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By the Hon. Mr. St. John
Kind regards.

THE
SCIENCE AND TEACHING
OF
FORESTRY.

A LECTURE

DELIVERED AT THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER,
July 7th, 1882,

BY

G. S. BOULGER, F.L.S., F.G.S.

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SCIENCE AND TEACHING

FORESTRY

A HISTORY

OF THE FORESTRY OF THE UNITED STATES

BY

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1891

THE SCIENCE AND TEACHING

OF

FORESTRY.

IT gives me much pleasure to address you here and on my present subject: here, because in one of the adjacent class-rooms, in 1876, before a large class of voluntary students, I had the honour of giving what was, I believe, the first course of lectures on forestry as a complete science ever delivered in this country; on my present subject, because I am fully convinced of its great national importance at the present time. There can hardly be said to be any interest in the science of forestry here in England; in fact, most people have but very vague ideas as to its scope, objects or importance. The word "forester," most commonly suggests a member of an admirable friendly society with a tendency to green silk scarves and badges, or occasional masquerading as Robin Hood and his merry men. A "forest" is to many of us a large wood or plantation, the most valuable function of which is to act as a game-preserve. This latter view has been prevalent throughout Europe for seven centuries. The original significance of the word "forest" is that land which was outside (Latin *foris*) the "ham," "mark," or "ton," that is, the home-farm or tilled land of the township, which was not cleared, or felled; not in "fields," and not under the same laws as the agricultural land which had itself once formed part of the primeval forest. Thus the forest was part of the "common" lands of the early village communities, who felled its timber for firewood or for building, and turned their cattle to graze in its open spaces, or to feed on the masts and acorns of its woodlands. Probably large tracts of land in many parts of Great Britain have never been covered with timber trees within the historical period, yet were forest in the strict sense of the word. This forest land was not subject to that periodical redistribution and primitive system of rotation of crops which applied to the "common fields" of the community; and thus when the Continental feudalism superseded the early English village system, the forest lands fell more completely into the hands of the Crown and the nobility, the "lords of the manor," subject generally, however, to the "common rights" of topping and lopping, cutting turf, pasturage, &c., varying in different cases. The primeval forests of England were probably of oak; the beech, the lime, and probably the elm being introduced during the Roman occupation, and the chestnut perhaps not till Norman times. The woodlands that had been the strongholds of the Britons, and in which Gurth and Wamba fed the swine of the Saxon thane

become, under the Normans, merely a game preserve, and our forest laws had only this object in view. The royal forests were drawn upon for the supply of timber to the navy; but there was no systematic management, but little regulation of felling, and probably no artificial planting till the writings of John Evelyn, in the reign of Charles II., roused Englishmen to a sense of the value of their timber trees.

The Sussex iron-works in little more than a century almost cleared the forests of the Weald; a similar demand for charcoal caused great destruction in the forest of Dean; the value of agricultural land, enhanced by the Corn Laws, no doubt led to much clearing of woodlands; and in many of the remaining forest districts the unrestricted rights of pasturage, and of topping and lopping prevented the proper growth of mature timber.

The forests of other countries have had a similar history, and it is from their experiences that I wish to demonstrate my first point, the national importance of scientific forestry.

