buds. These buds originate in the summer before that in which the flowers appear. As the ratio of carbohydrate to nitrogen increases, there is an increase in fruiting and a decrease in vegetative growth. Drought conditions not only stimulate carbohydrate formation but reduce the nitrogen supply by checking the intake of materials from the soil.

The summer of 1934-35 was exceptionally dry in most parts of New Zealand. Not only was the rainfall subnormal, but it was the hottest summer ever recorded. It is interesting to note that North Auckland did not experience this drought ; indeed rainfall was abovc the average. Seed production in this district was not good in 1936, probably less than usual according to local observations.

In the case of kauri and *Pinus* spp., in which cones take two seasons to mature, one must look for the effect of drought on seeding in the second year after its occurrence.

Abundant flowering will not necessarily result in abundant seeding owing to the possible intervention of such unfavourable factors as rain and frost at critical periods, and insect attack. Unfortunately records of seed production in this country are too meagre and unreliable to enable further correlation between seeding and climatic factors to be attempted. It is hoped that this note will stimulate observers to record such facts in this journal so that data may be accumulated.

G. H. HOCKING.

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## FORESTRY DOWN THE AGES.*

By C. M. SMITH.

**I. Introductory.**—Popular attempts at forest history will seldom bear the critical scrutiny of a scientific examination. They all fall into one of two classes, according to the axe their perpetrator desires to grind : the subjective viewpoint keeps man and his wants in the foreground and lauds the forest as man's free purveyor. The subjective historian sings the forest's praises in terms of cubic feet of timber, of human amenities, or of more aesthetics unalloyed, and usually ends on a Hearts-of-Oak note of braggadocio. The objective chronicler is much worse, for he cannot rid himself of the picture of the vanishing forests : and of others that have vanished from where forests never stood within historic times. In maudlin self-reproach he abjures his manhood and his writer's craft and bewails his inability

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to "make a tree" instead of a mere poem. To be quite fair, there are occasional welcome exceptions in both cases, and even the dispassionate and materialistic seeker after forest truth, assiduously winnowing out the proven grain from the mass of husks in literature of forests, must pause and respond to the rhythm of such a passage as : "The Forest of Hereth where David hid, is gone ; there is no Forest of Bethel to shelter bears to-day ; Kiriath-jearim, which means 'City of Forests', would have now no excuse for such a name ; and the Woods of Sharon, which Strabo called 'a great forest' and which once stretched from the Valley of Ajalon up to Mount Carmel, have now few relics of their ancient glory."

Here is the music of words, full of the appeal of "old, forgotten, far-off things," yet adhering closely to historical truth. But wherein lies the real tragedy ? Not solely, as appears at first glance, in the disappearance of the forests ; but in the disappearance of the forest and the forest denizens **without replacement by an organised human population.** London, Paris, Rome, and most other centres of human life and culture were once forests ; but even the most hardened and purblind sentimentalist cannot brave the gibes that would meet his pleas for reversion to the old forest conditions. Man left the forests early in his history or pre-history, and very soon so adapted himself to an extra-forest environment that he had to set about the creation of increased areas of such an environment to carry on his social evolution. The forest left its permanent mark on him as an individual, but the social structure he gradually adopted demanded its partial destruction—"Man is an arboreal mammal, which has left the forest. His remote ancestors, by continuing to live in the forest, preserved their jaws, teeth and limbs nearly on the primitive mammalian plan, while the brain alone made progress . . . . . If there had been no trees during the Tertiary era, man would probably not have appeared in his present form." The quotation is from an address of Sir A. Smith Woodward at last year's meeting of the British Association, and indicates the earliest and most lasting influence of the forest on mankind. Though the human race thus learned to live outside of the forest, it has not learned, and the forester contends that it never can learn, to live—save on a precarious existence in a very lowly culture—without the use of the forest.

The problem has ever been to draw the line between the partial forest destruction necessary for the existence and the development of human society, and the total or at least excessive forest destruction, which spells degradation or even local extinction of human society. The forester has to take cognisance of two populations, the human population and the forest population. The influences of the one on the other are inextricably interwoven ; action and reaction are of a truth equal and opposite, and the basic problem of all forestry is to co-ordinate man's evolved and evolving social life with the benefits supplied by and the demands made by the forest. In modern phrase, forestry is a sociological problem and many past failures to solve it

can be traced to attempts to make it a purely economic one, or a purely geographic one—or purely legal, purely botanical, purely scientific, purely what you will. It partakes of all of these and of many more and the keynote of success in technical forestry is co-ordination of all aspects. The late Dr. Chilton in his evidence before the 1913 Royal Commission on Forestry put the matter very clearly and correctly when he said "Forestry is not a science in itself, but is the application of many sciences to a particular purpose," and the modern forester could probably define that particular purpose as being "the full development of human society in the presence of the forest," or, alternatively, "the retention of the forest alongside a fully developed human society." This definition is unusual, so far as I know it is original : but is, I submit, the ultimate objective of the forester, and should be clearly understood and consciously admitted by any student of forest history.

