ESSAYS

ON THE

SCIENTIFIC MANAGEMENT

OF

FOREST TREES.

By G. CREE.

PRICE FOUR SHILLINGS.

Philip Sir
Sloane

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SCIENTIFIC MANAGEMENT

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FOREST TREES.

BY

GAVIN CREE,

NURSERYMAN, AND SURVEYOR AND PLANNER,

BIGGAR.

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TO

His Royal Highness Prince Albert.

PREFACE.

ARBORECULTURE, or the Management of Trees, is to render them of the utmost value. The value of Woods is of a compound nature—the timber, their show in summer, and their shelter in winter,—the first may be likened to simple, while the two last may be considered as compound interest.

Woods, like every other kind of produce, may, by proper management, be greatly increased in value, and the best method is by a regular system of pruning and thinning yearly.

The Management of Trees has been treated of by a great number of Authors, from the days of Evelyne in 1670, to the present time, and in many cases to little advantage.

My forefathers, for the last three generations, have paid great attention to the cultivation of trees, and, from what I have learned from their experiments, I have been induced to follow their example, and have always made it a rule to put every system, which I considered inconsistent, to the test of practical experiment.

Gardeners who have been bred to the grafting and training of Fruit Trees, and who have afterwards had the management of Forest Trees, in ninety-nine cases

out of a hundred, prune them all on the same system. Now this is absurd, for each kind of tree, shrub, &c ought to be treated according to its kind, either for flower, fruit, or timber.

Most of the Authors up to the present day have had little knowledge of the sound principles of pruning and thinning Forest Trees, and some state that no rule can be laid down; in this I consider they are incorrect.

While the Science of the present day enlarges our understanding, it equally tends to simplify and concentrate our judgment; and what may at first be deemed merely objects of enlightened curiosity, often, in time, become of the utmost importance to the country, and the discoveries of the present day are easily incorporated with the elementary.

All I have stated I submit to the judgment of the public; my object is to give the following Work in as concise a form as possible for the advantage of those interested, who I hope will find, on testing it, the good effects of the system.

INTRODUCTION.

The Science of Arboreculture is of the utmost importance to Britain, and all other Nations similarly situated, apart altogether from ultimate pecuniary advantage, beautifying the landscape, giving shelter in winter, and shade in summer.

The Science in question opens to proprietors a never failing source of pleasure and profit. In dropping the acorn and transplanting the seedling the planter's business is merely commencing, and he should never forget the numerous appliances essential to the nurture of genuine heart of oak, so potent, after passing through the hands of the ship-builder, in guarding the shores of our country.

"Britannia needs no bulwarks,
Nor towers along the steep;
Her march is o'er the mountain wave,
Her home is on the deep."

For many years I have made strenuous exertions to diffuse a knowledge of my system of pruning and thinning forest trees, and have succeeded in certain quarters to a considerable extent, and thereby acquired the approbation of several authors of eminence, familiar with wood-craft.

By adopting this system, trees are made to attain their full growth and to produce sound and valuable timber in one third of the time that would be required if they were neglected or their constitution destroyed

by improper treatment. I have proved the correctness of the system by upwards of forty years' practical experience, and it has now attained some celebrity in various quarters.

Previous to the year 1808 I pruned a number of neglected trees on the old system, making each tree a bare pole, believing that if I pruned so as to have a long body a head would be formed in time. So little did I then know of the value of branches, leaves, and sound timber—but I received experimental conviction of the inconsistency of the plan. I afterwards made a number of experiments, having a full command of trees, till at last I adopted my present system and brought it to fixed rules, which will be found detailed in the following pages.

Trees should be first pruned by shortening their branches from the time they are two or three feet till they are twenty-six feet in height which will keep them of a conical form, and thus they will receive more sun and air. Trees that are naturally conical have a rapid growth, such as the poplar, willow, silver, spruce, and larch firs, &c.; and when other kinds such as the oak, plane, elm, ash, and beech, &c., are pruned into the same conical form when young or neglected, the difference of their growth in height yearly is in many cases imperceptible. Although trees with spreading heads are pruned into a conical form when young, to produce a sound body of timber, when pruning is discontinued they will regain their natural form, and the value will be at least eight times greater than if they had been left unpruned or mismanaged.

Now it is of the utmost importance to prune trees, when young and neglected, into a conical form, for the

shoots at the end of the shortened branches are of a delicate texture, and producing, as they do, the healthiest and most profuse foliage, they are of the greatest value in elaborating the juices of the tree and inducing the increase of the woody fibre and other tissues which enter into the composition of the trunk.

Vegetables are perfect in their structure, and it is from the cultivatiou of the soil that they are raised to the utmost perfection.

Trees, on the contrary, are formed imperfectly, but pruning has provided for their improvement, independent of high cultivation of the soil, by the extremely simple process of first shortening the lateral branches, so as to concentrate the whole strength into the body of the tree. It will be found that young, neglected, and some kinds of old trees, when pruned by shortening their branches, their vegetable powers are improved by the finer and increased foliage, which attracts and imbibes a greater quantity of gases from the atmosphere. Air and water, combined with the soil, contain all the principles of vegetation, viz:— oxygen, hydrogen, carbon, nitrogen, and electricity, which last has been discovered to act in a wonderful, although imperceptible manner, on the growth of the vegetable creation; and in proportion to the sharp pointedness of any vegetable, or conical form of any tree, it is admitted that it acts more powerfully, which shows the advantage of my system of pruning forest trees.

This plan of pruning attracts all the elements that increase the growth, and as the spring advances, the elevated temperature, combined with the pressure of the atmosphere, acts in the first place on the sponglets of the roots, by the moisture of the soil, which insinu-

ates itself into them, combined with air. During the day the heat of the sun rarifies and expands the sap of the vegetable, which makes it ascend. The same air and sap cools during the night, and is condensed and contracted, so that the roots, being more open, receive the moisture of the earth pregnant with nutriment.

It is in this manner that all vegetables feed in the night and digest in the day. The ascending sap possessing the same chemical principles as the seed, forms the leaves, and evaporating a part of the sap useless for nutriment, and the part not decomposed mixes with that inhaled from the atmosphere by the leaves, which is now termed the descending or proper sap, and is acted on in the same manner as it acts on the rootlets upwards and has the same pressure downwards; and as the two saps first commingle in the leaves, the descending or proper sap at last extends to the rootlets, again commingling with the ascending sap after being divested of its nourishing properties, and of the same consistence as the ascending sap; so that a regular ascent and descent is continued through the summer, and, according to the health of the tree, the sap is of higher or lower temperature, and moves in proportion.

It is said that the pulse of a young infant beats from 130 to 140 times in a minute, and decreases as life advances so that in middle age, and in perfect health, it is from 72 to 75 per minute, and in the decline of life it falls to 60, so it must be obvious that a medical practitioner ignorant of these facts must be liable to make the most absurd blunders; and on the same principle it would be equally absurd for any person to prune a tree without having some knowledge of the effect that would be produced,—the result expected

would in all probability be retarded instead of increased growth; which shows that some fixed rule should be adopted consistent with reason.

When trees are old, stunted, or neglected, their foliage decreases till they cease to live; but there are other ways of making plantations regain a healthy state, independent of pruning, viz:—by keeping them properly thinned and well drained. It is the opinion of several eminent writers, that trees crowded together in plantations suffer more from a deficiency of carbonic acid and oxygen, (both of which are required for respiration through the leaves,) than from a want of nutriment by the roots; and this is a fact of which most proprietors and managers of plantations are not aware.

By the respiration of trees and vegetables, the carbonic acid gas is withdrawn, and an equivalent of oxygen substituted by the mutual action of the animal and vegetable kingdoms, and the balance of the constituted elements of the atmosphere is maintained. Although the laws of nature regulate the production of vegetables and trees, still we possess the most absolute power over them, that is, we hold in our hands the means of regulating their action, and if we neglect to use them as is too often the case, it is not Science that is to blame, but those who undervalue or neglect to use it. Trees will grow although they be neglected, but in that case it cannot be expected that they will all yield valuable timber; they are perpetually renewing themselves, and this they do more rapidly the more healthy they are.

We should not forget that the rate of production is accelerated and its quality improved by the rules to be laid down with regard to keeping plantations properly

drained, the temperature being higher on dry lands than on those that are damp. Cold air being heavier than warm air the stratum of the atmosphere next the soil will be in general colder, and more so in damp and undrained lands, for there the atmosphere contains less carbonic acid. When water abounds in any soil it prevents the gases of the atmosphere from entering, and the atmosphere over such lands is deficient in the gases compared to that over land sufficiently dry.

It is a well ascertained fact that the quantity of heat that flows in a given time from a body with a polished surface, is less than that which would flow from a body with a rough surface; the difference varies from 100 to 15. From this fact, which is admitted by the most eminent men of the day, we are enabled to deduce some knowledge with regard to trees covered with dead branches and moss. On this principle they must lose their temperature more rapidly; and on the contrary trees that are free from dead branches and moss will be found more healthy and of a higher temperature. This I have proven by actual experiment,...I directed the dead branches to be taken off a larch plantation about 50 years old, and a great improvement in the health of the trees and the cleanness of their bark very soon became apparent.

In 1830, there appeared in the Edinburgh Literary Gazette, an article stating that before the expiry of ten years we would look back with surprise on our ignorance of the management of trees; that is now twenty years ago, and some of the writers are going the backward way.

ESSAYS, &c.

(*This Essay was written in* 1832, *and was translated into German above ten years ago.*)

To its woods a country owes much of its beauty; they temper the severity of the climate for the benefit both of the flocks and the crops of the husbandman. But in a no less important point are woods to be viewed, for their economic value. As timber they are extensively, nay universally, employed in all the mechanical arts; and hence the proprietor of woods has to look to them not only as an interesting but as a highly valuable species of property.

Woods are so extensively grown, that there are few landed properties, however small they may be, where they are not to be found to a greater or less extent, either planted by the hand of man, or the spontaneous production of nature. That the management of woods is not well understood, or at least but imperfectly attended to, and therefore that the remarks which I am about to state are not uncalled for, may readily be admitted, if we may be allowed to judge from the present state in which a great majority of woods are to be found. I am sure, indeed, that any person of ordinary observation will agree with me in saying, that the mode of management bestowed upon woods in most places, is far behind its sister art,—the

agricultural operations of the field. But we ought always to keep in mind, that a mismanaged crop of wood is a very different thing from a mismanaged crop of corn. The latter is only an annual crop, and hence, however much a farmer may feel for the failure of any of his crops through carelessness or mismanagement, the loss is only that of a single season; whereas a mismanaged crop of wood is, comparatively speakiug, the loss of the land itself, the crop requiring frequently half a century, and sometimes more, to arrive at maturity. But it is much easier to admit that the evil of mismanagement of our woods does exist, than to explain the reasons of that carelessness or indifference towards this species of property, on the part of those to whom, under proper management, it would become such a source of profit.

The young and rising tree mnst be modified by art; for though nature performs her work unassisted and alone, she is often found to produce irregularities in the growth to maturity of a tree, which are not profitable, nor suited to the uses to which it is employed by man: hence it is for man to modify the tree, so as to suit the purposes required.

Much discrepancy exists in the statements of different authors on the subject of prnning. Pontey, Nicol, Sang, Monteath, and others, as is well known, hold very different opinions on many points connected with it. In such circumstances, those who have charge of woods, and who may be more guided by the opinions of others than from rules deduced from their own experience, may feel a difficulty in determining the proper system which ought to be adopted. Besides, it is not to be expected that foresters in general, and quiet

country gentlemen, should have in their possession the works of many authors on this snbject, to enable them to contrast and collate the different modes recommended, and to weigh their merits, or ascertain their correctness, by long-tried experiments. Hence it is that some have implicitly followed one system, until they ultimately found it to be a bad one; others again have followed a different system, which they, too, have found to fall short of their expectations in its beneficial effects; and the result of these attempts, commenced with a disposition to manage well, has often been to neglect their woods altogether. But that this is a state in which trees ought not to be left, is easy to be shown. Trees when left to themselves often have a tendency to shoot out into large forked branches, or two or more shoots contend with each other for ascendency as leaders; and such trees even at the period of maturation will frequently be fonnd to prcsent only a quantity of brushwood. Now, it is the province of pruning, under a proper system, to modify and correct these evils;—in short, in order to produce a clean and large stem of timber, pruning can rarely be dispensed with.

When opinions on the subject of pruning are in such an unsettled state, I conceive that it may not be deemed an intrusion in me to present an account of my humble efforts in this department of forest culture. And I may observe, that, whether the rules which I shall lay down shall be adopted generally or not, I have the satisfaction of stating that they are not ingenious speculations or theoretical schemes, bnt have been derived from observations and my own practice in that system during a period of nearly thirty years; and I may add, that, in whatever light it may be viewed by

others, the system has, in all cases which have come under my observation, been crowned with the most satisfactory results. As the system which I shall lay down, has an especial reference to the general functions of the plant, and will I trust always be found in accordance with the laws of these functions, to make myself understood to those who have not devoted attention to this subject, I find it will be necessary to state shortly so much of vegetable anatomy and physiology as falls within the pale of my subsequent remarks.

In explaining the anatomy of the wood, a transverse section of a young tree near the root will best show the parts to be mentioned. The pith is the part in the centre, which is composed of cellular tissue. Around the pith is the wood, formed of concentric cylinders, agreeing in number near the root with the age of the tree. Exterior to the outmost of these is the bark, which consists of three parts. The first is the outer covering, termed the epidermis: immediately below it is the soft pulpy substance of cellular tissue, or parenchyma. The third is the cortical concentric layers constituting the mass of the bark, the innermost of which is called the liber. And it is between this liber and the last concentric layer of wood that the alburnum is annually deposited.

The functions of vegetables, and in particular with reference to the modes and offices of the ascent and descent of the sap, have excited the scrutiny, and exercised the ingenuity, of physiologists. In this field have appeared Malpighi, Grew, Hales, Hedwig, Duhamel, Saussure, Senebier, Darwin, Ellis, Keith, Knight, and a host of others. When the earlier of these authors wrote, vegetable anatomy and physiology

was comparatively speaking little understood; and from the little that was known, or from their own observed facts of isolated cases, the whole structure of vegetable physiology was made up; but a considerable part of it, as was to be expected, consisted of the fanciful theories of these eminent men. Subsequent researches and observations, however, have dispelled the mist from most of these ingenious bnt fallacious theories, and the science may now be held to rest upon a pretty solid basis, to a part of which I shall briefly advert.

Early in spring, as the temperature of the atmosphere is elevated, the sap ascends in the tree. It is absorbed from the soil by the minute sponglets, at the extremities of the capillary rootlets of the root; and it ascends through the root upwards. In very young trees its ascent is through the pith and also in young branches; but in trees even of a few years old, as well as in old trees, it ascends neither through the bark, nor between the wood and the bark, nor the pith, but through the concentric layers of wood, and, in the greatest quantity, through those last formed.

The bud which is formed in the preceeding summer or autumn, is supposed to be nourished previous to the evolution of the leaf, by nutrient matter in the alburnum deposited in the preceding autumn. After vernation takes place, and the leaves are all expanded, the sap still continues to rise through the wood, ascends to the branches, and from them to the leaves. The leaf itself is formed of a vascular system of cellular tissue, covered with an epidermis. The sap when it ascends to the leaf, perspires or throws off a large quantity of aqueous vapour. It is then acted upon by

light and air, in a manner unnecessary to be here explained; and it is at this part of the plant and stage of the course of the sap, that plants, in the opinion of some philosophers, obtain the peculiar properties—aromatic, narcotic, and the like. After the common sap has been thus changed by the agency of the leaf, it is now called "proper juice;" it accordingly descends in what are called proper vessels, in contradistinction to those in which it rises, and which in trees are commonly situated in the bark. Trees, however, possess the properties of adding their new wood either from the liber or the alburnum, but it is generally deposited between the liber and the alburnum of the last year, which is now being formed into wood. The new vegetable matter thus formed, which was by Grew termed *cambium*, differs in colour and properties from the proper juice, and is regarded as a secretion, separated from the proper juice by the vascular structure of of the liber or alburnum. And it is in this state that it is fit for the formation of vegetable matter, and each year forms the concentric cylinder of new alburnum.

It thus appears that leaves form the primary objects of vegetable functions, and that they form the organs of communication between the wood and the bark, and are the chief cause of the ascent of the sap after they have expanded. The sap indeed does ascend, and even in greater quantity, before the leaves have expanded; but this is an effort which the tree is known to possess only for a limited period. And the experiments of Dr Hales and others made upon plants by divesting them of their leaves, clearly show the important functions which the leaves perform in the vegetable economy. Now as branches are the supports or pedes-

tals of leaves, and as the latter are of such vital importance to the proper growth of the tree and the increase in magnitude of the stem, it is the leading feature in the system of pruning just to be explained, to operate upon the branches in such a manner as not to prove injurious, but to accelerate the growth of the tree.

To manage woods in a proper manner, young trees should be examined even the third year after they are planted; and if any more leading shoots than one are found to exist, the best one should be selected, and the others shortened to one-half the length of the selected shoot. This practice of examining the trees, should be continued every year till they are about 15 feet in height. These shortenings, however, which should not be confined to superfluous leading shoots, but should include any branch which is gaining a disproportionate ascendency over other branches of the same year's growth, should, at first, and even for some time previous to this stage of the growth of the plant, be more cautiously done than is necessary to be observed afterwards; and should increase in severity as the tree approaches to, and after it is 15 feet in height.

The process of examining the tree is a simple one; it is done in a moment by the pruner casting his eye over the whole tree, and detecting the branches which require to be shortened. And, as a general rule, when it is found that any branch has a greater growth upon it than the leading shoot, it should be shortened by cutting off as much as will reduce it to half the length of the leading shoot, or even less. By this I mean any branch which is either of greater thickness generally, or near its junction with the main stem of the tree, than the leading shoot is at the same distance from its

top. And, as trees produce only one regular tier of branches in each year, any branch should be shortened which is of a greater length than the majority of the branches of the same tier, or if the whole are too long, they must be shortened. In the case of trees intended for timber, after they are at and above 15 feet in height, this rule of shortening the branches must be applied to the undermost tiers of branches. In this manner, all the under branches of any importance will have been shortened, which prepares them for the next operation.

After the trees are about 15 feet in height, the undermost tier of branches only should all be cut off close to the stem in one year; in the subsequent year another tier of branches should, in the same manner, be cut off, and so on every year afterwards, always cutting off only a single tier in one year. The same process of shortening the branches is always to be continued, as before directed, but must be discontinued some years before the cutting off of the branches shall be discontinued; so as to give a more extended top to the tree; for all trees that have naturally conical heads such as the willow, poplar, larch, silver and spruce fir, require longer heads than those trees that are of a spreading nature, such as the oak, beech, and others. But no branch, wherever it be situated, is to be cut off close to the stem, until such branch stands upon the undermost tier. In this mode of shortening the branches, it will be seen that the tree will at all times present a head of nearly a conical form; and advantage should also be taken of shortening such branches as will balance the tree best, aud produce a proper shape of the top. But in shortening the branches, too

much should never be done in one year; nor will it be necessary to do so, provided the trees are attended to in the regular manner I have described.

Many advantages resulting from this mode of shortening the branches, may suggest themselves to the careful enquirer. It is well known, that when a part is taken off from the leading shoot of a tree, however small that part may be, the growth of the remaining part of that shoot is greatly impaired, and is never afterwards able to keep pace in growth with the other branches. But the new leading shoot which springs out in consequence of the other having been impaired, and the part of the stem at which it springs out and downwards, will be found to increase in a greater proportion than even lateral branches of greater magnitude, than this new leading shoot. It thus appears that the greatest part of the energies of the tree is naturally directed through the main stem chiefly to the leading shoot; and where the tree has two leading shoots more, these energies are divided amongst them. Or where there are large branches with many subordinate branches upon them, these will also divide the efforts of the growth of the tree, and retain an undue proportion of them. Now, it appears, as has already been observed, that the growth of any particular branch or shoot may be greatly debilitated by merely shortening it. Nay, it will even be found, that to cut off the bud of a leading shoot, this purpose will, to a certain extent be accomplished. But we must ever bear in mind, that any great dismembering of the vegetable structure must operate upon many of its functions, and hence is often found to prove injurious to its growth. Whatever is done, therefore, ought to

be done gradually; and this method of shortening the branches, which I have explained, paves the way for their final amputation.

I have endeavoured to explain the important part which the leaves perform in the elaboration of the proper juice. Now, by this mode of shortening the branches, a number of smaller subordinate branches will still be left upon the shortened branch to produce leaves, and which will perform at least a considerable part of the functions of the branch in its shortened state. The effect produced on the remaining part of a shortened branch is to produce larger leaves the first year. This may be accounted for from the quantity of sap intended for the entire branch, which will ascend in the first spring, being now applied only to the part remaining. And, besides the neatness and uniformity of foliage which a tree so shortened is found to exhibit, the leaves on these shortened branches will still remain to perform their useful functions. I may add, that, under this mode of pruning, I have found that trees in general will advance in growth as much in one year, as they will advance in three or four years under similar circumstances, but when not so pruned.

At that period when the shortening and cutting off of the branches should commence, I have stated the size which the tree ought to be; but it remains to be shown, how long the practice ought to be continued, or, in other words, what proportion the head of the tree ought to bear to the pruned trunk. Pontey, Sang, and Monteath, conceive that the growth of the stem is as effectually promoted by having few branches to a head as by many. Were this the case, there would be no need of the care and attention of annual shortening

and cutting off of the branches, which I have stated to be the principle upon which my system rests ;—nay, further, it would set aside the established opinions of physiological botanists regarding the properties of the leaves in the elaboration of the proper juice of the plant. Neither, were their assumption correct, would we see those injurious effects result from sweeping prunings, as in many places practised, by which the trees remain almost stationary in their growth for a number of years afterwards. But that the assumptions of these individuals is incorrect, at a very early period of my practice I received experimental conviction. In one instance, I pruned a number of trees in a hedge-row in the common way, but a few of them were pruned much higher, leaving only a small top of branches. The trees were in other respects similarly circumstanced as to luxuriance of growth. And those which were most pruned, not only at the time did not keep pace in growth with the others, but even at this distant period, and it is now above twenty years since it took place, these trees are still far inferior to the others. Examples of this kind soon convinced me that extirpating many branches at once, or leaving a small head, were equally ruinous to the proper growth of timber. I have already stated that the cutting off of the branches should commence when the tree is about fifteen feet in height. The age of the tree at this height will depend upon the luxuriance or stuntedness of its growth. But supposing it then to have twelve regular tiers of branches, or to be thirteen years old, it is evident, that, for a number of years to come, by only taking off one tier in a year, the part of the tree covered with branches will be much greater than that

part of the trunk which will be cleared of branches. This will be more distinctly shown in the following Table. In it the statements are made at intervals of four years, for the sake of brevity; the growth of the tree, too, for the sake of simplicity, is assumed to be the same in each year, namely, fifteen inches. This, I am well aware, is much less than the annual growth, especially of properly pruned trees; neither indeed is the growth constant, but varies with the age of the tree and other circumstances. The assumption, therefore, here made, is taken merely because it is a convenient one for illustrating the effects of this system of pruning.

