Art. 94. The costs of establishing boundaries, surveying, and patrol shall be borne by the State and the joint owners, each in proportion to their interests.

The Waters and Forests Service shall nominate the guards, regulate their salaries, and shall have sole right to dismiss them.

Art. 95. In case of refunds and awards for damages the joint owners shall receive the proper amount each in proportion to their interests, as in the case of sales returns.

Art. 96. The provisions set forth under Arts. 92 and 93 are applicable to woods in litigation mentioned under Art. 1.

The proceeds arising from sales, refunds, or (civil) damages shall be paid into the treasury [17] for remittance to the owners, after final judgment, prorated in accordance with their recognized interests, after deducting the expenses of patrol and office administration, unless disputes arise or claims are made for indemnity or damages on the ground that the administration records (are incorrect).

Part VI. — Private Forests, Reforestation Areas, and Clearings

Art. 97. Private individuals exercise all the rights of ownership over their woods, except for restrictions enumerated in the following articles.

[16] Literally this could be rendered undivided or litigated woods placed under forest administration.

[17] La caisse des depôts et des consignations.

ART. 98. No private individual can claim the right to grub or clear his woods without having previously made a declaration at the office of the under prefect at least three months in advance, during which time the department can make known to the owner its opposition to the clearing. This declaration should give the election domicile in the canton where the woods are situated.

Within two months after the declaration, a Waters and Forests officer shall examine the condition and the situation of the woods, and shall draw up a detailed report.

After a consideration of this report, the conservator of Waters and Forests shall lodge his objection to the clearing if any exists.

In this case, the report shall be transmitted to the owner who can state his case. This report shall then be transmitted to the Governor General, who shall decide, after deliberation with the government council, if the objection shall stand.

If, within six months after the objection has been presented, the decision of the Governor General has not been rendered and the proprietor of the woods notified, the clearing may be effected.

ART. 99. Clearing can only be opposed in case the preservation of the woods is recognized as necessary:

1. For the maintenance of lands on mountains or slopes.
2. For protecting the soil against erosion and the encroachment of rivers, streams, or torrents.
3. To insure the existence of springs or water courses.
4. For the protection of dunes and shores against erosion by the sea and encroachment by the sand.
5. For the defence of territory in the frontier zone which shall be determined by a regulation of the civil authorities.
6. For the sake of public health.

ART. 100. In case of any violation of Art. 98, the person who shall have effected, or caused to be effected, the clearing shall be sentenced to a minimum fine of 200 francs ($38.60), and a maximum fine of 500 francs ($96.50) per hectare (2.5 acres) of woods which have been cleared.

Moreover, if ordered so to do by the Governor General, he shall replant the areas denuded within three years.[18]

ART. 101. In case the owner does not carry out the planting or sowing within the time prescribed by the order of the Governor General, the Waters and Forests Service can see that it is done at its own expense upon previous authorization from the prefect who shall order a memorandum of the work drawn up and the cost levied against the owner.

ART. 102. The provisions in the four preceding articles are applicable to sowing and planting executed in accordance of the Governor General's decision, for the replacement of denuded woods.

ART. 103. The following are excepted from the provisions of Art. 98:

1. Young woods during the first twenty years after their sowing or planting, except in the case set forth in the previous article.
2. Parks and gardens either fenced or adjoining habitations.
3. Woods not fenced, less than 10 hectares (24 acres) in extent, on condition that they do not form part of another wood which would bring up the area to 10 hectares (24 acres), or that they are not situated on the summit or slopes of a mountain.
4. Those portions of forests which the owners have been authorized to cut down in virtue of Art. 9 of the decree of Feb. 2, 1870.
5. The land which has been reserved as woods and forests included in areas (set aside for) colonization.

ART. 104. Excessive exploitation, grazing after fellings, coppicing operations or fires, which may cause the total or partial destruction of the forest in which they are practiced, shall be treated as deforestation, and in consequence those who have ordered them shall be subject to the penalties set forth under Arts. 100 and 101.

All owners of stock allowed to enter, or found in woods less than six years of age, shall be fined in accordance with the rules set forth under Art. 177, paragraph 2.

[18] Literally this is: "in a term which cannot exceed three years."

ART. 105. The provisions of the preceding article are not applicable to the afforestation enumerated under Art. 103.

ART. 109.[19] Woods or brush situated within reafforestation areas are considered as coming under the conditions set forth in Art. 76, and cannot be denuded at any time without the authorization of the Waters and Forests Service.

ART. 110. Owners desirous of special guards for the preservation of their woods must have them approved by the sub-prefect, in conformity with the provisions of the law of April 12, 1892.

The orders approving of these guards can be drawn up in accordance with paragraph 1 of the above-mentioned law.

These guards can only exercise office after having taken oath before the justice of the peace.

ART. 111. All private individuals shall have the privilege of freeing their forests from rights in the same manner, and under the same conditions as the State.

ART. 112. The rights of pasturage and of gathering of acorns in private woods can only be exercised (in case of disputes between the proprietors and right owners) in those portions of the woods declared closed by the Waters and Forests Service and according to the condition and yield of the forests reported by the Service.

The expenses resulting from the intervention of the Waters and Forests Service shall be adjudged according to the tariff applicable to experts, and shall be borne equally by the interested parties.

The roads over which the stock must pass to go to and from the pasturage shall be indicated by the owner. Their minimum breadth shall be 20 metres (22 yards).

ART. 113. All the provisions contained in Arts. 68, 69, 70, paragraphs 1, 71, 72, and 74 of the present law are applicable to the exercise of rights in woods belonging to private individuals. The owner, in this case, exercises the same rights and the same

[19] Arts. 106 to 108 have been treated above in Section VIII of Part III. The classification of the articles does not follow their sequence in the code but in accordance with the more logical arrangement adopted by Guyot in his commentary.

control as the Waters and Forests officers exercise in woods placed under forest administration.

ART. 114. The right holders shall contribute to the maintenance of the roads over private property where they exercise their rights.

ART. 115. In case of disputes between the owner and the right holder the case shall be brought into court.

ART. 116. Areas sown or planted on the summits or slopes of mountains and upon the dunes shall be exempt from all taxation for thirty years. Woods and forests which have been burned over shall be exempt from all taxation for a period of ten years so far as the part which has been destroyed by the fire is concerned, and in case the fire has not been caused by the owner.

PART VII. — POLICE AND CONSERVATION OF WOODS AND FORESTS

SECTION I. — PROVISIONS APPLICABLE TO ALL WOODS

Re damage other than fire.

ART. 117. Whoever shall have injured, destroyed, moved, or obliterated any boundary marks or fences which serve to the boundaries of the forests, or forest cantons, shall be punished by a fine of 5 to 500 francs ($0.96 to $96.50).

If a series of boundary marks, or a considerable length of fence has been destroyed, moved, or obliterated, the offender can in addition be sentenced to imprisonment for three days to three months. This without prejudice to the claim for civil damages.

In any event the return of the objects that have been removed and their repair shall be obligatory.

Imprisonment shall be obligatory in case of a repetition of the offence.

ART. 118. All unauthorized quarrying or removal of stones, sand, minerals, earth, turf heather, gorse, grass, green or dead leaves, manure found on the forest soil, acorns and other fruits, seeds of woods and forests, shall be punished by fines of 2

to 5 francs ($0.39 to $0.96) for each harnessed animal employed, of 1 to 2 francs ($0.19 to $0.38) for each pack animal, and 1 franc ($0.19) for each man.

In case of a repetition of the offence, the maximum fine shall always be enforced, and the offender can, in addition, be sentenced to from one to three days' imprisonment.

ART. 119. The Bridge and Road Service (Ponts et Chaussées) has the right to designate where excavations shall be made for materials for public works; nevertheless contractors who have undertaken such works shall be bound by the State, communes, and public institutions, as well as by private individuals to pay all legal indemnities and to observe all the prescribed laws and regulations in connection with such excavations.

ART. 120. Whoever shall have ploughed up any portion of the woods and forests shall be condemned to a proportionate fine from a minimum of 50 francs ($9.65) to a maximum of 200 francs ($38.60) by the hectare (2.5 acres), but no fine can be less than 10 francs ($1.93).

In case of a repetition of the offence the maximum fine shall be always enforced and the offender can be sentenced in addition to eight days' imprisonment.