**II. Early Forestry Activities.**—To end the fabled Golden Age, then, man forsook his forests : or, if you will, he was expelled from his Garden of Eden ; and it did not require very many generations after that expulsion to teach man the value of the forests he had left, for we find that when Abraham came out of the Land of Ur, he "planted trees." This is our earliest reference to afforestation, so far as I know ; and it matters little that the trees were probably date palms planted for food and shade, instead of for genuine forest purposes. The French Forest Service at the present day prosecutes exactly that Abramic type of forestry in Tunis and Algeria ; and the British foresters practise it still in Palestine. From Abraham it is not for us a far cry to Solomon, who was in such dire straits for timber that he imported it from Hiram of Tyre to build his temple. I think that Josephus records, although I have not been able to verify the reference, that Solomon decided not to get caught again in that fashion and that he had plantations made of the timber trees for which he had paid the heaviest prices—the earliest example of panic afforestation, with species unsuited to the site. In later times nation after nation copied his errors both of initial omission and tardy commission : and despite all that foresters can do or warn, there are recurrent outbursts of large scale afforestation with hopeless species.

After Biblical times, there do not appear to be many useful or dependable literary references to forests until the full power of Rome was felt in the world. The fleets of the same Solomon and Hiram of Tyre are said to have plied the sea route to India and to have brought home amongst other wares, the Indian sandalwood ; in some of the ancient Sanskrit epics there are references to burning off immense tracts of Indian forest for the settlements of twenty centuries before the Christian era. Arrian, in his history of Alexander the Great's Indian expedition of the 4th century B.C., describes in general terms forests extending "boundlessly" over areas which are now largely treeless, but there is no hint that any of the other civilisations up to Roman times made the slightest attempt to preserve the forest (save for some

sacred groves, etc.), far less to regenerate and perpetuate it. By the second century B.C., however, Cato found it necessary to prescribe a cultivated woodland as a portion of every well-conducted farm. His model farm of 100 *jugera* had 1-7th in woodland, ranking apparently equal in importance to the vineyard and the olive grove.

By the time of the Empire, something approaching a forest administration had been set up : and there are references to "*Saltuarii*" in Gaul, apparently a corps of foresters who worked in co-operation with the *agrimensores*, or surveyors—the earliest foreshadowing of the close liaison between the Lands and Survey Department and the Forest Service. It seems probable that by the time of Julius Caesar, forests had definitely come to have a value (not necessarily a money value) as a natural resource, for he records that, on his invasion of Britain, its timber trees were the same as those of Gaul, except that fir and beech are absent (Book IV). Very shortly after this, Vergil saw fit to publish a treatise in verse on sylviculture (Georgics II). It is surely a reasonable inference from this that by this time, the need of timber was pressing sufficiently hard on Roman civilisation to have induced for some years at least some attempts at artificial replenishment of the timber resources. Prosaic rural activities are practised for many years before they are sung by the Poet Laureate, and Vergil's Georgic is a compendium of traditional sylvan lore that must have taken centuries for its accretion. Nor is it without the glaring sylvicultural and botanical errors of mis-statement and over-statement that beset the layman, who accepts uncritically the "yarns" of the bushman bred and born. The orthodox commentator glosses these over as poetic license, or struggles with highly improbable variant readings. Though it be classical heresy, may not one assume that the rural and bush population even then ran true to type and pulled the bardic leg when it got the chance ? The errors in fact, the egregious and plainly ingenuous exaggerations, if you care to interpret them in this simple and natural fashion, are an added proof of the existence even at that early date of a seasoned and tried forest population ready to exploit the credulity of a townsman and poet !

However these details are interpreted, there can be little doubt that Vergil's poem is an indisputable proof that at least a primitive type of estate arboriculture was in general vogue by the early days of the Roman Empire, and the only reason for its existence must have been dearth of timber.