Syria, Mesopotamia, Asia Minor, and Cyprus, once most fertile, are now barren, whilst many of their harbours have become silted up, according to the high authority of Sir Richard Temple, mainly owing to disforestation. Sir Richard also looks upon this as the main cause of the famines of India and China. In Ceylon the removal of the forests exposing the ground to the full force of tropical rainfall, is resulting in the lowering of the general surface at the rate of a third of an inch per annum, thus removing the agricultural soil. In Mauritius, once the sanatorium of India, the climate has undoubtedly deteriorated as the air has become drier from the removal of the forests: and the springs are drying up; whilst, though gum-trees have been recently introduced from Australia, much timber has to be imported for building and firewood. Though possessing some of the finest species of timber trees in the world, the gum trees, some parts of Australia are already, from reckless felling, in want both of firewood and of timber for mining and other purposes; so that steps are now being taken towards forest conservation. In New Zealand, the most valuable timber tree, the Kauri pine, was five years ago threatened with rapid extermination. The immense lumbering trade of Canada and the United States, and such wholesale waste as felling thousands of fine hemlock-spruce for the sake of the bark alone, which is used in tanning, the timber being left to rot on the ground, threatens the very existence of their forests. At present rates of consumption, without conservation, North America will apparently be denuded of timber in less than a century, whilst the only eastern United States not already so denuded, Maine, New York, and Pennsylvania, will seemingly be so within the next fifteen years. Similarly, the wholesale felling of the greenheart in Demerara, where saplings are actually used as rollers in transporting the larger logs, and of the siphonia or caoutchouc in Brazil have produced a falling off in the supply of these valuable trees. Humboldt mentions that the water supply of Venezuela had decreased from the clearing of some of the forests; whilst some of the West Indian islands, in spite of a tropical rainfall, have been reduced to arid, sandy wastes. South Africa has suffered much in climate from the destruction of forests, the rainfall having become somewhat less and very irregular, months or years of drought being followed by torrents which flow off the land without benefiting it. The pine forests of Tunis have disappeared during the last hundred years, and Colonel Playfair, our Consul-General for Algeria, speaks thus of the resulting evils:—"A hill-side deprived of the forest whose foliage acted as a huge parasol to the ground, and whose roots served to retain the vegetable soil which was formed by its decay, very soon loses the

power of supporting vegetable life at all. The rich mould gets washed by winter rains into the valleys ; in the summer months the sand is blown down on top of this ; succeeding rains carry down stones and gravel, till very soon all the most fertile portions of the soil disappear, leaving a residuum which is only capable of supporting vegetation when it becomes fertilised by an exceptional amount of moisture, which, as time progresses, must become rarer and rarer."

Coming nearer home, to the continent of Europe, we find that all the countries bordering on the Mediterranean—Turkey, Spain, Italy, and to some extent France—have suffered from the destruction of their woodlands on the hill-sides, many springs having become dry. The political decadence of Spain has been attributed entirely to this cause. The deforesting of the Apennines during the last two centuries has much increased the violence of the mountain-torrents, and in Switzerland the existing forests are found to check both the formation and the descent of avalanches. Russia has not only the largest area of forest of any European State, but the largest percentage, namely, 42 of her whole area, and there is now much energy in conservation and planting. It was, however, recently reported that there was a decrease in the waters of the Volga and consequently in the Caspian, from timber-felling. The ably-managed forests of Sweden are an important source of national revenue, whilst I shall have presently to refer again to those of Germany, the birthplace of the teaching of forest science. In Denmark it appears that the felling of the woods on the Atlantic coast has exposed the country to the sharp sea winds and to drifting sand, forming lagoons and bogs, and causing a marked deterioration of the climate. France it is, however, that perhaps more than any of our Continental neighbours shows the advantages of scientific forestry and the danger of its neglect. Useful legislation, dating from the sixteenth century, was swept away at the Revolution, and reckless destruction of forests, especially in the south, has led to frequent and disastrous floods, as in the valleys of the Rhône and Saône. The government are now, at immense expense, replanting the slopes of the Alps, with the beneficial effect of lessening the force of such torrential streams as the Durance. Moreover the cultivation of the cluster pine in the department of Landes has converted low marshes between Bayonne and Bordeaux into valuable productive land.

In Great Britain the abundance of coal renders us independent of wood as fuel, and our geographical position so facilitates the importation of timber that we have to a great extent neglected our woodlands as a source of profit. Our mild insular climate also has enabled us to overlook the hygienic importance of forests, and very possibly the conclusion arrived at in the United States; that the soil is most productive when one-fourth woodland, may not be true in our case. Bad seasons and foreign competition, however, cause us to look around us on all sides for means of rendering our land more productive.

