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REPORT

ON THE

FORESTS AND ALPHA RESOURCES

OF

ALGERIA.

BY

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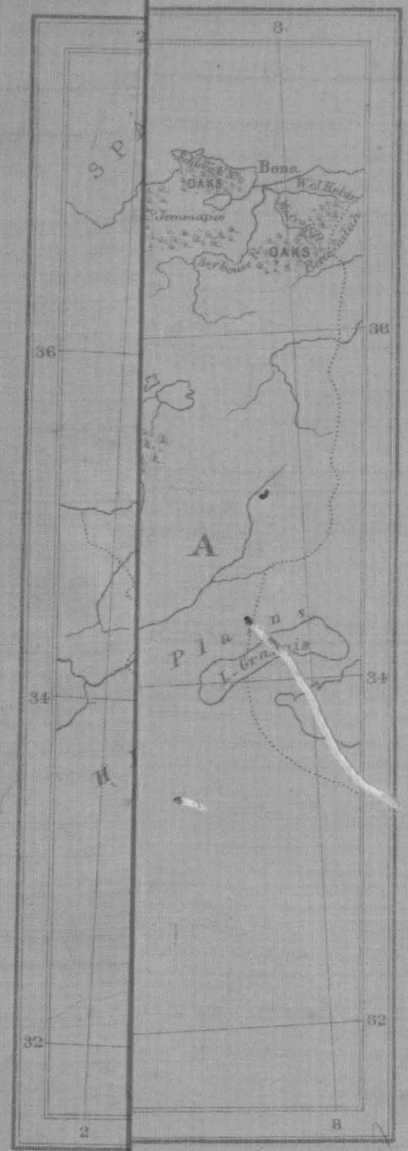

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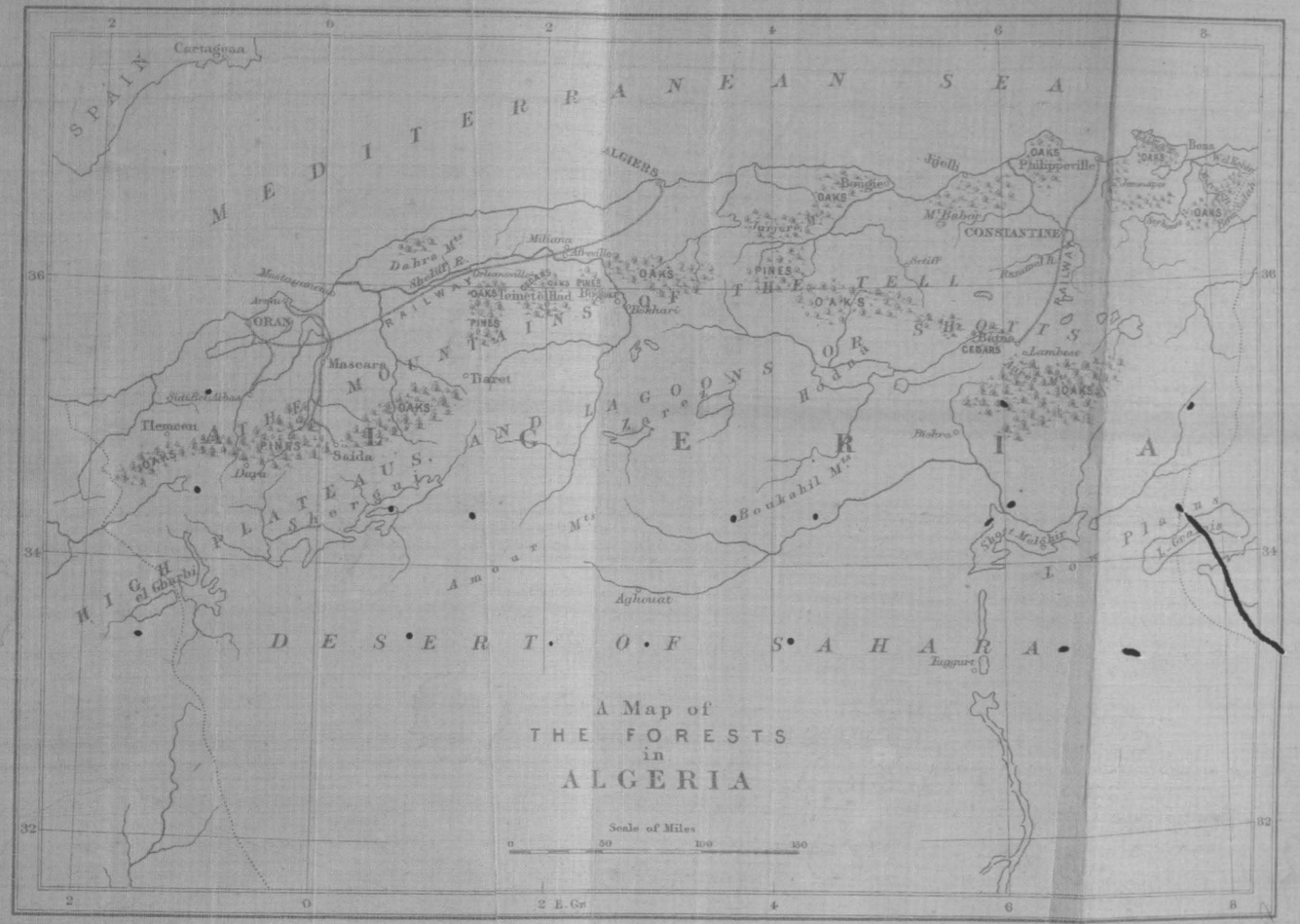

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INTRODUCTION.

FROM the similarity between Algeria and our northern provinces of India in respect of climate and vegetation, it has always occurred to me that it would be useful to ascertain the result of forest management in Algeria, and particularly of the measures adopted to check the evil of forest conflagrations.

After permission to visit Algeria had been obtained, and the necessary arrangements made, I learnt that *systematic* forest management had not made much progress, and that the forests were for the most part in an unsatisfactory state.

In the meantime, however, instructions had reached me directing attention to the collection of information regarding Alpha while in Algeria, and I concluded that with this additional object in view my visit would not be without useful results, particularly if information could be obtained of a more general and detailed character regarding the forests than was originally intended.

From the following pages it will be seen that the adoption of a regular system of management in the working of the Algerian forests has been precluded in a great measure by their unproductiveness, arising out of want of facilities of transport; hence the information on this head will be found to be somewhat meagre.

On the other hand much has been effected in the matter of forest rights and demarcation, and progress has latterly been made towards the suppression of forest conflagrations.

On all these points, as well as the internal working of the Forest Department in the conservancy of the forests, I have endeavoured to note such information as appeared likely to prove useful and interesting to my brother forest officers in India.

Proceeding viâ Paris and Marseilles, I reached Algiers on the 10th April, after a journey of four days.

With the advice of M. Mangin, the Conservator of

Forests, I made several journeys into the interior; the first to the Cedar Forest of Teniet-el-ahd, in the department of Algiers; the second to Bone, and thence viâ Constantine to the forests near Batna and Lambech; and the third to the Alpha region near Tegeerat, in the department of Oran.

These journeys, and time spent at Algiers in collecting information, occupied about five weeks, and, leaving Algiers on the 16th of May, I returned to London on the 19th.

I have to acknowledge having received a hearty welcome and every needed assistance from the Conservator and all officers of the Forest Department.

My thanks are specially due to M. Mangin, the Conservator at Algiers, M. Calinet, the Inspecteur at Constantine, and M. Lendri, Sous-Inspecteur at Batna; and I have also to record my indebtedness to Col. Playfair, our Consul-General at Algiers, for much information of a general character obtained from his hand-book for the province, and for assistance and advice in regard to my journeys.

From M. Bulard, in charge of the Government Observatory, I also obtained much valuable information.

CHAPTER I.

Section I.—General Description of Algeria.

General features of the province.

To give a comprehensive idea of the position and value of the forests it will be necessary to note the general features of the province, its climate and population.

Its extent.

Algeria is comprised between longitude 2° 21′ west and 8° 35′ east, and between 37° 5′ and 32° north latitude.

Its length from east to west may be roughly computed at 620 miles, and its maximum breadth from the seaboard to the southernmost point under French control in the Desert of Sahara about 250 miles.

Its natural divisions.

The natural divisions of the country are (1) the Tell, (2) the High Plateaux, and (3) the Desert of Sahara.

The Tell: its topographical features.

I. The Tell is the undulating and more or less mountainous region extending inland from the seaboard to a distance varying from 50 to 100 miles. It is the most important portion of the province by reason of population, cultivation, climate, and forests. The Atlas mountains, which comprise two parallel ranges called the Greater and Lesser Atlas, running from south-east to north-west, and enclosing considerable plains, occupy a large portion of the Tell. The northernmost spurs slope towards the Mediterranean, and are at one point within 30 miles of Algiers, while more eastward the Jurjura, one of the main offshoots of the Atlas, abuts on the coast.

Farther east isolated hills are met with near the coast, such as Ed-dough near Bone; and a separate hill range, known as the Dahra, flanks the coast line to the west of Algiers and shuts out from it the valley of the Cheliff.

The Aurès mountains, next in importance to the Atlas, occupy the south-east corner of the Tell close to the Tunisian frontier; its highest peak Chelliia is the loftiest in Algeria, being 7,611 feet above the level of the sea, whereas the highest points in the main Atlas do not exceed 6,700 feet, and those in the Jurjura 7,542 feet.

Its hydrographical system.