ART. 121. Any persons found in the woods and forests at night, off the highways and ordinary roads, with bill-hooks, axes, hatchets, saws, or other instruments of a similar nature, shall be sentenced to a fine of 5 to 10 francs ($0.96 to $1.93) and have the aforesaid instruments confiscated.

The maximum fine shall be enforced in case of repetition of the offence.

ART. 122. Any persons whose wagons, stock, pack, or saddle animals shall be found in the forest off the highways and ordinary roads shall be sentenced as follows:

To a fine of 5 to 10 francs ($0.96 to $1.93) for each wagon found in the forest, 10 years of age and upwards, and 10 to 20 francs ($1.93 to $3.86) if the wood is less than that age.

And for each head of stock of any kind unharnessed, to the fines fixed for grazing trespass under Art. 177. This without prejudice to the claim for civil damages.

In case of repetition of the offence the maximum fine shall be enforced.

ART. 134.[20] Decrees of the Governor General, delivered in the government council, shall determine the conditions for exploitation, advertisement, sale and export of cork, tan-bark, charcoal, wood and wood ash, alfa, resinous products of the forests, and sticks intended for cane manufacture.

Any person violating this regulation shall be sentenced to a fine of 1 to 100 francs ($0.19 to $19.30). They may, in addition, be liable to five days' imprisonment and the confiscation of the products without prejudice to the application of Art. 142 of the present law.

In case of a repetition of the offence, the imprisonment shall be obligatory.

ART. 135. No exploitation or even the felling of a tree can take place in the dayas[21] without the authorization of the Governor General or his deputy.

Re fires.

ART. 123. Kindling fires or carrying lights outside logging houses or buildings is prohibited inside and within a distance of 200 metres (218 yards) of woods and forests.

From the 1st of July until the 30th of October this prohibition is applicable even to owners of woods and forests, and includes the manufacture of charcoal, the distillation of tar and resin.

Nevertheless, during the period November 1 to June 30, the owners of woods and forests, or those having rights (over them), whatever may be the distance of the neighbouring property and provided that it is separated from their wood by a trench built and maintained in accordance with the following article, are authorized to establish charcoal pits and charcoal furnaces for the distillation of tar and resin, and to kindle fires in their workshops, as well as to burn in piles the brush and stumps left over and debris from the felling operations.

The employment of fire in the logging houses and buildings,

[20] Arts. 134 and 135 logically follow Art. 122.

[21] A local native subdivision.

shelters, camps, timber-yards, or workshops situated in the forest, or within a zone of 200 metres (218 yards), during the period from the 1st of July to the 31st of October, shall be subject to the regulations and decrees given in pursuance of the execution of this law.

ART. 124. An owner of wooded or forested land which has not been brushed out, or of land covered with dead wood, can be forced by the owner of a similar adjoining property to construct and maintain, on his side, on the boundaries between the two estates a (fire) line cleared of all brush, and of all coniferous wood, and to keep it thoroughly cleared of brush. This (fire) line, whose width may vary from 10 to 100 metres (11 to 109 yards), shall be constructed half on each side of the adjoining boundaries, by agreement between the interested parties, and in case of disagreement, by the prefect, the conservator of the Waters and Forests acting for him. Actions concerning the construction and the maintenance of such protective lines shall take place, be put in practice, and judgment delivered in the same manner as in the case of boundaries.

ART. 125. Setting fires, as well as the burning of standing growth, shall conform to regulations and decrees promulgated in the enforcement of this law.

Setting fire shall only be allowed after authorization by the Waters and Forests officers, and under the surveillance of employees, if it is a question of ground situated less than 200 metres (218 yards) from the woods and forests, during the period from the 1st of November until the 30th of June, and less than 500 metres (546 yards) between the 1st of July and the 31st of October.

ART. 126. If a case arise when, in spite of observing the precautions enjoined in the foregoing articles, the fire should extend to the neighbouring properties, the originator of the fire shall be liable to all damages, if any occur.

Any person setting a fire in violation of the provisions of the foregoing articles, which shall damage the neighbouring properties, shall be condemned to prison for from one to five years. In this case, Art. 363 of the Penal Code shall be applicable.

ART. 127. In the forest regions, the native rural population, and in general all right holders, shall be compelled, during the period July 1 to November 1, under pain of the penalties set forth in Art. 136, to act as watchmen, which duties shall be regulated by decree from the Governor General of Algeria.

This watch duty shall be obligatory for the right holders and, if there are insufficient, for all able-bodied men residing in the communes or section of communes bordering the forests. They shall not necessarily be paid.

ART. 128. During the period of watch duty the Governor General can have detachments, commanded by officers and subalterns, sent into the forests to co-operate with the Waters and Forests officers, in carrying out such measures as are legally undertaken against fires.

The officers and subalterns thus delegated shall be placed under the local administrative authority, and invested with legal police powers which the constabulary possess. The regulation of this force shall be applicated to them, in their relations with the official and civil authorities.

ART. 129. Any European or native requested to help in putting out a fire, who has refused his services without legitimate reasons, shall be liable to the penalties carried by Art. 136.

As concerns the native population, the request shall be considered as having been made legitimately, when it has been addressed to the headman (sheik, adjutant, hudsman (or), ouakhaf) by any officer of the civil authority or by a Waters and Forests officer, or employee, or even by a specially sworn guard-warden.

The right holders shall besides be punished by the suspension of their rights for a period of three months and a maximum of five years; sentence shall be pronounced by the justice of the peace.

ART. 130. In all territory, either civil or military, independent of the sentence passed on individuals incurred by the originators or accomplices of crimes, delinquencies or offences relative to forest fires, the tribes, douars, or divisions can be fined collectively in the following manner and conditions:

These fines shall be imposed by the Governor General at the government council, after review of the minutes, reports, and recommendations of the local administrative authority and of the Waters and Forests Service, the chiefs of tribes or douars having been previously notified.

The proceeds of the fines shall be deposited at the Treasury. They can be entirely or partly employed towards repairing the damage caused by the fires. In this case the Governor General shall draw up the assessment statement and shall forward it to the injured parties; these may protest to the Council of State against the decisions made by the Governor General with regard to them, within a period of two months after having received the notification.

When the fires by their nature, or by the fact of their occurring simultaneously, indicate preconcerted action on the part of the natives, they may be treated as acts of rebellion and in consequence can lead to an application for sequestration in accordance with the provisions actually in force under the Royal decree of October 13, 1845.

ART. 131. The right holders are forbidden to use their grazing privileges for a period of at least six years, throughout the whole area of woods and forests which have been burnt, under pain of the penalties imposed in Art. 177, paragraph 2, of the present law.

In private woods this prohibition can be removed by the Governor General at the request of the owner, after consultation with the Waters and Forests Service.

ART. 132. Railway or steam tramway companies having grants or leases, and built within or bordering woods and forests shall not allow any grass or herbaceous growth to grow on the railway right-of-way from June 1 to November 1 under penalty of a fine of 16 to 300 francs ($3.09 to $57.90).

Moreover, fire lines may be (required to be) constructed along the track, cleared of all brush and, if it is considered necessary, of all conifers, and constantly maintained in good condition. These fire lines shall be 20 metres (22 yards) in breadth, commencing at the railway right-of-way and shall be constructed

within six months from the date of the official order for their construction.

The work of constructing and maintaining these lines shall be performed by the companies at their own expense. In default they shall be punished by the penalties established by paragraph 1, and Art. 42 of the present law shall apply.

Within a month after the construction of the fire lines the owners can remove all or a part of the debris, the companies being bound to carry away the remainder. If any question of indemnity arises it shall be decided by expert authority, and in case of dispute, by the district council.

ART. 133. In cases of fire, the management of the fire fighters shall be assigned to the French Waters and Forests ranking officer on the ground, and if there is none, to the mayor or civil servant. In default of the Waters and Forests officers, of the mayor or civil servant, the ranking employee of the Waters and Forests shall direct the fire fighters.

In case it is necessary to back fire, the same persons shall take charge and direct this procedure.

This measure can never give grounds for damages against them.