There are other fragments of evidence tending to confirm this. The Plinian references to "*arbores peregrinae*" have been long construed as proof that the Romans dabbled in exotic trees (though recently this translation has been doubted) and orthodox British silvicultural text-books for the past century have taught that the tree introductions to Britain dating from Roman times include English Elm, Chestnut, Lime, Black and White Poplar and Horse Chestnut.

A recent archaeological report states that "even in the Lebanons, boundary stones set by Hadrian's foresters are being found." (Fosdick).

All of these are but casual and fragmentary references, but they certainly, when taken together, furnish strong presumptive evidence that the Roman Empire (and possibly the Roman republic before it) did develop some type of organisation for forest protection and possibly forest improvement. With the downfall of the Roman Empire, traces of forestry, like traces of many other activities of advancing civilisation, are obliterated for many centuries. The Middle Ages were responsible for the birth of rigorous, even savage, forest laws, beside which the much "detested and cruel forest laws" (to use Dickens's phrase) of the Restoration, were humanitarian legislation. The period was also probably responsible for much European forest destruction for military reasons : but, on the whole, it is doubtful whether during the whole period, there was any known activity which seriously altered man's relationship to forests. The forests of Europe as a whole were in process of attrition before a slowly developing European civilisation.

**III. English Forests and Forestry.**—For most of us, history after 400 A.D., is English history, and it serves as well as, if not better than any other to show the conflict between a progressing human population and a forest population. In every country, perpetuation of the forests has received setbacks from many other human activities ; and it is more than coincidence to find the same anti-forest factors occurring again and again. Agriculture, particularly pasturage, is an obvious competitor with forest culture for possession of the soil. It is less obvious that extensive mining should devastate forests ; but historically it can be shown that this has always been the case. Every revolution in methods of transport had its special effect on forest industries ; every war—particularly every naval war—had its timber supply as a crucial question ; every social and constitutional reform bore heavily on forests in ways that can be detected only by special research in relevant archives, or by careful interpretation of casual references in contemporary writers.

In a paper of this type, there is not space to do more than sketch the broad outlines of these factors affecting English forests and indicate the sources of information. In the earliest days after departure of the Romans, the numerous forests of Britain are little more than names ; but it is astonishing to follow through history the disconnected references to individual forests which persist despite centuries of abuse and neglect. For instance, it is on record that in 450-70 A.D. the Jutes under Hengist and Horsa were stopped in the westward march by the Andred Weald on the eastern marches of Sussex. At long intervals the name of this forest crops up again and again in English history until Elizabethan times, by which date the iron smelters had so devastated it that they were forbidden to take trees over twelve inches in diameter within fourteen miles of the sea (probably the earliest statutory attempt to save timber for shipbuilding).

It is considered that England, broadly speaking, enjoyed forest plenty until 1535, i.e., from a timber point of view there was no dearth

and the clearing was legitimate clearing for land settlement. This date was the year of Henry VIII's suppression of the monasteries: and not the least desirable of the monastic possessions from a revenue point of view were the ecclesiastical forests. The five centuries of land clearing on a large scale had at last brought a scarcity value to standing timber and Thomas Cromwell shrewdly appreciated the fact.

The period from the Conquest to 1535 was the period of legitimate land clearing—*i.e.* economically legitimate, but too often, not legally so. It was the era of the "forestry of vert and venison," the most picturesque in forestry history: and undoubtedly from that period dates the English inveterate and now apparently congenital hatred of forest control. The forests were the royal pleasaunce, the King's preserve for the beasts of the forest (red, fallow and roe deer and the wild boar) and beasts of the chase. Forest laws of the period were and are commonly held to be designed solely to preserve these animals for hunting—chiefly royal hunting—or, if they did give statutory protection to trees, it was only on account of their protective and food value to the forest fauna. This view is but a half-truth, sedulously fostered and preserved in English oral and written legend, and always attributing the evil to the Norman influence. It is not realised that forest law goes back to the times of Canute at least; that the forest laws were administered by special forest courts (eyre-motes); and that they conferred rights and privileges (e.g. housebote, haybote and firebote) as well as penalties. Perusal of the long records of the verdicts of the eyre-motes does not confirm the popular ideas of the historical novel and the Robin Hood legend, that the usual penalty for killing a deer was speedy death without trial; but that fallacy is firmly fixed in the head of every British child from his earliest years and he grows up with the firm conviction that forest laws and forest control are marks of serfdom. Robin Hood and Sir Walter Scott have much to answer for!