The Tell is drained by several rivers having their sources in its southernmost limits, or in the first slopes of the High Plateaux. The most important is the Cheliff, which, rising in the High Plateaux, has forced for itself a passage through the Atlas range at Bokhari, and flowing thence in a westerly direction almost parallel to the coast, falls into the sea some

50 miles east of Oran; its entire length does not, however, exceed 250 miles; it is, moreover, unnavigable at any part, and like all the more considerable rivers, such as the Mayfrag, Seybouse, the Maktar, and the Rammel, is barely able to force itself a passage through the sand-banks accumulated at its mouth, although during the freshes it may discolour the water for several miles at sea.

The characteristic feature in the hydrographical system of the Tell is the small extent to which the surface drainage is carried off by the rivers; many of the hill torrents disappear on reaching the nearest plain, the water being quickly absorbed by the sandy soil. The rivers also do not appear to drain the more considerable plains through which they pass, as the surface water is in most instances drawn off into marshes and lakes.

Geological formation of Tell.

The geological formation of the Tell is of a somewhat varied description. According to Col. Playfair, the greater part of the Atlas ranges is of the tertiary formation of the miocene epoch. Along their base are generally found marls and sandy limestones.

The cretaceous formation is well developed in places, particularly in the mountains near the sea to the west of Algiers, and granite, gneiss, and mica schist are also found, but to a very limited extent, chiefly in patches on the higher mountains near the coast, such as Jurjura and Ed-dough.

The country throughout possesses great mineral resources. Very rich iron ore is found in abundance, whole hills in some parts near the coast being largely composed of it, and, its removal being attended with little expense, it is exported in very considerable quantities to England for the manufacture of pig iron.

At present there are nine mines in course of being worked for iron ore, eight chiefly for copper, three for lead, and five principally for zinc, antimony, and mercury.

There are also numerous quarries, comprising ten of marble, one of green serpentine, and two of onyx marble, but only one or two are worked at present.

The High Plateaux.

II. The High Plateaux comprise a series of vast sandy plains extending generally from east to west, and separated by parallel ranges of mountains. Lying between the Tell on the north, the Desert of Sahara on the south, the frontier of Morocco on the west, and the Hodna Lake on the east, this region is about 360 miles in length, and 100 miles in breadth. It increases in elevation as it recedes from the Tell, and on attaining a maximum height of about 3,300 feet above the level of the sea, it slopes gradually in a succession

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of steppes towards the Sahara. Considerable depressions occur in the surface of the plains and form a series of lakes, generally salt, called chotts or sebkas, which drain the central portion of the region.

The southern and eastern portions are drained by the sources of several rivers flowing towards the Tell.

From this it is evident that the remarks on the hydrographical system of the Tell apply with more force to that of the High Plateaux.

According to Col. Playfair the disposition of the soil and existence of permeable rock of a concave form have given rise to the supposition that subterranean sheets of water exist in several parts of this region, and it is remarkable that artesian wells have in many instances brought to the surface copious supplies of water.

Viewed from an elevated point in the Tell, the region of the High Plateaux presents to the eye an enormous expanse of grassy land, relieved by an occasional range of hills, barren and almost destitute of trees. Cultivation is carried on to a limited extent, and only in places capable of irrigation.

It is, however, to this region that much interest attaches at present by reason of its enormous resources in alpha grass, now in great demand for the manufacture of paper in England.

The Sahara.

III. The Desert of Sahara comprises two distinct regions, designated the Upper and Lower Sahara: the former, composed of elevated rocky steppes with sand in the depressions, having a minimum elevation of 1,300 feet above the level of the sea, is immediately south of the High Plateaux, and extends westward from the Hodna mountains to the frontiers of Morocco; the latter, consisting of a vast depression of sand and clay, barely more than 360 to 400 feet above sea level, lies to the south of the Hodna and Aurès mountains.

It is almost needless to add that vegetation in both these regions is limited chiefly to groves of date, palms, and fruit trees cultivated by the Arabs in the various oases fed by the torrents, which in the case of the Lower Sahara descend from the Aurès mountains, and the deep ravines which furrow the eastern slopes of the Upper Sahara.

Climate of Algeria contiguous to the sea.

It will be convenient here to refer to the climate of the different regions of Algeria noted above.

Owing to difference in elevation, and greater or less distance from the seaboard, there are considerable diversities in the climate.

In the plains and on the lower hills contiguous to the sea it is not marked by such great extremes of temperature as

is the case in the valleys and plains more inland; the rainfall also is more regular. In the cool or rainy season the temperature at Algiers is—

Temperature at Algiers.

	Maximum.	Minimum.	Mean.
	°	°	°
November - -	79	43	61
December - -	76	37	56
January - -	69	44	56
February - -	67	38	52
March - -	77	41	59
April - -	75	50	62

During the dry months, between May and October, the heat is at times excessive, particularly when the south wind or sirocco makes itself felt; the temperature then ranges generally between 62° and 96°, and is occasionally as high as 108° in the shade; the temperature will be better explained by the following figures:—

	Maximum.	Minimum.	Mean.
	°	°	°
May - -	86	55	67
June - -	89	58	73
July - -	94	56	75
August - -	108	64	80
September -	89	60	78
October - -	82	55	70

Rainfall.

The average annual rainfall at Algiers during the eleven years from 1862 to 1872 was 38°, the maximum 52°, and the minimum 23°.

Climate of interior.

It was not possible to procure data regarding the temperature and rainfall of the more remote and elevated portions of the province, but it will be readily understood that the elevated plateaux and valleys in the Atlas and Aurès mountains, as well as the higher ranges and mountains near the sea, enjoy a climate very similar to that of the south of Europe.

The heat is no doubt somewhat trying during the dry months, and heavy falls of snow are common everywhere above an elevation of 2,000 feet in the cool season, even as late as April. During my stay at Teniet-el-ahd, at 3,807 feet elevation on the 14th of that month snow fell to the depth of several inches. The weather had been charmingly mild, and it appeared as if a change had set in over the whole province contemporaneous with a similar change in England and most parts of Europe.

All the higher mountains remained covered with snow for several days, including Jurjura; and it was to this fact that a very sudden fall in temperature in Algiers was attributed.

In the plains and valleys shut out from the influence of the sea by intervening mountain ranges, as the valley of the Cheliff, the climate is both hotter and dryer than that of any other part of the Tell; the heat in fact is quite tropical.

In the early part of May, when travelling through this valley, I observed that the temperature was as high as [illegible]° in the shade; this, however, is not to be wondered at, the lower hills on either side having been denuded of forest, and the slopes in many places being perfectly bare, as well as destitute of soil.

Climate of the High Plateaux and Sahara.

The High Plateaux, as can be readily imagined, are subject to great extremes of heat and cold. The rainfall there is also less than that of the Tell, and the entire region is exposed to the sirocco from the desert.

The climate of the Upper Sahara is very similar, while that of the Lower Sahara, owing to its depression, is not marked by such intense cold, although forests are not uncommon.

The rainfall is also believed to be much less, and limited in its distribution chiefly to the elevated parts of the Sahara.

General position of the forests.

The forests occupy two distinct positions:—

(1.) A line following the main chain of the Atlas, and contiguous to the southern boundary of the Tell, from the frontiers of Morocco to the Aurès mountains.

(2.) The somewhat broken chain of isolated hills and hill ranges flanking the sea-coast eastward from Algiers as far as Bone, and thence, after turning slightly to the south-west and south, terminating on the Tunisian frontier. The term forests is here applied only to those worth preserving. Besides these, and near their outskirts, there are considerable areas covered with scrub and dotted with stunted or mutilated trees, but if a bird's-eye view could be taken of the whole it would be found that the true forest limits have everywhere receded from the vicinity of the plains, and are now represented by two distinct belts following the summits of the higher hills, one near the southern and the other the northern border of the Tell, the intervening space being occupied by treeless plains and low hills either partly or wholly denuded of forests.

Area of forest land.

As it is of interest to note the proportion between forest land, waste and cultivated land, I subjoin the following figures, showing the distribution within the Tell:—

Area of each department—

	Algiers.	Oran.	Constantine.	
	Sq. Miles.	Sq. Miles.	Sq. Miles.	
	40,604·5	33,243·7	49,058·5	
Area cultivated by—				
	Acres.	Acres.	Acres.	Total.
Europeans -	245,563	233,166	281,031	
Natives -	1,390,935	554,588	3,333,109	
	1,636,498	787,754	3,614,140	6,038,392
Mar. Land	1,168,439	1,660,539	2,827,743	5,656,721
Arable Land	23,181,954	18,827,718	24,955,574	66,965,246
Total area -				78,660,359

It will thus be seen that the forest land represents only 7 per cent. of the area of the Tell, waste land as much as 85 per cent., and cultivated land 7·6 per cent.

In the absence of definite information as to the relative distribution of level ground and mountains, it can only be assumed that the forests which are generally limited to the hills must have at one time covered at least half the surface of the Tell, and that hence indiscriminate felling, grazing, and conflagrations have resulted in the destruction of at least four fifths of the entire forest area.

Extent of forest land compared with population.

The forest area is, however, more than sufficient for the wants of the population, which, according to the following figures, does not exceed 24 souls to the square mile in the Tell.

Population in each Department :—

	Algiers.	Oran.	Constantine.	
	Souls.	Souls.	Souls.	Total.
European -	113,106	103,633	76,978	293,717
Native -	806,184	436,931	1,411,703	2,654,818
Total -				2,948,535

Decrease in native population.

It appears that one quarter of the native population has disappeared since the French conquest in 1830, a very significant fact, when the vast area denuded of forest is considered.