At 15 feet in height, and supposing the tree to have 12 tiers of branches,	Height of the Tree.	Total number of Tiers of Branches.	No. of Tiers of Branches remaining.	No. of Tiers of Branches removed.	Length covered by Branches remaining.	Length of the part from which the Branches have been removed.
	Feet.				Feet.	Feet
	15	12	12	—	15	—
In 4 years afterwards,	20	16	12	4	15	5
In 4 years more,	25	20	12	8	15	10
In 4 years more,	30	24	12	12	15	15
In 4 years more,	35	28	12	16	15	20
In 4 years more,	40	32	12	20	15	25

In the last line of the table, it will be seen, that, at thirty-three years of age, at the assumed rate of growth, the tree will be 40 feet in height; it will have had in all thirty-two tiers of branches, of which twelve are still remaining, and twenty removed; and the height of the part of the stem cleared of branches will be 25 feet, and the part covered with branches 15 feet. It is a question of some importance, what proportion the trunk ought to bear to the head, or the part covered with branches, in a full grown tree. Pontey's proportion, as given in the Woburn beech, is 50 feet of trunk,

to 22 feet of head. Sang gives 50 to 25 The proportion which I have found to be best, is the trunk to be about 3-5ths of the whole height, and the head 2-5ths, —that is, in a tree of the size in question, 45 feet of trunk to 30 feet of head.

The proportion which the head stands to the trunk in the last line of the above table, is 25 feet of trunk to 15 feet of head. But in the example there given, the assumption is, that the tree has then arrived only at 40 feet in height. Climate, altitude, situation, and soil, operate very materially upon the growth of trees; and these circumstances must be taken into account in assuming the height to which the tree may be expected ultimately to arrive. Where, therefore, it is expected that the tree may arrive at a greater height than that given in the table, and this will, in the majority of cases, be so, the annual pruning should be occasionally omitted, but only for a single year at a time, a considerable period before, so that, at the full growth of the tree, the proportions of the trunk and head may be as stated above.

This is the proportion which the head ought to bear to the trunk, in forest trees; but where trees are intended for ornament or shelter, a different mode of pruning will require to be adopted. For ornament, the object in general aimed at is to have large heads, with long pendulous branches. In such circumstances, the tree may be pruned to the height of 5, 6, or more feet, as may suit the taste of the individual. The mode of pruning should be that of annually shortening and cutting off the branches, as recommended for forest trees, until they are at the height required. And to produce the conical form of the branches on the head,

if that is wished for, the long branches ought to be shortened; and in those which are of the proper length, but which are not required to be longer, the buds on the extremities of the branches should be cut off. Where shelter alone is wanted, in general the branches should only be shortened; and this will be found in a very material degree to augment the denseness of the branches. By this means, too, trees are enabled to stand closer together without requiring to be thinned, and the under branches also live longer. Trees planted as sheep-stells, as well as in woods and belts of plantations, are, by this mode of shortening the branches, in a great measure prevented from suffering by the destructive effects of heavy falls of snow.

Trees of a considerable size and age, which have been previously neglected, may be greatly improved by the system which I have laid down. But after the shortenings have been performed, a considerable period should be allowed to elapse before the branches are to be cut off close to the stem. And when this is done, especially in the case of large limbs, too much care and attention cannot be observed. The branches should always be cut off with a saw; and precaution should be taken, never to allow the branch to be split off by its own weight, or to injure in any other manner the main stem. Where this may be anticipated, and the branch cannot be propt up during amputation to prevent it, the branch should be removed at two operations,—first, by cutting off about 12 or 18 inches from the main stem, and, finally, by being cut off close to the main stem, but so as not to injure the adjoining bark. This additional trouble will be amply compensated for, by the earlier and superior manner in which the wound will be cicatrized.

Though the remarks which I have made regarding shortening and cutting off the branches, are intended to have reference in particular to deciduous and non-resinous trees, I am very far from thinking that resinous trees are not benefited by judicious pruning. The question of the propriety of pruning resinous trees has, I am aware, been very much agitated, and great diversity of opinion has existed, and does exist, on this point. But it must be evident, that, if clean straight timber, free from knots, be wanted, where branches exist, they must be removed, to prevent knots from being formed. Perhaps our best plantations of resinous trees prune themselves; and it has often appeared to me to be an injudicious assortment of trees, to intermix pines with hardwood, unless it be for nurses to be afterwards removed. Pines thickly planted by themselves, (the Scots pine, for example,) are found to produce the cleanest timber, of the most rapid growth, and frequently without any pruning. But still there are many cases, such as that of isolated trees, and especially when they are planted along with hardwood, where resinous trees produce large branches. Now these, in the case of the Scots fir, and larch in particular, ought to be removed, provided it can be done judiciously, so as not to injure the growth of the tree. By shortening and cutting off the branches in a careful manner, as recommended for deciduous trees, the object will be attained so as to injure the tree in the least possible degree.

In cutting off the branches of all kinds of trees, I wish it to be distinctly understood, that I mean them to be cut off as close to the stem as possible. But

there is a little swell at the junction of the branch with the stem which must not be cut off, by which the wound is not half the size that it would otherwise be. And no wound should be polished up to the circular form of the main stem, as such a process only enlarges the wound, and hence it requires a much longer period before it is healed over. Where the saw is used, the part, and particularly the bark, should be cut clean over.

Authors differ much regarding the mode of cutting off the branches. By some, it has been recommended to leave snags in pruning, that is, to leave a few inches between the stem and the part at which the branch is cut off. This I conceive to be a bad system. Even granting that trees suffer much by bleeding as it is called, especially resinous trees, when cut close to the stem, still that bleeding will soon be prevented by the wound being cicatrized. Now, there are two evils attending the practice of leaving snags. In the elm, Scots fir, and many other trees of considerable size, an effort is made by the tree to cover over the snag long before the annual growth of the wood arrives at this magnitude; the consequence of which is, that a large knot in the wood is formed, thus defeating one of the principal objects which it is the province of pruning to accomplish. But another evil consequent upon this practice, where no effort is made by the tree to cover it until the annual increase of the alburnum circles shall have done so, is, that the snag, in resinous trees in particular, is always liable to bleed until it is cicatrized; or where the snag has lost its vitality, it soon becomes liable to rot. From this latter circumstance, the danger is apparent of often finding large trees when cut down, though apparently sound on the

outside, rotted in the interior. Such is frequently the case with snags even in middle-sized trees. When large branches, too, are amputated from old trees, before the growth of the tree can cover the part, it has become rotted, and, by exposure to the atmosphere, moisture is carried down the pith of the tree, which commences the work of decomposition, spreading to the adjoining parts of the wood.

Thus, I think I have shown that the system of leaving snags is a bad one. And I may add, that I have pruned, or seen pruned, almost all kinds of trees both with and without snags; but I invariably found that those which were pruned close to the stem healed soonest over, and altogether gave the greatest satisfaction.

Some have recommended not to prune the pine tribe till the branches have become dead. From what I have stated regarding the impropriety of leaving snags, and the danger attending it when there is no vitality in the part, it will at once be inferred, that I recommended all branches to be removed before they are dead. But where dead branches are found to exist on any kind of tree, they cannot be too soon removed; and, for this reason, even fir plantations, which, when thick, are generally self-pruned, would be greatly benefited by the interference of the pruner.

With regard to the proper season for shortening and cutting off the branches, I conceive, that after the fall of the leaf in autumn is the best period for shortening the branches, except the gean, which should be shortened in August or September. I have made many experiments in order to ascertain the proper period for pruning or cutting off the branches. I have per-

formed it in March, May, June, July, and other periods of summer, and in autumn; but I always found, that the earlier in spring the pruning was performed, the part was the sooner cicatrized, and the tree did so much better afterwards. This I found to be the best period for trees in general. But the sycamore and birch should be pruned in January, the Scots fir in September or October, and the larch may be divested of its decayed branches at any period when it can be done with a blunt instrument.

From the limits to which this essay is necessarily prescribed, I have been able only to give a rapid, and I am therefore afraid, a somewhat imperfect outline of my system. To have done complete justice to the subject, a particular account ought to have been given of the manner of pruning trees, under their different modifications, as influenced by climate, soil, situation, and the like; and not only every species, but almost every variety of tree, ought to be brought under particular notice. In a generalized account such as this, therefore, and indeed in almost every case of pruning, a certain latitude, exercised in a judicious manner, must be taken by the pruner, so as fully to reap the benefit of the system under any particular situation or circumstance in which the woods may be placed.

To many, and to those in particular who may have paid little attention to their woods, the scheme of management which I have laid down may appear to be attended with too much trouble and expense for them ever to muster courage to attempt following it out. That it is attended both with trouble and expense, I am at once ready to admit; but for these to be objections of sufficient weight to set this system aside, it

would be necessary to show that the trouble and expense are not realized by the superior value of the ultimate crop,—a thing which cannot be shown. Let us observe what expense attends the production of many of the farmer's common crops, and, in particular, what additional trouble he must bestow on many of his drilled green crops: but the practice in his case is a common one, and therefore it is not alarming; and, besides, the farmer knows well, that the more care he bestows upon his crops, the surer he is of a better return. Now, the case of woods is quite a parallel one. Where they are improperly managed, or altogether neglected, they will seldom afford a bare return, and often be attended with a sheer loss: Whereas, where they are properly managed, they will not only repay the additional expense bestowed upon them, but will, besides, realize to the proprietor a handsome profit.

The history of the mode of pruning which I have endeavoured above briefly to explain, can be given in a few words: If I can say that I was indebted to any person or writer, either directly or indirectly, for the idea of my system, it was to the account given by Lord Kames of the manner of pruning hedges, by cutting off only a part of the lateral twigs. And, upon reflection, it appeared to me that a principle of this kind, in some shape or other, might be beneficially applied to the pruning of trees, After putting it to the test, however, I found that various modifications, upon such a principle, were necessary in the case of trees; and it was from experiments made in a variety of ways, and under different forms, and by carefully marking the results, that I at last arrived at the mode of pruning as above described.

A number of years ago I explained to Sir Henry Stuart of Allanton this system of pruning. At that time I pruned several trees at Allanton, and in two different years since I have pruned and repruned several more trees as examples of the system. The Baronet expressed to me at the time a very favourable opinion regarding it, and has since been pleased to publish his sentiments upon it in his Planter's Guide. As the paragraph explains the views which I then held regarding the history of the system, I shall here take the liberty of quoting it.

"There is a meritorious nurseryman in this kingdom," says Sir Henry (*Planter's Guide*, 2d ed. p. 448,) "to whom I was, some time since, indebted for the knowledge of this system, and who has practised it, as he states to me, for nearly thirty years, without having borrowed it from any one. It was first suggested to him, as it appears, by his own reflection, and has since been confirmed by considerable experience, and most nniform success. He was surprized when I informed him, that the principle was known, and acted on in some parts of England, with great effect. This person, who is not less unassuming than he is ingenious, is possessed of valuable materials for a treatise on the subject; by which, besides laying down specific rules for the art, under different circumstances, directions might be given, for raising and managing plantations under this system. According to the author's opinions, the pruning should be practised as early as the third year after the plantations are made, and be continued till the eighteenth or twentieth. He has likewise constructed Tables, showing the number and distances according to which the trees should be planted on an

acre of ground, and the comparative results of the ordinary, and of the terminal method. In the present low state of our arborecultural knowledge, I am of opinion, that a present more acceptable than such a treatise, could not be made to the British public."

I was totally ignorant at the time, when I explained to Sir Henry Stuart my method, that the system, in any of its forms, was known elsewhere; but from the conversation which then took place, I was afterwards induced to make research into the matter, to see whether the system which I had formed and adopted, was actually in practice. The only authors that have come under my research, who have treated of shortening the branches, are Mr Blaikie and Mr Billington; but neither of them accord in their details with my method. I may remark, however, that Mr Billington's work contains many valuable remarks on shortening the branches, and divesting them of the buds at the extremities of branches; and, besides, it is really a work of a practical description, evidently drawn from facts and observations by a practical man. A somewhat similar practice of pruning, by shortening the branches, is practised in France.

The practice of shortening the branches in pruning, has now, it would appear, gained some degree of celebrity. And it has already got a pretty fair share of names, all indicative, more or less, of the nature of the subject,—such as, "cutting in," "shortening the branches," "terminal pruning," and others, to which I feel disposed to add what I conceive to be the proper name of my system, "concentrate pruning." It seems there has also been some wrangling about the right to claim the invention. Since the bantling has

passed the critical months of infancy, and turns out to be a promising child, it bids fair for being legitimated; nay, of obtaining a plurality of paternity, a circumstance not very common in the animal kingdom at least. Bnt it is a thing possible, as has been found in circumstances of a similar nature with the case in question, that bantlings of the same class, and differing only perhaps in a few shades of lineament, might be produced nearly at the same time in France, in England, and in Scotland. Granting this to be the case, however, there might still arise a question of some nicety to determine, whether each country may be entitled to claim one for itself, or, if not, which was the first-born one, to claim the regal title of supremacy.

I have not the vanity nor the ambition to aim at a name, as the founder of any particular system; neither does my forte lie in polemical writing. My business in life has been, not to work out elaborate systems by the pen, but to work by manual labour the actual operations of pruning itself; and the system, such as it is, had only been communicated to a few friends, and was long confined chiefly within the circles in which the operations themselves were performed. Of late years, however, my system has become known through a considerable number of the central counties of Scotland. And, in the year 1823, the thanks of the Directors of the Highland Society were conveyed to me for a paper which I transmitted to them on the subject of pruning. But, besides these, were it a point of any importance to be established, I could show trees which have been pruned in the way I have mentioned, regularly during a period of upwards of fifteen years; though many more than I could at the moment claim,

have been pruned on the same principle, for a period of nearly thirty years.

The above Essay is the same as formerly published, but I have altered the close pruning from 15 *feet to* 26 *feet, as will be found in the last article fully explained.*

REMARKS ON THE FOREGOING ESSAY,

By Mr Matthew of Gourdie-Hill,

Which appeared in Vol. 3d. of "The Quarterly Journal of Agriculture."

I observed in your last Number a well written article on pruning, by Mr Gavin Cree, which, from the ability of the writer, the speciousness of the system, and his confidence in it, may lead to erroneous conceptions of the advantages of his system, amoug such of your readers as are incompetent, from want of experience or observation, to judge of its general inexpediency.

The system described in this article, and which has in substance been repeatedly described, may be given in a few words. Attend from the first to keep the tree to one stem and subordinate branches, by shortening any branch which may contend with the leader, or obtain a disproportionate ascendancy over other

branches of the same year's growth; the annual shortening to be more gently practised in the primary stages of the tree, and to increase in severity, so far as to crop a proportion of the length of the undermost tiers of branches as the tree approaches to, and after it is, 15 feet in height, or has twelve annual tiers of branches, that is, is *thirteen years of age from the seed.* When the tree has advanced thus far, remove the lowermost annual tier of branches close to the stem, and continue to remove a tier every year afterwards, so that when the tree shall have attained 40 feet of height, the cleared stem may be 25 feet, and the part covered with branches 15 feet. Should the tree be expected to arrive at a greater height than 40 feet, a year's pruning up to be occasionally omitted, so that the proportion of cleared stem, when the tree has completed its height, may be three-fifths of the height.

This author's estimate of the merits of this system of pruning, may be judged of from the following quotation: "I may add, that, under this mode of pruning, I have found that trees in general will advance in growth as much in one year as they will advance in three or four years under similar circumstances, but when not so pruned." I am almost ashamed to have to point out the incorrectness of this author's estimate of the advantage resulting from what he considers his system. Need our British growers be told, that, with regard to the one-half of the timber produced in the temperate zone,—the coniferæ,—pruning in any shape whatever will not increase the quantity of timber either in the single tree, or on a given space of ground? a well regulated closeness, or rather openness, being all that is required for extension; and the sweeping of

the smothered branches close down, being all that is required for cleanness of timber. Need I state, that in woods consisting of the other tribes of larger leaved trees, pruning will also have no influence in increasing the quantity of timber, provided the closeness be properly regulated, and the trees kept to one leader, till they reach the required height of stems, which every body knows should be done, and which every one can do; and which will require to be done in very few cases if the trees rise from the seed *in situ*, or be transplanted while small plants, and receive no pruning up to derange the fine natural balance which disposes them to rise in cones, and fits their structure to their situation? Need I say that the remaining portion of growing timber,—that which is disposed in solitary trees, clumps, hedge-rows, and outskirts of woods,—will, in very few instances, be benefited by Mr Gavin Cree's system, as these trees ought almost without exception to consist of oak, whose natural disposition, when so situated, to crooks and bends, requires a very different treatment than this author's "concentrate pruning." I am really at a loss for a situation where it might be advantageously practised, and can only bethink me of the roving woods of Allanton *, where, indeed, it seems already to have been successfully tried.

Pruning up, a part of Mr Gavin Cree's system, will never ultimately increase the size of the tree, or its

* This author, who attaches a high value to the approbation of Sir Henry Steuart, and who shows himself at least not dead to applause from so celebrated an arboriculturist, may find his endless cutting and carving system useful in restraining the exuberant luxuriance of the Baronet's trees, it being Sir Henry's practice when the trees of one park are a little exhausted of their particular pabulum, to drive them forth like cattle to feed in another. At all events, this author's system of pruning will all be required to form these unsettled trees into useful timber.

measureable timber, but on the contrary will greatly retard the extension, and destroy the capacity to attain to large size, and in many kinds will even induce early decay; *the lower branches more particularly promoting the enlargement of the roots,* in a manner almost similar to the radical leaves of herbaceous plants; the full natural extension of the roots, the source of supply, being in the highest degree essential to luxuriant extension and longevity. I have often remarked the superior rooting of trees with low branches to others of an equal quantity of foliage with long naked stems, from the distance between the foraging organs (the roots) and the assimilating organs (the leaves) being shorter, and also from a shorter distance of the stem being required to be covered with the annual wood layer, more assimilated matter will remain for, and go to, the enlargement of the rooting.

Pruning, therefore, may be regarded as a check upon the extension of the plant generally, and is useful, not in producing more timber, but in rendering the timber cleaner of knots, and of more convenient form. That Mr Gavin Cree had a sort of *conditional* belief,—a belief embracing all cropping but his own cropping,—that dismemberment or pruning tended to prevent extension,—appears from the following observation:—"The experiments of Dr Hales and others, made upon plants by divesting them of their leaves, clearly show the important functions which the leaves perform in the vegetable economy. Now, as branches are the support or pedestals of leaves, and as the latter are of such vital importance to the proper growth of the tree, and the increase of magnitude of the stem, it is the leading feature in the system of pruning just to be

explained to operate upon the branches in such a manner as not to prove injurious, but to accelerate the growth of the tree *." Now, excepting in the sometimes-occuring event of plurality of leaders, which every system of pruning I have seen gives directions to reduce to one, I am much at a loss to discover any reason why our author's pruning should be different in its effects from all other pruning. "What is thy beloved more than another beloved, that thou dost so charge us?" *His early pruning up, on the contrary, disposing the remaining branches to push as leaders, to become in proportion to their diminished number larger, thus rendering the upper part of the trunk rough timber, and also deterring the root extension, is on a par with the worst of systems.* I find I cannot better illustrate the uses of the lower branches, and my views of pruning in general, than by quoting a few passages from my work on "Naval Timber and Arboriculture," published a few months previous to Mr Gavin Cree's article.

"*Directions for Training Plank Timber* †.

"Divide all branches into leaders and feeders; leaders, the main or superior shoots which tend to become stems; feeders, the inferior branches.

"Should more than one leader appear from the time of planting the tree till it attain the required height for the plank, shorten all but the straightest most promising one down to the condition of feeders, making the

* See page 18.

† These directions are generally applicable, as well for what may be required for beams and for being bent for compass-timbers, and also for what may be used for land purposes, as for plank.

section immediately above a twig, preferring one which takes a lateral or horizontal direction.

"Should any feeder below the required height become enlarged beyond its compeers, reduce it by cropping to equality.

"Cut off, close to the trunk, all shoots which rise at a very acute angle with the main stem; also lop off all branches which, by taking an irregular direction, incline to rub upon the more regnlar, and remove all splintered, twisted, and diseased branches*.

"Do not cut away any of the lower branches (feeders) till they become sickly or dead. By pruning up these prematurely, you destroy the fine balance of nature, and throw too much vigour for a time into the top, which, in consequence, puts forth a number of leaders. You, in a very great degree, lessen the proportional increase of the fundamental and foraging part the roots, much less proper sap or organized deposite matter being furnished by high branches than by those near the ground for the extension of the roots. You diminish the growth of the stem by the loss of healthy feeders; the timber increasing in proportion to the quantity of healthy branches and foliage, (the foliage being the stomach and lungs of the plant.) You also, by diminishing the number of feeders, increase the comparative size of those remaining, which throws the upper part of the stem into large knots, improper for plank, and renders their future excision dangerous; as large feeders, when circumstances or decay require removal, or when they are rifted off by winds or snow, leave wounds which often carry corruption into the core of

* These extracts are taken from a copy of "Naval Timber and Arboriculture," in which I had inserted several additional explanatory remarks.

the tree. The removal of healthy feeders is in all cases detrimental to the ultimate extension of the individual, especially in exposed or arid situations, where the plant, in consequence of lengthened bare stem, and deficiency of rooting, generally falls into excessive seeding, and becomes prematurely aged: this is exemplified in the case of the trees of narrow stripes of plantation, which generally die at an early period; whereas trees equally exposed, as in single rows, from their low branching, and consequent strong rooting, attain to great size and age.

"After the tree has acquired a sufficient height for plank, say from 20 to 60 feet, according to circumstances of exposure, climate, &c., and also as much branching above this height as may be thought necessary to carry on advantageously the vital functions, as the superior head will now sustain small injury by being thrown out into large branches and plurality of leaders (if it be the oak, it will become more valuable by affording a number of small crooks and knees,) it will then be proper, in order to have timber as clean as possible, and regularly flexible, to loop clean off all the branches on the stem as far up as this required height; should these be covering the whole or a considerable portion of the stem, as will occur in the more open situations, where the lower branches have not gradually become sickly or dead, they ought to be removed by several successive prunings at intervals of at least two years, that the plant may not suffer an injurious check by losing too many branches at once. From the early attention to procure very numerous feeders, and to prevent any from attaining large size, the wounds will soon be closed over, leaving no ex-

ternal scar, and as little as possible of internal knot or breaking off of fibre. Should a number of small shoots spring out in consequence of this last pruning, they may be swept down, if good plank be desired; if not, they may remain, as their presence will not greatly injure the plank, and they occasion the stem to thicken considerably faster where they grow: they constitute "the gnarled and knotted oak,"—by the way, not so strong, though more difficult to split than the clean timber. The oak and elm are more disposed to this sprouting out than other kinds, and some varieties or individuals of these much more so than others. When the disposition exists in a high degree it ought to be encouraged, which can easily be done by pricking and slightly bruising the bark, and the timber set apart for the construction of cabinet-work, the knotted warty timber affording a beautiful veneer.

"This system of pruning—encouraging numerous feeders, and one leader, while the tree is young, and of allowing or rather inducing the branches, after the tree has acquired sufficient height, to spread out into a horizontal top, is in harmony with and only humouring the natural disposition of trees, and is therefore both seemly and of easy practice. The perfection of naval forest economy would consist in superadding (according to instructions to be given in training of ship-timbers) a top of which every branch is a valuable bend or knee, though, in consequence of the situation, the timber will be fragile, and of light, porous texture."