ART. 136.[22] All violation of Arts. 123, 124, 125, 129, and 135 of the present law, or against the decrees issued for its execution, shall be punished by a fine of 20 to 500 francs ($3.86 to $96.50), and in addition the offender can be imprisoned for six days to six months, without prejudice in cases of fire of the penalties declared under Art. 126 of the present law, and of all damages if any such occur.

SECTION II. — PROVISIONS APPLICABLE ONLY TO WOODS AND FORESTS PLACED UNDER FOREST ADMINISTRATION

ART. 137. No industrial works, employing fire or necessitating a story of combustible materials, can be established within or at less than 500 metres (546 yards) from the forest, without the authorization of the prefect, under penalty of a

[22] Arts. 134 and 135 follow Art. 122.

fine of 100 to 500 francs ($19.30 to $96.50) and the demolition of the buildings.

ART. 138. Aside from the native settlements already in existence, no tent or *gourbi*,[23] no building covered or thatched with straw diss[24] or any other inflammable material can be built within or at less than 100 metres (109 yards) distant from woods and forests, under penalty of a fine of 5 to 50 francs ($0.96 to $9.65) and demolition within a month from the day on which judgment was given.

Within such enclosures too limited in area for the preceding provisions to be put into practice, the distance between the dwellings and the borders of the forest can be reduced to 50 metres (54 yards), without any authorization, and below that figure by authorization of the sub-prefect, upon recommendation of the Waters and Forests Service, but under condition that the ground contained in the space between the dwellings and the forest boundaries shall be cleared of all conifers, and of all inflammable material and kept absolutely clear of all brush.

PART VIII. — PROSECUTIONS FOR MISDEMEANOURS AND OFFENCES

SECTION I. — PROSECUTIONS UNDERTAKEN IN THE NAME OF THE WATERS AND FORESTS SERVICE

Re prosecution.

ART. 139. The Waters and Forests Service undertakes, not only in the interest of the State, but also in the interest of the other owners of woods and forests placed under forest administration, to prosecute for misdemeanours and offences committed in these woods and forests.

The Service also undertakes to prosecute for misdemeanours and offences set forth in Arts. 98, 104, 123, 125, 126, 127, 129, 131, and 134.

Actions and prosecutions shall be brought and undertaken by the Waters and Forests officers, in the name of the Waters and

[23] Gourbi — Arab term meaning a brush hut.

[24] Diss is a local grass used for thatching native gourbis.

Forests Service without prejudicing the rights of the public prosecutor.

ART. 140. Before final judgment has been delivered the Waters and Forests Service is authorized to compromise trespasses and offences, for which it undertakes to prosecute in virtue of the preceding article.

Even after judgment has been delivered, it is also authorized to compromise civil suits and fines.

ART. 150.[25] All actions and prosecutions undertaken at the request of the Waters and Forests Service are brought before the police courts, or the justice of the peace, according to the jurisdiction as determined by the decrees of Aug. 19, 1854, March 29, 1902, and May 29, 1902.

ART. 152. The Waters and Forests employees have the right to present the case before the court and are expected to support their own conclusions.

ART. 161. The Waters and Forests Service officers can, in the name of the Service, lodge an appeal against the sentences, and appeal against decrees and sentences of last resort, but they cannot withdraw their appeals without the special authorization of the Governor General.

ART. 162. The right given to the Waters and Forests Service and to its officers to go beyond sentences and decrees by appeal, or by recourse to the supreme court, is independent of the same privilege, which is granted by law to the public prosecutor, who can always avail himself of it, even when the Service or its officers shall have acquiesced in the sentences and decrees.

Re examination.

ART. 141. The officers and employees of the Waters and Forests investigate and prove the trespasses and offences as follows: The officers over the whole territory for which they are commissioned, and the employees, within the jurisdiction of the court in which they have taken oath.

ART. 142. The employees are authorized to seize cattle which are trespassing, and implements, wagons, and teams of tres-

[25] To secure a more logical arrangement of subject matter the numerical order of the code has been somewhat modified.

passers and to sequestrate them. They shall trace all articles removed by trespassers to the places where they have been transported, and shall also sequestrate them there.

They cannot, however, enter the houses, courts, or enclosures, unless in the presence either of the justice of the peace or his deputy; of the mayor or his adjutant; of a commissary of police, or in addition, so far as natives are concerned, of either the native adjutant or the headman, sheik, or ouakaf.

ART. 143. The officials designated in the preceding article cannot refuse to accompany the employees in the field, when they have been thus requested to assist at the search.

In addition to this, they shall be bound to sign the report of the sequestration or of the search made in their presence, with the provision however, in case of a refusal to sign, that mention shall be made of this in the report.

ART. 144. The employees shall arrest and conduct before the justice of the peace, or before the mayor, or before the headman of the tribe or of the douer, any native entirely unknown to them, if he is caught in the act of trespass.

ART. 145. The officers and employees of the Waters and Forests Service have the right to requisition, directly, the help of the police in suppressing forest misdemeanors and offences, as well as for the search and seizure of forest products which have been illegally removed, sold, or advertised contrary to decrees of the Governor General as set forth under Art. 134.

ART. 147. The justice of the peace may allow a provisional withdrawal of the goods seized to cover the costs of seizure, after reliable bail has been given.

In case of any dispute as to the solvency of the bail, judgment shall be delivered by the justice of the peace.

ART. 148. Owners shall be notified of all seizures by the officer or employee of Waters and Forests, within a period of three days.

If the articles, or the cattle seized, are not reclaimed within five days following the seizure, or if good and sufficient bail has not been provided, the justice of the peace shall order them to be sold by auction at the nearest market. If the owner of the

articles or of the cattle is not known, the sale can be ordered five days after the seizure.

Proceedings shall be taken at the convenience of the public receiver who will announce them 24 hours in advance.

The expenses of seizure and sale shall be levied on the sale proceeds by the justice of the peace; and the surplus shall remain in the hands of the public receiver to be assigned to whomsoever it is due.

If the objection to any decision only takes place after the sale the owner can only claim the restitution of the net profit of the sale with all expenses deducted, in the case where judgment has been decided in favour of this restitution.

ART. 146. Officers and employees shall write their reports themselves and shall sign them, under penalty of their becoming null and void.

If, by reason of any impediment, the report is only signed by the guard but not written entirely in his hand, mention of this fact under oath shall be made in the report, and sworn to within a period of three days, before the cantonal magistrate or one of his deputies or before the mayor or his deputy, either of the commune where he resides or of that where the offence has been committed or proved, under penalty of becoming null and void.

The public officer who shall receive the affirmation shall previously read the report to the officer in charge, and afterwards make mention of this formality under penalty of becoming null and void.

In cases where the report shall lead to seizure, immediately after the closing of the case a copy of it shall be made, which shall be deposited within three days at the registry of the justice of the peace court, so that those who might wish to reclaim the articles seized can be notified.

ART. 149. Under penalty of becoming null and void the reports shall be registered within four days of the affirmation or closing of the case, when the registrar resides in the locality inhabited by the clerk who has drawn up the report. Should he reside elsewhere 10 days will be given.

In all cases within military territory the period of time is a fortnight.

The registration may be paid for by instalments.

ART. 153. Offences or trespasses against forest property shall be proved by reports, or by witnesses in default of reports, in case these documents are insufficient.

ART. 154. Reports invested with all the formalities prescribed by Arts. 146 and 149, and which are written and signed by two French Waters and Forests officers, shall be taken as proofs until they have been disproved of material facts relating to the trespasses and offences which they describe, whatever may be the convictions to which these offences and trespasses may lead. Consequently, no proofs beyond or against the material (facts) of these reports will be admitted unless legal ground exists for challenging one of the signatories.

ART. 155. Reports, invested with all the formalities prescribed, which are drawn up or signed only by a single French Waters and Forests officer, shall also be taken as proofs until they have been disproved, but only when the offence or trespasses shall not lead to a conviction for more than 100 francs ($19.30) either as fine or civil damages.

When one of these reports shall authenticate charges of distinct and separate offences and misdemeanors simultaneously against several individuals, it shall be equally admissible, according to the terms of the present article, for each offence or misdemeanor which shall not lead to a conviction for more than 100 francs ($19.30) for fines or for damages, whatever may be the amount of all the aggregate sentences.

ART. 156. Official reports which, according to the preceding provisions, do not furnish sufficient proofs or have been shown to be in error, as well as reports drawn up by native guards, can be corroborated or corrected by all the legalized tests as set forth in Art. 154 of the code of criminal procedure.