The greatest decrease took place in 1866 and the year following, when the excessive drought produced a general failure of the crops in every part almost of the province, and deprived whole tribes of all means of subsistence.

According to an eye-witness in the department of Constantine numbers perished of starvation in and near their villages in camps, being unable to reach the large towns and settlements, as evidenced by the corpses occasionally met with on the roads.

Cultivation in and near the forests.

It will not be out of place to refer here to the cultivation practised by the native population in and near the forests.

They raise chiefly wheat and barley, but use such small and primitive ploughs that it is not surprising that their crops never hardly exceed six times the quantity of seed sown. It must also be remembered that the land is [illegible] and manured, and but little pains are taken to free it [illegible] ever noxious weeds.

Among the Kabyles or descendants of the Berbers inhabiting the Jurjura and other mountains of the littoral, it was customary to cultivate forest land somewhat according to the method known as "jhoom" in India and "toungya" in Burma. All young trees and brushwood were cut down, and fire applied so as to kill the larger trees. After setting fire to the whole, grain was sown, and the land returned to for cultivation every three years. When finally exhausted it was abandoned for pasturage purposes, and a fresh plot cleared instead for cultivation.

Under French rule this system has been prohibited, but is allowed to be practised under special permission in the more remote localities under military rule.

As regards the State forests it has been everywhere suppressed, and the only cultivation practised within their limits is that of a permanent character on spots proved to have been used for that purpose before the conquest. These spots are in most places only a few acres in extent, and limited chiefly to ravines and hollows, where a little more or less level ground is to be found.

Section II.—The Forests.

Chief species.

The Algerian forests comprise six main species, the Aleppo pine or "pinus halapensis," chêne yeuse or "quercus ilex," chêne liège or "quercus suber," the Atlas cedar or "cedrus atlantica," chêne zeen or "quercus mirbeckii," and the thuya or Atlas cypress "callitris quadrivalis." The pinaster, "pin maritime," scarcely deserves mention.

Other species.

Associated with some of these, but to a small extent only, are found the chestnut-leaf oak, "quercus castaneefolia," the sweet acorn oak, "quercus bollota," and the "fraximus australe."

The pinsapo, "abies baborensis," remarkable for its pyramidical form, occurs only on two of the Atlas peaks, known as Babor and Ta-Babor, near Bougie.

Forests of Aleppo Pine—"Pinus Halapensis."

Aleppo pine forests; position.

The Aleppo pine forms forests of considerable extent along the whole chain of the Atlas and Aurès mountains, but not at a greater elevation than about 3,000 feet. It affects chiefly poor stony soil and rocky slopes, and is estimated to cover altogether an area of 1,901,202 acres.

Extent; general condition.

In many parts these forests have suffered much from fires and mutilation at the hands of the Arabs, who use the bark for tanning purposes. Many tracts, particularly in the Department of Oran, present a very desolate and open appearance, the pines occurring in thin groups and as isolated trees with large spaces intervening, occupied by grass, broom, and stunted juniper and cypress trees.

Growth of tree.

The growth of the tree is generally regular, and the stems tall where the forest is not too open.

Method of working.

In tracts which, by reason of accessibility and local demand, admit of being worked, the system of "jardinage" or selection felling is the only one hitherto in vogue, except where operations can be limited to dead and fallen timber.

Collection of resin.

During the civil war in America the collection of resin was carried on to a very considerable extent in some of these forests, its yearly value being estimated at 40,000*l*.

Recently it was collected in two forests only, leased out for a period of 18 years, and subject to payment of a fixed rent according to acreage.

For the extraction of the resin it was obligatory on the part of the leaseholders to follow what is known in France as the "methode hugues," which may be thus briefly described.

Flat cuts called "quarres" are made longitudinally in the bark a little above the base of the tree, and small earthen cups are affixed at the lower end to receive the resin, but in such a manner as will admit of their being readily removed.

One such "quarre" is allowed to trees from 2 feet to 3½ feet in girth, measured at 3¼ feet from the ground, and two to those of a larger size.

The "quarre" is commenced immediately above the collar of the roots and extended upwards to a height of 35 inches during the first year, and 29 inches during each of

the three succeeding years, whereby it attains in the fourth year a length of about 10½ feet, which it is never thought proper to exceed. In the case of forked trees it terminates at the first large branch. It is invariably abandoned at the close of the fourth year.

The result of this system is that a tree cannot receive more than two "quarres" successively or simultaneously, the only exception being in the case of trees destined to be felled, and which may, in accordance with the method known as "gemmage a mort," receive an unlimited number of "quarres."

A very sharp instrument is used for making the "quarre," which should not exceed 3 inches in width and 5¾ inches in depth. The period in which "gemmage" is carried on is between 1st March and 1st November, when the trees are in sap. In the case of the two forests referred to, the results of the work were not satisfactory, and for various reasons, such as fires, want of good roads, and the insurrection of 1871, the leaseholders were compelled to abandon operations. One of the leases was forthwith cancelled by the governor general, and in the case of the other orders have not been yet passed.

Collection of resin abandoned.

Comparing the Aleppo pine with the pinaster, it is found that the former yields much less resin, and requires much longer time to recover under the operation of "gemmage."

On the whole the process is deemed both unprofitable and prejudicial to the well-being of the forests, and is no longer practised in Algeria.

Situated as many of the forests are, and without natural advantages of any kind, it is fortunate that the bark of the Aleppo pine constitutes an article of considerable commercial value among the native population.

Bark of considerable commercial value.

The present market price of it in the interior is more than 50 francs per 100 lbs., and at Marseilles 17 francs.

The removal of the bark was of course placed under certain restrictions on the French occupancy of the country. Its importation was also prohibited except when accompanied by certificates of origin, signed by the Tunisian authorities.

The illicit removal of bark, however, continued to such an extent from the forests in contiguity to the frontier as to induce the French Government to interdict altogether, in April 1875, the importation by land of bark of foreign growth.

Forests of Chêne Yeuse—"Quercus Ilex."

Forests of "quercus ilex."

This species, known as the evergreen oak, has a wide distribution, being found at altitudes varying from 2,500 to 5,000 feet along the whole chain of the Atlas and higher hills near the coast. It affects generally good soil, more or less sandy, and forms in many parts almost pure forests, the total area of which in the Tell is estimated at not less than 1,337,829 acres.

Position and extent.

It occurs also, associated with the Atlas cedar, at the higher elevations, and with the Aleppo pine at elevations of about 3,000 feet.

Growth.

The tree very rarely attains a greater height than 25 to 30 feet, and for the most part has a small dwarfish appearance, while over large areas it occurs more in the form of dense scrub 10 to 15 feet in height.

From its wide distribution and great vitality, it forms one of the most important constituents of the forests of the Tell.

Wood in large demand.

The wood is everywhere largely in use for fuel, and the demand is so great that it has been found necessary to introduce regular cutting in many places on the "taillis" or coppice system.

System of working.

The rotation is generally from 18 to 20 years, and a considerable number of standards are left to shed seed. In the Forest of Boorsala, near Batna, where the Aleppo pine occurs in many parts intermingled with evergreen oak, no standards of the latter are left, it being deemed desirable to convert such portions into pure pine forest.

Forests of Chêne Liège—"Quercus Suber."

Forests of cork oak; position.

These forests, hitherto the most valuable in Algeria, from a commercial and economic point of view, are situated chiefly on the hills near the coast, and principally in the western part of the province, in the Department of Constantine.

Extent.

They embrace altogether an area of about 617,206 acres,

Elevation.

and are found at almost all altitudes up to 3,000 feet. Some even occur on the plains only a few hundred feet above the level of the sea, as at Jemmapes, about 20 miles south-east of Phillipville.

The tree is believed, however, to thrive best at an elevation of about 2,000 feet, but in very dry localities having somewhat poor sandy soil, it occurs more or less as pure forests, but at the higher elevation is intermixed with "quercus ilex" and "quercus mirbeckii."

From the fact that it is found in the plains where it is exposed to great heat, and even yields bark of considerable value in such sites where frosts and snow are unknown, it would seem to be adapted for introduction into some of the lower hills of India, having a mean temperature of 58° in the cold season and of 76° in the hot season.

It attains a very considerable girth, but trees with tall and regularly shaped stems are rare. Growth of tree.

Disposal by sale of large areas.

The Government has deemed it expedient to throw open these forests by sale to private enterprise, and at present there are 428,063 acres of cork oak forest in the possession of private individuals and companies.

As there are no conditions imposed upon the grantees or purchasers beyond those relating to the purchase money, the action of Government in regard to these forests is much deprecated by officers of the Forest Administration and others interested in the preservation of the forests.

With the high prices ruling as at present for the inner bark or liber for tanning, there is, no doubt, great temptation on the part of forest holders to seek quick returns by felling all trees of any size almost for liber, and this has been already done to a considerable extent.

The opinion very generally entertained is that in a country so much denuded of forest as Algeria is, no measures should be introduced which might tend to affect or diminish the forest area. It has, on the other hand, to be remembered that many of the cork oak forests are in localities possessing no facilities of transport, and that the preliminary operation of "demasclage" involves considerable outlay, for which little or no return can be expected for at least eight years.

The Government is therefore disposed to retain only a limited area of such forests in its own hands, and abandon the remainder free of restrictions so as to induce capitalists to take them. It is admitted, however, that the forest code fully provides for interference on the part of Government to check the destruction of forests when likely to affect public interests, as would be the consequence of denudation in Algeria.

For obtaining the cork of commerce the method generally followed is similar to that in vogue in the south of France and elsewhere.

"Demasclage."