In a report on a visit to the English and Scotch forests made to the India Office by M. Boppe, inspector of French forests, in March last, he says :

"Considering the present depressed state of agriculture all over Europe, it becomes more and more necessary to endeavour to draw the greatest possible advantage from the land, and, by properly adapting a different vegetation to different soils, to seek to obtain, through the medium of the enormous capital which the present generation can command, the maximum production from a minimum area. It is thus that the forests are called upon to play an important part in the immediate future, and the farmer will hence-

forth find a powerful auxiliary in the forester. After making every allowance for the great fertility of the soil in Great Britain, we feel certain that in many districts more than one of the forests which were cleared some time back, would now be jealously preserved by the same proprietors who formerly cut them down. It must also be borne in mind that the British empire is not confined to Great Britain and Ireland, and that, by reason of her immense possessions, England is, perhaps of all nations in the world, the most richly endowed with valuable timber forests. It is by hundreds of millions of acres that we may reckon the forests of Canada, India and Australia, New Zealand, and Cape Colony, not to speak of those in the West Indies and Borneo. All these natural resources of wealth are worked by British enterprise and British capital, and, seeing the present wonderful development of commerce throughout the globe, it is a matter of importance to every civilised nation that this vast accumulation of forest riches should not fall into the hands of ignorant persons, or be squandered away regardless of the future. For these reasons the establishment of a Forest School in England becomes a matter of primary importance." To come to figures, Great Britain has the smallest proportion of woodland to area of any State in Europe, little more than three per cent., the acreage being—England and Wales nearly $1\frac{1}{2}$ millions, Scotland little over 730,000, and Ireland 325,000 acres. The private plantations of Scotland are mainly coniferous; but in England 125,000 acres are in the occupation of the Crown, being mostly mixed forest. The chief state forests are the New Forest, in Hampshire, of 76,000; the Forest of Dean, in this county, of 22,000; and Windsor Park of 14,000 acres. The total acreage of forest in the British Empire is estimated at 340,000,000 acres.

If, then, the forests of our colonies are important for sanitary reasons and with reference to the timber supply of the world, and it is desirable that we should produce as much timber as possible, as cheaply as possible, for our home consumption, mines, railways, building, &c., I wish next to show the value of timber as an investment,—the value as capital of a growing tree.

Now, leaving increase of height out of consideration, since trees reach their full height before they attain their greatest dimensions, a healthy forest tree makes a new ring of wood each year of approximately equal width. If, then, we number these circles 1, 2, 3, 4, &c., from within outwards, their areas will be as the squares of these numbers, 1, 4, 9, 16 &c. or the yearly gain as the difference of these squares 3, 5, 7, 9, an arithmetical series having a common difference of 2. Few other investments can approach this rate of return.

In order to secure this return it is no doubt necessary in the first place to lay out a considerable capital; secondly, to lay it out properly; thirdly, not to trench upon this capital, but to expend a certain annual amount to sustain it, and lastly, to wait some years for the return. Obviously, then, the planting of woodland is a matter for proprietors rather than tenants. Few sober foresters claim that timber can be relied upon in England to pay the rental of the best agricultural land. The costliness of transport and the uncertainty of the market are important considerations; but it is maintained that many upland tracts, and other districts now barren, or nearly so, might be made to yield a handsome return to capital. For this, however, scientific management is necessary.

The science of forestry consists of two main divisions; silviculture and forest administration. Silviculture is concerned with geology so far as it relates to the soils suitable to various species; with meteorology in reference to aspect, altitude, and other climatic conditions; with chemistry as to the

composition of soils and of the various forest products; particularly with vegetable physiology, the vital processes of trees and other plants; with descriptive botany for the discrimination of species, and with entomology as to the insect foes and friends of the trees. It is necessary, in fact, that the theory of the healthy culture of trees, and its study in the lecture-room and laboratory, must be accompanied by that of the art of forestry, so far as it concerns sowing, planting, protecting and such pruning and thinning as the health of the trees require. It is as essential to the estate manager who plants for ornament, recreation, or game covert, as to him who plants for profit in timber.