"We admit that a tree becomes more stemmy by being repeatedly pruned up. We admit that, on removal of the lower branches, the upper part of the stem may

have, for a few seasons, larger annual circles; but the annual circles will be diminished in thickness in a much greater proportion on the lower part of the stem. We admit, that the timber, from being deposited in a clean lengthened cylinder, becomes far more useful, there being less redundant matter than when scattered out into stemmy branches, to which disposition trees in open situation often incline, especially if not transplanted when small plants, but to which they are, nevertheless, much more disposed, under the common mode of pruning up at an early stage of their growth, than when left to themselves. We admit, that trees, by pruning, raised to lengthened stem, and thence performing less assimilation, partly compensate for this less assimilation, for some time, by making more stem deposite, in proportion to the other deposite, which extends the parts more immediately necessary to new formation—the roots and twigs; but the deficiency of productory parts soon reacts, to diminish the amount of all the new products. We admit, also, that pruning in the first place impedes formation of flower-buds, and will sometimes thus prevent exhaustion of trees by seeding, which is so prejudicial both to the quality and quantity of the new wood-deposite; but the consequent greater length of stem, greater exposure to evaporation, constriction of bark, diminished formation of rooting, and slenderer connecting tubes between leaf and roots, all tend subsequently to promote formation of flower-buds, although the removal of the lower branches may for a few seasons have served to prevent this. We therefore consider pruning, excepting in a very slight degree, to guide to one leader, and to remove the sickly, lower, moss-covered branches a few

seasons earlier than they would have dropt off in the common course of decay, to be generally preventive of quantity of wood deposite, even of common marketable timber in a tree in any considerable number of years, although pruning to a greater degree is often necessary in hard wood, when fine clean timber is required."

It may, after all, be observed, that Mr Gavin Cree's troublesome and tedious annual system of pruning and mine differ only in regard to time. To procure clean timber, pruning up must be practised sooner or later, wherever the closeness of woods does not smother the lower branches. He, apparently unconscious that the strong extension of the rooting depends in a particular manner on the lower branching, and that the removal of the lower branches tends to increase the proportional size of the upper, and to derange the balance of the system of the tree, (facts which, I believe, have never before been pointed out) prunes up at an early period, which renders the lower part of the stem very clean timber, and the upper part course, and often destroys the power of extension to great timber. I defer pruning-up till the tree has acquired nearly its ultimate height, and has established a rooting and strength of constitution sufficient to swell out the cleared stem to great timber; which, at the same time, will be produced as equally clean as it is possible for the nature of a plant to admit.

[We willingly afford to Mr Matthew an opportunity of explaining his principles of pruning. The subject deserves all the investigation which can be bestowed upon it by intelligent men. Mr Matthew states correctly the practice so fully explained in our last number by Mr Gavin Cree. This consists in merely shortening the branches during the first stages of growth, so as to

promote the ascendancy of the leading shoot, and produce the growth of the upright stem, without at the same time depriving the tree more than is necessary of its lateral branches and leaves. When the tree has reached 15 feet in height, the process of close pruning commences. This is done by cutting off, each year, the lowest tier of branches, and no more. The operation being gradual, it is performed with the least violence to the tree, while it effects one of the main purposes of pruning forest trees—the obtaining as large a length of clean stem as the nature and vigour of the tree will allow. The principle appears to us to be perfectly sound, and the practice simple. Mr Matthew proposes to leave the lower branches to assist the tree in forming roots. Now, granting his hypothesis, that the lower branches contribute more than the higher to the forming of roots,—still, by leaving the lower branches, we deprive ourselves of the very object aimed at in clearing the trunk at all. Nearly all the valuable part of the timber of common trees is in the trunk, and it is important to get as much of this as possible free of knots and protuberances. Mr Pontey had long ago shown the effect of branches in forming knots in the tree, and proposes, accordingly, close pruning of the stem as the means of forming useful timber. The system proposed by Mr Cree, and long practised by him with success, while it attains the object proposed by Pontey, has regard to the no less important one of preserving the health of the tree. We conceive it combines better these two objects, than the system of leaving the lower branches untouched. In taking off the lower branches before the higher, we imitate Nature, for we find that it is the lower branches that always first fall off during the growth of the tree.

For these reasons, we give the decided preference to the simple practice of Mr Cree, and recommend it in the strongest manner to the attention of planters.—EDIT.—"*Quarterly Journal of Agriculture.*"

David Low, Esq., Professor of Agriculture, was then Editor.

THE AUTHOR'S REPLY TO MR. MATTHEW'S ARTICLE.

This appeared in Vol. 3d. of "The Quarterly Journal of Agriculture."

In the last Number of this Journal, I observe an article by Mr Matthew of Gourdie-Hill, containing remarks on a paper of mine, in the preceding Number, on Pruning Forest-Trees. That gentleman's avowed object in coming forward, is with the laudable design of showing the erroneousness of my system to such of the readers of this Journal as, he says, are incompetent, from want of experience or observation, to judge for themselves. How far he has accomplished this object will be seen in the sequel.

Mr Matthew gives a pretty correct abridgement of my principles of pruning forest-trees, with some slight inadvertencies ; in regard to which, however, as these are distinctly enough stated in the article itself, and as they do not particularly bear upon the matters at issue, I need not here waste time by putting him right.

It is contended by Mr Matthew that pruning will not increase the quantity of timber, and this he couples with his view of all that is necessary to obtain clean timber. "With regard," says he, " to the one-half of the timber produced in the temperate zone, the Coniferæ, pruning in any shape whatever will not increase the quantity of timber, either in the single tree, or on a given space of ground. A well regulated closeness, or rather openness, being all that is required for extension;

and the sweeping of the smothered branches close down, being all that is required for cleanness of timber In the woods consisting of the other tribes of larger leaved trees, pruning will also have no influence in increasing the quantity of timber, provided the closeness be properly regulated, and the trees kept to one leader till they reach the required height of stems." I ask Mr Matthew how these objects can be accomplished without pruning or cutting off the branches, or parts of branches, in some manner or other, which, if not pruning, must be held to be very nearly allied to it.

Mr Matthew then states that my system of pruning " will never ultimately increase the size of the tree, or its measureable timber,—but, on the contrary, will greatly retard the extension, and destroy the capacity to attain a large size, and in many kinds will even induce early decay; the lower branches more particularly promoting the enlargement of the roots." This can only take place with his solitary trees, hedgerows, outsides of clumps, and skirts of woods, and from a different cause than that which he assigns. Wherever trees are of the same age, and of a large size, it will be found, that the shorter the stem is, the circumference is the greater; but that does not show that the quantity of timber is greater. For many years after trees have attained their utmost height, they increase in circumference. To exemplify what I state—in 1829, I measured within the area of ten falls, situate at an altitude of 780 feet, ten different kinds of trees, fourteen years after having been planted,—and their average height was 18 feet 9 inches; their clean stem was 3 feet 8 inches; and their circumference, at six inches above the surface, was 14 inches and 3 parts. I also

measured four beech-trees in the south end of a hedge-row, at the same altitnde, planted in 1740 by my grandfather, and the lands have been in the possession of the family ever since, the average height of which trees was 72 feet, the clean trunk 28 feet 6 inches, and the average circumference for timber measure 6 feet 4 inches, which gives 95 cubic feet of timbei to each tree. This shows the proportions of the height to the circumference of younng and old trees. The young trees are 18¾ feet in hcight, to 14¼ inches in circnmference; the old trces are 72 fect in height, to the average circumference at 4 feet in height of 86 inches, which shows that young trees exceed in height in feet, their circumference in inches; and when of age, tlie circumference in inches exceeds the height in feet. And further, a tree 10 feet in length of trunk requires 12 feet 4 inches; 20 feet in length, 8 feet 9 inches; 30 feet in length, 7 feet 2 inches; 40 feet in length, 6 feet 2 inches, in circumference, to contain 95 cubic feet nearly. By a careful inspection of old trees, it will be fonnd, that, in proportion to the height of clean trunk and head, the greater nnmber of cubic feet will the tree contain in the same number of years.

Mr Matthew's criticism on my article will be pretty well illustrated by the following, amongst others of his paragraphs. "His early pruning," says he, "on the contrary, disposing the remaining branches to push as leaders, to become, in proportion to their diminished nnmber, larger; thus rendering the upper part of the trnnk rough timber, and also deterring the root extension, is on a par with the worst of systems." Had Mr Matthew taken the trouble to read my essay with any attention, he wonld have found it distinctly statcd,

that the remaining branches are all to be shortened, and more especially any large one which is gaining a disproportionate ascendancy over others; and thus this very pretended evil, which he wishes so largely to magnify, was in an especial manner provided against my system.

Mr Matthew, in his directions for training plank timber, says,—" Cut off, close by the trunk, all shoots which rise at a very acute angle with the main stem; also lop off all branches which, by taking an irregular direction, incline to rub upon the more regular, and remove all splintered, twisted, and diseased branches." By a single glance at this paragraph, it may be seen that he has transformed the principles of orchard pruning into that of plank timber.

He continues—"After the tree has acquired a sufficient height for plank, say from 20 to 60 feet, according to circumstances of exposure, climate, &c., and also as much branching above this height as may be thought necessary to carry on advantageously the vital functions, as the superior head will now sustain small injury by being thrown out into large branches and plurality of leaders, it will then be proper, in order to have timber as clean as possible, and regularly flexible, to lop clean off all the branches on the stem as far up as this required height; should these be covering the whole or a considerable portion of the stem, as will occur in the more open situations, where the lower branches have gradually become sickly or dead, they ought to be removed by several successive prunings, at intervals of at least two years, that the plant may not suffer any injurious check by losing too many branches at once. From the early attention to procure

very numerous feeders, and to prevent any from attaining very large size, the wounds will soon be closed over, leaving no external scar, and as little as possible of internal knot or breaking of the fibre. Should a number of small shoots spring out in consequence of this last pruning, they may be swept down, if good plank be desired."—"The oak and elm are more disposed to this sprouting out than other kinds."

Now suppose that proprietors were disposed to follow Mr Matthew's system, and that they had to commence with the making of young plantations,—and suppose further, that they wished only to have clean timber to the height of 40 feet, with a head conformable, —it is evident that they must, at the earliest, continue their exertions for nearly half a century before one tree would be in a state fit for being pruned up for his plank timber. And, from the uncertainty of human life, few, I am afraid, if any, would continue the system so long. I allow that taking out a few branches, even those that rise at an acute angle, is of benefit, and which is in conformity with the old system; and where the branches are taken off, numbers of small shoots spring out as feeders. But instead of trees having a handsome appearance, as is the case where the branches are only shortened to a proportional length, those trees where the branches are taken out, from whatever cause, always put out numerous feeders; or otherwise have all the appearance of a large bottle-brush, from the small size of branches, and large quantity of them which must be upon the tree. And those to be removed even to the height of forty feet of clean stem, at the intervals of two years, must require a considerable work and time, for so many branches

intersecting the body of a tree of such a size, and in most instances putting out new shoots for a great number of years, which it will be often found impossible to eradicate.

Although the wound of trees of the size stated should close over, the trees will always have a rugged and unshapely appearance instead of having a cylindrical form. It requires little inspection of trees generally to see, that below the ordinary-sized branches a hollow is made, in consequence of the descending or proper sap being turned out of its course. Even when the branch is small a hollow will occur, and the parts of the trunk of a large tree that are free of branches, and other parts above the branch, will be found to increase, while the part below the branch remains in a great degree stationary, and a hollow is formed; nay, though the branch should be removed, the hollow will still continue probably as long as the tree remains.

With regard to Naval Timber, almost all writers wish to let the world know that if their advice were taken, there would be sufficiency of timber for the British Navy of all kinds required, and that the great importance of the whole matter consists in understanding the growing of bent and crooked timber fit for any part of a ship. But this hobby has been long walking on crutches. Sir Robert Seppings long ago recommended the plan of uniting short timbers, which was adopted, by which every kind of compass formed timber that would be required was obtained from straight timber. The whole frame of a ship can be prepared without waiting as formerly for particular pieces of compass or crooked timber, and every part is now equally seasoned by the new system. All that is

required is to raise timber of the best and soundest quality, and of the different kinds; for such is now the state of the science of ship-building and the mechanical arts, that they can do very well without the advice of writers on Naval Timber.

I might have said much more on the subject of prnning; but as both Mr Matthew's system and my own are now before the pnblic, I have said as much as the public might feel interested in, and as bears chiefly upon the points at issue. Mr Matthew wields the pen with much ease, and will, I apprehend, like a true naval man as well as a naval timber writer, not easily be overcome. But always playing at long bowls will be of little service to the public. Let us therefore at once come to point blank distances, as ships are made to do when well commanded, and show by actual workmanship which of the systems will be of most advantage to the country. Let the trees which have been pruned under my system, and those pruned nnder Mr Matthew's system, be examined by a body of men qualified to judge, to be mutually chosen; Or, should Mr Matthew have no trees to show pruned under his system, let us both commence our work of pruning together; and let it be a distinct stipulation in the compact, that whatever decision regarding the respective merits of the systems these individuals may come to, that decision shall be laid before the public.

Copy of a Letter addressed to Prince Albert, By the Author.

Biggar, August, 1840.

Unto His Royal Highness Prince Albert,

I humbly Pray,

That Your Royal Highness will excuse the apparent presumption in so humble an individual as I am offering anything in the form of suggestion. It is only from the conviction that vast national advantage will accrue from the accomplishment of my proposal respecting arboreculture, or the management of woods, that I could have been led to take such a step. A high authority, in 1830, predicted that before the expiry of ten years we might look forward to a revolution in our ideas of British Arboreculture, not more complete than important to the interests of the Empire. There is no appearance, however, of the anticipated result, and it is probable that the highest power in the land will be alone adequate to advance the Science of Arboreculture with rapidity.

Your Royal Highness is most humbly petitioned, therefore, to weigh the subject as inseparably connected with the British Navy.

In 1836 the Highland and Agricultural Society of Scotland awarded prizes for Essays, to ascertain the best system of pruning forest trees, I, who was one of the competitors, received the Society's Silver Medal, but not the highest. It has since been ascertained that the most highly esteemed Essayist was neither a practical pruner nor was his system in accordance with the laws of vegetable physiology.

I humbly petition your Royal Highness to condescend

to patronize Arboreculture in the department of pruning forest trees, as by such notice it would at once attract general attention.

Should your Royal Highness condescend to recommend some honorary distinction or place at the disposal of the Highland and Agricultural Society, some token or other reward to be given to any person who has written on the subject and shall prove by experimental workmanship that his system of pruning forest trees is the most consistent with nature, (each competitor to prune according to the principles expressed in his Essay in his writings to the Society,) the benefit to the country in general, and to noblemen and gentlemen in particular, would be great.

The trial and experiment should be continued two or three years, near Edinburgh, and inspected by a committee of the Highland and Agricultural Society, which should include the Professor of Agriculture, and some practical men, and the awards to be adjudged to the person whose system of pruning makes the trees attain the greatest height and circumference in the season or seasons.

I have no doubt that a number would come forward, and the event would create such interest throughout the land as the patronage of your Royal Highness can alone achieve. As in duty bound I remain a loyal and faithful subject to Her Majesty your excellent Queen, and that all the blessings this world affords may be the lot of your Royal Family is the prayer of

Your Royal Highness'

Most devoted, Faithful and Humble Servant,

(Signed) Gavin Cree.

ANSWER RETURNED.

WINDSOR CASTLE,
Sept. 5, 1840.

Sir,

I am commanded by His Royal Highness Prince Albert to return you the enclosed cover and paper. His Royal Highness has no doubt, that if your system of management of forest trees is such as you describe, that it will force itself into public estimation, but His Royal Highness does not see how he can promote your views.

Sir,

Your most obedt. Servt.
G. E. Anson.

Gavin Cree, Esq.

AN ARTICLE BY J. C. LOUDON, F.L.S. H.S.

WHICH APPEARED IN THE GARDENER'S GAZETTE, 7TH AUGUST, 1841.

We have lately had an opportunity of observing the effect of Mr Gavin Cree's mode of pruning forest trees, and we have formed so favourable an opinion of it, that we are most anxious to direct the attention of our readers to the subject. The object of Mr Cree's mode of pruning is to throw the whole of the wood produced into one straight stem or trunk; and to increase the rapidity of the growth of this stem, in a greater degree

than has been done by any other method of pruning hitherto adopted. To accomplish these objects, Mr Cree shortens all the side branches soon after they are produced, but does not cut a single bough off close to the stem till the tree is above 18 feet in height, and not less than 15 inches in circumference at the surface of the ground. A tree thus treated forms a narrow cone, like a cypress, or a Lombardy poplar, clothed with branches from the ground to the summit; those at the ground being from two to three feet in length, and from half an inch to one inch in diameter close to the trunk, both the length of the branches and their thickness diminishing, of course, as they approach the summit. We repeat, that not one of these branches is cut off close to the stem till the tree has attained 18 feet or 20 feet in height; when the lower tier of branches is completely removed; and one tier is afterwards cut off annually, always close to the stem, till a sufficient length of clear trunk is produced; that length, of course, varying according to the kind of tree, the soil, and various other circumstances. The branches which are shortened always remain slender; and when they are cut off close to the stem, the wound is completely healed over, at the very latest, in the course of three years. The stem being surrounded by foliage fully exposed to light and air, from its base to its summit, an abundant supply of aerated sap is returned from the small branches to the stem; and this is found greatly to increase the growth of the stem both in height and thickness, as compared with the stems of trees either not pruned at all, or pruned in the ordinary manner. Mr Cree pointed out to us oaks, ash trees, elms, sycamores, poplars, willows, and thorns, which had been planted twenty years ago,

and pruned in his manner; and which are now, though in a very exposed situation in poor soil, from 20 feet to 25 feet in height, some of them having had only one tier of branches removed, and others two or three. We were most struck with the erect and rapid growth made by the oaks, the Scotch elms, and the common thorns, as compared with other trees of the same kind which had not been pruned; and the heads of which had spread out horizontally. To the pine and fir tribe, Mr Cree does not apply his method, except partially, and under particular circumstances, as these trees do not naturally produce side branches of a timber size.

Mr Cree says that he has found, experimentally, that broad-leaved trees (that is, all trees except the pine and fir tribe), under 18 feet in height, and 15 inches in circumference, advance at an average as much both in height and circumference in six years, if the branches are properly shortened, as they do in fifteen years, if these are not shortened, or if the trees are improperly pruned. The more trees are pruned up close to the stem, before they are 18 feet in height, the more, Mr Cree considers, is their growth retarded; and not only that, but from the open texture of the wood, the wounds so made, he says, admit damp, and cause the tree to rot at the heart.

Mr Cree's mode of pruning has been familiar to us in theory, since an account of it was published in 1828, in the third volume of the "Quarterly Journal of Agriculture;" but we now acknowledge that this account failed to make the impression on us that it ought to have done, and which the inspection of the trees under Mr Cree's care, and his conversation on the subject, have now done. We are astonished, indeed, that Mr

Cree's system has not been more generally adopted in all plantations made with a view to profit in Scotland, where the results of his practice might have been observed with little trouble; and we can only account for it from the little attention paid to vegetable physiology by foresters, gardeners, and their employers; from the remote situation in which Mr Cree lives (Biggar); and from the great simplicity and modesty of the man himself. This, indeed, when contrasted with his knowledge of vegetable physiology, practical geometry, land-surveying, engineering, and other matters connected with rural improvement, surprised us almost as much as his trees, till we looked at his books.

We do hope that, though Mr Cree has been comparatively neglected by his countrymen, some spirited English proprietors of plantations, will take his system into consideration, and either send their foresters to Mr Cree for instructions, or send for Mr Cree to instruct their foresters, and to prune some trees as examples. Mr Cree's principal employment is as a professional pruner, and he goes out at the very low terms of half-a-guinea a day, and his travelling expenses.

Perhaps it may be necessary to state, that Mr Cree's mode of pruning is adapted solely for plantations made with a view to profit. It is wholly unfit for ornamental plantations, because it reduces all the different natural forms of trees to one form, viz., that of a narrow cone; and it is equally unfit where the object is crooked timber, because, by it, all the timber produced is straight timber. Neither (as already observed) is Mr Cree's mode adapted for the pine and fir tribe, in which nature may be said to have adopted a mode of

growth, which is equivalent to his system of pruning.

Such proprietors of plantations as have any faith in what has been said respecting Mr Cree's system of pruning, will do well, at least, to impress on their foresters his principal rule; viz., to cut off no branch close to the stem of any tree that is under 26 feet in height.

The Author's Remarks on the foregoing Article.

Although Mr London states that my system is not adapted for ornamental trees, I consider that *all* young trees should be pruned, to forward them, even at the height of 20 or 30 feet; for, although trees are pruned to a conical form, they regain their respective characters in the course of three or four years, and then they afford both timber and beauty; and for naval purposes, trees may be pruned to any curve.

Mr DAWSON'S LETTER,

Which appeared in the Gardeners' Gazette, Sept. 1841.

ON SHEARS PRUNING.

Sir,—As you solicit your readers to communicate their thoughts to you on the various subjects treated of in the Gazette, I take the liberty of offering a few remarks on the leading article of last week.

In using the shears for shortening the side branches in Mr Cree's manner, nothing could be better. Much time is saved, and the healing of the wound at the ex-

tremity of a side branch of a forest tree is not a matter of much consequence; but that a wound made by shears will heal over sooner than that made by a knife is quite erroneous.

But the point to which I would more immediately come, is your recommending shears pruning as a remedy for all oblique, unhealing wounds, both in plantations and gardens. Now, Sir, nothing more barbarous could well be conceived, than using the shears in any shape on fruit trees. I have seen too much of the evil effects of this amusement ever to tolerate such a thing in the garden in any shape; and slovenly indeed must that nurseryman be who could think for a moment of substituting this bruiser on his young trees, instead of the knife. The cut of a knife, when properly used, is clean; and if judiciously used on a young subject, the wound will soon heal. But the cut made by shears is very different; it is merely a process of bruising; and however skilfully they may be used by turning the hooked side outwards, yet the cut made is such as no good gardener would wish to see his trees mutilated by. You say they are not applicable to wall trees, because they cannot be inserted behind a branch, or in confined spaces or crevices so well as the point or blade of a knife; but there are other and stronger reasons against using the shears than these. It is well known to every gardener that old snags, and sometimes dead spurs, are to be removed, and no one can remove those, nor yet any branch or shoot growing from a main branch, with the shears, however well they may be used, aud leave the wound anything like decent; every cut made by shears, by more or less bruising the wood, leaves it in fit condition for absorbing wet, and should the shears

be persevered with for a few years, the tree will soon be covered with *unhonourable* scars and black holes, which will soon end in death; and I hope all nurserymen, who deserve the name, know their own interest better than be guilty of using such things.

The shears is quite tolerable as an instrument for ladies, who are fond of amusing themselves by pruning among the old laurels, where they can do no harm, or by the path sides where they happen to interfere with it. For amateur pruners of all classes, who prune for exercise, nothing can be better than the shears, as there is no danger of cutting one's self as with a knife; but for the practical gardener, who prunes because it is wanted, and whose object is to maintain the health, vigour, and symmetry of his trees, the shears is worse than useless, and can never be used with propriety or success. Yours, &c.

Stamford-Hill Sept. 8. ALEX. DAWSON.

MR BILLINGTON'S LETTER,

This appeared in the same No. of the Gardener's Gazette.

SIR,—In your encomiums, in the GARDENERS' GAZETTE, No. 240, of Aug. 7, on a method of pruning forest trees, by a Mr. Gavin Cree, of Biggar, North Britain, you say that Mr. Cree's mode of pruning has been familiar to you in theory since 1828, when you saw an account of it in the "Quarterly Journal of Agriculture." Now, Sir, as it is exactly similar in

principle, and nearly so in practice, as you have described it, to *my* system, differing only a little as to the time, and number of branches to be taken off, after they have performed their functions sufficiently, I beg to remind you that my system was published in 1825, in my publication entitled "Facts, Hints, &c.," which you saw long before Mr Cree's appeared in the "Quarterly Journal of Agriculture," in 1828. And Sir Henry Stenart, in his "Planter's Guide," published in 1828, in the notes on pruning trees, mentions my system of pruning forest trees, which he calls terminal pruning; but ascribes it to a countryman of his, which I presume to be the very identical Mr Gavin Cree you mention. In the same notes on pruning, he says, that in my book published three years previous, I had given, probably, "the very best instructions for conducting the operation of pruning and thinning young plantations that exist in the language."