The first operation known as "demasclage" is simply the removal of the existing or virgin bark called "l'écorce male," which is of little value, and is generally left to rot in the forests. The operation usually takes place between the 15th May and 15th September. Circular and longitudinal incisions are made with an axe into the trunk of the tree, and the bark is

then forced off with the handle which is specially made for the purpose. Longitudinal incisions are then also made through the liber to the depth of the heart wood, with the object of facilitating the uniform expansion of the new bark and checking in it the formation of fissures. Generally two such incisions are made on trees of average girth, but as many as three and four on the smaller ones and those of exceptional size, on account of the rapid development in the former and larger circumference of the latter.

The operation requires careful and well-trained workmen, who are paid by the day in preference to employing under the job or contract system.

On an average one workman can operate on 40 to 50 trees in a day. Trees are not generally deemed fit for "demasclage" until they have attained a girth varying from 35 to 40 centimetres, measured at one metre from the ground.

They are then 25 to 30 years of age if grown from seed, and 15 to 20 years if the produce of a stool.

Trees of the above-mentioned size may be stripped of bark up to a height of 1½ metres from the ground, and larger trees, if of vigorous growth, as far up as the larger branches.

Regular cuttings.

Regular cuttings or removal of bark of commerce commence when the new bark has attained a thickness of 22 to 30 millimetres, which is not until after a lapse of 8 to 14 years. Generally the first cutting is after eight years, the second after eleven years, and the third three years later, when the trees backward in growth and passed over in the first and second cuttings are operated on without regard to thickness of bark.

To ensure regularity and a continuous as well as uniform yield, it is usual to divide the forest into "coupes" according to area, and work in each successively, returning to the first after a lapse of eight or nine years, and observing the same order of cutting.

Growth of bark.

On dry and more elevated localities the bark grows slowly, but is of much finer quality than the produce of trees at lower altitudes and on better soil. In the forest of Beni Sala, at a considerable elevation, bark nine centimetres in thickness was found on a tree which proved, on examination, to have been stripped of bark 80 years previously.

Inner bark for tanning.

In most forests the felling of trees for liber for tanning is carried on simultaneously with the removal of ordinary bark, but generally only old and decaying trees, and those in need of being thinned out, are selected for this purpose.

Exclusion of fire.

The exclusion of fire is a very important operation in the cork oak forests, and particularly in the portions recently subjected to "demasclage," the trees then being sure to succumb to fire.

The method generally [illegible] known as "contre feu," a cleared track or fire [illegible] being made around the portions to be protected, and fire applied on the outer edge when a conflagration is apprehended.

In the State forests the lessees or purchasers have to maintain fire traces for a period of three years after the operation of "demasclage."

These fire traces must be 50 to 80 metres in width, but of this only 10 metres in the centre is entirely freed from all overgrowth, the remainder being only partly cleared by the cutting down of grass and underwood.

Regular working plan projected.

Hitherto the system pursued in the working of the State forests has differed but little from that in vogue with private parties, but latterly a working plan has been submitted for the approval of Government, which will secure the simultaneous working and protection from fire of every part during a short period or *période transitoire*, at the close of which, with the information gained, the forests will be divided into regular séries, embracing trees of nearly equal capabilities as regards growth of bark.

To each série a separate revolution will also be assigned in accordance with its rate of production.

Forests of Atlas Cedar—"Cedrus Atlantica."

Forests of Atlas cedar.

The Atlas cedar has a somewhat limited range of distribution, being found only at the higher elevations, between about 4,000 and 7,000 feet above the level of the sea.

Principal cedar forests.

The principal cedar forests are those of Teniet-el-ahd and Beni Sala in the Atlas mountains, in the Department of Algiers, and Belesma, Djebel Tuggurt, and the Aurès mountains in the Department of Constantine.

The latter are by far the most extensive, as will be seen by the following figures:—

	Acres.
Department of Algiers: Cedar forests	5,182
" Constantine "	186,869

Much injured at lower elevations.

In the more accessible localities these forests have suffered considerably from fire and grazing, Arab herdsmen being formerly attracted to them in large numbers during the dry season, when water and pasturage become scarce in the plains.

Cedar forest of Teniet-el-ahd.

A large portion of the forest of Teniet-el-ahd has been thus injured, and numerous blanks are to be met with in it, some almost bare, others occupied chiefly by "quercus ilex." In this portion also nearly all the larger cedars bear traces of

injury, either by fire or hanging limbs, many being forked and having huge side branches as well as large hollows.

Reproduction, however, is progressing favourably in many parts, now that grazing is prohibited, and dense thickets of seedlings, and seedlings 15 to 20 feet in height, dotted thickly around old and decaying trees, constitute a characteristic feature of the lower portions.

The forest, in the more elevated part, is on the whole well stocked, the cedar standing chiefly in the condition of "massif assez complet," but intermixed with chêne zeen, "quercus mirbeckii," which, however, does not attain a very great size at these altitudes. The cedars are mostly very old trees, but none appear to exceed 15 feet in girth. Many have clear straight stems 60 feet in height and more, and, having lost the leading shoots, have tabulated crowns resembling a Burmese umbrella. Reproduction is almost at a standstill, and dead trees are numerous, many evidently killed by fire at the hands of the Arab herdsmen, who were in the habit of setting fire to large areas to stimulate and expedite the growth of young grass.

Extraction of timber is on a very limited scale, and restricted to chiefly dead trees and decaying trees where they can be best spared.

Cedar forests of Belesma and Djebel Tuggurt.

In the Belesma and Djebel Tuggurt forests, situated within 10 miles of Batna, the growth of the tree is very superior, particularly at the higher elevations, commencing at about 5,000 feet. The growth is at same time somewhat slow, 160 years being the age of trees 5 feet in girth. Young trees appear liable to injury from snow, which often breaks or bends the leading shoots, besides breaking the branches.

It remains on the ground to the depth of often three feet for several months consecutively.

Reproduction in lower portions.

Reproduction is good at the lower portions, where felling to a considerable extent has taken place on the "jardinage" system, the young trees covering the ground in dense masses like plantations. In another part, chiefly occupied by "quercus ilex," it was curious to observe the large number of cedar seedlings coming up between and partly sheltered by the oaks. They appear to have originated from seed shed by some cedars on an overhanging ridge, and will, it is expected, cause the oaks to disappear.

Timber road.

It is only within the last few years that a good road has been constructed to the higher parts of these forests.

Owing to the steepness of the gradient in many places, and presence of masses of rock (sandstone) on the surface, considerable difficulties had to be overcome. The road is

carried up zigzag, and through passages blasted for the purpose.

It was the labour of military convicts, and reflects no little credit upon the Engineer Department.

Coupes d'amélioration.

Although no working plan has yet been framed for these forests, all cuttings are now made on the principle of "coupes de régéneration."

In the first or "coupe d'ensemencement," it is necessary to leave a large proportion of trees, not only for seed, but also to maintain a sufficient amount of shade, without which the surface soil would become too dry to support the young seedlings. Sufficient attention has not been paid to this by a young officer entrusted with the selection of the trees in one of the earlier "coupes," and it was much feared that artificial means would have to be resorted to to insure the requisite crop of seedlings coming up.

As elsewhere, the next or "coupe secondaire" only takes place when the ground is sufficiently stocked and more light and space are required, and the third or "coupe definitive," when all the remaining trees can be safely removed.

It is noteworthy that grass and herbaceous plants do not threaten the existence of the young seedlings as might have been supposed; the greatest danger arises out of the ground being too much exposed to the sun, the result of which is that it becomes too dry and hard to support any vegetation beyond very short grass.

Restocking experiments in blank places.

Experiments are in progress to test the feasibility of restocking the open spots or blanks at a reasonable cost.

An area of about 3½ acres has been worked up by means of a native plough to the depth of 5 centimetres, and seed sown in rows 40 centimetres in width, and 1¾ metres apart. The seed, which was very lightly covered, had been obtained from cones taken from the trees in October and November, and kept perfectly dry until required in March, when they were steeped in water until partly swollen, and then finally subjected to a temperature varying from 68° to 77° Fahrenheit.

Towards the end of April many of the young seedlings were well above ground, and to protect them from the afternoon sun small banks of earth a few inches in height had been made on the south-west side of each row. Already 200 francs had been expended, and as 50 francs in addition would be required for weeding, &c., it was evident that a less costly method must be devised. The forest officer in immediate charge was in favour of nurseries and stocking the ground with transplants.

The next experiment about to be undertaken is ploughing the surface of the "coupes d'ensemencement."

Estimate of annual yield.

While on the subject of these forests it may be of interest to note that the "possibilité" or annual yield, judging from comparison with other well-known forests, has been estimated at 4 metres cubes per hectare, equivalent to 57 cubic feet per acre.

At present, however, the annual fellings are regulated by local demands, which are small.

As in France, the trees are sold standing in the forest; the price does not exceed at present 10 to 15 francs per metre cube, but will no doubt increase as soon as the railway is completed to Batna.

The branches and timber of no particular value are disposed of when possible at 20 to 25 centimes per stere or metre square, but realizes as much as 5 to 6 francs per stere in the towns and settlements; the high cost of labour, 6 to 8 francs per day for Europeans, and the long (land) transports will explain this.

Forests of Chêne Zeen—"Quercus Mirbeckii."

Forests of "quercus mirbeckii;" position.

This tree forms considerable belts of forest at the higher elevations on the mountains of the littoral, and is found intermixed with other species throughout the entire length of the Tell, at altitudes varying from 3,000 to 5,000 feet.