ART. 157. The accused, who wishes to disprove a report, shall be obliged to make in person, or else by proxy having a proper power of attorney, an affidavit to that effect at the registry of the court, or at the court of the justice of the peace, before the session mentioned in the summons.

This affidavit shall be received by the registrar and signed by the accused or his proxy; in case of his being unable or not knowing how to sign, express mention of the fact shall be made.

On the day fixed for the hearing, the tribunal shall certify and fix a period of three days at the least, or a week at the most, during which the accused shall be obliged to deposit at the registrar's office the proofs of the falsity, and the names, titles, and residences of the witnesses he wishes to have summoned.

After the expiration of this period, and without a new summons being necessary, the tribunal shall accept the proofs of the falsity, if they are of a nature to destroy the effect of the report, and they shall proceed on that assumption, in accordance with the law.

In the opposite case, or if the accused fails to comply with all the formalities described above, the tribunal shall declare that the proofs of falsity cannot be accepted, and shall order that sentence be pronounced.

ART. 158. The accused, against whom judgment has been given by default, shall be allowed to make his affidavit as to falsity during the period of time permitted him by the law, when he must appear personally at the hearing of the contest he has made.

ART. 159. When a report has been drawn up accusing several persons and when one or more of them shall plead "not guilty," the report shall still be held valid as proof against the others, unless the fact which the former declare false applies in like manner to the other persons accused.

ART. 151. The Waters and Forests Service employees can, in actions and prosecutions undertaken in the name of the Service, issue all necessary summonings, and judicial notices of writs, without formal subpœnas. The summons must contain a copy of the official report, under penalty of becoming null and void.

The remuneration due employees for these summonings (in the case of their being removed from office) shall be calculated according to the tariff applicable to the writs of sheriffs' officers or bailiffs, by orders of the justice of the peace.

ART. 160. If, in case of reparation for an offence or misdemeanour, the accused pleads a property right or other real right, the tribunal before which the case is presented shall deliver judgment in this matter, according to the following rules:

The aforesaid exception can only be admitted, if it be founded on some manifest title deeds, or rights, either on the facts of actual possession or their equivalent by the accused or his predecessors, and precisely enumerated by him, and if in the case where they shall be admitted by a competent authority, the deed produced and the facts enumerated shall be of a nature to remove from the case which serves as a basis to the prosecution, all character of misdemeanour or offence.

If the case is sent to the civil courts, the sentence shall be delayed for a brief period, during which the party who has raised the aforesaid question, shall lay it before competent judges of the case and justify his suit; if not, judgment shall be pronounced.

However, in case of conviction, there shall be a delay of execution as regards imprisonment, if this sentence has been pronounced, and the sum total of fines, restitutions, and damages shall be paid into the government bank of deposits, to be handed over to whomsoever the court shall order, who shall pass judgment on the question of these rights.

ART. 163. Actions in reparation of misdemeanours and offences, connected with forest matters, are enjoined for six months, to count from the day when the misdemeanours and offences have been verified, without prejudice (with regard to purchasers and contractors) to the provisions set forth in Arts. 48, 49, 51, 52, and 73 of the present law.

ART. 164. Actions having to do with the denudation of wood and brush, undertaken contrary to the provisions prescribed in Art. 98, are enjoined for two years, to date from the period when the clearing has been effected.

ART. 165. The provisions of Art. 163 are not applicable to offences, misdemeanours, and malpractices committed by Waters and Forests officers or employees in the exercise of their office;

the delays in carrying out the sentences passed upon them or their accomplices are those determined by the criminal code.

ART. 166. The provisions of the code of criminal procedure with regard to the prosecution of misdemeanours and offences, upon summonses and delays upon defaults, oppositions, judgments, appeals, and recourse to the court of appeal, are and shall remain applicable to the prosecution of misdemeanours and offences specified by the present law, except with regard to the modifications resulting from the present part.

SECTION II. — PROSECUTIONS FOR MISDEMEANOURS AND OFFENCES IN WOODS NOT UNDER FOREST ADMINISTRATION

ART. 167. Misdemeanours and offences committed in the woods not under forest administration shall also be inquired into and verified by federal or private forest employees, as well as by rural police, police, and in general by the officers of the judiciary police.

Reports drawn up by the federal employees shall be received in evidence as stated in Arts. 154 and 155 of the present law. Those of the private French guards shall hold good until contrary proof is given. Those of private native guards shall only be regarded as reports for the information of the officials. The weight given to the reports drawn up by officers of the judiciary police, policeman, and the rural police is determined by the law which applies to them. These reports, with the exception of those drawn up by private guards, shall be registered without advance payment.

ART. 168. The provisions contained in Arts. 142, 143, 144, 147, 148, 149, 160, 163, and 166 as above are applicable to the prosecution of misdemeanours and offences committed in words not subject to forest jurisdiction.

The provisions of Art. 146 shall be applicable to the drawing-up of reports made by private guards when they are able to write their reports themselves. If unable to write, these reports written out by a third party shall be subject to the formality of oath, and registered within the time fixed by Arts. 146 and 149.

ART. 169. Reports drawn up by private guards shall be forwarded to the attorney for the Republic, or the justice of the peace, according to their respective jurisdictions, within a period of ten days, to date from the registration.

Those drawn up by federal (forest) employees shall be transmitted, after the formalities prescribed by the present law have been complied with, and within the same period of time, by the Waters and Forests inspector to the attorney for the Republic, who alone shall undertake the prosecutions.

ART. 170. Cases of offences and misdemeanours committed in woods and forests belonging to private individuals shall be tried according to the regulations concerning jurisdiction indicated in Art. 150.

PART IX. — PENALTIES AND SENTENCES APPLICABLE TO WOODS AND FORESTS IN GENERAL

Re penalties.

ART. 171. The cutting or removal of trees 2 decimetres (7.9 inches) or more in circumference, one metre (1.1 yards) above the ground, shall be punished by a fine of 1 franc ($0.19) per tree as a minimum which shall not be less than the value of the tree.

In case of a repetition of the offence, the fine shall not be less than double the value of the tree.

In addition the offender can be condemned to a maximum of three months' imprisonment.

The report describing the trespass must give the number and size of the trees cut down or removed, or mention the circumstances which have prevented the recording of these details.

The (civil) damages shall be awarded by the court according to the data of the report and the merits of the case, but they shall not be less than the minimum fixed by Art. 180.

ART. 172. The fine for cutting down, pulling up, or carrying away trees less than 2 decimetres (7.9 inches) in circumference shall be for every cart load from 3 to 10 francs ($0.58 to $1.93) per harnessed animal, and from 2 to 5 francs ($0.39 to $0.96) for every pack load, and from 0.50 to 2 francs ($0.09 to $0.39)

for every fagot load carried by a man. In addition the offender can be sentenced to a maximum of five days' imprisonment. If trees sown or planted in the forests less than 5 years ago are concerned, the penalty will be a fine from 3 to 5 francs ($0.58 to $0.96) per tree, without respect to its size and in addition a maximum imprisonment of 15 days.

In case of a repetition of the offence, the maximum fine shall always be imposed.

ART. 173. Those persons who have lopped, barked, or mutilated trees in the woods or forests, or who have cut off the main branches, shall be punished as if they had cut them down at the stump.

ART. 174. Those persons who have taken or removed cork (liège de reproduction)[26] from the woods and forests, or those who are illegally keeping it contrary to the decrees promulgated by the Governor General, in accordance with Art. 134 of the present law, shall be condemned to a minimum fine of 20 francs ($3.86) and a maximum fine of 40 francs ($7.72) for every 100 kilos (220 pounds) of cork, in proportion to the amount removed or retained, also to imprisonment for a fortnight to six months.

Those persons who have removed ordinary cork-oak bark (liège mâle (1)) without damaging the tree shall be punished by fines which shall not be less than 10 centimes ($0.02) nor exceed 1 franc ($0.19) per tree.

Those persons who, in removing the cork-oak bark, have damaged the tree, shall be punished according to the penalties enacted in Art. 172.

In case of a repetition of the offence, the maximum fine shall always be enforced.

ART. 175. Whoever shall remove windfalls or wood cut in trespass shall be condemned to the same fines and payments as if he had felled it himself.