I also published a pamphlet in 1830, containing remarks on this very subject (a copy of which I sent to you), in answer to a Mr Withers, of Holt, and Sir Henry Steuart, who had made some very unfair remarks about my works; and I cannot but feel that it appears to me strange, that both you and Sir Henry should avoid taking any notice whatever that I had practised it long before, and published it the first of any one, having derived it entirely from my own observations, reflections, and experiments, without having had the least hint or instruction from any one, or any writer on the subject. So that it was from my own thoughts, reflections, and experiments, that I derived the knowledge of that system you so highly eulogise in another. But that you should keep that all out of sight, and

endeavour to give all the merit to a countryman of your own, I confess I think looks a little unfair and too partial to your countryman, especially from gentlemen of the high estimation each of yon bears in the science of Arboriculture. Therefore I trust, Sir, you will have the candour to allow these observations a place in the "Gardeners' Gazette," as I cannot believe that you, Sir, have done it intentionally, but rather from forgetfulness, or want of recollection; but I cannot say the same for Sir Henry Steuart's remarks in his publication.

Believing that some of yonr remarks on this method of pruning are wrong, and may lead some people into error of practice and opinion, I shall, with all deference, take the liberty to make a few observations relating to it.

You say that you are astonished that the system, which you call Mr Cree's, should have made no more progress among proprietors of woods, &c.; perhaps I can explain that to you from a little experience I have had. Most proprietors of woods of any considerable extent have agents employed, generally of the profession of the law (but it matters not what profession), who have too often "views of their own," and from the all-prevailing plea, economy, tell their employers that they perfectly understand the system, whatever it is, having read the authors, and that they can get it done much cheaper by their own labourers, than by employing a professional man; they, the agents, being very jealous of a third person, or in being thought not to have competent knowledge; besides; if they are shown how it should be done, if it is only followed up for a year or two, all the good effects that would have resulted

from it, if followed up for several years, are lost entirely, and it is forgotten or neglected.

Another great cause is the influence the mania for the preservation of game has in preventing any useful operations for the improvement of young plantations. Respecting Mr Cree's charges of 10s.6d. a day and travelling expenses, which you think very moderate as a professional pruner, I much fear it will be thought too high by the proprietors of woods in this country, having gone out a little myself as a professional planter, pruner, and thinner of plantations, both for ornament and profit, for only 7s. a day; and I have every reason to think that low charge has been thought too much by the proprietors themselves, or their advising agents, so little do the proprietors of woods of the present time appreciate the important advantage and value of the instructions given, or work performed, in that department, to themselves and heirs. But, were it for something more congenial to their paramount pursuits, such as hunting, shooting, and preservation of game, it would be thought a trifling expense; yet the preservation of game is not only a very serious loss to themselves annually, from injury to young trees by hares and rabbits, but to their unprotected tenants and neighbours, as well as to the public at large, by the annual destruction of so much valuable grain, added to the other causes for the high price of that most necessary article, wheat. I could state much more on this important subject, but I fear it is useless; what I have stated I know from my own experience.

You say, "the system is only adapted for plantations with a view solely for profit." Now, Sir, I entirely differ from you on this point, for it is applicable to all sorts

of trees, either for profit or ornament; even in the nursery for stocks, for standard fruit-trees, or ornamental trees for the park or lawn, and for shrubs also of some sorts, as it increases the strength of stem, and gets them much sooner to the desired height, as you have stated in your encomiums on it. Were I a nurseryman, I should practise it almost universally for a time, at a very early stage, whenever strong side shoots are formed. I have now perhaps the finest Rides sanguineum you ever saw, about seven feet high, with a single straight stem, pruned according to this system, which I shall allow now to form a close, compact, bushy or natural head, as taste or fancy suggests, a beautiful object for a grass plot or shrubbery. I have also Laburnums from 18 to 20 feet high, with straight single stems, which I shall allow now to form their own natural way of growth; and so, from this method, shall soon have fine clean-stemmed weeping Laburnums, as the weight of the flower spikes and seed pods will cause the branches to grow pendulous. Thus you see, I shall have clean straight stems of a very valuable wood when cut down, say from 10 to 15 feet in length; an ornamental forest tree, we may say, of a shrub, as it were. I practise this system on Walnuts, which I train up to any length of stem desired, and which can be planted out afterwards (if in a nursery) to form their natural heads for fruit-bearing, or valuable useful timber for various purposes. The Walnut, in its young state, is a soft, spongy wood, and does not like the knife; I only use my finger and thumb to prune young trees in the growing season. The Oak, Spanish Chestnut, in fact any tree designed for ornament, should be pruned according to this system, to the

desired height you wish to have the stem, before it is suffered to branch out agreeably to its natural mode of growth; and where they have room, there is no fear of them soon resuming their natural propensities. As for crooked timber, there will always be plenty of that from all isolated trees, and from trees in hedge-rows, or where they have plenty of room to spread their branches, after they have formed straight, clean stems for their base; say from 8 to 10, 15, or more feet.

You also say it is not applicable to the Fir or Pine tribe of trees; I differ from you on this point also, as it is of the greatest utility to the Scotch Fir, where they are not planted thick enough to prune themselves; as by breaking out the terminal buds of the strong side-branches, at from two to three feet from the stem, it prevents those strong, thick side-branches from increasing in size, which spoil the tree in a great measure for any useful purpose, and accelerates their advancing in height, and at a more regular thickness, according to the number of small side branches left on the stem. I could form very beautiful single trees, or groups, of this species, or of other trees, very expeditiously for parks or lawns on this principle, but must not now describe it. And as to the Larch, it is of the utmost importance in certain cases, where they are too thin to prune themselves, as in the case of the Scotch Fir just mentioned, which I have proved in my publication, would you give yourself the trouble to re-peruse the chapter on pruning; and to the Spruce or Silver Fir, in numerous cases where thick screens are wanted, or evergreen undergrowth for winter ornament and shelter for game. In the latter case they must be kept low, by destroying the leading upright shoot at the

desired height ; but for single trees, or those on the outside of groups and belts, I would not remove a branch from the Spruce Fir. Bnt I fear I shall run this article too long, or I could say a good deal more on the subject ; but as you have now seen its merits in part only, by Mr Gavin Cree's method, which is the same as mine in principle, you will now more clearly appreciate its merits, and no doubt endeavour to inculcate and extend its practice. But I am pretty certain it will make very little progress till there is a place established for experiments, to show its certain utility and effects by examples ; for theory will not achieve it, as you have acknowledged yourself. Some time ago I wrote an article on the subject, recommending the English Agricultural Society to establish, or use their influence with the Commissioners of Her Majesty's Woods and Forests to establish, one near the metropolis, as they would be the most influential, or else allow a few acres, either now planted, or to be planted, in the Regent's Park, or some other eligible place near London, to be set apart for examples, to show to such persons as are interested in such matters resorting to London, the importance and utility of having trees pruned and trained according to this system. Young men of the profession of gardeners or foresters might be instructed in such a school, which would greatly contribute to extend the knowledge and practice of it; at any rate this would be the most easy and surest way of convincing by examples. Therefore as you and I are both drawing towards the evening of our lives, and have the same object in view, namely, to communicate what knowledge each of us may possess, for the benefit of others, I hope you will use your influence

where, and in what way, you think it most likely to succeed, with the parties I have mentioned, or elsewhere, and in your publications, in trying to establish such an experimental plantation; what little aid I could render in any way would be willingly contribnted. I am, &c.,

Underhill, near Oswestry, W. BILLINGTON.
Salop, Aug. 21.

THE AUTHOR'S REMARKS ON MR BILLINGTON'S LETTER.

I coincide with Mr Billington in several things contained in the foregoing letter. Many Agents who have charge of Estates pay no attention to woods and particularly those under Minors' Trnstees and the Court of Session. He takes notice of Mr Loudon's remark on the small charge made by me of 10s.6d. per day, (this remark instead of doing me good rather injured me,) had he said 3s.6d. per day he would have been nearer the truth. I consider he had good canse of complaint against Sir H. Steuart, who, when he published his "Planter's Guide," availed himself of much of the information contained in Mr Billington's Works, he also embodied what writings I had beside me at the time. Sir H. Steuart neither pruned nor thinned his plantations; I prnned a few trees for him occasionally, and he promised to remit me something handsome for my trouble and expenses, which promise has never been fulfilled, altho' well known to Lady S. Steuart. I consider that Mr Billington's work contains many valuable remarks, and is evidently a work drawn from facts and observations by a practical man.

Copy of a Letter
Addressed to Sir CHARLES GORDON,

Secretary to the Highland and Agricultural Society of Scotland by the Author, in 1841.

I observe a notice of an essay read by John Boswell, Esq., of Balmuto, at the dinner of the Committee of the Highland and Agricultural Society, met at Aberdeen, 1840, recommending the application of science to Agricultural improvements more extensively than has hitherto been thought of, which proposal was approved of by Sir F. Mackenzie, Bart., who, at the same time, suggested that a farm should be submitted to the public on which experimentalists might put forth their skill and science, a proposition equally rational as the establishing of experimental gardens and other scientific institutions.

In the improvements of this farm, there is a department, among others, which ought, I think, to be attended to, namely, the scientific cultivation of trees for timber and shelter. The Society may think that they have done enough already for the advancement of this branch of culivation; but after all that has been done, arboreculture, in my opinion, has never been conducted, to any great extent, with scientific skill.

The abstract from the Society's *Transactions* of 1820, on the management of woods and plantations, only displayed ignorance in the writer of that date on the subject of pruning forest trees. The Society's committee awarded prizes to four different persons for essays on the pruning of forest trees in 1836. The

committee who decided the merits of these neither claimed nor expected any reference to vegetable anatomy in illustration of the different systems; in my opinion, an improper neglect, as the system of pruning which is best must be founded on the principles of vegetable physiology. The late Sir Walter Scott, Bart., gave his opinion in the *Quarterly Review*, 1830; and in the *Edinburgh Literary Journal*, 1830, the following remarks occur, attributed to the late Sir H. Steuart, Bart., which glaringly exhibit the inconsistency of those who follow out their methods without any natural principles to direct them. To reason with such men is vain. Their confidence and self-sufficiency are in the ratio of their ignorance; guided by such counsellors, however, they oftentimes succeed in misleading others, and in retarding the advancement of that knowledge that has made Boutcher, Marshall, and Nicol, all meritorious writers, appear unsatisfactory, Hanbury useless, and Pontey rediculous, and has rendered the pruning system of the last mentioned so ruinous to the woods of England. It is the same want that makes Billington and Cruikshanks, two of our most practical men, sometimes write nonsense, and Withers always. In a word, it is this want of indispensable scientific information that has kept arboreculture in all its branches, down to the low rank of a mechanical art. I should earnestly advise our planters and writers on planting to unite their best efforts in bringing about a new era in this neglected art. They should endeavour, at length, to learn that a tree is not, as many suppose, an inanimate substance, but a living being like themselves; that in its constituent parts it possesses the same chemical principles as they do, though with dif-

ferent properties and under different laws of organisation.

Without reviewing the prize essays, it may be stated that both Mr Grigor's and Mr Gorrie's are inconsistent in practice, and destructive to the healthy growth of trees.

The proportions of the stem to the top of the trees are more inconsistent than Pontey's; his is 50 ft. to 22 ft., theirs is 50 ft. to 25 ft., and Gorrie's, 50 ft. to 16 ft. 8 in. the top of the tree. The thinning out of the branches in the top of the tree is injudicious in practice. Such pruning close to the stem, when the diameter is not one inch, carries disease into the pith, and in the course of a few years the trees are decayed in the centre, which may be completely avoided by shortening the branches till the trees are about 18 ft. in height, and, when close pruning takes place, about 15 in. in circumference. The system of said essays puts science at complete defiance.

The most consistent system, whether it will be found agreeable to science, will be found in accordance with reason, that all trees should have heads conformable to the length of the trunk, and conical longer than spreading heads; and to show the correctness of my statements, I shall make a few extracts from Professor Lindley's *Introduction to Botany*, 1839, p. 382. "We see in practice the more plants are exposed to light, when growing naturally, the deeper is their green, the more robust their appearance, and the greater the abundance of their odours or resins; and we know that all the products to which these appearances are owing are highly carbonised. On the contrary, the less a plant is exposed to the sun's light, the less its

lustre, the fainter its smell, and the less its flavour.

"The fixing of carbon by the action of light contributes in an eminent degree to the quality of timber, a point of no small importance to all countries. It is, in a great degree, to the carbon incorporated with the tissue, either in its own proper form, or as resinous or astringent matter, that the different quality in the timber of the same species of tree is principally owing. Isolated oak trees, fully exposed to the influence of light, form a tougher and more durable timber than the same species growing in dense forests; in the former case, its tissue is solidified by the greater quantity of carbon fixed in the system during its growth."

P. 560. "Mr Rigg has investigated the connexion between nitrogen and plants. He finds the youngest parts of plants richest in nitrogen. Alburnum he finds to contain more nitrogen than duramen (or heart wood), and fast-growing timber more than slow-growing. He states that his enquiries all tend to prove that nitrogen is evolved during the healthy performance of the functions of plants, and that the atmosphere is the source from which they derive that element. The proportion which it bears to the oxygen given off is influenced by the sun's rays. The difference which he finds in the growth of plants in the shade and sunshine are due in a great measure to the influence of nitrogen."

Penny Cyclopædia, vol. ii. p. 121. "Trees crowded together in plantations suffer more from the deficiency of carbonic acid and oxygen, both of which are required for respiration, than deficient nutriment by the roots; a fact of which proprietors and managers of timber plantations are either not aware, or at least they neglect the practice to which it should lead.

"By the respiration of plants and trees the carbonic acid gas is withdrawn and an equivalent of oxygen substituted. By the mutual action of the members of the animal and vegetable kingdoms, the balance of the constituent elements of the atmosphere is maintained."

From the extracts above given it is evident that some advantage may be made of science in this neglected art.

I beg the Society's further attention to a few remarks. Mr Grigor, who received the Society's first prize, states that pruning will not ultimately increase the bulk and weight of timber; whereas Professor Lindley shows that the more succulent or younger parts of plants attract the more nourishment from the atmosphere. In trees pruned by shortening the branches, the whole tree is covered with healthy leaves often three times the size of the adjoining unpruned trees; by which management growths of feet instead of inches will be made. In trees clothed with a healthy foliage by shortening the branches, the ascending sap is so augmented, both in quality and quantity, that it keeps the trees free of mosses. The same takes place in the animal creation; when unhealthy they are infested with vermin, &c.

I shall conclude by suggesting the attention of the Society to follow out the principles inculcated in the remarks and extracts. In the mean time it would be of incalculable advantage, should any member or members place at the disposal of the Society a part of their plantations, containing trees at least six feet in height, to be treated under each system for one, two, or three years.

The sanction of the Highland and Agricultural Society would render the project of more national import-

ance, and their decision of the merits of the different systems would produce greater benefit than could result from the exertions or patronage of any single individual however high. It is, therefore, of more importance that the Society should bring the trial before the public.

PRUNING FOREST TREES.

This appeared in the Gardeners' Gazette, Oct. 29, 1842.

Sir,—I have read a review of Mr West's "Remarks on the Management (or rather Mismanagement) of Plantations," &c., in No. 302 of the Gazette. The reviewer and reviewed coincide very closely in opinion regarding the different subjects treated of. This is agreeable and praiseworthy, provided the doctrines be correct; but if otherwise, the concurrence of various authorities having a tendency to induce belief, error, under such corroboration, becomes only the more dangerous. It is not my intention to dispute any of his doctrines, except that on pruning. Being very industrious in this department, both in a practical and explanatory sense, I am naturally anxious to convince others that the systems which I deem injuriously erroneous, are really so. Mr West appears to be quite aware of the advantage of pruning—of "securing an erect and straight butt," and so on; it is his method in practice which we question. For example, "He will by an annual examination see whether the leading

shoot maintained a due superiority, and that no competition threatened to attract an nndue share of the sap. If any such appeared, he would instantly displace or shorten it, so that it might not attain to more than *one inch* in diameter. All other side branches he would leave, as, whether they lived or died, they wonld not be the cause of defect in the timber." There are two doctrines inculcated here of which I complain, namely, "The displacing of the branches so that they might not attain to more than *one inch* in diameter, and the leaving of all the other side branches of a less size entire." As I am quoting it may be just as well to go on with it, as my objections may answer eqnally all I have to notice. Further on it is said, "The only difficulty is, when three or four of the laterals arrive at the prescribed size at the same time. In this case, if the rule be observed, the whole of these should be removed at once, which would be, perhaps, too severe a dismemberment of the head, and would probably give such a check to the whole system, as to connteract the very purpose of the cultivator. But in such cases the pruner should be content to remove one or two close, and foreshorten the others, to prevent them swelling to a larger size. And while so retained they act as necessary parts of the head, and at another pruning may be removed entirely."

I oppose, in the first place, the displacing of the branches in the way Mr West recommends. In the first qnotation, he says, "displace or shorten;" had he approved of shortening only, I could have agreed with him, but to cut close to the butt of young trees, branches about an inch in diameter, is a practice as lamentably detrimental as it is common. There is no reason for

resorting to any such dismemberment. "If," says Professor Lindley, "of two unequal branches the strongest is shortened and stopped in its growth, the other becomes stronger; and this is one of the most useful facts connected with pruning, because it enables a skilful cultivator to equalize the rate of growth of all parts of the tree." To cut branches from the lowest tier of trees from 15 to 20 years old, may be oftentimes very proper. If they are about 18 feet high and 15 inches in circumference, this is just the plan I should adopt; but Mr West evidently means nothing of the kind, for he says, "If three or four laterals arrive at the prescribed size at the same time, he would remove one or two close and foreshorten the others." without any reference to their position on the tree. I, therefore, presume, that of these three or four, one or two would suffer the same treatment, whether on a butt of two, six, or 20 inches in diameter. Now to displace a branch of about an inch in diameter, from a stem of perhaps not more than two or so, is what one wonders to see often practised and encouraged by men of experience, as the injurious effects of it are obvious to all who will trouble themselves to observe. The pith in young trees is larger than in old and of a more open texture, and when close cutting is administered the wood dies backwards (it has not far to go) from the wound to the centre, which when hurt renders the tree unsound and the wood downwards valueless.

Mr West, I am happy to know, shortens as well as cuts close, and gives one good reason, I think, for shortening—"to secure a straight and erect butt." But when he speaks of "divesting it of every branch which by possibility could deteriorate from the quality

of the timber," the full extent of his meaning is to me less apparent. I repudiate the close cutting of all branches whatever on young trees, till they are 18 feet high and 15 inches in circumference, when I begin at the lowest tier. I shorten all that comes without a certain boundary, strong or weak, but displace none. When a strong branch is shortened it increases little in girth for a long time, produces in the meantime nourishment, while the wound when cut at the proper time is still small and the trunk strong. I have explained elsewhere in the GAZETTE, how the shortening of the branches conduces to the enlargement of the trunk, which is from the breadth of the foliage, the rapid circulation of the sap—the little deposited on the branches, thereby bequeathing more to the stem, and by its finer quality: all these advantages have been enlarged on lately, and, as Mr West appreciates a head and leaves, I think he might be advised to refrain from displacing the branches till the tree has arrived at a certain height and circumference, shortening the branches into a conical form, and removing only the lowest tier first, continuing annually to remove a tier upwards after this process has commenced.

Mr West calculates the duration of pruning by years. I should prefer the criterion of size as more consistent for all parts of the kingdom.

April and May are stated to be the best months for pruning forest trees; this I admit only in regard to the close pruning of deciduous trees: the shortening of the branches is altogether a different thing. Loudon, and also Professor Lindley, in his "Theory of Horticulture," give rules to horticulturists respecting the pruning of their wall trees, which may be applied to the shorten-

ing of all trees; that is, trees shortened in the lateral branches in the latter end of August, September, and October, will have the healthiest foliage next season, the same as fruit trees.

I am, &c. G. CREE.

PRUNING FOREST TREES.

This appeared in the Gardeners' Gazette, April 8, 1843.

SIR,—Though the season for pruning forest trees is nearly past, there are still some parts of Scotland where it might be applied with advantage; but when spring has advanced, it is good time to prune both the oak and sweet chestnut. In my younger days, it was a general opinion that the oak and chestnut could not then be raised in Scotland to the size it at one time had arrived at. I am enabled to confute this notion from observation, and likewise to assert, that no tree will grow freer than the oak if *properly lifted* and *planted;* when the reverse is the case, however, they may be planted five years without making five inches in height; whereas I have planted oaks, which, in the first year, have made nine inches in height. The tree ought to have the whole of its roots well preserved when in the lifting, and be planted with these unimpaired; the branches to be shortened during the progress of growth, but not pruned close.

Considerable exertions have been made by the Highland Society, in order to edify proprietors and

foresters, by giving prizes for different kinds of seeds, and so on, from abroad; but it is yet to be proved that these produce better trees than the native seeds. And, at any rate, till the managers of plantations improve, many woods will be destroyed through ignorance, let the seeds and soil be what they may.

I am inclined to say a word in reference to the larch, one of the best of trees when properly managed. It was said, in an essay approved of by the Highland Society, that this tree may be pruned with advantage at the time it sheds its leaves, and that pruning is unnecessary before it is from ten to fourteen feet high. Now, my opinion is, that to prune the larch at the said height is most injurious; even when growing at reasonable distance, the under branches of this tree die, from want of air, and it will not exist in health if shaded by any other tree. The dead branches only should be knocked off, as the pruning of the fresh branches renders these trees corked in the centre; from this pruning, and not from thinning properly, this effect is, in a great measure, incurred. Rot in the centre cannot be entirely prevented, but it may be greatly modified. On cutting a quantity of larch lately, I observed that rot had begun at the age of sixteen or seventeen years; and, on enquiry, I found that it corresponded with the time they had been pruned. On another estate the larches were pruned up as high as one can reach with a hedge-bill, when only sixteen years old; they are now twenty-five years old, and the sawyers inform me, that on comparison with those of another plantation, forty-nine years planted, the elder trees are more easily sawn than the young, these being so dried in the centre by the previous pruning. Larches

are not adapted for standing below another tree, but for the sides of hills where there is abundance of light and air.

I may notice, in conclusion, that the decayed branches ought to be strictly looked after and removed at this season. There is much of it observable on the venerable trees adjacent even to the mansion-houses of families, of whom we might expect more care and taste.

GAVIN CREE.

TREES AND THEIR MANAGEMENT.

This appeared in the Gardener's Gazette, Dec. 23, 1848.

Being in Edinburgh last week I naturally endeavoured to examine the state of matters connected with my own profession. Things are continuing much in the usual way in this respect. The trees about which I have such especial solicitude are managed, or not interfered with at all, nearly as they used to be. The larger branches are lopped off in some cases, and the small ones left; in others the stem is bare, with a tuft at the top; but the method which I approve of is, by no means, generally adopted, though some of the most eminent men have given it their decided approbation. It is not to be wondered at, however, that foresters should be bewildered, seeing that so wide a discrepancy subsists among those whom we would incline to look up to as guides. The committee of the Highland Society, for example, showed no aversion to the cutting of big branches close on young trees, though it is known to observant pruners that the prac-

tice in question induces rot to the centre of the plant. During my travel I saw parts whereto pruning had not reached; in others the saw and knife had been applied. About two miles west of Currie, branches from a diameter of two inches to two feet are cut off close to the trunk. Now, even though the wounds may in time be covered, the timber of these trees will be unsound—the carpenter will find the interior corrupt. Some of these were, I admit, on the road side; but, as the public could sustain no injury from their being cut at a proper distance, the deed must be voluntary on the part of the forester.