It seems to thrive best at the lower elevations, where it attains very stately proportions, a marked contrast to the tree at 4,000 and 5,000 feet altitude, where when young it suffers much from snow.

Extent.

It is estimated that there are altogether not more than 149,614 acres of forest of this description in Algeria.

Working of timber.

In the more accessible localities, such as Ed-dough, near Bone, these forests have yielded considerable supplies of timber for use as railway sleepers and for house building purposes. From certain forests it could only be extracted by means of slides leading down steep declivities overhanging the sea-shore, and in this manner over 900 tons at one spot were transported to the very edge of the beach.

System of felling.

As elsewhere, fellings have been chiefly regulated by local demand; but in a tract leased out to the Société Général Algerienne for 15 years the work is to be carried out more in accordance with a regular system of management.

After a careful survey and formation of "parcelles" or compartments representing separate conditions and stages of growth, the forest was divided into séries or portions sufficiently homogeneous to admit of the same treatment, and each série (about 5,000 acres in extent) into four "affectations."

Fifteen years, the term of the lease, being considered a "période transitoire," each "affectation" was divided into as many parts or "coupes," and a plan framed, denoting the operations to be conducted yearly in each, with a view to the ultimate introduction of a regular system at the close of the lease. The forest being of a very mixed description as regards age, operations chiefly comprise transformation cuttings.

Forests of Atlas Cypress—"Callitris Quadrivalis."

Forests of Atlas cypress; position and extent.

This species, of which there are 76,775 acres in the departments of Algiers and Oran, only occurs in any profusion in the lower and very arid portions of the Atlas range.

It is chiefly found associated with the Aleppo pine at elevations of about 2,500 feet, and affects very poor, stony, and calcareous soil.

Growth.

The maximum size which it attains is 15 to 20 feet in height and 2 to 3 feet in girth; but over large areas it is found in the form of large bushes, having numerous stems, the result doubtless of mutilation and fire.

Utility.

As it coppices readily it is considered a valuable constituent of the Algerian forests. It is largely used for fuel, and from the roots a beautifully grained wood is obtained for ornamental work.

Forests of Pinaster—"Pin Maritime."

Pinaster—"pin maritime."

As already mentioned, the occurrence of this species is too limited to deserve a place among the principal Algerian forest trees.

It is found in the department of Constantine, but not over a larger area than 3,765 acres.

Section III.—Constitution of Forest Area and the Forest Service.

Constitution of the forest area.

The forest area, exclusive of 807,666 acres in possession of private individuals and companies, is thus distributed:—

	Civil Territory.	Military Territory.	Total.
	Acres.	Acres.	Acres.
State forests	608,683	4,048,884	4,657,567
Communal forests	60,149	131,338	191,487

making a total of 4,849,054 acres under the management of the forest service in all matters relating to working and improvement.

For purposes of surveillance and prosecution of forest offences the forests are divided into three zones:—

First zone. (1.) Those situated in remote localities contiguous to the frontier, where, for political considerations, only military control is deemed expedient.

Forests of this category, embracing in all an area of 1,878,812 acres, have been provisionally withdrawn from the direct control of the Forest Department. The General Commanding is charged with the repression of forest offences by the means at his disposal.

Requisitions for timber are forwarded to the forest authorities, and the selection and removal of the trees are in accordance with the instructions received.

Second zone. (2.) The second zone embraces all forests situated within civil territory, and in which supervision and prosecution of forest offences are conducted as in France.

These forests embrace an area of 668,832 acres, and are divided according to their extent and importance into a certain number of ranges, called "triages," each in charge of a forest subordinate. The extent of a "triage," which rarely exceeds 1,900 acres in France, is on an average from 9,800 to 12,300 acres in Algeria.

Every forest subordinate is provided with a horse, but these areas are admitted to be too large, and endeavours are being made to reduce them very considerably. It has to be remembered, however, that the Algerian forests are not in need of such careful watching at all times as is the case in France, the population being so sparse. Where a "triage" embraces several forests spread over exceptionally large areas a native subordinate or "garde indigéne" is placed under the orders of the European subordinate in charge to assist in the detection and investigation of forest offences. The European subordinate is, however, held responsible for all violations of forest rules committed within his range or "triage."

He submits a written report of the circumstance, with full details, to his district officer or "chef de cantonnement," who forwards it on with his opinion and proposals, and notes at same time the penalty incurred and character and means of delinquent. The "inspecteur" in his turn transmits all the papers with his observations to the conservator, who passes the necessary orders and returns the papers. If the defendant fails to adjust the fine within 30 days he is summoned before the nearest judicial court, and proceedings are instituted against him by the "inspecteur." Cases involving a fine exceeding 1,000 francs are referred by the conservator to the Governor General.

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Third zone. (3.) The third zone comprises forests within military territory, but outside the first zone. They embrace a total area of 2,310,410 acres, and are wholly under the care of the Forest Department. The procedure in dealing with forest offences is the same as in the second zone, except when the delinquents are not French subjects, in which case the report, &c. are addressed to the military commandant, and the matter is either dealt with by him or a military court convened for the purpose.

Forest service. The Forest Department in Algeria is under that branch of the administration which is known as the "Direction des affaires civiles et financières."

It is under the control of a conservator, having his head-quarters at Algiers, and seven "inspecteurs" acting under his orders stationed as follows:—

Two at Algiers and Miliana, in department of Algiers.

Two at Oran and Sidi Bel Abbés, in department of Oran.

Three at Constantine, Bone, and Setiff, in department of Constantine.

Each of these inspectors has a "garde général adjoint sedentaire," similar to a personal assistant, permanently attached to his office establishment, to assist and carry on current work during his absence from head-quarters.

The inspectors have under their orders an executive establishment, comprising 21 "sous inspecteurs" and "gardes généraux" (the latter answering to our assistant conservators), who are located at 21 forest stations in charge of as many cantonments, there being seven "inspecteurs" and 21 "cantonnements."

The subordinate establishment is composed of 21 "gardes généraux adjoints sedentaires," 81 brigadiers, each in charge of a separate range, 137 European forest guards, and 80 native forest guards.

In addition to the controlling staff already noted there are five officers of the grades of "sous inspecteur" and "garde général," who constitute a commission charged with the demarcation and survey of forests and all cognate matters.

Section IV.—Forest Rights and Demarcation.

Land formerly divided into five categories. Consequent upon the previous simple division of the land under the Turkish authorities, the demarcation of forests as State forests has not been attended with any great difficulties.

On the occupation of the country the land was found to be divided into the following five different categories, the last of which, comprising forest land, was forthwith formed into State forests:—

(1.) Melk. Freehold, chiefly gardens and small areas of cultivated land, in possession of private individuals, and held under regular titles.

(2.) Arch. Tribal land, the common property of all the members of a tribe; the portions cultivated by each member remain the property of the tribe, and, as such, are liable to be transferred from one to the other at the will and caprice of the chiefs.

(3.) Habbous. Land attached to mosques, and belonging to religious fraternities.

(4.) Azel. Land the property of the State, but leased to private individuals for cultivation, &c.

(5.) Beylick. All forest and waste land not included in the above, and belonging to the State.

Forest land beset with rights of usage.

The French, however, found a large portion of the forest land known as beylick, beset with rights of usage.

These were formally recognized in the law of 16 June 1851, and in accordance with a resolution of the Senate in 1863 commissions were appointed to define their nature and extent, and wherever practicable to separate them from those of the State by giving up to the native population such portions of forest land as would be a fair equivalent.

These rights embraced not only grazing and collection of wood, but permanent cultivation over small scattered areas in the heart of the forests.

Procedure in exercise of forest rights in State forests.

In civil territory and forests in military territory, but under Forest Department control, the following procedure was enforced:—

(1.) *Collection of wood and fuel.*—Parties requiring wood, &c. submit once a year to the civil or military officer in immediate control, requisitions specifying the description and quantity of wood required, and the particular forest tract from which it would be taken. These requisitions are verified by the local officers, and after classification, according to douars or sections of a tribe, are submitted in one general statement to the prefect or general commanding the division, who forwards it with his remarks to the "inspecteur" of that particular division or inspection. This latter officer, after satisfying himself that such requisitions are not in excess of the "possibilité" of the forest in question, issues the necessary instructions for the marking and delivery of the timber, which is then removed by the different parties collectively on a fixed day, and under the supervision of the forest guards and control of a petty native official deputed by the chief of the tribe, who is held responsible for all injury and violations of forest rules.

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Parties absenting themselves at the time fixed forfeit all claim to wood during that year.

Where the forests are wholly under military control, as in the first zone, requisitions are transmitted by the local or tribal officers to the general commanding, and by the latter to the conservator of forests, who deputes an officer to see to the delivery, &c.

(2.) *Pasturage.*—The only condition enforced was that grazing is not to be carried on in any tracts or portions of the forests which the Forest Department may deem it necessary to close. Subsequently a resolution of the Governor General prohibited it definitely on all sites recently cleared of timber, and in all forests likely to be injured by it.

Formation of communal forests.

The necessity for forming communal or district forests was generally admitted, but at the outset it was left optional with the Arab tribes to have them.

Latterly it has been decided otherwise, and they are about to be formed wherever practicable. The procedure, which is very simple, commences with an inquiry, at which full information is collected from the tribal chiefs regarding the position and extent of the tracts over which rights have been enjoyed, and the nature of the latter.

The area of the forest is then determined by allowing a hectare as pasturage for every five goats, or six sheep, or two head of cattle or horses, and calculating a yearly yield sufficient to supply 3½ stère of wood in the form of "perchis" or posts for each gourbi or family tent, and 150 decimètre cubes of young timber for every plough.