ART. 177. The owners of animals trespassing during the day in woods 10 years and upwards in age shall be condemned to a fine of from 20 centimes ($0.04) to 1 franc ($0.19) for a hog, sheep, or calf; from 40 centimes ($0.08) to 2 francs ($0.39) for

[26] See p. 59 for a description of cork-oak management.

a steer, cow, goat or beast of burden; from 1 franc ($0.19) to 5 francs ($0.96) for a camel.

If the woods are less than ten years old, the fine shall be from 40 centimes to 2 francs ($0.08 to $0.39) for a hog, sheep, or calf; from 80 centimes to 4 francs ($0.16 to $0.77) for a steer, cow, goat, or a beast of burden; from 2 to 10 francs ($0.39 to $1.93) for a camel.

All of those fines without prejudice as to claims for damages if there be any.

In addition the herder may be sentenced to imprisonment for from five days to six months.

In case of repetition of the offence, or if it has been committed in the night, the maximum fine shall be enforced.

ART. 178. Those persons who have counterfeited or tampered with the brands of private individuals, or those who have made use of brands that have been tampered with or counterfeited, or those who have illegally secured the real brands and have applied them, or made use of them in a manner prejudicial to the interests and the rights of private individuals, shall be punished by imprisonment for from three months to two years.

ART. 185. In all cases not specified in the present law, recourse shall be made to the Penal Code.

Re enforcement of penalties, etc.

ART. 176. Where wood or other productions of forest soil have been illegally removed, damages may be claimed, over and above the fines for the return of the articles removed, or their equivalent value.

The saws, axes, bill-hooks, hatches, and other implements of a similar nature, with which the trespassers and their accomplices are provided, shall be confiscated.

ART. 179. If within the twelve months immediately preceding the day, when an offence has been committed, the offender has already been punished for a misdemeanour or offence, this shall be considered as a repetition of the aforesaid misdemeanour or offence.

ART. 180. In all cases of award for damages, these shall not be less than the fine imposed by the court.

ART. 181. Except in the case provided for in Art. 126 of the present law, Art. 463 of the Penal Code shall not be applicable to matters regulated by the present law, nor to the law of March 26, 1891.

ART. 182. Private owners are entitled to restitutions and damages; fines and confiscations are always reserved for the State.

ART. 183. In all cases where sales or auctions are declared null and void, by reason of fraud or collusion, the buyer or purchaser, independent of the fines and damages pronounced against him, shall be sentenced to return the wood which has already been cut down, or to pay the stumpage value of the auction or sale price.

ART. 184. The husbands, fathers, mothers, and guardians, and generally speaking all foremen and employees, shall be civilly responsible for the misdemeanours and offences committed by their wives, children who are minors, wards living with them and unmarried, workmen, teamsters and other subordinates, except in the case of legal redress.

This responsibility shall be regulated in accordance with the last paragraph of Art. 1384 of the Civil Code, and shall apply to restitutions, damages, and costs.

PART X. — EXECUTION OF JUDGMENTS

SECTION I. — JUDGMENTS CONCERNING MISDEMEANOURS AND OFFENCES IN WOODS UNDER FOREST ADMINISTRATION

ART. 186. Judgments delivered at the request of the Waters and Forests Service, or after proceedings by a public officer, shall be denoted by simple abstracts containing the name, residence of the parties, and the verdict of the court.

This notification will hold good during the delays of protest and appeal from judgments.

ART. 187. The recovery of forestry fines is entrusted to the general tax collectors (receveur des contributions diverses). These collectors are likewise charged with the recovery of restitutions, expenses, and damages, resulting from sentences for

misdemeanours and offences committed in the woods under forest jurisdiction.

The Waters and Forests Service can allow trespassers to settle fines, civil payments and costs, by means of maintenance or improvement work on rural roads (up to three days) or in the forests.

The general council shall fix the value of a day of such labor for each commune.

The labor can also be furnished by piece-work.

If this labor is not forthcoming, within the time fixed by the Waters and Forests Service, the offenders shall be prosecuted according to the previous sentence.

ART. 188. Imprisonment for debt is exercised in matters connected with the Forest Code, according to the law of July 22, 1867. The duration of such imprisonment is fixed by the sentence within a limit of a week to six months. If the offender has already been previously convicted, however, the sentence can run to a year.

SECTION II. — JUDGMENTS CONCERNING MISDEMEANOURS AND OFFENCES COMMITTED IN WOODS WHICH ARE NOT UNDER FOREST ADMINISTRATION

ART. 189. Judgments given in favor of private individuals for damages for misdemeanours and offences committed in their woods shall be, at their request, notified and executed according to the same forms and acts of constraint as in the case of judgments delivered at the request of the Waters and Forests Service.

The recovery of fines shall be effected by the general tax collectors.

Insolvent offenders shall be permitted to discharge their debts as already stated in Art. 187, but only in the case of fines and costs claimed by the State.

In this case the work of labor must be done on the rural roads depending on the commune in the territory where the offence has been committed.

Part XI. — General Provisions

Art. 190. The laws, regulations, decrees, and orders laid down as to matters dealt with by the present law are abrogated as to every point in which they are contrary to the regulations (of this Code) reserving to the Code the rights previously acquired, and especially the laws of May 21, 1827, May 4, 1837, June 18, 1859, Nov. 23, 1883 (in all matters concerning Algeria), July 17, 1874, Dec. 9, 1885. Likewise the regulations, decrees, and orders laid down as to subjects dealt with by the present law are abrogated in every point in which they are contrary to its regulations, and reserving to the Code the rights previously acquired, especially the regulations of Aug. 1, 1827, June 23, 1830, Mar. 10, 1831, May 20, 1837, June 10, 1840, Aug. 24, 1840, Dec. 4, 1844, Mar. 23, 1845, Feb. 5, 1846, Jan. 13, 1847 (in all matters concerning Algeria), the decrees of Apr. 2, 1857, May 19, 1857, Oct. 16, 1858, Dec. 21, 1859, Dec. 22, 1879, Feb. 17, 1888, Apr. 25, 1888, Mar. 19, 1891 (in all matters concerning Algeria), the decrees of Oct. 17, 1861, Aug. 26, 1881, and Aug. 18, 1885.

TABLE 25.—STATISTICS OF FEDERAL (STATE) FORESTS IN CORSICA UNDER PROVISIONAL OR REGULAR WORKING PLANS OR CUTTING REGULATIONS

Name of the forest and date of first plan of management.	Areas, hectares (acres).	Per cent of each species.	Method of treatment.	Total volume inventoried for the forest managed under high forest. Cubic metres (cords).	Rotation (years).	Periods for the high forests (years).	Yield, cubic metres (cords).	Remarks.
Aitone 2/14/1908	1673.88 (4,136)	Corsican pine.. 0.6 Maritime pine. 0.1 Silver fir..... 0.1 Beech..... 0.2	Selection high forest 1st series† 723.90 ha. (1,789 a.) Physical exploitability, 2nd series 624.09 ha. (1,542 a.)	Old wood..... 68,136 (18,797) Average wood..129,700 (35,783)	360 Physical exploitability	30 30	567 (155) by area	316.89 ha. (783 acres) outside area covered by the working plan.
Barocaggio-Marghese 5/15/1857	2738.50 (6,767)	Maritime pine. 0.70 Corsican pine.. 0.25 Holm oak..... 0.05	High forest 1st series (regular) 2nd series and 3rd series selection	44,623 (12,310) 29,185 (8,327) 23,109 (6,374)	125 20 } transitory 30 } transitory	25 { 20 { 30	1785 (491) 1459 (402) 770 (212)	Fellings suspended until a new order issued (since 10/10/1882).
Bavella 2/23/1882	877.08 (2,167)	Maritime pine. 0.30 Corsican pine.. 0.60 Holm oak..... 0.10	Regular high forest	86,622 (23,897)	160	40 years for the first 16 years 80 years for the last 64 years	2165 (597) 680 (187)	265.21 ha. (655 acres) outside area covered by the working plan. Fellings suspended until a new order issued. (Decision of 2/24/1886.)
Biancone 12/17/1903 *	115.49 (294)	Beech..... 0.9 Corsican pine.. 0.1	Selection high forest	2,774 (766)	...	7 5 fellings	555 (152)	Felling regulation approved 12/17/1908, for years 1909 to 1925 inclusive.
Calenzana 3/2/1906	3012.96 (7,445)	Maritime pine. 0.7 Holm oak..... 0.2 Corsican pine.. 0.1	Selection high forest	1st series..... 28,100 (7,751) 2nd series..... 27,220 (7,511)	160 160	20 20	1405 (388) 1361 (374)	Felling regulation approved 4/21/1906.
Cerotte 12/17/1908 *	137.64 (353)	Beech..... 0.9 Corsican pine.. 0.1	Selection high forest	4,304 (1,186)	160	10 7 fellings	615 (169)	Felling regulation approved 12/17/1908.