Appearances are not all unfavourable to my system in this quarter. On recommendation, I called on Mr M'Donald, gardener to Sir J. G. Craig, of Riccarton, and was most kindly received. The practice here hitherto has been to thin out the larger branches; but from what I have stated in the GAZETTE, and from examining the effects of my operations at Sir J. M. Naesmyth's, some doubts respecting the propriety of the former method have sprung up. In the course of the day, at his request, I shortened the branches of a few trees of different kinds. I was gratified at having this opportunity of displaying my handiwork, as William Craig, M. P., is very skilful in arboreculture, I have thus the satisfaction of counting on a comparative scrutiny with impartial judgement.

Mr M'Donald and I then went to Edinburgh, and attended an exhibition of fruits, &c., at the Horticultural Gardens. Lord Murray was in the Chair. The subject of most interest to me was an account of a horticultural tour by Mr M'Nab, jun., read by Dr. Neill. I heard indistinctly; but on treating of the

management of evergreens at Dalton Castle, he said, that there the dedora was grafted on the cedar instead of the larch, and the golden, silver and common Irish yews grafted on the common yew, and trained on the upright system.

I next visited East Prince's-street Gardens, where in 1837, 1838, and 1839, I pruned trees for the purpose of exemplifying the difference between those which are shortened and those which are not. To make the contrast more evident, I shortened some in the same range, and left others untouched. I was pleased to see the fine effect of the evergreens, upright, and covered from bottom to top with branches (as all evergreens ought to be) compared to those cut close. There is occasion for great reformation in the pruning department about Edinburgh; neither is there any great variety of trees—only the most common kinds are planted. The pruning in the Meadow Walk and Royal Terrace is overdone. We hope soon to see better management, and a more varied selection introduced. I noticed at the commencement of my letter, that some of the most eminent men approved of my system; and, in proof of this, I need do no more than mention the names of Lord Murray, Sir J. M. Naesmyth, Dr. Neill, Professor Balfour, Professor Low, J. C. Loudon, F. R. S. &c., who have given me their approbation.

GAVIN CREE.

ARBORECULTURE

This appeared in the Gardeners' Gazette, Oct. 5, 1844.

I observe in the 35th No. of the GAZETTE some remarks about Lord Ducie's Example Farm. As to the agricultural part we shall pass; but as to the fences and trees they are well grubbed up. It is only with the hedge row that I propose to make a few remarks; if the trees are allowed to spread, as is too often the case with trees around arable fields that are under crops, the deficiency adjoining the trees is a great loss to the farmer; but the rooting them out is the effectual way of getting rid of such a pest as trees where lands are always under crops. But if this plan was carried into effect through the kingdom it would be most inconsistent, although there is no doubt that most of the hedge row trees from mismanagement injure the crops, although the great connoisseurs say, leave the trees to themselves to enable them to show their beauties; but in most cases it should only be ranked according to the advantage to be derived when profit is put into competition. Trees planted wholly for effect, in lawns, &c., is one system, and for shelter and timber is another. I would strongly recommend to almost all proprietors that instead of rooting out their hedge row trees, to shorten their branches in such a manner as to prevent them overshading the crops, and when in pasture they will be found excellent shelter, which I have done to some extent. But as to tree reform, nothing has more need, both for the advantage of the crops and timber. And a great number of the trees adjoining the public roads are most disagreeable to people on coaches, &c.,

which should not be longer permitted, which is more the fault of the surveyor than the trustees. But the grand question is, whether it would be of greater advantage to let trees in hedge rows remain as bushes to injure the crops, for their effect, or, as some term it, for their beauty, or to prune them so as to make them good shelter and excellent timber; comparing a handsome person to one decrepid, is the same as comparing a handsome tree with a bush—we fondly hope that in a few years handsome trees will be more admired. Trees pruned by first shortening the branches attain a greater magnitude in a shorter time. I might put the question to planters, do they not wish their plantations to be in a most healthy state? for they at present treat their trees in the most barbarous manner—that cannot be by pruning the trees at an early age close to the stem, instead of only shortening the branches till the tree is above 24 feet in height. By the first, the young trees if cut up after being pruned a few years, will be found diseased into the pith and unsound, those only shortened will be found sound and in a more healthy state. By the pruning by first shortening the branches most of the hard wood can be made to surpass the Larch in height, and Oak equal Scotch Fir; but where is a plantation so managed that such trees can be seen? I could name many noblemen and gentlemen's plantations, and their management is anything but good, which, if reversed and laid before the public, they would feel the force of their neglect and mismanagement both for private and public advantage. It may be said to be something remarkable in the age that the pruning of forest trees is so much neglected and mismanaged, when some of the great societies

might put it to the test of experiment and competition the different systems, as the detection of a single error is a sure step to actual discovery of true principles. GAVIN CREE.

COPY OF A LETTER ADDRESSED TO THE

HONOURABLE SIR CHARLES GORDON.

MARCH, 1844.

SIR,—I beg to make a few observations for the consideration of the Directors of the Highland and Agricultural Society. I observe that the different essays and communications laid before the Directors, are fully discussed at the monthly meetings, and their merits fully shown among other subjects. Mr Borthwick gave a verbal account of a simple instrument for facilitating the thinning of woods,—the instrument placed on the end of a pole, with a rope attached, to guide the tree in its fall.

Lord Roseberry thereafter made some judicious remarks on the general neglect of thinning plantations, which, he thought, might arise from the natural disinclination which a person feels to cut down what he himself had planted, or from the notion that the longer the plantations are allowed to remain unthinned, the greater will be the value of the thinnings, not reflecting that the quality, and of course the value, of the remaining trees are thereby greatly diminished.

In my opinion, the remarks of His Lordship were eminently judicious. It may be said in reference to the subject, what rule is there for thinning, which may be adopted among so many schemes. That by Mr Withers, in the 2nd vol. of the "Quarterly Journal of Agriculture," is worthless, from the impossibility of thinning to the distances laid down in his tables. There is an account of the Athole system, in 1830, in the Society's transactions; the thinning of larch is there completed at the age of 30, had the heights at each thinning been stated instead of the age, it might have served to form a rule, but not otherwise. With regard to pruning larch, I conceive it most improper to practice it especially in the early summer months, farther than knocking off the dead wood. The valuation made of 100 acres of land planted is very incorrect, if other statements are equally incorrect the public may, by attending to them, be misled. It is stated that 180,000 larch was the calculation, and in the first 30 years 142,000 are thinned out at three times, then the value of 138,000 larch remaining is calculated at £12,350, when only 38,000 remain, which shows that the value is miscalculated by £8,950. From the practice I have had in marking trees for thinning plantations, my attention was led to the subject, and I made an attempt to reduce it to fixed rules, and prepared tables and directions, which were rejected by the "Quarterly Journal of Agriculture," but afterwards published in the "Glasgow Farmers' Register." And when the late Mr London was in Scotland, (1841) I had a call from him, when he inspected the trees I had pruned for above 20 years, and his opinion of the same was inserted in the "Gardeners' Gazette," and his Magazine, January,

1842, and the tables on thinning in November, 1841. I hope these will be examined by the Directors, who might suggest some further improvement for the public advantage, or produce some system more advantageous, which under the recommendation of the Directors, might awaken proprietors to a sense of the propriety of attending more to their woods, both for their own advantage and that of their country. On examining the abstract of woods and plantations, it is stated that the best managed woods in Scotland were those of the Duke of Montrose. Though at a distance of 60 miles, I, in summer 1823, went and inspected them, and was completely disappointed with regard to the pruning. The impropriety consisted in divesting the trees of their branches to within a few feet of the top. In 1824, 25, and 26, Sir T. G. Carmichael's gardener and forester carried on the pruning of his plantations, to such an extent, that the trees were divested of every side branch almost to the top, and so great was the nakedness of them round the Castle that there was neither shelter nor screen. Though the shelter is partly recovered, the hardwood thinnings are so unsound from the radical work perpetrated, that they are almost valueless. This is the more to be regretted as the management was left to those who were supposed competent to perform it. When I was, two years since, with Sir J. Naesmyth, employed in pruning, he informed me that W. M'Kenzie, M. P., complained to him that his trees were not thriving, though he and his gardener had pruned them in the most judicious manner. I am informed on the contrary, that they have been treated most improperly,—a fact of too common application around Peebles.

In 1826 I had a letter from the late Sir Henry Steuart requesting me to call, and afterwards, by agreement, I pruned and repruned part of his trees so as to enable him to judge of the effect of my system, before he inserted the article pruning, in his "Planters' Guide." He continued to prune part of the trees for a few years at the west gate; with respect to thinning it cannot be said that it has commenced. I could show the good effects of pruning by the shortening of the branches, in 1823, 24, and 25; the trees were nine years planted and most unhealthy, but so great was the effect of pruning on them, that in the course of three years the moss had fallen off, and they had made growth above 10 feet in height. This year, J. White, Esq., Netherurd, had these repruned, by only shortening the largest branches; 12 elms were measured, the circumference, at one foot high, was 3 feet and one line, height 45 feet in 30 years, altitude about 800 feet. A. Sim, Esq., Cultermains, has plantations 8 years old, in which there are some elms above 26 feet high, and oaks above 15 feet; he bought the Culter estate a few years ago for above £20,500, which is wholly enclosed with belts of planting and hedge rows; and he admits that on two acres of his other estate, in a plantation of about 36 years of age, that there are more handsome trees than on all the other. So much for a few shillings of expense yearly. I, in 1836, 37, and 38, pruned a few trees in East Prince's Street Gardens, Edinburgh, and this year repruned part, so that the pruned and unpruned can be compared as they stand side by side. Improper pruning may be noticed, I think, on the young trees in the Meadow Walks, and in the South Side of Calton Hill Royal Terrace Gardens. The late

W. Scott, Esq., who reviewed the different prize essays on the pruning of forest trees, the more fully to comprehend the effect of my system, attended, while I was pruning in East Prince's Street Gardens, 1837 and 38, and was so well satisfied that in September, 1839, I went and pruned a number of trees for him on his estate of Teviotbank, with which he was so well pleased, that, on his recommendation, I was employed in spring 1840, to prune the trees at Prestonfield, (Sir R. K. Dick's,) and it at the same time was agreed that I should reprune, but Mr Scott's partner, Mr Balderstone, having consulted Dr. Graham, Professor of Botany, Edinburgh, he condemned the system, which prevented all farther proceedings.

My system has received the approbation of Lord Murray; Sir J. Naesmyth; Dr. Balfour, Professor of Botany, Glasgow; Dr. Niell; Professor Low; the late J. C. Loudon, London; and a host of others.

Professor Low, in his "Elements of Agriculture," 1st and 2nd ed., states "that this system of pruning, by first shortening the branches, was brought into notice a few years since by Mr Billington, in England, and was further developed and explained by Mr Cree, in Scotland, to these two gentlemen the country is highly indebted, to the latter in particular, for bringing it to a point of improvement never before known."

From "Loudon's Gardeners' Magazine," Sept. 1842, "The great advantage of Mr Cree's system is that it is reduced to a rule as plain as the simplest rule in Arithmetic. The systems of Billington and Main are essentially the same as Mr Crec's, but both these authors have stopped short of giving the rule of practice, which Mr Crec has done, and in such a manner as to reduce

scientific pruning to the highest degree of simplicity."

The shortening of the branches naturally induces rapid growth. All trees with conical heads are those which grow fastest, such as the willow, larch, silver and spruce fir, &c., and pruning by shortening the branches is more quickly done than the more general plan of cutting out the strong branches, to make the others stand more open on the body of the tree. But if the two kinds of pruning are compared it will be found that there are fewer branches and slenderer on the body of the trees shortened, than on those which have the large branches cut off, thereby making the young trees unsound at the pith. Pruning is said by some to incur expense, but, from my own calculation, trees from 6 to 12 feet in height may be shortened by one man at the rate of from 400 to 600 per day, trees above 40 feet, 80 per day, and others proportionally.

I hope I have said as much as will make the Directors feel that there is an imperious necessity for them to make a grand effort in order to show to the other members of the Society the advantage of reducing both the thinning and pruning of trees to scientific principles, since experiment can be made at such small expense, especially as by this means the young woods will be rendered of five times more value.

I may remark, that when the road trustees were a disconnected body the roads were wretchedly bad, but when taken up as a national question, the roads became what they now are. I wish equal improvement in arboreculture. I hope that the directors will not suppose that I intend to lead them away by crude theories, nor could I expect that they should be entrammelled by any veneration for an irrational tho' ancient custom,

But to put the different systems to the test is a sure path. Should the Directors, as a body, find this inconvenient, I hope that there is some spirited and patriotic individnal amongst them, who will make the attempt, seeing the matter is of such importance, aud that agricnlture and horteculture are conducted on scientific principles. GAVIN CREE.

COPY OF ANOTHER LETTER ADDRESSED TO

SIR CHARLES GORDON.

MAY, 1845.

SIR,—I beg to make a few observations to the Dircctors of the Highland and Agricultural Society of Scotland, as the Society has almost invariably taken the lead in all matters tending to the improvement of Scotland, while the example has extended over not only the three kingdoms, but been of benefit throughout the civilized world. Undoubtedly there is still much occasion for improvement in many instances connected with the object of the Society, and what I propose, in the meantime, is with respect to Arboreculture. The Society in 1820 had an abstract prepared from their different essays and books, of value at the time, but from what I know, it is now a very insignificant production. In 1836 the prize essays were rather better, though on the whole these were, my own included, short of what they should be. My letter to the Directors last season, called forth a few remarks from Mr

M'Kenzie of Dolphinton, importing that he considered my system as too severe, which opinion was seconded by Dr. Graham, Professor of Botany, Edinburgh, but on the other hand, my system was defended by Dr. Neill, and others. My system appears not to be understood else it would at once become of general adoption. If healthy trees and sound timber are wanted, let the branches be shortened, if on the contrary, stunted trees and unsound timber are to be secured, prune young and old trees close. In the latter end of last season, I called on Mr M'Kenzie, at Dolphinton, and desired him to state, in writing, his objections to my plan, and likewise the method he approved of, that I might be enabled to make further improvement. He declined, saying that it was one thing to speak nonsense, another to write it; at the same time permitting me to prune such a number of trees as I considered an experimental specimen of my system, which I did at the time.

In the beginning of this year I was employed during a few months in conducting the thinning and pruning of Craigcrookhill plantation, near Edinburgh, and had there an opportunity of seeing the effects of the too general plan—pruning close to the body of the tree, even when only three feet to 30 feet in height.

Gardeners are so accustomed to close-prune standards for fruit trees, that they cannot be induced to treat forest trees otherwise. They may be compared to the fishwife who was in the practice of stripping the skins from the live eels, who on being questioned whether she did not think it a deed of cruelty? remarked, that at first it might be so, but now that they had been accustomed to it for 25 years, they might be well used to it. The general practice with regard to trees is to prune

both young and old close to the stem, which completely stops their healthy growth. My system is to shorten the branches till the tree is at least 18 to 24 feet high, before close pruning commences; but there is a very different specimen on the estate of Ravelston, (adjoining Craikcrook) which is performed by taking the whole of the branches off the trees to above 15 feet in one year, and some of the wounds are larger in circumference than the stem at the part; now this prevents the tree from becoming sound timber. As the root of every branch is from the centre of the tree, whenever ampntation of large branches takes place, or even small ones, if in disproportion to the circumference of the stem, when the tree is nnder 24 feet in height, the exposed part, although painted, incurs rot, and if large the rot proceeds to the centre. These parts are from the first destitute of sap, and obstruct the ascent of it, just as if the tree had as many holes made into it and afterwards plugged up with dry wood. So much is the ascending sap obstructed in such cases that the trees become nnhealthy, a circumstance generally attributed to the sub-soil. Now reverse the case:—only shorten the side branches, by taking off, we shall suppose, half their length,—this process will double the quantity of sap for the remainder, and the foliage is increased in the same ratio, whereby it is enabled to attract greater nourishment from the atmosphere, and the tree, by this means, will attain to greater height in three years than those under a different management will do in twelve

Another cause of failure, is the pruning of the roots of hardwood trees when planted. Not one particle of the roots of trees should be cut off when planted in the

field. I have seen oaks stand nine years and not make nine inches, and I have planted those which have made nine inches in height during the first year.

The shortening of the branches concentrates nearly the whole of the sap in the body of the tree, but when left unpruned, as much is deposited in the branches as goes to the body. With those who are against pruning we have nothing to do, but if pruning is admitted, what is the best method? I maintain that of the systems of shortening and close cutting, the one rapidly produces sound timber, while the other destroys it in a great measure. I have been employed for Craigcrook in thinning and pruning the trees on that estate, and the adjoining estate of Ravelston. The plantations on the roadside at Craigcrook has been pruned close; the difference between the two schemes is great. My system may also be seen at the Mid-Meadow Walks, East Prince's Street Gardens, Royal Terrace Gardens, Bailie Wright's, and Eagle & Henderson's Nurseries, Edinburgh, and at St. Catherine's, Liberton.

Should the Directors come to the important determination of nominating a Committee to examine the trees here mentioned as pruned (and I could name other Estates where an examination may take place, if necessary), and also Wood merchants as to the loss sustained by them on account of improper pruning, the result might be extensively beneficial both to them and to the country. It is not necessary that any expense should be incurred in conducting the examination, the trees can be seen in and around Edinburgh, along the accustomed walks of many members of the Society, and by only observing them, they should be

enabled to state their opinion at the meeting. I might probably, in the latter part of the year, attend, but if the trees on examination do not bring conviction, any comment on the propriety of my system must be unavailing. Sir, Your most obedt. Servant,

GAVIN CREE.

ANSWER SENT BY SIR CHARLES GORDON.

Highland and Agricultural Society's Hall,
Edinburgh, 14th July, 1845.

Sir,

I beg to acquaint you that your communication of the 30th May, on the management of trees, was lately submitted to the Directors of the Highland and Agricultural Society of Scotland, and that the Board voted their thanks for the communication, and remitted it to their Committee on Publications to report thereon.

I am, Sir,
Your most obedt. Servant,
CHARLES GORDON, Sec.

Mr Gavin Cree,
Biggar,

ARBORECULTURE.

This appeared in the Gardeners' Gazette, Feb. 15, 1845.

I observed an article on planting and pruning taken from the *Dumfries Courier*, which has gone the round of most papers. I observed it for the first time, when

in a reading room in Edinburgh. Mr Creadie proposes that larches, &c., should be pitted. There is no doubt it will be of great advantage to their after-growth, and in some cases they will not grow without it. But there is a great difference in the plan of making the pits for the trees to grow well. A number of years I had a large plantation to be planted with larch all to be pitted; the pits, the whole of which were made in the latter end of the year, were 18 inches long by one foot deep, the green part downmost, cut small, and planted in spring. Nothing could have done better. In another plantation, of about 1,200 feet in altitude, although planted and made up for six years, the trees made no advance, the land was a thin moss, on a retentive subsoil, the pits were made in September, and then raised with a pick, and the trees planted in spring, and nothing could do better. Mr Creadie further states that young plantations of larch should be pruned with a handknife. This I shall only state from what I have seen and know of larch that whoever wants to destroy their plantations do so for larches may be shortened, but cutting off the healthy branches make the trees corked in the centre and rot follows, for the trees require less attention in forming, for the under branches soon die, and they require to be only knocked off with a blunt instrument; improper pruning of larch has been carried on by many to a great extent; and from information and personal inspection of a larch plantation by two men employing sawing-felling, the pruned trees were a great deal worse to saw than the unpruned, from the interior of the tree being almost as dry as seasoned wood, but the look of the trees can be known by such maltreatment. He next states that all prun-

ing should be continued only so long as it can be done with a pocket knife. Gardeners and nnrserymen in general, by this mode of pruning, destroy a great number of trees by inconsistent management from want of knowledge how a tree should be treated, bnt I can prune a tree to as much advantage when above 24 feet in height as at three feet. But no tree should have the smallest branch cut off close to the stem till it is at least 24 feet high, and 24 inches in circumference, when trees are covered with healthy leaves to the height of 24 feet should be in a more healthy state than the same tree pruned np that the top was only six feet: all I have to complain of in pruning is over-pruning; there is, some say, that prune which is of great deal more advantage than improper pruning; but in the neighbourhood of Edinburgh, where I have been for some time, I observe what I consider the most inconsistent conduct in the pruning that has been done and at present carrying on. If large branches are cut off from the stem of the tree, and in such a manner that the circumference of the wound is larger than the circumference of the tree, will that tree be sound timber? In all pruning of trees sound timber should be the first consideration; when trees are standing single, and for effect, at present, these I pay no attention to; let us first decide as to pruning or not, and which is the best system for sound timber and rapid growth.

GAVIN CREE.

ARBORECULTURE—PRUNING TREES.

(*This appeared in the Farmers' Miscellany, in* 1847.)

Of late years, a great number of writers have contributed their notions on arboreculture, and had them made public through the periodical press. This is quite right; by this means their respective views are laid open for examination, and corrections and improvements may thus be gained by comparison of their methods and the experience of the writers In 1820, the Highland Society made an abstract from the books and essays to the number of 135, from which it might have been expected that a complete knowledge of the management of woods and plantations would have been got; but the scientific department is altogether deficient, and, in truth, it could not well be otherwise, as the compiler had no data to found upon on that part of the subject. In 1822, I handed to the Highland Society an account of my system of pruning forest trees. In 1823 I received from the Society a letter of thanks. My wish, however, was, that they would institute a competition of experimental pruning; or, if that could not be accomplished, that some of the directors might be induced to try the effect of different experiments. I wrote to the Marquis of Tweeddale, Lord Rosebery, the late Admiral Fleming, and others, who returned answers, and recommended the matter to the Society, but it went no farther. In 1837, the Highland Society gave prizes to four essays on the pruning of forest trees. I received the third. Some time afterwards I stated to the late Sir Charles Gordon, the secretary, that the committee had taken no notice of the scientific part of my essay;

he replied, that there were enough of books on vegetable physiology. There are abundance of books on pruning forest trees, too, I said; but what I had written on vegetable physiology was in a condensed form, and so plain that any forester might comprehend it; whereas, large publications take in the whole of the vegetable creation, including the various fanciful opinions of numberless authors.

I proceed to some remarks I have to make on the management of the oak. When a boy, and long afterwards, I heard much about the slow growth of the oak, and I believed the fallacy. In 1808, however, my father bought a small farm, the lowest part of which was 800 feet of altitude. He planted a good many acres, and, being a nurseryman, with a greater variety of different kinds than is commonly tried; among the rest, oaks, of about two feet in height, pitted with the whole of their roots; the roots were bent in the pits, but that did not hurt them. The longest growth of the first year was nine inches. In the latter end of the tenth year some of them had made growths of thirty-nine inches in one year. I understand that the general practice in the raising of oaks in public and private nurseries is as follows:—The oak acorns are mostly sown in drills, and the second year the top roots are cut with a spade, while standing in the drill, to make them fibry and bushy-rooted. Those which are not cut grow uprightly, or with one leading shoot, while those cut are forked in the top: so much is the oak deteriorated by such treatment. Farther, when transplanted in the nursery, they are cut in the roots, which has still the foresaid effect of forking them in the top; after which usage they require two or three years to recover their due vigour,

Finally, by this repeated cutting of the roots, they, making little growth for several years, are overtopped by other trees, and remain as underwood. The more inferior the soil and climate, the trees will be the more stunted.