Time and space do not permit me to dwell on this most picturesque and informative period; but it should be noted that the Magna Carta concerned itself to a very large extent indeed with forests. King John had proclaimed large tracts of country as royal forests and by the Magna Carta he formally revoked all such proclamations made during his reign. In 1217, the popular attack on forestry was renewed against Henry III, who was forced to sign a Charter of the Forest which was to all intents and purposes merely a long series of further "Revocations of Proclamation as Royal Forest," such as may be read in almost any copy of the New Zealand Gazette at the present day.

In the latter part of this Plantagenet/Tudor era of forest clearing for settlement, the anti-forest forces were strengthened by the growth of the iron smelting industry, already referred to above in respect of the Andred Weald in Sussex, and of frequent mention in all accounts of the Forest of Dean in Gloucestershire: and by early Elizabethan times the zest for exploration for sea voyages and expeditions had

already begun the toll of the forest that naval construction and repairs exacted for a period of two and a half centuries. British forestry and British timber trade became entangled in international questions. The first recorded British attempt at afforestation was carried out by Lord Burleigh in 1580, when the then new idea of sowing acorns to form a forest was successfully carried out at Windsor Park. From the present Empire viewpoint of forestry, the most significant date of the period is the last day of the 16th century, when the Queen signed the Charter of the East India Company. The teak supply thus made available was, as the years and centuries rolled on, to constitute the best substitute for British oak for naval needs ; and though many Indian forests were wrecked in the process, the teak was undoubtedly a powerful factor in establishing British maritime supremacy. It is also well to realise here that the naval timber supply involved two major factors, firstly the well-known demand for oak for hulls, and, secondly, the much less appreciated demand for pine timbers for masts. England could not supply her own mast timbers, and the whole international situation was handled for centuries with the mast supply from the Baltic as one of England's vital points. Between-line reading of Pepys' Diary gives some insight into the importance of the question of the feasts enjoyed by mast importers, and of the crumbs that fell to the lot of the Clerks of the Navy Office, who were in a position to place contracts for masts. Most writers stress the oak position and overlook the pine position ; but very definitely England's immense Baltic timber trade in softwoods began then.

Despite the urgency and the depletion of home supplies, adequate afforestation did not begin in England till the 18th century. The 17th was marked by forest depletion only—Cromwell and his men ruthlessly cut the timber on sequestered Royalist estates to supply their urgent needs ; Charles II, on his restoration, both felled his royal forests for his Navy and alienated them to naval contractors for his private purse. When he did try to protect them, he was both outwitted and maligned, even the kindly Dickens in his "Child's History of England" adding his meed of obloquy to the attempt to re-introduce forest laws, though never before had England's forests so sorely needed protective law !

The naval timber demand may be said to have ceased to be acute in the 1830-1840 decade, when iron vessels began to appear, ironically enough just when the extreme pressure of timber demands culminating in the Napoleonic period had forced England to some measure of forest replenishment, mainly by private effort. The softwood trade with the Baltic suffered no set-back from the change, the mast market being gradually replaced by the industrial wood demands for softwoods created by the Industrial Revolution and the increasing mining activity with its pitwood demands. The adoption of the Free Trade policy of Britain firmly established the domination of Baltic, Scandinavian, French and Portuguese softwoods on the English market

until at the present day 95% of English demands for such timber are imported. Only during the Great War was this importation interrupted : and for two years at least, thanks to the afforestation efforts of 70 to 100 years previously, England supplied her own essential needs, and released the ships required for this trade for other essential purposes.

The cycle is now again complete. A post-war afforestation effort has been in operation for 16 years. Close on 400,000 acres have been planted in Britain. The stage of marketing home-grown pit-props and other timbers in reduction of imports has arrived, and opposition is again fairly severe. There is, further, a very strong popular outcry against enclosure of any more open public land for softwood planting. The New Forest problem is still as beset with thorns as it was in the 12th century and is a topical Press item locally in England. Britain's wood imports of last year were valued at £39 million pounds (25% more than the next biggest single item, cotton), and amounted to eleven million tons, a most important item to shipping and labour interests. The forester contends that forestry, however, will absorb more labour than it displaces and is the most important single occupation available for ruralising a large section of the nation's labouring population and so counteracting the much deplored urban drift.

We are back to forestry as a sociological problem, and the point of interest is whether history will repeat itself in British countries and the forests of the country's well-being disappear before the country's ease and pleasure of the moment.

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