Forest administration deals with the realisation of the crop to the best advantage. The leading principle of this science is that the forest as a whole be regarded as capital, and that the interest thereon is the amount of wood formed in the year. This is the greatest amount of timber that ought to be removed in the year.

The methods by which this result is approximated are various; but there are four chief plans which we will consider in what is their chronological and natural order. They are felling by selection, or *Plänterbetrieb*; clearing by compartments, or *tire et aire*, felling by rotation of area, or *Fachwerke Methode*, with artificial planting, and the same method with reproduction by means of natural seeding.

The first of these, felling by selection, or *Plänterbetrieb*, is the primitive system, if system it can be termed, in all countries. The forester either fells just such trees as he wants over the whole forest area, or he takes all those of full age each year, so that there will be a corresponding number reaching maturity the next year. The drawbacks to this system are, 1st, its disregard of the annual increment of the forest in cubic feet of timber; 2nd, the difficulty of supervision when operations are spread over so large an area, and, 3rd, the damage done to seedlings and saplings all over the forest in removing the felled logs. This method is virtually followed in many small English woodlands and private forests in Germany; but the yield it gives is both uncertain and less in amount than that of more scientific methods. It has, however, been modified in some cases so as to resemble the French system of *tire et aire*. The forest is divided into twenty blocks, and in the first year all trees from eighty to a hundred years old are felled in block 1; in the second all trees from eighty-one to a hundred and one in block 2; and so on. Thus whilst in the twentieth year the trees felled will be from one hundred to one hundred and twenty years old in the twenty-first they will be from eighty to one hundred.

In the French system of *tire et aire*, now abandoned, a period called a revolution was fixed for the clearing of all existing trees, natural seeding being relied on for reproduction. The forest was then divided into as many compartments as there were years in the revolution, one being felled each year, with the exception of a few standards left as seed-bearers. It was found in practice that little dependence could be placed on this unsheltered seeding, and that not unfrequently trees of a quite distinct species sprang up, thus changing the character of the forest for a generation or more. This system was superseded in France by the German *Fachwerke Methode* about fifty years ago. In the Scotch plantations it is still followed with very satisfactory results, with the modification that each year's subdivision of the forest area is entirely cleared and then replanted. Thus the trees are all felled at one age, and those in any compartment are also all of one age.

Hartig, the father of German forestry in Nassau, at the beginning of the century, and Cotta, in Saxony, some ten years later, laid the foundation of

the present ideal method of German forest administration. On this system each two or three thousand acres is considered in all respects as a separate forest. In the case of each of these a period or rotation is agreed upon varying with the species of tree, 200 years for oak, 120 to 150 for beech and Scotchfir, and the forest is divided into as many blocks as there are years in the rotation. These blocks may be equal in area, or may vary with the productiveness of the soil, so as to equalise the yield. They are then subdivided into four, five, or six compartments, to each of which a sub-period of about thirty years is assigned. About one-fifth of the trees on one-sixth of the subdivision will be felled each year, some additional thinnings being necessarily carried on over the whole area continuously. The theory of this system is that we should follow closely the practice of nature. The young trees will draw each other up till they reach their maximum height, which will be when they are about half their full age. In nature the struggle for existence leads to the survival of the fittest; whilst in this system of forestry we fell the least vigorous trees, giving light to the others, whose stems will increase in diameter when they have ceased to lengthen, but have more room to spread their heads. In this way the seedlings are sheltered, no part of the forest being ever completely cleared.

It has been objected to this method that trees transplanted from a nursery have been shown experimentally to yield more timber than natural seedlings; but it may be doubted whether this difference is sufficient to counterbalance the loss of productiveness from not having the two crops on the ground simultaneously, the old trees still adding wood while the seedlings are growing up under their shade, and the seedlings beginning life some years earlier, before their predecessors are fully matured. My private opinion at present is in favour of the system of clearing and planting in coniferous plantations, such as those of Scotland; but of the German natural system in deciduous forests.