I have both cut the roots of the oak in transplanting and left them uncut. In transplanting them in the nursery lines, the uncut have completely the advantage. I generally transplant oaks when two-years seedlings, and lay them with their whole roots; these are better rooted in one year than those which are cut are in two years; and when planted in the field they come away equally well with other hardwood trees, and some of them equal the length in height. Silver and spruce fir, larch, poplar, and willow, are fast-growing trees; now, these have all short branches, and thereby deposit the sap the more rapidly on the body of the tree. The same law applies to all other trees, as the oak, elm, ash, beech, &c., which only require to be regularly shortened in the branches to secure rapid growth. Shortening augments the quantity and improves the quality of the timber, and preserves the branches in a slender form preparatory to close pruning. Trees, when neglected, have often a tendency to shoot into large forked branches, and produce only a quantity of brushwood. To ensure clean and sound timber of large body, pruning can rarely be dispensed with.

I have often stated that trees should be eighteen feet high and fifteen inches in circumference before close pruning commences. But I have now observed that oaks ought to be more than eighteen feet high, and there is nothing amiss in referring the close pruning till they are thirty feet high, provided they are regularly

and properly shortened. In some I have tried, I have found this measurement preferable to the other.

I have carried on the pruning of forest trees so long, and noted the result of my practice so carefully, that, comparing them with the results found in the writings of others, I am confident that whoever may follow my directions, shall have no reason to be dissatisfied with the trees thus managed. At the same time, I hope yet to see farther improvement, and that by thinning and pruning, a great many kinds of trees, and oaks in particular, may be brought to from five to eight times the value of the trees which are left to themselves, or improperly pruned.

The best season, in Scotland, to begin to prune oaks by shortening, is from the middle of August to the latter end of October. When cut late in the year, or winter, the frost often kills the branches, and injures the main stem. Close pruning ought to be practised in spring, when the tree is nearly in leaf. It is remarked in the 'Edinburgh Literary Journal,' 1830, that 'the misfortune of former able writers who may have failed of applying science to the practical operation of pruning, does not prove that the abstract sciences are useless, as some practical men of small attainment affect to say; but it proves only that those sciences are not sufficient in themselves to direct practical operations, and that to be productive it is necessary that they be combined with experimental knowledge. It is by connecting the one with the other, that we can assure ourselves of obtaining results both useful and satisfactory.' We conclude from this, that to extend securely the dominion of science in our department, we must to our knowledge add well-considered practice. GAVIN CREE.

THE TWO FOLLOWING ARTICLES,

Against Mr Cree's System,

Appeared in the Gardener's Chronicle, October, 1847.

I have just read the article on pruning forest trees, in the *Chronicle*, page 652, signed Gavin Cree, in which a system of planting and pruning is recommended which appears to me so contrary to nature, that I am desirous of further information on the subject. It is stated, in speaking of a plantation of several acres, that "the Oaks when pitted were about two feet in height, having the whole of their roots. The roots were bent in the pits, but that did not hurt them. The longest growth in the first year was nine inches. When two years old, some of them had made 39 inches in one year." Whether or not the others had died is not mentioned; but had I planted Oaks with their roots so much bent up as would be requisite for trees two feet high in holes of ordinary dimensions, I should have expected such a result in many cases. Knowing that Oaks had tap roots, and very long ones, and believing that shortening them at the time of planting caused them to throw out new ones afterwards, I thought Mr Cree's method an unkind one, as affording the tree no chance of making a new tap root, unless the first one should die, owing to its cramped position. I therefore referred to Cobbett for his opinion, and find the following in his 'Woodlands' (paragraph 67). "Several trees make tap roots of two feet long the first year. These tap roots cannot be preserved in transplanting; and if

they were put into the gronnd at full length, with an iron bar, they would be sure to die all the way nearly up to the top. These tap roots must therefore be cut off to within 3 or 4 or 5 inches of the plant." Can any of yonr correspondents, from experience, state which is the right one of these very opposite modes of planting? Mr Cree condemns the cutting of the roots, as being productive of forked heads. Would not this evil be more snrely counteracted by cutting down the young tree nearly close to the ground, after it had stood in the plantation one or two summers, and thereby causing it to throw up a new straight shoot? The same writer further advocates the foreshortening system of pruning, at an early age, to be followed by close pruning, after the tree is 15 inches in circumference, by which time it may be supposed that the shortened branch is one or two inches in diameter, the cutting away of which would cause a serious wonnd, and spoil the appearance of the stem for years. I am therefore desirous of knowing why the branch might not have been cut close away at first, thereby saving a larger amputation afterwards. I presume it cannot be to obtain leaves for the maintenance of the tree; as common sense teaches us that any deficiency in that respect, consequent upon a reasonable amount of pruning, would be immediately supplied by a uniform corresponding production of leaves at the extremities of the tree, where light and air would have their influence, far better than by a few sickly twigs on a foreshortened and overshadowed branch. When a child's teeth are too much crowded, the dentist does not partially file down each that is doing harm, to be extracted afterwards, but removes entirely whatever interferes with the growth of the good ones. Again,

when I have seen a child whose leg has been amputated, I have never understood that only part of the operation had been performed, and that the remainder was to be done when the patient attained a certain height and circumference; and why are trees to be treated differently? In making these remarks, my object is not to give an opinion, but to call forth those of others more qualified to do so, and to elicit, if possible, satisfactory reasons from the advocates of systems which appear unnatural. But I fear with regard to the foreshortening plan of pruning forest trees, I shall have to be satisfied with that which is happily nearly exploded from agriculture, and ought to be so from arboreculture also, viz: "It must be right, because my father did it, and his father did it before him.—*Larix, Birkenhead, Oct.*, 9.

My attention has been drawn to an article on pruning forest trees, by Mr Gavin Cree, of Biggar. It is a subject on which I feel no little interest, and I therefore venture to send a few crude reflections, with a view rather to awaken attention, and call forth the opinions of others, than to intrude my own upon the public. Almost all men are planters more or less, from the worthy citizen with his villa of an acre, to the powerful baron, with his park of a thousand acres, each according to the extent of his surface, and the measure of his abilities. Yet of trees the landowner for the most part 50 years ago knew little, so far as their management was concerned; still he laid out his money freely on the work, however executed, con-

ceiving, and with justice, that he had done a great thing, if not for himself, at least for posterity. Unacquainted with the history, properties and culture of trees, he naturally enongh saw with the eyes and heard with the ears of his gardener; and as the gardener, 99 times in 100, knew nothing himself, it was "the blind leading the blind" in this important branch of rural economy. Sometimes the forester was the operating person, which was still more unfortunate, as he was generally a mere lopper and cutter of wood. In ordinary cases he was much worse educated than the gardener, with eqnal pretensions as to arboreculture and equal ignorance. The fact is, that of all land produce, wood is the least studied and understood by the landowners themselves, and by consequence the worst managed. To all estates this snbject must be of some value; to many it is of vast and vital importance, involving the interests of more than one generation; while to others it is the principal and paramount source of revenue. In an age, therefore, when everything useful and ornamental becomes the subject of scientific investigation and general study, it seems singular that arboreculture should be at once so universally practised, and in its principle so utterly neglected. We may reasonably expect that the time is not far distant when arborecnlture, being of the same family as agriculture and horticulture, will at length share the same distinction; that it will be taken out of ignorant hands, and engage the attention of the ingenious and scientific. Nothing seems wanting to this charming art but some successful method of giving a speedy effect to wood, and of bringing the enjoyment of it in some sort withiu the life-time of any planter, that

is giving it at once a magnitude sufficient for picturesque purposes. As an instance of what may be accomplished by perseverance and system, I will mention the following circumstance. Some three or four years ago, having occasion to make a tour through a certain portion of north Wales, with a view to investigate its natural as well as moral aspect, my attention was particularly directed to the flourishing plantations of Oaks belonging to Mr. Wilson Jones (late M.P. for Denbigh), and Dr. Thackeray, of Chester. These occupy about 1000 acres, in Denbighshire and Flintshire, of what was once nothing but a barren waste; the fee-simple of the land cost 1*l.* per acre in the year 1804; the planting was then commenced; a regular and uniform system of pruning has been steadily pursued ever since, not only each year (as the case might require), but at all seasons of the year (herein differing somewhat from your correspondent Mr. Gavin Cree); and the results are such as cannot fail to strike even the most casual observer. To say nothing of the size and beauty of the Oaks, which taper like the Larch, I was informed on the best authority (on a second visit which I made to the same spot this summer), that the thinnings of the woods alone, viz., Larch, Scotch Firs, &c., have yielded a profitable revenue; so that, in this instance, the original planter has not only lived to see the fruits of his labours, but (rare felicity), to reap the benefit of them also.—*J. T.*

PRUNING FOREST TREES.

This appeared in the Gardener's Chronicle, Oct., 1847.

I approve of Mr Gavin Cree's shortening system; namely, "when the trees have more leading shoots than one, the healthiest and most upright should be selected as leader, and the adjoining one shortened to half the length of the selected shoot; these shortenings should include any branches which are gaining a disproportionate ascendency over the other branches." So far I consider Mr Cree to be correct, but I object to his close pruning, which I consider unnecessary (if not injurious) for hard woods, but positively injurious (with few exceptions) for the Conifers. If the shortening system is properly followed up, and the thinning timely and judiciously executed, no close pruning will be required until the lower branches decay, which they will do when of no further use to the trunk; then, and only then, in my opinion, should a tree be close pruned. I also approve of the shortening system for Conifers, but the knife should not be used, as the branch generally cankers at the cut; it should be about midsummer, either by breaking or pulling out of the socket the one-year old shoot. The first grand point to attend to is the soil. However carefully trees may be reared, finally planted, pruned, and thinned, the tree will not fully develope itself unless the soil is the suitable soil. For example, the timber of the Scotch Fir is of little value when grown on the low rich soil of England, but such is not the case with the timber produced in the native forests of Braemar. Plant the Oak on the hills of Scotland, and it will become as valueless, compared

with that produced in the low rich soils of England, as the Scotch Fir produced in England is inferior to that prodnced in Braemar, but from opposite causes, the Scotch Fir from over-feeding, the Oak from under-feeding. Climate and sitnation may do mnch, bnt little when compared with the soil. It is not uncommon for planters to have fancies for particular trees. This is very commendable in itself, if the soil is snitable; bnt as this point is not always fully considered, disappointment sometimes follows. When a proprietor determines on planting a portion of land, the first qnestion to settle is, which tree or trees are most snitable for the soil; let those be planted, and he can look forward with certainty to their being fully developed in due time. My idea is, that the Alder and Willow, though of little value compared with the Oak, on their own soil will give a greater return than the Oak or any other tree.—*C. B.*

ARBORECULTURE.

This appeared in the Gardeners' Chronicle, Dec. 1847.

Some strictures appeared on my article published on the 2d October, which must be adverted to. The first animadversion is fonnded on a misconception, or rather a misreading of the following statement—"The Oaks when pitted were about two feet in height, having the whole of their roots. The roots were bent in the pits, but that did not hurt them. The longest growth in the first year was nine inches. When two years old some of them had made 39 inches in one year." Substitute

ten for two in the above sentence, and the truth is undeniable. The writer continues, "Whether or not the others had died is not mentioned; but had I planted Oaks with their roots so much bent as would be requisite for trees two feet high in holes of ordinary dimensions, I should have expected such a result in many cases. Knowing that Oaks had tap-roots, and very long ones, and believing that shortening them at the time of planting caused them to throw out new ones afterwards, I thonght Mr Cree's method an unkind one, as affording the tree no chance of making a new tap-root, unless the first one should die, owing to its cramped position." I answer, that it must not be nnderstood that the roots are rolled np like a whip-cord, but that reasonable room is afforded them in the pits. The larger the tree the larger the pit. As to "cutting off the roots within three, four, or five inches of the plant," which the writer proposes, and "cutting down the young tree nearly close to the ground, after it had stood in the plantation one or two summers, and thereby causing it to throw np a new straight shoot," such treatment could only expend time unprofitably, the shoots thus produced will be both short and slender, and the other trees will completely overtop them. I quote farther: "The same writer advocates the foreshortening system of pruning at an early age, to be followed by close prnning after the tree is 15 inches in circumference, by which time it may be supposed that the shortened branch is one or two inches in diameter, the cutting away of which would canse a serious wound, and spoil the appearance of the stem for years. I am therefore desirous of knowing why the branch might not have been cut close away at first, thereby

saving a larger amputation afterwards." Does the writer know the effect of foreshortening? The shortened branches are, by the operation, forced to continue slender, and instead of being one or two inches in diameter, when the stem is 15 inches in circumference, they never exceed half an inch. I have often stated the cause of this. To my own mind the reason is quite satisfactory. When the branches are allowed to extend, a great part of the sap or nourishment is deposited on the branches, which, by shortening, is conveyed to the trunk. For example, a branch 12 feet long absorbs a very different quantity from one 4 feet in length, both from its greater length and thickness. In the shortened branches the sap moves rapidly, and soon returns and in proportion to the smallness of the branch the trunk is enlarged. I might say more on this head, but the fact will be obvious to all who will make the experiment. Farther, in cutting branches close when the tree is small, the pith is injured, young wood having a large pith dies back into the tree, and reaching half through its diameter the trees afterwards become rotten in the heart. With regard to thinning out branches (the largest probably are meant), the shortening suits this part of the process by dwarfing them, as I before noticed. The analogy drawn from the extraction of teeth and amputation of legs at the end of your correspondent's paper is most inapplicable; these operations are performed in consequence of debility —never of strength.

The second paper containing strictures on my article is sensible and well written. "Nothing," says this writer, "seems wanting to this charming art, but some successful method of giving a speedy effect to wood,

and of bringing the enjoyment of it in some sort within the lifetime of the planter; that is, giving it at once a magnitude sufficient for picturesque purposes." Now this is one of the objects I always aim at, and, though it cannot be done at once, we may assist thereto. Towards the end of the paper we have some remarks on "the flourishing plantations of Oaks belonging to Mr Wilson Jones (late M.P. for Denbigh,) and Dr. Thackeray, of Chester." It appears that the Dr. does not regard any particular time or season as peculiarly appropriate for pruning, but prunes every day in the year, treatment calculated to prevent injurious growth rather than to cure it. If I understand the Dr.'s system correctly, he does not possess that love of leaves which I cherish. Although pruning may be practised at any season without vital danger, I think different kinds of trees require different seasons of operation, and I have some compunction in stripping trees of leaves in full vigour, by pruning to any extent in summer.

It is not to be expected, however, that every one will prosecute so extensive a work as the management of woods on the very same plan; all that can be looked for, perhaps, is that some approximation to rational and scientific principles may be attained. When studying military tactics I recollect reading a sentence in James's Military Dictionary, which I wish foresters to act on. "It cannot be doubted that our respective duties can only be practised with success and effect, by men who have made themselves masters of their profession by learning and science." If prejudice could be rooted out, the art of pruning might be easily learned; the great obstacle in the way of its advancement is old notions tenaciously held, and put in practice, in very

many cases most mischievously. The method I follow is, I think, easily understood; I only wish that people would believe in its efficacy, so far at least as to give it a trial.

I never prune close to the stem till the tree is 18 feet high and 15 inches in circumference, and am now rather of opinion that 24 inches ought to be adopted. When trees are close pruned when slender, rot occurs. In pruning during successive seasons, at Dalwick, the seat of Sir J. Naesmyth, I observed this to a distressing extent; many of the trees had been close pruned when only 8 feet high, and in numerous instances the decay had reached 1 foot and a half along the pith.

The shortening of the branches enlarges the trunk. Trees, thus pruned, derive more nourishment from the sun's rays than the unpruned, from which, to a certain extent, these are included. In plantations, pruned in the foresaid manner, the temperature must be higher than when the sun's rays are excluded, and the healthier the trees are the wood is proportionally stronger in texture. It is an admitted fact that trees crowded together, or too near each other, suffer more from a deficiency of air (which is required for respiration) than from deficient nutriment from the roots. When the branches are shortened they are clothed with a finer foliage, which enhances the vegetative power; and the branches remaining slender, the sap returns rapidly, and by reason of their small superficies nearly the whole is deposited on the body of the tree. All trees of rapid growth have short, slender branches; and we only follow nature in adhering to our principle. By shortening the branches of the Oak, Elm, Ash, &c., till they are at least 25 feet high, they can be made to

equal in growth the Fir and Willow kinds—a fact never dreamt of under any other management.

To strengthen my position, let me quote a passage or two from Dr. Lindley's "Theory of Horticulture;"—"If, of two unequal branches, the strongest is shortened and stopped in its growth, the other becomes stronger, and this is one of the most useful facts connected with pruning; because it enables a skilful cultivator to equalise the rate of growth of all parts of the tree. In fact, the utility of the practice, so common in the management of fruit trees when very young, turns entirely on this. A seedling tree has a hundred buds to support; the stem grows slowly, and the plant becomes bushy headed; but being cut down, so as to leave two or three buds, they spring upwards with great vigour, and being reduced to one, receive all the sap which would otherwise have been diverted into a hundred buds, and thrive accordingly, the bushy head being no longer found, but a clean, straight stem. In the Oak and Spanish Chestnut, this is particularly conspicuous." "If a stem is trained erect it will be more vigorous than if placed in any other position, and its tendency to bear leaves rather than flowers will be increased in proportion; and as it deviates from the perpendicular its vigour is diminished." Cutting a young tree over that is unhealthy has the same effect. I can shorten the branches of a tree, 20 ft. in height, as well as one of 3 ft.; and old, stunted trees can be shortened and made to advance as much in 3 years as they may have done 15 years previous. They expand in circumference, and throw off the moss and lichens, and assume a clean stem—a method much more effectual than scraping or any other artificial cleansing.

GAVIN CREE.

ARBORECULTURE.

This appeared in the Gardeners' Chronicle, Nov. 1848.

In Brown's "Forester," p. 119, the following information is given: "The plantation was 12 years planted, the average height of Oaks was from 5 to 8 feet, the bark of the trees was clean and fleshy, and, generally speaking, they were in good health. In the pruning of these trees I first had all the small branches, not exceeding two-thirds of an inch of diameter at the base, cut from the trunk and close to the bark, to the height of about one-third the height of the tree in each case; next all the branches which grew upon the same part, with a diameter at base exceeding that last mentioned, I cut off to within about 4 inches of the stem or trunk from which they proceeded, leaving the stems in the meantime; and all large top branches which appear to be gaining strength upon the leading top shoot, I shorten down to nearly one-half of their whole length; bnt in all cases where two top shoots appear, I cut one of them closely away, leaving the one which appeared to be the most healthy and strong, and which appeared, at the same time, to come most directly from the centre of the system of the tree." I understand that the trees here referred to were well sheltered, and at no great height above the level of the sea, and in the county of Mid-Lothian; on which account, I think, their growth was by no means rapid. On the estate of G. T. Stodart, Esq., in Tweeddale, at 900 feet of altitude, there are Oaks, only seven years planted, 10 feet high. This superiority I attribute to the effect of management. The branches of these have only been

shortened, none of them cut close; and the advancement made by this method, when compared with the plan of cutting close, is greater than one could, without experience, believe. Undoubtedly the author referred to supposes that by taking away the branches more ascending sap is thrown into those that remain; but, on the other hand, the quantity of descending sap is thereby diminished, though, were this the only loss, much might be said on both sides. I have to state, moreover, on ample observation, that young trees pruned close, on Mr Brown's plan, will be found unsound, if dissected at an after period, at the parts where the branches are cut off close to the stem. The end of the branch dries back and carries rot into the pith, the distance being so short, only half the diameter of the stem of a young tree. When so great a proportion as one-third of the height of the tree is pruned close, the ends of the branches which have dried and afterwards decayed, must obstruct the flow of the sap; on the contrary, when trees are only shortened till they are 24 feet in height, they can safely bear close pruning, gradually performed from the ground upwards. The decay induced by the close pruning practised by Mr Brown engenders diseased sap, which mixes with the ascending sap, part of which, not carried off by evaporation, mixes in turn with the descending sap, and in proportion to the quantity of unsound sap, the quality of the wood will be found deteriorated, and if fully examined into, this would appear to be one of the causes whereby timber oftentimes becomes so early unsound. These evils may all be avoided by shortening the branches, instead of cutting close on young trees; and by this means, too, the timber is raised much

more rapidly, and is of stronger texture. In cutting close and shortening the branches of yonng trees the design is to angment the ascending sap for the remainder. Cntting close, however, deprives the tree of the full benefit of the descending sap which shortening secures. The advantages of these saps are fully realised, I think, by the process of shortening. It may be compared to the steam engine in its former and present efficiency. At first the steam raised the piston, when a vacunm was made, and the piston was forced down by atmospheric pressure. Now the steam is made to act both ways, and with snch rapid movement as was not at one time contemplated. I am convinced that Oaks may reach as great magnitnde in 100 years, if properly managed, as they have done in 300, and with no more expense in shortening, and so on, than is commonly expended on them. The older writers were ever devising means to raise crooked timber, as if they knew whether it would ever suit the desired bend in ship or boat, but straight timber is of more value in ship-bnilding than members of the crooked family. There will always be found a good deal of crooked timber in the tops of Oak trees, and I wonld have proprietors shake off their lethargy and betake themselves to the application of an improved system of managing their woods, and thereby have in England trees with stems of 50 or 60 feet in length, and in Scotland of 30 or 40, instead of from 5 to 15.

GAVIN CREE.

THE FOLLOWING LETTER

WAS RECEIVED BY THE AUTHOR

When he was awarded the Ises Gold Medal by the Society of Arts, London.

"Society for the Encouragement of Arts, &c.,
Adelphi, May 23d, 1848.

"SIR,—His Royal Highness, the President, having fixed Monday next, the 29th instant, for the presentation of the Rewards for the present Session, I am desired to request your personal attendance on this occasion, at 11 o'clock, to receive the Ises Gold Medal awarded yon by the Society,—

I remain, Sir, Your most obt. St.,
SAMUEL THS. DAVENPORT.

To Gavin Cree. *Actg. Secy.*"

"BIGGAR, 27th MAY, 1848.

"SIR,—I have to acknowledge the receipt of your letter to-day, but from the short notice, and other arrangements, I find it impossible for me to attend the Meeting at St. John's Street, Adelphi, on Monday the 29th instant."

Please state to His Royal Highness Prince Albert, President, and the Directors of the Society, that I am extremely gratified on receiving the Ises Gold Medal, convinced that the high authority whence it is conferred, will, if anything can, induce attention to my principles: and thereby, as far as my belief and experience has guided me, contribute, in a greater degree than is

generally thought of, to the advantage of the Nation as another source of wealth, by taking into consideration the profit arising from the raising of Timber more rapidly, and at the same time more sound and valuable, than has been accomplished by any different management previously pursued. I have the wish to assist to benefit my country, and repeat that I am glad that I have the sanction of such high authority for my system of pruning of Forest Trees; and may this, amongst other acts of the Society, be a lasting memorial for the good of their Countrymen, and prosperity of their Country, is the wish of your humble servant,

GAVIN CREE."

THE ISES GOLD MEDAL PRIZE ESSAY.

TREES are too often treated as if they were mere inorganic masses of matter, to be formed and fashioned after the manner of the operations of the carpenter and the blacksmith on the materials of their trades, in seeming forgetfulness how necessary it is for the pruner to possess a knowledge of the physiology of plants, to enable him to enter on his task with systematic propriety.