TABLE 25 (*Continued*). — STATISTICS OF FEDERAL (STATE) FORESTS IN CORSICA UNDER PROVISIONAL OR REGULAR WORKING PLANS OR CUTTING REGULATIONS

Name of the forest and date of first plan of management.	Areas, hectares (acres).	Per cent of each species.	Method of treatment.	Total volume inventoried for the forest managed under high forest. Cubic metres (cords).	Rotation (years).	Periods for the high forests (years).	Yield, cubic metres (cords).	Remarks.
Chiavari 2/14/1908	2256.52 (5,576)	Holm oak and "maquis" .. 0.9 Maritime pine. 0.1	Coppice under standards	4,304 (1,186)	30	10 7 fellings	by area	1174.97 ha. (2903 acres) outside area covered by the working plan. Felling regulation approved 3/15/1908.
Fango 1/17/1907	3992.35 (9,865)	Holm oak .... 0.9 Maritime pine. 0.1	Undetermined (Coppice under standards)	4,304 (1,186)	46	10 7 fellings	by area	2577.58 ha. (6369 acres) outside area covered by the working plan. Felling regulation approved 1/17/1907.
Libio 9/30/1911	1591.09 (3,932)	Maritime pine. 0.6	1st series 1215.84 ha. (3004 a.) Selection high forest	211,395 (58,321) of which Old wood..... 104,059 (28,710)	360	30	867 (240)	
		Corsican pine.. 0.4	2nd series 375.25 ha. (927 a.) Physical exploitability	Average wood.. 107,336 (29,611)	360	30	867 (240)	
Lindinosa 5/10/1910	728.82 (1,801)	Corsican pine.. 100	Selection high forest	Old wood..... 41,432 (11,431) Average wood.. 43,468 (11,992) Total..... 84,900 (23,423)	360	30	345 (95)	259.47 ha. (641 acres) outside area covered by the working plan.
Marmano 1/15/1908	2201.48 (5,440)	Corsican pine.. 0.65 Maritime pine. 0.05 Silver fir. .... 0.05 Beech ... 0.20 Holm oak 0.05	Selection high forest 1st series 2nd series Physical exploitability	Old wood..... 71,353 (19,684) Average wood.. 40,764 (11,247) Total 112,117 (30,931)	Corsican pine... 360 Maritime pine.. 120	40 30	767 (211) by area	166.88 ha. (412 acres) outside area covered by the working plan.

Pietrapiana 12/19/1900	1040.70 (2,571)	Corsican pine.. 0.48 Silver pine.... 0.40 Holm oak..... 0.01 White oak..... 0.01 Birch..... 0.03 Maritime pine..0.01	1st series Selection high forest 822.55 ha. (2,032 a.) 2nd series Physical exploitability 218.15 ha. (539 a.)	Old wood..... 48,979 (13,511) Average wood.. 41,999 (11,586) Total..... 90,978 (25,097)	280	28	525 (144)	
Pineta 4/15/1865	734.72 (1,815)	Maritime pine. 100	Regular high forest 629.76 ha. (1,556 a.)	11,200 (3,089)	80	20	560 (155)	104.96 ha. (259 acres) outside area covered by the working plan.
Rospa-Sorba 8/10/1896	773 (1,910)	Corsican pine. 0.976 Maritime pine 0.010 Silver fir..... 0.006 White oak.... 0.009 Holm oak.... 0.004 Miscel..... 0.001	Selection high forest	Old wood..... 49,472 (13,618) Average wood.. 29,684 (8,189) Total..... 79,156 (21,837)	240	24	618 (169)	
St. Antoine 4/9/1907	1037.62 (2,564)	Corsican pine.. 0.55 Silver fir..... 0.05 Beech..... 0.40	Selection high forest 1st series 448.70 ha. (1,108 a.) 2nd series Physical exploitability 235.18 ha. (581 a.)	Old wood..... 54,376 (15,001) Average wood . 38,295 (10,566) Total 92,671 (25,567)	360	30 30	530 (146) by area 7 83 (2)	353.74 ha. (874 acres) outside area covered by the working plan.
Sambuco 5/18/1869	931.65 (2,302)	Maritime pine. 0.9 Holm oak..... 0.1	Regular high forest	8,605 (2,373)	90 transitory	30	227 (62)	Fellings suspended until 1894. (Decision of 10/28/1879.)
San Martino 10/10/1896	400.14 (989)	"Maquis"..... 0.45 Holm oak .... 0.37 Maritime pine. 0.12 Cork oak..... 0.04 Ash..... 0.02	Coppice under standards	8,605 (2,373)	36	30	by area	A decision of March 10, 1910, suspended exploitation for years 1912 to 1928 in consequence of the fire of 1900.
Ste. Marie Siché 12/29/1904	357.83 (884)	Holm oak .... 0.37 Heather..... 0.33 Arbute..... 0.21 "Ply larca," aspen, alder and ash..... 0.09	Coppice under standards	8,605 (2,373)	30	30	by area	

TABLE 25 (*Concluded*). — STATISTICS OF FEDERAL (STATE) FORESTS IN CORSICA UNDER PROVISIONAL OR REGULAR WORKING PLANS OR CUTTING REGULATIONS

Name of the forest and date of first plan of management.	Areas, hectares (acres).	Per cent of each species.	Method of treatment.	Total volume inventoried for the forest managed under high forest. Cubic metres (cords).	Rotation (years).	Periods for the high forests (years).	Yield, cubic metres (cords).	Remarks.
San Pietro di Verde 5/12/1911	1020.29 (2,521)	Corsican pine.. 0.40 Beech..... 0.60	Selection forest 487.09 ha. (1,203 a.) Physical exploitability 311.38 ha. (769 a.)	Old wood..... 59,953 (16,541) Average wood.. 37,805 (10,445)	360	30 30	580 (160) by area	221.82 ha. (548 acres) outside area covered by the working plan.
Cartagine-Melaja 2/17/1909	2782.98 (6,876)	Corsican pine.. 0.80 Maritime pine. 0.20	Selection high forest 1080.64 ha. (2,670 a.) Physical exploitability 1072.34 ha. (2,649 a.)	Old wood..... 115,127 (31,761) Average wood.. 40,982 (11,304) 6,119 (1,688)	Corsican pine... 360 Maritime pine.. 120	20	489 (135)	
Tova 6/23/1902	2755.00 (6,807)	Corsican pine.. 20 Maritime pine. 60 Holm oak..... 20	Selection high forest North Tova 1st series 2nd series South Tova Physical exploitability 3rd series 4th series	Old wood..... 37,077 (10,230) Average wood.. 23,951 (6,607) Old wood..... 71,814 (19,811) Average wood.. 36,600 (10,096) 34,652 (9,559) 18,192 (5,018)	Corsican pine... 300 Maritime pine.. 100 Holm oak..... 140 Corsican pine.. 300 Maritime pine.. 100 Holm oak..... 149	20 20 20 20	960 (265) 1416 (390) by area "	293 ha. (724 acres) outside area covered by the working plan. Fellings suspended until 1912 inclusive. (Decision of 6/13/1907.) A working plan revision for resuming fellings in 1913 is being prepared.
Valdo Grosso 10/22/1897	83.71 (206)	Holm oak..... 75 " Maquis "..... 25	"	"	30	20	by area	Forest of the old factory of St. André de Tallano.