Whatever system is followed, it is as essential that the forester should have an accurate survey of the forest, an estimate of the amount of timber it contains, and of its annual increase, and a working plan of operations as it is for the farmer to be acquainted with the acreage and soil of his farm, and the number and weight of his cattle.

The aim and principles of forestry and agriculture are the same, namely, the greatest productiveness of the soil. They differ only in the crops raised. Neither is a distinct branch of pure science; they are both applications of the principles of various sciences to the practice of an art. In both, therefore, our motto must be, "Practice with science." Whilst no amount of book-learning or lecture-hearing will make a forester, the mere unassisted following of the rule-of-thumb routine of practical forest work, or trusting to one's own unaided powers of observation and inference, can seldom make a good forester, and never a good forest administrator. Hence the need for forest schools.

The first forest schools were those of Hartig and Cotta, which were superseded about the year 1820 by State academies in nearly all the German states. These are now being re-organised under the central government. In 1824 France followed the lead of Germany by establishing the forest school at Nancy, to the labours of the directors and staff of which, Lorenz, Parade, Nanquette, Bagneris, and Broillard, we owe very much. There are now forest schools in all the principal states of Europe. In Germany there are eight; viz., Eisenach in Saxe Weimar, Tharant near Dresden, Neustadt Eberswald, near Berlin, Münden in Hanover, Giessen in Hesse, Carlsruhe in Baden, Hohenheim near Stuttgart, and Aschaffenburg in

Bavaria. In the Austrian empire the chief schools are at Marienbrunn near Vienna, and at Schemnitz in Hungary. In Russia there are four chief schools, Evois in Finland, Nova Alexandria in Poland, Peteroffsky near Moscow, and Berdiansk on the sea of Azoff. Sweden has a State school at Stockholm; Denmark one at Copenhagen. In Spain there is a school in the Escorial; in Italy one at Vallombrosa in Tuscany; and even Roumania has recently established one. In the United States, owing to the energy of Dr. Hough, the Government have decided on the necessity of establishing such a school. In Great Britain, the state that is richer in forests than any other in the world, there is no proper provision for the teaching of forestry.

From the representations of Humboldt and others, the British Association in 1851 adopted the following conclusions:—

“1. That over large portions of the globe there is still an almost uncontrolled destruction of the indigenous forests in progress, from the wasteful habits of the population.

“2. That where conservancy has been introduced, considerable improvement has already taken place.

“3. That these improvements may be extended by a rigid enforcement of the present regulations, and the enactment of additional provisions of the following character, viz., careful maintenance of the forest by valuation, surveys and working plans, and by the preservation or plantation of seedlings in place of mature trees removed,—nurseries being established; prohibition of cutting until trees are well grown, with rare and special exceptions for peculiar purposes.

“4. That especial attention should be given to the preservation and maintenance of forests occupying tracts unsuited for other culture, whether by reason of altitude or peculiarities of physical structure.

“5. That in a country to which the maintenance of its water supplies is of extreme importance, the indiscriminate clearing of forests around the localities whence those supplies are derived is greatly to be deprecated.

“6. That it is a duty to prevent the excessive waste of wood, the timbers useful for building and manufacturers being reserved and husbanded.

“7. That as much local ignorance prevails as to the number and nature of valuable forest products, measures should be taken to supply, through the officers in charge, information calculated to diminish such ignorance.”

Roused by this warning note, attempts were made in India just before the mutiny, and more thoroughly after it, to organise a forest conservancy, and at the present time there is in that empire a forest department of about 150 officers, or rather less than a man to every hundred square miles, or over 60,000 acres of forests. For efficiency the department ought undoubtedly to be increased tenfold, though their efforts already result in a surplus forest revenue of nearly £300,000 per annum, or about £2,000 for each officer employed. The Indian government have established a school in the north of India, at Dehra Dun, for the training of the native subordinate forest officers. To this school a large forest area is to be attached for teaching purposes.