The Trunk of a deciduous tree, to the naked eye, apparently so compact and solid, is found, when examined by the aid of a microscope, to be composed of cells extremely minute and numerous, serving as conductors of nourishment to all parts. Looking at a transverse section, we find it is composed of distinct concentric circles. In the centre, a tube of cellular

tissue, called pith, surrounded by a circle of vessels, runs along the whole of the trunk and branches. The wood surrounding the pith is formed from the immediate layers of alburnum, known by the name of sap-wood. The process of formation may be observed by examining a young branch, when the sap circulates abundantly in all parts of the tree; a layer of fluid then appears, which, at first limpid and colourless, gradually thickens and acquires consistence. As this fluid (descending sap or cambium) thickens, filaments are seen to form in its interior; it is presently organized and assumes the appearance of vegetable tissue. Thus a new layer of alburnum is annually formed, while the preceding one is converted into wood. It is these yearly layers which constitute the concentric circles visible in a transverse section of the trunk; they are superimposed on each other, and increase in magnitude from the centre to the circumference. The circular layers which compose the stems of trees, are elongated cones, having their apices directed upwards. The apex of the innermost is within the apex of the second, the second within that of the third, and so on successively; which formation renders it impossible to ascertain the age of deciduous trees by the number of concentric woody layers, except at the base of the trunk, as they are all more or less conical, and the number of the layers diminish as gradually as they ascend from the base to the top. Besides these concentric layers, lines as rays of vessels diverge from the centre to the circumference of the tree. A thin partition of cellular tissue is interposed between each ray of vessels, which extends in the direction of the ray, through the entire substance of the wood

The Root, which forms the lower extremities of the trunk, generally descends towards the centre of the earth. This tendency is especially remarked at the period of germination of the embryo. The Pine, from the improper practice of shortening the roots when planted in the nursery, has the least tendency to descend. The roots which trees give out into the earth, are very similar to the twigs which they spread in the air. The principal differences which are observed, depend chiefly on the difference of the media in which they are developed. The structure of the roots is generally similar to that of the stems. The office of the roots is to absorb from the soil substances which contribute to growth. Absorption, however, is not performed by all parts of the root, but by the minute sponglets or mouths at the extremities of the small rootlets. Early in spring, the temperature being elevated, the lymphatic vessels distributed in the wood and alburnum, serve as canals for transporting the sap from the roots to the extremities of the branches. In very young plants the ascent is through the pith, but in those of even a few years old, as well as in old trees, the ascent is neither through the pith nor the bark, nor between the wood and bark, but through the concentric layers, and in greatest quantity in those last formed.

The Bark of trees is composed of the Epidermis, Herbaceous Envelope, Cortical layers, and Liber.

The Epidermis is a thin lamina of uniform tissue, which appears to be composed of cellules, varying extremely in form, and presenting numerous small openings or pores, whose office appears to be to give passage to air.

The Herbaceous Envelope is under the Epidermis, and consists of cellular tissue, similar to that which fills up the spaces existing between the ramifications of the leaves. This organ is pronounced to be the seat of a remarkable chemical phenomenon, it being there, by a cause not easily understood, that the decomposition of the carbonic acid gas absorbed from the air by the plant, is effected. The carbon remains in the interior of the vegetable, while the oxygen that has been disengaged is thrown out.

The Cortical Layers are under the Herbaceous Envelope, but in many plants so indistinct that they are not easily distinguished from the Liber.

The Liber or inner Bark, occurs between the Cortical Layers, which are external to it, and the woody body which is internal. The Liber is absolutely necessary for vegetation. If, for example, a circular band of Liber be removed from the trunk of the tree, so as to leave the woody body exposed, the entire tree will soon perish. We may here notify, however, that when the Liber is removed it may be restored, but before it can be reproduced, the part must be guarded from the contact of air. We have made the experiment, and if the trees were not in leaf it did not succeed, but if they have been in full vegetation for some time the Liber is replaced; a proof that the new bark is formed by the sap that descends at the part, as it does not cover unless the sap has continued to descend for some time previous to the experiment. This portion of the bark resembles the wood on ordinary trees, in being composed of vessels and cellular tissue. In these trees it is best characterised too, as it is there separated in a great measure from the ligneous texture.

A new layer of vessels is annually added to the wood, a similar, but much thinner one, is in like manner, added to the bark, and an expansive force is thereupon exerted outwards in proportion to the quantity of sap which descends. The expansion is proportionate to the quantity of sap with which the vessels of the bark are charged, the bark expanding so as to yield accommodation to whatever quantity of proper sap may be formed. From this, I think it an utter delusion to imagine that growth can be augmented in trees which are barkbound by ripping. It is want of nutriment which causes the defect, and by increasing the cambium, by means which will be hereafter explained, the evil is obviated, a result which can never be effected by ripping the bark.

The Buds which are formed in the preceding snmmer or autumn are supposed to be nourished by nntritive matter in the alburnum. When the sap arrives at the extremities of the branches, the buds swell and leaves are put forth. Leaves are formed of vessels coming from the stem; prolongations of the herbaceous envelope of the bark; and a portion of epidermis, by which they are covered in their whole extent. The epidermis, as before noticed, is a very thin substance, and that which covers the leaves is very porous, especially on the nnder surface. The leaves and the roots are the organs of absorption and nutrition. The former absorb nutritious substances from the atmosphere while the latter perform that function in the earth. Leaves are also subservient to other purposes of great importance in the economy of trees. They transpire and exhale the superfluous fluid absorbed by the root, but if necessary to vegetation, and it is by their agency

that the sap is freed of the aqueous juices which it contains, and acquires fresh nutritive qualities. This descending along the vessels of the bark, is deposited between the bark and last year's wood, which in turn forms this year's wood, then extends to, and strengthens the extremities of the rootlets, whereby they are made to extend themselves and extract more nourishment from the soil throughout the season.

Though the fall of the leaf takes place on the approach of the winter's cold, it is not to be thought, on that account, that cold is the only cause of the phenomenon. It is from the want of nourishment that the fall of the leaf necessarily occurs. The vessels contract and dry up, and the leaf soon after falls. The defoliation of deciduous trees occurs at the end of autumn.

The Descending Sap has been the subject of much discussion among physiologists. The truth of its existence was long denied by many, but is now fully admitted. It contains more nutritive principles than the ascending sap, being more highly elaborated. After the latter has been conveyed to the extremities of the branches, by an inherent power depending on the life of the tree, conjoined with atmospheric pressnre, and has been elaborated in the leaves, it descends encircling with its new properties the vegetative part of the stem, enveloping all parts with the matter necessary for the growth and development of the tree.

Great as the natural power of trees is in the developement of their growth, it can yet be aided by artificial means. The plant requires room to enable it to draw sufficient nourishment both from the soil and atmosphere; and skilful pruning enables it to do this with

greater freedom. Young trees must have their branches modified by art, as unassisted nature often produces irregularities in growth, rendering the trees unsuited for profitable employment by man. Our object is, therefore, to modify them, so as to render them suitable for the purposes required. Trees, when left to themselves, often have a tendency to shoot into large forked branches, contending with each other for ascendency as leaders, and such trees rarely produce any thing but brushwood. A large body of clean and sound timber can rarely be without pruning. The mischief arising from injudicions pruning has led many to doubt the utility of pruning at all; and so various are the opinions prevailing on the snbject, that there are reasonable doubts in what skilful pruning consists. That system must be acknowledged to be the best which produces the greatest height and circumference of clean timber in the shortest time. I shall explain the system I have followed for many years, and state the results. I should be glad if pruners generally would state the result of their operatious on the growth of the plant, for I am ready to renounce my method in favonr of any other that may produce larger trees of the same age, on similar localities.

The principal design of pruning forest trees then, is to economise the growth, by increasing the supply of nourishment in the proper direction. In order to accomplish this effectually, it is proper to prune early. Young trees ought to be examined as early as three or four years after they have been planted; and if more than one leadiug shoot is found to exist on any of them, the most healthy, vigorous, and upright shoot should be selected as leader, and the adjoining ones

shortened to half the length. If the leader be unhealthy however, it should be shortened down to some healthy shoot; for though the general rule is to shorten the branch likely to gain an improper ascendency, it is sometimes of advantage to shorten the leading shoot itself, and preserve the one adjacent, if stronger. Care must be taken in all cases to have a leading shoot. It is well known, that when the leading shoot is destroyed, the growth of the tree is greatly impaired. It is the danger of losing it which makes planters so careful in fencing their plantations. By increasing the number of leading shoots, the nutritious principle is rendered in a great measure ineffectual. But it is only on the uppermost branches that these directions are to be put in practice; those below must be allowed to increase in length, in order to sustain the regular proportion and balance. These shortenings however, should by no means be confined to the superfluous leading shoots, but must include any branch which may have acquired undue magnitude; so that the tree may take a conical form, the lower branches increasing in length in proportion to the height of the tree.

Branches should be shortened yearly till the tree is from 15 to 24 inches in circumference; the height betwixt these respective girths will range from 18 to 26 feet. The examination is not a tedious process; the experienced pruner can detect the branches which require shortening by a momentary glance of his eye. Deciduous trees give out what is called an irregular tier of branches each year; and besides the shortening of those which are of greater length than the majority on the same tier, the whole of them, if too long, ought to be shortened. Some pruners thin out only the strong,

others only the small branches; but, in my opinion, yonng trees should not be deprived entirely of any branch.

Trees thus pruned derive more advantage from the sun than the unprnned. The leaves are found to be of a larger size, and more energetic in their powers of evaporation and assimilation. The cause is plain. In a plantation pruned after this manner, the temperature is necessarily higher than in one from which the sun's rays are excluded, the case, to some extent, where trees are unpruned. The most eminent writers of the day admit the fact, that trees crowded together, snffer more from the deficiency of proper gases for respiration, than from want of nutriment at the roots; a fact not sufficiently known or attended to by owners or managers of plantations.

The branches which are shortened remain slender, a fact apparently not known to some pruners, from their desire to thin out close to the stem any branch of the slightest ascendency. They will observe that shortening dwarfs the branch. The sap in consequence of the smallness of the branches, returns rapidly, and little is retained by the branch, nearly the whole being deposited in the body of the tree. In addition to this the leaves are larger, and remain much longer on the shortened branches, and thus we may in some measure acconnt for the wonderful rapidity of growth effected by this method of prnning.

The smallness of the branches is of advantage likewise, if it shonld become necessary to prune close to the stem, as the wound is proportionally small, and it therefore, more rapidly cicatrizes. The great quantity of sap thus thrown into the main stem, enables the

tree to shoot up yearly several feet, instead of inches, and at the same time to maintain a proportional circumference It is of the utmost importance that trees shonld have a circumference of stem in suitable proportion to their height. When young there should be one inch of circnmference for every fifteen inches of height. If the circumference is proportionally greater, so much the better.

Before proceeding to consider the pruning of trees in a more advanced state, we may express our condemnation of the practice of pruning close to the stem, trees not above six feet high or thereabouts. In trees of this size the fibres are so delicate, that no close cutting can be practised without inflicting serious injury on the plant. Such management admits the damp to the centre, one principal cause of rot in the heart. The larch is more susceptible of injury from this cause than any other tree. We have examined many of them when thinning plantations, at different times, and have traced the commencement of the rot to the year in which such treatment had been adopted.

Another grievons but common error, is, to cut off, in one year, branches to the height perhaps of 14 feet, from a tree not above 20 feet high. When this is done, the trees remain for a long time nearly stationary, and are often so much checked in their growth as to assume the appearance of old age. Such an excess of amputation destroys the health of the tree, by depriving it of those organs by which alone a sufficiency of sap can be produced and elaborated for the production of new wood.

Where the branches have been properly shortened, on my system, till the trees are from 18 to 26 feet high,

we may expect the circumference of the stem near the ground to be from 18 to 24 inches. Pruning close to the stem should then commence. The lowest tier of branches should be cut off the first year, the tier above that the next year, and so on, taking away one tier in each successive year. This process, as well as shortening the branches as before directed must be continued until the trunk is considered to be of sufficient length, with a head conformable, or in proper proportion to it. In pruning trees such as the oak, beech, and others which have naturally spreading heads, care must be taken to give them something like the conformation which such trees naturally take. The trees must not be forced to a height above that which maintains the proportion one inch of circumference in the trunk to twelve inches of height. Trees whose height exceeds this proportion in reference to the circumference, are often strained in the roots by high winds, getting what is called a shake. This impedes their further growth, and is one great cause of the rot.

Trees with naturally conical heads, such as the willow, poplar, larch, silver and spruce firs, require longer heads than those that are of a spreading nature. These species however are, by pruning, kept within a narrower compass than they would otherwise occupy, and thus a greater quantity of timber may be raised on the same extent of ground, whilst greater shelter is afforded. When shelter alone is wanted, the shortening will be found greatly to increase the denseness of the branches. Trees so managed can stand closer together without requiring to be thinned, and all the branches are enabled to retain their vegetative power, and remain for any length of time in luxuriant beauty.

By different management we often see trees reduced to the appearance of poles, presenting no effectual obstruction to the winds. In sheep stalls, as well as in woods and belts of plantation, the shortening of the branches in a great measure prevents the trees from suffering from the destructive effects of heavy falls of snow.

Though the foregoing remarks are intended to have reference more particularly to deciduous and non-resinous trees, we are very far from thinking that resinous trees are not improved by pruning. The propriety of pruning resinous trees has, we are aware, been much questioned, and great difference exists on the point; but if clean, straight timber, free of knots is wanted, I am convinced from experience that the branches ought to be at first shortened and afterwards removed, to prevent knots from being established in the wood. Perhaps our best plantations of resinous trees, to a very considerable extent, prune themselves, but a little assistance may, at the same time, be of advantage. Pines thickly planted (the scotch pine, for example) produce fine clean timber, with great rapidity of growth, though not pruned. The thick planting prevents the lateral branches from attaining to a great size, and thus has an effect similar to shortening the branches by hand. In many cases, however, when resinous trees stand singly, or are planted along with hardwood, they throw out large branches. Now, in such situations, the Scotch fir and larch should have their branches shortened and cut off, in the same way as recommended for deciduous trees.

By this system, trees of considerable size, which by neglect become stunted, may be invigorated and re-

stored to a healthly state. After the shortenings have been made, and repeated, a considerable number of years should elapse before any branches are cut off close to the stem. If large, they never should be cut close, unless for some particular design, such as opening up a view, or some such purpose; for the removal of large branches most frequently admits the wet and therefore decay into the body of the tree, and renders it unfit for timber. But the shortening of large branches promotes the growth, cspecially in hedgerows and by the side of roads. Large branches should always be cut with a saw, and to prevent them from splintering down by their own weight, should be removcd by two operations. The branch should be cut first twelve or eighteen inches from thc main stem, and finally close to it, and so as not to injure the adjoining bark. This additional trouble will be amply compensated by the superior way in which the wound will cicatrize.

I may here add that in cutting off the branches of all kinds of trees, the branch must be cut close to the swell or protuberance which exists at its junction to the stem. The wound thus made is scarccly one-third the size it would be were the branch cut very close and dressed up to the circular form of the tree; a matter of no little importance, as the larger the wonnds the longer time is required for cicatrization. By adhering to the foregoing rule, of first shortening, and afterwards of pruning close to the swell, the wounds are healed in three or four years. In operating on more aged trees, (and in this I have been successful,) the distance from the trunk at which the branches should be cut is regulated by the size of the tree. The larger the tree the greater the distance. I necd scarcely obscrvc, that

dead branches cannot be too soon removed. Fir plantations, which, when thickly planted, are generally self-pruned, ought to have all their dead wood removed. Dead boughs are apt to infect the wood of the main stem with their rottenness.

It may be expected that something should be said about pruning for naval purposes. The oak, when intended for the nse of ship-builders, may, if required, be made to diverge into two, three, or four stems. By pruning it may be led to take almost any required curve. This kind of management will succeed best with trees which have arrived at considerable size.

The larch is next to the oak in importance for naval purposes, and though naturally the straightest of trees, it can with a little art and more readily than any other tree be made to bend into any curve or at any angle which the pruner may desire.

In truth, any tree may be made to produce bent timber, if the straight branches are pruned, and the lateral ones selected for bends.

Trees intended for ornament should have every variety of form given them best suited for the nature of the ground. Some should have broad, others conical heads. Trees standing singly, or by the side of drives, should have branches hanging down to the ground. These mnst be pruned no higher than the point from which the hanging branches can reach the earth. All trees however, when young, ought to be shortened in the branches, as every tree will in time acquire its characteristic form. There is a kind of pruning adopted by some, even at this day, viz. trimming and clipping, in opposition to all rules of taste or science, and without even the attempt to conceal the means

employed. To prune without offence to the eye is most desirable in all cases, but where timber is not the object, there need not, nor should there be, any glaring opposition or distortion to nature. This evil can easily be avoided by cutting the superfluous shoots where they are concealed from the view.

It is also of the first importance that trees should be pruned at the times best suited to the nature of each species; the branches of all kinds of trees, oaks especially, should be shortened after the beginning of September. The maple and birch kinds ought to be shortened before the succeeding January. The shortening of all the other kinds should be discontinued a short time before the buds swell.

The second portion of the process, or final amputation of the branches, should take place in the maple and birch kinds when the leaves are expanded, to avoid bleeding; in the oak and elm, also at the same period, as no suckers will then be thrown out. In all other kinds of decidnous trees this part of the pruning process may take place in the conrse of the winter, except the cherry species, which niust be pruned in August. Some have recommended August as the month in which this kind of pruning ought in all cases to be performed. We have put this opinion to the test several times, but have always fonnd, with the foregoing exception, that the sooner the operation was performed after the trees were in leaf, the better and more readily the wounds healed. Scotch firs (pinus sylvestris) should be pruned in September and October. The dead branches of the larch may be removed at any time, in other respects it may be pruned at the same time as the Scotch fir; and the same of other pines.

We have previously stated the period at which, in our opinion, close pruning ought to commence; it remains to be considered how long it should be continued, or, in other words, what proportion the head, or part covered with branches, should bear to the pruned trunk. Pontey's proportion, as given in the "Woburn Beech," is fifty feet of trunk to twenty-two feet of head. I was once of opinion, that the best proportion was fifty feet of trunk to thirty-five of head; but, on extending my observation more carefully, I now prefer fifty of head to the same length of trunk. Trees of this height are such rare objects that one cannot draw conclusions from them, but from others of smaller dimensions, we can judge what may be the best proportion, by examining the measurements of the general outline of the best trees in this country. From attentive observation, I find the largest trees to bear heads about as long as the pruned stem, if that stem be of the proper circumference. If there be any trees in Scotland with fifty feet of trunk, and fifty feet of head, the circumference at six feet from the ground ought to be sixteen feet, in order to withstand the force of storms. It is not, however, with trees of such dimensions that we have ordinarily to deal; our object is rather to put them in a way likely to approach such an altitude. By commencing to prune close at eighteen feet high, we leave seventeen feet of head; if we delay till twenty-four feet, we leave twenty-three. My plan is to cut off only one tier of branches in the year; though, after the tree is farther advanced, some liberty must be allowed to the operator. This process must go on till the trunk is made smooth to the height required; and during the whole proceeding an eye must be kept to the head of

the tree, as well as to the side branches, lest any irregularity should intervene to mar its uniformity and beauty.

Many writers imagine that the growth of the stem is as effectually promoted by having few branches to a head as by many. If this were the case, there would be no need of bestowing such care on the annual shortening of the branches, and pruning the tiers of branches; the principle on which my system rests; nay, farther, if these writers be correct, the established opinions of physiological botanists, with respect to the functions of the leaves in the elaboration of the proper juice of the tree, must be set at nought. Neither should we see inquiry from the sweeping prunings so often practised; by which the trees are almost ruined, and their means of affording shelter destroyed.

It is not, however, by the writings of theorists on either side that the effects of shortening the branches are to be judged, since the beneficial results are practically proved. It will be found that trees under 18 feet in height and 15 inches in circumference will, on the average, advance as much in six years, if the branches are properly shortened, as they will in fifteen if not shortened, or improperly pruned. The oak under this system is made to equal the Scotch fir in height at the same age, while the horse chesnut, beech, alder, elm, sycamore, and lime, surpass the larch, when all are about twenty-five feet high.

The effect of this method is even more conspicuous when applied to worn-out stunted trees, than to healthy ones. In pruning alternate trees in rows, where they have become unhealthy, the improvement wrought on them is almost incredible. While their neighbours continue in a sort of stand-still state, the pruned ones

cast their mossy and unhealthy coverings, and in many cases often advance 10 feet in the course of three years.

I have frequently seen transplanted trees, apparently consumptive and dying, restored to perfect health by this system. I pruned a number in this condition for Sir Henry Steuart, at Allanton, in October 1831, with great success. Transplanted trees, if considerably advanced, absolutely require this attention, otherwise their health will be very precarious.

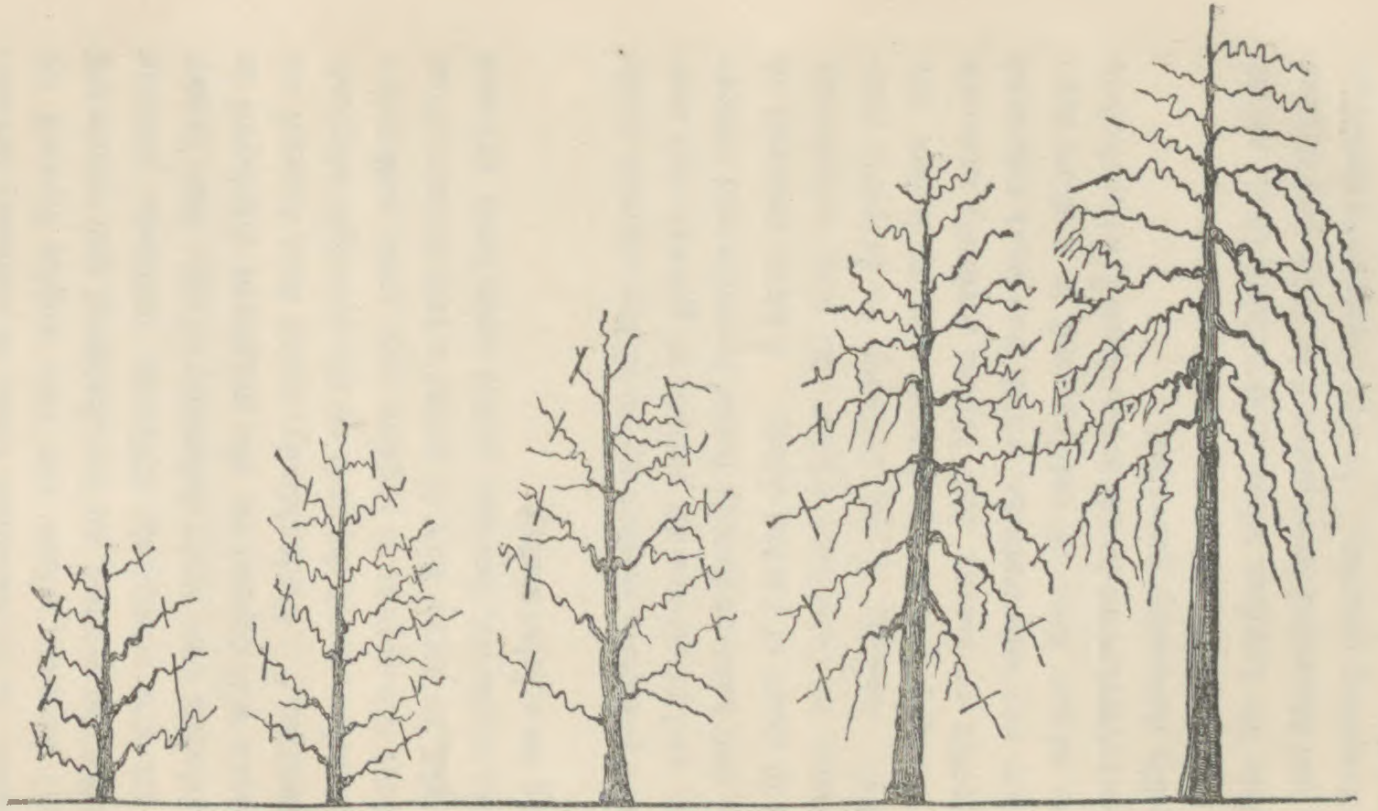
It would be easy to multiply instances, but the good effect of the system applied to decaying or unhealthy trees, has been proved in numerous cases. The method, however, requires modification to meet different diseases, and the pruner often has to cut down the whole tree to some leading shoot that is healthy; and he must be sure to get below the decay in the stem, and must not cut it close to the shoot.