Valdoniello 6/12/1901	4433.11 (10,954)	Corsican pine.. 70 Silver fir..... 10 Beech..... 20	Selection forest 1670.50 ha. (4,127 a.) ——— Physical exploitability 2762.61 ha. (6,826 a.)	Old wood..... 276,950 (76,409) Average wood.. 169,674 (46,812)	360 360	24 24	2308 (637) 2308 (637)	
Vero 3/19/1857	303.39 (749)	Maritime pine. 100	Regular high forest	13,625 (3,759)	20 transitory	24	681 (188)	Fellings suspended until a new order issued. (Decision of 8/11/1876.)
Vizzanova 5/26/1859	1534.94 (3,792)	Corsican pine.. 70 Beech..... 30	Regular high forest	126,329 (34,853)	25 transitory	24	5053 (1394)	282.98 ha. (699 acres) outside area covered by the working plan. Fellings suspended until a new order issued. (Decision of 10/23/1880.)
Zonza-Est 6/26/1869	1450.04 (3,583)	Maritime pine and some holm oaks	Regular high forest	6,587 (1,818)	90	30	220 (61)	Fellings suspended until further order. (Decision 10/29/1879.)
Zonza-Ouest 1/22/1903	825.89 (2,040)	Corsican pine.. 33 Maritime pine.. 63 Silver fir..... 4	Selection high forest 526.34 ha. (1,300 a.) ——— Physical exploitability 299.55 ha. (740 a.)	Old wood..... 46,186 (12,741) Average wood.. 24,273 (6,695) ——— Old wood..... 46,186 (12,741) Average wood... 24,273 (6,695)	Corsican pine... 300 Maritime pine.. 120	20 ——— 20	1287 (355) ——— 1287 (355)	
Tavignano 3/8/1886	966.00 (2,387)	Corsican pine 0.954 Beech..... 0.029 Holm oak ... 0.029 Alder..... 0.002 Miscel..... 0.001	Selection high forest	Old wood..... 132,065 (36,437) Average wood . 37,713 (10,403)	260	30	1219 (336)	337.56 ha. (834 acres) outside area covered by the working plan. A revision of the working plan is being prepared.

* Provisional regulation only. † The French word "series" corresponds to working group.

SALE OF A SPECIAL FELLING AREA[27] AUTHORIZED BY DECREE OF JUNE 8, 1909, IN THE COMMUNAL FOREST OF ASCO

The auction will take place at Corte, Wednesday, July 25, 1911, at precisely 9 A.M. in the Town hall.

SPECIAL CLAUSES

PART I. — AUCTION

ART. 1. The felling area comprises the whole of the communal forest of Asco which is under forest control and includes the trees (marked on the bole and root with the federal marking hatchet) whose number, species, size, distribution between the 15 forest compartments, estimated yield in lumber and beams, in fire wood and in resin will be found after the printed clauses of this circular, which will give a rough idea of the forested compartments . . .

ART. 2. The sale will be made in one lot, without guarantee as to boundaries, area, number of trees, volume, species, age, condition, or quality.

ART. 3. The auction is made under the clauses and conditions of the general sales circular, approved Aug. 4, 1909, except as hereafter modified.

ART. 4. The sale will be made at reduced prices; it will take place at Corte.

ART. 5. . . . each bidder must deposit 20,000 francs ($3860) before the auction . . .

ART. 6. Within 20 days after the auction the successful bidder will deposit:

1. One-tenth of the purchase price . . .
2. . . . stamp rights and registry charges . . .
3. . . . municipal levies . . .

ART. 7. Within 40 days after the auction the purchaser must pay . . . the remaining nine-tenths of the price . . .

ART. 8. . . . fiscal arrangements enumerated . . . a sum of 4000 francs ($772) is added to the purchase price of the felling area.

[27] Translated by the writer; the portions omitted are of no interest or application.

ART. 9. . . . for:

1. Cost of estimate made because of the sale.
2. Maintenance of official marks during felling.
3. Working plan of the forest after exploitation.

PART II. — EXPLOITATION AND REMOVAL

ART. 10. Under the penalties given in Art. 40 of the Forest Code of France, the exploitation and the removal over the entire felling area must be completely finished within a period of 18 years counting from the auction day. The compartments will be cut over in the order decided upon by the purchaser, and will theoretically each correspond to a separate sale. Yet several compartments may be exploited simultaneously, but the logging of a compartment cannot be commenced until the purchaser obtains from the inspector for this particular compartment a special cutting permit . . . stating that he has complied with all the requirements which are set by Art. 18 of the general circular.

Dating from the delivery of this compartment permit, which the purchaser must procure, there will be three years for the felling and removal of the wood from the compartment and under no circumstances can the time for removal exceed the period of 18 years fixed above for the removal of the whole sale.

On the other hand extensions of time may be granted, in case of accident, for good and unforeseen causes, under the conditions cited by Arts. 29 and 44 of the general circular; but the aggregate of these extensions cannot in any case exceed two years for any one compartment.

The stumps shall be checked by compartments, in the order of expiration of the term for felling figured for each from the date of the cutting permit.

. . . . . .

ART. 11. The imprint of the federal marking hatchet on the stumps of trees designated for felling must be pointed out by the purchaser when the stumps are checked.

If it is shown that these imprints have a tendency to become

obliterated in the last compartments to be cut over, the trees which bear them shall be freshly stamped with the federal mark in one or more operations, carried out by the Waters and Forests Service, always with the purchaser or his representative (present).

ART. 12. The volume of the wood to be delivered to the purchaser in the compartments during exploitation and during the regular felling term, in accordance with Arts. 21, 31, 36, 40, and 45 of this circular, shall be calculated on the basis of the diameters of the trees and in accordance with the following volume table:

D. B. H. metres (inches).	Volume cubic metres (cu. ft.)	Remarks.
0.10 (3.94)	0.03 (1.06)	The 0.10-metre (3.9-inch) diameter class will include all the stems measuring from 0.06 to 0.15 metre (2.4 to 5.9 inches) inclusive at breast height (1.30 metres (1.4 yards) above the ground); that of 0.20 metre (7.9 inches) trees will include all the stems measuring from 0.16 to 0.25 metre (6.3 to 9.8 inches) in diameter inclusive, and so on following.
0.20 (7.87)	0.13 (4.59)	
0.30 (11.81)	0.35 (12.35)	
0.40 (15.75)	0.75 (26.48)	
0.50 (19.68)	1.30 (45.90)	
0.60 (23.62)	2.15 (75.92)	
0.70 (27.56)	3.25 (114.77)	
0.80 (31.50)	4.35 (153.61)	
0.90 (35.43)	6.05 (213.64)	
1.00 (39.37)	7.60 (268.39)	
1.10 (43.31)	8.95 (316.05)	
1.20 (47.24)	11.60 (409.64)	
1.30 (51.18)	13.80 (487.33)	
1.40 (55.12)	16.20 (572.08)	
1.50 (59.07)	19.00 (670.07)	
1.60 (62.99)	22.60 (798.10)	

The volume of wood delivered in accordance with Articles 21, 31, and 40 of the general circular will be paid for at the average price of dimension stuff resulting from the sum total of the auction, that is to say, at the price obtained by dividing the grand total of the auction (both sales price and charges) by the total volume of the products estimated in board and dimension stuff in accordance with Article 1.

The volume of wood delivered in accordance with Arts. 36 and 45 of the general circular (reserved trees) shall be paid for at the same price be it more or less.

However, these prices shall not be applied in the calculation of the amounts due except to wood of merchantable size and quality or to products of merchantable value, which may be used by the purchaser.

The cost of stamping and registering papers relative to these deliveries shall be at the cost of the purchaser.

ART. 13. The sale is made under the actual conditions prevailing, and the Waters and Forests Service, as well as the commune of Asco, declines all responsibility because of delays which may retard the construction of the parish road of Asco.

The removal will take place along existing roads or by any other ways and means created by the purchaser, that is to say: mule trails, secondary roads, suitable for carts, skidding trails or slides, installation of Decauville lines, roll ways, inclined planes or cables, established in virtue of permits which shall be requested under the conditions given in Art. 33 of the general "cahier de charges."

In this respect the Waters and Forests Service will give all possible facilities, but because of a refusal the purchaser cannot base claims for a reduction in the purchase price or any indemnity whatsoever, even if the difficulty (of logging) was thereby increased, or in case of the impossibility of removal.