In Scotland the Highland and Agricultural Society have a very excellently organised examination in the theory and practice of forestry; but they have found great difficulty in getting candidates to present themselves. The obvious causes of this are two in number; 1st, the examination being unofficial, the Society has nothing to offer but its diploma; 2nd, and more important, there being no school of forestry in the kingdom and no systematic practical teaching in State forests, the wonder is, not that there are

few, but that there are any candidates for an examination, which is, as of course it should be, both theoretical and practical.

The Science and Art Department, holding as they do examinations in agriculture, have declined to add forestry to their list of subjects; and it may well be doubted whether any examination scheme would be of any use in the absence of proper arrangements for teaching.

Since I lectured on forestry here in 1876, taking as my text-book a translation, published in India, of Professor Bagneris' excellent "*Manuel de Sylviculture*," which was in your library, public opinion in this country has been a good deal directed to the establishment of a forest school, not only for the Indian department, the candidates for which are now trained, at a considerable expense and in a foreign language, at Nancy, but also for our own woodlands at home and the vast forests in Canada, Australia, New Zealand and the Cape. These colonies now are reduced to borrowing forest officers from India, where they cannot be safely spared.

For this reviving interest we are mainly indebted to the efforts of the Rev. J. Croumbie Brown, of Haddington, to whose writings I am much indebted, and to the proprietors of our excellent *Journal of Forestry*, which was started in May, 1877.

The Rev. Dr. Brown has ably advocated the establishment of a forest-school at Edinburgh, in connection with the University and Arboretum. Mr. Mackenzie, superintendent of Epping Forest, urges the establishment of such a school in connection with the 6,000 acres of forest land in Essex now under the control of the Corporation of London. M. Boppe, in the report from which I have previously quoted, recommends the endowment of professorships of Forest Economy and Sylviculture at Edinburgh, and at the Royal Indian Engineering College at Cooper's-hill.

As to these various schemes I would remark that whilst Edinburgh offers great facilities for the study of subsidiary sciences, languages and other subjects, in addition to that most valuable adjunct, the Arboretum, the drawback to it as the seat of a State school of forestry is the absence of any neighbouring state forest where scientific and systematic working has been carried out for any length of time and can be assured for teaching purposes in the future. Epping Forest is, like many of the school forests of the continent, in close proximity to the capital. It presents much variety of hardwood forest in a small area; but its future management is hampered by two conditions which render it probably unfit for an educational forest: 1st, the rights of the commoners, who have ruined the forest by pollarding in the past and who must seriously injure it by pasturage in the future; and 2ndly, the Act of Parliament which enacts that it is to be maintained only for recreation and not worked as a source of profit. The trees cannot, therefore, be felled when mature; no enclosures are allowed for any purpose, and, though there are large areas where planting may be most advantageously carried out, there can be nothing like scientific forest administration in connection with it. Windsor Park similarly affords but partial forest instruction, the conservation of the trees being the main object, and not their administration as a source of profit. The New Forest has been so ruined by the unrestricted exercise of the rights of common, that, according to M. Boppe's report, 49,000 acres will before very long be nothing but a worthless barren heath, whilst at least 50 years must elapse before the 14,000 acres reserved about 20 years ago can be so far restored as to be felled systematically as a source of revenue. In M. Boppe's words "it will not be here that a professor of sylviculture, desirous of teaching his science, will choose to pitch his tent."

Forest students require the stimulating prospect of Government employment. In Germany there are abundant competitors, though the training involves five years study without pay, and five years probation with but meagre allowances. The cost of education is naturally in inverse proportion to the number of pupils, so that it would probably not be remunerative for a private person to teach forestry in this country without State aid. I am inclined to think that two or three endowed chairs of forestry, as suggested by M. Boppe, an open competitive examination under Government, similar to that by which candidates are selected for the Civil Service of India, and perhaps a few scholarships like those established by the Government of Bengal in connection with this college, would be the cheapest, and perhaps the best means of inaugurating the teaching of forestry in the head-quarters of our empire.