The rapidity with which the pruned make timber, compared with the unpruned, is wonderful. Take twenty-five elms indiscriminately, of a size fit for naves of wheels, and they will be found, if unpruned, not to contain above five feet of timber fit for that purpose. On the other hand, I can produce twenty-five trees which I have pruned, which have between thirty and forty feet fit for naves. Trees regularly pruned are as smooth and straight and regularly proportioned in the trunk, as if they were formed in a turning lathe, which greatly enhances their value in the hands of the carpenter and joiner.

Thus I have endeavoured to explain as plainly and shortly as I can, my principles and plan of pruning forest trees. The representation I have given of the rapid growths, may appear startling to those who have

not studied, or rather practised the system. My statements are, nevertheless, true and open to the inspection of every one who has opportunity and inclination to visit the trees pruned on the system.

We hold pruning to be not only the simplest but the most efficient means of correcting irregularities or failures in trees. On turning to Sir H. Steuart's "Planter's Guide," 1st edition, page 143, we find it stated, "that a gentleman, not destitute of talents, or intelligence in rural affairs, had planted about two-thirds of his place, which was of some extent. When I saw it, this arborecultural experiment had gone on for above five and thirty years, and even the owner had, by that time, begun to despair of success. . . . The generality, and especially in trying exposures, had grown to large bushes. What was once their leading shoot, had lost its pre-eminence, plainly indicating, that no further elongation of the stem was to be expected." Now, instead of persuading the gentleman, as Sir Henry did, to remove the trees, and plant the ground with trees of from five and twenty to thirty feet high, I would just have pruned them as I have usually done with the most stunted and crooked, and with success, by cutting the branches in such a manner as to make the tree perpendicular, and selecting one leading shoot. By preserving always a healthy shoot, and shortening as formerly described, the tree is in a few years brought to beauty and vigour. If a tree bend too much from the perpendicular, it may be made to rise straight by shortening even though much exposed. I have had abundant proof of this in my experience. Indeed, Sir H. Steuart himself seems to admit this to a great extent, though



FIVE TREES WITH THE SHORTENINGS MARKED.

his practice did not exactly correspond. In a note at page 405, he says, "No one, of course, will suppose that it is meant to recommend the reversing or wheeling round of ill-balanced trees, in ordinary circumstances; because, where the two angles formed by trees with the ground, on the sheltered and windward sides, are not *excessively* different, judicious pruning may certainly cure every deformity of top. But, in any case, much will depend on the judgment displayed in the execution." Undoubtedly, much does depend on this, or rather, much depends on the principle adopted; for it does not appear to require any great profundity of thought, to know how to prune a tree on any given principle whatever, but the errors arise from pruners working on a false theory.

I have practised shortening on all the common kinds of trees, and at almost all periods of growth and conditions, and have uniformly found it excite and restore growth in cases of partial decay. I have restored in three years, to luxuriant vigour old trees completely neglected. Indeed, if the pruning be properly executed, a long period rarely if ever elapses before the new growth of leaves and shoots perfectly conceals from view any amputations, which may have appeared offensive at the time of cutting, and in a short time handsome trunks and heads are produced, where before only sickly deformity prevailed.

The late Mr Loudon, when in Scotland, 1841, called on me, and inspected trees planted in 1815 and treated in the foregoing manner. In the Gardener's Gazette, August 1841, and also in his Magazine for December

and January following, and in subsequent numbers he expressed his opinion that the system would be of national advantage.

ON THE THINNING OF FOREST TREES.

This appeared in the Gardener's Magazine, 1841.

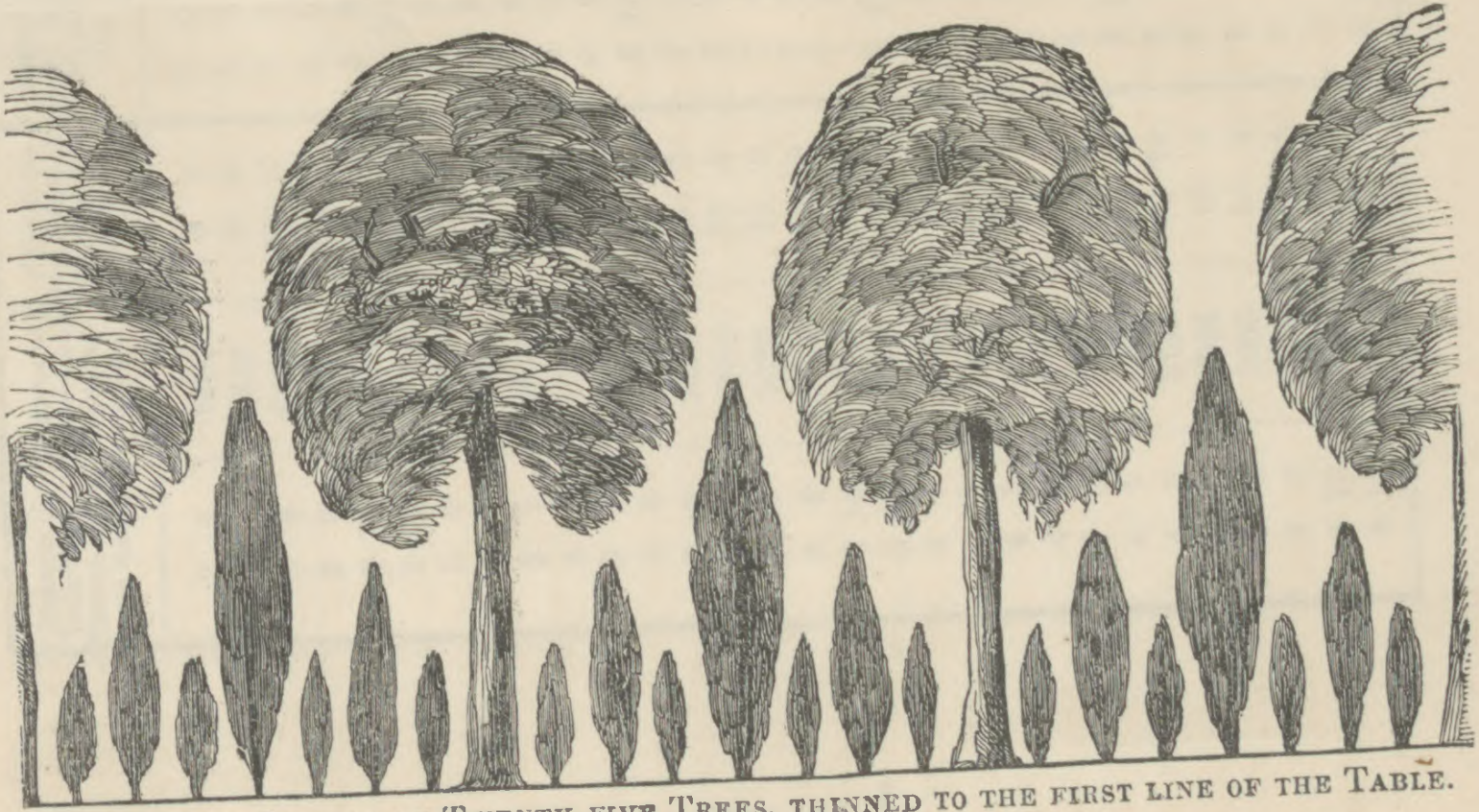
THE thinning of plantations is a branch of arboreculture of the highest importance. It may be thought superfluous to enlarge on a subject which has employed the attention of so many eminent rural and political economists; but be it known that many authors, and these men of eminence too, have published systems not at all beneficial in their practical application. Proposals are often made, and results stated, without, we fear, sufficient evidence of their accuracy. Planters, of course, adopt the plans most agreeable to their different tastes; and thus so many various schemes, with regard to the distance of trees, and the mode of thinning, are in operation, that it is impossible to reduce these plans to any given standard.

My design, at present, is to explain, by the assistance of a table, a system of thinning trees, which I have found to be highly successful, after many years of experimental observation of it. The first point to be considered is, the distance at which trees may be planted from each other, taking into account the height to which they may be expected to attain. Next, I shall take the thinning of twenty-five trees, and detail the

different heights at which these thinnings should take place.

The distance at which trees should be planted from each other cannot, in practice, be reduced to mathematical correctness ; yet it is possible to make a very near approximation to the most proper distance, making allowances for variation of soil, degrees of latitude, and altitude. From observations and experiments I have made, I will lay down such general rules as shall enable planters to see the impropriety of invariably planting at the same distance in all situations, from the level of the sea up to the altitudes of 1800 ft. Trees on land, at the sea's level, will attain to above 100 ft. in height, in the same time which is required to make them reach 30 ft. at an altitude of 1800 ft. This fact is demonstrative of the impropriety of planting trees at the same distance in different soils and climates. The distance ought to be regulated, likewise, by the height which the tree may be supposed to attain. When a plantation is resolved on, it may be necessary, or, at least, profitable, to examine the nearest plantation (if any be near) in an advanced state, and from it to judge of the probable height or heights the intended plantation may ultimately arrive at. Suppose the calculations regarding height to be 57 ft., 67 ft., and 85 ft., these three numbers are marked in the fourth division and third column of the accompanying table, and on the same lines, to the left hand, in the first column and first division, 2 ft. 6 in. is marked as a suitable distance for the first height, 3 ft. for the second, and 4 ft. for the third : and, in the same manner, the table may be consulted to ascertain the distance at which trees of any given height may be planted from each other.

Trees may be well planted, however, and yet be rendered comparatively valueless from the want of thinning. Many mixed woods and plantations may be seen in which the firs, not exceeding forty years old, have almost died out, and the deciduous trees are often mere poles. By management such as this displays, the proprietor renounces immense gain, and the country is disgraced. It is no less surprising than true, however, that such imperfect growth occurs in trees under the guidance of men who are reputed to be skilled in the management of woods. The most superficial observer must have remarked the comparative slenderness of all plants or trees crowded together, and the superior strength of those sufficiently distant from each other; though trees crowded together in plantations suffer more, at first, from the deficiency of carbonic acid and oxygen (both of which are required for respiration) than from a deficiency of nutriment from the roots. Trees, however, as is fully apparent, are a part of the vegetable creation that can only be brought to the greatest perfection by regular and sufficient support from the soil and atmosphere; and, as they advance in height, it is necessary to give them additional support, that they may increase proportionally in circumference. This can only be effected by taking part of the trees out; which operation, at the same time, prevents in a great measure the occurrence of disease, and infection, if disease should occur. When kept at regular and sufficient distances, corresponding to their height, by stated thinning, the trees are strengthened by the sun's rays, air, and motion; and all alpine plants, and such as are exposed to frequent agitation from the wind, have a firmer hold of the soil, and live



A Vertical Section of Twenty-five Trees, thinned to the first line of the Table.

A Table of Distances f

Distance the Trees may be Planted, in feet and inches	Number of Trees on each Acre, per distance	Heights the first thinning should commence at	Distance after the first thinning
2 6	6969	9 6	5 0
2 7	6527	9 9	5 2
2 8	6126	10 0	5 4
2 9	5760	10 2	5 6
2 10	5426	10 5	5 8
2 11	5120	10 8	5 10
3 0	4840	10 10	6 0
3 1	4581	11 1	6 2
3 2	4343	11 4	6 4
3 3	4124	11 6	6 6
3 4	3920	11 9	6 8
3 5	3731	12 0	6 10
3 6	3555	12 2	7 0
3 7	3392	12 5	7 2
3 8	3239	12 8	7 4
3 9	3097	12 10	7 6
3 10	2964	13 1	7 8
3 11	2839	13 4	7 10
4 0	2722	13 6	8 0
4 1	2612	13 9	8 2
4 2	2500	14 0	8 4
4 3	2411	14 2	8 6
4 4	2319	14 5	8 8
4 5	2233	14 8	8 10
4 6	2151	14 10	9 0
4 7	2073	15 1	9 2
4 8	2000	15 4	9 4
4 9	1933	15 6	9 6
4 10	1864	15 10	9 8
4 11	1810	16 0	9 10

A Table of Distances for Planting and Thinning Trees, per Imperial Acre.

Distance the Trees may be Planted, in feet and inches	Number of Trees on each Acre, per distance	Heights the first thinning should commence at	Distances after the first thinning	Number of Trees per distance	Heights the second thinning should commence at	Distances after the second thinning	Number of Trees per distance	Heights the third thinning should commence at	Distances after the third thinning	Number of Trees per distance.	Heights the Trees are supposed to attain at last
2 6	6969	9 6	5 0	1742	16 2	10 0	435	30 4	20 0	108	57 2
2 7	6527	9 9	5 2	1631	16 8	10 4	407	31 4	20 8	101	58 10
2 8	6126	10 0	5 4	1530	17 2	10 8	382	32 4	21 4	95	60 6
2 9	5760	10 2	5 6	1440	17 7	11 0	360	33 3	22 0	90	62 2
2 10	5426	10 5	5 8	1356	18 1	11 4	339	34 3	22 8	84	63 10
2 11	5120	10 8	5 10	1280	18 7	11 8	320	35 3	23 4	80	65 6
3 0	4840	10 10	6 0	1210	19 0	12 0	302	36 2	24 0	75	67 5
3 1	4581	11 1	6 2	1145	19 6	12 4	286	37 2	24 8	71	69 0
3 2	4343	11 4	6 4	1085	20 0	12 8	271	38 2	25 4	67	70 7
3 3	4124	11 6	6 6	1031	20 6	13 0	257	39 1	26 0	64	72 2
3 4	3920	11 9	6 8	980	20 11	13 4	245	40 1	26 8	61	73 9
3 5	3731	12 0	6 10	932	21 5	13 8	233	41 1	27 4	58	75 4
3 6	3555	12 2	7 0	888	21 10	14 0	222	42 0	28 0	55	76 10
3 7	3392	12 5	7 2	848	22 4	14 4	212	43 0	28 8	53	78 4
3 8	3239	12 8	7 4	809	22 10	14 8	202	44 0	29 4	50	79 10
3 9	3097	12 10	7 6	774	23 3	15 0	193	51 0	30 0	48	81 4
3 10	2964	13 1	7 8	741	23 9	15 4	185	46 0	30 8	46	82 10
3 11	2839	13 4	7 10	709	24 3	15 8	177	47 0	31 4	44	84 4
4 0	2722	13 6	8 0	680	24 8	16 0	170	4710	32 0	42	85 9
4 1	2612	13 9	8 2	653	25 2	16 4	163	48 8	32 8	40	87 2
4 2	2500	14 0	8 4	627	25 8	16 8	156	49 6	33 4	39	88 7
4 3	2411	14 2	8 6	602	26 1	17 0	150	50 4	34 0	37	90 0
4 4	2319	14 5	8 8	579	26 7	17 4	144	51 2	34 8	36	91 5
4 5	2233	14 8	8 10	558	27 1	17 8	139	52 0	35 4	34	92 10
4 6	2151	14 10	9 0	537	27 6	18 0	134	52 9	36 0	33	94 10
4 7	2073	15 1	9 2	518	28 0	18 4	129	53 6	36 8	32	95 6
4 8	2000	15 4	9 4	500	28 6	18 8	125	54 3	37 4	31	96 10
4 9	1933	15 6	9 6	483	28 11	19 0	120	55 0	38 0	30	98 2
4 10	1864	15 10	9 8	466	29 5	19 4	116	55 9	38 8	29	99 6
4 11	1810	16 0	9 10	450	29 11	19 8	112	56 6	39 4	28	100 10

longer, than those which grow in crowded plantations.

The table of distances applies equally to the thinning of woods. It is divided into four divisions, and each division into three columns. The first column in each division is the distance in planting; the second the number of trees per acre; the third the height in feet and inches at which the different thinnings should take place. The trees at 2 ft. 6 in. distance, 6969 per acre: thinning to commence when these are 9 ft. 6 in. in height, according to the first column in the second division. Trees at 5 ft., 1742 per acre: second thinning should commence when 16 ft. 2 in. height. Trees at 10 ft., 435 per acre; third thinning should commence when 30 ft. 4 in. in height. Trees at 20 ft., 108 per acre; at this distance trees have sufficient room to attain to the height of 57 ft. 2 in.

The theory adapted to the practical principles of thinning mixed woods and plantations is calculated to inches, and demonstrated on the same plan: if it makes the nearest possible approximation to practical correctness, it is all that can be expected. When trees are planted at 2 ft. 6 in. distance, and have risen to the average height of 9 ft., then each alternate tree of each alternate row, that is at the height or above the height of 9 ft., should be taken out: those below this height may stand till they arrive at it.

When any part of a plantation is much exposed to the wind, 1 or 2 feet, or thereabouts, should be taken off the tops of the trees intended to be cut, this being the most effectual way of retaining the shelter, and protecting the others from the effect of high winds.

Next season continue the thinning of the next alternate rows on the same plan; and the trees that had

been left formerly from not being 9 ft. high, if now that height, may be taken out or shortened. The trees will now be (mostly) distant 5 ft. by 2 ft. 6 in.

Three or four seasons afterwards the trees may be 14 ft. high; then the alternate rows which have been thinned must have those left on account of shortness either taken out or shortened. The remaining trees will be at the average distance of 5 ft. All this, whether clearly expressed or not, means that, at this stage of the process, all the trees are to be distant 5 ft., which may be considered as the first thorough thinning. The second thinning should begin when the trees are 16 ft. high averagely, and be conducted in the same regular manner as the former. It may be supposed that about six years will bring them to 25 or 26 feet and several years more to 30 feet., when the third thinning should begin, to be carried on in the same regular manner as to time, corresponding, likewise, with the calculations of the table.

All extensive woods and plantations, whatever the variation of soil or altitude, when properly thinned, receive shelter in all directions, one part flanking and protecting another from the effects of high winds. At whatever distance trees are planted, the same directions equally apply. Belts and clumps, of small breadth or size, can in nowise be defended from the effect or straining of high winds but by early and accurate thinnings. The lateral branches ought to be shortened, too, and allowed to remain on the trees from the bottom upwards, the same as on the outsides of all plantations, whereby the trees are sheltered, and the neighbourhood converted from bleakness and sterility, perhaps, to warmth and productiveness.

Silver and spruce larch and Scotch firs, on hilly or mountain lands, may be allowed to stand closer than the table indicates, as they receive more sun and air in proportion to the acclivities on which they stand. Silver and spruce fir will grow at considerable altitudes, provided the soil be suitable: these may be allowed to stand so close that the under branches may die from want of air. Where timber is alone required, Scotch firs should have a good soil and moderate altitude. Larch is a mountain tree, and will attain to a large size at high altitudes. It is stated that on the north-east side of the Alps the finest trees are fonnd; and in all onr mountain districts the same law prevails. The sonth-west sides of the hills in this district, at 1000 ft. altitude, are destitute of soil; whereas, on the reverse side, larch will attain a large size at 1600 ft. of altitnde.

Large plantations cannot be thinned exactly in the regular manner laid down in the table. In these it may sometimes be necessary to let the trees stand closer than there prescribed; and when two or three are closely sitnated, if there be intervals to give air around, they should stand. Plantations which have not been regularly and gradually thinned lie under great disadvantages. When fully thinned at an improper time, the trees, having overgrown themselves in height, become high without corresponding strength of stem; and, when acted on by high winds, the stem and roots are strained, or, perhaps, the tree overturned, on the same principle as any weight or force acts on a lever. When wind is of such force as to be eqnal to a pressnre of from 12 lb. to 17 lb. on the sqnare foot, the pine and fir tribe are often so injured that they show symptoms of decay, and die. Larch,

of all trees, is most susceptible of injury from high winds and the neglect of thinning. Spring should be well advanced, and the trees breaking out into leaf, before the thinning of neglected plantations commences; being partly exposed by the thinning, the action of light and air contributes, in an eminent degree, to the strength and quality of the timber. It is said that isolated oaks, fully exposed to the influence of light, form a more durable timber than the same species which have grown in dense forests: so with other species.

Different opinions undoubtedly prevail regarding the subject of distances in planting, some preferring one distance and some another; the same with respect to the time and modes of thinning: but, being convinced by experience of the utility of my method, I should like to have the reasons of opposition from those who disagree with me.

ON PRUNING TREES.

By Peter Mackenzie.

This appeared in the Gardener's Magazine, 1841.

We are informed by old writers that the ancients held the pruning of trees to be of so much benefit that they had a goddess who presided over the operation. Her Ladyship would probably be installed into that office by old Sylvanus, the reputed deity of the woods and forests; and in their deep recesses they could say—

——"Lucis habitamus opacis."
[We dwell in shady groves.]

Whether her local habitation was in the Lucus Petelinus, or in the groves of Pontus, or in merry Sherwood, or in the Sylva Caledonia, I am not informed; but one thing is certain, if ever there were such persons, real or imaginary, they have long since forsaken this part of the world, and gone I know not whither, perhaps to the celestial empire, and left us under the influence of Discordia. It is not to be wondered at that our arboreculturists should differ so much both in opinion and practice regarding the cutting of a branch, when they divide and continue to diverge so far concerning the junction of a leaf.

Mr Cree tells us of the large healthy leaves produced by his system of pruning, and shows us, upon physiological principles, that by means of them a large increase of wood is produced in the trunk of the tree; but Evelyn and his followers would call them "*phyllomania* which spent all the juice in the leaves, to the prejudice of the rest of the parts." But I have no doubt, if these worthies were alive, and placed under Mr Cree's tuition, they would soon embrace his doctrines, and would not be long in publishing their recantation to the world. Dr. Liebig, in his *Organic Chemistry*, says: "The power of absorbing nutriment from the atmosphere, with which the leaves of plants are endowed, being proportionate to the extent of their surface, every increase in the size and number of these parts is necessarily attended with an increase of nutritive power, and a consequent further developement of new leaves and branches." But as every possessor of young plantations has not studied vegetable physiology, and as there are many methods of pruning forest trees before the public, and as some of them appear plausible

enough upon paper, it is but right to give them a fair trial in practice. This Mr Cree is willing to do, and invites his opponents to do the same. I intend to do it upon a small scale with a young plantation of oaks, and will endeavour to do justice to all parties, if I can understand their methods from the description given in the works of those who have written on the subject. If this plan were adopted in various parts of the kingdom, in different soils and situations, it might soon be ascertained which is the best system of prnning, in order to produce the best timber. No doubt many obstacles will stand in the way of the working of such a plan, the chief of these will be prejudice. It is no easy matter for some who have been accustomed to work to one plan, or perhaps to no plan at all, to break through their ordinary routine of sawing and hacking. Every innovation is reckoned by them as newfangled nonsense; and an improved method of doing a thing is treated by them with scorn and neglect, until it is forced by ocular demonstration upon their obtuse intellects. It would be desirable to see foresters, and forests keeping pace with the improvement of the times; and whatever may be said respecting trees of other lands, may every lover of his country be enabled to say--

"Who will, another tree may sing;
Old England's Oak for me."

West Plean, Oct. 4, 1841.

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