ART. 14. The purchaser shall bear all costs of the improvement or construction on existing logging roads or on any he may be authorized to establish. The betterments will revert without payment to the commune of Asco after exploitation is finished. The same will apply to all the ties laid under Decauville lines or on sled roads, bridges, and fences (constructed) of wood, dams, flood gates including their fittings which shall become at the same time and without payment the property of the Asco commune. The total equipment only can be removed by the purchaser.

ART. 15. Every facility shall also be accorded the purchaser by the Waters and Forests Service for establishing in the forest under the conditions prescribed by Art. 31 of the general circular, huts, shanties, workshops, and mills necessary for the requirements of exploitation either of wood or gum, and to utilize, if there are any, streams for the generation of power.

The purchaser shall be granted a period of six months after the exploitation is finished (within which) to remove the lumber or other material from houses erected, as well as the tool equip-

ment and furnishings; but after this period the commune of Asco shall become the owner, and do as it pleases with all buildings and material which may not have been removed by the purchaser.

ART. 16. The responsibility decreed by Art. 45 of the Forest Code will be in force in compartments during exploitation, from the time the special permit for felling in these compartments is given until they are checked over, or until the release is given the purchaser.

Moreover no reduction in the price of the sale nor any refund can be claimed because of trespass damage committed on trees sold comprised in the compartments remaining for exploitation.

ART. 17. The purchaser cannot raise any claim for damages because of windfall or the death of trees, which shall have taken place since the marking among trees designated and marked for the sale.

PART III. — TAPPING

ART. 18. The purchaser shall have the privilege of tapping trees marked for felling.

ART. 19. In the compartments opened for felling and in the ordinary course of exploitation the tapping will be conducted at the option of the purchaser who can work the trees as desired.

For this purpose a special tapping to death permit will be included in the logging permit, on the preliminary written request from the purchaser, and in this event the period for the exploitation and removal for each compartment shall be fixed at 5 years, commencing from the date of the cutting permit (and) without any extension permissible.

ART. 20. In the compartments not yet opened for felling, but which have already been settled for, . . . the purchaser shall have in addition the right to tap alive the trees marked for felling by making a written request to the inspector, who after seeing the remittance receipt, will deliver to him a special permit for tapping alive. This permit will be valid up to the time (the compartment) is opened for regular felling and commencing with the date of the felling permit the purchaser will

have 5 years, as given above, to tap to death if he wishes, and to entirely finish the exploitation and removal in each compartment.

ART. 21. The tapping alive in the compartments not yet opened for felling must conform to the following rules:

The trees to be tapped alive shall be cut with only one face at a time which shall be begun above the root collar and always continued vertically. The face may be raised during the first year it is cut to 60 centimetres (23 inches), and each of the following years 70 centimetres (27 inches) provided that the total height of the face does not exceed 3.40 metres (3.7 yards).

The width of the face should not exceed 9 centimetres (3.5 inches) for the first two years they are cut, 8 centimetres (3 inches) commencing with the third year and 7 centimetres (2.7 inches) during the last year.

Their depth must not exceed 1 centimetre (0.4 inch), measured from a cord stretched from one side of the scar to the other, beginning with the cambium.

The successive faces shall be cut so far as possible on opposite sides of the tree perpendicular to each other.

The old faces shall be abandoned no matter what their height may be.

However, in the first compartments in which the period for tapping alive may be less than 5 years, the width of the faces or height may be modified by the conservator on the request of the purchaser.

ART. 22. Every tree worked contrary to the preceding rules in compartments not yet opened for cutting will be considered as having been mutilated and (therefore) falling under the force of Arts. 192 and 196 of the Forest Code (of France).

The purchaser will incur the same penalties every time (in order to conduct the gum into the cup) he shall cut at the base of the trees tapped alive circular incisions deep enough to hit the wood.

ART. 23. The tapping alive will only be allowed from March 1 to October 31 of each year, but the purchaser can com-

mence to clean off the (bark of the) pines which are to be tapped and place the nails from the first of February.

He can also collect resin barrels up to the 15th of December each year during the period for tapping alive.

ART. 24. The purchaser will have the privilege of barking (up to 4 metres (4 yards) in height) the trees to be tapped alive in the compartments not yet opened. He must immediately dispose of the products of this work.

ART. 25. In the case of tapping operations the exploitation and removal of the wood or resin must be completely finished within a maximum term of 20 years for the whole cutting area counting from the day of the auction and without any extension possible.

PART IV. — MISCELLANEOUS RULES

ART. 26. The Waters and Forests Service and the commune of Asco do not hold themselves responsible for:

1. Fires and acts of Providence (storms, floods, avalanches, slides, etc.) which may take place in the forest during the cutting period.
2. Delays which may affect the construction of the Asco parish road.

These occurrences will give under no circumstances any indemnity, deduction or reduction whatever in the sale price.

ART. 27. Of the total number of workmen employed by the contractor either for exploitation, handling or tapping, the proportion of foreign laborers must not exceed a percentage of 90.

ART. 28. The contractor must send to the Waters and Forests agent, chief of cantonment at Bastia, on every request, the complete list of the workmen employed on the woodyards and workshops of the felling area. The conservator can, on the recommendation of the local agents, strike from this list those persons who have committed any forest trespass, or those convicted either of poaching or insult or insubordination against an official.

Approved at Paris by the Secretary of Agriculture,
January 21, 1910.

ADDITIONAL LITERATURE

Tunisia

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5. Ch. Degreaux. Notice sur les forêts de la Khroumirie. Tunis. 1905.
6. Direction des forêts. Notice sur les forêts de la Tunisie. Tunis. 1889.
7. Compte rendu de la direction générale des travaux publics. Paris. 1898–1908.
8. Duveyrier. La Tunisie. Tunis. 1881.

Algeria

1. Gautier. Sahara Algerien. Paris. 1908.
2. Chudeau. Sahara Soudanais. Paris. 1909.
3. Battandier. Du rôle du boisement dans l'avenir de l'Algérie. Paris. 1898.
4. Combe. Les forêts de l'Algérie. Alger. 1889.
5. Lefebvre. Les forêts de l'Algérie. Alger. Mustapha. 1900.
6. Gouvernement général de l'Algérie. Programme du reboisement. Alger. 1885.
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EQUIVALENTS

The following equivalents have been used in conversions:

1 pound (avordupois)	=	0.45359 kilogram
1 pound (Troy)	=	0.37324 kilogram
1 millimetre	=	0.03937 inch
1 centimetre	=	0.3937 inch
1 metre	=	3.28083 feet
1 metre	=	1.093611 yards
1 kilometre	=	0.62137 mile
1 square millimetre	=	0.00155 square inch
1 square centimetre	=	0.1550 square inch
1 square metre	=	10.764 square feet
1 square metre	=	1.196 square yards
1 square kilometre	=	0.3861 square mile
1 hectare	=	2.471 acres
1 cu. millimetre	=	0.000061 cubic inch
1 cu. centimetre	=	0.061 cubic inch
1 cu. metre	=	35.314 cu. feet
1 cu. metre	=	1.3079 cu. yards
1 litre	=	1.05668 quarts (liquid)

1 litre	=	0.26417 gallon (liquid)
1 litre	=	0.9081 quart (dry)
1 litre	=	0.11331 peck
1 hectolitre	=	2.83774 bushels
1 gram	=	15.4324 grains
1 gram	=	0.03527 ounce (avordupois)
1 gram	=	0.03215 ounce (Troy)
1 kilogram	=	2.20462 pounds (avordupois)
1 kilogram	=	2.67923 pounds (Troy)
1 franc	=	19.3 cents (current rate in 1912–13)

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9—General; Algebra; Analytic and Plane Geometry; Calculus; Trigonometry; Vector Analysis.

MECHANICAL ENGINEERING

10a General and Unclassified; Foundry Practice; Shop Practice.

10b Gas Power and Internal Combustion Engines; Heating and Ventilation; Refrigeration.

10c Machine Design and Mechanism; Power Transmission; Steam Power and Power Plants; Thermodynamics and Heat Power.

11—Mechanics.

12—Medicine. Pharmacy. Medical and Pharmaceutical Chemistry. Sanitary Science and Engineering. Bacteriology and Biology.

MINING ENGINEERING

13—General; Assaying; Excavation, Earthwork, Tunneling, Etc.; Explosives; Geology; Metallurgy; Mineralogy; Prospecting; Ventilation.