In Germany it is the prevailing opinion that forestry acquires a more dignified position, and is more thoroughly taught when the school of forestry is not a distinct institution, but is affiliated to a university, a polytechnic, a school of engineering or of agriculture. Thus at Giessen it is associated with the University, at Carlsruhe with the Polytechnic, and at Copenhagen Tharant in Saxony, Hohenheim in Wurtemberg, Nova Alexandria, St. Petersburg and Petroffsky with a College of Agriculture.

When the Forest School at Nancy was established in 1827, there were only three professors, besides masters for drawing and German, viz., one of natural history, one of mathematics and one of forest economy, legislation and jurisprudence. There are now eight. At Aschaffenburg in Bavaria there are four professors, viz., of forestry, of forest law, of natural science, and of mechanics and engineering. In the Polytechnicum at Carlsruhe there are only two professors of forest science, though the entire staff numbers forty-nine, thus illustrating forcibly the advantages of affiliation.

The course of instruction varies considerably in the different continental schools. At Nancy pupils enter by competition, when between 18 and 20, and remain two years in the school, and a third as apprentices in the adjoining forest; at Copenhagen there is an entrance examination, and a course of from four to six years; in Germany, after leaving a first-class school the student has a year's practical work in the forest, two or two and a half years in the forest school, and then two more years' practical work before he is eligible for a Government office; in Austria and Poland the course extends over three years, and at Evois in Finland over two. Nearly all these schools agree in having an entrance examination, which generally includes the native language, mathematics, chemistry, physical geography, and sometimes a foreign language. The limit of age at entrance varies from twenty to twenty-three. Nearly all the continental schools are adjacent to forests of considerable extent under State control.

Now in the prospectus of this College, I see there are professors of chemistry, of geology, botany, and zoology, of mathematics and physics, of land surveying and engineering, of book-keeping, of agricultural law, and of estate management. In such an institution the courses are continually overlapping, one professor touching incidentally on the province of another; but, though I venture to think all the courses I have mentioned most useful to a forest student, and though the elements of forestry and the law of woods and forests are included in the syllabuses of two of your present staff, I yet consider the establishment of a chair of silviculture and Forest Economy necessary to enable you to add a thoroughly equipped faculty of forestry to that of agriculture. To this end, as I have intimated, you might, I think, well claim State aid.

In addition to your Botanic Garden, Meteorological Instruments and excellent Laboratories and Museum, you have within a day's easy travelling the best-managed and most instructive State forest in England. Here in addition to plantations of Scotch and other firs and of beech, we have forests of oak, that M. Boppe on his late visit expressly pointed out as affording a first-rate study in the management of such trees. It has occurred to me that as some of you sometimes arrange to devote an entire fortnight to the study of cheese making in the Cheddar district, so arrangements might be made for forest students to reside in the Forest of Dean during some of the busier times of the year. I suppose, moreover, that facilities might be obtained for the study of ordinary arboricultural processes nearer home in Lord Bathurst's beautiful woods.

With these few practical suggestions as to the teaching of forestry here, I must conclude, acknowledging my indebtedness to the writings of my friends Dr. Cleghorn and Colonel Pearson, and still more to you for the attentive hearing you have accorded me.

Part VIII.

LABIATARUM
GENERA ET SPECIES:

OR,

A DESCRIPTION

OF

THE GENERA AND SPECIES OF PLANTS

OF THE

ORDER LABIATÆ;

WITH THEIR

GENERAL HISTORY, CHARACTERS, AFFINITIES,
AND GEOGRAPHICAL DISTRIBUTION.

BY GEORGE BENTHAM, Esq., F.L.S.

LONDON:
JAMES RIDGWAY AND SONS, PICCADILLY.

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