For firewood no particular calculation is made, as the natives in many parts are in the habit of using dried cow-dung for fuel.

System of demarcation.

For the demarcation of forest boundaries small stone pillars, a few inches square, and about a foot in height, are fixed at the salient points, but very far apart. Small trenches, about a foot deep, are also made around some forests, but generally natural boundaries are selected.

Section V.—Forest Conflagrations and Breaches of Forest Rules.

Forest fires.

Conflagrations have for many years past been the main source of injury to the Algerian forests. The nomadic habits of the Arabs in the interior, and the practice of setting fire to large areas to increase and stimulate pasturage, no doubt occasion the evil.

Early measures for suppression of fires.

The measures taken to check the occupation of the country by the French were not of a very definite or practical nature. The forests were too extensive and too much scattered as well as too unproductive to admit of being carefully watched and protected by fire paths, and all that the small forest staff could undertake was the maintenance of "postes vigiles" on elevated positions, the suppression of fires by the "contre feu" method, and detection of offenders.

Unsatisfactory results.

When, in addition to this, the unsettled state of the country and the frequent occurrence of insurrections among the Arabs are considered, it is not surprising that the forests continued to be overrun in almost every part by fires, only those at the higher elevations escaping occasionally.

Destructive fires.

The most destructive fires appear to have been those which took place in 1865, during the insurrection of 1871, and in 1873, when, after a violent sirocco, numerous fires burst forth in all parts of the province. The forest of Ed-dough, near Bone, was then much injured, and the whole country within a radius of 30 miles was overrun by fire.

Cause of fires.

Some of these conflagrations were no doubt the result of ill-will on the part of the Arabs, but many arose out of carelessness, an instance of which was the great fire which

Effects of fire in the forest of Teneerat.

ravaged the forest of Teneerat, in the department of Oran, in 1872.

A road through this forest is much used for the transport of alpha to Sidi Bel Abbés, and no doubt is entertained that the fire originated with the carelessness of the Spaniards engaged in this work.

The forest consisted chiefly of belts and groups of Aleppo pine and cypress, more or less open, and interspersed between patches of high grass, lentisk bushes, and alpha grass. Such was the fury of the conflagration that it was impossible to check it or approach it by day. Counter-fires could not be started on a sufficiently large scale owing to the existence of large lentisk bushes, to remove which either by the axe or fire would have involved great labour and loss of time. It was only about daybreak, when the wind had somewhat lulled, that large bodies of Arabs directed by the forest guards could make any real attempt at extinguishing the fire, but even then it burst out afresh, and was only suppressed after raging three days and spreading over 54,362 acres.

The scene of desolation presented by this forest will be readily understood when I mention that it is studded in almost every part with dead trees, either black and charred or simply struck dead by the hot blast, as is the case in "toungya" clearing in Burma.

Signs of life are only to be seen where there are cypress trees, powerful suckers having started up around the black and charred parent stems.

Most destructive conflagrations.

The year 1871 was, however, characterized by the largest number of fires, one of the consequences of the insurrection which broke out towards the close of the Franco-German war. A portion of the cedar forest of Belesma suffered at that time, but not to a very great extent, young trees and felled timber being chiefly destroyed, although the hills in that quarter were entirely overrun by bands of revolted Arabs, who were, as elsewhere, guilty of the greatest atrocities. Several European workmen were surprised, and all but two killed; the temporary cabin of a timber merchant was set on fire, and the occupants, a woman and four children, were massacred. The "inspecteur" of the division was also surprised and killed, defending himself, revolver in hand, against more than 20 men, including two native forest guards, who had suddenly turned upon him.

Fire in the Belesma cedar forest.

Two forest houses or quarters of forest guards were also destroyed in this forest, but on the occasion of my visit three others had been constructed at a cost of 60,000 francs, the amount of indemnity paid by the Arabs to the Forest Department.

Fires in cork oak forests.

Fires occur with the greatest severity in the cork oak forests, and this may in a measure account for many outlying forests not being satisfactorily managed by the owners.

An exception is a forest of about 15,000 acres in the Beni Sala range, about 40 to 50 miles from Bone.

The owner, Capt. Hope, an Englishman, who has recently purchased it, has commenced the formation of *permanent* fire paths around and through various parts of the forest. The external ones are 150 feet wide and the inner ones 50 feet, but the entire removal of all grass, underwood, and trees is limited to about half the space noted.

It may be of interest to mention that he employs four native forest watchers on salaries varying from 30 to 50 francs per mensem, and entertains extra hands during the period of danger from fire, when a constant look-out has to be maintained from three elevated watch stations. He has adopted a very conciliatory method of treating the Arabs, and permits a number of them to reside within his forest on condition of assisting generally and keeping out fires.

Final measures adopted by Government for suppression of fires.

The constant ravages by fire, and the powerlessness of the authorities to trace out the offenders, at last induced the Government to take more direct measures to check the evil.

At the suggestion of General Chanzy, the Governor General, a special law was passed on 17th July 1874, the principal provisions of which are—

Forest law of 1874.

(1.) Absolute prohibition against carrying or lighting fire in the interior of or within a distance of 200 metres from the borders of the forests during the four months constituting the hot season, the owners of forests not even exempted from this rule.

(2.) Prohibition during the same period against setting fire to brushwood, grass, or any description of vegetation within a radius of 4,000 metres from the forest, except with the express permission of the local authorities and under certain conditions.

(3.) Maintenance of "postes vigiles," or watch stations, on elevated positions by the Arab tribes, with a view to the authorities being quickly advised of the approach of fires and the necessary assistance being despatched wherever required.

(4.) The neighbouring Arab tribes collectively held responsible for fires, and their members declared individually or collectively liable to sequestration of property, as may be warranted by the extent of injury denoting collusion and general participation.

(5.) Suspension of all rights of pasturage for a period of six years throughout the entire area of forests injured by fire.

(6.) For each contravention of this law a fine varying from 20 to 500 francs, with the option of imprisonment for periods varying from six days to six months.

(7.) Publication yearly in the official gazette, between 1st July and 1st November, both of this law and of the Monthly Reports of the measures taken or about to be adopted to give effect to the law.

Measures adopted to give effect to law of 1874.

In addition it may be noted that special instructions on the subject are issued yearly to all generals, prefects, and forest officers. The latter are required to submit to the generals commanding and prefects statements setting forth the stations to be taken up as "postes vigiles," the position, character, and extent of the forests to be protected.

A considerable military force is also called out to serve as patrols in the forests. In the department of Constantine it was fixed last year at 6,000 men. With the large force maintained this does not appear excessive, the strength of the army being about 60,000 men.

Enforcement of the law attended with good results.

The enforcement of this law and adoption of these measures are said to have been attended with excellent

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results, no serious conflagrations having taken place; but it remains to be seen whether they will not provoke some discontent among the Arab population.

The Arabs, however, prefer *military* rule and the short and summary process of dealing with delinquents and settling disputes, and hence it may be presumed that they will acquiesce in the course taken by the Government.

Breaches of forest rules.

During the year 1874 the number of cases reported was 1,895, of which 828 were in civil territory and 1,067 in military territory. The fines realized were 45,674 francs in the former and 92,987 francs in the latter, making a total of 138,661 francs.

The most common offences were theft of bark from the Aleppo pine, unlawful grazing, and causing fires.

The second of these offences requires untiring vigilance and activity on the part of the forest guards to insure detection of offenders.

Sympathy with offenders.

Another difficulty formerly experienced by the forest officers was the sympathy of the judicial officers for delinquents and consequent unwillingness to inflict suitable fines; an instance of which was a case of unlawful grazing in a small cedar forest near Setiff; the culprit, who was a wealthy and influential Arab, was fined only 15 centimes for having 3,000 sheep and 700 goats on the site of a large "coupe."

To add to the annoyance of the "inspecteur," who had to sleep out in the forest and make a forced march several hours before daybreak, the Arab when surprised was most insolent, and referred coolly to the large sum he hoped to realize by sale of wool.

CHAPTER II.

SECTION I.—"REBOISEMENT."

"Reboisement."

Experiments were commenced some years ago to test the practicability and ascertain the cost of planting up barren spots with suitable forest trees, but it was not until 1865, when funds were specially provided by the Société Générale Algerienne that definite measures on a somewhat extended scale were taken in hand.

The convention with Government provided that the society should loan 100 million francs to Government for work of public utility, and receive in return 100,000 hectares (250,000 acres) of the best land, at a nominal rent of one franc per hectare. It was with funds thus obtained that "reboisement" operations were undertaken near Constantine and Orleansville, in the valley of the Cheliff.

Sites selected.

The sites selected were perfectly destitute of trees, and, in the case of those near Constantine, were in many places simply dry slopes without a particle of soil and vegetation of any description, there being nothing on the surface but decomposed and disintegrated schist.

Method of planting Aleppo pine on barren slopes.

The method observed was that of raising seedlings of the Aleppo pine in nurseries, and putting out into holes nine inches square and deep, in rows two metres by one and a half metre apart. The holes have to be prepared some three months beforehand, and are left open till required. During the first hot season it is customary to water the plants either by irrigation or by carrying up water on mules.

Plantations of Atlas cedar.

Some slopes near Constantine have been successfully planted up with the Atlas cedar. The same system of raising and planting out seedlings is resorted to, but the plants in the nurseries require shading, and those in the main plantation have to be kept freed from weeds for two or three years. These slopes have good deep soil, and are about 2,500 feet above the level of the sea. The rock at the surface is sandstone.

Eucalyptus plantation.

There is also a small area planted with Eucalyptus globulus at about 2,000 feet elevation. The trees were planted out in rows 2 metres and 1½ metre apart, and are said to be only 12 years of age. The majority of them are from six to 12 inches in girth, but a few are much larger, one being as much as 3 feet 4 inches in girth and about 36 feet in height.

The existence of this little plantation is somewhat remarkable, as the trees have to contend with both frost and snow, and suffer yearly by the death of the leading shoots.

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Experiments with other varieties.

Operations at Constantine also embrace the raising of numerous European varieties of trees, including fruit trees for the use of colonists, but, apparently, the latter are not interested in experiments of this nature.

A trial was made also with some seeds received from India, but the results were not satisfactory. They came to hand at the wrong season, and the plants died down soon after germination had taken place, the only exception being two deodars, now about eight or nine years of age, which are doing well.

Total area planted up.

The total area planted up to date, with Aleppo pine and to a very small extent with the Atlas cedar, is 4324·2 acres.

Expenditure and labour.

The expenditure has been heavy, particularly at Constantine, and has been, on an average, 500 to 1,500 francs per hectare, equivalent to 8*l.* to 24*l.* per acre.

Labour, however, is costly, Europeans being paid at the rate of 6 francs and kabyles (from the hills) 3½ francs per diem. Military labour is sometimes employed at the rate of 10 sous daily for each private and two sous to the corporal for each man employed.

General introduction of Australian species.

In the matter of "reboisement" the Australian species, so remarkable for their rapid growth, are looked upon by many as the most suitable. The province is chiefly indebted to the perseverance and labour of three men, Messrs. Rammell, Cordier, and Trottier, for their successful introduction, and, at present, we meet with little plantations of Eucalyptus globulus near almost every large town near the coast and along the railway line between Algiers and Oran.

The most sanguine expectations, however, are entertained by M. Trottier, who has written several pamphlets on the "reboisement" of Algeria, and submitted a scheme for the consideration of Government, in which colonization and "reboisement" would progress hand in hand. Beyond having a considerable area sown with eucalyptus seed by way of experiment and encouraging the formation of small plantations, the Government has taken no decisive measures as yet, and this is hardly to be wondered at, as the great drawback with most of the Australian species hitherto tried is that they require good deep soil and are only suitable for the plains and lower hills in certain localities. Colonists, it must also be remembered, are difficult to obtain, and those who do come, very naturally prefer the elevated plateaus in the Atlas to the hot plains in the Cheliff and elsewhere, the proposed sites for eucalyptus plantations.

Rapid growth of eucalyptus.

Yet the eucalyptus deserves a fair trial, as its growth is certainly very rapid.

In a plantation belonging to M. Trottier at Hussein Dey, a few miles out of Algiers, the trees planted in 1868 at distances of 3 metres apart exhibit a maximum girth of 3 feet 3 inches (at 6 feet from the ground) and a mean girth of 2 feet. Some near the "Jardin d'Essai" at Algiers are 5 feet in girth and only 12 years old. These are, however, in an avenue somewhat open, and, as may be expected, have not very well shaped stems.

Section II.—Yield of the Forests.

The maximum annual yield or "possibilité" is roughly estimated at—

	Timber for ordinary purposes.	Firewood.	Total.
	Metres cubes.	Metres cubes.	Metres cubes.
State forests -	1,100,000	2,000,000	3,100,000
Communal forests	37,000	66,000	103,000
Private forests -	45,000	321,000	366,000
Total -	1,182,000	2,387,000	3,569,000

But local demand and difficulties of transport limit the annual out-turn on an average to—

	Timber for ordinary purposes.	Firewood.	Total.
	Metres cubes.	Metres cubes.	Metres cubes.
State forests -	779,000	1,223,000	2,002,000
Communal forests	26,000	41,000	67,000
Private forests -	31,000	205,000	236,000
Total -	836,000	1,469,000	2,305,000

The forests also yield 12,000,000 kilogrammes of bark for tanning, of which 7,000,000 are the produce of private forests, and about 50,000 tons of alpha grass.

The average annual yield of the cork oak forests is—

	Kilos.
State forests - -	265,000
Communal forests -	35,000
Private forests - -	2,100,000

or a total of 2,400,000 kilogrammes, equivalent to about 2,362 tons.

Of forest products noted above, it is estimated that in addition to all timber (except 950 metres cubes) 8,000,000 kilogrammes of bark for tanning and 400,000 kilogrammes of cork bark are consumed within the province.

Section III.—Financial.

Financial prospects.

Forest conservancy in Algeria has not yet proved remunerative from a financial point of view, and it is hardly necessary to remark that it could not well be otherwise in the case of forests so situated.

According to the budget for 1876 the expenditure of the Forest Department is estimated at 905,042 francs, and the actual receipts at 440,140 francs 60 c., whereby a deficit is anticipated of 464,901 francs 40 c.

If credit is taken for the value of forest produce supplied gratuitously on account of forest rights, the deficit is reduced to 603,446 francs, equivalent to about 24,000*l.*

An analysis of the expenditure sheet shows:—

	Francs.	c.
Establishment - -	423,637	50
Travelling expenses, horse allowance, and rents -	264,160	0
Compensation to employés and widows of same - -	5,000	0
Conservancy and working -	190,244	50
Reboisement - - -	12,000	0
Refunds and moiety of fines to employés - - -	10,000	0

Of the revenue estimated not less than 151,886 francs represents fines and proceeds of judicial awards.

Future prospects.

As long as one third to one half of the forests remain unproductive for want of facilities of transport there will be little prospect of any surplus revenue. Railroads are the pressing want of the province, there being at present only one line parallel to the coast between Algiers and Oran, and another from Phillipville to Constantine.

Neither of these serve to tap the resources of the forests, and it will yet be some years before anything so desirable will be effected.

It is certain, however, that when the railway line to Batna and the other lines to the High Plateaux are completed the forests will not fail to yield a considerable surplus revenue, as they will then be in a position to meet the demand of the seaport towns which are at present dependent in a great measure on imported timber, which amounts yearly to about 3,179 steres of rough wood and 878,982 metres courants of converted timber, including sleepers.

CHAPTER III.

Alpha Resources.

Alpha regions.

As has been already stated, the great alpha-producing region is the High Plateaux.

Alpha (*Macrochloa tenacissima*), or hulfa of the Arabs, here covers enormous areas, generally described by French writers as "mers d'alpha."

Next in importance are the alpha regions within the Tell, in the department of Oran, and, lastly, those in the department of Constantine, also within the Tell; but both of these lie well back to the south, and contiguous to the High Plateaux and Sahara.

Growth of alpha.

Alpha does not occupy the ground to the exclusion of other species of graminæ and herbaceous plants, as may at first be supposed by the description "mers d'alpha." Tufts of common coarse grass and other plants are largely intermixed with it, as also is a species of gramina called sennera (*Stipa tenacissima*), which resembles *Macrochloa tenacissima* somewhat, and is much used by Arabs for rope manufacture.

The alpha of commerce (*Macrochloa tenacissima*) occurs in the form of tufts, composed of numerous little stools, on which may be found at all seasons a dense crop of young, mature, and dead stems, or, strictly speaking, leaves, as they answer that purpose.

System of cropping.

Having regard to this condition of the plants, it is believed that the most suitable method of cropping would be the part removal of mature stems from time to time at regular intervals, so as to leave a certain proportion for the elaboration of sap to continue more or less unchecked. This system would, however, prove too expensive, and hence the only condition enforced in the State forests of the Tell is the observance of a close period from 1st January to 1st May. The lessees are left to crop as they please, and as it is not remunerative to spread the work over large areas the workmen take as much as possible from each plant when they can.

The *modus operandi* is very simple. The workman seizes with his hand *all* the *larger* stalks, and, twisting them round a short stick slung for the purpose from his girdle, gives a wrench and thus detaches them from the parent stools. He has no time to select, and generally pulls out a quantity of immature stems, which, instead of slipping readily out of the stools, break and leave portions inside the crown of the stools to decay and impede the growth of fresh stems.

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Present close period insufficient.

In the opinion of M. Mangin, the conservator of forests, the enforcement of a close period for a few months annually may suffice for tracts but little cropped, but it will be absolutely necessary in the case of those subjected to regular cuttings to afford rest to the plants for several years consecutively, and thus give time to recover from the injuries received in the cropping operation.

This opinion is also shared by M. Charrier, who has written a pamphlet on the alpha question, and believes that the State, in the case of the High Plateaux concessions, will be compelled to interfere after the first few years' harvesting and enforce measures to prevent the destruction of the alpha tracts.

Extent of alpha-bearing regions.

Various estimates have been made of the area actually covered by alpha in the High Plateaux. It is generally admitted to be about one-half of the surface of the High Plateaux, and the Forest Department, taking this view, estimates it at 13,590,000 acres.

By M. Charrier it is reckoned at only 9,884,000 acres.

About 274,000 acres in the western part were lately surveyed by Mr. Pitcairn and others connected with an English company constructing a railway line between St. Barbe Tlelat and Sidi Bel Abbés.

They found the alpha-producing area varying in different places between $\frac{2}{3}$rds and $\frac{1}{10}$th of the entire surface, and if $\frac{1}{10}$ths is taken as a fair mean the total area abounding with alpha will not exceed 8,448,000 acres.

If the mean of these three estimates is taken as likely to prove most correct the High Plateaux may be computed to embrace upwards of 10,640,000 acres of alpha-producing ground.

To these figures must be added 2,471,000 acres in the departments of Oran and Constantine within the Tell, as estimated by the Forest Department, and we have then a total of about 13 million acres as the area abounding with alpha in Algeria.

Yearly resources.

According to the results of M. Charrier's investigation, the mean yearly yield of an hectare (2·471 acres) of alpha-producing land is 1·77 tons of green produce of good quality. Of this 15 to 20 per cent. must be deducted for loss of weight in drying, and if, in addition, more care is taken than is customary at present in the selection of the stalks, a necessity admitted on all sides, there will be a further reduction of about 22 per cent., which would leave ·984 ton as the actual yield of one hecture, or 7·96 cwt. as that of 1 acre.

Yield per acre in the High Plateaux.

In calculating the annual yield of the High Plateaux allowance must be made for the area over which, as pointed

out by M. Mangin, operations will have to be suspended for several years at a time.

Total annual yield of High Plateaux.

Allowing a reduction of as much as one-half for this, there will yet be the enormous quantity of 2,117,360 tons as available yearly from the High Plateaux.

Yield of the Tell.

The tracts in the Tell being somewhat inferior, the yield per acre may be safely estimated at one-third less. The maximum yearly yield for the whole may then be computed at 327,407 tons, that is, presuming the same measures are enforced for preserving the alpha tracts so as to secure unimpaired production.

The alpha tracts in the Oran district, 1,900,000 acres in extent, having been hitherto the main source of supply, the following figures may be taken as the yield of the past few years from this part of Algeria:—

Yearly exports of alpha.

	1873.	1874.	1875.
	Tons.	Tons.	Tons.
Exported to France -	1,592	2,571	2,397
To other countries, chiefly England, for manufacture of paper - -	43,647	54,907	53,353
Total - -	45,239	57,478	55,660

If the estimate of the maximum annual yield is correct, it would appear that the exports of alpha represent a very small proportion even of the resources of the Tell, and point to the urgent need of opening up the country by means of railroads.

Development of the alpha exports.

Hitherto little progress has been made in this direction, but, fortunately for the prosperity of the province, this is not likely to be the case much longer.

Numerous routes for railways to connect the High Plateaux with the sea-coast have been surveyed, and some are in course of construction.

The Compagnie Franco-Algerienne.

The Compagnie Franco-Algerienne, which received a concession in 1873, has constructed a line of railway from Arzeu, on the coast, as far as Perrigaux, from which it is to pass up by way of Mascara through the Atlas range to Saidu, in the High Plateaux, where the company in question has the exclusive right, during a period of 99 years, of collecting alpha over nearly a million of acres, without prejudice, however, to the Arabs' right of pasture. It will have to pay 15 centimes on every ton exported up to 100,000 tons per annum, beyond which the rate will be 25 centimes.

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It has the privilege also of obtaining from the Government forests whatever timber is required on payment of 2 francs per métre cube for pine, juniper, and cypress, and 4 francs for oak. The company is under obligation to complete the railway within six years, and there is not much prospect of it being done in less time.

The Bel Abbés Railway.

Another company, known as the Tlelat and Bel Abbés Railway Company, is constructing a line between these points so as to tap the alpha regions in the Tell, and thence have a branch line to Sebdon in the High Plateaux.

Some progress has been made, and the line will probably be completed as far as Bel Abbés next year. This portion, about 50 miles, is being constructed under a guarantee from the Government of 6 per cent. on a total cost not exceeding 7 millions of francs; but yet, strange to say, a condition has been subsequently insisted upon to the effect that interest to be paid in any one year is not to exceed 400,000 francs.

Other railways to High Plateaux.

Recently arrangements were concluded with other parties for the construction of lines to connect the High Plateaux with the seaboard or Oran line of railway between Tiaret and Mostaganem and Bokhari and Affreville. Thus there will be in all four or five lines of railway to tap the resources of the High Plateaux.

The engineering difficulties are not very great, although very considerable in places, but the system of control and supervision adopted by the Government, even in matters of petty detail, is likely to occasion all kinds of delays. When these lines are completed, branch or feeding lines will have to be extended into all parts of the High Plateaux, and taking everything into consideration it may be safely presumed that a period of 10 to 20 years will elapse before the entire resources of this region are made available.

Labour question.

The labour question in connection with the High Plateaux is not without its difficulties.

No villages or fixed population are to be found there, water is scarce and wood rarely procurable, and the climate is characterised by great diversities and alternations of heat and cold, there being snow, heavy rain, and cold winds in winter, and great heat, sand storms, and siroccos in summer.

Morocco and the neighbouring Arab tribes would supply labour to some extent, but Europeans in considerable numbers would have to be introduced, and for these shelter and all the necessaries of life would have to be found or supplied in some way or other by the "concessionaires."

It is estimated that a European labourer working 10 hours daily would take five days to crop one hectare of alpha ground if working carefully and methodically. This would

represent a daily cutting of 275 kilogrammes of green alpha, equivalent to 220 kilogrammes of dried material. In the Tell the Spanish labourers collect as much as 350 to 400 kilogrammes in one day, but this contains much useless stuff, and could not be obtained without much risk of injury to the plants.

If the close period and wet stormy days are deducted, there will not be more than 200 working or field days in the year. Each workman would then collect yearly 200 kilogrammes, 200 = 43 tons of alpha, and thus for every 100,000 tons not less than 2,300 European labourers would be required. In the case of natives it is estimated that 130 kilogrammes daily, or 26 tons yearly, would be the maximum collected by each adult, and not more than seven tons yearly the maximum obtainable by each of the children who annually assist their parents. Allowing a proportion of each to be employed, there will be as many as 3,500 individuals required for every 100,000 tons of alpha extracted, and this number will be increased to 6,000 or 7,000 souls if the employés who weigh, dry, &c., and suttlers are added.

Cost.

At present throughout the Tell, to within a distance of 100 miles of the sea-coast, alpha merchants are paying 4½ francs per quintal or 45 francs per ton of dried and clean alpha, and 39 francs per ton for its transport by cart to Oran.

The total cost is therefore 84 francs per ton for alpha unbaled, and it remains to be seen whether with greater facilities of transport, such as railways from the High Plateaux, there is any prospect of the price being reduced.

The mean daily earnings of Europeans in the Tell are six francs, the same in fact as the ordinary rate throughout the Province. Hence no reduction can be looked for in cost of collection, drying, &c., amounting in all to 45 francs per ton, but on the contrary there may be a slight increase owing to cost of living being doubtless dearer, the distance from the coast being greater.

Probably as much as 3½ instead of three francs per quintal will have to be paid for collection, and two instead of 1½ franc per quintal for drying, cleaning, &c. The work of gathering to centre depôts by carts will be spread over considerable areas, and for this it is estimated the expenditure will not be less than 4 francs 60 centimes per ton.

To this again must be added transport by rail to a seaport, a distance of about 200 kilometres.

The maximum rate allowed to be charged on the Bel Abbès and Tlelat Railway is 13 centimes per ton per kilometre, but this line being wholly in the plains the rate on the High

Plateaux lines will be a little higher, probably 15 centimes per ton per kilometre.

Summary of cost.

The total cost may be thus detailed:—

	fr.	c.
Collecting per ton - - -	35	0
Loss in drying, cost of weighing, &c.	20	0
Transport to centre depôt - -	4	60
Ditto to seaport by rail - -	30	0
Total -	89	60

Thus there may be an increase of about five francs per ton on the present cost, and if 12 to 15 per cent. be added for commission, baling, &c., the total cost when ready for shipment will not exceed 100 francs or 4*l.* per ton.

Freight from Oran to England is generally from 15 to [illegible] francs per ton, and hence it will be possible to dispose of [illegible] with profit in England at 6*l.* or 7*l.* per ton.

Sales were recently effected at 7*l.* 10*s.* per ton for alpha of good quality.

Project of importing bamboo as a paper-making material.

The question of cost is one of considerable interest now that a project is on foot for importing bamboo from the tropics as a paper-making material.

Unfortunately sufficient data are not available for judging the success of this experiment in the matter of cost, and it may be some time before *continuous* and *regular* supplies can be brought into the English markets, a *sine qua non* to insure success against so long established rivals as esparto grass from Spain, and alpha from Algeria.

It is satisfactory to know from the experiments made by Mr. T. Routledge that bamboo can be made into superior paper than esparto and alpha, and this itself should be a sufficient incentive for pushing on the project.

Importation of alpha liable to interruption.

There are, however, other weighty considerations. Spain as a source of supply is well nigh exhausted, owing to the reckless system of cropping in vogue; and Algeria, as proved by her past history, is so subject to the danger of Arab insurrections, arising out of the fanatical disposition of the people, that the working of the more remote and important alpha grounds, such as the High Plateaux and those near the Sahara, may at any time be suddenly interrupted.

Added to this, complications may arise in England's relations with other powers, especially with reference to the Eastern question, and she may at any moment be compelled to look elsewhere for supplies of paper-making material.

Under these circumstances it would appear to be to her interest to encourage and develop as much as possible the

introduction of bamboo from her Eastern and Western possessions; and although alpha has the start in the market, yet, as already stated, it may be 10 to 15 years before the alpha resources of Algeria can be fairly developed.

That our French neighbours will not on their part be backward in maintaining and increasing the exports of alpha may be readily understood from the active steps now being taken to encourage the construction of railways, by granting concessions or leases on liberal terms over large areas of alpha ground.

It is significant, too, that 480 kilogrammes of alpha-seed, collected at considerable cost, 4½ francs per kilogramme, have been despatched to France to test the practicability of growing alpha on the enormous sandy wastes known as the "landes," near the river Gironde, and elsewhere along the coast.

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W. I. SEATON.

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